Issues Facing the Application of Telemedicine in Developing Countries: Hashemite Kingdom of Jordan and Syrian Arab Republic.

A Thesis submitted for the degree of Doctor of Philosophy

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Abstract

Telemedicine delivers healthcare between geographically separated locations using medical expertise supported by communication technology. Physicians and specialists from one site can provide diagnosis, treatment and consultation to patients at a remote site. This makes the use of telemedicine particularly affective in rural and remote areas that have limited access to healthcare services.

This study identifies the factors that affect the use and adoption of telemedicine in developing countries and rural areas in general, taking the Hashemite Kingdom of Jordan and the Syrian Arab Republic as cases studies. We have developed two guideline frameworks to be applied to telemedicine projects at the pre-implementation phase. The main purpose of the guideline frameworks is to assess the readiness of the Jordanian and Syrian health care system to use telemedicine and to assist any healthcare provider who is considering implementing a telemedicine project in either of these two countries. The guideline framework can be transferred and applied to any other country for which similar circumstances apply.

Our guideline frameworks are based on interviews with key stakeholders including doctors, technicians, engineers, and decision makers, and administering questionnaires to further key stakeholders including patients, ensuring that we gain opinion from people from different backgrounds and with different roles in the healthcare system.

Our research has identified specific key issues which inhibit the use of telemedicine: poor technology infrastructure; lack of funding; lack of IT education; insufficient training for clinicians; doctors' resistance; patients' resistance; and lack of knowledge about healthcare and technology.

This work provides a clear idea of the current readiness in both countries and proposes two guideline frameworks that will aid the use of telemedicine. Their dissemination will create awareness and spread knowledge, which will help the decision makers to appreciate the potential role of telemedicine and help them to facilitate the process of introduction and so spread telemedicine in both Jordan and Syria.

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Dedication

I would like to dedicate this work to my father Imad Alajlani (may he rest in peace), who always supported me in my PhD and who always used to say "*I hope to live to see the Dr next to your name*". I am glad that his dream has come true and I hope that he is proud of me wherever he is now.

Acknowledgement

I would like to thank my supervisor Dr Malcolm Clarke for his efforts and support. Without his guidance, this work would not be successfully completed.

And I would like to thank my family, my friends and everyone who supported me and helped me to complete this work.

Declaration

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Chapter One: Introduction

In the last 20 years, technological developments have revolutionised numerous sectors of society. Telecommunication technology (technology used for all kind of data transmission, voice, video, etc) has been one of the sectors that has reaped the benefits of this propagation. People can talk and track their business from different locations all over the world via internet, mobile phones and video conferences.

Healthcare in particular has employed the improvement in telecommunication to facilitate the exploitation of technology by medical practice, and has created the e-Health principle (see 1.1). Telecommunication is considered as a platform for e-Health services (including teleconsultation and video conferences). These services use different types of telecommunication facilities from ordinary Plain Old Telephone System (POTS) to complex satellite technology. Using such telecommunication technology to support healthcare from separated locations is defined as "*Telemedicine*" (Grigsby & Sanders, 1998).

Telemedicine is the "*utilization of telecommunication technology to provide medical and healthcare fields with the ability to exchange medical data*" (Grigsby & Sanders, 1998) where telemedicine gives the ability to exchange data between separated parties, typically specialist to specialist or patient to specialist.

Telemedicine delivers healthcare between geographically separated locations using medical expertise supported by communication technology. Physicians and specialists from one site can provide diagnosis, treatment and consultation to patients at a remote site. This makes the use of telemedicine particularly affective in rural and remote areas that have limited access to healthcare services. We can obviously observe this phenomenon in rural areas in Developed Countries and some Developing Countries.

Telemedicine has been much improved and became significantly enhanced, but many problems continue to obstruct its application (technical and organizational).The next section defines E-Health and Telemedicine in more detail, and provides an understanding of the environment of the research.

1.1 E-Health and Telemedicine

Telemedicine can broadly be defined as the utilization of communication technology to serve the medical care field, whether patient and specialist are physically in the same place or there is a large distance separating them. This makes telemedicine unique, as it can bridge the gap between geographical distance and deliver healthcare efficiently at the same time (Menachemi, Burke & Ayers, 2004).

Telemedicine is literately defined as "medicine at a distance" derived from the Greek meaning, but the Institute of Telemedicine has defined telemedicine as "*the use of electronic information and communications technologies to provide and support health care when distance separates the participants."* (Field, 1996). Hence, telemedicine is not just using simple communication technology to connect patient with provider, but it is a complex interaction between technology, clinical practice, organizational preparation and human factors (Garshnek, Hassell & Colonel, 1991).
This definition can confuse between Telemedicine, Telecare and Telehealth. These terms are used interchangeably by some and, at times with a difference in meaning. In this work the definitions of Norris (2002) will be used to differentiate

- Telemedicine: "*Use of information and communication technologies to transfer medical information for the delivery of clinical and educational services.*"
- Telehealth: "*The use of information and communication technologies to transfer healthcare information for the delivery of clinical, administrative and educational services.*"
- Telecare: "*The use of information and communication technologies to transfer medical information for the delivery of clinical services to patients in their place of domicile.*"

These terms go under the umbrella of e-Health which can be broadly defined as "*an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies*". (Eysenbach, 2001)
This term does not deal only with technical issues and technology, but it is also "a state-of-mind" and "a way of thinking" (Eysenbach, 2001) that widely embrace all

technical and social issues that are related to the interaction between technology and healthcare services. (Eysenbach, 2001)

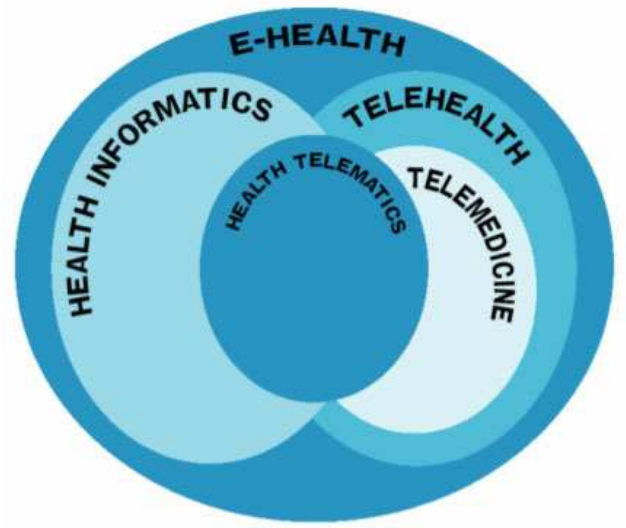

Figure 1: Relationship between the various terminologies associated with eHealth (Dario et al., 2004)

These definitions presume the use of information and communication technology, but are not restricted to new technologies. Telemedicine is not a new practice, and has been used for a long time via normal phone line or POTS.

1.2 The history of telemedicine

There are many suggestions for the earliest examples of telemedicine, but there are different views about what constitutes telemedicine, as it was not a well defined discipline at the beginning. Norris (2002) suggests that telemedicine started in the late 19th century by using telegraph and telephone. Zundel (1996) describes how the telegraph was used in the Civil War to order medical supplies, and physicians used the telephone to support their medical communications.

The first television transmission experiment was in 1927 with live sound and picture (Field, 1996). Improvement projects were seen in USA and Australia in 1970 and included STARPAHC (Space Technology Applied to Rural Papago Advanced Health) which was a product of 20 years work between NASA and the US Public Health Service to provide medical services to the Indian reservation in Arizona (Whitten, & Sypher, 2004). This project proved the ability of telecommunication to

support the medical sector effectively from a distance. After this time, many pilot projects were accomplished and in the 1990s, rapid progress was noticed due to the new computing and information technology. This included conversion from analogue to digital communication and the modern telecommunication infrastructure (Norris, 2002), with satellite telecommunication taking a major role in establishing live video conferences and live consultations in the global and earth-space communications.

1.3 Why Telemedicine?

Developed countries have utilized telemedicine effectively and gained benefits from it as a good tool for communication, an efficient way to exchange healthcare knowledge and to provide high quality healthcare.

Developing countries should exploit the experience of the developed countries in telemedicine as it is really required. Ethiopia (in Africa) provides a good example of the need for telemedicine in developing countries. It is a country with one million square kilometres and a population of 61 million inhabitants. 85.3% of this population live in rural areas where there is a lack of doctors, difficult to reach the healthcare centres and poor healthcare facilities (Androuchko & Nakajima, 2004). Such a country needs telemedicine and it is necessary for it to be made available to them; it can link the medical expert with the patient in the rural area, who finds it very difficult to travel to the capital of the country (where most of the doctors work). Furthermore, telemedicine can provide the rural areas with healthcare knowledge through teaching programs, video conferences and training sessions and in this way, the knowledge of the people will be enhanced. All these facilities can be provided by telemedicine at very reasonable prices for patients, doctors and healthcare professionals.

Patients can make cost savings, because they do not need to travel long distances to receive their treatment or their medical diagnosis, many can be provided by online consultation or by video conferences (Fitzmaurice, 1998). The same situation exist for the doctor or the physician, they do not need to travel long distances to check on patients. Furthermore, telemedicine can improve the communication and the collaboration between physicians and doctors as they can easily consult with each other and exchange experience (Menachemi, Burke & Ayers, 2004).

There is clear need for telemedicine, and developing countries can benefit from the services provided by telemedicine. It could be the solution for many of the health care problems that face the people in rural areas.

Despite the benefits of telemedicine, there remains the problem that in many rural areas, the technology and telecommunication infrastructure are very limited. This is a major problem which will impede the introduction of telemedicine. Further problems are highlighted in this research.

1.4 Problems of applying telemedicine

Given the need for telemedicine in developing countries and rural areas, and having introduced the benefits and the importance of telemedicine, this section considers some general obstacles and problems that are facing the application of telemedicine.

These problems come from different directions and different fields and they have direct impact on the application of telemedicine. Problems are technical, social, political, organizational and others.

The major barriers facing telemedicine application in the developing countries are technology and telecommunication infrastructure. Telemedicine applications such as teleradiology, telepathology, and teleconsulting (Wootton, 1997) in particular require significant funding for tools and equipment in order to undertake the operations required from those applications.

Adequate funding is not available in developing countries, as the concept of telemedicine remains to be accepted and the benefits to be gained from telemedicine to be recognised.

Another barrier is that the healthcare professionals believe that telemedicine limits their freedom and threatens their experience, as they feel afraid of exchanging their knowledge with their colleagues (Törnqvist, 2000). Some clinicians, especially the elderly, only believe in their own old ideas and old methods of treatment, and are unwilling to change to the new technology.

Some doctors are concerned that telemedicine prevents them from being able to examine the patients physically, which may cause a mistake in their diagnosis (Miller, 2003). Some patients would agree with this claim, and they believe that it is better to be physically present with the doctor. There is some concern that telemedicine may connect the patient with a doctor from a different background, and culture issues

(traditions and religion) may cause misunderstanding between them so that the patient may not feel comfortable with the way the doctor is diagnosing them. (Miller, 2003).
Many of these problems can be due to a lack of knowledge and training (Törnqvist, 2000). This includes the need for trained nurses and physicians to establish the session with the doctors, to explain the status of the patient and provide the doctor with accurate information to obtain correct diagnosis.
Further problems facing telemedicine are the guidelines and policies. In telemedicine the participants (patient and clinician) are separated and this brings complexity to the policies. In the USA for example, policies related to telemedicine in one state may differ from these in other state. This can prevent connection between two participants from two different states, because the doctor can not practice in a state unless licensed in that state. Likewise for nurses, physicians, and other health professionals (Field, 1996).

Above are some of the common obstacles that have been described as important to the application of telemedicine in developing countries and rural areas. This research will describe further obstacles that are specific to the Hashemite Kingdom of Jordan and the Syrian Arab Republic, two immediate neighbours in the Middle East.

1.5 Aims and Objectives

The aim of this research is to identify the factors that affect the application of telemedicine in developing countries and determine specific factors for the particular cases of the Hashemite Kingdom of Jordan and the Syrian Arab Republic. Develop a guideline framework that is applied to telemedicine projects at the pre-implementation phase in both countries and then used to provide a comparison of the issues of applying telemedicine between these two countries and between other than developing countries.

The objectives are to:

- Identify the issues that affect the application of telemedicine in developing countries and rural areas.
- Identify the issues specific to the application of telemedicine in Jordan and Syria.

- Determine potential solutions for these issues.
- Develop a guideline framework to inform a healthcare provider that is considering implementing a telemedicine project in Jordan or Syria.
- Test and validate the guideline framework with key stakeholders.
- Promote the guideline framework to the healthcare sectors and policy makers.

The objective will be accomplished by:

- Literature review including papers, books, articles and other knowledge resources.
- Review of previous telemedicine projects, to gain knowledge from actual implementation and learn from their successes and failures.
- Visit examples of implementation of telemedicine in developing and developed countries to investigate and observe the application.
- Interviewing key stakeholders in Jordan and Syria including decision makers, doctors, physicians, technical support specialists and others to determine opinion and information from their experiences of real practice.
- Applying questionnaires to key stakeholders and patients in both countries to determine their knowledge and awareness of telemedicine and its applications.
- Analysis of all the data to derive a guideline framework and solutions for each country.
- Test and validate the guideline framework and solutions with the key stakeholders in each country (Jordan and Syria).
- Refine the solutions and develop an improved guideline framework for each country (Jordan and Syria) from the comment of the key stakeholders and determine differences between the countries.

1.6 Methods

For the purpose of this study, a Phenomenological (Qualitative) approach was followed (Collis & Hussey, 2003) as the researcher cannot be separated from what is being investigated. It is also the intent that the outcome of this research will influence practice and policy.

Data was collected through both:

- Semi-structured interview with key stakeholders to gain deeper understanding of the issues that prevent the spread and use of telemedicine in each of the countries Jordan and Syria. The questions covered most of the concepts that might prevent the application of telemedicine in the developing world, and especially Jordan and Syria. Concepts range from simple technical issues to the political decisions concerning the application of telemedicine in those countries. All the interviews were with consent, but all participants preferred the interview not to be audio or video recorded and sought reassurance that it would be anonymous.

  The interviews were analysed using Thematic Analysis and by using NVIVO 7.0 (produced by QSR International).
- Questionnaires to key stakeholder and patients to determine their knowledge and acceptance of telemedicine.

1.7 Contribution

The study took place in the Hashemite Kingdom of Jordan and the Syrian Arab Republic. The outcome of this study is a guideline framework for each of these countries, to be followed prior to the inception of any telemedicine project in that country. The guideline framework can be generalised and applied to any other country for which similar circumstances apply.

The aim of the guideline framework is to identify the issues that might prevent the use and spread of telemedicine in Jordan and Syria and to assess the readiness of the health care system to use telemedicine in each country. The goal is to assist any healthcare provider who is considering implementing a telemedicine project in any of these two countries.

As its contribution, this work provides a clear idea of the current readiness in both countries. Dissemination of knowledge and awareness will help the decision makers to appreciate the potential role of telemedicine in order that they might facilitate the process of introduction and so spread telemedicine in both Jordan and Syria.

1.8 Structure of the thesis

- **Chapter one**: *Introduction*: Defines the telemedicine, its history and its applications. Highlights the need for telemedicine in developing countries and

in remote and rural areas. Describes the aims and objectives of this study, followed by the problems of applying telemedicine in developing countries and rural areas. Describes the approach and the research methods that have been followed to complete this research, in addition to the contribution provided by this study.

- **Chapter two**: *Literature review*: Describes telemedicine applications and their use. Shows the utilisation of telemedicine in developed countries, followed by the barriers facing the adoption of telemedicine in developed countries. Explains in depth the barriers to applying telemedicine in developing countries, and provides details about the differences in the application of telemedicine in developed and developing countries. Describes the advantages and disadvantages of the telemedicine application, followed by a number of examples of telemedicine projects from various countries around the world. It highlights the particular need for the telemedicine in developing countries. It distinguishes between developed and developing countries, and determines that Jordan and Syria do not belong to either of the two categories rather they fit between them. Finally, it describes various current studies and frameworks that are similar to this research, and highlights those that influenced this study.
- **Chapter three**: *Research Methodologies*: Describes the research approach that has been followed in this study, and the data generation methods used to collect data (interviews and questionnaires). It describes the data collection strategy, data analysis approach (thematic analysis). It explains the data quality issues such as reliability, validity and generalisation. It provides details about the ethical approval that was provided by the Brunel University Research Ethics Committee, and finally it defines the key stakeholders that can benefit from this study including decision makers, doctors, physicians, paramedics, technical support specialists and patients.
- **Chapter four**: *Barriers to Applying Telemedicine in the Hashemite Kingdom of Jordan*: It provides a description of the geography of Jordan, its health system and the role of telemedicine in the country. It then investigates the issues facing the adoption of telemedicine in Jordan (finance, training, doctors' resistance and patients' resistance), and proposes a guideline framework of solutions that can be followed prior to the establishment of any

telemedicine project. The guideline framework will be of assistance to any healthcare provider that is considering implementing such a project.

- **Chapter five**: *Barriers to Applying Telemedicine in the Syrian Arab Republic*: It provides a description of Syria and its health system. It then investigates the issues facing the adoption of telemedicine in the country (infrastructure, funding, training and education, doctor resistance and patient resistance), and proposes a guideline framework of solutions which provides a clear idea to the current level of e-Health readiness in the country and allow greater focus on the concerns that will most affect the implementation process of telemedicine.
- **Chapter six**: *A Comparison between Jordan and Syria Regarding the Issues Surrounding the Application of Telemedicine*: It provides a comparison between the different circumstances of Jordan and Syria, a justification for the differences between the two proposed guideline frameworks and a clarification of the fact that Jordan adopted the telemedicine before Syria
- **Chapter seven**: *Conclusion*: Provides a summary for this study and for the achieved guideline frameworks. Lists and explains the limitation of this research, and finally, talks about future work which might support this study and make it more comprehensive.

Chapter Two: Literature Review

2.1 Introduction

Telemedicine connects patients with medical specialists from different locations, in order to provide appropriate healthcare services in rural and remote areas.

Telemedicine has proven its efficacy in the last few years through several established projects in developed and developing countries, such as Malaysia (Oh, Lim & Besar, 2006) and Australia (Wootton, 1997) Further telemedicine applications will be described in the next section.

2.2 Telemedicine Applications

Telemedicine has been applied in many applications such as clinical, space, emergency and disaster, prisons and many others:

- Clinical applications: Telemedicine has had a good impact on medical practice by improving the quality of medical services, and by increasing access to healthcare facilities for people in remote and rural areas (Lin, 1999). Telemedicine facilitates the work of medical experts (cardiologists, pathologists, dermatologists, and psychiatrists) through the use of interactive audio and visual data

- Space applications: Telemedicine supports immediate need for medical treatment in space where there is an obvious lack of physicians and medical specialists. Therefore, NASA (the National Aeronautics and Space Administration) has put much effort into using telemedicine and developing telemetry devices to monitor vital signs of astronauts from Earth (Adler, 2000).

- Emergency and Disaster applications: Disasters (earthquakes, floods, wars, etc) occur regularly and result in many deaths and refugees. In 2002, more than 44 people died in the earthquake in Turkey and 318 were injured (Benner, Scachinger, &Nerlich, 2004). Telemedicine, and telemedicine via satellite in particular, are the most efficient solution in such situations. This was also the case in the Republic of Rabaul in 1994, when a volcano hit, causing severe

damage. The only way for the people to get help was by using telemedicine through a satellite connection (Dario et al., 2004). It became clear that telemedicine and technology application in emergency scenarios are promising tools for the future, and their application will create a new era of providing healthcare and monitoring in disaster and trauma situations.

