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Telehealth Practice in Eight Countries: New Zealand, Australia, the USA, Canada, UK, Malaysia, China and India

A thesis presented in partial fulfillment of the requirements of degree of Master in Information Science

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Abstract

This research examines the telehealth adoptions and developments in eight selected countries: New Zealand, Australia, the United States, Canada, UK, Malaysia, China and India. An array of methods has been employed into this research, such as PEST, SWOT, and CSF analysis. Each country has been studied individually and then all eight countries have been discussed together through comparisons from various perspectives. Thereafter, the conclusions summarize the key findings and then some recommendations are offered.

The studied countries all have certain needs of telehealth; however, these needs vary due to every country's particular conditions of demographic features, economic development, social and cultural diversity. The development of telehealth in these countries heavily depends on the countries' healthcare system, countries' priorities of healthcare needs, decision makers' vision in telehealth; as well as the development of telecommunication networks and the training level of end users. It is believed that telehealth will help to improve the healthcare service in all of the eight countries.

Through the comparison and discussion, the eight countries are found to share some points in common, which can be highlighted as general CSFs: standardization, legislation and regulation, business modelling and program evaluation, financial constraints, and need of more trained professionals into telehealth. While giving some recommendations to each country's development of telehealth, this thesis also suggested that future development of telehealth may have three priorities: further and continuous improving design and research in technical perspective, re-examination of the current healthcare system thus adjust it to suit telehealth development, and staying with an international perspective.

This topic is suggested for further research, with particular interest in extending to some country/region with very small territory and high population density.

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Contents

1. Introduction 8

1.1. Background 8

1.2. Telecommunication and computing technology 8

1.3. Telehealth 10

1.4. Scope of the research 13

1.5. Hypotheses of this research 14

1.6. Research objective and questions 14

1.7. Structure of the research report 15

2. Literature Review 17

2.1. Essentials of telehealth 17
2.1.1. Definition of telehealth 17
2.1.2. Brief history of telehealth 18

2.2. Practice of telehealth 19
2.2.1. Teleconsultation 19
2.2.2. Tele-education 20
2.2.3. Tele-monitoring 21
2.2.4. Tele-surgery 22

2.3. Benefits and limitations of telehealth 22
2.3.1. Benefits of Telehealth 22
2.3.2. Limitations of telehealth 24

2.4. Trends of telehealth development 26
2.4.1. Creating industrial and international standards for telehealth 26
2.4.2. Telehealth alliance 26
2.4.3. Stakeholders of telehealth 27
2.4.4. eHealth/mHealth 28
2.4.5. The future 28

2.5. Strategic thinking about telehealth 29
2.5.1. Telehealth and conventional healthcare 29
2.5.2. Areas of application of telehealth 30
2.5.3. Critical success factors of telehealth 32

3. Data and Methodology 34

3.1. Primary and secondary resources of data and information 34

3.2. Analytical models and tools 35
3.2.1. Macro environmental analysis: PEST 36
3.2.2. SWOT analysis 36
3.2.3. Strategic analysis: Critical Success Factors (CSF) 38

3.3. Analytical framework for this research 39

4. Telehealth in New Zealand (NZ) 41

4.1. Macro Environment scan of New Zealand 41
4.1.1. Summary statistics of demographics in New Zealand 41
4.1.2. PEST analysis of New Zealand 43

4.2. Health system in New Zealand *45*

4.3. Telehealth in New Zealand *48*
4.3.1. Applications of telehealth in New Zealand 48
4.3.2. Strategies for telehealth in New Zealand 50

4.4. Analysis of telehealth in New Zealand *54*
4.4.1. SWOT analysis of telehealth in New Zealand 54
4.4.2. CSF analysis of telehealth in New Zealand 56

4.5. Summary *57*

5. Telehealth in Australia 59

5.1. Macro environment scan of Australia *59*
5.1.1. Summary statistics of demographics in Australia 59
5.1.2. PEST analysis of Australia 61

5.2. Healthcare system in Australia *63*

5.3. Telehealth in Australia *64*
5.3.1. Applications of telehealth in Australia 64
5.3.2. Strategies of telehealth in Australia 66

5.4. Analysis of telehealth in Australia *68*
5.4.1. SWOT analysis of telehealth in Australia 68
5.4.2. CSF analysis of telehealth in Australia 69

5.5. Summary *70*

6. Telehealth in the USA 72

6.1. Macro environment scan of the USA *72*
6.1.1. Summary statistics of demographics in the USA 72
6.1.2. PEST analysis of the USA 74

6.2. Healthcare system in the USA *76*

6.3. Telehealth in the USA *78*
6.3.1. Applications of telehealth in the USA 79
6.3.2. Strategies of telehealth in the USA 83

6.4. Analysis of telehealth in the USA *84*
6.4.1. SWOT analysis of telehealth in the USA 84
6.4.2. CSF analysis of telehealth in the USA 85

6.5. Summary *86*

7. Telehealth in Canada 88

7.1. Macro environment scan of Canada *88*
7.1.1. Summary statistics of demographics in Canada 88
7.1.2. PEST analysis of Canada 91

7.2. Healthcare system in Canada *92*

7.3. Telehealth in Canada *94*
7.3.1. Applications of telehealth in Canada 95
7.3.2. Strategies of telehealth in Canada 96

7.4. Analysis of telehealth in Canada *97*
7.4.1. SWOT analysis of telehealth in Canada 97
7.4.2. CSF analysis of telehealth in Canada 98

7.5. Summary *99*

8. Telehealth in the UK **100**

8.1. Macro environment scan of the UK *100*
8.1.1. Summary statistics of demographics in the UK 100
8.1.2. PEST analysis of the UK 102

8.2. Healthcare system in the UK *104*

8.3. Telehealth in the UK *105*
8.3.1. Applications of telehealth in the UK 106
8.3.2. Strategies of telehealth in the UK 107

8.4. Analysis of telehealth in the UK *107*
8.4.1. SWOT analysis of telehealth in the UK 107
8.4.2. CSF analysis of telehealth in the UK 108

8.5. Summary *109*

9. Telehealth in Malaysia **110**

9.1. Macro environment scan of Malaysia *110*

9.1.1. Summary statistics of demographics in Malaysia *110*
9.1.2. PEST analysis of Malaysia 113

9.2. Healthcare system in Malaysia *114*

9.3. Telehealth in Malaysia *116*
9.3.1. Strategies of telehealth in Malaysia 116
9.3.2. Applications of telehealth in Malaysia 117

9.4. Analysis of telehealth in Malaysia *119*
9.4.1. SWOT analysis of telehealth in Malaysia 119
9.4.2. CSF analysis of telehealth in Malaysia 120

9.5. Summary *121*

10. Telehealth in China **123**

10.1. Macro environment scan of China *123*
10.1.1. Summary statistics of demographics in China 123
10.1.2. PEST analysis of China 125

10.2. Healthcare system in China *126*

10.3. Telehealth in China *128*
10.3.1. Applications of telehealth in China 129
10.3.2. Strategies of telehealth in China 130

10.4. Analysis of telehealth in China *131*
10.4.1. SWOT analysis of telehealth in China 131
10.4.2. CSF analysis of telehealth in China 132

10.5. Summary *133*

11. Telehealth in India **135**

11.1. Macro environment scan of India *135*
11.1.1.Summary statistics of demographics in India 135
11.1.2. PEST analysis of India 138

11.2. Healthcare system in India *140*

11.3. Telehealth in India *141*
11.3.1. Applications of telehealth in India 143
11.3.2. Strategies of telehealth in India 145

11.4. Analysis of telehealth in India *146*
11.4.1. SWOT analysis of telehealth in India 146
11.4.2. CSF analysis of telehealth in India 147

11.5. Summary *149*

12. Comparison and Discussion 150

12.1. Comparison *151*
12.1.1. Macro environment comparison 151
12.1.2. Healthcare system comparison 153
12.1.3. Telehealth status comparison 157
12.1.4. Telehealth analysis comparison 159

12.2. Discussion *162*
12.2.1. Developed vs. developing countries 163
12.2.2. Large vs. small 164
12.2.3. Other impacting factors 165
12.2.4. Western vs. eastern 166
12.2.5. Impact of national strategy 167

13. Conclusion 169

14. Recommendation 172

15. References 175

1. Introduction

1.1. Background

In modern times, improving the level of healthcare is one of the major targets in every society. In both developed countries and developing countries, governments have put considerable inputs, in terms of finance, policy, etc., into efforts to raise the level of healthcare. Globally, the level of healthcare is considered as an important indicator to judge the level of development of a certain country or region (Health Promotion Glossary, 1998).

Along with the fast development of science and technology, healthcare has been also rapidly developing, not only in terms of the content of healthcare services, but also in terms of the channels through which the healthcare services are provided. As a consequence of new technologies, healthcare services and other healthcare-relevant activities have formed a new aspect from traditional healthcare. This is often referred as telehealth. Telehealth has been experiencing rapid growth in last couple of decades. Most research has come up with the view that telehealth will become an indispensable part of healthcare that will meet the needs of different societies (Khan, Qurashi, and Hayee, 2007).

1.2. Telecommunication and computing technology

The most distinctive feature of telehealth compared with traditional healthcare is the prefix of “tele”, which means over a distance. Therefore, understanding the development of the technology is fundamental to the study of telehealth (Güler, 2002).

In recent times, communication technology has made great progress. By the end of 1877 there were only three thousand telephones in service worldwide. Today

telephones and mobile phones can be seen in all businesses and most families. In 2006, mobile subscriber reached 2.7 billion worldwide. In the last 30 years of the 20th century, computers and mobile phones technology have made it possible for telemedicine to take place; the computer has the potential to store and transform big images and other data, and mobile phones ensure that patients and healthcare professionals can communicate anywhere and at any time (CIA, The World Fact Book, 2010).

In 1876, Alexander Graham Bell invented the telephone in the USA. For the first time it made real time, real voice, double way communication a reality. However, the communication had to be between two fixed points. In 1892, automatic telephone exchange using Strowger's selector allowed direct dialing. In 1915, the first coast-to-coast telephone conversation was made in the United States of America (USA), (Juang & Rabiner, 2004).

In the 1940s, the first mobile telephone was invented and utilized in the Second World War. The size was much bigger than the today's devices. However, this wireless technology has removed the constraint of fixed position telephone communications. In 1977, the first fibre-optic telephone cables were installed. In 1997, the camera phone was invented, which enabled people to see a live picture of the other person while talking (Wymbs, 2004).

At the end of 2009, there were 4.6 billion people worldwide with mobile phones. According to the International Telecommunication Union (IUT), the number of cell phone subscriptions across the globe was expected to have reached 5 billion by 2010. Whitney (2010) explains "The explosion in cell phone use has been driven not only by developed countries, but by developing nations hungry for services like mobile banking and healthcare" (p1).

However, the first personal computer was made by IBM in 1981, marking the start of the personal computer age. In 1980's, networks were designed to connect computers together. The internet technical standard was constructed on the foundation of those networks. In the 1990's, internet, websites and emails became

personal communication tools (Internet Society, 2010). Today the internet is widely accessed by one quarter of the world's population. According to Internet World Stats (2010), 76.2% of North Americans, 60.8. % of Oceania Australian, 53 % European could access the internet in 2010 (see Figure 1).

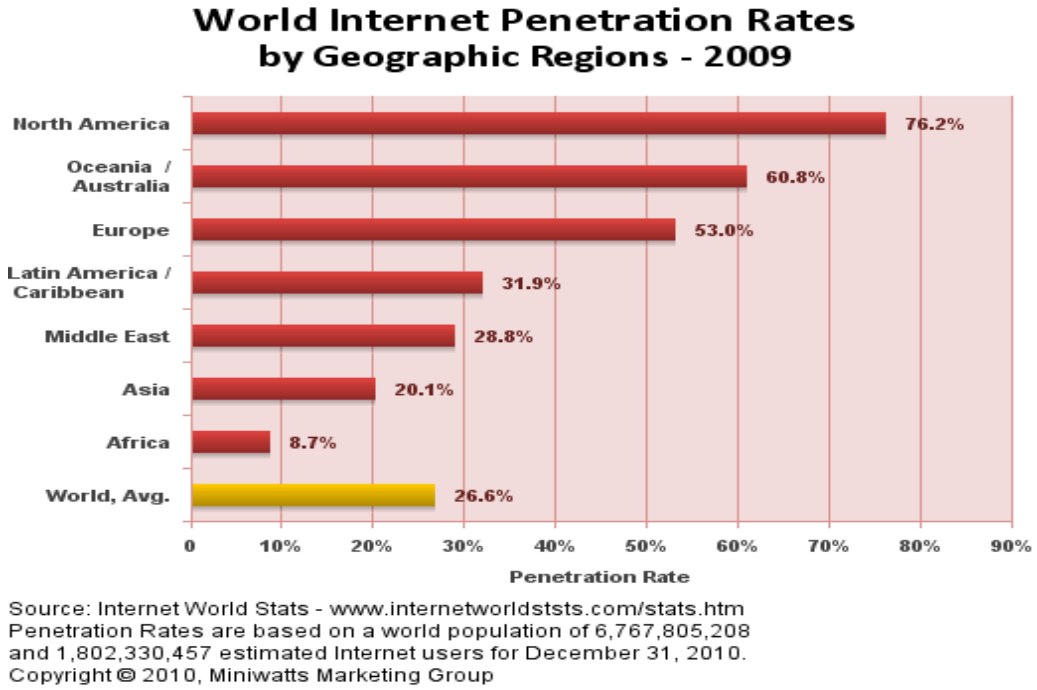


Figure 1: Internet Penetration around the World. Internet World Stats, 2010

The development of mobile and internet technology has created the technical basis for telemedicine. The ubiquity of mobile devices and internet users implies that telemedicine can widely serve communities in many countries.

1.3. Telehealth

The Internet and mobile technologies are changing people's life in many aspects. The changes have also taken place in healthcare delivery, both in developed countries, and in developing countries (Kerr & Norris, 2004). Telehealth is defined as "the use of information and communication technologies to transfer healthcare

information for the delivery of clinical, health administration, and health education services" (Kerr & Norris, 2004). A more thorough definition of telehealth was given by World Health Organization in 1997, which states:

> Telehealth/telemedicine is the delivery of healthcare services, where distance is a critical factor, by healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of diseases and injuries, and for the continuing education of healthcare providers as well as research and evaluation, all in the interest of advancing health of individuals and their communities.

In general, telehealth is engaged in the following major aspects:

Teleconsultation: The clinical consultation is at the heart of clinical practice. Not surprisingly, therefore, teleconsultation to support decision making is the most frequent example of telehealth procedures. Studies have shown that teleconsultation accounts for over one third of the usage of telehealth networks (Kerr & Norris, 2004).

Telemonitoring: refers to the use of a telecommunication link to gather routine or repeated data on a patient's condition. The acquisition process can be manual in which case the patient records the data and transmits them by telephone, facsimile, or a computer system. Alternatively and also becoming more trendy, the acquisition can be entirely automated so that continuous data can be submitted in real time or in store-and-forward mode.

Tele-surgery: Compared with the other 'tele' applications, tele-surgery is in its infancy. It is practiced in two ways: telementoring and telepresence. Telementoring is the use of video and audio connections by specialists to assist surgeons carrying out a surgical procedure at a remote location. Telepresence refers to the carrying out of remote surgical procedures through guiding robotic arms. In this case, the term 'remote' may describe comparatively short distances as well as long distances since the surgeon manipulates interfaces connected

mechanically and electronically to surgical instruments such as scalpels and needles.

Tele-education: Online information sources, often available over the internet, are now commonplace. These sources can offer excellent educational material with the benefits of low cost and easy access at the desktop. Where the information is oriented towards healthcare, it fits into the definition of tele-education of telehealth.

In addition, telehealth also includes some functions of administration within the healthcare sector. Telehealth can manage patient identification, healthcare professionals' locations, important equipment identification, and locations inside or outside of the hospitals (Wootton, 2001).

Telehealth is being used to communicate with patients; for example, to inform patients of test results, to remind patients of appointments or the deadlines of taking drugs, and to monitor patient's situations (Health information strategy, 2005).

One of the main issues discussed in the World Healthcare Organization (WHO) – Europe and America–is patient safety (Wu, Kuo & Liu, 2005). Mobile technology can help to reduce medical errors, which is one of the primary drivers to enhance patient safety. For instance, telehealth can assist healthcare providers in rural areas to stabilize and treat trauma victims when long distances or inclement weather prevents urgent transfer to an accredited trauma center (Champeau, 2009). Another example is that telehealth can help to identify a particular patient inside or outside a specific hospital, therefore preventing the mistakes made by using the wrong health history file for a patient (Champeau, 2009).

Telehealth can also help to use limited resources more efficiently, especially for remote places where there are transportation problems or an inadequate number of doctors and nurses. It has been suggested that mobile healthcare is especially useful for chronic diseases (Mirza et al., 2008). It is also proposed that the developing countries have more urgent needs for telehealth (Wootton, 2001).

In the developed nations such as New Zealand (NZ), the United Kingdom (UK), and the USA, the demand for healthcare services continues to rise, and it is increasingly difficult for them to deliver healthcare to their citizens. People are becoming more health-conscious. They are getting more well-informed, therefore more healthcares are needed. Because of the longer life-span in the developed countries, more healthcare options are needed (Wootton, 2001).

In reality, however, developed countries, such as the USA and the UK, have invested more in telehealth and have more projects in implementation (Wootton, 2001). Several research illustrate that more and more telehealth projects are planned and implemented in the USA, for example, in 2004, President Bush promised that all Americans will have their electronic record by the year 2014 (Terry & Francis, 2007). In 2004, at least 20 projects were in progress in New Zealand (Kerr & Norris, 2004).

1.4. Scope of the research

The scope of this research is to explore and compare telehealth practices in eight different countries: New Zealand, Australia, the USA, Canada, UK (developed countries), Malaysia, India, and China (developing countries). This selection of countries crosses not only different continents, but also the developed and developing worlds.

There are several reasons that make the research important. Firstly, the findings will show the similarities and differences of telehealth between the selected countries. Secondly, based on the background information of the countries, the results will reveal why the similarities and differences of telehealth exist. Thirdly, the research results will make it possible to suggest how improvements in telehealth can be made. Finally, the results will indicate what actions people, especially the stakeholders, should take, and may even identify some business opportunities.

1.5. Hypotheses of this research

The hypotheses in this research are:

1) In a particular country, the government and other stakeholders are all willing to develop telehealth to raise the level of healthcare in that country.
2) It is also supposed that due to the particular conditions of each country, telehealth should show differences in each country, in terms of both its development track, and current status and trends. However, there should also be some common points that could be found across different countries.

1.6. Research objective and questions

The main objective of this research is to discover the similarities and differences at a strategic level in telehealth practices in the eight countries by analyzing and evaluating the countries' healthcare status, including the healthcare system, demographic situations, level of economy development, etc.

This objective resolves into the following research questions:

1) *What are the current statuses of telehealth in these countries?*
These statuses will be primary findings of the research on which further analysis will be based.

2) *What are the major similarities and differences in telehealth practice in different countries?*
The similarities and differences include results of comparisons of all primary findings, such as covered area, covered population, provided services, financial inputs, efficiency and effectiveness, and other practical programs.

3) *What are the demographic, political, economic factors of the eight countries that constitute advantages or constraints? How do these factors impact on the adoption of telehealth in various countries/areas?*

The factors may include but are not limited to:

- Population and population distributions
- Healthcare systems in the eight countries
- Related technology developments in the eight countries
- Economy developments and geography of the eight countries
- Geography conditions of the countries

4) *What are the telehealth development strategies that the governments hold? What do these strategies and experiences tell us about how to develop telehealth in the future?*

The telehealth programs each country currently has will be identified. The features of the programs will be outlined, and key targets and reasons for those targets will be identified.

5) *What are the critical success factors (CSF) of telehealth in each country? Are there any common CSFs amongst the selected countries that can be considered as general factors and would be beneficial for other countries in their telehealth development?*

The CSF study will be the core of this research. All above research questions will serve this purpose and the recommendations of the report will be based on the results of the CSF study.

1.7. Structure of the research report

In this report, a literature review follows the detailed aim and objectives description of the research. Then the research methodology is introduced. Separate

chapters report on the situations in the eight countries, in terms of population, and economy development. A comparison, analysis and discussion of international practice are demonstrated, and finally conclusions are drawn and several recommendations for the future are proposed.

The rest of this thesis proceeds as follows: Chapter 2 summarizes the previous studies on the same and similar topics, including the existing theories and a review of the relevant literature; Chapter 3 describes the data sources and methodologies used; Chapter 4 to Chapter 11 will present the research results and findings of the eight selected countries; and Chapter 12, Comparison and Discussions, provides an overview of the research and attempts to analyze the findings. Finally, Chapter 13 will provide conclusions and recommendations for the thesis.

2. Literature Review

To study and investigate telehealth at a strategic level, it is necessary first to understand the features of telehealth. The literature focuses on three aspects of telehealth: the essentials, which includes the definition of telehealth and its brief history; the development of telehealth, which includes the major aspects of telehealth and trends in telehealth's development; and lastly, the benefits and limitations of telehealth types and practices. The chapter concludes with a section that 'draws' these elements together to reveal the current state of strategic thinking about telehealth and its role in healthcare.

2.1. Essentials of telehealth

2.1.1. Definition of telehealth

The term telehealth has its origin in telemedicine meaning "the use of audio, video and other telecommunications and electronic information processing technologies for the transmission of information and data relevant to the diagnosis and treatment of medical conditions, or to provide health services or aid healthcare personnel at distant sites" (Koch, 2005).

The term telemedicine has evolved into telehealth, often considered to have a broader scope towards health promotion and disease prevention. Telehealth is defined as "the use of information and communication technologies to transfer healthcare information for the delivery of clinical, health administration, and health education services" (Kerr & Norris, 2004).

The added functions of telehealth from telemedicine can be to some extent classified into the term of telecare, which is defined as "to provide independence to the old, frail and disabled people by supporting them by the use of Information and

Communication Technology (ICT)" (Yeandle, 2009). For a general understanding, telehealth is about telemedicine plus telecare.

2.1.2. Brief history of telehealth

As telehealth is developed from telemedicine, it shares the early history of telemedicine (Koch, 2005). The pilot testing of remote medical activities can be traced back to the first half of last century, such as Einthoven, firstly investigated ECG transmission over telephone lines in 1906 (Katsilambros, 2000) and some radio-based medical consultations in Norway took place as far as back as the 1920s (Qureshi, & Kvedar, 2003). However, in the 1950s, the transmission of radiographic images in USA and Canada was the first sustained application of telehealth (Mun et al., 1998).

The milestone most referred to in the applications of telehealth was by the efforts of National Aeronautics and Space Administration's (NASA) in 1960s. During these outer space missions in USA there were a total of fifteen projects, during which the physiological parameters from the spacecraft and the space suits were telemetered (Bashshur et al., 1975).

Telemedicine maturation began in the early 1990s and its first network was setup in North America. The new projects and developments on telemedicine were made on larger scale than earlier, and were led by state and province based initiatives throughout the USA and Canada (Ryu, 2010, p65). This saw a new wave of benefits from mobile communications and personal computing technology, so that telemedicine started to serve normal communities. This maturation is also called the "rebirth of telemedicine", which is also regarded as the appearance of the concept of telehealth (Maheu et al., 2001).

The telehealth services were primarily initiated by the federal agencies and telemedicine activists of the USA in the early 1990s. One such office that started large programs over half of all the states was the Office for Rural Healthcare, which was later known as the Office for the Advancement of Telehealth (OAT).

The concept of “telemedicine” and “telehomecare” being subsets of telehealth was the most vital outcome of home telehealth applications (Arizona Rural Health Resource Manual, 2006).

By 1993, there were at least ten telemedicine programs using interactive video-conferencing technology in the USA (Maheu, et. al, 2001). From then on, until about 2000, the number of programs approximately doubled every year. Meanwhile, the applications of new technologies proliferated through partnerships involving federal agencies, states governments, and private sectors. These broadened applications and widened involvement are also regarded as the signals for the derivation of telehealth from telemedicine (Darkins & Cary, 2000).

The wider opportunities in the telehealth system, but not considering the limits of the telemedicine, will fuel the telecommunication activities, generating the required revenue to operate telehealth system. Nowadays, telecommunication is indispensable for most people and with the development of telehealth, its importance and necessity is becoming more and more unslightable (Darkins & Cary, 2000).

2.2.Practice of telehealth

Kerr & Norris (2004), as well as Khan, Qurashi, and Hayee (2007) have contributed a clear and comprehensive classification of telehealth that covers all current practices of telehealth. They classify the types of telemedicine into four categories: teleconsultation, tele-education, telemonitoring, and tele-surgery.

2.2.1. Teleconsultation

Training physicians takes many years and training specialists will take even more time, leading to few experienced specialists who work in big hospitals in cities. Hence, patients have to travel long distances for the consultation with the specialists. Here, teleconsultation technology plays a vital role, as the patients and the physicians can consult experienced specialists, who are located miles

away. The quality of the healthcare system is improved both in efficiency and economically by the sheer benefits of teleconsultation technology (Teleconsultation, 2010).

Teleconsultation is very beneficial when an expert's opinion is required in making a clinical decision and statistics indicate that almost 35% of telemedicine use Teleconsultation (Kerr & Norris, 2004).

Two ways of Teleconsulting are:

1. Teleconsultation in Real-time: In this method, consulting is done between healthcare professionals with or without the presence of the patient's involvement in real-time.
2. Store and forward method: In this method the information of the patient is stored in some form and is sent to the healthcare professionals for consulting for their advice and opinions (Khan, Qurashi, & Hayee, 2007).

2.2.2. Tele-education

The education programs for the rural healthcare professionals have been provided by a means of tele-education for many years. This is performed by means of audio, video and a computer, wherein the audio or the voice of the instructor is transmitted to the learner in synchronous or asynchronous mode. In current practices of telehealth, tele-education consists of four aspects:

1. Tele-consulting for Clinical education
2. Use of internet for Clinical education
3. Use of internet for academic study
4. Use of internet for Public education (Khan, Qurashi, & Hayee, 2007).

In early times, the healthcare professionals employed a short-wave radio for audio-conferences. It has become very common now to communicate live visually and verbally through interactive video (Curran, 2006). Tele-education can be possible

by means of internet, world wide web, emails, computer based communication applications both synchronous or asynchronous and interactive multimedia applications using CD-ROM. Also tele-education has played a vital role in addressing the problem of professional isolation, especially for those who work in remote or rural places (Curran, 2006, p57).

Tele-communication is also getting more and more essential in today's healthcare. For example, in the USA, 20% of the population– about 50 million people– is living in rural areas. However, there are only 9% of the physicians of the country working in rural areas. In this case, prevention of professional isolation is very important and tele-education plays a vital role. (Zollo, 1999).

2.2.3. Tele-monitoring

Tele-monitoring is the use of telecommunication technology to gather the information of patients' condition remotely (Kerr & Norris, 2004, p3). Gathering or exchanging data on a patient's condition can be accomplished by telephone, fax, or computer/modem systems. The transmission also can be achieved by automatic, continuous ways in either real-time or store-forward mode (Kerr & Norris, 2004). The information can be received in two ways:

1. Manual: In this case, the patient records his medical condition and transmits that data through telephone, fax or computer
2. Automated: In this case, the patient's data is continuously monitored and transmitted or stored in a real-time basis (Khan, Qurashi, & Hayee, 2007).

Using a tele-monitoring system, patients can be anywhere in the world: they can be in a hospital, in their homes, aboard an aircraft, even in outer space. The information about the patients' condition can be continuously transferred to medical specialists, and the treatment plan can be made or adjusted at any time (Kerr & Norris, 2004).

2.2.4. Tele-surgery

There are two basic ways to implement tele-surgery: the first way is to use video and audio communications to assist surgeons in operation from remote place. Secondly, a robotic arm is used to do the surgery, which is controlled by the healthcare specialists remotely, which is known as tele-presence surgery. Kerr and Norris (2004) observed that tele-surgery was still in the research and design stage at that time. Optimists of tele-surgery, like Lobontiu and Loisance (2007), concluded that the robotic surgery, highlighted amongst tele-surgery, would be rapidly progressed along with the developments in system accuracy, planning and simulation of the surgical act; nevertheless, recent researches by Da Silva et al. (2010) shows that tele-surgery will become more facile as network latency becomes reduced through the use of more efficient codecs and the advancement of surgical robotics.

2.3.Benefits and limitations of telehealth

2.3.1. Benefits of Telehealth

It has been explained that the major benefits of telehealth can improve the cost, quality and access to healthcare services (Miller, 2007). To be more detailed, the benefits that telehealth can bring can be categorized in four ways: patient/public, practitioner, regional health authority, and the whole healthcare system. Some benefits from these four perspectives are shown in the following table:

Patient/Public Benefits	• Patients in rural and remote areas can easily access specialist services • Patients have to travel less • Appointment cancellations due to weather or travel condition will be lowered

	• Volunteers like care givers, teachers and others can participate in health services without the need of travel • Consultation becomes fast and hence reduces time for investigation, diagnosis and treatment • Provides for real time second opinions • Opportunities for public healthcare education increases
Practitioner Benefits	• Healthcare services in rural and remote areas can be increased • Care can be provided on continuous basis • Professional isolation is lowered • Healthcare access is improved for remote and rural practitioners • Provides greater access to continuing medical education • Teaching and review can be done on stored information • Other education opportunities are increased • Care givers can provide continuum of care to the patients present during the consultation • Specialists can provide a better teaching opportunity to physicians in their presence during the treatment process, leading to a greater breadth of experience
Regional Health Authority Benefits	• The primary care institutes can be provided with assistance by the regional health authority in specialist services • Healthcare team can provide continuous healthcare services even to long distant places • Productivity and efficiency is increased by reduced travel time • Healthcare providers can learn from the

	specialists during consultation, reducing training • Patients transfer is reduced • Educational opportunities are increased due to reduced financial demands like travelling, food etc.
HealthCare System Benefits	• Reduces re-testing of patients when transferring from one hospital to another • Cost for transferring patients can be reduced • Travelling cost for healthcare providers is reduced • Temporary staff costs can be lowered • Medical resources can be maintained in remote and rural areas • Facilitates communication between regional partners • Productivity can be increased even with limited resources • Patients can be provided high quality care at lower costs

Table 1: Advantages of telehealth services (Miller, 2007)

Miller's summary of the benefits of telehealth has provided a comprehensive overview of the benefits of telehealth at a general scope. However, for certain disciplines of medical practice, or for telehealth practice in certain areas, some of the above benefits would be achievable while others would not. The reasons may include a country's telecommunication infrastructure, policies of telehealth, and so on (Dabrowska, 2002). The most common barriers for these benefits of telehealth will be discussed in following section.

2.3.2. Limitations of telehealth

It is important to distinguish "limitations", where are inherent constraints that reduce the value of opportunities for a concept, and "barriers", which are external

constraints that can be relieved to realize the potential of a concept. “Benefits” tend to be intrinsic rather than external.

Important constraints on the success of telehealth include the breakdown in the relationship between health professional and patient, and the heavy reliance on a massive and complex system of equipment. These and other limitations can be classified as shown in following table:

Consumers	• Lowers level of trust between patient and provider • Users may be intimidated by the technology (such as the elderly population) • The uncertainty of their medical consultation privacy
Providers	• Requires a new design on risk management • Face to face communication has become complicated due to dynamic change communication technology • Lack of technical expertise by the clinicians • May have difficulty in communicating with seniors who have an increase in dementia and sensory impairment.
HealthCare Organizations	• Policies related to telemedicine must be developed • Liability may increase • Rural areas with limited technical support • Telehealth solutions must be in pace with the advancements in technology used

Table 2: Limitations of telehealth (Krupinski, 2002)

Krupinski’s comments on the limitations of telehealth have provided a clear structure to look into these issues. However, compared with the benefits of telehealth discussed previously, it can be seen that the limitations are of two types; those inherent in the approach and those barriers imposed by external constraints such as a country/area’s financial capability, policies or infrastructure into telehealth, etc. These conditions will be kept in mind during further studies of this research.

2.4.Trends of telehealth development

As practitioners and researchers discover what does and does not work in telehealth, more and more benefits are realized and barriers overcome. At the same time, changes in technology and organization development have improved practices.

