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An investigation into the use of the internet for medical informatics

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AN INVESTIGATION INTO THE USE OF THE INTERNET FOR MEDICAL INFORMATICS

by

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A dissertation submitted in partial fulfilment of the requirements for the Award of

Master of Science (Computer Science)

At the Faculty of Communications, Health and Science
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ABSTRACT

The rapid evolution and popularity of the Internet technologies, and the World Wide Web, have resulted in unrestricted worldwide access to medical and health information. This has provided the medical profession with the ability to access up to date research more immediately than by traditional means, and has created the potential for advanced information collation. Also the availability of medical literature, previously difficult to obtain for the general public, is having an effect that is both a benefit and a burden to the medical profession. Whilst benefits exist in the use of the Internet in General Practice for clinical support, communication and education, there are also barriers to its inclusion in daily clinical practice. These include the issues of security, access availability, quality, time, research experience and Internet navigation familiarity. Questions remain as to whether or not the Internet can be used in General Practice efficiently, in order to provide a significant advantage over traditional information dissemination methods. This issue is also relevant for other primary health care providers such as pharmacists. In Australia, there has been a relatively slow adoption of both the technology and the use of the Internet for acquiring clinical and medical information. This thesis investigates the current issues surrounding the use of the Internet in general practice and pharmacy in Western Australia. The underlying assumption that the Internet is a useful tool for such information retrieval is examined in terms of useability and usefulness in clinical practice. Further the attitudes to the use of the Internet technology as an effective medium of information delivery were sought.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

i. incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education:

ii. contain any material previously published or written by another person except where due reference is made in the text; or

iii. contain any defamatory material.

Signature:

Date: 22nd August 2001

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PUBLICATIONS BASED ON THIS RESEARCH

Williams, P. A. H., Maj, S. P., & Shaw, D. (2001). Does your doctor support your use of the Internet as a Decision Support System - an Australian perspective? *Proceedings of the International NAISO Congress on Information Science Innovations (ISI'2001)* (CD Rom). Dubai, U.A.E: American University.

Williams, P. A. H., & Maj, S. P. (2001). Drowning or waving? Is the Internet the lifebuoy for Australian General Practitioners drowning in a sea of reference material? Proceedings of the *eHealth: a Futurescope. Third International Conference on Advances in the Delivery of Health Care* (pp. 81-86). London: City University.

Williams, P. A. H., & Maj, S. P. (2001). Is the internet an integral part of general practice in Australia? *Paper presented at the Medinfo2001 Congress. Towards Global Health: The Informatics Route to Knowledge. 10th World Congress on Health and Medical Informatics* (in publication). London, UK.

CONTENTS

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GLOSSARY

BMJ	British Medical Journal
CHA	Faculty of Communications, Health and Science
CME	Continuing Medical Education
CT	Computerised tomography (a radiological scanning technique)
ECU	Edith Cowan University
EMR	Electronic medical record
GP	General Practitioner
HIC	Health Insurance Commission (Australia)
HISA	Health Informatics Society of Australia. Available at http://www.hisa.org.au/
HCN	Health Communications Network. Available at http://www.hcn.net.au/
IHR	Integrated health record
IHRIS	Integrated health record and information system
IT	Information technology
Medical Informatics	The study of how bio-medical information is created, Retrieved and used
MJA	Medical Journal of Australia
MRI	Magnetic resonance imaging (a radiological investigation technique)
NHS	National Health Service (UK)
Primary Care	The term used for front line medical service providers such as

	General Practitioners and Pharmacists
SCIS	School of Computing and Information Science (Edith Cowan University)
SPSS	A statistics package used at ECU
UK	United Kingdom
W3C	World Wide Web Consortium
WA	Western Australia
WHO	World Health Organisation
WWW	World Wide Web

CHAPTER 1. INTRODUCTION

1.0 Medical Informatics

In the early days of medicine, the treatment of disease was a relatively simple process involving no more than a personal consultation between the doctor and patient (Harper, 1986, p.168). The medical knowledge and the dissemination channels available limited the acquisition of information regarding medical practices, however as medical care became more complex in nature, so the amount of medical knowledge and research increased. The significant issue nowadays is not lack of information but its management i.e. the timely dissemination, manipulation and application of it. The effective and efficient access to information is required if any improvement in health care outcomes is to be achieved using the rapidly accumulating body of information. From this need, the discipline of Medical Informatics was born.