- Prisons: Telemedicine in prison is well established in many places, especially within developed countries, where prison populations are increasing and the need for healthcare in prison is requested more than before (Dario et al., 2004).

  Many prisons are located in remote areas and have a large number of older offenders. There is a need to provide healthcare to prisoners within a safe and secure environment, with full awareness of public security and safety (Dario et al., 2004). Telemedicine is considered as the best solution to provide healthcare services in prison, because it saves money and time for transporting prisoners to hospitals and it guarantees security for the public (Parson, 1994). In addition, telemedicine in prison can be used to provide prisoners with teaching programmes to support their talents and educational levels, so prisoners may become more active and useful people in society.

- Education: Telemedicine can support education in various ways, such as teaching students (Distant Learning), giving training and courses to nurses, online conferences to exchange knowledge between doctors and physicians, and providing patients with healthcare knowledge programmes.

Telemedicine applications are not limited to the above and there are many fields that can benefit from telemedicine and its applications (such as aeroplanes, mountain climbers). Developed countries utilize telemedicine more than developing countries (Martinez et al, 2004) due to many factors (funding, infrastructure, etc). This will be discussed in this research.

The next section will describe the state of telemedicine in industrial (developed) countries and how it is adopted and used.

2.3 Telemedicine in Developed Countries

2.3.1 Introduction

Telemedicine has proven that it is an effective means to provide a high quality healthcare service to rural and remote areas (Martinez et al, 2004). Developed countries have been using technology in healthcare systems for more than twenty years before developing countries, and their experience has been increasing significantly due to the availability of resources and encouragement from the public and private sectors (Elaine, Facchini & Maia, 2004). The main factors that have helped the deployment of telemedicine projects in developed countries have been the availability of funding and technology infrastructure, which have had a role in creating many telemedicine projects that contain high-tech and expensive equipment (Wright, 1998). It is suggested that there is a moral responsibility for the developed countries to help and support developing countries in applying telemedicine; they might help by providing inexpensive telemedicine equipment, until developing countries can fund their own projects (from tax, private sectors, etc) (Wright, 1998).

Telemedicine in developed countries is currently focusing on providing healthcare service to patients in their homes to manage chronic disease and elderly people during their daily activity (Heinzelmann, Lugn & Kvedar, 2005); this is possible due to the availability of healthcare resources and the robust infrastructure.

Although funding and infrastructure are available, no country can provide a fully-equipped hospital with high technology in every place in the country. Small clinics with inexpensive equipment can connect a patient to a specialist. Moreover, the cost of healthcare services, travel costs and hospital expenses are significant in developed countries, it should be paid by the patients, and this makes the role of telemedicine evident in this situation; it reduces the cost for patients as they will be connected via the means of telecommunication, furthermore, there is no need to pay travel expenses or hospital bills. This has helped to increase the interest in telemedicine in recent times in the developed countries, and led them to work hard to improve the healthcare delivery to their patients and to the rural and remote areas.

The European Commission has spent more than 305 million US dollars over an eight year period to support different types of telemedicine projects (Wright, 1998). The

governments in developed countries are making significant efforts to encourage the adoption of e-health and telemedicine applications. The NHS in the UK spent £1.3 million in 2008 to look at the effects of digital technology in delivering high quality healthcare services to its patients (DoH, 2009). According to the Department of Health (DoH) report in the UK in 2008, the DoH provided £31 million to support the innovation of technology such as telecare and telemedicine, including £12 million grant for i4i (Invention for Innovation Programme) which provides a new investment and improves identification of promising healthcare technologies (DoH, 2009).

2.3.2 Issues Facing the Application of Telemedicine in Developed Countries

There are some issues that have been raised by telemedicine in developed countries such as privacy and confidentiality. Telemedicine practice was inhibited in the past by the law, because of the patient privacy issues and medical licensure. For example, in the USA, doctors cannot consult with patients in a different state unless the doctor is licensed to practise in that state. Therefore, the State Medical boards from different States have come up with a few solutions to ease the licensure barriers between them, in order to facilitate the practice of telemedicine (Kumekawa, Puskin & Morris, 1997).

Privacy is an issue that is facing the application of telemedicine in developed countries, for example, in some cases, patients' records need to be shared between more than one state in the USA. A conflict between States and federal laws relating to the privacy and confidentiality of the patient's record will appear, (Demiris, 2003).

Developed countries have utilized telemedicine and have benefited from it. The next section will show the developing countries' experience with telemedicine and the need for its application in those countries.

2.4 Telemedicine in developing countries

The developed countries have applied telemedicine and have benefited from it. They face some problems, but they have utilised it effectively. In contrast, developing countries are experiencing a difficult situation; infrastructure is poor, healthcare services are limited and there is a significant shortage of doctors and medical staff. Developing countries need to learn from the experience of the developed countries in order to develop their technology utilisation in the healthcare field (Elaine, Facchini & Maia, 2004).

An essential factor that prevents the spread of telemedicine in developing countries is the lack of knowledge about technology and internet use by doctors and patients. The number of internet users in developing countries is increasing over time, but the number of internet users in industrial countries remains higher **(**Chen, Boase & Wellman, 2002**)**. In general, people in industrial countries are more familiar with the internet and technology, it is an essential part of their daily lives; a way to pursue their business, do online banking, pay bills, do online shopping and so on. In contrast, the internet cost is high in developing countries, and so people have lost interest in using the internet and resorted to alternative methods.

Developing countries have economic deficits, limited resources and many other factors that are preventing them from supporting a telemedicine project (Heinzelmann, Lugn & Kvedar, 2005). The absence of technology and internet utilisation in developing countries makes it harder for people to accept the idea of telemedicine because they have a fear of changing to use new technology **(**Chen, Boase & Wellman, 2002**).**

The lack of knowledge about the role of technology and internet use in telemedicine applications will lead to a shortage of funding, because the decision makers and those responsible will not sponsor such a project if they do not have a full understanding of the benefits that they will gain from it (Törnqvist, 2000). Healthcare providers and decision makers should be offered seminars and conferences about the advantages of telemedicine and its applications, because decision makers are the key to the introduction of telemedicine and they can convince their government to support telemedicine and to pay more attention to it.

Seminars and conferences also need to be offered to doctors and patients to avoid resistance from both sides. Some doctors assume that telemedicine will end their freedom and limit the choices they have in their practice; for example, many doctors believe that patients should be physically present with the doctor, in order to establish good contact and to give an accurate diagnosis, especially with skin and eye diseases (Miller, 2003).

Another barrier is time and money; doctors claim that telemedicine wastes their time and money, because it takes less time to diagnose patients by usual methods and a longer time to diagnose them via telemedicine. Many doctors fear changing to new technology and computers, especially the elderly, as they retain many of the ideas that they learned years previously and they found these more efficient (Törnqvist, 2000). Likewise, many patients agree with the idea that they should be present with the doctor at the same session, because they feel more comfortable to talk to the doctor face-to-face. Moreover, some patients like to deal with doctors from the same cultural and religious background in order to avoid any kind of misunderstanding, regarding culture and religious principles (Miller, 2003).

It is essential for developing countries to promote telemedicine through campaigns and conferences so people will appreciate the services that telemedicine can offer, in addition to courses to educate people and teach them how to use computers and technology from a young age. In this way they will become more familiar with this technology and become more open-minded about any changes related to new technology in the future.

Developing countries have many problems that are preventing them from deploying telemedicine and its applications, while developed countries overcame most of these problems and they are utilizing telemedicine effectively.

The next section will discuss the differences between the application of telemedicine in developed countries and developing countries.

2.5 Differences in the application of telemedicine in developed and developing countries

There are large differences between the application of telemedicine in developed and developing countries. This is mainly due to the dissimilarity of the available resources; developed countries have good resources that support telemedicine and its applications. On the other hand, developing countries are suffering from a lack of resources, that is why they are not able to utilise telemedicine effectively.

In addition to connecting patient and doctor, developed countries are also now using telemedicine to provide healthcare services to patients at home (health monitoring), whereas in developing countries where the infrastructure is poor and the healthcare service cannot be easily accessed, the main purpose of telemedicine remains only to connect patients to healthcare staff to provide diagnosis and referral to hospital (Heinzelmann, Lugn & Kvedar, 2005).

The deployment of telemedicine in developing countries is essential where patients find it hard to travel to the nearest clinic or hospital. For example, telemedicine will provide help in Ghana (in Africa) where there is a shortage of doctors and healthcare services; patients need to travel miles by foot to the nearest hospital, which serves around 800.000 people (Rao & Lombardi, 2009). Moreover, telemedicine can offer them help regarding skin diseases, as there is only one dermatologist for every 4 million people (Rao & Lombardi, 2009).

The need to apply telemedicine in developing countries is essential and is important because of the help that it can provide. The same situation exists in rural areas in developed countries, but the availability of funding and infrastructure is better allowing governments and the private sector to implement many telemedicine projects.

There are several examples where developed countries successfully applied telemedicine project such as Denmark (Northern Europe) which has a population of 5.3 millions. It started utilising information technology in the medical field from the 1980s. It made efforts to facilitate the use of IT and improve it by providing sufficient funds, and in 1997, the MedCom2 project was approved to develop the communication standards and establish telemedicine pilot projects (Protti & Johansen, 2003). Another example is Canada, as there were some problems facing the application of telemedicine in their remote areas, but they found that the adoption of telemedicine is promising and it will provide help to facilitate the delivery of healthcare services (Jennett, Yeo, Pauls & Graham, 2003).

Other examples would include Australia, Austria, England, Germany, New Zealand, Norway, Scotland and Sweden (Protti, 2007).

Table1 (WHOSIS, 2006) shows some examples that illustrate the difference between the developed and developing countries regarding economy, available resources and expenditure on health.

Location	Gross national income per capita (PPP international $,2006)	Population (in thousands) total, 2006	General government expenditure on health as percentage of total government expenditure (2006)	Hospital beds (per 10 000 population)	Year	Per capita total expenditure on health (PPP int. $,2006)
Ghana	1240	23008	6.8	9	2005	100
Nigeria	1410	144720	3.5	5	2004	50
Chile	11300	16465	14.1	23	2005	697
USA	44070	302841	19.1	32	2005	6714
Egypt	4940	74166	7.3	22	2005	316
France	32240	61330	16.7	73	2005	3554
Italy	28970	58779	14.2	40	2005	2623
UK	33650	60512	16.5	39	2004	2784
Nepal	1010	27641	9.2	2	2001	78
Australia	33940	20530	17.2	40	2005	3122

Table 1: Comparisons between developed and developing countries

The table draws comparisons between developed and developing countries, and shows the difference between them with regards to funds, available resources and the expenditure on health. In Ghana the total expenditure on health per capita is $100 whereas it is $3122 in Australia. These facts show one of the difficulties that the developing countries are facing with the application of telemedicine.

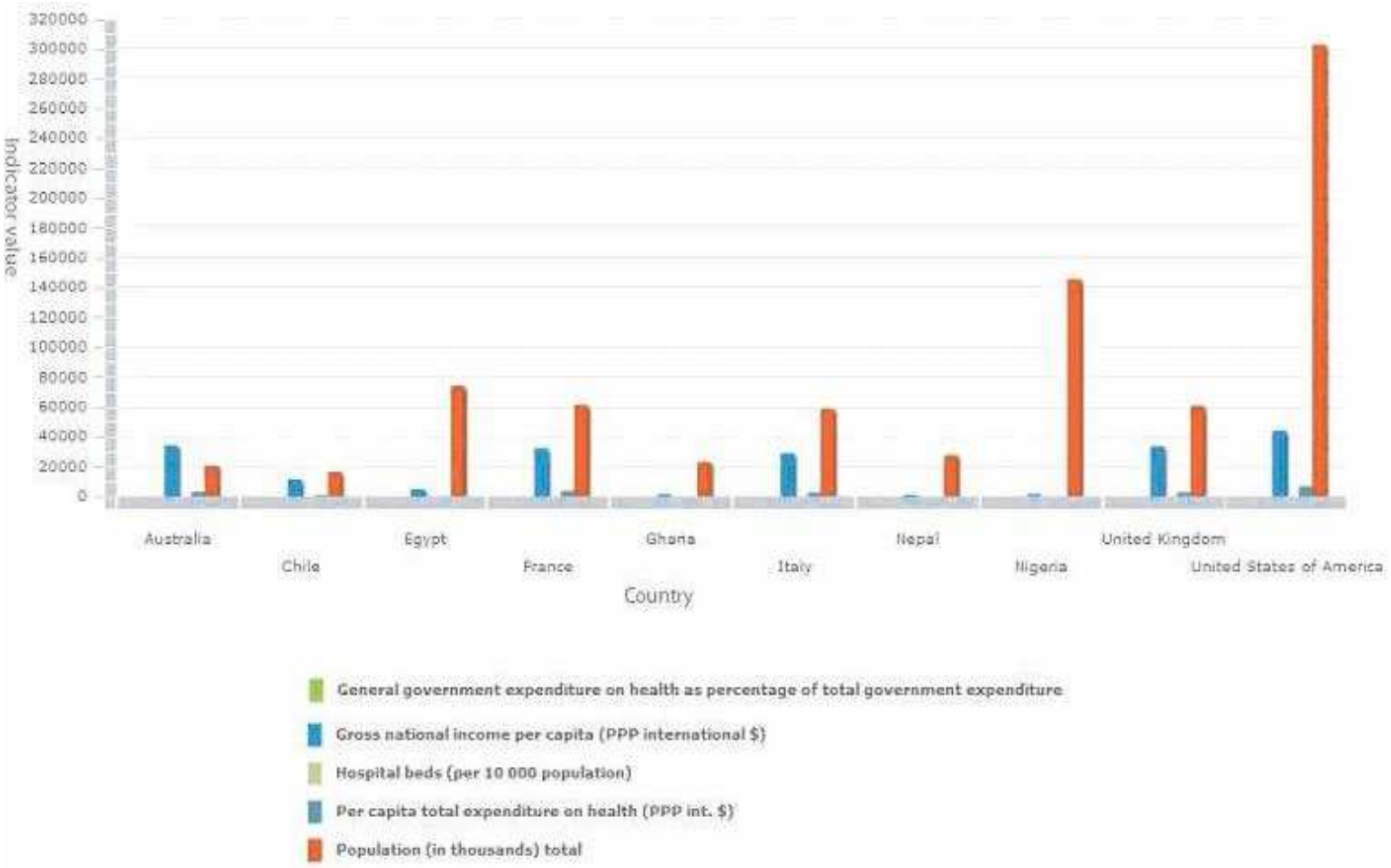

Figure 2: Difference between the available resources of developed and developing (WHOSIS, 2006)

The application of telemedicine is facing almost the same problems in developed and developing countries; these vary between technical problems (computer, networking) and organizational problems (resistance, lack of knowledge). Health organisations (including WHO) are making efforts to introduce telemedicine and its applications, but there should be more multi-discipline efforts and co-operation from doctors, patients, decision makers, private sector and governments in order to successfully apply telemedicine in both developed and developing countries. Although having some disadvantages, telemedicine has more benefits, which are described in the next section.

2.6 Advantages of Telemedicine

Telemedicine has proven to be an effective means of providing healthcare services to millions of people who suffer from different kinds of diseases. Although some consider that telemedicine has no disadvantages most would accept it has a few (Spring, 2008).

There are many examples where telemedicine has provided significant assistance to patients at a distance and saved cost and time

2.6.1 Telemedicine in military and wars

Globally, armed forces of different countries have employed different applications of telemedicine. Telemedicine has been found to be an effective means in wars as it can assist the military by providing different healthcare facilities including biosensors, bringing immediate responsiveness to patients needs and consultative services (Maheu, Whitten and Allen, 2001). Furthermore, telemedicine is being widely used to identify injury and illness and provide aid in the treatment to injured soldiers who are isolated by geography (Girard. 2007).

2.6.2 Telemedicine in disasters

The use of telemedicine can have a major role in disasters because it can provide different services, including monitoring of the medical situation and consultative support for the medical staff working in the disaster areas (Kobrinskiy and Petlakh, 2009).

Pakistan has gained the benefits of the telemedicine and realised the significant role of it during the 2005 earthquake, where telemedicine provided specialist care to the affected areas (Malik, 2007).

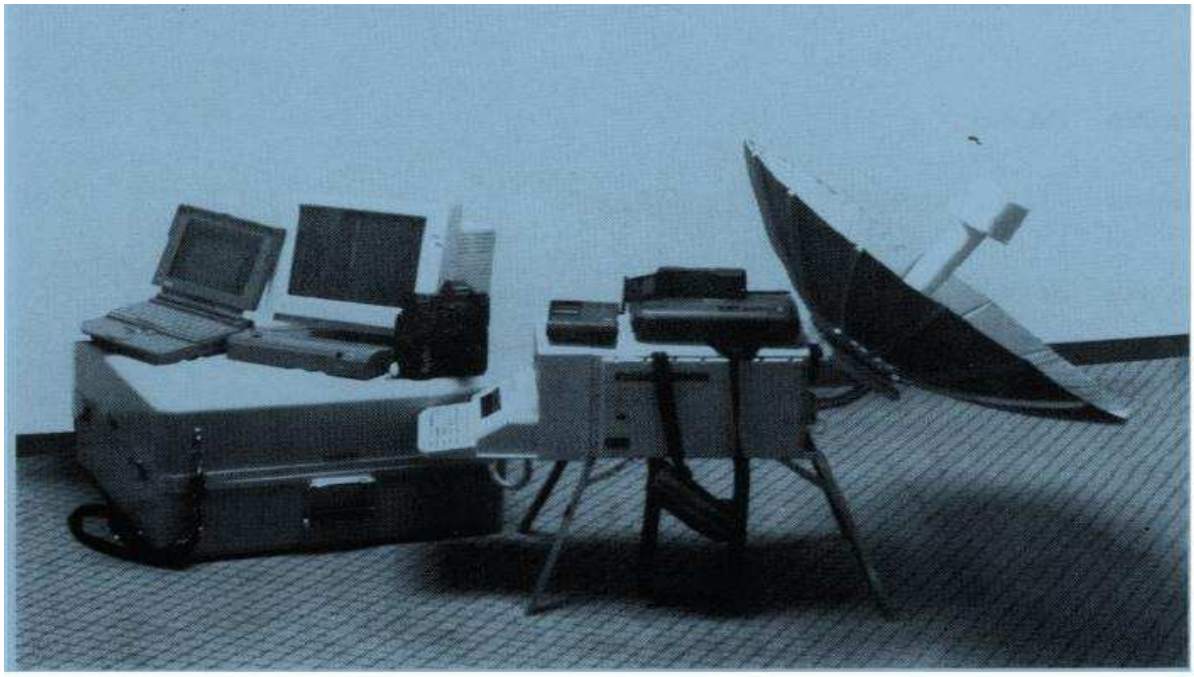

Figure 3: Telemedicine system includes laptop computer, colour monitor, high resolution digital camera, satellite transceiver, portable facsimile machine, portable text printer, and cordless telephone (Crowther & Poropatich, 1995).

2.6.3 Bridging the distant gap with remote areas

Telemedicine has obvious advantages in remote and rural areas as it obviates the need for healthcare specialists and patients to travel. In addition, telemedicine may provide reliable healthcare services that are cheaper than the conventional practice (Craig and Patterson, 2006).