2.4.1. Creating industrial and international standards for telehealth

The main aim of telehealth is to provide healthcare services from remote places by using telecommunications technology (Maeder, 2008). However, the establishment of these links is often hampered by a lack of industrial and international standards. One reason is that the technical solutions in different regions and practical areas can be very different, thus causing technical barriers. Another reason is that telehealth has a pattern of development that is best described as “bottom up”, which means telehealth was developed locally by enthusiasts from various regions, various medical disciplines, and through various technical solutions. All these characteristics of telehealth have made standardization a major impediment for telehealth growing across borders to increase the efficiency of resources sharing. Also, as patients’ mobility is increasing, there is a need for better and more interchangeable telehealth services to meet respondents’ needs. Therefore, the development of generic standards for telehealth activities has been widely recognized with high urgency. (Mars and Scott, 2010)

2.4.2. Telehealth alliance

In the last century, telehealth has been developed separately in different countries and regions. However, telehealth has overcome distance and more and more medical institutions are seeking better linkages with each other. (Khan et al., 2007)

Nevertheless, there is a long way for healthcare institutions to go before they are allied through telehealth systems. It is also determined by few factors in reality.

For example, looking at the telehealth alliance in the USA, where telehealth practice is most advanced, it is evident that many states and medical and healthcare institutions have set their own incompatible policies to meet their particular needs for healthcare. Some national alliances have been established, such as the Alliance for Home Health Quality, the American Telemedicine Association, and the Home Care Technology Association of America, etc., but much more remains to be done (Khan et al., 2007).

2.4.3. Stakeholders of telehealth

It is recognized that the accountability/interests of key stakeholders of certain industry are very important to the success of the industry, as the output from these stakeholders often heavily rely on their accountability and/or interests. Any individual or group or an organization having stakes in decision- making and actions, are stakeholders and usually have conflicting or competing interests (Heath & Norman, 2004). Dansky and Gamm (2002) defined three sets of stakeholders in the healthcare industry, who, depending upon the control of critical resources, can have immense influence on decision making of the organization.

1. Management and the staff within are the internal stakeholders
2. Medical staff, Board of Trustees or Directors, stockholders of telehealth industry are the interface stakeholders
3. Competitors, patients, managed care organizations and insurance companies, government officials, and other special interest groups can be the external stakeholders

Miller (2007) has studied the trend of telehealth from another perspective. He claimed that there is currently a disjunction in research and practice. He also believed the lack of knowledge about the feasibility and workability are the major drawbacks in the progress of telehealth system. The major inputs into telehealth are mostly made by governments, researchers, and providers in terms of financial investment, policies, technologies, and implementation; therefore, Miller’s study

points out the key stakeholders of telehealth are the government, the telehealth researchers, and the providers of telehealth services. Moreover, he emphasizes the importance and awareness of cooperation between these stakeholders for telehealth's development.

2.4.4. eHealth/mHealth

eHealth or mHealth are very newly introduced concepts derived from telehealth. The core of the concept of mHealth is to apply fast developing mobile communication technologies into telehealth thus enhancing the mobility of telehealth with even broader coverage and higher efficiency. This could be the latest trend in telehealth that might be able to bring telehealth to a new height (Vital Wave Consulting, 2009).

Meanwhile, the term of eHealth (earlier known as Health Informatics) is defined as the science and practice of the information in health leading to informed and assisted healthcare, and has come to mean the application of electronic and computational approaches to plan and deliver healthcare so as to optimize the balance between cost and quality. From this definition, it can be seen that eHealth is a broader concept than telehealth, which with its emphasis on remote communication via computer networks, and is therefore an application of eHealth.

Whereas telehealth can be executed between static locations, mHealth by definition requires at least one of the transmitter/receiver locations to be mobile. Therefore mHealth can be regarded as a subset of telehealth that will increase in importance as more and more applications of telehealth are becoming available on mobile communication devices such as cell phones and tablets.

2.4.5. The future

Some optimistic forecasts are predicting that telehealth will become increasingly common compared with traditional healthcare activities and will be fused into everyone's daily life (Klecun-Dabrowska, 2002). The achievement of this not only

depends upon the professionals using the internet as a source of transmitting services, but also the economic, political and cultural factors throughout the world (Kun, 2001). According to Lehoux, Battista, and Lance (2000), the internet must also be capable of reducing transportation needs, improvised services to people in remote areas, educating both patients and providers and also reducing rural isolation in order to be effective. However, it is unlikely that telehealth will replace the conventional method of face to face consulting (Jenkins & White, 2001), but will rather have great potential to provide services in the remote places (Sammons, 2009).

Based on the scientific literature published between 1990 and 2003, Sabine Koch (2006) studied telehealth and also analyzed abstracts of almost 600 publications, and concluded exploration of the influences on the patient and service provider relations and also the design of special groups like for disabled and elderly people is needed. Hence, further research and study is required in order to understand the benefits, impact and limitations of potential solutions and its restrictions. In particular, usability and interface friendliness are major concerns for both providers and users, especially for elder and/or disabled groups. As more and more new technologies are applied in telehealth, the usability of devices becomes a critical for telehealth's future.

2.5.Strategic thinking about telehealth

2.5.1. Telehealth and conventional healthcare

As discussed above, telehealth is developed from conventional healthcare and the very key characteristic of telehealth compared with conventional healthcare is the remote accessibility. To understand why there is telehealth in modern healthcare practices, a good perspective is to check the drivers for the development of telehealth at a strategic level. Wooding (2001) has outlined the strategic drivers of telehealth in his research, which is still valid ten years later. His points can be summarised as follows:

- An ageing population
- Change in the services from treatment to prevention and then to care
- Changing models of care (especially chrome care)
- Expanding diagnosis and treatment options
- Improved information technology and communication
- Market forces
- Pressures to reduce healthcare costs
- Consumer demands
- Urbanization and globalization

Other research also classifies the drivers of telehealth into categories of technological drivers and non-technological drivers. The technical drivers consist of:

- Computing and information technology
- Networks and Telecommunications infrastructure
- Technology-led societies

While non-technical drivers consist of:

- Improved access to healthcare services
- Providing healthcare facilities to travellers
- Application for military purpose
- Tele-care from home
- Reduced expenses
- Developed market
- Health policy and strategy (Khan et al., 2007)

2.5.2. Areas of application of telehealth

From above review of the literature, the main areas of application of telehealth can be classified from the perspective of the receivers of telehealth as follows.

- Military: Telehealth has been nurtured for military purposes since its early development until now. For example, the USA military is ahead in the telemedicine applications, providing a link between base hospitals and the remote military outpost.
- Outer space/other exploration: NASA has provided a good example for this application. During USA space missions, the health of the astronauts is being monitored by remote sensing and also by videoconferencing.
- Disaster/Emergency: The best example of telemedicine application was in April 1995, when an SOS email was sent from China helped a young female University student, Zhu Lingling, who was diagnosed with a rare syndrome through the internet. This is a typical use of telehealth for emergency purposes. In a scenario of natural disasters, like an earthquake, telemedicine could improve medical response and survival rates after a major earthquake by giving rescue teams access to specialists who are not on the scene. Using major, medium, and minor earthquake simulations, the study found that a telecommunication hub linking medical personnel at the scene with remote medical specialists could reduce mortality by 5.4%, 36.5%, and 27.3% respectively, compared with current disaster response systems. (Johnson, 2011)
- Home care: there are numerous applications for telehealth into home care, amongst which the most common ones are aged people care, and chronic disease care. (Stroetmann et al., 2010)
- Education: The students and trainees can be linked to the institutes, where the training and research is being performed. Hence, this remote access to the education provides an opportunity for the health professionals to learn (Cunningham, 2005).
- Administrative area: Clinical supervision and routine and other administrative functions within healthcare demand a high degree of accuracy and efficiency of information transfer and exchange/share. Utilizing the existing low-cost telemedical techniques and networks, these tasks could be done. Due to limited budget, existing technology is the only

means to build the systems and will advance as the technology progresses (Stamm et al., 1998).

2.5.3. Critical success factors of telehealth

In the University of Calgary, the Health Telematics Unit has identified the critical success factors for the implementation of telehealth services, which are community, funding, technology, management, education, practice and policies. Kodukula and Nazvia (2011) presented the critical success factors in the implementation of Telemedicine and they are as follows:

1. Policies and regulations made by government are well supported
2. Practices for standard project management must be adopted
3. Public acceptance
4. Political Support
5. Technical infrastructure like hardware, software and bandwidth must be available
6. Required funds must be available
7. Clearly defined legislation
8. Protocols and referral mechanisms for telemedicine must be well defined
9. Human resources must be well trained
10. Good rapport and communication must be maintained between stakeholders

A professor of Social work from the Michigan State University, Paul P. Freddolino has presented some criteria to evaluate the e-health in his report (E-health For Europe, 2002), and they are as below:

1) Needs requiring new resources must be prioritized.
2) Staff, patients and organizations must be educated about the technical based projects

3) Technology must be stable and easy to use
4) Resources and the training for the project must be available
5) The right patients and medical staff must use the system
6) Project effectiveness in addressing the specific prioritized health needs must be measured
7) A criteria to select technology and its options must be identified
8) Potential barriers must be identified
9) Obtaining feedback about the systems functionality from the patients and stakeholder for improvements
10) Unintended consequences both good and bad must be identified
11) Requirements of the project that could be replicated to other settings must be identified

From the above reviews, it can be concluded that different researchers have come up with their different summaries of CSFs regarding their different preconditions and scopes of their research. Are there any universal CSFs for most countries in their developments of telehealth? And what would the CSFs be in certain of preconditions? These are also considered as main research questions for this study.

3. Data and Methodology

3.1. Primary and secondary resources of data and information

This research will engage primary and secondary literature to explore and analyze the different practice of telehealth in the eight countries. According to Montereau, in 2005, primary resources have the following properties:

- Research is based on the primary sources which are original materials;
- Their results are in the form of print or electronic form; and
- The obtained results are always maintained in its original form and never modified or evaluated or interpreted.

For secondary resources of data or information:

- The primary sources are described, interpreted, analyzed and evaluated;
- Primary sources are commented on and discussed; and
- The academic works with removed steps are written with the benefit of hindsight (Montereau, 2005)

Both the primary and secondary sources in this research include academic journals, primary records, internet websites, government documents, publications, reports as well as periodicals. These resources are accessed through library, database of Massey University, and searching from the Internet. However, while every citation will be referenced according to APA style, they will not to be identified as primary or secondary resources.

The purpose of this research is to form a picture of how different countries view telehealth as a technology to deliver healthcare; for example, as a replacement, how their priorities and decisions are influenced by local polices and conditions, and how they implement their decisions.

Investigations covered in this study include the following, wherever available and accessible:

- Country demographics
- Country macro environment
- Government policies
- Laws and relevant regulations
- Medical system structure
- Telehealth programs
- Main stakeholders, players
- Investments and costs

Using these principal criteria, the investigation will develop comparisons between the countries which can help the introduction of telehealth. These principles will be helpful to countries and organizations to enhance the value of telehealth in their environment.

3.2. Analytical models and tools

While primarily focused on these criteria during the study, all necessary models and tools will be applied in the analysis. Amongst these tools and models, PEST, SWOT and CSF are regarded as key methods for this research. Like any other industry, telehealth is situated in a country's macro environment thus should never be regarded as isolated. While the application of PEST would provide a general overview of a country macro environment, SWOT analysis would provide a more close-up observation onto the telehealth sector in the country. The findings from PEST and SWOT analysis would be available for the CSF determination. These analytical tools are illustrated as follows.

3.2.1. Macro environmental analysis: PEST

PEST is concerned with the environment that affects the business or an organization and is defined as the Political, Economic, Social and Technological issues that can influence the development of a business.

The external aspects of the business that can affect its operation or functionality can be best identified by making PEST analysis. Also PEST analysis must be followed by the resolutions that can respond to these aspects (Shepard, 2008).

3.2.2. SWOT analysis

SWOT stands for Strengths, Weakness, Opportunities and Threats and is defined as the analysis to plan the strategy for operating a business or organization. In this analysis the internal and external factors that can affect the objective of the business are identified. SWOT analysis is very useful in identifying the businesses resources and capabilities to be prepared for the competition in which it operates. This method was initiated in 1960s by Albert Humphrey by collecting the data from fortune 500 companies. (RapidBI-orig, 2004)

The SWOT Matrix

A business or an organization may not necessarily be aiming for lucrative opportunities, but rather aiming for a balanced strategy between its strengths and future opportunities. They may also be able to provide a chance to overcome its weakness and achieve its opportunities. Hence, in order to plan a strategy considering the above factors a SWOT matrix is built. It is also known as SOWT matrix, which can be seen below (QuickMBA, 2010).

SWOT Analysis Framework

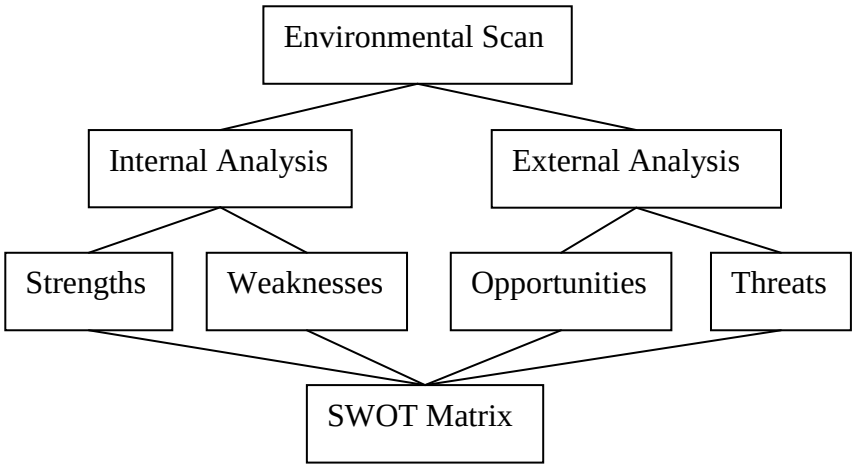


Figure 2. Adopted from (QuickMBA, 2010).

Strengths

The strength of a firm is its ability and resources that provides an advantage over its competition. For example the strengths of an organization could be its patents, brand name, reputation etc.

Weaknesses

The weakness of a firm is the lack of strengths that could provide an upper hand over its competition. For example the weakness of an organization could be lack of patents, weak brand name, poor reputation, high cost structure etc.

However, in some cases the strength of a firm could turn out to be its weakness. For example, an organization with large amount of manufacturing is considered its strength, but if the firm is unable to react to the changes to such huge manufacturing, then it becomes the weakness.

Opportunities

The opportunities of a firm may provide further growth of the company and its profit. For example the opportunities for a firm could arise from the arrival of new technology, regulations being eased, removal if international trade barriers etc.

Threats

The threats of a firm may cause a company to lose its business to its competition, which might occur due to external reasons as well. Some of the threats include change in the requirement of customers, new regulations, and substitute product emerging (QuickMBA, 2010).

3.2.3. Strategic analysis: Critical Success Factors (CSF)

The entity that is essential in achieving a firm's or an organization's objectives is called Critical Success Factor (CSF). Initially it was used in the analysis of data and business, but is being commonly used in different aspects; for example, user involvement is the CSF for a successful Information Technology (IT) project. Mostly the CSF represents the management or the entrepreneur, as these areas are the critical aspect in achieving high performance. The current activities of an organization must be included in the CSF for the success of future plans. More concisely, critical success factors refer to "the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department, or organization" (Ranjan, 2008).

Rogers (1995), in his theory of Diffusion and Innovations, has stated that the following five factors are essential in the success of telehealth applications.

1) Relative advantage
2) Compatibility
3) Complexity
4) Trial ability
5) Observation

Cain & Mittman, (2002) derived 10 more factors depending upon the above five factors. They are as below:

1) Relative advantage
2) Trialability
3) Observability
4) Communication channels
5) Homophilous groups (groups with similar characteristics)
6) Pace of innovation/reinvention
7) Norms, roles, and social networks
8) Opinion leaders
9) Compatibility
10) Infrastructure

The above 10 factors have provided a better understanding of Critical Success Factor (CSF) in this research.

3.3.Analytical framework for this research

As presented above, the analyzing framework for each country in this research will start from gathering relevant information from both primary and secondary resources. Then all available information will be analyzed from a macro level by applying PEST analyzing tool, to a more specific level of industrial analysis. After the analysis, by applying the criteria of CSF in 3.2., the critical success factors will be identified for the selected country in its telehealth development. During this process, any claimed CSFs by other authors in existing literature will be justified by this research's criteria as well.

This process will be respectively repeated for every selected country. Then, all identified CSFs will be gathered together for a comparison and further justifying, from which the generic CSFs will be determined. Based on these determined generic CSFs, a strategic framework for development of telehealth will be developed.

This analytical framework is illustrated in the following Figure 3.

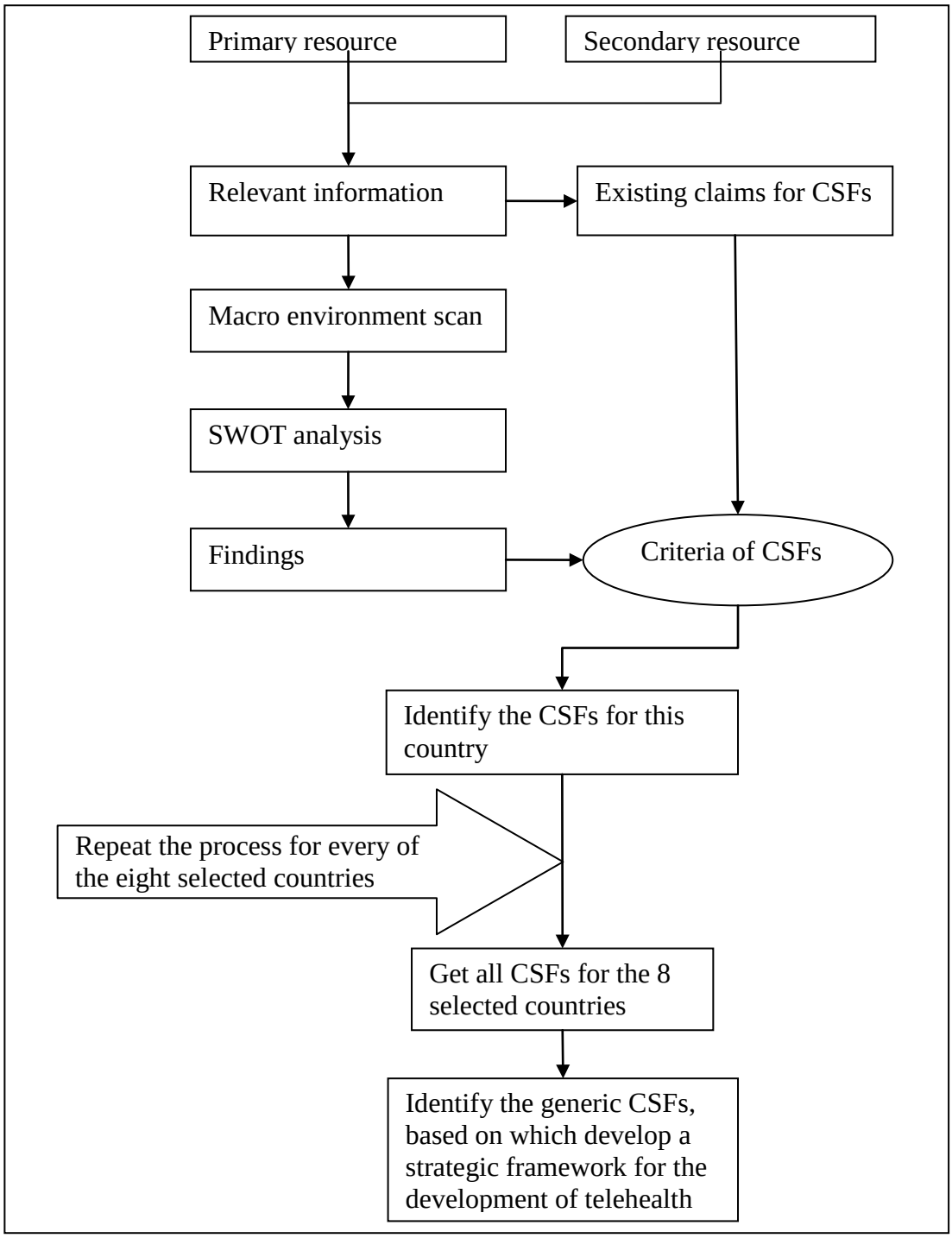


Figure 3. The research framework

4. Telehealth in New Zealand

4.1. Macro Environment scan of New Zealand

4.1.1. Summary statistics of demographics in New Zealand

The population of New Zealand (NZ) has been increasing for the last 30 years. The reasons for the continuous increase are both natural increase and net migration. The resident population of New Zealand was estimated at 4,403,000 at 31st March 2011. The increase in population in this year till March 2011 was 41,200 (0.9 per cent) which includes natural increase contributing 34,700 and rest was contributed by migrants. However, the increase in population is lower than the 56,000 of the previous year (National population estimates, 2010).

In comparison with the other OECD nations, New Zealand has been experiencing a change from high fertility/mortality state to a low fertility/mortality state (Statistic, New Zealand, 2010).

The below figure 4 represents the history of demographic transitions in New Zealand.

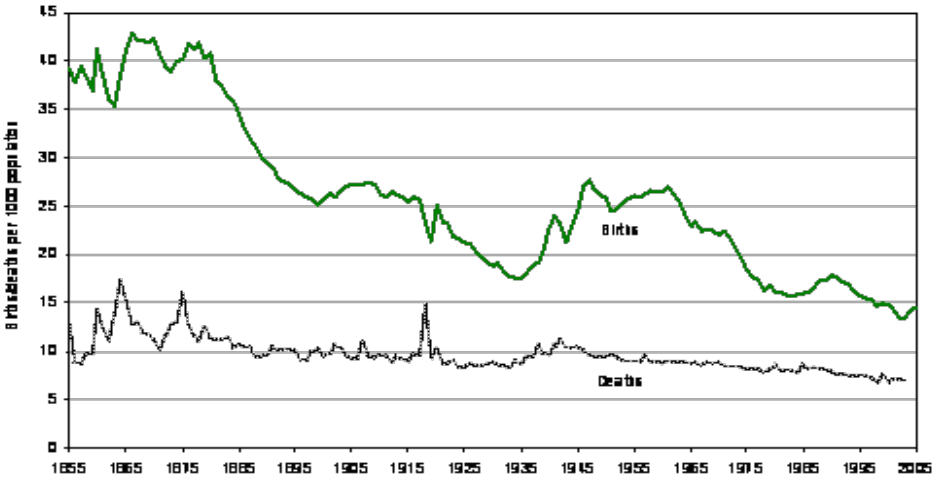


Figure 4: The long-run birth and death rates in New Zealand (Statistics New Zealand, 2010)

Figure 5 shows the long history of age-specific fertility rates. From Figure 5, it is clearly seen that only the 35-39 age group shows a significant rise from 1987 onwards.

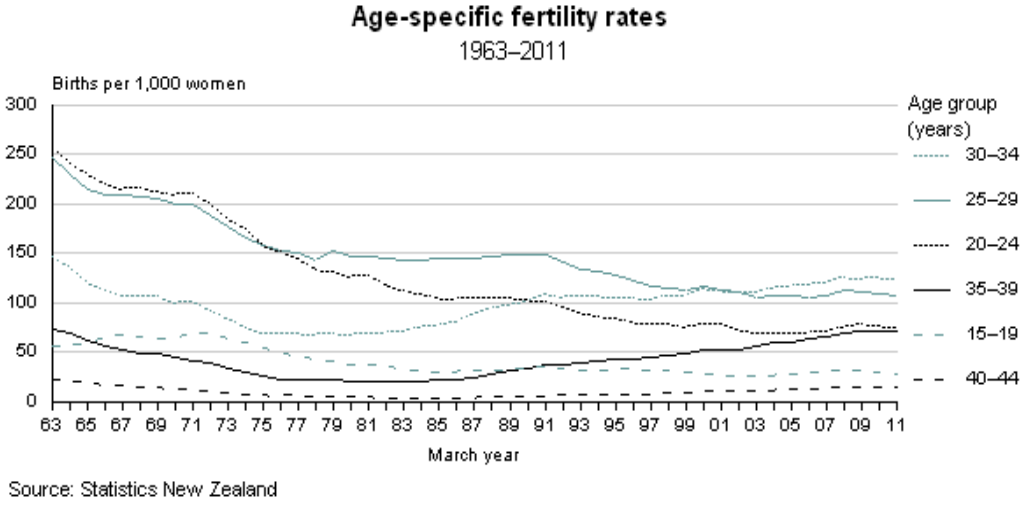


Figure 5: Age-specific fertility rates in New Zealand (Statistics New Zealand, 2010)

Figure 6 below shows the death rate in every age group in 1900, 1960 and 2000.

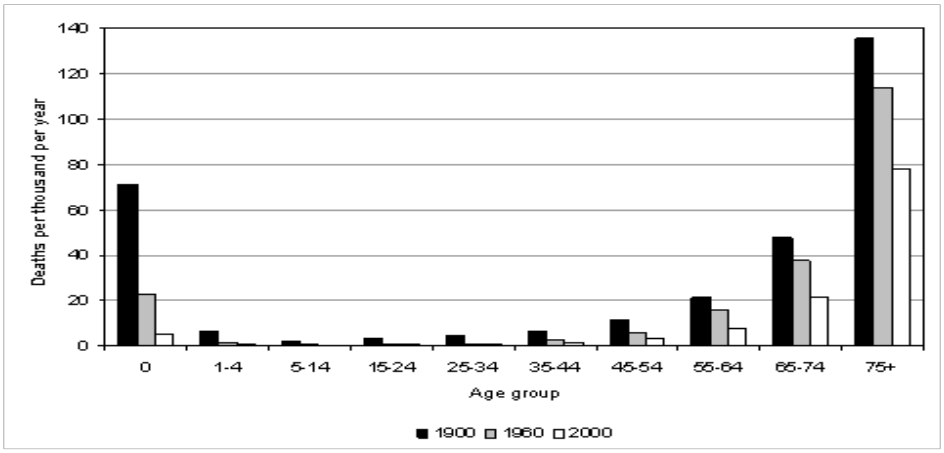


Figure 6: Death rate in every age group in the year of 1900, 1960 and 2000 (Statistics New Zealand, 2010)

The median age of New Zealand has been rising (apart from the arrival of the baby boom) and is expected to continue rising (Figure 7). As the death rates

continuously reduce, and median age rises, there are more and more aged people in New Zealand, who have a high demand for healthcare.

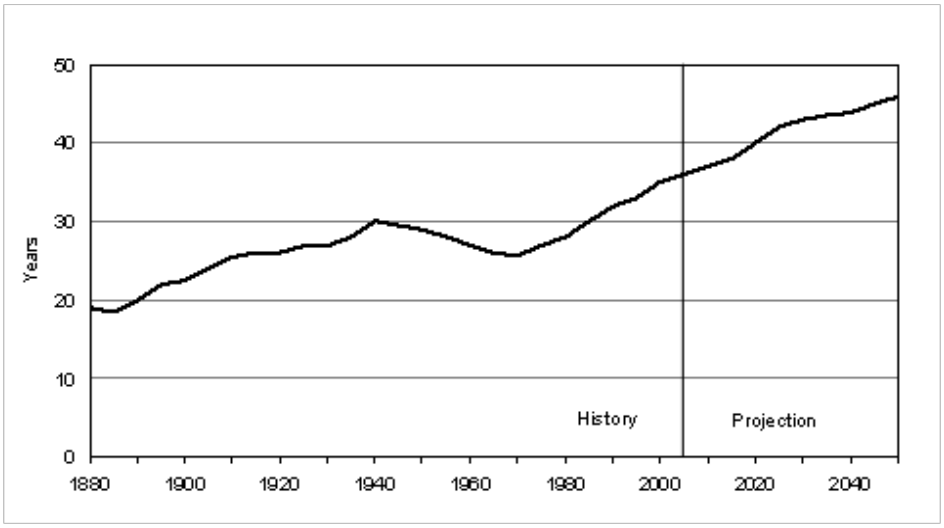


Figure 7: New Zealand population's median age (Statistics New Zealand, 2010)

According to the demographic statistics about 86% of the New Zealand population lives in urban areas, making it one of the most urbanised nations in the world. Also there are 138 towns and cities in New Zealand mostly located close to coastal area and almost 90% of the population is concentrated within 50 KM of this coastline, (Quinn & McGregor, 2002) and with 75% is concentrated in North Island.

The uneven population distribution, the increasing median age and ageing society made New Zealand a special demographic situation of healthcare. Relatively large areas with low population density offer significant room for telehealth development.

4.1.2. PEST analysis of New Zealand

Political and legal factor: Political governance and legal factors is the main factor influencing the trade policy of a country. Even though the election is held every four years, the political environment is very stable in New Zealand as most

policies would remain the same or similar regardless of which political party governs the country.

New Zealand has the best platform for performing business and trading activities as it provides 99.9% of Business freedom and 84.6% of trade freedom (Index of economic freedom, 2009)

Economic Factors: New Zealand is a developed country; however, its GDP per capital is lowly ranked in position among OECD countries. In 2009, GDP per capital was $27,400 – US dollars – ranked 51st in the world (CIA, 2009).

New Zealand has major industries such as agriculture, dairy farming, tourism, and education, etc. Many large enterprises of major industries in New Zealand are owned by overseas capital. Due to low manufacturing capability, the country heavily relies on imports of equipment while its export of certain products, such as food products, plays an important role in the economy.

During the last three years, as in most western countries, New Zealand has experienced an economic recession and is still recovering from the economic downturn.

Social and Cultural factors: Society in New Zealand consists of multi-ethnic groups, which also make up the multi-cultural environment in the country. Different cultures are mostly settled well in the country and bring the country an open cultural atmosphere in general. However, western culture dominates as the majority of the population in this country are local Europeans.

Geographically, there is tendency for people of a certain ethnic group to be concentrated in certain areas. This is observed more in large cities such as Auckland.

Technology factors: New Zealand has an advanced computing and communication infrastructure; the government, hospital, bank and business management are highly computerized. Figure 8 shows the key infrastructure of New Zealand in terms of

computer and telecommunications. Currently, most of the country is covered by 3G technology, which enables the use of the mobile internet. Telecom, Vodafone and 2degrees are the 3G providers in New Zealand. On average, almost 85% of people in New Zealand had a mobile phone by 2009 (statistics New Zealand).

Currently, the government is implementing the upgrading plan of its Internet infrastructure. It is proposed that up to 85% of Internet users will be connected to the Internet through optical-fibre access in the coming three to five years.

Relatively superior economy and better telecommunications infrastructures offer a high-quality environment for telehealth development in New Zealand.

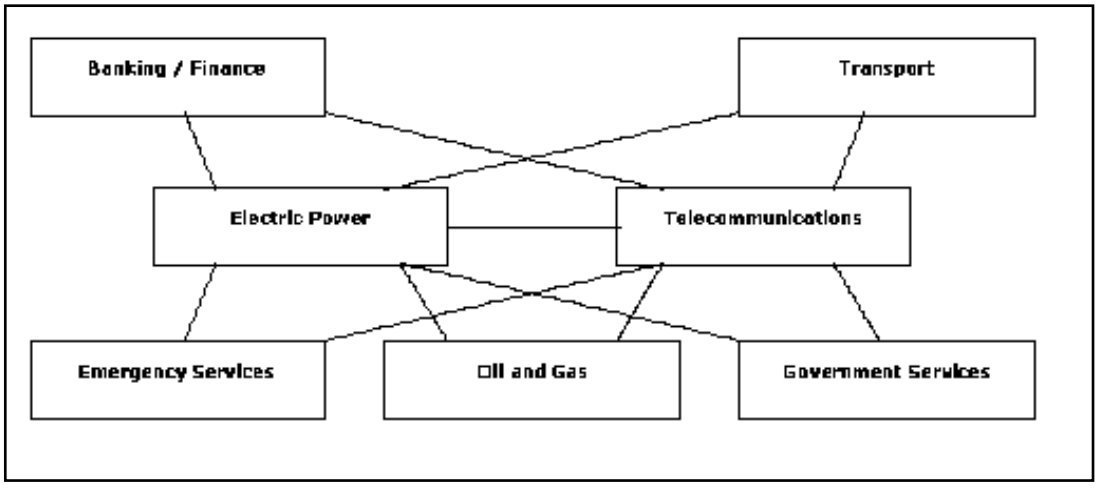


Figure 8. Critical infrastructure dependences (E-government New Zealand, 2010)

4.2. Health system in New Zealand

A significant change has been observed in the healthcare system of New Zealand since last century. The New Zealand health system has developed as a dual system of public and private provision in between 1938 and 1983. From 1983-1993 the gradual beginning of 14 Area Health Boards (AHBs) has been seen, which was funded by a population-based formula. Later in 1993, both the purchasing and

provision of health services were separated by establishing 4 Regional Health Authorities (RHAs). Also, 23 Crown Health Enterprises (CHEs) were configured from the 14 Area Health Board as profit based organizations and were subjected to the ordinary company laws. In 1998, a national purchasing agency was formed by the Health Funding Authority (HFA) by combining 4 RHAs and then Hospital and Health Services (HHSs) was formed reconfiguring 23 CHEs. In 2000, the Labour-Alliance Coalition Government formed a health system following which 21 District Health Boards (DHBs) and a Primary Health Organisation (PHOs) were developed in year 2001 and 2002 respectively (Parliamentary Library, 2009).

