UNIVERSITY OF SOUTHAMPTON

FACULTY OF PHYSICAL SCIENCES AND ENGINEERING

Electronics and Computer Science

A MODEL OF THE FACTORS THAT INFLUENCE THE IMPLEMENTATION OF A TELEMEDICINE SOLUTION IN SRI LANKA

By

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ABSTRACT

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In Sri Lanka, urban hospitals offer specialized healthcare services, while rural hospitals have limited services and normally offer only basic hospital facilities. Therefore people in rural areas have to travel relatively long distances to urban hospitals which offer specialized healthcare. This is expensive, while the poor transportation systems in rural areas make travel to urban hospitals time-consuming often involve an overnight stay.

The aim of this research is to improve access to healthcare by adopting telemedicine in rural areas where the patient and the clinician in the rural hospital can contact the consultant in the urban hospital using audio, video and data communication methods for specialized healthcare services.

The methods used were questionnaires and interviews in the exploratory study, which had small number of participants (83) covering three regions, followed by the main survey which had large number of participants (225) and ten regions. A model for adoption of a telemedicine system in Sri Lanka was developed from the analysis of the literature and the exploratory study. The exploratory study was conducted in three districts of Sri Lanka involving clinicians, hospital staff and the general public from both rural and urban areas, and Health Ministry officials, medical directors and consultants. The major study was conducted in ten districts and on two islands of Sri Lanka to identify the factors in the model which influenced the adoption of telemedicine.

The findings of the main survey clearly indicate how important the telemedicine solution is to the rural population. The results also show that hospital staff and the general public were very much in favour of adopting telemedicine. The results also indicate that both clinicians and hospital staff believe that staff involvement, and introducing new policies and standards, will influence the adoption of telemedicine. Clinicians believe that Internet connectivity and the equipment used will not have an effect on introducing telemedicine.

This model will be beneficial when implementing a telemedicine system into rural areas of Sri Lanka, which will provide patients with access to specialized healthcare services.

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Declaration of Authorship

I, Yasmin Dayani Jayasinghe

Declare that the thesis entitled

A MODEL OF THE FACTORS THAT INFLUENCE THE IMPLEMENTATION OF A TELEMEDICINE SOLUTION IN SRI LANKA

The work presented in the thesis is both my own, and has been generated by me as the result of my own original research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- where I have consulted the published work of others, this is always clearly attributed;
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- I have acknowledged all main sources of help;
- where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
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    1. Crowder, R.M, Jayasinghe, D, Wills, G. (2014). Barriers preventing the introduction of telemedicine in the rural areas of Sri Lanka. *Sri Lanka Journal of Bio-Medical Informatics.*

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Dedication

A special mention to my precious parents Mr W S Sumathiratne and Mrs Padma Sumathiratne for their passion for intellectual pursuit which inspired in me the joy of continuous learning and obtaining the highest achievement in my intellectual career. Both of you are the wind beneath my wings.

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To my darling Thaththi and Ammi, I dedicate this thesis to both of you.

Definitions and Abbreviations

Clinician: A person who has a medical degree and has a license to practice medicine

DSL	Digital Subscriber Line
EHR	Electronic Health Records
EU	European Union
HIS	Hospital Information Systems
HISSL	Health Informatics Society of Sri Lanka
HL7	Health Level 7 - Interoperability standards
Hospital staff	Nurses, Technicians and Administrative staff
ICT	Information and Communication Technology
ICTA	Information Communication and Technology Agency of Sri Lanka
LEDC	Less Economically Developed countries
LKR	Sri Lankan Rupees
MPCU	Model of PC Utilisation
PLC	Public Liability Company

Senior Managers: Medical directors and Consultants

TAM	Technology Acceptance Model
TMSL model	TeleMedicine in Sri Lanka model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
VIDUSUWA	VIduth DUrastha SUWAya
WHO	World Health Organization

Chapter 1. Introduction

The standard of the healthcare system in Sri Lanka is very high compared with other Less Economically Developed Countries (LEDC) and the UK (Smith et al., 2007). Table 1-1 shows how Sri Lanka compares to India and the UK. The free healthcare policy in the state sector, and the contributions made into the healthcare system, such as financing hospitals, staff and equipment by successive Governments in Sri Lanka, have made the healthcare system superior to any other LEDC (Pole, 2010).

Table 1-1 compares the differences in life expectancy, hospital facilities, doctors and the overall finances between the healthcare systems in India, Sri Lanka and the United Kingdom. From the figures, one can understand that Sri Lanka spends very much less per person for healthcare compared to the western world. This is due to spending in the LEDCs being lower – for example, Sri Lanka spends about one 60^{th} of the amount spent by the UK. Even though Sri Lanka spends less on each patient, the other metrics are not correspondingly degraded. These figures indicate that Sri Lanka has a very efficient healthcare system, similar to those in the western world.

Even though Sri Lanka has a very good healthcare system compared with other Asian regions, there is an uneven resource distribution of the availability of healthcare professionals in the rural areas of Sri Lanka (Chapman and Arunatileka, 2010a).

Table 1-1 Comparison of healthcare systems from India, Sri Lanka and United Kingdom

Source (NationMaster, 2012a) and (NationMaster, 2012b),

	India	Sri Lanka	UK
Life expectancy at birth (years)	66.80	75.73	80.05
Infant Mortality Rate per 1000 live births	57.92	14.35	5.90
Hospital beds per 1,000 persons	0.77	3.10	4.20
Doctors per 1000 people	0.60	0.55	2.20
Spending per person per year	$31.40	$29.00	$1675.00

Entering into the e-healthcare challenge can be a positive move because all the urban and the rural hospitals in the country have fixed line connectivity (Chapman & Arunatileka, 2010b),

and 78.6% of the people are using fixed and cellular phones (Hansson, Mozelius, Gaiani, & Meegammana, 2010).

According to the experiences of the author in the field of healthcare in Sri Lanka, there are many challenges faced by patients in rural areas. For example, difficulties in obtaining health records in a timely manner, an unequal distribution of specialist healthcare professionals, patients incurring transportation costs, inadequate facilities in the lower level hospitals, and such things as inadequate state of the art medical equipment, are some of the common problems faced by patients in rural areas (Wickramsinghe & Wijethilake, 2010). These are the problems faced by patients in implementing an ICT solution for the healthcare system (e-health) in Sri Lanka.

In this thesis hospital staff means nurses, technical staff and the hospital administrative staff while senior managers means medical directors and consultants.

1.1 Aims and objectives

The objective of this research is to investigate the problems faced by the healthcare systems in the rural areas of Sri Lanka and to identify the influential factors for the adoption of telemedicine in the country. Telemedicine in this context is the use of audio, video and data communication methods used to diagnose and treat patients (Omary, Lupiana, Mtenzi, & Wu, 2010). The final output is a model consisting of factors which influence the adoption of telemedicine.

This thesis considers two aspects of healthcare in Sri Lanka:

1. The problems faced by patients and healthcare professionals in rural areas when it comes to obtaining or providing good healthcare.
2. An evaluation of the methods and the technology used to introduce an e-healthcare solution which will be both affordable and supportive of rural patients.

An investigation into these two areas will help identify the problems faced by patients and the challenges faced by the healthcare system in Sri Lanka. This will lead to the design of a possible solution to overcome these challenges. The intention would then be to implement and evaluate the solution in rural Sri Lanka.

The main research question answered in the research is

"*What is an appropriate model for the adoption of telemedicine system in the rural areas of Sri Lanka?*"

For convenience the question is subdivided into four separate questions.

RQ1 *How will the attitude of the general public affect the introduction of telemedicine in rural areas?*

RQ2 *How will the attitudes of the clinicians and the hospital staff affect the introduction of telemedicine in rural areas?*

RQ3 *How will the staff involvement affect the introduction of telemedicine in rural areas?*

RQ4 *How can the government improve infrastructure of ICT to improve the healthcare of the rural population?*

1.2 Structure of the Thesis

The definitions and the various applications of e-health are presented in Chapter 2. E-health has become a very important part in healthcare provision. There are many definitions, various applications, and interoperability standards in e-healthcare. Many others have different views about e-health technology. For the LEDCs, telemedicine has become the most widely adopted version of such healthcare.

An overview of the current e-health solution in Sri Lanka and the problems facing its implementation is presented in Chapter 3. Observing the healthcare system in Sri Lanka, though there is an efficient healthcare system countrywide, rural hospitals still need improvements with regards to the efficiency and infrastructure of information technology. Therefore there are many challenges to be overcome when introducing a telemedicine system into rural areas.

Quantitative and qualitative methods were used to carry out an exploratory study which helped identify the problems faced in introducing a telemedicine system in rural areas. Interviews with experts, questionnaires for the general public and the reviewed literature were used during the exploratory study and G*Power calculations were used to determine the sample size. The results and the findings of the exploratory study led to developing a model for the adoption of telemedicine in rural areas. A major study was carried out to predict the success of implementing the system. Different methods were used to analyse the results of the questionnaires, and the findings of the interviews, during the main study which covered

several areas of Sri Lanka. The methodology used in both the exploratory study and the main study are explained in Chapter 4.

The exploratory study used questionnaires for clinicians, hospital staff and the general public from both rural and urban areas, while interviews were held with Ministry of Health officials, medical directors, clinicians and hospital staff from both rural and urban areas of the country.

Questionnaires were distributed during the exploratory study to clinicians, hospital staff and the general public in various selected parts of the country. The results of the questionnaires were processed using SPSS software. The statistical Student t-tests were used to compare the two groups: rural and urban. Interviews were conducted among experts, clinicians and hospital staff. The findings of the interviews were analysed using NVivo software. NVivo software helps to analyse the qualitative data in a research by managing and querying data, reporting and presenting the data in visual displays using models and matrices (Bazeley, 2006). The results and the findings of the exploratory study are explained in Chapter 5.

After the in-depth discussion from the exploratory study in Chapter 6, the factors which influenced telemedicine could be identified. This led to the development of the TMSL (TeleMedicine in Sri Lanka).

Since the data was to be collected separately using different questionnaires from clinicians, hospital staff and general public, the main TMSL model was divided into three sub-models: a sub-model for clinicians, a sub-model for hospital staff and a sub-model for the general public.

An online survey was conducted to determine the validity of the components of the model.

A main study was conducted in most parts of Sri Lanka to investigate how the new model would affect the clinicians, hospital staff and the general public. Quantitative and qualitative methods were used to gather information to test the hypothesis identified. The design of the questionnaires was mainly influenced by the models TRA, TPB, TAM, and previous surveys related to the topic.

The questionnaires were distributed to clinicians, hospital staff and the general public in the selected rural and urban areas of Sri Lanka. The interview questions were designed for the Ministry of Health officials and the medical directors. A "*comment*" box was available in the questionnaires for participants to add any additional comments regarding the new system.

The results of the main study questionnaires were analysed using descriptive statistics, Cronbach's alpha (to test the consistency and the reliability of the questionnaires) and MANOVA (to test the differences among the two groups: rural and urban). The chapter also analyses the questionnaires using Pearson's Correlation to measure the strength of linear correlation between two variables. More analyses were conducted in this chapter by using a one sample t-test to determine whether there was a difference between the sample mean and the hypothesized mean, and Factor Analysis was used to determine the number of factors in a dataset and how each variable loaded onto each factor. Finally, to minimise any weakness in the qualitative and quantitative results, a mixed method approach was used. This is discussed in Chapter 1.

The interviews conducted during the main study with Ministry of Health officials and medical directors used a content analysis method and were analysed using NVivo software. This is explained in Chapter 8.

The quantitative and qualitative results are discussed in Chapter 9, in relation to the main study conducted in most parts of the rural and urban areas of Sri Lanka with health ministry officials, medical directors, clinicians, hospital staff and the general public.

Finally, conclusions drawn from the research undertaken, the contribution of the thesis, the limitations of the study and possible areas for future research. These are covered in Chapter 10.

Chapter 2. E-health Technologies

This chapter discusses the definitions and various applications of e-health technology. The term *e-health technology* came into use around the year 2000 (Omary et al., 2010). E-health uses ICT to provide patient-related information electronically to the stakeholders such as patients, doctors, service providers and policy makers, mainly through the internet. E-health has helped to reduce medical errors, improve the relationship between patient and physician and improved the quality of care delivered (Omary, Mtenzi, & Wu, 2009).

John Naisbitt, one of the great futurists, said that the new source of power is not money in the hands of a few but information in the hands of many (Ball & Lillis, 2001). Information Technology has heavily influenced healthcare delivery where patients demand new systems such as Internet Health Portals, online consultations, online channelling, online administrative processes and online clinics.

Many people and organizations are promoting e-health as a method for improving the lives of the rural people. Although adopting e-health has many benefits to a nation, there are many challenges such as lack of funds, lack of healthcare policies and procedures, low internet bandwidth, confidentiality and security concerns, to be considered before adopting a system (Omary et al., 2010).

According to a Ministry of Health Sri Lanka report (Annual Health Bulletin, 2003), the health service is a hierarchical system ranging from the highest provision at national level, major provision for a regional area, local hospitals for a community, down to the health clinics and G.P. (General Practitioner) services covering a relatively small area, and Health services/Midwife/Medical Officer of Health covering the rural areas and villages of the country (see Figure 2-1).

Though changes are being made to the healthcare systems in Sri Lanka, both curative and preventive sectors still use manual- and paper-based systems as the mode of information communication. Therefore, to manage healthcare information effectively and efficiently, the country needs to adapt to ICT. Compared with developed countries, some healthcare institutes in Sri Lanka have introduced e-health projects on their own initiative. These projects have only addressed the local needs of the healthcare system.

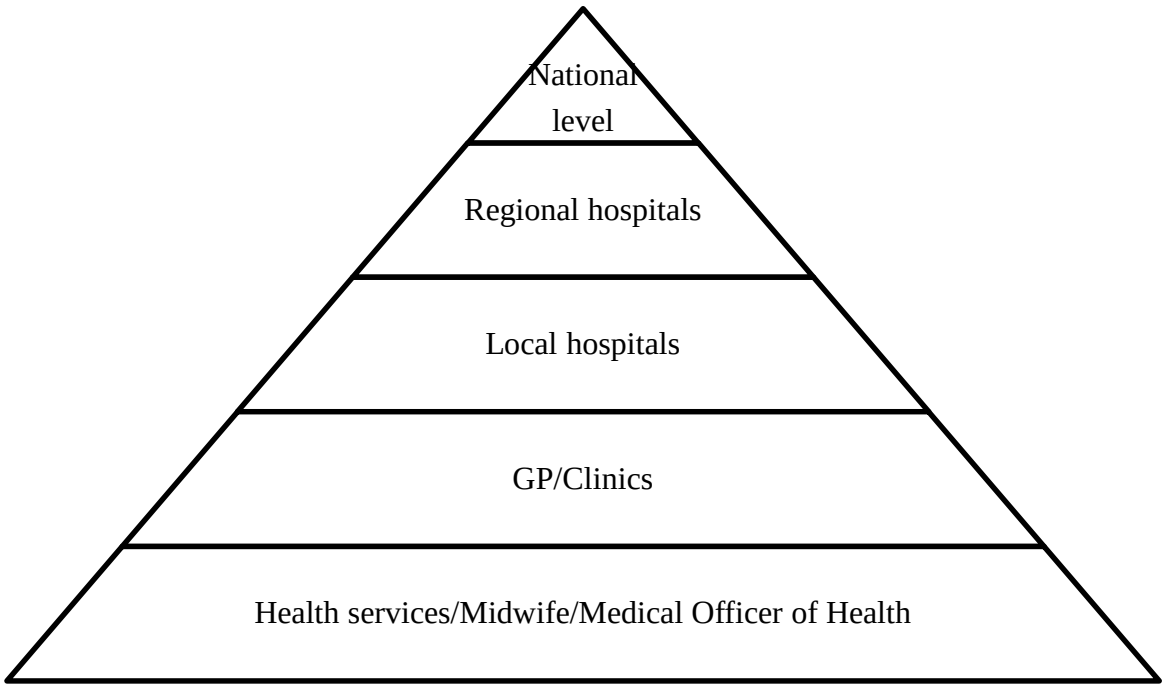


Figure 2-1 Hierarchical system of healthcare delivery

Adapted from (Annual Health Bulletin, 2003)

Sri Lanka thus needs to introduce e-health systems that will address the general healthcare system, which will allow the exchange of information between the different systems of healthcare (Ministry of Health Sri Lanka, 2011).

2.1 Definitions of e-health

A review of the literature provides the following definitions of e-health.

- World Health Organization [WHO] reports that e-health is a way of communicating information in the field of health-related areas such as health services, learning, research and surveillance through electronic connectivity (OpenClinical, 2005).
- Meeting the health-related requirements of stakeholders (citizens, healthcare providers, policy makers, healthcare professionals and patients) by using the internet (Europe's Information Society, 2005).
- Connecting medical informatics, public health and business through the internet to improve the health sector locally, regionally and worldwide (Eysenbach, 2001).
- e-health is using the internet or other electronic media to distribute health-related information or services to the people (Gustafson & Wyatt, 2004).
- Communicating information through the internet to retrieve, store and transmit data electronically for clinical, educational and administrative purposes (Fedorov, 2007).

Although these definitions give a positive effects of e-health in diagnostic procedures, it does not mention the negative effects, such as exposing medical information with descriptions and dealing with people who have no medical training (Omary, Lupiana, Mtenzi, & Wu, 2009).

Therefore taking into consideration the above definitions, one can come to the conclusion that e-healthcare is a combination of various services such as Electronic Health Records, Hospital Information Systems and Tele-medicine (Omary et al., 2010). The definition of e-health used in this thesis is an ICT system that allows stakeholders such as patients, physicians, healthcare administrative staff, and the general public to use the system as well as the policy makers who fund the system.

2.2 Models of e-health in the West and LEDCs

E-health means utilising the technology by balancing power between patients, medical professionals, industry and the state. In the developed world, e-health is not a new concept compared to the LEDCs. A few developments in the West and the LECDs are mentioned below.

Developed countries (West):

- The European Union has introduced EHR in primary care and health smart cards (Ipektsidis, 2005). The Health smart card is a card with a circuit chip embedded in it. These cards can store a variety of healthcare applications such as patient demographics, patient identity verification, and medical problems.
- Canada (Health-Canada, 2004), and the EU, has a very developed national and local infrastructure for Information Technology, have also developed models for e-health (Drury, 2012). Gartner has developed a model for e-health for EU member states which includes the Czech Republic, France, the Netherlands, Sweden, Spain and the United Kingdom. This model demonstrates how political goals, e-health technologies and potential benefits are linked to e-health, which helps to make decisions when investing in e-health solutions (Gartner, 2009). In the Gartner report says (page 46) that eHealth can be used as healthcare transformation and can bring substantial benefits. The report also mentions that member states should prioritise e-health initiatives based on political goals and documented benefits, improve the present systems, and improve the tracking of medical errors.
- In the United Kingdom, the PHR system has allowed over 54% of patients to book appointments electronically through the *Choose and Book* system. In addition, two-

thirds of the GPs in the UK use the GP2GP system to transfer records between sites. The UK was the first of the G8 countries to introduce the Picture Archiving and Communication System (PACS) to avoid retaking X-rays (Connely, 2009). In the UK, hospitals use Summary Care Records, Electronic Prescription Services, NHSmail and NHS Number in their e-health model (NHS, 2005).

- In Slovenia, the e-health project was launched in 2008 based on the model of the national Health Information Systems (eHIS). The objective of eHIS was to improve accessibility to healthcare services, mobilise the resources for areas of information technology, improve the quality and accessibility of healthcare and introduce e-administration as a standard method (Miklavcic, 2009).

LEDCs:

- Cambodia introduced a Hospital Information Systems (HIS) and Hospital Management Information Systems (HMIS) system in 2011, which provided the HMIS web page. The system has also introduced reporting forms for health centres and hospital, and data which is processed monthly is available to all levels of the hospital system. The country has also implemented the Patient Management Records System (PMRS) in number of clinics. Though the system produced promising results, lack of infrastructure, skills in using PMRS at hospitals, and internet accessibility in the rural areas, has challenged the system (Sambath, 2012).
- From 2002-2005 Bhutan introduced telemedicine in hospitals with the help of EHO and in 2009, a rural telemedicine project introduced at 14 sites. The Health Help Centres, which was introduced in 2010, was a successful project. The country is currently implementing a HIS system. But the progress of these areas were challenged by the infrastructure, poor commitment by the people, and budget constraints involving medical equipment and IT cost (Chikersal, 2013).
- In Vietnam, the Ministry of Health have integrated Information Technology for the medical sector and hospitals have their own IT departments. Several IT applications, projects and training activities have been introduced in different levels of the Ministry of Health. Progressing the Information Technology has been challenged by the areas such as infrastructure, lack of a unique patient identifier, lack of IT human resources and no proper architecture for health information systems (Phuong, 2012).

In comparison with developed countries, introducing an e-healthcare solution in LEDCs is difficult mainly due to the lack of a national policy and legal framework on telemedicine, the

lack of knowledge on application, the usefulness of e-learning, and the lack of a supportive infrastructure (Rampatige, Abusayeed, & Galappaththi, 2010). Poverty in rural areas, where people cannot afford to purchase computers or mobile phones so as to use internet facilities, can be identified as another barrier to an electronic form of healthcare, but it is also essential for developing countries to improve the health informatics infrastructure to improve the quality of their healthcare (Oak, 2007).

2.3 Views of e-health

Adoption of E-health is not only a financial problem. It also involves human trust. Therefore when introducing an e-health solution, developing countries need to consider the human elements as well (Cook, 2012). E-health can be considered from three different perspectives: clinical, technological and societal.

2.3.1 Clinical View

E-health has both positive and negative impacts on the healthcare industry. Some clinicians believe that using e-health can be beneficial during consultations because the information the patient has collected using the internet regarding the illness can also contribute towards better communication during the consultations. Whereas some clinicians are concerned with how patients will access and interpret the information they find. Another reported negative aspect of e-health from the clinicians' perspective is that when the patient gathers information about health problems from health sites, they are then more knowledgeable about the health problem before meeting the clinician, which might cause problems with the relationship between the clinician and the patient. The clinicians also believe that the complex medical terminologies contained in the health portals may result in self-harm from self-diagnosis and treatment (Robinson, 2008).

Clinicians' use of e-health may differ according to gender, practice location and their unique approaches. Most clinicians use the Internet for learning activities and to find medical information for their professional development. By using the Internet, the clinician can also obtain up-to date information from patient records (Casebeer, Bennett, Kristofco, Carillo, & Centor, 2002).

According to Mart (2008), clinicians have a rather conservative attitude towards e-healthcare because doctors are more used to writing than using keyboards. Clinicians are reluctant to use electronic media because it is difficult to express feelings, elicit memories and make face-to-face contact with patients.

Some physicians do not agree with the EHR systems because they believe that obtaining information from a range of computer applications is not a clinical skill. Physicians also argue that introducing e-prescriptions can have errors when transcribing that will be difficult to correct (Omary, Lupiana, et al., 2009).

2.3.2 Technological view

Availability of health information through the Internet has some positive effects. Patients can be well informed about the risks, benefits and different treatments for their illnesses through the Internet (Henwood, Wyatt, Hart, & Smith, 2003). ICT will help both clinicians and patients to access reliable medical information, adopt a strong patient-clinician relationship, have a better communication method and a way of storing, organising and retrieving medical information (Bodenheimer & Grumbach, 2003).

Online health information will help the patient with self-care and prevention. Patients will also be able to view alternative approaches to healthcare. Online healthcare will be very convenient to the patient by having access to diversified health information and also help the ageing population, with increasing healthcare needs, to get the necessary medical information from home (Cline & Haynes, 2001).

Use of Internet for health-related information also has some negative effects. The information provided by the Internet can be misleading or misinterpreted by the patient and the clinician. This might result in having inappropriate requests for the clinicians and the wrong treatment given to the patient (E. Murray et al., 2003).

2.3.3 Societal view

One reason most people use the Internet to get health information is due to the lack of communication between patient and clinician. A shortage of consultants, and time constraints on consultation time for patients, has led to patients using more internet facilities to obtain health information.

Introducing health information on government portals, having relevant web sites on healthcare and inexpensive online sources of information, have also contributed towards using health information from the internet (Jacobson, 2007).

Patients also feel more secure when using the Internet for information because they can be more informed about the particular illness they have, the medications they can use, and access information about nutrition and illness prevention (Robinson, 2008). The Internet

might help patients to be more knowledgeable about their illness before meeting the consultant. On the other hand, this will make the consultant feel insecure because the patient is able to find out about their health conditions and the treatment from the internet before meeting the consultant (McMullan, 2006).

2.4 Examples of e-health applications

E-health describes a wide range of applications that involve the use of ICT and include Electronic Health Records, Hospital Information Systems, Telemedicine, Tele-health, Health portals, Tele-surgery and tele-care.

2.4.1 Electronic Health Records (EHR)

An EHR system helps to minimize clinicians' workloads by creating a heath record system between the patient and the clinician. This record will include the patient's medical history, medicine, progress reports, immunizations, ECG reports, laboratory reports, demographics, problems and notes (The MITRE Corporation, 2006).

EHR can be used to monitor whether the patient is adhering to the medication prescribed by the clinician and provides information to the clinician as to when to perform the intervention using digitised health information (Mason, Denton, Smith, & Shah, 2012). EHR is also used to plan, set objectives, document, and deliver patient care, and assess the outcomes of patient care. This includes information provided by different professionals regarding the patient (Hayrinen, Saranto, & Nykanen, 2008).

Even though EHR system has lots of benefits such as improved quality, reduced medical errors and reduced costs, there also some drawbacks when adopting EHR especially in the developing world. These drawbacks can be summarized as financial issues, such as ongoing maintenance costs, implementation cost, and decline in revenues (Menachemi & Collum, 2011).

In practice an EHR system brings together the information about each patient's individual records such as immunization status, ECG reports, medicine, lab reports, problems and notes, demographics and x-ray reports onto one single electronic database. Figure 2-2 illustrates the inputs to an EHR system in a local hospital.

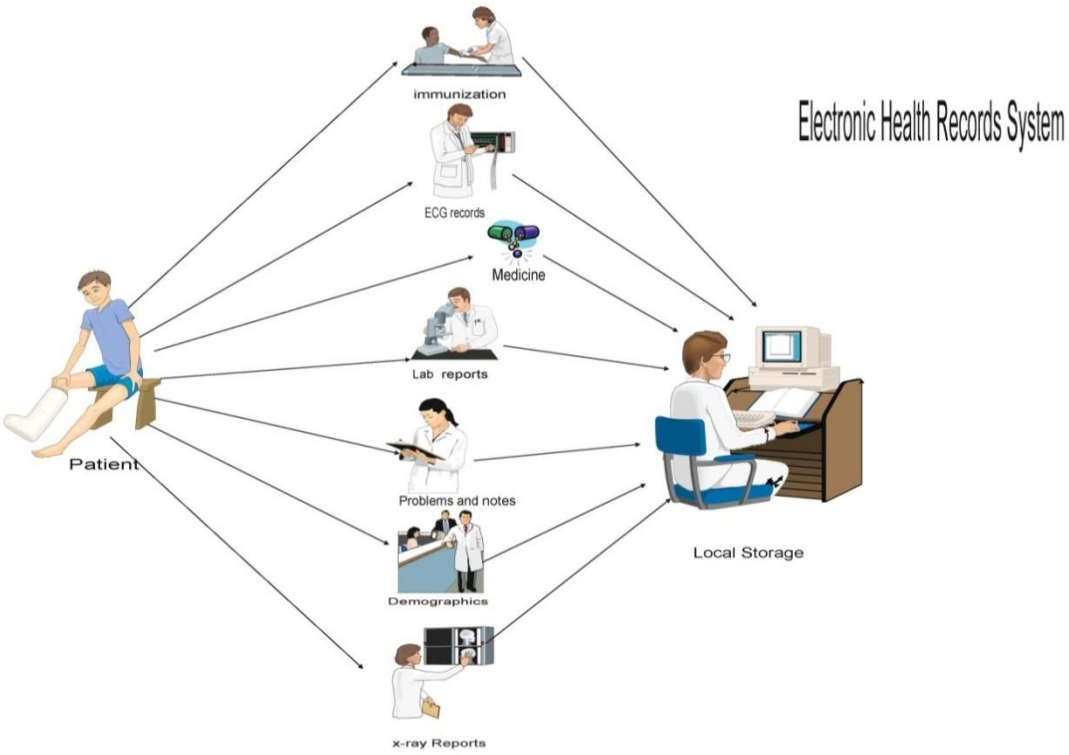


Figure 2-2 Overview of a single Electronic Health Records System in the local Hospital

2.4.2 Hospital Information Systems (HIS)

A Hospital Information System is designed to manage all the administrative tasks related to a hospital. This includes managing patient demographics, Electronic Health Records, Medication, Laboratory information, and finances (Omary et al., 2010). This method of sending information using an electronic data processing system can help professionals make efficient and fast decisions. Through this system, hospitals will be able to manage the administrative, clinical and financial areas in a very efficient manner (Ismail et al., 2010).

India has introduced a Hospital Information System which enables the distribution of data, knowledge, process, effective monitoring and mentoring by professionals from high end medical services to all the lower levels of the medical services. This system will be usable by all levels of hospitals in the country once hospitals are computerised (Bedi, Rajasree, & Srivastava, 2010).

If developing countries were to introduce HIS systems, they should have qualified and experience personnel to implement the system. Also major consideration is needed regarding the procedures needed for data collection, data quality control, reporting and feedback procedures (Kriemadis, Kotsovos, & Alexopoulos, 2009) .

2.4.3 Telemedicine

Telemedicine allows healthcare professionals to use audio, video and data communication methods to diagnose and treat patients (Omary et al., 2010). This is the curative part of healthcare which includes consultation, treatment, education and medical care delivery (Okuda, Sadoul, Hastings, Basocak, & Freire, 2007). Telemedicine uses information and communication technology to assist diagnosis, treatment and prevention of diseases, continuing education and research and evaluation (Rampatige et al., 2010).

The implementation of a telemedicine concept depends on its location. Therefore in developing countries, the telemedicine concept can have different applications such as tele-education, tele-health, tele-portals and tele-surgery depending on the location. Using ICT in telemedicine will help overcome geographical barriers and will help people access health services easily (WHO, 2010).

Telemedicine in the rural areas of developing countries can be beneficial when emergency healthcare is needed. The system can help to reduce the time and the cost of travelling long distances to obtain healthcare. Using telemedicine can reduce outpatient visits to the major hospitals. The system also helps the experts in healthcare to monitor and give advice to the primary level healthcare professionals (Solutions, 2014).

There are also some disadvantages when adopting telemedicine in rural areas. During online consultations there can be disruptions to the Internet connections due to inclement weather and poor bandwidth. Inadequate infrastructure and the physician's resistance to change are also some of the barriers in introducing telemedicine in the developing countries (Harper, 2012). Another disadvantage is that when the clinician is unable to have physical/live contact with patients, it might cause problems when investigating the health problem (Sarhan, 2009).

- **Tele-education**

Tele-education uses computers, audio and video to deliver educational programmes to healthcare professionals in rural areas. Computers can be used to obtain educational information using the internet, World Wide Web and email. Audio technology can be used to send voice messages between the learner and the instructor. Video can be used for live visual and verbal interactions between the instructor and the learner using videoconferencing (Curran 2006a).

Tele-education can be very helpful to the rural healthcare professional when providing healthcare services in a timely manner. This will provide continuous skills and knowledge

development to the rural healthcare professionals. The method also reduces the cost and the travel time to distant continuing programmes (Curran 2006b).

- **Tele-Health**

This is an expansion of telemedicine. This contains the methods of prevention, promotional activities and curative aspects of health (Okuda et al., 2007).

The Canadian Health-care system has introduced tele-health services to improve the quality of care, quality of access, and to clear inequalities in health status. It defines tele-health as being about exchanging health care information across different geographical areas using telecommunication technologies (Jennett et al., 2003). When introducing tele-health projects in the rural areas, it important to provide patients with the knowledge and the tools when using the technology. When introducing such technologies, one should also take into account of the resources available for the service, the knowledge of the healthcare workers, and the attitudes of the patients and the healthcare professionals towards the technology (Cook, 2012).

- **Health Portals**

Health Portals give information to patients regarding what patient care, healthcare services, preventative services and specialist information are available, and how to manage administrative tasks and so on, in a secure way using the Web (Microsoft, 2012).

Health Portals help in the retrieval of information on health-related matters and services, on disease prevention, interactive payment services and on personal medical sites for clinicians, and pharmaceutical information for both clinicians and patients (Di Giacomo & Maceratini, 2002).

- **Tele-surgery**

Tele-surgery is practised in very few countries, and is defined as performing robotic surgery remotely (Hanly et al., 2005). This was an area of technology which the US army was very interested in using on the battlefield. There are some challenges such as communication lag time over long distances, and business risks, in the use of robotic healthcare (Haidegger & Benyó, 2010).

If tele-surgery is to be introduced in developing countries there are number of technical and ethical issues that have to be taken into consideration. Some of these issues are the insurance policies for the individual surgeons and the institutions, which can be in two different

countries, the reliability of the links, and the cost of telecommunication equipment (Challacombe, Kavoussi, Patriciu, Stoianovici, & Dasgupta, 2006).

2.4.4 Tele-care

Tele-care is a service which uses technology to help people live independently at home. Tele-care delivers social and health services to people in their own homes using remote monitoring care through ICT. This system uses equipment and detectors, such as pendants or pull cords, community alarms, such as smoke and flood detectors, and sensors to monitor vital signs and other aspects of the home environment. These are used to provide remote monitoring of care and emergencies (Beale, Sanderson, & Kruger, 2009).

Another way of using tele-care is to remotely monitor patients, conduct patient examinations and provide expert advice to healthcare workers using ICT. Remote monitoring can be done using web cameras, video conferencing and cell phones. Developing tele-care in the developing world is very important especially in remote areas. Already, developing countries such as Nepal, Western and Central Africa are using this technology to save the lives of older people (Simpson, 2010).

The Swinfen Charitable Trust (SCT) in the UK has been involved in providing specialist advice to developing countries using digital cameras and email. In 1999, this type of tele-care was introduced to the rural areas of Nepal. SCT supplied telemedicine equipment such as digital cameras and computers to a rural hospital in Nepal. By 2002, five telemedicine links were in operation in Nepal (Swinfen & Swinfen, 2002).

In 2003, a four year project was launched in West Africa called RAFT (Réseau en Afrique Francophone pour la Télémedecine). The development of the infrastructure in medical teaching centres, connection to international and national computer networks, developing Internet access points in rural areas, and development and maintenance of locally and culturally adopted medical centres, has been funded by RAFT to improve tele-care in Western and Central Africa (Geissbuhler, Ousmane, Lovis, & Haire, 2003).

The Preventative Technology Grant in England allocated £80 million in grants to improve the lives of the older generation using tele-care facilities provided by the NHS. These facilities, such as community alarms and devices for monitoring vital signs, will help people with long-term health conditions to remain at home (Department of Health, 2005).

2.5 M-health Applications

The use of mobile phones for healthcare has become very popular in the developing world. Mobile phones can be used to communicate with a clinician, call an ambulance, and educate people by providing them with information regarding illnesses using text messages. These are just some of the commonly used methods in the health industry (S. Murray, 2010).

Nawaloka Hospitals PLC in Sri Lanka together with Sri Lanka Telecom Mobitel, the national telecom service, has introduced the first ever m-health platform which sends medical data over a mobile network (Mobitel, 2011).

In Uganda, mobile phones are being used to raise awareness about HIV/AIDS, while in Kenya mobile phones have been used to set up the EHR data of patients onto their mobile phones (The Economist, 2009).

There are several advantages of using M-health applications in developing countries. Mobiles can provide health contents on the web, mobile health videos, sending health care information using SMS and health applications. These can improve a patient's health by enabling the physician to keep track of the patient, reducing the cost of visiting the physician, and allowing the clinicians to connect to patients in different locations.

There also some disadvantages in M-health. Most of the people in the rural areas do not use smart phones or use computer for emails, the privacy of the patient information can be compromised, and a negative perception of the clinicians and the patients towards M-health (Attune-Technologies, 2013).

2.6 Interoperability Standards

The extent to which different Information Technology systems and software applications can exchange data, communicate and interpret data is called interoperability. An implemented standard can help to provide improved and effective healthcare for individuals and communities through health information systems within and across organization boundaries (Healthcare Information and Management Systems Society, 2013) .

Lack of interoperability has become one of the major problems in the healthcare industry. EHR has been a key area concerning interoperability in the healthcare industry. In most countries, medical records are stored in digitalized hardcopies, database tables or various other such storage methods. To address the issue of a lack of interoperability in these areas, HL7 and some other standards like Clinical Document architecture (CDA), CEN EN 13606

EHRcom and openEHR are being developed (Eichelberg, Aden, & Riesmeier, 2005). Most of the health institutes around the globe use HL7 (Health Level 7) which are self-administered Standards. HL7 is an organization which provides a framework to exchange, share and retrieve clinical information through electronic health information (Hammond, 1997).

Using interoperability standards can influence telemedicine in Sri Lanka in the context of using audio, video and data communication methods to diagnose and treat patients to protect a client's privacy by linking the health records. This will help to reduce costs and reduce medical errors (Puskin, Johnston, & Speedie, 2006)

2.7 Security

Security is another major concern when considering telemedicine. The most common security concerns are authorization, authentication and accounting. There are also some new challenges regarding telemedicine security which have been raised recently. These include security and privacy of the patient information. This is very important for building trust between the clinician and the patient (Garg, 2011). Introducing effective policies and standards for telemedicine will help to deliver effective and quality healthcare to the public. It will also help to build confidence among the consumers and providers regarding the reliability and safety of the service. Organizations such as the American Telemedicine Association (ATA) developed practice guidelines and standards relating to telemedicine. These standards have been accepted by the telemedicine community in America (Krupinski & Bernard, 2014).

Sri Lanka does not have any policies and standards for telemedicine. In Sri Lanka, manual patient records are considered as a legal document, and may only be accessed by authorized people. Even though confidentiality of the patient records is facilitated by some of the inbuilt features of some applications, there is no legislation to ensure privacy of any form of health data in digital format (Rampatige et al., 2010).

2.8 Models of adoption of e-health

E-health systems offer a very important advantage to health organizations. There are many benefits in adopting e-health. For example, reducing medical errors, facilitating medical research, improving access to tele-care and quality of care, and accessing health facilities without geographical barriers (Fitzgerald, Piris, & Serrano, 2008).

Addressing the barriers to adopting e-health will help to achieve a better system. Some of the barriers to e-health include ICT development issues such as infrastructure and national policy, and human factors such as awareness and skills. There are other barriers such as technology distribution, access to the internet, and the security and privacy of patient health records, which all need to be properly addressed if an appropriate relationship between patient, communities and providers is to be adopted (Rodrigues, 2008).

Various models are used in healthcare that involves different technologies and users. Some of these models, such as the Theory of Planned Behaviour (TPB), the Theory of Reasoned Action (TRA) model, the Technology Acceptance Model (TAM), and the Model of PC Utilization (MPCU), can be used to explain decisions made by physicians regarding acceptance of the technology used in healthcare (Morris, Hall, Davis, Davis, & Walton, 2003).

The Theory of Planned Behaviour is concerned with individual behaviour. Considering e-health, TPB can be used to determine the clinician's intention in using telemedicine according to their skills and resources. TPB is a way of explaining the positive or negative attitudes, behavioural controls and subjective norms, opportunities, perception and attitudes of the clinician using the technology (Chau & Hu, 2001). Attitude and the subjective norm can directly influence the behaviour of a person, such as happiness, unhappiness, likes and dislikes. Perceived behavioural control helps to predict a person's behaviour such as intention to use IT in healthcare. Therefore TPB can be applied to find out the understanding of individual acceptance and the use of technologies (Liang, Tao, Gu, Ding, & Wang, 2014). Considering the above characteristics of TPB, the attitude of the participants towards using IT in healthcare, and the intention to use the new technology in healthcare, were measured using questionnaires given to the participants and the interviews conducted during the study.

The Theory of Reasoned Action model is an intention-based theory which explains both positive and negative feelings of the target user about their technology experience. This model claims that the attitude of the user is influenced by their beliefs. It also analyses how the target user communicates with the characteristics of the technology (Chau & Hu, 2002). This model measures the attitude of an individual's positive and negative feeling about the new system and the perception about the thinking of the people around regarding performing or not performing the task (Phichitchaisopa & Naenna, 2013). In this research, the questions were designed to measure the perceived ease use of the technology and the perceived understanding towards the increasing developments in the technology of the participants.

The TAM model was designed to check the relevance of Information Technology to a particular job and how it can be used for that particular job by the user. This method excludes the attitudes of the user and analyses mainly the usefulness of the technology to the degree in which the user believes that the technology will help to improve the performance of the task. It also analyses to what extent the user believes that using the system will be effortless. (Morris et al., 2003) and (Venkatesh & Davis, 2000). TAM is used to measure both the use of the technology, and the usefulness of the technology (free of effort), to that individual (Djamasbi, Fruhling, & Loiacono, 2009). The research used this model mainly to measure how the participants will react to using the new technology and to measure their reaction towards the usefulness of the new technology in their work.

The Model of PC Utilization (MPCU) helps to predict both the acceptance of a particular technology by the individual user and how they will use a range of information technologies (Venkatesh, Morris, Davis, & Davis, 2003). MPCU was used in this research to predict different levels of technology acceptance in the provincial areas, such as urban areas having up-to-date technology.

2.9 Adoption of telemedicine

Telemedicine has become a very important part of what healthcare organizations around the world now offer. This technology is used by many countries to improve their healthcare services. The success of telemedicine depends on how organizations adopt a system to overcome the challenges relating to the management and the technology of the organization (Hu, Chau, & Sheng, 2002).

Most telemedicine applications have been adopted locally and not nationally(Zanaboni & Wootton, 2012). The factors for adopting telemedicine have mainly been tested using qualitative studies. Some qualitative models include the Technology Acceptance Model (TAM), the Theory of Planned Model (TPM), and the Theory of Interpersonal Behaviour (TIB). A small number of applications were adopted using quantitative methods. For example a North American telemedicine activity, an email telemedicine network adopted by the Swinfen Charitable Trust in UK, and a telemedicine system in use in the US prison system (Zanaboni & Wootton, 2012).

Most developing countries are in need of a telemedicine system because the majority of the community live in rural areas and are deprived of efficient healthcare facilities due to their location. Some other major factors which influence the introduction of a telemedicine system

in developing countries are the need to reduce healthcare costs, the need to focus more on preventative services, the need for more care in the treatment of infectious diseases, the ever-changing healthcare structure due to political changes, a reduction in travel costs, the number of physical visits to obtain health services, and the time lost from work (Tan, Kifle, Mbarika, & Okoli, 2005).

The following are some of the telemedicine projects introduced in developing countries.

Sri Lanka: A telemedicine system was designed in 2001 by researchers in Sri Lanka and Japan. Before introducing the new system, medical experts at Saga University in Japan had been helping clinicians with training research and surgical care at the Department of Oral and Maxillofacial Surgery in the Faculty of Dental Sciences at the University of Peradeniya in Sri Lanka in the fields of oral cancer, maxillofacial trauma and maxillofacial deformities. This method of exchanging medical information was carried out via email and by experts from Japan visiting Sri Lanka to deal with medical emergencies. To reduce the cost and time spent for these experts travelling to Sri Lanka, a new telemedicine system was introduced in 2001. This system was able to send real-time high quality images and interactive voice messages using a peer-to-peer collaborative system. This system functioned well between the two countries. There is now a plan to expand the system locally, and internationally, by accommodating multiple participants (Nishantha, Hayashida, Weerasinghe, Wijekoon, & Ihara, 2005).

In **Sri Lanka**, another low cost, user friendly telemedicine pilot project was launched in eight hospitals in five districts in the country. This system had a very simple interface which allowed data entry for consultation with medical experts on health problems and allowed expanded treatment and care in the field which also furthered medical education. This project was not carried forward due to lack of funding (Gunawardhana, 2004).

One view of a telemedicine system which allows healthcare professionals to use audio, video and data communication methods to diagnose and treat patients is shown in Figure 2-3.

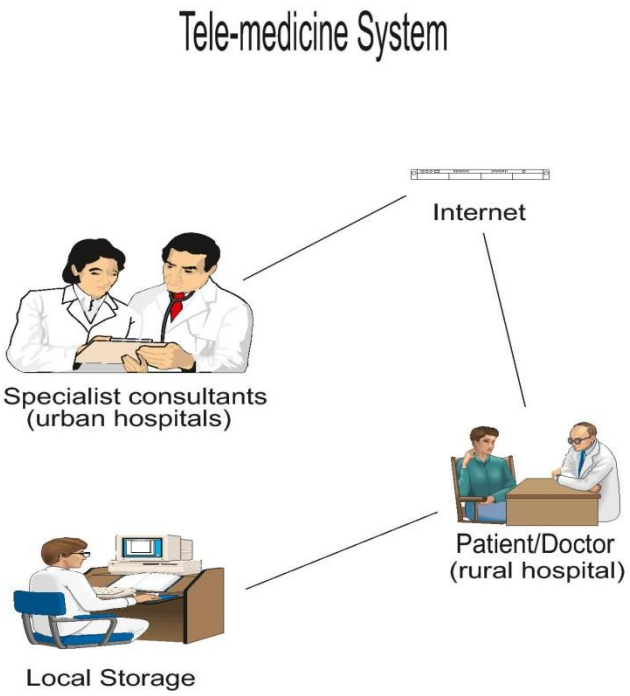


Figure 2-3 View of a telemedicine system

India introduced a telemedicine project to improve rural health. The project worked in conjunction with a rural kiosk which transferred medical information from rural areas to urban centres. Even though this was successful at the beginning, factors such as a lack of acceptability of the system by the villagers, a lack of awareness of the service, and the availability of competing services, caused a drop in the number of visits by patients to the kiosk (Elder & Clarke, 2007).

Indonesia developed a telemedicine system for primary community healthcare. This project introduced six PC-based medical stations for each referring hospital, health office and test laboratory. This project was not very successful because the human resource capacity building needed significant improvement. This project emphasised the importance of the human resource development component of implementing telemedicine systems in developing countries (Elder & Clarke, 2007).

Bangladesh: A telemedicine link was established between the Centre for the Rehabilitation of the Paralysed (CRP) in Dhaka and medical consultants abroad by the Swinfen Charitable Trust in the UK. This system used emails to transfer images captured using a digital camera. This system was successful since it required lower expenses and stress travelling abroad for second opinions (Vassallo et al., 2001).

In **Pakistan**, a telemedicine project was launched in conjunction with the state department, IBM and other organizations, to facilitate the treatment of patients in northern Pakistan. Virtual clinics on ENT, dermatology and radiology were introduced through this project (iHealthBeat 2008).

2.10 Summary

E-healthcare has become an important part of healthcare provision. Using Information and Communication Technology in healthcare has generated many different views and definitions of e-health from many authors across the globe. Most of the developed countries utilise the e-health technology in healthcare by balancing power between patients, medical professionals, industry and the state, whereas the LEDCs use less supportive infrastructure, less knowledge on applications, no proper understanding of the usefulness of e-health, and no proper national framework on e-health applications.

E-health can be considered from different perspectives.

- Clinicians' views on the positive and negative impact on the healthcare industry when using e-health applications
- Clinicians' and patients' positive and negative views about using the new technology
- The societal view of the new technology.

There are many different models of e-health applications used by the developed countries. Most developing countries have introduced EHR, HIS, telemedicine, tele-education, tele-health, health portals, tele-surgery and tele-care. Most developed countries, such as UK, have helped the developing countries adopt e-healthcare systems. For example, The Swinfen Charitable Trust (SCT) in the UK has been involved in providing specialist advice to developing countries such as Nepal in using digital cameras and email for tele-care (Swinfen & Swinfen, 2002). To improve tele-care in Western and Central Africa, the RAFT project (Réseau en Afrique Francophone pour la Télémedecine) has introduced tele-centres, helped in the development of the infrastructure in the teaching medical centres, established connections to international and national computer networks, and developed Internet access points in rural areas (Geissbuhler et al., 2003).

Most developing countries use mobile phones in healthcare to communicate with clinicians, call an ambulance or browse the Internet for health-related information. HL7 Standards are used mostly in developed countries to overcome the problems in the lack of interoperability in the healthcare industry.

Security is another major concern when considering telemedicine. The security concerns in telemedicine are authorization, authentication, accounting, security and privacy of the patient information.

In the world of e-healthcare, telemedicine has become important and widely used by LEDCs. This is mainly because telemedicine helps patients to reduce travel costs, reduce the number of physical visits to obtain health services, and reduce the time travelling long distances for better health facilities. Sri Lanka, India, Indonesia, Bangladesh and Pakistan have adopted telemedicine systems on a small scale which have been successful projects (Nishantha et al., 2005), (Gunawardhana, 2004), (Elder & Clarke, 2007), (Vassallo et al., 2001) and (iHealthBeat 2008).

Chapter 3. E-health in Sri Lanka

Sri Lanka has a very efficient government-funded healthcare system (Samarage, 2006). This health system comprises a mixture of medical intervention and traditional healing methods. Sri Lanka has a very efficient hierarchical hospital structure which covers the entire country. In rural areas, this still needs major improvements to become more efficient and to ensure the installation of the latest technology. The government of Sri Lanka faces many challenges in implementing the much needed e-healthcare system for its rural population.

3.1 Overview of the current level of healthcare in Sri Lanka

Although categorized as an LEDC, Sri Lankans have a life expectancy at birth of 75, literacy is at 90%, and the country provides free health care services to the entire nation (Samarage, 2006).

The health system of Sri Lanka is dominated by an Allopathic system of medicine which treats disease using drugs, radiation and surgery (MedicineNet, 2012). Most people however are accustomed to traditional methods of medicine such as:

Ayurvedic – originated in India, a treatment not only for treating disease but also used for people's general welfare. This method cures disease by strengthening the patient's immune system (P. L. N. de Silva, 2006).

Unani – originated in Greece, being not only limited to the treatment of some symptoms of disease but providing also a comprehensive approach both to curing disease and preserving health. The concept behind this medicine is the balancing of the body humours (Unani Lanka Medical Centre, 2012).

In Sri Lanka, the Ministry of Health and the Provincial Services are responsible for health awareness programmes, rehabilitation and disease prevention activities in the country (Samarage, 2006). In Figure 3-1 shows the curative services, the National Hospital being the largest hospital in Sri Lanka. 21 Teaching hospitals provide all specialist services and have a well-equipped accident service and several intensive care units. Three Provincial hospitals, 18 District hospitals and 66 base hospitals, which are situated in the larger towns, have a limited range of specialist services but well-equipped pathological laboratories and auxiliary services.

There are 483 Divisional hospitals that have lesser facilities and 475 Primary medical care units have just the basic in-patient facilities. The preventive services' personnel consist of the Medical Officer of Health (MOH), the Public Health Inspector (PHI), and the public health worker/the midwife (Ministry of health Sri Lanka, 2003).

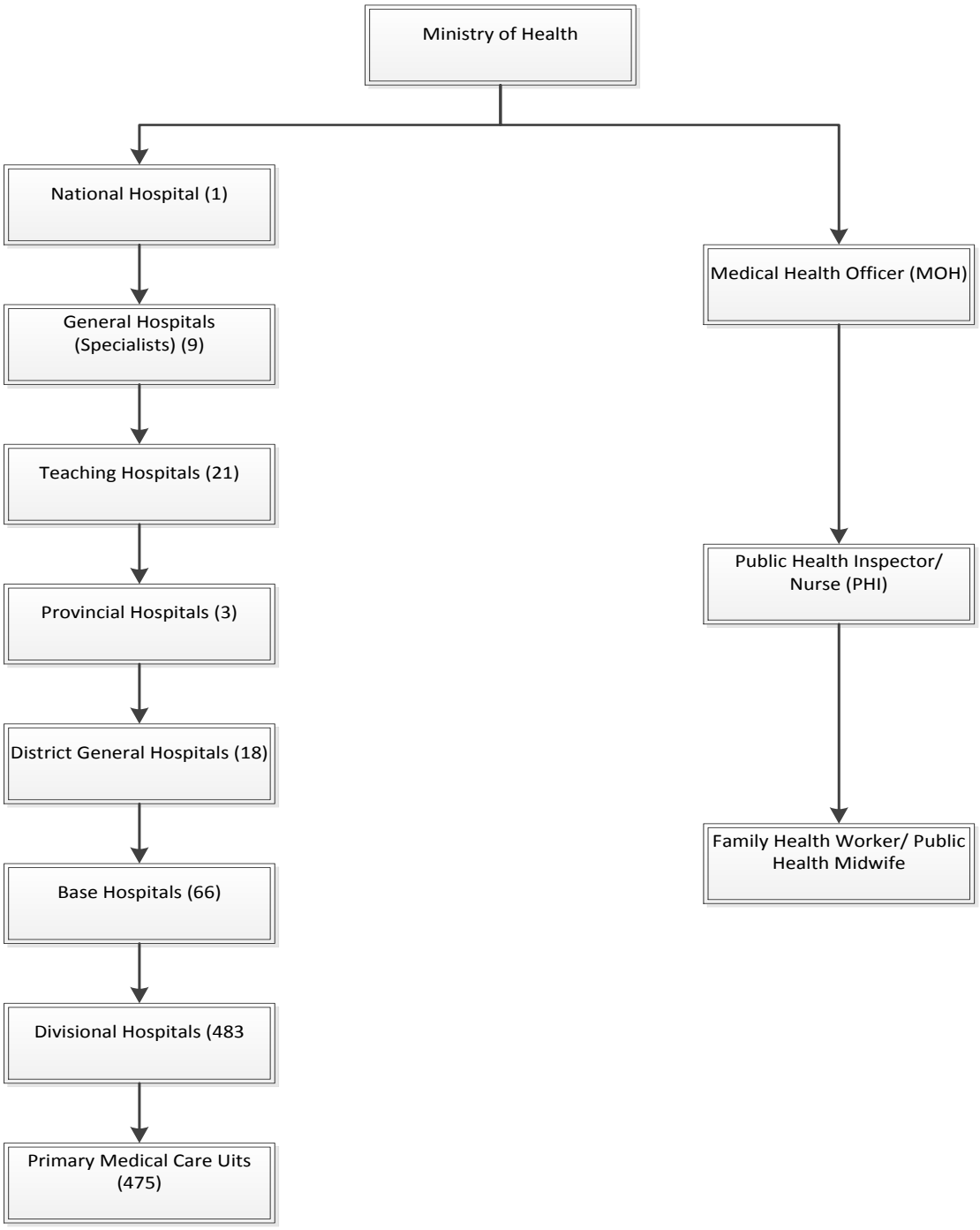


Figure 3-1 Health Organizational Structure of Sri Lanka

The number of hospitals in each category is given in brackets (Ministry of Health, 2011)

3.2 E-health initiative in Sri Lanka

Effective and efficient use of information technology can help the rural population of Sri Lanka to use identical facilities to those used by the country's urban population.

E-health support initiatives are provided by the Health Information Centre of the Ministry of Health, ICTA and the University of Colombo's School of Computing. Leadership support is given by the Health Informatics Society of Sri Lanka (HISSL). There are a few organizations like the WHO, the Ministry of Health and the University of Colombo who have launched telemedicine initiatives. The most successful so far are the VIdyuth DUrastha SUWAya (VIDUSUWA) telemedicine initiative from the Information and Communication Technology Agency (ICTA), and a NANASALA tele-consultation project from the University of Colombo (Rampatige et al., 2010).

A business model for e-health called BuduDas was developed by Yvonne Wickramasinghe, Dulindra Wijethilake and Dinusha Vatsalan in 2010 (Figure 3-2). The model identified the health institutes that are capable of accommodating an e-health solution. This model was used to test the sustainability in relation to economic, technological, anthropological stakeholder incentives and legal aspects of the system. The model had two phases: a background analysis and a sustainability check. This model was designed to identify the possibility of an e-Clinic in the rural hospital associated with the e-Consultation Clinic in the urban hospital managed by a consultant. The model connected the patient from the healthcare clinic located in the patient's area, via the internet to the consultant in the urban area. After implementing and testing the model at the Base Hospital Marawila (eConsultation center) and the District Hospital Dankotuwa, the results showed a significant decrease in time, cost and distance. This research was performed as action research and was backed up by a participatory approach (Wickramsinghe & Wijethilake, 2010).

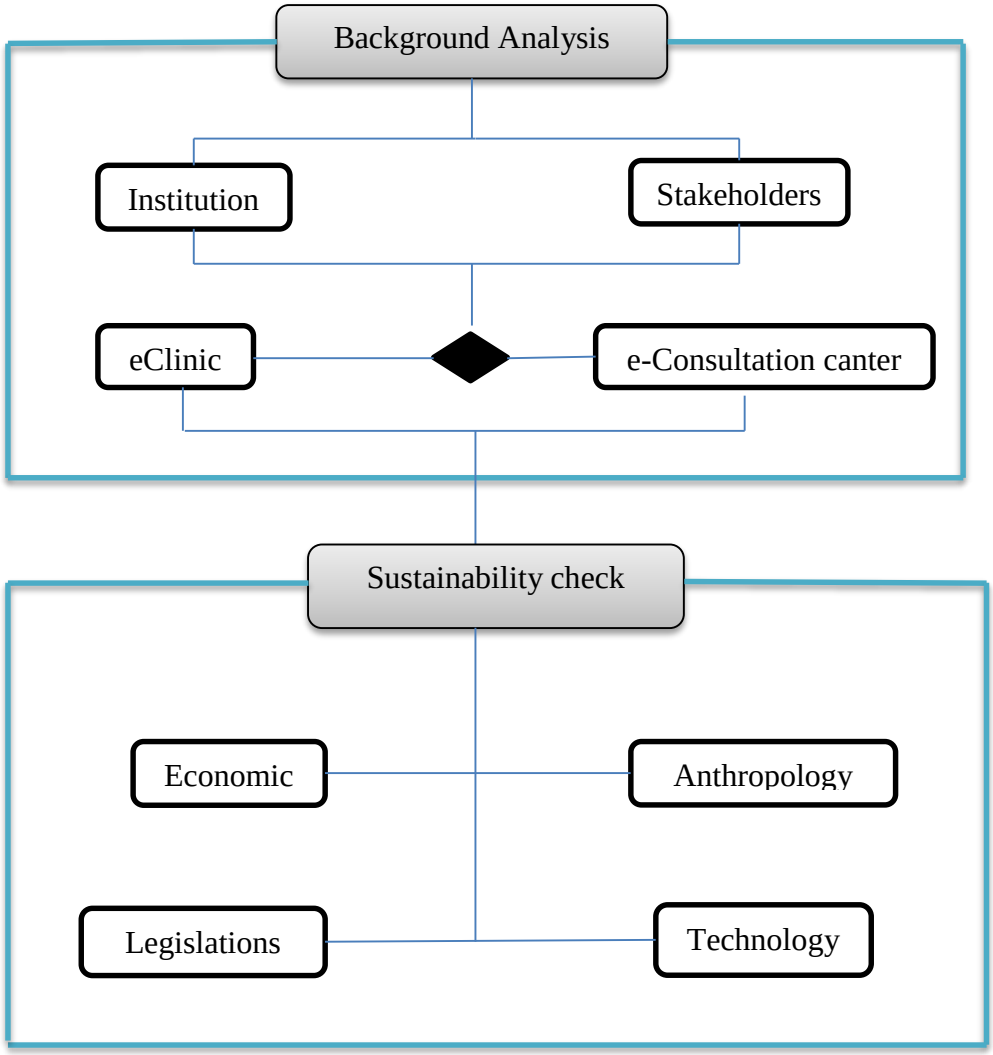


Figure 3-2 BudhuDas Business Model

(Wickramsinghe & Wijethilake, 2010)

Evidence from the action research conducted for the BudhuDas model suggests that prior to implementing an e-health system in rural areas, important factors such as the type of technology to use, patient safety, economic benefits, incentives for stakeholders, risk and legal issues, and research and development, should be considered (Wickramsinghe & Wijethilake, 2010).

The action research was conducted covering two hospitals in one district (Puthlum district). The model is a business one that does not actually focus on adoption of telemedicine. While

this is a good idea for an e-health system, the model has not been used since it was published. Although it could provide valuable information about the factors listed above, a new model was required to emphasise the adoption of telemedicine in Sri Lanka.

Even though LEDCs typically have comparatively poor information infrastructure, Sri Lanka is fortunate to have a very good telecommunication system, having fixed line connectivity to all the hospitals in the country. Introducing language-specific mobile phones has helped people overcome the language barrier which was a major problem faced by the government in introducing e-healthcare to Sri Lanka (Chapman & Arunatileka, 2010b).

Research has previously been conducted to find the barriers to implementation of an e-health solution Sri Lanka. Social factors, financial factors such as low income, transport costs, ignorance with regard to illnesses, superstitious and religious beliefs and a fear of using new technology, have each created a barrier to introducing e-health in the country (Chapman & Arunatileka, 2010b). However, adopting telemedicine will benefit all age groups by learning to use new technology, incurring lower costs in travelling to urban areas for consultations and help in the development of the country's infrastructure.

3.3 Problems faced in implementing a telemedicine system

Sri Lanka has adopted a healthcare system with elements from both developed and underdeveloped countries (Smith et al., 2007). One should acknowledge that, despite having a low level of annual expenditure on health services, those services have helped the country to achieve a relatively high status in health provision. Several factors have been identified which negatively affect the adoption of an e-health system. These are financial (transport cost, low income, etc.), low computer use among clinicians, the digital divide, low internet use, and the availability of alternative medicines. There are a number of other factors such as health policies and government procedures, infrastructure, staffing, ICT challenges and privacy, confidentiality and security issues, all of which reduce the take-up (Chapman & Arunatileka, 2010b).

3.3.1 Finance

Introducing e-health technologies has a significant impact on national expenditure. The total expenditure on health by the government of Sri Lanka in 2005 was 100,115 million LKR (US$ 996 million) which is equivalent to 4.2% of the Gross Domestic Product (GDP) (Rannan-eliya & Sikurajapathy, 2009). The main source of funding for e-health comes from

government and the two main donor organizations, the World Bank and the World Health Organization (Rampatige et al., 2010).

A shortage of nursing and paramedics, combined with the uneven deployment of current staff, are major problems for the human resources element of the health sector. Medical Officers and nurses migrating to other countries or are employed by private hospitals for better salaries, added to which the government lacks a proper human resources policy, are also major problems for the health industry (Samarage, 2006).

Difficulty in getting adequate funds for e-health projects, and fewer funds available to educate and train healthcare staff, are some of the main problems faced by the government of Sri Lanka.

3.3.2 Computer use among clinicians

Attitudes and perceptions of clinicians towards centuries of traditional methods have resulted in resistance to change. Most clinicians are reluctant to use a technology which is difficult to operate. Clinicians are also concerned when it comes to safety of the equipment and the technology used in their patient care (Hu, Chau, & Sheng, 2000). In Sri Lanka, government hospitals and clinics are very slow to introduce ICT compared to private hospitals which have a better ICT usage across the country. According to a survey conducted in 2008, only 1% of the clinicians in rural hospitals use computers in GP centres (Marasinghe, 2010).

3.3.3 Digital divide

The digital divide describes the gap between the people who have access to computers, and the skills to use them, and those who do not. This factor also has an impact on the introduction of an e-health system to rural areas of the country. This is mainly due to the income, age, gender, and the educational background of the people in Sri Lanka (Gamage & Halpin, 2007).

Computer literacy covers three levels of skill: basic, intermediate and advanced. Being able to use basic operating systems functions, using application software such as Microsoft Office packages and using the internet and email can be considered as basic and intermediate skills. The advanced skills include fixing software and hardware problems and programming. Computer awareness is defined as knowledge of the fundamentals of computers, internet, social ethical and legal issues, the ways that computers are used in society, and occupations related to computer use (Tharanganie, Wickremasinghe, & Lakraj, 2011).

The map shown in Figure 3-3 indicates a level of computer literacy (basic and intermediate) in the country, which is very low in the rural areas compared to the urban areas.

The Media Centre for National Development of Sri Lanka has found that, just 22% of males and 19% of females have basic and intermediate computer literacy. To improve computer literacy among the general public, training is carried out by private institutes, schools and universities in the rural and estate sectors, as well as by government training centres (Media Center for-National Development of Sri Lanka, 2010). This information provides some hope for the implementation of an e-health system in the future, see Table 3-1.

Table 3-1 Computer Awareness and Computer Literacy rate in the Residential and Provincial Sector

adapted from Department of Census and Statistics (Department of Census and Statistics, 2009)

Sector/Province	Computer Awareness (%)			Computer Literacy (%)		
	2006/07	2009	Increase (%)	2006/07	2009	Increase (%)
Country Average	37.1	43.8	18.06	16.1	20.3	26.09
Sector						
Urban	47.4	60	26.58	25.1	31.1	23.90
Rural	36.9	43	16.53	15.1	19.3	27.81
Estate	10.3	15.8	53.40	4.3	8.4	95.35
Province						
Western	47.9	50.7	5.85	23.2	27.7	19.40
Central	31	34.8	12.26	14.8	18	21.62
Southern	43.2	45	4.17	15.6	19.6	25.64
Eastern	31.5	46.6	47.94	11.4	12.9	13.16
North Western	31.8	42.1	32.39	12.6	16.5	30.95
North Central	27.5	40.4	46.91	8.9	14.1	58.43
Uva	22.3	29.3	31.39	9.9	14.7	48.48
Sabaragamuwa	30.2	44.6	47.68	12.3	19.1	55.28

Between 2007 and 2009, computer literacy and computer awareness increased by 26% and 18% respectively. One can also conclude that the estate sector has increased rapidly from 2006 to 2009 in terms of computer awareness (53%) and computer literacy (95%). Next comes the rural sector, with the least increase in computer awareness and computer literacy found in urban areas.