Verizon in the USA has launched a telemedicine project in New Jersey to deliver a new service which offers integrated audio, visual and video communication. The service facilitates remote real time connection between healthcare providers and patients, allowing them to provide good access to specialist services, monitor patient health more closely , and provide training courses to medical professionals (Merrill, 2009).

Moreover, the adoption of telemedicine has provided significant assistance to China and saved time and money for their patients by establishing a telemedicine project using mobile telecommunication. China has 70% of its population living in rural

areas. In 2004, the Beijing Health Administration, Motorola and MedDay established a telemedicine project using mobile telecommunication (RegPoint) to support people who suffer from high blood pressure and diabetes. The purpose of this large project is to link doctors with patients and transmit their medical data (including blood pressure and blood glucose) via the Motorola A760 mobile phone. 300 patients took part in this project within a six month time trial (Wang & Gu, 2009).

Furthermore, telemedicine has brought a significant value to healthcare in New Mexico, the fifth largest state in the USA, where almost half of the population live outside metropolitan areas and access to healthcare services is a major challenge (Alverson et al., 2004). The adoption of telemedicine has diminished professional isolation, reduced the need for travel, enhanced the access to healthcare facilities and improved the health quality of its people (Alverson et al., 2004). Furthermore, New Mexico has utilized telemedicine to provide training and educational courses to students via a three dimensional virtual system. It gave the students the ability to interact with virtual character and geographically disperse students (Hilty et al., 2006).

2.6.4 Saving time and cost

Telemedicine has provided major assistance to deliver healthcare service to remotely located patients in Alaska. More than 50% of the patients are located in remote villages and need to fly to seek medical treatment, this travel cost them money and time for their medical tests evaluation. Some patients had serious problems that went unrecognised while they awaited their evaluation.

Store and forward telemedicine allowed physicians to send images and clinical data to regional colleagues, which significantly reduced waiting time and improved access to quality healthcare services. Furthermore, the use of telemedicine saved travelling for 79 cases out of 91, saving $55.437 of travel coast (Kokesh, Ferguson and Patricoski, 2004).

Similarly, Croatia saved 400,000 km of distance travelled after three years of the application of their teleradiology system in 1998. The system connected 34 CT (Computed Tomography) and MRI (Magnetic Resonance Imaging) scanners in 29

hospitals with a referral centre in the neurosurgery department in Zagreb. After scanning, the image is sent to the radiologist to write their report and to the referral centre to get a second opinion. It is then returned to the remote centre where the radiologist will perform any further action required. In this way, the project overcame the lack of specialists including radiologists in remote centres, and saved the patient time by avoiding the travel from the remote centre to the referral and vice versa (Mark et al., 2009).

Baldwin et al. (2003) reported that in a 30-month study, telemedicine can significantly reduce the time of consultation. The study examined pathways of care to determine the efficacy of technology to provide the patient information to the consultant prior to the consultation session. As a result, the consultation time was reduced by 13 minutes for 30 patients who participated in the study. Moreover, this telemedicine clinic was a good opportunity for health professionals and the consultants to work as a team.

2.6.5 Providing second opinion

Telemedicine can offer more than time and money saving for patients; it can bridge the distance gap and provide the medical staff with educational and training courses.

In 1999, Mayo Clinic (USA) and United Arab Emirates utilised these benefits that telemedicine can offer and established a telemedicine project to provide a video communication link between the Al-Mafaraq Hospital, Mayo Clinic and its collaborating institutions in Minnesota, Florida and Arizona. The project offered a good chance to the physician at the Al-Mafaraq Hospital to exchange medical data with the experts at the Mayo Clinic and get a second opinion about their patients (WHO, 1999).

In another example, Pune district in India has established a telemedicine project in partnership with a global health portal and Tata Council for Community Initiatives to provide healthcare services to those who live in interior villages. The project connects 88 primary healthcare centres to doctors and specialists in major cities in order to seek second opinion (Samaddar, 2007).

2.6.6 Saving the environment

Some suggest that telemedicine might have an impact on the environment by reducing CO_2 emission by reducing the amount of travel on the part of patients and the doctors going to and from clinics and hospitals.

In September 2005, a telemedicine project was launched in Wales (UK) in order to assist multidisciplinary teams to improve cancer services using video conferencing; the team included different experts including physicians, nurses, surgeons and support staff. They utilized telemedicine to hold virtual meetings instead of travelling and attending the meetings in person. An evaluation has been made to assess the environmental impact of using video conferencing in 2006. The result was that 60 people used video conferencing to attend 21 meetings, which avoiding 18000 km of car travel saving £4400 in travel expenses, which in turn was equivalent to saving 1696 kg of CO_2 emissions (Lewis, Tranter & Axford, 2009).

2.7 Disadvantages of Telemedicine

Despite the benefits that telemedicine can offer, some people argue that telemedicine has many disadvantages.

2.7.1 Strips the humanistic quality from medicine

Evans (1993) believes that using technology in the medical field can strip the humanistic quality from medicine; physicians will make their decision relying on medical instruments and will neglect what the patient really feels. This can raise the issue that telemedicine may be mechanistic and will obstruct the growth of the personal relationship between physician and patient (Sisk & Sanders, 1998).

2.7.2 Will not replace a doctor

Telemedicine will not replace the valuable discussion between doctor and patient; doctors can determine several symptoms by reading the body language of the patients, also patients feel more comfortable if they talk to the doctor face to face (Spring, 2008).

2.7.3 Culture misunderstanding

There are some concerns that telemedicine may connect the patient with a doctor from a different background, and cultural issues (traditions and religion) may cause misunderstanding between them so the patients may not feel comfortable with the way in which the doctor is diagnosing them (Miller, 2003).

2.7.4 Privacy and licensure

Issues relating to privacy, confidentiality, and licensure are generating debate and anxiety. In the USA, policies related to telemedicine in one State may differ from those in other State. This can prevent connection between participants from different States; the doctor cannot practice in a State unless licensed in that State. This is the same for nurses, physicians, and other health professionals (Field, 1996).

Telemedicine has many advantages and disadvantages; the balance depends on why it is applied. Telemedicine will not solve all problems of the health services, and the need for telemedicine should be established prior to its application, or the project will fail

2.8 The Role of Telemedicine in Developing Countries.

Many developing countries are recognizing the importance of telemedicine and the potential role that telemedicine can play in order to improve the quality of healthcare services (Edirippulige et al., 2009).

This section will provide examples of how telemedicine has already achieved advantages in developing countries and rural areas.

Telemedicine has a role to overcome the shortage of doctors in rural and remote areas, for example South Africa, with a population of 48 million; had in 2004, 240 Cuban doctors and 1000 more from other countries, due to the lack of doctors in hospitals in rural areas. Studies show that doctors are not willing to work in hospitals in rural areas because of the low salaries and professional isolation (Mars, 2009). Using telemedicine in such situation can facilitate collaboration between professionals and provide continuing education, case conferencing, support for local treatment and management and ability to participate in regional meetings.

Ghana also has a severe deficiency of doctors and medical services. Located on the West coast of Africa with a population of 23 million people, the transportation system is very poor and patients who need a medical doctor need to travel by walking to the nearest medical centre or hospital, which might serve around 800 thousand people (Rao & Lombardi, 2009).

In Nepal (South Asia), one of the poorest countries in the world, telemedicine has bridged the distance gap for the people who live in remote areas as they suffer from shortage of specialists and poor healthcare services. Patients need to travel for long distances to the capital, Kathmandu to seek medical diagnoses or treatment, facing all the costs and the travelling hardships (Graham et al., 2003).

In 2000, a telemedicine pilot project was launched in Patan Hospital, Kathmandu to study the efficiency of low-cost methods of telemedicine (store-and-forward technique). Despite the problems that occurred during the project, such as the delay in sending the referrals due to the poor internet connection, the result of the study was promising: It was technically feasible; it was a good means to provide expert medical advice from a distance; and it was a powerful educational medium (Graham et al., 2003).

In addition, telemedicine can provide an essential help by providing educational and training courses to the public and to the medical staff, and it can be a good means to exchange information between doctors, especially for those in remote and rural areas. Telemedicine has been proven to be efficient in such situations by the project that has been established by Dr. Fred Binka (University of Ghana); his Research Centre is located in Navrongo, a 12-hour drive from the capital, Accra. The main goal of his telemedicine project was to educate people and exchange information about patients. The result from the trial was a reduction in deaths from Malaria in children under the age of five by one-sixth in Ghana (ITU, 1996).

Telemedicine projects can sustain collaboration between the public and the private sectors. This was evident in the project which was established in Madaba, South Jordan; the project was launched by the collaboration between the HeartBeat Centre

and the Ministry of Health. 515 electrocardiography calls have been received by the HeartBeat centre due to typical and atypical chest pain and advice provided 90% of these cases would have been referred to Nadim Hospital, which is the nearest hospital serving the people in Madaba. The project has saved the time of the specialists in addition to the cost of 300 referrals, X-rays and other services. The project has strengthened the relationship between the private and the public sectors, and it was a good step towards more public-private projects that will be useful to improve the quality of the health service in Jordan (WHO, 1999).

2.8.1 Why Developing Countries?

The need for and the use of telemedicine is crucial for the future of healthcare services in rural and remote areas, and it will facilitate the delivery of these services in a convenient way to the people in need. Adopting telemedicine can overcome the barriers of cost, distance, lack of medical experts and poor distribution of services and provide to many the facilities that are only available in urban areas. It can support medical staff that work in remote and rural areas by overcoming the professional isolation by offering education, clinical support and improved communication for meetings.

There is a lack of knowledge and understanding and so decision makers need to support the adoption of telemedicine by providing distance learning courses, conferences, seminars and commercial campaigns to inform people and healthcare providers about the benefits that can be gained.

There is a great similarity between developed and developing countries in terms of circumstances (rural, remote, professional isolation, distance, etc), and developed countries have well established programmes that demonstrate solutions. There are very few similar solutions in developing countries (see 2.8). It is known thatsolutions can work, but they are not widespread, mainly due to the lack of resources including human and funding.

Developing countries should exploit the telemedicine experience of the developed countries to help overcome the lack of medical staff in the large rural and remote areas. Moreover, this will require serious effort from the public and private sectors in

addition to the support from the health organizations such as WHO (World Health Organisation). In addition, there is a need for a "*Global Telemedicine Society*" which can be responsible for spreading telemedicine services across the borders, and can provide those services to the countries that are in need (Clarke, 2007).

2.9 Developed and Developing Countries

This section will distinguish between different types of developing countries. This distinction is important because in terms of economic development, infrastructure, levels of skill and financial resources there is a wide variation between developing countries, which creates very different barriers for telemedicine. Furthermore, there are differences at the political system, geography, etc. Therefore the distinction on only developed/developing is not sufficient, and development should be seen as a continuum. For example, some countries deemed at the top end of the continuum may not have a continuous supply of electricity, or a more advanced developing country may be more similar to a developed country and although it might have the infrastructure and skills, it lacks the funding or support for telemedicine.

Several parameters are used to distinguish between developed and developing countries such as "rich and poor", "high income and low income" and "industrial and agricultural". Archibugi & Coco (2004) categorise countries into four groups based on the technological capability of each country including; creation of technology, technological infrastructures and development of human skills. The four groups are:

- Leaders: Countries able to create technology innovations and keep them growing over time, such as USA, UK and Japan.
- Potential Leaders: Countries able to achieve some innovations, and have invested in developing human skills and standard technological infrastructures, such as Greece, Argentina and United Arab Emirates.
- Latecomers: The largest group which comprises countries that try to improve their technological progress in parallel to the formation of human skills, such as China, India, Malaysia, Jordan and Syria.
- Marginalised: Composed of marginalised countries that are poor in technology and human skills, and do not have full access to even the basic technologies such as electricity and telephony, such as Nigeria, Nepal and Sierra Leone.

Adams (2001) has also divided countries into four categorise, based on the income of the country (per capita): Low (US$755 or less), Lower middle (US$756-US$2995), Upper middle (US$2996-US$9265) and High (US$9266 or more).

There is a wide range between countries in the high income (leaders) compared to the low income groups (marginalised), although some of these countries are at the beginning of their development process whilst others are growing rapidly. Some countries still have a large rural population engaged in agriculture whereas others have some of world's largest growing cities.
Jordan and Syria fall into this third category of country. According to Archibugi & Coco (2004), Jordan and Syria are included in the latecomers group as both are trying to improve their technological progress in parallel to the formation of human skills. And according to Adams (2001), Jordan and Syria belong to the upper middle group since the per capita income for each country is over US$4100.

For the purpose of this research, Syria and Jordan will be classified by the definition of Adams (2001) as it is measured objectively and will be classed as upper middle income developing countries.

The findings of this research should be applicable to countries at a similar level of economic development, infrastructure, human skills and financial resources, which includes other upper middle income developing countries and may also extend to some lower middle income countries.

2.10 Review of Current E-Health Readiness Frameworks

This section considers the research previously conducted on creating e-Health readiness frameworks with a view to defining a framework that might form the basis of a tool to assess the readiness in specific e-Health areas in Jordan and Syria. The section describes the three frameworks that influenced the study.

Jennet et al. (2003) readiness framework aims to identify the main factors that affect the adoption of telehealth in rural and remote areas in Canada. Sixteen semi-structured interviews were made with four sets of stakeholders, patients, practitioners,

organisations and public to examine the social, political, organisational and infrastructure factors that affect the e-health readiness in those areas.

Wickramasinghe et al. (2005) framework aims to assess the readiness and preparedness of countries. It highlights the key elements that are required for successful e-Health initiatives. It provides a tool that allows analysis beyond the quantifiable data into a systematic synthesis of four main impacts and four major prerequisites

Khoja et al. (2007) framework aims to test the reliability of e-Health readiness evaluation tools for both healthcare providers, and managers who work in healthcare institutions in developing countries. Each tool contains four categories of items to determine if an organization is well prepared for E-health service implementation.

2.10.1 The description of the frameworks

The Jennet et al. (2003) study took place in rural Canada.

The study found four main types of readiness:

- Core Readiness: Refers to the satisfaction and dissatisfaction with the current situation.
- Engagement Readiness: Refers to the involvement of people in the e-health concept, assessing the risks and advantages and disadvantages of telehealth adoption.
- Structural Readiness: Considers the quantity of data needed to establish an efficient structure as a foundation to build a successful telehealth project, including human, training and funding.
- Non-Readiness: Refers to the lack of need or failure to recognize the necessity of change and apply telehealth technology.

There are six main themes identified within each type of readiness:

- Core readiness: Recognizing the need for the service with dissatisfaction towards the current circumstances.
- Structural readiness: Concerned with whether the organization has appropriate equipment and human resources that can lead to a successful telehealth service, or might easily be modified.

- Projection of benefits that telehealth can bring such as improve access to services, reduce the need to travel and enhance professional education.
- Assessment of risk including loss of face to face contact, financial risks and inability to obtain reliable information.
- Awareness and education: Understanding telehealth and its related applications, the benefits and the limitation.
- Intra-group and inter group dynamics: Refers to the communication and cooperation between the community groups.

The framework suggested methods to determine overall readiness categorisation. It mainly assists the organisational, health provider, public and patient readiness for e-Health. It did not study the technical and infrastructure issues in depth. However, tool reliability has not been assessed and the study provides little information regarding demographics or current technological practices (Li et al., 2008).

The Wickramasinghe et al. (2005) framework consists of four prerequisites with four impacts, together with the implications of these prerequisites and impacts to the goals of e-Health.

The main four prerequisites:

- Information communication technology (ICT) architecture/infrastructure: Refers to ICT infrastructure including phone lines, fibre trunks and submarine cables as well as satellites, earth stations and teleports
- Standardisation policies, protocols and procedures: As telehealth can bridge the distance gap and can connect many different parties together, significant amounts of document exchange and information flows must be accommodated. Standardisation can be the key for this, like using a universally accepted protocol such as TCP/IP.
- User access and accessibility policies and infrastructure: Refers to the access to internet services and the access to e-services. Developing countries will consider providing e-Health as a challenge as a large part of the population can not afford to join e-commerce services, and will have little computer literacy. It is important that the user will not only be familiar with computer but also with the internet and e-services.

- Governmental regulation and control: The key challenge in this case is cost effectiveness, functionality ease of use, and information security.

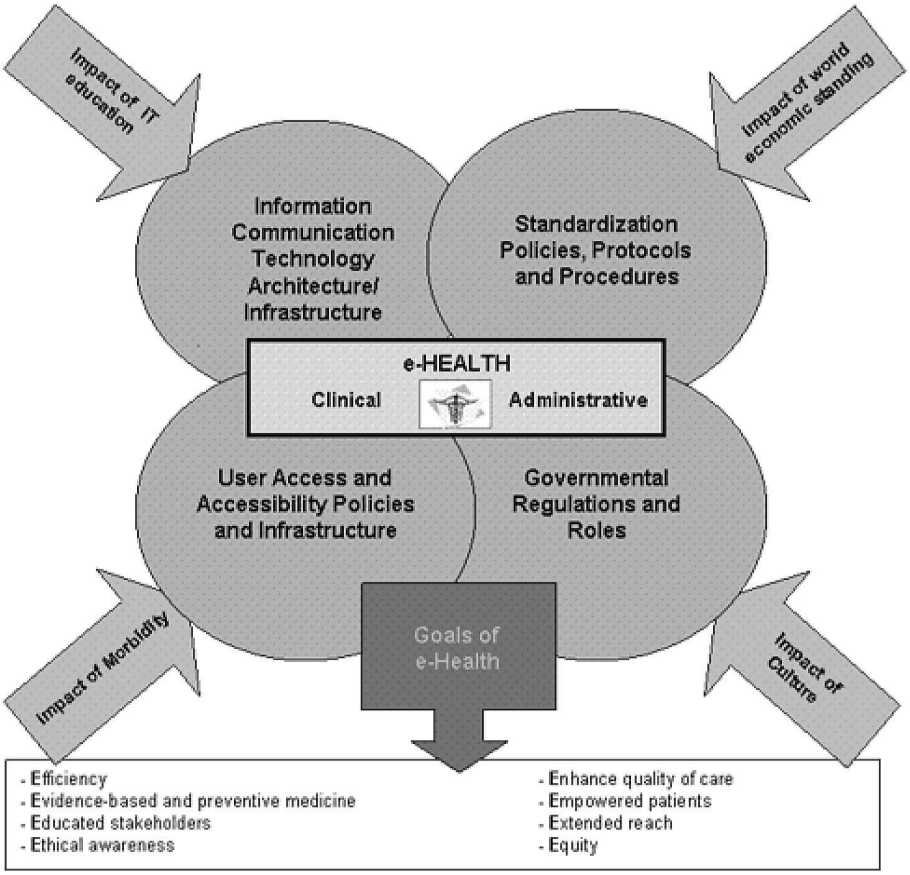

Figure 4: "Framework for assessing a country's/region's e-health potential". (Wickramasinghe et al., 2005)

And the main four impacts are:

- Impact of IT education: Well educated people can facilitate the adoption of technology to provide more effective services such as telemedicine.
- Impact of morbidity rate: Refers to the relationship between health education and the overall health standing of the country. A more health conscious society is more likely to embrace e-health initiatives.
- Impact of cultural/social dimensions: Refers to culture and tradition issues and the related factors that can affect it such as language and religion.
- Impact of world economic standing: The critical role of the internet is the economy of a country, and how this will help to form a bridge between a traditional healthcare present and a promising e-Health future.

The Wickramasinghe et al. framework can assess the e-Health readiness of a country based on multiple perspectives including technical and cultural by examining both the prerequisites and the impacts, and it can also assess the ability of a country to maximise the utilisation of e-Health systems.