The New Zealand healthcare system targets all New Zealand citizens and permanent residents. Hospitals in New Zealand are managed by District Health Boards; hence they are free of charge. However, currently the cost of visiting a GP would be $0 to $45 for children and $0 to $75 for adults. In 2005, the government spent US $2,403 per capita for healthcare. The total healthcare spending took 8.9% of the annual GDP; approximately 77% was government expenditure (World Health Organization, 2010).

The following Figure 9 shows the mechanism of healthcare in New Zealand.

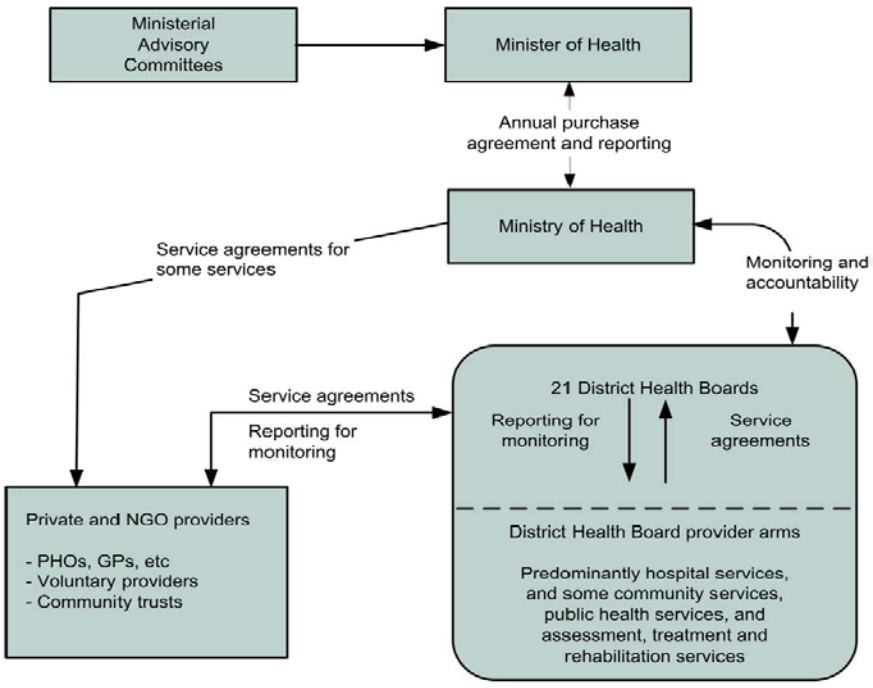


Figure 9. The operating mechanism of New Zealand's health system. (Ministry of Health, New Zealand, 2008)

Other factors of healthcare system in New Zealand include:

- The cost for the treatment of accidents is taken care by ACC (Accident Compensation Corporation) which is a government body, for all people living legally in New Zealand (including tourists).
- The medical treatment for the citizens and the permanent residents of New Zealand is free, causing delays in the treatment process which can take sometimes months. Hence, health insurance schemes have been initiated to provide funds for medical treatment privately
- Patients with community services card and high user health card are given subsidies by the New Zealand government for their medical treatment.
- New Zealand's charity organization, St. John, provides the emergency services and is supported by both public and private funds.

The healthcare standards in New Zealand are maintained by the Ministry of Health and are also responsible for funding and organizing the 21 District Health Boards (DHBs).

However, most of the New Zealanders with health issues are not satisfied with the healthcare system, as surveyed by the Commonwealth funded International Health Policy Survey in 2002. The major points of dissatisfaction were as following according to Commonwealth Fund (2002):

1) Almost 23% of New Zealanders with health problems have reported of medical mistakes or medication errors in their treatment, out of which three-fifth of the patients has experienced serious health problems. Most of these mistakes have happened when patients visits multiple doctors
2) New Zealand adults seeking multiple physicians have experienced coordination problem, causing conflicting information between different doctors.
3) Many New Zealanders depend upon the multiple medical prescriptions for taking drugs and most of these patients have reported that their doctors do not review or discuss all their prescriptions.

4) Due to lack of communication between doctors and their patients nearly 47% of New Zealanders have experienced that their doctors don't ask them about their ideas and opinions, 25% reported that their doctors don't specify their galas for treatment clearly and almost 37% said that their doctors don't motivate them. Also it has been reported that one-fifth of the patients leave doctor's office without getting answers to their important questions (Commonwealth Fund, 2002, p3).
5) Another reason for patient's dissatisfaction is the long waiting times for their treatment. It has been surveyed that almost 12% find it "Very", 24% "somewhat" difficult to see a specialist and 21% said that waiting is a big problem for them.
6) This high level of dissatisfaction indicates that telehealth can be a solution to improve the quality of the healthcare in New Zealand, especially in the areas of reducing waiting time and the chances of medical errors.

4.3. Telehealth in New Zealand

The above situation analysis concluded that population distribution is a reason for New Zealand to initiate telehealth. New Zealand has the economy power and infrastructure to implement telehealth. Also, the level of New Zealand people's dissatisfaction with their healthcare can be regarded as the opportunity for telehealth development. All the above factors indicate that New Zealand needs telehealth. However, the New Zealand government has not made any clear strategic planning for the development of telehealth in the country.

4.3.1. Applications of telehealth in New Zealand

In 1993, one of the earliest telehealth practices was observed in New Zealand. In this case, images of radiology were transmitted by using leased telephone lines between two hospitals (Qirim, 2004). Since 2000, the number of projects based on

telehealth has been increasing and have seen 12 projects in development. Some projects include tele-radiology (the process of transmitting images of x-rays and CT scan for remote diagnosis) and tele-psychitary (Psychiatrist consultation from a remote place). The telehealth projects were increased in 2003; there were 22 different projects with tele-radiology being the most common telehealth application. However, due to high maintenance issues, the use of teleclinics was reduced after 2000 (Fraser, 2006).

The Waitemata Health centre in North Island, has two teleconferencing systems for psychiatry use and one for the training and administration (Qirim, 2004). Whereas, in Health Waikato centre two of the teleconferencing systems were used in dermatology department and one system is used for training and administrative purpose. The two Telehealth Video conference systems in Northland Health Ltd (Whangarei) are used in psychiatry and for training purposes. The Starship Children's Hospital (part of Auckland Healthcare Services) is in the initial stages of establishing a nationwide network for tele-paediatric across 23 HHS. In addition, Middlemore Hospital (South Auckland Health) has one group telehealth conferences system, Auckland University School of Medicine has one group of TMVC system and Lakeland Health LTD has two groups of video teleconferencing systems for training purposes (Qirim, 2004). In the South Island, Coast HealthCare LTD have three TMVC systems, Canterbury Health Ltd (Christchurch) has one video conferencing system, Healthlink South LTD (Christchurch) has two group of systems, Health South Canterbury Ltd (Timaru), Healthcare Otago LTD, Nelson-Marlborough Health Services LTD, and Southern Health LTD each have one group system (Qirim, 2004).

Recently, according to the National Health IT Plan (2010), there are series of programmes carried out in the country. These programmes include the following priority areas:

1. eMedications programme
2. National Systems

3. Regional (DHB) Information Platforms
4. Integrated Care Initiatives

The efforts in these programmes and the effects from these programmes are considered to some extent beneficial to the development of telehealth; however, these programmes are have limited relevance to telehealth. Although the Ministry of Health has developed a National Health IT Plan, its priorities do not include telehealth to any extent and there is no overall strategy for it.

In 2003, advancement in the telecommunication technology has been seen especially in mobile and internet technologies when compared to predominant ISDN line. However, the telehealth projects were not developed as expected and were dependant on the availability of local clinical champions (Fraser, 2006). Also the other reason for slow development of Telehealth projects was that these projects were not distributed evenly across the country, but were mostly concentrated in Auckland region due to funding and other factors. Hence, there is a need to establish a national strategy to encourage the use of telehealth applications and teach its benefits (Kerr &Norris, 2004).

4.3.2. Strategies for telehealth in New Zealand

The health sector is one of the major areas for digital technology in New Zealand, and telehealth is an important application in the area. The health sector will collaborate with the other sectors such as education, government and ICT industry to achieve the future economic improvements (Ministry of Economy Development, 2008).

In 2008, the New Zealand Ministry of Economic Development released a strategic plan entitled “Digital Strategy 2.0”. The strategy gave a vision of the future economy development leveraged by digital technology. This strategy includes

Digital healthcare and telehealth, and to improve the nationwide healthcare quality (Ministry of Economy Development, 2008).

The digital strategy 2.0 maintained by the Ministry of Health, has initiated a connected health system by improving the broadband connectivity between all the health providers, enabling the development of the clinical applications such as lab tests, ePharmacy, GP notes and health referral applications forming an integrated health center. This strategy has been targeted to eliminate the lack of access to broadband between the health providers by 2012 (Ministry of Economy Development, 2008).

On the other hand, however, this strategy has not included any information or and strategic plan about how to develop telehealth system within the country. It is believed that the Ministry of Economy Development does not have any responsibility to do so. Nevertheless, telehealth development has been included in a national economy improvement strategy. The Ministry of Health has emphasized the telehealth applications on a number of occasions. In their official strategy work: Strategy Direction Statement 2008-11, telehealth is mentioned to be an effective means to prove the future quality of healthcare (Ministry of Health, 2008). In the similar situation, in the strategic document of "Child Health Information Strategy", the telehealth again is mentioned as an effective way to improve information sharing (Ministry of Health, 2010). It seems the government departments have understood telehealth and its benefits, but no single strategic plan has been made by New Zealand government.

Parallel with government's strategic plan, the professional organizations and associations have dedicated spaces to telehealth development strategies. In July, 2008, the New Zealand Medical Association (NZMA) issued a strategic document: "Telehealth – Position Statement". The document has regulated usage of telehealth in New Zealand, in the following aspects:

- What telehealth must be?

- Communication with Patients
- Standards/Quality of Clinical Care
- MCNZ – Statement on Internet and Electronic Communications
- Patient Confidentiality
- Use of Telehealth Services Based Overseas

As mentioned above, the Health and Hospital Services (HHS) manages the entire crown owned hospitals in New Zealand. HHS is the organization which manages local hospitals; it became District Health Boards (DHBs) after the year 2000. Several HHS have one hospital and others have more than one. Because the New Zealand central government has no clear strategy, the local HHS always initiates telehealth programs on their own. Therefore, some applications overlap, and others repeat.

The National Health IT Board is a subcommittee of National Health Board (NHB) has made remarkable efforts in providing strategic leadership on information systems and ensures that the IT strategy makes an impact on the capital allocation and capacity planning decisions. The image in Figure 10 shows the strategy of National Health IT Plan (2010) proposed by the National Health IT Board, in which it can be seen that there are two strategic steps of development and tasks for each step.

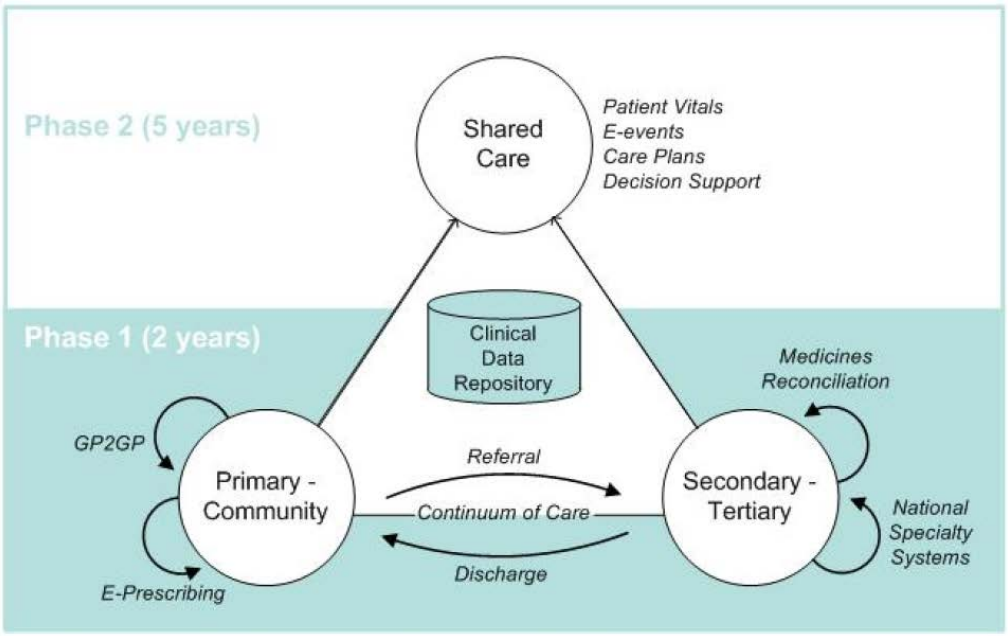


Figure 10. Enabling an Integrated Healthcare Model (National Health IT Plan, 2010)

As shown in Figure 10, the National Health IT Plan (2010) has an emphasis on integrated care and infrastructure sharing but there is barely sufficient reference to telehealth and no detail. Obviously, this strategy is still under development.

According to the telehealth literature, the regulatory environment has failed to keep in pace with the telehealth, causing the legal framework to intervene with the healthcare practices and between specialists and technology raising legal concerns among patients and HHS (Edelstein, 1999) (Qirim, 2004).

Finally it can be concluded that the New Zealand Ministry of health has realized the importance of telehealth for the betterment of healthcare and economy and is yet to make strategic planning. However, the smaller organizations like HHS and other professional bodies have made reasonable efforts within their limited powers.

4.4. Analysis of telehealth in New Zealand

4.4.1. SWOT analysis of telehealth in New Zealand

The above analysis has presented an overview about the telehealth in New Zealand. However, a SWOT analysis is carried out below to get better understanding considering the internal and external.

Strengths:

- Sound healthcare system and infrastructure with ideal demographic characteristics (Qirim, 2004)
- Well established telecommunication networks
- Apparent need of telehealth applications like consulting, diagnosis, transfer of patient records, therapy, case studies, training and meetings (Qirim, 2004)
- High level of awareness and consensus on the development of telehealth in relevant institutions and some local health boards, unfortunately, except the Ministry of Health

Weaknesses:

- Relatively fragmented Regional Health Boards
- Weak in national technical development and manufacturing in terms of equipment for telehealth networks
- Possibility of change in doctor's interest when dealing with patients face to face and when dealing through television screens (Qirim, 2004)
- Rising concerns about causing work hazard when working with video or screen based consultation for longer period (Qirim, 2004)
- Limited financial inputs vs. expensive technology
- Lack of technical expertise in certain areas (Qirim, 2004)

Opportunities:

- Staying up with the global trend of healthcare for the new century
- Integrating the current available resources of healthcare
- Lowering costs and improving efficiency
- Better accuracy in diagnostics and treatment as more doctors could be involved
- Much better condition for training and information exchanging/sharing
- Better working environment, especially for rural healthcare workers on more connected and interactive networks
- Benefits for patients in terms of shortening waiting times, lowering travel costs, etc.
- Promote other products/services through the telehealth network (Qirim, 2004)

Threats:

- Input/benefit justification, measures for success
- Proper distribution of usage of the telehealth networks
- Complicacy and difficulty in funding
- Cost and sustaining a profitable business may not be justified (Qirim, 2004)
- Technology that matches the medical requirements
- Risk of dated technology
- Legal risk (such as license over the networks, responsibility of treating, etc.) and issues of liabilities (Qirim, 2004)
- Risk of technical reliability and its relevant liabilities
- Barrier of acceptance by doctors

From above SWOT analysis, we can briefly see that the development of telehealth has good prospects (opportunities) but there are challenges (threats). However, it maybe that there are more amount of weaknesses than strengths in the current circumstances. In other words, there is a long way to go for the telehealth to thrive in New Zealand. In this situation, catching the key points to focus efforts would be extremely important.

4.4.2. CSF analysis of telehealth in New Zealand

Critical success factors (CSF) in this research refer to those key points in the strategy of telehealth development in New Zealand. These CSFs are the most important factors that needed by stakeholders to make telehealth sustainable. Based on the above analysis, the following points can be summarized as the CSFs for telehealth in New Zealand. These CSFs can be classified into two categories: intrinsic and external. While intrinsic CSFs are believed to be common across all telehealth markets, and are determined by the nature of the technology and practice; the external CSFs are considered more country dependent, which means they can depend upon a country's conditions and cannot be simply copied by other countries.

- **Alignment of stakeholders in telehealth in the country, in terms of shared vision, goals and financial investment**. This means not only a consensus of stakeholder on the development of telehealth, but also the leadership to drive the integration of all available resources into the development of telehealth. This is the very primary condition to be satisfied for successful telehealth in New Zealand.
- **Based on the alignment stated above, a proper development and operation environment is essential for the development of telehealth**. This environment includes three parts: first, setting up a transparent and open partnership between healthcare providers and IT vendors, so that the desired health solutions can be developed (National Health IT Plan); second, a proper business model to justify cost and to sustain a profitable development; third, an operational mechanism that encourages the healthcare service providers to make use of the technology and information management process (Qirim, 2004).
- **Strength in promoting educational and research initiatives in chronic disease/disability support services**. As an emerging sector deriving from conventional healthcare, telehealth needs a proper point or perspective to

start from. Educational/research and chronic disease/disability care are the main initiatives for the development of telehealth in this country. This means two things: one is that such needs exist across the country and another is that telehealth will greatly assist the satisfaction to such needs.

- **The demographic setting in this country**. Telehealth is ideally suited to a small-scaled population with a relatively low density. The aging issue of the population is also promoting the need for telehealth. However, some demographic fact may increase the difficulty of telehealth development, such as large amount of new migrants, etc.
- **Legal issues may generate risk and act as a barrier when more and more medical activities are implemented via telehealth networks**. This means issuing relevant liabilities and maintaining restrictions for medical practices throughout the country. However, the legal issues related to the operations of a telemedicine network include confidentiality of patients and privacy, malpractice, fraud and abuse, intellectual property etc.

4.5. Summary

This chapter has reviewed the macro environment and the healthcare system in the country of New Zealand, therefore given an illustrated background for telehealth in the country. Then, at a more specific level, telehealth in New Zealand has been examined with focuses on its current applications and its strategy of development. The key finding is that with the absence of a well-developed nation-wide strategy, telehealth in this country has developed, but is to some extent fragmented. To be optimistic, most major stakeholders have a quite high level of awareness of developing telehealth, different parties are implementing various programmes, and some pilot telehealth programmes are also observed. All of these efforts will be beneficial for telehealth in the long run; however, they need to be integrated.

In summary, as telehealth is derived mainly from conventional healthcare by using modern IT technologies, most development will be determined by healthcare

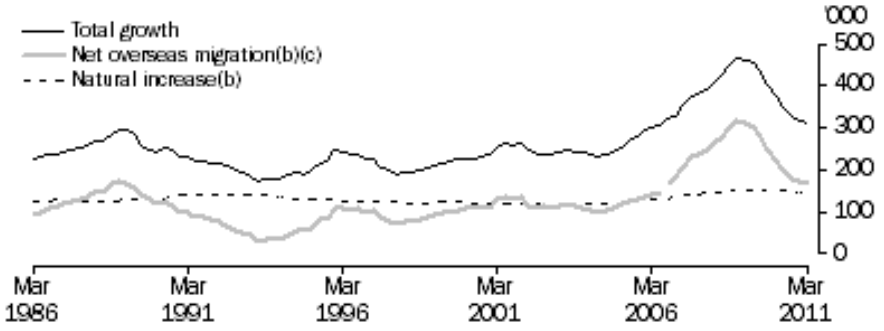
providers rather than IT solution providers. Therefore, within New Zealand, the factors that more determined by IT providers are considered as external CSFs and other CSFs are considered as intrinsic ones. For New Zealand, the specified five CSFs all need to be satisfied for a sound development of telehealth.

5. Telehealth in Australia

5.1. Macro environment scan of Australia

5.1.1. Summary statistics of demographics in Australia

Being the sixth largest country in terms of area, Australia has only ranked at the 51st of population in the world, which is less than 23 million. The population of Australia has doubled in the last some 50 years, and the government has projected the population will double again in next thirty years. However, the annual growth of the population in Australia has not been consistent, but has fluctuated between less than 100 thousand and nearly 500 thousand in last couple of decades. The reasons for the continuous increase are both natural increase and net migration. As shown in the following Figure 11, the natural increase has been quite stable, while the change of total population increase is mainly caused by the fluctuation of net overseas migration (ABS, 2010)



(a) Annual components calculated over each quarter.
(b) NOM estimates for March quarter 2010 onwards, and Natural Increase estimates for September quarter 2010 onwards are preliminary.
(c) NOM estimates have been calculated using a range of methods over the period, and include a break in series from September quarter 2006 onwards – see paragraphs 12–19 of the Explanatory Notes.

Figure 11: Components of Annual Population Growth of Australia
(ABS Australian Demographic Statistics 3101.0, 2010).

Figure 12 shows the long history of age-specific fertility rates. From Figure 12, it is clearly seen that only the 30-34 and 35-39 age groups show significant rises from 1980 onwards to 2005, and this trend has been kept up.

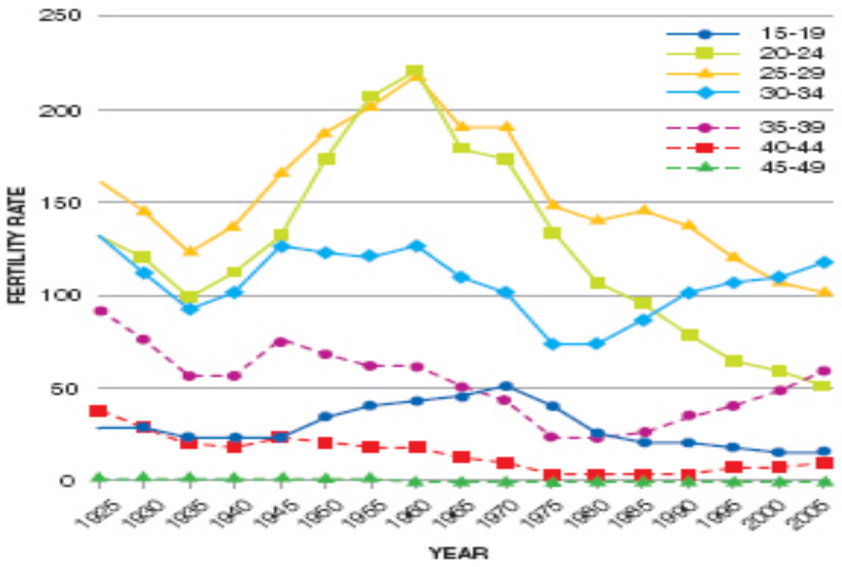


Figure 12: Age-specific fertility rates in Australia (ABS, 2010)

Figure 13 below shows the age and sex distribution between capital cities and the remaining part of Australia.

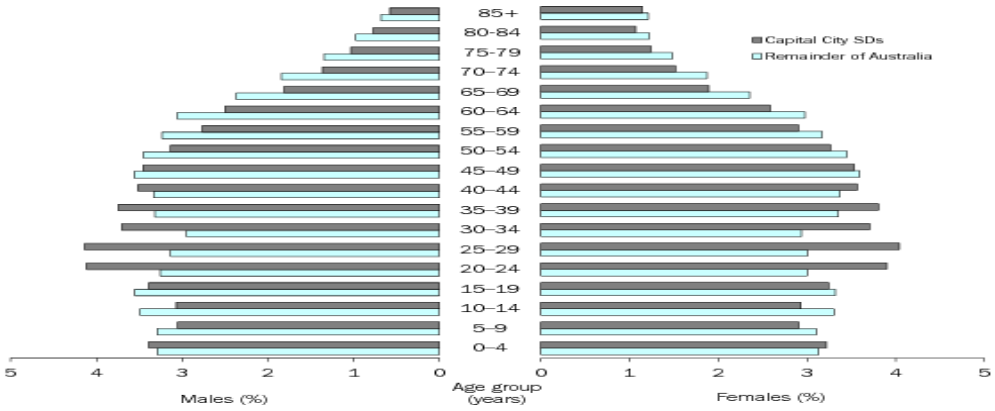


Figure 13: Distribution of age and sex in percentage between capital city and the remainder of Australia - 30 June (ABS, 2010)

From Figure 13 above, there is a distinctive feature that can be observed. Both for male and female, from 20-24 age groups to 40-44 age groups more people are living in capital cities than in the remainder of the country. This is due to the attraction of young to middle aged adults towards education, job and other opportunities in cities, whereas, on the contrary 36.6% of older adults aged 45 or more live in capital city compared to the remainder of Australia which is 41.9% (ABS, 2010).

It is common in most of the OECD countries that the combination of increasing life expectancy and low level of fertility is causing the ageing of the population, as is seen in the case of Australia. In 2007, the median age of Australia's population was between 36-37, and it is expected to increase to between 38.7 years and 40.7 years by 2026, and then between 41.9 years and 45.2 years by 2056. Hence, age composition is expected to change causing people aged 65 or more to be greater in number than people below aged 15 by 2056. In 2007, Australia's population has 13% of people aged 65 years and is projected to increase to between 23% and 25% in 2056 (ABS, 2008).

By 2010, 89% of the Australia's population lived in urban areas, making Australia one of the most urbanized nations in the world. The majority of Australian people live in coastal regions, especially in south east of the continent. However, there is a considerable feature that the traditional remote areas, such as the West Australia, are have had greater population growth in recent years. From the demographic perspective, the uneven population distribution, and the ageing society have made Australia a special situation of healthcare; more importantly, the very large large areas with low population density offer significant room for telehealth development. (ABS, 2010)

5.1.2. PEST analysis of Australia

Political and legal factors: One of the important factors for any country which affects industrial development is their legal rules, regulation and policies from

their government. According to the World Bank, Australia is business-friendly as it takes just 2 days to complete the regulatory procedures (About Australia, 2008). This is due to relaxed environmental and economic laws and regulations.

Australia's economic freedom score is 82.5 in 2011, which is ranked 3rd in the world. Business freedom in Australia is 90.1% and trade freedom is 84.4%, which indicates that Australia has a good environment for business and trading (Index of economic freedom, 2011).

Economic Factors: Australia has a very strong economy with gross public debt standing at less than 25 per cent of GDP. The reason for Australia's strong economy is its ability to withstand the internal and external events like major droughts, housing boom and the Asian financial and economic crisis (About Australia, 2008).

Apart from the above mentioned reasons, Australia's strong reforms, low inflation rate, increasing housing market and strong economic ties with the fastest growing economic country China are responsible for a strong economy. Australia, being a leading exporter of agricultural products, minerals, metals and fossil fuel has seen a surplus in its budget since 2002. However, recent events like droughts, robust import demands, and a strong currency has increased the international trade deficit of the country. This is widely discussed as a potential issue for its economic sustainability (CIA, 2011).

Social and Cultural factors: From the country's demographic feature, it can be seen that the increase of population in Australia is greatly contributed to net overseas immigrations. This also determines that the country has a multi-cultural social environment. While multicultural diversity brings the country vividness, it is also considered as a potential cause for the increase of healthcare burden. Reasons include lifestyle change, nutrition unbalance, and more people flow (Australian Bureau of Statistics, 2008)

Technology factor: Matching its economy scale, Australia has good capability in terms of technology development and relevant manufacturing. Australia has excellent domestic and international telecommunication infrastructure. Over 80% of Australians are Internet users, and there are some 5 million broadband connections. Almost every Australian has one cell phone. In recent years, Australia has emphasized its ICT infrastructure to be suited to serving the needs of modern, international businesses and economic development. Current major upgrading is coaxial cable to 100Mbps in some areas and anticipates further upgrades could achieve speeds of up to 200Mbps nationwide. (ICT Infrastructure, 2008)

5.2. Healthcare system in Australia

The healthcare system of consists of two sectors: Medicare system and private health services. The Medicare system was introduced into the country in 1984 by the government allowing all eligible Australian residents access to free to low-cost health facilities and/or services which are financially funded by taxation called a Medicare levy (Hilless, and Healy, 2001).

Medicare system is a tax-funded public insurance scheme that covers the medical treatments like consulting physicians, hospital services and prescription, and has helped Australia to achieve 100% healthcare coverage. The public hospitals in Australia are funded by the government and are administered by state and territory health departments. Private insurances, in addition with the government subsidy, cover half of the Australian's health coverage. The majority of the doctors work privately and get paid on fee for service basis and act as gatekeepers for specialist care. The Department of Health and Ageing and the Department of Human Services have designed goals to develop a new management system for public hospitals by increasing government funding, monitoring performances and strengthening primary care (Commonwealth Fund, 2010).

Currently, Australia faces many concerns with their healthcare system. The most common ones are:

1) A consistent shortage of nurses (Quan, 2006)
2) Lack of accessibility. The Medicare system has been ranked in leading position around the world. However, since 2002, the supply of General Practitioner (GP) fell by 2% and on the other hand the supply of specialists increased by 17%. This indicates rise in the cost of health treatment and non-availability of GPs when required. Also due to ageing of GPs, the average age is over 50 years; there will be a shortage of GPs in future (Mitchell, 2010).
3) Urgent needs for training facilities as new GPs are needed to fill practices (Mitchell, 2010).
4) Fall of insurance companies due to malpractices (Quan, 2006).
5) Unavailability of adequate equipment (Quan, 2006).

5.3. Telehealth in Australia

The above situation analysis concluded that population distribution is a reason for Australia to develop telehealth. Also, there are other two current circumstances that require development of telehealth. Firstly, the access to health system is unequal and secondly, the health system in rural and remote areas is poor. All above issues/concerns of healthcare in Australia could be resolved or partially eliminated by the development of telehealth.

5.3.1. Applications of telehealth in Australia

In Australia, telehealth is conceptually recognized as the delivery of health-related services and information via telecommunications technologies. At a practical level, telehealth can cover a wide range of healthcare deliveries: as simple as a consultation via a telephone call to as advanced as a telepresence through video

conference or even tele-surgery using remotely guided devices such as a laparoscope (Telemedicine in the context, 2011).

As the primary benefit of telehealth is to overcome the inaccessibility due to physical barriers, in Australia, telehealth has been widely admitted to have great opportunity for development as three quarters of the country is considered as 'geographically remote'.

According to the Department of Human Services of Australian Government in 2010, the government of Australia has initiated the telehealth services from 1 July 2011, to the eligible Australians through Medicare Australia, to present the challenges faced. The patients participating in the telehealth consultation were provided with financial incentives.

Within Australia, the earliest implementation of telehealth started in 1928 with the Royal Flying Doctor Service delivering healthcare services via a 'pedal wireless'. Since then, telehealth is now common in most public health systems utilising technology such as videoconferencing. Nowadays, two of the most important examples are as follows:

1) In NSW Health, the NSW Telehealth Program provides a network of 35 clinical services over 270 facilities across the state. It provides services in critical care, primary and chronic care, tribunal and forensic services and integration with other agencies. (Draft HNE Health, 2010)
2) In QLD Health, the State-wide Telehealth Service provides access to more than 507 video conferencing sites across the state. Clinical areas which use these services include radiology, diabetes clinics, emergency coordination, foetal monitoring, geriatrics, mental health, pre-admission, oncology, ophthalmology, orthopaedic, paediatric, pharmacy, intensive care, etc. (Queensland Statewide Health, 2007)

5.3.2. Strategies of telehealth in Australia

The traditional driver of telehealth in Australia is the country's demographic features, while the valid and recent driver for telehealth development is more likely the population ageing issue of the country. The number of Australians aged 65 or more is expected to double from 1999 to 2021 (Banks & Togno, 1999).

In 2001, the National Health Information Advisory Committee (NHIMAC), commissioned the National Telehealth Plan for Australia and New Zealand (known as ANZ01). This national telehealth plan clarified that telehealth includes telemedicine and is emerging as a sustainable and acceptable health service delivery technology for clinicians and clients. Also, this plan recommended a number of actions in the following areas:

- Development of an appropriate national management strategy for telehealth;
- Development and execution of a marketing and education strategy for telehealth;
- Development of a national research and evaluation agenda;
- Formalising links with key bodies in health to support the collaborative development of future strategies around telehealth;
- Exploring national purchasing power options that could reduce capital funding costs as well as a review of Medicare claiming rules around services that need to be delivered face-to-face;
- Identification and development of national standards for telehealth; and
- Identification of infrastructure requirements and development of a national strategy to respond to gaps in telecommunications infrastructure (National telehealth plan, 2001).