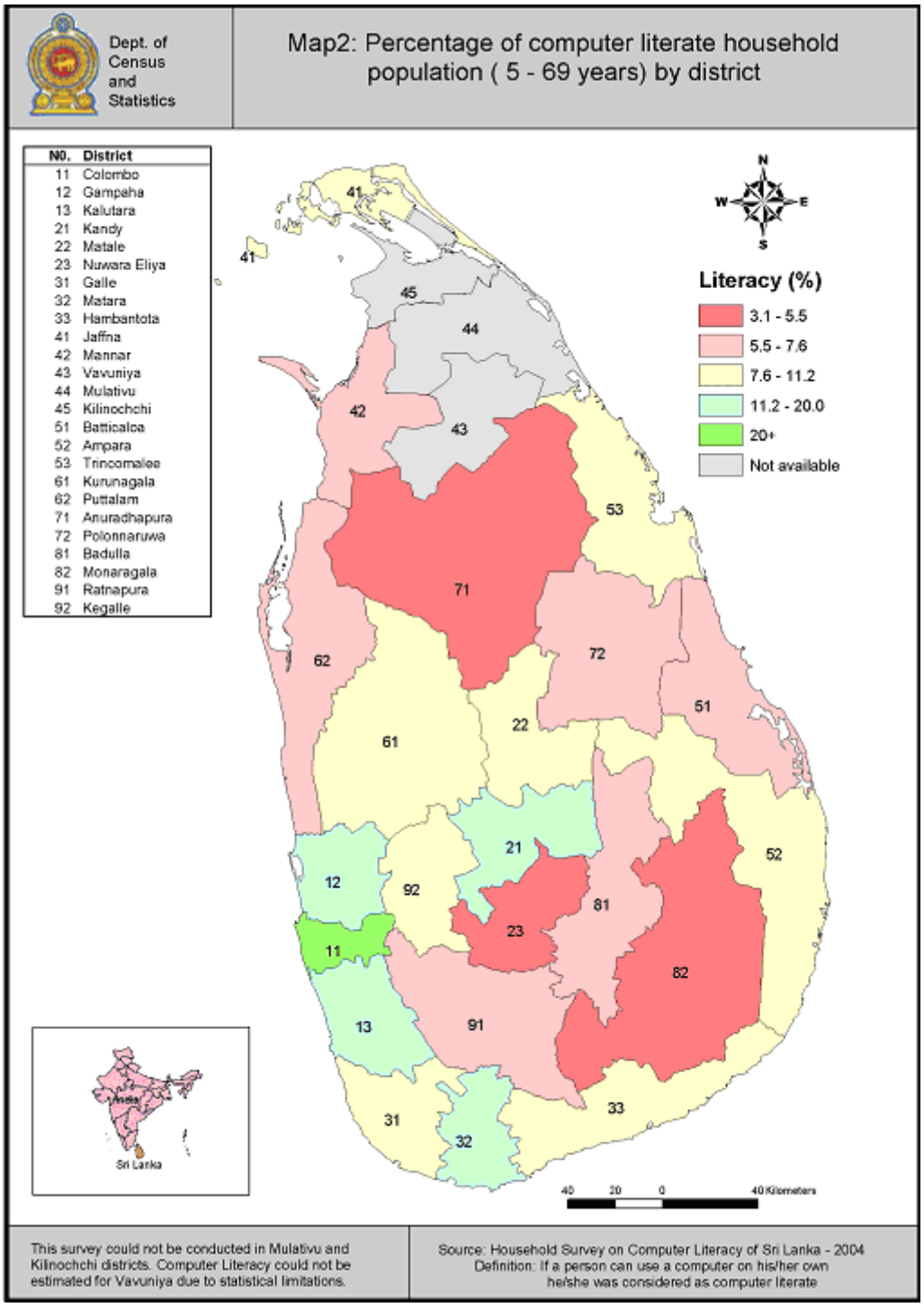


Figure 3-3 Computer literacy of Sri Lanka by district

reproduced from Department Census and Statistics (Department of Census and Statistics, 2004)

The results show that, even though in urban areas computer awareness and literacy is much higher than in the other two sectors, increase in the computer literacy and the awareness in both rural and estate sectors demonstrates that people are showing an interest in learning to use computers.

The increase in computer literacy and awareness indicates that people have the ability to learn and use the facilities of the internet if the opportunity is given to them (Table 3-1). Adequate funding by the government to increase computer awareness and learning will help educate the people who in turn are more likely to adopt e-health solutions.

3.3.4 Internet use

Internet use is another factor that the government needs to consider when planning to implement an e-health system. The cost of equipment, literacy, Internet service providers and coverage are some of the barriers the government are currently facing in implementing such a system (Marasinghe, 2010).

The number of people using computers in the urban sector is much higher (23.6%) compared to the rural sector (9.2%), and the estate sector is the lowest at only 3.1%. Comparing computer awareness by sector, in urban areas it is 60% but a very low 15.8% in the estate sector. The Western province has the highest computer awareness at 51% as well as e-mail use of 18.5% compared to the other eight provinces (Media Center for-National Development of Sri Lanka, 2010).

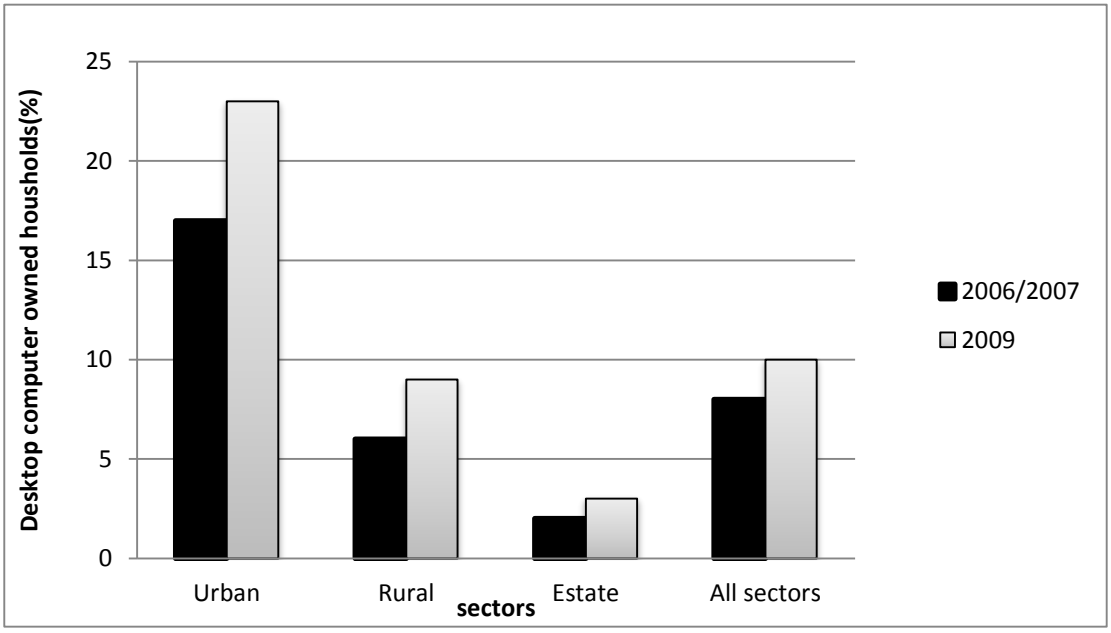


Figure 3-4 Desktop computer owning households by Sector: 2006/2007 and 2009

adapted from Department of Census and Statistics (Department of Census and Statistics, 2009)

Figure 3-4 reflects the level of affordability of buying computers in rural areas, Users of computers find it difficult to buy computers in rural areas, and there is a lack of computer literacy among the rural population. This gives some idea of the difficulties faced by the

government in implementing an e-health solution. It can be seen that the number of computer owning households is much higher in urban areas. Rural areas and the estate sector have a low percentage of computer ownership, mainly due to the income earned by people in these areas being very low compared to those in urban areas.

3.3.5 Alternative medicines

Having an alternative medical system like Ayurveda present also causes a problem when implementing a system. People in rural areas believe in traditional alternative medicines that have been passed on for generations. Ayurveda, (Ayu – life and Veda – knowledge), the science of life as it is called, was introduced to Sri Lanka by Indian doctors as early as the third century B.C. This approach treats not only disease but is also used for general wellbeing. Most people in rural areas still rely on alternative medicine (de Siva, 2006).

3.3.6 Health policies and strategies

Ever-changing health policies due to political changes in the Ministry, combined with not having a proper policy for e-health, are hindrances to implementing a system. The most up to date health policy of the government is to reduce disability, health problems, preventable diseases and to improve health promotional activities in order to increase both life expectancy and quality of life of the people of Sri Lanka (Annual Health Bulletin, 2003).

According to the Information and Communication Agency of Sri Lanka (ICTA) Act in 2003, easy access to government information and services for citizens, managing ICT resources properly, and developing ICT competence among government employees, are some of the policies introduced by the ICTA to improve the e-health sector in the country (Information and Communication Technology Agency of Sri Lanka (ICTA), 2009).

3.3.7 Infrastructure

If a country is to adopt telemedicine, sufficient infrastructure should be provided in the rural areas to allow systems to have the capacity to gather and exchange images, data and other health information (Hein, 2009).

Physical needs such as state of the art hospital equipment, computer equipment, internet connectivity and transportation in rural areas are some of the major problems faced by the government when developing a proper infrastructure to implement an e-health facility.

Those responsible for health services in the country are the Central Ministry under the Cabinet Minister who is the head of the health services in the country, where protection and

promotion of the people's health is managed. The Provincial Directors of Health Services are responsible for the effectiveness of the health services in their respective provinces (Annual Health Bulletin, 2003).

The rural population makes up 77% of the total population of the country. Considering the health facilities available in a country which has 2.9 beds per 1000 head of population and 0.041 physicians per 1000, Sri Lanka faces a major crisis in the health care sector. Another major problem is that most of the hospitals that have state of the art technology and specialist physicians are in urban areas. Patients living in rural areas have to travel great distances to receive the best medical consultations and facilities in the country (Smith et al., 2007).

The distribution of health care professionals, and the low level of facilities on offer, has caused problems to people in the rural areas in using the latest health services and facilities in the country (Perera, 2009).

3.3.8 Staffing

Staffing is another major problem faced by the health ministry. Improper hospital management has resulted in doctors admitting too many patients which produce overcrowded work environments. This in turn impacts on the limited number of hospital staff available. Inadequate recruitment of students into state nursing schools, limited facilities to educate nurses, poor working conditions, poor salaries and overcrowded working environments are some of the major reasons for there being insufficient nursing staff in the hospitals (B. S. De Silva & Rolls, 2010).

According to the Annual Health Bulletin 2004/2005, most of the specialized consultancies such as in neurosurgery, oncology, and oncological surgery, are mainly situated in urban areas. This causes a major problem for patients in rural areas requiring such specialist consultations when considering the travel time and the money they have to spend (Chapman & Arunatileka, 2010b).

3.3.9 ICT Challenges

The problems that have caused a major setback in implementing an e-solution to the health sector are: a lack of e-literacy among hospital staff, a lack of computer equipment in peripheral hospitals, insufficient funds to implement the system and to train hospital staff, no proper ICT policy, and poor internet connections between hospitals. These are some of the major issues faced by the Sri Lankan government in implementing a system (Boutilier, 2008).

Another important factor is the e-Readiness of the community. e-Readiness in e-health means to what degree the community is prepared to learn and participate in e-health application and how far the community is willing to accept or reject the change (Jennett et al., 2003).

3.3.10 Privacy, confidentiality and security issues

The Introduction of e-health should consider the protection of the privacy and confidentiality of patient data by having a government professional body that could provide advice to patients. Therefore it is mandatory to have a reputed professional medical organisation to observe and regulate the universally accepted norms of ethical conduct. Telecommunication service providers also have a major role in introducing e-health where they should have the technical capacity in providing quality standards to protect client's privacy and confidentiality of data (Siriwardena, Hewage, & Dissanayake, 2013).

Sri Lanka does not have any legislation covering the storage of patient data in digital format. The only legal document is the manual patient record, where only authorised people can have access to patient records (Rampatige et al., 2010).

The Computer Crimes Act of 2007 has been implemented to reduce unauthorised access to computers, programs, data and information and to improve data protection. The government has adopted a Data Protection Code of Practice to educate people regarding security issues related to computers (Information and Communication Technology Agency of Sri Lanka (ICTA), 2009).

3.4 Summary

When comparing the models of e-healthcare in the West with e-healthcare in LEDCs, the West has made enormous advances in implementing e-health solutions.

There are many e-health supportive initiatives provided by different organizations in the country. With the help of donor organizations, some telemedicine pilot projects were started on a small scale which were not very successful.

A business model (BudhuDas) was developed in 2010 in Sri Lanka to identify the capability of introducing an e-health solution. The model was designed to identify possible e-Clinics in the rural areas with an e-Consultation clinic in the urban hospital. This was a business model and the action research was carried out in only one district of the country. The model, which was not been used since, suggests that a new model is required to emphasise the adoption of telemedicine in Sri Lanka.

Sri Lanka has implemented a very good healthcare system compared to other LEDCs (Samarage, 2006). Even though Sri Lanka has a very good telecommunication system to all the hospitals in the country, it still faces many challenges in implementing an e-health solution.

The main reasons discussed are:

- An uneven distribution of consultants, most of them being located in urban hospitals that have the latest technologies is one of the problems faced by rural people.
- Financial factors such as costs incurred when travelling from rural areas to urban hospitals for consultations and obtaining medical reports being another problem faced by the rural population.
- A lack of computer and Internet use among clinicians, hospital staff and the general public. The rural population earning a low income, due to the lack of highly paid jobs in those areas, meaning they have to think twice before purchasing a computer.
- The lack of E-readiness of the rural population.
- The lack of infrastructure in rural hospitals.
- Staffing issues.
- Alternative medicines.
- The lack of health policies and procedures.
- Privacy, confidentiality and security issues.

The next stage of this research was to confirm the issues people in the rural areas have faced in having an e-health solution. An exploratory study was conducted in January 2013 in both rural and urban areas of Sri Lanka with the participation of clinicians, hospital staff, the general public and senior managers using questionnaires and interviews to confirm the issues.

Chapter 4. Methodology

4.1 Introduction

This chapter explains the research methods used in the exploratory study, and in the main study, both conducted in Sri Lanka. The methodology used in the research is discussed in section 4.3. In section 4.4 in-depth discussion about the research methods used in the exploratory study is provided. That section also looks at the questionnaire design, and the interview question design, used in the exploratory study. The online survey conducted after the exploratory study to confirm the factors of the TMSL model is also discussed in this section. The research method used in the main study is discussed in section 4.5. In-depth discussion about the questionnaire design for the main study is discussed in section 4.7. Interview question design for the main study is discussed in section 4.8 and the field work carried out during the main study is explained in section 4.9.

4.2 Research Methods

The exploratory study and the main study used both quantitative and qualitative research methods. This section will discuss the different research methods used in this research.

4.2.1 Qualitative research

Qualitative data provides open-ended information. This method allows the participants to answer questions using their own words and ideas. Qualitative data can also be gathered using private (diary) or public sources (minutes and meetings) (Creswell, 2006).

The main process of gathering data is through narratives (verbal and textual) and observations. Most of the qualitative research is conducted through field work. Most of the reports include personal voice and expressive language and qualitative research uses text as data. Qualitative data cannot readily be reduced to numbers (Anderson, 2010).

The most common method of collecting qualitative data is through interviews. There are four types of interview (Rogers, Sharp, & Preece, 2011).

1. Unstructured interviews – these are open-ended questions with an interview structure more like a conversation between the interviewer and the interviewee. These questions can explore different options about the topic.

2. Semi-structured interviews – these are a mixture of both closed and open-ended questions where structured and unstructured interview techniques are combined. Questions are prepared before the interview and the interviewee can explain the question in detail at the interview.
3. Structured interviews – these ask closed questions. These questions are short and clearly worded. For all the participants, the same worded questions and the same order have to be adopted.
4. Focus groups – this method is used when interviewing a group of people together. The discussion is led by a facilitator and the group often consists of three to ten people. Individual ideas about the topic are discussed in focus groups.

Since interviews come under the category of open-ended questions when using face-to-face interviews as part of qualitative research, the interviews take a more personal form than the questionnaires. This type of interview helps the interviewer to interact directly with the interviewee and allows for an opportunity to ask follow-up questions of the interviewee (Valenzuela & Shrivastava, 2007).

The exploratory study and the main study both used semi-structured interviews during the studies conducted in Sri Lanka. Semi-structured interviews were used to allow the respondent to talk about their opinions on the subject in detail and depth. This helped to gain an understanding of the respondent's points of view about the subject.

4.2.1.1 Content analysis

During the exploratory study and the main study of this research, content analysis was used to analyse the textual data. In qualitative content analysis, the focus is on the characteristics of the language used as a contextual meaning of that narrative. The text data can be in print, electronic or verbal form. These narratives can be obtained from interviews, open-ended questions, narrative responses, focus groups or print media (manuals, books or journals) (Hsieh & Shannon, 2005).

According to Hsieh and Shannon (2005) there are three approaches to content analysis.

1. Conventional: the data is collected through interviews and open-ended questions. This approach also uses participants' comments.
2. Directed: this approaches a structured approach to validate a theoretical framework or theory.

3. Summative: this approach uses latent content analysis by discovering the underlying meaning of the word and identifying and quantifying the words in the text (Hsieh & Shannon, 2005).

The exploratory study and the main study used a conventional approach to content analysis; both studies used interviews and a participant's comment box in the questionnaires. NVivo software was used to interpret the content of the comment box by classifying it using codes and by identifying themes.

4.2.2 Triangulation

Triangulation is a method of combining methodologies in a study. Triangulation can have other meanings such as "within-method" which collects and interprets data within a given method by using multiple techniques. Testing the external validity is done by using the "between-methods" (Jick, 1979).

Four different approaches to triangulation can be undertaken (Rogers et al., 2011).

1. Triangulation of data – data is gathered from different people, different places and different sources.
2. Investigator triangulation – collecting and interpreting data is done by using different researchers.
3. Triangulation of theories – viewing the data using different frameworks.
4. Methodological triangulation – using different data gathering techniques.

Triangulation of data was used in the exploratory study. The three approaches involved in gathering data were: interviews with experts in the healthcare such as Ministry of Health officials, medical directors and consultants; questionnaires distributed to clinicians, hospital staff and the general public; a literature review undertaken stating the problems faced by the government and the general public in rural areas before the exploratory study.

4.2.3 Quantitative research

Responses to questions can be in different forms (Rogers et al., 2011). Check boxes and ranges is one form of answering questions. Another form of answering questions is using a rating scale. Though there are a number of different rating scales, the two most commonly used are the Likert point scale and the semantic differential scale. The Likert point scale is used to measure opinions, attitudes and beliefs, while the semantic differential scale is used to measure the cognitive meaning of objectives.

Quantitative research uses close-ended questions. Closed information can be gathered by testing people's behaviour, attitudes and performance (Creswell, 2006). Quantitative results may be illustrated by tables and graphs from raw data. This data can be either numerical or categorical such as "Yes" and "No" answers. Data in quantitative research is suitable for statistical analysis (McLeod, 2008).

A quantitative research method is used to analyse the answer to a set of questions related to particular chosen variables asked from the sample population so as to illustrate and predict human behaviour. There are two types of question, structured and unstructured. The structured questions are mainly used in quantitative research where answers are related to opinion based questions. Unstructured questions use open-ended questions (Acharya, 2010).

4.2.3.1 Determination of required sample size

G*Power is a software program used to perform power analysis for comparing means which calculates the sample size necessary to achieve a given level of power. *A priori* power analysis is used when designing a study. In *a priori* analysis, the sample size is calculated using the pre-specified significance level alpha, required power level (1–β) and the population effect size to be detected with probability (1–β) (Field, 2009).

In calculating the sample size, type one and type two statistical errors need to be considered. Type one error (α) occurs when the true null hypothesis is rejected, which means the null hypothesis is wrongly rejected. By convention alpha is set between 0.01 and 0.10. Type 2 error (β) occurs when the null hypothesis is not rejected when it is false. By convention beta is between 0.05 and 0.20 (Banerjee, Chitnis, Jadhav, Bhawalkar, & Chaudhury, 2009).

Finally in order to calculate an appropriate sample size, the effect size needs to be calculated. The effect size is a measure of the strength of a phenomenon. By convention, effect size = 0.3 for small effects, effect size = 0.5 for medium effects, and effect size = 0.8 for large effects (Cohen, 1977). The effect size is obtained by calculating the difference between the Mean of the control group and the Mean of the experimental group divided by the standard deviation (Banerjee et al., 2009).

According to Hair, Blake, Babin &Anderson (2010), degree of freedom provides a measure of how restricted the data are to reach a certain level of prediction. Degree of freedom is calculated from the total number of predictions minus the number of estimated parameters (Hair, Blake, Babin, & Anderson, 2010).

The definitions of the statistics used in the research are given below (Field, 2009).

One tailed test is a test of a directional hypothesis and two tailed test is a non-directional hypothesis.

The mean or arithmetic mean, $\bar{x}$, for n samples is given by:

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \cdots + x_n}{n}$$

The population mean is given by, for a population of N:

$$\mu = \frac{\sum_{i=1}^{N} x_i}{N}$$

Standard deviation of the sample:

$$s = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Standard error of the mean

$$SE_{\bar{x}} = \frac{s}{\sqrt{n}}$$

For the population N, the standard deviation is computed as above and equals σ, hence the true standard deviation for the population is given by:

$$SD_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

These two values will become equal as n approaches N.

4.2.3.2 Independent two sample t-tests

Independent two sample t-tests are used to determine whether there is a statistically significant difference between the means of two groups. This is an inferential test and tells whether the null hypothesis should be accepted or rejected (Field, 2009). This method was used in the exploratory study to compare the means of the rural and urban groups.

4.2.3.3 One sample t- test

One sample t-test is used to determine whether there is a significant difference between the sample mean and the hypothesised value (Field, 2009). t-tests were used in the main survey

to compare the negative and the positive impact of the components and the variables used in the model for the clinicians, hospital staff and the general public, which addresses the adoption of telemedicine in the rural areas of Sri Lanka.

4.2.3.4 Multivariate Analysis of Variance (MANOVA)

MANOVA is used to test for differences between groups. It determines whether the vectors of the means for two or more groups are sampled from the same population. Therefore MANOVA includes all the dependent variables in the same analysis which helps to reduce the type 1 error (Field, 2009).

MANOVA was used in the main study rather than individual ANOVA's because MANOVA maintains the type 1 error rate at alpha and it has the power to detect whether groups differ along a combination of dimensions when testing the differences between the rural and urban groups.

4.2.3.5 Cronbach's alpha

Cronbach's alpha is used to measure the internal consistency of a questionnaire. The items should all measure the same thing which can be correlated with one another. When the correlations between the items increase, Cronbach's alpha also increases. Cronbach's alpha is affected by the test length (Tavakol & Dennick, 2011). Questionnaire items need to have internal consistency because they need to measure the given variable. These items should correlate with each other (Blan & Altman, 1997).

The internal consistency of the questionnaires given to the participants during the main study was evaluated using Cronbach's alpha.

4.2.3.6 Pearson's correlation

To measure the strength of a linear association between two variables, Pearson's correlation coefficient method was used. This is represented in a sample by *r*. The coefficient ranges from –1 to +1. If *r* is closer to –1 or +1, then the linear association is said to be stronger. If *r* is closer to zero, then the linear association is said to be a weaker (Sedgwick, 2012). In a positive correlation, an increase in the first variable corresponds to an increase in the second variable. Where an increase in one variable corresponds to a decrease in the other variable, the correlation coefficient is then a negative correlation (Taylor, 1990).

Pearson's correlation was used in the main study to determine the correlation between the *Adoption of telemedicine* and the related variables associated in relation to the clinicians, hospital staff and general public.

4.2.3.7 Factor analysis

Factor analysis determines the number of factors in a set of data and how each variable loads onto the factors. Some variables will load more and other variables will not load very much onto the factors. The variables which do not load much onto the factors are not contributing to the factor structure. Such variables are said to have less communality. The variables which participate in the factor structure are said to have high communality.

Two major techniques are used to find the factors in the data. (1) Principle Component Analysis (PCA), which assumes that all variables are contributing fully to the factor structure and therefore the communalities are all set to one, and (2) Principle Axis Factoring (PAF), which does not assume all the variables are contributing completely. Instead, PAF estimates the degree of participation and inserts communality values (Field, 2009).

Factor analysis was used in the main survey to determine the number of factors in the model and how the variables loaded onto each factor. To find the factors in the data collected from the main survey, PCA was used because, theoretically, the research suggests that all the variables are contributing completely to the factor structure and the communalities are all set to one.

4.2.4 Mixed Methods Approach

The mixed methods approach uses both qualitative and quantitative research. The main aim of the mixed method approach is to minimise the weaknesses of both the quantitative and qualitative studies in a single research study (Johnson & Onwuegbuzie, 2004).

The mixed method approach provides a better understanding of the research problems rather than using the qualitative and quantitative approaches alone. The mixed method approach provides three ways to mix the data: merging the two datasets by bringing them together, connecting the two datasets by building one on the other, and embedding the dataset by providing support for one dataset from the other dataset (Creswell, 2006).

4.3 Overview of the methodology used in the research

The development and evaluation of the TMSL (TeleMedicine in Sri Lanka) model used a number of research methods, as illustrated in Figure 4-1.

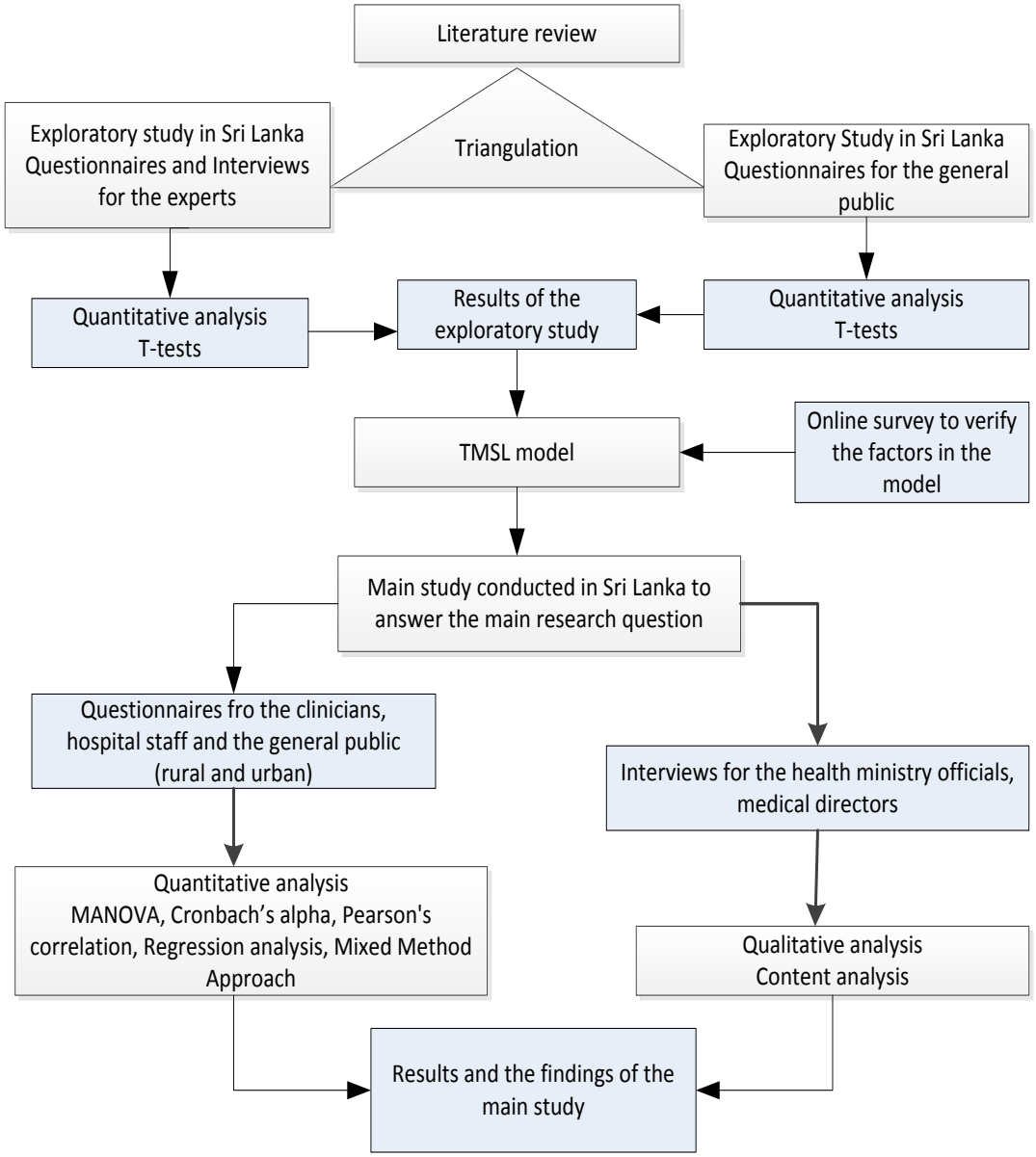


Figure 4-1 Overview of the methodologies used in this research

First the triangulation method (see Section 4.2.2) was used to gather information. An exploratory study (see Section 4.4) was conducted in three districts of the country – these being an expert review with health ministry officials, medical directors, clinicians and hospital staff, questionnaires for the general public and a review of the literature about e-health, the three aspects being triangulated. The results of the exploratory study led to the development of the TMSL model, discussed in Section 6.3. An online survey (see Section

4.4.5) was conducted from a randomly selected sample of the general public to determine the validity of the components of the model.

Next a main study (see Section 4.5) was conducted in ten districts and two islands of the country to answer the main research question using the TMSL model. The research methods used in the study were qualitative research (see Section 4.2.1) and the quantitative method (see Section 4.2.3). The qualitative research method used content analysis to analyse the text data collected during the interviews and the *comments box* in the questionnaires. The results obtained came from using several quantitative tools. MANOVA (see Section 4.2.3.4) was used to measure the differences between the two groups, rural and urban. Cronbach's Alpha (see Section 4.2.3.5) was used to measure the reliability and consistency of the questionnaires given during the main study to clinicians, hospital staff and the general public in the two areas of the country rural and urban. Pearson's correlation (see Section 4.2.3.6) was used to measure the strength of linear association between two variables in the model. One sample t-test was used to determine whether there was a difference between the sample mean and the hypothesized value (see Section 4.2.3.3), and factor analysis was used to determine the number of factors in the dataset and how each variable loaded onto each factor (see Section 4.2.3.7).] The mixed method approach (see Section 4.2.4) was used to minimise the weaknesses in the qualitative and the quantitative results of the study.

4.4 Exploratory study

This section describes the exploratory study conducted in January 2013 in rural and urban areas of Sri Lanka examining the challenges faced by rural and urban clinicians, hospital staff and the general public.

4.4.1 Target locations for the exploratory study

Sri Lanka has a population of approximately 20.2 million people of whom 9.8 million are males and 10.4 million females (Department of Census and Statistics 2012). The country comprises nine provinces divided into 25 districts. 84.9% of the people live in rural areas and 15.1% live in urban areas (Trading Economics 2012). During the exploratory study, a visit to the districts of Kandy, Matale and Colombo gave a better understanding of the distribution of the population in the country (Figure 4-2), information crucial to analysing the need for a telemedicine system in Sri Lanka. The more populated areas provide a better chance of enjoying improved facilities than the less populated areas. Figure 4-2 provides the details of the population by district and identifies the districts the exploratory study was conducted in.

In order to understand the issues faced by the rural population in having an e-health solution, interviews and questionnaires were conducted in several parts of both rural and urban areas of Sri Lanka.

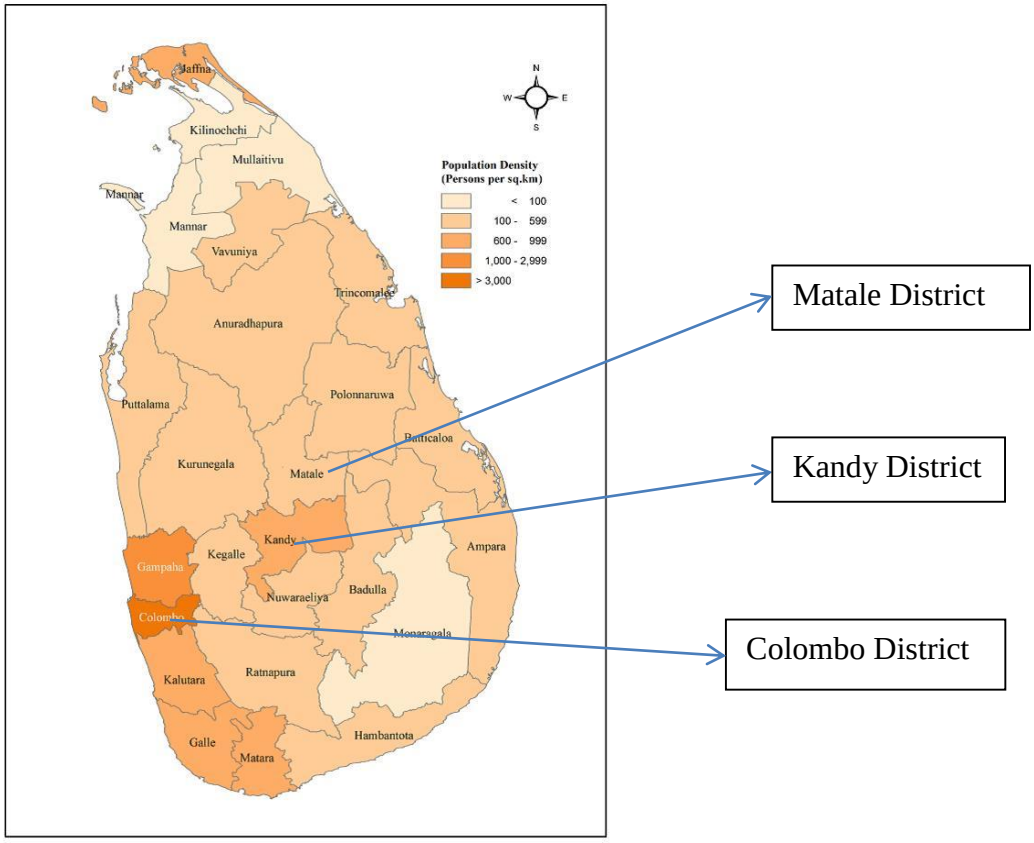


Figure 4-2 Areas used for the exploratory study showing their population densities

Reproduced from (Depatment of Census and Statistics, 2012)

4.4.2 Research method used in the exploratory study

To discover the attitudes of the rural population regarding introducing telemedicine, a study was conducted in three districts: Colombo district (population density 300+ per km^2), Kandy district (600-999 per km^2), and Matale district (100-599 per km^2). The study was conducted by distributing questionnaires to the general public, clinicians and hospital staff of both rural and urban areas. The expert review was obtained by interviewing several ministry officials, medical directors and clinicians from both rural and urban areas.

An online survey was conducted from a selected sample of the general public to determine the validity of the variables of the model.

The sample size was calculated using G*Power calculations with the statistical test:

means – the difference from the constant (one sample case)

The total sample size was determined to be 13 participants per group, where the two groups were from the rural and the urban areas.

A four-point Likert scale was used in this survey to allow only for definite choices of opinion to be made by respondents so avoiding a neutral answer. The scale as used in the survey is sound provided that it does not affect the reliability of responses (Garland, 1991). The sample size was based on the data given in Table 4-1.

$$Effect\ size = \frac{\text{mean of the experimental group } (2.5) - \text{mean of the constant group } (2)}{\text{Standard deviation } (0.5)}$$

The hypothesis was tested using t-test calculations. H_0 (null hypothesis) means there is no effect from the predictions. H_1 (alternative hypothesis) means there will be an effect presented from the predictions. Statistical significance provides a probability that a score could have arisen by chance. The Null hypothesis will be rejected if and only if the *p* value is less than the significant level of 0.05. In this research, $\beta = 0.1$ by convention (Banerjee et al., 2009).

Table 4-1 Minimum Sample size using the G*Power calculations

t tests - Means: Difference from constant (one sample case)

Tail(s)	t	2
Effect size	d	1
α error prob.	α	0.05
Power (1–β err prob)	1–β	0.9
Degree of freedom	df	12
Minimum sample size		13

An exploratory study was conducted in several parts of both rural and urban areas of Sri Lanka. The questions were given to the following to answer: 13 clinicians from rural hospitals, 11 clinicians from urban hospitals, 15 hospital staff from rural hospitals and 19 hospital staff from urban hospitals. The exploratory study was conducted amongst 13 members of the general public from rural areas and 13 members of the general public from urban areas of Sri Lanka. The questions were designed in Sinhalese, and also in English.

4.4.3 Interview design

The interviews were designed using semi-structured questions. This technique allows the interviewee to expresses his or her feelings about a particular question using their own words and perspectives (Kvale, 1996). Semi-structured interviews have many advantages and disadvantages in research. The main advantage is that they can provide much more detailed

information than that available through other data collection methods. During semi-structured interviews, the interviewer can gather lot of extra information from the interviewee through the social cues such as voice, body language, etc, of the interviewee, which can be an advantage when gathering information. Another advantage is to arrange the time and the place according to the preference of the interviewee. Termination of the interview is also easy during a semi-structured interview (Opdenakker, 2006).

The disadvantages of using semi-structured interviews are the reliability of the response can introduce bias. This can depend on how the questions are asked and how the respondent answers the question. Another disadvantage is that the sample size is usually small because each interview can last for a long time. Therefore the results can have a bias in representing a particular population. The validity of the questions also may be a disadvantage because there is no real way of knowing whether the respondent is lying (Phellas, Bloch, & Seale, 2012).

24 participants were interviewed during the exploratory study. The study included experts from the health sector, clinicians, hospital administrative staff, nurses, and technicians from both rural and urban hospitals to identify the appropriate model for adopting telemedicine. The interviewees were contacted prior to the interview through personal contact to arrange a suitable time and venue for the interview. Before the interview, the researcher explained the purpose of the interview and how the interview was going to be conducted. The interviews were recorded using a LiveScribe pen with consent of the interviewee. Most of the interviews were conducted in Sinhalese while some interviews were conducted in English. (Appendix B lists the interview questions in English). Table 4-2 gives details of the participants who were interviewed from both rural and urban areas of Sri Lanka and Table 4-3 provides detailed links between the theories, methods, area, participants and the question numbers during the exploratory study.

Table 4-2 Participants who were interviewed from the rural and urban locations of Sri Lanka

Position	Number	Location
Senior managers: ministry officials, medical directors, consultants	4	Urban
Clinicians	3	Urban
Technicians	4	Urban
Nurses	4	Urban
Clinicians	4	Rural

Position	Number	Location
Administrative staff	3	Rural
Nurses	2	Rural
Total number of participants	24	Rural and Urban

Table 4-3 Connection between the Interview questions, theory and methods

Question	Theory	Area	Participants	Question No	Reference
What are the problems faced by the patients in the rural area in obtaining the health facilities which are offered in the urban hospitals?	TRA, TPB, MPCU	Culture	Experts	2,3 (Figure 4-3) 1 (Figure 4-4)	(Venkatesh et al., 2003)
	TAM	Culture	Clinicians and the Hospital staff	2,3 (Figure 4-3) 1 (Figure 4-4)	(Djamasbi et al., 2009)
What are the problems faced by the government in introducing the system?	TPB,MPCU	Technology Infrastructure	Experts Experts	2 (Figure 4-3) 1,2,3,4 (Figure 4-3)	(Venkatesh et al., 2003)
	TPB,MPCU	Infrastructure	Clinicians and the Hospital staff	1 (Figure 4-4)	(Venkatesh et al., 2003)
Doctors' and Hospital staffs' perception towards the e-healthcare solution in the rural areas	TPB and TAM	Culture	Experts	1,2 (Figure 4-3) 1 (Figure 4-3)	(Chau & Hu, 2001)
	TPB and TAM	Technology Culture	Experts Clinicians and the Hospital staff	1,3 (Figure 4-4) 1 (Figure 4-4)	(Venkatesh et al., 2003)
	TPB and TAM	Technology	Clinicians and the Hospital staff	1,3 (Figure 4-4) 1 (Figure 4-4)	(Venkatesh et al., 2003)

Two types of semi-structured interviews were used in this survey. One set of questions for the experts and another set of questions for hospital staff and clinicians. The questions were designed in relation to the research questions.

Figure 4-3 shows a summary of the interview structure used for the experts, while that for clinicians and hospital staff is shown in Figure 4-4. The actual sample size for the interviews were above the minimum sample size of 13 required by the G*Power calculation.

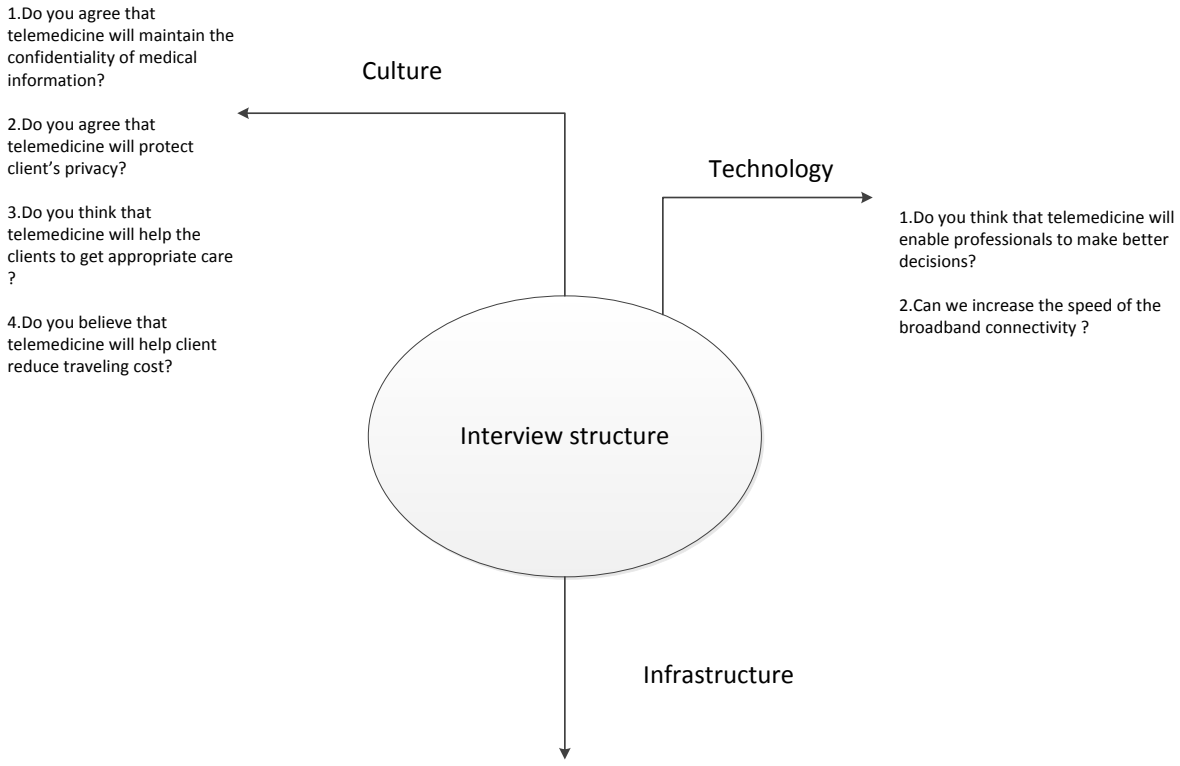


Figure 4-3 Exploratory study Interview Structure for the Experts

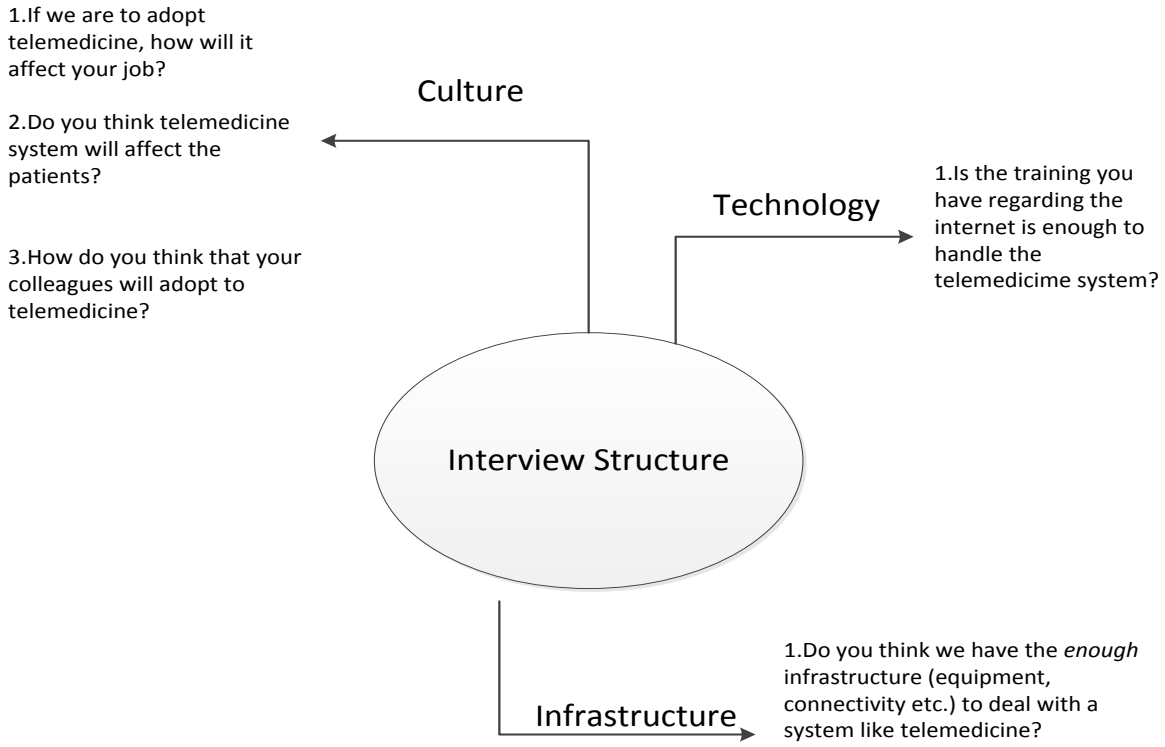


Figure 4-4 Exploratory study Interview Structure for the Clinicians and hospital staff

4.4.4 Questionnaire design

The questionnaires were based upon underpinning theories of Theory of Planned Behaviour (TPB), Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM) and Model of PC Utilization (MPCU). The literature review showed that Culture, Technology and Infrastructure were the three main factors affecting the adoption of a telemedicine system in rural areas of the country. The importance of these factors was confirmed through the results and findings of the exploratory study. Therefore the discussion has been divided into culture, Technology and Infrastructure areas.

The questions to be asked were:

- *What are the problems faced by patients in the rural area in obtaining health facilities which are offered in urban hospitals?*
- *What are the attitudes of the rural population to using computers and the internet for health services?*
- *How will the rural population react to using mobile phones for the internet in health facilities?*

Questions were also based upon an extension of the Technology Acceptance Model (TAM) (Venkatesh & Davis, 2000) (see Figure 4-5). Questionnaires related to attitude, perceived ease of use, perceived usefulness and the intention to use, were given to both hospital staff and the general public in the selected rural and urban areas.

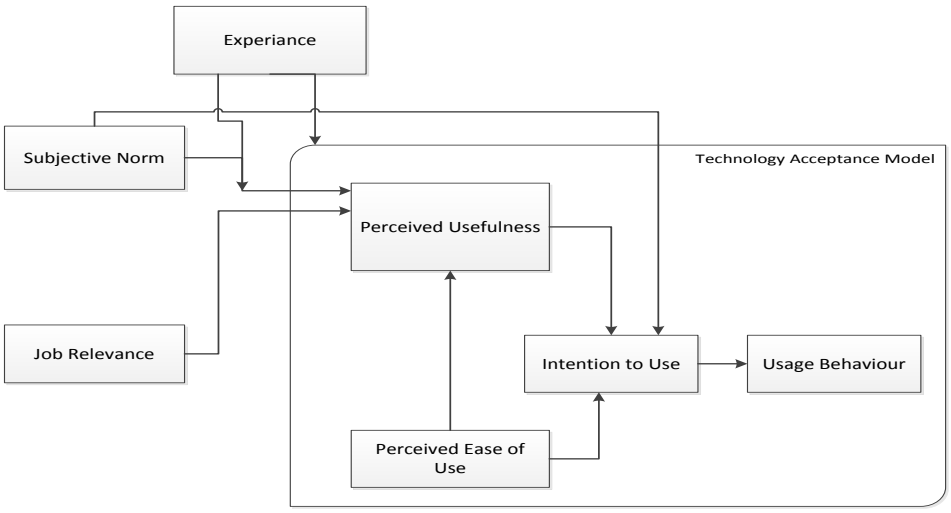


Figure 4-5 Technology Acceptance Model with the extensions discussed

in (Venkatesh & Davis, 2000)

Questionnaires for the question *Doctors' perception towards the e-healthcare solution in the rural areas* were given to clinicians from rural and urban areas to assess the attitude, subjective norms, perceived behavioural control and intention to use. These questions were also based upon the Theory of Planned Behaviour (TPB) Model, See Figure 4-6.

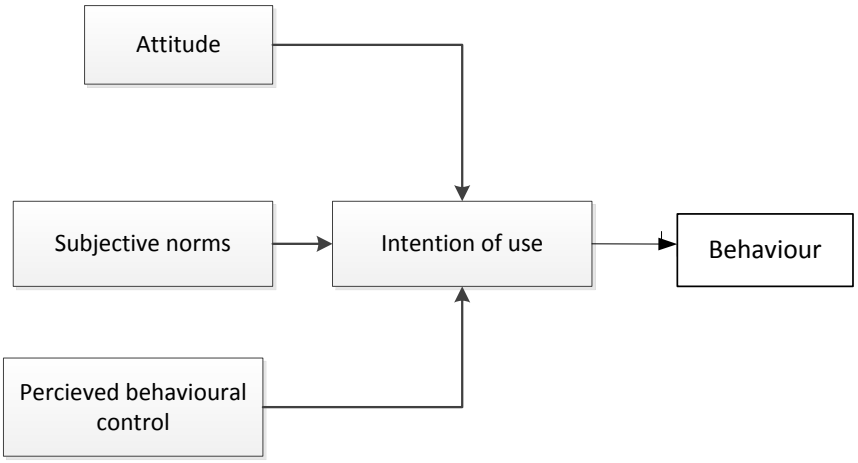


Figure 4-6 Theory of Planned Behaviour (TPB) Model

adapted from (Chau & Hu, 2001)

The questions were designed with the literature review in mind, which is shown in the **I**nfrastructure **C**ulture **T**echnology model. The main aim of this questionnaire was to find people's opinions on a telemedicine system if an appropriate model for adopting such a telemedicine system was introduced into rural areas of Sri Lanka. The questionnaires were designed to test people's opinions using the scaling method, where the scaling of the opinion varied from the extreme negative to the extreme positive. This research covered the following areas.

- Benefits from the system for the clinician and general public
- Time, cost, training and funding
- Attitudes of the people using the system
- Technology
- Infrastructure
- Policies and procedures

Table 4-4 provides details of the participants who were give the questions from both rural and urban areas of Sri Lanka and Table 4-5 provides detailed links between the theories, methods, area, participants and the question numbers during the exploratory study.

Table 4-4 Participants who completed the questionnare in the urban and rural areas of Sri Lanka

Position	**Number**	**Location**
Clinicians	11	Urban
Clinicians	13	Rural
Hospital staff	19	Urban
Hospital staff	15	Rural
General Public	13	Urban
General Public	13	Rural
Total number of participants	84	Rural and Urban

Table 4-5 Connection between the questionnare, theory and the methods

Question	Theory	Participants	Area	Question No	Reference
What are the problems faced by the patients in the rural area in obtaining the health facilities which are offered in the urban hospitals?	TRA, TPB, MPCU	Clinicians	Culture	1,2,3 (Figure 4-7)	(Venkatesh et al., 2003)
	TAM	Clinicians	Infrastructure	1 (Figure 4-7)	
		Hospital staff	Culture	2,3 (Figure 4-8) 1 (Figure 4-8)	(Djamasbi et al., 2009)
		Hospital staff	Infrastructure		
		General public	Culture	2,4,5 (Figure 4-9) 1 (Figure 4-9)	
		General public	Technology Infrastructure	1 (Figure 4-9)	
What are the attitudes of the rural population in using the computer and the internet for health services?	TAM	General public	Culture	1,3 (Figure 4-9)	(Campbell, Harris , & Hodge, 2001)
	TAM	General public	Technology	2,3 (Figure 4-9)	
Doctors' perception towards the e-healthcare solution in the rural areas	TPB and TAM	Clinicians	Culture	4,5,6,7,8 (Figure 4-7)	(Chau & Hu, 2001)
		Clinicians	Technology	1,2,4,5 (Figure 4-7)	(Venkatesh et al., 2003)
		Clinicians	Infrastructure	1,2,4 (Figure 4-7)	
		Hospital staff	Culture	1 (Figure 4-8)	
		Hospital staff	Technology	2,3,4,5,6 (Figure 4-8)	

The questionnaires are shown in Figure 4-7, Figure 4-8 and Figure 4-9. Appendix A lists the questionnaires in Sinhalese and their English translations.

A summary of the questions for clinicians is shown in Figure 4-7. Though questions 1 and 4 in the Infrastructure section look similar, they are not. Client privacy refers to the right of the client to control the use of, disclosure and control of health information while client data refers to the client records such as X-rays, medical reports, etc. Confidentiality refers to how the personal health information can be controlled in releasing to or using by a care provider (Omary et al., 2010). Questions for hospital staff are shown in Figure 4-8, and the questions for general public are shown in Figure 4-9.

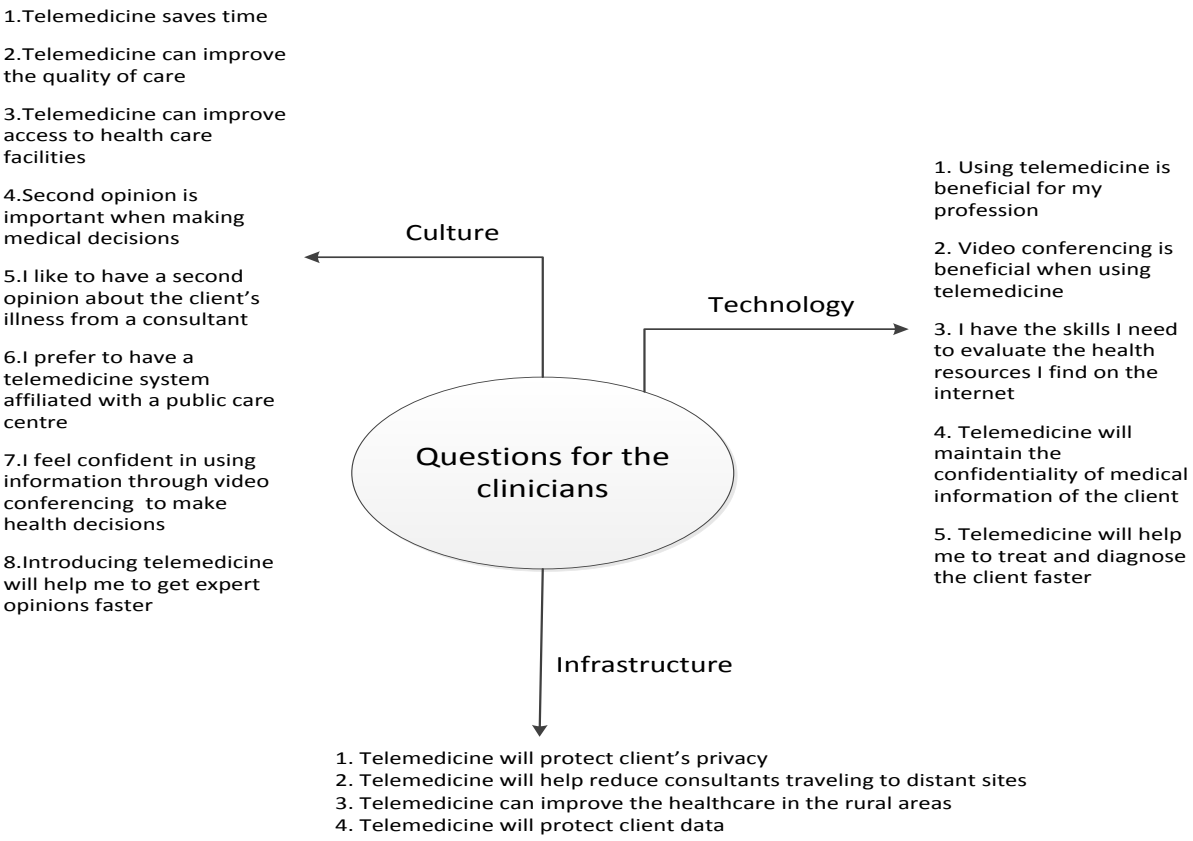


Figure 4-7 Exploratory study statements for clinicians to rate, grouped by theme

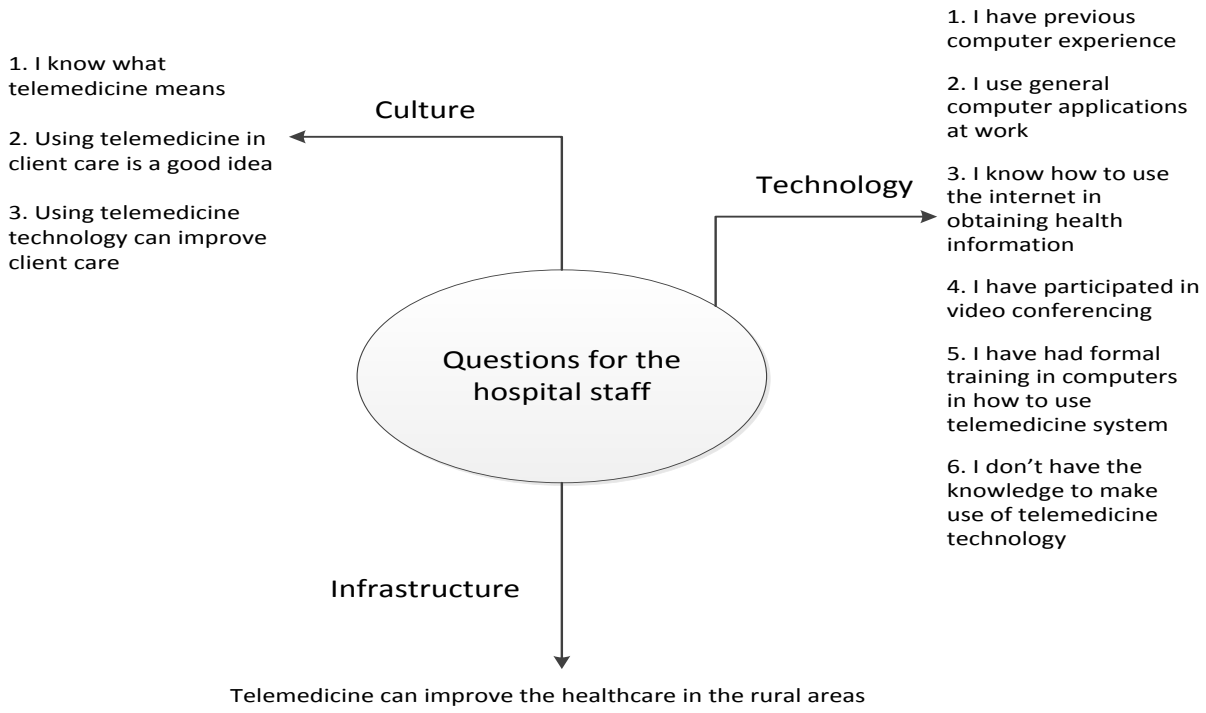


Figure 4-8 Exploratory study statements for hospital staff to rate, grouped by theme

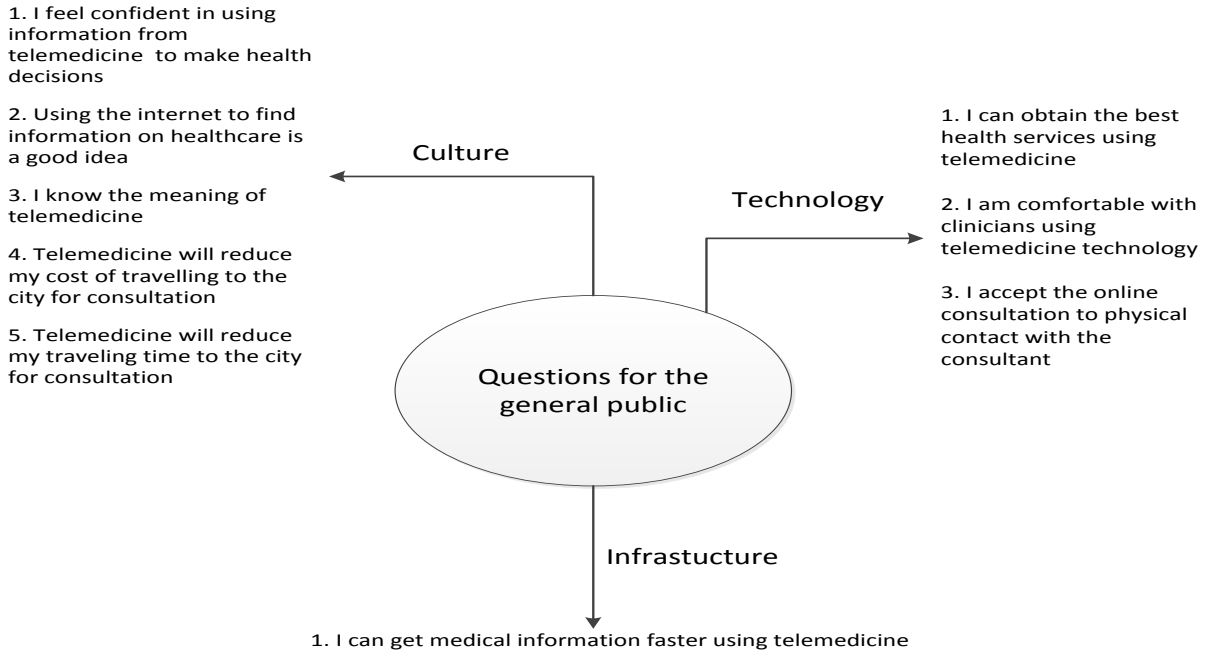


Figure 4-9 Exploratory study statements for general public to rate, grouped by theme

In meeting the required ethical standards for the exploratory study, approval was sought from the Ethical Committee of the School of Electronics and Computer Science at the University of Southampton who approved it issuing ethical approval number 4371.

4.4.5 Online survey design

An online survey was conducted from a selected sample of the general public to determine the validity of the variables of the model. These questions were designed using a four-point Likert scale ranging from 1: Very important, 2: Important, 3: May be important 4: Not important. The general public were selected from a sample list and the questions were emailed to the people selected. This survey used the *SurveyMonkey* tool which allows users to create and publish online surveys. The questions and the results of the online survey are attached in Appendix A0.

4.5 Methods used in the main survey

Figure 4-10 shows the research methodology used in the main survey. The research methods used include a quantitative methods approach and a qualitative methods approach to gather information. The survey also used MANOVA to test the equality of mean vectors in different groups, which measures how independent variables influence the response of the dependent variable. Cronbach's Alpha was used to measure the reliability and the consistency of the questionnaires given to the participants. Pearson's Correlation was used to measure the strength of linear association between two variables, one sample t-test to determine the difference between the sample mean and the hypothesised value, and Factor analysis to determine the number of components in the model and how the variables loaded onto each component in the model.

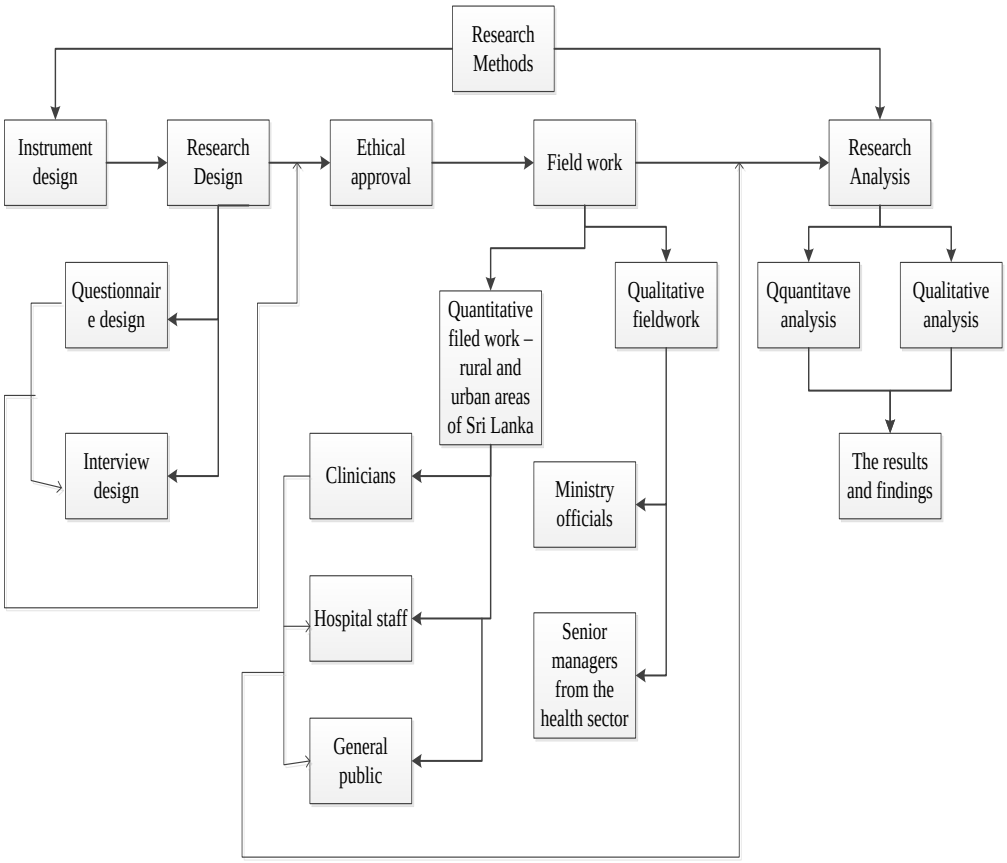


Figure 4-10 Research method used in the main survey

4.6 Instrument design

The main objective of this research was to address the following research question "*What is an appropriate model for the adoption of telemedicine in the rural areas in Sri Lanka*?" The main study will answer the following sub-questions.

