A STUDY OF INFORMATION TECHNOLOGY (IT) ADOPTION AMONG DOCTORS IN SINGAPORE

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ABSTRACT

Objective

This is a study of Information Technology (IT) adoption among doctors in Singapore.

Method

A quantitative survey was conducted among 6138 Singapore doctors. It gave an overview of the level of IT adoption. A focus group session was conducted which yielded deeper insights into why doctors adopt IT or otherwise. A qualitative survey reported which Medical-IT applications were supported.

Results

IT adoption among Singapore doctors is high. Top uses are email, Internet and recording of patients' medical information. Focus group results indicated there are significant push and pull factors to IT adoption. The qualitative survey explored Medical-IT specific applications deeply. Doctors support Online CME, clinical research aided by information systems and Electronic Medical Records. They do not support Telemedicine and Telesurgery. Doctors' future IT needs were highlighted.

Given these results, recommendations are made to assist doctors in embracing IT and fulfill doctors' future IT needs.

Keywords:

Technology, Adoption, Doctors, Healthcare, Singapore, Medical-IT

146 Words

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

OBJECTIVE

"**IT adoption among doctors in Singapore**" has yet to be studied. This study addresses this need. First, it gives a macro view of IT adoption among Singapore doctors through a quantitative survey. Next, it delves deeper though a focus group interview session and a qualitative survey. Topics discussed are Medical-IT specific applications, push and pull factors to IT adoption and future IT needs of Singapore doctors.

RESULTS

Ninety five percent of doctors does computing each week. IT use at home is high: 86.9% for email, 81.7% for Internet and 65.9% for word processing. 79.2% of work computers are connected to the Internet. Doctors use the computer for email (70.3%), research on the Internet (56.3%) and recording of patient's medical information (47.4%).

The focus group provides insights into the push and pull factors that affect doctors' decisions to adopt IT or otherwise. Further insights provided are the need to enable GPs to adopt IT, sensible use of IT to enhance work productivity and open-mindedness regarding the use of IT platforms. Above all, the chief purpose of IT adoption is to improve patient care and not distract the doctor from his core responsibility.

The qualitative survey explores Medical-IT specific applications deeply. Young and middle-aged doctors support Online CME, clinical research aided by information systems and Electronic Medical Records. They do not support Telemedicine and Telesurgery. Older doctors cite barriers to IT adoption, such as "IT benefits do not outweigh time, cost and effort", "insufficient IT training", "negative IT experiences", "poorly designed IT systems", "insufficient information in selecting good IT systems" and "interference with the doctor-patient relationship".

RECOMMENDATIONS

Based on the findings from this study, here are some recommendations for Ministry of Health, medical organisations and healthcare clusters, in order to encourage Singapore doctors to embrace IT more:

1) Implement Online CME, clinical research aided by information systems and Electronic Medical Records. Do not implement Telemedicine and Telesurgery.
2) Create a common IT platform.
3) Institute formal IT training in medical school. Encourage doctors to go for IT training after graduation and practise often.
4) Provide hardware and software at affordable rates.
5) Recommend efficient and reliable IT support vendors to fix doctors' IT problems.
6) Provide IT demonstrations on hardware and software.
7) Have an IT support group where more IT savvy doctors can help less savvy doctors.

8) Encourage more sharing of good medical content on the Internet or content that can be downloaded into the PDA.
9) Involve doctors in IT design and implementation. Have friendly IT user-interfaces.
10) Encourage doctors to obtain broadband connectivity.
11) The government to act as a catalyst for IT adoption.
12) Top management of healthcare clusters and medical organisations to show strong support for IT initiatives.
13) Address issues of IT standards, security and confidentiality.
14) Design smart systems and applications where the doctor-patient relationship will not be compromised.

480 words

CHAPTER ONE
INTRODUCTION

1 INTRODUCTION

Studies have been conducted on the use of IT in healthcare. Applications such as online Continuing Medical Education (CME), Telemedicine, Telesurgery, information systems assisting clinical outcomes, Electronic Medical Records (EMR) and E-Genomics have been conducted. Studies to explain the barriers and pull factors to IT adoption in healthcare have also been done.

IT adoption among doctors in Singapore has yet to be studied. As such, this study addresses this subject. This study first gives a macro view of IT adoption among Singapore doctors through a quantitative survey, and then delves deeper into the issue though a focus group interview session and a qualitative survey. Topics discussed are Medical-IT specific applications, the push and pull factors to IT adoption, and the future IT needs of Singapore doctors.

As many acronyms are used throughout this study, a list of these can be found in Appendix E for easy reference.

This chapter is divided into the following sections:

1.1 INFORMATION TECHNOLOGY (IT) IN SINGAPORE TODAY

Information Technology (IT) is a term that encompasses all forms of technology used to create, store, exchange, and use information in its various forms. [1]

The Singapore Government has been strong in supporting IT nationwide. One of its initiatives is the Infocomm 21, of which the Infocomm Authority of Singapore (IDA) Technology Roadmap is one of the supporting pillars. The Roadmap charts the vision, trends and developments of the technology landscape in Singapore for the next five years. It aims to align Singapore's technological direction with worldwide infocomm developments and come up with a collective vision of future technologies. [2]

In a media release on 26 November 2002 [3], IDA, together with the Infocomm industry, identified key technological trends and developments that would impact the way Singaporeans communicate over the next five years, leading to 2007.

The key technology trends and developments highlighted in IDA's fourth Infocomm Technology Roadmap include:

- Present ADSL (Asymmetrical Digital Subscriber Line) broadband and cable to replace dial-up as the predominant means of Internet access.
- The connected home for a connected lifestyle - the convergence of 'infotainment' technologies that bring together information, communications and entertainment.
- Mobile wireless on 3G networks to offer ubiquitous services. Computing capabilities of mobile handheld devices are also expected to improve significantly.

[1] *Glossary of Telecommunication Terms*, 1996, edited by the Institute for Telecommunication Sciences (ITS) in Boulder, Colorado
[2] IDA, Singapore http://www.ida.gov.sg/Website/IDAhome.nsf/Home?OpenForm
[3] IDA, http://www.ida.gov.sg under 'Technology Development'.

- Security technologies will become increasingly important to facilitate e-commerce developments and manage the risks (e.g. online fraud) from increased inter-enterprise dealings/ transactions.

In today's dynamic business environment, early adoption of emerging Infocomm technologies is crucial to give Singapore an added competitive edge in business and economic opportunities, and this includes the healthcare industry.

1.2 HEALTHCARE IN SINGAPORE TODAY

Singapore has a dual system of healthcare delivery. The public system is managed by the Government, while the private system is managed by private hospitals and general practitioners. The healthcare delivery system in Singapore comprises primary health care provision at private medical practitioners' clinics and outpatient polyclinics, and secondary and tertiary specialist care in the private and public hospitals.

Eighty percent of the primary healthcare services are provided by the private practitioners while the government polyclinics provide the remaining 20%. For the more costly hospital care, it is the reverse situation with 80% of the hospital care being provided by the public sector and the remaining 20% by the private sector.

Based on Singapore Medical Council (SMC) records, as of 5 February 2003, there were 6035 doctors in employment[4]. 227 doctors were either not in practice or were working in other fields. The detailed demographics of practising doctors are tabled below. In Chapter Four presents the quantitative survey questionnaire results.

[4] Singapore Medical Council's (SMC) records differ slightly from Singapore Medical Association's (SMA). SMC's records take into account practising doctors only. SMA's records take into account retired doctors as well. SMC's records show there are 6035 practising doctors as of 5 February 2003. SMA's records show there are 6138 records as of early October 2002.

DOCTORS' DEMOGRAPHICS					
	Private			**Public**	
Type of Practice	2887 (47.8%)			3148 (52.2%)	
	Male			**Female**	
Gender	4174 (69.1%)			1861 (30.1%)	
	20 – 29	**30 – 39**	**40 – 49**	**50 – 59**	**> 60**
Age	13.7%	37.3%	23.2%	14.0%	11.8%

Table 1.2: Demographics of employed doctors in Singapore. Source: Singapore Medical Council's demographic records as of 5 February 2003.

In 1999, the public healthcare delivery system was re-organised into two vertically integrated delivery networks: National Healthcare Group (NHG) and Singapore Health Services (SHS). This enables more integrated and better quality healthcare services through greater co-operation and collaboration among public sector healthcare providers. Patients are free to choose the providers within the dual healthcare delivery system, at any private clinic or government polyclinic.[5]

The overall health status of Singaporeans is good and the standard of medical care high. In the World Health Organisation (WHO) World Health Report 2000, Singapore's healthcare system was ranked sixth among 191 countries, an indication that the healthcare delivery system for Singaporeans is comparatively more cost-effective. Spending on healthcare in 1997 as a percentage of the Gross Domestic Product (GDP) has reached 13.7% in the United States (US) and 5.8% in the United Kingdom (UK)[6]. In Singapore, the healthcare spending is comparatively lower at 3.1%.

[5] MOH: Singapore's healthcare system http://app.moh.gov.sg/our/our01.asp
[6] World Health Report 2000: Selected national health accounts indicators for all member states, estimates for 1997.

However, “rising healthcare costs” is currently the main concern of healthcare providers in Singapore, and also a universal concern among other developed countries.

With the advent of IT, the fields of life sciences, drug development, bio-medical engineering and related disciplines have advanced and continue to advance at a spectacular pace. While revolutionising the treatment of diseases, these new medical knowledge and technologies will also drive healthcare costs up significantly. Disease management strategies have been introduced to o help keep healthcare costs low.

Disease management covers disease prevention and control through health promotion and screening, the use of evidence-based clinical practice guidelines, and a patient-centred and self-management approach, within a seamless continuum of care from preventive to rehabilitative care. "Effective disease management is therefore, an important tool in our goal to keep our population healthy and healthcare cost under control." [7]

Medical advances have also resulted in prolongation of life and better control and cure of many diseases. Over the years, the life expectancy of Singaporeans has progressively increased. In Year 2000, life expectancy at birth was 80 years for women and 76 years for men. However, longevity, coupled with low fertility rates is giving rise to a rapidly aging population. The Ministry of Health (MOH) has increased its healthcare spending in this area by providing more healthcare services for the elderly, and increased the subsidies for the elderly’s medical treatment and continual care.

[7] Speech by Mr Lim Hng Kiang, Minister for Health and Second Minister for Finance, at the opening of The First National Disease Management Conference on 25 May 2001. http://www.nhg.com.sg/speeches/s2505.htm

The phenomenal rate at which new medical knowledge is being made available, not just to the doctor, but also to the more informed and savvy patient, has resulted in changes to the way doctors practise and the doctor-patient relationship. Hence, to ensure that doctors are up to date in their professional knowledge and stay abreast of the latest developments in medical science and technology, compulsory Continuing Medical Education (CME) has been introduced to all doctors since 1 January 2003. [8]

1.3 HEALTHCARE MEETS TECHNOLOGY

Modern medicine of today leverages IT. Life expectancy has gone up, and in turn, the quality of life as well. Patients expect timely and efficient delivery of healthcare, minimal pain and discomfort, and especially faster recovery rates. Much of these have been made possible with the increasing rate at which new medical treatments and technologies are being made available.

1.3.1 Medical Informatics

The emergent field of Medical Informatics encompasses a wide array of Medical-IT topics such as distance Continuing Medical Education (CME), Telemedicine, Telesurgery, information systems to aid medical decision-making and research, Electronic Medical Records (EMR), Hospital Information Systems (HIS), Clinical Management Systems (CMS), patient monitoring systems, and imaging systems. The researcher explores some of the above Medical-IT uses in today's context:

1.3.1.1 Online CME (CME)

Doctors rely heavily on medical knowledge and patient information for decision making on treatment and care. Current medical knowledge and skills can be learnt through online medical journals, databases and electronic communications (e.g.

[8] MOH Ministerial Speech 19 Jul 2002, http://app.moh.gov.sg/new/new02.asp?id=2&mid=3701

videoconferencing and email) with doctors worldwide.

1.3.1.2 Telemedicine and Telesurgery

Telemedicine is "the use of medical information exchanged from one site to another using electronic communications for the health and education of patients or providers and to improve patient care."[9]

Telesurgery consists of performing the entire procedure remotely. The challenge lies in the latency, or time delay, between transmission of surgical actions and images, creating incompatibility with the coordination of the surgeon's acts.[10] Robotic Telesurgery is defined as "microsurgery in which the surgeon performs surgery by manipulating the hands of a robot".[11]

Both Telemedicine and Telesurgery have not been widely adopted by doctors in Singapore because of the reasons highlighted in Chapter 6.

1.3.1.3 Information Systems to Assist Healthcare Delivery

A recent trend is the use of wireless devices in patient care, such as Personal Digital Assistants (PDAs) and Tablet PCs. The National University of Hospital (NUH) has wireless access in every ward. Since early 2002, all NUH doctors may use handheld devices to help them retrieve patient records during ward rounds. The hospital's emergency medicine department has a useful application that allows doctors to order blood and other laboratory tests wirelessly. These wireless initiatives speed up the retrieval of information and improve patient care.

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[9] Centers for Medicare & Medicaid Services, http://cms.hhs.gov/glossary/default.asp
[10] Operation Lindbergh: A World First in Telesurgery (2001), http://www.websurg.com/lindbergh/pdf/lindbergh.pdf
[11] Hyperdictionary, http://www.hyperdictionary.com/

Hospitals have systems to support patient management, patient accounting, financial management, and material management. They have introduced online ordering of laboratory tests and medication, and online transmission of test results. An internet-based system termed *Central Appointment and Referral System* (CARES)[12] allows GP clinics and polyclinics to book appointments electronically with Specialist Outpatient Clinics. An ambulance link termed *Hospital & Emergency Ambulance Link* (HEAL)[13] transmits patient information from the ambulance to the receiving hospital before the patient arrives. Ms Yong Ying-I thinks that, "there is tremendous potential for healthcare providers to use Information and Communication Technology (ICT) innovations to create, use and share medical and healthcare information for treatment and care delivery." [14]

1.3.1.4 Electronic Medical Records (EMR)

Singapore's two public health care clusters, SingHealth and NHG, have finished the major phases of consolidating their IT systems. The purpose is to provide seamless treatment for patients, through greater sharing of electronic medical records. Previously, "patient data was spread over disparate systems, with the patient having to fill in separate forms, providing personal history and details, every time he visited a new institution under the cluster" (Chief Technology Officer of NHG, Dr Colin Quek).[15]

Both SingHealth and NHG have fourteen institutions each, made up of restructured hospitals (RH), specialists' centres and polyclinics. Now, patient data can be retrieved online from any institution within the cluster. Data includes laboratory test results, radiology reports and patient discharge summaries. "There are about 400 gigabytes

[12] Central Appointment and Referral System (CARES): https://www.cares.com.sg
[13] Hospital & Emergency Ambulance Link (HEAL): http://pdm.medicine.wisc.edu/Han.htm
[14] Speech by Ms Yong Ying-I, Deputy Secretary, Ministry of Communications & Information Technology, at the launch of Changi General Hospital Technology Month Open House, on 9 September 1999. http://www.ida.gov.sg
[15] Computer Times (Singapore), 8 January 2003, p22.

of medical records data in the common repository which can be accessed from about 1600 workstations," (Chief Technology Officer of SingHealth, Mr Fong Choon Khin).[16] With EMR, patients no longer have to fill up the same forms all over again when they visit institutions within each cluster. Doctors will have faster access to patient information; the timeliness of information will add to the capability of doctors to serve patients.

1.3.2 Bioinformatics

Bioinformatics combines the storage and retrieval of complex biological data, with analysis and annotation of biological information. It uses IT tools that automate many of the processes. Bioinformatics is pertinent in medical. For example, a team at the National Neuroscience Institute (NNI) studies whether variations in genetic structure can make a person particularly susceptible or "pre-disposed" to epilepsy or Parkinson's disease. Without the aid of IT, it might have taken them years to store, study, compute and analyze data pertaining to tens of thousands of genes.

The Singapore government is committed to Bioinformatics development in Singapore. The following are some updates.

1.3.2.1 Biomedical Research Bill

The Biomedical Research Bill may be introduced in Singapore Parliament in December 2003, allowing adult and embryonic stem cell research to take place under the purview of strict regulations.[17]

[16] Computer Times (Singapore), 8 January 2003, p22.
[17] Today (a Singapore newspaper), 11 November 2003, p4.

1.3.2.2 State of the Art Bio-Research Facility at NUS

A cutting-edge $15 million Structural Biology Research corridor will be set up at the NUS biological sciences department. It allows researchers to study about proteins, in order to find new drugs to combat diseases. A budget has been set aside for research programmes looking into areas such as cell regeneration and cell death and food safety and production.[18]

1.3.2.3 Genetic Link Found in Three Auto-Immune Diseases

Scientists found a genetic link among three common auto-immune diseases: psoriasis, rheumatoid arthritis and systemic lupus erythematosus. The link involves a protein that helps the thymus gland train cells of the immune system. Auto-immune diseases are caused when such cells mistakenly attack the body's own tissues. By identifying the cellular path through which these three diseases are touched off, the findings may help biologists design new treatments.[19]

1.3.2.4 Coin-sized Chip to Detect Early Signs of Breast Cancer

The Institute of Bioengineering and Nanotechnology (IBN) has developed a one-cent-coin-sized chip that can detect breast cancer even before lumps are noticed. Researchers hope to pack the chip into a biosensor about the size of a mobile phone, which can screen genetic material from a living thing for information on a range of medical conditions or diseases.[20]

[18] Straits Times (Singapore), 12 Nov 2003, p11.
[19] Straits Times (Singapore), 11 Nov 2003, pH10.
[20] Straits Times (Singapore), 13 November 2003, pH12.

1.3.3 Future of IT in Medicine

The challenge now is to address emerging trends in healthcare, and to ensure that our doctors and healthcare institutions are ready to leverage IT to meet the changing needs of patients.

It is envisioned that a Medical-IT Hub can fulfill these needs by developing seamless web linkages among doctors, medical organisations such as Singapore Medical Association (SMA), College of Family Physicians Singapore (CFPS), Academy of Medicine (AM), clusters such as Singapore Health Services (SHS) and National Healthcare Group (NHG), and policymakers such as Ministry of Health (MOH), Singapore Medical Council (SMC) and Infocomm Authority of Singapore (IDA).

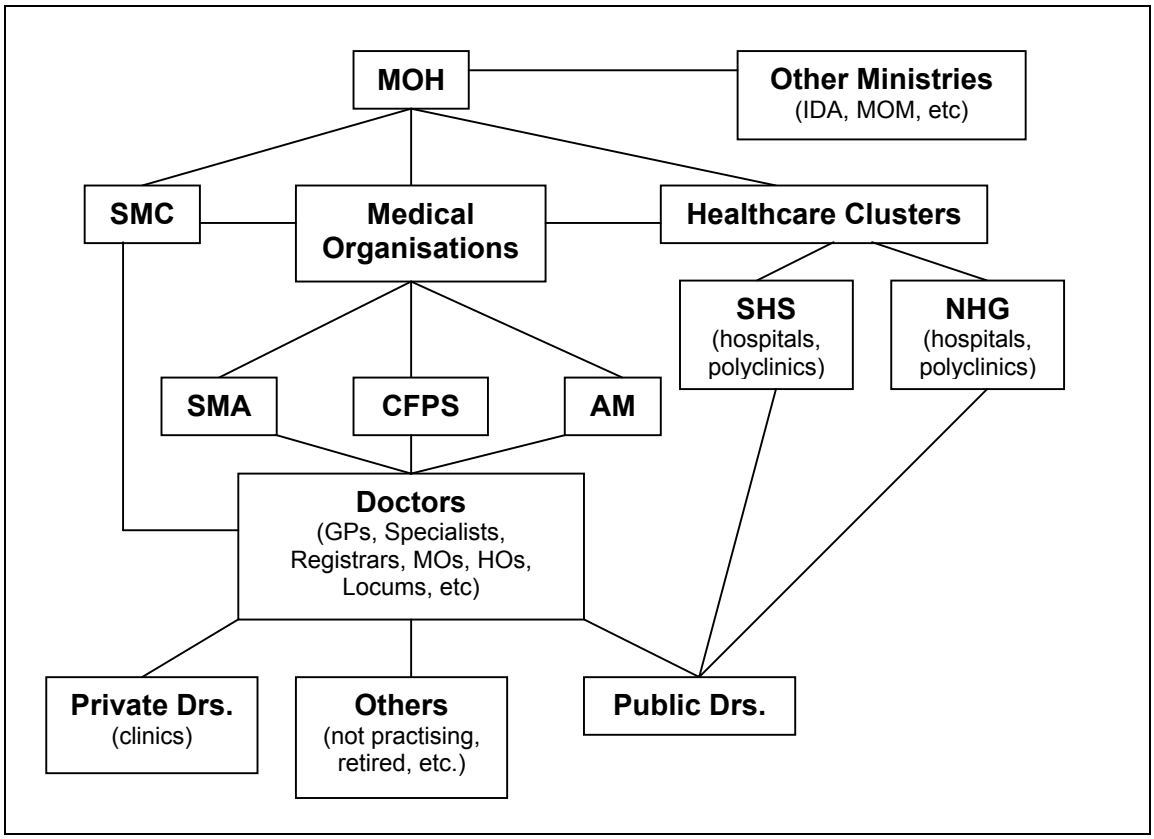

Figure 1.3: Schematic diagram showing the relationships among MOH, other ministries, SMC, medical organisations (SMA, CFPS, AM), healthcare clusters (SHS, NHG), hospitals, polyclinics, clinics and doctors.

It is only with the consolidated effort and resources of these various stakeholders in healthcare that Singapore can make the most out of the “information revolution”.

1.4 JUSTIFICATION OF STUDY

The successful use of technology in healthcare among doctors depends on several factors. They include user mindset, past experiences, necessity, availability of reliable hardware and software at affordable prices, good vendor support, availability of good medical content, IT training, and encouragement from family, friends and colleagues.

Doctors have special IT needs. They include Continuing Medical Education (CME), doctors' directory for referrals, locum listings, patient information, drug databases, and medical updates. To ensure quality healthcare delivery, doctors need information at their fingertips, which is to be deployed in a fast and efficient manner. Technology can fulfill these needs. The onus is on relevant ministries, medical organisations and hospitals to address doctors' ever changing IT needs and plan for their future needs.

Given the increasing prevalence and importance of IT in today’s world, the findings from this study on will also have much relevance to the fundamentals of healthcare planning in Singapore. Policymakers (MOH, IDA), healthcare clusters (SingHealth, NHG), and medical organisations (SMA, CFPS, AM) will find this data useful.

1.5 OBJECTIVES OF ENTIRE STUDY

The following are the objectives of this study:

1) To examine the level of IT adoption among doctors in Singapore.
2) To discover doctors' views on specific Medical-IT applications, such as Online Continuing Medical Education, Telemedicine, Telesurgery, clinical research aided by information systems, and Electronic Medical Records.

3) To explore the push (barriers) and pull (encouraging) factors to IT adoption.

4) To define IT needs among doctors, in areas of training, hardware and software.

5) To identify future potential and insights of IT in Medicine.

6) To make recommendations in the light of the findings of this study.

1.5.1 Hypotheses

The following are some hypotheses examined in this study.

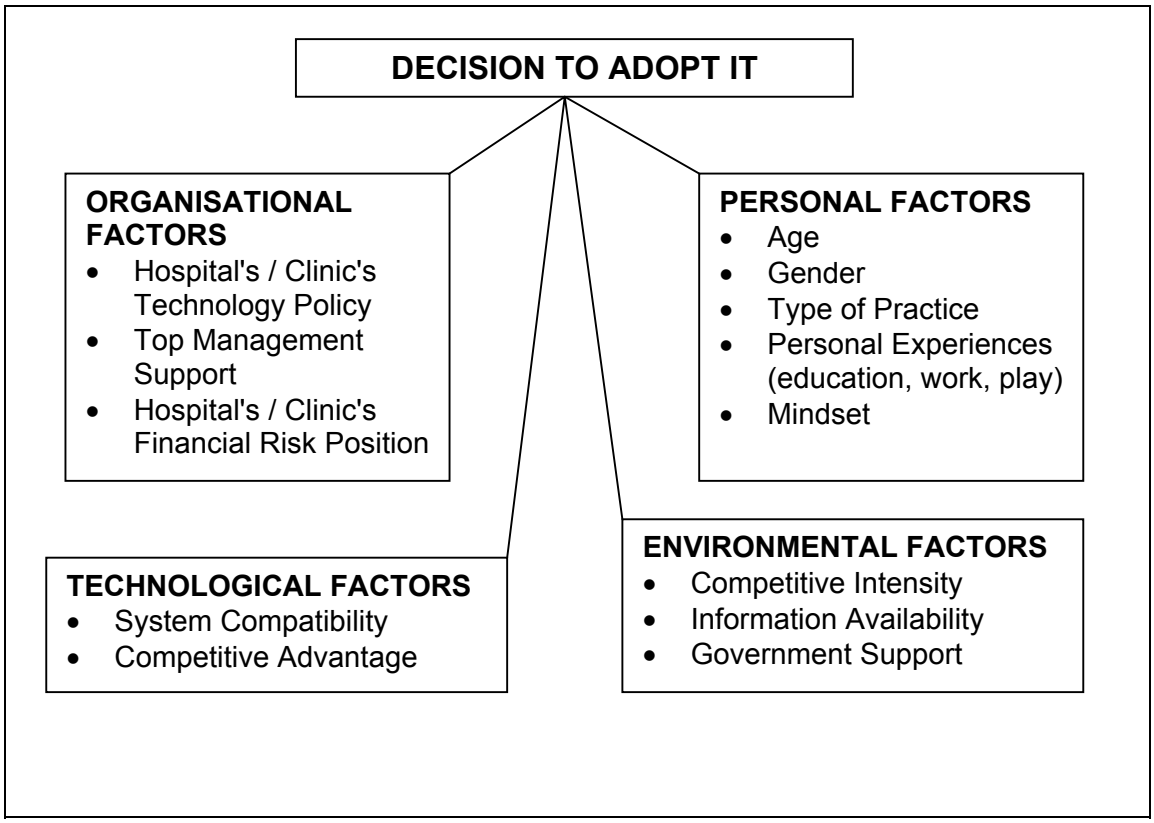

Figure 1.5.1: Factors affecting a doctor's decision-making in IT adoption.

The above model is adapted from Wong (1997)'s model. [21] It shows that a myriad of organisational, technological, environmental and personal factors affects a doctor's decision to adopt IT.

In organisational factors, the prevailing hospital's or clinic's technology policy affects

[21] Model adapted from Wong K.B. (1997), "A Contingency Model of Internet Adoption in Singapore", National University of Singapore.

the level of IT usage. Top management support is important in encouraging IT adoption. How much of a risk taker is the hospital or clinic can also determine the amount set aside for IT use.

In technological factors, if the old system is compatible with the new system, the chance of the new system being adopted is higher. How much more benefits the new system brings over the old one also determine its level of being deployed.

In environmental factors, the more intense the competition is within the healthcare industry, the higher the probability the hospital or clinic will consider IT to gain competitive advantages. The more information there is available on IT options, the higher the chance new IT can be deployed. The higher the level of government support, in terms of financial incentives and policy, the higher the probability of IT being adopted.

In personal factors, the younger the doctor is, the more readily he adopts IT. Male doctors generally adopt IT earlier than female doctors. However, female doctors do catch up in IT adoption. Mindset and past personal IT experiences can affect a doctor's level of future IT adoption.

From the above figure "Factors affecting a doctor's decision-making in IT adoption", the researcher wishes to examine the outcome of six selected hypotheses. The hypotheses are as follows.

Organisational / Environmental / Personal Factors

H1: **Organisational structures of healthcare institutions (hospitals, polyclinics, group/ solo clinics, laboratories, etc) affect the degree of IT adoption at work, the types of IT devices used and the ways IT is used.** *(Organisational factors: technology policy, management support, organisation's financial risk position.)*

H2: **Adoption of IT is greater in the public than private sector.** *(Environmental factors: competition, information availability, government support.)*

H3: **A doctor's future IT needs is related to his type of practice.** *(Personal factor: type of practice)*

H4: **Technological factors may be more effectively exploited by certain sectors of healthcare that leverage on new technology.** *(Environmental factor: competition)*

H5: **There are age differences in the adoption of IT. Older doctors use less IT than younger doctors.** *(Personal factor: age)*

H6: **Mindset and IT experiences affect a doctor's level of IT adoption.** *(Personal factors: mindset and personal experiences)*

The above hypotheses will be examined in Chapters Four to Six and discussed in Chapter Seven.

1.6 STUDY METHODOLOGY

Quantitative and qualitative methods were used to fulfill the study objectives and determine the outcome of the above six hypotheses:

1) A quantitative questionnaire survey aimed to examine the level of IT adoption among doctors in Singapore, and to understand the various factors that influence a doctor's decision for adopting the Internet and the possible reasons for not doing so. The questionnaire was mailed to a sample (n = 6138) of all doctors in Singapore. The sample population was derived from Singapore Medical Association records as of October 2002. Chapter Four presents the survey results.

2) A qualitative focus group session that aimed to further examines the reasons of IT adoption or otherwise, and to chart the roadmap to the future of IT in healthcare. The focus group attendees were selected to comprise a good mix of stakeholders: users (doctors), developers (programmers), administrators (SMA, CFPS, AM), and policymakers (MOH, IDA). The selection was based on a few criteria -- the authority that the participant has within his organisation, the knowledge he can share at the focus group, and his unique role as IT user/ developer/ administrator/ policymaker in this focus group. Chapter Five presents the results

3) A qualitative open-ended survey was conducted among doctors to garner deeper insights into the adoption/ non-adoption of specific Medical-IT applications. There is further examination of the push and pull factors of IT adoption. Doctors' future IT needs are mapped out. Chapter Six presents the results.

1.7 PRESENTATION OF STUDY

This study is presented in seven chapters.

Chapter One gives an overview of IT in Singapore today, the current state of healthcare in Singapore and Medical-IT applications in use. This chapter also highlights the aims and rationale of the study.

Chapter Two presents a review of previous research done in the area of Medical-IT. Previous studies reveal there are push and pull factors to IT adoption.

Chapter Three focuses on the research methodology, questionnaire design, and field procedure. The research methodology includes a quantitative IT survey involving all doctors, a qualitative IT Focus Group session involving a small group with diverse IT interests, and lastly a qualitative survey of selected doctors (SMA Members) to delve deeper into the reasons why doctors adopt/ do not adopt certain Medical-IT applications. Again, push and pull factors are involved.

Chapter Four presents the findings and analysis from the nationwide IT survey among doctors in Singapore (n = 6138 doctors). Results are compared against those of Infocomm Authority of Singapore (IDA), which has conducted similar surveys (n = 3.4 million Singaporeans). The purpose is to see how the healthcare sector fares vis-à-vis the general Singapore population. The profile of respondents in this doctor survey is compared to the actual doctor population of Singapore Medical Council records, to determine the extent of validity of results.

Chapter Five presents the findings and analysis from the IT Focus Group session. The group consisted of users (doctors), developers (IT programmers), administrators

(medical organisations) and policymakers (MOH and IDA). The in-depth qualitative results added much value to the quantitative survey questionnaire design.

Chapter Six presents the findings and analysis from the Qualitative Survey. The survey was conducted among 4198 doctors (SMA Members) to obtain in-depth responses from doctors on the adoption/ non-adoption of Medical-IT applications such as Online Continuing Medical Education (CME), Telemedicine, Telesurgery, clinical research aided by information systems and Electronic Medical Records (EMR). Doctors reported on which are the push and pull factors involved in IT adoption and also expressed their future IT needs.

Finally, Chapter Seven presents a summary of findings (Chapters Four to Six), analyses, limitations, and directions for future research. This summary reveals some recommendations on how IT can be more successfully. A "Medical Hub" model is proposed to fulfill the IT needs of doctors in Singapore.

CHAPTER TWO
LITERATURE REVIEW

2 LITERATURE REVIEW

"In early times, medicine was an art, which took its place at the side of poetry and painting; today they try to make a science of it, placing it beside mathematics, astronomy, and physics." (Armand Trousseau)[22]

2.1 INTRODUCTION

A review of the literature included studies on the areas and extent of IT adoption by overseas and Singapore healthcare providers, their experiences and future IT needs. The researcher examines the barriers to IT adoption and finds out what are the pull factors to IT adoption.

The scope for IT usage in Medicine is vast. The challenge is in getting doctors to be trained in order to exploit the benefits of IT. The main applications the researcher has looked in healthcare are Online Continuing Medical Education (CME), Telemedicine (remote consultation/ monitoring of patients, Telesurgery, Clinical research aided by information systems and Electronic Medical Records (EMR).

The researcher also examines what are the barriers to IT adoption in hospitals, clinics and laboratories. There are various IT needs to be met among doctors, encompassing training, hardware and software. The challenge is to find out what are doctors' IT needs to be addressed.