Also in this document, a catalogue of active Australian telehealth projects was developed, which identified more than 175 projects. The most common uses of telehealth in Australia include mental health and the delivery of multidisciplinary care. There are also a range of other uses in areas such as radiology, obstetrics,

paediatrics, ophthalmology, renal, diabetes, pathology and rehabilitation. (National telehealth plan, 2001)

Along with the progressing of the above telehealth projects, from a macro perspective, it has been realized that broader uptake of telehealth in Australia has been limited by a range of barriers, including:

a) Lack of high level successful implementation nationwide
b) Lack of dedicated funding and access to Medicare claims for teleconsults
c) High infrastructure costs (Telehealth Standards Scoping Study, 2007)

In 2007, the Department of Health and Ageing commissioned a scoping study on telehealth. This study recommended the following areas be further developed:

- Personal monitoring device standards
- Standards for recording telehealth episodes of care
- Telepresence and networking standards
- Still image capture standards (Telehealth Standards Scoping Study, 2007)

Recently in early 2011, the Australasian Telehealth Society (ATS) has submitted a research report on the role and benefits of National Broadband Network (NBN) to the Australian House of Representatives Infrastructure and Communications Committee Inquiry. This research report has presented the issue of strengthening the NBN in order to provide affordable and easy to access high definition video conferencing. Hence, the advanced infrastructure would be more beneficial by providing the healthcare services remotely (ATS, 2011). This development addresses barrier c) above.

5.4. Analysis of telehealth in Australia

5.4.1. SWOT analysis of telehealth in Australia

While the above analysis has provided an overall picture of telehealth in Australia, a SWOT analysis in which the internal and external conditions and situations are better described and analysed will give further insights.

Strengths:

- Long existence and tradition of telehealth
- National level organizations established to develop and promote telehealth
- More advanced system could be provided by National Broadband Network (Telemedicine in the context, 2010)
- Due to the demographic feature of the country, creating awareness and consensus on the development of telehealth is achievable
- Well established telecommunication networks
- Nation approach taken by Australasian Telehealth Society

Weaknesses:

- State based health system is fragmented (Wilson, 2010)
- The advanced network and user interface technology may not be easily accessible (Wilson, 2010)
- Lack of national standardizations in telehealth, in terms of technical standards, business model, payments, etc.

Opportunities:

- Unequal opportunity to access the excellent health system (Wilson, 2010)
- Rural and remote areas having poor health outcomes (Wilson, 2010)
- Apparent needs for telehealth to deal with issues like ageing population, remote and very low living density, etc.

Threats:

- Fast pace of technology innovations, such as bandwidth, wireless, mobility, etc. that may make applications dated quickly
- Constraints of in funding
- Difficulty to promote telehealth at GP level
- Legal issues in providing distant healthcare like privacy, registration and security (Banks, & Togno, 1999)
- Choice of technology to use by healthcare providers and patients may be a risk.

From above SWOT analysis, we can briefly see that telehealth has been developed well in Australia in past years, however, there are still threats and weakness that challenging its further advancement.

5.4.2. CSF analysis of telehealth in Australia

Critical success factors (CSF) in this research refer to a limited number of characteristics, conditions or variables that have a direct impact on viability, efficiency and effectiveness of a project, program or an organization in the telehealth development in Australia. These CSFs are the most important factors for sound and sustainable development. Based on above analysis, the following points can be summarized as the determined CSFs for telehealth in Australia.

- **To improve the technical and operational aspects by leveraging the well-established telecommunication infrastructure and video system is possible with the coordination of a national cooperative approach**. This means the development of telehealth is not just for the stakeholders but also for the integration of all available sources.
- **Well-established National Telehealth operations network and its further development**. The structure of this network includes two parts: firstly, it provides support to all the parties by providing facilities like

directory and interoperability; secondly, it provides a choice of technology for use by clinicians and patients, according to their preferences.

- **People participating in the video conferencing for telehealth services must be coordinated and share the common guidelines based on clinical and technical experience**. This includes two parts: firstly, implementing guidelines (both technically and operationally) for clinicians who are considering the introduction telehealth services or are reviewing its capacity; secondly, the publication of a common listing of specialists and GP clinics who are willing to conduct Telehealth consultations.
- **Australia has the financial capability to invest into the development of telehealth; however, these investments should be more efficient and effective.** This should be in terms of: first, Interoperability – there has been considerable investment across the health sector in endpoints and a means to fully leverage those investments by allowing equipment from different vendors to easily interoperate, again in a way seamless to the user; second, appropriate and sustainable funding models are also required to embed telehealth as normal practice.

5.5. Summary

In summary, the overall impression of telehealth in Australia is that the country has a high level of consensus and commitment to the development of telehealth. The Government (decision makers) seems to have higher awareness than the GPs (endusers), have formed a kind of top-down mechanism in its development. However, during this research, relevant examples of telehealth were less than expected. This can be understood in the way that perhaps practitioners were using more often off-the-shelf rather than innovative technologies, and reporting less.

Due to the unique demographic features and the strong economy of this country, it is confidently believed that telehealth will carry on its development in Australia in coming years. Nevertheless, it is also expected that Australia would be capable of

taking more responsibilities in the development of telehealth in the world, not only due to its capability, but also its enthusiasm.

6. Telehealth in the USA

6.1. Macro environment scan of the USA

6.1.1. Summary statistics of demographics in the USA

The USA has the third highest population and accounts for 4.5% of world's population. The population of USA in 1950 was 152.3 million and now is doubled to 308.7 million. The Population Reference Bureau has presented a report highlighting the demographics changes in USA since 1950 and its impact on nation's future. It also reports that the USA is getting bigger, older, and more diverse (Shrestha, and Heisler, 2011).

The USA is getting bigger: The increase in the population of the USA is due to increase in birth rates, lower death rates and increased immigration. The population increase and its trend in coming decades are shown in following Figure14.

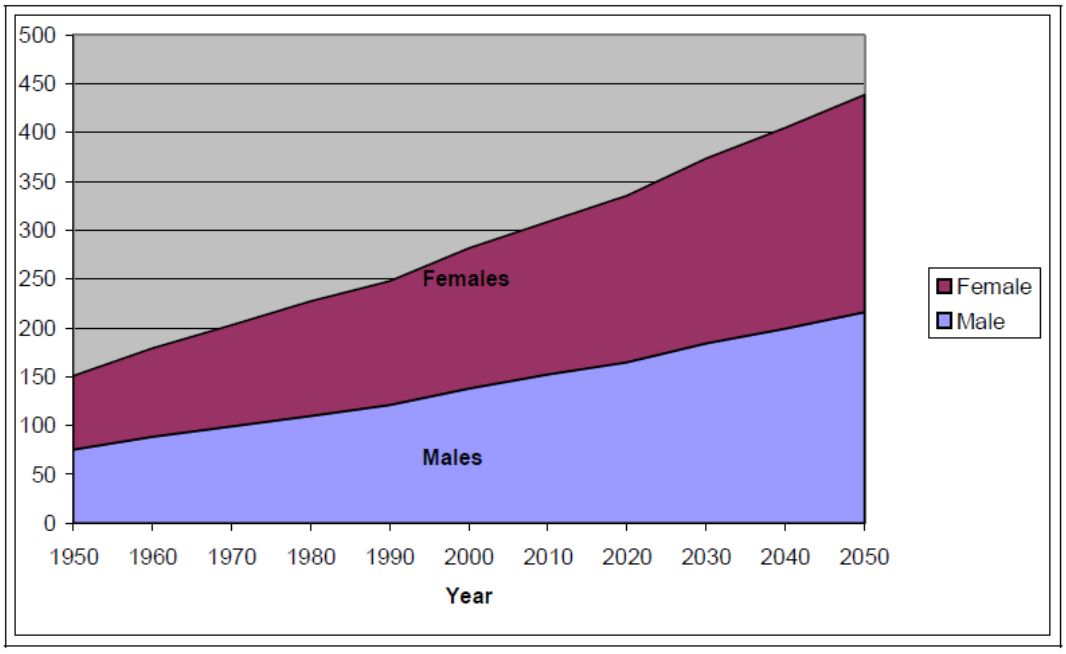


Figure 14. U.S. Population, by Sex, 1950-2050, in Millions (*Demographic Trends in the 20th Century and 2010 – 2050 projection*, Census Bureau of USA, 2011)

The USA is getting Older: Apart from the country's size, the age and sex of the population is an important demographic characteristic for public policies. The increased number of people aged 65 or more and the increasing median age represents the rapid ageing of the population.

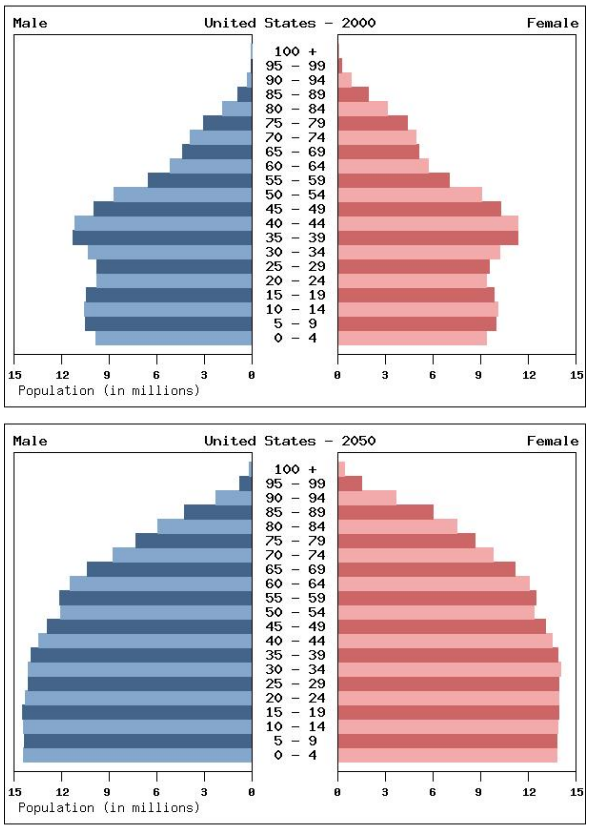


Figure 15. Comparison of age distribution of USA population (*Demographic Trends in the 20th Century and 2010 – 2050 projection*, Census Bureau of USA, 2011)

The above figure15 have given an illustrated comparison of the increase of ageing population in the USA. The number of people aged 65 or more has increased to 35.1 million by 2000 and accounts for12.4% of the entire nation's population. It is expected that this number would increase to 88.5 million, representing 20% of nation's population by 2050.

The USA is racially and ethnically diversified: This refers to the influence of immigrants considering both size and age structure of USA population. For example, the population of Hispanic or Latino accounted for 12.6% in 2000 and is expected to rise to 30.2% of USA population by 2050 (CIA, 2010).

In terms of urbanization, 82% of the people are living in cities, 18% are in the countryside (CIA, 2010). The population distribution is not even through the country, the following figure shows the population in the diverse states in the federation. Most people are living in four states: New York, California, Florida, and Texas (see Figure 16), which illustrates the populations in every state.

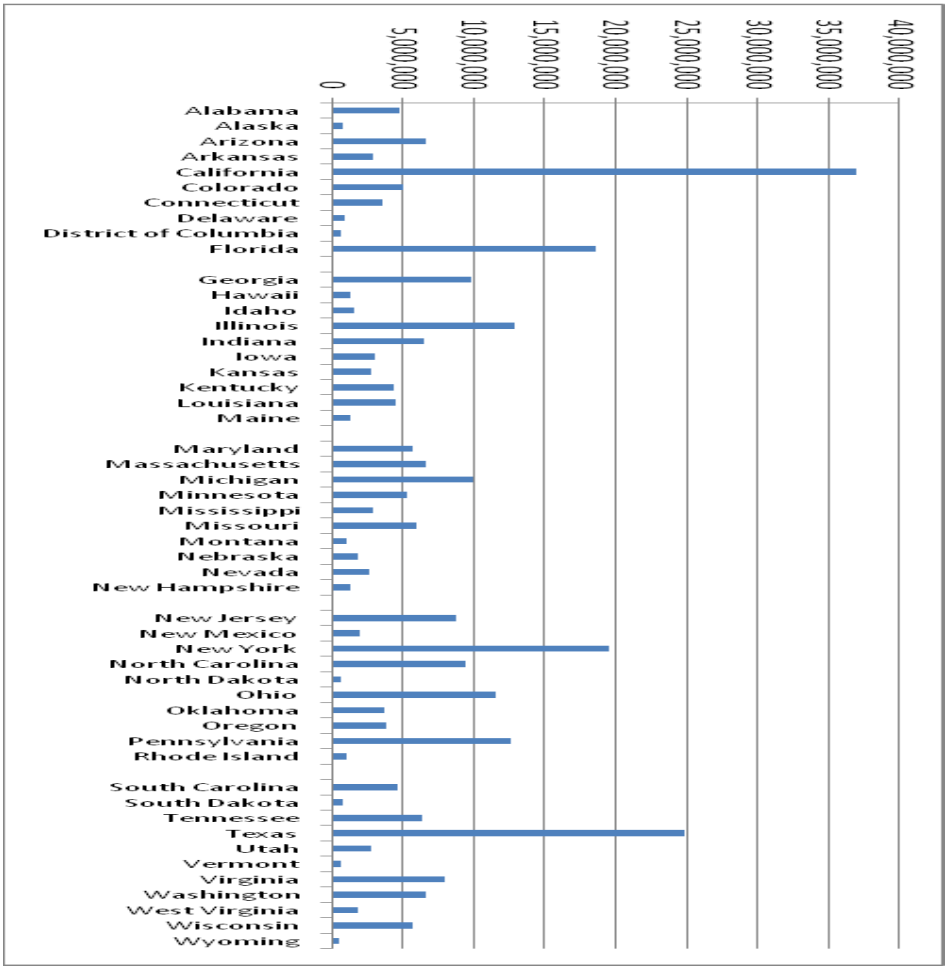


Figure 16: Population Distribution in different states in the federation (Source: ICA, 2010)

6.1.2. PEST analysis of the USA

Political and legal factors: The USA has sustained more than 145 years of political stability since the end of the Civil War (1861-1865). The two major political parties in the USA are the Democratic Party and the Republican Party.

In the USA, laws are made at the federal and state levels. This has been the main reason for the impacts of state-by-state variances in various industries in the USA. For instance, even though there are laws for healthcare at a national level, healthcare policies may vary in different states. (Eddy, 2010)

Economic Factors: The USA was ranked 11th for its GDP per capita being $46,400 in 2009 making it the largest and technically most advanced nation in the world. Also almost one fifth of the purchasing power parity was under USA making it the largest in the world.

Since the global recession which was triggered by the sum-prime crisis in this country, the USA now is experiencing very low economy increases. In 2009, the increase was -2.6%, ranking 157th in the world (CIA, 2010).

Social and Cultural factors: The USA is considered as the most diversified country in the world in terms of its multi-cultural elements in its society. While multicultural diversity brings the country vitality, it is also considered as a potential cause for the increase of healthcare burden. Reasons include lifestyle change, nutrition unbalance, and various beliefs in healthcare etc.

Technology factors: The USA has been in the leading position in the development of modern science and technologies; this is considered an important factor in gaining American advantage in the world. “The reason behind these advancements are the mixed system of government and privately funded research universities, providing research funding based on peer review, the strong tradition of patents, the top ranking USA business schools and USA owned investment banking, accounting, and management consulting firms” (Gordon, 2002). These advantages have nurtured the development of the Internet, IT technologies such as virtual technology; and are often reflected in various industries in the USA, such as healthcare and telehealth. (Gordon, 2002)

6.2. Healthcare system in the USA

There are many entities in USA that provide Healthcare services; most of these healthcare services are provided and owned by the private organizations. However there are local state government owned medical facilities open to the general public (David, 2005).

Insurance plays a fundamental role in healthcare in the USA, and it is also primarily provided by private sectors. However the Family USA, which is a Government body, reported in 2009 that at least 15.3% of the population is completely uninsured and almost 35% of the population unable to cover the medical needs or "Underinsured" (Economic Note, 2005). Health Maintenance Organization (HMO) has provided the facility of insurance to the USA residents by means of monthly premiums. This insurance covers all the medical costs like consulting or any kind of medical tests depending on the contract with HMO.

Almost 90% of Americans don't reimburse the healthcare provider directly, but by means of "third party payers", who determine and apply the policies like Medicare, Medicaid, HMO and employment based insurance plans. All these "third party payers" need to be licensed before performing reimbursement. This complicated mechanism would probably be a barrier for telehealth to overcome during its operations (Brantley, Laney-Cummings, and Spivack, 2004).

The Institute of Medicine for the USA National Academies has stated in its report in 2004, that the USA is the only wealthy, industrialized country that does not ensure health coverage for its citizens and also states that it results in 18000 unnecessary deaths every year (Insuring America's Health, 2004).

According to recent research, the healthcare system in the USA has shown three major trends which are as follows:

Most expensive healthcare system in the world: In the USA, healthcare research and development are financed by both government and private funding. The USA has spent almost US $95 billion on research and development in 2003, which accounted for $40 billion from the public and the remaining from private sources (Improving Europe competitiveness, 2010). Therefore, the USA is the global leader in drugs, research and development of healthcare systems both in revenue and in production (Improving Europe competitiveness, 2010).

The USA has spent $2.2 trillion on healthcare which is on an average $7,421 per person, which is an increase from 7.2% of GDP from 1970 to 16.2% in 2007. However, this amount is used to treat just 55% of the USA population. It is believed by the policy experts that a lot of spending has to be done on the new technology for medical care and its growth (Healthcare costs, 2009).

While being the world most expensive healthcare system, healthcare spending in the USA has been constantly increasing in the past 50 years. This increase is shown in the following figure 17

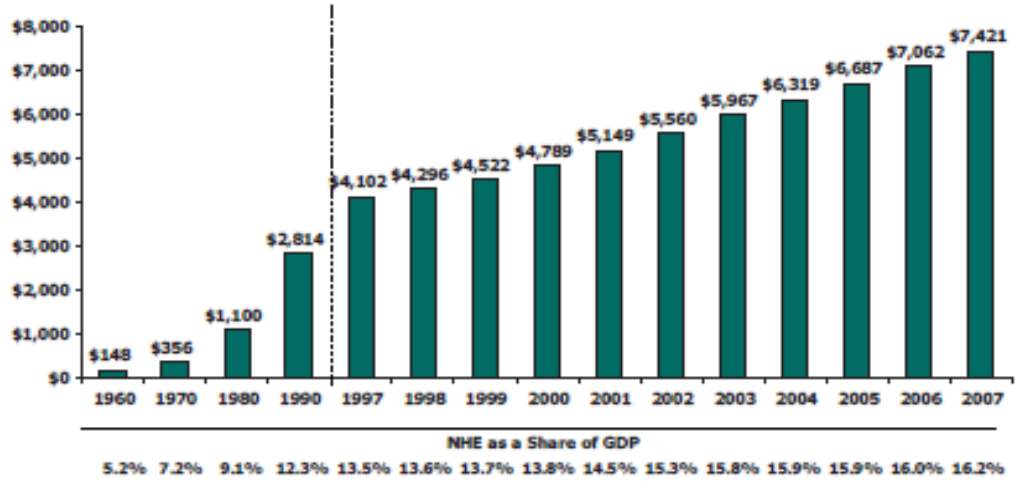


Figure 17: Per capita National Health Expenditure and its share of GDP from 1960 to 2007 (Healthcare costs, 2009)

Lower accessibility healthcare system: Except for the South Africa, USA is the only other developed country that does not provide healthcare facilities for its

citizens. Hence, most of the USA citizens do not get the required healthcare, as it is very costly. However, they are willing to consult healthcare specialists given if they are insured (Davis et al., 2010).

Lack of doctors due to restriction on physician trainings: According to Association of Medical Colleges, the USA is expected to face a shortage of 150,000 doctors in another 15 years due to slow rates of graduation and training. Despite the efforts of teaching hospitals and medical schools to increase the number of doctors, which is now 950,000, the shortage of doctors is imminent, especially primary-care physicians.

The U.S. has 352,908 primary-care doctors now, and the college association estimates that 45,000 more will be needed by 2020. However, the number of medical-school students entering family medicine fell more than a quarter between 2002 and 2007. A shortage of primary-care and other physicians could mean more-limited access to healthcare and longer wait times for patients.

6.3. Telehealth in the USA

The American healthcare system is currently facing four major problems:

1) A large proportion of uninsured population
2) The over expensive and continuously increasing spending
3) The lower accessibility, as the insurance cannot cover most of the residents
4) In-sufficient number of doctors restricted by education system

While the first problem is more complicated and economic related, telehealth can be one of the most effective solutions to solve the rest of the problems. Bransford, Nahabedian and Waterson (2010) have presented a report stating that almost 50% of treatments can be provided by using advanced healthcare systems and also could save up to 40% of the healthcare costs.

Telehealth has become an important entity of the healthcare system as it has improved record maintenance, reduced time and cost, and avoided unnecessary healthcare services. In 1996, nine government bodies invested at least US $229 million in telehealth (Kerr & Norris, 2004). The spending on telehealth services has increased from $379.3 million in 2005 to $4.5 billion in 2010, at a Compound Annual Growth Rate (CAGR) of 64% generating nearly $3.6 billion of annual revenue within the next 5 years. It can only be possible when IT infrastructure is increased like faster broadband, smart phones and data compression techniques requiring 70% of total market expenditure within 5 years (Telemedicine Spending. 2009). Figure 18 shows the accelerating spending on telehealth in the USA.

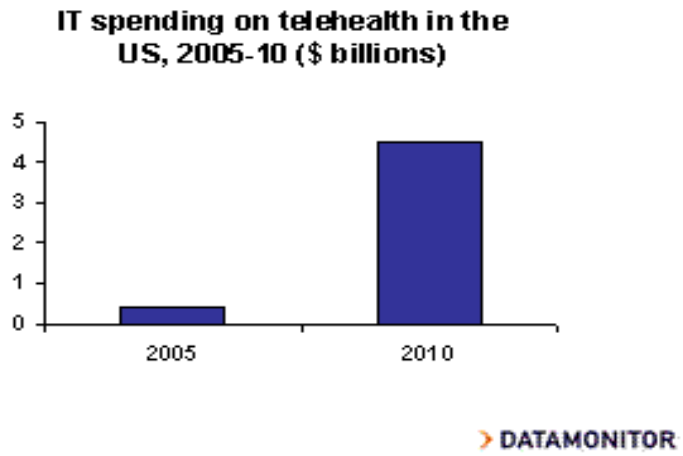


Figure 18. Source:Extending the Delivery of Healthcare Beyond the Hospital Setting. (Telehealth: US spend, 2006)

6.3.1. Applications of telehealth in the USA

The USA Federal government does not have proper policies and strategies to promote and control telehealth in the country, although there many projects and applications. Telehealth practice in the USA started in 1960s. It obtained a boost in 1970 because of the space-flight program and NASA healthcare. In 1990, Maritime Health Services (MHS), based in Washington, initiated a telehealth

program which enabled the shore-based healthcare professional to provide healthcare to the on board people (Edwards & Halawi, 2007).

There are many telehealth applications initiated currently. However the major applications are as the following:

1) **NASA's Telehealth applications**

   Started in the early 1970's and continuing practicing to today, NASA has been testing and implementing telehealth capabilities. For the past 40 years NASA has been co-operating with telehealth organizations like Indian Health Service, East-West Space Science Center (EWSSC), U.S. Department of Health and Human Services and U.S. Department of Education, etc. (Edwards & Halawi, 2007)

2) **Telehealth application in disaster response**

   In 1985, Mexico City earthquake, NASA was the first to use telecommunication technology to furnish disaster aid.

   NASA has also attempted to co-operate USSR to create a "Space Bridge Project" to provide consultation in the areas of neurology, orthopedics, psychiatry, infections disease, and general surgery (Edwards & Halawi, 2007).

3) **The USA Department of Defense and telehealth**

   The Department of Defense (DOD) and the Veterans Affairs (VA) are the other federal government agencies which have invested and contributed in telehealth services. The research institution is called The Army's Telehealth and Advanced Technology Research Centre. This research aimed at bringing medical care to the soldier on the front lines of battle. Veterans Affair (VA) also has made great investments in telehealth

for their own national hospital network, to provide services for veterans (Kim, 2004).

4) **Telehealth programs operated at a scale of within certain state**

Table 3 gives examples of some telehealth programs including the Arizona Telemedicine Program, Maine Telemedicine Services, and programs in Tennessee and Georgia:

	Maine Telemedicine Services	Tennessee- U. of Tennessee Telehealth Network	Georgia Statewide Telemedicine Program	Arizona Telemedicine Program
Program Affiliation	Program of the Regional Medical Center at Lubec, a nonprofit community health center	University of Tennessee, Department of Preventive Medicine in College of Medicine	Wellpoint- owns BC/BS (private business) Part of Medical College of Georgia until 2003	Situated at the University of Arizona Health Sciences Center Department of Pathology – program of the legislature since 1996.
Services offered	• Set up telemedicine projects- link partners • Technical support • Information on policy/ reimbursement • Purchase of new equipment • Connect users to other network partners for services • Grant writing	Rural physicians calling to set up consultations/ refer their patients to specialists	Operational, not yet fully deployed	• Calls from rural areas asking for telemedicine svces. • Calls to set up training • Calls for specialty consultations Most common uses: 1.Radiology, 2.Behavioral Health, 3.Dermatology 4. Educational, admin.
Patient populations/users	All residents of Maine including those housed within the Department of Corrections.	Predominantly rural population; beginning in urban- just opened 2 clinics in Memphis	Citizens of Georgia	Isolated communities Indian Tribes Rural prisons Schools Home health
Funding/Long-term	Funding Sources Federal	Funding Sources U of Tennessee	Funding Sources (prior to 2003)	Funding Sources State

sustainability	Foundation Revenue from administrative and educational use of system Long-term sustainability Each individual site has a contract with MTS (training, tech support). Each year they can renew or go to fee for service.	Medical College Federal Grants Some state funding for 1 city and 4 county jails and youth development. Long-term sustainability Unknown	State ($10 million from 1994-2000) MCG ($6 million) Local sites ($24,000/yr + salary of Telemed Coordinator) Current Funding Sources Wellpoint (Georgia BC/BS carrier) Long-term sustainability Unknown	Federal Foundation Membership Fees Long-term sustainability Application service provider business model- sites join together in a sharedcost model to capitalize on economies of scale.
Most significant barriers	• Physician acceptance • Integration of telemedicine into healthcare delivery • lack of organizational commitment • small volume in rural areas	Geographical setup of the state. In rural areas, clinicians are very suspicious of new ideas. Patient satisfaction surveys at the end of each clinical visit. About 98% patients said they will use again. Perception that telemedicine is for specialists only.	Sustainability	Unknown

Table 3. Telehealth programs in USA. Source: NHTP Planning Committee meeting at the New Hampshire Hospital Association in Concord, NH, on September 13, 2006

While many telehealth applications are in operation, there are a few concerns that could limit further development. Firstly, in rural areas, many applications do not have high standard ICT infrastructure to let the local people to use them. Additionally, ICT infrastructure investment is expensive (Kerr & Norris, 2004). Secondly, new technology comes with uncertainty of system operation, so reducing reliability. Thirdly, telehealth may have some liability and malpractice issues. Finally, while rural communities are steadily making the necessary

telecommunication investments to facilitate delivery of telehealth services, the slow rate of device approval by the Food and Drug Administration is a restraining factor (Edwards & Halawi, 2007).

6.3.2. Strategies of telehealth in the USA

From government department to other business or non-business organizations, various entities in the USA are making efforts in promoting telehealth in the country.

The Health Resources and Service Administration (HRSA), which is operated by U.S. Department of Health and Human Services, has reported that Telehealth provides long distance healthcare by means of telecommunication technology. To improve the telehealth services, the HRSA has implemented the following practices:

- Maintaining improved partnerships within HRSA, and with other Federal agencies, public and private sectors for the advancement of telehealth projects
- Implementing grants for telehealth programs
- Providing technical assistance
- Evaluation of the use of telehealth technologies and its programs
- Improving the quality of telehealth services by initiating policies
- Teaching about the telehealth practices

In 2010, HRSA has budgeted $11.6 million to improve the quality of healthcare for underserved, vulnerable, and special needs populations (HRSA, 2010).

The Office of Technology Policy (OTP), which is a part of the U.S. Department of Commerce, has reported that there are legal, financial and regulatory barriers in innovation, adoption and deployment of telehealth services. Hence, there is a need for a framework that defines the telehealth applications, reflecting the technology's quality and cost; also with the coordinated efforts by the community stakeholders its acceptance can be increased. Furthermore, the interoperability issue can be

resolved by developing the industry wide standards. Hence, it can be concluded from this research that is necessary to discuss the merits, policies and issues associated with national healthcare infrastructure throughout the country (Brantley, Laney-Cummings, and Spivack, 2004).

All relevant researchers have found that there is an increasing consensus on the need of national strategy for telehealth in the USA, and the lack of government control and promotion is the first barrier to cross. (Sao & Gupta, 2010) However, this research has found no existing strategy for the development of telehealth in the USA. Possible reasons for this would be discussed in following section.

6.4. Analysis of telehealth in the USA

6.4.1. SWOT analysis of telehealth in the USA

While the above analysis has provided an overall picture of telehealth in USA, a SWOT analysis in which the internal and external conditions and situations are better described and analysed will give further insights.

Strengths:

- Technical advances and well established telecommunication networks
- Long existence and tradition of telehealth and leading programs in telehealth
- Some national level organizations established to develop and promote telehealth
- Sufficient financial funding for telehealth

Weaknesses:

- Highly fragmented development of telehealth due to state-based health systems and special functional departmental settings
- Lack of national coordination in telehealth, in terms of technical standards, business model, payments, etc.

- Currently constraints caused by the financial crisis in the country

Opportunities:

- Great domestic needs for telehealth to cover more people, and to lower healthcare costs
- Traditional leading position of technology development bring the country potential to export its success of telehealth in terms of technologies, business models, and marketing strategies, etc.

Threats:

- High level of cost
- Uneven development in different states and people coverage
- Complicated system of reimbursement and licensure

6.4.2. CSF analysis of telehealth in the USA

According to above analysis, some critical success factors for the telehealth development in the USA are as:

- **The efforts of the key stakeholders can be aligned by initiating a national level strategy, addressing the public issues on policies and improving the returns for the progress of telehealth and development of the country.** As the leading country in telehealth development, it was expected that certain strategies in the USA at a national level in the development of telehealth would be found. However, this research has found increasing concerns for a national level strategy for telehealth development in the USA. It seems that the government has not employed such a strategy in current stage. This has raised a question whether there should be strategy for the current stage or maybe the telehealth development is right now just in its multi-headed progressing stage in the USA.
- **To achieve efficient solutions and realize the potential of telehealth services, the coordination between governments, public and private stakeholders is required.** Due to the lack of coordination among the

telehealth community, the opportunities for technical advancements, the efficiencies of a larger integrated market, greater innovation, demand and investment are limited. Only recently telehealth programs of high importance were started, whose benefits can be realized by the greater need of collaboration and opportunities.

- **More financial effective and lower costs:** The effectiveness of financial investments is viewed as another critical success factor for telehealth in the USA. As the current conventional healthcare system in the country is regarded as the most expensive system in the world, one of the primary tasks for telehealth is to lower the current high costs of healthcare. However, if the telehealth system has been developed in the same expensive way as the conventional medical system, then the operational costs of telehealth in the USA would be possibly as high as the normal medical system.
- **The healthcare provider and doctor licensure issue and the shortage of doctors in the country.** As there is an apparent short number of medical graduates comparing with the demand of doctors, the shortage of doctors will be continued and even increased by as many as 150,000 in the coming 15 years (Sataline & Wang, 2010). It is expected that telehealth system could make available doctors to cover more patients than before; however, there is also the concern that the new system would increase the working loads or training time of the current doctors to make them capable for the new and additional system of telehealth.
- **Converge the new aspects of telehealth into the existing healthcare system and make it into a nationwide system by crossing state boundaries.** The development of telehealth will include more of new parties and equipment into the formation of the new system; also, the emerging telehealth system should bring more convenience to the current medical services rather than bringing more chaos (Brantley, Laney-Cummings, and Spivack, 2004).

6.5. Summary

The massive country area, uneven population distribution, lack of doctors and also the economical profits drive the developments of telehealth applications in the

USA, especially in home healthcare area. Also, the high healthcare expenditures in the country have played as major motivation for the development of telehealth. Due to the traditional advances in technologies and well-established infrastructure, plus the large scale of financial and innovation inputs, the country is in the leading position in telehealth.