The research question was subdivided into four sub-questions

1. *How will the attitude of the general public affect the introduction of telemedicine in rural areas?*
2. *How will the attitudes of the clinicians and the hospital staff affect the introduction of telemedicine in the rural areas?*
3. *How will the staff involvement of the clinicians and the hospital staff affect the introduction of telemedicine in the rural areas?*
4. *How can the government improve infrastructure of ICT to improve the healthcare of the rural population?*

The design of the questionnaires for the main study was prepared for use with three groups of people: clinicians, hospital staff and the general public.

The questionnaires were designed according to the variables of the TMSL model shown in Figure 6-1.

The formulation of the questions was influenced by the TRA, TPB and TAM models (Venkatesh et al., 2003). The questions in the survey relating to the TMSL model were then changed to comply with the research questions. The questions were also designed from previous surveys related to the attitude towards the use, perceived ease of use and the users' behavioural intention to use the system (Shroff, Deneen, & Ng, 2011). Table 6-1describes the connection between the research questions and the theory, methods and variables in TMSL model. The questionnaires were designed using a five point Likert scale where the scaling varied from 1: strongly disagree 2: disagree 3: not sure 4: agree and 5: strongly agree.

The questionnaires were designed in English and translated into Sinhalese and then into Tamil. Appendix FAppendix F lists the questions given to the clinicians, Appendix G lists the questions given to the hospital staff, and Appendix H lists the questions given to the general public during the main survey.

For the main survey, a number of questions were constructed for each variable in the model. In particular for the variables, *Connectivity, Equipment, Software standards,* and *Adoption of telemedicine*, the answers in the "*comment*" box at the end of the questionnaire were used to derive answers to the questions. A rating scale of 1 = "Strongly disagree" to 5 = "Strongly agree" was used on the comments provided in the "*comment*" box by the clinicians, hospital staff and the general public.

The questions designed according to the variables in the model are in Table 4-6 to Table 4-20.

Table 4-6 Questions for the variable: Attitude to learning (1.1) in the TMSL model

1.1.1.	I have generally favourable attitude towards using telemedicine
1.1.2.	I feel more at ease using telemedicine than in a traditional face-to-face consultation
1.1.3.	I expect to feel more independent when using the internet to obtain health information
1.1.4.	Clinician using telemedicine for my consultation is entirely my choice
1.1.5.	I believe it is a good idea to use telemedicine in the rural areas of Sri Lanka

Table 4-7 Questions for the variable: Attitude to Learning (Medical) (1.2) in the TMSL model

1.2.1. I intend to use telemedicine for client care as often as is needed
1.2.2. I will spend less time on routine job tasks when using Telemedicine
1.2.3. Using telemedicine will increase my chances of obtaining a Promotion
1.2.4. Using telemedicine in client care is a good idea
1.2.5. I like to be an early adopter of new technology in my practice
1.2.6. I am confident that telemedicine will improve my relationship with my clients

Table 4-8 Questions for the variable: Education of general public (1.3) in the TMSL model

1.3.1. I am confident that telemedicine will reduce my travelling cost
1.3.2. I find it easy to use the Internet to obtain health information
1.3.3. I am confident that use the internet for assistance in getting health information
1.3.4. I am confident that using telemedicine ill reduce the travelling Time
1.3.5. Interacting with the consultant online in a clinic will be pleasant

Table 4-9 Questions for the variable: Awareness of the hospital staff (1.4) in the TMSL model

1.4.1. Senior colleagues who influence my job think that I should use Telemedicine
1.4.2. Senior management think I should use telemedicine
1.4.3. People who are important to my job consider that I should use Telemedicine
1.4.4. Telemedicine enables me to have time for other responsibilities

Variables C*onnectivity* (2.1) and *Equipment* (2.3) questions were designed to be used in the interviews.

Questions created using the answers from the *comment* box for *Connectivity* (2.1)

Table 4-10 Questions for the variable: Connectivity (2.1) in the TMSL model

IQ(2.1).1 Rural hospitals have sufficient telephone connections
IQ(2.1).2 Rural hospitals have sufficient internet connections to adopt telemedicine
IQ(2.1).3 Rural areas have sufficient speed to use the internet
IQ(2.1).4 All the rural areas have sufficient coverage to adopt telemedicine

Questions created using the answers from the *comment* box for *Equipment* (2.3) are given in Table 4-11.

Table 4-11 Questions for the variable: Equipment (2.3) in the TMSL model

IQ(2.3).1 Rural hospitals have sufficient computers to use telemedicine
IQ(2.3).2 The infrastructure in the rural areas are sufficient to introduce Telemedicine
IQ(2.3).3 The government has sufficient funds to supply telemedicine equipment to the rural hospitals

Table 4-12 Questions for the variable: Ease use of equipment (2.2) in the TMSL model

2.2.1	Quality of the output of telemedicine is high
2.2.2	Assuming I have access to the system, I intend to use it

The questions for the variable *Incentives* (3.1) were designed as interview questions for the Health Ministry officials and senior managers in the health sector.

Table 4-13 Questions for the variable: IT literacy of staff (3.2) in the TMSL model

3.2.1. I find it easy to get health information from the internet to enable to do what I wish
3.2.2. It is easy to understand how to perform tasks using the internet
3.2.3. I find the Internet easy to use

Table 4-14 Questions for the variable: Job relevance (3.3) in the TMSL model

3.3.1. Using telemedicine helps reduce the risk of error in my specialised area
3.3.2. In my job using telemedicine is important
3.3.3. In my job using telemedicine is relevant
3.3.4. In my specialised area, it is expected that I use computers as part of my daily work
3.3.5. Telemedicine will broaden the scope of the services offered by my practice
3.3.6. Telemedicine will improve my care delivery process
3.3.7. Learning to operate the internet for my job is easy
3.3.8. In my job using telemedicine is important
3.3.9. I find the Internet easy to use

Table 4-15 Questions for the variable: Perceived use of telemedicine (3.4) in the TMSL model

3.4.1. Using telemedicine will increase my productivity
3.4.2. Using computers will enhance my effectiveness in client care and management
3.4.3. Using telemedicine decreases the time needed for my job responsibilities

3.4.4. I expect to find telemedicine easy to use
3.4.5. Telemedicine will improve my practice
3.4.6. Using telemedicine enhances my effectiveness in my job
3.4.7. Using telemedicine will improve the quality of care in my speciality
3.4.8. Telemedicine will help me to use the most up to date technology in my practice
3.4.9. Telemedicine is useful when sharing information with other colleagues
3.4.10. Telemedicine is useful when sending and receiving information to other practitioners
3.4.11. Telemedicine will improve my ability to collaborate with other consultants
3.4.12. Using telemedicine will increase my patients' engagement in managing their health
3.4.13. I will spend less time on routine tasks when using telemedicine
3.4.14. I find telemedicine easy to use

Table 4-16 Questions used for the variable: Training for hospital staff (3.5) in the TMSL model

3.5.1. I believe health institutes have policies in using computers
3.5.2. Telemedicine will help me to improve my continuing Education
3.5.3. Telemedicine will require me to have new training courses

Table 4-17 Questions for the variable: Hospital polices (4.1) in the TMSL model

4.1.1 I believe health institutes have policies in using telemedicine
4.1.2 I believe health institutes have client privacy policy for data

Table 4-18 Questions for the variable: Software Standards (4.2) in the TMSL model

4.1.1 I believe health institutes have software standards

The questions designed from the answers in the *comments* box for the above variable were

I-Q1 I believe that government has software available for introducing telemedicine
I-Q2 I believe that the hospital staff is aware of the software standards

Questions were also designed for the above variable using the interview questions for the Health Ministry officials and senior managers.

Table 4-19 Questions for the variable: Government policy (4.3) in the TMSL model

4.3.1 I believe government has data protection act for health information
4.3.2 I believe government has introduced policies for using the internet for health information

Questions were also designed for the above variable using the interview questionnaires for the Health Ministry officials and senior managers.

Questions were designed from the answers given in the *comment boxes* for the variable *Adoption of telemedicine*.

Table 4-20 Questions for the variable: Adoption of telemedicine in the TMSL model

IQ1. Telemedicine will help to improve patient care
IQ2. Conducting awareness programmes will help understand telemedicine better
IQ3. Telemedicine is a very good practice for the rural areas
IQ4. Transport cost for the rural people will be reduced by introducing telemedicine
IQ5. Time taken to travel to the urban areas will be reduced by introducing telemedicine

4.7 Questionnaire distribution method

Prior to distributing the questionnaires, the department heads of the hospitals were contacted by the researcher. Then the questionnaires were manually distributed to the clinicians by the researcher who then collected them once they had finished with them.

Table 4-21 gives the associations between the factors in the TMSL model and the relevant questions given to the clinicians during the study.

Table 4-21 Questions given to the clinicians

Variable	**Question Number**
Attitude to learning (Medical) (1.2)	All the questions
Connectivity (2.1)	All the questions
Equipment (2.3)	All the questions
Job relevance (3.3)	3.3.1- 3.3.6
Perceived use of telemedicine (3.4)	3.4.1- 3.4.12
Hospital Policies (4.1)	All the questions
Standards (4.2)	All the questions
Government policy (4.3)	All the questions

Questionnaires were also distributed to hospital staff in rural and urban areas of Sri Lanka. Table 4-22 gives the associations between the factors in the TMSL model and the relevant questions asked of hospital staff during the study.

Table 4-22 Questions given to the hospital staff

Factor	Question Number
Awareness of hospital staff (1.4)	All the questions
Connectivity (2.1)	All the questions
Easy use of equipment (2.2)	All the questions
Equipment (2.3)	All the questions
IT literacy of staff (3.2)	All the questions
Job relevance (3.3)	3.3.3, 3.3.7, 3.3.8,
Perceived use of telemedicine (3.4)	3.4.6, 3.4.9, 3.4.13, 3.3.14
Training for hospital staff (3.5)	All the questions
Hospital Policies (4.1)	All the questions
Standards (4.2)	All the questions
Government policy (4.3)	All the questions

Questionnaires were also distributed to the general public in both rural and urban areas of Sri Lanka. Table 4-23 gives the associations between the factors in the TMSL model and the relevant questions given to the general public during the study.

Table 4-23 Questions given to the general public

Variable	Question Number
Attitude to learning (1.1)	All the questions
Education of general public (1.3)	All the questions

Using G*Power calculations, the minimum sample size was determined as 19 after having selected $\alpha = 0.05$, $\beta = 0.1$ ($1-\beta = 0.9$) and medium effect size = 0.8. Approximately 200 participants from rural and urban areas of Sri Lanka were used. As a rule of thumb, the number of participants was calculated as 10 per factor in the TMSL model (Child, 2006).

4.8 Interview design

The interviews were designed mainly to address the research questions "*How will the new technology affect the attitudes of the clinicians and the hospital staff in introducing telemedicine?*" and "*How can the government improve infrastructure of ICT to improve the healthcare of the rural population?*" Interviews were conducted with Health Ministry officials and senior managers. A *comments* section was available for those clinicians, hospital staff and the general public completing the questionnaires to add any ideas of their own related to introducing telemedicine in rural areas.

Some of the interviews were conducted in English and some in Sinhalese.

A semi-structured interview technique for the interviews was used. The interviewee was contacted before the interview to arrange an appropriate time and a place for the interview. Before starting, a brief explanation of the survey was given to the interviewee. Face-to-face interviews were conducted with an approximate length of around 45 minutes each. The interviews were audio recorded with the consent on the interviewee. The interviews were conducted with two Health Ministry officials and three senior managers. The questions were designed in relation to the variables in the TMSL model. The structure of the interviews conducted during the research for the senior managers is given in Table 4-24 and the structure of the interviews for the Health Ministry officials is given in Table 4-25.

Table 4-24 Association between the TMSL model and the interview questions given to senior managers

Variable	Question
Job relevance/ Perceived use of telemedicine	How engaged are you in telemedicine currently?
Attitude to learning (Medical)	How do you feel about to participating in telemedicine?
Job relevance	What are the reasons for participating? Can you foresee how telemedicine will affect your profession?
Attitude to change (Medical)/ Job relevance	Is there anything that you are unhappy about telemedicine?
Perceived use of telemedicine	How do you think that telemedicine will improve the standards of healthcare in the rural areas?

Table 4-25 Association between the TMSL model and the interview questions given to Health Ministry officials

Variable	Question
Government policy/ Incentives	What is the strategy for introducing telemedicine for the consultants?
Perceived use of telemedicine	How do you think that the consultants will react to the adoption of telemedicine?
Hospital policies	What are the policies you are using for telemedicine?
Standards	What is your opinion regarding the medical association agreeing to the standards of telemedicine?
Hospital policies/ government policy	What is your opinion regarding the medical association agreeing to the policies of telemedicine?
Connectivity/Equipment	What is your opinion about the infrastructure we have in the country to adopt telemedicine?

4.9 Fieldwork carried-out during the main survey

The fieldwork involved travelling round Sri Lanka to collect data. The data collected from the clinicians and hospital staff was gathered by travelling to both rural and urban areas of the country. The data collected from the general public also covered both rural and urban areas.

Heads of the clinicians and the hospital staff of the relevant hospitals were contacted prior to conducting the survey. The questionnaires were then distributed to the clinicians and hospital staff by the researcher and collected after they had answered them.

The data was collected from the general public in both rural and urban areas by the researcher personally handing them out, and then collecting them after they were completed. The areas covered in the survey are shown on the map, Figure 4-11.

The areas covered by the survey are the populated areas of the country. The districts in which the survey was carried out were 10 of the 24 Districts: Colombo, Kandy, Gampaha, Kaluthara, Badulla, Nuwara Eliya, Matale, Anuradhapura, Jaffna, and Kilinochchi. Two islands, Kayts (pop. 16 300) and Nagadeepa (pop. 2 700), were also selected because transport was by boat and the new system will help to overcome the medical difficulties hospitals in these islands face. The survey was carried out in these districts because the facilities for adopting the system are better in hospitals in populated areas rather than the less populated areas. Kilinochchi and Jaffna were selected as having being recently liberated by the Sri Lankan armed forces following the civil war which continued for three decades.

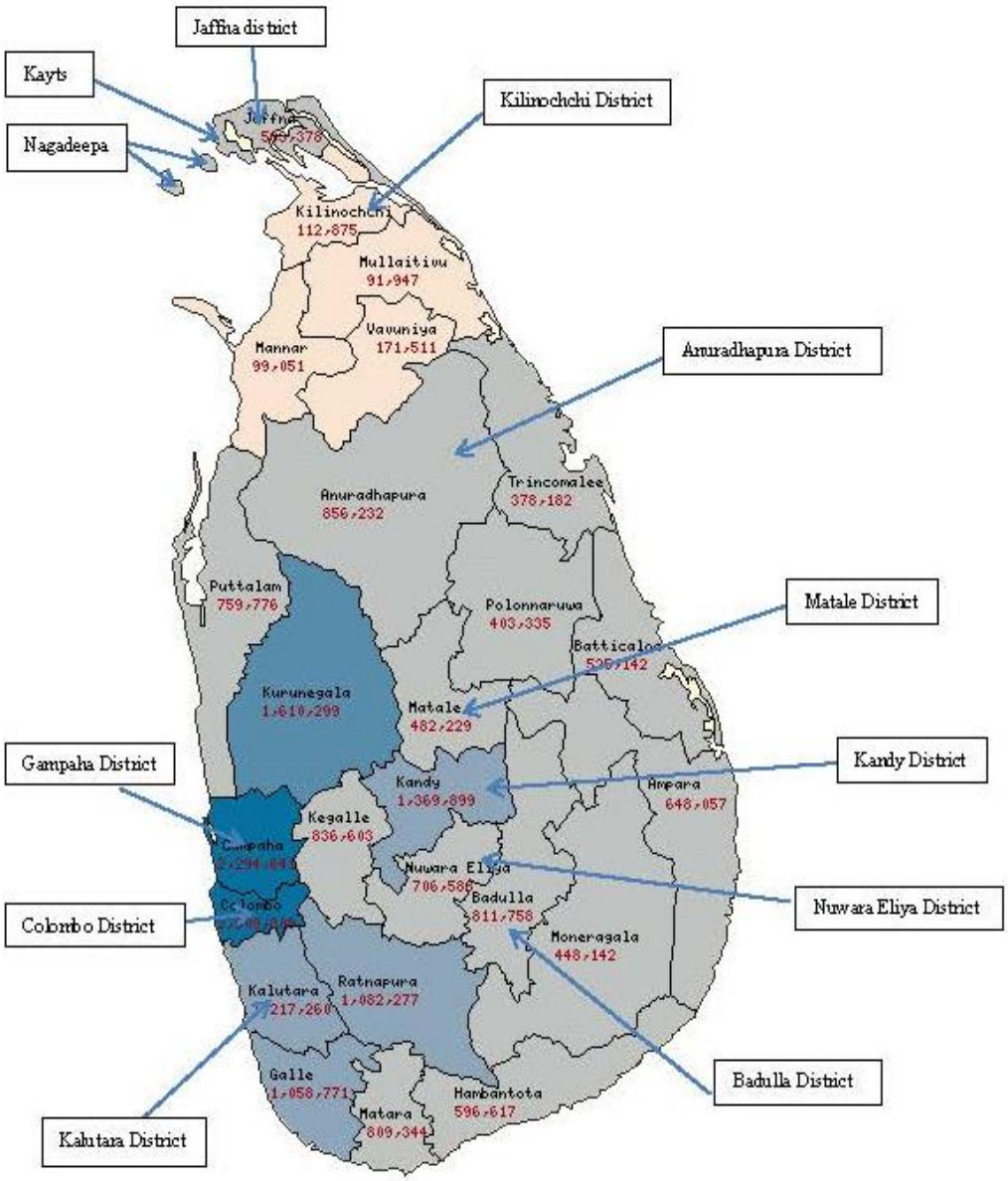


Figure 4-11 Areas covered during the survey and the population by district

Reproduced from (Department of Census and Statistics, 2012)

4.10 Summary

Quantitative research methods were used to design the questionnaires for clinicians, hospital staff and the general public for both rural and urban areas of Sri Lanka. The questions were intended to answer the main research question and the sub-research questions. The questionnaires were based on the variables of the TMSL model.

Qualitative design methods were used to formulate the interview questions. The questions were related to the sub-research questions 2 and 4. The interview questions were intended for use by ministry officials and senior managers in the health sector.

Questionnaires were distributed to clinicians, hospital staff and the general public in both rural and the urban areas. Interviews were also conducted with Health Ministry officials and senior managers. The study mainly focused on the areas identified in the Technology Acceptance Model and the Theory of Planned Behaviour model. While qualitative methods were used for the interview design, quantitative methods were used to design the questionnaires. The questionnaires comprised closed questions using a four-point Likert scale. The need for a telemedicine system was explained in detail by considering the population in the country, and the hospitals and the clinicians distributed in the districts. The exploratory study was conducted in the three districts of Kandy, Colombo and Matale.

Qualitative research methods and quantitative research methods were used by the researcher for the exploratory study and the main study. In the qualitative research, content analysis was used to analyse the text data. Triangulation consisted of the literature review in Chapter 3, the interviews for the experts, and the questionnaires for the general public during the exploratory study. This produced the TMSL model as described in Chapter 6. The sample size needed for the exploratory study and the main study were calculated using G*Power calculations.

Different types of quantitative approaches were used to analyse the questionnaire data. To measure their internal consistency, and the reliability of the questionnaires, Cronbach's alpha was used. A Multivariate Analysis of Variance (MANOVA) was used to measure differences among the groups. Pearson's correlation was used to measure the strength of the linear association between two variables "*Adoption of telemedicine"* and each variable associated with each sub-model. Independent two sample t-tests were used to determine whether there is a statistically significant difference between the means of two groups rural and urban. Factor analysis was used to determine the number of factors in set of data and how each variable loaded onto the factors. A mixed method approach was also used to measure the strengths of the variables in the model.

Chapter 5. Results of the exploratory study

5.1 Introduction

This chapter presents the results of the questionnaires, the online survey, and the findings of the interviews which were collected during the exploratory study conducted in three districts of Sri Lanka (Kandy, Colombo and Matale) during January 2013.

The questionnaires were distributed to clinicians in both rural and urban hospitals and hospital staff likewise, and were collected at the same time as they were filled in. The same method was used for the general public in the same districts. 24 clinicians, 34 hospital staff, and 26 general public participated in the questionnaires, all from both rural and urban areas.

An online survey was conducted with the general public to clarify the themes and the model to be adopted in the rural areas of Sri Lanka.

Semi-structured interviews were also conducted in the same districts in January 2013. Seven clinicians and 13 hospital staff including nurses, technicians and administrative staff in both rural and urban areas were interviewed. Four senior managers, including Health Ministry officials, and both consultants and medical directors from the same districts were also interviewed in the study. The interviews, at a time and place convenient to the participants, lasted between 30m and 60m for each and was recorded using a Live Scribe pen with the consent of the interviewee.

The results of the questionnaires were calculated using SPSS software and the interviews were analysed using NVivo10 software.

5.2 Results of the questionnaire

13 clinicians from rural hospitals and 11 clinicians from urban hospitals completed the questionnaire, together with 15 hospital staff (nurses, administrative staff and technicians) from rural hospitals and 19 hospital staff from urban ones. 13 ordinary people from urban areas and 13 from rural areas also completed a questionnaire. The questionnaires were administered in Sinhalese and in English. The English and the Sinhala versions of the questionnaire are detailed in Appendix A.

The questionnaire was constructed using a four-point Likert-type scale ranging from 1: Strongly agree, to 4: Strongly disagree.

The raw data provides a brief indication of what clinicians' reaction to adopting the system is likely to be in both rural and urban hospitals.

It was noted that there were no disagreement among the clinicians over the statement "*using telemedicine would be beneficial for their profession*". There were also no disagreements among the clinicians in answering the questions "*telemedicine saves time*", "*improving the access to healthcare facilities*", and "*second opinion is important when making medical decisions*".

There were some disagreements among the clinicians over specific issues. 4% of the sample disagreed on "*telemedicine can improve quality of care*" and 8% of the sample disagreed on not having the skills needed to evaluate health resources on the internet. The study also showed that 21% were not confident in using information through video conferencing to make health decisions, while 3% disagreed on the need to get expert opinion faster. 4% disagreed that telemedicine would help in treating and diagnosing the patient faster, and 1% disagreed saying they could get a second opinion about the patient illness from a consultant and were not willing to have the telemedicine system affiliated with a public care centre. The study also showed that 10% disagreed that telemedicine would maintain the confidentiality of the patient's medical information and 11% disagreed that telemedicine would protect patients' privacy. Finally, 2% said that telemedicine would not help reduce consultant travel to distant sites, 3% disagreed that telemedicine can improve healthcare in the rural areas, and 5% disagreed that telemedicine would protect patient data. (Appendix D has a summary of the raw data).

The questions distributed to the hospital staff during the survey regarding adopting a telemedicine system in the rural areas of Sri Lanka are given in in Appendix A.

The results indicate that there are disagreements among hospital staff for each category. 79% of the hospital staff has experience in working with computers, and 85% use general computer applications at work, 70% know how to use the internet to obtain health information while 82% know about telemedicine. 85% of staff believes that using telemedicine for patient care is a good idea and 88% agreed that telemedicine can improve patient care. Among hospital staff, 20% have participated in video conferencing, 23% have

had formal training in using telemedicine and 82% believe that telemedicine can improve healthcare in rural areas of Sri Lanka. (Appendix D has a summary of the raw data).

The questionnaire used for the general public from both rural and urban areas is found in Appendix A.

The results show that 92% of the general public from both rural and urban areas agree that using the internet to obtain healthcare information was a good idea. In addition, 100% of people knew the meaning of telemedicine, 96% agreed that telemedicine could reduce the cost of their travel, while 92% said that they could reduce the time travelling to the city if they used telemedicine. 50% thought that they could obtain the best health services using telemedicine. 50% were comfortable with clinicians using telemedicine technology and 92% were confident with the clinicians using information from telemedicine to make health decisions. The survey results also indicated that 92% of the general public believe that they can get medical information faster using telemedicine. (Appendix D has a summary of the raw data).

The questionnaire data was analysed using SPSS software and the hypothesis was tested using the One-Sample T test. In the analysis, the test value was taken as 2.5 from a four-point Likert-type scale ranging from 1 (strongly agree) to 4 (strongly disagree).

Clinicians from both rural and urban hospitals gave a mean value of < 2.5 which shows that everyone agreed on all the questions. The above conclusion was made after considering the mean values from the T-test calculations (See Table 5-1).

Table 5-1 One-Sample Statistics for the clinicians

Clinicians (rural and urban)	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Using telemedicine is beneficial for my profession	23	1.7	0.4	0.1	<0.001
Telemedicine saves time	22	1.7	0.5	0.1	<0.001
Telemedicine can improve the quality of care	22	1.7	0.6	0.1	<0.001
Video conferencing is beneficial when using telemedicine	22	1.5	0.5	0.1	<0.001
Telemedicine can improve access to healthcare facilities	23	1.7	0.5	0.1	<0.001
Second opinion is important when making medical decisions	22	1.3	0.5	0.1	<0.001
I have the skills I need to evaluate the health resources I find on the	21	2.0	0.7	0.1	0.001

Clinicians (rural and urban)	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
internet					
I feel confident in using information through video conferencing to make health decisions	23	2.3	0.7	0.1	0.110*
Introducing telemedicine will help me to get expert opinions faster	23	1.7	0.7	0.1	<0.001
Telemedicine will help me to treat and diagnose the patient faster	23	2.0	0.6	0.1	<0.001
I like to have a second opinion about the patient's illness from a consultant	21	1.6	0.6	0.1	<0.001
I prefer to have a telemedicine system affiliated with a public care centre	21	1.9	0.5	0.1	<0.001
Telemedicine will maintain the confidentiality of medical information of the patient	23	2.4	0.6	0.1	0.381*
Telemedicine will protect patient's privacy	23	2.5	0.6	0.1	0.862*
Telemedicine will help reduce consultants traveling to distant sites	20	1.7	0.7	0.1	<0.001
Telemedicine can improve the healthcare in the rural areas	20	1.8	0.7	0.2	<0.001
Telemedicine will protect patient data	21	2.3	0.6	0.1	0.143*

**p value* > 0.05

In the same set of questionnaires, the answers were significant except for the following questions

1. *I feel confident in using information through video conferencing to make health decisions* where the *p*(value) = 0 .110 >0.05,
2. *Telemedicine will maintain the confidentiality of medical information of the patient* where the *p*(value) = 0.381 > 0.05,
3. *Telemedicine will protect patient's privacy* where the *p*(value) = 0.862 > 0.05
4. *Telemedicine will protect patient data* where *p*(value) = 0.143 > 0.05

As explained in section 4.4.4 in Sri Lanka, confidentiality, patient's privacy and patient data are viewed differently. Therefore the participants answered them differently. Hence that is the reason for the different *p* values.

Though the results of the above four questions suggest that the results were not statistically significant, so these results could have been obtained by chance, it does not follow that clinicians disagree on those questions where the mean is < 2.5.

Clinicians from both rural and urban hospitals reach an overall mean value of < 2.5 which shows that everyone agreed on all the questions except for the question "*telemedicine will protect patient's privacy*". Rural clinicians disagreed on the question "*telemedicine will protect patient's privacy*" which had a mean value of 2.8 > 2.5 while urban clinicians agreed with a mean of 2.4< 2.5 for the same question. The above conclusion was made after considering the mean values from the independent sample T-test calculations. (See group statistics in Table 5-2 for the results).

Table 5-2 Comparison table of urban and rural clinicians

Clinicians from the rural and urban hospitals		**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Using telemedicine is beneficial for my profession	Rural	12	1.5	0.5	0.151
	Urban	11	2.0	0.0	<0.001
Telemedicine saves time	Rural	11	1.7	0.5	0.141
	Urban	11	1.7	0.5	0.141
Telemedicine can improve the quality of care	Rural	11	1.7	0.6	0.195
	Urban	11	1.6	0.5	0.152
Video conferencing is beneficial when using telemedicine	Rural	11	1.4	0.5	0.152
	Urban	11	1.6	0.5	0.152
Telemedicine can improve access to healthcare facilities	Rural	12	1.6	0.5	0.149
	Urban	11	1.8	0.4	0.122
Second opinion is important when making medical decisions	Rural	11	1.2	0.4	0.122
	Urban	11	1.4	0.5	0.152
I have the skills I need to evaluate the health resources I find on the internet	Rural	11	1.6	0.5	0.152
	Urban	10	2.3	0.7	0.213
I feel confident in using information through video conferencing to make health decisions	Rural	12	2.1	0.7	0.193
	Urban	11	2.5	0.7	0.207
Introducing telemedicine will help me to get expert opinions faster	Rural	12	1.7	0.8	0.225
	Urban	11	1.7	0.6	0.195
Telemedicine will help me to treat and diagnose the patient faster	Rural	12	1.9	0.7	0.193
	Urban	11	2.0	0.6	0.191
I like to have a second opinion about the patient's illness from a consultant	Rural	10	1.5	0.7	0.224
	Urban	11	1.6	0.5	0.152
I prefer to have a telemedicine system affiliated with a public care centre	Rural	10	1.7	0.5	0.153
	Urban	11	2.0	0.4	0.135

Clinicians from the rural and urban hospitals		N	Mean	Std. Deviation	Std. Error Mean
Telemedicine will maintain the confidentiality of medical information of the patient	Rural	12	2.4	0.7	0.193
	Urban	11	2.4	0.5	0.152
Telemedicine will protect patient's privacy	Rural	12	2.7**	0.7	0.188
	Urban	11	2.4	0.5	0.152
Telemedicine will help reduce consultants traveling to distant sites	Rural	9	1.4	0.7	0.242
	Urban	11	1.9	0.5	0.163
Telemedicine can improve the healthcare in the rural areas	Rural	9	1.7	0.7	0.236
	Urban	11	1.9	0.7	0.211
Telemedicine will protect patient data	Rural	10	2.3	0.8	0.260
	Urban	11	2.3	0.5	0.141

**mean >2.5

An identical method was used in calculating the means for the hospital staff which included nurses, technicians and the administrative staff from rural and urban hospitals.

Hospital staff gave a mean value of < 2.5 and agreed on all the answers except for the questions

1. *I have participated in video conferencing* where the mean = 2.8 > 2.5
2. *I have had formal training in computers in how to use telemedicine system* where the mean = 2.9 > 2.5

The above conclusion was made after considering the mean values from the T-test calculations. (See Table 5-3 for results).

Table 5-3 One-Sample Statistics for the hospital staff

Hospital staff (rural and urban)	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
I have previous computer experience	34	2.0	0.7	0.1	<0.001
I use general computer applications at work	34	1.8	0.7	0.1	<0.001
I know how to use the internet in obtaining health information	34	2.0	0.8	0.1	0.001
I know what telemedicine means	31	2.0	0.5	0.1	<0.001
Using telemedicine in patient care is a good idea	33	1.8	0.7	0.1	<0.001
Using telemedicine technology can improve patient care	34	1.9	0.6	0.1	<0.001
I have participated in video conferencing	32	2.8**	1.0	0.2	0.050*

Hospital staff (rural and urban)	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
I have had formal training in computers in how to use telemedicine system	34	2.9**	0.8	0.1	0.005
I don't have the knowledge to make use of telemedicine technology	33	2.6**	0.8	0.1	0.445*
Telemedicine can improve the healthcare in the rural areas	33	2.0	0.8	0.1	0.001

** mean >2.5 **p value* > 0.05

In the same set of questionnaires, the answers were all statistically significant.

The same method as that above was used to measure the mean and the *p* value for hospital staff in the urban and rural areas.

Both rural and urban hospital staff disagreed on the questions "*I have participated in video conferencing*" and "*I have had formal training in computers in how to use telemedicine system*" with a mean value >2.5. The above conclusion was made after considering the mean values from the independent sample T-test calculations. (See Table 5-4 for the results).

Table 5-4 Comparison table for urban and rural hospital staff

Hospital staff from the rural and the urban areas		N	Mean	Std. Deviation	Std. Error Mean
I have previous computer experience	Rural	15	1.9	0.6	0.153
	Urban	19	2.1	0.7	0.162
I use general computer applications at work	Rural	15	1.7	0.6	0.153
	Urban	19	1.8	0.8	0.175
I know how to use the internet in obtaining health information	Rural	15	2.0	0.8	0.195
	Urban	19	2.1	0.8	0.179
I know what telemedicine means	Rural	13	2.1	0.5	0.137
	Urban	18	1.9	0.5	0.111
Using telemedicine in patient care is a good idea	Rural	15	1.5	0.6	0.165
	Urban	18	2.1	0.7	0.171
Using telemedicine technology can improve patient care	Rural	15	1.8	0.6	0.145
	Urban	19	2.1	0.7	0.162
I have participated in video conferencing	Rural	14	2.8**	1.1	0.281
	Urban	18	2.9**	0.9	0.212
I have had formal training in computers in how to use	Rural	15	2.8**	0.8	0.200
	Urban	19	3.0**	0.8	0.187

Hospital staff from the rural and the urban areas		N	Mean	Std. Deviation	Std. Error Mean
telemedicine system					
I don't have the knowledge to make use of telemedicine technology	Rural	14	2.6**	0.8	0.202
	Urban	19	2.6**	0.8	0.191
Telemedicine can improve the healthcare in the rural areas	Rural	15	2.0	0.8	0.195
	Urban	18	2.0	0.8	0.181

** Mean > 2.5

The same method as above was used to measure the mean and the *p* value for the general public in the rural and the urban areas.

The general public gave a mean value of <2.5 and agreed on all the answers to the questions except for the questions:

1. *I accept the online consultation to physical contact with the consultant* where the mean = 2.6 > 2.5
2. *I feel confident in using information from telemedicine to make health decisions* mean = 2.6 > 2.5

The above conclusion was made after considering the mean values from the T-test calculations. (See Table 5-5 for the results).

Table 5-5 One-Sample Statistics for the general public

General Public (rural and urban)	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Using the internet to find information on healthcare is a good idea	26	1.7	0.6	0.1	<0.001
I know the meaning of telemedicine	26	2.0	0.2	0.0	<0.001
Telemedicine will reduce my cost of travelling to the city for consultation	26	1.7	0.5	0.1	<0.001
Telemedicine will reduce my travelling time to the city for consultation	25	1.6	0.6	0.1	<0.001
I can obtain the best health services using telemedicine	25	2.5	0.8	0.2	0.898*

General Public (rural and urban)	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
I am comfortable with clinicians using telemedicine technology	25	2.4	0.6	0.1	0.446*
I accept the online consultation to physical contact with the consultant	25	2.6**	0.5	0.1	0.166*
I feel confident in using information from telemedicine to make health decisions	25	2.6**	0.6	0.1	0.395*
I can get medical information faster using telemedicine	26	1.7	0.6	0.1	<0.001

** Mean > 2.5 *p value* > 0.05

In the same set of questionnaires in Table 5-5the answers were statistically significant except for the questions

1. *I can obtain the best health services using telemedicine* where the *p*(value) = 0.898 > 0.05
2. *I am comfortable with clinicians using telemedicine technology* where the *p*(value) = 0.446 > 0.05
3. *I accept the online consultation to physical contact with the consultant* where the *p*(value) = 0.166 > 0.05
4. *I feel confident in using information from telemedicine to make health decisions* where the *p*(value) = 0.395 > 0.05.

The results in Table 5-5 indicate that they are not statistically significant, meaning the results could have been obtained by chance, but that does not mean the general public did not disagree on questions 1 and 2 where the mean of each was < 2.5 and questions 3 and 4, where the general public disagreed on the answers to the questions because the *p* (values) > 0.05 and the means are > 2.5.

5.2.1 Results of the online survey

The online survey was conducted among the general public to clarify the sections in the model to be adopted. 29 people participated in the survey. The survey was conducted using a four-point Likert-type scale ranging from 1 (very important) to 4 (not important). The questionnaire data was analysed using SPSS software and the hypothesis was tested using the One-Sample T-test. The test value was taken as 2.5. The priori was above 13 and the study

had 29 participants in the survey. The analysis shows that the power of $\alpha = 0.05$, $\beta = 0.2$ and the effect size was 0.8. Therefore having a sample size of 29 participants for the online survey is sufficient. The summarised raw results are listed in Appendix A0. Table 5-6 shows that all the results are significant. The general public agreed on all the questions. The above conclusion was made after considering the mean values from the T-test calculations using a test value of 2.5.

Table 5-6 Online survey results

	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Acceptance to technology : to understand the attitude of the people towards Introducing telemedicine	29	1.4	0.6	0.1	<0.001
Attitude to learning (General public) : Willingness to learn about telemedicine	29	1.7	0.7	0.1	<0.001
Attitude to learning (Medical Professionals) : willingness to learn about telemedicine	29	1.3	0.5	0.1	<0.001
Education regarding e-health literacy : willingness to learn about the internet facilities for health	29	1.5	0.6	0.1	<0.001
Availability : The availability of telemedicine will help improve health facilities in the rural areas	29	1.6	0.7	0.1	<0.001
Connectivity : Having sufficient internet and telephone connectivity in the rural areas	29	1.4	0.5	0.1	<0.001
Government policy : Having a government policy for telemedicine in the country	29	1.4	0.5	0.1	<0.001
Staff involvement : Hospital staff involvement in adopting telemedicine	29	1.3	0.7	0.1	<0.001
Incentives for staff : giving incentives for staff	29	1.4	0.8	0.1	<0.001
IT literacy of staff : checking the IT literacy of the staff	29	1.5	0.7	0.1	<0.001
Training for non-medical staff : Training for non-medical staff	29	1.7	1.0	0.2	<0.001
Applications : types of e-health applications going to be used in rural areas	29	1.6	0.7	0.1	<0.001
Hospital policies : to check the policies for the hospitals for adopting telemedicine	29	1.7	0.6	0.1	<0.001

	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Awareness : awareness about the applications going to be used	29	1.3	0.7	0.1	<0.001
Standards : what are the standards we are going to use	29	1.3	0.5	0.1	<0.001
Equipment : types of equipment we need in the rural hospitals	29	1.2	0.6	0.1	<0.001

5.3 Findings from the interviews

In order to answer research question "*What are the problems faced by the government in introducing the system*", semi-structured interviews were carried out among several experts in the Health Sector. Semi-structured interviews were also conducted with four clinicians, three hospital administrative staff and two nurses from the rural areas, and three clinicians, four technicians and four nurses from the urban hospitals. The main aim of the interviews was to capture participants' opinions regarding adopting a telemedicine system in rural areas of Sri Lanka. The results were analysed by using NVivo10 software. The transcripts were translated from Sinhalese into English and the key concepts were coded.

Codes were developed to identify aspects of culture, infrastructure and technology from the questions asked of clinicians, nurses, technicians and hospital administrative staff. These codes included patient difficulties, colleagues' opinions, confidence on having a consultant online, effect on their job, infrastructure, legislation, training and whether they had a positive attitude to telemedicine in rural areas of Sri Lanka.

A separate set of codes was developed from the questions asked of senior management which included Health Ministry officials, consultants and hospital directors. These codes included appropriate care, confidentiality and the privacy of medical information, connectivity, decision making, and government funding, investing in telemedicine and the cost of travelling.

The following conclusions were arrived at after analysing the semi-structured interviews with the clinicians and hospital staff with NVivo software.

5.3.1 Findings of the interviews conducted in the rural hospitals

This section gives a brief description of the interviews conducted with clinicians and hospital staff in rural areas of Sri Lanka regarding adopting a telemedicine system in those areas. The

main themes were Culture, Technology and Infrastructure. The numbering system in this section is: Q = question number, I = interview number.

5.3.1.1 Culture

When considering the phrases related to culture in adopting telemedicine in rural areas, there was a mixture of negative and positive answers when answering the question "*confidence in having a consultant online*". Not having confidence in online consultation could be related to not having a physical examination by the consultant, where patients in rural areas are used to having a consultant give them a physical examination. Online consultations can also be affected by the trustworthiness of the correct medical information passing between the consultant and the GP in the rural hospital. The following examples highlight this point:

Q3 I3 (clinician) rural: "*Obstetric patients will like to be examined by the doctor*."

Q2 I2 (nurse) rural: *"Patients prefer physical examination. GPs refer to the Consultant because they are unable to come to a final decision. Therefore the patient might not like Telemedicine because the Consultant is not physically examining the patient*."

Q2 I2 (admin) rural: "*Since there is no physical examination by the Consultant, the diagnosis might not be correct*."

Q1 I1 (clinician) rural: "*In telemedicine, the Consultant depends on the GP's analysis and findings (because the Consultant is not physically examining the patient). Therefore if we have a legalised system between the GP and the consultant, the patient will trust the telemedicine system, i.e. GP has to decide after the Consultant gives his opinion*."

Q1 I1 (nurse) rural: "*Even in a rural hospital, there is a Medical Officer. So he can decide and tell the patient and the Consultant regarding the illness. Therefore it won't be an issue to the patient since the Medical Officer can educate the consultant regarding the illness*."

5.3.1.2 Technology

When considering the phrases connected with the technology of adopting telemedicine in rural areas, it was found during the interviews that more respondents recognised that adopting telemedicine would reduce the time and the cost of travelling to urban areas for consultation. This type of patient difficulty is due to the uneven deployment of consultants across hospitals, an inadequate transportation system, high travel costs and the time taken to travel to the urban areas. For example:

Q1 I1 (clinician) rural: "*At present the patient will have to go at least to a base hospital to meet a Consultant which is a waste of time and money for the patient and the difficulty in travelling too long distances*."

Again on the theme of technology, when the question was raised regarding the effect on their job if telemedicine was introduced in rural areas, most of the respondents answered that telemedicine would have a positive effect on their jobs. The positive effect on the jobs of the hospital staff was related to the reduction in the time taken for consultants to travel to rural areas. There is also evidence that by introducing telemedicine, medical staff can learn a new technology. The following examples address these issues.

Q3 I3 (clinician) rural: "*Sometimes it might make it easy if the consultant has to travel to rural areas which takes about 3-5 hours. Therefore telemedicine will make our lives easier*."

Q2 I2 (nurse) rural: "*Can learn new things. New experience and can get new information*."

But one respondent answered negatively regarding the effect that telemedicine would have on their job by not having a proper distribution of medical professionals in the country. The following example will demonstrate this.

Q2 I2 (clinician) rural: "*It is already affected. We don't have a proper system. We don't have a proper GP system. We are short of consultants. But we have adopted mobile clinics. Introducing telemedicine in the government sector or the private sector is a bit of a question*."

Most of the participants from rural areas said that they needed more training on the internet if a telemedicine system were to be adopted. Training issues in rural hospitals are related to the lack of Internet training given to hospital staff. Computer literacy among hospital staff is very poor due to lack of training and facilities. This issue is explained in the examples below:

Q1 I1 (clinician) rural: "*We need more training. I can use the internet but I am not an expert*."

Q2 I2 (nurse) rural: "*I don't have any training. Therefore we need more training regarding Internet*."

5.3.1.3 Infrastructure

When considering the phrases related to infrastructure in adopting telemedicine in rural areas, almost every participant responded negatively regarding the facilities in rural hospitals when to adopt telemedicine. Though there is telephone connectivity to every rural hospital in the country, these hospitals lack internet facilities. Lack of infrastructure can be due to economic reasons, lack of connectivity and the uneven distribution of resources across hospitals. The following examples demonstrate this issue:

Q1 I1 (nurse) rural: "*No computers and the Internet facilities in the rural hospitals*."

Q1 I1 (admin) rural: "*Rural area - there is less facilities due to the economic reasons. Also, the corruption of the government officials. Resources are divided among certain sections of*

the society. Unless we eradicate corruption of the government, the general public will not benefit from things like this."

When discussing the infrastructure, legislation was one of the main issues participants mentioned. At the moment Sri Lanka does not have a Data Protection Act to protect patient information. The conflicts between the human rights and civil rights commissions and the clinicians regarding patient issues are also related to infrastructure. The following examples demonstrate this issue:

Q1 I1 (clinician) rural: "*The confidentiality of the patient information will depend on the legal system of Sri Lanka*."

Q2 I2 (clinician) rural: "*Matter of confidence. We don't have an in-service adviser to give advice on the modern technology. Therefore they will not have the experience in this type of technology. Human rights and civil rights commissions do not agree with lots of things we do. We cannot give the patients the correct information regarding some illnesses (e.g. HIV) due to lack of knowledge in the rural population. No legal guarantee regarding telemedicine. Need to talk to the medical council and should have an ethics committee. No proper ethics committee yet*."

5.3.2 Findings of the interviews conducted in urban hospitals

This section describes the findings of the exploratory study conducted in urban hospitals involving clinicians and hospital staff discussing adopting a telemedicine system in rural areas of Sri Lanka.

5.3.2.1 Culture

When considering phrases related to culture in adopting a telemedicine system in rural areas, the responses to the question "*confidence in having a consultant online*" were mostly answered saying "*it depends on the patient*." Confidence in having a consultant online depends on the attitude, beliefs, trust in the system and the computer literacy, of the patient. Examples are given below to address this issue:

Q1 I1 (technician) urban: "*Depends on the patient. Surgery side might need physical examination but medication will not need any physical examination. Telemedicine is ok if all the investigations are done about the patient early. Got to get ideas*."

Q1 I1 (nurse) urban: "*Sometimes certain patients might not like it since there is no physical examination by the Consultant*."

5.3.2.2 Technology

When considering the phrases related to technology in adopting telemedicine in rural areas, the question was asked by the interviewer about the effect on their job if telemedicine was

adopted in rural areas. Most of the responses were positive regarding this issue. The effect on jobs being seen as having a positive effect because the travelling costs and time would be reduced. Introducing telemedicine would also improve the knowledge and the skills of the clinician by getting the proper information and advice from a consultant. Supporting examples are demonstrated below:

Q3 I3 (clinician) urban: "*Very useful as dental practitioners. Since we don't have much knowledge about it now but we can use telemedicine in the future after getting the proper knowledge.*"

Most of the participants from the urban hospitals mentioned that they need more training related to the Internet if a telemedicine system was to be adopted. Lack of training regarding the internet has caused problems in clinicians' use of the Internet. The following examples demonstrate the issue:

Q1 I1 (clinician) urban: "*We don't have training at all, mainly for the older generation. But the newly appointed clinicians have a better knowledge.*"

Q3 I3 (clinician) urban: "*I have a general idea about the internet but telemedicine training will help the clinicians to understand the system better*."

5.3.2.3 Infrastructure

Taking into consideration the phrases related to infrastructure when adopting telemedicine in rural areas, the opinions expressed by both clinicians and hospital staff in the urban hospitals were a mixture of positive and negative answers to the question regarding the facilities in rural hospitals. The answers related to the poor infrastructure in rural hospitals. Though the country has internet coverage for most areas, facilities and equipment are not distributed equally around the country. Urban hospitals have most facilities and rural hospitals lack internet facilities. The following examples demonstrate the issue:

Q3 I3 (clinician) urban: "*Enough facilities with lot of coverage*."

Q1 I1 (technician) urban: "*Mostly yes. There are some rural areas where they lack basic facilities*."

Q2 I2 (technician) urban: "*Not in the rural areas. Not enough coverage in the rural areas. But urban areas are ok.*"

5.3.3 Findings of the interviews conducted with senior management

This section will cover the findings of the interviews conducted among senior managers in the health sector which included ministry officials, medical directors and consultants. The main themes covered in this section were Technology, Culture and Infrastructure.

5.3.3.1 Culture

Considering the phrases related to culture, when the interviewee was asked for their opinion about investing in telemedicine, the responses were positive. Most of the hospitals in rural areas lack the facilities for having consultants. The reasons are the uneven distribution of consultants, and consultants not being willing to go to rural areas because of the lack of facilities there. So, to solve the problem of having consultants in rural areas, the responses from senior managers were "yes" depending on who was funding the project. Since Internet connectivity charges are very low in the country, investing in the project will be worthwhile. Examples are given below to demonstrate the issue:

Q2 I2 senior managers: "*Worthwhile adopting. Depends on who is going to fund this project. Lot of projects get off the ground without planning and without a feasibility study. Whether it is sustainable is the question.*"

Q3 I3 senior managers: "*Of course, you don't have to invest so much money. You really need a basic computer and maybe the connectivity to the internet. So when we compare with India or Australia or any other country, Sri Lanka is the cheapest provider of internet facilities. It is affordable for anyone to have an internet system. Not cost you more than Rupees 500 a month.*"

In relation to patients getting appropriate care if telemedicine was introduced in rural areas, senior managers' responses were both positive and negative. In rural hospitals, appropriate care depends on the institution and the facilities the institution has. Using telemedicine, the clinician in the rural area can get the best advice from the consultants online and then treat the patient. An example is given below to demonstrate the issue:

Q4 I4 senior manager: "*Appropriate care I am not sure of but, appropriate advice yes. Your care depends on the place you will ultimately seek treatment. Even though there is no physical contact, it can be done because there is a clinician on the other side. But caring will depend on the institution.*"

5.3.3.2 Technology

The phrases related to technology produced mixed ideas from respondents. In relation to the question "*whether telemedicine will enable professionals to make decisions*", the responses were more positive. The responses were related to the educational level of clinicians in rural hospitals. Having the consultants online, and having all the rural hospitals connected to a major hospital, would help professionals to make better decisions. The issue is demonstrated below:

Q3 I3 senior manager: "*Of course, because most of the areas get the services of the specialists or the consultants. For example, the medical officers who specialises in some*

areas such as surgery, radiology and pathology. So if they don't have the basic qualified clinician, then these clinicians have some problem. Then they can consult a specialist or a consultant in the centre and then they can discuss the patient and transfer these ideas. The patient will definitely get a better deal. In Sri Lanka specially in the rural areas where they are connected to a major hospital."

The responses to the question "*do you agree that telemedicine will protect patient's privacy?*" the answers were positive. This is related to fact that Sri Lanka does not have a Data Protection Act at the moment. Therefore protection of patient data depends on the internet service provider and the hospital management. The following example will demonstrate the issue:

Q2 I2 senior manager: "*As long as the highest standards of confidentiality are maintained by the provider and the person who gives that service to both parties (clinician and the patient).*"

5.3.3.3 Infrastructure

The phrases related to infrastructure the responses were mainly positive. Responding to the question "*is the government capable of providing resources and funding to use telemedicine*", the responses were positive. Sri Lanka has a number of different internet service providers. Reducing the taxes on the products and the services related to telemedicine, offering cheaper internet packages to rural areas, and widening connectivity to rural areas will help in the adoption of telemedicine in those areas. The following example will demonstrate the issue:

Q3 I3 senior manager: "*If they are interested it's not a costly affair. The internet will be from a company. We have all sorts of sophisticated companies. But you will just need basic computer and a carrier. It is very cheap. And Sri Lanka is the cheapest where you can purchase as far as I know we are heading most of the Asia. Being the cheapest for the internet the government sector has discounted internet facilities and they even have internet on the phones*."

Another respondent said

Q1 I1 Senior manager: "*If the government is willing, yes. Kandy hospital started something similar to telemedicine but was stopped half way through due to lack of support*."

Overall culture, technology and infrastructure are the three main areas which influence the adoption of telemedicine in rural areas of Sri Lanka. Some of the cultural factors include attitudes towards having a consultant online, the cost and the time taken by the consultation, and trust between patient and clinician. Technological factors include lack of training and the level of knowledge about the Internet. Some of the infrastructure factors were concerned with

Internet connectivity, facilities and Internet service providers. One major concern of having incentives for the clinicians was raised unofficially at most of the interviews conducted with hospital staff in both rural and urban areas. The question raised was "*will there be an incentive for the clinicians when using telemedicine*?" This issue will be considered when developing the model.

5.4 Summary

Quantitative data from the questionnaires, and the qualitative data from the interviews, were analysed to investigate the impact on the three domains of culture, technology and infrastructure in adopting a telemedicine system in rural areas of Sri Lanka.

One factor which influenced telemedicine was the lack of transport in rural areas and the wages earned by the rural population. Uneven deployment of consultants means the rural public have to visit urban areas to see a consultant. The cost and time of travelling to urban hospitals are high for the rural population.

Another factor which influenced telemedicine was the lack of knowledge regarding the internet among hospital staff. A lack of internet facilities in rural hospitals, and a lack of knowledge about how to use the internet, and the language barrier are some of the factors.

Other factors that influenced telemedicine were a problem with protecting patient data, insufficient infrastructure facilities in the rural hospital in the country, and the allocation of funds to rural hospitals.

Understanding the culture of Sri Lanka is absolutely essential in implementing a telemedicine system in the rural areas of the country. Improving the confidence of the rural population, and of hospital staff, will be the key issue in implementing a telemedicine system.

Chapter 6. Discussion of the exploratory study

6.1 Introduction

The results and the findings of the exploratory study have addressed the following research question.

"*What is an appropriate model for the adoption of telemedicine system in the rural areas of Sri Lanka*?"

The exploratory study was conducted in January 2013 with clinicians, hospital staff including nurses, technicians and administrative staff, the general public in both rural and urban areas of Sri Lanka as well as senior managers in the health sector which included ministry officials, consultants and medical directors.

Reviewing and relating the results and findings with the Culture, Technology and Infrastructure variables, issues have been investigated separately in relation to understanding how telemedicine will affect the rural areas of Sri Lanka.

The literature review discussed in Chapter 3 showed that Culture, Technology and Infrastructure were the three main factors affecting the adoption of a telemedicine system in rural areas of the country. The importance of these factors was confirmed through the results and findings of the exploratory study. Therefore the discussion has been divided into culture, Technology and Infrastructure areas.

The key factors associated with the results and findings were confidence in using information through video conferencing, protecting patients' privacy, protecting patients' data, training for e hospital staff, internet facilities and having a consultant online.

6.2 Discussion of the results and findings

This section will discuss the questionnaire results and the findings of the exploratory study conducted for clinicians, hospital staff and the general public in both rural and urban areas of Sri Lanka.

6.2.1 Results and findings of the cultural factor

The clinicians from rural and urban hospitals gave a mixture of positive and negative answers concerning culture when adopting telemedicine. The clinicians agreed 100% that telemedicine is beneficial for their profession. This cultural factor indicates that clinicians are ready to accept the change and they have a highly positive attitude towards adopting telemedicine. They also agreed on the factors of telemedicine saving time and telemedicine improving the quality of care. All the clinicians who responded to the survey questionnaire mentioned that a second opinion is important when making medical decisions. Having a second opinion by a consultant shows that the clinicians will be successful in making health decisions when using telemedicine (Appendix D lists the summarised raw results).

Findings presented in Section 5.3.1.3 were that most the clinicians preferred a legal data protection framework that would be introduced by the Government before the transfer of medical information from consultant to clinician.

Results from the questionnaires showed that 82% of hospital staff knew the meaning of telemedicine. This was a positive indicator for adopting telemedicine in rural areas. Furthermore, the attitude to the use of telemedicine was shown by 82% of the hospital staff agreeing that the adoption of telemedicine would improve healthcare in rural areas.

Findings presented in Section 5.3.2.1 showed that there was a deep concern about consultants not doing a physical examination of the patient. This concern about the consultant not examining the patient physically grew in proportion to the lack of confidence in using computers to make health decisions.

In the survey, 92% of the general public agreed that using the internet to find information on healthcare was a good idea and everyone from the general public sample in rural and urban areas knew the meaning of telemedicine. However, there was some concern in the results for the general public where 42% disagreed saying they were not comfortable with clinicians using telemedicine and 38% disagreed that the best health services were obtained using telemedicine. This cultural factor indicates that the general public have mixed ideas about the use of telemedicine for healthcare (Appendix D for the summarised raw results).

6.2.2 Results and findings of the technology factor

As with culture, adopting technology also gave a mixture of positive and negative answers from clinicians in rural and urban hospitals. Almost every clinician agreed that telemedicine can improve access to healthcare facilities and video conferencing is beneficial when using

telemedicine. The implication being that clinicians will be successful when using the new technology in health related matters.

But there was some concern among the clinicians with around 22% disagreeing, saying that they were not confident in using information through video conferencing to make health decisions and 44% of the clinicians disagreed about maintaining the confidentiality of the medical information of the patient. This indeed suggests a lack of confidence among clinicians in using the new technology (See Appendix D for summarised raw results).

There was a deep concern about the training they had about the Internet. Most clinicians knew how to use the Internet but did not have sufficient training to deal with the technology of telemedicine. Introducing new training programmes about the Internet to the clinicians' curriculum would help the health sector to handle the latest up-to-date health information using new technology.

The main concern of hospital staff was that 21% of them do not have previous computer experience, 29% do not know how to use the Internet to obtain health information, and 73% have not participated in video conferencing.

Findings in 5.3.2 also show that there is a major concern of hospital staff that they do not have proper Internet and computer training.

As a developing country, if Sri Lanka is to have an efficient health system as in developed countries, the government needs to educate and train its clinicians and hospital staff in the latest technology.

The general public had concerns over technology in relation to telemedicine. 46% of the general public disagreed on getting the best health services using telemedicine and 54% disagreed on using information from telemedicine to make health decisions. But 94% of the general public agreed that they could get medical information faster using telemedicine.

Looking at the above results, it becomes evident that educating the general public about telemedicine technology will help them to understand the positive effects of having a telemedicine system in rural areas.

6.2.3 Results and findings of the infrastructure factor

As with culture and technology, results of the questionnaire for infrastructure had positive answers. 87% of clinicians from rural and urban areas agreed that telemedicine should be affiliated to a public care centre. This indicates that Internet connectivity and computer

facilities are poor in those rural areas. Developing the infrastructure in rural areas depends on funds allocated by government. If the government is willing to fund the development and maintenance of computer centres in rural areas, many people will benefit from the new technology.

For clinicians, 78% agreed that consultants' travel time to distant sites would be reduced and 73% agreed that telemedicine would improve healthcare in rural areas.

There was a deep concern about the financing of clinicians and hospital staff in rural and urban areas with a view that there is insufficient infrastructure for computer facilities and connectivity in rural areas of Sri Lanka. As a developing country, improving infrastructure in the rural areas is a major concern of the government. Introducing telemedicine in rural areas would help to improve the infrastructure in rural areas.

96% of the general public from both rural and urban areas answered positively to the question that telemedicine would reduce the cost of travelling to the city for consultation and 92% agreed that travelling time to the city to meet the consultant would be reduced. Building the infrastructure to develop telemedicine depends on the government and the policies and the strategies of the government.

6.2.4 The findings with senior managers

According to the findings of the interviews with senior managers, addressing the question whether investing in telemedicine is worthwhile, the answers were mainly positive depending on who would fund the project. Most senior managers responded positively that getting appropriate care for the patient through telemedicine was possible. There were positive responses from senior managers stating that the professionals can make better decisions using telemedicine. Most of the senior managers agreed that confidentiality of the medical information can be maintained through telemedicine and telemedicine would protect patient privacy. But there was some concern about patients' privacy stating that the privacy of the patient depends on the service provider and the person who gives the service (clinician and the patient).

Every senior manager agreed that Sri Lanka has sufficient coverage to adopt telemedicine in rural areas. Having several Internet Service Providers in the country has enabled the public to select cheaper internet rates and best connectivity. When it comes to funding the project, most of the respondents mentioned that funding depends on how much the government is

going to allocate, who will be in charge of the funding and how the funding will be distributed in rural areas.

This implies that if telemedicine was introduced to rural areas, there would be major benefits for both patients and clinicians in rural areas of Sri Lanka.

After considering these results and the findings, the exploratory study explored the major impact of telemedicine in terms of cultural effects when using new technology, an availability of resources, involvement by hospital staff, and both training and clear policies being provided when using telemedicine in rural areas of Sri Lanka. This presents a model for telemedicine in the rural areas perceived by clinicians, hospital staff, the general public and senior managers. After considering the impacts of adopting telemedicine in the rural areas from the exploratory study a new model was developed.

6.3 The model

The results of the exploratory study using the questionnaires and interviews made it clear that a new model was required to answer the research question "*what is the appropriate model to introduce telemedicine in the rural areas of Sri Lanka*?"

The TeleMedicine in Sri Lanka model (TMSL Model) has four components: Acceptance of technology, Availability of infrastructure, staff involvement, and policies and standards. Each component is then divided into sub components (see Figure 6-1).

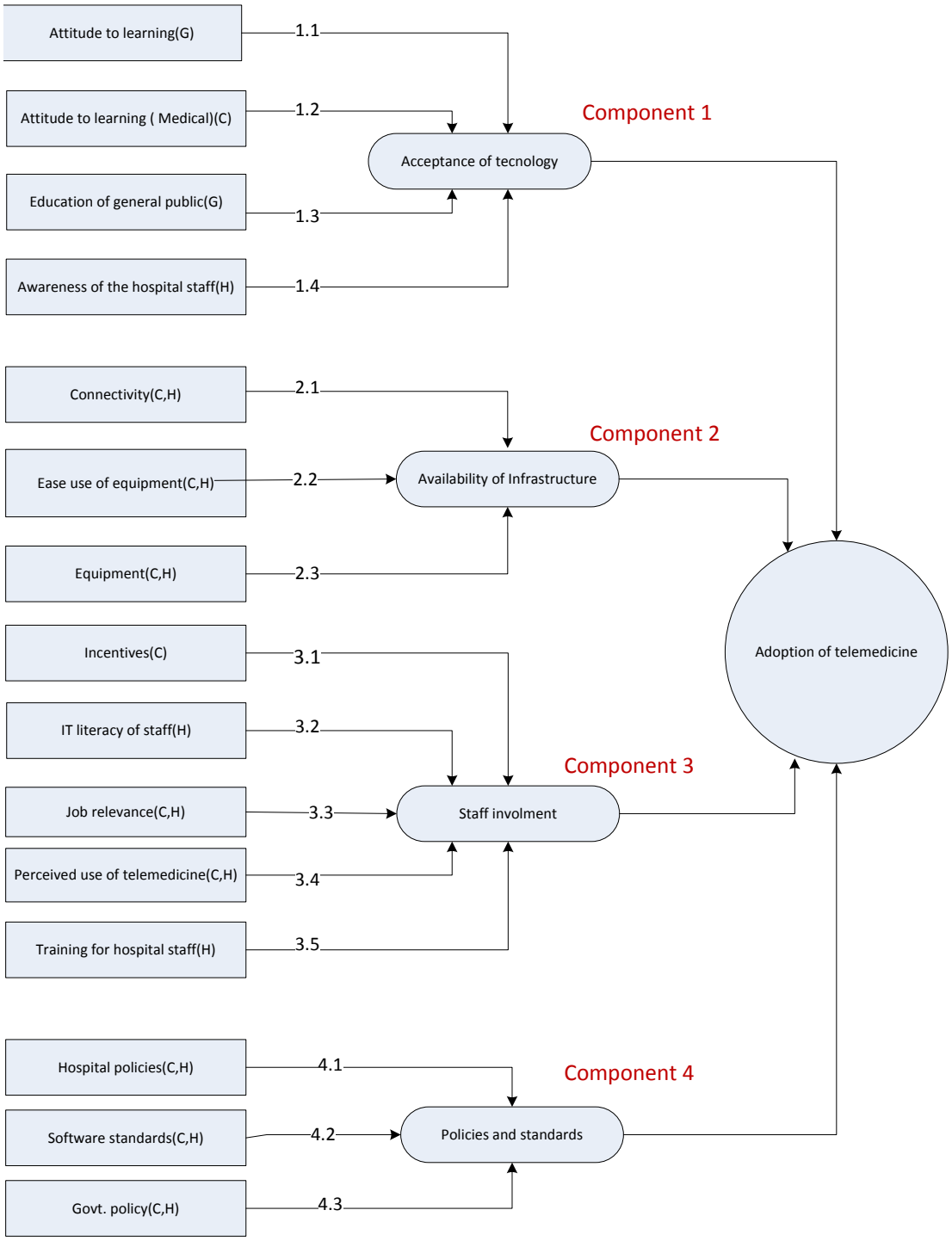


Figure 6-1 TMSL Model for adopting telemedicine in the rural areas of Sri Lanka

G = general public C = clinicians H = hospital staff

Component 1 of the model will investigate how hospital staff, clinicians and the general public will accept the new technology. This component will be subdivided to investigate attitudes to learning by the general public and by clinicians. The knowledge level of the general public regarding the internet will also be investigated in this component. Another

point to be addressed is awareness of new technology by hospital staff introduced to telemedicine. The attitude of the hospital staff was not directly tested because in the proposed use of telemedicine, the hospital staff does not directly get involved with the patient or the clinician.