Khoja et al. developed tools that each contains four categories of items in order to assess the readiness of an organisation for the adoption of e-Health system.
The categories for the Healthcare providers are:

- Core readiness.
- Learning readiness
- Societal readiness and
- Policy readiness

The categories for the Managers are:

- Core readiness.
- Technological readiness
- Societal readiness and
- Policy readiness

Considering these issues before developing any e-health readiness assessment tools will provide the planner with a comprehensive idea about the adoption of a particular e-health service that will facilitate good access for staff and different clients in developing countries, and this can play a potential role by supporting e-Health adoption in developing countries.

2.10.2 The influence of the frameworks on this study

Table 2 **s**hows the main points in each framework that influenced this study.

Author	**Issues considered**
Jennet et al., 2003	- The aim of the study was to identify the main factors that affect the adoption of telehealth in rural and remote areas. - Semi-structured interviews used as data collection method.

	- Includes social and technical issues - Involves the people opinion to assess the advantages and disadvantages of telehealth adoption.
Wickramasinghe et al., 2005	- Considers the impact of ehealth adoption on the education and the culture issues. - Consist of issues that should be considered prior to the application of ehealth system.
Khoja et al., 2007	- The aim is to test the reliability of E-Health readiness evaluation tools in developing countries. - Includes social and infrastructure issues - Considers issues prior to the development of any ehealth system. - Evaluation tools for both Managers and healthcare providers.

Table 2: Main points that influenced the study

There are other e-Health readiness frameworks in the literature, but the above frameworks were the most that influenced this study since they include several factors that are directly related to this research.

The Jennet et al. framework took place in rural Canada; it considers core readiness (refers to the recognition of needs and expresses satisfaction with the current situation) which was neglected in the Wickramasinghe et al. framework. Also, the Khoja et al. framework aims to test the reliability of e-Health readiness evaluation tools in developing countries. These frameworks had significant influence on the current study as their components reflect the organisational and the healthcare providers perspectives. Additionally, the Khoja et al framework aims to assess the societal factors and to determine the situation of the existing infrastructure. The Jennet et al. framework is more comprehensive in terms of the evaluation scope and it examines social, political, organisational and infrastructure factors.

This study considers the social and infrastructure factors but it does not talk deeply about political factors. Moreover, the Wickramasinghe et al framework influenced this study because it concerns three domains related to the e-Health readiness:

practitioner, organisation and public. These are the major domains that are required for successful telemedicine systems in the current study.

The three frameworks have influenced the current study, but none of them is sufficient to explain the particular circumstances in Jordan and Syria. Relevant components of these frameworks will be incorporated into two new guideline frameworks that will be informed by the data collected in Jordan and Syria.

Chapter Three: Research Methods

3.1 Introduction

Telemedicine is a means by which high quality healthcare services can be provided to rural and remote areas. It can connect patients with specialists from many different locations. The method has proven its effectiveness across many applications, including clinical, emergency, disaster and prison. In addition, it can help to overcome the barriers of cost, travel and lack of medical expertise in a given area.

The main purpose of this research is to identify the factors that affect the use and adoption of telemedicine in developing countries and rural areas, and to study deeply these factors in the Hashemite Kingdom of Jordan and the Syrian Arab Republic. It will also develop a guideline framework that might be applied to any telemedicine project at the pre-implementation phase in each of these countries.

In order to obtain data for the study, the researcher sought opinions from all perceived key stakeholders, including doctors, technicians, engineers and decision makers. Data was collected through interviews with the key stakeholders, and questionnaires were completed by people including patients, to ensure that the opinions of people from complete set of backgrounds were included.

The research had ethical approval from The Brunel University Research Ethics Committee. An Ethical Approval Certificate was issued and was presented to the key stakeholder before their interview.

3.2 Research Approach

There are a number of different types of research methodologies which can be used under either a positivistic (quantitative) or phenomenological (qualitative) paradigm.

3.2.1 Qualitative Paradigm

The qualitative paradigm deals with "*social sciences deal[ing] with action and behaviour which are generated from within the human mind*," (Collis and Hussey, 2003).

The researcher will deal with the social world and will make contact with people in order to investigate the factors that prevent the use and spread of telemedicine in

Jordan and Syria. The researcher will study the current situation of the countries, undertake in depth investigation with the key stakeholders to determine perceived barriers, construct guideline frameworks and then evaluate them with the same stakeholders. The researcher can not be separated from what he is investigating and the outcome of the study will affect opinions that will affect the reality, and this is why the study will follow the qualitative (phenomenological) approach in order to achieve the required aims.

Qualitative data analysis has a few drawbacks; it is time consuming and depends significantly on the knowledge background of the researcher. The researcher took these drawbacks into account, and tried to minimise their effects by dealing with the information objectively and by interpreting the information with maximum rigour. The purpose was not to develop a general theory, rather to develop a guideline framework that can provide insight and be used in other contexts.

3.3 Data Generation Methods

"*A Data generation method is the means by which you produce empirical (field) data or evidence*" (Oates, 2006).

There are many data generation methods. Each is different and has its purpose and strengths and weaknesses. Methods include the case study, questionnaires, interviews and observation.

- **Case Study**

  The case study focuses on one particular object (department, system, organisation, etc). The aim is to study this object in depth, in order to understand its complex relationship and gain more information. This can be achieved by using more than one data generation method (Oates, 2006). This study considers Jordan and Syria as the two cases and it investigates the barriers of applying telemedicine in each country, using two data collection methods, questionnaires and interviews.

- **Questionnaire**

  The questionnaire is a list of pre-prepared questions, organised in a specific order with a restricted set of answers which aims to provide the researcher with data that can be analyzed and then generalised for a larger population or made transferable to other domains.

Unlike the interview, the questionnaire can be administered with or without the presence of the researcher. Questionnaires can be sent by post, can be carried out via phone, can be sent by mail and web, or can be done with the attendance of the researcher (Oates, 2006).

- **Interview**

The interview is a planned conversation between people (usually two people). One of them (the researcher) has the aim of gaining information or data from the other person. The interview should be scheduled and organised by the researcher, unlike any normal conversation between two people, and the researcher is the person who leads the interview to the benefit of their research.

There are three types of interview; Structured interview, Semi-structured interview and Unstructured interview (Oates, 2006).

1. *Structured Interview*: The interviewer has to ask the same questions in the same order for each interviewee, and notes their response without comment. It is as if the interviewer is asking the interviewee to complete a questionnaire, but the interviewer writes the answers on behalf of the interviewee.
2. *Semi-structured Interview*: There is no need for the questions to be the same or to be in the same order in this instance. The main goal of the questions is to cover specific issues that help the researcher to achieve his objectives from the interview. The interviewer can ask additional questions if the interviewee raises some interesting points and the interviewer would like to gain more details about these points.
3. *Unstructured Interview*: The interviewer brings in a topic and the interviewee talks about it without constraints. This is useful for discovering new concerns in depth.

The Interview was chosen as the main method for collecting data from the key stakeholders for this study because it includes questioning and/or discussing issues with participants, which is a useful technique for collecting data with great depth and insight (Karlm, 2001).

The researcher was interested in the points that the interviewees would mention in the interviews and was trying to gain deep insight from the key stakeholders and so required freedom to allow them to express themselves, but required a prepared structure to direct the discussion to ensure it can cover specific range of topics. Therefore, the semi-structured interview was chosen as the data collection method for this study.

The questions were prepared in advance of the interviews. The questions covered most of the concepts that have been identified as preventing the application of telemedicine in Jordan and Syria. These concepts will be from simple technical issues to political policies and decisions.

Interviews have different styles, including face to face, voice to voice (phone) or screen to screen (e-mails) (Blumberg, 2005). For this research, the face to face interview was more suitable, because the aim of this interview was to gain answers to the predefined questions, in order to directly address the aims of the research.

There are several advantages to interviewing. The information gained from the interviews is rich, and the researcher can control the questions during the interview. Answers can easily be discussed, and can create new questions and trigger new ideas from answers gained from the interviewees.

Furthermore, the physical interaction between the researcher and the interviewees is only available in the face to face interview. Sometimes the interaction and the conditions of the interview require the researcher to change the language, simplifying and explaining the questions to prompt better discussion.

Despite all the advantages of the interview it has a few disadvantages. Its major disadvantages are cost and time; interviews can be rather expensive as it is hard to find participants such as physicians or specialists that are willing to in participate, and they may demand money for their time. Moreover, interviews can be very time consuming, especially if they require travelling to the interviewee and take a long time to arrange with a busy interviewee (Blumberg, 2005).

In addition, questionnaires were completed by other participants, including patients, in order to determine the understanding and knowledge the people had about telemedicine. The questions were prepared to focus on the familiarity of people with telecommunication means in general, the main concepts of telemedicine, the barriers to applying telemedicine, and expectations regarding the future of telemedicine.

3.4 Data Collection Strategy

This research took place in The Hashemite Kingdom of Jordan and The Syrian Arab Republic, with its aim to find the issues that affect the use and spread of telemedicine in each country. Jordan was chosen as the location for the case study as it is the researcher's home country, and the researcher has good connections with key stakeholders and so facilitates the study and provides a smooth process of data collection.

Syria was chosen as the location of the second case study as it is the immediate neighbour to Jordan, and both countries share many circumstances in terms of technology infrastructure, policies and culture. Having similar circumstances makes the study significant as comparison between the two countries is possible and allows analysis of similarity and so generalisability and transferability. In addition, the geographical closeness of the two countries facilitates travel for the researcher for the data collection process.

The initial information was collected through books, articles and papers about e-Health systems, and particularly about telemedicine applications. The objectives of this data collection was to build a deep understanding of telemedicine and its applications, and to ascertain how they will provide good quality healthcare services to needy areas. In addition, general information about Jordan and Syria, and particularly the healthcare systems, were gathered and studied in order to understand the specific needs of the two countries.

Primary information included visits to six hospitals (A&E and Dialysis units) and clinics (GP and dentist) in each country by the researcher, in order to make direct observations and understand the healthcare system.

Semi-structured interviews were selected as the principle source of data collection, with interviewees being selected as being involved in the area.

Interviewees in both countries were selected for this study as being employed by the respective Research and Development departments in the Ministry of Health and the Ministry of Telecommunications. Further interviewees were selected on recommendation by the initial interviewees. Additional clinical interviewees were added through personal acquaintance with the researcher. All interviewees were selected as having appropriate knowledge to participate in this research. Interviewees were selected from both urban and rural districts of each country.

Prospective interviewees were called in advance and asked if they were willing to participate in the study and appointments were booked in order to meet with them. Consent forms were signed by the interviewees before starting their interview. All preferred that their names should remain anonymous, and that they would not have their interviews recorded as either audio or video. All the interviewees were between the age of 25 and 65. The gender, profession and location are illustrated in the following two tables.

Decision Makers	Job Position	Male/Female	Private/Public Sector	Urban/Rural Area
	Director Directorate of Information, Studies and Research Ministry of Health.	Male	Public	Urban
	Colonel in the Royal Medical Centre	Male	Public	Urban
	Owner of a hospital	Male	Private	Urban
Doctors				
	Ophthalmologist	Male	Private	Rural
	Ophthalmologist	Male	Private	Urban
	GP	Male	Private	Urban
	A&E	Female	Public	Rural
	A&E	Male	Public	Rural
	Dentist	Male	Public	Rural
	Dentist	Male	Private	Urban
	Anaesthetist	Male	Public	Urban
	Surgeon	Male	Public	Urban
	Radiologist	Male	Private	Urban
Paramedic				
	Nurse	Male	Public	Rural
	Nurse	Female	Private	Urban
Technicians				
	Network Engineer	Male	Private	Urban
	QA engineer	Male	Private	Urban
Others				
	Director, marketing department, telecommunication company	Male	Private	Urban
	Financial Manager, trade company	Male	Private	Urban
	Lecturer, PhD in Computer Science	Male	Private	Urban
	Statistician, Ministry of Statistics	Female	Public	Urban
	Owner of importing and exporting company	Male	Private	

Table 4 *Interviewees in Jordan*

Decision Makers	Job Position	Male/Female	Private/Public Sector	Urban/Rural Area
	Deputy Minister of Communication	Male	Public	Urban
	Head of the IT and decision making department, Ministry of Health	Female	Public	Urban
	Founder of the Syrian Computer Society for Informatics.	Male	Private	Urban
	Member of Chamber's Bureau. Chamber of Industry.	Male	Public	Urban
	Owner of hospital	Male	Private	Urban
Doctors				
	Anaesthetist and head of operations.	Male	Private	Rural
	Pathologist	Male	Private	Rural
	Pathologist	Male	Private	Urban
	Ophthalmologist	Male	Private	Urban
	A&E	Male	Public	Rural
	Surgeon	Male	Public	Rural
	Radiologist	Male	Private	Urban
Paramedic				
	Nurse	Female	Public	Rural
	Nurse	Male	Private	Urban
	Nurse	Male	Private	Urban
Technicians				
	Medical Engineer.	Female	Public	Rural
	Medical Engineer.	Male	Public	Urban
	Electrical Engineer.	Female	Private	Rural
	Telecommunication Engineer.	Male	Private	Urban
Others				
	Financial Manager. Auditing Company.	Male	Private	Urban
	Financial Auditor.	Male	Private	Urban
	Owner of a factory, electrical machines.	Male	Private	Urban
	Owner of importing and exporting company	Male	Private	Urban

Table 5 *Interviewees in Syria*

A total of 45 interviews took place (22 in Jordan and 23 in Syria). The researcher had intended to have a larger number of interviews, but it became apparent that answers from the interviewees were consistent and the researcher determined that a smaller number of interviews would suffice for the purpose of this study.

An initial set of interview questions was created in advance of the interviews from the research into secondary source of data and literature review. These were then reviewed by experts and stakeholders to ensure that they would be appropriate for this study. Small modifications were made to the questions to form the final set.

A total of 100 questionnaires were completed (50 in each country) to determine the acceptance of telemedicine by people and evaluate their knowledge about it. The researcher visited hospitals in both urban and rural areas, Ministry of Health and Ministry of Telecommunications and in order to distribute the questionnaire to the doctors, nurses, technicians, financial managers, and patients. All were between the age of 25 and 65.

The following tables show the job position of the people who completed the questionnaire, their gender and place of work in each country.

	Job Position	**Male/Female**	**Private/Public Sector**	**Urban/Rural Area**
Doctors				
	Dentist	Male	Private	Urban
	Dentist	Male	Private	Urban
	GP	Male	Private	Urban
	GP	Male	Private	Urban
	GP	Female	Private	Rural
	GP	Male	Private	Rural
	A&E	Male	Private	Urban
	A&E	Male	Private	Urban
	A&E	Male	Public	Urban
	A&E	Male	Public	Rural
	A&E	Female	Public	Rural
	Radiologist	Male	Private	Urban
	Radiologist	Male	Private	Urban
	Anaesthetist	Male	Public	Rural

Paramedic				
	Nurse	Male	Private	Urban
	Nurse	Male	Private	Urban
	Nurse	Male	Public	Rural
	Nurse	Female	Public	Urban
	Nurse	Female	Public	Urban
	Nurse	Female	Private	Rural
	Nurse	Female	Private	Rural
Technicians				
	Network Engineer	Male	Private	Urban
	Network Engineer	Male	Private	Urban
	Network Engineer	Male	Private	Urban
	Medical Engineer	Male	Public	Rural
	Telecommunication Engineer	Female	Private	Urban
	Telecommunication Engineer	Female	Public	Urban
	Medical Engineer	Female	Public	Rural
	Electrical Engineer	Male	Private	Rural
Others				
	Patient	Male	Private	Urban
	Patient	Male	Private	Urban
	Patient	Male	Private	Urban
	Patient	Male	Private	Urban
	Patient	Male	Private	Urban
	Patient	Male	Private	Urban
	Patient	Male	Private	Urban
	Patient	Male	Public	Rural
	Patient	Male	Public	Rural
	Patient	Male	Public	Rural
	Patient	Male	Public	Rural
	Patient	Female	Private	Rural
	Patient	Female	Private	Rural
	Patient	Female	Public	Urban
	Patient	Female	Public	Urban
	Patient	Female	Public	Urban
	Financial Manager	Male	Private	Urban
	Financial Manager	Male	Private	Urban
	Medical Student	Male	Private	Urban
	Medical Student	Female	Private	Urban
	Owner of business company	Male	Private	Urban

Table 6 *Questionnaire in Jordan*

	Job Position	Male/Female	Private/Public Sector	Urban/Rural Area
Doctors				
	Dentist	Male	Private	Urban
	Dentist	Male	Private	Urban
	Dentist	Male	Private	Urban
	GP	Male	Private	Urban
	GP	Male	Private	Urban
	A&E	Male	Private	Urban
	A&E	Male	Public	Rural
	A&E	Male	Public	Rural
	Radiologist	Male	Private	Urban
	Radiologist	Male	Private	Rural
	Radiologist	Male	Private	Rural
	Anaesthetist	Male	Public	Rural
	Anaesthetist	Female	Public	Rural
Paramedic				
	Nurse	Male	Private	Urban
	Nurse	Male	Private	Urban
	Nurse	Male	Private	Rural
	Nurse	Female	Private	Rural
	Nurse	Female	Private	Rural
	Nurse	Female	Public	Urban
	Nurse	Female	Public	Urban
	Nurse	Female	Public	Urban
Technicians				
	Network Engineer	Male	Private	Urban
	Network Engineer	Male	Private	Urban
	Network Engineer	Male	Private	Urban
	Medical Engineer	Male	Private	Urban
	Medical Engineer	Male	Private	Urban
	Medical Engineer	Female	Public	Urban
	Medical Engineer	Female	Public	Rural
	Techincal Support	Male	Public	Rural
	Techincal Support	Male	Private	Rural
	Electrical Engineer	Female	Private	Urban
Others				
	Patient	Male	Private	Urban
	Patient	Male	Private	Urban

Patient	Male	Private	Urban
Patient	Male	Private	Urban
Patient	Male	Private	Urban
Patient	Male	Private	Urban
Patient	Male	Public	Rural
Patient	Male	Public	Rural
Patient	Male	Public	Rural
Patient	Female	Private	Urban
Patient	Female	Private	Urban
Patient	Female	Private	Rural
Patient	Female	Public	Rural
Patient	Female	Public	Rural
Marketing Manager	Male	Private	Urban
Financial Manager	Male	Private	Urban
Financial Auditor	Male	Public	Urban
Owner of business company	Male	Private	Urban
Owner of business company	Male	Private	Urban

Table 7 *Questionnaire in Syria*

The difference in awareness of telemedicine between Jordan and Syria was investigated by using Chi-Squared statistics. The results suggest that there is a significant difference (at the level of 5%) in the awareness of telemedicine between the two countries. The reason for the difference of awareness is investigated in detail in chapter six.

The first question of the questionnaire determines the experience people have had of telemedicine. This showed that 72% of the people in Jordan have experienced telemedicine applications whereas only 18% of the people in Syria had experience. According to the results in this study, people in Jordan have significantly greater experience of telemedicine than people in Syria.

Crosstab

			Q1		Total
			No	Yes	
Country	Jordan	Count	14	36	50

		Expected Count	27.5	22.5	50.0
		% within Country	28.0%	72.0%	100.0%
	Syria	Count	41	9	50
		Expected Count	27.5	22.5	50.0
		% within Country	82.0%	18.0%	100.0%
Total		Count	55	45	100
		Expected Count	55.0	45.0	100.0
		% within Country	55.0%	45.0%	100.0%

The Chi-Squared comparisons suggests that there is a statistically significant difference between the awareness of telemedicine between the two countries (x^2 (1) =29.45, p<0.005)

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	29.455[a]	1	.000		
Continuity Correction[b]	27.313	1	.000		
Likelihood Ratio	31.193	1	.000		
Fisher's Exact Test				.000	.000
N of Valid Cases	100				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 22.50.

b. Computed only for a 2x2 table

The second question is designed to determine the level of use of technology to obtain knowledge about healthcare. The result shows that 86% of people in Jordan use technology whereas only 32% of Syrians do.