[22] Armand Trousseau, *Lectures on Clinical Medicine (vol. 2)*, The New Sydenham Society, 1869. Submitted to BMJ by A L Wyman, retired physician, London.

2.2 SEARCH METHODOLOGY

The literature review is chiefly drawn from PubMed[23], a major medical database with over 14 million citations for biomedical articles dating back to the 1950's. Secondary sources are published journals from MedInfo (Annual World Congress on Medical Informatics) and IEEE[24] conferences.

Keywords used in PubMed and results yielded from the online searches were:

- Technology + Singapore = 72 results, 7 selected.
- Technology + Adoption + Doctors = 18 results, 4 selected.
- Barriers + Technology + Doctors = 20 results, 3 selected.
- Incentives + Technology + Doctors = 60 results, 1 selected.
- Internet + Use + Doctors + Work = 40 results, 3 selected.
- Training + Doctors + Technology = 345 results, 11 selected.
- Future + Technology + Doctors + Use = 132 results, 6 selected.

Titles were inspected and the ones with relevant articles were selected, read and findings examined. Journal articles were also drawn from MedInfo and IEEE conference proceedings.

2.3 IT - HEALTHCARE APPLICATIONS AROUND THE WORLD

Before the researcher examines the Singapore case studies, the following are some worldwide case studies, which present a macro view of IT usage prevalent in healthcare.

[23] PubMed is a service of the National Library of Medicine. http://www.ncbi.nlm.nih.gov/PubMed/
[24] IEEE is a leading authority in technical areas ranging from computer engineering, biomedical technology and telecommunications, to electric power, aerospace and consumer electronics, among others. http://www.ieee.org/

2.3.1 Online Continuing Medical Education

Wiecha *et al* (2002)[25] discussed collaborative online learning, as a new approach to distance CME. Most online CME programs were generally completed in a one-on-one relationship between the computer and the learner. The authors believed online CME would benefit from interaction between learners and from opportunities for reflection.

The authors implemented a prototype online course designed to improve the skills of general practitioners (GPs) in the care of patients with type 2 diabetes. Twenty GPs from England, one in Bosnia and one from New Zealand were enrolled. Participants logged in twice weekly for seven weeks to study one of seven interactive modules on diabetes from evidence-based sources.

GPs engaged in two online discussions. One discussion group reflected on the modules and discussed how the material was being applied clinically. The second discussion group applied concepts from the modules to the collaborative management of a problem-based case of a patient with newly diagnosed diabetes.

Participant feedback was overwhelmingly positive. Many noted how well the course design and timing matched their learning styles and schedule constraints. The course could identify additional educational needs and add content online. The course yielded evidence of its effectiveness in changing the actual clinical practices of GPs.

[25] Wiecha J, Barrie N. (2002), "Collaborative online learning: a new approach to distance CME", Acad Med. 2002 Sep;77(9):928-9.

2.3.2 Telemedicine

Singh *et al* (2002)[26] of UK observed that physicians, hospitals and medical schools have been exploring the uses of telemedicine since 1964, primarily in the area of medical education. At present, telemedicine is utilised by health providers in dermatology, oncology, radiology, surgery, cardiology, psychiatry and home health care.

Eadie *et al* (2003)[27] wrote that telemedicine has huge potential to alter surgical practice but improvements are required in telesurgical technology with respect to tactile feedback, instrumentation, telecommunication speed and availability. Issues of liability, legislation, cost and benefit require clarification. The future of telemedicine in surgery may lie in facilitating complex minimally invasive techniques.

Allaërt *et al* (1998)[28] wrote that telemedicine has a role in humanitarian aid by providing medical care in developing countries where there are doctor shortages. He cautioned however that the rapid growth of telemedicine has created a need for the definition of doctors' responsibilities. The responsibilities must be analyzed "according to the tort of negligence as a function of the level of competence of each doctor, their unequal access to the relevant information and their command of the telemedicine system".

Allaërt *et al* (1998) opined that the generalisation of the practice of telemedicine presents medico-legal problems if the patient suffers injury. The doctor participating in telemedicine must be aware of the various aspects of his professional responsibility

[26] Singh G, O'Donoghue J, Soon CK. (2002) "Telemedicine: Issues and Implications", Technol Health Care 2002;10(1):1-10.
[27] Eadie LH, Seifalian AM, Davidson BR. (2003), "Telemedicine in Surgery", Br J Surg. 2003 Jun;90(6):647-58.
[28] Allaërt F, Dusserre L. (1998), "Telemedicine: Responsibilities and Contractual Framework", MedInfo 1998; 4:261-164.

and the conditions in which he may be required to produce proof of his actions. The considerations are the a) assignment of responsibilities, b) principle of care, c) level of competence of the doctors, d) unequal access of the doctors to the information, e) command of the telemedicine system, and f) equipment malfunctions. In the case of medico-legal litigation, doctors must present proof that they have behaved diligently and in accordance with the usual practices of the profession, by producing the images transmitted and replies given. The law should also acknowledge the legal value of electronic records on non-rewriteable optical disks, in addition to traditional paper records.

In Singapore, telemedicine is not widely deployed as many hospitals and clinics are located well within the easy reach of most patients, unlike those in geographically dispersed or inaccessible areas, such as parts of rural China or Australia bushlands. Telementoring and teleconferencing have been used for surgical teaching and training. However, long-distance telesurgery procedure has not been performed yet, due to accessibility of hospitals, culture, mindset and the preference of high touch over high tech.

Telemedicine can also play its role in Singapore in instances involving patients with poor mobility, such as the elderly who can no longer walk. Doctors in hospitals can, with the help of telemedicine equipment and nurses stationed in these nursing homes, conduct more regular progress checks on elderly patients.

2.3.3 Telesurgery

Marescaux *et al* (2003)[29] advocated that with the advent of laparoscopic surgery, a method characterized by a surgeon's lack of direct contact with the patient's organs and tissue and the availability of magnified video images, it has become possible to incorporate computer and robotic technologies into surgical procedures. Computer technology has the ability to enhance, compress, and transmit video signals and other information over long distances. These technical advances have had a profound effect on surgical procedures and on the surgeons themselves because they are changing the way surgery is taught and learned.

2.3.4 Information Systems to Aid Practice of Medicine

Rothschild *et al* (2002)[30] of USA examined the problems involved in retrieval of drug information, often causing serious medication errors. Although the information that clinicians need is often available somewhere, retrieving it expeditiously has been problematic. At the same time, clinicians are faced with an ever-expanding pharmacology knowledge base. The solution is in handheld computing. In a study of physicians' use of Personal Digital Assistant (PDA) with ePocrates Rx (a comprehensive drug information guide), results showed that ePocrates Rx saves physicians' time during information retrieval, is easily incorporated into their usual workflow, and improves drug-related decision making. They also felt that it reduced the rate of preventable adverse drug events.

[29] Marescaux J, Rubino F. (2003), " Telesurgery, telementoring, virtual surgery and telerobotics", Curr Urol Rep. 2003 Apr;4(2):109-13.
[30] Rothschild JM, Lee TH, Bae T, Bates DW. (2002), "Clinician Use of a Palmtop Drug Reference Guide", J Am Med Inform Assoc 2002 May-Jun;9(3):223-9.

In Singapore, hospitals are encouraging doctors to use PDAs to make medical references, especially drug information. They enforce the keying in of patient medical records through networked desktops or PDAs, which are later hot-synced into the hospital servers. The clinical and practical value of handheld devices in clinical settings will clearly grow further as wireless communication becomes more ubiquitous and as more medical applications and resources become available. This is an important evolution of IT in Medicine, and more research needs to be done in Handheld Computing.

2.3.5 Electronic Medical Records

Medical records serve "to identify the patient, support the diagnosis, justify the treatment, document the course and results, and promote continuity of care among healthcare providers".[31] Laing (2002)[32] of USA examined the benefits and challenges of computerised medical records. They are not only fast to retrieve but also serve well as a financial and legal record, aid in clinical research, support decision analysis, and guide professional and organisational performance improvement.

Bates *et al* (2003)[33] of USA argued that providers' and patients' information and decision support needs can be satisfied only if primary care providers use electronic medical records (EMR). Although robust EMRs are now available, only about 5% of U.S. primary care providers use them. Recently, with only modest investments, Australia, New Zealand, and England have achieved major breakthroughs in implementing EMRs in primary care. Substantial benefits realisable through routine use of electronic medical records include improved quality, safety, and efficiency,

[31] Joint Commission on Accreditation of Healthcare Organizations. Management of Information. 1996 Accreditation Manual for Hospitals: Vol. 2. JCAHO.
[32] Laing K. (2002), "The Benefits and Challenges of the Computerized Electronic Medical Record", Gastroenterol Nurs 2002 Mar-Apr;25(2):41-5.
[33] Bates DW, Ebell M, Gotlieb E, Zapp J, Mullins HC. (2003), "A Proposal for Electronic Medical Records in U.S. Primary Care", J Am Med Inform Assoc 2003 Jan-Feb;10(1):1-10.

along with increased ability to conduct education and research. Nevertheless, barriers to adoption exist and must be overcome.

In Singapore, hospitals are now embarking on electronic medical records to deliver healthcare seamlessly to patients. More research needs to be done in areas such as addressing concerns such as ownership of records, security, privacy and confidentiality. Cost-benefit analysis needs to be examined as well.

From the above worldwide examples, it is apparent that there is a need for IT in Medicine. The uses include:

- **Online Continuing Medical Education**: collaborative online learning (interaction among learners, with opportunities for reflection) increases doctors' knowledge and skills and improves their clinical practices.

- **Telemedicine**: helps bring medical aid to remote/ rural areas, facilitates complex minimally invasive techniques, and monitors patients from a distance.

- **Telesurgery**: creates more precision in surgical procedures due to robotic arms (surgeon's lack of direct contact with the patient's organs and tissue) and the availability of magnified video images.

- **Information Systems to Aid Practice of Medicine**: saves doctors' time during information retrieval and improves drug-related decision making.

- **Electronic Medical Records**: create speed in retrieval of records. They serve as a financial and legal record, aid in clinical research, support decision analysis, and guide professional and organisational performance improvement.

The researcher now looks at Singapore case studies of IT usage in healthcare, to compare how Singapore stands in relation to other countries.

2.4 IT - HEALTHCARE APPLICATIONS IN SINGAPORE

For the healthcare provider and medical practitioner, IT is becoming increasingly relevant, from the ubiquitous electronic mail (e-mail) to the integration of healthcare services within an institution. In a review of the IT scene in Singapore, it was noted that albeit a little too slowly, doctors are starting to catch onto this new wave of digital empowerment and creating niches that will enhance their ability to care for their patients and ultimately add value to their practices. The challenge is to encourage every doctor to come on board.[34]

For the patient, the Internet brings about the power of information. Greenes (2001)[35] found that patients are increasingly consulting the Web for medical information and resources from databases that are generally accessible to the public as well as physicians. This changes the power in the doctor-patient relationship. However, Boyer et al (1999) [36] cautioned that pertaining to medical information for the public, the "quality (is) often questionable".

[34] Chin, R. (2000), " The Internet: Another Facet to the Paradigm Shift in Healthcare", Singapore Medical Journal 2000 Sep; Vol. 41(9): 426-429.
[35] Greenes RA. (2001), "eCare and eHealth: the Internet Meets Healthcare.", J Med Pract Manage 2001 Sep-Oct;17(2):106-8.
[36] Boyer C, Appel RD, Griesser V, Scherrer JR. (1999), "Internet for Physicians: a Tool for Today and Tomorrow", Rev Med Suisse Romande 1999 Feb; 119(2): 137-44.

Several studies on Medical-IT usage in Singapore have been conducted, namely:

2.4.1 Online Continuing Medical Education (CME)

Continuing Medical Education is now compulsory in Singapore. All doctors have to fulfill 50 points in two years in order to have their licenses renewed. Doctors can obtain up to ten CME points under "Category III A - Self Study" (distance learning without verification) under the compulsory SMC CME system. The approved journals include Singapore Family Physician, Singapore Medical Journal, British Medical Journal, American Family Physician, Australian Family Physician and Canadian Family Physician. Most of these journals are available online. After reading these journals, doctors are to submit claims of CME points online at the SMC-CME website[37].

The College of Family Physician, Singapore (CFPS)[38] is developing an Online CME portal with National University of Singapore (NUS). The software is called "Integrated Virtual Learning Environment" (IVLE). This software has been deployed in NUS and has proven to be a success. IVLE supports over 2000 courses and 25000 NUS students[39]. In June 2003, CFPS launched an "E-learning Module on SARS" (Severe Acute Respiratory Syndrome)[40]. Doctors are able to log on to access readings, case scenarios, videos on counseling and disease transmission, and take an online multiple-choice-questions (MCQ) test. CME points will then be submitted to the SMC-CME website for doctors' accreditation.

Encouraging and providing continuing education to doctors is an important activity of CFPS' CME Committee. It ensures that the standard of family medicine in Singapore

[37] SMC-CME website: http://www.smc-cme.gov.sg
[38] CFPS website: http://www.cfps.org.sg
[39] NUS WizLearn's IVLE program: http://www.wizlearn.com/resources.htm
[40] E-learning Module on SARS: http://www.onlinemedlearning.org/

remains high. Aside from the online CME programmes, the committee runs physical seminars as well on Graduate Diploma of Family Medicine (GDFM) and the Family Medicine Fellowship Programme (FMFP). The combination of online and physical seminars ensures that doctors are up to date on their skills and knowledge. They receive the convenience of CME learning from their homes and offices and at the same time are able to attend some physical seminars and hands-on workshops to enhance doctors' interaction and exchange of ideas.

2.4.2 Telemedicine

Chew *et al* (1998)[41] examined the cost-effectiveness of the use of telemedicine in Ophthalmology. 'OphthWeb' is an ophthalmic electronic medical record that can be accessed locally and globally via the Internet. It provides secure multimedia patient data to doctors, patients, and healthcare providers at any time and in any place. A data transmission trial was conducted between the Xiamen Eye Centre (Fujian, China) and Singapore. Clinical records, voice messages, and fundus and slit-lamp images were transmitted from Xiamen, and an off-line dialogue by e-mail and Internet-relay chat were conducted. It was found that OphthWeb could provide telemedicine and electronic medical records at low cost and great convenience.

2.4.3 Telesurgery

Cheah *et al* (2000)[42] reported on the first two international telesurgical, telementored, robot-assisted laparoscopic cholecystectomies performed in the world, between the Johns Hopkins Institute, Baltimore, Maryland, USA, and the National University Hospital, Singapore. Tele-Surgery is a form of operative videoconferencing in which a

[41] Chew SJ, Cheng HM, Lam DS, Cheng AC, Leung AT, Chua JK, Yu CP, Balakrishnan V, Chan WK. (1998), "Ophthweb - Cost-Effective Telemedicine for Ophthalmology", Hong Kong Med J 1998 Sep;4(3):300-304.
[42] Cheah WK, Lee B, Lenzi JE, Goh PM (2000), "Telesurgical Laparoscopic Cholecystectomy between Two Countries", Surg Endosc 2000 Nov;14(11):1085.

remotely located surgeon observes a procedure through a camera and provides visual and auditory feedback to the operative site.

2.4.4 Information Systems to Aid Practice of Medicine

Tan *et al* (1990)[43] conducted a study on how the computer can assist in minimising transcription errors during the monitoring of analytical performances of laboratory tests. The computer reduces turn-around time of testing and reporting, and improves the quality of laboratory reports.

Doctors in Singapore are able to register for online MIMS CliniConsult[44] to access clinical resources that assist them in making more informed medical decisions and providing better patient care. Resources include comprehensive and concise drug information, diagnostic and laboratory information and medical technology news.

2.4.5 Electronic Medical Record (EMR)

Lee *et al* (2001)[45] carried out a study on a computerised medical record system, Emergency Medicine Department System (EMDS), in the emergency department of the National University Hospital, Singapore. EMDS replaced handwritten records. The results showed that EMDS improved the quantity of data capture, compared to the old records. Enforcement mechanisms in the EMDS also helped achieve almost full capture of critical information, such as examination time.

[43] Tan IK, Jacob E, Lim SH (1990), "Use of Computers in Quality Assurance of Laboratory Testing", Ann Acad Med Singapore 1990 Sep;19(5):724-30.
[44] MIMS CliniConsult is provided by Atmedica: http://www.atmedica.com.sg
[45] Lee FC, Chong WF, Chong P, Ooi SB (2001), "The Emergency Medicine Department System: a Study of the Effects of Computerization on the Quality of Medical Records", Eur J Emerg Med 2001 Jun;8(2):107-15.

The two Singapore healthcare clusters, SingHealth and National Healthcare Group, are working with Singapore's Ministry of Health (MOH) to explore the feasibility of implementing EMR in all the restructured hospitals (RH) of Singapore.

2.4.6 Genomic Testing

The Singapore Government will spend about S$4 billion into E-Genomics from Years 2000 to 2005 to develop a full-fledged biotech industry.[46] The Genome Institute of Singapore (GIS) was first launched on 24 June 2000 to drive the life sciences in Singapore. Many pharmaceutical, medical technology and biotechnology companies have invested in Singapore. E-Genomics harnesses technology to uncover the structure and sequence of the genetic material that defines an organism. The tasks are to map the position of the genes to each other, and to sequence every unit of genetic information in that genome.[47] Results may transform the diagnosis, treatment and even prevention of diseases that today still cripple many in our society.

The above reports on applications serve to illustrate how useful IT is in Medicine. The uses include:

- **Online CME**: ensures doctors are up to date on their skills and knowledge, from the convenience of their offices/ homes.
- **Telemedicine**: provides patient data (eg. telemonitoring) to doctors, patients, and healthcare providers at any time and place.
- **Telesurgery**: collaborations among doctors from various parts of the world. Doctors are able to provide visual and auditory feedback to the operative site.
- **Information Systems to Aid Practice of Medicine**: provides assistance in medical decision making. Reports laboratory results with more accuracy

[46] Business Week Online, 27 November 2000, http://www.businessweek.com/2000/00_48/b3709032.htm
[47] Liu Edison T. (2002), "Genomics and Medicine in Singapore", SMA News 2002; 34 (11): 1, 7.

- **Electronic Medical Records**: improves the quantity and quality of data capture. Creates convenience to doctors and nurses who need patient information fast and accurately.
- **E-Genomics**: introduces genetic testing that may help prevent diseases.

2.5 BARRIERS TO IT ADOPTION

Doctors are influenced by push and pull factors in their efforts to adopt IT. The researcher examines the push factors, followed by the pull factors.

In spite of the many applications and potentials of IT in healthcare, successful adoption is not without several barriers of cross hassles and attitude. The following studies highlight some of the factors affecting the rate of IT adoption in various countries.

2.5.1 Time and Cost in Implementation

Koh (1990)[48] described his experience using a computer during consultation in a large computerised academic practice in Manchester, U.K. Prescribing, preventive health screening and recall, the use of disease registers and billing are common medical applications with proven usefulness. However, system implementation had problems. Issues that had to be resolved included the capital cost to the practice, decisions regarding hard and software, the conversion of written to computerised records, access and confidentiality, and staff training. Computer use may also extend consultation and staff time.

[48] Koh KT. (1990), "The Computer In Group Practice -- A British Experience", Ann Acad Med Singapore 1990 Sep;19(5):741-4.

2.5.2 Attitude, Mindset and Experiences

Loomis et al (2002)[49] investigated attitudes and beliefs about Electronic Medical Records (EMRs) between existing EMR users (early market) and non-users (mainstream market) in Indiana, USA. EMR users were more likely to practise in urban areas or to be hospital-based, and reported seeing fewer patients. Non-users were less likely to believe that: a) physicians should computerise their medical records; b) current EMRs are a useful tool for physicians; c) EMRs improve quality of medical records and decrease errors; and d) it is easy to enter data into current EMRs. Non-users were also more likely to believe that paper records are more secure and confidential than EMRs. However, both users and non-users believed that current EMRs are too expensive. Issues that affect EMR implementation include necessity, usefulness, data entry, cost, security and confidentiality.

2.5.3 Money, Hassle and Patient Care

Guthrie (2001)[50] examined the factors influencing physicians who adopt or do not adopt Internet in their medical systems. He found that the components necessary to assure physician acceptance and utilisation of new tools are: (1) Do not underestimate the personal nature of a physician's practice; it really isn't a "business". (2) Most physicians are extremely pragmatic and practical. (3) For physicians to adopt a new technology, it must address three major issues: money, hassle, and patient care. Indeed, some technological innovations are presented to physicians without sufficient respect for their knowledge of how medical practices really work. The benefits promised often do not match the needs of the physicians.

[49] Loomis GA, Ries JS, Saywell RM Jr, Thakker NR.(2002), "If Electronic Medical Records Are So Great, Why Aren't Family Physicians Using Them?", J Fam Pract 2002 Jul;51(7):636-41.
[50] Guthrie MB. (2001), "Get Real: What will Draw Physicians to the Web?", Physician Exec 2001 Mar-Apr;27(2):36-40.

2.5.4 Lack of Technical Support

Leung *et al* (2003)[51] sought to understand the contributory barriers and potential incentives associated with IT implementation. Time, costs, lack of technical support and large capital investments were the biggest barriers to computerisation, whereas improved office efficiency and better quality care were ranked highest as potential incentives to computerise. Respondents who were concerned with the costs of computerisation also perceived financial incentives and government regulation to be important incentives/ catalysts toward computerisation.

2.5.5 Interference with the Doctor-Patient Encounter

Johnston (2002)[52] sought to identify physicians' attitudes towards the use of computers in the clinical setting. While there was strong support for the benefit of computerisation to patient care, it was much less for electronic medical records. The most important disincentives to computerisation were the potential for interference with the patient-physician encounter and the cost of computerising multiple practice locations. Turning these disincentives into opportunities for change remains the challenge.

There are lessons to be learnt from these case studies. **Barriers to IT adoption include**:

- High costs in hardware and software.
- Previous bad IT experiences.
- Fixed mindset.
- Time and effort.

[51] Leung GM, Yu PL, Wong IO, Johnston JM, Tin KY. (2003), Incentives and Barriers That Influence Clinical Computerization in Hong Kong: A Population-based Physician Survey, J Am Med Inform Assoc 2003 Mar-Apr;10(2):201-12.
[52] Johnston JM, Leung GM, Wong JF, Ho LM, Fielding R. (2002), "Physicians' Attitudes towards the Computerization of Clinical Practice in Hong Kong: A Population Study", Int J Med Inf 2002 Apr;65(1):41-9.

- Manpower costs in the conversion of written to computerised records.
- Staff training to use the new IT systems.
- Lack of/ inadequate IT vendor support.
- Medico-legal issues: Security, Patient Confidentiality and Ownership of Medical Records.
- Interference in the doctor-patient relationship, rendering it less personalised.

Just as there are barriers to IT adoption, there are factors that draw doctors to adopt IT. The next section explores which are some of these pull factors.

2.6 PULL FACTORS TO IT IMPLEMENTATION

2.6.1 IT Improving Patient Care

Ong (2002)[53] advocated that IT can improve the safety of patient care by minimising prescribing errors and organising patient-specific information from diverse databases. Apart from legibility, prescribing safety is enhanced as online access to databases carrying patient drug history, scientific drug information and guideline reference, and patient-specific information is available to the physician. The latter includes discharge summaries, surgical procedure summaries, laboratory data and investigation reports. For such system implementations to work, there must be a) Fast and reliable IT backbone with simple user interface; b) End-user involvement and ownership of all aspects of development; c) Strong hospital leadership to mandate and support IT development efforts.

[53] Ong BK. (2002), "Leveraging on Information Technology to Enhance Patient Care: A Doctor's Perspective of Implementation in a Singapore Academic Hospital", Ann Acad Med Singapore 2002 Nov;31(6):707-11.

2.6.2 Financial Incentives

Bates (2002)[54] found that many healthcare organisations in the United States have demonstrated that quality can be substantially improved if IT use is increased in ways that improve care. Computerisation of processes that are error-prone and computerised decision support may substantially improve efficiency and quality. He suggested that there are five key policy domains that needed to be addressed: standards, incentives, security and confidentiality, professional involvement, and research. Financial incentives represent the most important lever.

2.6.3 IT Training

Liaw (2000)[55] implemented and evaluated a computer education and support programme for General Practitioners (GPs) in Victoria, Australia. After six months of training, GPs reported greater change in their skills than their younger colleagues. Awareness of relevant computer applications, confidence with computers and intention to use applications also increased. The conclusion is that computer education and support programmes were relevant to GP needs. Other GP organisations should be assisted to establish similar education and support programmes, and perhaps target older doctors.

From the above case studies, the researcher discovers that **there are pull factors to encourage doctors to adopt IT**. They include:

- Financial incentives, eg. subsidised hardware, software and IT training.
- Visible results in improvement in patient care.
- Strong hospital or group clinic leadership and support.
- End-user involvement and ownership.

[54] Bates DW. (2002), "The Quality Case for Information Technology in Healthcare", BMC Med Inform Decis Mak 2002 Oct 23;2(1):7.
[55] Liaw ST, Ugoni AM, Cairns C. (2000), "Computer Education. Don't Forget the Older GPs.", Aust Fam Physician 2000 Aug;29(8):802-5.

- Fast and reliable connectivity.
- IT systems with simple user-interfaces.
- IT training to instill computer confidence and chances to practise and apply what one has learnt.
- Awareness of the usefulness of computer applications.
- The government as a catalyst in IT adoption.
- IT standards, security and confidentiality issues to be addressed.

2.7 DISCUSSION

From this literature review, we have explored the work done by previous researchers on various topics concerning IT in Medicine. The selected topics include Online Continuing Medical Education, Telemedicine, Telesurgery, Information Systems to Aid the Practice of Medicine and Electronic Medical Records. By looking at various studies done worldwide and in Singapore, the researcher discovers the myriad of uses that these IT applications bring towards Medicine. At the end of the day, the focus is still on the patient. Hence, it is important that these applications bring about a greater level of healthcare, be it by increasing the knowledge and skills of doctors through Online CME, or ensuring the timely delivery of healthcare through fast retrieval of patient information.

In this literature review, the researcher also explores what are some of the barriers to IT adoption, and what are the pull factors towards IT adoption. Barriers include high costs in hardware, software and training, inadequate IT vendor support, and medico-legal issues such as security, patient confidentiality and ownership of medical records. Doctors also fear that IT will interfere in the doctor-patient relationship. Pull factors towards IT adoption include financial incentives, top-down leadership and

support (government/ hospitals/ medical organisations), user-friendly systems, good IT vendor support, training and awareness.

IT implementation in Medicine is not easy. Doctors have traditionally not been exposed to IT, as IT knowledge and application was never a prerequisite in the path of becoming a good doctor. The challenge of future IT implementation lies in surmounting the mindset, cost, training and medico-legal issues.

CHAPTER THREE METHODOLOGY

3 METHODOLOGY

The aim of this study is to investigate the state of IT adoption among doctors in Singapore. The researcher seeks to establish and verify the reasons for high and low diffusion rates of various IT applications. These reasons form implications for health policy and technology adoption strategies.

In this study, three methods were employed:

1) A **quantitative questionnaire survey** to examine the level of IT adoption among doctors in Singapore, and to understand the various factors that influence a doctor's decision for adopting the Internet and the possible reasons for not doing so.

2) A **qualitative focus group session** that further examines the reasons of IT adoption or otherwise, and charts the roadmap to the future of IT in healthcare.

3) A **qualitative open-ended survey** to garner deeper insights into the adoption/ non-adoption of specific Medical-IT applications. There is further examination of the push and pull factors of IT adoption. Doctors' future IT needs are also mapped out.

3.1 QUESTIONNAIRE SURVEY (QUANTITATIVE)

The questionnaire (Appendix A) was developed from preliminary research and conversations with various doctors in Singapore. This process involved several refinements and a small-scale pilot before a satisfactory questionnaire was developed for distribution.

Responses were sought for demographic data, computer use/ non-use at home/ office, adoption barriers, IT training awareness, and present and future trends of IT use. The questionnaire comprised of five main sections:

1) Present State of Computing
2) Internet Use at Home
3) Internet Use at Work
4) The Future
5) Practice Profile

The researcher constructed mainly closed multiple choice questions (MCQ) and some open-ended questions in the survey to elicit information. Writing space was available for comments where needed. The design of the questionnaire made allowance for a coding schema to be in place for easier transcription of response data into an SPSS spreadsheet for further analysis.

With financial and manpower support from Ministry of Health (MOH) and Singapore Medical Association (SMA), all questionnaires mailed out were accompanied by suitable covering letters and prepaid envelopes. SMA provided the mailing list, comprising of names and addresses of all doctors in Singapore.

The questionnaires were sent out to a sample (n = 6138) of all doctors in Singapore in early October 2002, based on the SMA mailing list[56]. A repeat mailing without prepaid envelopes was done in late October 2002 to further increase the response rate. The response rate to the first mailing was 14% (859) and second mailing 7% (430). The number of valid respondents, within the stipulated dateline of 11 November 2002, was 1289 out of 6138, accounting for a 21% response rate. This return rate just made it

[56] The SMA mailing list and not the Singapore Medical Council (SMC) mailing list. The main reason is "access" as the researcher works at SMA.

within the 20% to 30% range required to validate survey findings.[57] The results are summarised in *Chapter Four: Mailed Questionnaire - Results & Analysis*.

3.2 FOCUS GROUP (QUALITATIVE)

A focus group "provides a complete and clear framework for staging effective interview sessions, accurately interpreting their results and using them in successful marketing strategies".[58] It forms a somewhat informal technique that can help the researcher to assess user needs and feelings on a discussion topic. In a typical focus group, six to nine users are brought together to discuss issues and concerns about a discussion topic. The focus group typically lasts about two hours and is run by a moderator who maintains the group's focus. Focus groups often bring out users' spontaneous reactions and ideas and allow the researcher to observe group dynamics.

For this study, a focus group session was carried out on 28 January 2003 and moderated by Associate Professor Goh Lee Gan. It comprised of twenty persons selected randomly from representative groups: Users (doctors), Developers (programmers), Administrators (SMA, CFPS, AM), and Policy Makers (MOH, IDA). The objective was to discover in-depth:

1) How do participants view the results of the quantitative survey?
2) What are the barriers to IT adoption for doctors? How does one encourage doctors to adopt IT?
3) What are the IT needs of doctors to be met?
4) What is the future potential of IT in Healthcare?
5) Further insight participants can contribute to this topic?

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[57] Berg M. (1997), *Rationalising Medical Work: Decision Support Techniques and Medical Practices*, PhD., Maastricht University, MIT Press, Cambridge.
[58] Templeton J. F. (1996), *The Focus Group: A Strategic Guide to Organizing, Conducting and Analyzing the Focus Group Interview*, McGraw-Hill Trade.

Although the above questions were asked in the survey questionnaire, the answers have not fully emerged. Hence, a focus group was necessary. One-to-one interviews with various doctors could have been conducted, but it was more time and cost efficient to have an interactive focus group in a single session.

For participants, the focus group session was free flowing and relatively unstructured. In reality, the moderator followed a preplanned script of specific issues and set goals for the type of information to be gathered. During the group session, the moderator had the difficult job of keeping the discussion on track without inhibiting the flow of ideas and comments. Even though the group was relatively big at twenty persons, the moderator ensured that all group members contributed to the discussion and discouraged monopoly of the discussion by one or more participants.

After the session, data analysis comprised a short report written to sum up the ideas discussed, illustrated with a few quotes from participants. The results are summarised in *Chapter Five: Focus Group - Results & Analysis*.

3.3 OPEN-ENDED SURVEY (QUALITATIVE)

The objective of this open-ended qualitative survey is to delve deeper into the research question and find out answers in relation to Medical-IT. Participants were encouraged to define which aspects of Medical-IT were important to them. Entitled "A Quick Information Technology (IT) Survey" (Appendix D), the survey has four open-ended questions to elicit in-depth information. There was sufficient writing space available for comments. Respondents were encouraged to use separate pieces of paper if their answers exceeded the space given.

The questionnaire was divided into three age groups: 35 and below, 36 to 50, 51 and above. The researcher is more interested in finding out the results of the first (35 and below) and last (51 and above) age groups, as they represent the two extremes - the young and the old. However, to avoid making this intention too obvious, the middle group (36 to 50) was included in this survey as well.

The questions asked for the first two groups (35 and below, 36 to 50) sought to find out the Medical-IT applications adopted at work, which IT gadgets were likely to be used by doctors, and which IT initiatives (Online CME, Telemedicine, Telesurgery, Clinical research aided by IT systems, Electronic Medical Records) would be well accepted by doctors. The questions asked for the last age group (51 and above) sought to find out what were the barriers that older doctors' perceived in IT adoption, what were their IT needs (training, software, hardware), and how medical organisations could assist in making IT usage easier for them. Even though there were only four questions in total for each age group, the questions required some reflection before answers could be given.