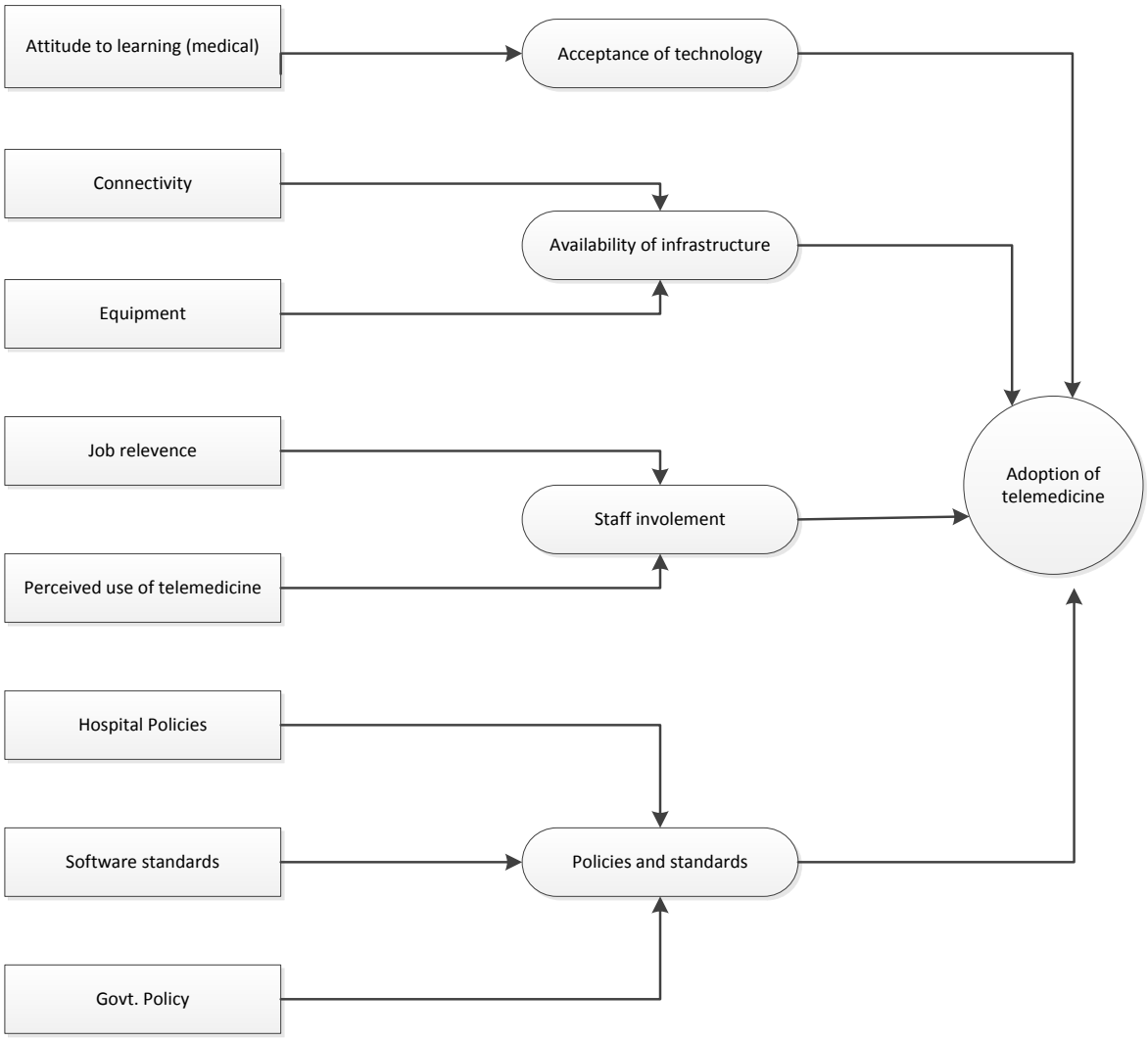


Figure 6-2 Sub-model for the clinicians

Component 2 of the model investigates whether there is sufficient infrastructure available in rural hospitals to introduce telemedicine. This includes investigating the availability of the Internet in rural hospitals and how the government can improve it. This component also investigates the ease of use of equipment for the hospital staff. The component also investigates what new equipment will be needed in rural hospitals when telemedicine is introduced.

Component 3 of the model will investigate how clinicians and hospital staff will be involved after the introduction of the new technology. The component also investigates how

management is going to introduce incentives for clinicians and consultants to use the new technology. The current level of IT literacy of hospital staff, and the training they need when telemedicine is introduced, will be investigated in this component. This component also investigates the job relevance and the perceived use of telemedicine for clinicians and hospital staff.

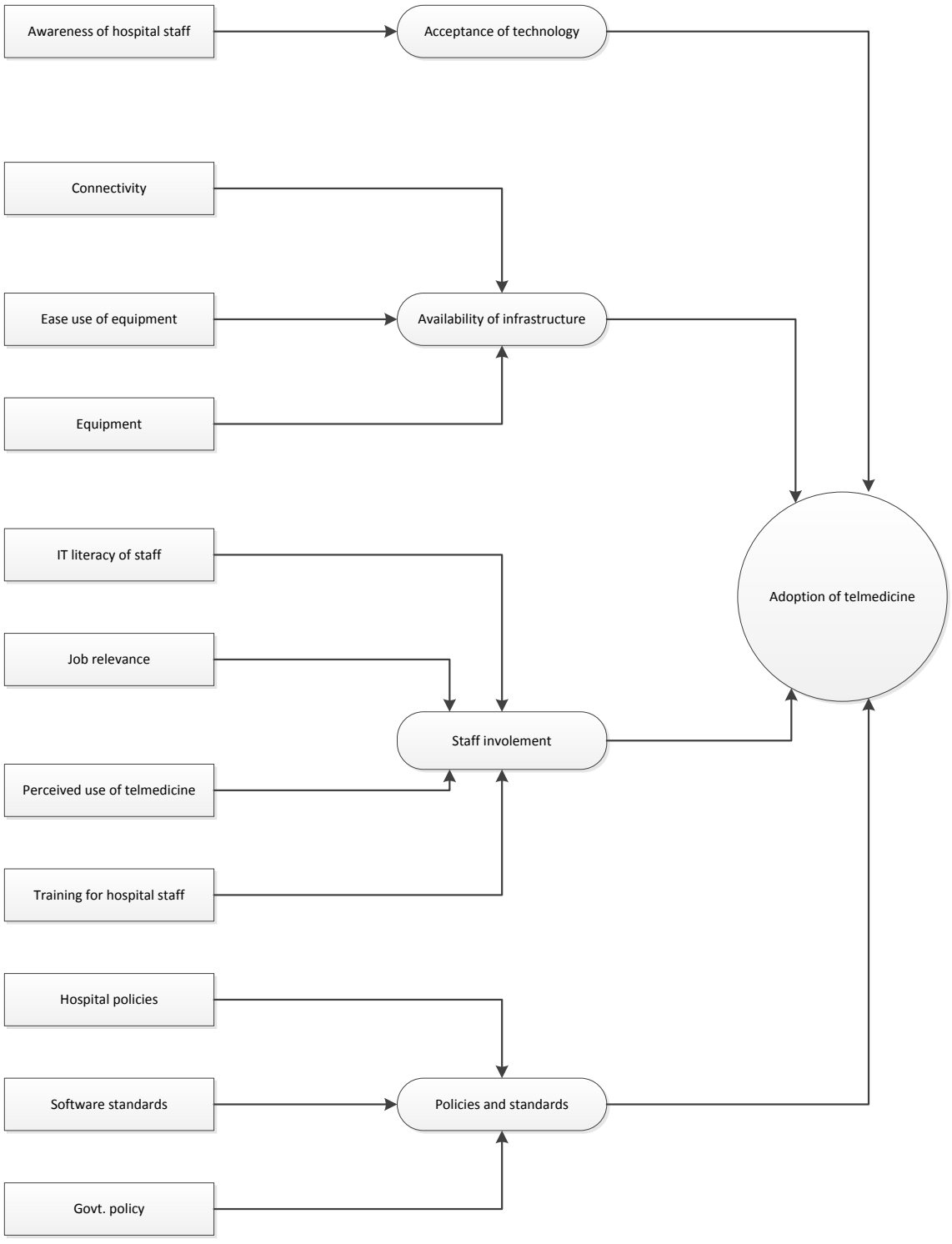


Figure 6-3 Sub-model for the hospital staff

Component 4 of the model will investigate the policies and standards needed when introducing telemedicine into rural areas. This component investigates what new policies should be introduced into hospitals and how standards can be improved when introducing the new technology. This component will also investigate what new Government policies, such as data protection, should be included when introducing telemedicine to rural hospitals.

Since the data is to be collected separately using different questionnaires for the clinicians, hospital staff and the general public, the main TMSL model was divided in to three sub-models (see Figure 6-2 Figure 6-3 and Figure 6-4).

After conducting the major study, and analysing the results and findings, an appropriate model will be designed to adopt telemedicine in rural areas of Sri Lanka.

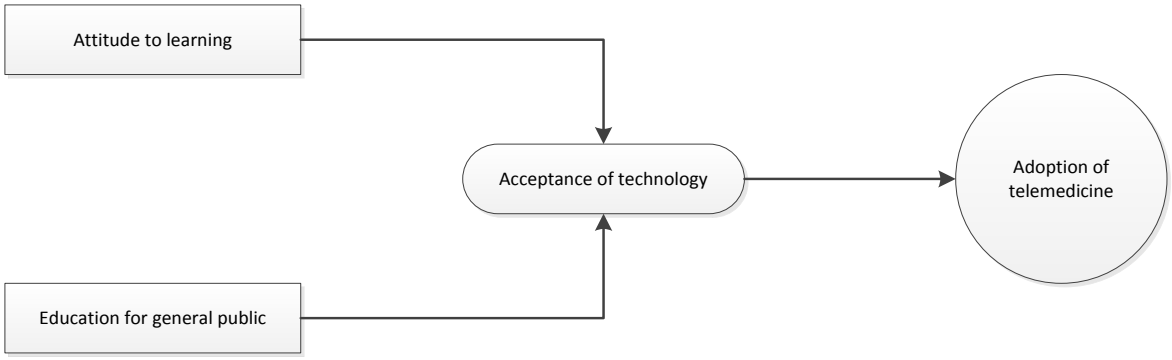


Figure 6-4 Sub-model for the general public

Table 6-1 Connection between the research questions, theory, methods and the new model will help to clarify '*what the major study is going to investigate*' by linking the research questions, research method and the new model.

Table 6-1 Connection between the research questions, theory, methods and the new model

Research question	Theory	Methods	Main model components
1. How will the attitude of the general public affect the introduction of telemedicine in rural areas?	TRA, TPB, TAM	Questionnaires	Acceptance of technology
2. How will the attitudes of the clinicians and the hospital staff affect the introduction of telemedicine in rural areas?	TAM, TRA, TPB	Questionnaires	Acceptance of technology
3. How will the staff involvement affect the introduction of	TAM, TPB, MPCU	Questionnaires	Staff involvement

Research question	Theory	Methods	Main model components
telemedicine in rural areas?			
4. How can the government improve infrastructure of ICT to improve the healthcare of the rural population?	TPB, DTPB, MPCU, compatibility (IDT)	Questionnaires and interviews	Availability of infrastructure Policies and Standards

Table 6-2explains "*how the major study will be investigated*" by linking the major theories used and the sub-components related to the theories in the model.

Table 6-2 Connection between the main theories used and the sub-components of the model

Theories		Sub-components	Main model components
TRA	Attitude	3.1, 3.5	Staff involvement
	Subjective norm	3.2, 3.3, 3.4	Staff involvement
TPB	Attitude	1.1, 1.2	Acceptance of technology
	Subjective norms	1.1, 1.4 4.1, 4.3	Acceptance of technology Policies and standards
	Perceived behavioural control	1.3, 4.2, 3.5	Accept to change Policies and standards
TAM	Perceived usefulness	2.1, 2.3, 3.4	Availability of infrastructure
	Perceived ease of use	2.2, 3.4	Availability of infrastructure

The numbers within the Sub component category refer to Figure 6-1

6.4 Summary

The results and findings of the exploratory study were discussed in this chapter. By dividing the results and the findings of the exploratory study into the three main categories of culture, technology and infrastructure, there were some positive and negative answers from clinicians, hospital staff and the general public and from senior managers, about adopting a telemedicine system in rural areas of Sri Lanka. The major impacts of adopting telemedicine were cultural effects when using new technology, the availability of resources, the involvement of hospital staff, and the need for training and policies to be clear.

Chapter 7. Main study questionnaire results

7.1 Introduction

This chapter presents the results of the main survey questionnaire, with subsequent statistical analysis of the relationship between the variables of the TMSL model discussed in Section 7.2.4. The quantitative data obtained was analysed using SPSS software. The results of the data collected are presented using descriptive statistics and inferential statistics. To measure the relationship between the components of the model Cronbach's alpha, Multivariate Analysis of Variance (MANOVA), Pearson's correlation, t-tests and Factor Analysis were used.

7.2 Analysis of the Quantitative data

Quantitative data questionnaires were used to answer the research question "*What is an appropriate model for the adoption of telemedicine system in the rural areas of Sri Lanka*?" to produce the variables for the TMSL model.

The sections demography of the participants (Section 7.2.1), computer use and participants' computer skills (Section 7.2.2), and internet use (Section 7.2.3) are presented below through descriptive statistics using graphs to illustrate the findings.

The questionnaire data was analysed using SPSS software and the hypothesis was tested through reliability analysis.

7.2.1 Demography of the participants

Participants were divided into clinicians, hospital staff and the general public. The recipients of the 225 questionnaires were 84 clinicians, 79 hospital staff and 62 members of the general public from both rural and urban areas. As the current retirement age in Sri Lanka is 55, 50 was used as a demarcation value, since it is those under 50 who will be most likely to have contact with telemedicine in the future.

7.2.1.1 Demography of the clinicians

84 clinician participants from both rural and urban areas participated in the survey as shown in Figure 7-1. Most of the clinician participants from the rural (91%) and urban (90%) areas

were under 50. The clinicians who participated in the survey who were over 50 years of age were a relatively small number being only 9% from rural areas and 10% from urban areas.

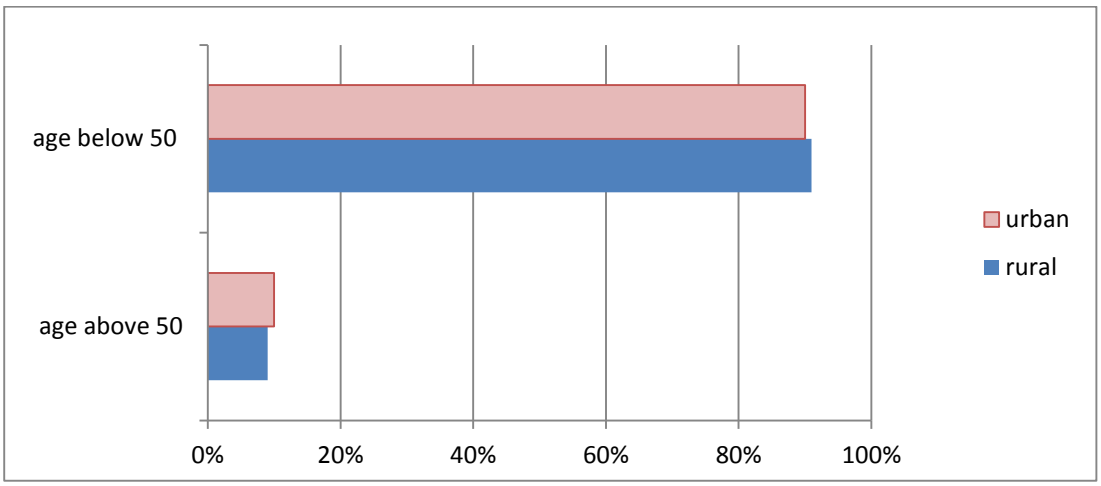


Figure 7-1 Ages of the clinicians

7.2.1.2 Demography of the hospital staff

79 hospital staff participants from rural and urban areas participated in the survey as shown in Figure 7-2. 78% of the participants from rural areas were under 50 and 22% of the participants from rural areas were over 50 years of age. In the urban areas, 93% of participants were under 50 and only 7% of the participants were over 50 years' old. This clearly indicates that hospital staff from the urban areas who participated in the survey was younger than hospital staff in rural areas.

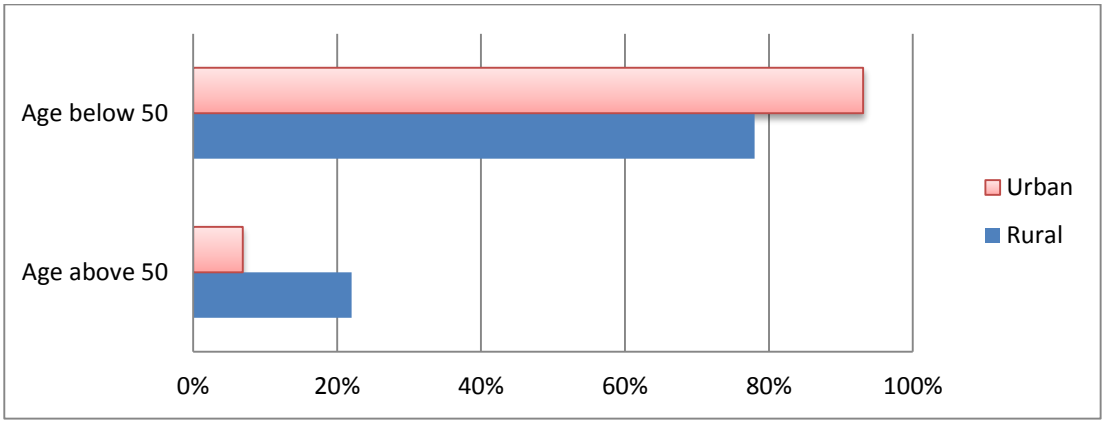


Figure 7-2 Ages of the hospital staff

7.2.1.3 Demography of the general public

62 general public participants from the rural and the urban areas are shown in Figure 7-3. More of the participants from rural areas (29%) than from urban (15%) areas were over 50 years' old. A similar number of participants from rural areas (63%) and urban areas (66%) under 50 participated in the survey.

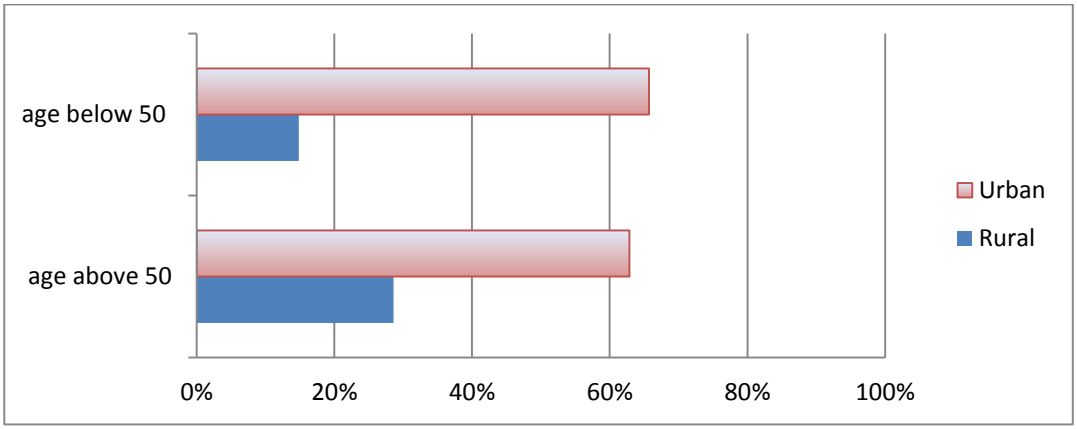


Figure 7-3 Ages of the general public

7.2.2 Computer use and computer skills of the participants

In this section, computer use among the participants, and a description of participants' self-assessed computer skills will be discussed. Computer skills are regarded as basic and intermediate computer skills, such as identifying external computer parts, browsing the Internet, using basic office software, understanding how to use the file system, and using e-mail.

7.2.2.1 Computer use and the computer skills of the clinicians

Figure 7-4 shows that about 51% of rural clinicians, and 59% of urban clinicians, use computers at home every day. The figure also shows that 23% of those from rural areas, and 17% of urban clinicians, use computers weekly. Around 12% from rural areas, and 10% from urban areas, use computers only occasionally. There are also 7% from rural areas, and 15% from urban areas, who sometimes use computers at home. 5% of clinicians from rural areas never use computers at home. These results indicate that the majority of clinicians from both rural and urban areas use computers at home.

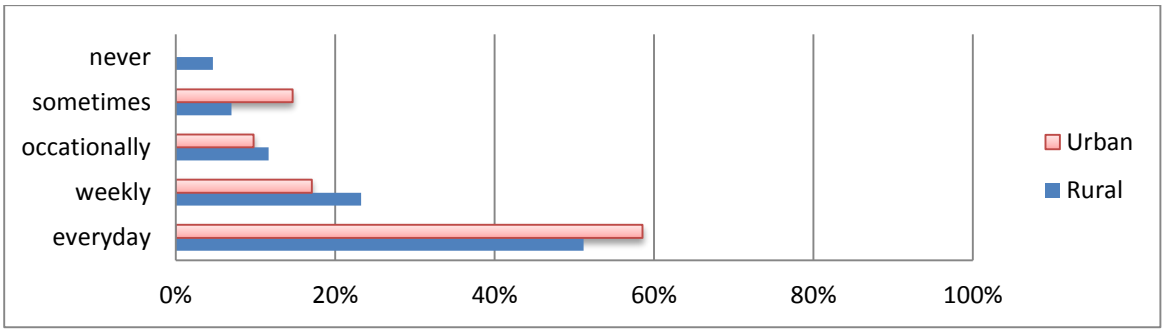


Figure 7-4 Computer use at home – clinician participants

Figure 7-5shows that about 12% of clinicians from rural hospitals and 24% from urban hospitals, use computers at work every day. Some clinicians from rural hospitals (12%), and some from urban hospitals (22%), use computers weekly at work whereas 30% from rural hospitals, and 27% from urban hospitals, use computers occasionally at work. Some rural clinicians (19%), and some urban clinicians (10%), use computers sometimes at work and 28% of rural clinicians and 24% of urban clinicians never use computers at work. This indicates that most of the clinicians from both rural and urban hospitals prefer not to use computers at home.

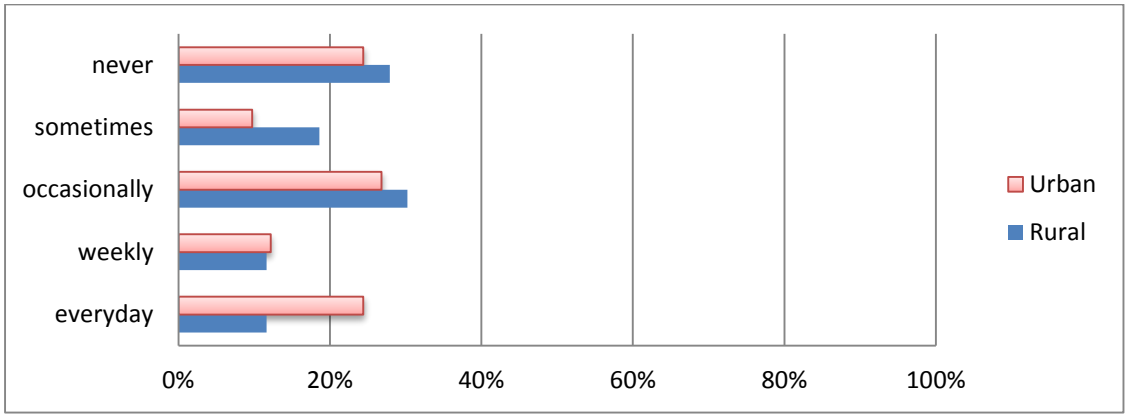


Figure 7-5 Computer use at work – clinician participants

It is good to note that all the clinicians had some familiarity with computers. Figure 7-6 shows that 40% of clinicians from rural areas, and 35% of from urban areas, claimed a fair knowledge of computers, while 33% from rural hospitals, and 46% from urban hospitals, had good computer skills. Surprisingly, 5% of the clinicians from rural hospitals had excellent computer skills and 21% clinicians from rural hospitals, and 12% clinicians from urban

hospitals had poor computer skills. Overall, results show that most clinicians from both rural and the urban areas have a fair knowledge of computers.

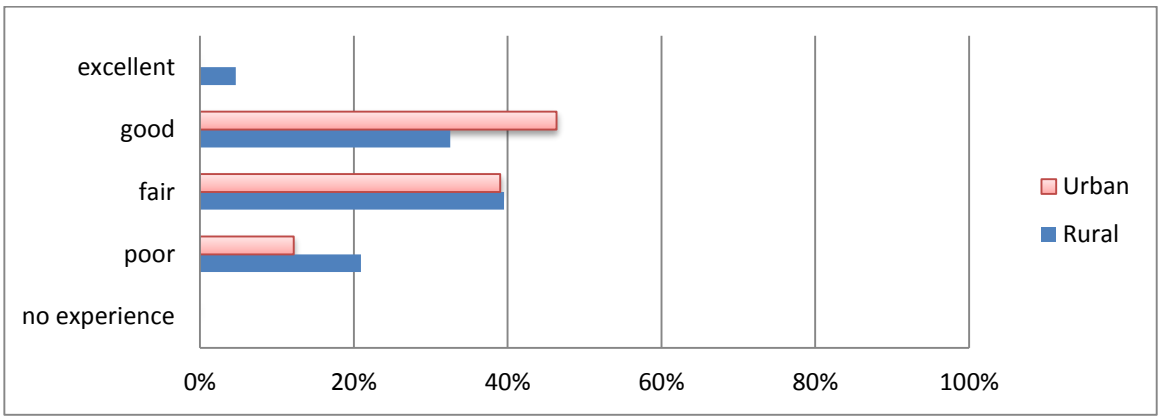


Figure 7-6 Self assessed Computer skills – clinician participants

7.2.2.2 Computer use and the computer skills of the hospital staff

Figure 7-7shows that 16% of the rural, and 31% of the urban hospital staff, use a computer every day at home, while 4% of the rural staff, and 14% of the urban staff, use computers weekly. There are also 30% of the rural, and 21% of the urban staff, who use computers occasionally, and 32% of the rural, and 17% of the urban hospital staff, who sometimes use computers at home. Even though 18% of the rural, and 14% of the urban hospital staff, never use computers at home, most of hospital staff do use computers at home.

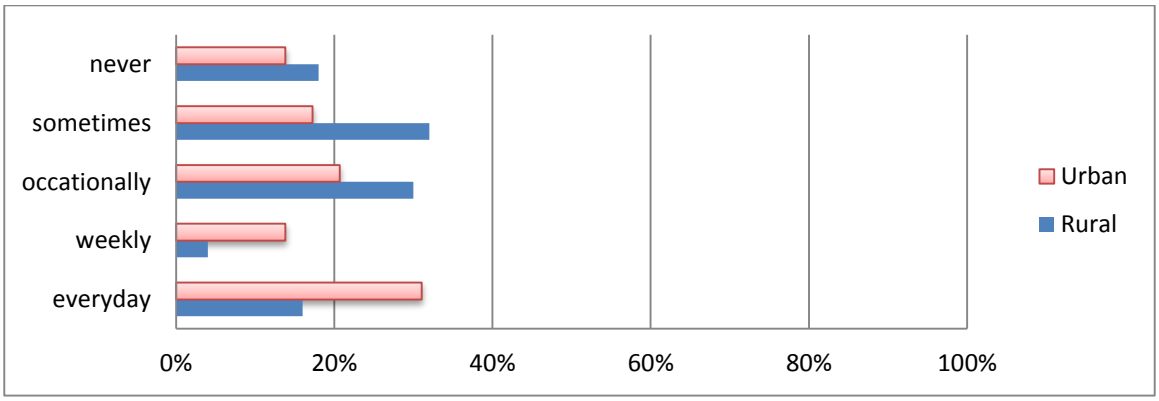


Figure 7-7 Computer use at home – hospital staff participants

Figure 7-8 shows that 18% of hospital staff from the rural areas, and 38% from the urban areas, use computers every day at work, while 4% from rural areas use computers weekly at work. There are about 2% from rural areas, and 17% from the urban areas, who use

computers occasionally at work and 22% from rural areas, and 17% from urban areas, who sometimes use computers at work. Just over half (52%) from rural areas and 28% from urban areas never use computers at home. These figures indicate that most of hospital staff from both rural and urban areas do not use computers that much at work.

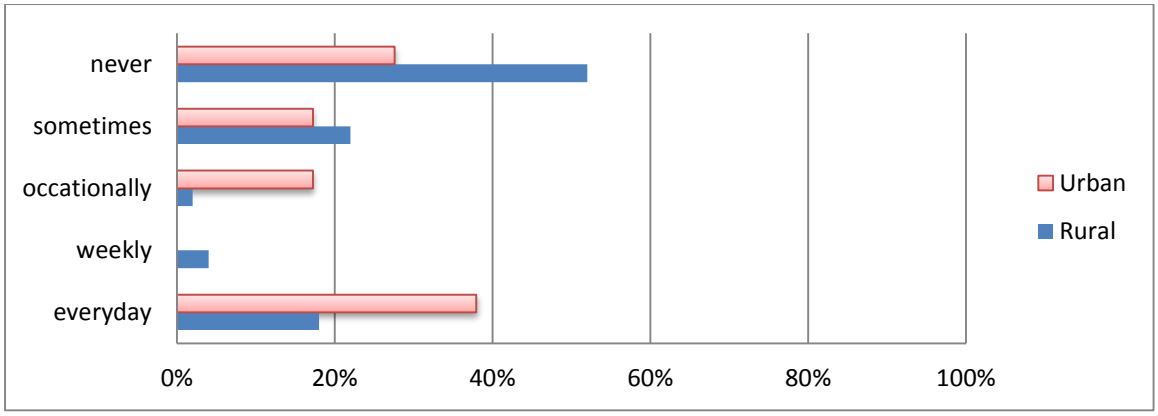


Figure 7-8 Computer use at work – hospital staff participants

Figure 7-9 shows that 18% of hospital staff from rural areas, and 14% from urban areas, claim to have a poor knowledge of computers and 44% from rural areas, and 45% from urban areas, have a fair knowledge of computers. Hospital staff from rural areas (18%), and 44% from urban areas, had a good knowledge of computers. Figure 7-9 also indicates that 6% of hospital staff from the rural areas had a very good knowledge of computers. Although 12% hospital staff from rural areas had no experience in computers at all, the overall statistics indicate that the computer skills of hospital staff in both rural and urban areas were satisfactory.

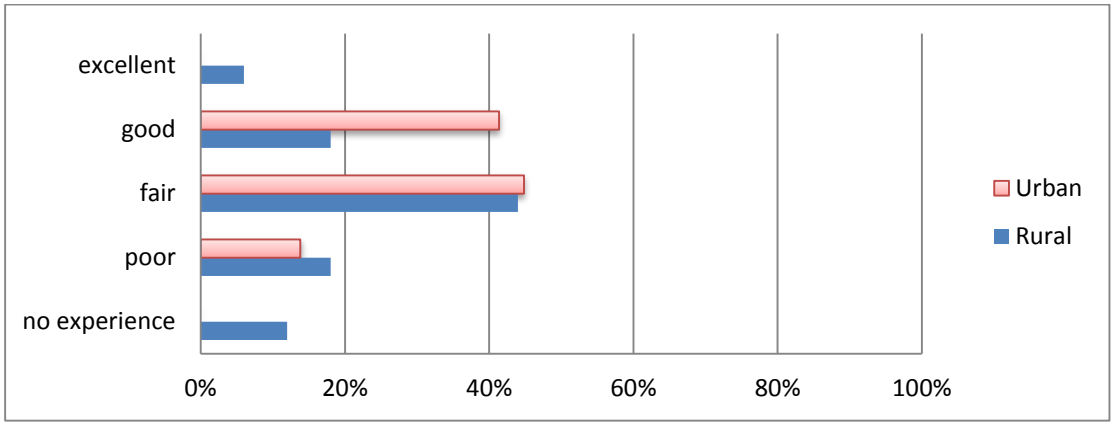


Figure 7-9 Self assessed Computer skills – hospital staff participants

7.2.2.3 Computer use and the computer skills of the general public

Figure 7-10 shows that most of the general public in both rural and urban areas use computers at home. 31% of those from rural, and 33% of those from urban areas, use computers every day at home and 14% of the rural, and 26% of the urban general public, use computers at home. There are also 34% of the rural, and 15% of the urban general public, who occasionally use computers at home, and 14% of the rural, and 19% of the urban general public, sometimes use computers at home. Even though 3% of the rural, and 7% of the urban general public, who never use computers at home, the majority of both rural and urban hospital staff do use computers at home.

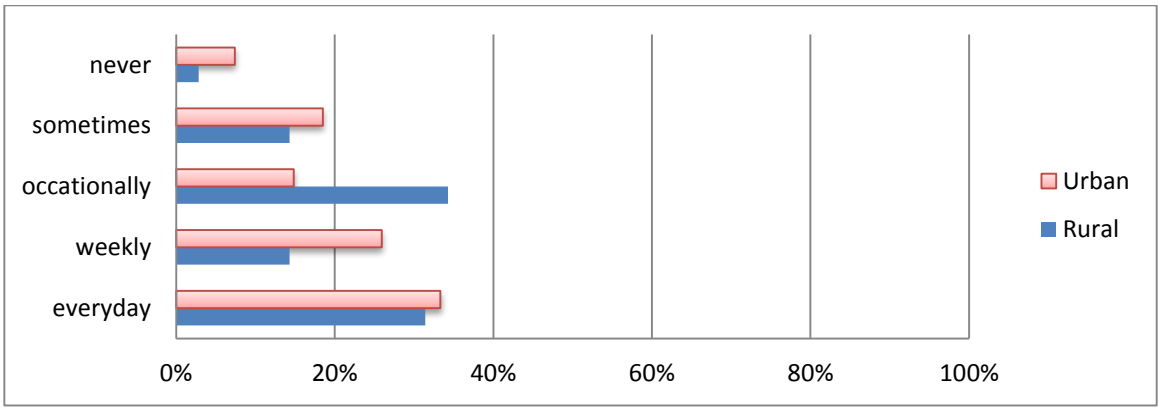


Figure 7-10 Computer use at home – general public participants

As shown in Figure 7-11, 29% of the general public from the rural, and 37% from urban areas, use computers every day at work, and 6% from the rural and 26% from the urban areas use computers weekly at work. 26% from the rural and 11% from the urban areas use computers occasionally at work, while 6% from the rural and 15% from the urban areas sometimes use computers at work. Of the general public, 31% in the rural areas, 7% in urban areas public never use computers at work. This indicates that even though most of the general public from urban areas use computers at work, computer use at work by the rural public is low compared to that of the urban public.

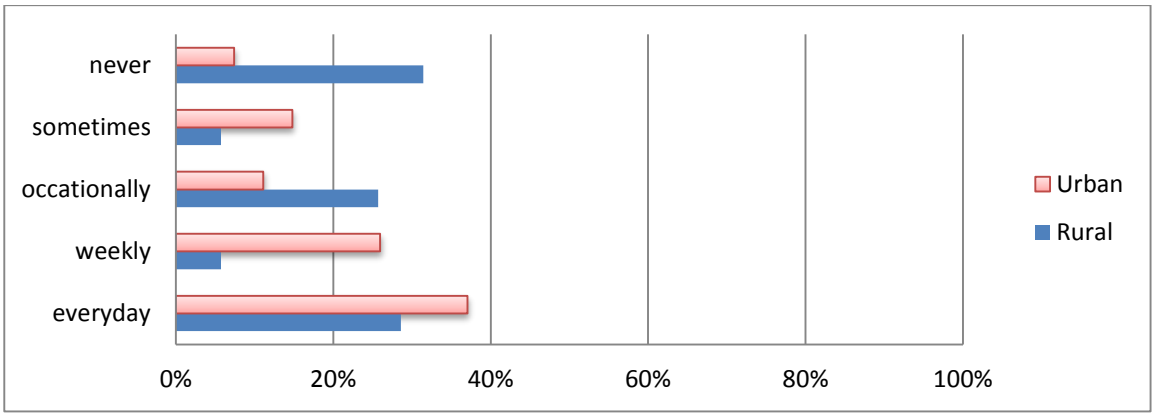


Figure 7-11 Computer use at work – general public participants

Figure 7-12 shows that 14% from the rural areas, and 15% of the urban general public claimed a poor knowledge of computers and 37% of the general public from the rural, and 26% from the urban areas, had a fair knowledge of computers. A good level of computer skills is indicated by the rural public's 31% and by the urban public's 44%. Surprisingly, 9% of general public from the rural areas, and 11% from urban areas had excellent computer skills. Even though 6% of the rural general public had no experience of computers, overall most of the general public from both rural and urban areas had a fair knowledge of computers.

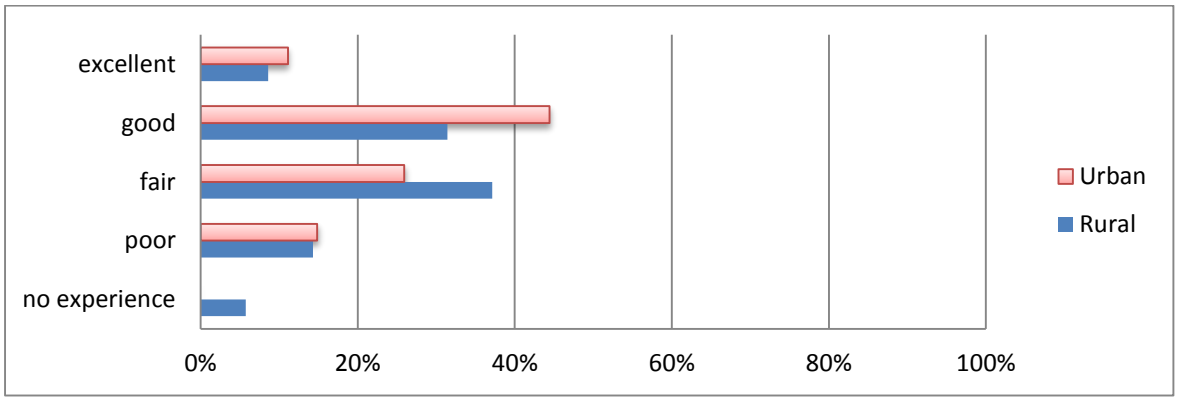


Figure 7-12 Computer skills – general public participants

7.2.3 Internet use of the participants

This section discusses how the participants (clinicians, hospital staff and the general public) access the Internet, the Internet connections used at home by participants and participants' experience using the Internet.

7.2.3.1 Internet access, and connections used and experience – clinicians

Figure 7-13shows that 86% of rural clinicians, and 95% of urban clinicians, access the Internet from home. As a matter of interest, none of the clinicians from the rural areas, and only 2% from the urban areas, access the internet from their offices. For rural clinicians, 2% access the internet from Internet cafes, though none of the urban clinicians use Internet cafes to access the Internet, and 5% of rural clinicians use other methods such as hot spots, to access the internet. Surprisingly, 5% of rural clinicians and 7% of urban clinicians never access the internet at all. These figures show that most of the clinicians from both rural and urban areas access the internet from home.

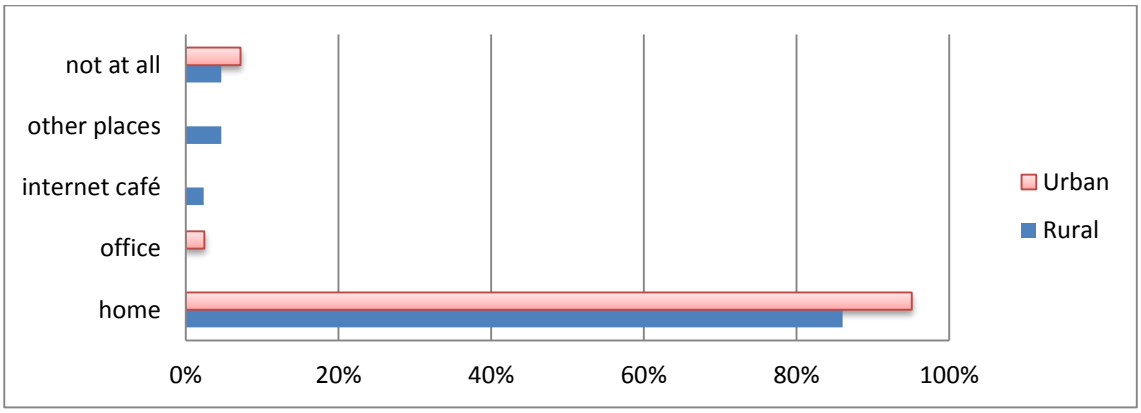


Figure 7-13 Accessing the Internet – clinician participants

Figure 7-14 shows that 19% of rural clinicians, and 10% of urban clinicians, use ISDN and 30% of rural clinicians, and 20% of urban clinicians, use DSL to connect to the Internet from home. Most of the clinicians from rural areas (33%), and urban areas (49%), use mobile phones to connect to the internet. 9% of rural clinicians, and 10% of urban clinicians, use LAN and 2% of rural clinicians use other methods (e.g. hot spots) to connect to the Internet from home. This indicates that the majority of clinicians from both rural and urban areas use either leased lines, or mobile phones, to connect to the Internet from home.

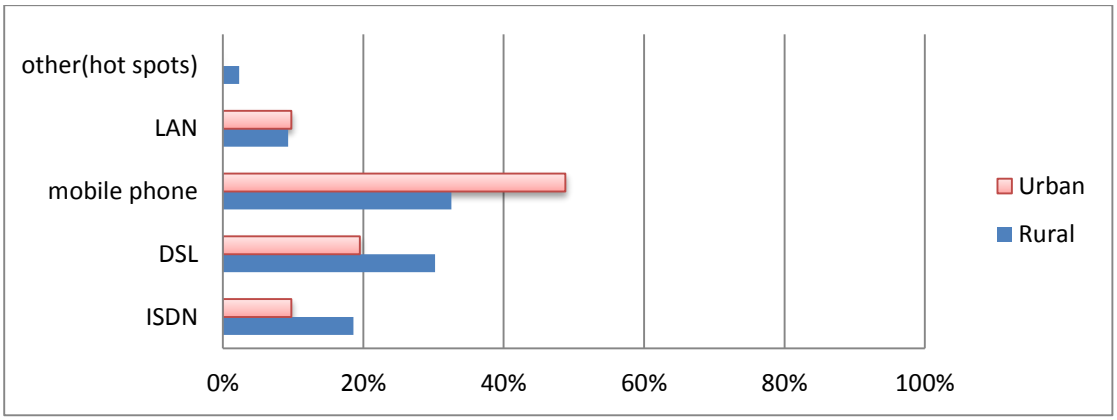


Figure 7-14 Type of internet connections at home – clinician participants

Figure 7-15 shows that 53% of rural clinicians, and 63% of urban clinicians, have over 5 years' experience in using the Internet and 33% of rural clinicians, and 29% of urban clinicians, have less than 5 years' experience. Thus the majority of clinicians from both rural and urban areas have a good level of experience in using the internet.

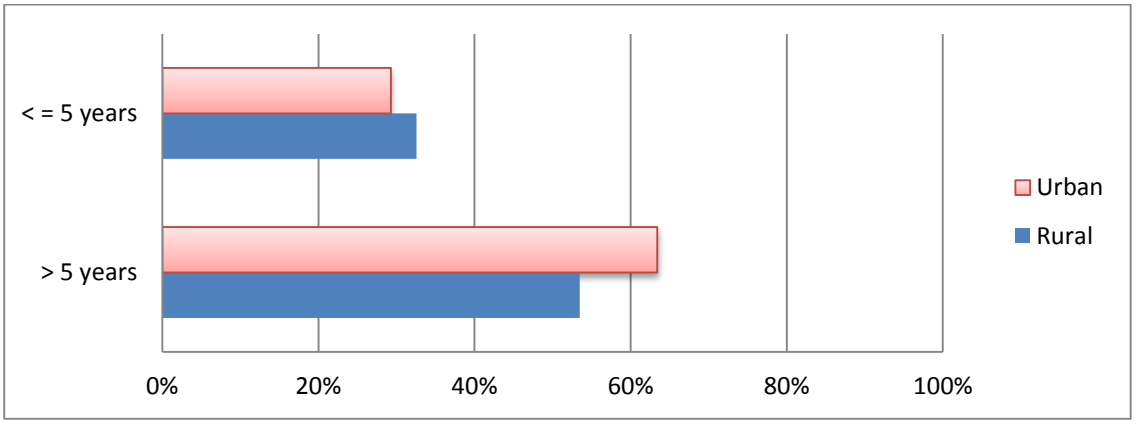


Figure 7-15 Experience using the Internet – clinician participants

7.2.3.2 Internet access, connections used and experience – hospital staff

Figure 7-16 shows that 58% of rural hospital staff, and 66% of the urban hospital staff, access the Internet from home, and that the same percentage (4%) of hospital staff from rural areas, and (7%) of urban staff access the Internet either from the office or from an Internet café. Even though 26% of rural staff, and 14% of the urban staff, do not access the Internet at all, 8% of rural staff and 7% of urban staff access the Internet from other sources such as hot spots. Thus more than half of both rural and urban hospital staff access the Internet from home.

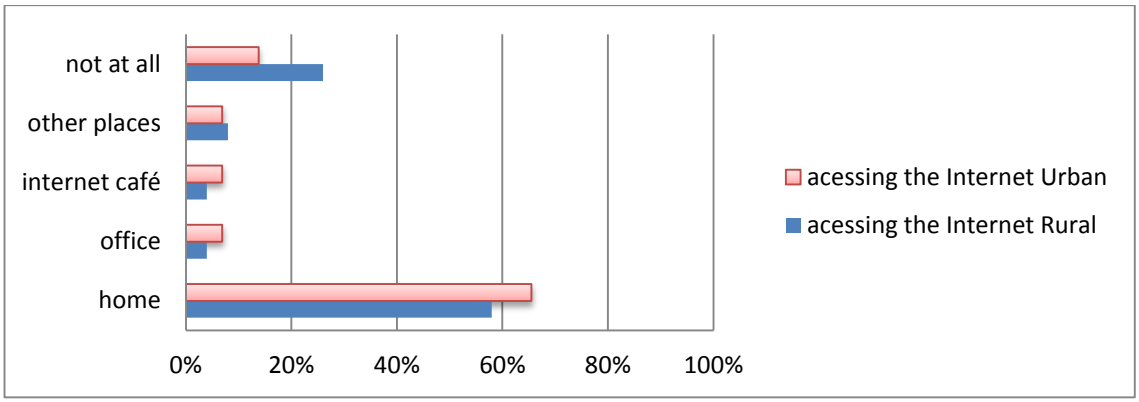


Figure 7-16 Accessing the Internet – hospital staff participants

Figure 7-17**Error! Reference source not found.** shows that 2% of the rural and 31% of the urban hospital staff use ISDN, and 10% of the rural, and 3% of the urban, use DSL to connect to the Internet. 30% of rural staff and 14% of urban staff use mobile phones to connect to the Internet. Around 22% of rural and 21% of urban staff, use LAN and 3% of urban hospital staff use other sources to connect to the Internet. A fair number of rural hospital staff use the mobile phone and fair number of urban hospital staff use leased lines to connect to the Internet.

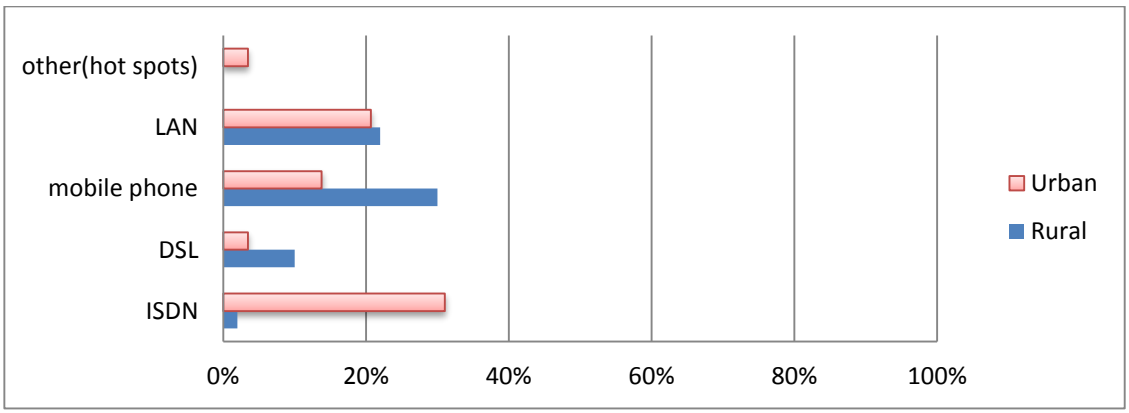


Figure 7-17 Type of Internet connections at home – hospital staff

Figure 7-18 shows that 24% from rural areas, and 31% from urban areas, have over five years' experience of using the Internet. Rural hospital staff (26%), and urban staff (55%) have less under five years' experience of using the Internet. These figures indicate that urban hospital staff have more experience in using the Internet than do rural hospital staff.

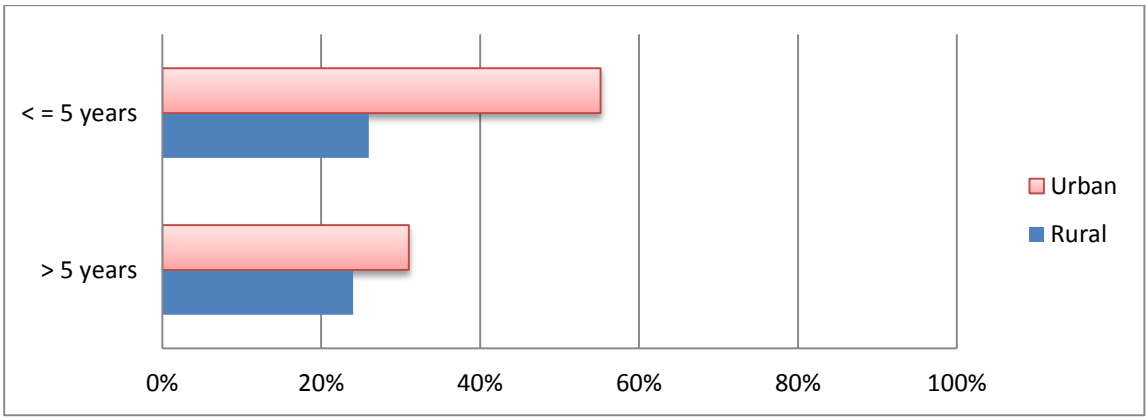


Figure 7-18 Experience using the Internet – hospital staff

7.2.3.3 Internet access, connections used and experience – general public

Figure 7-19**Error! Reference source not found.** shows that 69% of the rural general public and 89% of the urban general public use the Internet from home. Only 6% of the rural, and 7% of the urban general public, use the Internet from their offices and 6% of the rural general public who use Internet cafés to access the Internet. Even though 11% of the rural general public, and 4% of the urban general public do not access the Internet at all, 3% of the rural general public access the Internet from other sources such as hot spots. Thus more than half of the rural and urban general public access the Internet from home.

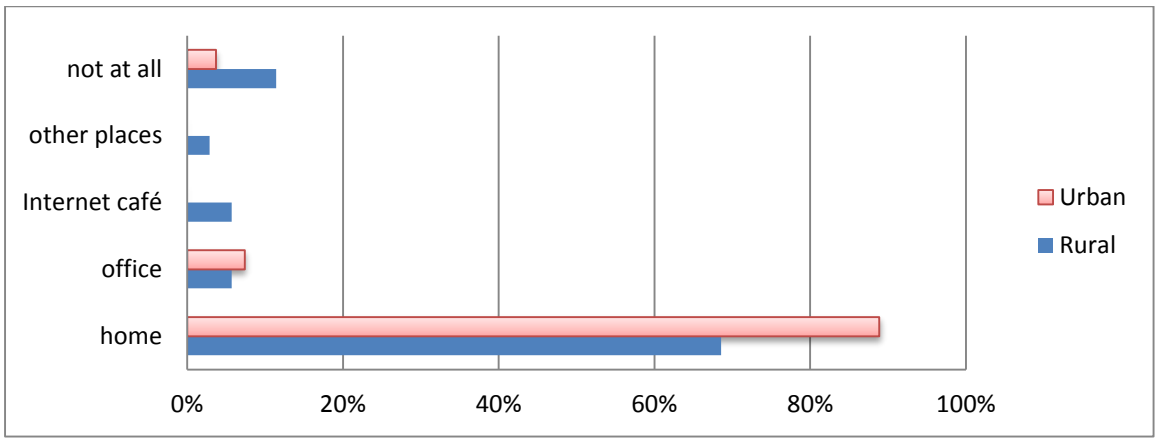


Figure 7-19 Accessing the Internet – general public participants

As shown in Figure 7-20, 9% of the rural general public use an ISDN connection while 40% of them use DSL to connect to the Internet, and 19% of the urban general public use the latter. Around 26% of the rural, and 15% of the urban general public, use mobile phones to connect to the Internet. Some 3% of the rural, and 41% of the urban general public, use LAN

and 6% of the rural, and 7% of the urban public, use other methods to connect to the Internet. This indicates that most of the general public use leased lines to connect to the Internet.

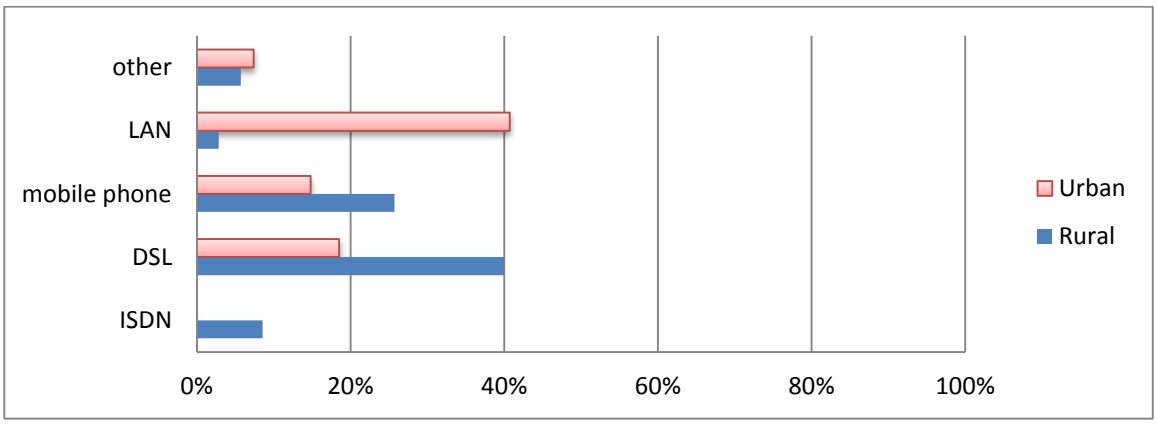


Figure 7-20 Type of Internet connections at home – general public

Figure 7-21 shows that 26% of the rural, and 63% of the urban general public, have more than five years' experience using the Internet. The figures also show that 74% of the rural, and 15% of the urban general public, have under five years' experience in using the Internet. Thus the urban general public has more experience in using the Internet than does the rural general public.

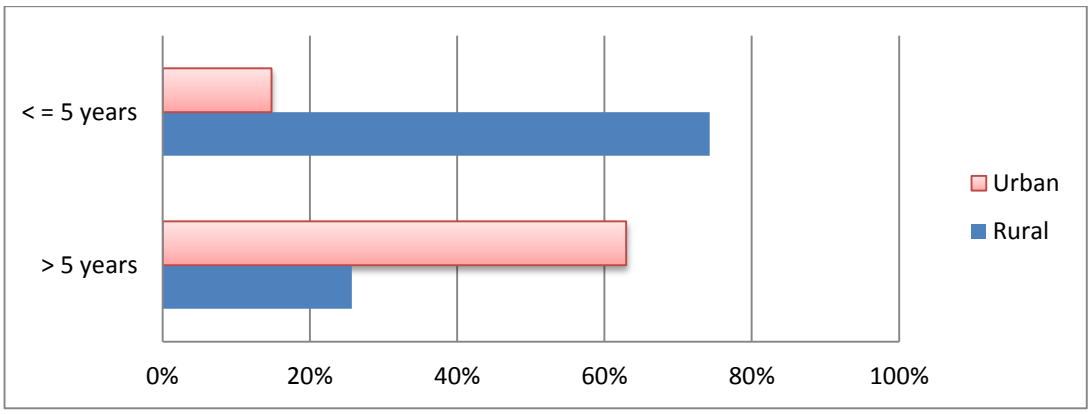


Figure 7-21 Experience using the Internet – general public participants

7.2.4 Relationship between the components of the model (Questionnaire results)

This section presents the results of the data collected during the survey conducted in Sri Lanka from 9 June to 17 July 2013. The questionnaires were distributed to the clinicians, hospital staff and the general public from most parts of the rural and urban areas. The

questionnaires given to the clinicians are in Appendix F. The questionnaires given to the hospital staff are in Appendix G and the questionnaires given to the general public are in Appendix A.

7.2.4.1 Reliability of the questionnaire

Cronbach's Alpha (α) was applied to the questionnaire to test its reliability. The value of 0.6 was determined and is an acceptable value for Cronbach's Alpha (Field, 2009).

7.2.4.2 Reliability analysis for the clinicians' questionnaire

The analysis for the questionnaire given to the clinicians was based on eight variables. Each variable had several questions as explained below.

1. Variable 1.2 attitude to learning (medical) had 6 questions
2. Variable 2.1 Connectivity had 4 questions
3. Variable 2.3 Equipment had 3 questions
4. Variable 3.3 Job relevance had 6 questions
5. Variable 3.4 Perceived use of telemedicine had 12 questions
6. Variable 4.1 hospital policies had 2 questions
7. Variable 4.2 software standards had 3 questions
8. Variable 4.3 government policy had 2 questions

The overall Cronbach's alpha for variable *Attitude to learning* (1.2) was 0.658 for 81 participants. This indicates a good reliability of the questionnaire (Field, 2009).

Table 7-1 Item total statistics for Attitude to learning (Medical)

Variable: Attitude to learning (medical) (1.2), α = 0.658			
No	Question	Item-total correlation (r)	Cronbach's Alpha if question deleted
1	I intend to use telemedicine for client care as often as is needed	0.174	0.681
2	I will spend less time on routine job tasks when using telemedicine	0.362 *	0.644
3	Using telemedicine will increase my chances of obtaining a promotion	0.276 *	0.672
4	Using telemedicine in client care is a good idea	0.491 *	0.602
5	I like to be an early adopter of new technology in my practice	0.600 *	0.555
6	I am confident that telemedicine will improve my relationship with my clients	0.651 *	0.532

*$p<0.05$, r > 0.232

Although the overall Cronbach's alpha of 0.658 suggests good reliability, Question 1 in Table 7-1 has an item-total correlation less than critical value of 0.232 indicating that it is not statistically significant (Roscoe, 1975) (table of critical values of the Pearson's correlation).

The item-total correlations for the remaining questions are statistically significant. Even though deleting question 1 only increases α from 0.658 to 0.681, a marginal improvement in the reliability of the questionnaire.

Since the variable *Attitude to learning* is considered reliable (Cronbach's alpha > 0.6) and the question does not make a big difference in α, it was decided not to delete question 1.

The questions for the variable *Connectivity* were derived using the answers given by the clinicians in the *comment* boxes as explained in Section 4.4.3. Overall Cronbach's alpha for the variable *Connectivity* (2.1) is 0.953 for 84 participants. This indicates that the questionnaire is very reliable (Field, 2009). The item-total correlations for all the questions are statistically significant (Table 7-2).

Table 7-2 Item total statistics for Connectivity

Variable: Connectivity (2.1), α = 0.953			
No	Questions	Item-total correlation (r)	Cronbach's alpha if question deleted
1	Rural hospitals have sufficient telephone connections	0.744 *	1.000
2	Rural hospitals have sufficient internet connections to adopt telemedicine	0.959 *	0.919
3	Rural hospitals have sufficient speed to use the internet	0.959 *	0.919
4	All the areas have sufficient coverage to adopt telemedicine	0.959 *	0.919

*$p<0.05$, r > 0.232

The ratings for the variable *Equipment* were also derived from the answers given by the clinicians in the comment boxes. For the variable *Equipment,* Cronbach's alpha was 0.568 for 84 participants. This indicates fairly close reliability to the guideline of 0.6 which suggests adequate reliability of this variable (Field, 2009). The question "*government has sufficient funds to supply telemedicine equipment for the rural hospitals*" was not used in the subsequent analysis because participants did not answer the question, and so is excluded from the table. The item-total correlation for both questions 1 and 2 were statistically significant (Table 7-3).

Cronbach's alpha is 0 if either question is deleted, since it does not apply to a variable which computes only one question, the other having been deleted.

Table 7-3 Item total statistics for Equipment

Variable: Equipment (2.3), α = 0.568			
No	Questions	Item-total correlation (r)	Cronbach's alpha if question deleted
1	Rural hospitals have sufficient computers to use telemedicine	0.491*	0.0
2	The infrastructure in the rural areas are sufficient to introduce telemedicine	0.491*	0.0

*p<0.05, r > 0.232

For the variable *Job relevance*, Cronbach's alpha was 0.647 for 77 participants. This indicates a good reliability of the questionnaire (Field, 2009).

Since the item-total correlations for all the questions are greater than the critical value of 0.232 (Roscoe, 1975) they are all statistically significant (Table 7-4).

Table 7-4 Item total statistics for Job relevance

Variable: Job relevance (3.3), α = 0.647			
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	Using telemedicine helps reduce the risk of error in my specialised area	0.394 *	0.598
2	In my job using telemedicine is important	0.259 *	0.650
3	In my job using telemedicine is relevant	0.578 *	0.517
4	In my specialised area, it is expected that I use computers as part of my daily work	0.404 *	0.594
5	Telemedicine will broaden the scope of the services offered by my practice	0.260 *	0.641
6	Telemedicine will improve my care delivery process	0.386 *	0.604

*p<0.05, r > 0.232

For the variable *Perceived use of telemedicine*, Cronbach's alpha was 0.817 for 77 participants. This is a good reliability for the questionnaire (Field, 2009).

Since the item-total correlation for all the questions is greater than the critical value of 0.232 (Roscoe, 1975) they are all statistically significant (Table 7-5).

Table 7-5 Item total statistics for Perceived use of telemedicine

Variable: Perceived use of telemedicine (3.4), α = 0.817			
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	Using telemedicine will increase my productivity	0.649*	0.791
2	Using computers will enhance my effectiveness in client care and management	0.295*	0.818
3	Using telemedicine decreases the time needed for my job responsibilities	0.300*	0.834
4	I expect to find telemedicine easy to use	0.531*	0.798
5	Telemedicine will improve my practice	0.655*	0.786
6	Using telemedicine enhances my effectiveness in my job	0.572*	0.795
7	Using telemedicine will improve the quality of care in my speciality	0.533*	0.798
8	Telemedicine will help me to use the most up to date technology in my practice	0.369*	0.813
9	Telemedicine is useful when sharing information with other colleagues	0.573*	0.799
10	Telemedicine is useful when sending and receiving information to other practitioners	0.525*	0.802
11	Telemedicine will improve my ability to collaborate with other consultants	0.536*	0.800
12	Using telemedicine will increase my patients' engagement in managing their health	0.394*	0.810

*$p<0.05$, $r > 0.232$

For the variable *Hospital policies*, Cronbach's alpha was 0.73 for 83 participants. This was a good reliability for the questionnaire (Field, 2009). Since the item-total correlation for all the questions is greater than the critical value of 0.232, (Roscoe, 1975), they are all statistically significant (Table 7-6).

Cronbach's alpha is 0 if either question is deleted, since it does not apply to a variable which computes only one question, the other having been deleted.

Table 7-6 Item total statistics for hospital policies

Variable: Hospital policies (4.1), α = 0.73			
No	Questions	item-total correlation (r)	Cronbach's Alpha if question deleted
1	I believe health institutes have policies in using telemedicine	0.579*	0.0
2	I believe health institutes have client privacy policy for data	0.579*	0.0

*p<0.05, r > 0.232

The reliability of the variable *Software standards* was not measured because the clinicians were given only one question relating to the variable.

For the measurement of the variable *Government policy*, Cronbach's alpha was 0.79 for 83 participants. A value of α between 0.65 and 0.84 is an indicator of good reliability of the questionnaire.(Field, 2009).

Since the item-total correlations for all the questions is greater than the critical value of 0.232 (Roscoe, 1975), they are all statistically significant (Table 7-7).

Cronbach's alpha is 0 if either question is deleted, since it does not apply to a variable which computes only one question, the other having been deleted.

Table 7-7 Item total statistics for Government policy

Variable: Government policy (4.3), α = 0.79			
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	I believe government has data protection act for health information	0.676 *	0.0
2	I believe government has introduced policies for using the internet for health information	0.676 *	0.0

*p<0.05, r > 0.232

7.2.4.3 Reliability analysis for the hospital staff questionnaire

The analysis for the questionnaire given to the hospital staff was based on 11 variables. Each variable had several questions as explained below.

1. Variable 1.4 Awareness of hospital staff had 5 questions
2. Variable 2.1 Connectivity had 4 questions
3. Variable 2.2 Ease use of equipment had 3 questions
4. Variable 2.3 Equipment had 3 questions

5. Variable 3.2 IT literacy of staff had 3 questions
6. Variable 3.3 Job relevance had 3 questions
7. Variable 3.4 Perceived use of telemedicine had 4 questions
8. Variable 3.5 Training for hospital staff had 3 questions
9. Variable 4.1 Hospital policies had 2 questions
10. Variable 4.2 Software standards had 3 questions
11. Variable 4.3 Government policy had 2 questions

Cronbach's alpha for the variable *Awareness of hospital staff* (1.4) was 0.655 for 76 participants. This indicates a good reliability for the questionnaire (Field, 2009).

