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Telemedicine and the Digital Door Doctor

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Abstract

Telemedicine is changing the way medicine can be practiced, and how medical knowledge is communicated, learnt and researched in today's technologically oriented society. The adoption of internet based communication has significantly expanded the patients' ability to access a multitude of world class medical information. Research has shown that patients would welcome the ability to consult a doctor using the same computing tools they use to communicate with family, friends and work colleagues. This paper discusses the use of telemedicine today and how it could be used to access medical services from home. Further, it investigates the incentives and barriers to widespread adoption of such services in Australia with particular reference to the issues of information security. The technology to make home telemedicine a reality is already available and all that remains for this to come to fruition is a shift in culture to accept it as a suitable alternative to current medical consultation practice.

Keywords

Home medical consult, hospital without walls, teleconsult, telemedicine, information security.

INTRODUCTION

New medical consultation options are surfacing as a result of the evolution of the Internet and its pervasive integration into many aspects of modern life. Information technologies have allowed medical science to exponentially expand the capabilities of physicians and have significantly increased the resources available to patients. One area that has arisen from this is telemedicine. Telemedicine is "the use of electronic medical information and communication to provide and support health care when distance separates the participants" (Hospital Management.net, 2006). Today, telemedicine is changing the way medical practice is delivered to an increasing number of patients, where the geographic boundaries that once prevented information exchange are no longer an issue. As domestic electronic transmission bandwidth is increased, more possibilities emerge to enable the home user to benefit from the widening array of online medical services. Consumer demand, as well as the value of good health, is driving the next generation of medical consultation services (Australian Government, 2005).

In Australia, according to the Australian Bureau of Statistics - Multi Purpose Household Survey (2005) as shown in figure 1, approximately 67% of Australian households have a home computer, with 56% having one or more computers connected to the Internet. Home users access a wide range of activities including communication, work/business, educational, purchases and entertainment purposes.

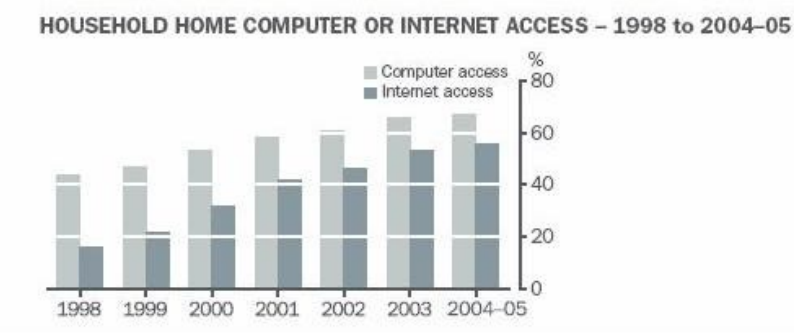

Figure 1: Household Home Computer / Internet Access (Australian Bureau of Statistics, 2005).

The continual growth in popularity of internet based services from home indicates that they provide a convenient communication medium which may have value for medical service ventures. However, there exist fundamental concerns in the use of this technology for home telemedicine activities. This paper discusses telemedicine as a viable medical service for patients in a home setting. The current state of telemedicine, its practical application, the possible implications of its widespread adoption in Australia, and the associated security issues are examined.

CURRENT SITUATION

Computerisation in Australian General Practice

Many medical practices in Australia have already adopted computer based systems over paper based record systems for efficiency, cost saving and time saving (Western et al., 2003). The technological shift towards the use of electronic medical record (EMR) systems typically means that healthcare providers are looking to streamline processes and remain viable cost effective business entities. In an Australia wide study entitled "Computerisation in Australian general practice" by Western et al. (2003), computerisation levels were believed to have increased from 30-40% in 1999-2000 to almost 85% of all Australian general practices in 2003. The amount of usage varied largely between practices but the trend showed that both clinical and administrative uses were represented. The fastest growing of these was the clinical function at an increase of 76% over the four years of the study compared with a 47% increase in administrative use.