Singapore Medical Association (SMA) supported this qualitative survey by mailing out the one-page questionnaire to all its 4198 doctor members[59] (n = 4198). The entire doctor population is 6138 doctors. The SMA membership represents 68.4% of all doctors in Singapore. The main reason why this qualitative survey was not sent out to all Singapore doctors (n = 6138) is "cost". With this survey going out with SMA's monthly mailout to its members, postage and distribution costs were kept low.

[59] SMA membership tally as of 31 September 2003.

Doctors were asked to respond via mail, fax and online submission. The number of valid responses, by 9 November 2003 (a month after the questionnaire was mailed out on 9 October 2003), was 107 out of 4198, accounting for a 2.55% response rate. The breakdown is 0.07% (3) via mail, 0.88% (37) via fax and 1.60% (67) via online submission. This overall 2.55% response rate may seem low. However, seen in the light of the number of quality in-depth responses received, the objectives of this qualitative survey have been met. The results are summarised in *Chapter Six: Qualitative Survey - Results & Analysis*.

3.4 DISCUSSION

The quantitative questionnaire survey and qualitative focus group session together created better understanding of the critical success and failure factors in computerisation The qualitative survey with open-ended questions unearthed deep opinions on Medical-IT applications, and brought forth doctors' myriad of concerns in the use of IT in Medicine.

CHAPTER FOUR

SURVEY QUESTIONNAIRE

4 SURVEY QUESTIONNAIRE - RESULTS & ANALYSIS

The first part of this study is a quantitative survey using a survey questionnaire (Appendix A).

4.1 STUDY POPULATION

The total sample was used in the questionnaire survey. The list of registered doctors was obtained from the Singapore Medical Association register in October 2002.

4.2 DATA ANALYSIS

After coding and processing 1328 returned survey forms, the results were tabulated and run in SPSS 11.0, a recognised statistical programme. Results are summarised here according to the five different sections of the questionnaire.

The profile of respondents is compared to actual Singapore Medical Council (SMC)[60] doctor demographics.

[60] The Singapore Medical Council (SMC) (www.smc.gov.sg) is government related. Its main roles are to register doctors for medical practice in Singapore, work with Ministry of Health and medical organisations on health laws and regulations, and act as a watchdog towards errant doctors. The Singapore Medical Association (SMA) (www.sma.org.sg) is the national medical organisation representing the majority of medical practitioners in both the public and private sectors. Its main roles are to maintain the honour and interests of the medical profession, to support a higher standard of medical ethics and conduct, and to enlighten the public on health problems in Singapore.

4.3 RESULTS

4.3.1 Profile of Respondents: Age, Gender and Type of Practice

The overall profile of this survey's doctor respondents is as follows.

Profile of Survey Respondents

	Private	Public	Not Practising	Missing	Total
Type of Practice	823 (62.0%)	480 (36.1%)	19 (1.4%)	6 (0.5%)	1328 (100%)

	Male	Female	Missing	Total
Gender	959 (72.2%)	365 (27.5%)	4 (0.3%)	1328 (100%)

	≤ 30	31 to 40	41 to 50	51 to 60	> 60	Missing	Total
Age	161 (12.1%)	466 (35.1%)	353 (26.6%)	210 (15.8%)	133 (10.0%)	5 (0.4%)	1328 (100%)

Table 4.3.1a: Profile of Survey Respondents.

The above profile of survey respondents is compared against that of official demographics from the Singapore Medical Council (SMC) found in Chapter One.

Doctors' Demographics (SMC Records)

	Private	Public
Type of Practice	2887 (47.8%)	3148 (52.2%)

	Male	Female
Gender	4174 (69.1%)	1861 (30.1%)

	20 – 29	30 – 39	40 – 49	50 – 59	> 60
Age	13.7%	37.3%	23.2%	14.0%	11.8%

Table 1.3 (repeated from Chapter 1): Demographics of Employed Doctors in Singapore. (Source: Singapore Medical Council's demographic records as of 5 Feb 2003.)

The differences in the type of practice between the two tables are 14.2% for "Private Practice" and 16.0% for "Public Practice". If the results are within the 10% range, they

would be better. SMC, in its records, did not take into account doctors who are no longer practising. Perhaps it keeps only records of doctors who are actively practising.

The following table shows a more detailed breakdown of survey respondents' profile. Results are derived from cross tabulations among Age, Gender and Type of Practice.

Male Respondents							
Doctors (%)		**≤ 30**	**31 to 40**	**41 to 50**	**51 to 60**	**> 60**	**Total**
Private	**General Practitioner**	0.7	13.8	10.9	7.1	4.2	36.6
	Specialist	0.3	5.3	7.4	6.7	5.1	24.8
	Laboratory	0.1	0.2	0	0	0	0.3
	Others	0.1	0.5	0.4	0.1	0.2	1.4
Public	**Polyclinic**	0.2	1.5	0.2	0.1	0.1	2.1
	Hospital	8.8	12.2	4.9	2.6	0.8	29.3
	Laboratory	0.1	0.4	0	0.1	0.1	0.7
	Others	1.7	0.8	0.8	0	0.3	3.7
Others	**Not practising**	0	0.3	0.1	0.1	0.5	1.0
TOTAL		12.0	35.1	24.7	16.8	11.4	100.0

Table 4.3.1b: Profile of Male Survey Respondents.

Female Respondents							
Doctors (%)		**≤ 30**	**31 to 40**	**41 to 50**	**51 to 60**	**> 60**	**Total**
Private	**General Practitioner**	1.4	15.2	12.1	5.2	2.5	36.4
	Specialist	0.8	5.0	10.2	3.9	0.8	20.7
	Laboratory	0	0	0.3	0	0	0.3
	Others	0.3	0.8	1.1	0	0.3	2.5
Public	**Polyclinic**	0.8	3.0	0.6	1.4	0.6	6.3
	Hospital	9.4	11.0	6.6	1.9	0.6	29.5
	Laboratory	0	0.3	0	0	0.3	0.6
	Others	0	0.3	0.8	0.3	0	1.4
Others	**Not practising**	0	0.3	0.3	0.3	1.7	2.5
TOTAL		12.7	35.8	32.0	12.9	6.6	100.0

Table 4.3.1c: Profile of Female Survey Respondents.

4.3.1.1 Validity of Study

Regarding the internal validity of the study, according to the response per medical occupational group (private and public) and per gender, it appears there is sufficient spreading. The differences in gender (male and female) between Table 4.3.1a and Table 1.3 lie within a small 3.5% range. Again, the differences between the different age groups of these two tables lie within a small 3.5% range. Hence, one can extrapolate that the survey results are quite representative of the actual doctor population. These findings indicate that internal validity is plausible.

Regarding external validity, it seems prudent to conclude that the scope of results and conclusions may not be extrapolated to other countries' doctor population. After all, the survey results are dependent on a number of situational factors.

The following sections report on the results of this quantitative survey questionnaire.

4.3.2 Present State of Computing

Q1) How many computers (PC, Macintosh, Laptop, PDA, etc) do you have?

The breakdown of doctors who have one or more computers is shown in Figure 4.3.2.1. One answer was given for each of the three options: Home PC, Office PC and Mobile PC. Doctors can own any number of each of the three options. Each of the three columns in the following chart totals 100%.

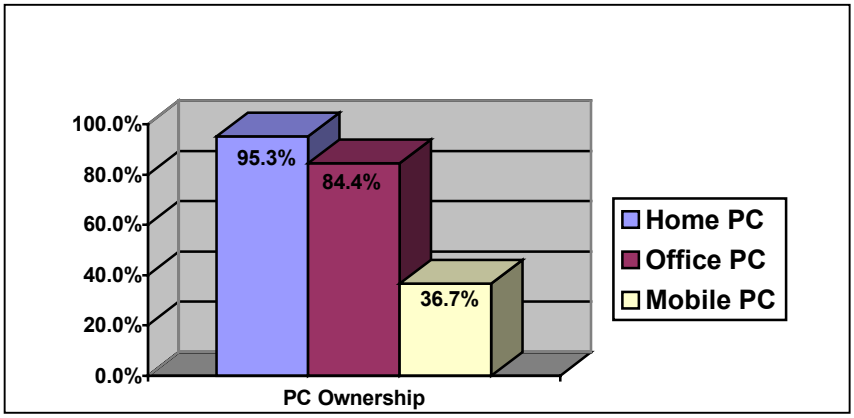

Figure 4.3.2.1: Computer Ownership among Doctors

Most doctors have computer access at home or in the office. Computers and Internet connectivity are no longer seen as luxury items, but common and necessary resources. Hospitals and clinics are increasingly committing more operational funds to IT equipment and connectivity. Mobile computing devices (e.g. PDAs) ownership is surprisingly high at 36.7%, perhaps indicating that more doctors are increasingly finding such devices useful as they move around and need information at their fingertips.

In the IDA Literacy Survey 2000, the results showed that "the usage of Personal Computer (PC) is the highest among the total residential population. The usage rates for the rest [Personal Digital Assistant (PDA), Wireless Application Protocol (WAP) Phone and Web TV] are low (10% or less)." [61]

In the IDA Household Survey 2000, the results showed that six out of ten homes in Singapore have at least one computer. (This figure would have risen by now in Year 2003, to perhaps seven or eight out of ten homes in Singapore.) The rapid increase in ownership was largely attributed to national programmes that promoted Infocomm

[61] IDA Infocomm Literacy Survey 2000, www.ida.gov.sg

usage among the general public and the workforce, as well as the emphasis on Infocomm usage in school curriculum. [62]

The following table shows a cross tabulation (CT) between "Computer Ownership" and "Age". Cross tabulations (or crosstabs) are necessary to derive more substantial and useful findings from the survey results.

CT1: Computer (PC) Ownership -- Age

The objective is to examine if age has a bearing on doctors' computer ownership.

Doctors who own PCs (%)	**≤ 30**	**31 to 40**	**41 to 50**	**51 to 60**	**> 60**
At home	100.0	96.0	96.3	97.5	85.1
In office	68.0	89.8	90.3	87.3	68.4
On the move	43.1	45.2	38.2	29.3	14.4

Table 4.3.2.1: Crosstab of Computer Ownership and Age

The rate of PC ownership at home is rather high and uniform across all age groups. It shows that PCs can be considered an almost essential tool at home.

The rate of PC ownership in the office is high among doctors aged 31 to 60 but decreases to 68.4% in those 60 years and older. Those younger than 30 years have only a 68.0% ownership of office computers.

Computers on the move (PDAs, Laptops) show a clear trend of over 43% for those younger than 30 and in those 31-40 years dropping stepwise to 14.4% in those 60 years and over.

[62] IDA Survey on Infocomm Usage in Households 2000, www.ida.gov.sg

The age group analysis shows that there is an age difference in the adoption of IT. Older doctors use less IT than younger doctors in the office and on the move (**supporting H5**).

Q2) How many hours do you spend on computing per week?

The following chart depicts the breakdown of the number of hours that doctors spend on computing each week.

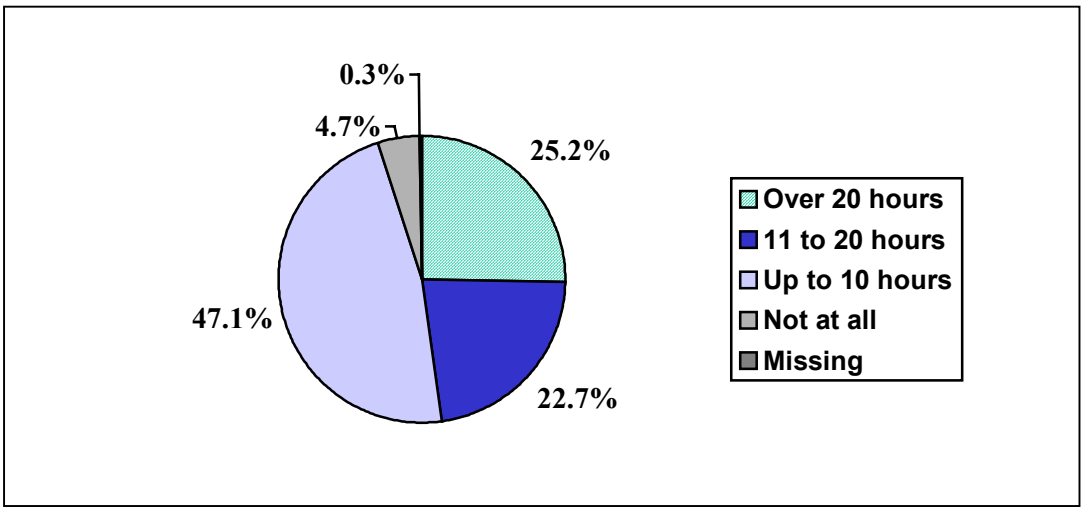

Figure 4.3.2.2: Number of Hours That Doctors Spend on Computing Each Week.

Nearly half of the doctors (47.1%) spends up to 10 hours a week on computing. One quarter spends over 20 hours.

CT2: Hours Doctors Spend on Computing -- Age

The objective is to examine if age has a bearing on the number of hours that doctors spend on computing.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Do computing each week	97.5	98.0	96.3	92.5	85.0

Table 4.3.2.2: Crosstab of Number of Hours Doctors Spend on Computing Each Week and Age

The rate of computing by doctors is high and rather uniform up to age 60. The 31 to 40 age group has the highest number of doctors computing each week at 98.0%.

85.0% of doctors aged above 60 does computing each week. A small group of doctors aged above 60 may be retired, or may not find computing necessary in their work. These doctors also belong to the older generation that is not as comfortable as the young generation with new technology.

4.3.3 IT Use At Home

Q3) What uses do you have for your computer at home?

The following chart illustrates the usage pattern of doctors for their home PCs.

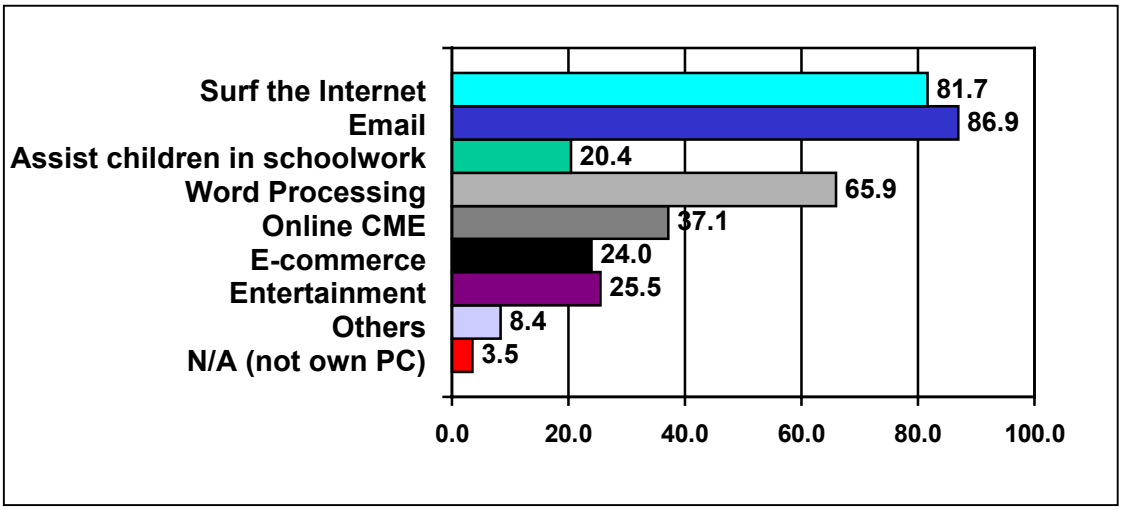

Figure 4.3.3.1: IT Uses Doctors Have for Their Home PCs.

The results show that doctors use the home PC mostly to email, surf the Internet for information, and do word processing.

CT3: Computer Use at Home -- Age

A breakdown by age group was done to examine if age affects the uses doctors have for their PCs at home.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Surf Internet for information	95.9	85.8	79.3	77.4	65.3
Email	95.1	89.2	84.6	87.4	74.3
Assist children in schoolwork	3.3	18.2	39.8	16.4	4.0
Word Processing	75.4	75.0	62.8	57.2	46.5
Online CME	30.3	37.8	36.5	44.7	32.7
E-Commerce	31.1	32.4	20.3	13.8	13.9
Entertainment	39.3	28.4	24.4	20.1	9.9
Others	8.2	7.4	7.5	10.7	10.9

Table 4.3.3.1: Crosstab of Number of Hours Doctors Spend on Computing Each Week and Age

The results show that the younger the doctors are, the more they surf the web. Across the age groups, the rate of emailing is rather high and uniform. This shows that emailing is a ubiquitous and important tool for communication. Doctors aged 41 to 50 use the home PC much (39.8%) to assist their children in schoolwork. Word processing is also widely used in the home. Online Continuing Medical Education (CME) is surprisingly uniformly high at around 38%. This figure looks likely to rise from Year 2003 onwards, as CME becomes compulsory. Doctors have to fulfill 50 CME credits every two years, in order to renew their practice licenses.

Doctors aged up to 40 use PCs to do electronic transactions (E-Commerce), for example in purchases of theatre tickets and books. The rest of the age groups have not adopted E-Commerce as readily, perhaps remaining somewhat distrustful of it. Doctors aged up to 30 use the PC much for entertainment (39.3%) compared to other age groups.

As age increases, the level of IT usage decreases (**satisfies H5**). This is evident in the above categories: Surf the Internet for information, Email, Word processing, E-Commerce and Entertainment.

Q4) The first time you logged onto the Internet was:

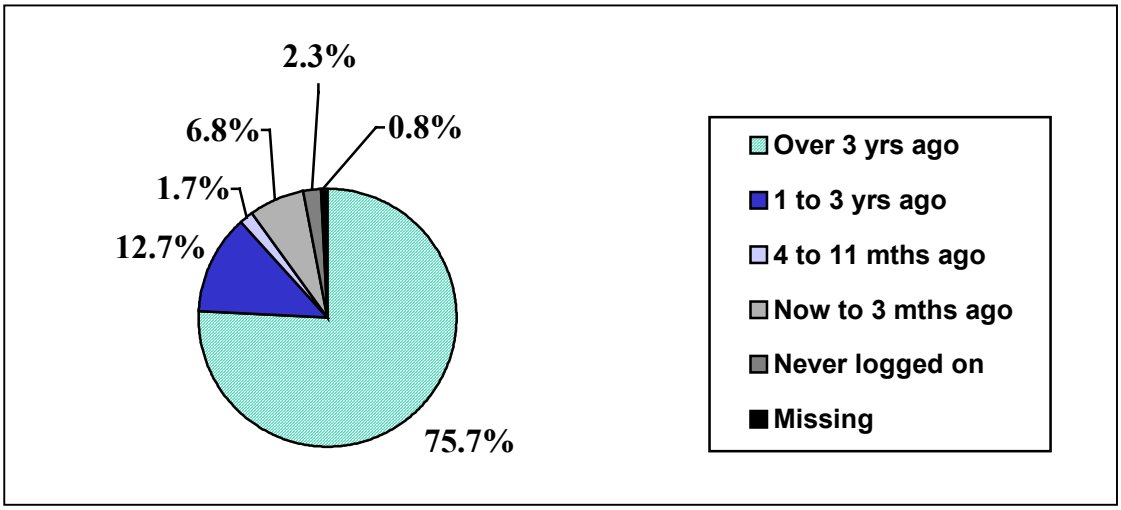

Figure 4.3.3.2: The First Time Doctors Logged onto the Internet

The figure of 75.7% for doctors who logged on over 3 years ago is surprisingly good. Respondents are either positively inclined towards computers or wish to project a higher competency rate. In either case, there may be a slight bias in results here.

The IDA Report 2000 [63] found that "younger and higher educated adults are more likely to be infocomm literate. Those who are fluent in English are more likely to be infocomm literate. Literacy level generally improves as the type of dwelling improves. Working adults are more likely to be infocomm literate as compared to non-working adults. The study also shows that the higher the personal monthly income, the higher will be the infocomm literacy". Doctors fulfill most of the criteria above, which explains why IT literacy level among doctors is high.

[63] IDA Infocomm Literacy Survey 2000, www.ida.gov.sg

CT4a: First Time Logged onto Internet -- Age

The objective is to examine if age affected when doctors first logged onto the Internet.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
First logged onto Internet over 3 years ago	87.8	87.4	73.4	66.7	47.5

Table 4.3.3.2a: Crosstab of When Doctors First Logged onto the Internet and Age

Across all the age groups, there is a clear decrease in rates of doctors who first logged onto the Internet over 3 years ago. The rate is highest at 87.8% for those up to 30 years old, followed by those aged 31 to 40 at 87.4%. The rate decreases to 47.5% for those aged above 60.

Doctors aged up to 40 are the best candidates to experiment with, or to adopt, new technology. It is expected that younger doctors adopt new technology faster than older doctors (**supporting H5**).

Q5) The speed of your current Internet connection is:

The speed of doctors' current Internet connectivity is as follows.

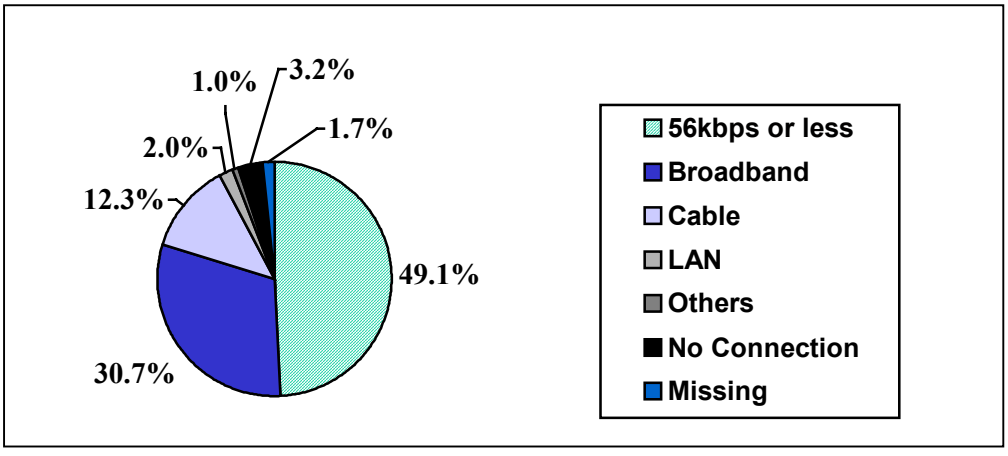

Figure 4.3.3.3: Speed of Doctors' Internet Connectivity

Most doctors view 56kbps connectivity as "too slow". They wish to upgrade to broadband connectivity but find it too expensive. SMA and some of the other medical organisations can assist doctors with getting more affordable rates for broadband connectivity. With Online CME being compulsory Year 2003 onwards, more doctors are expected to upgrade to Broadband or Cable connectivity.

The first IDA Roadmap, released in July 2000, identified broadband and mobile wireless as the key technologies for the local Infocomm industry for Years 2000 to 2005.[64] These technologies look set to be well deployed in the healthcare industry.

CT5: Speed of Internet Connection -- Age

The objective is to examine if age has a bearing on the speed of Internet connection that doctors choose.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Fast: broadband, cable, LAN	44.7	37.2	54.7	54.4	40.0
Slow: 56kbps dial-up or less	54.5	59.4	41.6	41.1	47.0
Difference	-9.8	-22.2	13.1	13.3	-7.0

Table 4.3.3.3: Crosstab of Doctors' Speed of Internet Connection and Age

The older and more established doctors, aged 41 to 60, adopt faster broadband, cable and LAN, than younger doctors (reversal of trend). This is due to broadband being much more expensive than dial-up. Younger doctors may not be able to afford it. Perhaps Internet Service Providers (ISP) could bring down the rates of high-speed connectivity so that people of all age groups may enjoy fast Internet speed.

[64] IDA Roadmap 24 July 2000, "First Infocomm Technology Roadmap - Charting the Future of Technology for Singapore", www.ida.gov.sg

4.3.4 IT Use At Work

Q6) On computer systems, the computer devices that you now use in your practice are:

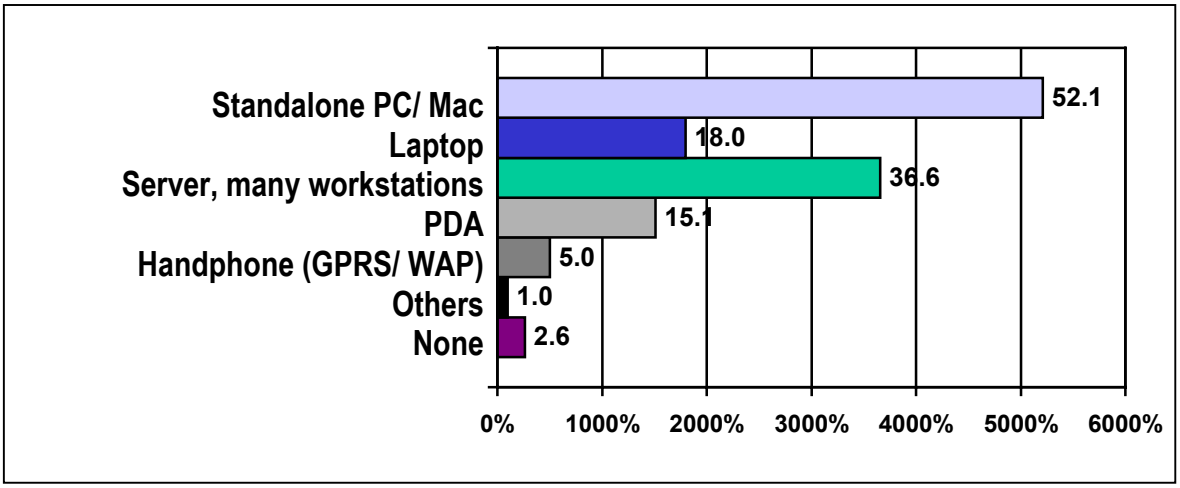

Figure 4.3.4.1: IT Devices Doctors Use at Work

CT6a: IT Devices at Work -- Type of Practice

The objective is to examine if the type of practice affects how doctors use their PCs at work. Short forms are used to display the entire chart within the space constraint.[65]

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Desktop	60.3	57.9	66.7	37.5	36.4	45.5	42.9	48.4	20.0
Laptop	13.5	26.3	0	18.8	9.1	19.5	28.6	9.7	20.0
Server	19.8	35.8	66.7	56.3	54.5	55.9	42.9	48.4	30.0
PDA	7.4	18.3	0	12.5	6.1	22.2	14.3	32.3	20.0
Hand-phones	3.3	7.9	0	6.3	0	5.1	0	6.5	10.0
Others	1.4	0.8	0	0	0	0.7	0	0	10.0
None	4.1	1.7	0	0	6.1	1.7	0	3.2	0

Table 4.3.4.1a: Crosstab of Doctors' IT Devices at Work and Type of Practice

[65] Short forms for practice types are GP (General Practitioner), Spec. (Specialist), Lab. (Laboratory), Other (Others), Poly. (Polyclinic), Hosp. (Hospital), Not Prac. (Not Practising). Short forms for IT devices are Desktop (Standalone PC or Macintosh), Server (Server with multiple workstations), PDA (Personal Digital Assistant), Handphones (with GPRS/ WAP).

The desktop (PC or Macintosh) remains the most highly used IT devices among doctors. Reasons include its affordability and its early entrance in the IT scene, compared with other IT products above.

H1: Organisational factors determine the types of IT devices used.

Public hospitals and polyclinics, forming large conglomerates, utilise many servers with multiple workstations. Networked computers are essential to operations. Standalone PCs are sufficient for Private GPs and Specialists, who mostly operate small clinics.

The laptop is more widely used by Private GPs and Specialists than public doctors. Perhaps private doctors can afford more expensive IT devices. The Personal Digital Assistant (PDA) is widely used among public hospital doctors and private specialists. The handphone (with latest GPRS and WAP technology) has an adoption rate of less than 10% and does not appear to be popular among doctors.

Private laboratories are well-equipped with many servers and desktops. They are usually well-funded. Public laboratories not only have servers with multiple workstations. They also utilise PDAs and laptops.

Thus, organisational structures of healthcare institutions (hospitals, polyclinics, group/ solo clinics, laboratories, etc) affect the degree of IT adoption at work, the type of IT devices used, and the ways in which IT is used (**supports H1**).

CT6b: IT Devices at Work -- Age

The objective is to examine if age affects how doctors use IT devices at work.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Desktop	49.6	51.5	56.2	55.9	51.1
Laptop	14.9	20.7	20.2	15.5	12.8
Server	43.8	44.8	32.2	34.2	20.2
PDA	25.6	17.9	13.5	11.2	5.3
Hand-phones	3.3	4.8	7.9	5.0	2.1
Others	0	1.1	1.5	1.2	1.1
None	3.3	2.0	2.2	3.1	5.3

Table 4.3.4.1b: Crosstab of Doctors' IT Devices at Work and Age

Most of the above IT devices register an upward and then gradual downward usage trend. The PDA, despite being a relatively new technology that came into the IT scene less than five years ago, is popular among younger doctors aged up to 40.

The job scope of every doctor changes with age. Hence, the use of IT is related to the nature of work at every stage of a doctor's career (**supporting H3**). From age 25 to 34, doctors are Housemen or Medical Officers working in hospitals. Around age 35, doctors leave hospitals and polyclinics to set up their private GP or specialist clinics. From age 60 onwards, some doctors retire from practice.

Q7) Is the computer at your workplace connected to the Internet?

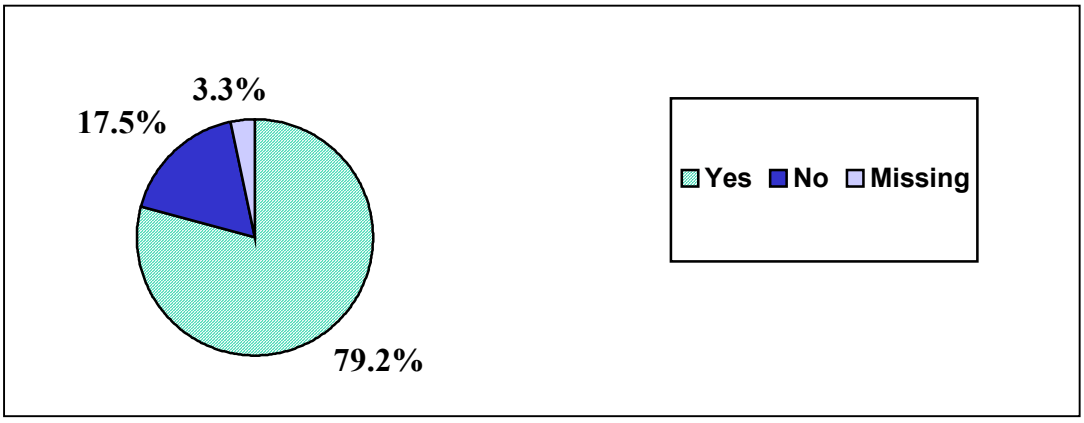

Figure 4.3.4.2: Computer at Workplace Connected to the Internet

The most cited reason for non-connectivity to the Internet is concern that a connection to the Internet may cause system corruption or introduce viruses into the computer.

CT7: Work PC Connected to the Internet -- Type of Practice

The objective is to examine if the type of practice affects the rate of Work PCs being connected to the Internet.

Drs. (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Work PC connected to Internet	70.3	81.3	100.0	75.0	88.2	96.7	85.7	80.0	55.6

Table 4.3.4.2: Crosstab of Doctors' Work PCs Connected to the Internet and Type of Practice

The public sector is better connected to the Internet than the private sector (**supporting H2**). The exception is private laboratory sector that has more funds due to the nature of work. Non-practising doctors are the least connected.

In the private sector, Specialist and Laboratory doctors are more connected to the Internet than GPs. In the public sector, workplaces are very well connected to the Internet (over 80%), with public hospitals and polyclinics leading the way.

Future studies can focus on comparisons of IT adoption rates between Private GPs in group practices and those in solo practices.

Q8) The factor(s) that have motivated you to computerise are (please tick all applicable):

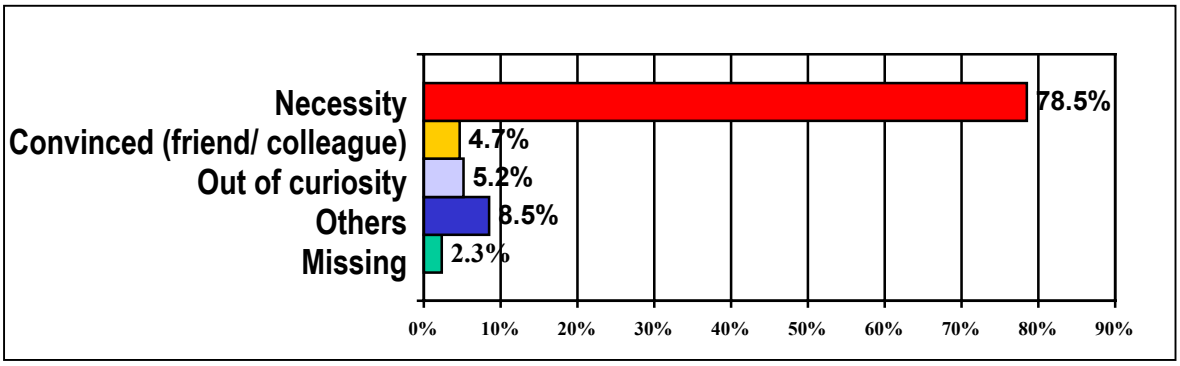

Figure 4.3.4.3: Factors Motivating Doctors to Computerise at Work

The top reason to computerise in the office is "Necessity" (78.5%).