According to Table 7-8, the item-total correlation for all the questions is greater than the critical value of 0.232 (Roscoe, 1975). Hence they are all statistically significant.

Table 7-8 Item total statistics for Awareness of hospital staff

Variable: Awareness of hospital staff (1.4), α = 0.655			
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	Senior colleagues who influence my job think that I should use telemedicine	0.362 *	0.636
2	Senior management think I should use telemedicine	0.495 *	0.562
3	People who are important to my job consider that I should use telemedicine	0.374 *	0.632
4	Telemedicine enables me to have time for other responsibilities	0.541 *	0.505

*$p<0.05$, $r > 0.232$

The ratings for the variable *Connectivity* was derived from the answers given by the hospital staff in the comment boxes. The mean rating for the variable *Connectivity* was 3.1 and the standard deviation was 0.3. Table 7-9 indicates perfect correlations. This is because 71 participants answered "3" (not sure) for all the questions and 8 participants answered "4" (agree) for all the questions.

Table 7-9 Item total statistics for Connectivity

Variable: Connectivity (2.1), α = 1			
No	Questions	Item-total correlation (r)	Cronbach's alpha if question deleted
1	Rural hospitals have sufficient telephone connections	1.000	1.000
2	Rural hospitals have sufficient internet connections to adopt telemedicine	1.000	1.000
3	Rural hospitals have sufficient speed to use the internet	1.000	1.000

4	All the areas have sufficient coverage to adopt telemedicine	1.000	1.000

The Cronbach's alpha for the variable Ease use of Equipment (2.2) was 0.425 for 79 participants. This indicates poor reliability of the questionnaire (Field, 2009).

According to Table 7-10 the item-total correlations for all the questions are greater than the critical value of 0.232 (Roscoe, 1975). Hence they are all statistically significant.

Table 7-10 Item total statistics for Ease use of Equipment

Variable: ease use of equipment (2.2) α = 0.425			
No	Questions	item- total correlation (r)	Cronbach's alpha if question deleted
1	Assuming I have access to the system, I intend to use it	0.270 *	–0.156
2	Quality of the output of telemedicine is high	0.270 *	0.079

*p<0.05, r > 0.232

The ratings for the variable *Equipment* was also derived from the answers given by the hospital staff in the comment boxes. The mean rating for the variable *Equipment* was 3.1 and the standard deviation was 0.3. Table 7-11 indicates perfect correlation. This is because 71 participants answered "3" (not sure) for all the questions and 8 participants answered "4" (agree) for all the questions.

Table 7-11 Item total statistics for Equipment

Variable: Equipment (2.3), α = 1			
No	Questions	Item-total correlation (r)	Cronbach's alpha if question deleted
1	Rural hospitals have sufficient computers to use telemedicine	1.000	1.000
2	The infrastructure in the rural areas are sufficient to introduce telemedicine	1.000	1.000
3	The government has sufficient funds to supply telemedicine equipment to the rural hospitals.	1.000	1.000

The Cronbach's alpha for the variable *Equipment* was 0.761 for 72 participants. This indicates a good reliability of the questionnaire (Field, 2009).

Table 7-12 shows the item-total correlations for all the questions on *IT literacy* are greater than the critical value of 0.232 (Roscoe, 1975). Hence they are all statistically significant.

Table 7-12 Item total statistics for IT literacy of staff

	Factor: IT literacy of staff (3.2), α = 0.761		
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	I find it easy to get health information from the internet to enable to do what I wish	0.612 *	0.657
2	It is easy to understand how to perform tasks using the internet	0.485 *	0.793
3	I find the Internet easy to use	0.689 *	0.562

*p<0.05, r > 0.232

Cronbach's alpha for the variable 3.3 *Job relevance* was 0.518 for 76 participants. This not so reliable (Field, 2009).

Since the item-total correlation of 0.163 for the question 1 in Table 7-13 is less than the critical value of 0.232 (Roscoe, 1975), it is not statistically significant. Item-total correlation for questions 2 and 3 are statistically significant.

Table 7-13 Item total statistics for Job relevance

Variable: Job relevance (3.3), α = 0.518			
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	Learning to operate the internet for my job is easy	0.163	0.640
2	In my job using telemedicine is important	0.493 *	0.202
3	In my job using telemedicine is relevant	0.411 *	0.297

*p<0.05, r > 0.232

Cronbach's alpha 0.6 is a reasonable measure for the variable *Job relevance* (3.3). Yet as Table 7-13 shows, Cronbach's alpha for the measurement of the variable is 0.518 which is not so reliable. If question 1 is deleted, the reliability of the questionnaire will increase to 0.640 suggesting that the measure of the variable is reliable. Although the item-total correlation for question 1 is not statistically significant, nonetheless the choice was made to retain the question to keep as many questions as possible in the scale.

Cronbach's alpha for the variable 3.4 *Perceived use of telemedicine* was 0.413 for 79 participants. This not so reliable (Field, 2009).

Table 7-14 illustrates the total-item correlations of 0.133 for question 1 and 0.030 for question 2 are less than the critical value of 0.232 (Roscoe, 1975). They are not statistically significant.

Item-total correlation for questions 3 and 4 are statistically significant (Table 7-14).

Table 7-14 Item total statistics for Perceived use of telemedicine

Variable: Perceived use of telemedicine (3.4), α = 0.413			
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	I will spend less time on routine tasks when using telemedicine	0.133	0.496
2	Telemedicine is useful when sharing information with other colleagues	0.030	0.480
3	I find telemedicine easy to use	0.453 *	0.107
4	Using telemedicine enhances my effectiveness in my job	0.340 *	0.215

*p<0.05, r > 0.232

Cronbach's alpha 0.6 is a good reliable measure for variable 3.4. But Cronbach's alpha for the measurement of the variable is 0.413 which is not so reliable. If questions 1 and 2 are removed, then the reliability of the questionnaire will be improved as indicated by the increase in Cronbach's alpha suggesting that the measure of the variable will be somewhat reliable. Nonetheless the choice was made to retain the questions to keep as many questions as possible in the scale.

Cronbach's alpha for the variable 3.5 *Training* was 0.726 for 74 participants. This indicates a good reliability for the questionnaire (Field, 2009).

Table 7-15 illustrates the item-total correlations for all the questions are greater than the critical value of 0.232, (Roscoe, 1975). Hence they are all statistically significant.

Table 7-15 Item total statistics for Training for hospital staff

Variable: Training for hospital staff (3.5), α = 0.726			
No	Questions	item- total correlation (r)	Cronbach's alpha if question deleted
1	I will have access to the training to make use of telemedicine	0.469 *	0.735
2	Telemedicine will help me to improve my continuing education	0.557 *	0.627
3	Telemedicine will require me to have new training courses	0.625 *	0.549

*p<0.05, r > 0.232

Cronbach's alpha for the variable 4.1 *Hospital policies* was 0.56 for 77 participants. This indicates a good reliability of the questionnaire (Field, 2009).

Table 7-16 illustrates the item-total correlations for all the questions are greater than the critical value of 0.232 (Roscoe, 1975). Hence they are all statistically significant.

Cronbach's alpha is 0 if either question is deleted, since it does not apply to a variable which computes only one question, the other having been deleted.

Table 7-16 Item total statistics for Hospital policies

Variable: Hospital policies (4.1), α = 0.56			
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	I believe health institutes have policies in using computers	0.391 *	0.0
2	I believe health institutes have client privacy policy for data	0.391 *	0.0

*p<0.05, r > 0.232

The reliability of the variable *Software standards* was not measured because hospital staff was given only one question relating to the variable.

Cronbach's alpha for the factor 4.3 *Government policy* was 0.68 for 78 participants. This indicates a good reliability for the questionnaire (Field, 2009).

Table 7-17 illustrates the item-total correlations for all the questions are greater than the critical value of 0.232 (Roscoe, 1975). Hence they are all statistically significant.

Cronbach's alpha is 0 if either question is deleted, since it does not apply to a variable which computes only one question, the other having been deleted.

Table 7-17 Item total statistics for government policy

Factor: Government policies (4.3), α = 0.68			
No	Questions	Corrected item-total correlation (r)	Cronbach's alpha if question deleted
1	I believe government has data protection act for health information	0.520 *	0.0
2	I believe government has introduced policies for using the internet for health information	0.520 *	0.0

*p<0.05, r > 0.232

7.2.4.4 Reliability analysis for the general public questionnaire

The analysis for the questionnaire given to the general public was based on two variables. Each variable had several questions as explained below.

1. Variable 1.1 Attitude to learning has five questions
2. Variable 1.3 Education of general public has five questions

The Cronbach's alpha for the variable *Attitude to learning* is 0.671 for 60 participants. This indicates a good reliability for the questionnaire (Field, 2009).

Table 7-18 illustrates the item-total correlations for all the questions is greater than the critical value of 0.273, (Roscoe, 1975). Hence they are all statistically significant.

Table 7-18 Item total statistics for Attitude to learning

Variable: Attitude to learning (1.1), α = 0.671			
No	Questions	item-total correlation (r)	Cronbach's Alpha if question deleted
1	I have generally favourable attitude towards using telemedicine	0.491 *	0.591
2	I feel more at ease using telemedicine than in a traditional face-to-face consultation	0.486 *	0.590
3	I expect to feel more independent when using the internet to obtain health information	0.292 *	0.674
4	Clinician using telemedicine for my consultation is entirely my choice	0.414 *	0.627
5	I believe it is a good idea to use telemedicine in the rural areas of Sri Lanka	0.457 *	0.608

*p<0.05, r > 0.232

Cronbach's alpha for the variable *Education of the general public* is 0.747 for 61 participants. This indicates a good reliability for the questionnaire (Field, 2009).

According to Table 7-19, the item-total correlations for all the questions is greater than the critical value of 0.273 (Roscoe, 1975). Hence they are all statistically significant.

Table 7-19 Item total statistics for Education of the general public

Factor: Education of the general public (1.3), α = 0.747			
No	Questions	item-total correlation (r)	Cronbach's alpha if question deleted
1	I am confident that telemedicine will reduce my travelling cost	0.516 *	0.701
2	I find it easy to use the Internet to obtain health information	0.557 *	0.692
3	I am confident that use the internet for assistance in getting health information	0.422 *	0.735
4	I am confident that using telemedicine ill reduce the travelling time	0.580 *	0.677
5	Interacting with the consultant online in a clinic will be pleasant	0.507 *	0.704

*p<0.05, r > 0.232

7.2.5 Multivariate Analysis of Variance (MANOVA)

MANOVA was used in the survey to test differences among two or more groups or two or more variables, see section 4.2.3.4, (Field, 2009).

7.2.5.1 Multivariate test for the clinicians

Table 7-20 presents the results of MANOVA for the eight variables of the clinicians sub-model between the rural and urban groups. The variables included were:

- Attitude to learning (medical)
- Connectivity
- Equipment
- Job relevance
- Perceived use of telemedicine
- Hospital policies
- Software standards
- Government policy

Table 7-20 MANOVA – test for the clinicians

Effect	Value	F	Hypothesis df	Error df	*p* (Sig)
Rural/Urban – Pillai's Trace	0.083	0.845[b]	8.000	75.000	0.566

b = Exact statistic

Pillai's Trace = 0.083 and p = 0.566 which is > 0.05. This indicates that the differences between the mean variable scores are not statistically significant (Field, 2009).

The results in Table 7-21shows that there is no significant difference between the rural and the urban groups of clinicians in relation to *Attitude to learning (medical)*, *Connectivity*, *Equipment*, *Job relevance*, *Perceived use of telemedicine*, *Hospital policies and Software standards*.

Table 7-21 MANOVA – test of between-subjects effect for the clinicians

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	*p* (Sig.)
Attitude to learning (medical)	13.520	1	13.520	1.114	0.294
Job relevance	0.035	1	0.035	0.003	0.958
Connectivity	0.880	1	0.880	1.151	0.286
Equipment	0.015	1	0.0.1	0.183	0.627
Perceived use of telemedicine	36.282	1	36.282	1.171	0.282

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	*p* (Sig.)
Hospital policies	3.252	1	3.252	1.327	0.253
Software standards	0.175	1	0.175	0.217	0.643
Government policy	0.009	1	0.009	0.003	0.954

7.2.5.2 Multivariate tests for the hospital staff

Table 7-22 shows the results of the MANOVA for the 11 variables in the hospital staff sub-model of rural and urban groups. The variables included were:

- Awareness of hospital staff
- Connectivity
- Ease use of equipment
- Equipment
- IT literacy of staff
- Job relevance
- Perceived use of telemedicine
- Training for hospital staff
- Hospital policies
- Software standards
- Government policy

Table 7-22 MANOVA – test for the hospital staff

Effect	Value	F	Hypothesis df	Error df	*p(*Sig.)
Rural/Urban – Pillai's Trace	0.245	2.201[b]	10.000	68.000	0.028

b = Exact statistic

Pillai's Trace = 0.245, $p = 0.028$ which is < 0.05. This means some or all of the variables show differences between the rural and urban groups of hospital staff. The variables *Connectivity*, *Equipment*, *IT literacy of staff* and *Job relevance* show significant differences (Table 7-23) and are illustrated by the graph in Figure 7-22. The differences in the dependent variables of *Connectivity* (CV), *Equipment* (EQ), *IT literacy of staff* (ITL) and *Job relevance* (JR) are very small.

Table 7-23 MANOVA – test of between-subjects effects for the hospital staff

No	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	*p* (Sig.)	Mean Rural	Mean Urban

No	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	*p* (Sig.)	Mean Rural	Mean Urban
AHS	Awareness of the hospital staff	0.411	1	0.411	0.050	0.824	17.5	17.3
CV	Connectivity	7.518	1	7.518	5.384	0.023 *	12.6	12.0
EUE	Ease use of equipment	9.643	1	9.643	3.281	0.074	11.4	10.7
EQ	Equipment	4.229	1	4.229	5.384	0.023 *	9.5	9.0
ITL	IT literacy of staff	15.792	1	15.792	4.775	0.032 *	12.1	11.2
JR	Job relevance	20.409	1	20.409	7.345	0.008 *	12	10.9
PUT	Perceived use of telemedicine	19.537	1	19.537	3.437	0.068	13.5	12.5
THS	Training for hospital staff	0.117	1	0.117	0.024	0.877	10.9	11
HP	Hospital policies	2.836	1	2.836	1.250	0.267	7.4	7.8
SS	Standards	0.563	1	0.563	0.594	0.443	3.5	3.7
GP	Government Policy	0.108	1	0.108	0.053	0.818	7.2	7.1

*p < 0.05

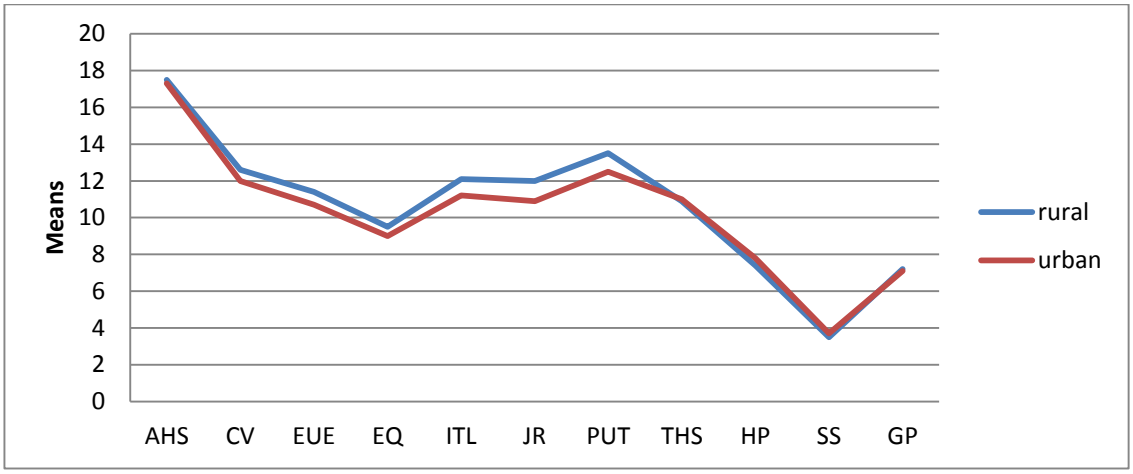


Figure 7-22 Differences in the dependant variables

7.2.5.3 Multivariate test for the general public

Table 7-24 show the results of the MANOVA for the two variables in the general public sub-model of the rural and the urban groups. The two variables included were:

- Attitude to learning
- Education of the general public

Table 7-24 MANOVA – test for the general public

Effect	Value	F	Hypothesis df	Error df	*p* (Sig.)
Rural/Urban – Pillai's Trace	0.036	1.105[b]	2.000	59.000	0.338

b = Exact statistic

The value for Pillai's Trace = 0.9, p = 0.3 which is > 0.05, indicates that the difference between the mean variable scores is not significant (Field, 2009). Therefore there is no significant difference between the general public rural and urban groups. Table 7-25 shows that there is no significant difference between the rural and the urban general public in relation to *Attitude to learning* and *Education of the general public* since p > 0.05 for both variables.

Table 7-25 MANOVA – test of between-subjects effects for the general public

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	*p* (Sig.)
Attitude to learning	14.352	1	14.352	2.238	0.140
Education of the general public	4.867	1	4.867	0.940	0.336

7.2.6 Correlation

This section discusses Pearson's correlation between the ratings derived from the answers given by the clinicians, hospital staff and the general public in the comment boxes for the variable related to *Adoption of telemedicine* and the related variables in the sub-models of the TMSL model.

7.2.6.1 Clinicians

Table 7-26 provides Pearson's correlations between the variable *Adoption of telemedicine* and the variables associated with the sub-model for the clinicians. The abbreviations for the variables are:

ATL Attitude to learning (medical)
EQP Equipment
PUT Perceived use of telemedicine
SWS Software standards
ATM Adoption of telemedicine
CTY Connectivity
JR Job relevance
HP Hospital policies
GP Government policy

Table 7-26 Pearson's correlation between adoption of telemedicine and the variables related to sub-model for the clinicians

	ATL	CTY	EQP	JR	PUT	HP	SWS	GP	ATM
ATL	1.0	–0.075	0.295 **	0.613 **	0.76 6**	0.431 **	0.035 **	0.309 **	0.027
CTY		1.0	0.145	–0.014	–0.020	–0.057	–0.199	–0.150	–0.317 **
EQP			1.0	0.113	0.152	0.279 *	0.146	0.239 *	–0.140
JR				1.0	0.594 **	0.521 **	0.485 **	0.327 **	0.195
PUT					1.0	0.309 **	0.258 **	0.171	0.181
HP						1.0	0.720 **	0.658 **	0.068
SWS							1.0	0.537	–0.018
GP								1.0	–0.098
ATM									1.0

* correlation is significant at 0.05 level (2-tailed)

** correlation significant at 0.01 level (2-tailed)

The results suggest that the variable *Adoption of telemedicine* does not significantly correlate with the variables except for variable *Connectivity* (CTY). There is a moderate negative relationship $r = 0.317$, $p < 0.01$ which is further considered in the Discussion chapter.

7.2.6.2 Hospital staff

Table 7-27 discusses the correlation between the variable *Adoption of telemedicine* and the variables related the sub model for the 79 hospital staff participants.

The abbreviations for the variables are given below:

AHS	Awareness of hospital staff	CTY	Connectivity
EUE	Ease use of equipment	EQP	Equipment
ITS	IT literacy of staff	JR	Job relevance
PUT	Perceived use of telemedicine	THS	Training for hospital staff
HP	Hospital policies	SWS	Software standards
GP	Government policy	ATM	Adoption of telemedicine

Table 7-27 Pearson's correlation between the adoption of telemedicine and the variables related to sub-model for the hospital staff

	ASH	CTY	EUE	EQP	ITS	JR	PUT	THS	HP	SWS	GP	ATM
AHS	1.0	0.250 *	0.536 **	0.250 *	0.135	0.339 **	0.307 **	0.371 **	0.147	0.147	0.059	0.172
CTY		1.0	0.326 **	1.000 **	0.202	0.289 **	0.317 **	0.219	0.018	–0.015	–0.066	0.528 **
EUE			1.0	0.326 **	0.200	0.328 **	0.480 **	0.204	0.263 *	0.202	0.105	0.345 **
EQP				1.0	0.202	0.289 **	0.317 **	0.219	0.018	–0.015	–0.066	0.528 **
ITS					1.0	0.403 **	0.495 **	0.351 **	0.248 *	0.201	0.106	0.185
JR						1.0	0.360 **	0.405 **	0.113 *	0.23 7*	0.174	0.211
PUT							1.0	0.400 **	0.388 **	0.167	0.190	0.407 **
THS								1.0	0.418 **	0.490 **	0.364 **	0.298 **
HP									1.0	0.478 **	0.669 **	0.229 *
SWS										1.0	0.564 **	0.148
GP											1.0	0.075
ATM												1.0

* correlation is significant at 0.05 level (2-tailed)

** correlation significant at 0.01 level (2-tailed)

From Table 7-27, the correlations between *Adoption of telemedicine* (ATM) and the variables *Awareness of hospital staff* (AHS), *IT literacy of staff* (ITS), *Job relevance* (JR), *Software standards* (SWS) and *Government policy* (GP) are not significant.

Connectivity (CTY) has a significant correlation with *Adoption of telemedicine* (ATM), r = 0.528, p =< 0.01, suggesting a strong positive relationship between the two variables.

The variable *Ease use of equipment* (EUE) correlates with *Adoption of Telemedicine*, r = 0.345 (p < 0.01). This suggests that there is a moderately positive relationship between the variable EUE and the variable *Adoption of Telemedicine*.

The variable *Equipment* (EQP) correlates with *Adoption of Telemedicine*, r = 0.528 (p < 0.01). This suggests that there is a strong positive relationship between the variable EQP and the variable *Adoption of Telemedicine.*

The variable *Perceived use of telemedicine* (PUT) correlates with *Adoption of Telemedicine*, r = 0.407 (p < 0.01). This suggests that there is a strong positive relationship between the variable PUT and the variable *Adoption of Telemedicine.*

The variable *Training for hospital staff* (THS) correlates with *Adoption of Telemedicine* and r = 0.298 (p < 0.01). This suggests that there is a weak positive relationship between the variable THS and the variable *Adoption of Telemedicine.*

The variable *Hospital policies* (HP) correlates with *Adoption of Telemedicine* and r = 0.229 (p < 0.05). This suggests that there is a moderate positive relationship between the variable EUE and the variable *Adoption of Telemedicine.*

The inter-correlations of the other variables are analysed further in Factor Analysis below.

7.2.6.3 General public

Table 7-28 shows Pearson's correlation between *Adoption of telemedicine* and the variables *Attitude to learning* (1.1) and *Education for the general public* (2.3) for 62 general public participants.

Table 7-28 Pearson's correlation for the adoption of telemedicine and the variables related to the sub-model for the general public

	Attitude to learning	Education for general public	Adoption of telemedicine
Altitude to learning	1	0.699 **	0.150
Education for general public		1	–0.093
Adoption of telemedicine			1

According to Table 7-28, the variables *Attitude to learning* and *Education for general public* do not have a statistically significant correlation with *Adoption to Telemedicine.*

7.2.7 Student t-tests

Student t-tests compare the mean rating of the variables used against the value "3" from the Likert scale which represents "not sure". *Post hoc* tests that consist of multiple comparisons should be corrected so that the level of significance over all comparisons keeps the type 1 error at 0.05. The method to control the error rate used was the Bonferroni correction, which is calculated by dividing the α by the number of comparisons (Field, 2009).

7.2.7.1 Clinicians

A one sample t-test was performed to test the hypotheses of the clinicians' view of adopting telemedicine in the rural areas. Using the Bonferroni method, an α *value* of 0.006 (0.05/8) was considered for the t-test for the clinicians. The test value is the "not sure" rating of 3 applied to the number of questions in the variable. For example, the test value for *Attitude to learning (medical)* is 18.

Table 7-29 Student t-test for the variables related to adoption of telemedicine for clinicians

	Test value	N	Mean	t	df	*p* (sig)
Attitude to learning (medical)	18	84	21.65	9.61	83	<0.001 *
Connectivity	12	84	11.08	–2.12	83	0.04
Equipment	9	84	8.94	–1.92	83	0.06
Job relevance	18	84	22.86	12.73	83	<0.001 *
Perceived use of telemedicine	36	84	46.40	17.11	83	<0.001 *
Hospital policies	6	84	7.26	7.37	83	<0.001 *
Software Standards	9	84	3.42	–57.20	83	<0.001 *
Govt. Policy	6	84	7.06	5.88	83	<0.001 *

*p < 0.05

In Table 7-29, for the variable *Attitude to learning (medical)*, the mean was significantly higher than the test value, $t(83) = 9.61$, $p < 0.001$.This suggests that the clinicians' attitude to learning telemedicine will improve the adoption of telemedicine.

The variable *Connectivity* had four questions and the test value was 12. The mean was significantly lower than the test value, $t(83) = –2.12$, $p = 0.04$. This suggests that clinicians disagree that having more connectivity will improve the adoption of telemedicine.

The variable *Equipment* which had three questions, shows that the mean was significantly lower than the test value, t(83) = –1.92, $p = 0.06$. This indicates that clinicians disagree with the idea that more equipment in the hospitals will improve the adoption of telemedicine.

The mean for the variable *Job relevance* which had six questions was significantly higher than the test value, t(83) = 12.73, $p < 0.001$. This indicates that the job relevance of the clinician will improve the adoption of telemedicine.

The mean for the variable *Perceived use of telemedicine* containing twelve questions was significantly higher than the test value, t(83) = 17.11, $p < 0.001$ indicating that the perceived use of telemedicine by the clinicians will improve the adoption of telemedicine.

The variable *Hospital policies* which had two questions shows that the mean was significantly higher than the test value, t(83) = 7.37, $p < 0.001$. This suggests that the clinicians agree that hospital policies will improve the adoption of telemedicine.

The mean for the variable *Software standards* which had three questions was significantly lower than the test value, t(83) = –57.20 and $p < 0.001$ indicating that clinicians disagree that software standards will contribute to the adoption of telemedicine.

The variable *Government policy* which had two questions shows that the mean for the variable was significantly higher than the test value, t(83) = 5.88, $p < 0.001$. This indicates that clinicians agree that for the government to have a data protection policy will help in the adoption of telemedicine.

7.2.7.2 Hospital staff

To test the hypotheses of the view of hospital staff towards the adoption of telemedicine in rural areas, a one-sample t-test was used. Using the Bonferroni method, a p value of 0.005 (0.05/11) was considered for the t-test for the hospital staff. For example, test value for *Awareness of hospital staff* is 12.

The means for all the variables, except for *Software standards,* were significantly higher than the respective test values, as shown in Table 7-30. This indicates that hospital staff agree that the variables *Awareness of hospital staff, Connectivity, Ease of use of technology, Equipment, IT literacy of staff, Job relevance, Perceived use of telemedicine, Training for hospital staff, Hospital policies* and *Government policy* will help in the adoption of telemedicine.

Table 7-30 Student t-test for the variables related to adoption of telemedicine for hospital staff

	Test value	N	Mean	t	df	*p* (sig)
Awareness of hospital staff	12	79	13.58	5.42	78	0.001 *
Connectivity	12	79	12.41	2.67	78	0.004 *
Ease of use of technology	6	79	7.27	8.80	78	0.001 *
Equipment	9	79	9.30	2.96	78	0.004 *
IT literacy of staff	9	79	11.76	13.17	78	0.001 *
Job relevance	9	79	11.39	12.25	78	0.001 *
Perceived use of telemedicine	12	79	13.10	4.04	78	0.001 *
Training for hospital staff	9	79	11.00	7.68	78	0.001 *
Hospital policies	6	79	7.54	9.09	78	0.001 *
Software standards	9	79	3.54	–49.92	78	0.001 *
Government policy	6	79	7.15	7.24	78	0.001 *

*p < 0.05

The variable *Software standards*, which had three questions, shows that the mean of the variable is significantly lower than the test value. This suggests that hospital staff do not agree that improving software standards will help in the adoption of telemedicine.

7.2.7.3 General public

A one sample t-test was used to test the hypotheses for the view of the general public in adopting telemedicine in rural areas. A *p* value of 0.025 (0.05/2) was selected using the Bonferroni Method to keep the overall type one error as 0.05. For example, test value for *Attitude to learning* is 15.

Table 7-31 Student t-test for the variables related to adoption of telemedicine for the general public

	Test value	N	Mean	t	df	*p* (sig)
Attitude to learning	15	62	19.18	12.86	61	<0.001 *
Education of the general public	15	62	20.10	17.65	61	<0.001 *

*p < 0.05

The means in Table 7-31 for both variables are higher than their respective test scores. This suggests that attitude towards learning about telemedicine, and improving the education of the general public about the Internet and telemedicine, will help to improve the adoption of telemedicine.

7.2.8 Factor analysis

Principle Component Analysis (PCA) is used here because the theory suggests that all the variables are participating completely in the factor structure and the communalities are all set to 1.

The number of extracted components to retain for the next stage of factor rotation was given by the eigenvalue >1, a rule of thumb (Field, 2009).

7.2.8.1 Clinicians

The following results relate to the data collected from the clinicians. Using the rule of thumb, a three component solution was retained. Table 7-32 and Table 7-33give the loadings for the three components retained and the commonalities for the solution.

The clinician variables are:

- Hospital policies
- Government policy
- Software standards
- Perceived use of telemedicine
- Attitude to learning (Medical)
- Job relevance
- Connectivity
- Equipment

Table 7-32 Loading* for 3 components retained with eigenvalue > 1, for clinicians

Eigenvalue > 1	Component		
Variables	1	2	3
Hospital policies	0.851		
Government policy	0.841		
Software standards	0.813		
Perceived use of telemedicine		0.925	
Attitude to learning (Medical)		0.872	
Job relevance		0.752	
Connectivity			0.782
Equipment			0.720

*Loading > 0.40

Table 7-33 Communalities for the three component solution for clinicians

Variables	After extraction
Attitude to learning (medical)	0.825
Job relevance	0.693
Perceived use of telemedicine	0.859
Hospital policies	0.819
Software standards	0.739
Government policy	0.717
Connectivity	0.673
Equipment	0.632

A four component solution was also analysed because the model involved four components (see Table 7-34 and Table 7-35).

Table 7-34 Loading* for 4 components retained, for clinicians

Factors to extract = 4	Component			
Variables	1	2	3	4
Hospital policies	0.872			
Software standards	0.841			
Government policy	0.810			
Perceived use of telemedicine		0.924		
Attitude to learning (medical)		0.868		
Job relevance	0.441	0.735		
Equipment			0.952	
Connectivity				0.981

*loading > 0.40

Table 7-35 Communalities for the four component solution for clinicians

Variables	After extraction
Attitude to learning (medical)	0.859
Job relevance	0.764
Perceived use of telemedicine	0.862
Hospital policies	0.845
Software standards	0.770
Government policy	0.717
Connectivity	0.983
Equipment	0.953

Comparing the communalities between the three component and the four component analysis, the variables *Connectivity* and *Equipment* participate more in the four component solution. In addition, *Connectivity* and *Equipment* participate less on component 3 in the three component solution. *Connectivity* loads high on component 3 and *Equipment* loads high on component 4 in the four component solution. Compared with the three component solution, communalities for *Connectivity* and *Equipment* are higher in the four component

solution. Additionally, in the four component solution, variable *Job relevance* loads onto two components. In the three component solution, all the variables load exactly onto one component. Hence the proposed four component model was adjusted to a three component model. This is further elaborated in the Discussion chapter.

7.2.8.2 Hospital staff

The following results relate to the data collected from the hospital staff. Table 7-36 and Table 7-37 give the loadings for the components and the commonalities for the component solution.

The hospital staff variables are:

- Government policy
- Hospital policies
- Software standards
- Training for hospital staff
- Connectivity
- Equipment
- IT literacy of staff
- Perceived use of telemedicine
- Job relevance
- Awareness of hospital staff
- Ease use of equipment

Table 7-36 Loading* for 4 components retained with eigenvalue > 1, for hospital staff

Eigenvalue > 1 Variables	Component			
	1	2	3	4
Government policy	0.885			
Hospital policies	0.818			
Software standards	0.778			
Training for hospital staff	0.540		0.449	
Connectivity		0.974		
Equipment		0.974		
IT literacy of staff			0.891	
Perceived use of telemedicine			0.642	
Job relevance			0.632	
Awareness of hospital staff				0.866
Ease use of equipment				0.801

*loading > 0.40

Table 7-37 Communalities for the four component solution for hospital staff

Variables	After extraction
Awareness of hospital staff	0.780
Ease use of equipment	0.728
IT literacy of staff	0.810
Job relevance	0.523
Perceived use of telemedicine	0.600
Training for hospital staff	0.558
Hospital policies	0.703
Software standards	0.635
Government policy	0.785
Connectivity	0.998
Equipment	0.998

Four components were extracted with eigenvalue > 1, which was identical to the four factor solution given in the model. Therefore there was no need for a second analysis to extract four components because the solution already had four factors.

The low communalities for the two variables *Job relevance* and *Training for hospital staff* suggests that these variables are not participating in the four component model quite as highly as they could, whereas for the clinicians, all the variables are participating high in the three factor model. This will be further elaborated in the Discussion section.

7.3 Summary

Descriptive statistics were used to prepare graphs to illustrate the demography of the participants, their computer use and computer skills, and their internet use. These were analysed using descriptive statistics. The participants were the clinicians, hospital staff and the general public from the rural and urban areas of Sri Lanka. The results indicate that most of the participants who participated in the survey were less than 50 years' old.

Cronbach's alpha was used to test the reliability of the questionnaires given to the participants. The results indicate that all the questions distributed to the clinicians were statistically significant except for question 1 in variable 1.2: *Attitude to learning (medical).* The results for the hospital staff for the reliability of the questionnaires indicate that the questions were statistically significant except for question 1 in the factor *Job relevance* and questions 1 and 2 in the variable *Perceived use of telemedicine*. The questionnaires distributed to the general public during the survey were all statistically significant.

The results of the questionnaire were tested using inferential statistics. A Multivariate Analysis of Variance (MANOVA) was used to test the difference among the two groups,

rural and urban areas. The results show that there is no difference between the rural and the urban clinician participants. Except for the factors *IT literacy of staff* and *Job relevance*, the remaining factors indicated that there is no difference between the rural and urban hospital staff participants. The results for the general public participants indicate that there is no difference between the rural and urban respondents.

Pearson's correlation was used to determine whether there is a correlation between the *Adoption of telemedicine* and the variables related to the research questions. The results for the clinicians indicated that there are no significant correlations between the variables related to sub-research question 2 and sub-research question 3 with adoption of telemedicine. For the hospital staff, there were significant correlations between the variables *Awareness of hospital staff, Perceived use of telemedicine, Training for hospital staff* and sub-research question 2 and sub-research question 3 with adoption of telemedicine. The results for the general public indicate that there is no statistical correlation with adoption of telemedicine.

The one sample t-tests carried out for clinicians, hospital staff and the general public, showed that most of the variables influence the adoption of telemedicine.

Finally, a Factor Analysis was used to determine which variables cluster more on the components given in the model. Using Principal Component Analysis (PCA), the results suggests that three component solutions may be a better match for the clinicians' data and the model.

Chapter 8. Main study interview results

8.1 Introduction

This chapter explains the findings of the interviews conducted with the Health Ministry officials and senior managers in the health sector. The views of the rural and urban clinicians and hospital staff are also discussed, given in the "*comments*" section of the questionnaires.

The interview questionnaires were mainly designed to answer the sub-research questions "*How can the government improve infrastructure of ICT to improve the healthcare of the rural population*?", and "*How will the new technology affect the attitudes of the clinicians and the hospital staff in introducing telemedicine*?"

The main areas of interest covered during the interviews in relation to the adoption of telemedicine were the availability of the Internet in rural hospitals, the availability of equipment in rural hospitals so as to be able to adopt telemedicine, current hospital standards, and the software standards available to adopt telemedicine. The information gathered during the interviews explained the current infrastructure facilities in the rural hospitals of Sri Lanka.

8.2 Analysis of the Qualitative data

The interviews were conducted using personal contacts. Six participants from the Health Ministry and senior managers were interviewed by the researcher. There were also 225 participants (clinicians, hospital staff and the general public) who expressed their ideas in the "*comments*" section in the questionnaires.

In order to answer the research questions "*How can the government improve infrastructure of ICT to improve the healthcare of the rural population*?", and "*How will the new technology affect the attitudes of the clinicians and the hospital staff in introducing telemedicine*?" semi structured interviews were carried out among several Health Ministry officials and senior managers, including hospital directors and consultants. The "*comments*" section in the questionnaires allowed the clinicians, hospital staff and the general public to express their ideas about the adoption of telemedicine in the rural areas of Sri Lanka. The results were analysed using NVivo10 software. The interviews were conducted in English and in Sinhalese. The transcripts were later translated from Sinhalese to English and the key concepts were coded.

Six codes for the interviews were developed from the questions asked of the Health Ministry officials and the senior managers in the health sector. The codes were *Connectivity, Equipment, Incentives, Hospital standards, Software standards,* and *Job relevance.*

This Section will give a description of the interviews given by the Health Ministry officials and its senior managers. Also covered are the comments given by the clinicians, the hospital staff and the general public regarding the introduction of a telemedicine system into rural areas of Sri Lanka.

The Northern Province was selected because there had been a civil war there for three decades until it ended in 2009. This region can demonstrate better the ICT challenges of introducing telemedicine. The two islands were selected for the interviews because the transport facilities are very poor and so would be a good demonstration of the need for a telemedicine system.

The data collected from the rural areas for the interviews showed poor connectivity and lack of equipment in rural hospitals. The data collected from these areas will help to improve these facilities when adopting telemedicine.

The urban areas selected for the interviews were mainly to gather information about how urban clinicians will adopt to telemedicine and also the job relevance, incentives and the perceived use of telemedicine that the clinicians foresee.

The numbers of clinicians and hospital staff from the rural and the urban areas were selected randomly.

The numbering system in this section is: C = comment number, I = interview number.

8.2.1 Connectivity

When considering the internet connectivity in the rural hospitals, most of the answers were positive stating that there is enough coverage in rural hospitals. In the Northern Province, the answers showed that the internet facilities are improving rapidly. This could be related to the ending of the civil war in the north of the country in 2009. The following examples highlight this point:

Ministry official: "*We have the latest methods and up to date equipment in the hospitals in the Northern Province. Where ever you go you will find a computer or a laptop.*"

Senior manager: "*Earlier we didn't have ADSL or any other connections. But now we have the connections to the city hospitals and for the remote areas we have dongles*."

Clinician (rural-I3): "*We have only the connection using the dongles. Therefore we use the hand phone to get information*."

Clinician (rural-C22): "*If all the consultants are linked together we can solve the problem very easily*."

Hospital staff (rural-C32): "*Having the proper connectivity will help to have medical training sessions for the rural clinicians using telemedicine*."

Clinician (urban-C70): "A*vailability of the internet has to be improved*."

Hospital staff (rural-C26): "*Excellent communication method will be developed*."

Hospital staff (rural-C33): "*Introducing low cost internet connections to the health workers will help to use telemedicine in a very good standard*."

8.2.2 Equipment

Considering the equipment related to the telemedicine system, there was a mixture of positive and negative answers. The answers stated that all the major hospitals are well equipped with the latest technology. This could be due to donations from other countries and the Health Ministry allocating money for the use of the latest technology in hospitals. However, peripheral hospitals are still not up-to-date with the latest technology. The following examples highlight the point:

Ministry official: "*We have the latest equipment in our hospitals. Government has allocated money to purchase the latest equipment. We also have donations from countries like Japan and Korea*."

Senior manager: "*Peripheral hospitals are at a very primitive level now. That is lack of equipment and lack of consultants*."

Clinician (rural-I3): "*We cannot use Skype at the moment because we don't have the facilities in the hospital because we don't have cameras*."

Clinician (rural-C24): "*Before introducing telemedicine hospital authorities should establish internet and computer facilities in the hospital staff labs*."

Hospital staff (rural-C27): "*Introducing telemedicine will help the infrastructure in the rural hospitals to be upgraded to the next level*."

8.2.3 Incentives

Considering the incentives for clinicians when telemedicine is introduced, the answers were positive and negative. This could be because the rural patient and the clinicians in the rural areas will benefit from the system. It can also be due to less travelling for the consultants to the rural hospitals. The following examples highlight the point:

Ministry official: "*In the Northern Province I don't think consultants are very much worried about the money. The consultants in the north want to do a service to the rural population more than the money*."

Clinician (urban- I1): "*Travel time and the cost can be reduced for the consultant as well as the patient*."

Senior manager: "*Costs can be reduced for the consultant*."

Clinician (rural-I2): "*I am very much interested in participating in telemedicine because it will benefit the rural patient*."

Clinician (rural-C1): "*Private practice might be affected by telemedicine*."

Clinician (rural-C3): "*Consultants might think that it will reduce their private practice*."

8.2.4 Hospital standards

Considering the hospital standards when introducing telemedicine, the answers were mainly negative. The reason for this could be the lack of infrastructure and lack of technology in the rural hospitals. For example:

Clinician (urban-I1): "*You have to have the whole network connected. Sometimes there will be legal issues because we are treating the patient without physically seeing the patient*."

Senior manager: "*The rural hospitals are run by the medical officers. If we get the advice from the medical directors from the medical institutes and the medical association, we can improve and adopt hospital standards*."

Clinician (rural-I2): "*I don't have any idea*."

Clinician (rural-C30): "*If telemedicine is to be implemented in the rural areas, the privacy policy, data protection should be maintained in all the hospitals*."

Hospital staff (rural-C2): "*We need to think about the confidentiality of the patient's records and patient's information. I don't think we have proper standards to cover these areas*."

Hospital staff (urban-C60): "*Confidentiality of the patient record should be maintained if you are introducing telemedicine*."

Hospital staff (rural-C2): "*Not sure we have proper privacy policy and data protection about the patient*."

8.2.5 Software standards

When considering the software standards in hospitals were telemedicine adopted, most of the responses were not very clear. This could be due to the lack of knowledge about the software standards among the clinicians and the hospital staff.

8.2.6 Job relevance

When considering how relevant telemedicine will be for the job, most of the answers were positive but some were negative. For certain areas in medicine, consultants might need to do a physical examination of the patient. For example:

Clinician (rural-I3): "*We can get more information, we can educate ourselves more and we can get the patient information immediately*."

Senior manager: "*Can enhance our quality and productivity of our medical services*."

Clinician (rural-I3): "*We can gain the knowledge without transferring the patient. The consultant can guide us what to do. Therefore when the patient visits next time, we can try the methods and ideas*."

Hospital staff (rural-C4): "*Telemedicine system will be very useful for my profession*."

Clinician (urban-C76): "*The doctors will probably have no time to practice telemedicine with their very busy schedule*."

Clinician (rural-C25): "*Before introducing telemedicine improve the computer literacy of the hospital staff*."

Clinician (rural-C26): "*All health care workers should improve their computer knowledge and skills*."

Clinician (rural-C27): "*Telemedicine will be appreciated by many consultants who work in the rural areas*."

Clinician (urban-C66): "*Awareness programmes should be held for the medical doctors*."

Clinician (urban-C69): "*To the rural health institutes, telemedicine is a good practice as it is difficult to get specialist opinion due to the distance and transport problems*."

Hospital staff (rural-C31): "*Meeting consultants takes a long time. Using telemedicine can get medical information and treatment immediately*."

8.2.7 Perceived use of telemedicine

Considering how telemedicine would enhance job performance for clinicians and hospital staff, the answers was positive. This can be due to the government improving the IT facilities in rural hospitals, introducing new ICT programmes to the medical curriculum, and conducting pilot projects regarding e-health in the country. The following examples highlight these points:

Clinician (rural-C9): "*Telemedicine supports to increase the quality of care. I am so glad of this project. It is useful in every aspect*."

Clinician (rural-C11): "*Sometimes without seeing the patient it is difficult to comment about the diagnosis and treatment*."

Clinician (rural-C31): "*Telemedicine will improve my speciality (radiology).*"

Clinician (urban-C76): "*Quality of telemedicine depends largely on whom we get in touch with*."

Hospital staff (rural-C4): "*Telemedicine will be very important to my profession*."

Hospital staff (rural-C16): "*Using the internet to communicate with the consultants will be very useful as well as important to the profession*."

Hospital staff (rural-C26): "*Improves our productivity*."

Hospital staff (rural-C28) "*Improves the quality and the standards of the medical service*."

Hospital staff (rural-C29): "*Can conduct training sessions for the staffs in the rural areas using the internet*."

Hospital staff (rural-C30): "*Introducing telemedicine can help to improve our general knowledge about medicine and the computer knowledge*."

Hospital staff (rural-C36): "*Can treat the patient immediately and efficiently*."

Hospital staff (rural-C37): "*Can save time and get the best of health information and medicine immediately. Also, can get patient information very quickly*."

8.3 Summary

This chapter summarises the semi-structured interviews carried out with the Health Ministry officials and senior managers from the health sector, and the "*comments*" section in the questionnaire for the clinicians and the hospital staff during the main study in June 2013.

The interview questions along with the entries in the "*comments*" in the questionnaire helped to make clear the attitudes of the clinicians and the hospital staff to adopting telemedicine. The areas covered during the interviews were job relevance and the perceived use of telemedicine.

These results indicate that adopting telemedicine will be beneficial for the rural hospitals. Improving the infrastructure of the hospitals will help the rural population to obtain medical information more cost effectively. As a developing country, improving the infrastructure in rural areas will help the development process in Sri Lanka.

Chapter 9. Discussion of results

9.1 Introduction

In this research, telemedicine was described to each interviewee as being the following:

> Telemedicine consists solely of tele-consultation through the use of audio and video conferencing. Therefore in practice, it does not need any other equipment apart from a laptop with a camera and an Internet connection. There is no method of transmission of data in this method of telemedicine.

Software standards in this research mean the basic Microsoft Windows standards and not W3C standards.

This chapter brings together the results of the main survey concerning the TeleMedicine in Sri Lanka (TMSL) model for the adoption of a telemedicine system in rural areas of the country. Section 7.2.4 identified certain statistically significant paths have been identified in the TMSL model.

Reviewing the research results helps to link the theoretical explanations of the earlier chapters to the concerns raised in the analysis. Information and Communication Technology (ICT) can have a strong impact on the progress of a developing nation. Sri Lanka entered the ICT era when the country geared itself up to being an open economy in the 1970s, followed by a process of globalization. Many industries, and private and public institutions involving travel, airlines and financial services, introduced ICT to automate their systems in the early 1980s (Hansson et al., 2010). Having an efficient and effective healthcare system is known to help improve the development of a country. Developing countries, such as Sri Lanka, still show a disparity between their rural and urban communities when considering the health services rendered to the community (Smith et al., 2007). Improving access to healthcare services through ICT will help reduce that disparity and provide better healthcare facilities to rural communities (Perera, 2009). A review of the literature on e-health in Sri Lanka, and the problems faced by the government in adopting a tele-healthcare system, were discussed in Chapter 3.

It is not only Sri Lanka that is facing problems in introducing e-health. India faces a major challenge in introducing e-health to the country due to a lack of infrastructure, illiteracy, poverty and the increasing population. Low budget allocations from government, a lack of

funding for the health sector, and inadequate planning has pushed India back from introducing ICT to the healthcare system (Mahapatra, Das, & Patra, 2010).

After the literature review identified the problems faced by the government in introducing telemedicine to Sri Lanka, an exploratory study was conducted in several parts of the country to confirm the issues. The results of the exploratory study were discussed in Chapter 6. Following the exploratory study, the TSML model was developed to address the primary research question "*What is an appropriate model for the adoption of telemedicine system in the rural areas of Sri Lanka*?" For convenience the question being then subdivided into four separate questions.

RQ1 How will the attitude of the general public affect the introduction of telemedicine in rural areas?

RQ2 How will the attitudes of the clinicians and the hospital staff affect the introduction of telemedicine in rural areas?

RQ3 How will the staff involvement affect the introduction of telemedicine in rural areas?

RQ4 How can the government improve infrastructure of ICT to improve the healthcare of the rural population?

The main survey was conducted in several parts of Sri Lanka to address the research question and the results of the major survey were discussed in Chapter 1 and Chapter 1.

9.2 Demographics of the participants

In developing countries, telemedicine will take a long time to reach its full potential (Miller, 2010). The implementation of a new system takes at least five years and so only people who are under 50 now will have direct contact with telemedicine. The demarcation line of 50 was chosen for this study because the retirement age in Sri Lanka is 55. The results of the main survey indicate that the majority of clinicians, hospital staff and the general public from both the rural and urban areas who participated in the survey were less than 50 years' old. Another reason for there being less participation from those over 50 could be that some patients prefer face-to-face interaction with a consultant rather than using a computer for the consultation. This was confirmed during the interviews conducted during the exploratory study. Improving the infrastructure in rural areas, having continuous training for health professionals, and conducting familiarisation programmes for the general public, will all help the older generation have a better attitude to telemedicine (Oak, 2007).

9.3 Computer use and self-assessed computer skills of the participants

The majority of clinicians from both rural and urban hospitals use computers at home. Taking into consideration how many clinicians use computers when they are at work, it is interesting to find that most of the clinicians from urban hospitals use computers at work, which is not the case to the same extent for clinicians from rural hospitals. These results were confirmed from the analysis of the main survey. Results of the exploratory study suggest that urban hospitals have better computer facilities, and better internet connection facilities, than do rural hospitals, which could be a reason for clinicians from rural hospitals using computers at home (Marasinghe, 2010). Medical information as printed material rather than provided electronically is preferred by clinicians in rural areas, which could be another reason for rural clinicians using computers less at work (Senanayake, 2006) and (Mart, 2008). The rapid development of infrastructure in the country, and the government allocating more funds to improve ICT development, will help to overcome this problem in the near future.

On the subject of the self-assessed computer skills, the majority of clinicians from urban hospitals claim a good knowledge of computer skills compared to clinicians from rural hospitals (Gamage & Halpin, 2007). The results shown in Section 7.2.2.1 suggest that clinicians from urban areas are much more knowledgeable than are rural clinicians when it comes to their computer skills. One reason for this could be a lack of training for clinicians in rural hospitals. To improve computer literacy among clinicians, the training should commence at the initial stages of the undergraduate curriculum. Introducing formal computer training programmes during their university years would help young clinicians acquire new technological skills to match the rapidly evolving technology (Ranasinghe, Wickramasinghe, Pieris, Karunathilake, & Constantine, 2012).

Overall, the results suggest that there are better computer facilities and internet connections in urban hospitals than in rural hospitals. If medical institutes can provide the necessary facilities and equipment such as computers, webcams and fast internet connections to hospitals, clinicians will have a better command of computer skills.

Since the average annual income per capita in the country is around $1000, purchasing a computer for an employee in a rural area will be relatively costly relative to their earnings (Hansson et al., 2010). The lack of internet facilities in rural areas also has an impact on the rural employee in making the decision not to purchase a computer. In contrast, in urban areas

Internet connections are very good, and the higher wages of the employees in those areas means that they can afford to buy a computer. The survey results show that the majority of hospital staff in urban areas uses computers at home most of the time but that hospital staff in rural hospitals uses computers very little at home. Rural employees will have better access to computers at home as a result of the rapid growth of Internet Service Providers, third party ISPs once Internet access is obtained, the government allocating more funds to develop the infrastructure in rural areas, and having a competitive market for computers that reduces their cost (Hansson et al., 2010).

A lack of computers and poor Internet connections in rural hospitals and a lack of staff to tackle the heavy workload in those rural hospitals, have made it difficult for hospital staff to use computers at work compared with hospital staff working in urban areas who have better computer facilities (Boutilier, 2008). Introducing projects such as the eCapacity enhancement project to improve the ICT infrastructure needed through lower costs and easy-to-use technologies in peripheral areas, will help hospital staff in rural areas to use computers more often at work (World Bank, 2005).

There is an emerging trend in the country regarding the Internet and information technology. The government of Sri Lanka has identified the importance of ICT as a priority and has introduced many projects with the help of donor organizations such as the WHO, the UN and the World Bank, to improve ICT education in the country. The results from the main survey show that the implementation of the e-Sri Lanka development project by the Information and Communication Technology Agency of Sri Lanka (ICTA), to improve people's IT literacy, has helped both rural and urban hospital staff to improve their computer skills (ICTA, 2010).

As a developing nation, ICT plays a major part in the development of Sri Lanka. Introducing short duration training courses and developing telecentres into rural areas of the country has helped the general public to learn general computer applications fast and effectively. (Hansson et al., 2010). The survey results suggest that a majority of the general public from both rural and urban areas use computers at home, and a majority of the urban and the rural population have good self-assessed computer skills.

Most private companies and government and private institutes are situated in urban areas. Computer facilities for companies situated in urban areas are very much better than those for companies situated in rural areas (Marasinghe, 2010). Therefore, the general public working in urban areas have better computer access and facilities than do the rural general public

(Media Center for-National Development of Sri Lanka, 2010). The results from the main survey confirm these observations. Developing the infrastructure of the Internet and improving coverage island-wide will help companies in rural areas have better computer and internet facilities.

Using the Internet from home has become more popular among clinicians, hospital staff and the general public in both rural and urban areas. Bringing down the barrier of the state monopoly of telecommunications, and allowing private investors and Internet Service Providers into the telecommunication industry in the early 1990s, helped to take ICT to rural areas of Sri Lanka by providing affordable rates for services (Business Editor, 2013). The results from the main survey suggest that over 50% of clinicians, hospital staff and the general public from rural and urban areas access the internet from home (see Section 7.2.3). This could be due to the heavy workload in hospitals and also the lack of availability of IT resources in hospitals.

The rapid growth in mobile technology, where over 50% of the population now have access to mobile phones, helps people to access the Internet fast and easily (Perera, 2009). The results in Section 7.2.3 show that most urban clinicians use mobile phones to connect to the Internet while rural clinicians use mobile phones and broadband connections equally. This could be due to the fact that wireless access in urban areas is much faster, and accessing the internet using mobile devices is more appropriate in urban areas where a busy lifestyle is more likely.

The government's introduction of the e-Sri Lanka initiative with the help of the World Bank has helped to improve the use of IT in the country (Rampatige et al., 2010). The availability of computer facilities has helped the population to learn more about IT and the Internet. The results in Section 7.2.3 show that taking ICT to the villages by introducing the Global Knowledge Centres, overseen by the ICTA, has helped rural and urban populations to improve their IT knowledge (Gamage & Halpin, 2007).

9.4 Discussion on Sub Research Question 1

"*How will the attitude of the general public affect the introduction of telemedicine in rural areas*?"

Promoting ICT based services, introducing telecentres into rural areas of the country, and conducting awareness programmes related to health informatics, have all helped the general

public, especially in rural areas, to gain better knowledge and understanding in the use of ICT applications (Perera, 2009).

Sri Lanka is creating an ICT environment as part of the telecommunications infrastructure. The government has also decided to improve IT facilities in the country by helping people to learn IT regardless of their gender and/or living conditions (Weerasinghe, 2004). The government's introduction of pilot projects in tele-health in the country, including private hospitals, has helped people to understand the value of ICT in the healthcare industry (Marasinghe, 2010). The questionnaires given to the general public for the component *Acceptance of technology* had two variables. The reliability of the questionnaires was determined using Cronbach's alpha. The questionnaires for the variable *Attitude to learning* had good reliability and the correlations for all the questions for this variable were statistically significant. These results suggest that the general public has a positive attitude towards learning about telemedicine (Jacobson, 2007).

Having a good reliability for the questionnaires for the variable *Education of the general public* in Table 7-19 suggests that the general public have a good knowledge of how to use the internet for health services (McMullan, 2006).

Introducing medical-related information using the bi-lingual medical information portal *Wedananasala* has also helped the rural public to have a better understanding and access to the internet (Rathnayake, 2013). Understanding how costs can be reduced, and also the time spent travelling to urban areas for better medical services when telemedicine is available has increased through the introduction of various awareness programmes which have helped the general public understand the importance of telemedicine. The results of the MANOVA test in Section 7.2.5.3 clearly show the mean factors scores were not statistically significant. Therefore there was no difference between the rural and urban general public indicating that the variables *Attitude to learning* and *Education about the internet* will not have an effect in the adoption of telemedicine among the rural public and urban public. This indicates that people in both rural areas and urban areas have confidence in using telemedicine (Henwood et al., 2003).

The results in Section 7.2.6.3 clearly indicate that, whether there is a less or more positive attitude to learning about telemedicine, and the amount of education people have about it and the internet, there is no significant relationship with their opinion about adopting telemedicine (Bodenheimer & Grumbach, 2003).

The t-tests indicate that adopting a telemedicine system in rural areas will help to improve the attitudes of the general public in learning about telemedicine and improve their education about the Internet (Jacobson, 2007).

The above results suggest that the general public in both rural areas and urban areas are very much in favour of adopting a telemedicine system in rural areas of Sri Lanka.

9.5 Discussion on Sub Research Question 2

"*How will the attitudes of the clinicians and the hospital staff affect the introduction of telemedicine in the rural areas*?"

A majority of clinicians believe that e-health will have a major role to play in the health sector. Introducing new ICT-related subjects to the medical curriculum, having access to computers and the Internet from rural hospitals, and encouraging clinicians to use e-health in their practice, will help clinicians to improve their services to the general public (Edirippulige et al., 2006). The results in Table 7-1 show that the measurement of the factor is reliable and the correlations for all the questions except for question 1 in the factor *Attitude to learning (medical)* were statistically significant. Deleting question 1 would not have a major impact on the other questions since the increment in α after deleting the question is very small. These results indicate that clinicians in both rural and urban areas have a positive attitude about learning new technology (Casebeer et al., 2002).

Most clinicians in the early stages of practising will have to start work in rural areas. Working in rural areas is difficult with their poor health infrastructure and facilities. Introducing e-health into rural areas will help clinicians provide better health services and networking to the rural public and could also improve their professional development activities (Smith et al., 2007). The results clearly show that both urban and rural clinicians' attitudes towards learning new technology have no effect on the adoption of telemedicine in rural areas.

The results show that the variable *Attitude to learning (medical)* will not have a direct effect on the adoption of telemedicine (Casebeer et al., 2002). t-tests indicate that the positive attitude of clinicians towards telemedicine can be used to predict the adoption of telemedicine. These results indicate that clinicians from both rural and urban hospitals are in favour of adopting telemedicine.

Hospital staff in both rural and urban hospitals know how telemedicine will help them in their work if telemedicine was to be introduced in rural hospitals (Jacobson, 2007). This can be seen from the results which indicate that there is good reliability for the questionnaires for the variable *Awareness of telemedicine.*

Conducting awareness programmes relating to e-health, and contributions by institutions and organisations such as the Health Informatics Society in Sri Lanka (HISSL) to promote e-health in hospitals, has helped hospital staff have a better understanding of the subject (Marasinghe, 2010). The results suggest that hospital staff in both rural and urban hospitals demonstrate a good standard of knowledge about telemedicine.

Introducing IT facilities to rural hospitals will help hospital staff becomes more involved in using computers and the Internet at work. The results show that the variable *Awareness of hospital staff* does not have a direct effect on the adoption of telemedicine. Introducing e-learning as a tool to promote continuing education for hospital staff will help them to improve their knowledge of telemedicine (Rampatige et al., 2010).

The t-tests indicate that hospital staff having an awareness of telemedicine will help them in adapting to telemedicine.

9.6 Discussion on Sub Research Question 3

"*How will the staff involvement of the clinicians and the hospital staff affect the introduction of telemedicine in the rural areas*?"

Telemedicine can help consultants make themselves available across distances more effectively and more quickly. Knowledge transfer between the peripheral clinician and the urban consultant can be done well using telemedicine, which will benefit the clinician in those rural hospitals (Chapman & Arunatileka, 2010a). The results in Section 7.2.4.2, and the findings from Section 8.2.6, suggest that clinicians in both rural and urban hospitals see a positive effect on their jobs and the usefulness of telemedicine if telemedicine is adopted in the country.

Using telemedicine in rural hospitals will reduce congestion in urban hospitals by reducing the number of incoming patients. This will help to improve the quality of care by utilising resources effectively (Chapman & Arunatileka, 2010a). The results suggest that there is no difference between rural clinicians and urban clinicians regarding the component *Staff*

involvement which consists of the variables *Job relevance* and *Perceived use of telemedicine* when adopting telemedicine.

The results also show that there is no correlation between the adoption of telemedicine and the variables *Job relevance* and *Perceived use of telemedicine* related to the component *Staff involvement*. This could be due to the fact that clinicians are already familiar with e-health programmes (Casebeer et al., 2002).

The variable *Perceived use of telemedicine* is not a predictor of adopting telemedicine. Some of the reasons could be: an inability to carry-out the entire physical examination using telemedicine, elderly patients not accepting the physician appearing in front of them but on a computer, and physical and mental factors such as hearing and reduced vision suffered by the general public (Hjelm, 2005).

Introducing ICT to rural hospitals has created some problems. A lack of IT literacy, a lack of confidence in using IT-related programmes, the fear of losing one's job and a general phobia concerning IT, have made it somewhat difficult for hospital staff in rural areas to accept telemedicine (Weerasinghe, 2004). The results show that there is a significant difference between rural and urban hospital staff for the variables *Job relevance* and *IT literacy of staff*. Hospital staff in the rural areas can have a better understanding of telemedicine if they are helped through workshops and on the job training courses, using IT-literate and experienced workers as peer support to improve IT literacy among workers, and helping hospital staff to maintain their professional competence and motivation (Koivunen, Valimaki, Koskinen, Staggers, & Katajisto, 2009).

The existence of poor health infrastructure, inadequate IT facilities in rural hospitals, no proper IT related training programmes, and the language barrier, have made it difficult for hospital staff to understand and adopt the new system (Smith et al., 2007). The results show that there is a significant correlation between adopting telemedicine and the variables *Perceived use of telemedicine* and *Training for hospital staff*. Introducing new IT-related subjects to the curriculum, improving IT facilities in rural hospitals, and conducting tele-health programmes using the local language, will all help hospital staff have a better understanding of the subject (Boutilier, 2008).

The t-tests indicate that adopting telemedicine will improve IT literacy and training for the hospital staff (Jennett et al., 2003).

Introducing new responsibilities related to IT, gaining experience and confidence to perform IT-related tasks, involvement in IT-related demonstrations and training programmes, will all help hospital staff understand more about telemedicine (Tharanganie et al., 2011).

9.7 Discussion on Sub Research Question 4

"*How can the government improve the infrastructure of ICT to improve the healthcare of the rural population*?"

The Sri Lankan government is working with donor agencies such as the WHO and the World Bank to improve telecommunications and the ICT infrastructure for the health sector (WHO, 2006). The change in telecommunication technology from wired to wireless, and the introduction of communication devices transmitting information in different forms such as text, voice, video and data, have given a fresh boost to ICT. After the government had allowed the private sector to invest in the telecommunication industry, competition among investors grew rapidly. The competitive edge of the private sector has allowed better coverage, easy and fast connectivity, and more ISPs to introduce cheaper and better island-wide coverage by the Internet (Marasinghe, 2010). The results show that the government and the private sector are investing money in the telecommunication infrastructure to develop ICT in rural areas.

Having proper interoperability standards to exchange information, and safeguarding patient information by introducing effective privacy and security solutions, will help the government to improve ICT (Sylva et al., 2012). The results show that hospital standards and software standards are positive predictors for adopting telemedicine (Rampatige et al., 2010).

9.8 Discussion on Primary research question

"*What is an appropriate model for the adoption of telemedicine system in the rural areas of Sri Lanka*?"

Many variables and factors need to be considered when developing a model. A model was proposed in Section 6.3 for the adoption of a telemedicine system in the rural areas of Sri Lanka, based on the literature review and the results of the exploratory study. Using the data from the main study gathered from clinicians and hospital staff questionnaires, Factor Analysis was used to confirm the model proposed.

After conducting the factor analyses for the data collected from clinicians and hospital staff, the sub-models (Figure 6-2 and Figure 6-3) were revised.

9.8.1 Clinicians

From the Factor Analysis, the variables were loaded onto different components in the proposed model. The majority of the variables stayed within the same components. However, the variable *Attitude to learning (medical)* loaded onto Component 2 in both the three factor and four factor solutions. The two variables *Perceived use of telemedicine* and *Job relevance* also loaded onto Component 2 in both the three factor and four factor solutions. These three variables relate to how the clinicians will be involved in using the technology. Hence component 2 was labelled *Staff involvement*, and the component *Acceptance to technology* in the proposed sub-model, which had only the variable *Attitude to learning (medical)*, was removed.

The revised model is shown in Figure 9-1, the four components which were identified in the proposed sub-model (Figure 6-2) being changed to three components.