In 1999, the Australian Government created a Practice Incentives Program that financially rewards medical practices that use computer based systems to help provide medical condition data to the government. The program promotes the use of electronic medical records and prescription printing together with education in the use of security measures to protect data (Australian Government, 2006a). This increase in computerisation has the potential to contribute towards reducing medical care costs, both in terms of staff hours and greater effective use of allocated hospital/practice budgets. More recently, following the uptake of computers in general practice, the Australian government released the Broadband for Health Program and allocated AU$60 million to provide broadband internet access to General Practitioners (GP's). This will enable this sector of the health care market to participate in e-health activities (Australian Government, 2006b). This could potentially provide the required bandwidth for future home teleconsultation services.

Telemedicine Today

Telemedicine is the electronic transmission of medically related data between two or more remote locations for the improvement of patient health and/or education of a healthcare provider. It can encompass the areas of consultative, diagnostic and treatment services (MedicineNet.com, 2006). Some of the medical specialties now utilising this electronic communication medium include telecardiology, teledermatology, teleophthalmology, telepathology, telepsychology and teleradiology. Telemedicine communications are undertaken in one of two states, either real-time (synchronous) or store-and-forward (asynchronous). Examples of real-time telemedicine range from a simple physician-to-patient phone-call, to a more complex remote robotic surgery in which data is

sent and received simultaneously. In contrast, the store-and-forward state involves a delay in transmission from when the message or image is recorded to when it is received and assessed by another person or system. Some specialties are better suited to real-time or store-and-forward states, and are transmitted on the basis of the requirements of the specialty (Wikipedia, 2006).

This rapidly expanding area of medical service provision is enabling new patient treatment and care applications to emerge. They utilise web based technologies and existing infrastructure emplacements. As patients already use the internet to self-confirm or further investigate a medical complaint in conjunction with a doctor's diagnosis, the internet has given patients greater capacity for self sourcing knowledge specifically related to their condition (Gerber and Eiser, 2001). With this familiarity in internet use for medical purposes it may be assumed that the widespread adoption of home teleconsultation services could improve, if offered to technologically progressive patients.

Hospital Without Walls

Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) developed a home telecare initiative in 2000 called "Hospital without walls", which was aimed at monitoring patients with specific health disorders, in their own home environment. The participating patient either wears or connects small monitoring devices to themselves, from which it is possible to transmit health status data to medical professionals via phone or internet modes of communication (Wilson et al., 2000). From these early small scale trials where patients were selected and provided with monitoring equipment, larger clinical trials are now underway to gauge the efficacy of wider scale application. It is hoped that these types of home based monitoring systems will give patients better healthcare response should they have an accident or require assistance which would give them the ability to live a more self sufficient lifestyle (CSIRO, 1999).

There are an increasing number of home telemonitoring product systems available for domestic use, in conjunction with hospital based providers. Two such systems used overseas: The Polytel and Genesis systems already comprise of easy use peripheral medical attachments which include a weight scale, sphygmomanometer (blood pressure meter), spirometer (lung volume meter), PT/INR system (blood coagulation time meter), pulse oximeter (blood oxygenation meter), glucometer (blood glucose meter) and a digital camera for remote wound examination and care (Polymapwireless, 2003). For those patients who need to be more closely monitored, perhaps due to a history of falls, around the clock monitoring is an available option and gives the patient the ability of turning the unit off themselves at anytime to provide some element of privacy if they wish (Virtual Medical Worlds, 2001).

Telemedicine in the Remote Environment

Telemedicine is seen as a necessity in remote rural areas. This is primarily due to the vast distances needed to be travelled to see medical professionals. In eight independent rural studies, instigated by the Health Resources and Services Administration (HRSA)'s Office of Advancement of Telehealth between September 2002 and August 2003, an estimated 2,100 nurse hours were saved as a result of telehome care programs. This is time that would otherwise have been spent travelling to and from patient assessment and treatment locations. This time saving, estimated at US$80,000, also allowed the nursing staff to see more patients and thus improved patient access to vital medical care (United States Department of Health and Human Services, 2005).