CT8: Factors Motivating Doctors to Computerise -- Type of Practice

The objective is to examine if the type of practice affects doctors' decisions to computerise.

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Necessity	74.2	81.6	100.0	80.0	72.7	88.2	71.4	83.9	60.0
Convinced by friend/ colleague	4.1	5.0	0	6.7	6.1	5.1	14.3	9.7	0
Curiosity	4.1	7.5	0	6.7	6.1	4.7	14.3	12.9	0
Others	9.3	6.3	0	20.0	21.2	8.4	14.3	9.7	0

Table 4.3.4.3: Crosstab of Factors Motivating Doctors to Computerise and Type of Practice

Necessity is a major factor for doctors computerising. This is seen in all types of practice. Doctors adopt IT due to various factors brought on by necessity, e.g. competition in the healthcare industry, government regulations, etc.

Q9) You use your computer system(s) in the office for (please tick all applicable):

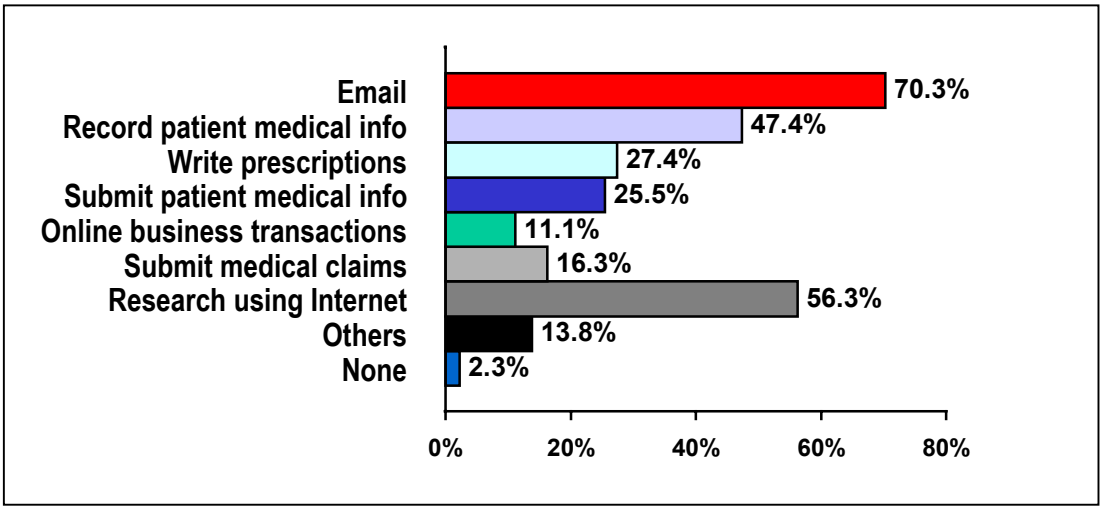

Figure 4.3.4.4: Computer Usage at Work

Doctors use the office PC mainly for email and research purposes.

In the IDA Literacy Survey 2000 report, the usage of general office applications varies among the infocomm literate group, with 97% performing e-transactions, 77% using word processing and 50% using spreadsheets. The results of the top two usage categories in this survey coincide with those of IDA Household Survey 2000. IDA reported that "Email/ Chat remains the 'killer applications' for Internet users in 2000, with 92% of respondents using it. The other most frequently used applications are Information retrieval (75%), Web applications (40%), and News/ Webcast (40%)." [66]

[66] IDA Survey on Infocomm Usage in Households 2000, www.ida.gov.sg

CT9a) Computer Use at Work -- Type of Practice

The objective is to see if the type of practice affects doctors' computer use at work.

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Email	55.1	73.4	100.0	60.0	78.8	89.6	85.7	86.7	50.0
Record Patient info	45.5	54.6	66.7	33.3	27.3	52.5	28.6	45.2	0
Prescrip-tions	24.0	22.1	0	13.3	12.1	41.8	0	29.0	0
Submit patient info	26.2	20.4	33.3	0	45.5	32.0	28.6	9.7	0
Online purchases	15.2	10.8	0	13.3	6.1	8.1	14.3	12.9	0
Submit claims	36.4	7.5	33.3	6.7	6.1	4.4	0	3.2	0
Online research	31.4	57.5	100.0	46.7	57.6	87.2	71.4	77.4	40.0
Others	9.1	17.9	33.3	0	15.2	15.8	28.6	16.1	30.0
None	3.6	2.1	0	6.7	6.1	0.7	0	3.2	0

Table 4.3.4.4a: Crosstab of Doctors' Computer Use at Work and Type of Practice

Email usage is high in almost all categories. Only Private GPs and retired doctors do not use email so extensively (less than 60%) compared to doctors in other types of practice. Doctors in public hospitals use the computer more frequently than their private practice counterparts to record patient's medical information, write prescriptions, and submit patient specific information (e.g. over the Electronic Notification System). The reason could be due to public hospitals' mandatory policies.

Doctors in private practice use the computer to submit medical claims more than their public counterparts, while doctors in public hospitals, private and public laboratories, frequently use the computer to do research over the Internet.

Doctors in private laboratories use IT more over those in public laboratories (**not supporting H2**). Areas include online research, recording of patients' medical information, and submitting medical claims.

However, overall, the public organisations utilise IT more during work than private organisations (**supporting H2**).

CT9b) Computer Use at Work -- Age

The objective is to see if age affects doctors' computer use at work.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Email	75.2	76.8	70.8	70.2	53.7
Record Patient info	58.7	51.0	46.6	47.8	30.5
Prescriptions	40.5	33.9	24.4	19.9	12.6
Submit patient info	32.2	28.0	18.8	29.8	20.0
Online purchases	6.6	12.3	10.9	13.0	11.6
Submit claims	4.1	19.3	17.7	21.7	11.6
Online research	75.2	66.9	53.0	49.1	25.3
Others	8.3	14.3	15.0	13.0	20.0
None	1.7	1.1	2.6	2.5	6.3

Table 4.3.4.4b: Crosstab of Doctors' Computer Use at Work and Age

The results are rather uniform across all age groups. Doctors aged up to 40 use medical IT applications actively. Doctors aged over 60 use the computer less than other age groups for work, perhaps retired or have not adopted IT in their work. Age does not appear to play a major differentiating role in determining computer usage rate for work among doctors (**not supporting H5 much**).

Q10) If there is a central portal for medical applications, what type of applications do you see as useful for this portal? Please list three most useful applications.

On useful medical applications for a central medical portal, doctors cite preference for an online community-based portal with features such as Discussion Forums for clinical topics, Singapore Doctors' Directory, Locum Listings, Electronic Medical Records, Research and Drug Databases, Medical news and alerts, and Continuing Medical Education.

The next two questions examine the level of usage for two specific medical applications that need online submission.

Q11) Are you currently using the Electronic Notification System to submit notifications of infectious diseases?

Q12) Do you personally update your Continuing Medical Education (CME) training credits via Singapore Medical Council's CME website?

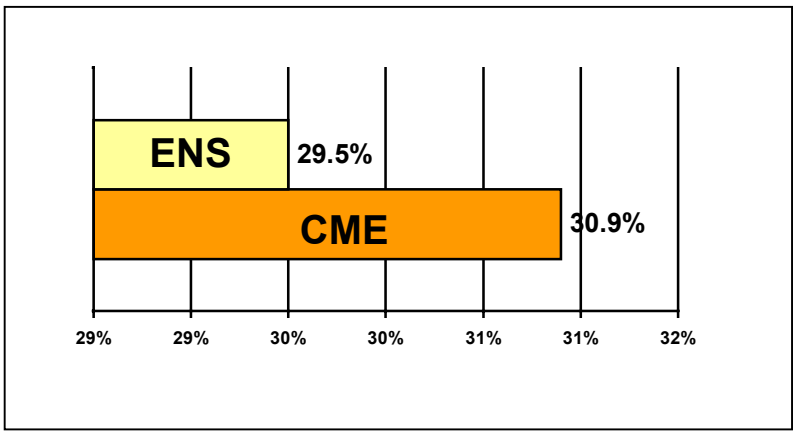

Figure 4.3.4.5: Usage of Online ENS and CME Systems

Doctors visit the SMC-CME website more to update their CME credits than visit the ENS website to update notifications on infectious diseases.

CME is compulsory for all doctors now. They have to accumulate 50 credit points every two years in order for their practice licenses to be renewed by SMC. Submission of CME credits is done online, via the SMC-CME system. Thus, from 2003 onwards, the number of doctors who use the SMC-CME website is likely to increase.

However, there are some doctors who do not personally use the ENS and CME system, as they delegate administrative work to support staff, such as department secretaries, nurses, clerks, hospital administrators, medical officers and housemen. A problem with delegation is that the staff is often not trained to use the applications. A few doctors have also indicated that they could not remember the passwords for the various systems. Additionally, there is an administrative charge imposed by SMC, which acts as a deterrent for logging in. The system is not user-friendly in this aspect.

The feedback (120 responses) for ENS is that since most doctors encounter infectious diseases patient cases infrequently, they may have forgotten how to use the ENS online system.[67] Moreover, certain medical specialties do not encounter patients with infectious diseases (e.g. Anesthesia, Psychiatry), and therefore these doctors do not need to use the system.

[67] Perhaps this has changed since the Severe Acute Respiratory Syndrome (SARS) outbreak in Singapore from Mar to May 2003. It is compulsory for doctors to notify infectious diseases cases in the MOH website.

CT11: Electronic Notification System (ENS) -- Type of practice

The Electronic Notification System (ENS) is an online system used by doctors to report to the Ministry of Health on infectious diseases. The objective is to examine if doctors' types of practice affect the rate of ENS notification.

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Yes, using the ENS	23.2	27.5	66.7	12.5	67.6	40.1	28.6	20.0	0

Table 4.3.4.5a: Crosstab of Doctors' Use of the Electronic Notification System and Type of Practice

ENS is mostly used by doctors in public polyclinics and hospitals, and private laboratories. Only a small selection of Private GPs and Specialists use ENS. This is due to more enforcement of ENS usage in public institutions.

CT12a: Update CME points in SMC's CME System -- Type of practice

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Yes, using the ENS	27.3	36.0	33.3	31.3	54.5	28.9	57.1	45.2	33.3

Table 4.3.4.5b: Crosstab of Doctors' Use of SMC's Continuing Medical Education System and Type of Practice

CT12b: Update CME points in SMC's CME System -- Age

The objective is to see if age affects doctors' use of Singapore Medical Council's online Continuing Medical Education (CME) system to update CME credits.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Yes, using online SMC's CME system	19.7	33.6	32.1	38.4	28.7

Table 4.3.4.5c: Crosstab of Doctors' Use of SMC's Continuing Medical Education System and Age

The rate of SMC's online CME system usage is rather uniform (approximately 30%) in all categories, except for doctors aged 30 and below. Many of them are Housemen or Medical Officers working in hospitals. Housemen do not need to accumulate CME points; Medical Officers can accumulate CME credits easily over ward rounds and attending various hospital seminars. The hospitals, being the seminar organisers, usually update the points for seminar attendees.

Q13) If you do not use IT in the course of your work, why? Please tick all applicable.

There were not many responses on why doctors do not use IT in the course of their work. Some of the reasons are found in the following chart.

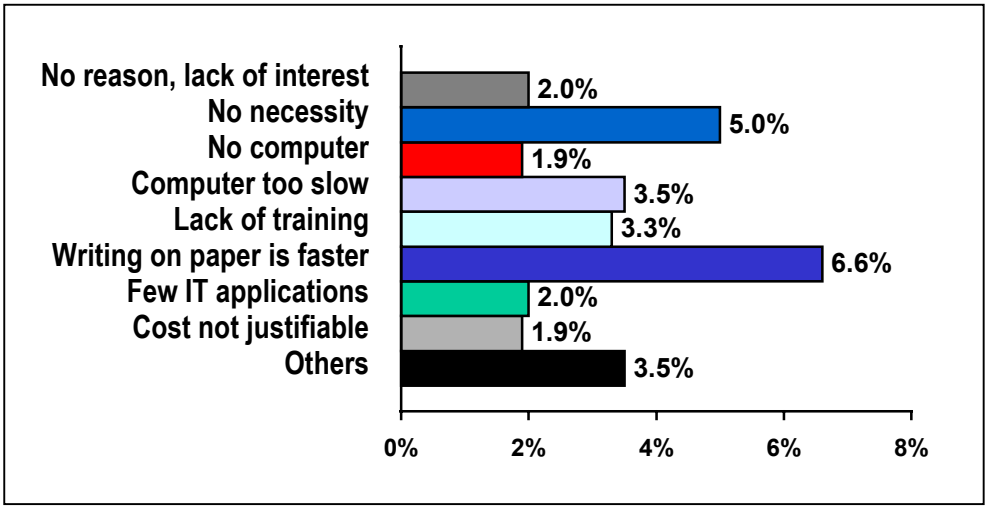

Figure 4.3.4.6: Reasons Why Doctors Do Not Use IT in Work

Other reasons include "high touch over high tech". Patients may be more comfortable when doctors spend more time examining and talking to them, rather than focusing their attention on computers and typing away.

Further information on why some doctors choose not to adopt IT in work is found in Chapters Five and Six.

Cross-compared with the IDA Report 2000 on barriers to IT adoption, many citizens cited the lack of knowledge/ skills to use Infocomm technology as a reason for not owning a computer or subscribing to the Internet. To address this, IDA has introduced training initiatives such as the National IT Literacy Program (NITLP) and the Infocomm Competency Program to provide customised training to meet specific needs of the trainees. Senior citizens are also encouraged to participate in NITLP classes to enable lifelong learning and to enjoy the benefits of an e-lifestyle.[68]

CT13a: Non-Usage of IT in Work -- Type of Practice

The objective is to explore if the type of practice affects doctors' non-usage of IT at work.

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
No reason	3.9	2.1	0	0	3.0	0.3	0	0	0
No necessity	8.8	7.1	0	6.3	0	0.7	0	0	0
No PC	3.3	0.8	0	6.3	3.0	1.4	0	0	0
PC too slow	4.1	2.1	0	6.3	6.1	4.7	14.3	0	0
Lack of training	4.7	3.3	0	6.3	6.1	2.0	0	0	0
Writing on paper faster	11.8	5.4	0	12.5	12.1	1.7	0	3.2	0
Few IT applications	2.5	1.7	0	6.3	0	2.0	0	0	0
Cost not justifiable	3.3	2.5	0	6.3	0	0	0	0	0
Others	3.3	3.3	0	0	12.1	3.4	0	6.5	0

Table 4.3.4.6a: Crosstab of Reasons Why Doctors Do Not Use IT at Work and Type of Practice

Many doctors did not respond to this question. One reason is that they already use the PC to some degree at their work. Another possibility is they simply do not wish to reveal they do not use the PC at work, in case they are identified and coerced by the regulatory bodies into doing so.

[68] IDA Survey 21 Aug 2001, "Over Half Of Singapore Households Embracing An E-Lifestyle Making

Of the few doctors who have responded to this question, the results show that besides those in the category "Private Others", Private GPs are interestingly the ones who are most resistant to technology. They cite reasons such as "No necessity to use IT in my work", "Lack of training", and "Writing on paper is faster, not comfortable using a PC/ Macintosh".

Private GPs, especially those in solo practices, are the ones that MOH and medical organisations can pay more attention to, expose them to technology (e.g. through IT training) and demonstrate how IT can assist doctors in their work.

CT13b: Non-Usage of IT in Work -- Age

The objective is to explore if age affects doctors' non-usage of IT at work.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
No reason	0.8	1.4	1.1	4.3	4.2
No necessity	1.7	2.5	5.2	7.5	15.8
No PC	2.5	2.0	0.7	1.2	5.3
PC too slow	8.3	3.4	2.6	3.1	2.1
Lack of training	1.7	2.5	2.6	5.0	9.5
Writing on paper faster	5.0	4.5	6.7	9.3	12.6
Few IT applications	5.8	1.4	1.5	2.5	0
Cost not justifiable	0	0.8	3.0	3.1	3.2
Others	4.1	2.8	4.5	3.1	3.2

Table 4.3.4.6b: Crosstab of Reasons Why Doctors Do Not Use IT at Work and Age

Doctors aged 51 and above, especially aged over 60, feel that there is no necessity to use the PC at work, there is lack of IT training, writing on paper is faster, and the cost in having an IT system at work is not justifiable (**supporting H6: mindset and past IT experiences**).

Singapore A Place Where The 21st Century Feels Like Home", www.ida.gov.sg

The younger doctors, aged 30 or less, feel that the PCs at work are too slow and there are too few medical IT applications available.

Q14) What types of IT courses have you attended?

The following chart displays a list of some of the IT courses which doctors have attended.

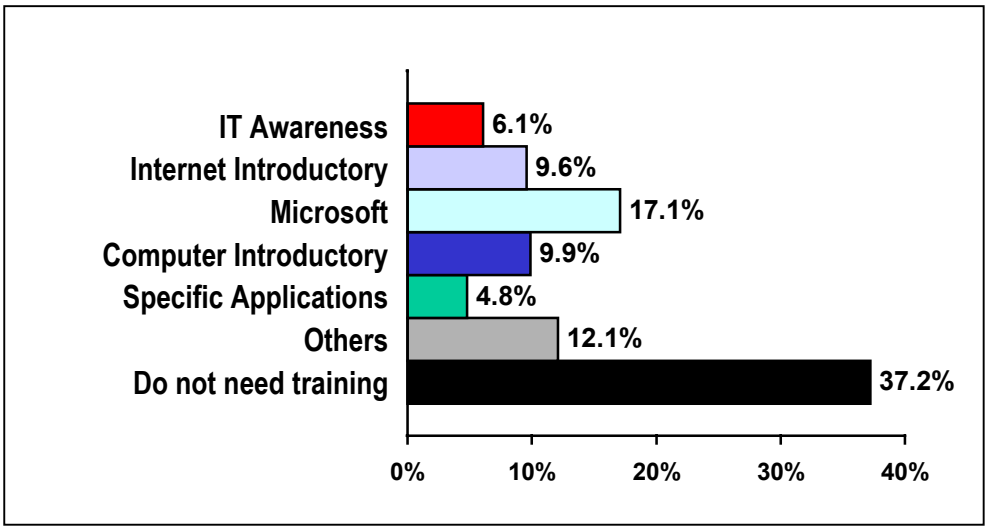

Figure 4.3.4.7: Types of IT Courses that Doctors Have Attended

CT14a: IT Training Attended -- Type of Practice

The objective is to examine if the type of practice affects doctors' IT training choices.

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
IT awareness	6.9	6.7	0	12.5	6.1	3.7	14.3	16.1	20.0
Internet introduction	9.9	11.7	0	12.5	15.2	6.8	28.6	16.1	0
Microsoft	6.9	23.3	33.3	18.8	15.2	22.3	42.9	38.7	30.0
Computer introduction	9.9	14.2	0	12.5	12.1	6.4	28.6	16.1	10.0
Specific applications	2.8	3.3	33.3	6.3	6.1	8.1	14.3	6.5	20.0
Others	14.0	11.3	0	18.8	21.2	10.5	0	16.1	0
Not need training	36.9	37.9	33.3	25.0	33.3	44.6	28.6	29.0	10.0

Table 4.3.4.7a: Crosstab of IT Training Courses Doctors Have Attended and Type of Practice

Doctors who have undergone IT training come mostly from public and private laboratories, and public and private "Others". Private GPs do not seem to have gone for much IT training, most probably due to the long hours they work (typically 9am to 9pm on weekdays, and 9am to 1pm on Saturdays; some work on Sundays too).

An important result is that a high percentage of doctors (approximately 35%) feel that they do not need formal training at all. Some doctors indicate that they self-learn IT or learn it from their friends and colleagues.

CT14b: IT Training Attended -- Age

The objective is to examine if age affects doctors' IT training choices.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
IT awareness	4.1	2.5	7.5	9.3	13.8
Internet introduction	4.1	4.5	10.4	16.1	23.2
Microsoft	16.5	15.8	22.4	18.0	11.6
Computer introduction	5.0	5.4	10.4	14.3	26.3
Specific applications	5.0	5.6	5.6	3.1	2.1
Others	7.4	13.8	13.4	11.8	11.6
Not need training	50.4	46.1	33.6	30.4	19.1

Table 4.3.4.7b: Crosstab of IT Training Courses Doctors Have Attended and Age

The most popular courses are Microsoft and Internet Introductory. A high percentage of doctors (around 18%) across all age groups have attended Microsoft courses. Supply can be created by organising more Microsoft courses, facilitated by the Singapore Medical Association (SMA). Currently, SMA has, in collaboration with One Learning Place (OLP) [69], facilitated the training of over 300 doctors in Internet Introductory and Microsoft courses since 2001. More such courses can be arranged. The Ministry of Health, Clusters and medical organisations can arrange for more courses on specific medical IT applications.

[69] One Learning Place, www.olp.com.sg

Many doctors who have gone for IT training are aged 41 and above. They see IT as a useful tool to be deployed in their work and lives. Most have not received formal IT training in school or in the course of their work.

Younger doctors aged 40 and below seem rather IT-savvy. A high percentage (around 48%) of younger doctors feel that IT training is not necessary.

There is a growing awareness of the value of Infocomm usage among Singaporeans. IDA continues to drive public education programs to raise awareness and adoption of an e-lifestyle. To increase IT literacy, IDA subsidies up to 80% of the course fees for programs conducted by training schools such as One Learning Place. OLP conducts courses such as basic Internet and Computing, Microsoft Office, and Web development. Many Singaporeans have benefited from these heavily subsidised IT lessons, including doctors.

The government also encourages IT adoption in school, by making sure that all students have easy access to computers. There is widespread availability of over 7000 public Internet access points in community libraries, cyber cafes and schools. [70] Students learn computing from the teachers and are involved in projects that require hands-on practice on computers. Many doctors, especially those from the older generation, gave feedback that they did not have formal IT training in school nor much practice at work. Hence, they did not have the chance to pick up computing. It is recommended that the National University of Singapore and other relevant universities should incorporate IT learning in their medical curriculum.

[70] IDA Survey 21 Aug 2001, www.ida.gov.sg

4.3.5 The Future

Q15: Future IT Uses that you intend to adopt are:

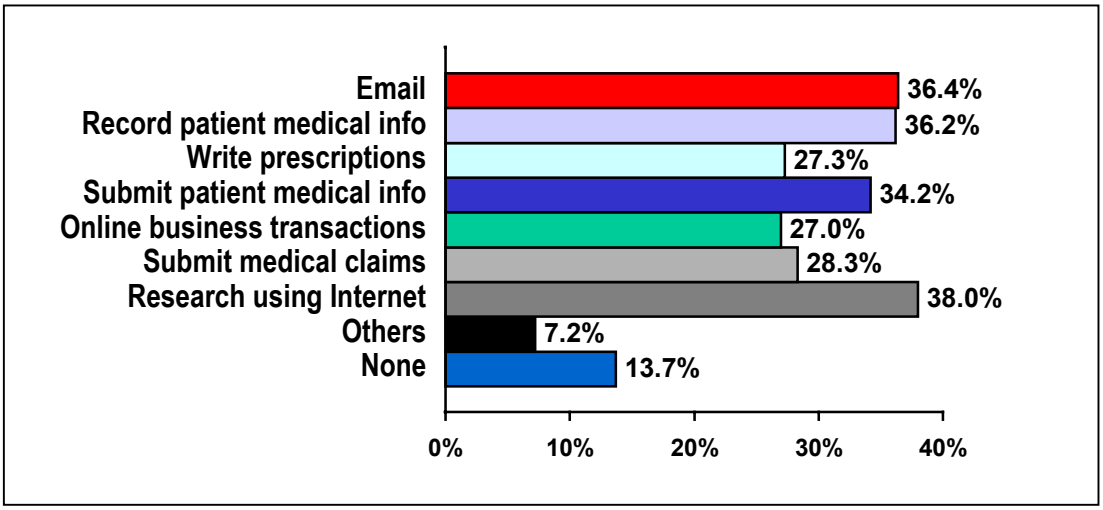

Figure 4.3.5.1: Future IT Uses Doctors Intend to Adopt

The top three IT applications doctors intend to adopt in the future are Research using the Internet, Email and Recording of patients' medical information. There are also calls for other uses such as CME, Hospital Medical Records, and Medical Library.

CT15a: Future IT Uses to Adopt -- Type of Practice

The objective is to examine if the type of practice affects doctors' decision-making of future IT uses to adopt.

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Email	42.1	36.1	33.3	47.1	36.4	30.0	28.6	26.7	50
Record Patient info	32.3	33.2	66.7	41.2	60.6	44.0	14.3	33.3	0
Prescrip-tions	26.8	21.4	33.3	35.3	54.5	31.4	0	30.0	0
Submit patient info	40.2	32.8	0	47.1	33.3	30.4	0	33.3	7.1
Online purchases	29.0	25.6	0	47.1	9.1	28.0	28.6	30.0	14.3
Submit claims	32.5	26.1	0	41.2	15.2	27.6	42.9	23.3	7.1
Online research	37.4	37.4	0	70.6	42.4	37.9	28.6	43.3	21.4

Others	8.5	7.6	33.3	5.9	6.1	5.5	0	10.0	7.1
None	13.1	13.9	66.7	11.8	3.0	13.7	28.6	20.0	35.7

Table 4.3.5.1a: Crosstab of Future IT Uses Doctors Intend to Adopt and Type of Practice

Doctors in categories "Private GP", "Public Hospital" and "Private Others" indicate their intention to adopt more IT uses during work in the future. The IT uses are email, writing prescriptions, submitting patient specific medical information, online business transactions (e.g. ordering of pharmaceutical products from the Internet), submitting medical claims and conducting research over the Internet.

CT15b: Future IT Uses to Adopt -- Age

The objective is to examine if age affects doctors' decision-making of future IT uses to adopt.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Email	36.9	28.7	37.8	42.1	52.5
Record Patient info	46.7	38.4	33.7	37.7	22.8
Prescriptions	35.2	29.3	26.2	26.4	16.8
Submit patient info	41.8	32.1	33.0	34.0	35.6
Online purchases	36.9	28.1	24.7	26.4	18.8
Submit claims	33.6	29.3	27.3	27.0	23.8
Online research	45.9	37.5	33.3	41.5	38.6
Others	3.3	8.0	8.6	6.9	6.9
None	11.5	14.8	13.9	13.2	12.9

Table 4.3.5.1b: Crosstab of Future IT Uses Doctors Intend to Adopt and Age

Doctors aged up to 40 indicate that they are most willing to adopt the following IT uses: record patient's medical information, write prescriptions, submit patient specific medical information, conduct online business transactions (e.g. order pharmaceutical products from the Internet), submit medical claims and conduct research over the Internet.

Q16) The computer equipment that you intend to buy within the next one to two years are:

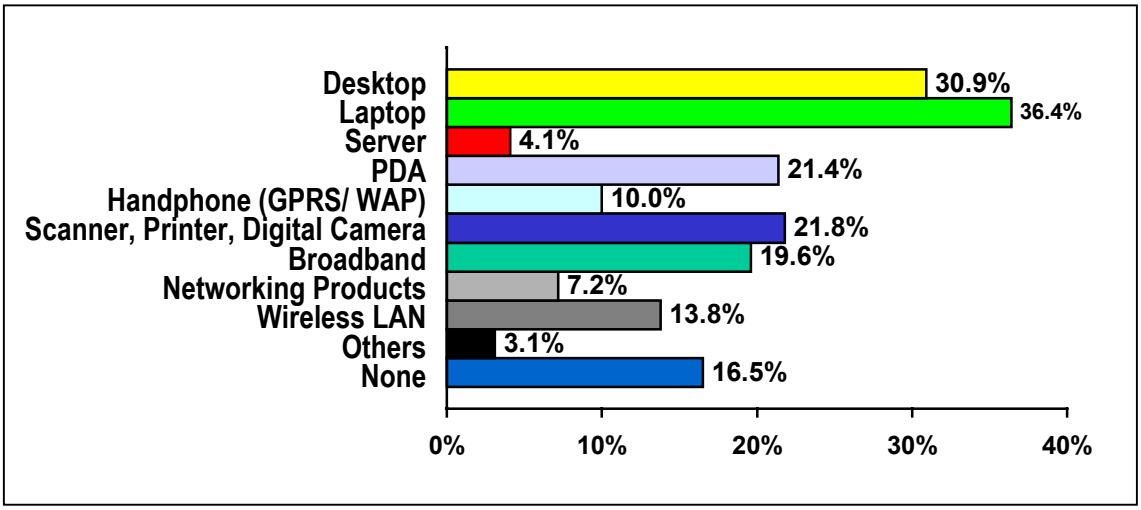

Figure 4.3.5.2: Doctors' Future IT Purchases

The top IT items in a doctor's purchasing list are Laptop, Desktop, Scanner/ Printer/ Digital Camera, Personal Digital Assistant (PDA) and Broadband. The immediate task for medical organisations would be to assist doctors in getting good equipment and connectivity at affordable prices. Wireless technology also looks set to be widely adopted in hospitals and clinics in the near future.

CT16a: Future IT Purchases -- Type of Practice

The objective is to examine if the type of practice affects doctors' decision-making in purchasing IT products within the next one to two years.

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Desktop	30.4	32.4	33.3	29.4	24.2	30.4	42.9	40.0	21.4
Laptop	29.3	37.4	66.7	23.5	36.4	44.0	71.4	46.7	28.6
Server	5.5	3.8	0	0	0	3.4	28.6	0	0
PDA	14.8	21.4	66.7	23.5	24.2	27.6	28.6	46.7	7.1
Handphone (GPRS/ WAP)	6.8	11.8	33.3	11.8	6.1	12.3	14.3	16.7	7.1
Scanner/ printer/ digital camera	17.8	18.1	66.7	29.4	18.2	30.0	28.6	23.3	7.1

Broadband	16.7	17.2	33.3	17.6	27.3	23.2	14.3	36.7	14.3
Networking products	6.6	8.4	0	11.8	6.1	7.5	14.3	6.7	0
Wireless LAN	10.1	14.3	33.3	23.5	6.1	18.4	14.3	16.7	14.3
Others	4.7	3.4	0	5.9	0	1.7	0	0	7.1
None	20.3	12.6	0	17.6	24.2	13.3	28.6	6.7	42.9

Table 4.3.5.2a: Crosstab of Doctors' Future IT Purchases and Type of Practice

Doctors in laboratories are likely to purchase more new IT equipment. This could be related to the nature of their work (research and discovery) requiring constant adoption of new technology (**supporting H4**).

Doctors in public hospitals and polyclinics indicate the need for IT equipment purchases, with costs borne by the hospitals and clinics. Private GPs and Specialists are not likely to purchase much new IT equipment, primarily as costs are borne by themselves (**supporting H3**).

Popular future IT purchases include the desktop, laptop, PDA and broadband connectivity. Among the new innovations, Wireless LAN and Handphone (GPRS or WAP capability), the former is more likely to be adopted.

CT16b: Future IT Purchases -- Age

The objective is to examine if age affects doctors' decision-making in purchasing IT products within the next one to two years.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Desktop	39.3	29.5	29.6	30.2	30.7
Laptop	46.7	39.5	34.1	33.3	22.8
Server	4.1	4.5	5.2	3.1	1.0
PDA	29.5	24.4	20.2	20.1	6.9
Handphone (GPRS/ WAP)	9.8	13.4	8.6	8.8	5.0
Scanner/ printer/ digital camera	34.4	26.7	16.5	17.0	10.9

Broadband	25.4	22.4	18.7	16.4	10.9
Networking products	8.2	8.8	6.7	6.9	2.0
Wireless LAN	12.3	15.9	15.7	13.8	4.0
Others	0	3.1	3.0	4.4	5.0
None	9.0	15.6	18.4	17.6	21.8

Table 4.3.5.2b: Crosstab of Doctors' Future IT Purchases and Age

Doctors in age groups "less than 30" and "31 to 40" are most likely to purchase IT products in the next one to two years (**supporting H5**). These two age groups should be the target groups that IT sales and marketing personnel are to focus their attention on. As such, this study also provides useful data on market research.

Among the favourite IT products that young doctors intend to buy, are the following (in order of priority): laptop, desktop, scanner/ printer/ digital camera, PDA and broadband connectivity. Among the newer IT products, Wireless LAN is favoured over Handphone with GPRS/ WAP capability.

Doctors in the age groups "over 60" and "51 to 60" are not likely to purchase many IT products in the next one to two years (**supporting H5**).