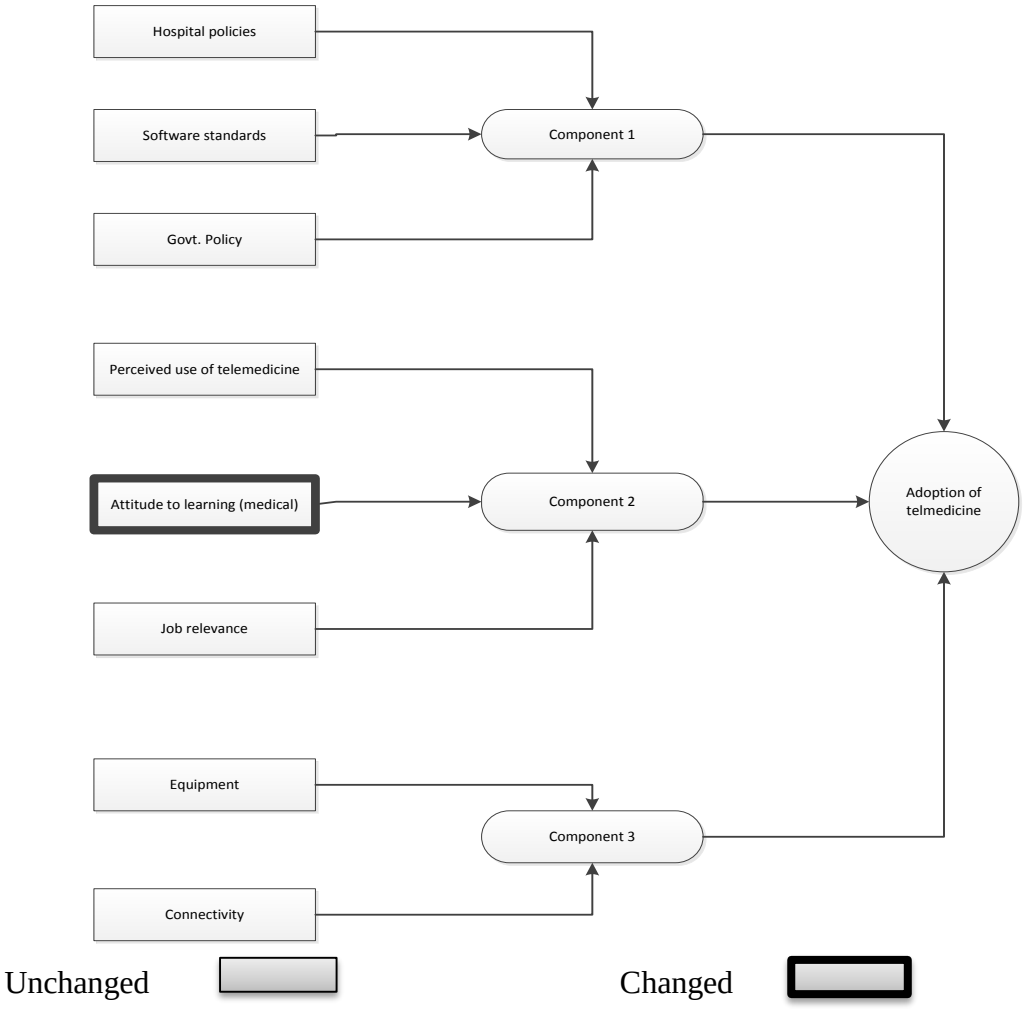


Figure 9-1 Revised sub-model of the TMSL model for the clinicians

The variables *Connectivity* and *Equipment* load differently on the four factor solution, but load on the same component in the three factor solution. Both these variables relate to the availability of the technology and the infrastructure. Hence the component was labelled *Availability of infrastructure*, the reason being that all the variables loaded exactly onto one component and the commonalities for those components were between 0.40 and 0.70, so the proposed four component model was adjusted to three component model (Costello & Osborne, 2005). The Factor Analysis for the clinicians' results suggested a three component solution using the eigenvalue to underlie the association between the variables in the model. This is supported by the Factor Analysis reported in Section 7.2.8.

The loadings of the variables to the components for the three factor solution are given below.

- The variables *Government Policy*, *Hospital policies* and *Software standards* loaded onto component 1.
- The variables *Perceived use of telemedicine*, *Attitude to learning (medical)* and *Job relevance* loaded onto component 2.
- The two variables *Connectivity* and *Equipment*, in the three component solution, both loaded onto component 3.

The revised sub-model items for the clinicians are given in Figure 9-1above. The variable which loaded into a different component from the Factor analysis is shown using a thick bold box.

The revised sub-model consists of

- Component 1 named as *Policies and standards*, which includes the variables *Hospital policies*, *Software standards* and *Government policy*.
- Component 2 named as *Staff involvement*, which includes the variables *Perceived use of telemedicine, Attitude to learning (medical)* and *Job relevance.*
- Component 3 named as *Availability of infrastructure*, which includes the variables *Connectivity* and *Equipment.*

The final sub-model for the clinicians is given in Figure 9-2.

The proposed sub-model was designed using the literature survey and the exploratory study conducted in three districts of Sri Lanka with a small number of participants. The sub-model was revised with the data collected from the main survey that covered several districts of the country and with many more participants.

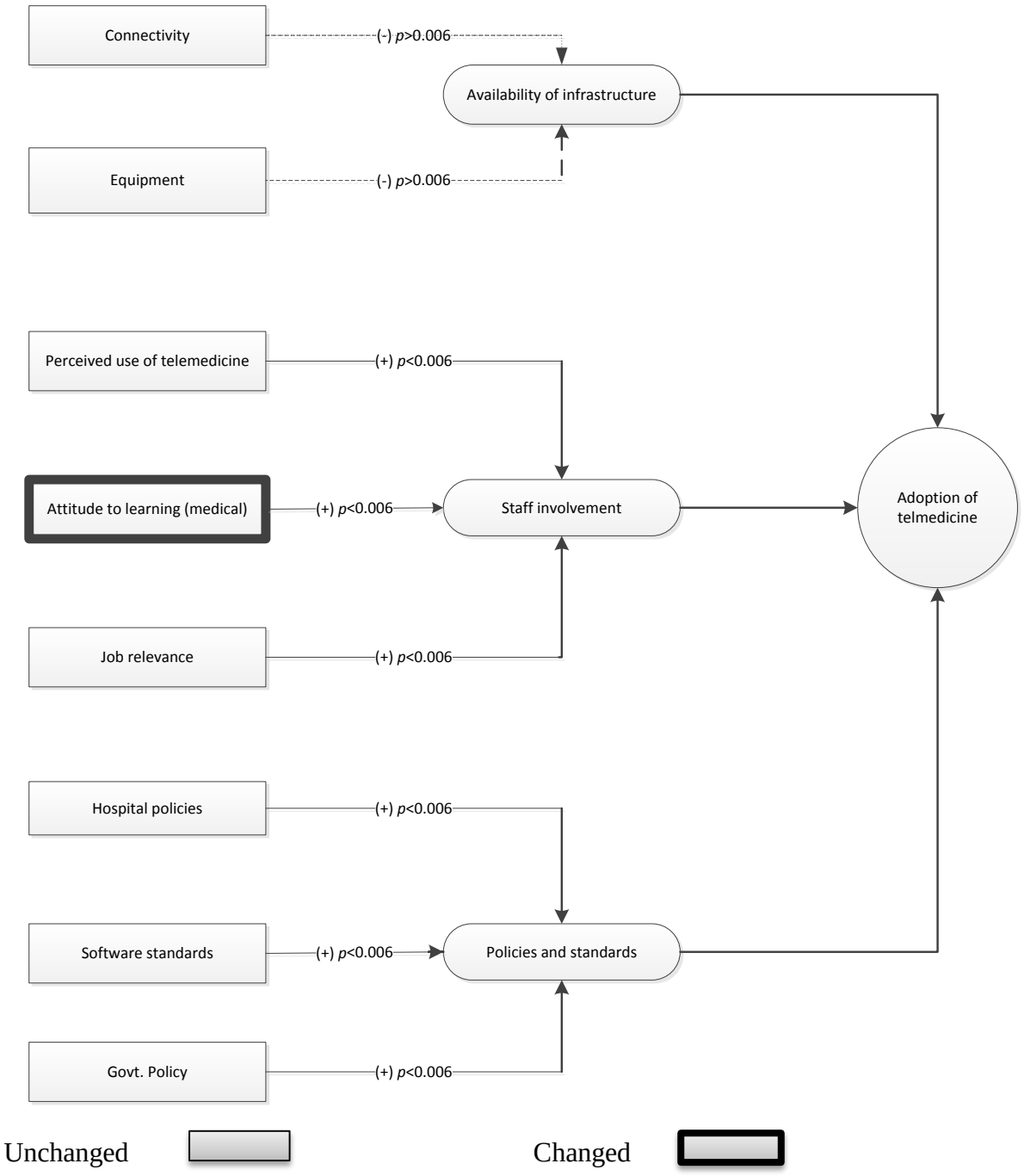


Figure 9-2 Final sub-model of the TMSL model for the clinicians

As far as the clinicians are concerned, they mostly had their own laptops that were enough to carry out the tasks of telemedicine. Therefore the clinicians were not interested in the equipment and the connectivity when introducing telemedicine, as seen in Table 7-32**.**

Most people, including clinicians, are not exposed to any software standards other than Microsoft Windows. Hospital clinicians are quite familiar with the latest Microsoft Windows standards.

The variable *Software Standards* indicated a negative correlation in Table 7-29**,** the test value *t* being –57.20 for the correlation with adoption of telemedicine. The answers on this topic given by the clinicians correlate negatively with the replies to other questions asked of the clinicians. Therefore rephrasing the direction of the questions for the variable *Software standards* would make the correlation a positive one.

9.8.2 Hospital staff

In the revised model shown in Figure 9-3, the four components which were identified in the proposed model remain unchanged.

In the proposed sub-model (Figure 6-3), the Factor Analysis showed that eight variables stayed within the same components, while three variables loaded onto different components. The four items loaded onto Component 1 relate to how knowledgeable the hospital staff is relevant to the software standards and the policies related to the technology. Variables loaded onto Component 2 relate to the availability of the technology and the infrastructure. Variables loaded onto Component 3 relate to the importance of the technology to their job, and Component 4 relates to how knowledgeable the staff is when using the new technology.

The loading of the variables to the components are given below.

- Variables *Government policy*, *Hospital standards*, *Software standards* and *Training for hospital staff* load onto component 1.
- Variables *Connectivity* and *Equipment* load onto component 2.
- Variables *IT literacy of staff, Perceived use of telemedicine* and *Job relevance* in the four factor solution load onto component 3.
- Variables *Awareness of hospital staff* and *Ease use of equipment* load onto component 4.

In Figure 9-3, the variables which were loaded onto different components from the Factor analysis are shown using a thick bold box.

Therefore from the four component model from the data,

- Component 1 can be named as *Policies and standards,* which included the variables *Hospital policies*, *Software standards*, *Government policy* and *Training for hospital staff.*
- Component 2 can be named as *Availability of infrastructure*, which includes the variables *Connectivity* and *Equipment*.

- Component 3 can be named as *Staff involvement*, which includes *IT literacy of staff*, *Perceived use of telemedicine* and *Job relevance*.
- Component 4 can be named as *Use of equipment*, which includes *Awareness of hospital staff* and *Ease use of equipment*.

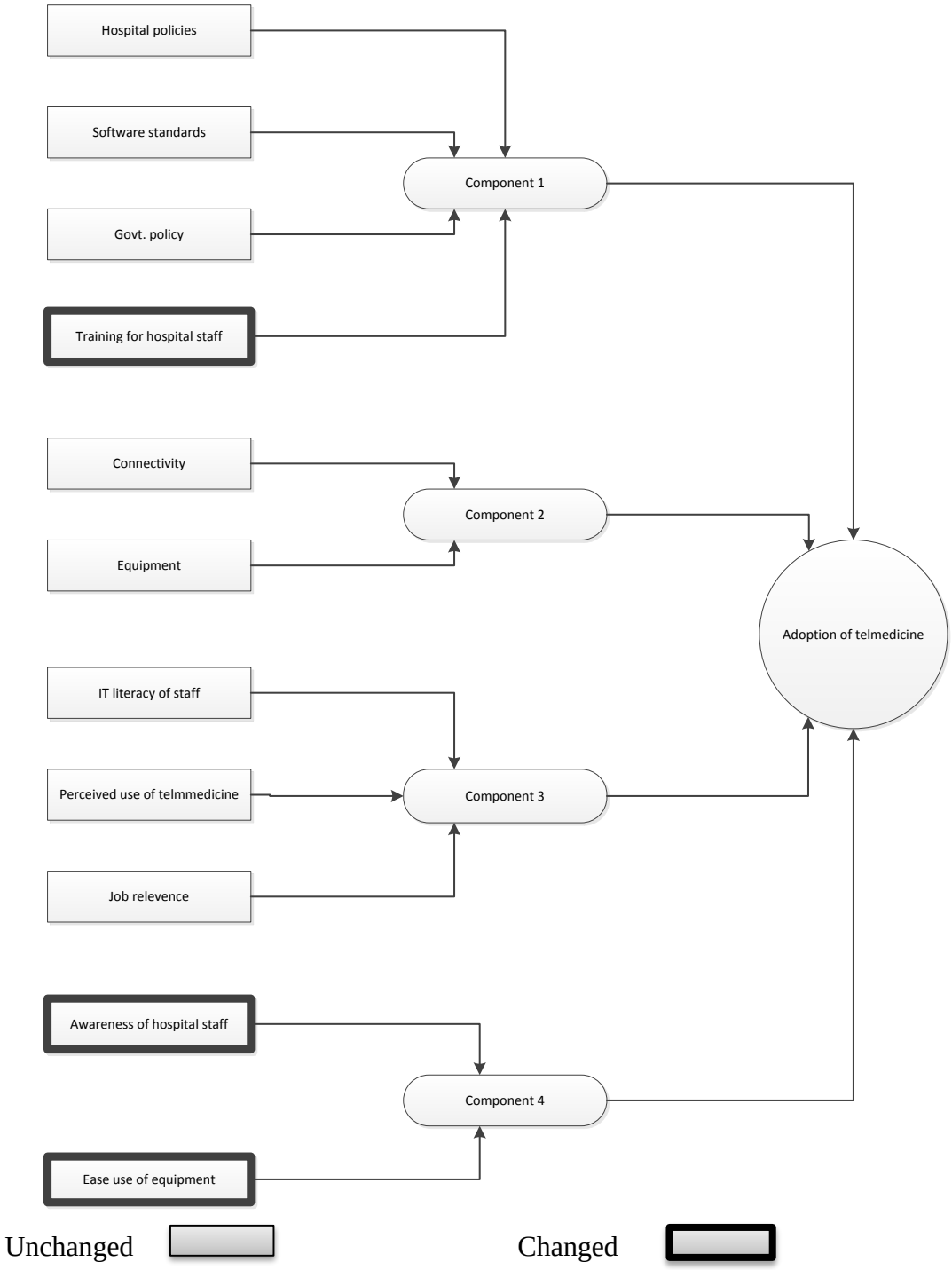


Figure 9-3 Revised sub-model of the TMSL model for the hospital staff

The final sub-model items for hospital staff are given in Figure 9-4.

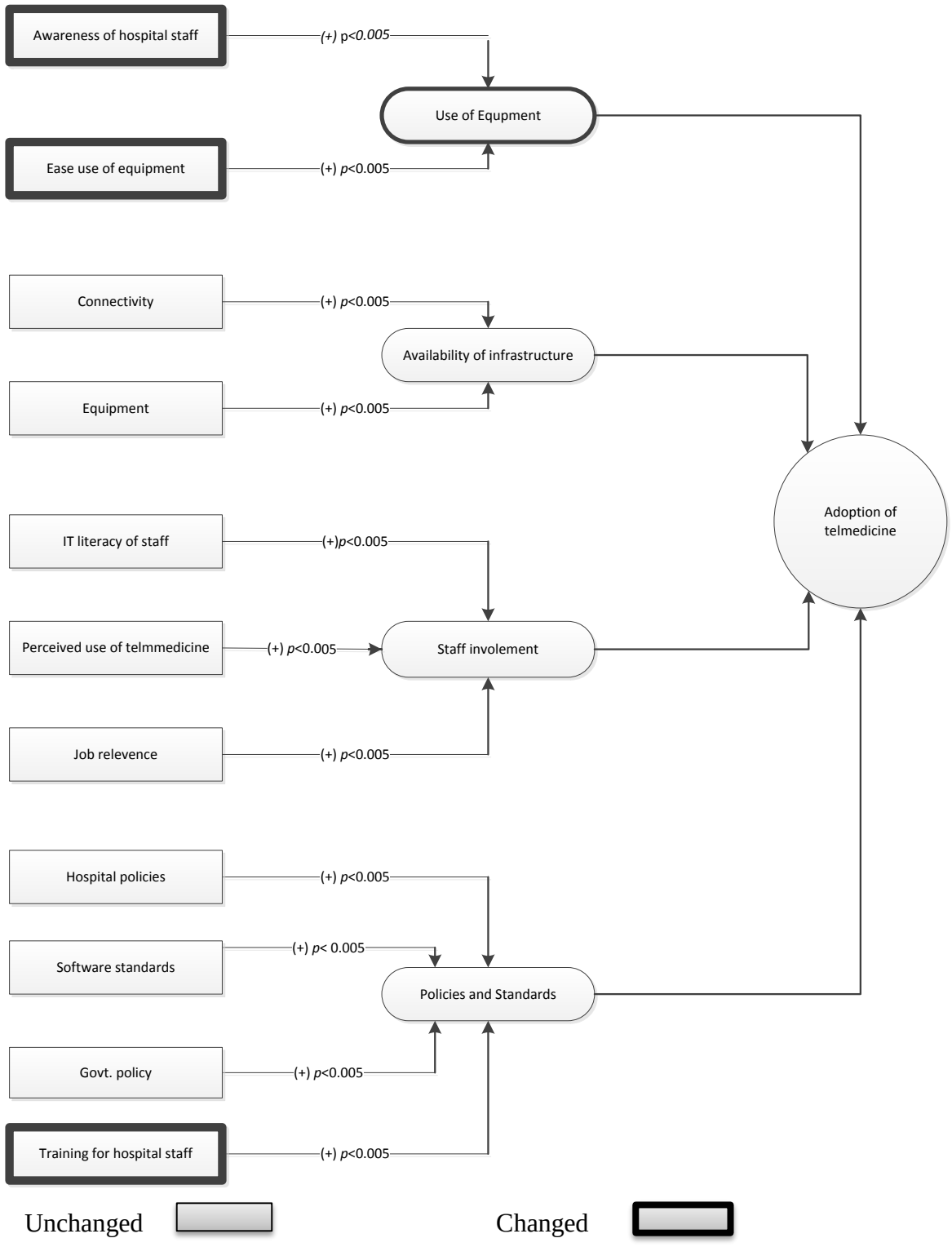


Figure 9-4 Final sub-model of the TMSL model for the hospital staff

Most of the hospital staff does not have their own laptops. Therefore they rely on the equipment and the connectivity provided by the hospital to carry out the tasks of telemedicine in the hospitals in which they work, using computers which are not replaced or upgraded as frequently as in the United Kingdom. This leads to hospital staff believing that having new and the latest equipment will influence the adoption of telemedicine, as shown in Table 7-36.

Hospital staff are not very familiar with Microsoft Windows standards.

The means for all the variables, except for *Software standards*, were significantly higher than the respective test values, as shown in Table 7-30. This indicates that hospital staff agrees that the variables *Awareness of hospital staff*, *Connectivity*, *Ease of use of technology*, *Equipment*, *IT literacy of staff*, *Job relevance*, *Perceived use of telemedicine*, *Training for hospital staff*, *Hospital policies* and *Government policy* will help in the adoption of telemedicine.

Table 7-30**,** the test value *t* for "Software standards" is –4 for the correlation with adoption of telemedicine. The answers on this topic given by hospital staff correlate negatively with the other questions asked of hospital staff. Therefore rephrasing the questions of variable *Software standards* will make the correlation positive.

Both sub-models have four components but the loading was slightly different. Therefore the names of the components in the revised sub-model were changed to reflect the loading from the wider survey.

9.8.3 General Public

The proposed sub-model for the general public shown in Figure 6-4 could not be subjected to Factor Analysis because the sub-model had only one component.

In conclusion, all the variables participated in the factor structure. The loading of the variables in the revised TMSL model was slightly different from the proposed TMSL model. The revised TMSL model was drawn up to reflect the loading from the wider survey.

The final TMSL model is shown in Figure 9-5. The TMSL model shows the variables which influence the adoption of telemedicine.

The final TMSL model indicates that all the variables influence the adoption of telemedicine. The results indicate that the general public believe that accepting the changes of the new technology will influence the adoption of telemedicine. The results also indicate that both clinicians and hospital staff believe that staff involvement, and introducing new policies and standards, will influence the adoption of telemedicine. Even though clinicians showed no interest in internet connectivity, or that the equipment used will have an effect on the introduction of telemedicine, hospital staff believe that internet connectivity and the new equipment will influence the adoption of telemedicine.

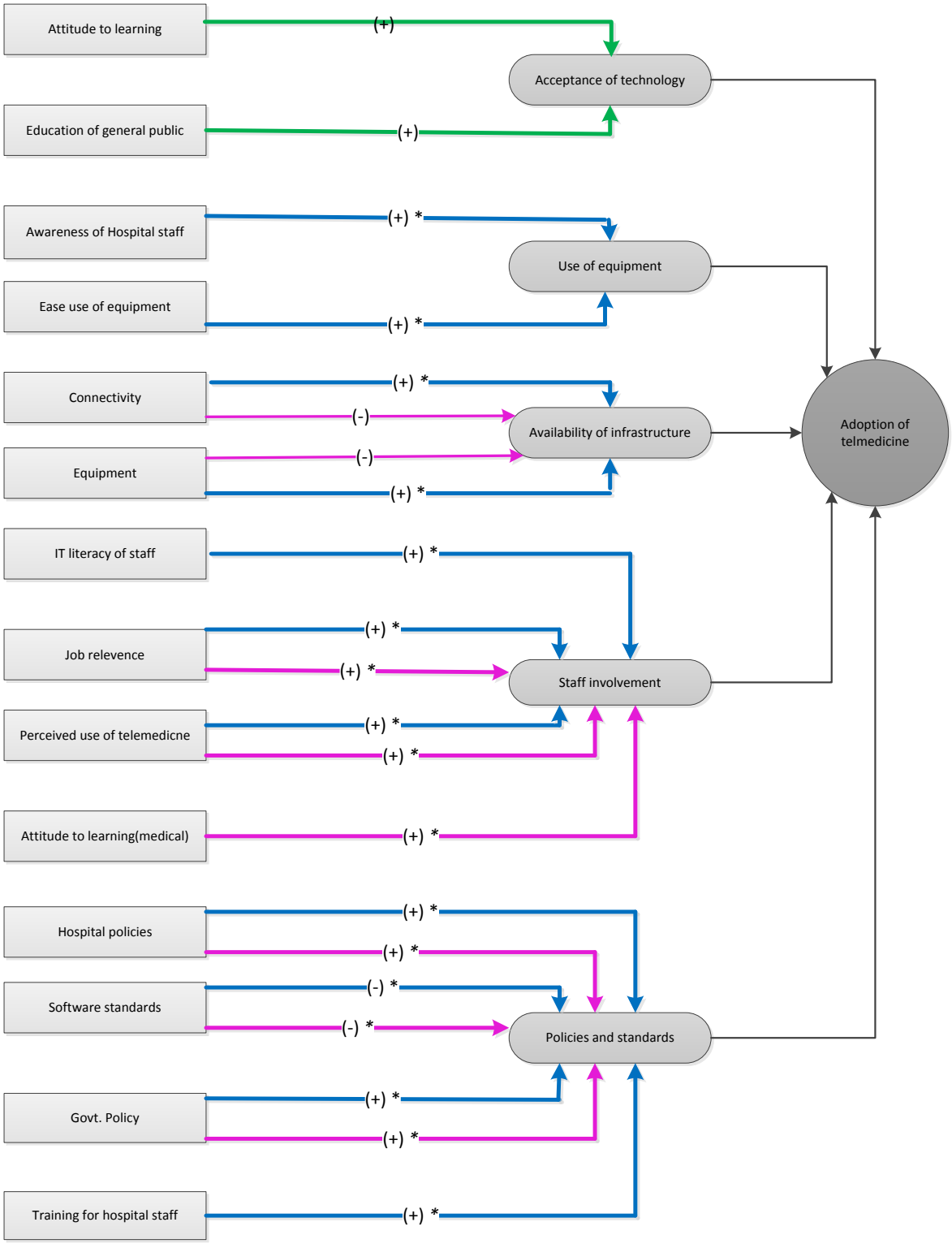


Figure 9-5 Final TMSL model of the factors that influence the adoption of a telemedicine system in the rural areas of Sri Lanka

9.9 Summary

The chapter began with discussion of the demographics, computer use and the self-assessed computer skills of the participants. The results of the main survey indicated that the majority of the participants were under 50 years' old. They also indicated that more participants use computers from home and that there are better computer facilities in urban hospitals than in rural ones.

The four sub-research questions and the primary research question were discussed in-depth from the results in Chapter 1 and Chapter 8, based on data provided by the participants during the main survey. The final TMSL model of the factors that influence the adoption of a telemedicine system in the rural areas of Sri Lanka was developed after analysing these results.

The overall results indicate that the majority of participants are willing to accept a telemedicine system for the rural areas of Sri Lanka. The rapid infrastructure development projects, and the wide range of internet coverage in the country, will help in the adoption of a telemedicine system in the rural areas of Sri Lanka.

Chapter 10. Conclusions and Future Work

E-health systems provide patient-related information electronically to clinicians, patients and policy makers. The definition used here for telemedicine consists solely of tele-consultation which uses audio and video conferencing. The literature review and the findings of the two surveys helped to identify the factors from which the TeleMedicine in Sri Lanka (TMSL) model was developed, that it is hoped will influence the adoption of a telemedicine solution in the country.

There are many e-health applications which can be employed in the healthcare environment. For example: Electronic Health Records (EHR), Hospital Information Systems (HIS), telemedicine and tele-care. Of these, telemedicine has become the most acceptable and affordable solution for the Less Economically Developed Countries (LEDCs).

In comparison with the developed world, where hospitals are equipped with the latest IT solutions and equipment, LEDCs lack the necessary IT infrastructure, knowledge of applications and the usefulness of e-technology, and also a national policy and legal framework to introduce e-health solutions. Thus research is needed to find a new technological solution for introducing e-healthcare that will be both affordable to and supportive of rural patients.

Compared with other LEDCs, Sri Lanka has a high standard of healthcare nationwide (Smith et al., 2007). Even though healthcare provision at urban hospitals is of a high standard, they have more up-to-date facilities and professional care than the rural hospitals who serve 70% of the population.

The three primary issues faced by Sri Lanka's rural population in the current healthcare system are:

- Patients travel long distances from the rural areas where they live to the urban hospitals to obtain better health facilities, which involves high costs for transport and long hours of travelling.
- Inadequate infrastructure in the rural hospitals and uneven distribution of healthcare professionals.

- Inadequate health policies and procedures which are not well defined in the rural areas.

This research concentrated on looking for solutions to the e-healthcare system in Sri Lanka and proposed a suitable model. To resolve these issues, introducing a telemedicine system will be beneficial to both the rural and urban populations.

A summary of the research and the processes to develop the TMSL (TeleMedicine in Sri Lanka) are given in Figure 10-1.

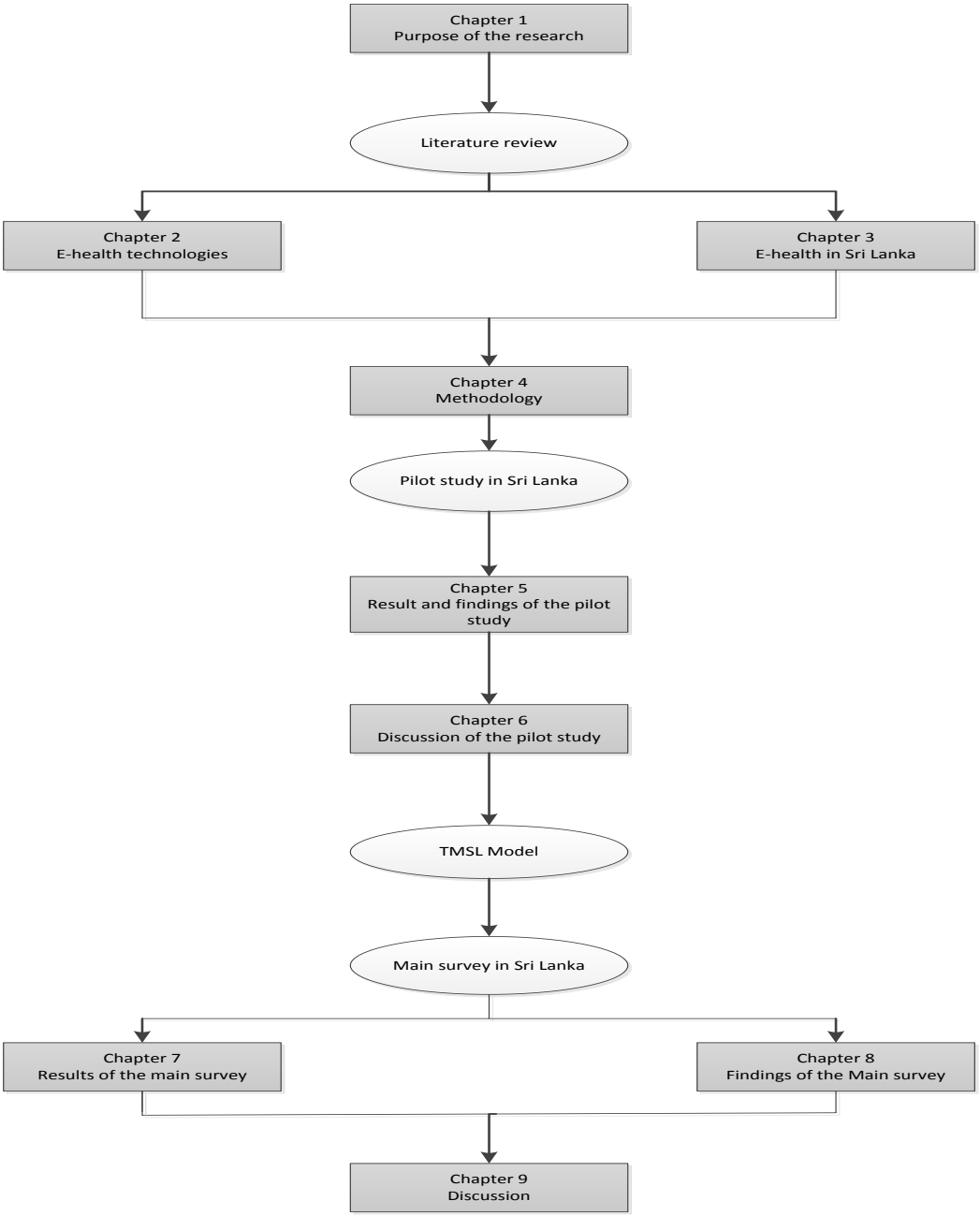


Figure 10-1 Summary of the research undertaken to implement the TMSL model and its location in this thesis

In order to develop the TMSL model for the implementation of a telemedicine system in the rural areas of Sri Lanka, an exploratory study followed by the main study was conducted in parts of the country. Both surveys were conducted using quantitative and qualitative data. Several techniques were used during the two surveys which were explained in Chapter 4 Methodology. The questions for the exploratory study and the main survey were designed using familiar theories such as the Theory of Planned Behaviour (TPB), the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM) and the Model of PC Utilization (MPCU). The interview questions for the exploratory study, and the main study, used semi-structured interview techniques.

The exploratory study was conducted in three districts of the country to address the key issues raised in the literature review, which included financial (for example, transport costa and low incomes), low computer use among clinicians, internet use, health policies and government procedures, infrastructure, staffing, ICT challenges, privacy, confidentiality and security issues.

The exploratory study showed that:

- Clinicians, hospital staff and the general public agreed that adopting telemedicine will improve the quality of care in rural hospitals. They also agreed that the cost and time of travelling to urban areas for medical interventions will be reduced when using telemedicine.
- The government should have proper security methods to transfer medical data securely through the Internet and was a major concern raised by clinicians, hospital staff and senior managers.
- Not having proper Internet and computer training for medical and non-medical staff was another concern raised by both clinicians and hospital staff during the exploratory study.
- Not having physical examinations by the consultants when using telemedicine was a concern raised by the general public.
- Not having a proper infrastructure, and the poor availability of Internet connectivity in rural areas, were also raised by clinicians and hospital staff.

The triangulation and the exploratory study led to the development of the TMSL (**T**ele**M**edicine in **S**ri **L**anka) model. The model consists of four main components:

- Acceptance of technology
- Availability of infrastructure
- Staff involvement
- Policies and standards

The main model was divided into three sub-models to accommodate the needs of the three main groups: clinicians, hospital staff and general public. The sub-models for the clinicians and the hospital staff had four components:

- Acceptance of technology
- Availability of infrastructure
- Staff involvement
- Policies and standards

While the sub-model for the general public had only a single component:

- Acceptance of technology

One aim of the TMSL model was to investigate the reaction of the general public, hospital staff and clinicians to accepting the new technology. The TMSL model also showed how hospital staff can be involved in the new technology. The other major outcome of the model involves how the government is going to improve the infrastructure of rural areas so that they can be ready to adopt telemedicine.

The main survey was conducted in 10 districts and on two islands in Sri Lanka collecting data for the variables of the TMSL model to find out what factors influence the adoption of telemedicine by clinicians, hospital staff and the general public. Several quantitative research and qualitative research methods were used to conduct the main survey. Questionnaires were designed for clinicians, for hospital staff and for the general public, both in rural and urban areas of Sri Lanka. Interviews were designed to gather data from Health Ministry officials and senior managers.

The answers to the questions on participants' demographics, computer use, computer skills and internet use, were analysed using descriptive statistics. The results showed that most participants were below 50 years' old.

Results from the main study confirmed:

- The general public's willingness to adopt, and the acceptance of, the change to a telemedicine system. The general public agreed that telemedicine will help reduce the

cost and time of travel from rural areas to urban areas for better health services and they have confidence in using telemedicine.

- Clinicians and hospital staff's willingness to adopt, and acceptance of, the change to a telemedicine system. Clinicians and hospital staff have a positive attitude towards learning new technology and are in favour of adopting telemedicine. Both clinicians and hospital staff agree that they have a good knowledge of telemedicine, of introducing IT facilities to rural hospitals, and to improving continuing education so that staff will improve their knowledge of telemedicine.
- Considering the availability of resources when introducing telemedicine, both clinicians and hospital staff believe that major hospitals are well equipped with the latest technology, but that peripheral hospitals are still not up-to-date with the latest technology. They believe that introducing telemedicine will help to improve the availability of resources to rural hospitals.
- Considering rural hospitals' connectivity to the Internet, clinicians and hospital staff believe that there is a need for improvement in rural hospitals in this area and also that telemedicine will help to improve the Internet connectivity to rural hospitals. In contrast, ministry officials indicated that Internet connectivity had already vastly improved in rural areas due to the low-cost internet packages introduced by the government and the ever-increasing number of Internet Service Providers who had established internet coverage to the whole country. The results also indicate that communication methods and Internet connectivity will be improved in rural areas after the introduction of telemedicine.
- Clinicians believe that telemedicine will reduce congestion of patients coming in to urban hospitals. This will help utilise resources effectively. They also believe that telemedicine will improve the knowledge transfer between the rural clinician and the urban consultant. They also believe that adopting telemedicine will have a positive effect on their jobs.
- Hospital staff believe that introducing new IT-related subjects to the curriculum, and conducting tele-health related programmes using the local language, will make for a better understanding of the subject. They also believe that gaining experience and the confidence to perform IT-related tasks, being involved in IT-related programmes and IT-related demonstrations, will help them understand telemedicine better.

- The findings of the main study confirmed that obtaining donations from donor agencies has helped the government improve the infrastructure in rural areas. Investing more money in the telecommunication infrastructure to develop ICT in rural areas by both the government and the private sector will help in the adoption of telemedicine. Introducing proper interoperability standards for the exchange of information, and safeguarding patient information through the introduction of effective privacy and security policies, will help in the introduction of telemedicine to rural areas.

Participants' willingness to accept a telemedicine system for rural areas of Sri Lanka was indicated by the results from the two surveys. The rapid infrastructure development projects, and a wide range of Internet coverage in the country, will help in the adoption of a telemedicine system in rural areas of Sri Lanka.

As a result of the findings from the main study, the proposed model was revised, as discussed in Chapter 1. The main model is a combination of the three sub-models which includes that for the clinicians, that for the hospital staff, and the sub-model for the general public. The main model consists of 14 variables and 5 components. Use of the TMSL model, and the findings from the main study, explain how the variables identified in the model influence the clinicians, hospital staff and general public when introducing the technology. The variables in the TMSL model that would have a positive and negative effect on implementing the system will help the government and policy makers have a better understanding when implementing a telemedicine system in rural areas of Sri Lanka.

10.1 Contribution

In addressing the research question "*What is an appropriate model for the adoption of a telemedicine system in the rural areas of Sri Lanka*?" will help the rural population in the country to obtain the specialist care and advice in those rural areas without having to travel to urban areas. This will help the rural population to save on the cost and time of travelling.

There is one major contribution and two minor contributions made by this research as a result of implementing a model for the factors that influence the adoption of a telemedicine system in the rural areas of Sri Lanka.

The major contribution made to this research is the TMSL (TeleMedicine in Sri Lanka) model. This model is the first to examine the use of telemedicine in Sri Lanka. The model

was developed using the literature review and the exploratory study. The main study helped to identify the factors that influence the adoption of telemedicine in Sri Lanka.

The minor contributions of the research are:

- The instruments designed for clinicians, hospital staff and the general public for the pilot and the main studies.
- The data gathered from clinicians, hospital staff and the general public during the exploratory study and the main study, in rural and urban areas of Sri Lanka, and the data gathered from ministry officials and senior managers during the pilot and main studies.

These minor contributions provide a resource base for others to use and analyse. They can also be reused in other studies.

A review of the current literature identified the major issues raised in implementing a telemedicine system in rural areas of Sri Lanka. The exploratory study confirmed those issues which are important in implementing a telemedicine system in the country. The model was developed using the findings from the current literature and the exploratory study. The main study confirmed that the model can be used to implement a telemedicine system in rural areas of Sri Lanka. This model will help policy makers and the people implementing the system to identify issues and address them in order to produce a successful telemedicine system which will be beneficial to the rural population in the country.

10.2 Limitations of the study

The major survey was conducted in 10 districts of the country representing the majority population of the country. However, there are 24 districts in Sri Lanka. While it is believed that the survey was a representative sample, more work could have been done by expanding the survey throughout the country. Conducting the survey in different districts could have picked up on local needs such as infrastructure, attitudes of the public, clinicians and hospital staff.

It was noticed that some consultants were not prepared to make their opinions known regarding the questionnaire, possibly because they did not want to risk their publicly-funded work.

The small number of senior management interviewed was another limitation of the study. Conducting more interviews with consultants, medical directors and ministry officials would

have given a better opportunity to understand the infrastructure, policies and procedures of the respective hospitals.

The questions were written in English and then translated into Sinhalese and Tamil. These were translated back into English and compared; they were the same. The questions were piloted by six people which included two clinicians, two hospital staff and two independent members of the general public, to make sure that the questions were clear and not leading questions.

On reflection, there may still have been some leading questions, but it would now be unethical to change the questions asked, and this may be a limitation of the study.

10.3 Future work

The TMSL model included the essential concepts that are important when implementing a telemedicine system in rural areas of Sri Lanka.

Introducing a telemedicine system to the entire country is a new concept even though there were pilot projects conducted in different parts of the country. This research covered many areas of the country in which telemedicine could have been used. However, the research did not cover the entire country, and therefore there may be local variations. Hence it may be beneficial to work in-depth and cover the entire country to have a better idea of local variation.

In addition, this research focuses on Sri Lanka, although many of the issues are similar to other LEDCs. Therefore it would be good to repeat the study in the other LEDCs such as India, Pakistan, Malaysia and Bangladesh, to see what different cultural factors, availability of technology and infrastructure will affect the TMSL model.

The TMSL model focuses very much on telemedicine. However, the similarities to other areas of e-health, such as tele-health, health portal and tele-surgery, could be investigated to see whether the TMSL model can also be applied.

From this research, many items were raised by the clinicians that need to be addressed outside of this research.

Implications for policy makers

- Telemedicine uses video and audio conferencing via the Internet to communicate between different locations. Hence Internet connectivity is a vital aspect of telemedicine. LEDCs need to improve Internet connectivity if they are to use the

latest technologies for healthcare. The results from the main study show that Internet connectivity for rural hospitals has improved over the resent years. Having an open market economy and letting the private sector to invest in the telecommunication industry, allowed the competition among investors to grow rapidly. This can be explored further by improving the competitive edge of the private sector by encouraging more ISP providers, who can then offer better coverage, easy and fast connectivity, cheaper packages and better nationwide coverage in the country.

- As a developing nation, Sri Lanka needs to improve the infrastructure in the country, especially in rural areas, in order to introduce new technologies. Introducing telemedicine will help the government and policy makers improve the infrastructure of the country. Better communication facilities and up-to-date computer facilities will help to improve the healthcare system. Improving the infrastructure mainly in the rural areas will be beneficial to other areas such as education, transport and economic development in the country. This can be further explored by examining the experience of governments and policy makers in other developing countries.

Implications in general

- When introducing telemedicine, the government and the Medical Association of Sri Lanka will benefit from policies and procedures which consist of proper guidelines and steps to implement the system. The results indicate that the limited questions asked of participants led to less discussion on the subject. Conducting surveys introducing more questions for the participants related to each factor will help in understanding the areas for improvement. Therefore research into a proper policy will be important. This could be investigated further in other LEDCs to examine the policies and procedures in those countries
- Telemedicine is a new concept especially for the rural population that makes up 70% of the country. Therefore educating people about the new technology is vital before introducing telemedicine. Since telemedicine has not been implemented in Sri Lanka, it is best to educate the clinicians, hospital staff and general public by conducting seminars, awareness programmes and training programmes before implementing the system. Introducing e-health applications and its usefulness to the curriculum for medical students will help clinicians have a better understanding of the subject.

Appendix A. Exploratory study questionnaire for the clinicians, hospital staff and the general public (English and Sinhalese)

Questions for the clinicians

Introduction

The main aim of this research is to adopt a telemedicine system in the rural areas of Sri Lanka. This framework will help to develop a set of guidelines to adopt a telemedicine system for the rural population. The result of this survey will be used to find the gaps in the guidelines which in return will be used to adopt the telemedicine system in the rural areas of Sri Lanka. This research is under the direction of School of Electronics and Computer Science, University of Southampton. United Kingdom. You are invited to participate in this research as you are a Sri Lankan who believes in improving the healthcare facility in the rural areas. I would greatly appreciate your participation in this research by answering the questions given below. The information given below will be used in this research only and the responses will be treated as anonymous and highly confidential. Thank you very much for your co-operation in answering the questions to make a better and efficient healthcare system in Sri Lanka.

Researcher : Yasmin Dayani Jayasinghe

Instructions :Please indicate the importance in your rating about adopting telemedicine in Sri Lanka by placing an "X" in only **ONE**.

	Strongly agree	Agree	Disagree	Strongly disagree
Using telemedicine is beneficial for my profession				
Telemedicine saves time				
Telemedicine can improve the quality of care				
Video conferencing is beneficial when using telemedicine				
Telemedicine can improve access to health care facilities				
Second opinion is important when making medical decisions				
I have the skills I need to evaluate the health resources I find on the internet				
I feel confident in using information through video conferencing to make health decisions				
Introducing telemedicine will help me to get expert opinions faster				
Telemedicine will help me to treat and diagnose the client faster				
I like to have a second opinion about the client's illness from a consultant				
I prefer to have a telemedicine system affiliated with a public care centre				
Telemedicine will maintain the confidentiality of medical information of the client				
Telemedicine will protect client's privacy				
Telemedicine will help reduce consultants traveling to distant sites				
Telemedicine can improve the healthcare in the rural areas				
Telemedicine will protect client data				

Thank you for your cooperation

Yasmin Dayani Jayasinghe 1

Introduction

The main aim of this research is to adopt a telemedicine system in the rural areas of Sri Lanka. This framework will help to develop a set of guidelines to adopt a telemedicine system for the rural population. The result of this survey will be used to find the gaps in the guidelines which in return will be used to adopt the telemedicine system in the rural areas of Sri Lanka. This research is under the direction of School of Electronics and Computer Science, University of Southampton. United Kingdom. You are invited to participate in this research as you are a Sri Lankan who believes in improving the healthcare facility in the rural areas. I would greatly appreciate your participation in this research by answering the questions given below. The information given below will be used in this research only and the responses will be treated as anonymous and highly confidential. Thank you very much for your co-operation in answering the questions to make a better and efficient healthcare system in Sri Lanka.

Researcher : Yasmin Dayani Jayasinghe

Instructions

Please indicate the importance in your rating about adopting telemedicine in Sri Lanka by placing an "X" in only **ONE**.

	Strongly agree	Agree	Disagree	Strongly disagree
I have previous computer experience				
I use general computer applications at work				
I know how to use the internet in obtaining health information				
I know what telemedicine means				
Using telemedicine in client care is a good idea				
Using telemedicine technology can improve client care				
I have participated in video conferencing				
I have had formal training in computers in how to use telemedicine system				
I don't have the knowledge to make use of telemedicine technology				
Telemedicine can improve the healthcare in the rural areas				

Thank you for your cooperation

Questions for the general public

Introduction

The main aim of this research is to adopt a telemedicine system in the rural areas of Sri Lanka. This framework will help to develop a set of guidelines to adopt a telemedicine system for the rural population. The result of this survey will be used to find the gaps in the guidelines which in return will be used to adopt the telemedicine system in the rural areas of Sri Lanka. This research is under the direction of School of Electronics and Computer Science, University of Southampton. United Kingdom. You are invited to participate in this research as you are a Sri Lankan who believes in improving the healthcare facility in the rural areas. I would greatly appreciate your participation in this research by answering the questions given below. The information given below will be used in this research only and the responses will be treated as anonymous and highly confidential. Thank you very much for your co-operation in answering the questions to make a better and efficient healthcare system in Sri Lanka.

Researcher : Yasmin Dayani Jayasinghe

Instructions

Please indicate the importance in your rating about adopting telemedicine in Sri Lanka by placing an "X" in only **ONE**.

	Strongly agree	Agree	Disagree	Strongly disagree
Using the internet to find information on healthcare is a good idea				
I know the meaning of telemedicine				
Telemedicine will reduce my cost of travelling to the city for consultation				
Telemedicine will reduce my traveling time to the city for consultation				
I can obtain the best health services using telemedicine				
I am comfortable with clinicians using telemedicine technology				
I accept the online consultation to physical contact with the consultant				
I feel confident in using information from telemedicine to make health decisions				
I can get medical information faster using telemedicine				

Thank you for the cooperation

ප්‍රවේශය :

මෙම පර්යේෂණයේ ප්‍රධාන අරමුණ වන්නේ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශයන්හි ටෙලි මෙඩිසින් ක්‍රමයක් ආරම්භ කිරීමයි. මෙම පාදක ව්‍යුහය, පිටිසර ජනගහනය සඳහා ටෙලිමෙඩිසින් ක්‍රමයකට අවශ්‍ය ප්‍රතිපත්ති මාලාවක් සකස් කර ගැනීමට උපකාරී වේ. මෙම සමීක්ෂණයේ ප්‍රතිඵලය මඟින් ප්‍රතිපත්ති මාලාවේ හිඩැස් හඳුනාගෙන ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශවල ටෙලි මෙඩිසින් ක්‍රමයක් ආරම්භ කිරීමට යොදා ගැනේ. මෙම පර්යේෂණය කරනු ලබන්නේ එක්සත් රාජධානියේ සවුත්හැම්ප්ටන් විශ්ව විද්‍යාලයේ ඉලෙක්ට්‍රොනික හා පරිගණක අංශ විදුහලේ අධ්‍යක්ෂණය යටතේය. මෙම පර්යේෂණයට සහභාගි වීම සඳහා ඔබට ආරාධනා කරන්නේ ඔබ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශවල සෞඛ්‍ය සත්කාර පහසුකම් වැඩි දියුණු කිරීම ගැන විශ්වාසයක් දක්වන හෙයිනි. පහත සඳහන් ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් මෙම පර්යේෂණය සඳහා ඔබගේ සහභාගීත්වය මම බෙහෙවින් අගය කොට සලකමි. පහත සඳහන් තොරතුරු මෙම පර්යේෂණය සඳහා පමණක් යොදා ගැනෙන අතර ප්‍රතිදත්තර වල නිර්නාමික බව හා අධිරහස්‍ය භාවය ද සුරකිමි. ශ්‍රී ලංකාවේ වඩා යහපත් හා කාර්යක්ෂම සෞඛ්‍ය සත්කාර ක්‍රමයක් ඇති කිරීමට ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් දෙන ලද සහයෝගය ගැන ඔබට බෙහෙවින් ස්තුතිවන්ත වෙමි.

පර්යේෂණ මෙහෙයුම්කරු : යස්මින් දයානි ජයසිංහ

උපදෙස් : ශ්‍රී ලංකාවේ ටෙලිමෙඩිසින් ක්‍රමයක් ආරම්භ කිරීම සඳහා ඔබගේ තක්සේරු අගයේ වැදගත්කම කරුණාකර <u>එක කොටුවක පමණක්</u> එක්ස් 'X' සලකුණු යොදා පෙන්නුම් කරන්න.

	තදින් එකඟ වේ	එකඟ වේ	එකඟ නොවේ	තදින් එකඟ නොවේ
ටෙලි මෙඩිසින් ක්‍රම භාවිතය මගේ වෘත්තියට වැඩදායක වේ				
ටෙලි මෙඩිසින් ක්‍රමයෙන් කාලය ඉතිරි කර ගැනීමට හැකි වේ				
ටෙලි මෙඩිසින් ක්‍රමයෙන් රෝගී සත්කාර තත්ත්වය වැඩි දියුණු කරගත හැක				
ටෙලි මෙඩිසින් ක්‍රමය භාවිතා වන විට 'වීඩියෝ කොන්ෆරන්සින්ග්' වාසිදායක වේ				
ටෙලි මෙඩිසින් ක්‍රමය භාවිතයෙන් සෞඛ්‍යය සත්කාර පහසුකම්වලට ලඟාවීම වැඩි දියුණු කරගත හැක				
වෛද්‍ය තීරණ ගන්නා විට දෙවනුව ගන්නා අදහස වැදගත් වේ				
අන්තර්ජාලයෙන් ලබාගන්නා වෛද්‍ය සම්පත් ඇගයීමට අවශ්‍ය දක්ෂතා මා සතුව ඇත				
වෛද්‍ය තීරණ ගැනීමේදී 'වීඩියෝ කොන්ෆරන්සින්ග්' මඟින් ලබාගන්නා තොරතුරු ගැන මට විශ්වසනීය හැඟීමක් ඇත				
ටෙලි මෙඩිසින් ක්‍රමය ස්ථාපිත කිරීමෙන් මා හට විශේෂඥ දැනුම් ඉක්මණට ලබා ගැනීමට උපකාරී වේ.				
ටෙලි මෙඩිසින් ක්‍රමයෙන් ඉක්මණින් රෝග ප්‍රතිකාර ලබාදීමට හා රෝග හඳුනාගැනීමට මට උපකාරී වේ				
විශේෂඥ වෛද්‍යවරයෙකුගෙන් රෝගියාගේ රෝගය පිළිබඳ කරුණු හැදෑරීමෙන් දෙවෙනි අදහසකට මම කැමතිය				
පොදු සත්කාර මධ්‍යස්ථානයක් හා බැඳුණු ටෙලි මෙඩිසින් ක්‍රමයක් පවත්වාගෙන යෑමට මම වඩා වැඩි මනාපයක් දක්වමි				
ටෙලි මෙඩිසින් ක්‍රමය රෝගියාගේ වෛද්‍ය තොරතුරුවල රහස්‍ය භාවය පවත්වාගෙන යයි.				
ටෙලි මෙඩිසින් ක්‍රමය රෝගියාගේ පෞද්ගලිකත්වය ආරක්ෂා කරයි				
ටෙලි මෙඩිසින් ක්‍රමයෙන් විශේෂඥයින් ඈත ස්ථානවලට ගමන් කිරීම් අඩු කෙරේ				
ටෙලි මෙඩිසින් ක්‍රමයෙන් පිටිසර ප්‍රදේශවල සෞඛ්‍ය සත්කාරය වැඩි දියුණු කෙරේ.				
ටෙලි මෙඩිසින් ක්‍රමය රෝගීන් පිළිබඳ දත්තයන් ආරක්ෂා කරයි.				

ඔබගේ සහභාගිත්වයට මගේ ස්තුතිය.

යස්මින් දයානි ජයසිංහ

ප්‍රවේශය :

මෙම පර්යේෂණයේ ප්‍රධාන අරමුණ වන්නේ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශයන්හි ටෙලි මෙඩිසින් ක්‍රමයක් ආරම්භ කිරීමයි. මෙම පාදක ව්‍යුහය, පිටිසර ජනගහනය සඳහා ටෙලිමෙඩිසින් ක්‍රමයකට අවශ්‍ය ප්‍රතිපත්ති මාලාවක් සකස් කර ගැනීමට උපකාරී වේ. මෙම සමීක්ෂණයේ ප්‍රතිඵලය මඟින් ප්‍රතිපත්ති මාලාවේ හිඩැස් හඳුනාගෙන ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශවල ටෙලි මෙඩිසින් ක්‍රමයක් ආරම්භ කිරීමට යොදා ගැනේ. මෙම පර්යේෂණය කරනු ලබන්නේ එක්සත් රාජධානියේ සවුත්හැම්ප්ටන් විශ්ව විද්‍යාලයේ ඉලෙක්ට්‍රොනික හා පරිගණක අංශ විදුහලේ අධ්‍යක්ෂණය යටතේය. මෙම පර්යේෂණයට සහභාගි වීම සඳහා ඔබට ආරාධනා කරන්නේ ඔබ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශවල සෞඛ්‍ය සත්කාර පහසුකම් වැඩි දියුණු කිරීම ගැන විශ්වාසයක් දක්වන හෙයිනි. පහත සඳහන් ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් මෙම පර්යේෂණය සඳහා ඔබගේ සහභාගිත්වය මම බෙහෙවින් අගය කොට සලකමි. පහත සඳහන් තොරතුරු මෙම පර්යේෂණය සඳහා පමණක් යොදා ගැනෙන අතර ප්‍රතිඵලවල නිර්නාමික බව හා අධිරහස්‍ය භාවය ද සුරකිමි. ශ්‍රී ලංකාවේ වඩා යහපත් හා කාර්යක්ෂම සෞඛ්‍ය සත්කාර ක්‍රමයක් ඇති කිරීමට ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් දෙන ලද සහයෝගය ගැන ඔබට බෙහෙවින් ස්තුතිවන්ත වෙමි.

පර්යේෂණ මෙහෙයුම්කරු : යස්මින් දයානි ජයසිංහ

උපදෙස් : ශ්‍රී ලංකාවේ ටෙලිමෙඩිසින් ක්‍රමයක් ආරම්භ කිරීම සඳහා ඔබගේ තක්සේරු අගයේ වැදගත්කම් කරුණාකර <u>එක කොටුවක පමණක්</u> එක්ස් 'X' සලකුණු යොදා පෙන්නුම් කරන්න.

	තදින් එකඟ වේ	එකඟ වේ	එකඟ නොවේ	තදින් එකඟ නොවේ
මම කලින් ලැබූ පරිගණක පළපුරුද්දක් ඇත				
මම සාමාන්‍ය පරිගණක භාවිතය, කාර්යයන් සඳහා යොදා ගනිමි				
සෞඛ්‍ය තොරතුරු ලබා ගැනීමට අන්තර්ජාලය භාවිතා කරන අන්දම මම දනිමි				
ටෙලි මෙඩිසින් හි තේරුම කුමක්ද යන්න මම දනිමි				
රෝගී සත්කාරය සඳහා ටෙලි මෙඩිසින් යොදා ගැනීම මනා අදහසකි				
ටෙලිමෙඩිසින් තාක්ෂණය භාවිතයෙන් රෝගී සත්කාරය වැඩි දියුණු කරගත හැක				
දෘශ්‍යය පිළිබඳ සම්මන්ත්‍රණයන්ට මම සහභාගි වී ඇත				
ටෙලි මෙඩිසින් ක්‍රම භාවිතය කෙසේද යන්න දැන ගැනීමට විධිමත් පරිගණක පුහුණුවක් මම ලබා ඇත				
ටෙලි මෙඩිසින් තාක්ෂණ භාවිතය ගැන මට දැනුමක් නැත				
ටෙලි මෙඩිසින් ක්‍රමය මඟින් පිටිසර ප්‍රදේශයන්හි සෞඛ්‍යය සත්කාරය වැඩි දියුණු කිරීමට පුළුවන				
ටෙලි මෙඩිසින් තාක්ෂණ භාවිතය ගැන මට දැනුමක් නැත				
ටෙලි මෙඩිසින් ක්‍රමය මඟින් පිටිසර ප්‍රදේශයන්හි සෞඛ්‍යය සත්කාරය වැඩිදියුණු කිරීමට පුළුවන				

ඔබගේ සහභාගිත්වයට මගේ ස්තුතිය.

යස්මින් දයානි ජයසිංහ

ප්‍රවේශය :

මෙම පර්යේෂණයේ ප්‍රධාන අරමුණ වන්නේ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශයන්හි ටෙලි මෙඩිසින් ක්‍රමයක් ආරම්භ කිරීමයි. මෙම පාදක ව්‍යුහය, පිටිසර ජනගහනය සඳහා ටෙලිමෙඩිසින් ක්‍රමයකට අවශ්‍ය ප්‍රතිපත්ති මාලාවක් සකස් කර ගැනීමට උපකාරී වේ. මෙම සමීක්ෂණයේ ප්‍රතිපලය මඟින් ප්‍රතිපත්ති මාලාවේ හිඩැස් හඳුනාගෙන ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශවල ටෙලි මෙඩිසින් ක්‍රමයක් ආරම්භ කිරීමට යොදා ගැනේ. මෙම පර්යේෂණය කරනු ලබන්නේ එක්සත් රාජධානියේ සවුත්හැම්ප්ටන් විශ්ව විද්‍යාලයේ ඉලෙක්ට්‍රොනික හා පරිගණක අංශ විදුහලේ අධ්‍යක්ෂණය යටතේය. මෙම පර්යේෂණයට සහභාගි වීම සඳහා ඔබට ආරාධනා කරන්නේ ඔබ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශවල සෞඛ්‍ය සත්කාර පහසුකම් වැඩි දියුණු කිරීම ගැන විශ්වාසයක් දක්වන හෙයිනි. පහත සඳහන් ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් මෙම පර්යේෂණය සඳහා ඔබගේ සහභාගිත්වය මම බෙහෙවින් අගය කොට සලකමි. පහත සඳහන් තොරතුරු මෙම පර්යේෂණය සඳහා පමණක් යොදා ගැනෙන අතර ප්‍රතිඵලවල නිර්නාමික බව හා අධිරහස්‍ය භාවය ද සුරකිමි. ශ්‍රී ලංකාවේ වඩා යහපත් හා කාර්යක්ෂම සෞඛ්‍ය සත්කාර ක්‍රමයක් ඇති කිරීමට ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් දෙන ලද සහයෝගය ගැන ඔබට බෙහෙවින් ස්තුතිවන්ත වෙමි.

පර්යේෂණ මෙහෙයුම්කරු : යස්මින් දයානි ජයසිංහ

උපදෙස් : ශ්‍රී ලංකාවේ ටෙලිමෙඩිසින් ක්‍රමයක් ආරම්භ කිරීම සඳහා ඔබගේ තක්සේරු අගයේ වැදගත්කම කරුණාකර <u>එක කොටුවක පමණක්</u> එක්ස් 'X' සලකුණු යොදා පෙන්නුම් කරන්න.

	තදින් එකඟ වේ	එකඟ වේ	එකඟ නොවේ	තදින් එකඟ නොවේ
සෞඛ්‍ය සත්කාරය පිළිබඳ තොරතුරු ලබා ගැනීමට අන්තර්ජාලය යොදා ගැනීම මනා අදහසකි.				
ටෙලිමෙඩිසින් යන්නේ තේරුම මම දනිමි.				
ටෙලිමෙඩිසින් ක්‍රමය නිසා විශේෂඥ උපදෙස් ලබා ගැනීමට නගරයට පැමිණීම සඳහා වැය වන මගේ වියදම අඩු කෙරේ.				
ටෙලිමෙඩිසින් ක්‍රමය නිසා නගරයට යෑමේ දී ගත වන මගේ කාලය අඩු කෙරේ.				
ටෙලිමෙඩිසින් භාවිතය නිසා මට උසස් සෞඛ්‍ය සේවාවක් ලබාගත හැක.				
ටෙලිමෙඩිසින් තාක්ෂණය භාවිත කරන වෛද්‍යවරුන් සමඟ සබඳතා අපහසුතාවකින් තොරව මට පවත්වා ගත හැක.				
විශේෂඥ වෛද්‍යවරයාව කායික හමුවීමකට වඩා අන්තර්ජාලය මඟින් උපදෙස් ලබා ගැනීම හොඳයයි මම පිළිගනිමි.				
සෞඛ්‍ය පිළිබඳ තීරණ ගැනීමේදී ටෙලිමෙඩිසින් ක්‍රමය මඟින් ලබා ගන්නා තොරතුරු භාවිතය ගැන මට විශ්වසනීය හැඟීමක් ඇත.				
ටෙලිමෙඩිසින් ක්‍රමය භාවිතයෙන් වෛද්‍ය තොරතුරු මට වඩා ඉක්මණට ලබා ගත හැක.				

ඔබගේ සහභාගිත්වයට මගේ ස්තුතිය.

යස්මින් දයානි ජයසිංහ

Appendix B. Exploratory study interview questions

Semi structured questions to be asked at the interview

Thank you for taking your valuable time off to attend the interview. My name is Yasmin Dayani Jayasinghe and I am a second year PhD student from The University of Southampton in England. I will be recording your answers using the Live Scribe pen recorder. I will be looking at your answers when I get back to England which will help me to understand the need for a telemedicine system in the rural areas of Sri Lanka and how I can adopt the system to give the same facilities and care to the rural populations as the urban population in the country.. Your identity will be protected so I encourage you to tell me your honest opinions. I assure you that the identity and the information you give will be highly protected.

1. Do you think that telemedicine will enable professionals to make better decisions?
2. Do you think Investing in a telemedicine system is worthwhile?
3. Do you agree that telemedicine will maintain the confidentiality of medical information?
4. Do you agree that telemedicine will protect client's privacy?
5. Do you think that telemedicine will help the clients to get appropriate care ?
6. Do you believe that telemedicine will help client reduce traveling cost?
7. Is the government capable of providing resources and funding to use telemedicine?
8. Is the connectivity available is sufficient enough to introduce a telemedicine system which uses video and audio conferencing?
9. Can we increase the speed of the broadband connectivity ?
10. Can we reduce the cost of broadband connectivity

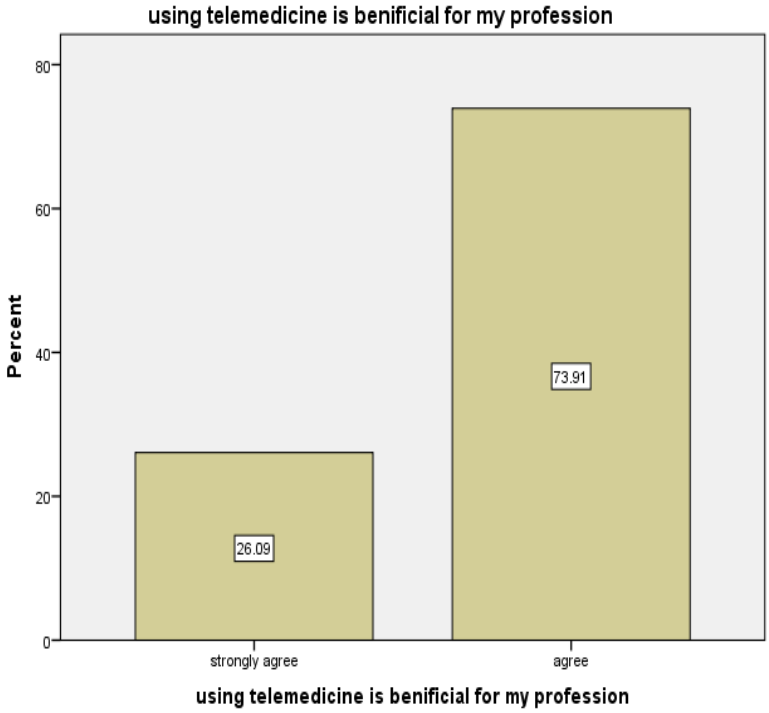
Thank you once again for your time. Please feel free to contact me if you have any further thoughts or want to ask me any questions about the study.