The absence of a national strategy and lack of government control and promotion are still the primary barriers to lifting telehealth up to a higher new level in the country. Nevertheless, the multi-headed development of telehealth can be also understood in a more positive way; that it is the consequence of lax policies and free market circumstance rather than the absence of unified strategy. Also, technically, telehealth is widely considered as being in the stage of seeding and initially growing. Unified strategies and standardized business model would be beneficial for its robustness; however, this would take time to be developed.

7. Telehealth in Canada

7.1. Macro environment scan of Canada

7.1.1. Summary statistics of demographics in Canada

Canada is the 35th most populous country with less than 34 million people and is the 2nd largest country in the world. The demographic change in Canada is mainly because of two reasons: immigration and natural increase. Immigration is an important criterion of change because it accounted for almost two-thirds of Canadian population in 2010-11. As shown in Figure19, the natural increase has been slightly and stably declining, while the change of total population increase is mainly caused by the fluctuation of net overseas migration (STATCAN, 2010)

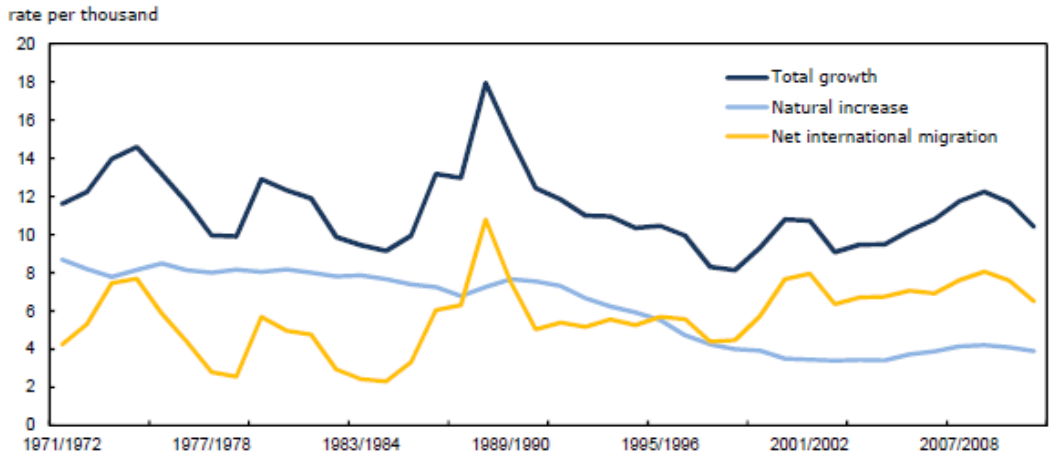


Figure19: Components of Annual Population Growth of Canada (STATCAN, 2010).

Figure 20 shows the historical view of changes of the young group and aged group of population in Canada. It is clear that the aged group has been increasing alongside the drop of young group population in Canada.

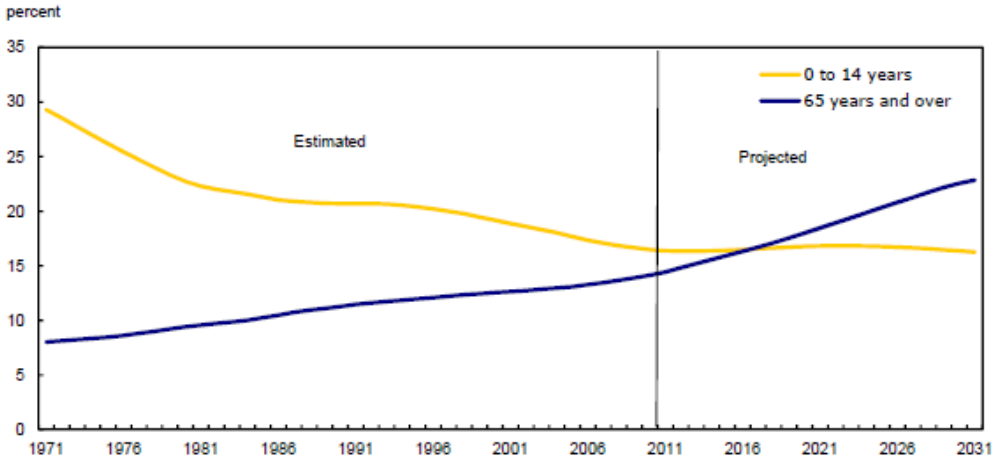


Figure 20: Graph representing the proportion of population aged 65 and over and children aged 14 or less from 1971 to 2031, Canada (STATCAN, 2010)

The image below in Figure 21 provides a better view of age distributions of Canadian population and their changes in last forty years. It shows that middle aged and aged groups are swollen while the young groups (0 to 30 years old) have all declined.

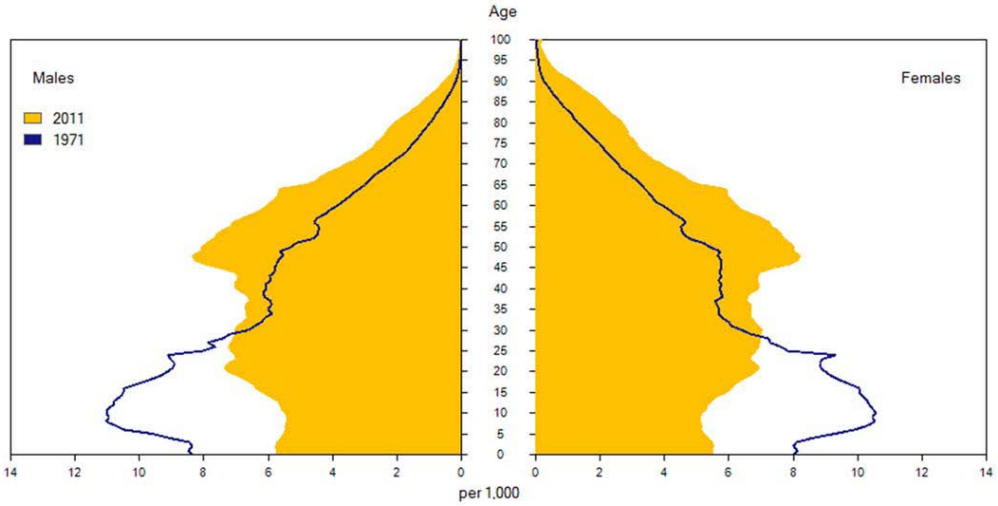


Figure 21: Canadian population estimate formed by pyramid of age as of July 1, 1971 and 2011 (STATCAN, 2010)

From Figure 20 and 21 above, it can be seen that the ageing issue will be the number one concern for the Canada in coming years (STATCAN, 2010). The ageing of the Canadian population, like any other OECD country, is expected to continue mainly due to increasing life expectancy and low fertility rates. The median age of Canada's population in 1971 was 26.2 and this had increased to 37.6

years by 2001, and was estimated to increase to around 40 years by 2011 and could reach 44.0 years by 2040. Hence, the composition of the Canadian population is expected to change. The population aged 65 or more is going to increase and those aged less than 15 years will be lower in proportion in future, compared to 2007. As of July 1, 2011, the population aged 65 or more was 14.4%, which was an increase of 0.3% from the previous year and increase from 8% in 1971. The ageing of Canadian population is expected to rise at faster pace between 2011 and 2031, as a large proportion of baby boomers would become seniors, as observed in 2011. This group is expected to account for one-fifth of the population by 2026, and then rise to one-quarter by 2056 (STATCAN, 2010).

By 2010, more than 80% of the Canadian people lived in urban areas. This makes Canada one of less urbanised nations in OECD countries. Most of the Canadian population resides in the 25 largest urban centres – Census Metropolitan Areas – in the country, which accounts for 70% of the population. Along with the immigration and natural increase of population, interprovincial migration is another reason of increase in population at provincial level. In 2010-11 the growth in some of the provinces like the western provinces (Manitoba, Saskatchewan and Alberta), Prince Edward Island and Nunavut were higher than the others like Atlantic Provinces and in the Northwest Territories and Yukon (Leonard, 2011).

Another distinctive demographic feature is the climate in the country. Canada is considered as one of the most northern countries and experienced longer and colder winters than most other countries. The demographic perspective, including the ageing society, the uneven population distribution, and colder climate, make Canada a special situation of healthcare; more importantly, the very large areas with low population density offer significant room for telehealth development. (STATCAN, 2010)

7.1.2. PEST analysis of Canada

Political and legal factors: There is a multi-party political system in Canada and aall government parties are talking about how they will address climate change, and how they would improve the healthcare in the country.

Canada's economic freedom score is 80.8 in 2011, which is ranked 6th in the world, and its score is well above the regional and world averages. Business freedom in Canada is 96.4% and trade freedom is 88.1%, which indicates that Canada has a very good environment for business and trading (Index of economic freedom, 2011).

Economic Factors: Along with the USA and Mexico and others, Canada is member of North American Free Trade Agreement (NAFTA). Though Canada trade with a lot of countries around the world, the major trading partner of Canada is the U.S., accounting for 77.7 per cent of exports in 2008 (Canada's State, 2011)

Canada has been significantly affected by the global recession and Canadian economy growth began to slow in the fourth quarter of 2008. Real GDP declined by 3.7 percent in the fourth quarter of 2008. Although the Canadian economy is being affected by the global recession, the Canadian economy is still better than other industrialized countries. (CIA, 2011).

Social and Cultural factors: From the country's demographic feature, it can be seen that the increase of population in Canada is greatly contributed to by net overseas immigrations. This also determines that the country has a multi-cultural social environment. While multicultural diversity brings the country vividness, it is also considered as a potential cause for the increase of healthcare burden. Reasons include lifestyle change, nutrition unbalance, and more people flow. Another feature of social and cultural factor in Canada is the aboriginal population in the country is mostly living in remote areas and this may increase in differences between provinces and territories in terms of languages, lifestyles, and cultural diversities (CIA, 2011).

Technology factors: Matching its economic scale, Canada has good capability in terms of technology development and relevant manufacturing. Canada has excellent domestic and international telecommunication infrastructure. The number of internet users in Canada is 26.96 million. Canada ranks 20th in the world with an average speed of 1.5 Mbit/s (megabits per second), which can transmit a VGA (640x48) video with good quality. The bandwidth has been increased due to the recent competition between Internet Service Providers (ISP) and with an average speed from 10 Mbit/s to 20 Mbit/s (CIA, 2011).

7.2. Healthcare system in Canada

The healthcare system in Canada was province-by-province, with Saskatchewan being the first such province built in 1947 which was publicly funded. However, a provincial-federal partnership was initiated in 1971 for a universal healthcare system, although there were differences in many provinces, which remains even now. Hence, for the last four decades many reforms have been developed in response to the changes in medical care and throughout the society, with the basics being the same.

The healthcare system in Canada is financed solely by the government; hence it prohibits any private health insurance that may duplicate the public health benefits. The role of these private insurance companies is only to fill up the blanks in the health coverage. However, there are certain insurance schemes and companies that operate only in some provinces (Telehealth Benefits and Adoption, 2011).

The Canadian provinces and territories are responsible for the administration of universal health plan called “Medicare”. However, the federal government looks after the regulation, federal transfers or funding to the provinces. The private and public delivery of the Canadian healthcare is different from the public nature of the healthcare administration, which indicated that most of the physicians work from their private hospitals. Hence, the term “Socialized Medicine” assigned to

Canadian healthcare system is not apt, as socialized medicine means government solely operates the healthcare system (Chua, 2006).

Currently, the healthcare system in Canada is experiencing some problems, amongst which the major ones include:

- The hospital budgets and the reimbursements to physicians were decreased as the federal government lowered the funding to provinces due to the budgetary shortfalls in the early 1980's
- Privatization of the healthcare system by the funding's from the private insurance companies might result in inequalities
- For the outpatient's prescriptions and home-care, there is no full health coverage
- There are significant differences between the federal and provincial government over funding and jurisdiction
- In certain Canadian provinces, the elective procedure's waiting list is a problem (Makarenko, 2008)

According to Browne (2001) while the challenges facing the Canadian health system as a whole are daunting, the issues facing Aboriginal, northern, rural and remote communities are even more longstanding, difficult and complex. For many patients living in the northern, rural and isolated regions in Canada, getting access to appropriate healthcare is hindered by long commutes, which get worse in inclement weather; high travel costs for gas, accommodations, food and the like; and by the stress of leaving home and going to an unfamiliar, larger city. Patients are often willing to travel to the larger centers for major one-time interventions such as an MRI or major surgery.

The geographic landscape of Canada represents one such obstacle for those living in rural and northern areas. In 2006, 14.9% of Ontario, 56.6% of Nunavut, 42.2% of Newfoundland and Labrador, and 19.8% of the total Canadian population was located rurally (Evaluating the benefits, 2010). However, making a series of trips

for ongoing pre- and post-intervention care such as consultations and follow-ups can be very disruptive to a patient's personal and professional life. Providers and healthcare delivery organizations in rural areas and the north also face challenges. The healthcare services may vary from urban area to that from a distant place, as it is difficult to recruit health human resources and hence do not remote to distant places. Equal access and universal healthcare cane be provided, but sometimes it may not be possible to maintain clinical competency or justify expenditure. Hence, it has become a challenging task for policy and planning organizations to effectively provide healthcare services in remote places (Telehealth Benefits and Adoption**,** 2011).

7.3. Telehealth in Canada

The above situation analysis concluded that population distribution is a reason for Canada to develop telehealth. Also, there are other two current circumstances that require development of telehealth. They are unequal access to excellent healthcare services and poorer health outcomes in rural and remote areas. According to the Canadian Health Act of 1984 there are set of five criteria that has to be met for providing funding to healthcare system. They are Public administration, Universality, Comprehensiveness, Accessibility and Portability (easy transfer when citizens move to new provinces). This is also considered as the initiative of the development of telehealth in Canada. There is a range of responses to meet the challenges that Canadian healthcare is confronting, such as recruiting more staff, training already-employed staff, acquiring or improving facilities, and investing in process improvements and technology. Telehealth is one such technology which can have a truly transformational effect on cost structures, as well as on overall health outcomes and equitable access to care. Indeed, some of the most effective organizations are already seeing telehealth as just another channel for delivering healthcare service, and have subsumed the technology and processes of everyday operations (Chua, 2006).

7.3.1. Applications of telehealth in Canada

Canada has made better use of telecommunication technology to improve the access to healthcare system for remote and isolated communities. Most of the Canadian population have or are willing to have the articulating strategy, which is a centralized telehealth plan for maintaining long term funding and improving the access to telehealth services by means of technological advancements. Canada has variety of telehealth programs in terms of its growth, scope of services and structure. However, the trend of Canadians in accepting technology would be barrier for a better telehealth services in Canada (Ho & Jarvis-Selinger, 2006).

At national level, usage of telehealth in Canada has shown a practical distribution amongst clinical, educational and administrative aspects. The following Figure 22 shows this distribution in 2010.

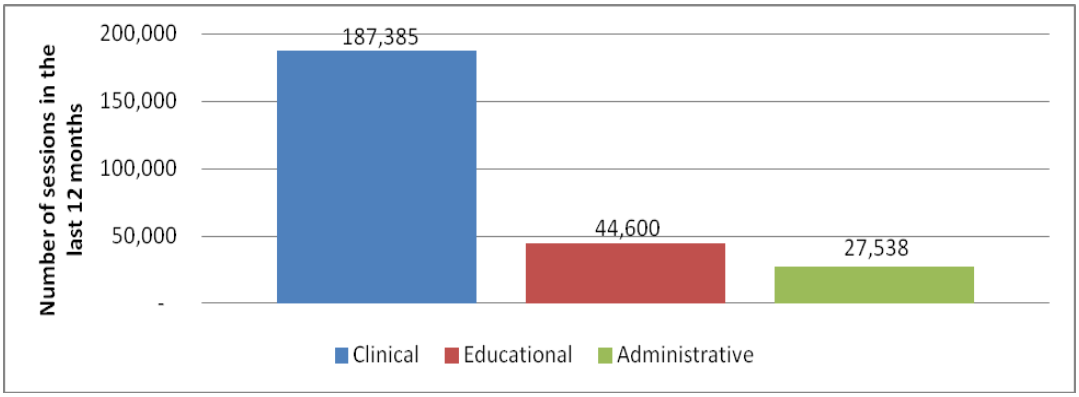


Figure 22: Total Number of Telehealth Sessions in 2010, Source: 2010 CTF Pan-Canadian Telehealth Survey (Telehealth Benefits and Adoption. 2011).

As shown in Figure 22, jurisdictions reported 187,385 clinical events 44,600 educational events and 27,538 administrative events. In addition, nearly 2,500 patients were enrolled in telehomecare. Ontario has the largest absolute telehealth program, with more than one-half of the telehealth events reported (Telehealth Benefits and Adoption, 2011).

7.3.2. Strategies of telehealth in Canada

As most current telehealth programs running in Canada are operated by each province or provincial entities, there is no a national level strategy for the development of telehealth in the country. However, such studies have more focused onto the concerns for such a national strategy and some even proposed the key points for the strategy. For instance, St. Andrew's Conference Centre (2007) has issued a workshop study which highlighted that the national strategy for telehealth should include the following:

- **Convergence of developed Business Cases**
  - The value and benefits of convergence must be mentioned clearly
  - Result oriented value propositions
  - Investments by means of leveraging value proposition by CIOs
  - Convergence being more than technology
- **Develop a plan with importance to education**
  - Tasks performed for the advancements of things in jurisdictions
  - Individual jurisdiction must be given individual task
  - Monitoring the implemented strategies
- **Supporting Business cases by developing communications plan**
  - Decision makers can be operated when approached by larger group
  - By means of educating using case studies
- **Other stakeholders must be involved**
- **The jurisdiction convergence must include telehealth as a part of overall eHealth planning**
  - Risks must be identified
  - Considering the service points that have not been used before
  - Current activities must be monitored
- **Standardization of Technology**

7.4. Analysis of telehealth in Canada

7.4.1. SWOT analysis of telehealth in Canada

While the above analysis has provided an overall picture of telehealth in Canada, a SWOT analysis in which the internal and external conditions and situations are better described and analysed will give further insights.

Strengths:

- Long existence and tradition of telehealth
- National level organizations established to develop and promote telehealth
- Relatively evenly development of telehealth in all provinces (territories), in terms of networks, coverage, and provided services
- High level of awareness and consensus on the development of telehealth throughout the country due to the demographic features of the country
- Well established telecommunication networks

Weaknesses:

- Lack of national level strategy for the development of telehealth
- Lack of national level standardizations in telehealth, in terms of technical standards, business model, payments, etc.
- Fragmentation due to state-based telehealth systems

Opportunities:

- Telehealth is in great expansion in recent years due to the increasing demands
- Technical booming of ICT is providing telehealth much better platform than ever before

Threats:

- Limited Availability of healthcare personnel and services

- Geographic barriers
- Impact of healthcare reform

From above SWOT analysis, we can briefly see that telehealth has been developed well in Canada in past years, however, there are still threats and weakness that challenge its further advancement.

7.4.2. CSF analysis of telehealth in Canada

- **Clinician reimbursement:** Telehealth use and uptake by providers has been higher where relevant incentives are in place. A critical success factor for increasing adoption and deployment of telehealth is a transparent reimbursement model for institutions, physicians and allied healthcare providers.
- **Professional development:** Telehealth requires new job roles and new care processes. A critical success factor for increasing adoption and deployment of telehealth is the recognition that new roles and skills are needed and that training, education and in-service support be provided to develop these new skills and insights.

- **Technology implementation:** In order to be successful, current programs have developed strong capabilities for implementing and operationalizing very complex technologies. Successful implementations currently provide high availability, and reliable and consistent network quality of service. Implementation of these underlying technologies will make the results of the Telehealth encounter available in a computable and actionable format to all other relevant care providers. This level of integration facilitates the move of Telehealth into the mainstream of care provision. Therefore it is a critical success factor to Telehealth adoption and benefits realization.
- **Benefits realization and measurement:** This can be understood as another way of describing a sound and capable business model and operational smoothness. Even though telehealth in Canada has less

financial constraints due to government support, it is still in need of financial investment from other stakeholders. To sustain the development of telehealth, a successful and profitable business model is a critical success factor (Telehealth Benefits and Adoption, 2011).

7.5. Summary

Based on above studies, it seems that Canada is at the forefront in the use of some Telehealth technologies and service programs, combined with a collaborative effort of other stakeholders in the healthcare and education sectors, set the stage for a series of large-scale telehealth initiatives at the provincial level (e.g. the Alberta Telehealth Network, Alberta; the IIU Telehealth Network, Nunavut) and the federal level (the Pan-Canadian Telehealth initiative led by Canada Health Infoway). These initiatives focused on the development of multimedia real-time and store-and-forward applications and programs dedicated to the provision of health, education and social services, and facilitation of collaboration between individual care providers and professional groups beyond the jurisdictional or clinical specialty boundaries. These telehealth initiatives mark a significant step forward in providing more equitable access to key services required in rural communities and integration of these services across the health continuum. In many cases, telehealth is used as a community building tool. Telehealth forms the foundation of Canada's future electronic healthcare systems.

8. Telehealth in the UK

8.1. Macro environment scan of the UK

8.1.1. Summary statistics of demographics in the UK

According to a 2011 estimate, the UK has 62.7 millions of total population that is ranked 22nd in the world and is ranked 80th in the world in terms of area. The growth in the population of UK in last 10 years is mainly due to immigration and natural increase. The increase in the population was mainly due to immigrants from 2000 till 2006. In last five years, natural growth in the country has been the driving factor to the population growth and the country has experienced its largest population growth in year of 2010 to 2011, which is 0.557% (CIA, 2011).

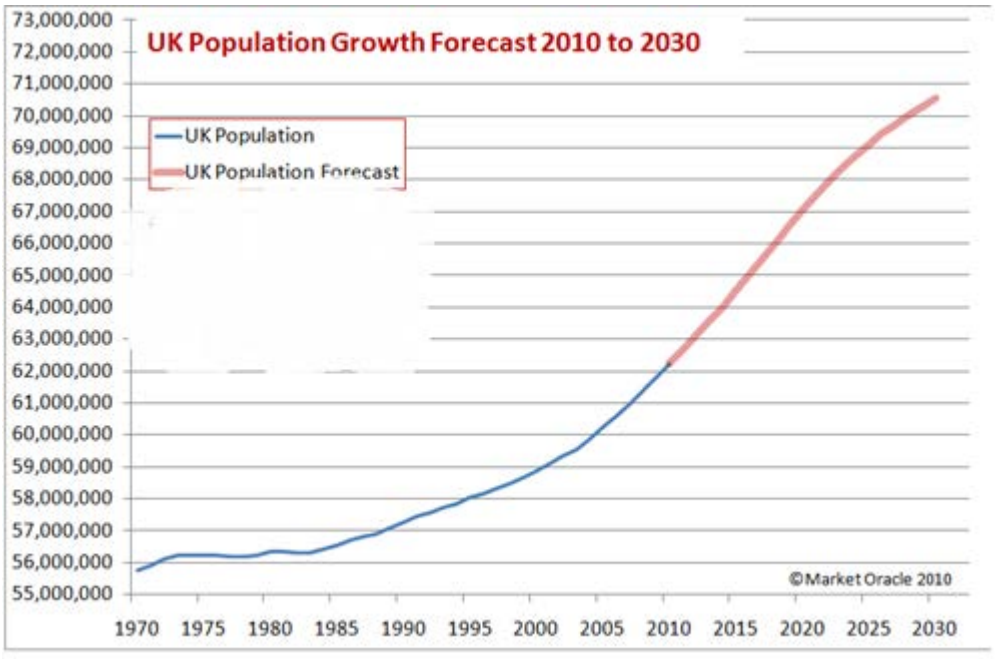


Figure 23: Annual Population Growth of UK (Source: The Market Oracle, 2011)

Figure 23 shows the historical view of changes of total population in the UK. It is clear that the population in the UK will keep increasing in the coming years. It is a fact that Western Europe is experiencing stagnation in population growth.

However, the population growth of UK accounts for one-third of the annual increase in Europe's population (Walayat, 2010).

Figure 24 below shows the ageing of UKs population in 2000, 2010, 2020 and 2050 by comparing the structure of age and sex, providing a better view of age distribution for 50 years. And it is clear that the population of middle aged in more than the younger people of age 30 or below. Indeed, the so-called pyramid will not be like a pyramid shape but more like a 'vase' shape with a larger proportion in upper part, which means the middle aged and aged people will be the main part of the total population in the UK in coming decades.

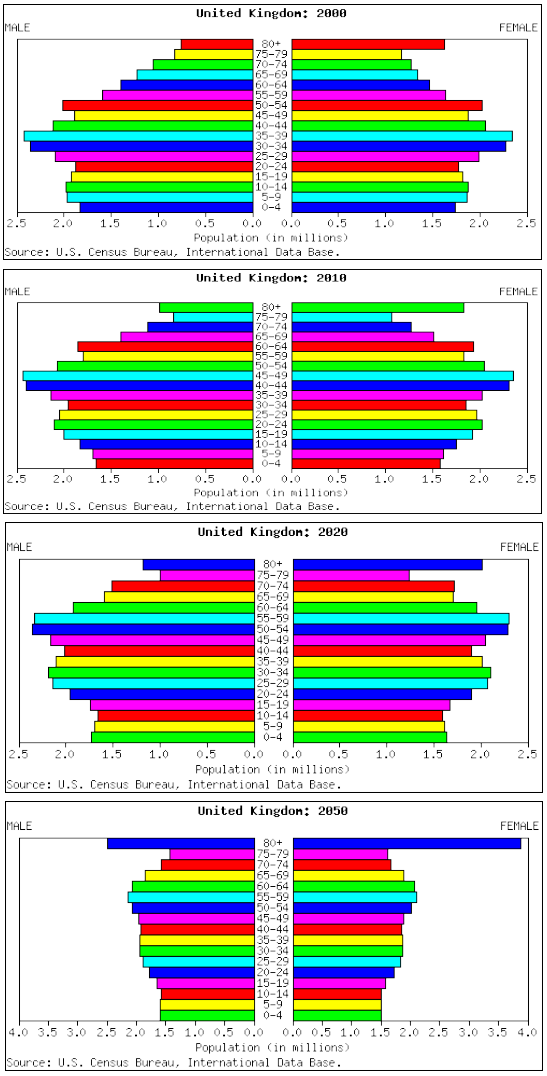


Figure 24: pyramid for ageing of population and estimates as of 2000, 2010, 2020, and 2050 in the UK (Facts & Statistics, 2011)

By 2010, more than 90% of the British people lived in urban areas. 80% of urban people in the UK live in main big cities such as London (near 9 million), Birmingham (2.3 million), and Manchester (2.2 million). Approximately 70% of the UK's population live in the England thus making England the most crowded country in Europe (Nation Master, 2011). Figure 25 illustrates the comparison of population density and aged population distribution in the UK. From the figure, it is clear to see that while most of people in the UK live in urban areas surround cities, aged people are more likely to live in rural area and coastal areas. This may bring some extra burden to the local healthcare systems (Rural England, 2006).

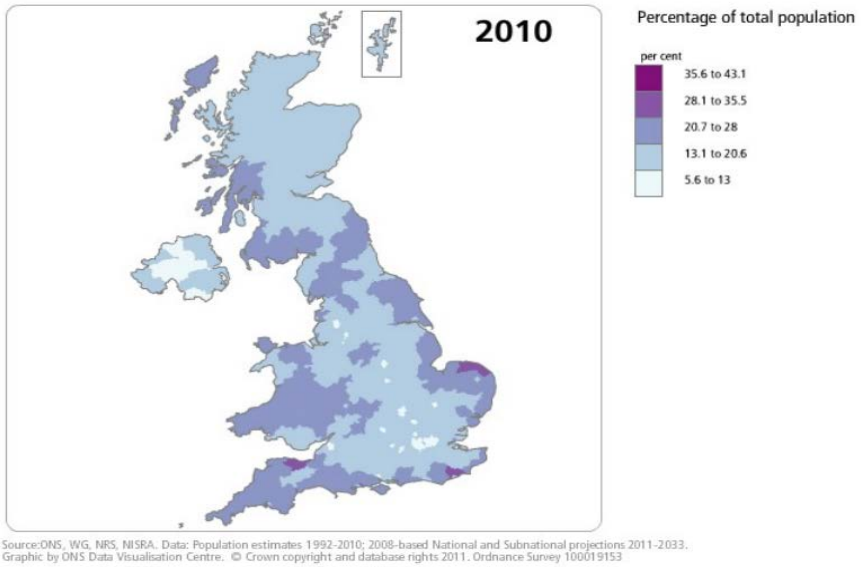


Figure 25: Population density (left) and aged population distribution (Facts & Statistics, 2011)

8.1.2. PEST analysis of the UK

Political and legal factors: The head of the state in UK is a monarch, whereas the head of the government is the Prime Minister. The UK is politically allied with others countries in different forms or international organizations, and the Conservative and Labour Parties have dominated British politics.

The UK's economic freedom score is 74.5 in 2011, which is ranked 16th in the world, and its score is well above the regional and world averages. Business freedom in the UK is 94.6% and trade freedom is 87.6%, which indicates that the UK has a very good environment for business and trading (Index of economic freedom, 2011).

Economic factors: The UK is one of the most globalised countries and has the 8th largest economy in the world in 2010 with low inflation, interest rates and unemployment rates until the recession period in 2008 (Economic Review, 2011).

The UK has been significantly affected by the global recession and its economy has suffered from the economic downturn since 2008. The global economic and financial crisis has made the government to take drastic measures by nationalizing or seizing ownership of major banks. Also, public finances have deteriorated, benefits for welfare programs have been lowered, deficit has increased sharply and gross public debt has increased to 70% of GDP (CIA, 2011).

Social and Cultural factors: The country in UK includes England, Scotland, Wales, and Northern Ireland, with ethnicity and cultural diversity. Hence, UK is a multi-cultural nation with a modern and innovative outlook (Doing Business in the UK, 2011).

In recent years, mostly impacted by immigrations and globalization, the UK has experienced its cultural diversification with other social and cultural changes, such as demographic change as stated above. Lifestyle changes are happening along with the total population ageing; and predictions for the coming years suggest a society that continues to be polarised with up to 30% unemployed or living of basic state benefits. (Wilkinson, 2011)

Technology factors: The UK has excellent domestic and international telecommunication infrastructure. The growth in telecommunication technologies in the UK has been seen since 1980s, which has allowed telephone cable companies to build their infrastructure supporting telephone systems and also

Internet Services. This has led to the widespread use of optical fibre cables, covering almost 4.5 million homes. There were 51 million internet users by 2010, which is more than 80% of the population in the country. More than 90 per cent of the adults in the UK have mobiles. It has been estimated that there is over 70 million mobile phone connections, while the population is only 60 million (Facts & Statistics, 2011).

8.2. Healthcare system in the UK

The healthcare system in the UK is a universal system, which means the Department of Health (DOH) provides almost free healthcare and personal social service to its residents. The department determines policies for public health and related areas, such as environmental and food matters. In addition, the National Health Service (NHS) is also responsible; it accounts for 86% of total healthcare expenses and is funded by 76% of general taxation, 19% by national insurance and the remainder by the user (Boyle, 2008).

A set of groups/divisions have been organized according to a specific area or professional responsibility, such as the Nursing Group and the Research and Development Division. The Chief Medical Officer is tasked with providing expert medical advice to the whole department. The NHS Executive (NHSE) supported ministers in the development of health policies in relation to the NHS. The NHSE had several regional offices which were responsible for regional implementation of national health policy; they also monitored the performance of the health authority. NHSE ceased to exist on 1 April 2002. Several other governmental departments are also involved in health related matters, including:

- Social Security department
- The Environment, Transport and the Regions department
- The Ministry of Agriculture, Food and Fisheries
- The Department for Education and Employment (Boulos, 2010)

There are many independent medical/surgical hospitals based in the UK. However, there are also many profit based and not for profit based insurance companies that supplements the private health insurance. These private insurance companies provide choice of specialists, shortened waiting time for elective surgery and better standards of comfort and privacy than the NHS (Boulos, 2010).