Q17) What kind of IT training do you think would be useful for you?

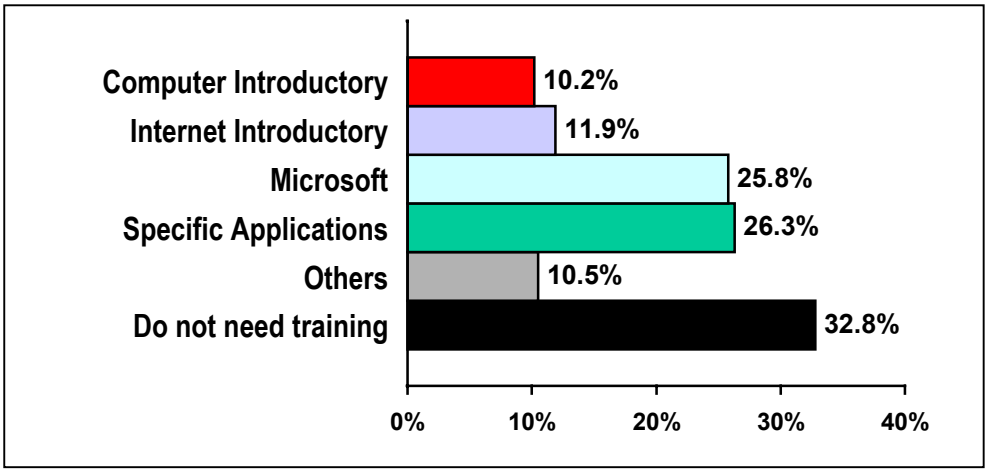

Figure 4.3.5.3: IT Training that Doctors Think Are Useful to Them

The popular courses that doctors would like to attend are Specific Medical-IT Applications and Microsoft (PowerPoint, Word, Excel).

An interesting finding is that almost one third of the respondents feel that they do not need training and can self-learn. Respondents who indicate that they would attend training mention the following type of courses - Microsoft products (eg. PowerPoint, Excel, Access), Statistical tools (eg. SPSS), Digital photo and webpage editing, and Specific applications (eg. ENS, EMR).

Further verification of the needs of doctors in training, hardware and software was obtained through Chapters Five and Six.

CT17a: Future IT Training -- Type of Practice

The objective is to examine if the type of practice affects doctors' choices in future IT training.

Doctors (%)	Private				Public				Others
	GP	Spec.	Lab.	Other	Poly.	Hosp.	Lab.	Other	Not Prac.
Computer Introductory	13.4	10.5	0	5.9	15.2	6.8	0	0	21.4
Internet Introductory	15.6	12.2	0	11.8	15.2	8.2	14.3	3.3	7.1
Microsoft	30.1	26.9	0	23.5	45.5	18.8	14.3	20.0	21.4
Specific applications	26.0	27.7	0	29.4	18.2	27.0	42.9	30.0	14.3
Others	7.9	9.7	0	11.8	15.2	13.3	0	20.0	7.1
Not need training	33.1	31.1	66.7	29.4	27.3	35.4	42.9	20.0	35.7

Table 4.3.5.3a: Crosstab of Doctors' Choices on Future IT Training and Type of Practice

Doctors who indicate they need IT training are from public polyclinics (possibly little opportunity for IT training), Private GPs (who are too busy for training or feel that training costs are high), and non-practising doctors (likely retired and have free time

to pick up computing skills). This **supports H3**. It is a good sign that doctors are willing to be IT-trained.

The Ministry of Health and medical organisations can look into the provision of such IT courses for doctors (in the following order of importance): Microsoft, specific medical applications, Internet Introductory and Computer Introductory.

Doctors in private and public laboratories seem confident that they do not need IT training. They are likely to be in constant touch with the latest technology due to the nature of their work.

CT17b: Future IT Training -- Age

The objective is to examine if age affects doctors' choices in future IT training.

Doctors (%)	≤ 30	31 to 40	41 to 50	51 to 60	> 60
Computer Introductory	6.6	8.0	8.6	15.1	19.8
Internet Introductory	6.6	8.8	10.9	20.1	18.8
Microsoft	21.3	20.7	24.3	35.2	37.6
Specific applications	27.0	23.3	26.2	32.1	25.7
Others	11.5	12.5	10.9	8.2	5.0
Not need training	33.6	40.1	33.0	24.5	20.0

Table 4.3.5.3b: Crosstab of Doctors' Choices on Future IT Training and Age

Those who indicate they need training most are doctors aged 51 and above. They have not been exposed to IT much and would like to pick up IT skills. For doctors in the 51 to 60 age group, their careers are well established. They can now make time to learn IT as they perceive such skills to be useful. Some doctors aged over 60 are retired and have plenty of time. They wish to catch up with their children and grandchildren in terms of IT knowledge.

A relatively high percentage (approximately 37%) of younger doctors aged up to 40 feel that they do not need IT training (**supporting H5**). They mostly pick up computing skills on their own or learn from their friends and colleagues.

4.4 SUMMARY TABLE SUPPORTING HYPOTHESES GENERATED

The hypotheses, as listed again, are:

Organisational / Environmental / Personal Factors

H1: **Organisational structures of healthcare institutions (hospitals, polyclinics, group/ solo clinics, laboratories, etc) affect the degree of IT adoption at work, the types of IT devices used and the ways IT is used.** *(Organisational factors: technology policy, management support, organisation's financial risk position.)*

H2: **Adoption of IT is greater in the public than private sector.** *(Environmental factors: competition, information availability, government support.)*

H3: **A doctor's future IT needs is related to his type of practice.** *(Personal factor: type of practice)*

H4: **Technological factors may be more effectively exploited by certain sectors of healthcare that leverage on new technology.** *(Environmental factor: competition)*

H5: **There are age differences in the adoption of IT. Older doctors use less IT than younger doctors.** *(Personal factor: age)*

H6: Mindset and IT experiences affect a doctor's level of IT adoption.

(Personal factors: mindset and personal experiences)

The following is a summary table supporting all hypotheses generated in this study.

"T" represents "Hypothesis is True". "F" represents "Hypothesis is False".

		HYPOTHESES					
CT	**CROSSTABS**	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**
1	Computer Ownership - Age					T	
2	Hours Doctors Spend on Computing - Age						
3	Computer Use at Home - Age					T	
4a	First Time Logged onto Internet - Age					T	
5	Speed of Internet Connection - Age						
6a	IT Devices at Work - Type of Practice	T					
6b	IT Devices at Work - Age			T			
7	Work PC Connected to the Internet - Type of Practice		T				
8	Factors Motivating Doctors to Computerise - Type of Practice						
9a	Computer Use at Work - Type of Practice		T				
9b	Computer Use at Work - Age						
11	Electronic Notification System (ENS) - Type of practice						
12a	Update CME points in SMC's CME System - Type of practice						
12b	Update CME points in SMC's CME System - Age						
13a	Non-Usage of IT in Work - Type of Practice						
13b	Non-Usage of IT in Work - Age						T
14a	IT Training Attended - Type of Practice						
14b	IT Training Attended - Age						
15a	Future IT Uses to Adopt - Type of Practice						
15b	Future IT Uses to Adopt - Age						
16a	Future IT Purchases - Type of Practice			T	T		
16b	Future IT Purchases - Age					T	
17a	Future IT Training - Type of Practice			T			
17b	Future IT Training - Age					T	

Table 4.4: Summary Table Supporting Hypotheses Generated

Summary of hypotheses findings:

H1: Supported (CT6a)

H2: Supported (CT7, CT9a)

H3: Supported (CT6b, CT16a, CT17a)

H4: Supported (CT16a)

H5: Supported (CT1, CT3, CT4a, CT16b, CT17b)

H6: Supported (CT13b)

Hence, all the six hypotheses are supported.

4.5 DISCUSSION

This quantitative survey of "IT Adoption Among Doctors in Singapore" has given us good insight into the IT usage patterns of the doctor population:

1) There is a high IT adoption rate among doctors in Singapore. 95.3% spends time computing each week.
2) IT use at home is as high as 86.9% for Email, 81.7% for Surfing the Web, and 65.9% for Word processing.
3) IT use at work is as high as 79.2% for being connected to the Web. Doctors use the computer for Email (70.3%), Research on the Internet (56.3%), and Recording of patient's medical information (47.4%).
4) The number of doctors answering the question on barriers is few. The commonly cited barriers are "Writing on paper is faster, not comfortable using a PC/ Mac" (6.6%), "No necessity to use IT in work" (5.0%), and "Computer is too slow" (3.5%).
5) The IT needs for doctors in the near future include Research (38.0%), Email (36.4%), and Recording of patient information (36.2%).

6) IT equipment doctors are willing to invest in within the next 1 or 2 years are Laptop (36.4%), PC/ Mac (30.9%), Scanner/ Printer/ Digital Camera (21.8%), and PDA (21.4%).
7) IT training courses doctors think are useful for them are Specific application training (26.3%), Microsoft Office (25.8%), and Internet Introductory (11.9%). A high 32.8% of doctors feel that they do not need training.

4.5.1 Hypotheses

All the hypotheses set out in Chapter One have been supported. They are:

H1: Organisational structures of healthcare institutions (hospitals, polyclinics, group/ solo clinics, laboratories, etc) affect the degree of IT adoption at work, the types of IT devices used and the ways IT is used.

H2: Adoption of IT is greater in the public than private sector.

H3: A doctor's future IT needs is related to his type of practice.

H4: Technological factors may be more effectively exploited by certain sectors of healthcare that leverage on new technology.

H5: There are age differences in the adoption of IT. Older doctors use less IT than younger doctors.

H6: Mindset and IT experiences affect a doctor's level of IT adoption.

4.5.2 Achieving the Objectives of Study

Some of the objectives of the study set in Chapter One have been achieved in this chapter. They include:

1) To examine the level of IT adoption among doctors in Singapore. (**Yes**)
2) To discover doctors' views on specific Medical-IT applications, such as Online Continuing Medical Education, Telemedicine, Telesurgery, clinical research aided by information systems, and Electronic Medical Records. (**No**)
3) To explore the push (barriers) and pull (encouraging) factors to IT adoption. (**Yes**)
4) To define IT needs among doctors, in areas of training, hardware and software. (**Yes**)
5) To identify future potential and insights of IT in Medicine. (**Yes**)
6) To make recommendations in the light of the findings of this study. (**No**)

4.5.3 Limitations of This Quantitative Survey

This quantitative survey has its limitations. It merely serves as an overview to determine IT adoption rates, IT uses, push and pull factors to IT adoption and future IT needs of Singapore doctors. Hence, the findings may appear superficial. This problem is addressed with the focus group session of Chapter Five and the qualitative survey of Chapter Six.

The constraint faced in this quantitative survey is this is a survey collaboration with the Singapore Ministry of Health (MOH). Hence, there are a few specific questions that MOH wishes to see appear in this survey. Despite this, research integrity is still upheld as much as possible.

CHAPTER FIVE
FOCUS GROUP

5 FOCUS GROUP RESULTS & ANALYSIS

The focus group forms the second part of the study.

5.1 INTRODUCTION

An IT Focus Group was conducted to yield in-depth qualitative results to add value to the quantitative survey questionnaire design. This focus group serves to investigate issues surrounding the adoption of IT in Medicine. It serves to uncover the concerns and needs of users (doctors who are basic, intermediate, or advance users), developers (programmers), administrators (medical organisations such as SMA, CFPS, AM) and policy makers (MOH, IDA).

The results complement the survey findings in Chapter Four and consolidates insights into why doctors adopt/ do not adopt technology, what are the push and pull factors of IT adoption, and what are the future IT needs of doctors. Please see Appendix C for full transcripts of this IT Focus Group session.

5.2 OBJECTIVES

The objectives of this focus group (Appendix B) are to find out the following:

1) What comments do participants have on the quantitative results of Chapter Four?
2) What are the barriers to IT adoption? How does one encourage doctors to adopt IT?

3) What are the IT needs of doctors to be met, in terms of training, hardware and software, etc?
4) What is the future potential of IT in Healthcare?
5) Any further insights to contribute?

5.3 DESIGN OF FOCUS GROUP

The focus group was set up to obtain a cross fertilisation of IT use in response to the questions set up above.

The aim was to bring together a good mixture of:

1) Users - doctors who are very IT savvy, intermediate users or basic users.
2) Developers - IT Officers from both healthcare clusters SingHealth and NHG, and commercial IT developers.
3) Administrators - doctors and executives from SMA, CFPS, AM.
4) Policy makers - executives from MOH and IDA.

The above stakeholders were carefully selected to ensure that there was a clear representation of each of the above groups.

Doctors who turned up for the focus group came from different types of practices: private or public specialist, private or public general practitioner, registrar and medical officer. They have different levels of IT skills and knowledge. Both hospital and commercial developers were invited to the focus group, but only commercial developers turned up. All invited administrators from medical organisations and policymakers turned up at the focus group.

Focus group invitees were referred by doctors and then personally invited over telephone, fax and email by Singapore Medical Association to participate in this focus group. Of the 30 invitees, 18 turned up, giving a response rate of 60%.

Focus Group Participants

The participants of this focus group were de-identified to ensure confidentiality. Please refer to Appendix E for a list of organisations' acronyms.

A/Prof GLG, Chairman of the Meeting

Dr DV, Clinic for Women, Basic User

Dr RN, TTSH/ SGH/ PGMI, Basic User

Dr LKH, CFPS, Intermediate User

Dr LSH, AM, Intermediate User

Dr JC, SGH, Advanced User

Dr TPC, RSN Medical Corps, Advanced User

Dr CUJ, SGH, Advanced User

Ms RC, SMA, Administrator

Ms KT, SMA, Administrator

Ms CGE, SMA, Administrator

Ms KAL, AM, Administrator

Ms LFY, AM, Administrator

Ms THC, SMC, Administrator

Ms SW, SMC, Administrator

Mr HK, MOH-IDA, Policymaker

Ms SL, MOH-IDA, Policymaker

Mrs TP, Vision Healthone Corp, Developer

Mr BP, Healthsynchro Pte Ltd, Developer

The moderator of this focus group was A/Prof GLG. His role was to maintain the group's focus and ensure that everyone has a chance to contribute to the discussion.

This focus group was tape recorded, with notes taken by two persons (RC and KT) and later transcribed into a full report, which is available at Appendix C.

The 18 participants participated freely and were able to build on each other's contributions synergistically. The facilitation resulted in an orderly flow of the discussion and adequate exploration of the findings from the quantitative survey.

Tuesday, 28 Jan 2003, 5:20 to 6:30pm (1 hour 10mins) was set aside for a focus group comprising of the above stakeholders. The venue was the conference room of Singapore Medical Association.

5.4 RESULTS OF FOCUS GROUP DISCUSSION

The following is a summary of the discussion that flowed during the focus group session. The discussion was so active that it is rather difficult to slot the responses under specific questions. Many relevant areas were covered, though not necessarily in a question-and-answer format.

Q1) IT Adoption Rate among Doctors in Singapore - Any Comments on This?

Ms THC asks if the data presented is representative. A/Prof GLG agrees that the results could be more optimistic than actual. One reason given is that perhaps the more active or IT savvy ones have responded. Dr LSH concurs on this.

Ms SL says that based on the SMC profile, the demographics of the respondents shadow that of Singapore Medical Council's demographics. Hence, the data is rather representative. Even though a 40% response rate over the actual response rate of 21% is preferred, she maintains that the feedback from doctors is still very valuable.

Dr RN highlights that it is very easy to indicate "Yes" to PC ownership, as many homes and clinics have them. But what is the actual level of usage by doctors themselves? He thinks that the actual IT adoption rate is much lower than what is seen in the presentation.

Dr LKH agrees that the results are too good to be true. One can assume that those who have responded are "more pro-active, more *gung ho* and more likely to use computers". That being said, he feels that the survey is quite good, and "in the real world, it is as good as it gets".

Q2) What are the Barriers to IT Adoption? How Do We Encourage Doctors to Adopt IT?

- ***Barriers to IT adoption:***

Ms SL says that doctors prefer to ask their staff to fax in rather than use the e-notification system for reporting of infectious diseases. So inconvenience (many steps online) and unfamiliarity with IT systems are barriers to IT adoption. Dr JC agrees, saying that he sees tuberculosis cases on average once in six months only - "suddenly, I have to remember all the steps in the ENS system".

Ms SL says that secondly, the doctors are used to clerks and admin personnel using the computer to take care of administrative work for them. Even for personal updating

of CME points on the SMC system, their admin personnel or the CME organisers update the data on behalf of the doctors.

Dr RN says that younger doctors have the practice opportunities of completing things on the computer all the time. Unfortunately, there are limited opportunities for older doctors to do so.

Dr JC says there are too many platforms, eg. Palm, Windows CE, etc. This is confusing to users - what platform does one adopt? For developers, administrators, and policy makers, is there a general consensus?

Even with common platforms decided upon for different devices, platforms come and go. What may be dominant today becomes secondary soon. Does one have the necessary resources to support different platforms over time? If one chooses to develop two or more different platforms at the same time, work is multifold and much more resources need to be allocated.

He cites another example of hospitals have many different IT systems that confuse the doctors, especially Housemen and Medical Officers who have to rotate among the hospitals. They take up much time to learn many different systems, and when they have adapted to them, it is time to go onto the next posting. "There's no unity, no unifying aspect to it all."

Dr TPC feels that one of the main barriers is "lack of IT support", especially in local content availability. Ms RC says that it is very difficult to obtain permission to reproduce good medical content in another channel. For example, the PDA project by SMA was received with much enthusiasm in the beginning, but was not sustainable due to lack of new medical content. Dr JC agrees, saying that he and other doctors

came up with "wall after wall of bureaucracy" when they tried to make the KK Book for Pediatrics available in PDA format for the benefit of all doctors.

On equipment, Ms SL says that some hospitals do equip doctors with PDAs. Dr JC says they are too old and heavy. Dr TPC says that some nurses in NUS and TTSH have new and light PDAs, but doctors have no access to them. Dr LSH says that NUH has thought of implementing the PC Tablet, but did not, due to high costs. Dr JC says that some of the equipment is so expensive that some doctors keep them at home safely for fear of damaging them. Ms SL feels that MOH and the hospitals can equip doctors with the best equipment, but if they are not put to good use, then resources are wasted.

Dr LSH thinks that the greatest barrier is "mindset". For example, SGH doctors had to get used to the E-Prescription system. In the beginning, it was difficult as it took much time to key in the entries. Some attention was also focused on the computer instead of the patient. After a while, as doctors got used to the system, the mindset changed and they found that it was much faster to prescribe electronically than in writing.

- ***Ways to encourage doctors to adopt IT:***

Ms SL says that organisations like SMA, CFPS and AM can encourage IT adoption among doctors. Through IT courses, SMA hopes to train doctors in IT, especially the older ones.

Dr RN says that SMA's IT courses[71] are useful, but should incorporate many more practice sessions.

[71] IT courses are conducted by One Learning Place. Such nationwide IT courses are heavily subsidised by the Singapore government, sometimes up to 80%. Learners have to pay only 20% of course fees.

Dr JC says that all stakeholders need to determine what is the common platform we can use. And they should encourage doctors to adopt this platform. It is "a lot easier if we have the same goals, same target". He also says that stakeholders need to promote a core group of users who will in turn influence other users positively.

Dr CUJ cites the example of NUS where students can buy laptops at greatly reduced prices. This removes a main barrier - cost. With a good package and perhaps interest free loans, purchasing computer equipment will become attractive for doctors.

Dr TPC says that local content availability and support from various stakeholders are very important. Users can also encourage non-users to try out computing.

Dr JC says there is a lack of formal structured IT training in medical school. NUS should make it compulsory for medical students to go through computing classes. Then doctors will adapt to computer systems in hospitals more readily. In addition, when information is at one's fingertips, referring to it is easier. Less medical accidents happen.

Dr LSH thinks that hospitals should enforce certain IT initiatives. This would generate the need to learn computing. For example, if there is an alternative of handwritten prescriptions to electronic prescriptions, then doctors can choose not to prescribe electronically.

Dr LKH jests that if one wishes to convince people on board, one either convinces or coerces them, and "in Singapore, we like to coerce people". He feels however that one should not force doctors to adopt IT, rather to show them how useful IT can be. (He is speaking from the GP point of view.)

Dr JC and Ms RC feel that MOH should encourage all hospitals to make medical content freely and easily available, for the benefit of all doctors in Singapore. Doctors, having written most of the content, should have a part in content ownership and deciding "This is written for doctors". Medical content should not be wholly owned by hospitals and kept for their own doctors' usage. Instead, hospitals should encourage the sharing of content, for the benefit of mankind.

Q3) What are the IT Needs of Doctors to be Met, in Terms of Training, Hardware and Software, etc?

Dr RN says that doctors need more IT training and practice opportunities. Without these, any sophisticated equipment just exists redundantly.

Ms RC says that doctors not only need time to practise what they have learnt in IT courses, they also need lots of guidance from family and friends. When they encounter IT problems, having a good IT support vendor on hand to fix the problems is useful.

Dr TPC says that doctors need a huge amount of reliable medical information. Local content can be further developed. For example, drug information (MIMS by Medimedia) is envisioned to be accessible at all times when one is on the move. One is not constrained "by huge books or terminals". A/Prof GLG agrees that content is very important. Without content, there are few reasons to use computers.

Dr JC feels that it is very important to have formal structured IT training in medical school. "What we need to do is to get rid of apprehensions at all levels" and he sees formal IT training in school as a solution.

Taking up Dr CUJ's idea of removing the cost issue, A/Prof GLG suggests SMA and other medical bodies look into bulk discounts on IT purchases (broadband connectivity, PDAs, laptops, desktops) for doctors. "Without economies of scale, we definitely cannot keep up".

Dr LSH says that different doctors have different needs. For senior doctors, they need good laptops and desktops. When he travels, he needs his laptop to access emails. In the office, he prefers a bigger screen to PDA's small screen. For junior doctors or highly mobile doctors, since they are on the move most of the time, PDAs are more portable and hence more suitable for them.

Dr LKH feels that there are two ends of the spectrum. At one end, there are IT Evangelists who "think that the world can be saved if everyone buys the PDA". At the other end, there are Technophobes who are frightened of technology and think that society "marginalises them". He advocates that it is important that when one implements IT policies, to plan for the person in the middle of these two extremes.

He says that it is important to work on both ends at the same time - train doctors for IT skills and develop the medical content and applications for their use. "So this Medical Hub, you should not waste time - you should quickly go ahead."

Q4) What is the Future Potential of IT in Healthcare?

Dr TPC dreams of the day when doctors can use PDAs to take pictures of patients' conditions, send them wirelessly to other doctors and ask for their opinions. Case histories can be recorded verbally and stored effortlessly, so that they can be retrieved in cases of dispute.

A/Prof GLG looks forward to the day when he can use the PDA as an indispensable medical tool - check patient records, lab results, and messages left to him by colleagues.

Dr CUJ would like to see E-Commerce for doctors in the proposed Medical Hub. Aside from purchases related to the medical profession, such as indemnity (malpractice insurance coverage for doctors), he would like to see lifestyle purchase options available online too.

Dr JC feels that IT will continue to play a big role in the lives of doctors for years to come. There will be ever-changing needs for a particular person in any point in time, but there will always be certain skills the person needs to have. For this young generation of doctors, if they do not pick up computing skills, they will likely be left behind by the next generation. He would rather have the freedom of choice, knowing he is well equipped for future challenges.

Q5) Any Further Insight to Contribute?

Dr CUJ says that the people who need the most IT enabling are the GPs. He was Locum in a number of clinics, and many of the solo-practice GP clinics have no or very old PCs. This is the group that stakeholders should give more attention to. Ms THC and A/Prof GLG both concur.

Dr LKH says that one cannot be too harsh on anyone on such issues - "Doctors do not need it, so why force them?" He adds that doctors go to clinics primarily to see patients, not to do computing, which can be done at home. He says that if he needs to do computing just to be a better and more effective doctor, he would do it. However, "don’t make me fill up claims just because you want to increase the IT usage rate".

Ms RC reports that some doctors have given feedback that ministries create many online notification systems ("e-everything") mainly for the benefit of the ministry staff members themselves (cut down on much administrative responsibilities on their side), and not so much for the benefit of doctors. Now instead of looking after patients, doctors have to fulfill additional roles of much e-filing that takes up much of their time. Technology is supposed to save time and money for doctors, but it appears the other way round now.

Dr LKH says, "The bottom line of IT is to increase productivity. It's not having IT for IT's sake."

5.5 SUMMARY OF INFORMATION FROM THE FOCUS GROUP

The following are the points noted by the focus group.

5.5.1 IT Adoption Rate

- The IT adoption rate appears to be more overstated than actual, but given the high IT adoption in the general population (IDA Survey mentioned in Chapter Four), the figure of 95.3% of IT use at home may not be far from actual.

5.5.2 Barriers to IT Adoption

- Office needs for IT can be fulfilled by manual methods, eg. fax rather than email.
- Too many computer platforms result in confusion and doctors' lack of confidence in purchasing hardware systems, for fear that the changing platforms will make the devices obsolete.
- Lack of IT support by organisations and key players in Medicine to push for IT adoption.

- Non-progressive mindset of doctors that needs to be overcome, eg. manual prescriptions rather than electronic prescriptions.

5.5.3 Ways to Encourage Doctors to Adopt IT

- Adopt a common platform for doctors because it is easier with a common platform to achieve the same goals and targets in computer use.
- Encourage formal structured IT training in medical school and among graduate doctors.
- Show doctors how useful IT can be rather than deploy coercion of IT use.
- Encourage the sharing of medical content for professional use across all hospitals and medical bodies.

5.5.4 IT Needs of Doctors to Be Met

Applications

- Develop content, eg. drug information that is accessible at all times when one is on the move.
- Encourage the use of PDA as a portable data entry and retrieval device for doctors on the move.

Hardware

- Make the purchase of hardware easier for doctors. SMA or other medical bodies can look into bulk discounts for IT purchases of broadband connectivity, PDAs, laptops and desktops.
- Source for efficient and reliable IT support vendors to fix doctors' hardware and software problems.

Training

- Create more IT training and practice opportunities.[72]
- Encourage IT savvy doctors to share their knowledge and passion in computing with less IT savvy colleagues.
- Encourage top-down positive approach to IT, that is, senior doctors who have authority can convince junior doctors and staff to embrace IT in Medicine.
- Accept there are extremes -- the IT Evangelists and IT Technophobes. Plan for the middle, to strike a good balance.

5.5.5 Future Potential of IT

- To develop more useful applications and content for doctors so they can find more usage for PDAs, laptops and desktops.
- To share knowledge and medical content freely, for the good of doctors and ultimately mankind. To minimise bureaucracy in hospitals and organisations that impede the free sharing of medical knowledge.
- To tie up with some commercial companies, eg. Medimedia which has MIMS, to see if medical content (drug information) can be made freely or cheaply available online to doctors.

Medical Platform

- To build the Medical Hub for doctors to have a one-stop place for all services.
- For ministries, to develop IT systems that will assist doctors in their work, ie. increase productivity and save them more time. To avoid increasing doctors' workload by more administrative work.
- To watch out for doctors' ever changing IT needs, and plan for their future needs.

[72] Doctors themselves bear the costs of IT training. At times, the organisations doctors are working in (e.g. government hospitals and polyclinics) bear the costs for them.

5.5.6 Insights to IT Adoption

- To enable GPs, especially those in solo practices.
- IT is to increase productivity; it is not having IT for IT's sake.
- Open-mindedness in adopting IT.

5.6 DISCUSSION

This focus group proved to be very useful in consolidating the information obtained from the quantitative survey. In particular, it provided information with regards to IT in Medicine, barriers to IT adoption, and how to encourage doctors to use IT. It also defined the IT needs of doctors in terms of training, hardware and medical applications.

The future IT potentials identified by the focus group were wider use of the PDA, E-Commerce and common platforms for Medical-IT applications.

Further insights given by the focus group were the need to enable GPs to adopt IT, sensible use of IT to enhance work productivity and open-mindedness in adoption of IT platforms.

5.6.1 Achieving the Objectives of Study

Some of the objectives of the study set in Chapter One have been achieved in this chapter. They include:

1) To examine the level of IT adoption among doctors in Singapore. (**Limited**)
2) To discover doctors' views on specific Medical-IT applications, such as Online Continuing Medical Education, Telemedicine, Telesurgery, clinical research aided by information systems, and Electronic Medical Records. (**No**)
3) To explore the push (barriers) and pull (encouraging) factors to IT adoption. (**Yes**)
4) To define IT needs among doctors, in areas of training, hardware and software. (**Yes**)
5) To identify future potential and insights of IT in Medicine. (**Yes**)
6) To make recommendations in the light of the findings of this study. (**Yes**)

The next chapter comprises of an open-ended qualitative survey that delves deeper into the research question to find out which Medical-IT applications doctors support. It also explores push and pull factors to IT adoption.

CHAPTER SIX
QUALITATIVE SURVEY

6 QUALITATIVE SURVEY

6.1 OPEN-ENDED SURVEY (QUALITATIVE)

The objective of this open-ended qualitative survey is to delve deeper into the research question and find out answers in relation to Medical-IT. Participants were encouraged to define which aspects of Medical-IT were important to them.

Entitled "A Quick Information Technology Survey" (Appendix D), the survey has four open-ended questions in each of the following three sections (according to age groups) to elicit in-depth information from:

1) Doctors aged 35 and below

2) Doctors aged 36 to 50

3) Doctors aged 51 and above).

Doctors in the first two categories were asked similar questions. The objectives are to find out which Medical-IT applications are being used actively in the healthcare setting, which IT gadgets are useful in doctors' area of work, and which Medical-IT initiatives will be well accepted by doctors currently and in the next five years. These initiatives are Online CME, Telemedicine, Telesurgery, clinical research aided by information systems and Electronic Medical Records.

Doctors in the third category were asked a different set of questions, presumably as they belong to a generation that has not been exposed to IT much. The objectives are to find out what are the barriers to IT adoption in the healthcare setting, which are the IT needs of this group that need to be met, and how medical organisations can assist doctors in trying out IT.

The results, after coding and processing of the questionnaires, are summarised according to the different sections of the questionnaire.

6.2 DOCTORS AGED 35 AND BELOW

(Q1) How is Medical IT being actively used in your hospital/ clinic/ laboratory now? Examples include MRI, ECG, EMR, Clinical Management System, etc.

Of the young doctors aged 35 and below, IT is related to their work. 27.2% of General Practitioners (GPs) reports use of the Clinic Management (recording of patient records, accounting and submitting E-Claims, etc). 27.2% of young doctors use the Electronic Medical Records (EMR) system in the hospitals. They use the EMR to store and retrieve patient information, laboratory results, surgical information, X-rays, discharge summaries, send electronic prescriptions to the pharmacy and notify the hospital of incidents.

Other Medical-IT uses by young doctors are shown in Table 6.2.1.

Code	Medical IT Uses	Occurrence	(%)
6.2.1.1	Clinic Management System in GP clinics (patient records, accounts, Clinic Assist, E-Claims, etc)	**6**	**27.2**
6.2.1.2	Electronic Medical Records in hospitals (patient information, laboratory/ investigative results, surgical information, digitised X-rays, discharge summaries, E-Prescriptions, notification of incidents, etc)	**6**	**27.2**
6.2.1.3	ECG	3	13.6
6.2.1.4	Diagnostic Radiology	2	9.1
6.2.1.5	E-mail acceptance of bookings	1	4.5
6.2.1.6	Clinic web site	1	4.5
6.2.1.7	Digital photography of skin lesions	1	4.5
6.2.1.8	PDAs for reference	1	4.5
6.2.1.9	Broadband	1	4.5
6.2.1.10	**TOTAL**	**22**	**100.0**

Table 6.2.1: Medical-IT applications used in hospitals/ clinics/ laboratories by doctors aged 35 and below.

(Q2) In your opinion, which IT gadgets are likely to be useful and highly adopted by doctors now and in the next five years? Examples include PDAs, digital cameras to capture medical images, tablet PCs, etc.

Forty percent of young doctors report that the use of Personal Digital Assistants (PDAs) are useful and widely used in their work. This is understandable as young doctors have to refer constantly to clinical information such as drug interaction and keep updated on medical treatments and procedures. Other useful medical applications available on the PDA include tracking of patients' progress, tracking of one's CME progress, access to medical databases and libraries, usage of medical calculators, and capturing of medical images.

Thirty-six percent of young doctors report the use of the Digital Camera. This is understandable as the digital camera is a useful tool in capturing medical images, especially dermatological and surgical images. These images can later serve as teaching materials.

Sixteen percent of young doctors use the Tablet PC. This IT innovation finds its appeal in hospital ward rounds. Doctors can key in the information immediately after checking on patients' progress. They can scribble clinical notes instead of type them in. These clinical notes are immediately translated to electronic text, due to handwriting recognition software installed in the Tablet PC. Doctors can also make clinical drawings in the Tablet PC, which are saved as electronic images. This data is then either hot-synched into the hospital's server, or wirelessly captured by the server in real time. The data captured forms part of the Electronic Medical Records of a patient.