Crosstab

			Q2		Total
			No	Yes	
Country	Jordan	Count	7	43	50
		Expected Count	20.5	29.5	50.0
		% within Country	14.0%	86.0%	100.0%
	Syria	Count	34	16	50

	Expected Count	20.5	29.5	50.0
	% within Country	68.0%	32.0%	100.0%
Total	Count	41	59	100
	Expected Count	41.0	59.0	100.0
	% within Country	41.0%	59.0%	100.0%

The Chi-Squared comparisons suggests that there is a statistically significant difference between the number of people who use technology to gain knowledge about healthcare between the two countries (x^2 (1) =30.13, p<0.005).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	30.136[a]	1	.000		
Continuity Correction[b]	27.945	1	.000		
Likelihood Ratio	32.188	1	.000		
Fisher's Exact Test				.000	.000
N of Valid Cases	100				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.50.

b. Computed only for a 2x2 table

The third question determines any preference regarding diagnosis by doctor or through telemedicine applications. The result in both countries was similar, with 82% of Jordanians preferring to be diagnosed by a doctor and 92% of Syrians preferring to be diagnosed by a doctor.

Crosstab

			Q3		Total
			Telemedicine	Doctor	
Country	Jordan	Count	9	41	50
		Expected Count	6.5	43.5	50.0
		% within Country	18.0%	82.0%	100.0%
	Syria	Count	4	46	50
		Expected Count	6.5	43.5	50.0

	% within Country	8.0%	92.0%	100.0%
Total	Count	13	87	100
	Expected Count	13.0	87.0	100.0
	% within Country	13.0%	87.0%	100.0%

The Chi-Squared comparisons shows that there is no statistically significant difference between the number of people who prefer to be diagnosed by doctor in both countries because (x^2 (1) =2.21, p>0.005).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.210[a]	1	.137		
Continuity Correction[b]	1.415	1	.234		
Likelihood Ratio	2.261	1	.133		
Fisher's Exact Test				.234	.117
N of Valid Cases	100				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.

b. Computed only for a 2x2 table

The fourth question determines the expectation of people regarding the usefulness of the adoption of telemedicine. The result indicates that expectation in Jordan is higher than Syria by 16% (58% and 42% respectively).

Crosstab

			Q4			Total
			No	Yes	Neutral	
Country	Jordan	Count	7	29	14	50
		Expected Count	14.5	25.0	10.5	50.0
		% within Country	14.0%	58.0%	28.0%	100.0%
	Syria	Count	22	21	7	50
		Expected Count	14.5	25.0	10.5	50.0
		% within Country	44.0%	42.0%	14.0%	100.0%
Total		Count	29	50	21	100

	Expected Count	29.0	50.0	21.0	100.0
	% within Country	29.0%	50.0%	21.0%	100.0%

The Chi-Squared comparisons suggests that there is a statistically significant difference between the number of people who expect that the adoption of telemedicine to be useful in the two countries ($x^2(2) = 11.37$, $p<0.005$).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.372[a]	2	.003
Likelihood Ratio	11.812	2	.003
N of Valid Cases	100		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.50.

The fifth question investigates the effect of culture and religious issues on the adoption of telemedicine. The result shows that 62% of Syrians believe that adoption of telemedicine will be affected negatively whereas only 28% of Jordanians have the same belief.

Crosstab

			Q5			Total
			No	Yes	Neutral	
Country	Jordan	Count	28	14	8	50
		Expected Count	21.0	22.5	6.5	50.0
		% within Country	56.0%	28.0%	16.0%	100.0%
	Syria	Count	14	31	5	50
		Expected Count	21.0	22.5	6.5	50.0
		% within Country	28.0%	62.0%	10.0%	100.0%
Total		Count	42	45	13	100
		Expected Count	42.0	45.0	13.0	100.0
		% within Country	42.0%	45.0%	13.0%	100.0%

The Chi-Squared comparisons show that there is a statistically significant difference between the two countries regarding the affect of culture and religion issues on the adoption of telemedicine applications (x^2 (2) =11.78, p<0.005).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.781[a]	2	.003
Likelihood Ratio	12.040	2	.002
N of Valid Cases	100		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.

The sixth question investigates if people would be willing to use telemedicine applications in the future. The results show that 62% of people in Jordan would use telemedicine whereas only 34% of Syrians would do so.

Crosstab

			Q6			Total
			No	Yes	Neutral	
Country	Jordan	Count	10	31	9	50
		Expected Count	18.0	24.0	8.0	50.0
		% within Country	20.0%	62.0%	18.0%	100.0%
	Syria	Count	26	17	7	50
		Expected Count	18.0	24.0	8.0	50.0
		% within Country	52.0%	34.0%	14.0%	100.0%
Total		Count	36	48	16	100
		Expected Count	36.0	48.0	16.0	100.0
		% within Country	36.0%	48.0%	16.0%	100.0%

The Chi-Squared comparisons suggests that there is a statistically significant difference between the two countries regarding willingness of using telemedicine application in the future (x^2 (2) =11.44, p<0.005).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.444[a]	2	.003
Likelihood Ratio	11.760	2	.003
N of Valid Cases	100		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.00.

The seventh question investigates the affect of technical issues on the adoption of telemedicine applications. Results show that people in Jordan and Syria have almost the same opinion (86% and 78% respectively).

Crosstab

			Q7			Total
			No	Yes	Neutral	
Country	Jordan	Count	4	43	3	50
		Expected Count	5.0	41.0	4.0	50.0
		% within Country	8.0%	86.0%	6.0%	100.0%
	Syria	Count	6	39	5	50
		Expected Count	5.0	41.0	4.0	50.0
		% within Country	12.0%	78.0%	10.0%	100.0%
Total		Count	10	82	8	100
		Expected Count	10.0	82.0	8.0	100.0
		% within Country	10.0%	82.0%	8.0%	100.0%

The Chi-Squared comparisons suggests that there is no statistically significant difference between the two countries regarding the affect of technical issues on the adoption of telemedicine applications (x^2 (2) =1.09, p>0.005).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.095[a]	2	.578
Likelihood Ratio	1.103	2	.576

N of Valid Cases	100		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.00.

The eighth question investigates the effect that social issues (culture or religion) might on the adoption of telemedicine. The results show that 54% of Jordanians and 48% of Syrians have the opinion that these will have a potential impact.

Crosstab

			Q8			Total
			No	Yes	Neutral	
Country	Jordan	Count	13	27	10	50
		Expected Count	14.5	25.5	10.0	50.0
		% within Country	26.0%	54.0%	20.0%	100.0%
	Syria	Count	16	24	10	50
		Expected Count	14.5	25.5	10.0	50.0
		% within Country	32.0%	48.0%	20.0%	100.0%
Total		Count	29	51	20	100
		Expected Count	29.0	51.0	20.0	100.0
		% within Country	29.0%	51.0%	20.0%	100.0%

Therefore, the Chi-Squared comparisons suggests that there is no statistically significant difference between the two countries regarding the belief that social issues have a potential impact on the adoption of telemedicine (x^2 (2) =0.48, p>0.005).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.487[a]	2	.784
Likelihood Ratio	.487	2	.784
N of Valid Cases	100		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.00.

The ninth question investigates whether the government should be providing more funding to support the adoption of telemedicine. The results show that Jordanians and Syrians have a strong belief (90% and 86% respectively) that there should be more funding.

Crosstab

			Q9			Total
			No	Yes	Neutral	
Country	Jordan	Count	3	45	2	50
		Expected Count	3.5	44.0	2.5	50.0
		% within Country	6.0%	90.0%	4.0%	100.0%
	Syria	Count	4	43	3	50
		Expected Count	3.5	44.0	2.5	50.0
		% within Country	8.0%	86.0%	6.0%	100.0%
Total		Count	7	88	5	100
		Expected Count	7.0	88.0	5.0	100.0
		% within Country	7.0%	88.0%	5.0%	100.0%

The Chi-Squared comparisons shows that there is no statistically significant difference between the two countries regarding the belief that the government should provide more funding to support the adoption of telemedicine (x^2 (2) =0.38, p>0.005).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.388[a]	2	.824
Likelihood Ratio	.390	2	.823
N of Valid Cases	100		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 2.50.

The tenth question investigates whether the government should amend policies in order to support the adoption of telemedicine. The results show that 90% of Syrians and 60% of Jordanians consider that policies should be amended.

Crosstab

			Q10			Total
			No	Yes	Neutral	
Country	Jordan	Count	16	30	4	50
		Expected Count	9.0	37.5	3.5	50.0
		% within Country	32.0%	60.0%	8.0%	100.0%
	Syria	Count	2	45	3	50
		Expected Count	9.0	37.5	3.5	50.0
		% within Country	4.0%	90.0%	6.0%	100.0%
Total		Count	18	75	7	100
		Expected Count	18.0	75.0	7.0	100.0
		% within Country	18.0%	75.0%	7.0%	100.0%

The Chi-Squared comparison shows that there is a statistically significant difference between the two countries regarding the belief that the government should amend policies in order to support the adoption of telemedicine (x^2 (2) =14.0, p<0.005).

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.032[a]	2	.001
Likelihood Ratio	15.559	2	.000
N of Valid Cases	100		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.50.

Although adjacent countries in the Middle East, with generally similar demographics, comparison of results shows there to be some significant differences in opinion between Jordan and Syria regarding telemedicine and its applications. These differences are explored in greater detail within the interviews in order to gain insight.

3.5 Data Analysis of interviews

The interview data was analysed using thematic analysis since it enables the researchers to deliver their findings and interpretations to others easily, and it allows

researchers to use a wide range of information in a systematic manner that increases their accuracy in understanding and interpreting their observations about a phenomenon or an organisation.

According to (Boyatzis, 1998) there are three different approaches to develop themes, and those approaches move the researcher towards theory (guideline framework) development

- Theory driven: Is frequently used in social science. The researcher starts with their own hypotheses or theory or someone else's and formulates evidence that would support this theory. The value of the themes is highly dependent on the theoretical knowledge of the researcher. Therefore, the composition of the themes will be determined according to the researcher's anticipation of the expected results.

  The theory driven approach is preferred by various disciplines since it moves them from the dominant learning style and abstract concept to more natural way of interpreting the phenomenon. In contrast, the theory driven approach is more sensitive to projection because it involves some difficulties such as being susceptible to lower consistency of judgement.
- Prior research driven: The researcher builds themes depending on the findings of other researchers and the themes that they constructed. The themes are valid as long as the current researcher is using the same or similar raw information.

  Building on prior research can be an effective technique because sometimes the series of findings and hypotheses can provide elements that help construct the code of themes. On the other hand, the researcher accepts the assumptions, biases and projections of another researcher, and this might create a mismatch between the details in the themes and the nature of the source material.
- Data driven (inductive from raw data): Is constructed inductively from the raw information, the role of the researcher is to interpret the meanings after obtaining the findings and to construct a guideline framework after finding the results. Working directly from raw information increases the appreciation of the information which should be in a form that is easy to be reviewed repeatedly, such as written interviews or small parts of audio/video taped material.

Although researchers may have difficulties identifying the dependant variables, data driven approach is still recommended in social and healthcare research as it is the most fundamental method of developing themes (Boyatzis, 1998).

For the purpose of this research, prior research driven and data driven approaches to thematic analysis have been followed. The researcher read the literature, including various examples about telemedicine and e-Health in order to gain knowledge about telemedicine, its applications and the barriers of applying it in developing countries in general (prior research driven) and then focused on the specific issues that face the application of telemedicine in Jordan and Syria. The next step was several visits to Jordan and Syria to interview the key stakeholders in order to obtain more knowledge about the issues that face the application of telemedicine in both countries. In addition questionnaires have been completed in both countries in order to assess the knowledge of people about telemedicine applications.

Consequently, the researcher gained a written material from the interviews, and moved to the stages of analysing the data by developing themes using data driven approach. Boyatzis (1998) steps and recommendations were followed, and were adapted to suit the current research, as follows:

- Reducing the raw information: Read the raw information (interviews) trying to consciously process the information, and obtain an overall picture of the collected data, in particular focusing on the issues relating to the barriers of the telemedicine application and create outlines of rephrased items.

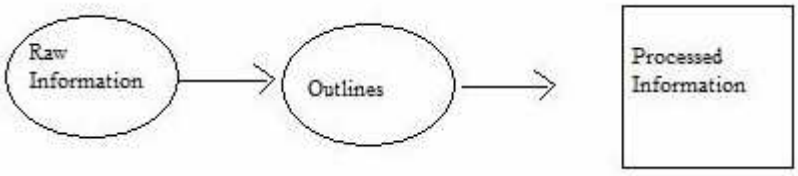

Figure 5: Processed Information

- Identify themes: Read the processed information and compare it with each interview trying to find similarities and patterns between them in order to create a list of similar themes.

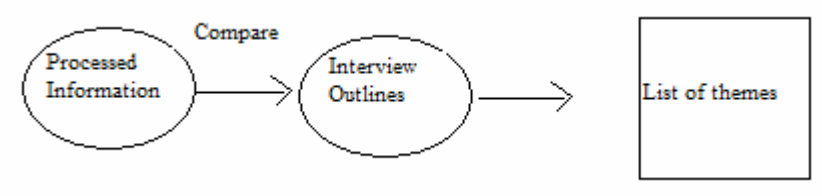

Figure 6: List of themes

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- Compare the similarities among the lists of themes in order to identify the final themes that characterise the issues that face the application of telemedicine in Jordan and Syria.
- Link the themes together in order to recognise the relations between them.
- NVIVO 7.0 (produced by QSR International) was used as a tool to help organise the themes and their relations.
- The themes and their relations were studied in order to construct a guideline framework of solutions to address the identified issues that prevent the adoption of telemedicine.
- A return visit to the stakeholders was made to validate the proposed guideline framework and seek their opinion on it.
- The guideline framework of solutions was amended according to their recommendations.
- The final draft of the guideline framework was developed.

3.6 Data Quality Issues

3.6.1 Reliability

Reliability is related to the consistency of the data collected. In other words, if others were to repeat the research they should have similar results (Collis and Hussey, 2003). Reliability is usually a high priority in quantitative studies, since the information obtained must be consistent. However, within qualitative studies, reliability may not hold the same high level of importance, because the information can be interpreted in different ways. Different researchers can study the barriers of applying telemedicine in developing countries, and can develop a guideline framework of solutions, and although the guideline frameworks will largely be similar, there will be inevitable differences in the interpretation, point of view and background knowledge.

3.6.2 Validity

According to Collis and Hussey (2003), validity is concerned with the accuracy of the information obtained during the course of the research. Coolican (2009) states that a study can be considered a valid study "if it demonstrates or measures what the researcher thinks or claims it does".

Validity is low in quantitative studies, since it focuses on the precision of measurement and the ability to repeat the experiment reliably.

In qualitative studies validity is high, because the qualitative approach aims to capture the essence of the phenomena and extract data which is rich in its explanation and analysis (Collis and Hussey, 2003). Also, the researcher's role is to access the knowledge and the meaning that are embedded in those phenomena.

In this study the researcher studied the issues that are preventing the spread and use of telemedicine and its applications in Jordan and Syria. He investigated those issues, sought opinions from experts, and developed a guideline framework of solutions that will provide help for healthcare providers.

3.6.3 Generalisation

Generalisation refers to the ability to apply the result of research to cases or situations that are different from those examined in the original study (Collis and Hussey, 2003). In quantitative research, one type of generalisation is using statistics to generalise from the sample to the population. However, in qualitative research, generalisation is concerned with the pattern, concepts and theories that have been generated from the study, and their ability to be applied in another environment. In order to do this, the researcher should have a full understanding of the behaviour and the activities of the study.

3.7 Ethical Approval

The research followed the qualitative approach, with interviews and questionnaires as data collection methods. The research study is compliant with the Data Protection Act 1998. All data and participants' personal information has been securely stored to meet the confidentiality requirement of the research ethics, and will not be mentioned in

publication unless the participant has provided the researcher with written permission to publish his/her information.

The research received ethical approval from the Brunel University Research Ethics Committee. An Ethical Approval Certificate was issued and was presented to the interviewee before their interview.

All interviewees were notified of the following before participating in the study:

- All were informed about the aims, benefits and potential hazards of this study.
- All were provided with the Ethical Approval Certificate that has been issued by the Brunel University Research Ethics Committee.
- All signed a consent form showing that they freely agree to participate in the study.
- All had their interview with/without audio and video recording as expressed.
- All were able to share their ideas and views regarding the barriers to applying telemedicine in developing countries and particularly Jordan and Syria.
- All information has been securely stored after the interview.
- All have had anonymous IDs.
- All retain the right to withdraw from the research at any time.

In this research, ethical issues were considered, and the privacy and confidentiality of data was protected during and after its collection.

3.8 Key stakeholders

The research can benefit many stakeholders including decision makers, doctors, physicians, paramedics, technical support specialists and patients.

- The study helps the decision makers to understand the benefits of telemedicine and its applications and reduces their resistance towards their adoption. It provides instruction that will help them applying successful telemedicine projects, and encourage them to enhance the collaboration between the public and private sectors in order to improve the healthcare quality in Jordan and Syria.

- Doctors and healthcare providers can benefit from this study by knowing the social and technical barriers that affect the adoption of telemedicine applications so they will be aware of them prior to the application of any telemedicine project.
- Patients will be interested in this study as it shows the assistance that telemedicine applications can offer, and this will reduce their resistance and will encourage them to support the application of telemedicine which in return will provide them with higher quality healthcare services.

Chapter Four: Barriers to Applying Telemedicine in the Hashemite Kingdom of Jordan

4.1 Introduction

Jordan is a country in the Middle East, South West Asia, bordered by Syria to the north, Saudi Arabia to the south, Iraq to the east, and Palestine and Israel to the west. Its population is around 5,723,000 (DIS, 2007). Jordan is a constitutional monarchy with a representative government. The King is the head of state, commander in chief and chief executive.