A key benefit for the investment into telemedicine services is the ease of adoption for both practitioner and remotely located patient. In a trial period from March 1998 to June of 2002, 412 consults were conducted using teleconsultation sessions by consultants of the University of Arkansas for Medical Sciences, Rural Hospital Telehealth Project. Of the 47 consultants, 62% had never had any form of telemedicine training and yet only 21 consults from 412 reported minor problems with equipment, with an additional 76 not returning responses. Various specialist equipment was also used during many consults including: Ophthalmoscopes, Dermascopes and document cameras (typically for radiological images), showing the versatility of specialties suited to this form of electronic consultation (Bynum et al., 2006). Not only did this means of communication provide a more

convenient mode of communication but in many instances afforded a more timely diagnosis for rural patients versus a deferred face to face consultation.

Patient Home Telehealth Services

The ability to apply specialist advice and treatment in the home environment may well represent a significant improvement in patient care and convenience. Essentially there are four main types of patient home telehealth services currently in use. These services are facilitated between two locations where the required technical infrastructure is in place, for instance between a hospital, medical institution or private practice facility and a patient's home or other location. The four types are:

1) Use of telephone only (patient to physician direct audio conversation);
2) Use of website and/or email (webform or email questionnaire);
3) Use of home monitoring devices only (illness specific or general medical diagnostic devices sends information to physician for assessment); and
4) Home consult video conference via personal computer (patient to physician direct video conference via internet with or without use of medical diagnostic devices).

The medical home teleconsult criterion will essentially require the elements of diagnostic accuracy, patient satisfaction, effective consultative process and cost effectiveness, if the efficacy of the home teleconsult is to be realised (The University of Queensland, 2004). Australia has a number of telemedicine and telehealth programs available to patients. Some of these include the Health WA Telepsychiatry Network, the NSW Telehealth Initiative, the e-Mental Health Pilot Study in Queensland, the Rural and Remote Mental Health Service Telepsychiatry Program of South Australia, and the Telepaediatric Research Project in Queensland (Telemedicine Information Exchange, n.d.).

APPLICATION

Home Medical Teleconsulting via Personal Computer

With the increase in home based personal computer usage in Australia and the computerisation of general practice within Australia, the technical components needed to carry out an effective home medical teleconsult via personal computer would need to be defined. The average home users' existing infrastructure is sufficient to facilitate a home medical teleconsult. The main requirements are a computer consisting of minitower or the main processor and peripheral connectivity box, a keyboard, mouse, monitor, audio speakers, ADSL modem and a webcam or video camera (figure 2).