Other useful Medical-IT gadgets adopted by young doctors are shown in Table 6.2.2.

Code	Useful IT Gadgets in Medicine	Occurrence	(%)
6.2.2.1	**Personal Digital Assistant (PDA)** - With wireless capability - Suitable for junior doctors	**10**	**40.0**
6.2.2.2	**Digital Camera** - Capture medical images	**9**	**36.0**
6.2.2.3	**Tablet PC** - For ward rounds - With broadband Internet connectivity	**4**	**16.0**
6.2.2.4	**Laptop**	1	4.0
6.2.2.5	**Personal Computer (PC)**	1	4.0
6.2.2.6	**TOTAL**	**25**	**100.0**

Table 6.2.2: Useful IT gadgets adopted by doctors aged 35 and below, in Years 2003 to 2007.

(Q3) Do you think these Medical-IT initiatives will be well accepted by doctors now and in the next five years? Why or why not?

All the young doctors support Online Continuing Medical Education (CME). The majority supports clinical research aided by information systems and Electronic Medical Records.

Telemedicine and Telesurgery are not supported by the young doctors as growing applications.

Code	IT Initiative / Number of Responses	Yes	No	Maybe/ Not Sure	No Answer
6.2.3.1	Online CME	**14 (100%)**	0	0	0
6.2.3.2	Telemedicine (remote consultation/ monitoring of patients)	3	**8 (57.1%)**	3	0
6.2.3.3	Telesurgery	3	**7 (50.0%)**	3	1
6.2.3.4	Clinical research aided by information systems	**13 (92.9%)**	0	0	1
6.2.3.5	Electronic Medical Records (patient records in text and images)	**12 (85.7)**	2	0	0

Table 6.2.3: Medical-IT initiatives supported by doctors aged 35 and below, in Years 2003 to 2007.

Number (N) = 14

- **Online CME:**

The majority feels that Online CME is convenient. It saves them commuting time and is easy to use. They can also track their CME progress online.

Code	ONLINE CME	Occurrence
Acceptance of Online CME		
6.2.3.1.1a	Convenience: no need to travel, easy to use, easy to monitor CME points.	**5**
6.2.3.1.1b	More opportunities to gain CME points	1
6.2.3.1.1c	CME is now compulsory	1

Table 6.2.3.1: Reasons for acceptance of Online CME by doctors aged 35 and below.

- **Telemedicine and Telesurgery:**

"Loss of human/ personal touch" is why doctors do not readily adopt Telemedicine and Telesurgery. Doctors need to physically examine patients to come up accurate diagnoses and treatments. Patients want surgeons to be physically present in operations, so that they can respond quickly to emergencies.

The lack of remote areas in Singapore does not favour Telemedicine and Telesurgery. Hospitals and clinics are very accessible. Patients would rather be attended physically by doctors rather than over video-conferencing.

Doctors aged 35 and below are not ready for Telemedicine and Telesurgery.

Code	TELEMEDICINE	Occurrence
Acceptance of Telemedicine		
6.2.3.2.1a	Speed and convenience	1
6.2.3.2.1b	For consultants to review juniors' findings esp. at night	1
Non-Acceptance of Telemedicine		
6.2.3.2.2a	Lacks human/ personal touch. Physical examination is needed.	**3**
6.2.3.2.2b	Lack of remote areas in Singapore. Hospitals and medical care are very accessible.	2
6.2.3.2.2c	Medico-legal (issues that may arise)	1

Table 6.2.3.2: Reasons for acceptance/ non-acceptance of Telemedicine by doctors aged 35 and below.

Code	TELESURGERY	Occurrence
Non-Acceptance of Telesurgery		
6.2.3.3.2a	Surgeon to be on site for emergencies	1
6.2.3.3.2b	Lack of remote areas in Singapore.	1
6.2.3.3.2c	Physical examination is needed.	1

Table 6.2.3.3: Reasons for acceptance/ non-acceptance of Telesurgery by doctors aged 35 and below.

- **Clinical research aided by information systems:**

Doctors support Information Systems assisting them with clinical research. This convenience saves them time and effort.

Code	CLINICAL RESEARCH	Occurrence
Acceptance of Clinical Research Aided by Information Systems		
6.2.3.4.1a	Facilitates capturing and computation of data and literature search.	1
6.2.3.4.1b	IT aids clinical research.	1
6.2.3.4.1c	Convenience	1

Table 6.2.3.4: Reasons for acceptance of clinical research aided by information systems among doctors aged 35 and below.

- **Electronic Medical Records:**

Doctors support Electronic Medical Records, as the system creates much convenience to them. It is fast and easy to search and retrieve patient information. The timely information can be critical in saving lives. On the other hand, there are concerns over patient confidentiality and security. They fear that EMR systems can be easily hacked into. These are valid concerns that need to be addressed.

Code	ELECTRONIC MEDICAL RECORDS	Occurrence
Acceptance of Electronic Medical Records		
6.2.3.5.1a	Convenience: fast and easy way of retrieving patient information.	**4**
6.2.3.5.1b	Comprehensive and integrated records	2
6.2.3.5.1c	Extension of existing electronic discharge summaries.	1
Non-Acceptance of Electronic Medical Records		
6.2.3.5.2a	Concerns over confidentiality.	1
6.2.3.5.2b	Security concerns, eg. hacking	1

Table 6.2.3.5: Reasons for acceptance/ non-acceptance of Electronic Medical Records by doctors aged 35 and below.

(Q4) Any other comments and suggestions?

Some of the young doctors' comments are given below.

Code	Comments/ Suggestions	Occurrence
6.2.4.1	Should implement IT as soon as possible.	1
6.2.4.2	Since maximising IT is one of the eight priorities of the new Health Minister, MOH should unify the IT systems of all restructured hospitals (RH) so as to facilitate data portability and to allow RHs like TTSH and AH to catch up.	1

Table 6.2.4: Comments and suggestions by doctors aged 35 years and below.

6.3 DOCTORS AGED 36 TO 50

The following are answers given by doctors aged 36 to 50. They have been given the same set of questions as doctors aged 35 and below. The answers between these two age groups do not differ greatly.

(Q1) How is Medical IT being actively used in your hospital/ clinic/ laboratory now? Eg. MRI, ECG, EMR, Clinical Management systems, etc.

The majority (37.5%) uses the Clinic Management System (CMS). The myriad of CMS uses is listed below. CMS is increasingly becoming an indispensable tool in a Private GP/ Specialist's clinic. The challenge lies in finding a good affordable CMS system that suits the clinic's needs.

Doctors (19.4%) use the Internet for various purposes, which are listed below. Other IT uses among doctors aged 36 to 50 are also listed below.

Code	Medical IT Uses	Occur-rence	(%)
6.3.1.1	**Clinic Management System (CMS)**. Uses: - Registration/ appointments - Storage & retrieval of patients' records from database - Records of attendance / case notes - Image repository - Print labels, prescriptions, MC - Billing	**27**	**37.5**

	- Clinic administration - Statistics and reports - Medication dispensing - Pharmacy data / inventory/ ordering - Accounts and audit		
6.3.1.2	**Internet.** Uses: - HMO billing (e-filing of medical claims to Healthcare Managed Organisations) - Internet search for information (eg. on drugs/ diseases), online journals study, medical literature review - Email for (global) communication & updates - MOH alerts, eg. SARS updates - Online notification of infectious diseases - CME/ distance learning and medical updates - Patient information and education - Online drug ordering, eg. Zuellig, Pan Malayan - Online registration for CME courses	**14**	**19.4**
6.3.1.3	**ECG**. Uses:	11	15.3
6.3.1.4	**Electronic Medical Records (EMR)**. Uses: - Patient data / inpatient records - Blood investigations in outpatient clinics - Results review, eg. laboratory results - Digital images review, eg. X-ray/ radiology images - Diagnosis - E-Prescription - Teaching -	10	13.9
6.3.1.5	**Other PC Applications**. Uses: - Word processing, eg. referral letters	3	4.2
6.3.1.6	**Picture Archiving & Communication System (PACS)** - Use: Neuroimaging	3	4.2
6.3.1.7	**Electron Discharge Summary (EDS)** in hospital	1	1.4
6.3.1.8	**Clintek (Bayer) Urinalysis**	1	1.4
6.3.1.9	**Hearing Aid Program**	1	1.4
6.3.1.10	Digital radiology clinic: **X-rays, CT, MR generated digital data and images** are reviewed on computer workstations. **Radiology Information System (RIS)** for registration, billing and reporting.	1	1.4
6.3.1.11	**TOTAL**	**72**	**100.0**

Table 6.3.1a: Current Medical-IT uses by doctors aged 36 to 50.

Code	Comments/ Suggestions	Occurrence
6.3.1.12	System is important. Very much to the point of being indispensable.	2
6.3.1.13	Software is irrelevant to GP practice. CMS is pointless if you see 20 patients a day! All can be done manually.	1
6.3.1.14	Records on paper, then inputs into CMS	1

Table 6.3.1b: Comments and suggestions by doctors aged 36 to 50 on current Medical-IT uses.

(Q2) In your opinion, which IT gadgets are likely to be useful and highly adopted by doctors now and in the next five years? Examples include PDAs, digital cameras to capture medical images, tablet PCs, etc.

Some doctors (36.4%) aged 36 to 50 report that the digital camera is widely used in Medicine. The various uses are listed below. The Personal Digital Assistant (PDA) is also widely used (26.3%). It presents convenience to doctors, especially when they need information urgently while on the move.

The new Tablet PC is increasingly being adopted by doctors (12.1%). Convenience plays a major role. Doctors are able to carry the tablet PC like a notepad and scribble notes into it. The bigger user-interface, as compared to the PDA with limited screen size, is also a plus factor. The main limitation of a tablet PC is cost. Nevertheless, if hospitals are willing to invest in money for doctors to use tablet PCs in their ward rounds, it may prove to be even more popular than the laptop or PC.

In comparison with younger doctors aged 35 and below, doctors in this 36 to 50 age group rank the digital camera as most useful, followed by PDA and Tablet PC. Younger doctors feel that PDA is most useful, followed by digital camera and Tablet PC.

Code	Useful IT Gadgets in Medicine	Occur-rence	(%)
6.3.2.1	**Digital camera**. Uses: - Capture medico legal cases - Photo-documentation, - Dermatology opinion - Photographing lesions/conditions and for follow-up/ teaching purposes.	**36**	**36.4**
6.3.2.2	**Personal Digital Assistant (PDA)**. Uses: - Convenient, good for ward rounds and on the move esp. with Bluetooth / wireless access to get patient info as well as lab results e.g. emergency Trop T /specialist review updates etc. - Web-based medical content, medical search engine, mobile communications.	**26**	**26.3**

6.3.2.3	**Tablet PC**. Uses: - Access online medical review - Online consultation, X-rays - Medical records	**12**	**12.1**
6.3.2.4	**Laptop/ Notebook**. Uses: - Paperless, wireless - With Internet access via WI-FI and Bluetooth	6	6.1
6.3.2.5	**Personal Computer (PC)/ Macintosh**. Uses: - Computerised imaging - Mac for its presentation capabilities.	4	4.0
6.3.2.6	**Video conferencing**. Uses: - Teleradiology, teleconsultation - Conference and discussion	3	3.0
6.3.2.7	**Electronic Medical Records (EMR)**, including X-rays	3	3.0
6.3.2.8	**Scanner**	2	2.0
6.3.2.9	**Webcam**	1	1.0
6.3.2.10	**IT Network**: - Linking the labs, X-rays with the clinics in the hospital	1	1.0
6.3.2.12	**Voice recognition software**	1	1.0
6.3.2.13	**All in one device** - able to record ECG, analyze & store blood results.	1	1.0
6.3.2.14	**PACS**	1	1.0
6.3.2.15	Online **Continuing Medical Education (CME)**	1	1.0
6.3.2.16	**Portable echo machine**	1	1.0
6.3.2.17	**TOTAL**	**99**	**100.0**

Table 6.3.2a: Useful Medical-IT gadgets adopted by doctors aged 36 to 50.

Some comments by respondents include the caution that additional IT costs will accrue and have to be passed onto the patients, the need for more IT training and exposure and the need for good useful software relevant to the practice of Medicine.

Code	Comments/ Suggestions	Occurrence
6.3.2.18	Any gadget that does not incur additional expenditure e.g. Software cost, Hardware cost, Monthly subscriptions. Do not forget that there is already an Internet subscription cost. All these add up to increase cost for the patients!	1
6.3.2.19	All these are fine, but we need to be more IT-savvy. Need to expose us to all these.	1
6.3.2.20	All depends on the software available.	1
6.3.2.21	Everything above can be used, only need customisation and training and plenty of useful applications software.	1

Table 6.3.2b: Comments and suggestions by doctors aged 36 to 50 on useful Medical-IT gadgets.

(Q3) Do you think these IT initiatives will be well accepted by doctors now and in the next five years? Why or why not?

The responses are consistent with those given by the "35 and below" age group. The two groups' participants remain anonymous, have no interaction and no influence over each other's opinions. The results are thus a good reflection of doctors' true opinions and usage intentions on these Medical-IT applications.

Doctors report that 79.2% of them will support Online Continuing Medical Education (CME). 50.9% of doctors objects to Telemedicine. 54.7% of them objects to Telesurgery. A high 84.9% supports clinical research aided by information systems. 71.7% of doctors supports Electronic Medical Records. The reasons for adoption or non-adoption of these five Medical-IT initiatives are given below.

Code	IT Initiative / Number of Responses	Yes	No	Maybe/ Not Sure	No Answer
6.3.3.1	**Online CME**	**42 (79.2%)**	5		6
6.3.3.2	**Telemedicine** (remote consultation/ monitoring of patients)	20	**27 (50.9%)**	3	3
6.3.3.3	**Telesurgery** (Some did not answer. Not area of specialty.)	6	**29 (54.7%)**	9	9
6.3.3.4	**Clinical research aided by information systems**	**45 (84.9%)**	1	2	5
6.3.3.5	**Electronic Medical Records** (patient records in text and images)	**38 (71.7%)**	5	6	4

Table 6.3.3: Medical-IT initiatives supported by doctors aged 36 to 50, in years 2003 to 2007.

Number (N) = 53

- **Online CME:**

The majority (79.2%) agrees to Online Continuing Medical Education (CME). Doctors work very long hours and have rare leisure time. Now with compulsory CME, already effected from Year 2003 onwards, doctors have even less time for themselves, their family and friends. Doctors have to accumulate up to 50 CME points per two years,

else they will not have their licenses renewed. With Online CME, doctors save time travelling to physical venues for CME sessions. They can achieve distance learning in the convenience of their homes and clinics, at their own time and pace.

Some of the reasons why doctors do not accept Online CME are given below.

Code	ONLINE CME	Occurrence
Acceptance of Online CME		
6.3.3.1.1a	**Convenience**: - Easily accessible and most doctors are now Internet savvy. - Yes, if it's easy to navigate through. Saves the doctor from travelling long distances to attend lectures during rare leisure periods. - Good for GP setting. - Saves time and can have CME in-between patients or when waiting.	**11**
6.3.3.1.1b	**Compulsory CME**, increasing availability of quality websites.	3
6.3.3.1.1c	CME should be 100% online and computerised to encourage and increase IT usage among doctors.	1
6.3.3.1.1d	**Cost**. Yes, if it is free. No, if there is a need to pay.	1
Non-Acceptance of Online CME		
6.3.3.1.2a	**Effort and Cost** - No, waste more time in trying to get online. Besides, business online packages are expensive at $300 per month!	1
6.3.3.1.2b	**Limitations** - Limited by doctors' poor IT skills and lack of broadband connection (most clinics). Lack of good online-tailored programmes for subspecialty (and overseas material probably prohibitively expensive).	1
6.3.3.1.2c	**Culture** - Useful and refreshing to attend CME in a physical venue.	1

Table: 6.3.3.1: Reasons for adoption/ non-adoption of Online CME by doctors aged 36 to 50.

- **Telemedicine and Telesurgery:**

The majority of doctors do not accept Telemedicine (50.9%) and Telesurgery (54.7%). Doctors believe in the need for patient examination and interaction. Due to the inability to examine the patient, the diagnosis and hence treatment may be wrong. If so, medico-legal cases can arise. Patients can sue and obtain huge compensation

amounts, which drive up doctors' medical insurance rates and eventually higher patient medical fees. This is a vicious cycle that many doctors wish to avoid.

Further to medico-legal issues, the question of responsibility arises. If things do go wrong and patients die, who is to be blamed - the doctor, the patient for poor communication of the ailment, the technician operating the telemedicine/ telesurgery equipment, the manufacturer for faulty and inaccurate equipment? Potential litigation is really an issue.

Lastly and importantly, telemedicine and telesurgery do not look likely to take off in Singapore due to its geographical nature. Singapore, occupying just 685.4 sq km[73], is very small. Hospitals and clinics are strategically located to cover mainland Singapore well, so access to medical facilities is just minutes away. Telemedicine will only come to good use in remote areas and areas that medical expertise is lacking. Some wealthy patients in neighbouring countries with almost the same time zone may prefer to consult Singapore Specialists over telemedicine link-ups, for professional opinions on their medical conditions.

Code	TELEMEDICINE	Occurrence
Acceptance of Telemedicine		
6.3.3.2.1a	**Convenience** to patients who need minor quick consults.	1
6.3.3.2.1b	Yes, esp. with aging population. Need for **monitoring**.	1
6.3.3.2.1c	Yes, with **Singapore as a medical hub** with expertise for other remote areas/ developing nations.	1
6.3.3.2.1d	Telemedicine can be used for patients with problems that require specialist opinion. Instead of sending patient to see specialist for **second opinion**, we can liaise with specialist via this mode of new age communication.	1
6.3.3.2.1e	Applicable **in hospital, not clinic**.	1
Non-Acceptance of Telemedicine		
6.3.3.2.2a	**Need for Patient Examination and Interaction**: - No human touch/ not personal. Touch is important. - Because of inability to examine patient, diagnosis may be wrong. Patient feels insecure too.	**6**

[73] Facts and figures about Singapore: http://www.sg/snapshot/snap_land.asp

	- Patient may refuse to pay for the consultation (just like getting free consultation over the telephone). - Difficult to charge, lack of human interactions. - No, doctors are not comfortable giving diagnosis without seeing the patients themselves. But yes if it is for monitoring e.g. OT connected to a common area.	
6.3.3.2.2b	**Geographical Nature of Singapore**: - Singapore is too small. Hospitals and clinics are everywhere, and easily accessible. - Works only for remote areas and where medical expertise is lacking. - Doctors are too accessible for real telemedicine demand, unless we consult for patients in the region (Indonesia/Malaysia).	**5**
6.3.3.2.2c	**Medico-Legal Factors**: - Responsibility of care provider. Who bears responsibility if things go wrong - the GP or the teledoctor? Remote monitoring of patients: gadgets can fail and create problem of litigation in event of death. - Fear of potential litigation.	**4**
6.3.3.2.2d	**Clinical Situations**: - Difficult to assess clinical situations esp. in a multilingual society with poor grasp of English/ Mandarin. Miscommunication can occur easily. - We are heavily burdened by patients at the doorstep. Busy enough.	3

Table: 6.3.3.2: Reasons for adoption or non-adoption of Telemedicine by doctors aged 36 to 50.

Code	TELESURGERY	Occurrence
Acceptance of Telesurgery		
6.3.3.3.1a	Good for **teaching**, eg. at seminars/ conferences.	2
6.3.3.3.1b	Definitely we are trying to **pioneer telerobotics** ourselves	1
Non-Acceptance of Telesurgery		
6.3.3.3.2a	**Geographical Nature of Singapore**: - Singapore is too small. Distances are not great and commuting is not a problem. No demand/ need for telemedicine in Singapore. - Too many hospitals in competition which are readily accessible. - Works only for remote areas and where surgical expertise is lacking.	**8**
6.3.3.3.2b	**Cultural factor**: - Patients will not accept it. Asians tend to be wary of technology.	3
6.3.3.3.2c	**Medical**: - In case of complications or unexpected outcomes, there may not be any qualified personnel to deal with them. - Inaccurate	2

Table: 6.3.3.3: Reasons for adoption or non-adoption of Telesurgery by doctors aged 36 to 50.

- **Clinical Research Aided by Information Systems:**

The majority of doctors (84.9%) favours information systems assisting clinical research. Such systems include powerful medical search engines, online medical journals in full text, presentations, drug interaction clinical guides, and statistical tools for data analysis. "Convenience" is the main reason; it is easy and fast to search, gather and store data. Research efforts can be further enhanced with interactions among local and overseas colleagues.

Code	CLINICAL RESEARCH	Occurrence
Acceptance of Clinical Research Aided by Information Systems		
6.3.3.4.1a	**Convenience**: - Good for knowledge gathering, data recording. - Saves time and manpower - Speeds up analysis and cross-referencing	**8**
6.3.3.4.1b	Much data is already in **electronic form**.	1
6.3.3.4.1c	Excellent as long as there is **no extra cost**.	1
Non-Acceptance of Clinical Research Aided by Information Systems		
6.3.3.4.2a	Start-up **cost** Initial **learning curve** **Ethical considerations**, e.g. confidentiality.	1

Table: 6.3.3.4: Reasons for adoption or non-adoption of clinical research aided by information systems among doctors aged 36 to 50.

- **Electronic Medical Records (patient records in text and images):**

A high 71.7% of doctors supports Electronic Medical Records (EMR). Reasons cited include convenience in storage and retrieval of patient data, reduction of paper wastage and lessening the suffering of patients from repeated medical tests (due to poor record keeping or lack of communication).

However, doctors acknowledge that many issues need to be worked out before full-scale implementation of EMR. They include medico-legal factors, unsuitability of EMR deployment in small settings such as solo clinics, the need for good user-interfaces, and EMR creating more work for junior doctors who do most of the patient data entry.

Doctors who oppose EMR cite reasons as tremendous time and effort to key in patients' data, especially data accumulated over the years, security (hacking, virus attacks), and unreliable IT systems breaking down. Hence, doctors still need to keep extra set of paper records, creating duplicity. The bigger concerns are unresolved issues involving patient privacy and confidentiality, ownership of medical records, and medico-legal matters.

Pertaining to "patient privacy and confidentiality" and "ownership of medical records", even though the patient does not own his medical records (the doctor or hospital does), he has the right to insist that all information in the medical records is kept secret. The doctor has a duty of care to the patient. He is prevented from disclosing the patient's medical information to a third party without the patient's consent.[74] The doctor is under no obligation to produce or surrender the medical records, except in the case of a valid police search warrant or subpoena from the court.[75] If EMR is to be implemented, it is imperative to work out the different levels of patient data access by different healthcare personnel (doctors, nurses, administrative staff), so that a patient's privacy is not compromised. EMR systems must also have a high level of security against unauthorised access, hacking, and virus attacks.

Regarding medico-legal matters, there is the issue of responsibility. When errors are keyed into the EMR system, resulting in wrong diagnosis and treatment, who is responsible? Often, the person keying in the patient data may not be the attending doctor, but an administrative clerk or a junior doctor. Sometimes, the equipment fails and results in patient data errors. Who is responsible then, the hospital or EMR

[74] Tham T.Y. (2003), "Management of Medical Records", SMA Medical Convention 2003, http://www.sma.org.sg/whatsnew/convention2003/ppts/4thamty.ppt
[75] SMA Website (2000), "Medical Records: Making and Retaining Them", http://www.sma.org.sg/position/medical_records.doc

software provider? Do hard copies need to be kept despite EMR in place? If so, would this lead to redundancy? Are EMR records over traditional hard copy records valid as evidence in the court?

All the above concerns need to be addressed before EMR can be effectively deployed throughout all hospitals and clinics in Singapore.

Code	ELECTRONIC MEDICAL RECORDS	Occurrence
Acceptance of Electronic Medical Records		
6.3.3.5.1a	**Convenience**: - Easy to store, retrieve, transfer data - Saves space, reduces wastage (less paper)	**5**
6.3.3.5.1b	**Medico-legal:** - Legal aspects need to be sorted out first, e.g. need for hardcopies to be kept despite EMR? - Better to capture the patient record as an image also for medico legal purpose.	**3**
6.3.3.5.1c	**Suitability**: - More suitable for big institutions, eg. hospitals. Not for small clinics. - Yes for inpatient situation. No for outpatient situation, as unable to type as fast as patients can talk for 10mins.	**3**
6.3.3.5.1d	**Lessen inconvenience/ suffering of patients** from unnecessary repeated tests.	1
6.3.3.5.1e	**Yes, but it adds more work for junior doctors**. Better IT software should be used to help ease the collating work.	1
6.3.3.5.1f	Yes, currently medicine and revenue are captured by many clinics on CMS. **EMR will be an extension** of that. Good designs for EMR is essential.	1
Non-Acceptance of Electronic Medical Records		
6.3.3.5.2a	**Time and effort**: - Too time consuming for the solo GP to key in data. Likely to increase consultation and waiting time. - GP may not have the time to scan his patient's medical records into the computer. - Computer breaks down often, still need paper backup (redundancy).	**4**
6.3.3.5.2b	**Medical Confidentiality**/ Patient Privacy	2
6.3.3.5.2c	**Medico-legal** (who is responsible for keying in mistakes, resulting in wrong decisions made?)	1
6.3.3.5.2d	**Hacking** (system can be hacked into, data copied and released to the public).	1
6.3.3.5.2e	**Cost**	1

Table: 6.3.3.5: Reasons for adoption or non-adoption of Electronic Medical Records by doctors aged 36 to 50.

(Q4) Any other comments and suggestions?

Here is a summary of comments and suggestions by doctors aged 36 to 50:

1) The ethical issues of electronic records need to be studied and emphasized.
2) IT is fraught with hacking, virus attacks and unstable systems.
3) Educate doctors in IT. Develop good Medical-IT applications at reasonable costs.
4) IT is only a tool; it will not make better doctors. Instead, doctors need to focus on ethics, professionalism, and a patient-centred approach of doctoring.

Code	Comments/ Suggestions	Occurrence
6.3.4.1	**Electronic Medical Records (EMR):** I hope the patient records from various hospitals can be linked. Having said that, we have witnessed free flow of patient identifications and records in the emails with no respect for confidentiality. The ethical issues of electronic records have to be studied and emphasized. Is it medico legal to be completely paperless? It would be good if patient hospital data can be accessed. I still prefer paper records of patients visiting clinics. Still waiting for the IT connections between the hospitals and clinics.	**5**
6.3.4.2	**Negative Impressions of IT:** With the frequent reports of hackers, computer virus, unstable computer systems, occasional computer breakdowns, I'm reluctant to rely too much on the computer for daily running of the clinic. IT is overblown. It is not really useful for doctors like GPs. It is only good for advertisements, show how modern the practice is. To increase image of clinic, but essentially, it is a white elephant! Use of e-application seems to inflate cost. E.g. E-application for renewal of clinic License (compulsory) result in increase of License fee from $600 to $700.Might as well continue old way of paper application. IT is only a tool, it will not make us better doctors. We need to ask ourselves the real reasons for implementing IT. If it is not for the patient's sake, we need acknowledge it and call a spade, a spade. At the same time, we need to focus on the ethics, professionalism, and patient-centred approach of doctoring and consider seriously if we have compromise them in any way as we pursue advancement in medical technology and IT.	**4**

6.3.4.3	**Telemedicine:** Everything well said, there are unfortunately many of us (like myself) who share clinic space with dental partner, therefore we have space constraint. So limited is my clinic space, that is impossible (literally) to find any table space to place a computer or even a laptop. That is the reason why I need to do all my computer work at home. This being the case, it will not be possible for me to see patients and enjoy some form of teleconferencing with another colleague over the diagnosis or treatment, all at the same time. You may have to make this Telemedicine friendly to users like me who have no choice but to bring work home to do. Teleradiology should be promising with broadband capability.	2
6.3.4.4	**Suggestions on IT:** Implement online medical guidelines and MIMS. IT can be well accepted if found to be cost effective and efficient.	2
6.3.4.5	**Positive Impression of IT:** IT is here to stay. It is education of the doctors and developing good application at reasonable cost that will help make it successful as is evident in USA amongst the IT savvy doctors.	1

Table: 6.3.4: Comments and suggestions by doctors aged 36 to 50.

6.4 DOCTORS AGED 51 AND ABOVE

Forty-one doctors aged 51 and above responded. **Number (N) = 41**

(Q1) In your opinion, what are the barriers to IT adoption in your hospital/ clinic/ lab/ home?

Some of the doctors feel that there are no barriers to IT adoption for them. They adopt a willing attitude to learn and use IT in their home or clinic. They admit they have to put in more time and effort in IT learning than younger colleagues.

Doctors who feel that there are barriers to IT adoption cite reasons as IT breakdowns, benefits not outweighing the time, effort and cost, insufficient IT training, mindset and negative IT experiences, poor IT system designs, insufficient information on how to choose a good IT system, and interference in the doctor-patient relationship. Details are given in the table below.

Code	BARRIERS TO IT ADOPTION	Occur-rence	(%)
No Barriers to IT Adoption			
6.4.1.1	**No barriers**. Responses: - Have home PC and have taken basic lessons from NTUC. - No problem if one is prepared to learn. - Question of need and desire to adopt IT in home/ clinic. - Except we have to put in more effort than the younger ones to learn IT. - I don't think IT is necessary except for emailing.	**15**	**100.0**
Yes, Barriers to IT Adoption			
6.4.1.2a	**IT Break-downs** - Cannot afford to employ IT personnel. - Problems with support services. When system breaks down, cannot get help immediately. - Don't trust IT gadgets! They break down, get hit by viruses, and sometimes are unable to work for no apparent reason. - No problem when standalone PC. Problem when networked up (LAN). - Nobody to turn to when there are problems with hardware or software. - Attempts at using IT are often frustrated by long waiting time to get connected and difficulty in remembering codes of different login sites. Often when you encounter difficulty, no one is available on the spot and you end up switching off in frustration. - Inefficient after-sales service. - Lack of knowledge of where to get immediate direct contact for help when problems arise.	**8**	**21.6**
6.4.1.2b	**Effort/ IT Experiences** - Volume of work does not justify the benefits. - Logistics of wiring up the clinic for computers. Inputting and updating the data of patient files. - IT is supposed to help users go paperless. Is that so? You still need to keep hard copies. When computers hang, all information gets wiped out. - IT used in part. Medical records on paper still faster and safer. - Introducing IT in my office is probably more inefficient. Our staff is much better off without IT. - Fast changing technology - Need to do your work in front of the PC. Whereas, you can read articles (paper) anywhere in the home, while waiting for food or for your child.	**7**	**18.9**

6.4.1.2c	**Lack of/ Insufficient IT Training & Practice** - No one to turn to for help when difficulties are encountered. Limited hands-on opportunities. By the time the IT courses has finished, I have forgotten some aspects and dare not embark on practical applications in the clinic. - Not enough hands-on computer use. - No time to learn IT. - Lack of IT training and support	**6**	**16.2**
6.4.1.2d	**Mindset** - Older staff not comfortable with IT. - Ignorance mostly. Fear of new and 'modern' IT knowledge. Generation gap. - Resistance to change, happy in comfort zone.	5	13.5
6.4.1.2e	**Cost**	4	10.8
6.4.1.2f	**Insufficient Information/ IT Promotion** - Too many different schemes to choose from. Need advice on how to choose a good system. - Ignorance of usefulness of IT among the elderly/ solo doctor. - Lack of hard-sell on the various IT programmes and applications in clinics/ labs/ homes.	3	8.1
6.4.1.2g	**Poor IT System Designs** - Not user-friendly - Slow	2	5.4
6.4.1.2h	**Patient-Doctor Interaction** - Preoccupation with computer at the expense of patient-doctor interaction. - Use of computer during consultation, ignoring patient. Data input later uses more time. Not convinced of advantages versus effort.	2	5.4
6.4.1.2i	**TOTAL**	**37**	**100.0**

Table 6.4.1: Barriers to IT adoption (doctors aged 51 and above).

(Q2) What are your IT needs to be met? In terms of training, hardware, software etc.

Doctors aged 51 and above report various needs in the areas of IT training, hardware and software. These needs are summarised in the table below.