8.3. Telehealth in the UK

The above situation analysis concluded that population distribution and the ageing issue are primary reasons for the UK to develop telehealth. Therefore, telehealth in the UK has been aimed at resolving the recognized and important problems as follows:

- Increase in demand of healthcare for elderly and those suffering from chronic diseases
- Higher demand for in-home health services for patients
- Standardized quality, efficiency and individualization at low cost is needed
- Healthcare service personnel providing service in hospitals and at home especially to elderly people are difficult to recruit and retain (Boulos, 2010)

In July 2004, the Department of Health allotted a Preventative Technology Grant (£80 million) for the advancements of telehealth technologies in UK that can provide independence to the elderly people. The expected benefits of implementing such a strategic initiative for telecare provision were as follows:

- Lowers the need for in-home health services
- Resources can be better allocated
- Service users have better choice and independence
- Healthcare service provides will be less burdened and more personal freedom
- Contribute to care and support for people with long term health conditions
- Acute hospital admissions can be reduced

- Accidents and falls in home can be reduced
- Support hospital discharge and intermediate care
- Contribute to the development of a range of preventative services
- Patients can be discharged early
- Lowers the individual cost (Boyle, 2008)

8.3.1. Applications of telehealth in the UK

Due to the demographic feature in the UK, telehealth in this country has an emphasis on telecare and telemonitoring. In July 2007, the new Telecare National Framework Agreement was issued, so that user can directly use the health and social care services. The following are the intended solutions that can be used for investigation and implementation:

- Telecare/Community Alarms: It includes the equipment of avoiding any kind in-home accidents, monitoring the environment, activities and lifestyle, integrated telecare and healthcare systems and also Community (social) alarms
- Telehealth/Medicine: This includes monitoring blood pressure, glucose levels, cardiac arrhythmia, asthma, personal medical care units, integrated health monitors and medication reminder systems (Boulos, 2010)

There are a number of telehealth programs practicing in counties of the UK; Whole System Demonstrator (WSD) is one such program. This WSD program is used to compare findings of service users and the control group involves 6000 people and costs around £31 million. It was initiated in 2006, and was later continued with selected evaluators, building teams, recruitment and data gathering. Hence, WSD is in its evaluation stage. This program was mainly designed to answer the questions concerning the feasibility of operation, profitable finance and results against the conventional healthcare system. Hence, WSD provides the convincing yet developed results based on benefits, returns on investments and new ways of operation. Primary evaluation of the WSD has started to show that

telehealth/telecare is capable of increasing the efficiency and effectiveness of healthcare delivery while lowering its costs up to one third (Stubbs, 2011).

8.3.2. Strategies of telehealth in the UK

There appears to be no overall national level overall strategy in the UK for broad and comprehensive telehealth development. Nevertheless, there are strategies, as mentioned above, with particular targets in the scope of telehealth development for the country. These strategies seem to be working well to meet the national situation and have therefore enhanced telehealth advancement in the UK.

8.4. Analysis of telehealth in the UK

8.4.1. SWOT analysis of telehealth in the UK

While the above analysis has provided an overall picture of telehealth in UK, a SWOT analysis in which the internal and external conditions and situations are better described and analysed will give further insights.

Strengths:

- National level organizations established to develop and promote telehealth
- Clear awareness and consensus on the development of telehealth with determined targets to the demographic situation of the country
- Soundly established telecommunication networks
- Strong technical backup

Weaknesses:

- Financial constraints due to recent economic recession and debt crisis
- Fragmentation due to the tradition of healthcare systems

Opportunities:

- Telehealth is in great expansion in recent years due to the increasing demands

- Technical booming of ICT is providing telehealth much better platform than ever before

Threats:

- High financial burden onto the fragile economy
- National level integration across countries' boundaries

From above SWOT analysis, we can briefly see that telehealth has been developed well in the UK in past years, however, there are still threats and weakness that challenge its further advancement.

8.4.2. CSF analysis of telehealth in the UK

- **National Level integration**: This may involve series of issues, including but not limited to: system openness, universal technical standards, interchangeable operation model, evenly trained teams across counties, integrated protocols and a unified supreme organization with an overall national strategy, which is supposed to form 'Phased mainstreaming' rather than projects/pilots.
- **Telehealth program evaluation**: This also includes monitoring and audit systems built into implementation and service delivery.
- **Smoothened business modelling**: This may include partnership (stakeholders) working, Joint/integrated commissioning, pooled funds, relationship management, project management and technical expertise, and cost-effective procurement of equipment and services.
- **Legal, ethical, regulatory concern**: This involves early attention to ethics, consent, practical considerations with user involvement, service design and workforce issues (structures, training and awareness).

8.5. Summary

The UK is not the earliest host for telehealth; however, it has not stopped the country from becoming one of the leading countries in advancing telehealth. The rapid growth is determined by multiple factors: demographic situation, sound telecommunication infrastructure, matured convention healthcare system, and so on. Apart from the critical success factors which have been stated as above, there is another concern for the UK to sustain its development of telehealth: the financial capability. The whole of Europe is now experiencing a severe debt crisis. The UK is not the worst victim, nevertheless, it is widely predicted that this crisis will hit the UK and slow its economic development, including healthcare sector.

9. Telehealth in Malaysia

9.1. Macro environment scan of Malaysia

9.1.1. Summary statistics of demographics in Malaysia

Malaysia has 329,847 sq. km of territory area, which is ranked 67th in the world, and the country has slightly more than 28 million of total population, which is ranked 43rd in the world. From figure 26, it can be seen that the total population of Malaysia has kept increasing in last forty years and this trend is predicted to remain the same in the coming years. On average, the total population of Malaysia has increased by more than four million for every decade in last forty years; however, the population growth rate has dropped from nearly 4% in 1970 to 1.58% in 2011 (CIA, 2010).

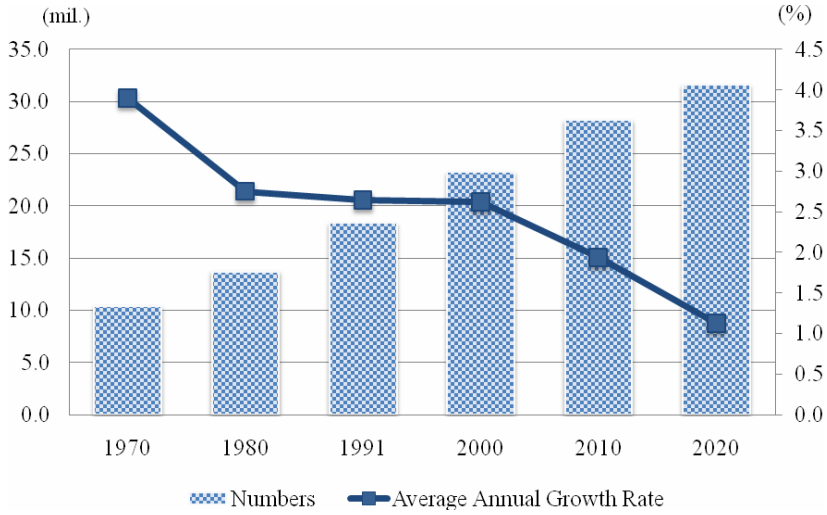


Figure 26: Population growth of Malaysia, 1970-2020 (STATCAN, 2010).

Figure 27 shows the historical view of changes of young group, middle aged group and elder aged group of population in Malaysia. It is clear that the middle aged group (15-65) and elder aged group (>65) have been increasing while the young group (<15) population in Malaysia would remain relatively stable.

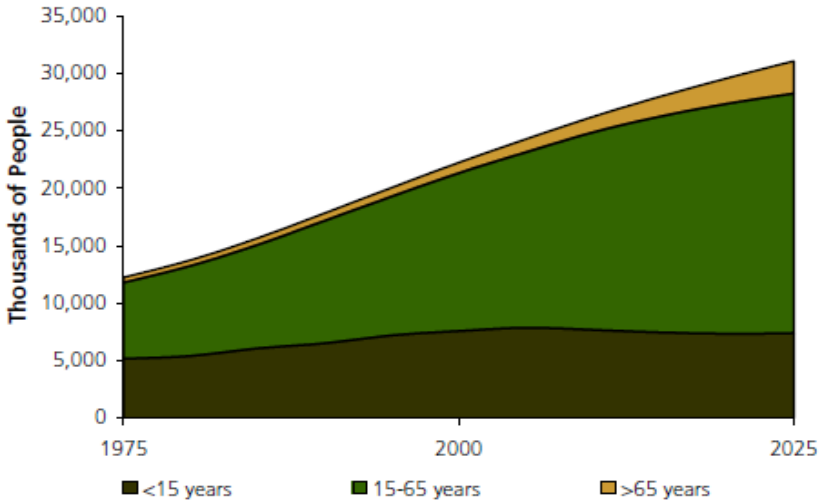


Figure 27: Population by Age Group, Malaysia, 1975-2025, (Source: EarthTrends.com, 2003)

The image in below figure 28 represents the aging of Malaysian population by comparing age and sex in the form of a pyramid 1990, 2010, 2020 and in 2050. It shows that along with the decreasing growth rate of population in the country, the increase of younger groups will slow down in coming years. The population structure will show a swollen middle, however, it won't happen until at least forty years from now.

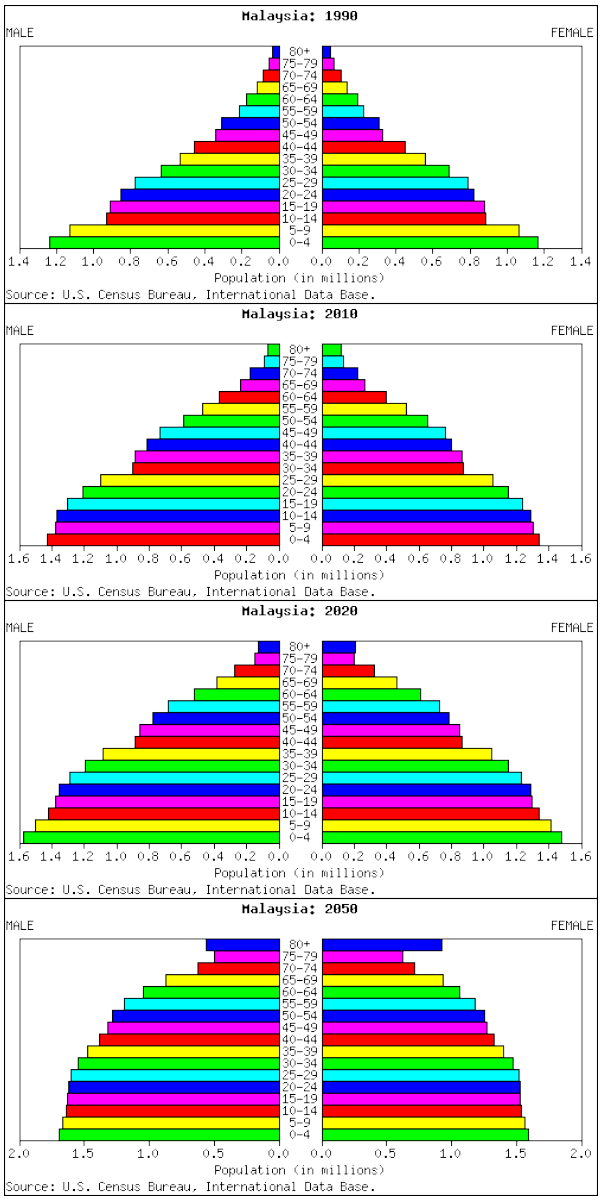


Figure 28: Age pyramid of population comparison of 1990, 2010, 2020, and 2050 in Malaysia (Source: nationmaster.com, 2010)

From above, it can be seen that due to the previous structure of population, the ageing issue is not that urgent in this country. The population of Malaysia is very young, as it is evident from 1990 census that only 6.1% of Malaysia's population was aged 60 or more. By year 2020 Malaysia will be a matured society with 9.5% of its population aged 60 and above. Comparing the population pyramid of 1990, 2010 with of 2020 (Department of Statistics, 2010). It is clear the major shape of pyramids is similar, which means the ageing of the total population in last couple

of decades is caused by the very low percentage of aged people in this country in the 1990's, and the ageing rate would stay quite stable or increase very slightly in coming ten years or so, as every age group in the country will increase its numbers. Later, when the birth rate drops while life expectancy stays increasing, the country will be confronted by the ageing issue (Population, health, and human, 2003).

By 2010, more than 72% of the Malaysian people lived in urban areas. This puts Malaysia in leading position of urbanization among most developing countries. Malaysia has a total population of 28.3 million with 91.8% Malaysian citizens and remaining non-citizens. Also, Malaysia is a multi-ethnic nation with 67.4% Malays, 24.6% of Chinese, 7.3% of Indians and the remaining by other ethnic groups (Department of Statistics, 2010).

9.1.2. PEST analysis of Malaysia

Political and legal factors: The political system in Malaysia is constitutional monarchy and a bicameral parliament with the State being governed by a federal constitution. There is a multi-party system in Malaysia; however, racial issues have a significant impact on the democratic dialogue in the country (Fionna, 2008).

Malaysia's economic freedom score was 66.3 in 2011, which ranks it as 53rd in the world and its score is well above the regional and world averages. Business freedom in Malaysia is 69.7% and trade freedom is 78.7%, which indicates that Malaysia has a fairly environment for business and trading (Index of economic freedom, 2011).

Economic factors: Since the 1970s, Malaysia has transformed its economy by producing raw materials for the emerging multi-sector economy. Also, Malaysia is attempting to move from being a middle-income country to a higher income nation by 2020. This transformation is being achieved by advancing the value added

production chain by investments in Islamic finance, advanced technology and better services. The major trading partners of Malaysia include the USA, European Union, China, Japan, and Singapore (CIA, 2011).

Social and Cultural factors: The ethnic composition of Malaysia has determined that the country has a multi-cultural and multi-religion social structure. While Malay has been the predominant ethnic group in Malaysia (roughly two third of total population), Chinese (quarter of total population) and Indian (some less than 10% of total population) are other two major ethnic groups. Islam is the national religion while Buddhism and Hinduism are also popular (Snodgrass, 2001).

Technology factors: The national shifting from raw materials trading to multi sectors manufacturing and servicing has also nurtured the development of technologies in Malaysia. Along with the country's economic transformation in last couple of decades, Malaysia has also built up a modern telecommunication network. In 2010, the country had 4.5 million land line telephones in service while there were more than 34 million cell phones in use. The internet is also well spread in the country. In 2009, there were more than 15 million internet users in Malaysia (CIA, 2011).

9.2. Healthcare system in Malaysia

The Malaysian healthcare system consists of two parts: public and private sectors. They both play important roles in providing healthcare services in the country.

The Ministry of Health is the government agency, responsible for providing healthcare services in public sector. The public sector has four different types of hospitals: the state general hospital, district hospital, national referral centre and special institution, and non-MOH hospitals. These hospitals vary in scale (number of beds) but are evenly distributed throughout the nation. The private sector mainly consists of registered private practitioners and has five to six thousands of private

general practitioners and five to six hundred private specialists in the country (Hamidy, 2010).

This public sector is mainly funded by the general taxing. However, health insurance is becoming popular due to health insurance not being mandatory and no National Health Insurance (NHI). In public hospitals, fees are highly subsidized by the government for both inpatients and outpatients. Hence, there is a rapid increase in the corporate, investor-owned services and specialist clinics, allowing the Malaysian healthcare to shift from a taxation-based system to a social insurance system (Chee & Barraclough, 2007).

According to the World Health Organization (WHO), there are several challenges that the Malaysian healthcare system is confronting and/or will confront soon, which are highlighted as follows:

- Public and private health service sectors do not have enough cooperation and integration of in surveillance and response to communicable diseases.
- Globalization and rapid urbanization is increasing the risk of health challenges, such as increasing prevalence of non-communicable diseases (NCDs).
- Improving the coverage and equitable access to health services in terms of geographical remote areas and lower social classes.
- There is a need for more well trained and skilled workers in the healthcare sector (WHO, 2010).

Telehealth is considered capable to resolve the above issues to a certain extent. However, the first issue stated above is also in needs of some policies from government to deal with.

9.3. Telehealth in Malaysia

Malaysia has built up a modern and up-to-date telecommunication and network infrastructures with broadband penetration of 35.4% on average over all its population. The broadband networks consist of two aspects: High–speed Broadband Project (HSBB) with speed more than 10Mpbs, and Broadband for General Population (BBGP) with speed up to 2 Mbps. This network infrastructure is the platform currently available for the healthcare sector to exert its telehealth programmes.

9.3.1. Strategies of telehealth in Malaysia

As early as July 1997, the Ministry of Health (MOH) of Malaysia issued its official document "Telemedicine Blueprint: Leading Healthcare into the Information Age". This document can be regarded as the initial set up of national strategy for the development of telehealth. In this document, all relevant elements for the development of telemedicine has be covered such as policies, law/regulations, technical standards, organizations, process, finance, and people; however, it is all within the context of telemedicine rather than telehealth. This document has been the primary guidance for the development of telemedicine from then on till now. It is also sensible to explain why the current status of telehealth development in Malaysia is much narrowed to teleconsultation aspect (Hisan, 2010).

It is remarkable for Malaysia, as a developing country, to have such a national level strategy for the development of strategy determination in telemedicine. This document was developed very well in terms of practicability and feasibility, therefore, has provided a very good fundamental base for upcoming modifications and realignments from telemedicine to telehealth. This document has already set up a forward looking vision to the year 2020. However, many conditions and needs have been developed and changed since the documents year of 1997. There is an apparent need for appropriate updates (Hisan, 2010).

9.3.2. Applications of telehealth in Malaysia

The telehealth services managed by the Telehealth Division of Ministry of Health aims at developing a multimedia network integrating all the healthcare products and service providers for better access and delivery. The four main applications are: Teleconsultation (TC), Multimedia Super Corridor (MSC), Mass Customized / Personalized Health Information and Education (MCPHIE), Lifetime Health Plan (LHP), and Continuing Medical Education (CME) (Singh, 2011).

The Multimedia Super Corridor (MSC) was started in 1996 by the former Prime Minister of Malaysia Dr Mahathir Mohamad. Its main goals and vision was to transform the whole nation into a knowledge based economy driven by a knowledge society. With this initiative Malaysia is determined to improve the socio economy of the country by means of ICT.

Currently, the outstanding example of telehealth is the aspect of teleconsultation, which consists of four major parts: Cardiology, Radiology, Neurosurgery, and Dermatology. The following Figure 29 shows its current networks for these applications. (Singh, 2011)

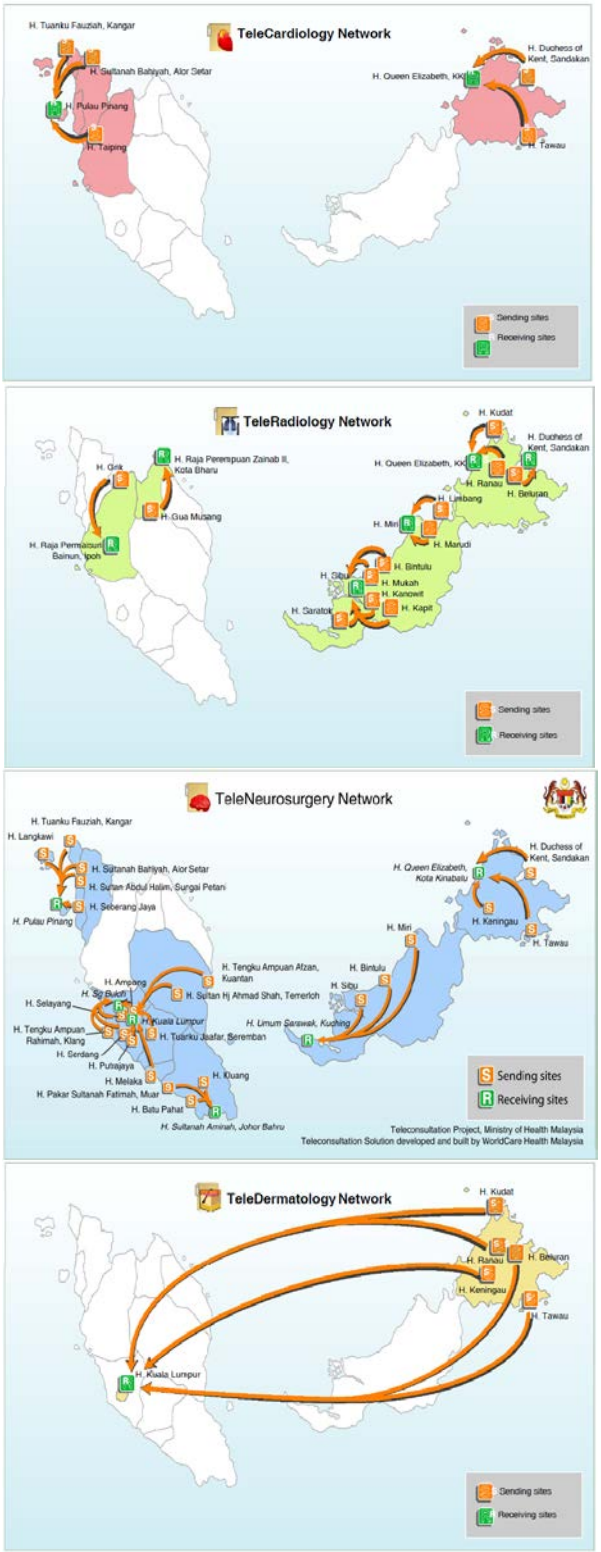


Figure 29: Teleconsultation networks in Malaysia (Source: Telehealth Division, Ministry of Health, 2010)

The current applications of telehealth in Malaysia are largely based on the current healthcare system in terms of speciality and discipline allocations, administrative set-ups, and population density and distribution in the country. It is also reported that Malaysia is running a Teleprimary Care (TPC) program mainly with focus on online consultations and with total connected sites of 73 clinics, 4 hospitals, and 10 health offices across the country (Singh, 2011).

9.4. Analysis of telehealth in Malaysia

9.4.1. SWOT analysis of telehealth in Malaysia

While the above analysis has provided an overall picture of telehealth in Malaysia, a SWOT analysis in which the internal and external conditions and situations are better described and analysed will give further insights.

Strengths:

- National level strategy for the development of telemedicine
- National level organizations established to develop and promote telehealth
- High level of awareness and consensus on the development of telehealth throughout the country due to the demographic features of the country
- Long existence and tradition of telehealth
- Established telecommunication networks

Weaknesses:

- National strategy for telehealth in needs to be updated
- Telecommunication networks in needs to be upgraded to meet the needs for further development of telehealth
- Lack of business modelling and operating mechanism for telehealth
- Uneven accessibility

Opportunities:

- Slower but upcoming issue of ageing population leaves the country few more years to develop its telehealth networks
- Technical booming of ICT is providing telehealth much better platform than ever before

Threats:

- Changing disease pattern
- Lack of trained professionals
- Potential lack of financial supports due to economic slowdown

From above SWOT analysis, we can briefly see that telehealth has been developed well in Malaysia in past years, however, there are still threats and weakness that challenge its further advancement.

9.4.2. CSF analysis of telehealth in Malaysia

- **Networks update:** This includes the hardware updates and software updates. As the current networks used in telemedicine/telehealth were developed ten years ago, technical specifications, especially the bandwidth, need to be upgraded to date to meet the modern needs and future developments of telehealth. The country is doing well in telehealth but mostly in teleconsultation and education; for better development in telehealth, telecommunication networks should be updated to meet the needs of upcoming other applications of telehealth. (Hisan, 2010)
- **Business modeling and operation mechanism:** Even though Malaysia has got national level organization and national strategy for the development of telehealth, however, the strategy is little dated as it was set up in 1997. The update of this strategy is urgently required, especially in terms of the business modeling and operation mechanism, which would also include organizational changes, process flows, patient management and relevant human factors, etc. (Hisan, 2010)

- **Human factors:** This includes getting an adequate number of professionals and other staff trained up for the implementation of telehealth programs, through which to transfer these newly applied technologies to end users. (Singh, 2011)
- **Change management and system evaluation:** Telehealth in Malaysia is facing a changing situation and the change would continue in near future. This requires a sound and continuous change management for telehealth. Also, a proper monitoring and evaluation system would be beneficial for the development of telehealth especially when more stakeholders are getting involved into the development of telehealth in the country (Singh, 2011).

9.5. Summary

Based on above studies, it can be concluded that Malaysia is at the forefront in the use of telehealth technologies and service programs amongst developing countries in several disciplines, of which the example of excellence is in teleconsultation. It is remarkable the Malaysia has had a national level strategy and a relevant national level organization for the development of telemedicine since 1997, which is quite early and even earlier than lot of developed countries. However, that national strategy was focused on telemedicine rather than telehealth due to developing status of telehealth at that time; therefore, it needs to be updated.

Malaysia had the tele-education as one of the focuses in its national strategy in 1997. After more than ten years of development, it is still confronting the issue of lack of trained professional and other staff. There might be series of factors causing that, however, it also raised a concern that the country has intentionally and highly profiled the development of telehealth. This concern will be remarked and brought into deeper analysis and discussion later on in this thesis.

10. Telehealth in China

10.1. Macro environment scan of China

10.1.1. Summary statistics of demographics in China

China has been the world's most populous country for centuries. Now it makes up one-fifth of the world's population. It is estimated that there are 1,338,612,968 (July 2010 est.) people living in China (CIA, 2010). Along with the rapid developments in the country, the population in China is showing some trends in today and near future.

A coming aging society: The drastic change in the aging of China's population is due to the lower mortality rate and also the one-child policy (Eberstadt, 2006). Figure 30 illustrates the clear comparison of population structure change in China. Comparing with 2000, by 2025, the aged population will increase dramatically while the younger age groups will decrease.

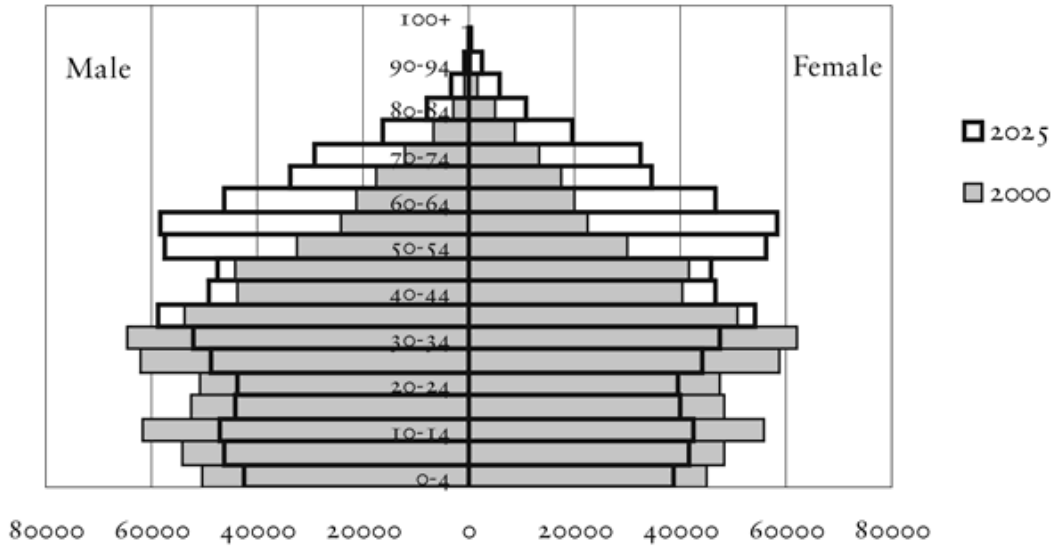


Figure 30: Estimated and Projected Population Structure of China: 2000 vs. 2025 (Eberstadt, 2006).

According to the New England Journal of Medicine, the elderly population of china is increasing rapidly due to low birth rate and improved life expectancy. It has been recorded that almost 6.5% of Chinese population is above 65 years of age in 2005 and is expected to rise to 11% by 2020, which can be seen in figure 31 below.

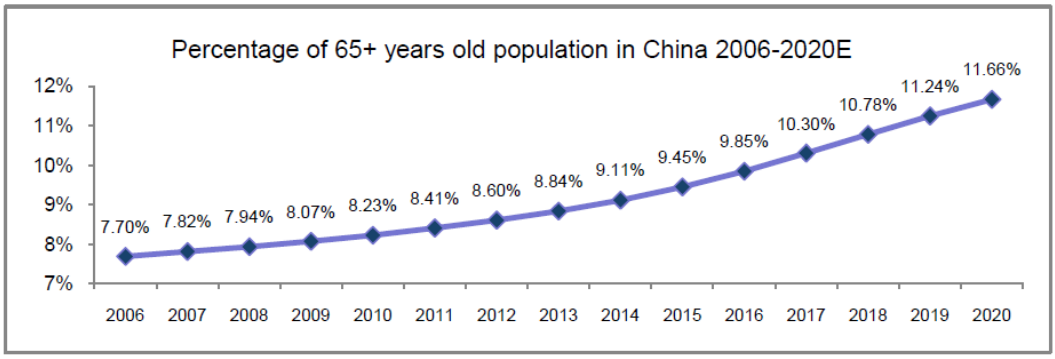


Figure 31: Percentage of 65+ years old population in China 2006-2020 (Source: Frost & Sullivan, 2011)

Uneven population distribution: As with the USA, a country of similarities, China's population is unevenly distributed through the country. Figure 32 shows the details, from which it can be seen that most people are living in the middle and eastern or southern area.

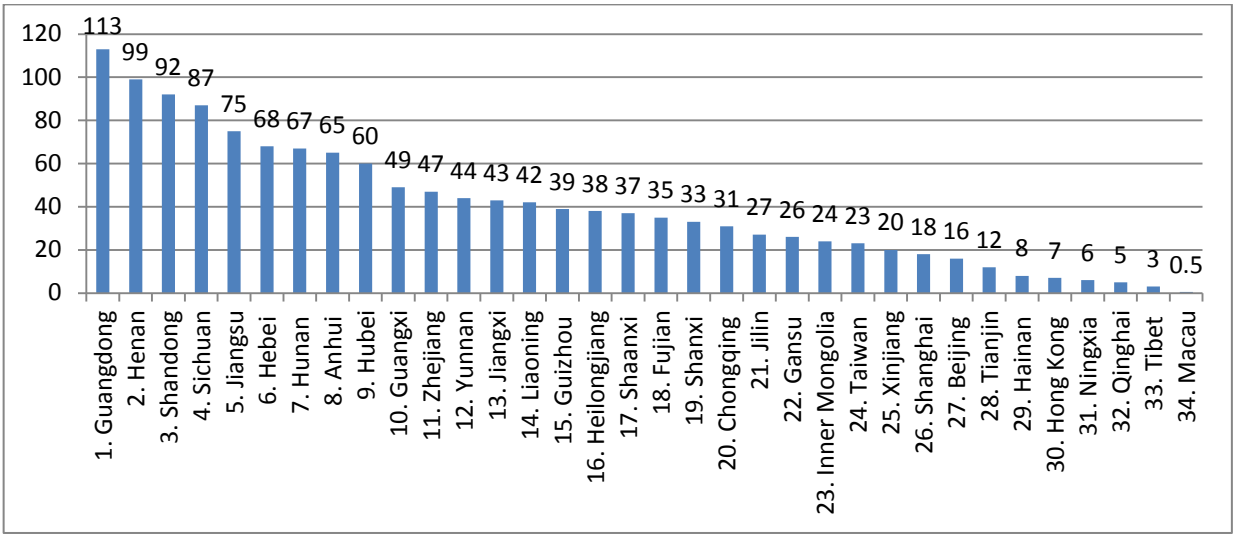


Figure 32: Population in different provinces in China (Source: CIA, Factbook. 2010**)**

Fast pace of urbanization vs. limited living resources: The society of China is experiencing rapid changes. More and more people have left their countryside homes to make life in cities. In 2005, the rate of urbanization was 2.7%, but the level of urbanization was still low (CIA, 2010). In 2008, the urban population was just 43% of the total population (CIA, 2010). The rapid industrialization has put great pressure of limited water and useful land onto the country's sustainable development.

10.1.2. PEST analysis of China

Political and legal factors: China has kept its political stability to ensure its economic development since late 1970's. In January 2008, the Chinese government initiated a scheme to improve healthcare system along with its economy. Its functionalities include:

1. Providing healthcare to both rural and urban population
2. Access and services to healthcare system must be improved
3. People's perception of consulting a doctor must be improved by 2011

Aligned with relevant policies, large financial support has been put into the healthcare system in China in five different categories:

1. Providing insurance schemes covering 90% of rural and urban population
2. Insurance covering all the national basic medicine
3. Healthcare system in rural and remote place must be improved
4. Access to healthcare system must be made easy, also maintaining individual healthcare profiles and developing healthcare projects
5. Strengthening the reforms and services of the healthcare system

Economic factors: China has been experiencing an economic rise for the last 30 years with an average annual GDP rise of 10%. However, due to recent slowdown of the economy, the government has started using fiscal stimulus to improve the economy. The government has invested in the healthcare system by developing

hospitals in rural and remote places and also community hospitals in cities and by initiated insurance schemes to reduce the expenditure of people.

According to the World Health Report in 2009, the number of High Net Worth Individual's (HNWI) have surpassed that of UK in 2008 and China is ranked 4th after the US, Japan and Germany. Home-based personalized healthcare systems are in demand by most of the wealthy middle class citizens. However, China is still having an uneven social wealth distribution and it reflects a different level of healthcare amongst urban and rural residents.