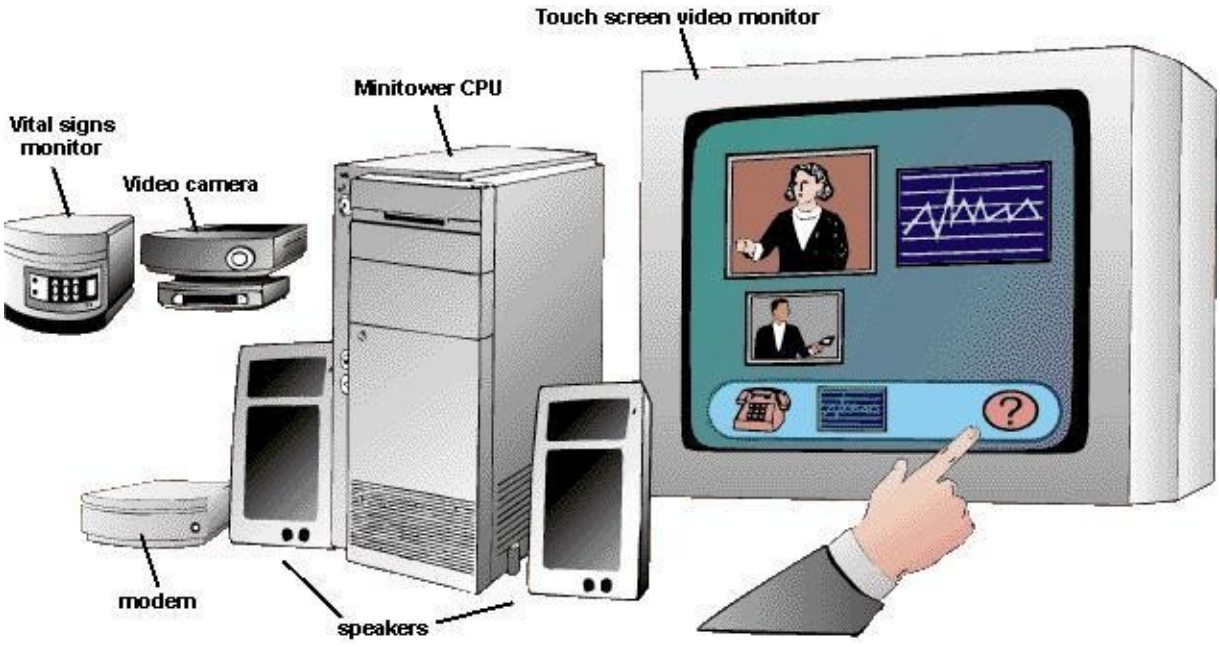

Figure 2: Tools for an Electronic House Call (Jerant et al., 1998).

A webcam is an important component as it allows a video signal of the patient to be recorded and sent to the doctor during the teleconsult. A touch screen monitor could also be used to help those with visual or keyboard use adversities. The greatest expense to the new teleconsultation patient would be the medical diagnostic equipment that would need to interface to the existing computing infrastructure via USB, firewire or wirelessly with an additional wireless access point. Non-interfacing equipment could be used but patient data entry could be seen as an area for error mitigation. Equipment purchased would need to be approved by Australia's Therapeutic Goods Administration (TGA) before being sold to patients. This could be purchased for example, online via the medical practice that the teleconsult occurs with or from a pharmacist. Dependent upon the patient's specific disease diagnosis, the patient would need to purchase medical diagnostic equipment that would electronically interface with a computer enabling data from that device to be transmitted to the doctor via the internet (University of Connecticut Health Centre, 2002).

The American Electronic Housecall Project which ran from February to November 1996 was an early but highly successful example of using the above infrastructure to provide effective medical care remotely via cable TV lines. The program conducted 166 teleconsults with 13 chronically ill patients and found huge improvements to both patient satisfaction and financial savings associated with not needing an extended hospital stay which was beneficial to all. It also demonstrated the effective use of equipment data transfer using many different peripheral medical devices such as stethoscopes, sphygmomanometers, otoscopes, thermometers and pulse oximeters. Realising then that teleconsultation could be done so effectively in 1996 even before the internet bandwidth made video conferencing by internet protocol (IP) possible, makes the current possibilities infinitely better (Jerant et al., 1998). The actual functionalities of the teleconsult would be dependent upon the system software incorporated into either a software application or a medical practice's website that allowed users to perform those functions.

Figure 3 shows procedurally how consults could prospectively be conducted. A patient contacts their health care provider either by phone, email or call-in and a teleconsult time is scheduled. The patient then completes an online medical form outlining the reason for the consult and any symptoms they may have (various templates could be used for speciality conditions) and submits or emails it to the doctor's practice/hospital. Prior to the consult, the doctor would review the patient's form and retrieve the patient's medical history. At the scheduled time both the doctor and patient would login to an internet based secure teleconsult application and commence the consultation. During the consult the doctor may request diagnostic devices be used such as an automatic sphygmomanometer (blood pressure cuff) to provide current data of the patient's health status. Once the consult has been completed the patient could electronically be issued with a prescription, which could then be forwarded to a pharmacy by either the doctor or patient and the medication ordered online. Finally the patient would be billed and either pay online or forward the account to their health fund electronically.