Code	IT Needs to be Met	Occur-rence	(%)
6.4.2.1	**Training**: - SMA is of great help in organising IT courses. - Instill in doctors the basics and principles of IT (knowledge and application). - Lack time to go for IT courses, now that we have to meet CME requirements. - To be available after office hours. Affordable and better teaching. - Lessons on use of new medical websites, PowerPoint, Email, hardware and software, PC upgrading. - Most times I've to figure out things myself. I spend more	17	50.0

	time figuring IT out than using. - IT manuals are impossible to understand. One needs a patient guide/ teacher to be on hand all the time during the early stages. - We can learn IT ourselves or from the younger ones.		
6.4.2.2	**Software**: - I am prepared to buy. Some are free. - Advice on good software. - Software easily affected by virus and worms. - Need good and reliable Windows-based clinical management system (reasonably priced), IT security, more IT knowledge to make full use of the system. - Need CMS. Patient databases: entry, retrieval, analysis, appointment, contact, allergies, special conditions. Drugs: inventory etc. - Need software for interpretation of biopsy specimens, obtain PC imaging (not just report from radiology), obtain images from endoscopies, endoscopic surgery. - Maybe we have to get the experts to write the software for us. The SMA may be able to recommend some suitable software or engage some experts to do them to suit our needs.	9	26.5
6.4.2.3	**Hardware**: - Am prepared to pay for good hardware. - The beginner is often confused with different types of hardware and software in the market. Advice on suitable equipment/ upgrades available is useful. - Need more user friendly IT system. - Concerned about recurring expenses, eg. hardware parts replacement. - Declining patient load, hence questioning the cost effectiveness of some expensive IT hardware.	8	23.5
6.4.2.4	**TOTAL**	**34**	**100.0**

Table 6.4.2a: IT needs to be met (doctors aged 51 and above).

Code	Suggestions	Occurrence
6.4.2.5	Invest in a PC. Take a course on how to use a PC, learn to do Internet searches. Just plunge in and do!	1
6.4.2.6	Helpful: a) subsidise purchases of hardware and software, b) sponsor training. However, whether one goes the IT way or not eventually rests on one's needs and wishes.	1
6.4.2.7	Post CME Schedule over email.	1
6.4.2.8	Many young doctors in private practice who are computer savvy will find it very helpful if all CME programmes are on Internet, esp. if we miss certain physical seminars. At least, we can still learn online. After all, the purpose of CME is to keep us up-to-date.	1

Table 6.4.2b: Comments and suggestions by doctors aged 51 and above, on how some of their IT needs can be met.

(Q3) How can organisations such as MOH, SMC, SMA, AM, CFPS help in making it easier for you to try out IT from your hospital/ clinic/ home?

Medical organisations can help doctors become more IT savvy through three areas - training, hardware and software. They can hold more IT courses and demo sessions, recommend good reliable IT hardware, software and support, and make available more useful medical content on their websites. The details are given below.

Code	Suggestions	Occur-rence	(%)
6.4.3.1	**IT Training**: - Make available more IT courses, free or at discounted prices. - More demos/ exposure to IT. - Guide to software choices, eg. drug information. - Courses on use of existing and new systems. - Publish a list of MOH, SMC, SMA, AM, CFPS websites. - Hold centralised courses or engage vendor to go to clinic to do hand-holding. - Would be helpful to have IT tutors for individual lessons at home. - Doctors must be willing to learn, in order for training to be effective.	12	34.3
6.4.3.2	**Software/ Content**: - Have a nationwide system for all doctors to use, rather than having individual clinics/ hospitals use their own systems. - Have a common entry point for S'pore medical websites. Too many websites, UserIDs and passwords to remember! - Good planning of websites, making them user-friendly and easy to navigate around would encourage even the least IT-savvy to access the sites. - Help source for a reliable clinic system. - Commission a generic clinic management software and sell it at a cheap price (under $1,000) with free or near free periodic updates. - Set up an IT clinic and hospital mock-up so doctors can try out cost effective software system for hire. Some doctors about to retire may not want to try out for fear of having to put old patients' data into the new format. Therefore, help and advice are needed. - Help those who have no IT in their clinics / homes to set up some simple software to get them started - More medical updates via email and website. - Email CME lecture notes to us or have them online when we are unable to turn up for actual seminars due to personal reasons.	9	25.7
6.4.3.3	**Hardware**: - Supply a new PC and other apparel. Or subsidise hardware purchases. - Offer good and affordable IT hardware packages. - Offer low-cost hardware and LAN systems.	7	20.0

	- Help doctors get basic requirements for the functional running of clinics. Encourage them to upgrade IT in premises.		
6.4.3.4	**IT Support**: - Provide a good 24-hr helpline and speedy on-site technical assistance in troubleshooting hardware/ software that are not working. - Have personnel available over phone to make recommendations on hardware and software. - Publish a small booklet on anticipated problems IT beginners are likely to encounter. - Provide identical IT systems. - Design software that has easy recovery mode, in event of failure.	7	20.0
6.4.3.5	**TOTAL**	**35**	**100.0**

Table 6.4.3: How medical organisations can assist doctors in embarking on IT.

(Q4) Any other comments/ suggestions?

Further comments and suggestions by doctors aged 51 and above are given below.

Code	Comments/ Suggestions	Occurrence
6.4.4.1	**Suggestions on how to improve IT adoption rates among doctors:** SMA can organise customised IT courses for doctors, eg. on Sunday afternoons, free of charge. Courses must be focused. Those who are already using or about to embark on IT will benefit more. SMA can supply free PCs for IT Starters, esp. those over 51 years old. If SMA can source for a good package, better still, form a subsidiary, to supply IT software and hardware. Hands-on practice sessions at SMA or MOH on the various packages available from time to time as part of CME Enable online registration for seminars. Provide regular updating courses on new IT items. Have more activities available via the Internet to encourage clinics to start IT. To change the mindset and remove the barriers. Persuasion is the answer. When there is a will, there is a way. Coercion will create resentment, as doctors were not expected to be familiar with IT when they decided to become good doctors and surgeons.	9

6.4.4.2	**IT Wish List:** Evaluation of good software, which can translate written medical notes into the computer for storage of patients' medical records. Perhaps one day, clinics and hospitals can be linked via a network to facilitate referrals and communication etc.	2
6.4.4.3	**Negative Impression of IT:** I am using computer in SGH as a visiting consultant. It is a big white elephant!	1
6.4.4.4	**Positive Impression of IT:** Thank you for thinking about this problem. Old doctors need a little nudge!	1

Table 6.4.4: Comments and suggestions by doctors aged 51 and above.

6.5 DISCUSSION

From the results of this qualitative survey, the following observations can be made:

1) This qualitative survey fulfills the objective of a deeper exploration into Medical-IT specific applications. It highlights the reasons why doctors adopt or do not adopt them.

2) The researcher compares the responses given by young doctors (aged 35 and below) and middle-aged doctors (aged 36 to 50). Both age groups report that they support Online Continuing Medical Education (CME), clinical research aided by information systems and Electronic Medical Records (EMR). Both groups do not support Telemedicine and Telesurgery.

3) Pertaining to Medical-IT uses in their workplace, young doctors use Clinical Management System (CMS) and EMR most often. Middle-aged doctors use CMS and the Internet most often.

4) Asked which IT gadgets are useful to doctors, young doctors rank the Personal Digital Assistant (PDA) as most useful, followed by the Digital Camera. Middle-aged doctors rank the Digital Camera as most useful, followed by the PDA. Both young and middle-aged doctors rank the Tablet PC as the third useful IT device in Medicine.

5) Pertaining to doctors aged 51 and above, some of these doctors feel there are no barriers to IT adoption. Those who perceive barriers exist cite reasons as:-
   a) the benefits of IT do not outweigh the time, cost and effort in implementing IT,
   b) insufficient IT training,
   c) negative IT experiences,
   d) frustrations at poorly designed IT systems,
   e) insufficient information on how to choose a good IT system, and
   f) interference with the doctor-patient relationship.

6) Older doctors have the following IT needs:-
   a) IT training,
   b) obtaining reliable IT hardware and software at reasonable rates,
   c) fast and efficient IT support, and
   d) good medical content provided online by medical organisations.

The next sub-section examines if objectives of the study set in Chapter One have been met.

6.5.1 Achieving the Objectives of Study

Some of the objectives of the study set in Chapter One have been achieved in this chapter. They include:

1) To examine the level of IT adoption among doctors in Singapore. (**Limited**)
2) To discover doctors' views on specific Medical-IT applications, such as Online Continuing Medical Education, Telemedicine, Telesurgery, clinical research aided by information systems, and Electronic Medical Records. (**Yes**)
3) To explore the push (barriers) and pull (encouraging) factors to IT adoption. (**Yes**)
4) To define IT needs among doctors, in areas of training, hardware and software. (**Yes**)
5) To identify future potential and insights of IT in Medicine. (**Yes**)
6) To make recommendations in the light of the findings of this study. (**Limited**)

The next chapter consolidates findings from Chapters Four to Six and discusses them.

CHAPTER SEVEN

CONCLUSION

7 CONCLUSION & RECOMMENDATIONS

Chapter Seven revisits the discussions in Chapters One to Six and makes some recommendations on how to increase the rate of IT adoption among doctors in Singapore. A Medical Hub framework is constructed in this chapter.

7.1 CONCLUSION

The conclusion is that this study has accomplished what it has set out to do. It has proven the six hypotheses true and achieved the six objectives.

7.1.1 Proven Hypotheses

This study shows the effect organisational, environmental and personal factors have on the level of IT adoption among doctors. Findings from Chapter Four support the six hypotheses.

H1: Organisational structures of healthcare institutions (hospitals, polyclinics, group/ solo clinics, laboratories, etc) affect the degree of IT adoption at work, the types of IT devices used and the ways IT is used.

H2: Adoption of IT is greater in the public than private sector.

H3: A doctor's future IT needs is related to his type of practice.

H4: Technological factors may be more effectively exploited by certain sectors of healthcare that leverage on new technology.

H5: There are age differences in the adoption of IT. Older doctors use less IT than younger doctors.

H6: Mindset and IT experiences affect a doctor's level of IT adoption.

7.1.2 Achieved Objectives of Study

The objectives of this study have all been met:

1. **Examined the level of IT adoption among doctors in Singapore (Chapter Four)**. There is a high IT adoption rate among doctors in Singapore. 95.3% of doctors spends time computing each week. The main uses at home are email (86.9%), surfing the Internet (81.7%) and word processing (65.9%). 79.2% of doctors has Internet access at work. The main IT uses at work are email (70.3%), research on the Internet (56.3%) and recording of patients' medical information (47.4%).

2. **Discovered doctors' views on specific Medical-IT applications (Chapter Six)**. Doctors support Online CME, clinical research aided by information systems and Electronic Medical Records. They do not support Telemedicine and Telesurgery.

3. **Explored the push (barriers) and pull (encouraging) factors to IT adoption (Chapters Four, Five, Six)**.

   a) Barriers*:*

   In Chapter Four, barriers perceived by doctors are "writing on paper is faster, not comfortable using a PC/ Mac" (6.6%), "no necessity to use IT in work" (5.0%) and "computer is too slow" (3.5%).

In Chapter Five, barriers cited include "too many computer platforms resulting in confusion and fear of devices being made obsolete", "lack of efficient and reliable IT support " and "mindset".

In Chapter Six, barriers reported include "IT benefits do not outweigh time, cost and effort", " insufficient IT training", " negative IT experiences", " frustrations at poorly designed IT systems", "insufficient information on how to choose a good IT system", " security and confidentiality" and "interference with the doctor-patient relationship".

***a) Encouraging factors**:*

In Chapter Five, pull factors to IT adoption include " common IT platform", "formal IT training in medical school and after graduation", "IT demonstrations creating awareness of hardware and software" and "online sharing of medical content".

Other pull factors include "users' involvement and ownership", "fast and reliable connectivity", "IT systems with simple user-interfaces", "government as catalyst in IT adoption" and "addressing of IT standards, security and confidentiality issues".

The above findings on push and pull factors that affect doctors' decisions to adopt IT can assist MOH, medical organisations and healthcare clusters make informed decisions on the implementation of Medical-IT initiatives in Singapore.

4. **Defined IT needs among doctors, in areas of training, hardware and software (Chapters Four, Five, Six)**.

In Chapter Five, doctors defined these IT needs: "more medical and drug information available on the PDA", "more affordable hardware and software", "efficient and reliable IT support vendor to fix IT problems", "more IT training and practice", "sharing of IT knowledge", "top management's strong support of IT initiatives" and "keeping the average IT user in mind when implementing IT initiatives".

In Chapter Six, doctors aged 51 and above cited these IT needs: "IT training", "reliable IT hardware and software at reasonable rates", "fast and efficient IT support" and "good online medical content".

5. **Identified future potential and insights of IT in Medicine (Chapters Four, Five, Six)**.

   In Chapter Four, doctors identified their Medical-IT needs as research (38.0%), email (36.4%) and recording of patients' information (36.2%). The IT equipment they intend to invest in within the next two years are laptop (36.4%), PC/ Mac (30.9%), scanner/ printer/ digital camera (21.8%) and PDA (21.4%). IT courses they would like to attend are Medical-IT specific applications (26.3%), Microsoft Office (25.8%) and Internet Introductory (11.9%).

   In Chapter Five, doctors identified future IT potentials as the PDA, E-Commerce, and common platforms for Medical-IT applications. Further insights provided by the focus group were the need to enable GPs to adopt IT, sensible use of IT to enhance work productivity, and open-mindedness with regards to the adoption of IT platforms. Above all, the chief purpose of IT adoption is to improve patient care, and not distract the doctor from his core responsibility.

In Chapter Six, young doctors ranked the PDA as the most useful IT gadget in Medicine, followed by the digital camera. Middle-aged doctors ranked the digital camera as most useful, followed by the PDA. Both young and middle-aged doctors ranked the Tablet PC as the third useful IT device in Medicine.

6. **Made recommendations in the light of the findings in this study (Chapter Seven)**. Recommendations are derived from the above sections 7.1.2.2 to 7.1.2.5. They are summarised in the next section.

7.2 RECOMMENDATIONS

The following are some recommendations for ministry policymakers, medical organisations, healthcare clusters, IT developers and doctors.

1) Implement Online CME, clinical research aided by information systems and Electronic Medical Records. Do not implement Telemedicine and Telesurgery.
2) Create a common IT platform.
3) Institute formal IT training in medical school. Encourage doctors to go for IT training after graduation and practise often.
4) Provide hardware and software at affordable rates.
5) Recommend efficient and reliable IT support vendors to fix doctors' IT problems.
6) Provide IT demonstrations on hardware and software.
7) Have an IT support group where more IT savvy doctors help less savvy doctors.
8) Encourage more sharing of good medical content on the Internet or content that can be downloaded into the PDA.
9) Involve doctors in IT design and implementation. Have friendly IT user-interfaces.
10) Encourage doctors to obtain broadband connectivity.
11) The government to act as a catalyst for IT adoption.

12) Top management of healthcare clusters and medical organisations to show strong support for IT initiatives.
13) Address issues of IT standards, security and confidentiality.
14) Design smart systems and applications where the doctor-patient relationship will not be compromised.

7.2.1 Medical Hub Model

A Medical Hub is envisioned under Singapore Medical Association, College of Family Physicians and Academy of Medicine. It will be created in collaboration with the Singapore Ministry of Health, Singapore Medical Council, and healthcare clusters SingHealth and NHG.

Results from the survey and focus group session show that doctors would like to have a one-stop central portal comprising the following medical-IT applications. They are: Discussion Forums for Clinical Topics, Singapore Doctors' Directory, Locum Listings, Patient Information (Electronic Medical Records), Drug Information (index, search capability, allergies, dosage, listing by price), Latest Medical Information (alerts, announcements, news), Research Information, and Continuing Medical Education.

New technologies like Tele-Surgery, Electronic Medical Records, and E-Genomics can also be hosted on this central portal. The enabling Internet technologies are common IT platforms and broadband connectivity, and in the near future, wireless solutions as well.

This Medical Hub concept can become a reality with the support of the above key healthcare stakeholders. Constant feedback during the Medical Hub's development should be garnered from the doctors themselves, who are the main users.

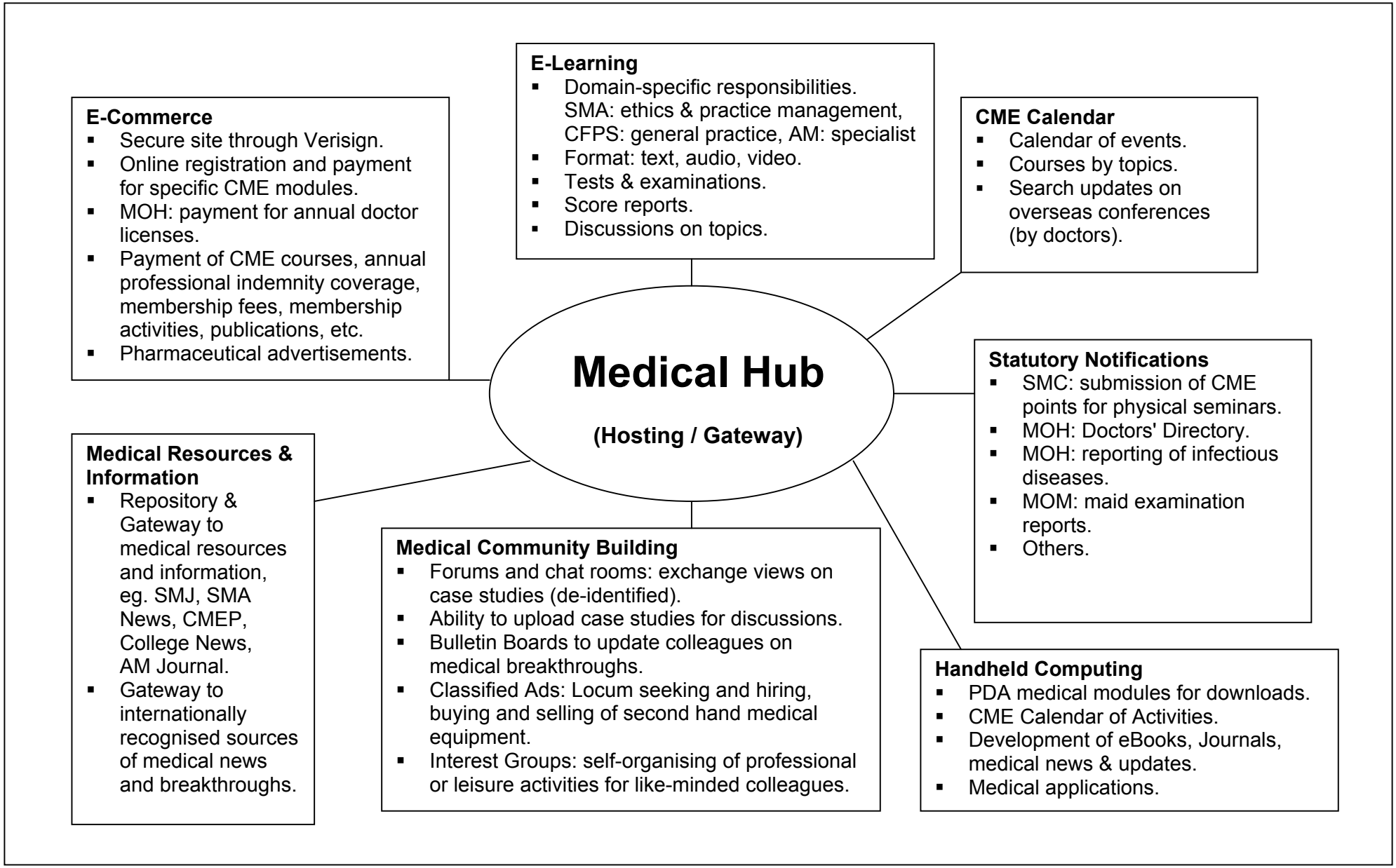

Figure 7.2.1: The Medical Hub

7.3 LIMITATIONS OF STUDY

A possible limitation of the quantitative survey is that the total response rate is 21.0%. The response rate is slightly short of the 30% rate that will give this study a stronger validation.

Although the selection bias in this survey is a possible limitation, a comparison of age, gender, and type of practice records from the Singapore Medical Council and this survey's respondents shows that the profile of the latter group does mirror closely that of the actual doctor population from SMC's records. We can therefore assume that the respondents are representative of the total doctor population.

Furthermore, the limitation of this study was taken into account of by having interviews with doctors in the IT Focus Group session and garnering in-depth responses from the qualitative open-ended survey. The deeper insights have proved to be invaluable in this study.

7.4 SUGGESTIONS FOR FUTURE RESEARCH

An in-depth feasibility study, involving numerous interviews with all the stakeholders (policymakers, medical organisations, developers and users) of the envisioned Medical Hub needs to be conducted. This study is to examine organisational, technological, environmental and personal factors that need to be considered prior to the development and launch of this nationwide Medical Hub.

Various components of the Medical Hub make it a one-stop site for doctors' professional needs. The IT needs should be researched upon, based on doctors' core responsibilities. As policymaker, MOH is to contribute materials on Practice Guidelines, directives, and medical announcements. As administrators, SMA is to

contribute materials on Medical Ethics, Professionalism, Practice, and Health Law; CFPS is to contribute materials on Family Medicine; AM is to contribute materials on Specialist topics. As developers, the IT departments of healthcare clusters and private commercial companies need to involve the end-users (doctors) in developing user-friendly applications for the Medical Hub that are ultimately useful to doctors.

There is therefore much scope for further research.

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APPENDIX

Our Ref. _____

APPENDIX A

Fax to: 6224 7827

SURVEY OF INFORMATION TECHNOLOGY (IT) ADOPTION AMONG DOCTORS IN SINGAPORE

If you have not already done so, please complete this survey on *Information Technology (IT) Adoption among Doctors in Singapore*. Please put a tick in the boxes provided. Unless otherwise stated, please tick only 1 box per question. All information will be kept confidential. Only aggregate results of this survey will be published; no names will be mentioned. Lucky winners of this survey stand to win some IT prizes.

SECTION 1: PRESENT STATE

1) How many computers (PC, Macintosh, Laptop, PDA, etc) do you have? Please circle:
a. At home: 0 1 2 3 4 5
b. In the office: 0 1 2 3 4 5
c. On the move: 0 1 2 3 4 5

2) How many hours do you spend on computing per week?
a. ☐ Over 20 hours
b. ☐ 11 to 20 hours
c. ☐ Up to 10 hours
d. ☐ Not at all

SECTION 2: INTERNET USE AT HOME

3) What uses do you have for your computer at home? (please tick all applicable):
a. ☐ Surf the Internet for general/ work-related information
b. ☐ Send and read email
c. ☐ Assist my children in their schoolwork
d. ☐ Do word processing
e. ☐ Do online Continuing Medical Education (CME)
f. ☐ Do E-commerce/ Internet online shopping
g. ☐ Have entertainment, e.g. games
h. ☐ Others: _____
i. ☐ Not applicable (I do not own or use a PC/ Macintosh)

4) The *first time* you logged onto the Internet was:
a. ☐ Over 3 years ago
b. ☐ Between 1 year and 3 years ago
c. ☐ Between 4 months and 11 months ago
d. ☐ Between this month and 3 months ago
e. ☐ Never logged on before

5) The speed of your current Internet connection is:
a. ☐ 56kbps or less
b. ☐ Broadband
c. ☐ Cable modem
d. ☐ LAN connection
e. ☐ Others: _____
f. ☐ No Internet connection

SECTION 3: INTERNET USE AT WORK

(Please skip Section 3 if you and your nurse/ clinical assistant do not use the computer at work.)

6) On computer systems, the computer devices that you now use in your practice are:
a. ☐ Standalone PC/ Macintosh
b. ☐ Laptop
c. ☐ Server with multiple workstations
d. ☐ Personal Digital Assistant (PDA)
e. ☐ Handphones (with GPRS/ WAP)
f. ☐ Others: _____
g. ☐ None

7) Is the computer at your workplace connected to the Internet?
a. ☐ Yes
b. ☐ No

8) The factor(s) that have motivated you to computerise are (please tick all applicable):
a. ☐ Necessity
b. ☐ Convinced by a friend/ colleague
c. ☐ Out of curiosity
d. ☐ Others: _____

9) You use your computer system(s) in the office for (please tick all applicable):
a. ☐ Email
b. ☐ Recording patient's medical information
c. ☐ Writing prescriptions
d. ☐ Submitting patient specific medical information (eg Electronic Notification System)
e. ☐ Conducting online business transactions (eg Ordering of pharmaceutical products)
f. ☐ Submitting medical claims
g. ☐ Research using Internet
h. ☐ Others: _____
i. ☐ None

10) If there is a central portal for medical applications, what type of applications do you see as useful for this portal? Please list 3 most useful applications.

a) _____

b) _____

c) _____

11) Are you currently using the Electronic Notification System to submit notifications of infectious diseases?
a. ☐ Yes
b. ☐ No
c. ☐ If no, please state reason(s):
_____

_____

12) Do you personally update your CME training credits via the Singapore Medical Council's "Continuing Medical Education" website?
a. ☐ Yes
b. ☐ No
c. ☐ If no, please state reason(s):
_____

_____

Please Turn Over

Our Ref. _____

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13) If you do not use IT in the course of your work, why? Please tick all applicable:
a. ☐ No reason, lack of interest
b. ☐ No necessity to use IT in my work
c. ☐ No computer
d. ☐ Computer too slow
e. ☐ Lack of training
f. ☐ Writing on paper is faster, not comfortable using a PC/ Macintosh
g. ☐ Too few IT applications available
h. ☐ Cost is not justifiable
i. ☐ Others: _____

14) What types of IT courses have you attended?
a. ☐ IT awareness courses
b. ☐ Internet introductory courses
c. ☐ Microsoft courses (eg Word, Excel, Powerpoint)
d. ☐ Computer introductory courses
e. ☐ Specific application training (eg Electronic Notification System)
f. ☐ Others: _____
g. ☐ Do not need training

SECTION 4: THE FUTURE

15) Future IT uses you intend to adopt are:
a. ☐ Email
b. ☐ Recording patient's medical information
c. ☐ Writing prescriptions
d. ☐ Submitting patient specific medical information (eg Electronic Notification System)
e. ☐ Conducting online business transactions (eg Ordering of pharmaceutical products)
f. ☐ Submitting medical claims
g. ☐ Research using Internet
h. ☐ Others: _____
i. ☐ None

16) The computer equipment that you intend to buy in the next 1 or 2 years are:
a. ☐ Desktop computer system (PC/ Macintosh)
b. ☐ Laptop/ Notebook
c. ☐ Server
d. ☐ Personal Digital Assistant (PDA)
e. ☐ Handphones (with GPRS/ WAP)
f. ☐ Scanner / Printer/ Digital Camera
g. ☐ Broadband Connectivity
h. ☐ Networking Products (Switch, Hub, Ethernet Card)
i. ☐ Wireless LAN in the office/ home
j. ☐ Others: _____
k. ☐ None

17) What kind of IT training do you think would be useful for you?
a. ☐ Computer introductory courses
b. ☐ Internet introductory courses
c. ☐ Microsoft Word, Excel, Powerpoint
d. ☐ Specific application training (eg Electronic Notification System)
e. ☐ Others: _____
f. ☐ Do not need training

SECTION 5: YOUR PRACTICE PROFILE

These entries will be kept confidential. Only aggregate results from this section will be published; no names will be mentioned.

18) Gender *(Important, please do not omit.)*
a. ☐ Male
b. ☐ Female

19) Age *(Important, please do not omit.)*
a. ☐ 30 or younger
b. ☐ 31-40
c. ☐ 41-50
d. ☐ 51-60
e. ☐ 60 and above

20) Please indicate your type of practice

Private	**Public**	**Others**
a. ☐ GP	e. ☐ Polyclinic	i. ☐ Not practising
b. ☐ Specialist	f. ☐ Hospital	
c. ☐ Laboratory	g. ☐ Laboratory	
d. ☐ Others	h. ☐ Others	

21) Indicate your main specialty ___ ___
(See Annex A below for code values.)

Name (optional):

_____

MCR Number (optional): _____

Thank you for your time and effort. **Please send in this completed survey ONCE only.** If you have sent it in already, please ignore this survey.

Please send completed survey to:

Ministry of Health
College of Medicine Building
16 College Road
Singapore 169854

Or, fax to SMA: 6224 7827

IT SURVEY PRIZES

5 Cisco Wireless LAN Cards
(worth S$330 each)

3 Trend Micro Anti-Virus Gatelocks
(worth S$329 each)

5 After Office Basic AVO Package for 5 users (80MB server space)
(worth US$180 for one year)

Complete this survey and send it in today!

Annex A: **List of Specialties** ***Code / Specialty*** 00 No speciality 01 Anaesthesiology 02 Cardiology 03 Cardiothoracic Surgery 04 Dermatology 05 Diagnostic Radiology	06 Emergency Medicine 07 Endocrinology 08 Gastroenterology 09 General Surgery 10 Geriatric Medicine 11 Haematology 12 Hand Surgery 13 Infectious Diseases 14 Internal Medicine 15 Medical Oncology 16 Neurology	17 Neurosurgery 18 Nuclear Medicine 19 Obstetrics & Gynaecology 20 Occupational Medicine 21 Opthalmology 22 Orthopaedic Surgery 23 Otorhinolaryngology (ENT) 24 Paediatric Medicine (inc Neonatology) 25 Paediatric Surgery	26 Pathology 27 Plastic Surgery 28 Psychiatry / Psychological Medicine 29 Public Health Medicine 30 Rehabilitation Medicine 31 Renal Medicine 32 Respiratory Medicine 33 Rheumatology 34 Theurapeutic Radiology 35 Urology

APPENDIX B

IT Focus Group Session 2003

Thank you for attending this IT Focus Group Session 2003, chaired by A/Prof Goh Lee Gan.

Further to the MOH-SMA nationwide IT survey to find out what doctors' IT needs are, we are having this informal IT focus group session to solicit your views on the following issues. This focus group comprises of Users (doctors), Developers (programmers), Administrators (SMA, CFPS, AM), and Policy Makers (MOH, IDA).

Date: Tuesday, 28 January 2003
Time: 5:15pm to 6:30pm
Venue: SMA Conference Room, 2 College Road, Level 2, Alumni Medical Centre, Tel: 6223 1264.

A powerpoint on the findings of the recent IT Survey will be presented. Discussion topics thereafter are:

1) IT adoption rate among doctors in Singapore - any comments on this?

2) What are the barriers to IT adoption? How to encourage doctors to adopt IT?

3) What are the IT needs of doctors to be met? In terms of training, hardware, software, etc.

4) What is the future potential of IT in Healthcare?

5) Any further insights to contribute?

The valuable comments and suggestions in this IT Focus Group Session 2003 will chart the IT scene for doctors in the next few years.

Thank you.

APPENDIX C: TRANSCRIPTS OF FOCUS GROUP SESSION

IT FOCUS GROUP SESSION 2003

Date, Tuesday, 28 Jan 2003
Time: 5:15pm to 6:30pm
Venue: Singapore Medical Association (SMA) Conference Room

In Attendance (in no particular order):

A/Prof GLG, Chairman of the Meeting
Dr DV, Clinic for Women, Basic User
Dr RN, TTSH/ SGH/ PGMI, Basic User
Dr LKH, CFPS, Intermediate User
Dr LSH, AM, Intermediate User
Dr JC, SGH, Advanced User
Dr TPC, RSN Medical Corps, Advanced User
Dr CUJ, SGH, Advanced User
Ms RC, SMA, Administrator
Ms KT, SMA, Administrator
Ms CGE, SMA, Administrator
Ms KAL, AM, Administrator
Ms LFY, AM, Administrator
Ms THC, SMC, Administrator
Ms SW, SMC, Administrator
Mr HK, MOH-IDA, Policymaker
Ms SL, MOH-IDA, Policymaker
Mrs TP, Vision Healthone Corp, Developer
Mr BP, Healthsynchro Pte Ltd, Developer

Meeting started at 5:20pm.

Ms RC did a presentation on the results of the MOH-SMA IT Survey, conducted in Oct 2002.

A/Prof GLG:

We are assembled here so that we can share ideas on IT and learn from one another - that we do not re-invent the wheel. So that we can link together and synergise with one another. To start the ball rolling, there are 5 questions here. Please respond in a free way. Any comments on these 5 questions?

1) IT adoption rate among doctors in Singapore - any comments on this?

2) What are the barriers to IT adoption? How to encourage doctors to adopt IT?

3) What are the IT needs of doctors to be met? In terms of training, hardware, software, etc.

4) What is the future potential of IT in Healthcare?

5) Any further insights to contribute?

We shall allocate about 10 minutes per question.

Ms THC:

I notice that the feedback is from 1000+ doctors. Is the data representative of the entire 6000+ doctors?

A/Prof GLG:

We think maybe the respondents are the most active 1000+ out of the 6000+ population. The rest are maybe too busy or not so active. So in a way, **this gives a more optimistic number than is true**.

Ms SL:

Based on the SMC profile, the results of the respondents shadow that of SMC's. Data is rather representative. Private and public sector - profile is skewed towards private. In terms of age group and gender, they match with SMC's doctor profile.

In terms of analysis, we prefer about 40% response rate. The **percentage is not absolute, but we have valuable feedback from doctors** - in how they use IT, and the impediments of IT implementation. Equipment is not an issue, ownership is not a problem. Connection to the Internet - there are some who do not have connection to the Internet. If they have, they worry about things like viruses - they do not know how to handle viruses coming in. So some choose not to connect.