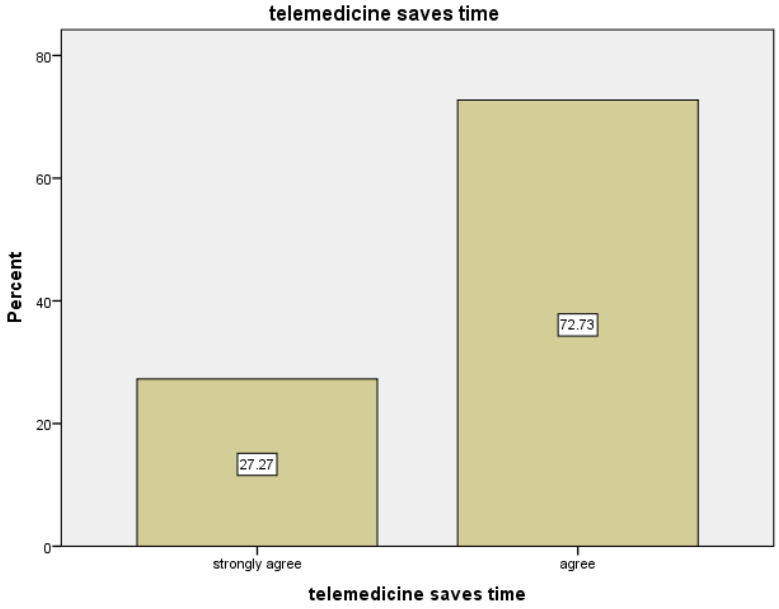
My email address is ydj1g11@soton.ac.uk

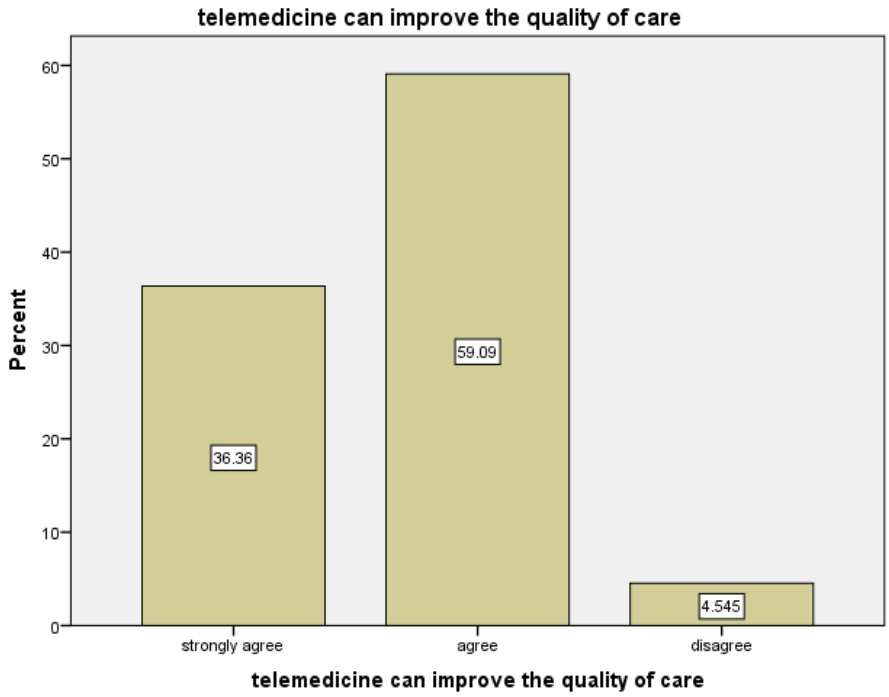
Interview Questions to be asked from the Clinicians, nurses and the technicians

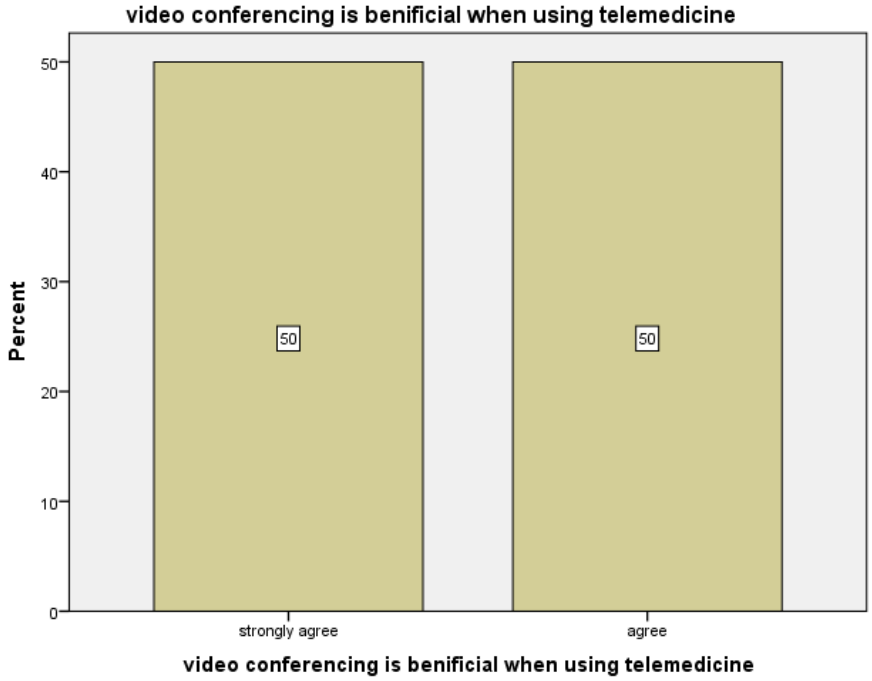
1. If we are to adopt telemedicine, how will it affect your job?
2. Do you think telemedicine system will affect the patients?
3. How do you think that your colleagues will adopt to telemedicine?
4. Do you think we have the enough infrastructure (equipment, connectivity etc.) to deal with a system like telemedicine?
5. Is the training you have regarding the internet is enough to handle the telemedicime system?

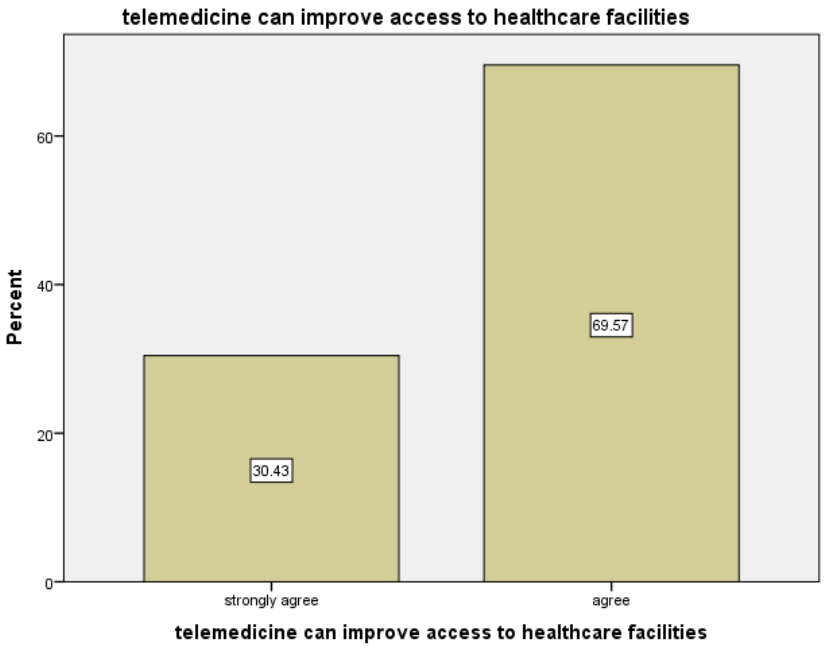
Appendix C. Results in bar graph form

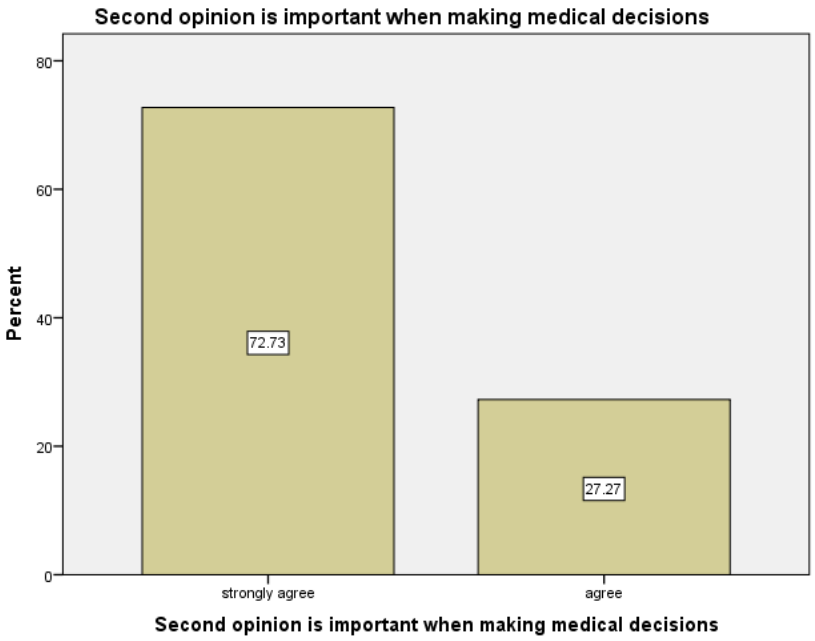


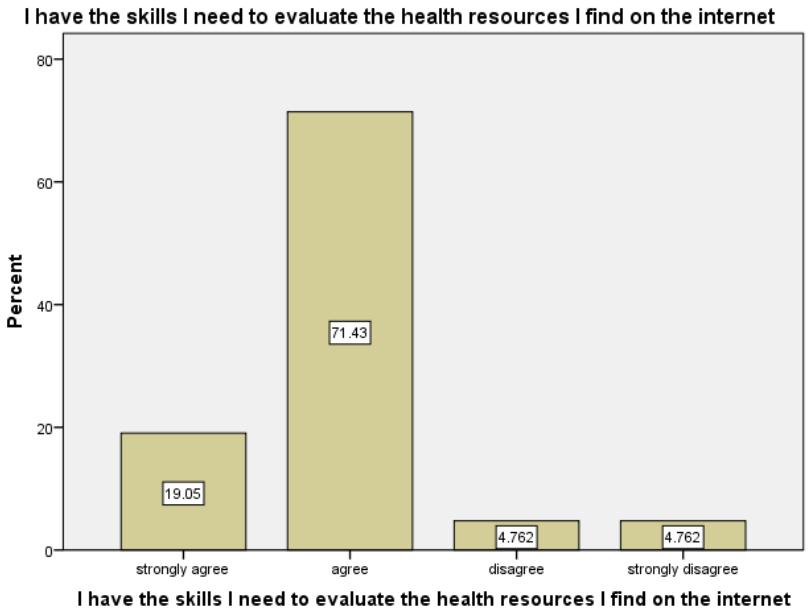


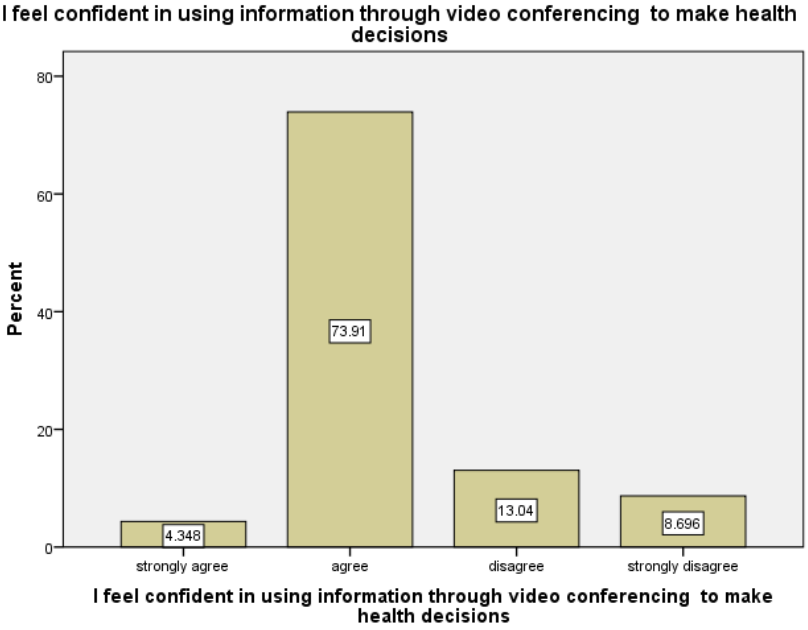

telemedicine can improve the quality of care
Percent
60
50
40
30
20
10
0
36.36
59.09
4.545
strongly agree
agree
disagree
telemedicine can improve the quality of care

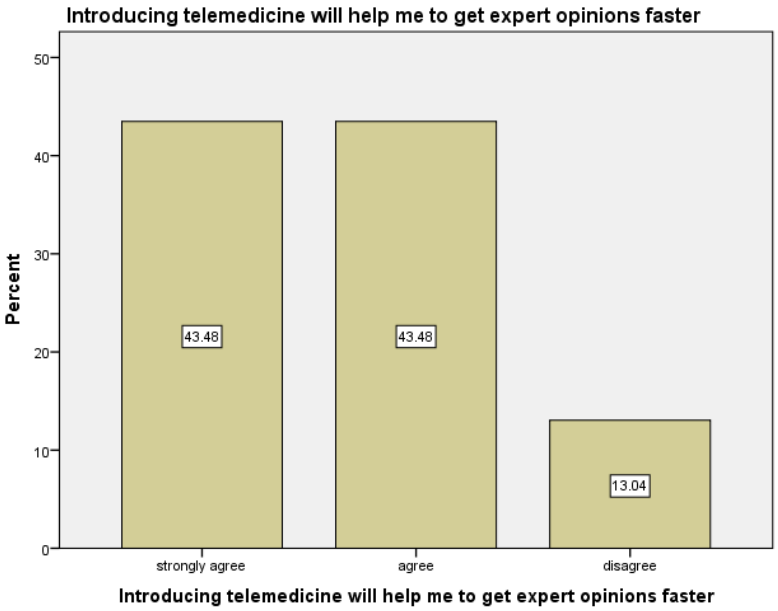

video conferencing is benificial when using telemedicine
Percent
50
40
30
20
10
0
50
50
strongly agree
agree
video conferencing is benificial when using telemedicine

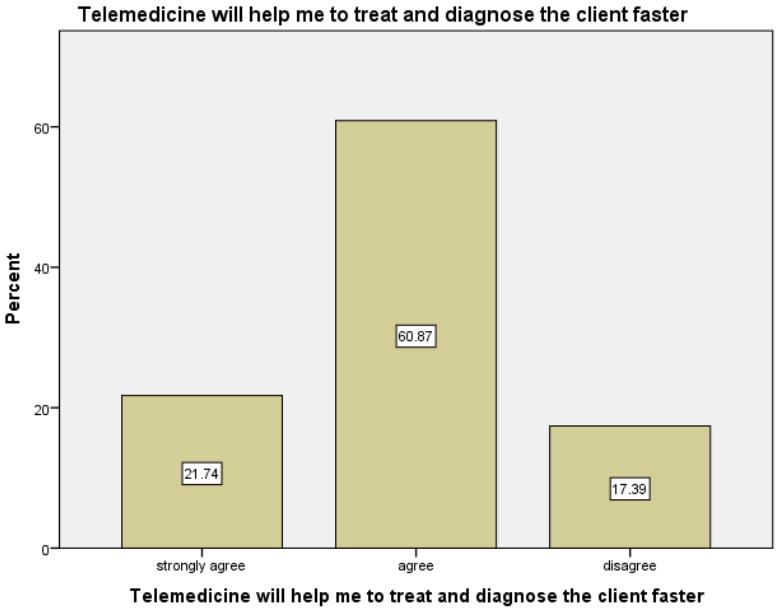

telemedicine can improve access to healthcare facilities
Percent
60
40
20
0
69.57
30.43
strongly agree
agree
telemedicine can improve access to healthcare facilities

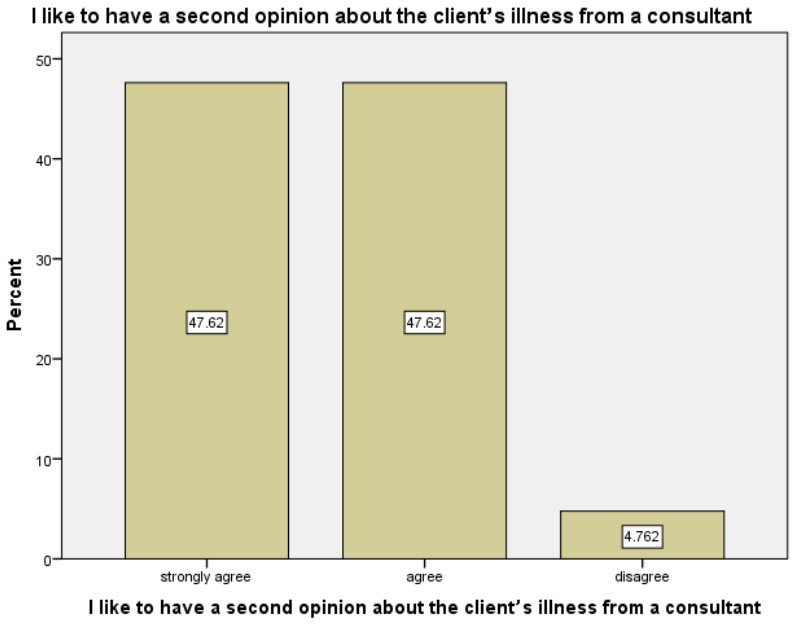

Second opinion is important when making medical decisions
Percent
80
60
40
20
0
72.73
27.27
strongly agree
agree
Second opinion is important when making medical decisions

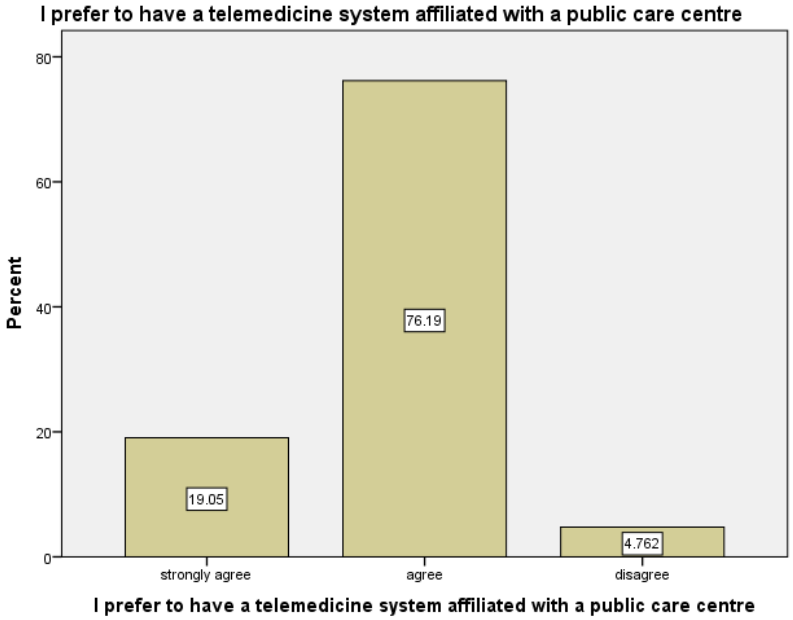

I have the skills I need to evaluate the health resources I find on the internet
Percent
80
60
40
20
0
19.05
71.43
4.762
4.762
strongly agree
agree
disagree
strongly disagree
I have the skills I need to evaluate the health resources I find on the internet

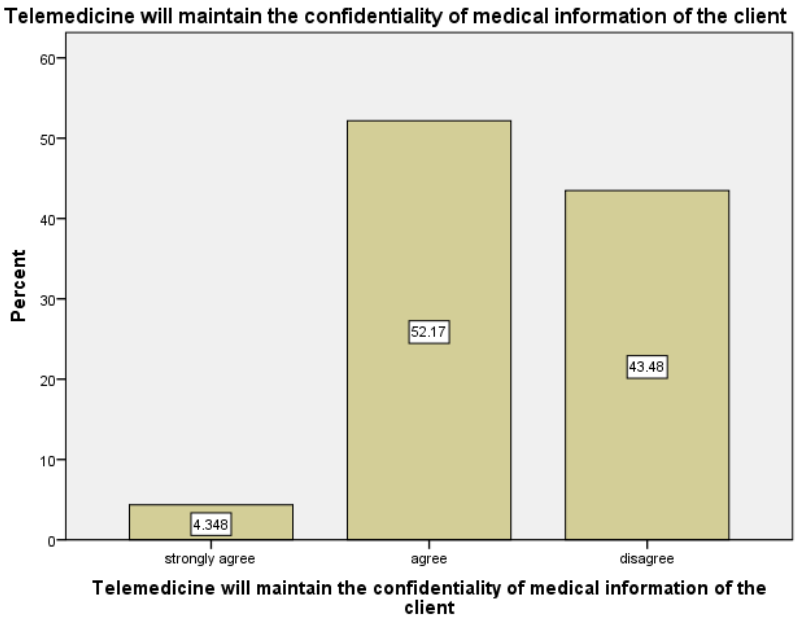

I feel confident in using information through video conferencing to make health decisions
Percent
80
60
40
20
0
4.348
73.91
13.04
8.696
strongly agree
agree
disagree
strongly disagree
I feel confident in using information through video conferencing to make health decisions

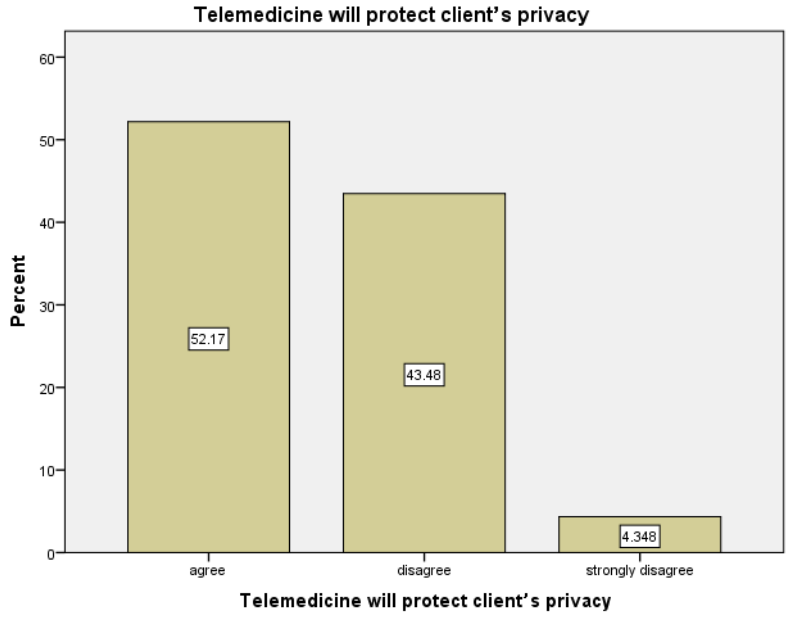

Introducing telemedicine will help me to get expert opinions faster
Percent
50
40
30
20
10
0
43.48
43.48
13.04
strongly agree
agree
disagree
Introducing telemedicine will help me to get expert opinions faster

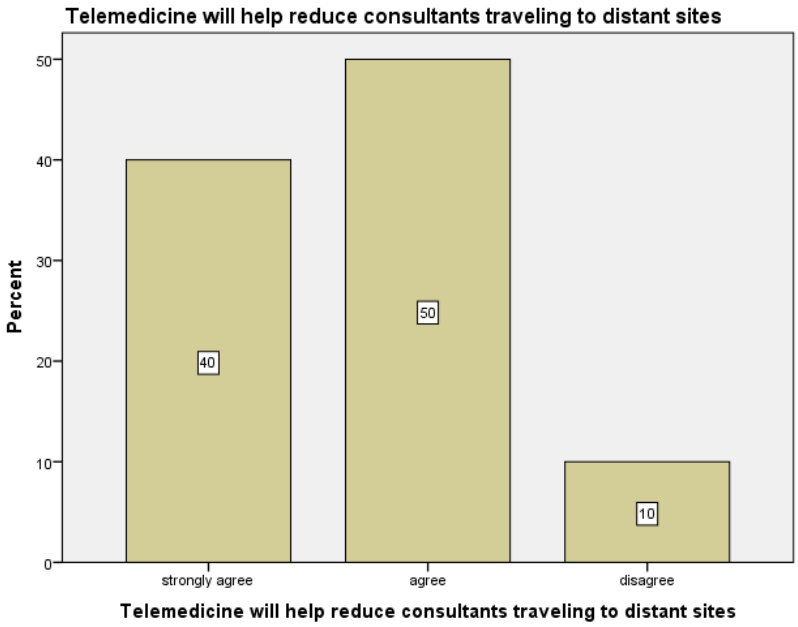

Telemedicine will help me to treat and diagnose the client faster
Percent
60
40
20
0
21.74
60.87
17.39
strongly agree
agree
disagree
Telemedicine will help me to treat and diagnose the client faster

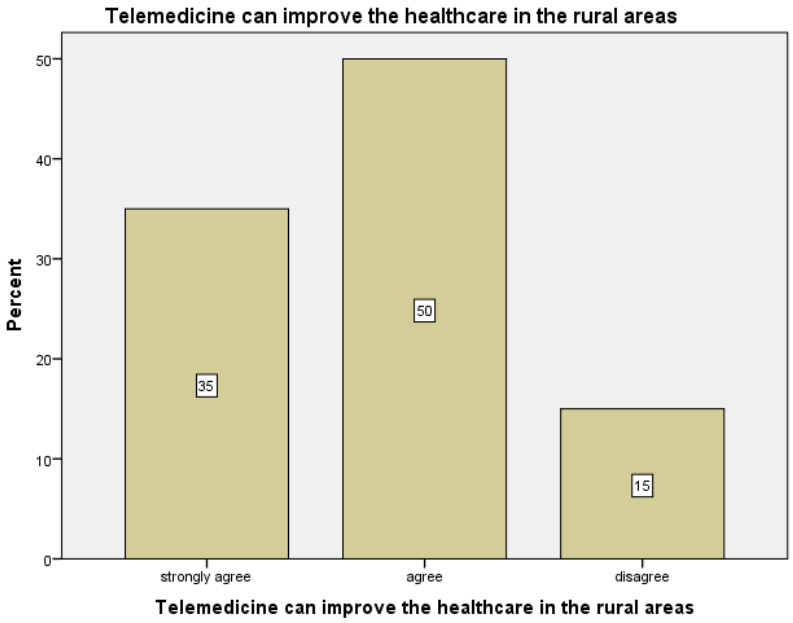

I like to have a second opinion about the client's illness from a consultant
Percent
50
40
30
20
10
0
47.62
47.62
4.762
strongly agree
agree
disagree
I like to have a second opinion about the client's illness from a consultant

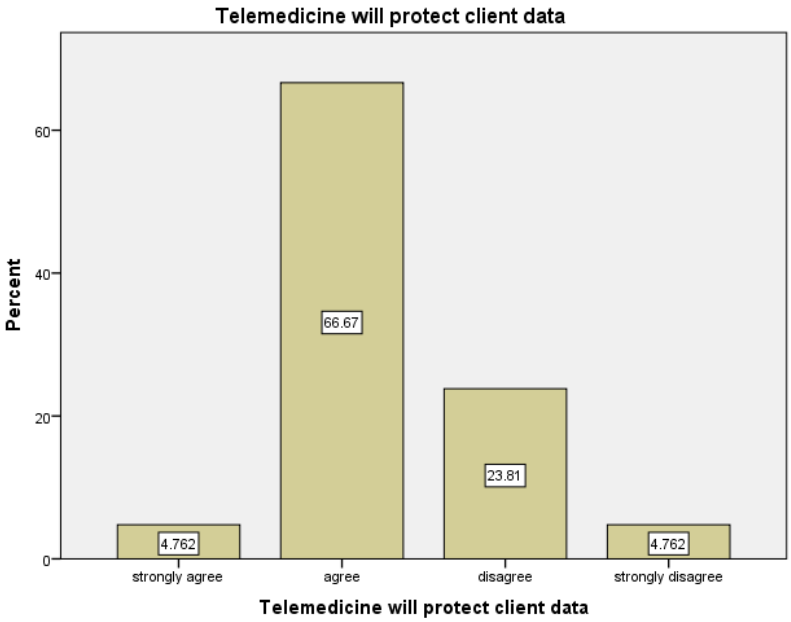

I prefer to have a telemedicine system affiliated with a public care centre
Percent
80
60
40
20
0
19.05
76.19
4.762
strongly agree
agree
disagree
I prefer to have a telemedicine system affiliated with a public care centre


Telemedicine will maintain the confidentiality of medical information of the client
Percent
60
50
40
30
20
10
0
4.348
52.17
43.48
strongly agree
agree
disagree
Telemedicine will maintain the confidentiality of medical information of the client


Telemedicine will protect client's privacy
Percent
60
50
40
30
20
10
0
52.17
43.48
4.348
agree
disagree
strongly disagree
Telemedicine will protect client's privacy


Telemedicine will help reduce consultants traveling to distant sites
Percent
50
40
30
20
10
0
40
50
10
strongly agree
agree
disagree
Telemedicine will help reduce consultants traveling to distant sites


Telemedicine can improve the healthcare in the rural areas
Percent
50
40
30
20
10
0
35
50
15
strongly agree
agree
disagree
Telemedicine can improve the healthcare in the rural areas


Telemedicine will protect client data
Percent
60
40
20
0
66.67
23.81
4.762
4.762
strongly agree
agree
disagree
strongly disagree
Telemedicine will protect client data

Appendix D. Results of the exploratory study questionnaires

Questionnaire results for the clinicians in rural and urban hospitals

Question	*Scale*		*Frequency*	*Percent*
using telemedicine is beneficial for my profession	Valid	strongly agree	6	26.1
		agree	17	73.9
		Total	23	100.0
telemedicine saves time	Valid	strongly agree	6	26.1
		agree	16	69.6
		Total	22	95.7
	Did not answer		1	4.3
	Total		23	100.0
telemedicine can improve the quality of care	Valid	strongly agree	8	34.8
		agree	13	56.5
		disagree	1	4.3
		Total	22	95.7
	Did not answer		1	4.3
	Total		23	100.0
video conferencing is beneficial when using telemedicine	Valid	strongly agree	11	47.8
		agree	11	47.8
		Total	22	95.7
	Did not answer		1	4.3
	Total		23	100.0
telemedicine can improve access to healthcare facilities	Valid	strongly agree	7	30.4
		agree	16	69.6
		Total	23	100.0
Second opinion is important when making medical decisions	Valid	strongly agree	16	69.6
		agree	6	26.1
		Total	22	95.7
	Did not answer		1	4.3
	Total		23	100.0

Question	*Scale*		*Frequency*	*Percent*
I have the skills I need to evaluate the health resources I find on the internet	Valid	strongly agree	4	17.4
		agree	15	65.2
		disagree	1	4.3
		strongly disagree	1	4.3
		Total	21	91.3
	Did not answer		2	8.7
	Total		23	100.0
I feel confident in using information through video conferencing to make health	Valid	strongly agree	1	4.3
		agree	17	73.9
		disagree	3	13.0
		strongly disagree	2	8.7
		Total	23	100.0
Introducing telemedicine will help me to get expert opinions faster	Valid	strongly agree	10	43.5
		agree	10	43.5
		disagree	3	13.0
		Total	23	100.0
Telemedicine will help me to treat and diagnose the patient faster	Valid	strongly agree	5	21.7
		agree	14	60.9
		disagree	4	17.4
		Total	23	100.0
I like to have a second opinion about the patient's illness from a consultant	Valid	strongly agree	10	43.5
		agree	10	43.5
		disagree	1	4.3
		Total	21	91.3
	Did not answer		2	8.7
	Total		23	100.0
I prefer to have a telemedicine system affiliated with a public care centre	Valid	strongly agree	4	17.4
		agree	16	69.6
		disagree	1	4.3
		Total	21	91.3
	Did not answer		2	8.7
	Total		23	100.0
Telemedicine will maintain the confidentiality of medical information of the patient	Valid	strongly agree	1	4.3
		agree	12	52.2
		disagree	10	43.5
		Total	23	100.0

Question	*Scale*		*Frequency*	*Percent*
Telemedicine will protect patient's privacy	Valid	agree	12	52.2
		disagree	10	43.5
		strongly disagree	1	4.3
		Total	23	100.0
Telemedicine will help reduce consultants traveling to distant sites	Valid	strongly agree	8	34.8
		agree	10	43.5
		disagree	2	8.7
		Total	20	87.0
	Did not answer		3	13.0
	Total		23	100.0
Telemedicine can improve the healthcare in the rural areas	Valid	strongly agree	7	30.4
		agree	10	43.5
		disagree	3	13.0
		Total	20	87.0
	Did not answer		3	13.0
	Total		23	100.0
Telemedicine will protect patient data	Valid	strongly agree	1	4.3
		agree	14	60.9
		disagree	5	21.7
		strongly disagree	1	4.3
		Total	21	91.3
	Did not answer		2	8.7
	Total		23	100.0

Questionnaire results for the hospital staff in rural and urban hospitals

Question	*Scale*		*Frequency*	*Percentage*
I have previous computer experience	Valid	strongly agree	7	20.6
		agree	20	58.8
		disagree	7	20.6
		Total	34	100.0

Question	*Scale*		*Frequency*	*Percentage*
I use general computer applications at work	Valid	strongly agree	12	35.3
		agree	17	50.0
		disagree	5	14.7
		Total	34	100.0
I know how to use the internet in obtaining health information	Valid	strongly agree	9	26.5
		agree	15	44.1
		disagree	10	29.4
		Total	34	100.0
I know what telemedicine means	Valid	strongly agree	4	11.8
		agree	24	70.6
		disagree	3	8.8
		Total	31	91.2
	Did not answer		3	8.8
	Total		34	100.0
Using telemedicine in patient care is a good idea	Valid	strongly agree	11	32.4
		agree	18	52.9
		disagree	3	8.8
		strongly disagree	1	2.9
		Total	33	97.1
	Did not answer		1	2.9
	Total		34	100.0
Using telemedicine technology can improve patient care	Valid	strongly agree	7	20.6
		agree	23	67.6
		disagree	3	8.8
		strongly disagree	1	2.9
		Total	34	100.0

Question	*Scale*		*Frequency*	*Percentage*
I have had formal training in computers in how to use telemedicine system	Valid	strongly agree	2	5.9
		agree	6	17.6
		disagree	19	55.9
		strongly disagree	7	20.6
		Total	34	100.0
I don't have the knowledge to make use of telemedicine technology	Valid	strongly agree	2	5.9
		agree	13	38.2
		disagree	14	41.2
		strongly disagree	4	11.8
		Total	33	97.1
	Did not answer		1	2.9
	Total		34	100.0
Telemedicine can improve the healthcare in the rural areas	Valid	strongly agree	7	20.6
		agree	21	61.8
		disagree	3	8.8
		strongly disagree	2	5.9
		Total	33	97.1
	Did not answer		1	2.9
	Total		34	100.0

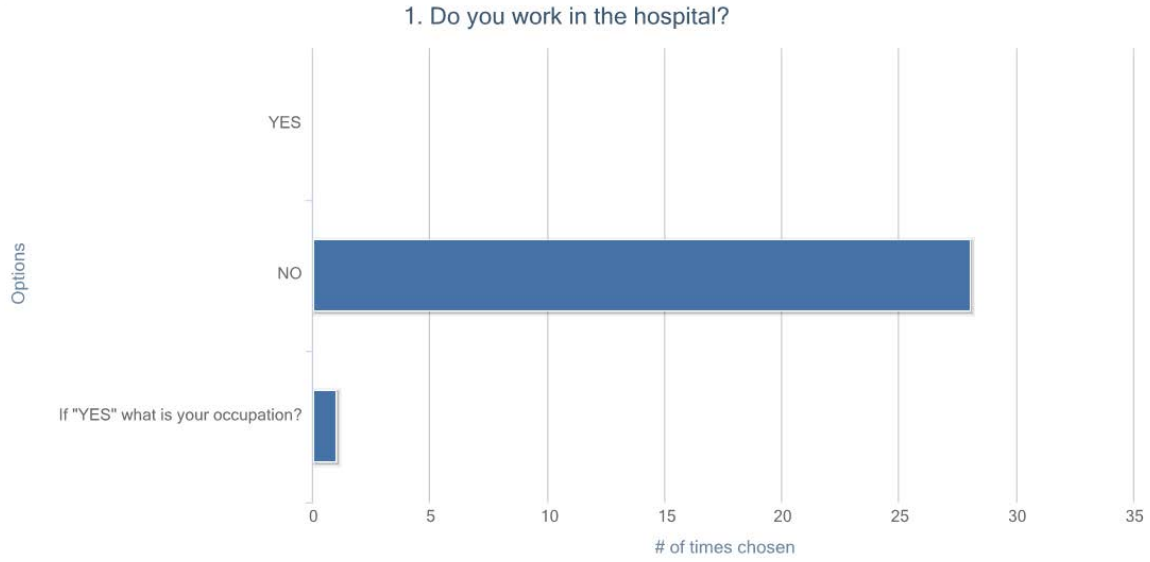
Questionnaire results of the general public in rural and urban areas

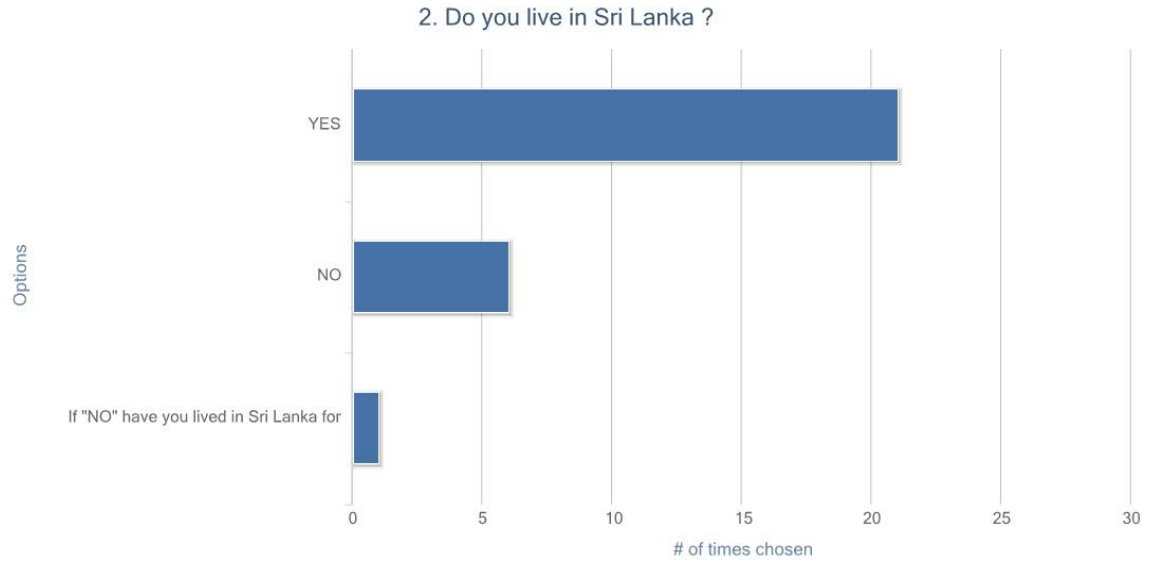
Question	*Scale*		*Frequency*	*Percent*
Using the internet to find information on healthcare is a good idea	Valid	strongly agree	11	42.3
		agree	13	50.0
		disagree	2	7.7
		Total	26	100.0

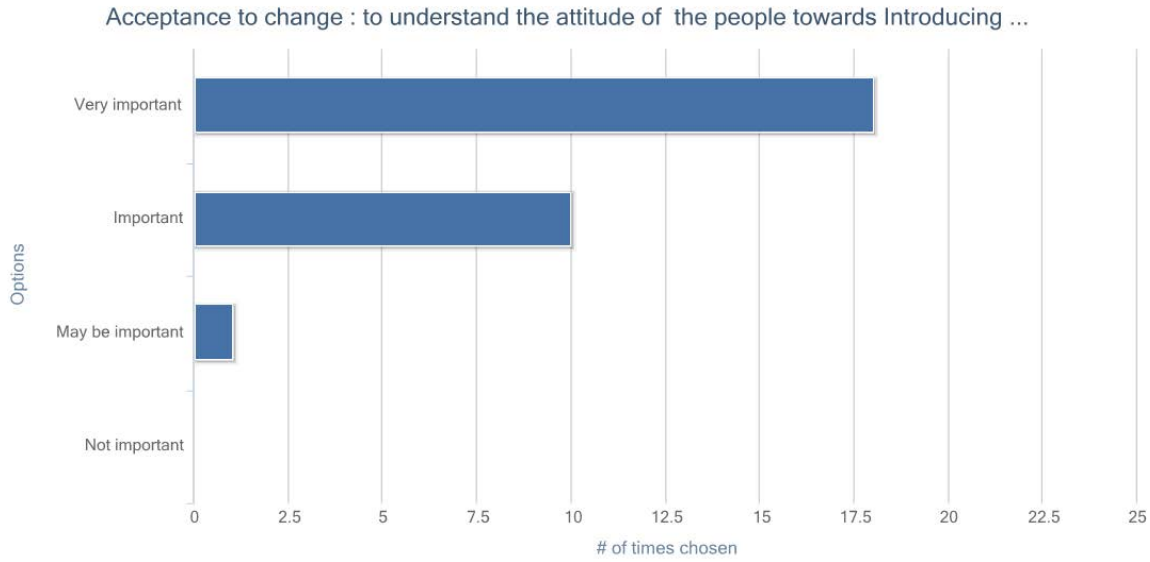
Question	*Scale*		*Frequency*	*Percent*
I know the meaning of telemedicine	Valid	strongly agree	1	3.8
		agree	25	96.2
		Total	26	100.0
Telemedicine will reduce my cost of travelling to the city for consultation	Valid	strongly agree	9	34.6
		agree	16	61.5
		disagree	1	3.8
		Total	26	100.0
Telemedicine will reduce my traveling time to the city for consultation	Valid	strongly agree	11	42.3
		agree	13	50.0
		disagree	1	3.8
		Total	25	96.2
	Did not answer		1	3.8
	Total		26	100.0
I can obtain the best health services using telemedicine	Valid	strongly agree	2	7.7
		agree	11	42.3
		disagree	10	38.5
		strongly disagree	2	7.7
		Total	25	96.2
	Did not answer		1	3.8
	Total		26	100.0
I am comfortable with clinicians using telemedicine technology	Valid	strongly agree	2	7.7
		agree	11	42.3
		disagree	12	46.2
		Total	25	96.2
	Did not answer		1	3.8
	Total		26	100.0

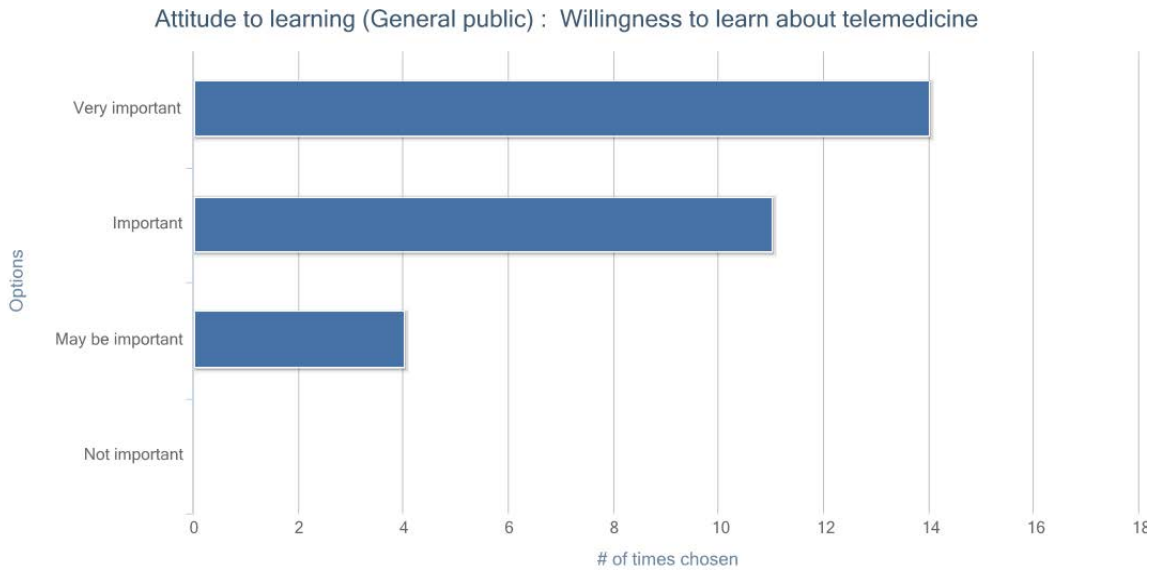
Question	*Scale*		*Frequency*	*Percent*
I feel confident in using information from telemedicine to make health decisions	Valid	agree	11	42.3
		disagree	13	50.0
		strongly disagree	1	3.8
		Total	25	96.2
	Did not answer		1	3.8
	Total		26	100.0
I can get medical information faster using telemedicine	Valid	strongly agree	9	34.6
		agree	15	57.7
		disagree	2	7.7
		Total	26	100.0

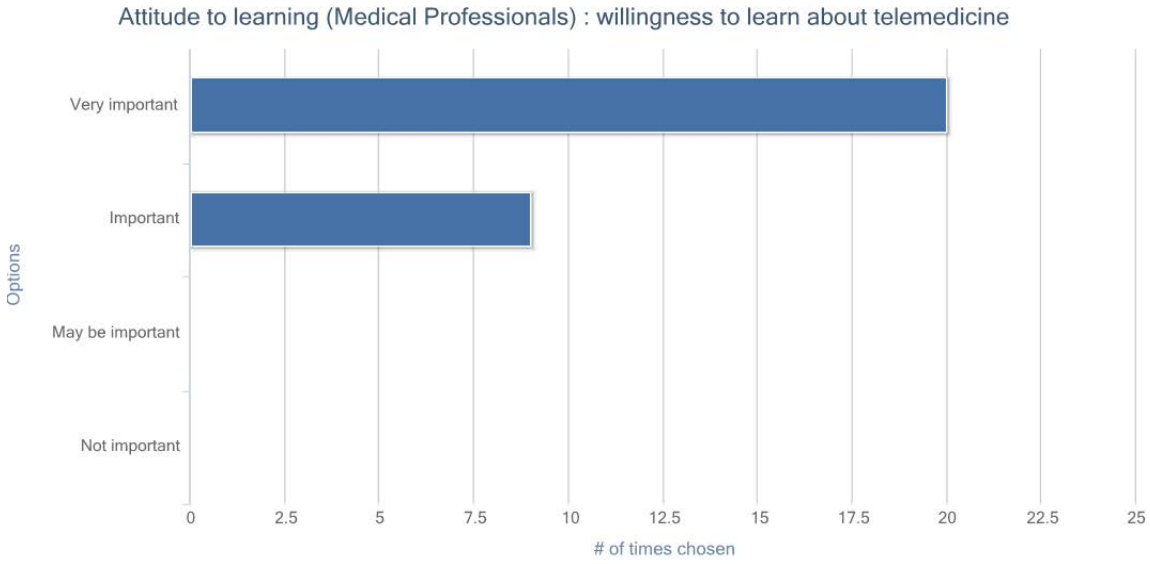
Appendix E. Online survey results

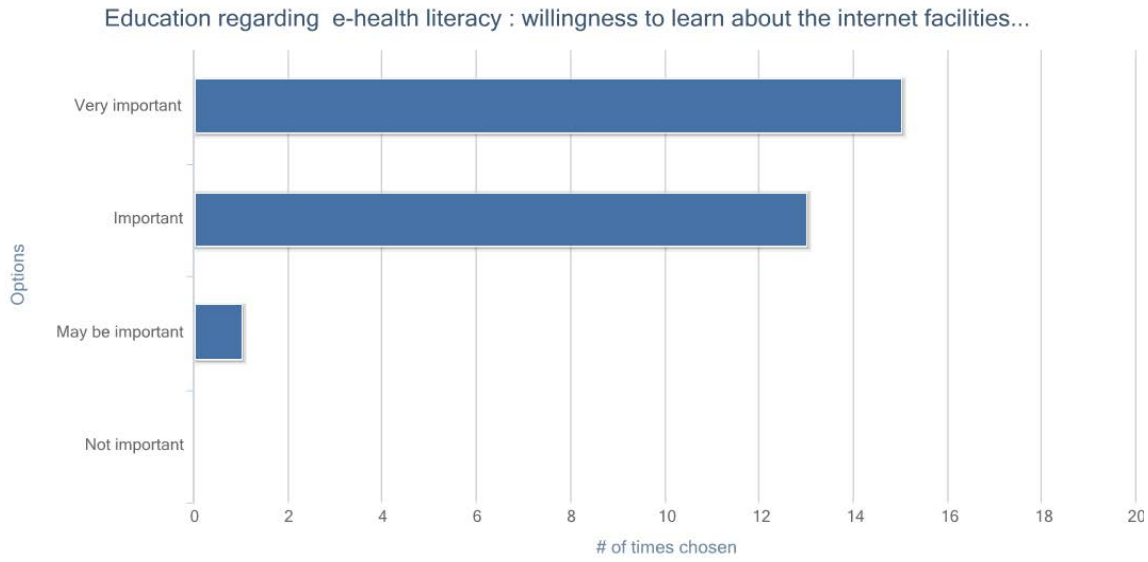


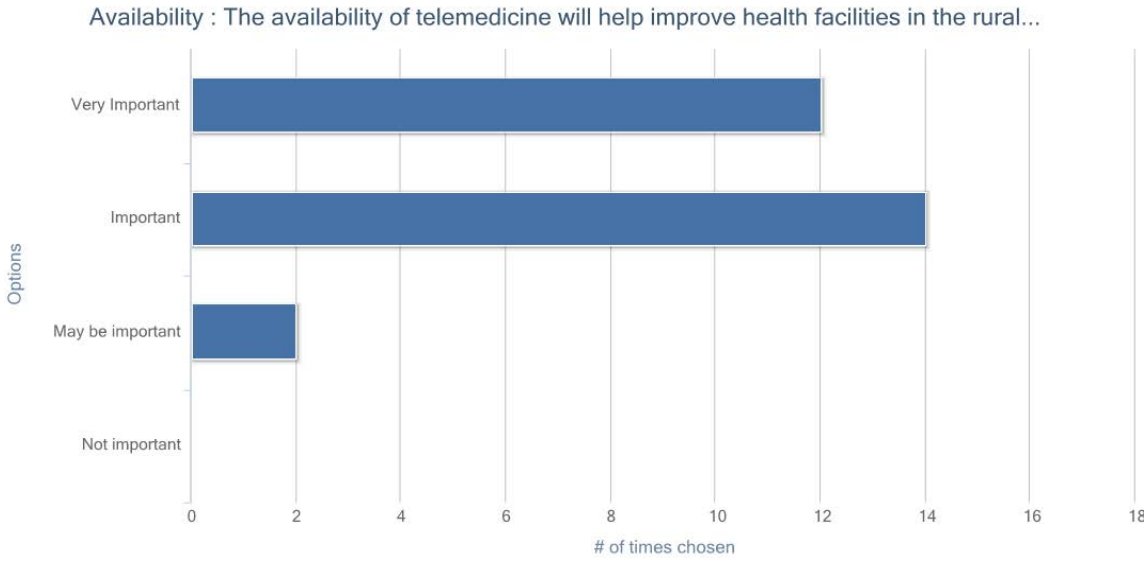


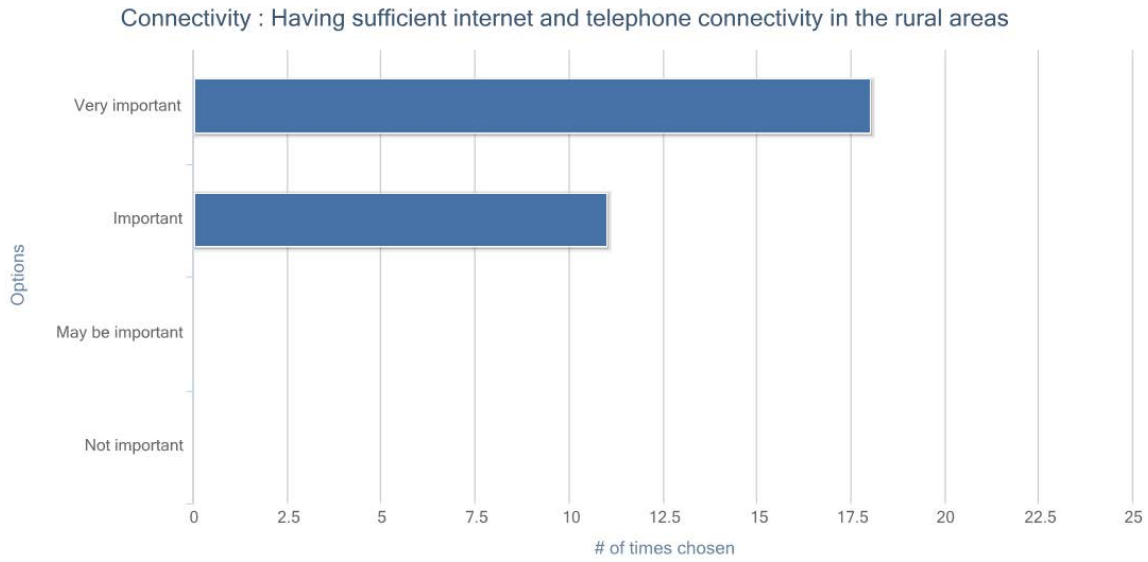

Acceptance to change : to understand the attitude of the people towards Introducing ...
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
# of times chosen

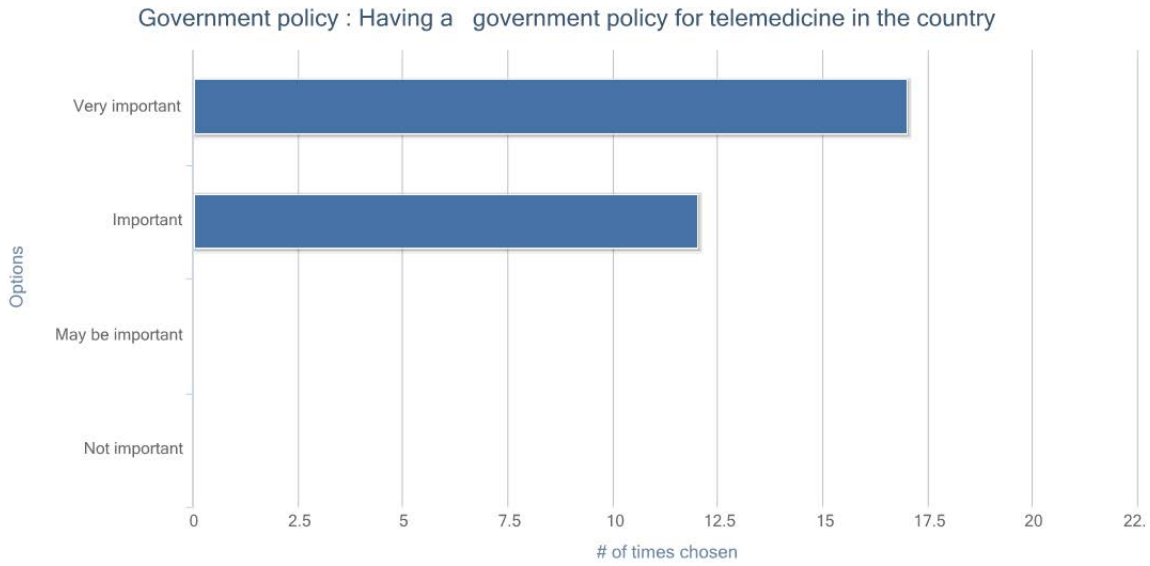

Attitude to learning (General public) : Willingness to learn about telemedicine
Very important
Important
May be important
Not important
Options
0
2
4
6
8
10
12
14
16
# of times chosen

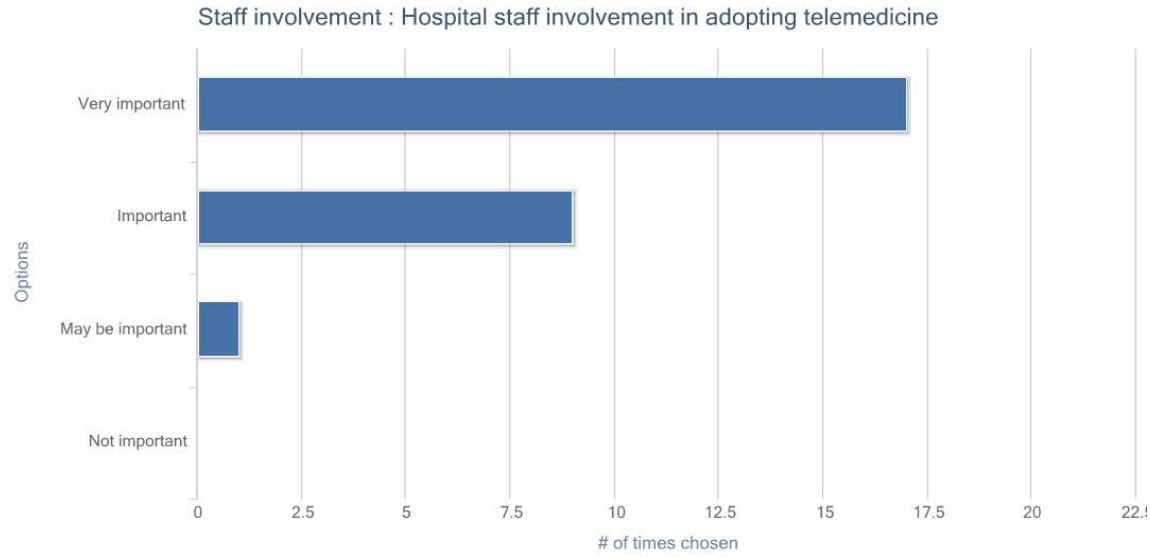

Attitude to learning (Medical Professionals) : willingness to learn about telemedicine
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
# of times chosen

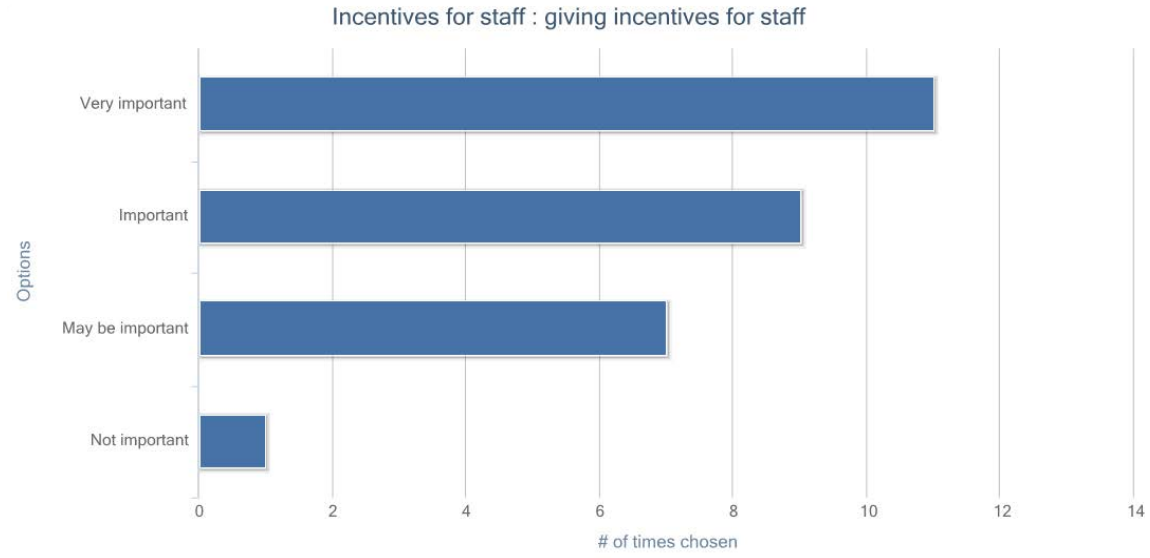

Education regarding e-health literacy : willingness to learn about the internet facilities...
Very important
Important
May be important
Not important
Options
0
2
4
6
8
10
12
14
16
18
20
# of times chosen

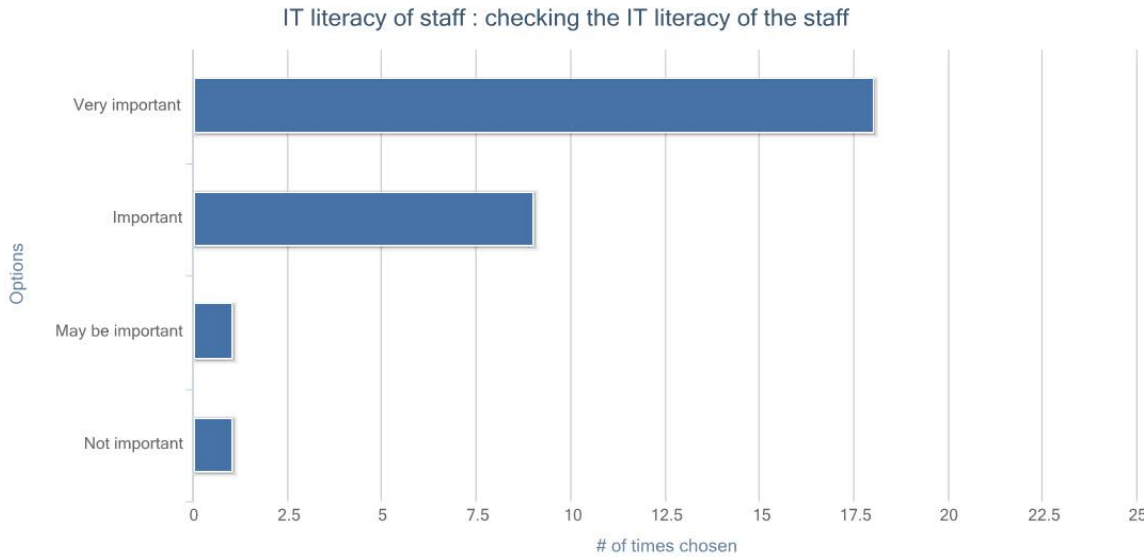

Availability : The availability of telemedicine will help improve health facilities in the rural...
Very Important
Important
May be important
Not important
Options
0
2
4
6
8
10
12
14
16
18
# of times chosen

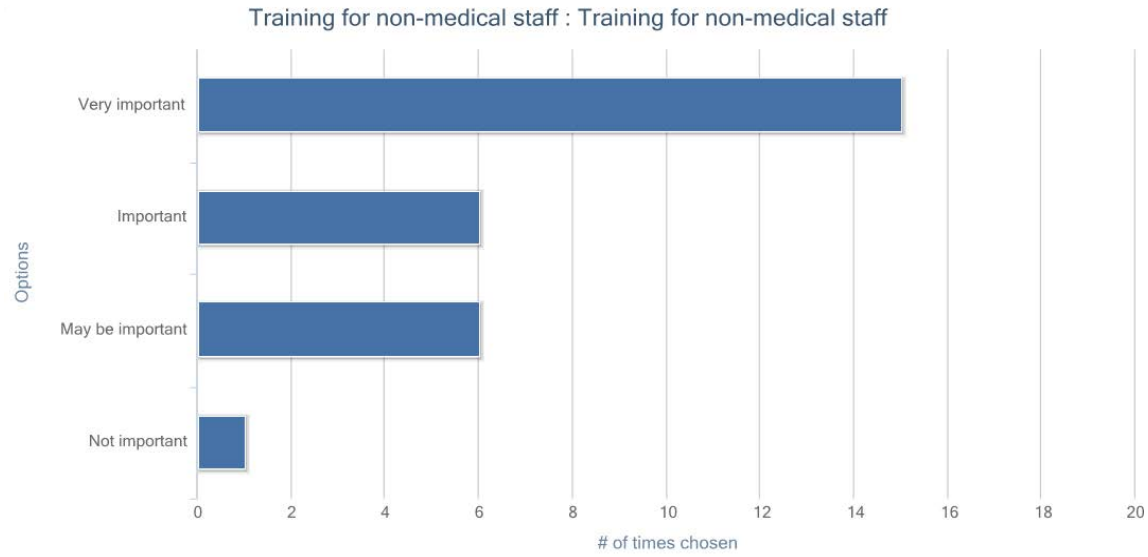

Connectivity : Having sufficient internet and telephone connectivity in the rural areas
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
# of times chosen

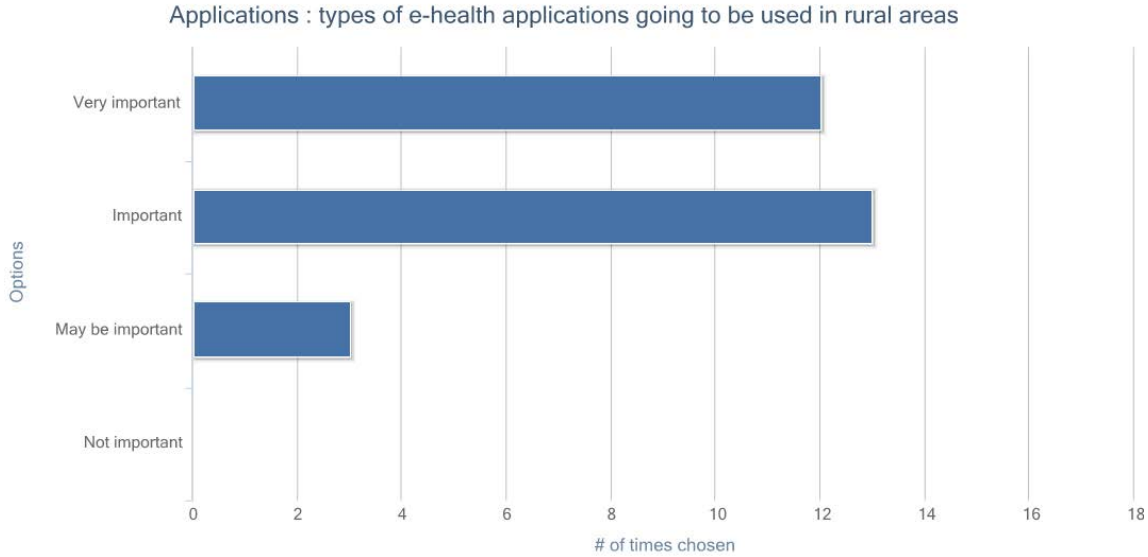

Government policy : Having a government policy for telemedicine in the country
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.
# of times chosen

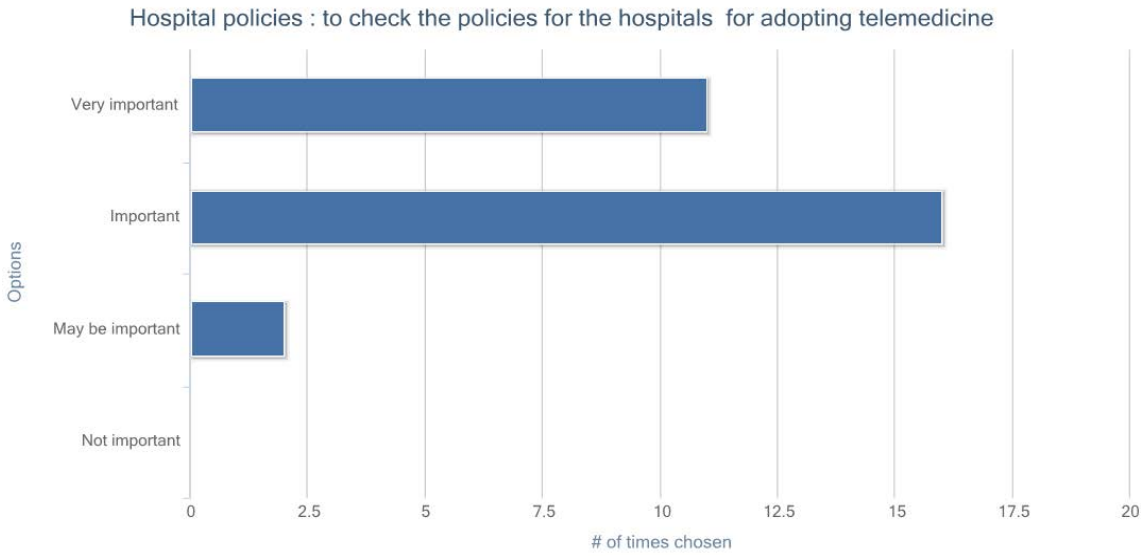

Staff involvement : Hospital staff involvement in adopting telemedicine
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
# of times chosen

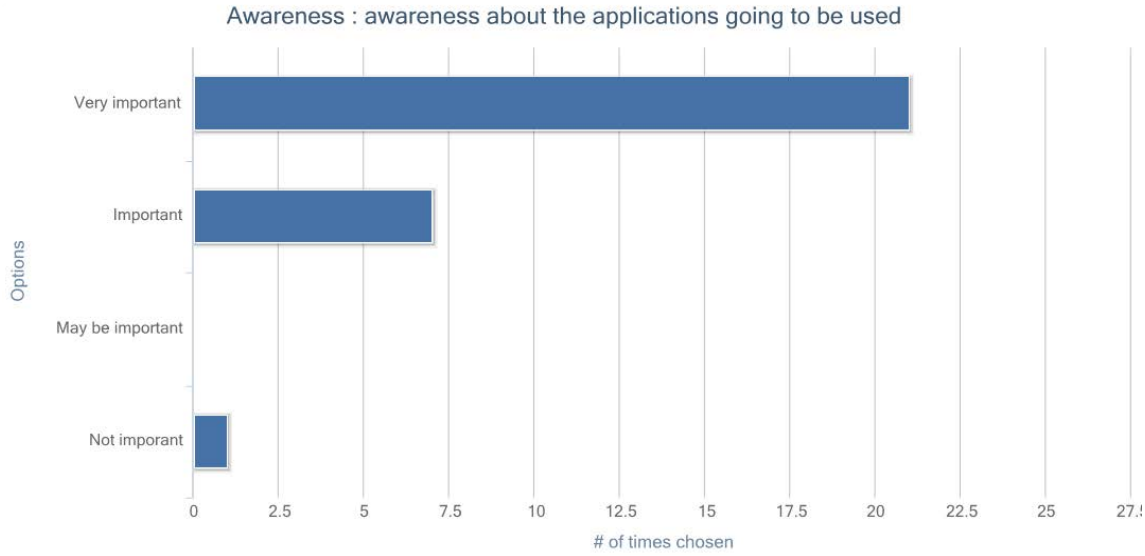

Incentives for staff : giving incentives for staff
Very important
Important
May be important
Not important
Options
0
2
4
6
8
10
12
14
# of times chosen

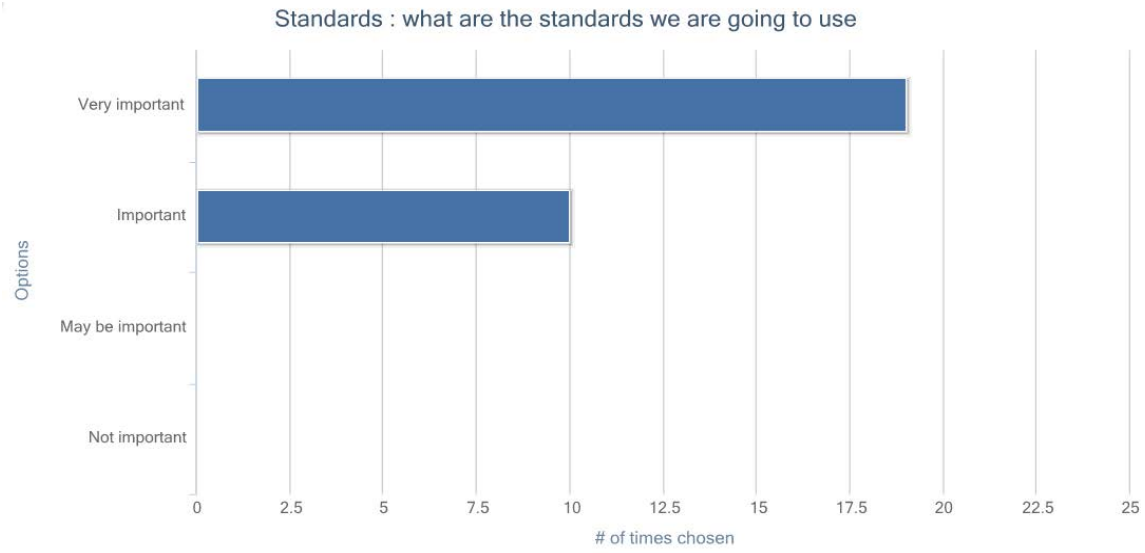

IT literacy of staff : checking the IT literacy of the staff
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
# of times chosen

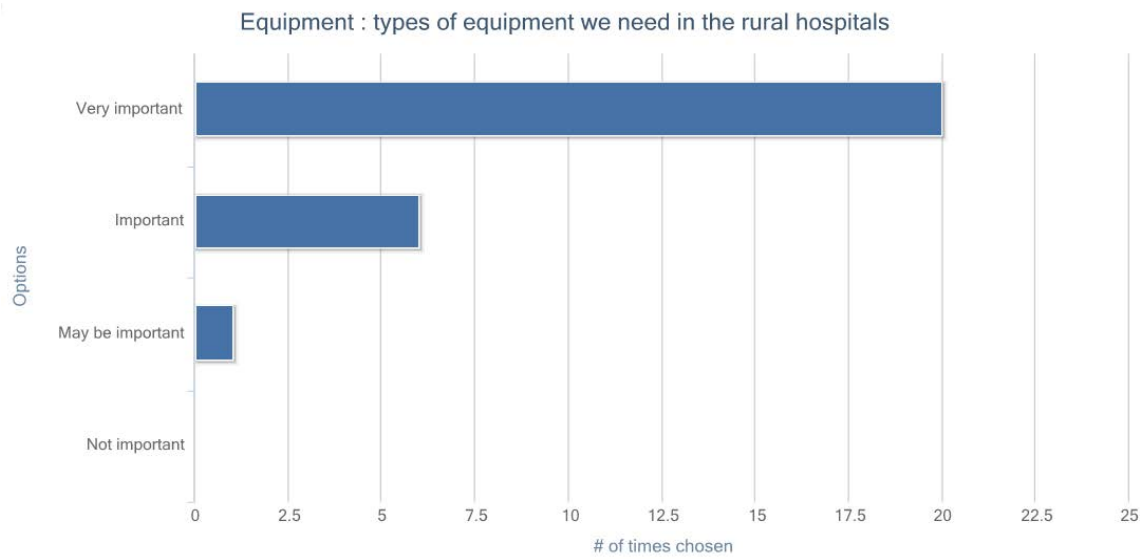

Training for non-medical staff : Training for non-medical staff
Very important
Important
May be important
Not important
Options
0
2
4
6
8
10
12
14
16
18
20
# of times chosen


Applications : types of e-health applications going to be used in rural areas
Very important
Important
May be important
Not important
Options
0
2
4
6
8
10
12
14
16
18
# of times chosen


Hospital policies : to check the policies for the hospitals for adopting telemedicine
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
# of times chosen


Awareness : awareness about the applications going to be used
Very important
Important
May be important
Not imporant
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
# of times chosen


Standards : what are the standards we are going to use
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
# of times chosen


Equipment : types of equipment we need in the rural hospitals
Very important
Important
May be important
Not important
Options
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
# of times chosen

Appendix F. Questions distributed to the clinicians during the main survey

Questions for the clinicians – major survey

Introduction

The objective of this research is to inform the development of a model and a set of guidelines for the adoption of a telemedicine system in the rural areas of Sri Lanka. The result of this survey will be used to identify the gaps in current guidelines. This research is under the direction of Electronics and Computer Science, University of Southampton. United Kingdom.