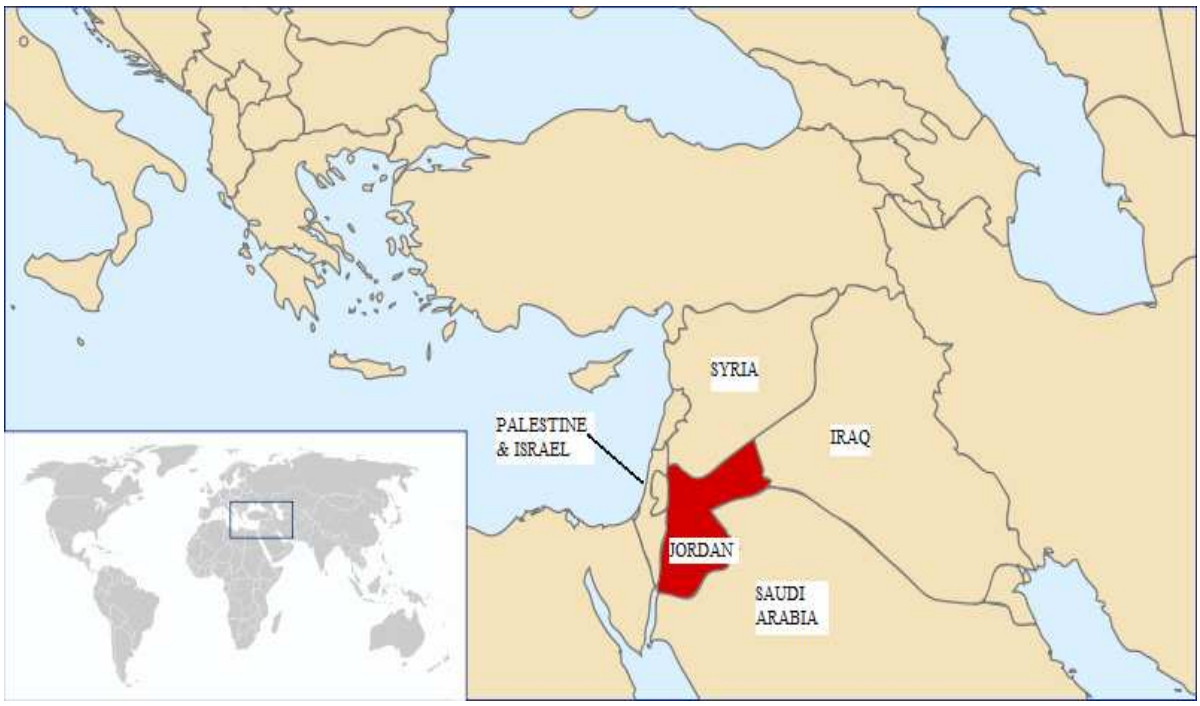

Figure 7: Map of Jordan

Jordan has one of the most modern health care infrastructures in the Middle East (WHO, 2006) which combines three sectors: public, private and donation-based. There are 103 hospitals in Jordan, 60 private and 43 public (DIS, 2007). There are 4258 registered doctors (estimated in 2007). The public sector is represented by the Ministry of Health, through which the public funding and provision of health care services is achieved. The Royal Medical Services mainly provide secondary and tertiary care services, operating 10 hospitals. The private sector also plays an essential role in terms of delivering and funding healthcare services. Private health insurance can be purchased by any individual or by any company on behalf of its employees.

Donors include both national and international organisations such as UNRWA. (WHO, 2006).

Medical insurance is provided by public and private providers and 86% of the population of Jordan is covered by either type of medical insurance (JPHR, 2009). The government has increased the capital allocated for healthcare to fulfil the target of 100% public or private medical insurance coverage by 2012 (JPHR, 2009).

Although Jordan has an advanced health care system, services remain highly concentrated in the capital Amman. Private hospitals are generally in excellent condition and offer high quality services. However, few public hospitals run by the government (Ministry of Health) can match these standards, mainly due to lack of funding and large numbers of patients.

4.2 Role of telemedicine

Although a minority of private hospitals and clinics already use telemedicine in its simplest form (phone or internet connection with web camera), the more remote hospitals are poorly equipped, employ insufficient numbers of doctors and nurses, possess unreliable medical devices and exhibit poor technical knowledge. It has been anticipated that collaboration between these hospitals, the exchange of experiences and improved communication, can fill the gaps in these hospitals and provide a means to support healthcare in the entire country. This collaboration might be facilitated by the application of telemedicine.

The policy of the government in Jordan is to encourage healthcare providers to establish telemedicine projects, but to date few projects have been realised, these being restricted to a small and limited range of applications in private clinics. Telemedicine is yet to be properly applied or used in Jordan. The next section will describe the issues facing the application and adoption of telemedicine in Jordan in more detail.

4.3 Issues Facing the Application of Telemedicine in Jordan

The research was conducted in Jordan in 2008. Questionnaires were completed by a representative sample of key stakeholders including doctors, technicians, engineers, decision makers and patients. In addition, the stakeholders were all interviewed.

The study has identified the following major common themes.

4.3.1 Funding

Funding was identified by several people in Jordan as a major problem that the healthcare system is suffering. Most of the private clinics and hospitals are successful in terms of funding because the owners believe that those hospitals are investments and business projects; the better the services they provide the more benefits they receive. However, problems remain in the public hospitals in Amman particularly in the remote areas. Such public healthcare services are in need of funding and support so that improvements can be made. The government has dedicated a portion of money to every ministry; it has a limited budget for healthcare and this amount goes well with the country budget. The government can only focus on improving existing healthcare services and is unable to invest in new techniques. "*The government is doing its best to support the healthcare field but it has a limited budget, that's why we all have to support and help to raise the quality of healthcare*" (Owner of a hospital/ Amman). In case of an emergency or disaster, help can be provided by private hospitals "*If any emergency or crises occur, the private hospital will help us saving lives*" (A&E Doctor/ rural area).

Although the country is relatively wealthy, too little is being invested in telemedicine, with investment in only a few private hospitals and clinics that are using telemedicine in its simplest form. This is because there is no interest in such projects, as it is not perceived as making business sense: "*Why shall I risk my money in a project that may not give me good profit in return? It is still unclear how it will work and how we can get income from it*." (Dentist/ Amman)

There have been a few telemedicine projects in Jordan. Madaba in 1998 ran for three months, and was a joint venture between the King Hussein Medical Centre and Mayo Clinic in 1990. These efforts ceased due to lack of funding. The Mayo Clinic project

was funded by His Majesty King Hussein but was stopped a few months after his death in 1999 because the government could not afford the high cost of maintenance and communication: "*The Mayo Clinic project was set up by a grant from His Majesty King Hussein and stopped after his death because of funding problems*" (Anaesthetist/ Amman).

The general opinion of all the interviewees, and most especially the technicians, was that funding should be concentrated on providing main medical devices (such as MRI) in public hospitals and health centres. It should also improve the IT infrastructure and provide equipment to support telemedicine (computers and telecommunication devices, etc).

Many highlighted the need for funding to provide training for doctors, nurses and all other staff that are involved in telemedicine applications. "*They (government) should give more attention to us*" (Nurse/ rural area). Many of the medical staff and the paramedics learned about telemedicine in university or college but never experienced using it due to lack of IT training given to them. Today they are keen to gain more knowledge about it but cannot afford it, and the government will not provide them with training: "*I have been working in public hospitals for 20 years and have never taken any course related to healthcare or IT. How can I run a telemedicine application?*" (A&E Doctor/ rural area)

4.3.2 Training in IT

The role of training is no less important than funding or infrastructure, and is especially important for telemedicine in order to understand the equipment and how it is managed. There is a need for trained nurses and physicians who understand exactly how telemedicine applications work in order to conduct sessions with a remote doctor, to explain relevant information to the patient and provide the doctor with accurate information for a correct diagnosis: *"I need to have trained staff in order to run the application"*. (Ophthalmologist/ Amman)

Most elderly doctors in Jordan are, in general, apprehensive about using new technology as they lack knowledge about it. They retain many of the ideas learned in

medical school in the past. "*I am having difficulties using my mobile phone so how can I use advanced computers to run telemedicine*?" (Surgeon/ Amman)

Doctors in public hospitals blame the government for not providing them with IT training, but at the same time understand that the government has a limited budget for public healthcare services. Then again, this does not mean that improving the quality of healthcare should not be given a high priority. "*We blame the government for not offering us IT courses, but we know that it has other issues to worry about*". (Nurse/ Amman) Furthermore, the better training of doctors will increase patient trust, as they will feel comfortable when they know that they are dealing with well qualified doctors. This in turn will help to avert patient resistance towards the application of telemedicine: *"training will help us gain the patients' trust*" (Dentist/ Amman).

4.3.3 Doctors' Resistance

A significant issue raised by several of the doctors that prevents telemedicine being accepted in Jordan is the belief that the patient should be present physically with the doctor in the same session, so that the doctor can diagnose the patient properly, which will help to reduce the errors in their diagnosis. Some of them also stated that they can recognise many things about the patient from their "*body language*". They further mentioned that female patients in Jordan prefer to be diagnosed in a culturally-sensitive way. They prefer their body to be fully covered (if the doctor is male) and to uncover only the part that needs to be examined. "*Patients should be diagnosed in a special way known by doctors, especially when the patient is a woman, and according to the culture, she would prefer to cover her body and only reveal the part that needs to be diagnosed".* (GP/Amman)

Other doctors have claimed that telemedicine wastes their time and money because it takes longer to diagnose a patient via telemedicine than by usual methods, especially in public hospitals where there is a shortage of doctors and a large number of patients. Moreover, the more patients doctors receive, the more money they earn. Patients pay doctors directly for their treatment so it is to the benefit of the doctor to enlist as many patients as possible and telemedicine will act to contravene this intention. *"We have around 200 patients a day and we are 11 doctors in the emergency unit. If we have to*

work with technology and books, we will only check on 10 to 20 patients a day; where shall the rest of the patients go?"(A&E Doctor/rural area)

Several doctors in Jordan are concerned about the business aspects. They are unwilling to exchange information with their colleagues because they are trying to establish their own reputation. They are afraid to share their ideas with their colleagues out of fear that this will make their colleagues more knowledgeable. This in turn will make colleagues better known and allow them to enlist more patients. *"Actually, and to be honest, these days we are looking more for the business side than the spiritual side*." (Radiologist/Amman)

4.3.4 Patients' Resistance

This study found that a number of patients in Jordan do not accept telemedicine and show a preference for face to face contact with a doctor. Most of them express concern about the background of the doctor they will be consulting (in case of online consultation for instance) where telemedicine might connect them with a doctor from a different background, and which may cause misunderstandings between them due to culture or religion, especially with regard to female patients as described earlier. Furthermore, many patients have lost trust in public doctors and paramedics, having observed a lack of training and knowledge, but at the same time they need to visit public hospitals because they cannot afford the treatment in private hospitals. This particularly applies to people in remote areas, and doctors are aware of this issue. "*Despite all the disadvantages of public hospitals, people prefer to visit them because they charge much less than private hospitals*" (Nurse/ rural area)

The researcher observed several cases that show the need for patients in general to improve their knowledge about healthcare and technology, and how technology can support healthcare services. Doctors and decision makers have concerns that "*Educating the people is essential, they have to know and appreciate the importance of the use of technology and they have to have more knowledge about the basics of healthcare*." (Director/Ministry of Health)

4.4 Framework of Solutions

From the analysis, the study identified four main issues affecting the acceptance of telemedicine in Jordan: finance, training, doctors' resistance and patients' resistance. This concurs with the findings of others (Rawabdeh, 2007). From these findings, a guideline framework of solutions to the problems posed by telemedicine in Jordan has been constructed. The opinion of the same key stakeholders has then been sought and recommendations requested.

The responses and recommendations were combined to refine the guideline framework. The solutions are considered in three sections: funding, training and resistance.

4.4.1 Funding

General opinion is that the health budget of Jordan (5.6% of GDP) (DIS, 2007) is insufficient to provide the full range of healthcare needs within the public sector and that it continues to fall behind. On the national level, there is also a lack of targeted funding for infrastructure and training. In addition, to requests for an increase to the health budget and targeted funding, it was suggested that public awareness of the issues should be raised, and more training courses, seminars and marketing campaigns should be provided to the public in order to help them understand and appreciate telemedicine and its applications. Another suggestion is that there should be a public-private partnership which will be more convincing to the decision makers in the public sectors, ensuring that the application of telemedicine will be better facilitated. "*We need sponsors who are able to fund the project and sponsors should be convinced about telemedicine and its benefits*." (Director, Marketing Department/Amman).

On the local level, it is believed that the cost of equipment for telemedicine remains high and there was a request to determine ways in which costs could be reduced. This request can be directed to both private providers so that they can offer telemedicine equipment at lower prices and public providers so they can facilitate the processes related to the application of telemedicine, such as the import and customs procedures.

Those involved in telemedicine projects assert that there should be targeted government funding to establish commercial interest. However, doctors were keen to

stress that there was not just a simple question of funding but also a need for recognition of provisioning, such as presenting adequate and appropriate space to work. "*To apply telemedicine, we need a suitable and comfortable environment and a quiet place with tools and equipment*." (Financial Manager/Amman).

4.4.2 Training

Doctors and nurses in public hospitals commented about the lack of training in IT provided by their hospital or by the Ministry of Health at a national level. It is essential that all healthcare staff are competent in IT and this requires training. The need for this training to begin in university medical schools was clearly identified in both national and local level,, with some doctors explaining that they had received no such training. Indeed the curriculum of the Faculty of Medicine at the University of Jordan (established as the first medical school in Jordan in 1971) currently offers only two modules with specific IT content, constituting a total of 6 out of 255 credit hours. Furthermore, no other modules feature any IT. There is no teaching or training on telemedicine.

Moreover, an essential requirement is to provide seminars and conferences to the decision makers to help convince them of the advantages of the application of telemedicine and make them use the technology. "*We need to convince the decision makers because they are the key to the telemedicine application; if they are satisfied then they can convince the government to pay more money and to pay more attention to the healthcare field*." (Dentist/Amman)

4.4.3 Resistance

At the national level, training and education about the benefits of telemedicine will help overcome resistance to telemedicine on the part of the public and doctors. Most of the stakeholders believe that educating people include doctors and decision makers is a major issue that should be considered "*if we want such project to work, we should start with providing knowledge to people about the advantages of telemedicine, especially those who can take decisions about it.*" (Lecturer in Computer Science /Amman).

Also marketing campaigns and seminars should be seriously considered as a tool to offer the information to people, especially those who are far from the technology field and have lack of knowledge about it "*Marketing will have a big role in this situation in order to provide people with the knowledge about technology and healthcare field*" (Owner of a business company/Amman).

Moreover, at the local level, there should be serious efforts to establish projects so that people can observe the benefits. Most of the stakeholders are assured that people and doctors will accept telemedicine applications if they see actual successful examples "*it is just matter of time, but there should be a pilot project to convince the people*" (Colonel in the Royal Medical Centre/Amman).

4.5 The Guideline Framework

From the analysis of the factors preventing the application and expansion of telemedicine and validation with the key stakeholders, the study proposes the following guideline framework to direct the introduction of any telemedicine projects in Jordan. At the same time it acknowledges that such solutions are specific to the circumstances in Jordan, but the problems may be the same in many countries:

- Fully understand the readiness of telemedicine in the country.
- Study the needs of the country and its requirement for telemedicine applications.
- Differentiate between urban and rural requirements, as there can be large differences between the two areas in Jordan.
- Study the availability of essential resources, both technical and human.
- Employ local resources in the telemedicine application so that people will be motivated and more involved in the application.
- Consider the status of the infrastructure and the limitation of telecommunication in the country.
- Conduct feasibility studies and cost effectiveness analysis with consideration of any policy restrictions.

- Apply an efficient model to facilitate payment transactions between patients and doctors in rural areas as people in rural areas in Jordan were not introduced to modern payment methods such as credit cards and e-banking.
- Understand all current government policies regarding telecommunication and healthcare service provision as the government in Jordan may apply new rules and tax regarding telecommunication.
- Understand the social and cultural requirements (religion, language, etc) because it will have a direct effect on the adoption of telemedicine in Jordan.
- Consider the situation and the relationship between Jordan and any other countries that may be connected via telemedicine, as certain issues regarding communication and medical practice may be specific to particular countries In addition to the time difference between Jordan and other countries.
- Provide training to healthcare staff through seminars, courses and online conferences, and facilitate all the training resources (books, journals, computers etc) to keep the staff updated on and motivated about the application of telemedicine.
- Create a partnership with government organizations in Jordan to guarantee the support from the government and to ensure smooth progress of the adoption of telemedicine applications.
- Establish a connection with international health organizations (e.g. WHO) to gain support and help.
- Promote the project properly through campaigns and advertisements so it gains acceptance by everyone, especially the patients in Jordan.

4.6 Summary

The study identified that before any e-health service can be established it is essential to understand the readiness in the area, recognize the barriers and risks and determine solutions for all perceived problems. In this way, major mistakes might be avoided and the application of the service be more efficient.

This guideline framework can be followed prior to the establishment of any telemedicine project. Although the guideline framework was developed specifically

for and applied in Jordan, it could be generalised to provide guidance for any other country that has similar circumstances.

The goal of this guideline framework is to identify the main issues involved in assessing the readiness for telemedicine in Jordan, and it will be of assistance to any healthcare provider that is considering implementing such a project. Following the guideline framework will allow a clear idea about the current level of e-Health readiness in the country to be gained together with a focus on the issues that most affect the implementation process of telemedicine.

Chapter Five: Barriers to Applying Telemedicine in the Syrian Arab Republic

5.1 Introduction

Syria is a country in the Middle East, bordered by the Mediterranean Sea to the west, Turkey to the north, Iraq to the east and Jordan to the south.

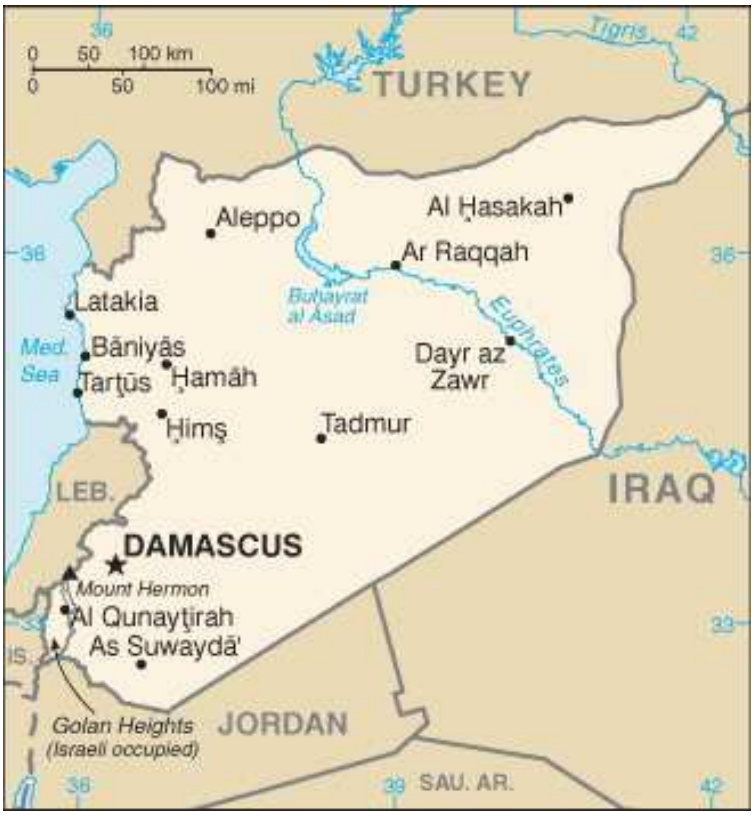

Figure 8: Map of Syria

Syria has a population of around 22 million inhabitants (CIA, 2010), there are 15 hospital beds per 10.000 people and the total health expenditure is 4% of the GDP (MOH, 2008).

The Syrian constitution has enshrined the right of all of its citizens to comprehensive health coverage. The government and specifically the Ministry of Health is responsible for managing and facilitating health care services for everyone, and all health treatment was free until 1998 when some hospitals started to become autonomous (WHO, 2006).

Syrian healthcare services are provided by a mix of both public and private sectors. The public sector is represented by several ministries including the Ministry of

Health, which is the prime provider operating 67 hospitals and 1534 health centres in addition to the medical points for primary and preventive care. In addition the Ministry of Social Affairs and Labour operates one hospital, and the Ministry of Higher Education operates the 12 university hospitals. The private sector offers additional of ambulatory and secondary healthcare services in 376 hospitals and more than 12000 pharmacies and clinics (WHO, 2006).