The third thing is, the **applications out there**. Some of them might use Electronic Notification System (ENS) to summit infectious diseases. Not all doctors see infectious diseases, maybe once a year, so why bother to log in? Just fax.

For CME, doctors **assume organisations will update CME points in the SMC system** on their behalf. If not, they assume their department secretaries and admin people will update for them. A few wrote in to say that they will only consider doing it if it is compulsory.

Younger doctors are good with IT, but others are not. So it is up to us organisations to work with them, and to service them. SMA is rolling out courses and IT training for them, especially for extreme cases. We also bear in mind that some doctors feel that they don't need training.

Dr LSH:

Maybe those who've responded are those who are more computer savvy. I don't remember seeing a slide of the demographic of respondents against the total demographic population of doctors. How many of the younger ones have actually responded compared to the different age groups? The 1300+ respondents, are they closer to the younger age group? Among their cohort, do they follow their percentage?

Ms SL:

For doctor's population, **we have compared the respondents' breakdown by age, and it shadows that of SMC's, but is not 100% exactly**. On this premise, we have gathered some assumptions. It is not that responses are skewed towards those by

younger ones. **We have people writing in at age 72 and saying "I'm too old to learn"**.

Dr RN:

I can answer some of the questions on behalf of a lot of doctors. I think the questionnaire here just asks if one is using the computer at home or in the office, and what it is used for. The answer to that, simply, **it is very easy for doctors to put "Yes" for the questions**. Some of their children have computers. Even in the workplace, whether you use it or not, one has a computer. Now the question is, **what is the actual level of usage?**

The point is that younger doctors - MOs, Junior Registrars - they've got to use it all the time. If you go age-wise, people like myself, we have very little knowledge of the use of computer, beyond email. It is not that we don't want to learn it, but the opportunities must be provided. We'll like to get there, PDA, E-Learning, Medical Hub etc, but there is a long way to go. **The big problem is that younger people have the facilities of completing things on the computer all the time. But unfortunately, there is no driver for those playing mahjong downstairs like ourselves.** When we do a course, eg. this course that SMA organises which was very useful, the only point is, it didn't give us many times of practical usage and before that, the course was already over.

In answer to the first question on IT adoption rate among doctors in Singapore, I think it is much lower than what you see in the graph. A large group of people knows only minimal usage, eg. to receive and reply "Thanks, noted." to emails, that's about it. We really need to have practical doctor-customised courses like what you've arranged before, repeated over and over again. I think that Microsoft courses you organise for instance, instead of once a week for four weeks, maybe we'll like once a week for perhaps 18 weeks. The people teaching in these commercial courses, they are so used to it, and they are just repeating on the job, and they go so fast, we just cannot catch up with them. Courses have to be spaced out a bit more, and do incorporate more practice in the courses.

What are the IT needs of doctors? Well, this is it - training and practice. We go and buy a sophisticated piece of equipment, and it just sits at home, can't use it! So basically that's the problem.

Dr JC:

IT is all encompassing. There are many platforms - Palm, Windows CE, etc. **Which platform does one adopt?** What is the general consensus - who uses what most? I don't know how you can go about this. **We need to determine what is the common platform we can use. And we should encourage doctors to adopt that platform.** It's a lot easier if we have the same goals, same target. We don't have to be concerned with so many people with so many opinions. It's a bit dictatorial, but I suppose it's the only realistic option we have to make this thing move. One should say, "Hey look, this is what we propose and what we should adopt, even though it goes against your personal beliefs, but this is what SMC and SMA propose. Get on board and you can get the benefits**." We need to promote a core group of users, and this core group of users will then influence others**. Nothing works more than when you are on the ward rounds, somebody pulls off a PDA, demos it, and the next guy says, "Gee, I would like that too". And we can do that, **if we have the same platform. So that has to be decided upon, and well thought of**.

This unfortunately is also a **barrier to IT adoption**. **Platforms come and go - why something is dominant becomes secondary in a matter of weeks and months.** So if we do stick to something, then we have to **make sure that we have the manpower necessary to support that**. I don't know how that can be overcome. Again that is a barrier to IT adoption. The minute we decide on something, knowing how bureaucracy works, that's going to be many more months down the road. By that time, what was then once very good would be passé.

A/Prof GLG:

Please elaborate more about this platform - what is important about it.

Dr JC:

The only thing I can talk of now is of mobile computing - the Pocket PC versus the Palm platform. Originally, two years ago, the Palm platform was dominant. We had a lot of software for Palm. But by and large, Pocket PC has caught up, and now it is about 50-50 ratio. So what happens is some people find Pocket PC suitable for their needs, and some find Palm suitable. Now if we get a case when it is 50-50, and we as so called providers decide to provide for both, we end up doing work twice. There are such things as Avantgo, which allows you to download stuff from the Net, and you can use that for both Pocket PC and Palm platforms. **However, if you are going to tailor specific programs that are interactive and doctors can actually use to their benefits, that is actually you have to divide work load into two ways - programs both for Pocket PC and Palm, so that's going to be a major hurdle.** I don't have any suggestions or solutions how to overcome that. But I definitely see that as a **major hurdle**.

Dr CUJ:

Dr JC, maybe I can comment on that. 7 years ago when I was in NUS, we'd just used the NUS computers. Now you go there, and every student has a laptop - why? **Because the costs have really gone down for the laptops. So that's a major removal of a hurdle.** If you choose a platform that is versatile enough, maybe not a mobile PC, just a desktop, you remove the barrier - cost. **And you give them a good package**, everyone will take it.

Dr JC:

So we get people - convince them through their pockets.

Dr CUJ:

They have good vendors like Toshiba, and they give super discounts for NUS. On top of that, they give them **interest-free loans**. With interest-free loans, they do not have to pay till a certain time.

A/Prof GLG:

Actually what you've said is absolutely true.

Flashback to the 1970s, that time having a computer was quite a big thing. And so we said, "Why don't we get people to buy Apple. Get some of these people who sell Apple, and we got people who bought by the dozens. So that was our first wave. And

when the Apple died, IBM came in during the 1980s. That was the second wave. I guess the next wave is either the Palmtop or the CE.

So I can see that there is some kind of trend. The **common denominator is that we can get enough people to buy machines, to get the machines cheap**, through mass marketing.

Dr CUJ:

The mobile platform is a good sexy idea, but ultimately, it will not replace the desktop or laptop. **I think laptops are here to stay.**

Dr JC:

But bear in mind that the O/S in the PC platform, for example when they teach Word for PC, there is also a Word for Mac. They were **designed by different teams, for the same purpose**. If we are trying to provide them, we **must make sure that we have enough manpower to do that**.

A/Prof GLG:

Would there be more PCs than Macs?

Dr JC:

I don't know the percentage, but it is about 90% PC to 10% Mac.

A/Prof GLG:

Do you think the Windows CE version will stay?

Dr JC:

I think it's here to stay. It is only a question of who will take predominance over who in the next few months. And if we are going to do it, we might as well do it right from the start, I think. Otherwise, we just have to make sure that we are going to provide for both.

A/Prof GLG:

I guess this is where we have to **touch base with IDA, to ask if they can give us some vision down the road**. Okay, good, let us move on. Maybe we can now take Questions 2, 3, 4 together - barriers, needs, and potentials.

Dr TPC:

I think we've got different issues. One, it's about the Internet version - laptop or desktop PC. And the other one, it's the **PDA**. And we have to ask what are the end results we wish to get. Personally, I use a Palm top, and I've found it useful as a Houseman, mainly because there is a huge amount of data. The **main barrier I felt was that there was a lack of support**. Basically, I feel it is good, and I assure people it is good. But in daily work, I was not using my PDA. Rather, I was using it to read about cases in the States where hospitals have wireless access to blood test results and they can request tests, request information using PDA. This kind of thing, this **kind of support, will really encourage adoption**.

And as for the **needs**, firstly, the PDA performs wonders in attracting people to use it. One thing that **doctors need is huge amount of information**. And especially when you specialize, you need more information about other specialties that you're not in. That's what PDAs can do. Already you have Skyscape, Handheldmedscape, etc that can provide Harrison's, Merck Manual, Griffith's 5-Minute Clinical Consult. The entire thing on PDA. And there are even Yahoo groups that port pirate applications, and there's huge amount of information. **I've encouraged and convinced my friends to use it. Some like it**. Equal amount of doctors tell me that after they've bought the PDA, they find that **they don't use it**. They find that they do **not have time or are not supported**. So I have equal reactions both ways. But information is knowledge-based. You can source for information everywhere you go, even without the need for you to be bound by a desktop. That's fantastic.

Even better if you can give a quality source of information. **MIMS** for example has an Internet version. People in Australia, they subscribe yearly, and they get the most up to date versions of MIMS. Just **drugs alone** - being able to refer to them **wherever you go, wherever you are, without being tied down by huge books or terminals.** That's fantastic - **drugs and information, that's what we need to have access to.** And we have MIMS, with easy use and encouragement, that'll be good.

And, **the future**, what I dream of, is using **PDAs to take pictures or conditions, send them wirelessly to other doctors**, asking "What do you think this visual is?" Or better, **record down histories in verbal format**, so that in the future if anything happens or you forgot something, you can always refer to this patient on a particular day, "What did I say exactly?" That's the ultimate - that's what I dream of. These are few ideas that I have.

A/Prof GLG:

Good, I think certainly you are not the only dreamer, that others have similar if not identical dreams. I would say that there are 3 things we need in our hands, that are information based - email, PowerPoint, word processing, visual/ imaging tool. If they are on the PDA, each of us will be walking around with the PDA.

Ms SL:

Local hospitals already have such services, by NUH, on PDAs.

Dr JC:

PDAs issued are four generations old. They are very heavy - how do you expect us to shove them in our pockets and walk around with them in ward rounds?

Dr TPC:

Some nurses in NUH and TTSH have Compaq iPAQs, but **doctors have no chance to touch them**.

Dr LSH:

For NUH itself, the inpatient system, they have sort of integrated things - desktop, laptop, and PC tablet. **As for the tablet, due to cost, they didn't really implement it.**

Dr JC:

I can only say from SGH experience. Previously, there was a changeover in Council, and they were all given this Sharp machine, I mean I haven't see that before - it has to be that old. First thing they did **when they got home was put it in a safe deposit place - at home, so you don't lose it** (laughter). It's an absolute waste of money and time.

Ms SL:

We are off the ground, so am are not speaking on any official terms. But the **feeling is that we can equip you with the best to our standards out there, but there'll be people who take the equipment, and put it somewhere else.**

Dr JC:

That's why I think that if you really wish to tackle the issue, you should go really deeper. At our level, we have picked up habits that are very difficult to change. We are probably **stuck to platforms that we are very comfortable with, and there'll be opposing platforms.** But if I may use a term, "Malleable minds begin when you are at school". And if we can't go that deep, at least we can reach out to the medical students. **Equip them - get NUS involved.** As long as the opposites occur, **it is not feasible to get companies to concentrate on one platform, and provide solutions to only one platform. And it'll be very expensive to do everything twice over.** So that's where you get your major barrier.

One way of reaching out is, I don't know, we can go in, and see if they can adopt those things there. And get the support at the level that is easier to manage - at the school level**. Make it a compulsory section, for example. In SGH, we ask the Housemen to use the computers.** Days are wasted in teaching them how to access these things. TTSH and SGH use different platforms, so **when you move around, you end up learning three or four different things. So there's no unity, there's no unifying aspect to it all**. And worse thing is they (Housemen) come in absolutely wrong. They have no preparations whatsoever, and you expect them to learn. And it's chaos for the first two days. It's absolute madness for the next two weeks. **And by the time they are ready, and they know, it is time to go.** There's a lot of wasted energy.

A/Prof GLG:

Maybe, Dr JC, there is some hope. **I see my Year 1 students with the PDA, and they actually have lots of stuff in that thing.** And I was asking him, "Where did you get it from?" And then he went onto that page and he presented it from there. And I said, "hey, that's cool".

Dr JC:

By and large, these are very individual cases - **there's no structure or formal aspect to this. It's all on our own initiative**. At least we are aware that habits good or bad are learnt. These are habits we take with us. So **when are actually full-fledged into things, it's actually very hard for us to pick up something new**. That's where al these barriers will continue to be perpetuated.

Ms RC:

Do you all have any formal training in IT? Like basic computing? Do you all type out your essays? Or do you have modules on PDA or it's just a hobby? **Do you have formal IT training, and do you think it is important to have it?**

Dr JC:

I think it is **absolutely important**. Because sooner or later, there's going to be a shift where more and more authoritative aspects are going to come into this. And then one of these days, **an accident's going to happen**, and someone's going to say, **"Why didn't you refer? The information's available."** And then it becomes negligent on our part, or we are not at forefront anymore, or things get blown up.

A/Prof GLG:

I suppose there is one instance here when there is an oxymoron. Clusters have no common platforms due to competition. Quite clearly there needs to be a common platform in the things we do - with MOH, the Clusters, and NUS. So that we can begin to leverage on what we call the economies of scale. Because **without economies of scale, we definitely cannot keep up**. Singapore is not very big. Kheng Hock, you wish to make some comments on this?

Dr LKH:

I would like to take a step back, because we all fall within the spectrum. But one end of the spectrum, we call the IT **Evangelists - people who think the world can be saved if everyone buys the PDA**. On the other extreme is the **Technophobists who are very frightened of technology. They think that society marginalises them**. So when we think **of policies to implement IT, we have to accept that people are of two extremes**. With the IT Focus Group, it tends to be dominated by people who are at the pro-IT side of curve. So we may come up with very good ideas, but when you bring it up to the general population, you may find that people are very resistant and do not adopt the ideas. We have to **plan for the guy in the middle** of the bell curve. So probably it is unrealistic that people will get a lot of PDAs straightaway, but I think the tide is going in. and **each generation of doctors, like it or not, will be more and more IT savvy. And he one at the other end will have to catch up**. Unfortunately, some will be pushed out or left behind. **So if we set our targets right, we can implement the right policies.**

Now, whether this sample is representative or not, I think the question can be answered if you look at the 3.2% who do not have access to the Net. If you look at the profile and say, "This is older, tend to be more female", then we can know which are the areas to be addressed. **My feeling when I saw the results was, I couldn't believe it, as it was so good to be true.** I think most of us have this same impression. **The assumption is that people who would bother to fill up the form tend to be more pro-active, more *gung ho*, and more likely to use computers.** I think this is a fair assumption. So maybe we can take it with a pinch of salt and say, "Maybe not 80%, but it is better than we'd expected". **As far as the survey goes, it is quite good. In the real world, it is as good as it gets. So I don't think we can get any better data than this.**

Dr JC:

Award 1 CME point for this. (laughter)

Dr LKH:

Which brings me to another point. **How do you convince people on board? You either convince them or coerce them.** So in Singapore, we like to coerce people. So maybe SMC can do that (laughter). Probably SMA will convince and the rest will coerce (laughter). And then, one more thing is, we need to **train people for IT skills** first and then we develop the products for them, or you **develop the products**, and then encourage people to develop IT skills? **I think you've got to work on both ends. So this Medical Hub, you should not waste time - you should quickly go ahead.**

Now, people who are already in it (adopted IT) will feel so happy and **will go and invest more and more hardware and software**. People who are at the margin will say, "I'm already wasting time. I really need to learn how to get on". So I think, we should go both ways. **Teach them, and at the same time, give them things to use.**

Dr JC:

Don't forget the ones who are already using IT - they are a lot easier to teach; they pick up a lot faster. Someone mentioned economies of scale. **If we can make it cheap enough for them to own something and not afraid of breaking it, then it'll be more viable.** So what if I crash something, I can replace one easily. If you pay a thousand bucks for something, you'll probably make it into a monument.

Ms SL:

Can I understand what is the response rate for the IT training sessions?

Ms RC:

So far, last year in 2002, we've trained about 180 doctors. This year we plan to train 200 and above doctors. The feedback has been good. The trainees like the basic foundation courses and would like to have more - go onto Level 2, etc. One problem is what Prof Dr RN has pointed out - there is not enough time for doctors to practise during the sessions, ranging from three to four Sunday afternoons per course. **They just don't have enough time for practice**. Even at home, they **actually need a lot of guidance - from family and friends. They may lack support in this crucial area. IT vendor support is very important too**. In case computers crash and network connectivity goes down, there's no one to fix all their problems. This can be rather discouraging in their IT learning efforts.

Ms SL:

Do you think that E-Learning will help?

Ms RC:

E-Learning will only be useful when it comes to CME modules being rolled out online. Those who are IT savvy would have no qualms about going online for E-Leaning. But **those who are already lagging behind may have apprehensions about going online**.

Dr JC:

What we need to do is to get rid of apprehensions at all levels. If people are frightened of technology, they won't use the Medical Hub. And vice versa.

A/Prof GLG:

I would like to ask - this PDA is something worthwhile to look into. What is your world view there - to promote the PDA as an instrument which will truly become your encyclopaedia? Let me ask Kheng Hock.

Dr LKH:

I think it will start at one end (IT savvy). For the other end, if you force it down, it will be quite difficult. In the middle, probably you can show them that it is useful. I'm in my forties, so am somewhere in the middle of the curve. I use the PDA for medical applications. I have a BMI calculator that is so troublesome to use. I'd rather use the slight rule of thumb (laughter). Why don't we get the Griffith's 5-Minute Clinical Consult, encyclopedia, and we shoot it down into the PDA? I think probably I'll get that one, but it is expensive. There's no pirated version for that (laughter)?

A/Prof GLG:

So maybe we start mailing out information. For example the Family Medicine notes, that's one of the best. You actually can download the Word files. So I don't know whether PDA can do this?

Dr JC:

Yes, two ways of doing this. There is a direct source where you can read Word file transcriptions. Otherwise, someone actually takes the step to convert notes into an iSilo (PDA reader application) file. It is easily do-able.

A/Prof GLG:

So it is a question of trying to get enough content. I mean, if there is nothing to look, there is no reason to use the PDA.

Ms RC:

In the Handheld Medical project (www.sma.org.sg/handheld), we've linked up with many good companies who offer medical applications. We've also developed this site in Avantgo, where we've come up with eBooks. We've got SMJ online and some of the perks and privileges for members, all downloadable on the PDA. The **take-on rate was all right in the beginning, but started to tail off later, primarily due to lack of manpower resources to update the Avantgo channel** well. We'd actually needed to get a lot of licensing rights to the content. So that's another barrier to PDA adoption. **Unless both the Clusters and all the hospitals grant us the free access to the content *sans* licensing fees, else this won't work. We do need lots of good medical content to keep this channel useful for doctors.**

Dr JC:

I can add on to this. We'd actually tried to get the KK blue book for Pediatrics. I came up with **dead wall after wall of bureaucracy**. They just refused to let us have the

rights, with reasons as, "It's not applicable… people will change stuff in it and it wouldn't be authoritative anymore." All the excuses in our faces.

A/Prof GLG:

Can you find something generic enough for the PDA, eg. KK plus?

Dr JC:

But we need authority, you see. We **need someone who's an expert in the field to say, "This is written for doctors"**. I've found the argument a bit hollow, to say that just because some of the stuff will be changed on the PDA, we'll cross out some of the stuff in the book. **But we can see that there is phobia there. They're not used to it, and they can't imagine how this will be useful to us doctors.**

Ms RC:

Can doctors unite on this? Can we get Administrators to say, "Okay, this book itself belongs to doctors. **The doctors themselves have the right to say if it goes onto the PDA.** Then at least we can make some headway in this. Otherwise, forever we'll be stuck behind the **bureaucracy**.

A/Prof GLG:

Dr JC, actually the solution is quite easy. This is what I do for the Family Medicine Programme. I look at the Clinical Practice Guidelines, issued by MOH. Two, three years have passed since publication. I take that older version as my template. **I value-add to the notes. I just don't mention anyone's name. And then I upload as a set of notes.** People will say, this is not bad. I don't own it; I don't put my name down. Else people will say, "Hey A/PROF GLG, who gave you the authority to write that?" If there's no name, then I can say, "Hey**, these are study notes, compiled for the good of mankind**". So this is how I'd overcome things. In Family Medicine, you've got to teach people lots of things. There is no time to be involved in all these disputes.

So maybe we can now think of PDA and content, before we persuade people on it.

Dr LSH:

All the points are taken. I neither belong to the young generation nor the old generation. I think I'm somewhere in between. I haven't stared using PDA yet, because I don't find the need. The reason is I can go straight to the computer, either a desktop or a notebook. I don't need the PDA, and especially many of us, **people like me, actually prefer a bigger screen. There are many ways of accessing information from the Internet. In fact, I'd already stopped using a lot of textbooks. Even journals, I read from online journals.** To find information on the Internet, it's endless.

It all depends on where we work. Most of the time, even if I do ward rounds for one or two hours a day or when I'm in the clinic, there is no time to look at the PDA. The only time I have to access information is only in my office. So actually I don't need to carry a PDA around and look for information. Unlike the junior doctors where they may use the PDA to trace results, look at the references and so on. **Different groups of doctors have different needs**. Either in the ward, in the clinic, at the office, all needs are different. So maybe we have emphasized too much on the PDA. I'm not saying

that PDA is not good. I myself wanted to have one, just that the models keep on changing, and I'm still waiting for the latest model. I can say that I observe a lot of my junior doctors - almost everyone has a PDA.

You can have a lot of textbooks, downloaded onto the PDA. Basically, it's for those who spend a lot of time in wards, who don't have direct access to computers. I think we need to cater for different needs. In the past**, I thought that the greatest barrier to the use of IT is actually mindset**. But I don't think that is a main issue now. It's actually the **demand and necessity.** For example in SGH, all of us have to use the E-Prescription system. We have to type in the prescriptions. In the past, a lot of people have complained - **you have to turn to the computer, not facing the patient. It actually delays your own time, especially if you have a busy clinic.** But because I was sitting in certain committees, I said, "If I don't do it, nobody else would do it." So I had to set an example. **After a while, you find that it is actually much faster to actually prescribe electronically than in writing**. So if you **enforce it - no more handwritten prescriptions**, everybody will just switch. It's just a matter of time to switch. So I think enforcement, and the demand of the hospitals, will generate the need to learn. If there is an alternative - handwritten prescriptions, nobody will want to go to the computer.

A/Prof GLG:

I would say that you are partially right, and partially not right. Right in the sense that the computer and Internet now form truly a good source of information. If you do a Google (www.google.com) search, you will probably get more than Medline or Pubmed searches.

There is scope for us to create lots of good information. We need to get a lot of live stuff, put back to our doctors. My hidden agenda for promoting the use of PDA is this - **I look towards the day when we can use the PDA as an indispensable tool.** That means I use it to check my patient records, I use it to check lab results, I use it to check messages left to me by my nurses or whatever my colleagues want to tell me along the way. This becomes like the passport. We may arrive at the day, with this PDA in hand, the whole world is in our hands. Then our desktop is the backup. If you ask me which I would rather read, I would say the **desktop, as it's so much bigger. But the thing is we, some of us, spend a lot of time walking around the world, so the PDA has become important.**

Dr LSH:

I totally agree with you. Nowadays **when I travel, if I don't bring along my notebook, I find that I have a handicap, because there are no emails to read**. It's actually very bad, leaving the country. To that extent, every country that I go, I must find a hotel that I can have no problems accessing my emails. But again, if I walk to the ward, I don't have to trace my patients, because I have my juniors to do that for me. I'm not sure whether that is bad or good, because I can always order someone, "Where is my patient? Tell me which ward." I expect my juniors to seek these patients out, with whatever means they have, so that's PDA in the use.

Ms RC:

So we can summise that junior doctors need PDAs and senior doctors need laptops (laughter).

A/Prof GLG:

I discover the wonders of being a senior. I don't even have to look at the emails. I say to a junior, "Can you download the emails for me into the PDA?". Then I pack it into a briefcase and go home to read the emails. So actually I realise that being a senior, there are many things that people would do for you.

Dr LKH:

Just think of them as human PDAs. (laughter)

Dr JC:

I agree with what Dr Lim has said. **There will be ever-changing needs for a particular person, but for that person in any one time, there will always be certain skills that the person may need to have**. Maybe it's just that when you are at that level, you can still survive comfortably without all these extra skills**. For the younger generation, if we feel that we don't need these skills, we are going to get left behind by the next generation**. Previously, it was books or journals, eg. New England, all my beautifully arranged together and bound volumes. Now I subscribe to New England online, I may put them aside. Next time, I don't know, maybe I can get it from here (Medical Hub). So I would **rather have the freedom of choice, knowing I'm equipped at all levels**.

Dr CUJ:

Previously I was involved with looking at some IT initiatives, with Ms RC, for GPs. I think we are missing a huge chunk of doctors here. I look at our doctors in 3 big groups - the public sector, the private sector group, the private sector small group/ solo practice. **The people who need the most IT enabling are the GPs**. I was Locum in many of these private practices. The computers are there, whether they use them or not, is another thing. To many **GP clinics, solo practices**, only the younger ones and those who want to spend a bit more money, get good PCs with broadband or cable. The rest of them either have **no PCs or have 486s/ Pentium 1s, just doing basic word processing**. **And I think this is the big group that we should concentrate on**. We should bring them up to the level (good desktops), and we go from there.

From reports I've read, Singapore is very (IT) penetrated. 40% of Singaporeans buy something online. Actually, that's my main interest - **E-Commerce for doctors**. With respect to GPs, as in how we can make their lives better - everything is written there in the **Medical Hub. I only find that one thing is missing, and that is a lifestyle portion.**

A/Prof GLG:

I think we should not neglect the larger world. After all, we can be so engrossed in CME, that we neglect our lives.

Dr JC:

Th only thing I'll like to interrupt is that **we may end up re-inventing the wheel** with that (E-Commerce). We have Amazon.com and Barnes and Nobles and all these E-Commerce sites are online.

Dr CUJ:

Oh, I don't mean that. I mean things like Sensory. The SMA business development team has one to great efforts get good deals for members. But so far, it is "call this number to buy something" or "click here to go to their site". **It's not that difficult to have an integrated site to buy lifestyle stuff, as well as your indemnity**, why not?

A/Prof GLG:

Okay, that's a good one.

Ms THC:

Backtracking a little, SMC statistics - generally half the doctor population is in private practice, and half in public. I don't thing there's a problem with doctors in the public institutions getting access to PCs etc. **It's those in the private sectors that we should focus on, especially those in solo practices**. Those in the group practices are also not a big issue. It's those in solo practices that do not have Internet access.

Dr CUJ:

I've talked to **many GPs. One is the machine, get them a good deal at a cheap rate, be it desktop or laptop. Second thing is, get a good deal for broadband. Third thing, the necessity**. Either you **give them incentives or disincentives**. My wife was telling me, "If you can't encourage them, then make them." For example, on claims - they obviously can cope, so why not? They don't do the e-claims themselves.

Dr LKH:

I think you **cannot be too harsh on anybody on such things. Doctors do not need it, so why force them?** For me, in my clinic, I have a simple computer on dialup. At home, I have a very powerful computer on broadband. When I need to do my IT stuff, I do it at home. Why do I need it at the clinic? **I go to the clinic to see patients. Now if I need to use the computer to be a better doctor, to be more effective, I'll use it. But then don't make me fill up claims just because you want to increase the IT usage rate. That's very cynical.**

Ms RC:

There's a view by **some doctors that many of the ministries create online systems of e-notifications, e-everything, for the benefit of the ministry staff members themselves, not so much for the benefit of doctors.** Do you all agree with this view?

Dr JC:

Yes, I agree.

Ms RC:

So do you agree that doctors are generally more inconvenienced? Now, **instead of looking after patients, they have to fulfill more roles of e-filing here and there.** These take up a lot of their time. The advantages of time and effort saved will only accrue to the ministries themselves. **Technology is supposed to save time and money for doctors, but it appears the other way round now.**

Dr JC:

Picking up from what Prof Dr RN has said earlier on - we don't use it (e-notifications) often enough. In my practice, **I see tuberculosis cases half a year. Suddenly I have to remember all the steps to the ENS system**. The guy, this is only our perception, sitting in the ministry goes, "Oh great, incoming email. I'll give him the location." It should be the other way round.

Dr LKH:

The **bottomline of IT is to increase productivity. It's not having IT for IT sake.** The advent of IT has not led to a worldwide increase in productivity. **The extra time we've saved, we just goof off, surfing the Net**. If you ask the doctor to go online, he'll just surf the stock exchange and monitor his stocks. To the patient, this is **a distraction - may not be a good thing**, you know. It's always a double-edged sword. We have to think carefully.

A/Prof GLG:

Certainly, we must remember the cautious side as well. Ok, time has caught up. Can I just have a last round? Then I can quickly sum up and we can zip for home. Okay, I must thank all of you. It has been a very good discussion. Certainly, it will help us a lot in trying to do something with the info given.

Just to answer the last question "Any further insights?", **we can work towards**:

1) Medical Hub

2) IT Training

3) Local medical content

4) Hardware (PDA, Laptop, Desktop) and broadband at good prices for doctors.

5) Productivity and wisdom must be the end.

With that note, let me thank all of you around the table. We will get the notes of this meeting out and send to you. What I'm going to suggest to Ms RC is to take these action items up with the various stakeholders, eg. Ms SL of MOH, Ms THC of SMC, Ms FY and Ms AL of AM, and Dr LKH of College. The rest of you users will also contribute to this new wave of information usage.

This is certainly not going to be the last focus group. We will meet sometime again.

Thank you.

APPENDIX D

Fax to: 6224 7827

A QUICK IT SURVEY

The SMA IT Committee is conducting **"A Quick Information Technology (IT) Survey"** among doctors. We welcome a free flow of answers. Please use a separate A4 piece of paper if your answers exceed the space given here. Thank you very much for your time.

Survey for (please select):

- ❑ ***Doctors aged 35 and below***
- ❑ ***Doctors aged 36 to 50***

(Q1) How is Medical IT being actively used in your hospital/ clinic/ laboratory now? Eg. MRI, ECG, EMR, Clinical Management systems, etc.

(Q2) In your opinion, which IT gadgets are likely to be useful and highly adopted by doctors now and in the next 5 years? Eg. PDAs, digital cameras to capture medical images, tablet PCs, etc.

(Q3) Do you think these IT initiatives will be well accepted by doctors now and in the next 5 years? Why/ why not?

- Online CME:
- Telemedicine (remote consultation/ monitoring of patients):
- Telesurgery:
- Clinical research aided by information systems:
- Electronic Medical Records (patient records in text and images):

(Q4) Any other comments/ suggestions?

Survey for:

- ❑ ***Doctors aged 51 and above***

(Q1) In your opinion, what are the barriers to IT adoption in your hospital/ clinic/ lab/ home?

(Q2) What are your IT needs to be met? In terms of training, hardware, software etc.

(Q3) How can organisations such as MOH, SMC, SMA, AM, CFPS help in making it easier for you to try out IT from your hospital/ clinic/ home?

(Q4) Any other comments/ suggestions?

Please fax your answers to **6224 7827**, or answer them online at **www.sma.org.sg/tech**, or mail answers to **SMA, 2 College Road, Level 2, Alumni Medical Centre, S (169850)**. Thank you.

Appendix E: Acronyms and Abbreviations

Here is a list of acronyms and abbreviations used in this study.

AH - Alexandra Hospital
AM - Academy of Medicine Singapore
CARES - Central Appointment and Referral System
CFPS - College of Family Physicians Singapore
CGH - Changi General Hospital
CME - Continuing Medical Education
CMS - Clinical Management System
CT - Computerized Tomography
CT - Cross Tabulation
Dr - Doctor
ECG - Electrocardiogram
E-Commerce - Electronic Commerce
Email - Electronic Mail
EMR - Electronic Medical Records
ENS - Electronic Notification System
FM - Family Medicine
GP - General Practitioner
GPRS - General Packet Radio Service
HEAL - Hospital & Emergency Ambulance Link
H1 - Hypothesis One
HIS - Hospital Information Systems
HMO - Healthcare Managed Organisation
HO - Houseman
Hosp. - Hospital
IDA - Infocomm Authority of Singapore
ICT - Information and Communication Technology
IT - Information Technology
IVLE - Integrated Virtual Learning Environment
Lab. - Laboratory
LAN - Local Area Network
MC - Medical Certificate
MO - Medical Officer
MOH - Ministry of Health
MOM - Ministry of Manpower
MRI - Magnetic Resonance Imaging
NHG - National Healthcare Group
NUH - National University Hospital
NUS - National University of Singapore
OLP - One Learning Place
PACS - Picture Archiving and Communication System
PC - Personal Computer
PDA - Personal Digital Assistant
PGMI - Post Graduate Medical Institute
Poly. - Polyclinic
RH - Restructured Hospitals
RSN - Republic of Singapore Navy
SGH - Singapore General Hospital
SHS / SingHealth - Singapore Health Services
SMA - Singapore Medical Association
SMC - Singapore Medical Council
Spec. - Specialist
SPSS - a statistical software
TTSH - Tan Tock Seng Hospital
WAN - Wide Area Network
WAP - Wireless Application Protocol
WHO - World Health Organisation