Social and Cultural factors: Currently, 80% of china's medical resources are available in cities, making it expensive and difficult to access for the rural population. Also, a lack of experienced doctors has caused inconvenience to both rural and urban population because of the long waiting times.

In China, it's a tradition for children to look after their elderly parents, but due to their work and busy lives it has become difficult to do so. Also the one child policy has caused the one child to look after his/her elderly parents. However, general caregivers are affordable and easy to find, but good caregivers with professional knowledge are hard to find.

Technology factors: In 2008, the number of internet users was 350 million with an annual increase of 22.5, with 90% of them using broadband connections. Also the number internet users in the rural areas increased to 84.6 million which is a 60% rise from the previous year, 2007. Also, China has almost 1billion landline users and 730 million mobile users, of which 117 million people also access internet through mobiles.

10.2. Healthcare system in China

For the most of the 20th century, China was under a communist structure in terms of political ideology, economy and social service system. At that time most people were looked after by the government. After 1979, the country was reformed to the

free market system. The reform also took place in the healthcare area; the old system was terminated, but for a long time no system was established. China's healthcare was left to the free market behind its economy development.

Almost overnight, the Chinese healthcare system vanished, leaving some 900 million Chinese without a safety net. Indeed, over years, the rates of health coverage amongst rural Chinese—who today still make up about two thirds of the nation's population—plummeted. In 1997, the World Bank estimated that a mere 10 percent of China's farmers had community-based health coverage, down from a high of 85 percent in 1975. Even today, less than one third of the total Chinese population can feel secure as they have a place to go for care (Karvounis, 2008).

In 2003, SARS broke out in China and the government demonstrated a very poor ability to react. Because of this, the government launched "New Cooperative Medical System" (NCMS). NCMS is voluntary and operates at the country level targeting on particular groups.

The funding of the system is from three sources which are:

1. The central government funding
2. A special funding from central government to poor area governments
3. The annual premium to enroll in the plan from the individuals

The NCNS system improved quickly, Yip and Hsiao (2008) estimated that by the end of 2008, the NCMS covered 86 percent of the rural population, and in 2010 the program was projected to reach 100 percent of villagers. It seemed that the system was working well. However, a World Bank analysis found that NCMS has not reduced out-of-pocket spending or the risk of catastrophic spending (Karvounis, 2008).

According to Dong and Phillips (2008), the central government of China supports the NCMS in rural areas and has also initiated a parallel plan in city communities for the uninsured people. There are two plans that aim to achieve a universal

healthcare coverage by 2020. The most important task for the system is to "focus attention and resources on improving the quality, comprehensiveness, and cost-effectiveness of services" (Dong & Phillips, 2008).

The development of healthcare in China is far behind the economic development. Expenditure in healthcare as a percentage of GDP remained lower than that of developed countries. For example, the OECD countries spend 8 percent of GDP on healthcare in 2002, while China only spent 5.8 percent of GDP on healthcare. This percentage in China was also lower than some developing countries such as South Africa (8.7 percent), Brazil (7.9 percent) and India (6.1 percent) (Healthcare in China, 2010).

The major challenges towards the system are:

- Access to an affordable healthcare
- Efficient use of healthcare resources
- A high-quality patient care (Healthcare in China, 2010)

10.3. Telehealth in China

Telehealth development in China was driven by the substantial needs rather than government promotion. For example, in 2008 Beijing Olympic Games, a telehealth program was established for water sports centre, located in Qingdao City. According to the China Daily (Newspaper controlled by central government in English language), "A long-distance Telehealth Consultation Center is connected with 35 hospitals in Beijing, Shanghai and Jinan and an international clinic will provide treatment" in Olympic village Qingdao city (Yanhong, 2008).

The central government has no systematic strategy to promote telehealth in the country. However, the Ministry of Health recognizes the importance for supervising the programs, so established rules and regulations for telehealth. For

example, in 2009, the Ministry of Health of People's Republic of China issued a policy document to regulate the telehealth programs. The document was issued to provincial Health Bureaus, which are the top provincial healthcare government departments, because in the current stage most of the telehealth programs are developed by provincial governments. The documents stated that telehealth in China was in the beginning stage; the principle of the development, and process for issues a license for the telehealth programs.

On the other hand, the Ministry of Health has participated in a number of telehealth programs, and telehealth projects evaluations (Construction and Evaluation, 1998). This has effectively directed the development of telehealth in China.

10.3.1. Applications of telehealth in China

The earliest telemedicine program was developed in 1995. Shanghai Medical University launched the program with support from the Shanghai Education and Research Network. The program was based on video conferencing via the telephone network (Chen & Xia, 2009).

In 1997, the telemedicine program launched by Shanghai Medical University has been recognized and praised by central government leaders. This generated high interests in telemedicine countrywide (Chen & Xia, 2009). The name of this application is IMNC network, which is primarily based on telephone lines and the Internet. This telemedicine system has two subsystems: a teleconsultation system and an online medical information system (Wang & Gu, 2009).

Since the late 1990s, telemedicine has been rapidly progressed in China. One of the most important telemedicine network, Golden Health (Jin Wei- in the Chinese language) Network (GHN) started its operation 1n 1997. Many national hospitals joined this network. GHN enabled remote consultation and remote education via satellite between the hospitals in 21 provinces in China (Chen & Xia, 2009). This

telemedicine program was supported by the Health Ministry of People's Republic of China. The aim of this program was targeting the highest level hospitals in China (Chen & Xia, 2009).

In the same year, another application, the International MedioNet of China (IMNC) network, started to work. This network is developed by International Medical Network Committee of the China Medical Foundation (non-profitable organization).This program provides healthcare services with community level hospitals.

Another major program is established by PLA (People's Liberation Army); the main functions of it are for military purposes **(**Wang & Gu, 2009**).**

The Shuang-wei, a Satellite Health Education Network was established by Ministry of Health in 2001. It provided multi-function educational services to hospitals as well as medical educational institutions (Chen & Xia, 2009).

The above four major programs in China are targeting the top level, community, and military. After these programs launched, many provincial programs went live. Until this stage, in late 1990s, the national health authority recognized the importance of supervising the local programs. The Ministry of Health established regulations for telemedicine in 1999.

More and more local telemedicine programs have been established in late 1990s, including programs in Shanghai (Program of BYL), and the programs in Guangdong, Sichuan and Yunnan provinces (Chen & Xia, 2009).

10.3.2. Strategies of telehealth in China

Since the 1980s, the Chinese government has been attempting to implement new reforms, strategies and plans for new healthcare system. However, by 2005 the Chinese Ministry of Health had failed to execute these as expected. Hence, in 2009 a new reform for the healthcare system was initiated by the government.

Meanwhile, researchers have more and more interests in telehealth in China. These research projects have suggested that China could learn from the experienced developed and industrialized nations and act as per the following:

- The government must be strengthened to develop telehealth services
- Strengthen the supervision of telehealth development
- Development of the telehealth standards must be promoted with the help of users, researchers, technical and scientific bodies, and through the industry
- Develop a legal and regulatory infrastructure that will facilitate telehealth
- Increase the investment in telehealth
- Telehealth professionals and technical staff must be fully trained
- International sharing and collaboration with developed nations must be promoted

10.4. Analysis of telehealth in China

10.4.1. SWOT analysis of telehealth in China

While the above analysis has provided an overall picture of telehealth in China, a SWOT analysis in which the internal and external conditions and situations are better described and analysed will give further insights.

Strengths:

- Access to telehealth and its cost is lowered due to the awareness and consensus of telehealth among the people
- Telecommunication Network is well established
- Financial investment is huge
- Foreign parties interested in both financial and technical investment

Weaknesses:

- Lack of understanding of telehealth by society

- Lack of human resources and incomplete telehealth organizations
- Lack of standards and evaluation of telehealth programs
- Absence of legislation and regulation
- Lack of funding and high cost for the development of telehealth
- Level of development is unbalanced in different regions of China
- Lack of reimbursement for telehealth services (Chen & Xia, 2009)

Opportunities:

- Population of China being largest in the world
- Medical resource are not balanced properly
- Advanced information technology

Threats:

- Huge complicity in terms of the demographic size
- Cultural barrier in acceptance of modern telehealth from developed world
- Some potential instability in terms of international relationships and internal social status
- Uneven development across the country

From above SWOT analysis, we can briefly see that telehealth has been developed well in China in past years, however, there are still threats and weakness that challenge its further advancement.

10.4.2. CSF analysis of telehealth in China

- **Complicity and difference caused by the size and political system: B**eing such a big country, China is facing issues in dealing with the massive scale of telehealth system development. Also, China is one of the few socialist countries. Foreign experiences can be borrowed; however, it may confront the issues of transforming to suit the country's own political and social situation.

- **Cultural barrier and diversifications:** Telehealth requires a relatively unified system across different areas in the whole country of China and between China and other countries. The unique Chinese culture and great cultural diversity within China may become barriers for the interactive operation in such a large scale system. These barriers may refer to languages, industrial standards, and even dialects.
- **Policies, strategies, and business modeling:** In order to be successful, telehealth development in China will need the involvement of various parties, including foreign entities. A national level strategy will provide an overall guidance to the development of telehealth and more favorable policies would attract more financial and technical investment into telehealth. In the practice of telehealth, sound business modeling would ensure it sustainability, which is even more important in China as there would be more different stakeholders in it.
- **Evaluation mechanism:** It is also crucial for the development of telehealth in China to have a balanced and practical system of evaluation during the development of telehealth, especially when various parties are involved in the development of telehealth.
- **Sufficient professional and experts:** Training will help health professionals to understand telehealth, and will also promote the efficiency of telehealth systems. These personnel needs include doctors, local administrative staff, technical staff; and more particularly, sufficient professionals with international knowledge to adopt advanced experiences/technologies from outside of the country.

10.5. Summary

Telehealth is relatively new to China. It can overcome geographical barriers and make high-quality services available without regard to location. This can help to reduce the unbalanced distribution of health resources. Because telecommunications are developing rapidly in China, there are many opportunities to develop telehealth. There are also many challenges for telehealth to overcome.

China is in its fast track of development in various aspects; many things are all changing in the country, including social structure, healthcare system, and technology applications. Every development has huge potential due to the large scale of the country, but at the same time, every development is complicated and difficult. In such an environment, opportunities will be always accompanied by challenges in the development of telehealth.

11. Telehealth in India

11.1. Macro environment scan of India

11.1.1. Summary statistics of demographics in India

India is the world's second-largest country by population, and is the seventh largest country in the world with an area of 3.28 million sq kilometres. According to the Census of India 2011, the total population in India is currently of more than 1.21 billion. With a total population growing rate of 1.34 % in the country, India is estimated to surpass China and be the leading populous country in the world by 2030. Following Figure 33 shows this trend of population growth in India. (CIA, 2011)

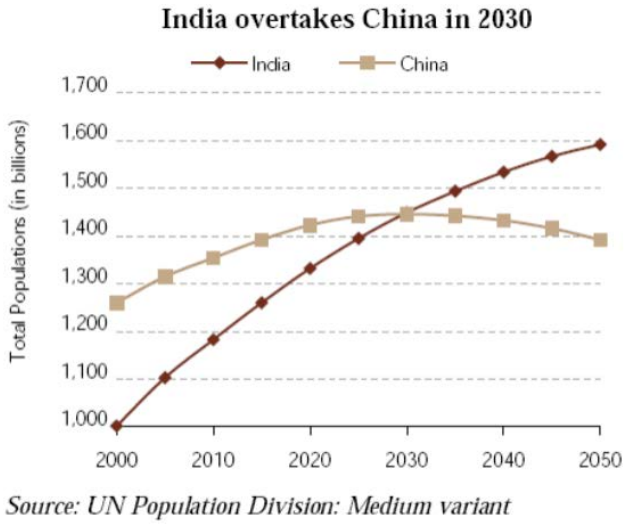


Figure 33: Components of Annual Population Growth of India (STATCAN, 2010).

Figure 34 shows the historical view of changes of total population and birth rate in India. It is clear that even though the birth rate has been declining and will keep declining in India, the total population in India will keep growing and reach its peak around 2050 at nearly 1.7 billion.

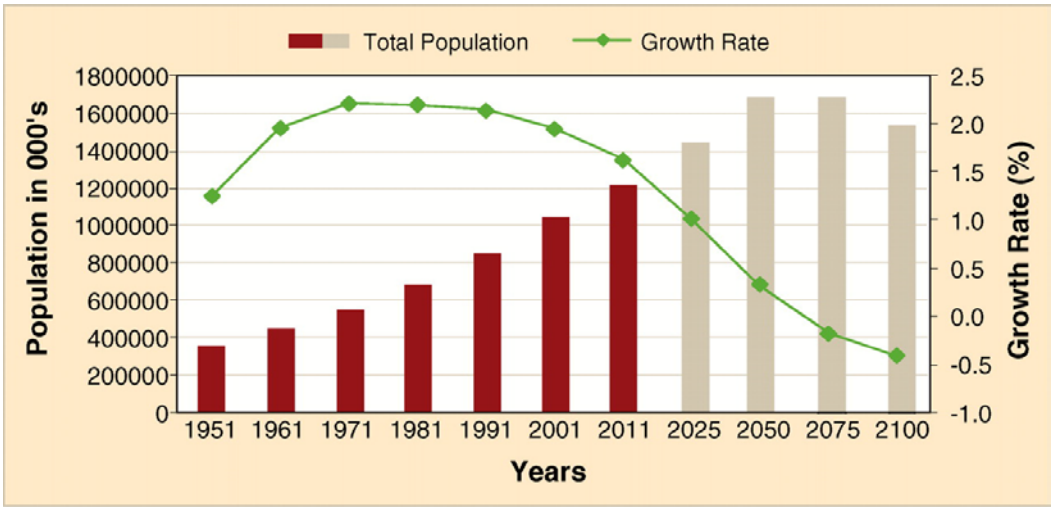


Figure 34: Population size and its annual growth rate in India for 1951–2100. (Source: K. S. James, 2011)

The age pyramid below (Figure 35) clearly shows the aging of India's population by comparing the structure of the Indian population by age and sex in 2000, 2010, 2020, and in 2050. It also provides a better view of age distributions of the Indian population and their changes in a fifty year spectrum. These figures show the ageing issue, which is commonly seen in most developed countries and some developing countries, may not be that urgent in India until 2020; however, it is also expected that once the Indian population starts ageing, the aged group would be at a massive scale due to its large population base.

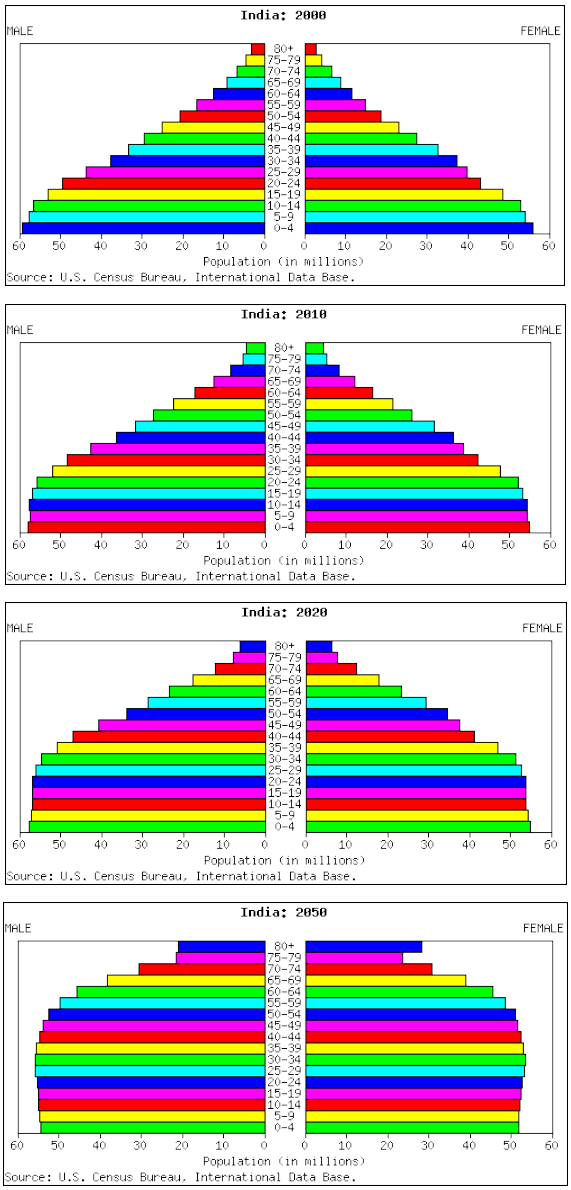


Figure 35: Age pyramid of population estimates as of 2000, 2010. 2020, 2050, India (Source: nationmaster.com, 2010)

From Figure 34 and 35 above, it can be seen that the ageing issue is not the number one concern for the India in coming years. However, the coverage of healthcare over the large population is a greater concern and this concern will worsen in the coming years when the ageing issue is beginning to surface.

By 2010, some 30% of the Indian people lived in urban areas and this ratio has increased at 2.4% in recent years. This makes India one of less urbanised nations compared with other developed countries. Less urbanization can leave fewer

burdens to healthcare system in cities; however, it also leave the healthcare system with the issue of accessibility as there are more people living in rural areas, and remote areas that the healthcare system needs to cover. (Haub & Sharma, 2006)

11.1.2. PEST analysis of India

Political and legal factors: Democracy in India is the biggest in the world, governed by the federal republic. The federal government of India is mostly led by Indian National Congress (INC) and by several other parties within the states including INC.

India's economic freedom score is 54.6 in 2011, which is ranked 124th in the world, it consists of 39.6 of business freedom and 64.2 of trade freedom. India is ranked 25th out of 41 countries in the Asia–Pacific region, and its overall score is below the world average (Index of economic freedom, 2011).

Economic factors: The economy of India has experienced an 8% growth despite of the global melt down of economy in the last 5 years. Also, there has been added demand and continuing strengths in services and manufacturing.

Due to the massive internal demands and market size, India has been less affected by the global recession that started in 2008. In terms of telehealth, growth is not implemented in the economic freedom policies also progress is uneven. The state plays a major role in maintaining the health sector through public organizations due to a restrictive environment making it difficult for the private organizations to stop the growth of the economy. Also the rising inflation, high corruption, and an inefficient judicial system are posing a potential threat to the stability of macroeconomics in India (CIA, 2011).

Social and Cultural factors: There are 6 major ethnic groups in India along with several other tribes, castes, religions and ethnic groups. Every region has its relative caste and sub-caste with its distinctive rank, traditions, names, occupation

forming a hierarchical structure. However, tribes do not have the hierarchical structure but have their own internal structure. There are four major language families, each with numerous languages, which cover four areas of the country: the northern half of the country, the southern third, the middle regions, and the north-eastern hills (Culture of India, 2011).

The great diversity of India makes difficulties for the country in terms in social and cultural development and interactions; however, English is official language thus making the country more communicable with rest of the world.

Technology factor: India is a fast growing economy and is becoming an emerging open market. Matching its economic scale, India has good capability in terms of technology development (especially software development) and various manufacturing.

In the last decade, India's IT sector has had a gradual boom, coupled with the remarkable growth of the IT infrastructure. By 2010, there were more than 100 million Indian internet users that reached 8.5% of the total population. This seems much lower than developed countries and even lower than some developing countries. However, when realizing it has increased from 0.5% in 2000, this can be regarded as the remark of very high growth of IT development in the country.

The telecommunication industry of India is the world's second fastest growing telecommunication industry following China. There are 688.38 million telephone subscribers in 2010, among them there are 652.42 million mobile phone subscribers. India has the second largest wireless telecommunication network in terms of number of users in the world, following China (Kannan, 2010). This means 56.4 per cent of the population has a mobile phone. (CIA, 2010)

11.2. Healthcare system in India

In India, healthcare is provided by both the private and the public healthcare providers, with the private sector experiencing rapid growth in recent years covering almost 80% of the healthcare systems. The healthcare system in India is a universal healthcare system, covering all the members of the society for both the health financing and the health services (World Health Organization, 2007).

The healthcare system is monitored by the state or central government. The government or public hospitals provide best healthcare service, are funded by the government and also most of the drugs are free of cost. However, it is difficult for the government to provide the needed funding and health standards considering the population, hence people go to private hospitals (National Health Policy, 2002).

Public hospitals offer healthcare for free or a minimal charge that is heavily subsidized by governments. For example, the patient can buy an outpatient card. After purchasing this card, the medical advice for this person will be free. In-hospital treatment costs vary according to two factors:

1) The financial situation of the patient -if the patient is below poverty line, the treatment can be free for the patient.

2) The facilities used by the patient - for example, if a patient would like an air-conditioned room in the hospital, the patient needs to pay the extra costs. However, the prices are much lower than that of the private hospitals.

The city and district hospitals and rural primary health centres (PHCs) provide primary health services free of charge. These health service centres mostly provide treatment towards immunization, prevention of malnutrition, pregnancy, childbirth and other common illnesses free of charge. However, if a patient requires specialist services then they are referred to the secondary specialist care located either in

districts or taluks, also sometimes referred to the tertiary health service centres located in districts or state headquarters (Healthcare in India, 2009).

In the last 10 years, the healthcare system in India has been rapidly increasing. However, there are two areas of medical care system which needed to be developed further. They are emergency care and special medical care. Emergency care is at lowest level of services, whereas, the special medical care is slightly better than the former with access to higher and middle class Indians only. Due to the lack of vital components like centralized administrative body training, centralized emergency phone numbers and quality ambulance services the Emergency Medical Services (EMS) are lacking. However, recently government has been initiating growth in the EMS system (WHO, 2010).

The quality and access of the specialist medical care facility is different in rural and urban areas and also depends upon the socio-economic position of the person. Even though there are many specialist medical student graduating every year, there is a lack of medical specialists due the fact that most educated Indians immigrate to western countries. However, recently, specialist medical services to the middle and upper class people have increased due to an increase in the number of private hospitals with improved quality, infrastructure and better salaries due to higher demand of these services (Healthcare in India, 2009).

In short, the healthcare system in India has most characteristics common to a developing country, and issues can be magnified or complicated by the massive scale of population. These are the primary telehealth in India should be targeted towards.

11.3. Telehealth in India

The Indian government has crafted a clear vision for telemedicine development to cover a large population. It is implemented using a three tier hierarchical structure, which includes firstly a Primary Heath Centre (PHC), which is linked to the hospitals at the district level connected to District level hospitals. Secondly,

hospitals at the district level are connected to the selected hospitals at the state level, and finally hospitals at the state level and selected hospitals of the district level are connected to the super speciality hospitals at the national level (Bedi, 2003).

According to the "Indian Telemedicine Network" (2010), there are several policy documents that have been initiated from different government agencies that relate to telemedicine practice. These documents effectively promoted and regulated telemedicine development in India at a practice level. According to Indian Telemedicine Network in 2010, the important government documents are as following:

1) The framework for Information Technology Infrastructure for Health (ITIH) by DIT

   Initiator: The Department of Technology (DIT), Ministry of Communications and Information Technology (MCIT)

2) National Task Force on Telemedicine by Ministry of Health & Family Welfare and its terms of references (September 2005)

   Initiator: Ministry of Health and Family Welfare (MoH&FW)

3) Recommended Guidelines & Standards for Practice of Telemedicine in India.

   Initiator: Department of Information Technology (DIT), Ministry of Communications and Information Technology (MCIT)

4) Expression of Interest for Evaluation of existing Telemedicine / eHealth initiatives.

   Initiator: The Ministry of Health & Family Welfare (MoH&FW)

It can be seen that Indian government bodies have put telemedicine at a strategic level to improve the healthcare of the country. This is because the above four government documents working together systematically regulated the technology standard for telemedicine; build a national Task Force to improve the telemedicine practice; regulate telemedicine practice; and build the regulations to evaluate the telemedicine systems in India.

According to Bedi, Senior Director of Department of Information Technology Ministry of Communications & IT, Government of India, Telemedicine is very necessary for India, because:

- The healthcare services in India are available mostly in urban areas, whereas 68% of the Indian population lives in rural areas
- Basic healthcare facilities are insufficient in rural areas
- Rural and remote places in India are still lacking in quality healthcare system, even after several initiatives of government and private sectors
- Most of the patients in the rural and remote areas can be consulted to specialists without travelling
- Public and private healthcare organization driving the value of healthcare in India (Bedi, 2003)

In 1999, a government body "'Development of Telemedicine Technology" was set up by central Indian Government. This is the only government body found which specializes in telemedicine development in this research. The mission of the body is: 1) to implement telemedicine technology at three premier tertiary level hospitals by identifying the required tools and services in the northern part of India. 2) To maximize the efficiency of telemedicine technology by developing and integrating the health system (Sood & Bhatia, 2009).

11.3.1. Applications of telehealth in India

The private sectors in Indian healthcare account for 60% of the services (Mishra, Pradeep & Mishra, 2009). For the above reason, both government bodies and private organizations have evolved telemedicine development (Indian Telemedicine Network, 2010).

The government bodies include: Indian Space Research Organization (ISRO), the Department of Information Technology, the Ministry of Communication and IT, the Department of Science and Technology, and the Ministry of Defence.

As a facilitator, the Department of Information Technology Ministry of Communications & IT has set a long term objective of the effective utilization and incorporation of telemedicine including technology development, pilot schemes initiation, technology standardization, framework building for IT Infrastructure in health.

The Ministry of Health and Family Welfare has launched two national telemedicine programs:

1) oncoNet India - this program connected 25 regional cancer centers with four medical educational institutions each.

2) Integrated Disease Surveillance Project - this project will connect all the district hospitals with regional medical education institutions.

These programs indicate that the government body is trying to improve the service quality by combining the advanced medical knowledge from research and education institutions with the hospital practice in both secondary level and tertiary level. (Mishra, Pradeep & Mishra, 2009)

Telemedicine programs are also initiated by Department of Space. Instead of using these programs solely for outer space purposes, they can be used to improve rural healthcare under Space for Health program by using satellite connectivity.

Other telemedicine programs have been initiated at state or area level in the country, according to Bedi (2003). Some of the important programs are listed in the following:

- Telemedicine in Kerala: In order to setup the telemedicine and telehealth education system in Kerala, the district level hospitals must be linked with the speciality hospitals like MCH, SCTIMST and RCC
- Continuing Medical Education (CME)
- CancerNet: Telemedicine system for Cancer Patients in Kerala

- Utilizing Technology developed by WEBEL & IIT Kharagpur: Telemedicine could be used for diagnosis & monitoring of tropical skin related diseases in West Bengal.
- Kolkata and two district Hospitals: Two of the referral hospitals and four of the district hospitals are being upgraded to provided services to almost 800 patients (Bedi, 2003)

To conclude, India has a universal healthcare system which aims to service everybody equally, but with the shortage of funding as well as medical professionals, the system performance has long been at a very low level. The fast economy development and ICT infrastructure development is providing the country with a better opportunity for telemedicine development. The government sees telemedicine as a mean to improve healthcare services through the country. (Balarajan et al., 2011)

In this situation, the government is setting up a clear vision for telemedicine development, as well as a special government agency to manage it. Several government bodies have been involved telemedicine practice. The government has set up regulations in terms of technology standards, telemedicine program standards, as well as the standards to evaluate telemedicine programs. The government body is heavily involved in programs initiation. Through the programs and regulations, the government strategy can be seen clearly: the government is trying to connect the hospitals with research and educational institutions; connect different level of the hospitals from primary to tertiary; and also concentrate on special disease in order to improve the healthcare standard as a whole (Mishral & Sathyamurthy, 2008).

11.3.2. Strategies of telehealth in India

There are some organizations set up for telehealth/telemedicine in India, which are named as to be at national level, such as Indian Association for Medical Informatics (IAMI) and Telemedicine Society of India (TSI). While these

organizations are having some academic events and studies in this field, no national level strategy has been found for the development of telehealth in India, either from the government or any government agency. (Mishral & Sathyamurthy, 2008)

11.4. Analysis of telehealth in India

11.4.1. SWOT analysis of telehealth in India

While the above analysis has provided an overall picture of telehealth in India, a SWOT analysis in which the internal and external conditions and situations are better described and analysed will give further insights.

Strengths:

- Enthusiasm of research and study in telehealth development by local academic institutions and individual researchers
- Certain level of awareness and consensus on the development of telehealth throughout the country due to the demographic features of the country
- Some national level organizations established to develop and promote telehealth

Weaknesses:

- Massive population with shortage of physicians (1 per 1000 people) and nurses (0.8 per 1000 people) and care facilities(1 bed per 1000 people) in the country (ITU, 2011)
- Lack of national level strategy for the development of telehealth
- Geographical barrier, cultural barrier, and lack of national level standardizations in telehealth, in terms of technical standards, business model, payments, etc.
- Unevenly distributed telecommunication networks that might become obstacle to develop telehealth

Opportunities:

- Unbalanced distribution of healthcare facilities, with over 70% of the population in rural areas and over 60% of healthcare work force in urban areas (ITU, 2011)
- ICT strength in some areas may be able to provide telehealth with much better technical support than present

Threats:

- Human resource constraints especially in terms of computer literacy amongst medical practitioners
- Great demographic diversity such as linguistic diversity seems a major barrier in the way of cross region communication between patients and doctors
- Financial constraints as the government has to put most financial inputs into the conventional healthcare system

From above SWOT analysis, we can briefly see that telehealth has been studied well in India in past years; however, there is still a long way for the country to develop telehealth into practices.

11.4.2. CSF analysis of telehealth in India

- **National level strategy up-to-date:** There are plenty of relevant studies and researches regarding to the development of telehealth in India. To make these numerous visions and great ideas into more realistic and practical sense, it is the government's responsibility to upgrade its strategy of telehealth development. This strategy can be based on the dated "Development of Telemedicine Technology" strategy that was issued in 1999; however, as situations such as demographics, economy, and technologies all have changed since then, a newer strategy for telehealth

must be updated and become the general guidance for the entire country (Pal et al., 2004).

- **Adapt User-Friendly Interfaces:** This means two things. One is the capability of telehealth system to deal with the language diversity across the country. Some practical solutions may include using some local languages in some local telehealth systems and/or making the system with more multi-lingual capable. Another aspect is the user-friendliness of the interfaces of telehealth system to deal with the relatively low computer literacy, for example, a writing pad would be a good alternative to people with unfamiliarity in typing (Pal et al., 2004).
- **Upgrading telecommunications and Internet networks thus improve accessibility of telehealth system:** This is a major concern and may become main obstacle in the way of telehealth development in India, as the current telecommunication networks do not cover many of the remote areas in the country. While some current telehealth projects tend to employ vehicle-mounted facilities, thus adding mobility to increase accessibility; further development of telehealth may pay more attention to satellite based data transferring and mobile telecommunication networks to increase the coverage (Bowonder et al., 2010).
- **Implement Standards and Protocols:** This factor consists of three parts. Firstly, the standards at a national level are needed to ensure current piloting programs will be able to extend to a national context seamlessly. Secondly, it is important to ensure that current systems are capable for further upgrading of the telecommunication networks, or at least staying open for future upgrading with networks' advancing. Thirdly, telehealth programs in India must align with international standards in terms of both technologies and business modeling, which would be a very efficient way for telehealth in India to learn from other advanced countries, and to exchange and share experiences in further developments (Bowonder et al., 2010).

11.5. Summary

At a national level, telehealth in India is in its piloting stage and with a number of programmes commencing in different disciplines and geographical areas. There are numerous studies and research in this field and the government is paying more and more attention to telehealth as there is a rising awareness that telehealth could be a solution and/or to some extent a shortcut to the development of a better healthcare system in the country. Telehealth does have natural advantages to supplement the conventional healthcare in the country, such as is better coverage in remote areas, its mobility, and its efficiency in communication. However, challenges remain due to the great demographical diversity in India in terms of residential distribution, linguistic diversity, English and computer literacy, and so on. India has remarkably increased the government expenditure into healthcare sector in recent years; however, telehealth is still confronting financial constraints due to the considerable proportion of financial input going into conventional healthcare rather than telehealth. Personnel and trained staff would be another shortage in the further development of telehealth, as well as the unevenly developed telecommunication networks, which has already driven the telehealth development in the country reclining to a more M-health context.

In short, India has great potential in developing telehealth. The government is putting efforts into it and it can be seen that telehealth will be growing up along with the long way of the development of the country's healthcare system.

12. Comparison and Discussion

This research has investigated and compared telehealth practices in the eight countries: New Zealand, Australia, Canada, the USA, UK, Malaysia, China and India. The eight countries have different situations in terms of macro environment, economic development (especially at the telecommunications level), healthcare systems, the government policies and strategies for telehealth development, and the current status of telehealth development. Each country has been studied respectively from its macro environment to its telehealth status and critical success factors (CSFs) of its telehealth development. The findings for each country from generic to specific will be presented in this chapter.