Syria has no previous experience with telemedicine and government policy does not prohibit any healthcare provider from establishing a telemedicine project. Overall, though, telemedicine has not been properly realized due to many issues such as poor infrastructure that will be discussed later.

5.2 Issues Facing the Application of Telemedicine in Syria

The research was conducted in Syria in 2008, where a representative sample of key stakeholders including doctors, technicians, engineers, decision makers and patients were interviewed, and questionnaires were completed by the key stakeholders and patients.

The study has identified the following major common themes:

5.2.1 Infrastructure

Interviewees emphasised that the major problem facing the application of telemedicine in Syria is the poor technological infrastructure. Syria's experience of high-technology is still in its infancy, with mobile phones and internet only having been present in the country for a few years. According to the Global Information Technology Report (2008), Syria has the poorest network infrastructure among the eastern Mediterranean countries, has a low internet penetration (an estimated 7.8% in 2007), high cost of internet access and lack of internet security. Recently, large international companies opening new branches in Syria find that poor internet performance and security are major threats to their business. Therefore connection to the internet had to be achieved through an internet service provider (ISP) based in a neighbouring country. "*This company is one of the top three accountancy companies in the world … I have to connect to the internet via Dubai, it is expensive but I can guarantee the line is robust*". (Financial Manager/ Damascus).

Furthermore, the electricity infrastructure is poor in both the capital Damascus and in the rural areas; there is a daily scheduled electricity interruption for a few hours in almost every region of the country. Hospitals, clinics, and different kinds of industries and professions rely on electricity generators during the interruption hours, but not every hospital or company can afford the cost of a generator that is adequate to run all the facilities they need, "*we have to think about plan B, what if the electricity went off? There will be serious consequences*" (Medical Engineer/ Damascus). Although the Ministry of Communication and Technology (MoCT) is working on improving the network infrastructure, much preparation is still needed and this will require a long time to be accomplished.

A further issue found in this study is a lack of regulations protecting the privacy and security of e-applications such as e-transaction, e-documentation and e-commerce. Consequently, patients' data will not be protected or secured if they are transmitted online between doctors or hospitals. "*Where shall I go to claim? Who will protect my information?*" (Radiologist/ Damscus). Decision makers state that the delay in internet and technology adoption is due to US sanctions against Syria that are limiting technology. "*We were a closed country, we had a hard time regarding technology use, but now we are hoping to exploit this technology properly and follow the world's evolution*" (Owner of a factory/ Damascus).

5.2.2 Funding

Application of telemedicine in Syria will incur a huge cost as the infrastructure is in such a poor condition. The government will need to dedicate an adequate portion of money to develop and maintain the infrastructure and support the application of telemedicine. There should be serious efforts toward collaboration between different ministries in order to accomplish this mission. "*We will ask the government to fix the infrastructure before we think about establishing such a project*; *we are talking about a fortune here*"(Telecommunication Engineer/Damascus) . At the same time, the Ministry of Health and the Ministry of Communication are not willing to fund such a project since they are not sure if it will yield benefits. They are waiting for the private sector to establish a telemedicine project and then they will make their decision about it. "*We will not stop anyone from establishing a telemedicine project, but we will not*

be involved until we see good results" (Head of decision making department/ Ministry of Health). Furthermore, the private sector is not willing to fund any telemedicine project until the government provides a proper infrastructure and eases the process of importing computers and medical devices. "*It is a big hassle to get medical devices from abroad, and if I got them, they will not perform properly because of the infrastructure*" (Owner of importing and exporting company/Damascus). Moreover, a sufficient amount of the funding should be dedicated to train doctors, paramedics and all the staff that will be involved in such a project as "*it is essential that we find the trained staff that will work on these projects*" (Pathologist/ rural area). Furthermore, an adequate portion of money needs to be dedicated to establish marketing campaigns in order to educate the public about the benefits of telemedicine and its applications.

5.2.3 Training and Education

According to Kurdy (2006), training employees and finding staff that have experience in technology are two major problems facing Syrian companies. Syria's market is in need of competencies in the IT field, and this issue raises the importance of training staff that are involved in telemedicine application. Many hospitals and clinics are still using a paper based system to record patients' information; they have never used computers or technology in their jobs, "*we write the patients' details in a book and we put it in a big drawer. This is the only record we have for patients*" (A&E doctor/ rural area). Further training is required for paramedics as they play a large role in running the telemedicine applications and communicating between doctors and patients. "*I still struggle with my nurses; they don't know how to send me an email*" (Pathologist/ Damascus). Furthermore, providing training and seminars for doctors and decision makers is highly important, because if they value the benefits of technology in the medical field, they will appreciate the adoption of telemedicine and facilitate its application. "*Is there an invention like this out there? Are you serious? (i.e. telemedicine)"* (Anaesthetist and head of operations/ Damascus). In addition, providing proper training will assist in countermanding the resistance from doctors and patients.

5.2.4 Doctor Resistance

Almost all the interviewees in Syria stated that social issues including doctor and patient resistance are the main barriers that face the use and expansion of telemedicine in the country. Most of the doctors were opposed to the idea of telemedicine as they had had no previous experience of it, and they felt worried about changing to this new technology: "*I don't know if I can run such a project, I feel it is too advanced for me*" (A&E doctor/ rural area). Doctors who had knowledge about new technology were aware that the current infrastructure was not suitable for telemedicine projects, and that they could do nothing about it until the government started supporting the internet and the network infrastructure. "*I find it hard even if I want to send a picture by email, the internet is extremely poor*" (Radiologist/ Damascus). A further issue is that some doctors believe in live contact with their patients, because this enhances patient comfort and trust. Furthermore, several doctors consider the communicative aspect of telemedicine as a threat to their career since it can be used as a means of competition between doctors, i.e. the doctor who has more knowledge will have more patients so every doctor should keep their knowledge to themselves in order to gain more customers: "*Every doctor has their own kingdom, they are not willing to exchange experience with other colleagues*" (Ophthalmologist/Damascus). Others consider that the use of technology is not necessary in clinics and is just a marketing tool: "*I believe that telemedicine is just to show off, I can use my money for useful things*" (Pathologist/ Damascus). Another concern is that most of the doctors are sure that patients will need a long time to be convinced about the telemedicine applications as they do not believe in "*talking to a screen*". They are too used to going to a clinic or a hospital to consult with a doctor who is physically present with them in the same room. This is especially true of older patients since they may be more set in their ways, with little or no experience of modern technology such as computers.

5.2.5 Patient Resistance

Most of the patients interviewed in Syria had not heard of telemedicine before, although when explained, a number of them considered telemedicine a promising tool that could help improve healthcare standards. The rest regarded it as unnecessary given that "*nothing can replace a real doctor*" (Nurse/Damascus). This is because of the lack of general knowledge about technology and the internet. Only a small percentage of the people of Syria have any knowledge about technology; the number

of personal computers was estimated in 2005 to be only 800,000 (ESCWA, 2007). Another issue is that patients have lost their trust in the current medical devices and the ability of doctors to run such instruments, "*all the medical machines are really old, I don't trust their results and I don't trust to be diagnosed by them*" (Medical Engineer/ Damascus). Patients do not feel comfortable with computers and the internet since they know that the information they give may not be secure and that there more than one party may be able to access their details, such as the Ministry of Communication and Technology and the Intelligence Agency. "*I will never send my details by the internet because every email we send can be read by the different government agencies*" (Medical Engineer/ Damascus).

Educating people will help avert resistance and encourage them to accept and promote the adoption of telemedicine and its applications. "*We are talking about culture issues for a whole society, people are used to going to the clinic to talk to a live doctor, it will take a long time for them to accept the telemedicine invention*" (Deputy Minister of Communication/ Damascus).

5.3 Framework of Solutions

After evaluating the above issues, this study found five main issues regarding the adoption of telemedicine in Syria at the national level and local level: infrastructure, funding, training and education, doctor resistance and patient resistance. These issues are similar to the findings of other studies (Al-Shorbaji, 2006), (Al-Shorbaji, 2008) and (Kurdy, 2006). The study of Al-Shorbaji (2006) found that the main barriers of applying telemedicine in eastern mediterranean countries including Syria: are lack of awareness; lack of training; financial constraints; poor communications infrastructure; absence of legal, legislative, ethical, and constitutional frameworks. These studies emphasized the need for more research about the adoption of technology in different fields and healthcare in particular. This raises the value of the current study as it will provide a guideline framework of solutions to help address the problems facing the adoption of telemedicine in Syria.

The researcher returned to the same key stakeholders to validate the guideline framework and seek their opinions for further recommendations. The responses and recommendations were used to refine the guideline framework. The solutions are

categorized into four sections: infrastructure, funding, training and education, and resistance.

5.3.1 Infrastructure

The infrastructure in Syria needs much of work at national and local levels to make it suitable for new technology and especially new projects such as telemedicine. The main responsibility is on several ministries including the Ministry of Telecommunication and Technology and the Ministry of Health, and there should be collaboration between the government affiliated organisations such as the Syrian Telecommunications Establishment and the Syrian Computer Society in order to develop the infrastructure. Moreover, the government should support the adoption of technology by easing the procedures for importing, exporting and applying new technologies in the country, "*customs is a big problem for us; they take a lot of time to give permission to import new devices*" (Owner of a factory/ Damascus).

At the national level, there are some efforts by the government to improve the infrastructure and internet use, with the aim of increasing the internet penetration rate to 20% by 2013. The process of making a decision about technological infrastructure can take a great deal of time, and this is one of the major factors that makes healthcare providers lose interest in adopting telemedicine and its applications. For example, people started to use the internet in Syria in 1999 (ESCWA, 2007) and in 2002, the government-affiliated Syrian Telecommunications Establishment (STE), which is currently the sole telecommunications operator in the country, started a project to build a separate internet backbone for a public data network. STE worked on drafting internet regulations for the MoCT to study, and as a result, the MoCT granted the first licence to two private ISPs in May 2005 (ESCWA, 2005). As a result no one would risk establishing any telemedicine project or any similar project requiring internet connection between 1999 and 2005 since there were no regulations protecting rights. "*Why shall I pay money to establish a telemedicine project and I have no clear law to protect me, it is a big risk because the government can put my project down at any minute*" (Telecommunication Engineer/ Damascus). There should be a multidisciplinary collaboration between different ministries in Syria to study the infrastructure issues, and decisions should be made quickly concerning the

infrastructure in order to follow the evolution of the technology in the rest of the world.

5.3.2 Funding

The Ministry of Health and the Ministry of Telecommunication and Technology are willing to support and fund telemedicine projects if the private sector takes the initiative and establishes such projects. This shows that the government believes that such projects are feasible and of benefit, and can then lead to the government accepting a private-public partnership. Alternatively, at the local level, telemedicine projects should be totally funded by the private sector and in order to convince the private sector to give support and funding, then training, seminars and market campaigns should be provided to the public to help them understand and appreciate the importance of technology in general and specifically telemedicine applications. "*I don't think people will run this project because of the expected long procedures in the government, but we are happy to support it if someone can show that it can give us a good income*" (Head of decision making department, Ministry of Health).

Managing the finance is an issue that must be seriously considered before establishing a telemedicine project in Syria. One of the best ways of doing this is through public - private partnership, which will facilitate all the procedures before and after the project is adopted.

5.3.3 Training and Education

Training and education are essential requirements for a successful telemedicine project, at both national and local levels, and should be provided to doctors, nurses, paramedics, public, and decision makers, in order to prepare people to be receptive to technology. Moreover, these training courses should be provided by either the public or the private sector in order to produce staff that understand the need for technology in the medical field and have competence in using this technology efficiently. "*We need staff that have knowledge about our field (medical) and computers, but they are very few"* (Owner of hospital/ Damascus*).* This should begin with the addition of IT courses to the curriculum for medical students in universities and colleges because "*we never heard about it in university*" (A&E doctor/ rural area). Marketing

campaigns and advertisements can increase the interest of people in the potential benefits of the applications of telemedicine.

A serious step should be to raise public awareness in the use of technology in medicine followed by the use of telemedicine and its applications. Lack of knowledge and awareness lead to resistance against the use and spread of telemedicine.

5.3.4 Resistance

Poor infrastructure, lack of funding and lack of training and education can be major causes for the resistance of public, decision makers and healthcare staff. Policies should be amended to reduce resistance and motivate the public and healthcare providers to support the adoption of telemedicine applications. At the national level, the current laws and regulations in Syria do not grant special advantages such as exemption from tax or customs procedures to ICT companies (ESCWA, 2005). Moreover, poor internet services and high access costs make the internet an unfavourable means of accessing information. Many doctors are keen to gain knowledge about telemedicine and other e-Health related issues but poor internet service is not motivating them to do so. "*We need a source of information like online journals and online articles; we need to educate ourselves*" (Pathologist/ Damascus). Promoting telemedicine applications by advertising and providing training courses can help overcome the barrier of resistance, and people will appreciate telemedicine when they learn about it. One recommended solution could be a high profile pilot project to convince the public, medical staff and decision makers about the benefits of telemedicine applications: "*It will help if a private hospital will make a project and show us the advantages of it*" (Medical Engineer/rural).

5.4 The Guideline Framework

From the analysis of the factors that are preventing the adoption of telemedicine in Syria, this study proposes the following guideline framework as guidance to anyone who would like to establish a telemedicine project in Syria at either national or local level.

- Fully understand the readiness of telemedicine in the country.

- Study the needs of the country and its requirement for telemedicine applications, because the need of adopting telemedicine in Syria can be different from the needs of other countries
- Study the country polices and be sure that the law and the regulations support your project.
- Understand all current government policies regarding telecommunication and healthcare service provision .
- Check the policies regularly and keep yourself always updated as there are always new regulations regarding the telecommunication in Syria.
- Consider the status of the infrastructure and the limitations of telecommunications in the country because there are some restriction regarding tecommunication between Syria and other countries.
- Check the customs policies in order to know what devices you are allowed to import and what you are not allowed to import. The government will not allow medical devices to be imported to Syria if they do not match the standards that have been set by the customs.
- Create a partnership with Syrian government organizations (public-private partnership) to gain their support and ensure smooth progress of the telemedicine application.
- Establish a connection with international health organizations (e.g. WHO) to gain support and help. Since Syria is at early age of applying technology, it is necessary to seek help and support from international health organizations.
- Promote the project properly through campaigns and publicity so it gains acceptance by everyone as this study shows that large number of people in Syria are not aware of telemedicine applications.
- Convince decision makers of the viability of the project before the project application, because decision makers are they are the key for the adoption of telemedicine in Syria.
- Ensure that the infrastructure is prepared and robust.
- Study the availability of essential resources, both technical and human because the infrastructure is poor and there is a lack of trained staff in Syria.
- Employ local resources in the development of the telemedicine application so that people will be motivated and more involved in the application.

- Provide intensive training to healthcare staff through seminars, courses and online conferences, and facilitate all the training resources (books, journals, computers, etc) to keep the staff updated and motivated about the application of telemedicine.
- Conduct feasibility studies and cost effectiveness analysis with consideration of any policy restrictions such as online banking in Syria.
- Apply an efficient model to facilitate payment transactions and consider that the modern methods of payment such as credit cards and e-banking are newly introduced in Syria.
- Understand the social and cultural requirements (religion, language, etc) since people in Syria hold on to traditions.
- Consider the relationship between Syria and other countries that may be connected via telemedicine, as there may be some specific issues regarding communication and medical relevant to a particular country and consider that Syria has restriction on technology as it is still under sanction from the USA.

This study has identified issues that should be considered prior to the establishment of any telemedicine project in Syria. Further details about the guideline framework and comparison will be discussed in Chapter six. Following this guideline framework is essential as it will present a clear idea as to the current level of e-Health readiness in the country and allow greater focus on the concerns that will most affect the implementation process of telemedicine.

The solutions recommended in this guideline framework are specific to the circumstances in Syria but can be generalized to include any other country with similar conditions.

The goal of this guideline framework is to identify the main issues involved in assessing the readiness for telemedicine in Syria, and it will be of assistance to any healthcare provider that is considering such an enterprise.

The next section will describe the differences between the guideline frameworks of Jordan and Syria, and give explanations for these differences according to the circumstances of each.

Chapter Six: A Comparison Between Jordan and Syria Regarding the Issues Surrounding the Application of Telemedicine

6.1 Overview

The issues surrounding the application of telemedicine in Jordan and Syria have been described and from the analysis a guideline framework for each country has been proposed. This section will consider the differences and their reasons. Such differences are a result of many country-specific reasons such as infrastructure, culture, education, economics, politics and so on. Some factors lie outside the space of this work and will not be discussed, rather the most relevant factors will be identified and prioritised.

6.2 Infrastructure

The major difference between the two countries has been that Jordan embraced the use of technology many years ahead of Syria. This has resulted in a far more advanced infrastructure being in place and greater awareness of its potential by doctors and patients, such that a number of telemedicine projects already exist. The majority of its doctors and healthcare providers are aware of telemedicine but some have no understanding of its benefits. Although the proper infrastructure is available in urban areas, advantage is not being taken of telemedicine and its applications are not being utilized properly. This is mainly due to issues of resistance, training and funding. There is a need for sponsors and support from different public and private organizations.

In contrast, the Republic of Syria has had no experience with telemedicine applications (except a very small percentage of doctors who use e-mail to obtain a second opinion). This is because they are only in the early age of technological advancement. The majority of doctors and healthcare providers are unaware of telemedicine applications. The infrastructure in the whole country is poor and unsuitable for supporting telemedicine projects. Indeed there are barriers to telemedicine in Syria even prior to its adoption and there is both public and private sector resistance to the application of telemedicine before they have even observed how it functions. This is mainly due to the lack of knowledge.

6.3 Funding

From our study we have ascertained that funding was mentioned as a major barrier to the application of telemedicine in Jordan, but this same barrier was not primary in Syria because that country does not possess a full understanding of telemedicine, how it works and what its predicted expenses might be. This lack of knowledge emphasizes the essential need for providing training courses and IT education to the public and to the staff who would be involved in telemedicine, such as doctors, paramedics, technicians and decision makers.

6.4 Resistance

Moreover, the study found that patient and doctor resistance varies between the two countries; doctor resistance, for example, to the adoption of telemedicine in Syria is higher than it is in Jordan, but patient resistance is higher in Jordan. Doctor resistance in Jordan is caused by concerns about what might happen after a telemedicine project is adopted, such as running out of funds. But doctors in Syria are resisting the adoption of telemedicine for fear that the telemedicine application will threaten their careers because they are unable to predict the consequences of adopting such an approach.

6.5 Awareness of technology

The study has found that the number of people with knowledge about telemedicine is higher in Jordan than in Syria, but there is still a need for more training to be provided to medical staff in Jordan in order to run telemedicine efficiently.

Other factors will influence the difference in the two countries. This includes population, GDP and the government budget on health and education. Table 3 (CIA, 2010) highlight the important factors that differ between the two countries.

	Jordan	**Syria**
Population (2009)	6,269,285	21,762,978
GDP per capita (US Dollar) (2009)	5,300	4,600

% GDP on Education Expenditure (1999)	4.9	3.9
% of Unemployment Rate (2009)	13.5	9.2
% of internet user (2008)	24	16.3
% GDP on Health Expenditure	5.6	4

Table 3: Important factors that differ between the two countries

Jordan has the greater spend on education and is currently ranked 76th in the world. Syria is 109th (CIA, 2010). This is one reason why the public in Jordan are more literate and knowledgeable about technology. With the public in Jordan being more educated about technology and having better infrastructure, internet use is 7.7% higher than Syria. This could explain why people in Jordan are more familiar with the concept of telemedicine. Moreover, health expenditure at 5.6% of GDP in Jordan (DIS, 2007) is 1.6% higher than Syria (MOH, 2008). This might account why some telemedicine projects have been funded.