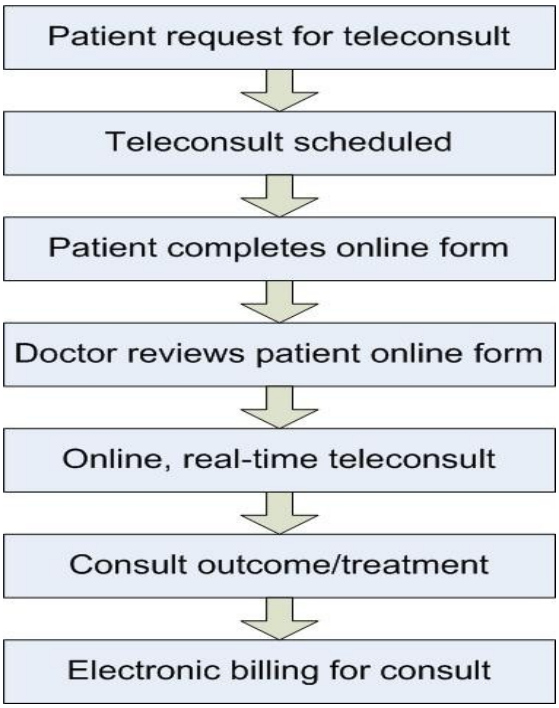

Figure 3: Home Teleconsulting Process Flowchart

Users of the home medical teleconsult would primarily be physicians, including specialists, and home or other remotely located patients. Care givers could also use the system to act as a proxy for a patient who was too sick to perform the required computer terminal based consultation.

Incentives and Barriers to Adoption

There are several incentives to the adoption of home telehealth consultations in Australia. These are primarily related to the aging population, population health planning, efficiency of resource allocation, and costs. Home telemedicine consult practices have several unique advantages over physical face to face medical consults. These include convenience, cost effectiveness, time savings, data accuracy and possible access to other reluctant patient cohorts. In contrast, there are some disadvantages in relation to equitable access, privacy, ethical and legal concerns, equipment costs, diagnostic limitations and doctor reputation. It is clear that these issues go beyond the usual security issues in using internet technologies. The categorisation of the concerns can be viewed from security versus non security related perspectives. Further, the security related issues can be classified further into confidentiality, integrity and availability.

Incentives - Non-security related

- Convenience. Both the physician and patient can benefit from teleconsulting as appointments can be scheduled sequentially in much the same manner as in a doctor or specialist's practice but without the need to wait in a waiting room wasting important personal time. The risk of potentially passing on other illness, such as cold and flu, to patients who just came to get a new script repeat would also be avoided. The potential benefits of this alone could save thousands or millions of consults in Australia per year.
- Cost effectiveness. In Australia, the current population average age is set to increase, largely due to the post World War II baby boomer generation. It is estimated that the percentage of the population aged over 65 years is set to increase from 13.3% at June 2006 to approximately 26.4% at June 2056 (Australian Government, 2006c). As a result of this ageing population, the number of consultations will increase a practitioner's workload leading to a possible further increase in practitioners leaving the medical field due to stressful understaffed workloads. (Australian Medical Association, 2006). Introduction of a stress reducing, timesaving technology such as teleconsulting may even offer some

hope of retaining qualified medical doctors to help deal with the current and potentially worsening future medical staff depletion. In Australia, with hospital and medical services still being one of the biggest contributors to the consumer price index increase at 4% in the quarter to June 2006 (Australian Bureau of Statistics, 2006b), telemedicine might possibly offer a cost effective means to reduce the pressure on a burgeoning national healthcare problem. In a 2004 study of 1st year medical students in Denmark, it was found that approximately 90% regularly used email, 80% used the internet for study related resources and 60% had internet access from home. This demonstrates the increasing realisation to medical students that the Internet is a valuable tool facilitated by information technology (Dørup, 2004). The flow on effect is such that, as new medical graduates commence service they will by majority have a strong technological dependence enabling them to adapt to and potentially drive development of new work efficiency tools such as internet teleconsulting.