At beginning of each country's study, demographic features are firstly studied as they are considered as the primary factors that determine the country's healthcare, and further the development of telehealth in that country. Then, a PEST analysis for that country has been undertaken to illustrate the country's macro environment, in which political, economic, social/cultural, and technical factors are all possible factors that have impacts and/or influences onto the healthcare and telehealth development in that country. After the environmental scanning, the healthcare system of the country has been reviewed, and the telehealth development in that country has been studied and analyzed. SWOT analysis has been employed in these analyses, and thereafter, CSFs for the development of telehealth in that country have been concluded as the main results for the above analysis. At the end of each chapter on each country, key findings have been highlighted as the summary for that country.

As stated in the introduction chapter of this thesis, the main objective of this research is to discover the similarities and differences at a strategic level in telehealth practices in the eight countries by analyzing and evaluating the countries' healthcare status, including healthcare system, demographic situations, level of economy development, etc. Therefore, in the final part of this report, an overall discussion based on the studies on each particular country will be

undertaken. This part will commence with the comparisons of the findings from each country studied, and then based on these comparisons, all key findings for these countries will be discussed from selected perspectives. The comparisons and discussions will form this chapter. Afterwards, the conclusion will not only conclude the overall comparisons and discussions of this chapter, but also identify the conclusions of the entire research in this study. Then, finally, the recommendations will be presented based on the conclusions.

12.1. Comparison

The situation comparisons will concentrate on the following perspectives: macro environment, healthcare system, telehealth status, and telehealth analytical comparisons. The analytical comparison will focus on the findings of previous SWOT and CSFs analysis.

12.1.1. Macro environment comparison

The demographic highlights of the eight studied countries are presented as in the following table.

Country	Population	Population Density	Average Age	Population Increase	Urbanization Level
New Zealand	Small 4.4m	Low 202nd	Old 36.6yr	Medium 0.95%	High 86%
Australia	Small 23m	Low 235th	Old 37.3yr	High 1.148%	High 89%
The USA	Big 308m	Low 179th	Old 36.9yr	Medium 0.963%	High 82%
Canada	Small 34m	Low 230rd	Old 41yr	Medium 0.794%	High 80%
UK	Medium 62.7m	High 53rd	Old 40yr	Low 0.557%	High 80%
Malaysia	Small 28m	Medium 116th	Very Young 26.8	High 1.576%	Medium 72%
China	Very Big 1,337m	High 80th	Getting Old 35.5	Low 0.493%	Low 50%
India	Very Big 1,189m	Very High 33rd	Very Young 26.2	High 1.344%	Very Low 30%

Table 4. Demographic highlights of the eight studied countries (Source: previous chapters)

Demographically, the eight studied countries have a wide variance in terms of territory areas, populations, urbanization level, etc. These countries do share some demographic factors in common such as the ageing populations; however, even for the ageing issue, these countries are at different levels. For instance, the ageing population issue is much more current in UK's healthcare, while it is more either urgently or becoming urgent in other countries, and is relatively less urgent in India. However, when the ageing issue really become urgent in India and China, it would become much more massive burden in these countries' healthcare system due to the massive population basis versus relatively lower healthcare level in these countries.

Urbanization level is another important demographic factor that would impact the direction of the development of telehealth. In the eight studied countries, it is very clear that all developed countries (New Zealand Australia, the US, Canada, and the UK) have higher urbanization levels than the developing countries (Malaysia, China, and India). Also affected by the stages of telehealth development, the developments of telehealth in these countries are having slightly different focuses. In those countries with higher urbanization, telehealth is developed well in the form of regional networks, in which it is more focused on tele-monitoring and tele-clinical applications to improve and to supplement the conventional healthcare system. For inter-region networks of higher urbanized countries, telehealth projects are more focused on information sharing. In developing countries with lower urbanization, telehealth have more focuses on transferring and spreading their centralized healthcare capacity in big cities to remote areas with less healthcare capacity, and functionally these networks focus more on the primary healthcare and tele-consulation through telehealth networks.

All eight countries have open market economy, while the Chinese economy status is slightly arguable. While five of the eight studied countries are already regarded as developed countries, the remaining three countries, Malaysia, China and India,

are all fast developing countries with higher economic growth in the developing world. It is commonly believed that a stronger economy can always put more strength into healthcare and telehealth developments. On the other hand, along with economic and social developments, people are expecting more healthcare and/or current with higher service accessibility and quality. This is one major motivation for the development of telehealth.

From the demographic perspective, each of the eight countries has different characteristics. For instance, some countries have a population ageing issue, like UK and the USA; while other countries has low populous density that may cause higher costs in healthcare services, like New Zealand and Australia; and some countries have large land areas that needs better coverage and accessibility of their healthcare services, like Canada and China, and some countries have higher population growth that means there will be increasing needs for healthcare, like Malaysia and India. Telehealth is in demand in these countries, because telehealth can make healthcare easy to access, improve communications across distances, make healthcare education easy and continuous; and also make better use of the healthcare resources (Norris, 2001). Nevertheless, different situations in these countries, in terms of demographic factors and healthcare systems, will probably determine the various status of telehealth development in these countries.

12.1.2. Healthcare system comparison

In the eight studied countries, New Zealand, Australia, Canada and UK have universal healthcare system with single payer mechanism. As Australia and Canada are federal states, in these two countries, the healthcare system is more independent in each state, while New Zealand has a more centralized healthcare system. The UK is different from other studied countries as it consists of four countries, and healthcare system in each country of UK shows even more independency than those federal states countries. Malaysia, China and India have universal healthcare systems but each has different means. Big differences of healthcare services have been observed in these three countries in terms of quality,

accessibility, etc. These differences are heavily related to the differences of economic development of different provinces in these countries. The USA has a Health Maintenance Organization (HMO) based healthcare system that needs more fees paid for healthcare services. The USA is the only wealthy, industrialized nation that does not ensure that all citizens have coverage of healthcare.

In the four countries with single payer universal healthcare system, there are also to a certain extent private medical services that are parallel to the public healthcare system. In Canada, single payer mechanism has been protected by law since the 1980s. Within the country, the largest part of the healthcare system is publically funded; however, it does not stop a considerable proportion of healthcare services being provided by private companies or providers. Most Canadian doctors receive visiting fees rather than annual salary. Private insurance is not prohibited, but it competes with better or more incentive public insurance policies. Still, many Canadians have private insurance, and as such, less than 30% of total cost in healthcare in the country is paid by private insurance or by individuals, most of which goes to less subsidized healthcare, such as dental care or vision care. In general, the healthcare system in Canada has provided a good environment for the development of telehealth. However, telehealth systems may become relatively isolated within each state due to the states federation in the country.

As another country of federal states, Australia has a similar healthcare system with Canada. As in Canada, the Australian Government has also tried to take up the private insurance sector in the country. However, it seems not to be successful so far as still approximately one third of total health expenditure in the country is paid by private insurances. Like in Canada, the healthcare system in Australia is also a good environment for the development of telehealth.

The UK has a universal system with single payer mechanism. Unlike Canada, there is no intention to reduce private insurance or other healthcare services by any policy in the country. Professionals working in the public sector are paid salaries,

while those in private sectors are mainly paid by visiting fees. In fact, the private sector has been regarded as necessary to supplement the public healthcare system and commercial health insurances are somewhat promoted and encouraged to reduce the current burden on public healthcare, through ways such as reducing waiting time, shortening queuing at public hospitals, etc. As the UK consists of four countries, some considerable differences exist between the healthcare systems and services in different countries of the UK. Accordingly, telehealth development in UK has higher independency in each country of the UK compared with other countries in this study.

New Zealand has a similar healthcare system with UK; precisely, more like in England. A unique feature in the healthcare system in New Zealand is the ACC system – Accident Compensation Corporation that provides comprehensive, no-fault personal injury cover for all New Zealand residents and visitors to New Zealand – which has sometime been criticized as an extra burden on the healthcare system as well as onto tax payers. With the effect of ACC, private insurance in New Zealand only contributed just over 20% of total health expenditure. For a country with such a low population density, there is a concern that the overall cost of healthcare can be more expensive in New Zealand; plus with the extra burden of ACC, New Zealand has been suffering financial constraints in its healthcare development as well as its telehealth development.

China and India share similar situations in their healthcare. With super large population and low urbanization rates, the healthcare systems can hardly cover all residents in these two countries, even though they both claim that they have or are developing universal healthcare systems. Both India and China are aware that providing healthcare services to cover all the population is the primary job for the government and the public healthcare sector rather than private healthcare service providers. Nevertheless, in these two countries, private healthcare providers are both welcomed, not only in order to supplement the capability of public healthcare system, but also to meet the diversified needs in healthcare markets. India is not as

urgent as China in dealing with the ageing issue and relative healthcare concerns; however, when the ageing issue becomes current in India, it would exceed that of China because it is predicted that the Indian population will be in excess of China by that time. In such a situation, telehealth has a greater focus on service coverage and accessibility in addition to its primary tasks, such as lowering costs, improving efficiency and quality, etc.

Malaysia has GDP rank of 75th in the world, which is right between the average of developed countries and the average of developing countries. Meanwhile, the healthcare system and its capability in Malaysia are in a position right between the four universal healthcare countries and China/India. This reflects the fact that the healthcare level of a nation is relative to its overall level of economic development. Currently, the healthcare system in Malaysia consists of both public and private sectors, and public and private sectors are balanced well especially comparing with developing countries like China or India. Most of the primary healthcare and clinical healthcare are covered by public system; meanwhile, in recent years, the private sector of healthcare in Malaysia is developing rapidly. Furthermore, the government is also keen to combine the public healthcare sector with the private sector in order to increase the overall capability of healthcare services, due to the fact that the country has the greatest population growth amongst the eight studied countries. Demographically, Malaysia has a very uneven population distribution, and the distance between the two major parts of its territory is relatively larger than in most countries. While this physical distance provides an opportunity for developing telehealth, it also can be regarded as a physical barrier for the country's development, including conventional healthcare and telehealth.

In the US, healthcare is mainly left to the market: the private hospitals and insurances. There is no universal healthcare system in the US. Many people who are under the poverty line cannot access healthcare at all. On the other hand, the USA has 14% of GDP spending on healthcare, which is the highest in the eight studied countries. The current USA Government is promoting its reform of the

healthcare system and seeks to build up a “near-universal” healthcare system in the current decade. If the reform proceeds well, the USA government expects to cover nearly 95% of its legal residents with healthcare insurance by the year 2020.

Overall, the USA has the most marketed healthcare system, and it is shifting back to government controlled public healthcare system to some extent. In Australia, the healthcare system is less marketed than the USA but more than other countries. The funds of Medicare in Australia are mainly from taxation and the Government are putting efforts in commercializing these funds in financial market. New Zealand and Malaysia both have similar healthcare systems to the UK due to historical reasons, while the ACC system in New Zealand is unique amongst the eight countries. India and China are both building up their universal healthcare systems. However, due to the low coverage of current healthcare and the massive population burden in India and China, the primary task for the proposed universal healthcare systems in these two countries would be to increase coverage and accessibility.

12.1.3. Telehealth status comparison

The telehealth applications in the eight studied countries have shown variances in several ways.

Firstly, in a practical level, the US, the UK, Canada, Australia and Malaysia are implementing telehealth at relatively higher level than other three countries. As the pioneer in telehealth development, the USA has a major driving force for the development of telehealth that is the needs from military applications and outer space exploration. Fragmentally, there are also various telehealth applications in different states in the US. Canada and Australia share some characteristics in telehealth application due to their demographic similarity such as large remote areas and very uneven population distribution. Malaysia has put considerable efforts into telehealth development. However, telehealth in Malaysia is quite multi-faceted, including covering remote areas, enhancing medical trainings and

continuing education, dealing with fast growing population, and so on. In general, Malaysia is doing well in telehealth development and could be a paradigm or benchmark for other developing countries such as India and China.

It is recognised that China and India are facing much greater difficulties in telehealth development both from historical reasons, current healthcare capabilities, and heavy population burdens. Although development started around the same time as some of the developed countries in this study, development in China and India has been much slower. China started from late 1990's and India started in very early 2000's. After ten years or even longer, the practical levels of telehealth are still very low in these two countries. This is a topic worthy of further investigation.

Compared to China and India, the situation in New Zealand is slightly better. The application of telehealth in New Zealand is at medium level in the eight countries, which is highly determined by the "not-that-much" factors in the country: not that many people (least population size in the eight countries), not that much settlement in remote areas, not that large a proportion of aged population, not that much economic strength, etc. Issues of ageing population, chronic disease monitoring, and shortage of specialists are all definite needs for telehealth in New Zealand that have become the driving forces for the telehealth development. However, these driving forces are not as strong as in some other of the eight countries.

The telehealth status in the UK should be highlighted here not just for its current telehealth programmes with slightly more focus on tele-monitoring as the country experiencing the most serious ageing issues in the eight countries, but also for a new pilot programme called the Whole System Demonstrator (WSD). The WSD was a £31 million trial involving more than 6,000 users of telehealth services comparing findings between those using services and a control group. It was defined, agreed and commenced from 2006, and thereafter has passed its periods of sites and evaluators selection, building of teams, beginning recruitment and data

gathering. Therefore, the WSD is currently in its evaluation progress. The significance of this program is that it has been designed to answer a series of questions related to operational feasibility, financial profitability, and actual results against the conventional healthcare system. This is the only telehealth program of such kind that can be found amongst the eight countries during this research. It is believed to be a milestone in the development of telehealth.

12.1.4. Telehealth analysis comparison

Within this part of this paper, the key findings of telehealth for each country will be analyzed and compared against each other.

The USA government does not have any policy or strategy to promote the use of telemedicine for civil healthcare. However, at the federal level there are some telemedicine programs for other purpose: the NASA telemedicine programs for outer space competition, the DOD programs – Department of Defence Programs – for soldiers in a war (world largest investment in telemedicine research and development), and also the veteran's national network. However, these programs do not have a mission for residential healthcare purposes. All the civil programs are at state level, and initiated by the states or private sectors.

In New Zealand, the government has a clear understanding that telehealth will benefit New Zealand healthcare services. However, both the Ministry of Economic Development and the Ministry of Health only see telehealth as an optional supplement to conventional healthcare rather than a must for sustainable development of healthcare in the country. There is no national level strategy for telehealth development in New Zealand. Accordingly, telehealth projects and/or programs in New Zealand are very fragmented.

In China, there are needs for telehealth to balance its medical capacity amongst unevenly developed regions, and to cover its massive rural population, especially in primary healthcare. These needs are the driving force for telehealth

developments. However, on the one hand, the government (and local governments) made regulations for the telehealth practices; on the other hand, the government (and local governments) are practically involved many telehealth programs developments. This has to some extent caused a situation in which the game setter is also the game player, which has made some of confusion for other players in this field, such as private investors. This also reflects the status of the open market in China that is often criticized by other countries. The government strategy can be seen from these program distributions, although no strategic document was found: the Ministry of Health (national government body) has initiated programs in every key area: the program for the top hospitals, community hospital program, PLA (army) program, educational program, and traditional Chinese medicine program.

The Indian government has clear vision, strategy and implications in telehealth. Many government departments are involved in telehealth developments. A new government agency has been established to deal only with telehealth development and regulatory expansion. The government is also involved in program developments, which systematically use telehealth to connect the hospitals with research and education institutions at every level to improve the healthcare quality.

Amongst the eight studied countries, only Australia and Malaysia have national level strategies for the development of telehealth. Consequently, the applications of telehealth in these two countries are progressing well. As discussed before, Australia has a high level of consensus and commitment to the development of telehealth; Malaysia is at the forefront in the use of telehealth technologies and service programs amongst developing countries. There have been no national level strategies found for the countries of New Zealand, China and India (India had a rather dated strategy). Accordingly, the practical levels of telehealth applications in these three countries are comparatively lower amongst the eight countries.

For UK, Canada and the US, there is no national level strategy for telehealth development either; however, these three countries are in different situations from

New Zealand, China and India. For instance, a number of regional strategies for telehealth development in UK and Canada have been found during this research. Also, regional strategies and some industrial level strategies for telehealth development in the USA have been observed. Even though these strategies are fragmented from a national level of view, these strategies are working well for the telehealth development in those relevant functioning area and/or industries, such as NASA applications in the US, and the tele-monitoring programs in England. As a consequence, the overall performances of telehealth development in these three countries are in leading positions, which are mainly contributed to by regional/industrial level of practice, rather than the telehealth in the whole country.

As presented in previous chapters, the analyses for each of the studied countries are concluded with the summaries of critical success factors (CSFs). Reviewing these CSFs with a comparative view, it is not difficult to find that the eight countries share some CSFs in common, while some particular countries can have specific CSFs. The summary of CSFs review and comparison for the eight countries are as follows:

- From a common perspective, most of the studied countries need standardization and business modelling for telehealth development.
- India and Malaysia are more in need for upgrading their telecommunication networks, while China must improve the utilization level of established networks.
- Another common CSF shared by eight countries is the need for more and better trained professionals for telehealth development.
- Advanced countries in telehealth are more concerned with legislation, regulation, and other relevant jurisdiction frameworks. This is proportional to the total volume of telehealth applications and practices.
- Cooperation and coordination of all stakeholders, from government, medical service providers (both public and private) to telecommunication providers, is also a common need for most of the countries either to put telehealth on track or to lift telehealth up to a higher level.

- National level organizations (such as associations) to oversee telehealth are needed. Some countries have already set up such organizations, amongst which it is observed that the more close these organizations related to government, the more efficient they perform in enhancing the development of telehealth, such as in Australia, Malaysia and UK.
- Efforts and capabilities to deal with any possible cultural barriers internally and/or internationally need development. For instance, China is facing greater difficulty in dealing with the diversity caused by multi cultures internally as well as the uniqueness from other countries.
- India has its unique CSF of making more user friendly interfaces in telehealth applications, which is due to its comparatively lower computer literacy amongst medical staff, especially in remote areas.

In general, the development of telehealth needs sufficient financial investment. For the eight studied countries, they are either developed countries or developing countries with strong economic growth. The overall economic strength of the eight countries covers a wide spectrum and can be regarded as representatives of most countries of the world. However, as the current global economic downturn is impacting these countries' economies as well as their healthcare sectors, it is believed that telehealth is and will be subject to some extent of financial constraints in these countries.

12.2. Discussion

As compared above, all eight countries that have been studied in this study have different situations in their demographical, political, economic, environmental and other characteristics. Therefore, these countries are in various states in the development of telehealth. From studies in previous chapters and the comparative analyses shown as above, there are some further discussions from several perspectives as follows.

12.2.1. Developed vs. developing countries

Five of the studied countries are developed countries while the remaining three are developing countries. In general, developed countries have better telehealth development than developing countries. This is in proportional to the countries' development level and their healthcare level. However, this should not become the reason for developing countries to feel pessimistic in telehealth development. Indeed, amongst the eight studied countries in this research, the three developing countries seem all to have faster economic growth compared with the five developed countries. This can be regarded as strength that enhances the opportunities for these countries in telehealth development. This is because faster economic growth has made it possible to put more financial investment into the development of healthcare and telehealth. Also, as the conventional healthcare systems in developing countries are less developed, when these countries have financial capabilities, they have better opportunities to justify the balance of conventional healthcare and telehealth. Therefore, developing countries seem to have even greater opportunities for developing telehealth, because telehealth is possibly a suitable solution for developing countries in improving their overall healthcare. In some cases, telehealth is not only supplementary to healthcare or extension of healthcare, but can be even a short cut for developing countries in shortening the gap of healthcare compared with developed countries.

Moreover, comparing developing countries with developed countries, it is not hard to recognize that developing countries and developed countries have different focuses in telehealth development. For instance, developing countries (e.g. China) are trying to cover more population through telehealth while developed countries (e.g. UK) are trying to provide more and better healthcare services. Appreciating this existing difference, developing countries should keep their telehealth development on track with the leading developed countries. For instance, in developing countries like India, telehealth consists of a certain proportion of vehicle mounted medical facilities rather than telecommunication based networks.

This may be practical solution for their current medical needs, however, it should not be considered as the main direction of telehealth development.

From a “developing point of view”, Malaysia is doing quite well in telehealth development, which can be a good example and benchmark for other developing countries to learn from. This means two things: one is to learn what and how Malaysia is developing its telehealth, another is to learn what and how Malaysia has learned from developed countries and transferred these learnt experiences into localized practices.

12.2.2. Large vs. small

In terms of population, there are three large countries in this research: China, India, and the USA; one medium country: UK; three small countries: Canada, Malaysia, and Australia; and one very small country: New Zealand. Regardless of population size, all these eight countries are in need of telehealth. The level of these needs are mainly determined by the age structure (e.g. ageing issue) and geographical distribution (e.g. urbanization level) of the populations, also determined by the current healthcare status in these countries (e.g. healthcare service costs, quality and accessibility); but slightly determined by the absolute size of total population. It is admitted that larger populations would bring greater difficulties in telehealth development due to the size and complexity of the system. However, larger population also has positive effects onto telehealth development. Firstly, larger population means a larger telehealth system, which is possibly easier to reach the scale of economy; secondly, a larger population often means a relatively large sum of financial inputs into telehealth, which provide decision makers more leeway to justify and focus on the priorities.

In terms of territory area, there are five large countries in this research: Canada, China, the USA, Australia, and India; other three countries, Malaysia, New Zealand, and UK, are small countries. Amongst the large countries, the US, Canada and Australia are doing well in telehealth development while China and

India are at lower level; nevertheless, amongst small countries, UK and Malaysia are progressing better than New Zealand in telehealth development. Therefore, size of area does not determine the development level of telehealth, but, it maybe provides a more broad stage for telehealth to apply and perform. In general, larger land area always means more remote regions to reach and lower accessibilities to healthcare system, however, there is another point for telehealth to be noticed that telehealth does not only mean the networks connected remote areas. Due to the technical development in telecommunication (such as 3G, Wi-Fi), telehealth also has very large room of development in small area with high populous density.

12.2.3. Other impacting factors

Certain industries in some of the studied countries are also the driving forces that have considerable impacts on the development of telehealth. For instance, military applications in the USA and in China have been major drivers for telehealth development; as well as aerospace applications in these countries. Meanwhile, climate in Canada is a unique factor that is particularly well suited to the adoption of telehealth activities in the country. Amongst the eight studied countries, Canada is the only one with certain proportion of its population living in Arctic Circle. Many aboriginal communities – including the First Nations (American Indians), Inuit and Métis – in Canada reside in far north and have a lack access to quality healthcare as a result of remoteness and isolation, especially during long and cold winters. This has been great challenge to the healthcare system in Canada and also the major driver for the country's telehealth development.

Despite the climate factor, Canada may share some uneven populous distribution with other countries such as Australia, and China. In these countries, on one hand urbanization levels are very high or getting higher rapidly; on the other hand there is still a certain proportion of population residing in remote areas with traditionally less developed healthcare systems, like the aboriginals in the outback of Australia, and the minor ethnic groups in southwest of China. Consequently, telehealth in these countries has more diversified tasks that not only lift up quality and

efficiency of healthcare for urbanized people, but also spread healthcare capacity to cover remote populations.

12.2.4. Western vs. eastern

Amongst the eight studied countries, India and Malaysia are eastern and China is Far East, while the rest countries are all western. There is no apparent difference between the studied countries that can be clearly classified by the western versus eastern criterion. During this research, it has been observed that publications on telehealth for China are much fewer than for other countries, which is not proportional to the country's size at all. There could be a language barrier caused by fewer Chinese studies published in English or caused by fewer researchers of western languages approaching the topic of China. In contrast, there are numerous published studies and researches for telehealth in India, although, most of these papers are relatively theoretical, which has probably contributed to the country's lower level of telehealth practice.

Also, China is the only socialist country in this research, which may cause an extra difficulty to study and understand issues in China from view of social structure. As a widely criticized, socialist country, it has more centralized control with less free marketing mechanisms. This can be another barrier for the telehealth development in China in terms of less free competition for local companies as well as possible higher barriers for international entrants.

In the foreseeable future, westernisation will be still the mainstream of development, while telehealth will not be exception. This can be easily understood that all basic elements of telehealth, such as telecommunication technology, medical technology, and business mechanism, are mostly from western countries. Nevertheless, when the westernization goes to countries with other cultures, such as eastern countries, some extent of localization will be essential for better local adaption and better user acceptance.

12.2.5. Impact of national strategy

None of the three highly populated big countries in this research, China, India, and the US, have a national level strategy for telehealth; possibly large countries have more difficulties in unifying their development of telehealth. Indeed, in the eight studied countries, regardless of size, developed or developing, there are only two countries that have national level strategies for the development of telehealth: Australia and Malaysia. While these existing national level strategies enabled Australia and Malaysia may have a higher level of telehealth practice, it brings the question why the other leading countries in telehealth do not have any national level strategy.

The USA does not have national strategy for telehealth; however, this has not stopped the country becoming the leader of telehealth development, as regional strategies and industrial strategies are well defined and working well in the country, and of course, there are major technical advances in the USA as well. As another example, UK does not have national level strategy in terms of the entire Kingdom. There is no clear national strategy for each country either. However, the UK's telehealth system is also in an advanced position amongst the eight countries. This is also because regional strategies are well established and working well. The UK's leading position is also remarkable for its pilot telehealth program of WSD, which is probably the only program focused on the feasibility studies, in terms of financial, operational, and functional effects.

This study has found that countries with national strategies tend to have good development in telehealth, but this does not necessarily mean that telehealth developments is bad in those countries without a national strategy. It has been noticed that in the eight studied countries, when populously small countries (e.g. Australia, Malaysia) have a national strategy, telehealth tends to be developing well. Also, in large population countries (e.g. the US, the UK) with absence of national level strategies, region/area level strategies are often observed and often have positive effects in the telehealth development in those regions/areas.

Therefore, it can be summarized that an overall strategy to cover certain size of country or region would be beneficial for the development of telehealth. In New Zealand for instance, the total population size of New Zealand is just like a region or area of those big countries (not even as a big region/area). As such a small country, the total financial capacity is quite limited. In this situation, when there is no national level strategy, pilot programs of telehealth would be highly fragmented into 'tiny' pieces. These 'tiny' pieces tend to be towards various directions due to different interests, thus are far too small to reach any possible scale of economy. Also, when the limited financial input has been fragmented, it loses the capability to focus on priority to make any remarkable progress. This is probably why New Zealand has less development in telehealth.

13. Conclusion

Based on above discussions and previous studies, some points can be highlighted as conclusions for this report as follows:

First, the eight studied countries have different healthcare backgrounds, in terms of demographic features, economic and social development, healthcare system, even ethnic culture background. This research revealed that all the eight countries have a high demand on telehealth, although the situations are different. The high demand for telehealth is also caused by series of reasons, such as aging society, high costs of current healthcare system, big population against low healthcare service coverage, unevenly population distribution, higher population increase rate, low satisfaction on current healthcare services. Each country shared some of these reasons depending on the country's specific situation.

Second, telehealth is directly relevant to the overall healthcare in a country, and it has shown strong tendency to become mainstream in the further development for any modern healthcare system. The eight studied countries all have a certain level of awareness on this trend. This awareness may come from different stakeholders of telehealth: governments, policy makers, investors, medical service providers, researchers, network providers and operationers, and so on. For countries in which more stakeholders have consensus on telehealth, the practical levels of telehealth in these countries seem to be higher. This is because of the high efficiency caused by clarified targets, better alignment, smoother operation and coordination, and so on.

Third, strategies are crucial for the development of telehealth. However, successes of established strategies in telehealth are not necessary only at national level. Actually, there is no successful of strategy for any big country in this research; instead, strategies in small countries (e.g. Malaysia) and/or in certain regions of some big countries (e.g. the UK) seem to have the possibility of being more successful in promoting the development of telehealth in that area. This

phenomenon may be decoded in this way: In general, telehealth in still in its initial stages in most countries around the world. Due to the complicity of multi inputs and involvement from various stakeholders, it is not yet a right time to form a national level strategy, especially for those big countries. Nevertheless, strategies for small countries and certain regions of big countries are definitely beneficial to the development of telehealth as it not only provides guidance for telehealth development in the current stage, but it may also be fundamental to the upcoming national level strategies. Moreover, for countries not having a national strategy for telehealth, it is still possible to launch some policies favourable to telehealth while forming strategies at the national level.

Fourth, development of telehealth would raise a series of issues and concerns. As every country has its specific situation, these issues and/or concerns may greatly vary in these countries. However, there are still some issues and concerns that most countries would probably share in common. These common issues/concerns may include but not limited to:

1) Standardization: this mainly refer to technical specifications of equipment as well as treatment procedures
2) Legislation and regulation: this may means two things: alignment with current laws and regulations in healthcare sector in the country, and unification for further international cooperation
3) Business modelling and program evaluation: this may include operational feasibility, financial profitability and evaluation
4) Financial constraints: one of the major issues that every country has to confront when develop telehealth in current global economic recession
5) Need of more trained professionals into telehealth: with a focus on multi-discipline talents with knowledge and experience in both medication and telecommunication

These above five points can be regarded as the general CSFs in development of telehealth. Telehealth is relatively new and has many uncertain factors such as

weaknesses of ICT infrastructure and malpractice, complicity of legal issues and so on; nevertheless, even though opportunities will be accompanied by challenges, the overall prospect of telehealth is optimistic, at least within the scope of the eight studied countries.

14. Recommendation

Based on all above, the recommendations will be made from three perspectives: for the eight studied countries, for telehealth development in general, and for further studies in same/similar topic.

For the eight studied countries:

1) New Zealand: First, set up a government body to manage telehealth at national level whose primary task is to craft a national strategy for telehealth development; second, when setting up a national strategy, some other countries' experiences can be good to learn from, Also, some regional experience of other countries could be even more suitable due to the demographic similarity between New Zealand and these regions.
2) The USA: There is no central government body to manage healthcare for the country, where the presence of one organization that can work as a promotional and regulatory government body to look after telehealth practice at the country level is necessary. If this kind of organization is legally established, the organization will coordinate telehealth activities at the country level, in terms of policy crafting, strategy making, regulation making. This organization can also initiate programs which have strategic importance for the country. In the USA, there are more than 200 telemedicine programs. The newly established federal government body can not only coordinate and make the whole country share some of the programs, and so to improve program efficiency, but also keep the USA in a leading position in telehealth development.
3) Australia and Canada: These two countries are doing well in telehealth. Setting up national level strategies would help to promote telehealth up to a higher level; nevertheless, while lifting up telehealth programmes up to national level in coming years, there should be an emphasized task for both countries to improve coverage in rural/remote areas and in minor ethnic groups.

4) Malaysia: Unlike Australia and Canada's lifting up to national level, Malaysia should be more focused deepening its telehealth applications to improve its practical level, such as upgrading its networks, getting more trained professionals, etc. In doing this, the country would keep its leading position in telehealth in the developing world.
5) India and China: There is no doubt that these two countries have the same primary task to improve their whole healthcare systems, and telehealth is just a subcategory mission. Their massive populations challenges, therefore, instead of highly profiling telehealth, these two countries need to undertake pilot programs with high practical level regardless whether the program is national or regional. There are many valuable lessons from other countries to be learned from, such as regional success in Canada, military and industrial driving force in the US, business modelling in UK, etc.
6) The UK: Being one of the leading countries of telehealth, the UK has its own task priority to investigate further in "how to sustain telehealth" rather than "how to do it". This is not only to keep the country's leading position, but also the country's own needs as UK is confronting serious ageing issue that is getting worse.

For the development of telehealth: In general, firstly, further and continuous improvement in design and research from a technical perspective is important, as these improvements will effectively reduce the uncertainty factors of telehealth, and give the governments and other related organizations more confidence to initiate strategies and policies. Secondly, as stated above, this research revealed that the healthcare system exerted heavy impacts on healthcare policy making and program initiation. Thirdly, in international perspective, the World Health Organization (WHO) needs to establish regulations and strategies to develop telehealth programs in international level, for example, international telehealth technology standards.

For further studies: This study has revealed a broad view to oversee the development of telehealth. From a general view, every common CSF is worth investigating further for the overall development of telehealth. Also, international comparisons would be highly recommended for further studies. Even if the study is about a single certain country or region, a broader international view would be still valuable in making sense. There is one more recommendation, which is that there should be some attention given to a country or state with tiny territory land area but with relatively high population density, such as in Singapore or Hong Kong. This has been absent within this study due to the limitation of the scale of studies. However, this point has become increasingly attractive to the researcher as it is believed that this kind of study would broaden the spectrum of research thus making more sense in a general perspective.

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