You are invited to participate in this research as you are a Sri Lankan who believes in improving the healthcare facility in the rural areas. I would greatly appreciate your participation in this research by answering the questions given below. The information given below will be used in this research only and the responses will be treated as anonymously and confidential.

Thank you very much for your co-operation in answering the questions to make a better and efficient healthcare system in Sri Lanka

Researcher : Yasmin Dayani Jayasinghe

Instructions: please answer the following questions by placing "X" in the appropriate box.

Finally please feel free to add any comments if you have regarding the implementation of the system in the comment section at the end of the form.

1. What is your age?

   ☐ 20 – 30 years ☐ 31-40 years ☐ 41-50 years ☐ 51 – 60 years
   ☐ over 60 years

2. How often do you use a computer at home?

   ☐Everyday ☐weakly ☐occasionally ☐sometimes ☐never

3. How often do you use computers at work?

   ☐ Everyday ☐weekly ☐occasionally ☐ sometimes ☐never

4. How would you rate your own computer skills

   ☐ No experience ☐ poor ☐ fair ☐ good ☐ excellent

5. How do you access the internet?

   ☐ From your home computer
   ☐ From your own office
   ☐ From an internet café
   ☐ From other places (please specify) _____
   ☐ I don't at all

Yasmin Dayani Jayasinghe – STUDENT ID – 25115529

6. If you access the internet from your home, what kind of internet connection do you have?

☐ISDN
☐DSL
☐Mobile phone
☐LAN
☐Other (please specify)

7. How many years have you been using the internet? _____(years)

Knowledge, Skills and Performance						
no	questions	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
1	I intend to use telemedicine for client care as often as is needed					
2	Using telemedicine will increase my productivity					
3	I will spend less time on routine job tasks when using telemedicine					
4	Using computers will enhance my effectiveness in client care and management					
5	Using telemedicine will increase my chances of obtaining a promotion					
6	Using telemedicine will increase my chances of getting a raise					
7	Using telemedicine decreases the time needed for my job responsibilities					
8	I expect to find telemedicine easy to use					
9	Telemedicine will improve my practice					
10	Using telemedicine enhances my effectiveness in my job					

Yasmin Dayani Jayasinghe – STUDENT ID – 25115529

Safety and Quality						
No	Questions	Strongly disagree	disagree	Not sure	agree	Strongly agree
11	Using telemedicine will improve the quality of care in my speciality					
12	Using telemedicine helps reduce the risk of error in my specialised area					
13	Telemedicine will help me to use the most up to date technology in my practice					
14	Telemedicine will help me to use most up to date equipment in my practice					
15	In my job using telemedicine is important					
16	In my job using telemedicine is relevant					
17	I believe health institutes have policies in using telemedicine					
18	I believe health institutes have client privacy policy for data					
19	I believe health institutes have software standards					
20	I believe government has data protection act for health information					
21	I believe government has introduced policies for using the internet for health information					
Communication, partnership and Teamwork						
No	Questions	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
22	Using telemedicine in client care is a good idea					
23	I like to be an early adopter of new technology in my practice					
24	In my specialised area, it is expected that I use computers as part of my daily work					

Yasmin Dayani Jayasinghe – STUDENT ID – 25115529

No	Questions	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
25	Telemedicine will broaden the scope of the services offered by my practice					
26	Telemedicine will improve my care delivery process					
27	Telemedicine is useful when sharing information with other colleagues					
28	Telemedicine is useful when sending and receiving information to other practitioners					
29	Telemedicine will improve my ability to collaborate with other consultants					
Maintaining Trust						
No	Questions	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
30	Using telemedicine will increase my patients' engagement in managing their health					
31	I am confident that telemedicine will improve my relationship with my clients					

Comments:

Please continue overleaf

Yasmin Dayani Jayasinghe – STUDENT ID – 25115529

Sinhalese Translation

වෛද්‍යවරුන් සඳහා ප්‍රශ්න - ප්‍රධාන පරීක්ෂණය

හඳුන්වාදීම

මෙම පර්යේෂණයේ අරමුණ වන්නේ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශයන්හි ටෙලිමෙඩිසින් ක්‍රමය යොදා ගැනීම සඳහා මොඩලයක් (ආකෘතියක්) හා අනුගමනය කළ යුතු මඟපෙන්වීම් සමූහයක් වර්ධනය කළ යුතු ආකාරය දැන්වීමටය. මෙම පරීක්ෂණයේ ප්‍රතිඵල දැනට පවතින මඟපෙන්වීම් වල හිඩැස් හඳුනා ගැනීම සඳහා ද යොදා ගැනේ. මෙම පර්යේෂණය එක්සත් රාජධානියේ සවුත් හැම්ප්ටන් විශ්ව විද්‍යාලයේ විද්‍යුත් හා පරිගණක විද්‍යා අංශයේ මඟ පෙන්වීම යටතේ සිදු කෙරේ.

මෙම පර්යේෂණය සඳහා සහභාගි වීමට ඔබට ආරාධනා කරන්නේ ඔබ පිටිසර ප්‍රදේශයන්හි සෞඛ්‍ය සේවා පහසුකම් වැඩි දියුණු කළ යුතු බව විශ්වාස කරන ශ්‍රී ලාංකිකයෙකු බැවිනි. පහත සඳහන් ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් මෙම පර්යේෂණයට ඔබගේ සහභාගිත්වය බොහෝ සෙයින් මම අගේ කොට සලකමි. පහත සඳහන් තොරතුරු මෙම පර්යේෂණයට පමණක් යොදා ගන්නා අතර, සපයා දී ඇති පිළිතුරු නිර්නාමික හා රහසිගත ලෙස සැලකේ.

ශ්‍රී ලංකාවේ සෞඛ්‍ය සේවාව වඩා යහපත් හා කාර්යක්ෂම කිරීමට ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් ලබා දුන් සහයෝගය ගැන මම ඔබට ස්තුතිවන්ත වෙමි.

පර්යේෂක : යස්මින් දයානි ජයසිංහ

උපදෙස්:- කරුණාකර ගැලපෙන කොටුවේ 'X' සලකුණ පමණක් යොදා පිළිතුරු සටහන් කරන්න. කරුණාකර මෙම පෝරමයේ අග ඇති ''අදහස් ප්‍රකාශන කොටුවේ'' මෙම ක්‍රමය ක්‍රියාත්මක කිරීම ගැන ඔබගේ අදහස් නිදහසේ සඳහන් කිරීමට ඔබට අවකාශ ඇත.

යස්මින් දයානි ජයසිංහ

වෛද්‍යවරුන් සඳහා ප්‍රශ්න - ප්‍රධාන පරීක්ෂණය

01. ඔබගේ වයස කීයද ?
20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 60 ට වැඩි ☐

02. ගෙදර දී කොපමණ වාරයක් ඔබ පරිගණයක භාවිතා කරනවාද?
දිනපතා ☐ සතිපතා ☐ ඉඳහිට ☐ සමහරවිට ☐ කොහෙත්ම නැත ☐

03. වැඩ කිරීමේදී කොපමණ වාරයක් ඔබ පරිගණක භාවිතා කරනවාද?
දිනපතා ☐ සතිපතා ☐ ඉඳහිට ☐ සමහරවිට ☐ කොහෙත්ම නැත ☐

04. ඔබගේ පරිගණක කුසලතාව ඔබගේ තක්සේරු මට්ටම අනුව කුමක්ද?
අත් දැකීමෙක් නැත ☐ සුළුයි ☐ තරමක් හොඳයි ☐ හොඳයි ☐ විශිෂ්ටයි ☐

05. අන්තර්ජාලයට ඔබ ප්‍රවේශ වන්නේ කෙසේද?
ඔබගේ ගෙදර පරිගණකයෙන් ☐
ඔබගේ කාර්යාලයෙන් ☐
අන්තර්ජාල මධ්‍යස්ථානයකින් ☐
වෙනත් ස්ථාන වලින් (කරුණාකර නම ලියන්න) .....
කෙහෙත්ම නැත ☐

06. ඔබගේ අන්තර්ජාල ප්‍රවේශය ගෙදරදී නම්, ඔබට ඇත්තේ කුමන වර්ගයේ අන්තර්ජාල සම්බන්ධයක්ද?
ISDN ☐
DSL ☐
Mobile Phone (ජංගම දුරකථනයක්) ☐
LAN ☐
වෙනත් (කරුණාකර නම සඳහන් කරන්න)

07. ඔබ කොපමණ වසර ගණනක් අන්තර්ජාලය භාවිත කරමින් සිටීද? ..... (අවුරුදු)

යස්මින් දයානි ජයසිංහ - සිසු හැඳුනුම්පත 25115529

වෛද්‍යවරුන් සඳහා ප්‍රශ්න - ප්‍රධාන පරීක්ෂණය

	දැනුම, කුසලතා, ක්‍රියාවට නැංවීම					
අංකය	ප්‍රශ්න	දැඩිව විරුද්ධයි	විරුද්ධයි	ස්ථිර නැත	එකඟයි	දැඩිව එකඟයි
01	රෝගීන්ගේ ප්‍රතිකාර සඳහා අවශ්‍ය වාර ගණනක් ටෙලි මෙඩිසින් භාවිතා කිරීමට මම අදහස් කරමි.					
02	ටෙලි මෙඩිසින් භාවිතයෙන් මගේ ඵලදායිතාව වැඩිවේ					
03	ටෙලි මෙඩිසින් භාවිතා කරන විට දිනපතා වැඩවලට ගතවන කාලය අඩුවේ					
04	පරිගනක භාවිතයෙන් රෝගීන්ගේ ප්‍රතිකාර සහ මගේ කලමනාකරණයේ කාර්යක්ෂමතාවය වැඩිවේ					
05	ටෙලි මෙඩිසින් භාවිතය නිසා උසස් වීමක් ලබා ගැනීමට මට ඇති ඉඩකඩ වැඩි වේ.					
06	ටෙලි මෙඩිසින් භාවිතය නිසා වැටුප් වැඩිවීමක් ලබා ගැනීමට මට ඇති ඉඩකඩ වැඩි වේ					
07	ටෙලි මෙඩිසින් භාවිතය නිසා මට ඇති වෘත්තියමය වගකීම්වලට අවශ්‍ය කාලය අඩු වේ.					
08	ටෙලි මෙඩිසින් භාවිතය පහසු බව සොයා ගැනීමට මම අපේක්ෂා කරමි.					
09	ටෙලි මෙඩිසින් භාවිතයෙන් මගේ වෘත්තීමය කටයුතු දියුණු වේ.					
10	ටෙලි මෙසිඩිසින් භාවිතයෙන් මගේ වෘත්තීය තුල මගේ කාර්යක්ෂම භාවය ඉහලයයි					
	සුරක්ෂිත බව හා ගුණාත්මක බව.					
11	ටෙලි මෙඩිසින් භාවිතයෙන් මගේ විශේෂිත දැනුමේ ප්‍රතිකාර ගුණාත්මක භාවය දියුණු වේ.					
12	ටෙලි මෙඩිසින් භාවිතය මගේ විශේෂිත දැනුම් අංශයේ පවතින වැරදි සිදුවීම්වල අවදානම අඩු කර ගැනීමට උපකාරී වේ.					
13	ටෙලි මෙඩිසින් මඟින් මගේ වෘත්තියේ මේ දක්වා සොයාගෙන ඇති. ඉහලම තාක්ෂණය භාවිතා කිරීමට මට උපකාරී වේ.					
14	ටෙලි මෙඩිසින් මඟින් මගේ වෘත්තියේ මේ දක්වා භාවිතා කරන ඉහලම උපකරණ භාවිත කිරීමට මට උපකාරී වේ.					
15	මගේ වෘත්තියේ දී ටෙලි මෙඩිසින් භාවිතාව වැදගත් වේ.					
16	මගේ වෘත්තියට ටෙලි මෙඩිසින් භාවිතා කිරීම අදාල වේ.					
17	සෞඛ්‍ය ආයතනවල ටෙලි මෙඩිසින් භාවිතා කිරීම ගැන ප්‍රතිපත්ති ඇති බව මම විශ්වාස කරමි.					
18	සෞඛ්‍ය ආයතනවල රෝගීන්ගේ දත්ත පිළිබඳ රහස්‍ය ප්‍රතිපත්තියක් රඳවාගෙන ඇතැයි මම විශ්වාස කරමි.					
19	සෞඛ්‍ය ආයතන වල මෘදුකාංග ප්‍රමිති ඇතැයි මම විශ්වාස කරමි.					
20	සෞඛ්‍ය තොරතුරු සඳහා දත්ත ආරක්ෂිත පනතක් රජයට ඇතැයි මම විශ්වාස කරමි.					
21	සෞඛ්‍ය තොරතුරු සඳහා අන්තර්ජාල භාවිතය සම්බන්ධයෙන් රජය හඳුන්වා දුන් ප්‍රතිපත්ති මාලාවක් ඇතැයි මම විශ්වාස කරමි.					
	සන්නිවේදනය, සහකාරත්වය, එක්ව කටයුතු කිරීම					
22	රෝගීන්ගේ ප්‍රතිකාර වෙනුවෙන් ටෙලිමෙඩිසින් භාවිතය යහපත් අදහසකි.					
23	මගේ වෘත්තියේදී කලින්ම නවීන තාක්ෂණය භාවිතා කරන්නකු වීමට මම කැමතිය.					
24	මගේ විශේෂිත අංශයේදී දිනපතා ක්‍රියාවන් වල කොටසක් වශයෙන් පරිගණක යොදා ගැනීමට මම අපේක්ෂා කරමි.					
25	ටෙලි මෙඩිසින් භාවිතය නිසා මගේ වෘත්තීමය සේවා ප්‍රමාණය පුළුල් කරයි.					
26	ටෙලිමෙඩිසින් භාවිතය නිසා මගේ ප්‍රතිකාර ලබා දීමේ ක්‍රියා මාර්ගය දියුණු කරයි.					

යස්මින් දයානි ජයසිංහ - සිසු හැඳුනුම්පත 25115529

27	අනිකුත් සම වෘත්තිකයන් සමඟ තොරතුරු හුවමාරු කර ගැනීමේ දී ටෙලි මෙඩිසින් භාවිතය ප්‍රයෝජනවත් වේ.					
28	අනිකුත් සම වෘත්තිකයන්ට තොරතුරු යැවීමේ දී හා ලබා ගැනීමේදී ටෙලි මෙඩිසින් භාවිතය ප්‍රයෝජනවත් වේ.					
29	ටෙලි මෙඩිසින් භාවිතය නිසා අනිකුත් උපදෙස් ලබා දෙන්නන් සමඟ සහයෝගයෙන් ක්‍රියා කිරීම අතර මගේ ශක්තිය දියුණු වේ.					
	විශ්වාසය රඳවා ගැනීම					
30	ටෙලිමෙඩිසින් භාවිතය නිසා මගේ රෝගීන් මඟින් ඔවුන්ගේ නිරෝගීතාවය පාලනයට අවශ්‍ය තත්වය දියුණු කරයි.					
31	මගේ රෝගීන් සමඟ මගේ ඇති සම්බන්ධතාවය ටෙලි මෙඩිසින් භාවිතය නිසා දියුණුවන බව මට විශ්වාසයි.					

පෞද්ගලික අදහස් ප්‍රකාශන කොටුව

කරුණාකර අනෙක් පිටුව යොදා ගන්න

යස්මින් දයානි ජයසිංහ - සිසු හැඳුණුම්පත 25115529

Appendix G. Questions distributed to the hospital staff during the main survey

Questions for the hospital staff – major survey

Introduction

The objective of this research is to inform the development of a model and a set of guidelines for the adoption of a telemedicine system in the rural areas of Sri Lanka. The result of this survey will be used to identify the gaps in current guidelines. This research is under the direction of Electronics and Computer Science, University of Southampton. United Kingdom.

You are invited to participate in this research as you are a Sri Lankan who believes in improving the healthcare facility in the rural areas. I would greatly appreciate your participation in this research by answering the questions given below. The information given below will be used in this research only and the responses will be treated as anonymously and confidential.

Thank you very much for your co-operation in answering the questions to make a better and efficient healthcare system in Sri Lanka

Researcher : Yasmin Dayani Jayasinghe

Instructions: please answer the following questions by placing "X" in the appropriate box.
Finally please feel free to add any comments if you have regarding the implementation of the system in the comment section at the end of the form.

1. What is your age?

   ☐ 20 – 30 years ☐ 31-40 years ☐ 41-50 years ☐ 51 – 60 years
   ☐ over 60 years

2. How often do you use a computer at home?

   ☐ Everyday ☐ weakly ☐ occasionally ☐ sometimes ☐ never

3. How often do you use computers at work?

   ☐ Everyday ☐weekly ☐ occasionally ☐ sometimes ☐never

4. How would you rate your own computer skills

   ☐ No experience ☐ poor ☐ fair ☐ good ☐ excellent

5. How do you access the internet?

   ☐ From your home computer
   ☐ From your own office
   ☐ From an internet café
   ☐ From other places (please specify) _____
   ☐ I don't at all

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6. If you access the internet from your home, what kind of internet connection do you have?

   ☐ ISDN
   ☐ DSL
   ☐ Mobile phone
   ☐ LAN
   ☐ Other (please specify)

7. How many years have you been using the internet? _____(years)

No	Questions	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
1	Senior colleagues who influence my job think that I should use telemedicine					
2	Senior management think I should use telemedicine					
3	People who are important to my job consider that I should use telemedicine					
4	Assuming I have access to the system, I intend to use it					
5	I will spend less time on routine tasks when using telemedicine					
6	We have fast broadband connection in the hospital					
7	Quality of the output of telemedicine is high					
8	Learning to operate the internet for my job is easy					
9	I find it easy to get health information from the internet to enable to do what I wish					
10	It is easy to understand how to perform tasks using the internet					
11	I find the Internet easy to use					
12	In my job using telemedicine is important					
13	In my job using telemedicine is relevant					
14	Telemedicine enables me to have time for other responsibilities					
15	Telemedicine is useful when sharing information with other colleagues					
16	I find telemedicine easy to use					
17	Using telemedicine enhances my effectiveness in my job					

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No	Questions	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
18	I will have access to the training to make use of telemedicine					
19	Telemedicine will help me to improve my continuing education					
20	Telemedicine will require me to have new training courses					
21	I believe health institutes have policies in using computers					
22	I believe health institutes have client privacy policy for data					
23	I believe health institutes have software standards					
24	I believe government has data protection act for health information					
25	I believe government has introduced policies for using the internet for health information					

Comments:

Please continue overleaf

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Sinhalese translation

රෝහල් කාර්ය මණ්ඩලය සඳහා ප්‍රශ්න - ප්‍රධාන පරීක්ෂණය

හඳුන්වාදීම

මෙම පර්යේෂණයේ අරමුණ වන්නේ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශයන්හි ටෙලිමෙඩිසින් ක්‍රමය යොදා ගැනීම සඳහා මොඩලයක් (ආකෘතියක්) හා අනුගමනය කළ යුතු මඟපෙන්වීම් සමූහයක් වර්ධනය කළ යුතු ආකාරය දැන්වීමටය. මෙම පරීක්ෂණයේ ප්‍රතිඵල දැනට පවතින මඟපෙන්වීම් වල හිඩැස් හඳුනා ගැනීම සඳහා ද යොදා ගැනේ. මෙම පර්යේෂණය එක්සත් රාජධානියේ සවුත් හැම්ප්ටන් විශ්ව විද්‍යාලයේ විදයුත් හා පරිගණක විද්‍යා අංශයේ මඟ පෙන්වීම යටතේ සිදු කෙරේ.

මෙම පර්යේෂණය සඳහා සහභාගි වීමට ඔබට ආරාධනා කරන්නේ ඔබ පිටිසර ප්‍රදේශයන්හි සෞඛ්‍ය සේවා පහසුකම් වැඩි දියුණු කළ යුතු බව විශ්වාස කරන ශ්‍රී ලාංකිකයෙකු බැවිනි. පහත සඳහන් ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් මෙම පර්යේෂණයට ඔබගේ සහභාගිත්වය බොහෝ සෙයින් මම අගේ කොට සලකමි. පහත සඳහන් තොරතුරු මෙම පර්යේෂණයට පමණක් යොදා ගන්නා අතර, සපයා දී ඇති පිළිතුරු නිර්නාමික හා රහසිගත ලෙස සැලකේ.

ශ්‍රී ලංකාවේ සෞඛ්‍ය සේවාව වඩා යහපත් හා කාර්යක්ෂම කිරීමට ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් ලබා දුන් සහයෝගය ගැන මම ඔබට ස්තුතිවන්ත වෙමි.

පර්යේෂක : යස්මින් දයානි ජයසිංහ

උපදෙස්:- කරුණාකර ගැලපෙන කොටුවේ 'X' සලකුණ පමණක් යොදා පිළිතුරු සටහන් කරන්න. කරුණාකර මෙම පෝරමයේ අග ඇති ''අදහස් ප්‍රකාශන කොටුවේ'' මෙම ක්‍රමය ක්‍රියාත්මක කිරීම ගැන ඔබගේ අදහස් නිදහසේ සඳහන් කිරීමට ඔබට අවකාශ ඇත.

යස්මින් දයානි ජයසිංහ

රෝහල් කාර්ය මණ්ඩලය සඳහා ප්‍රශ්න - ප්‍රධාන පරීක්ෂණය

01. ඔබගේ වයස කීයද ?
20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 60 ට වැඩි ☐

02. ගෙදර දී කොපමණ වාරයක් ඔබ පරිගණකය භාවිතා කරනවාද?
දිනපතා ☐ සතිපතා ☐ ඉදහිට ☐ සමහරවිට ☐ කොහෙත්ම නැත ☐

03. වැඩ කිරීමේදී කොපමණ වාරයක් ඔබ පරිගණක භාවිතා කරනවාද?
දිනපතා ☐ සතිපතා ☐ ඉදහිට ☐ සමහරවිට ☐ කොහෙත්ම නැත ☐

04. ඔබගේ පරිගණක කුසලතාව ඔබගේ තක්සේරු මට්ටම අනුව කුමක්ද?
අත් දැකීමෙක් නැත ☐ සුළුයි ☐ තරමක් හොඳයි ☐ හොඳයි ☐ විශිෂ්ටයි ☐

05. අන්තර්ජාලයට ඔබ ප්‍රවේශ වන්නේ කෙසේද?
ඔබගේ ගෙදර පරිගණකයෙන් ☐
ඔබගේ කාර්යාලයෙන් ☐
අන්තර්ජාල මධ්‍යස්ථානයකින් ☐
වෙනත් ස්ථාන වලින් (කරුණාකර නම ලියන්න) .....
කෙහෙත්ම නැත ☐

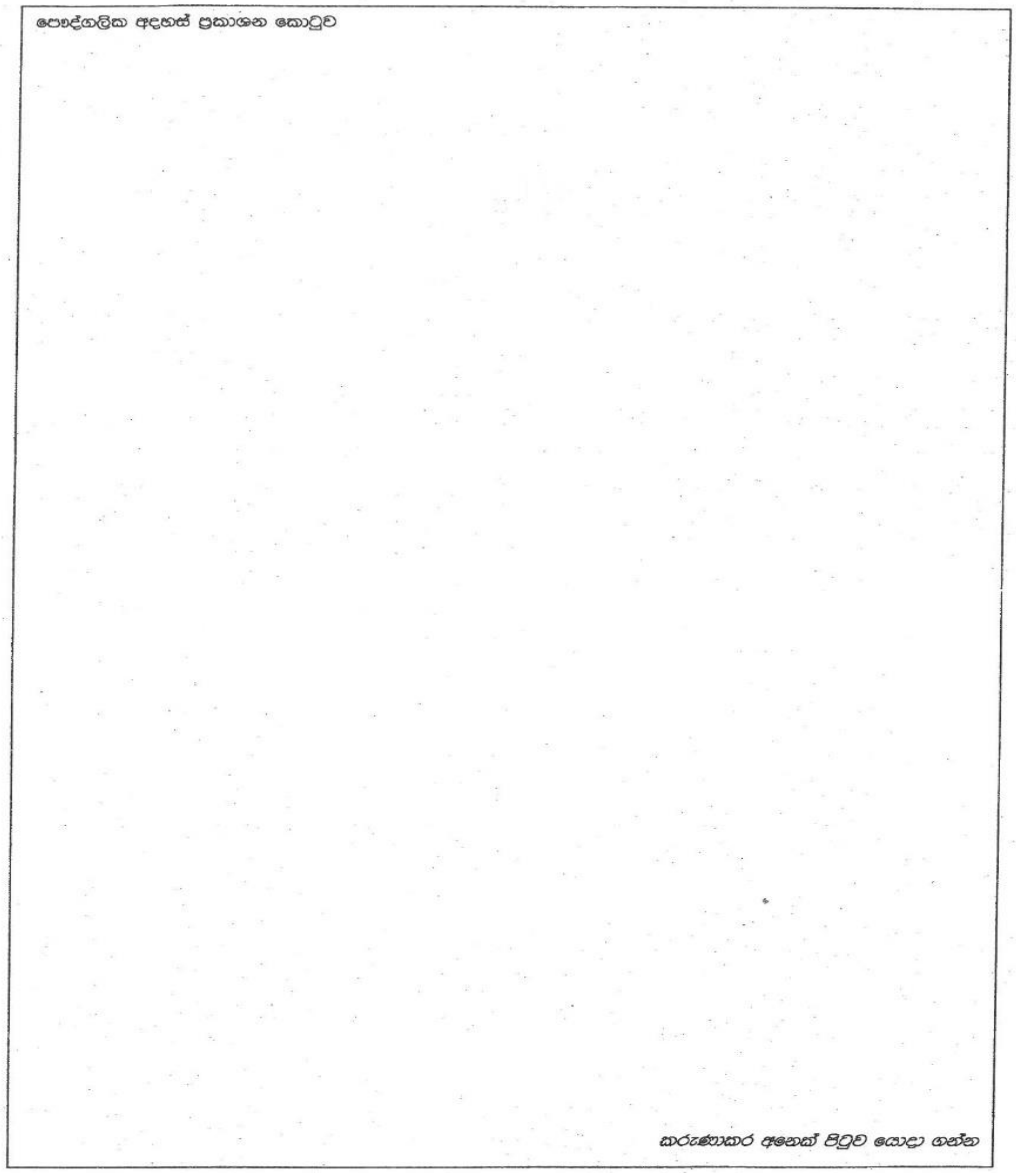
06. ඔබගේ අන්තර්ජාල ප්‍රවේශය ගෙදරදී නම්, ඔබට ඇත්තේ කුමන වර්ගයේ අන්තර්ජාල සම්බන්ධයක්ද?
ISDN ☐
DSL ☐
Mobile Phone (ජංගම දුරකථනයක්) ☐
LAN ☐
වෙනත් (කරුණාකර නම සඳහන් කරන්න)

07. ඔබ කොපමණ වසර ගණනක් අන්තර්ජාලය භාවිත කරමින් සිටිද? ..... (අවුරුදු)

යස්මින් දයානි ජයසිංහ - සිසු හැඳුනුම්පත 25115529

අංකය	ප්‍රශ්න	දැඩිව විරුද්ධයි	විරුද්ධයි	ස්ථිර නැත	එකඟයි	දැඩිව එකඟයි
01	මම ටෙලි මෙඩිසින් භාවිතා කළ යුතු බව මගේ වෘත්තියට බලපෑමක් දක්වන මගේ ජ්‍යෙෂ්ඨ මිතුරන් අදහස් කරයි.					
02	මම ටෙලි මෙඩිසින් භාවිත කළ යුතු බව ජ්‍යෙෂ්ඨ පාලක මණ්ඩලය අදහස් කරයි.					
03	මම ටෙලි මෙඩිසින් භාවිත කල යුතු බව මගේ වෘත්තියට වැදගත් වන මහජනතාව සලකති.					
04	මෙම ක්‍රමයට ප්‍රවේශයක් මා හට ඇතැයි සිතා මම මේ ක්‍රමය භාවිතා කිරීමට අදහස් කරමි.					
05	ටෙලි මෙඩිසින් භාවිතා කරන විට දිනපතා කරන වැඩපිළිවෙල සඳහා මට ගත කරන්න වන්නේ අඩු කාලයකි.					
06	රෝහල තුළ වේගවත් බ්‍රෝඩ් බෑන්ඩ් සම්බන්ධයක් අපට ඇත.					
07	ටෙලි මෙඩිසින් නිපැයුම්වල ගුණාත්මක භාවය ඉහලයි.					
08	මගේ වෘත්තීය සඳහා අන්තර්ජාලය ක්‍රියාත්මක කිරීමට ඉගෙන ගැනීම පහසුය.					
09	මගේ අභිමතය අනුව ක්‍රියාත්මක වීම ශක්තිමත් කිරීමට අන්තර්ජාලයෙන් සෞඛ්‍ය තොරතුරු ලබා ගැනීම පහසු බව මට පැහැදිලිය					
10	අන්තර්ජාලය භාවිතය නිසා කාර්යයන් කෙසේ සිදු කළ යුතු ද යන්න තේරුම් ගැනීම පහසු වේ.					
11	අන්තර්ජාල භාවිතය පහසු බව මට වැටහී ඇත.					
12	මගේ වෘත්තීය සඳහා ටෙලි මෙඩිසින් භාවිතා කිරීම වැදගත් වේ.					
13	ටෙලි මෙඩිසින් භාවිතා කිරීම මගේ වෘත්තිය සඳහා අදාල වේ.					
14	ටෙලි මෙඩිසින් භාවිතා කිරීම නිසා මගේ අනිකුත් වගකීම්වලට කාලය ඉතිරි වී ඇත.					
15	අනිකුත් වෛද්‍ය මිතුරන් සමඟ තොරතුරු හුවමාරු කර ගැනීමට ටෙලි මෙඩිසින් භාවිතය ප්‍රයෝජනවත් වේ.					
16	ටෙලි මෙඩිසින් භාවිතා කිරීම පහසු බව මට වැටහී ඇත.					
17	ටෙලි මෙඩිසින් නිසා මගේ වෘත්තිගේ පලදායිතාවය වැඩි වී ඇත.					
18	ටෙලි මෙඩිසින් භාවිතා කිරීමට පුහුණුවක් ලබා ගැනීම සඳහා ප්‍රවේශයකට මට අවකාශ ඇත.					
19	ටෙලි මෙඩිසින් භාවිතය මගේ අධ්‍යාපනය තවදුරටත් ඉදිරියට ගෙන යෑමට මට උපකාරී වේ.					
20	අලුත් පුහුණුවීම් පාඨමාලා ලබා ගැනීමට ටෙලි මෙඩිසින් මාව යොමු කරවයි.					
21	පරිගණක භාවිතය ගැන සෞඛ්‍ය ආයතනවල ප්‍රතිපත්ති තිබෙනු ඇතැයි මම විශ්වාස කරමි.					
22	සෞඛ්‍ය ආයතනවල රෝගීන්ගේ දත්ත සම්බන්ධයෙන් රහස්‍ය ප්‍රතිපත්තියක් තිබෙනු ඇතැයි මම විශ්වාස කරමි.					
23	සෞඛ්‍ය ආයතනවල මෘදුකාංග ප්‍රමිති තිබෙනු ඇතැයි මම විශ්වාස කරමි.					
24	සෞඛ්‍ය තොරතුරු සඳහා දත්ත ආරක්ෂිත පනතක් රජයට තිබෙනු ඇතැයි මම විශ්වාස කරමි.					
25	සෞඛ්‍ය තොරතුරු සඳහා අන්තර්ජාල භාවිතය සම්බන්ධයෙන් රජය හඳුන්වා දුන් ප්‍රතිපත්ති මාලාවක් ඇතැයි මම විශ්වාස කරමි.					

යස්මින් දයානි ජයසිංහ - සිසු හැඳුණුම්පත 25115529



යස්මින් දයානි ජයසිංහ - සිසු හැඳුණුම්පත 25115529

Tamil translation

வைத்தியசாலை அலுவலர்களுக்கான வினாக்கள் - பெரிய கருத்துக் கணிப்பு

அறிமுகம்

இவ்வாய்வின் குறிக்கோள் இலங்கையின் கிராமப்புறப் பிரதேசங்களில் தொலை மருத்துவ முறைமையினை கைக் கொள்வதற்கான ஒரு மாதிரியையும் வழிகாட்டல்கள் தொகுதியொன்றையும் உருவாக்குவதனைத் தெரிவிப்பதாகும்.

கிராமப்புறப் பிரதேசங்களில் சுகாதார மருத்துவ வசதிகளை மேம்படுத்துவதில் நம்பிக்கை கொண்டுள்ள ஓர் இலங்கையர் என்ற வகையில் தாங்கள் இவ்வாய்வில் பங்குகொள்ள அழைக்கப்படுகிறீர்கள். கீழே தரப்பட்டுள்ள வினாக்களுக்கு விடையளிப்பதன் மூலம் இவ்வாய்வுக்கு தாங்கள் வழங்கும் ஒத்துழைப்பை நான் பெரிதும் மதிக்கிறேன். கீழே தரப்படும் தகவல்கள் இவ்வாய்வில் மாத்திரமே பயன்படுத்தப்படும் என்பதோடு, அப்பதில்கள் பெயர் குறிப்பிடப்படாதவையாகவும் இரகசியமானவையாகவும் கையாளப்படும்.

இலங்கையில் மிகச்சிறந்த மற்றும் செயற்றிறன் மிக்க சுகாதார மருத்துவ முறைமையொன்றினை உருவாக்கும் பொருட்டு இவ்வினாக்களுக்கு விடையளிக்க தாங்கள் காட்டிய ஒத்துழைப்புக்கு என்னுடைய மனமார்ந்த நன்றிகள்.

ஆய்வாளர் : யஸ்மின் தயானி ஜயசிங்ஹ

அறிவுறுத்தல்கள் : தயவு செய்து பின்வரும் வினாக்களுக்கு உரிய கூட்டில் "X" அடையாளமிட்டு விடையளிக்கவும்.

இறுதியாக, தயவு செய்து இம்முறைமையை அமுல்படுத்துவது தொடர்பிலான உங்களது எத்தகைய கருத்துக்களையும் இந்தப் பத்திரத்தின் முடிவில் காணப்படும் கருத்துக்கள் பகுதியில் தெரிவிப்பதில் எத்தகைய தயக்கமும் வேண்டாம் என்றும் வேண்டிக் கொள்கின்றேன்.

1. உங்களது வயது என்ன?

   ☐ 20 – 30 வருடங்கள் ☐ 31-40 வருடங்கள் ☐ 41-50 வருடங்கள் ☐ 51 – 60 வருடங்கள
   ☐ 60 வருடங்களுக்கு மேல்

2. வீட்டில் உங்களது கணணிப் பாவனை எப்படி?

   ☐ தினமும் ☐ வாரந்தம் ☐ இருந்து நின்று ☐ சில நேரங்களில் ☐ பாவிப்பதேயில்லை

3. அலுவலகத்தில் உங்களது கணணிப் பாவனை எப்படி?

   ☐ தினமும் ☐ வாரந்தம் ☐ இருந்து நின்று ☐ சில நேரங்களில் ☐ பாவிப்பதேயில்லை

4. உங்களது கணணி அறிவை நீங்கள் எவ்வாறு தரப்படுத்துவீர்கள்?

   ☐ அனுபவமில்லை ☐ குறைவு ☐ சாதாரணம் ☐ நன்று ☐ மிக நன்று

5. நீங்கள் எங்கிருந்து இணையத்தள வசதியைப் பெற்றுக் கொள்கிறீர்கள்?

   ☐ உங்கள் வீட்டுக் கணணியிலிருந்து
   ☐ உங்கள் அலுவலகத்திலிருந்து
   ☐ இண்டர்நெட் க.ஃபேயிலிருந்து
   ☐ வேறு இடங்களிலிருந்து (குறிப்பிடவும்)_____
   ☐ அறவே பாவிப்பதில்லை

யஸ்மின் தயானி ஜயசிங்ஹ - மாணவர் அடையாள அட்டை – 25115529

6. நீங்கள் வீட்டிலேயே இணையத் தளத்தைப் பாவிப்பதாயின் எவ்வகையான இணைப்பு உங்களிடமிருக்கிறது?

☐ ISDN
☐ DSL
☐ கைத்தொலைபேசி
☐ LAN
☐ வேறு (குறிப்பிடவும்)

எத்தனை வருடங்களாக நீங்கள் இணையத் தளத்தைப் பாவிக்கிறீர்கள்?
_____(வருடங்கள்)

இல.	வினாக்கள்	உறுதியாக மறுக்கிறேன்	மறுக்கிறேன்	உறுதியாகத் தெரியாது	சம்மதிக்கிறேன்	உறுதியாக சம்மதிக்கிறேன்
1	எனது தொழிலில் செல்வாக்குச் செலுத்தும் சிரேஷ்ட சகபாடிகள், நான் தொலைமருத்துவத்தைக் கையாள வேண்டும் என நினைக்கின்றனர்					
2	நான் தொலைமருத்துவத்தைக் கையாள வேண்டும் என உயர் முகாமைத்துவம் கருதுகிறது.					
3	நான தொலைமருத்துவத்தைக் கையாள வேண்டும் என எனது தொழிலுக்கு இன்றியமையாதவர்கள் கருதுகின்றனர்					
4	இம் முறைமையைக் கையாள எனக்கு வாய்ப்பு இருக்கின்றமையால் அதனைப் பயன்படுத்த நான் விரும்புகிறேன்					
5	நான் தொலைமருத்துவத்தைக் கையாளும் போது வழமையான பணிகளுக்கு குறைவான நேரத்தையே ஒதுக்குவேன்					
6	எமக்கு வைத்தியசாலையில துரித ப்ரோட் பாண்ட் இணைப்பு இருக்கிறது					
7	தொலைமருத்துவத்தின் பெறுபேறுகளின் தரம் உயர்வானது					
8	எனது தொழிலுக்கு இணையத்தைப் பயன்படுத்தக் கற்பது இலகுவானது					
9	நான் விரும்பியதைச் செய்யும் இயலுமையைப் பெற்றுக் கொள்வதற்கான சுகாதாரத் தகவல்களை இணையத்திலிருந்து பெற்றுக் கொள்வது இலகுவானது.					
10	இணையத்தைப் பயன்படுத்தி காரியங்களை எப்படிச் செய்வது என்று புரிந்து கொள்வது இலகுவானது					
11	இணையம் பாவனைக்கு இலகுவானது					

12	எனது தொழிலில் தொலைமருத்துவத்தைப் பயன்படுத்துவது முக்கியமானது					
13	எனது தொழிலில் தொலைமருத்துவத்தைப் பயன்படுத்துவது பொருத்தமானது					
14	வேறு பொறுப்புக்களுக்கான நேரத்தைப் பெற்றுக்கொள்ள தொலைமருத்துவம் எனக்கு உதவுகிறது					
15	ஏனைய சகபாடிகளோடு தகவல் பரிமாறிக் கொள்ள தொலைமருத்துவம் எனக்கு உதவுகிறது					
16	தொலை மருத்துவமானது கைகொள்ள இலகுவானது					
17	தொலைமருத்துவத்தைக் கைக்கொள்வதானது எனது தொழிலிலான எனது செயற்றிறனை மேம்படுத்துகிறது					
18	தொலைமருத்துவத்தைப் பயன்படுத்துவதற்கான பயிற்சியைப் பெற்றுக் கொள்வதற்கான வாய்ப்பு எனக்குக் கிடைக்கும்					
19	எனது உயர் கல்வியைத் தொடர தொலைமருத்துவம் எனக்கு உதவும்					
20	புதிய பயிற்சி நெற்களைக் கற்க தொலைமருத்துவம் என்னைத் தூண்டும்					
21	கணணிப் பாவனை தொடர்பில் சுகாதார நிறுவனங்களுக்கு கொள்கைகள் இருப்பதாக நான் நம்புகிறேன்					
22	தரவுகள் தொடர்பில் சுகாதார நிறுவனங்களுக்கு வாடிக்கையாளர்களது இரகசியம் பேணும் கொள்கை இருப்பதாக நான் நம்புகிறேன்					
23	சுகாதார நிறுவனங்களுக்கு மென்பொருள் தராதரக் கட்டுப்பாடுகள் இருப்பதாக நான் நம்புகிறேன்					
24	சுகாதாரத் தகவல்கள் தொடர்பில் அரசிடம் தரவுப் பாதுகாப்புச் சட்டம் இருப்பதாக நான் நம்புகிறேன்					
25	சுகாதாரத் தகவல்களுக்காக இணையத்தைப் பாவிப்பது தொடர்பில் கொள்கைகளை அரசு அறிமுகப்படுத்துயிருப்பதாக நான் நம்புகிறேன்					

கருத்துக்கள்:

யஸ்மின் தயானி ஜயசிங்ஹ - மாணவர் அடையாள அட்டை – 25115529

Appendix H. Questions distributed to the general public during the main survey

Questions for the general public – major survey

Introduction

The objective of this research is to inform the development of a model and a set of guidelines for the adoption of a telemedicine system in the rural areas of Sri Lanka. The result of this survey will be used to identify the gaps in current guidelines. This research is under the direction of Electronics and Computer Science, University of Southampton. United Kingdom.

You are invited to participate in this research as you are a Sri Lankan who believes in improving the healthcare facility in the rural areas. I would greatly appreciate your participation in this research by answering the questions given below. The information given below will be used in this research only and the responses will be treated as anonymously and confidential.

Thank you very much for your co-operation in answering the questions to make a better and efficient healthcare system in Sri Lanka

Researcher : Yasmin Dayani Jayasinghe

Instructions: please answer the following questions by placing "X" in the appropriate box.

Finally please feel free to add any comments if you have regarding the implementation of the system in the comment section at the end of the form.

1. What is your age?

   ☐ 20 – 30 years ☐ 31-40 years ☐ 41-50 years ☐ 51 – 60 years
   ☐ over 60 years

2. How often do you use a computer at home?

   ☐ Everyday ☐ weekly ☐ occasionally ☐ sometimes ☐ never

3. How often do you use computers at work?

   ☐ Everyday ☐weekly ☐ occasionally ☐ sometimes ☐ never

4. How would you rate your own computer skills

   ☐ No experience ☐ poor ☐ fair ☐ good ☐ excellent

5. How do you access the internet?

   ☐ From your home computer
   ☐ From your own office
   ☐ From an internet café
   ☐ From other places (please specify) _____
   ☐ I don't at all

Yasimn Dayani Jayasinghe – STUDENT ID - 25115529

6. If you access the internet from your home, what kind of internet connection do you have?

   ☐ ISDN
   ☐ DSL
   ☐ Mobile phone
   ☐ LAN
   ☐ Other (please specify)

7. How many years have you been using the internet? _____(years)

No	Questions	Strongly Disagree	Disagree	Not sure	Agree	Strongly agree
1	I have generally favourable attitude towards using telemedicine					
2	I am confident that telemedicine will reduce my travelling cost					
3	I find it easy to use the Internet to obtain health information					
4	I feel more at ease using telemedicine than in a traditional face-to-face consultation					
5	I expect to feel more independent when using the internet to obtain health information					
6	I am confident that use the internet for assistance in getting health information					
7	I am confident that using telemedicine ill reduce the travelling time					
8	Clinician using telemedicine for my consultation is entirely my choice					
9	Interacting with the consultant online in a clinic will be pleasant					
10	I believe it is a good idea to use telemedicine in the rural areas of Sri Lanka					

Yasimn Dayani Jayasinghe – STUDENT ID - 25115529

Comments:

Please continue overleaf

Yasimn Dayani Jayasinghe – STUDENT ID - 25115529

Sinhalese translation

පොදු ජනතාව සඳහා ප්‍රශ්න - ප්‍රධාන පරීක්ෂණය

හඳුන්වාදීම

මෙම පර්යේෂණයේ අරමුණ වන්නේ ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශයන්හි ටෙලිමෙඩිසින් ක්‍රමය යොදා ගැනීම සඳහා මොඩලයක් (ආකෘතියක්) හා අනුගමනය කළ යුතු මඟපෙන්වීම් සමූහයක් වර්ධනය කළ යුතු ආකාරය දැන්වීමටය. මෙම පරීක්ෂණයේ ප්‍රතිඵල දැනට පවතින මඟපෙන්වීම් වල හිඩැස් හඳුනා ගැනීම සඳහා ද යොදා ගැනේ. මෙම පර්යේෂණය චක්ෂත් රාජධානියේ සවුත් හැම්ප්ටන් විශ්ව විද්‍යාලයේ විද්‍යුත් හා පරිගණක විද්‍යා අංශයේ මඟ පෙන්වීම යටතේ සිදු කෙරේ.

මෙම පර්යේෂණය සඳහා සහභාගි වීමට ඔබට ආරාධනා කරන්නේ ඔබ පිටිසර ප්‍රදේශයන්හි සෞඛ්‍ය සේවා පහසුකම් වැඩි දියුණු කළ යුතු බව විශ්වාස කරන ශ්‍රී ලාංකිකයෙකු බැවිනි. පහත සඳහන් ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් මෙම පර්යේෂණයට ඔබගේ සහභාගිත්වය බොහෝ සෙයින් මම අගේ කොට සලකමි. පහත සඳහන් තොරතුරු මෙම පර්යේෂණයට පමණක් යොදා ගන්නා අතර, සපයා දී ඇති පිළිතුරු නිර්නාමික හා රහසිගත ලෙස සැලකේ.

ශ්‍රී ලංකාවේ සෞඛ්‍ය සේවාව වඩා යහපත් හා කාර්යක්ෂම කිරීමට ප්‍රශ්නවලට පිළිතුරු සැපයීමෙන් ලබා දුන් සහයෝගය ගැන මම ඔබට ස්තුතිවන්ත වෙමි.

පර්යේෂක : යස්මින් දයානි ජයසිංහ

උපදෙස්:- කරුණාකර ගැලපෙන කොටුවේ 'X' සලකුණ පමණක් යොදා පිළිතුරු සටහන් කරන්න. කරුණාකර මෙම පෝරමයේ අග ඇති ''අදහස් ප්‍රකාශන කොටුවේ'' මෙම ක්‍රමය ක්‍රියාත්මක කිරීම ගැන ඔබගේ අදහස් නිදහසේ සඳහන් කිරීමට ඔබට අවකාශ ඇත.

යස්මින් දයානි ජයසිංහ

පොදු ජනතාව සඳහා ප්‍රශ්න - ප්‍රධාන පරීක්ෂණය

01. ඔබගේ වයස කීයද ?
20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 60 ට වැඩි ☐

02. ගෙදර දී කොපමණ වාරයක් ඔබ පරිගණයක භාවිතා කරනවාද?
දිනපතා ☐ සතිපතා ☐ ඉදහිට ☐ සමහරවිට ☐ කොහෙත්ම නැත ☐

03. වැඩ කිරීමේදී කොපමණ වාරයක් ඔබ පරිගණක භාවිතා කරනවාද?
දිනපතා ☐ සතිපතා ☐ ඉදහිට ☐ සමහරවිට ☐ කොහෙත්ම නැත ☐

04. ඔබගේ පරිගණක කුසලතාව ඔබගේ තක්සේරු මට්ටම අනුව කුමක්ද?
අත් දැකීමෙක් නැත ☐ සුළුයි ☐ තරමක් හොඳයි ☐ හොඳයි ☐ විශිෂ්ටයි ☐

05. අන්තර්ජාලයට ඔබ ප්‍රවේශ වන්නේ කෙසේද?
ඔබගේ ගෙදර පරිගණකයෙන් ☐
ඔබගේ කාර්යාලයෙන් ☐
අන්තර්ජාල මධ්‍යස්ථානයකින් ☐
වෙනත් ස්ථාන වලින් (කරුණාකර නම ලියන්න) .....
කොහෙත්ම නැත ☐

06. ඔබගේ අන්තර්ජාල ප්‍රවේශය ගෙදරදී නම්, ඔබට ඇත්තේ කුමන වර්ගයේ අන්තර්ජාල සම්බන්ධයක්ද?
ISDN ☐
DSL ☐
Mobile Phone (ජංගම දුරකථනයක්) ☐
LAN ☐
වෙනත් (කරුණාකර නම සඳහන් කරන්න)

07. ඔබ කොපමණ වසර ගණනක් අන්තර්ජාලය භාවිත කරමින් සිටීද? ..... (අවුරුදු)

යස්මින් දයානි ජයසිංහ - සිසු හැඳුනුම්පත 25115529

අංකය	ප්‍රශ්න	දැඩිව විරුද්ධයි	විරුද්ධයි	ස්ථිර නැත	එකඟයි	දැඩිව එකඟයි
01	ටෙලි මෙඩිසින් භාවිතය ගැන මට ඇත්තේ සාමාන්‍යයෙන් සතුටුදායක ආකල්පයකි					
02	ටෙලි මෙඩිසින් නිසා මගේ ගමන් වියදම් අඩු වන බව මට විශ්වාසයි.					
03	සෞඛ්‍ය තොරතුරු ලබා ගැනීමට අන්තර් ජාලය යොදා ගැනීම පහසු බව මට පැහැදිලිය.					
04	තොරතුරු ලබා ගැනීමට සම්ප්‍රදායික මුහුණට-මුහුණලා ක්‍රමයට වඩා ටෙලි මෙඩිසින් භාවිතය පහසු බව මට හැඟේ					
05	සෞඛ්‍ය තොරතුරු ලබා ගැනීමට අන්තර්ජාලය භාවිතා කරන විට වැඩි නිදහසක් දැනේ යැයි මම අපේක්ෂා කරමි.					
06	සෞඛ්‍ය තොරතුරු ලබා ගැනීමේදී අන්තර්ජාලය යොදා ගැනීම ආධාරයක් වන බව මම විශ්වාස කරමි.					
07	ටෙලි මෙඩිසින් භාවිතය නිසා ගමන් බිමන් සඳහා ගත වන කාලය අඩු වන බව මම විශ්වාස කරමි.					
08	මා උපදෙස් ලබා ගැනීමේ දී වෛද්‍යවරුන් මඟින් ටෙලි මෙඩිසින් භාවිත කරන්නේ මූළුමනින්ම එම ක්‍රමය මගේ තේරීමක් නිසාය.					
09	වෛද්‍ය සායනයේ මගේ වෛද්‍යතුමා, ඔහුගේ උපදේශක සමඟ 'ඔන්ලයින්' ක්‍රමය මඟින් සම්බන්ධ වීම සතුටට කරුණකි.					
10	ශ්‍රී ලංකාවේ පිටිසර ප්‍රදේශයන්හි ටෙලි මෙඩිසින් භාවිතය යහපත් අදහසක් බව මම විශ්වාස කරමි.					

පෞද්ගලික අදහස් ප්‍රකාශන කොටුව

කරුණාකර අනෙක් පිටුව යොදා ගන්න

යස්මින් දයානි ජයසිංහ - සිසු හැඳුනුම්පත 25115529

Appendix I. Ethical approval documents

Ethical approval numbers approved by the University of Southampton Ethics Committee

Exploratory study : 4371

Main study : 6073

UNIVERSITY OF Southampton

CONSENT FORM (*Insert Version number*)

Study title: A study to validate a model to describe the adoption of telemedicine system in the rural areas of Sri Lanka

Researcher name: Yasmin Dayani Jayasinghe
Ethics reference number: 6073

Please initial the box(es) if you agree with the statement(s):

I have read and understood the information sheet (insert date /version no. of participant information sheet) and have had the opportunity to ask questions about the study.	☐
I agree to take part in this research project and agree for my data to be used for the purpose of this study	☐
I understand my participation is voluntary and I may withdraw at any time without my legal rights being affected	☐

Data Protection
I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purpose of this study. All files containing any personal data will be made anonymous.

Name of participant (print name).....

Signature of participant.....

Date.....

03/05/2013 version 1

Consent from Sinhalese translation

UNIVERSITY OF Southampton

කැමැත්ත ප්‍රකාශිත පෝරමය *(පිටපත 1)*

පර්යේෂණයේ නම : ලංකාවේ පිටිසර ප්‍රදේශවල ටෙලිමෙඩිසින් තුමය පිහිටුවීම ගැන විස්තර කෙරෙන ආකෘතිය වලංගු කරවා ගැනීම

පර්යේෂණය මෙහෙයුම්කරුගේ නම : යස්මින් දයානි ජයසිංහ

එතික්ස් යොමු අංකය : 67073

ඔබ ප්‍රකාශනවලට එකඟ වන්නේ නම් කරුණාකර කොටු තුළ කෙටි අත්සන යොදන්න.

මෙම තොරතුරු පත්‍රිකාව කියවා බලා තේරුම් ගතිමි. (සහභාගිවන්නාගේ තොරතුරු දිනය/ පිටපත් අංකය ඇතුළත් කරන්න) තවද පර්යේෂණය ගැන ප්‍රශ්න ඇසීමට මට අවස්ථාවක් ලැබුණි.

මම මෙම පර්යේෂණ ව්‍යාපෘතියට සහභාගි වීමට එකඟවන අතර, මෙම පර්යේෂණයේ අරමුණු සඳහා මාගේ දත්තයන්ද යොදා ගැනීම ගැන ද එකඟ වෙමි.

මගේ සහභාගිත්වය ස්වේච්ඡා සහගත බවත්, ඕනෑම වෙලාවක මගේ නීතිමය අයිතීන්ට බලපෑමක් නොමැතිව මෙයින් ඉවත්විය හැකි බවත් යන කරුණු ගැන මට අවබෝධයක් ඇත.

මෙම පර්යේෂණයට සහභාගි වන කාලය තුළදී මා ගැන රැස් කළ තොරතුරු 'පාස්වර්ඩ්' එකක් සහිත පරිගණකයක ආරක්ෂා කර ගබඩා කර ඇති බවද, මෙම තොරතුරු මෙම පර්යේෂණයේ අරමුණු වෙනුවෙන් පමණක් යොදා ගැනෙන බව ගැන මට අවබෝධයක් ඇත. පෞද්ගලික දත්ත අඩංගු සියළුම ලිපිගොනු නිර්නාමික බවට පත්කර ඇත.

සහභාගි වන්නේගේ නම (මුද්‍රිත අකුරෙන්) :.....

සහභාගි වන්නාගේ අත්සන :.....

දිනය :.....

අනුවාදය 2.0, 3 පිටපත 1

Consent form Tamil translation

UNIVERSITY OF Southampton

இணக்கப் படிவம் (*பதிப்பு இலக்கத்தை உட்படுத்தவும்*)

ஆய்வின் தலைப்பு : இலங்கையின் கிராமப்புறப் பிரதேசங்களில் தொலை மருத்துவ முறைமையினை கைக்கொள்வதனை விவரிப்பதற்கான மாதிரியொன்றை வலுபடுத்துதற்கான ஓர் ஆய்வு.

ஆய்வாளர் பெயர் : யஸ்மின் தயானி ஜயசிங்ஹ
நன்னெறி உசாத்துணை இலக்கம் : 6073

பின்வரும் கூற்றை (அல்லது கூற்றுக்களை) நீங்கள் ஏற்றுக் கொள்வதாயின் இக்கட்டங்களில் சுருக்கக் கையெழுத்திடவும்:

தகவல் படிவத்தை நான் வாசித்து விளங்கிக் கொண்டேன். (பங்கு கொள்வோர் தகவல் படிவத்தின் திகதி / பதிப்பு இலக்கம் ஆகியவற்றை உட்படுத்தவும்) மேலும் ஆய்வு குறித்த வினாக்களைக் கேட்பதற்கான சந்தர்ப்பத்தையும் பெற்றுக் கொண்டேன்.	☐
இவ்வாய்வுச் செயற்திட்டத்தில் பங்கு கொள்ளவும் இவ்வாய்வின் நோக்கங்களுக்காக எனது தரவுகள் பயன்படுத்தப்படுவதற்கும் நான் இணங்குகின்றேன்.	☐
எனது பங்குபற்றலானது சுய விருப்பின் பேரிலானது என்பதனையும், எனது சட்ட உரிமைகள் பாதிக்கப்படாத வகையில் எந்த நேரத்திலும் நான் வாபஸ் பெற்றுக் கொள்ள முடியும் என்பதனையும் நான் அறிவேன்.	☐

தரவுப் பாதுகாப்பு

இவ்வாய்வில் நான் பங்குபற்றும் வேளை என்னைப் பற்றி சேகரிக்கப்பட்ட தகவல்கள் குறியீட்டுச் சொல்லால் பாதுகாக்கப்பட்ட கணனி ஒன்றிலேயே சேகரித்து வைக்கப்படும் என்பதனையும் மேலும் இத்தகவல்கள் இவ்வாய்வின் நோக்கங்களுக்காக மாத்திரமே பயன்படுத்தப்படும் என்பதனையும் நான் அறிவேன். எத்தகைய தனிப்பட்ட தரவுகளையும் கொண்டிருக்கும் அனைத்துக் கோவைகளும் பெயர் குறிப்பிடப்படாததாக ஆக்கப்படும்.

பங்குபற்றுபவரது பெயர் (பெயரை அச்சிடவும்).....

பங்குபற்றுபவரது கையொப்பம்.....

திகதி.....

03/05/2013 version 1

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