- Electronic billing. Automatic electronic payment systems like those used by product purchasing websites, for instance Amazon.com, could be used to charge already registered eftpos/visa patient accounts at the completion of a teleconsultation. This would greatly reduce both the paper work and staff time required to bill online patients. As well as this, doctors who often speak to patients over the telephone would be able to bill patients for online consults that would otherwise be time consuming with no resultant income.
- Time saving. If patients were to fill out an electronic form stating their condition and current medications before consulting the doctor online, time could be saved for both parties. In this situation the doctor would not have to re-enter patient statements or device measured statistics at the end of the consultation, reducing the handling of data.
- Medical considerations. Situations can occur where patients' vitals are altered due to apprehension or generally being unwell as many patients by definition are, such as white coat syndrome where blood pressure varies significantly due to the presence of a doctor in a medical practice (Archives of Internal Medicine, 2000). These occurrences could be greatly minimised for patients suffering from such anomalies when undergoing consultations in familiar surroundings.
- Reluctant male patient cohort. According to the Australian Bureau of Statistics (2006a) National Health Survey 2004-2005 only 20% of males consulted a doctor in the two weeks preceding the survey compared with 26% of females. Former AMA President, Dr Bill Glasson, in 2003, stated that one in four Australian men had not consulted a doctor over the last year. This indicated that more research was necessary to identify the needs of the gender difference and find ways of providing different opportunities in the delivery of care (Australian Medical Association, 2003). On average, Australian men die five years earlier than Australian women (Australian Medical Association, 2003). It is possible that the medical teleconsulting computing medium could suit the more typically technologically inclined males to consult a doctor leading to improved consulting rates and health outcomes.

Barriers – Non-security related

Whilst there are few non-security related barriers, suitability of consult type, the quality of care and reimbursement for services may prove difficult to address.

- The suitability for a patient to participate in a telemedicine consult will have to be first assessed by the practitioner who can then complete subsequent visits via a digital medium. Indeed not all patients may be able to or wish to have a consult via this method and the option should be given to the patient to commence or cease teleconsulting, as well as giving the doctor the choice to physically see the patient at any time.
- Linked to legal liability is the issue of quality of medical care. This is discussed further under the barriers in security related confidentiality section below. However, medical malpractice and negligence issues are significant barriers when the law and the standards in telehealth are not well developed (Klein, 1995; MacRae, 1999).

- Limitations on diagnostic capability due to lack of physical examination would make some consultations inadequate. This would affect the standard of patient care delivered.
- The current medical federal reimbursement for medical services does not cover telehealth consultations, as these require a face-to-face component under the Commonwealth Health Insurance Act (MacRae, 1999). This has been a fundamental problem of adoption of such services in countries with both private and public health service funding such as the United States.

Incentives – Security related

Confidentiality: Whilst there are few obvious security incentives in terms of confidentiality, one factor that may promote increased use is the relative anonymity of the patient to the physician as there is no face to face to face contact. This may facilitate more open communication in cases where sensitive health issues are discussed. In addition, the confidentiality of the technical transfer of information can be addressed with cryptography and other forms of secure messaging.

Integrity: Incentives related to integrity include data recording accuracy, use of diagnostic devices and simplification of the shared electronic health record environment.

- Data recording errors can occur at several stages throughout a standard physical consultation between a practitioner and a patient. Errors can occur if the doctor mishears, misunderstands or incorrectly transcribes the patient's statement either onto paper or into a computer based system. By use of medical diagnostic devices at the patient's end of the teleconsultation, the data could be sent to the doctor and interface into the medical practice's medical records system without any further need to re-enter data. This eliminates the need for the doctor to re-enter data from either a patient's online verbal statement during the consult or from the patient misreading a non-interfaced type device. As well as the possibility of reduced data entry error from these methods, medical diagnostic devices have been shown to be on average more accurate than humans in reading patient vital statistics. Human subjectivity plays an important part in the diagnosis process of medical visits. In 1999 a report released by the Institute Of Medicine of the National Academies of Medicine stated that it was believed that medical errors cost somewhere between 44,000 to 98,000 deaths yearly resulting from medical errors such as misdiagnosis and misinterpretation of medical orders. Computers have been shown in assessing 100,000 patients' Pap smear samples, to have a 0.00001% error percentage against a human's 5-10% error percentage, it thus becomes apparent that where human error can be removed, it should be (Biomedical Computation Review, 2006).
- Although no figures currently exist as to the prevalence of personal blood pressure monitoring devices in Australian homes to date, there is evidence to suggest that in America, an estimated 20-50% of homes in some states already own a personal blood pressure measuring device, largely due to medical diagnostic technology improvements and device affordability (University of Connecticut Health Centre, 2002). The fact that many people already have diagnostic devices may be beneficial to encourage adoption of home medical teleconsulting.
- Disclosure of information by physician to physician, or by the doctor to the patient in a shared electronic health record environment presents many integrity and authentication security issues (Gaunt and Roger-France, 1996, p.11). However the one-on-one consult does not have the same complex problems as there is no sharing of the patient record and therefore no duplication of records, nor ownership and record access concerns.