6.6 Governmental procedures

Neither government has prohibited telemedicine projects in their country, but the complex and time-consuming import processes for medical devices in Syria are inhibiting uptake of technology in healthcare, and telemedicine in particular. This would emphasize the need for the public-private partnership in Syria because the government can smooth the process of importing devices and consider providing exemptions. The process of importing medical devices is easier in Jordan, although the government cannot currently afford the cost of such devices to establish telemedicine projects.

The following table compares Jordan and Syria on topics found most important and highlights the differences and similarities between the two countries.

	Jordan	Syria
Infrastructure	Available and appropriate to support adoption of telemedicine projects in urban areas. Poor in rural areas	Poor in urban and rural areas and unsuitable to support telemedicine projects
Awareness of telemedicine	- Doctors aware of telemedicine applications - Large number of people aware of telemedicine applications	- Only a small number of doctors aware of telemedicine applications - Small number of people aware of telemedicine applications
Funding	Major barrier	Reported as minor barrier (may be due to the lack of knowledge related to the cost of telemedicine projects)
Resistance	- Patients resist the adoption of telemedicine more than doctors - There are concerns about the issues that might occur during and after adopting telemedicine projects.	- Doctors resist the adoption of telemedicine more than patients - There are concerns before adopting telemedicine projects
Governmental procedures	Standard procedures to import medical devices	Complex procedures to import medical devices
Other Issues	Internet is secure	Lack of internet security

Table 8 *Differences and similarities between Jordan and Syria regarding the adoption of telemedicine*

This chapter provides a comparison between the different circumstances of Jordan and Syria, a justification for the differences between the two proposed guideline frameworks and an understanding why Jordan has adopted telemedicine before Syria.

This project is unable to provide deeper analysis of comparison on the use of telemedicine in each country as there is a paucity of projects, especially in Syria. Almost none have been reported, resulting in an almost total lack of available literature on which to make comparison. This work is the first to undertake systematic survey of telemedicine activity in the two countries and to determine attitude and barriers.

Chapter Seven: Conclusion

7.1 Conclusion

Telemedicine has been defined for the purpose of this study, and its applications and their advantages and disadvantages have been described. The need for telemedicine applications in two developing countries has been considered, The Hashemite Kingdom of Jordan and The Syrian Arab Republic, and especially in their rural areas. Interviews have been conducted with the key stakeholders including doctors, technicians, engineers and decision makers, and questionnaires have been completed by further key stakeholders including patients, to ensure that a broad cross-section of opinions have been gained.

In-depth study of the issues around the adoption of telemedicine in developing countries and rural areas identified the most important issues applying to Jordan and Syria. From these, potential solutions for these issues were determined and used to develop a guideline framework for each country.

The main purpose of the guideline frameworks is to assess the readiness of the health care system in each country to use telemedicine and to assist any healthcare provider who is considering implementing a telemedicine project in any of these two countries. The guideline framework can be transferred and applied to any other country for which similar circumstances apply.

Comparison of the two guideline frameworks showed that the main barriers preventing the adoption of telemedicine in Jordan and Syria are different in the two countries and are a result of the different circumstances in each country. The barriers in Jordan are: lack of funding, lack of IT training, doctor resistance and patient resistance. The barriers in Syria are: poor infrastructure, lack of funding, lack of IT education and training, doctor resistance and patient resistance.

The guideline frameworks, if followed prior to the establishment of any telemedicine project, will provide clear information on the current level of e-Health readiness of each country, and help direct the focus for the essential concerns affecting the success of the project. Furthermore, the guideline frameworks should be promoted to the

healthcare sectors and policy makers to help them understand the benefits of the telemedicine applications and facilitate their adoption.

7.2 Contribution

This research makes four significant contributions to the field of telemedicine:

1. An assessment of the readiness for telemedicine from a number of different perspectives including social and technical in two developing countries, Jordan and Syria.
2. Identification of any issues which might prevent the use and spread of telemedicine in Jordan and Syria including lack of fund, lack of training, poor infrastructure, doctors resistance and patients resistance.
3. The development of two guideline frameworks for decision makers and healthcare providers in Jordan and Syria that can be used to assist the conception and implementation of telemedicine projects in these countries, and that can be adapted for other developing countries with similar circumstances.
4. First efforts at creating awareness of these guideline frameworks in Jordan and Syria and promoting their use with key decision makers.

7.3 Future of telemedicine in the Middle East

The Middle Eastern countries, like the rest of the word, have become highly dependent on new technology in almost all aspect of modern life, including communication and medical science (Al-Damen, 2010). Despite all the barriers that face the adoption of telemedicine, there is interest in telemedicine applications in the Middle East, and this can be clearly noticed through the various projects in several Middle Eastern countries such as United Arab Emirates and Saudi Arabia (Al-Damen, 2010). However it is the case that these countries have good funding, proper infrastructure and available resources, which have helped to overcome the barriers of the adoption of telemedicine

Moreover, the internet has been utilised to enhance the relationship between Middle Eastern countries and the rest of the world and it has been used to improve trade and communication with other countries (Amin and Gher, 2000). Furthermore, the growing number of internet users and the use of wireless and mobile technology, is having a significant impact on healthcare delivery (Pal at el, 2002) and has increased

the enthusiasm of people in the Middle East to experience and learn more about the telemedicine applications.

Telemedicine is changing rapidly as the technology develops, and the Middle East is following this growth despite the technical and social problems. It can be clearly anticipated that the future of telemedicine in the Middle East is bright and promising; it will improve the local economy as it will prevent the need for people to travel abroad for consultation, releasing the money to be spent locally within the Middle East (Amin and Gher, 2000). In addition, this study indicates that telemedicine will grow rapidly and will become a major contribution to the healthcare systems. It is going to take time for some countries such as Syria to adopt it and there will be significant advances in countries such as Saudi Arabia.

7.4 Research Limitations

There were limitations associated with this study. During the data collection phase:

- The study found few telemedicine projects to have been conducted in Jordan and none in Syria. This lack of projects limited those that could be interviewed with experience.
- The study restricts the focus of the guideline framework to the pre-implementation phase of a telemedicine project and determining readiness; it does not consider project implementation.
- The study would benefit from more accurate data but global statistics (e.g. WHO) tend to be somewhat out of date.
- Some of the interviewees were reluctant and guarded in their answers, and they expressed discomfort at commenting on issues relating to policies of the country or the role of government in the telemedicine adoption process.
- The research might have identified further issues relating to government policy regarding the adoption of telemedicine, but meeting with decision makers was problematic and limited.
- The research deemed direct political and economic issues were not directly relevant to the research topic and interviewees were reluctant to comment directly.

- The research sought to identify the general barriers and issues that are impact the adoption of telemedicine and not investigate specific issues relating to any specialism of telemedicine.

7.5 Future Work

The research should not be limited to this level and more comprehensive studies ought now to be made to include all the issues relating to the adoption of telemedicine, such as those of a political or economic nature. This study will be applied to actual projects to assess their efficacy. Furthermore, the study will be promoted to government and decision makers in order to increase awareness and so the use of telemedicine in Jordan, and establish the first telemedicine project in Syria. Moreover, this study can be widely generalized to include other countries in the Middle East and other developing countries and rural areas with similar characteristics in order to spread the use of telemedicine in the countries that most need it. In addition, this study can be an initial step in analysing the readiness of a country seeking to adopt any other e-Health application.

Telemedicine has yielded many benefits and has a promising future. Therefore, research to improve telemedicine applications should not close and there should be multi-disciplinary collaborations to increase awareness of the advantages of telemedicine to both the public and private sectors in order to improve healthcare quality and save both time and money.

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Appendices

Appendix A: Ethical Approval

School of Information Systems, Computing and Mathematics
K Darby-Dowman, Head of School, Professor of Operations Research
G Fitzgerald Head of IS&C, Professor of Information Systems
J Kaplunov, Head of Mathematical Science, Professor of Applied Mathematics

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Mark.Perry@brunel.ac.uk

Date: **13.08.2008**

STATEMENT OF ETHICS APPROVAL

Proposer: **Mohannad Alajlani**

Title: PHD in Information System and Computing

The school's research ethics committee has considered the proposal recently submitted by you. Acting under delegated authority, the committee is satisfied that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that you will adhere to the terms agreed with participants and to inform the committee of any change of plans in relations to the information provided in the application form.

Yours sincerely,

A. M. Payne

Dr. Annette Payne Chair of the Research Ethics Committee
SISCM

Appendix B: Participant Information Sheet (English)

School of Information Systems, Computing and Mathematics

Brunel
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Fax: +44 (0) 1895 251686
Web www.brunel.ac.uk

Participant Information Sheet

Title of Study: "Issues facing the application of Telemedicine in Developing Countries."

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information. Ask me if there is anything that is not clear or if you would like more information.

Thank you for reading this.

What is the purpose of the study?

I am interested in finding out the problems of applying the Telemedicine in Developing Countries. The knowledge gained from the interview will be fed into my research, which will investigate different kind of problems facing the application of Telemedicine.

Do I have to take part?

Participation is completely voluntary, and you can change your mind about taking part at any time.

What will happen to the results of the research study?

The results of the study will form a part of my thesis document, and will be published in national and international journals and at conferences. The raw data will be anonymised and stored securely until destroyed.

Appendix C: Consent Form (English)

School of Information Systems, Computing and Mathematics

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CONSENT FORM

Title of Project: "Issues facing the application of Telemedicine in Developing Countries."

Name of Researcher: Mohannad Alajlani

1- I confirm that I have read and understand the information sheet for the above study. I am fully aware about the purpose of this research.	☐
2- I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.	☐
3- I agree to the interview being audio-recorded for purposes of transcription.	☐
4- I agree to take part in the above study.	☐

Comments:_____

_____

_____

_____

_____

_____ _____ _____

Name of participant Date Signature

Appendix D: Participant Information Sheet (Arabic)

School of Information Systems, Computing and Mathematics

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معلومات للمشارك بالبحث

عنوان البحث:"قضايا تواجه تطبيق الطب عن بعد في بلدان العالم الثالث"

أنت مدعو الى المشاركة في دراسة بحثية عن تطبيق الطب عن بعد. ومن المهم ان تعلم الغاية من البحث والاهداف التي يسعى لها البحث.

أرجو منك ان تسألني اذا كان هناك اي معلومات غير واضحة أو اذا أردت اي معلومات اضافية عن البحث.

وشكراً لك على وقتك لقراءة المعلومات التالية

ما هي الغاية من البحث؟

انا مهتم بالبحث عن المشاكل والعوائق التي تواجه تطبيق الطب عن بعد في بلدان العالم الثالث.

المعلومات التي سأحصل عليها من هذه المقابلة ستكون فقط من أجل هذا البحث.

هل يجب علي المشاركة في البحث؟

المشاركة في البحث هي تطوعية و لك الحق في الانسحاب من المشاركة في حال قمت بتغيير رأيك في أي وقت شئت.

ماذا سيحصل لنتائج البحث؟

المعلومات والنتائج من هذا البحث ستكون جزء من رسالة الدكتوراة خاصتي وممكن أن يتم نشر النتائج من خلال نشر بعض الاوراق في المؤتمرات والمجلات المتخصصة . والمعلومات الاولية ستُحفظ بسرية تامة حتى يتم اتلافها.

Appendix E: Consent Form (Arabic)

School of Information Systems, Computing and Mathematics

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نموذج موافقة

عنوان البحث:"قضايا تواجه تطبيق الطب عن بعد في بلدان العالم الثالث"

اسم الباحث: مهند العجلاني

☐	أؤكد اني قرأت وفهمت ورقة معلومات البحث اعلاه.واني ادركت تماما الغرض من هذا البحث.
☐	ادرك بأن المشاركة طوعية في هذا البحث ولي مطلق الحرية بالإنسحاب في اي وقت ، دون ابداء أي سبب.
☐	أوافق على أن يتم تسجيل المقابلة صوتياً
☐	أوافق على المشاركة في هذا البحث

ملاحظات:_____

_____

_____

_____

_____

_____ _____ _____

التوقيع **التاريخ** **اسم المشترك**

Appendix F: Interviews questions

Decision makers:

1- Could you tell me about the nature of your job, please?
2- What kind of daily technology (Email-mobile phone, etc) do you use usually?
3- Is any telemedicine practised in your region?
4- What are the advantages and disadvantages of using telemedicine in your opinion?
5- What are the factors that affect the decisions related to telemedicine applications?
6- What support do you think should be available in order to establish a telemedicine project?
7- Finally, do you recommend any solution to help the application of telemedicine in Jordan (or Syria)?

Doctors, Technicians:

1. Could you tell me briefly about the nature of your work, please?
2. Do you usually use the technology (Email-phone, etc) to diagnose patients?
3. Have you ever participated or practised your job via any type of telemedicine.

(**If the answer is "Yes")**

4. Describe the telemedicine application (i.e. what form of telemedicine did you use?)
5. What were the advantages of using telemedicine in your opinion?
6. Were there any problems facing you during the use of telemedicine? (**Discussion*)
7. According to your experience in this country, what are the barriers of applying telemedicine in Jordan (or Syria)? (**Discussion*)
8. What support (infrastructure, etc.) do you think should be available in order to establish a telemedicine project?
9. Finally, do you recommend any solution to help the application of telemedicine in Jordan (or Syria)?

(If the answer is "No")

A. If you were to use telemedicine in your work, what do you think the advantages will be?
B. According to your work experience, what are the problems that you expect to face if you were to use telemedicine in your job? (**Discussion*)
C. According to your experience in this country, what are the barriers of applying telemedicine in Jordan (or Syria)? (**Discussion*)
D. What support do you think should be available in order to establish a telemedicine project?
E. Finally, do you recommend any solution to help the application of telemedicine in Jordan (or Syria)?

* The discussion concerns technical, social, political and other factors that the interviewees will mention.

Appendix G: Questionnaire (English)

Telemedicine Questionnaire

Name: _____ Date: _____
Job: _____

Question	Yes/No	Comments
Have you ever had any experience of any type of Telemedicine before?	Yes ☐ No ☐	
Do you use technology (Email, Mobile Phone, etc) to obtain knowledge about health care?	Yes ☐ No ☐	
Would you prefer to be diagnosed via telemedicine, or to be diagnosed by a doctor in person?	Telemedicine ☐ Doctor ☐	
Do you think applying telemedicine in Jordan/Syria will be useful?	Yes ☐ Not much ☐ No ☐	
Do you think telemedicine will be affected negatively by the culture and religion issues?	Yes ☐ Not much ☐ No ☐	
Do you think people in Jordan/Syria are willing to use telemedicine?	Yes ☐ Not much ☐ No ☐	
Do you think technical issues have a potential impact on applying telemedicine?	Yes ☐ Not much ☐ No ☐	
Do you think social issues (culture or religion) have a potential impact on applying telemedicine?	Yes ☐ Not much ☐ No ☐	
Do you think the government should make available more fund for telemedicine projects?	Yes ☐ Not much ☐ No ☐	
Do you think the government should amend policies in order to support telemedicine projects?	Yes ☐ Not much ☐ No ☐	
In your opinion, how can we overcome the barriers of applying telemedicine?		

Thank you for your time

Appendix H: Questionnaire (Arabic)

استبيان حول تطبيق الطب عن بعد

الاسم:_____ التاريخ:_____

المهنة:_____

السؤال	نعم\الا	ملاحظات
هل لك أي خبرة سابقة مع الطب عن بعد؟	نعم ☐ لا ☐	
هل تستعمل التقنيات الحديثة (مثل البريد الالكتروني او الانترنت) للحصول على معلومات عن الصحة العامة؟	نعم ☐ لا ☐	
هل تفضل ان يتم تشخيصك ومعالجتك عن طريق الطب عن بعد ام تفضل زيارة الطبيب شخصياً؟	الطبيب ☐ الطب عن بعد ☐	
هل تعتقد ان تطبيق الطب عن بعد سيكون مفيداً في الاردن\سوريا؟	نعم ☐ وسط ☐ لا ☐	
هل تعتقد ان تطبيق الطب عن بعد سيتأثر سلبياً بسبب معتقدات الدين والثقافة ؟	نعم ☐ وسط ☐ لا ☐	
هل تعتقد أن الامور التقنية (التكنولوجيا والشبكات) لها تأثير كبير على تطبيق الطب عن بعد؟	نعم ☐ وسط ☐ لا ☐	
هل تعتقد أن الاجتماعية والشرعية سيكون لها تأثير كبير على تطبيق الطب عن بعد؟	نعم ☐ وسط ☐ لا ☐	
هل تعتقد أن الشعب الاردني\ السوري سيرحب بفكرة تطبيق الطب عن بعد في الاردن؟	نعم ☐ وسط ☐ لا ☐	
هل تعتقد أن الحكومة يجب أن توفر المزيد من الاموال لدعم تطبيق الطب عن بعد؟	نعم ☐ وسط ☐ لا ☐	
هل تعتقد أن الحكومة يجب أن تعدل على بعض القوانين من أجل دعم تطبيق الطب عن بعد؟	نعم ☐ وسط ☐ لا ☐	
في رأيك ، كيف يمكننا التغلب على الحواجز التي تعيق تطبيق الطب عن بعد في الاردن\سوريا؟		

شكراً لك على تعاونك.

Appendix I: Questionnaire Statistics (Jordan)

Question	Yes	Not Much	No
Q-1: Have you ever had any experience of any type of Telemedicine before?	72%	____	28%
Q-2: Do you use technology (Email, Mobile Phone, etc) to obtain knowledge about health care?	86%	____	14%
Q-3: Would you prefer to be diagnosed via telemedicine, or to be diagnosed by a doctor in person?	18% Telemedicine	____	82% Doctor
Q-4: Do you think applying telemedicine in Jordan will be useful?	58%	28%	14%
Q-5: Do you think telemedicine will be affected negatively by the culture and religion issues?	28%	16%	56%
Q-6: Do you think people in Jordan are willing to use telemedicine?	62%	18%	20%
Q-7: Do you think technical issues have a potential	86%	6%	8%

impact on applying telemedicine?			
Q-8: Do you think social issues (culture or religion) have a potential impact on applying telemedicine?	54%	20%	26%
Q-9: Do you think the government should make available more fund for telemedicine projects?	90%	4%	6%
Q-10: Do you think the government should amend policies in order to support telemedicine projects?	60%	8%	32%

Appendix J: Questionnaire Statistics (Syria)

Question	Yes	Not Much	No
Q-1: Have you ever had any experience of any type of Telemedicine before?	18%	____	82%
Q-2: Do you use technology (Email, Mobile Phone, etc) to obtain knowledge about health care?	32%	____	68%
Q-3: Would you prefer to be diagnosed via telemedicine, or to be diagnosed by a doctor in person?	8% Telemedicine	____	92% Doctor
Q-4: Do you think applying telemedicine in Syria will be useful?	42%	14%	44%
Q-5: Do you think telemedicine will be affected negatively by the culture and religion issues?	62%	10%	28%
Q-6: Do you think people in Syria are willing to use telemedicine?	34%	14%	52%
Q-7: Do you think technical issues have a potential	78%	10%	12%

impact on applying telemedicine?			
Q-8: Do you think social issues (culture or religion) have a potential impact on applying telemedicine?	48%	20%	32%
Q-9: Do you think the government should make available more fund for telemedicine projects?	86%	6%	8%
Q-10: Do you think the government should amend policies in order to support telemedicine projects?	90%	6%	4%