Availability incentives are related to easier access to doctors and medical services, convenience to the patient, location independence, and cost effectiveness.

- Unique to Australia is the geographical displacement of population into vast rural areas which could serve as a motive for development of home medical teleconsulting services via the Internet.

- From the viewpoint of the patient, the time spent in visiting a doctor often involves extensive time away from work, resulting in a loss of income or productivity for employer, as well as transport costs. Given that a large proportion of medical consults are repeat script and/or monitoring consults of existing long-term conditions especially in the elderly (Straand and Skinlo Rokstad, 1999), teleconsults would in particular enable these patient/consult types to be serviced much more efficiently from home.
- Location, providing the necessary equipment is available, can be independent and may allow consultations from locations other than the patients' home. This may be convenient for people who travel and wish to consult their regular doctor.
- When compared to existing video conferencing and telemedicine, real-time consultations, Internet Protocol (IP) consults can be performed for a fraction of the costs associated with Integrated Services Digital Network (ISDN) phone line usage as internet based systems do not require expensive video conferencing units at both (the doctors and patients) localities. As well as this hardware and transmission cost saving afforded by IP communication, their reliability is much greater than ISDN phone lines which depend upon multiple international phone networks, all of which must work cohesively to provide effective quality communication (Health Management Technology, 2006,). Further to the cost savings resulting from not needing specialised video conferencing units, a home medical teleconsulting system using the internet would not require any further connections or hardware purchases other than specialist equipment used to monitor a patient's current medical condition or specific disorder.

Barriers – Security related

Confidentiality disincentives include concern over loss of privacy, numerous legal and ethical issues and record sharing.

- Some patients may see teleconsulting as a step towards the depersonalisation of the practitioner-patient relationship, making the process of gaining the important confidentiality trust of the system much harder to achieve. A patient's fear of losing their privacy could also play a part in the willingness of patients to consult over the internet which is often viewed as having its publicly unknown security risks (U.S. Department of Justice, 2001).
- The legal and ethical issues of telemedicine are a vast minefield of medico legal judgment and ethical debate. They are concerned with the use, rights, responsibility and ownership of the various elements that are associated with medical data transfer by electronic means. Serious issues such as cross border jurisdiction of sensitive patient information, patient privacy and autonomy as well as the legal obligations of medical professionals all need to be addressed. These processes can sometimes take a long time to ratify due to the involved nature of the content regarding patient rights and the outlining of government guidelines and regulatory body policy (Stanberry, 2006, p.166). Medical liability for teleconsultation as in the case of face to face consultations, would need to be defined if doctors are to maintain legal indemnity for services rendered via the new medium (Lobe, 2004). These issues are a significant problem in the Australian medical system as doctors are registered to practice in particular State or Territory of Australia and must abide by the State and Territory regulations. Similarly, legal liability is assessed on a state basis: if the doctor and patient are in different States or Territories, the legal issues become complicated and uncertain (MacRae, 1999).
- The patient record will still be held by the medical practitioner, and it is not access to this record as in the case of shared electronic health records, that is of concern in telemedicine: the concerns are of protection of the communication during the consultation.

Integrity disincentives include authentication and non-repudiation of the patient and the doctor, data aggregation, and correct use of equipment.

- With the use of the internet, and the degree of anonymity it affords to users, there is as always the potential for malicious objectives perpetrated by people misrepresenting organisations or qualifications

that they do not actually have (American College Of Physicians, 1996). With the physical existence and staff of a medical practice or institution comes a level of confidence for the patient. Via the internet this translates to a perception of trust in the *bonafide* teleconsultation with appropriate and qualified medical personnel. In order to assure patient confidence in such a system there would need to be some regulatory body to ensure operational quality of the teleconsulting practitioners, which would provide certification and assurance that any patient requests or complaints would be investigated.

- Similarly, there exists an opportunity for patient impersonation for obtaining illegal prescriptions or other drug related offences. This requires that strong authentication is used (not simply passwords) to mitigate the potential problem.
- The aggregation of data, from the exchange of information into existing databases, may require additional technical expertise. Despite increasing the accuracy of the data, supplementary programming and data integration processes would need to be developed.
- One inhibitory factor in the patients' use of diagnostic equipment is that if a newer type of device with computer interface was deemed necessary to participate in a particular teleconsult system thus making the price of upgrading to a newer machine financially non-viable. Additionally the quality and accuracy of the medical device as well as the home patient's correct use of it will undoubtedly play an important role in reliable diagnostic accuracy.

Availability barriers are concerned with accessibility and diagnostic equipment costs.

- Lack of access to the Internet and associated bandwidth could be an inhibiting factor for some patients. This would be the case with patient using dial-up internet access, for which the telehealth services may not be feasible. Service accessibility could also be dependent upon the patient's Internet Service Provider's (ISP) consistency in providing reliable bandwidth resources to its customer.
- Cost of specialist equipment could be either financially unattainable to many people, or deemed unimportant enough to warrant the purchase expense to those who do not wish to monitor their health with such a home oriented device.

CONCLUSION

As computer processing power, internet bandwidth and connectivity increases throughout the world, it can be assumed that new and more efficient ways of utilising future technologies will be developed. Home medical teleconsulting, is currently bound by technological limitations of existing infrastructures of home computing processor power and ISP bandwidths. If the future generations of products and services for teleconsulting and the wider area of telemedicine are to evolve, financial investment in new developing technologies must be available to facilitate it.

Teleconsultation should eventually be a modular component of a complete online patient care system that could streamline the processes of appointment requesting, consultation, electronic medical records, prescription issuing and pharmaceutical purchasing tasks for the patient. Some of the future technology elements may include the use of a personal care assistant (PCA) which would encompass a device that would be programmed with the patient's care plan and intelligently learn the patient's daily living preferences and behaviours. As well as this the PCA would adapt to any loss of function and coherence as well as enabling patient interpretation better than any human and with increased patience. Smart homes could also play a role in patient welfare by making living functions easier to perform (Soar & Gururajan, 2005, p. 112).

We are in exciting times of technological advancements, where applications that were not possible a few years ago are now capable through ubiquitous technology. Telemedicine represents the fusion of medical practice and telecommunication, facilitated by computers and other technological devices. The Internet has come to play a large part in the development of these medico-technological interactions and will more than likely be the basis of further remote service technologies well into the future.

Australia is poised for the next step in the adoption of home medical consultation via the Internet. The crossroads in medical services is approaching where an increased ageing and subsequently ailing Australian population will, over the next decade, put more financial pressure on the government to provide medical services and put further strain on practitioners to facilitate increasing client visits (Australian Bureau of Statistics, 2006b). Current technologies are allowing web based consults to speed up consult times, increase record keeping accuracy as well as save the patient's personally valuable time. Investigation into the further utilisation of existing home infrastructures such as the home personal computer should be seen as an option for reducing at least some of the pressure on an increasing healthcare dilemma.

Clearly, new technological possibilities give rise to new opportunities in the healthcare environment. Home teleconsultation is just one of these possibilities despite the many security issues that need to be addressed. The technical requirements for secure exchange of information is being developed for the shared electronic environment, however it is the authentication and non-repudiation factors are important for the success of telemedicine. The reality of a mainstream home medical teleconsult system and practice could still be many years away but for those who are perhaps early adopters of new practices, the option of interacting with healthcare providers in a modern technologically convenient way may just be a harbinger of greater things to come.

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