Medical Informatics is "*the study of how medical knowledge is created, shaped, shared and applied*" (Coiera, 1997, p. xxi). Hogarth (1997, p. 1) describes it in more definitive terms as "*the rapidly advancing scientific field that deals with the storage, retrieval and optimal use of biomedical information for problem solving and decision making*". Modern medicine is dependent upon information; information on pharmaceuticals, research, treatments, drug interactions, clinical guidelines and so on. Medical practitioners are constantly bombarded with textual information delivered in a random manner and medical informatics aims to address this issue.

Medicine, as described in The Concise Oxford Dictionary (1984, p. 315), was once considered an entirely empirical science, relying upon or derived from observation or experiment, however significantly there has been a shift towards more 'evidence based' practice - a movement advocating the practice of medicine according to clinical guidelines, developed to reflect best practices as captured from a analysis of the clinical literature. As this movement gains momentum, the management of the information used in the practice of medicine becomes crucial. As indicated by Stanford University (1998, p.1) medical informatics is being driven not only by advances in computer and communications technology, but also with the awareness that the medical knowledge base is unmanageable by paper-based methods, and that '*informed*' clinical decision making is essential. Another major issue, aside from the management of the body of Internet publicised information, is that of maintaining currency in medical treatments and developments, which is a professional obligation of General Practitioners (GP) worldwide (Petersen, 1999). Keeping up to date with the vast amount of clinical information, traditionally obtained from journals and reference texts, poses a significant problem for the medical profession. *Information overload* is the new term to describe this state of affairs, and is one that needs to be addressed (Hanka, 1999).

Traditionally the medical practitioner relies upon two forms of information – the personal medical record and clinical support information. The personal medical record contains clinical findings, assessment and treatments, as observed and defined by the practitioner and diagnostic data such as pathology and radiology results. The clinical support is the body of reference material that assists a medical practitioner to manage the health status of an individual or group of individuals. The clinical support information consists of drug reference material i.e. Drug schedules,

interactions, and contra-indications from published sources such as MIMS; specific pharmaceutical information obtained direct from drug companies through marketing, advertising and representative visiting; medical and clinical textbooks (eg. Grays Anatomy); up-to-date medical research via the plethora of medical journals (eg. BMJ, MJA, Lancet); peer contact, discussion and information transfer; and education through lectures and seminars.

1.1 The Internet

Computerisation has resulted in some significant changes in information management and procedures in general practice. Whilst the majority of changes to date have been apparent in administration, the clinical aspect of primary care is increasingly taking advantage of computers and the Internet. In 1997 there were 10,000 health and medical web sites (Ferguson, 1998) and in 2000 there are well over 100,000 (Gottlieb, 2000). In May 2000 there were 304 million users of the Internet worldwide of which 0.8 million were in Australia (United States Internet Council & Inc., 2000). Such statistics confirm that the Internet offers unparalleled access to information, the volume and variety of which is not available from any other single source. This rapid expansion and development of the World Wide Web (WWW), together with the availability of the low cost technologies of the Internet have resulted in convenient and unrestricted access to worldwide medical and health information at the "*touch of a button*" (Williams, Maj, & Shaw, 2001). This makes it an increasingly important medium for information delivery. The benefits of this form of access to information over other methods can be seen in various forms. The first of these is easier access to up to date research, evidence-based data and electronic journals. This is due to the many traditional sources of clinical information now being available in electronic format, such as Harrison's Principles of Internal

Medicine and medical journals such as The Lancet (n.d.) and the British Medical Journal (BMJ) (n.d.). Pharmaceutical and clinical guidelines are also available, as is the ability to transfer diagnostic data and provide remote consultations using Telemedicine. Also, the now widespread use of e-mail has the potential to significantly improve communications between medical professionals (peer contact) and has the potential to alter the dynamics of GP to patient relationships.

Despite the many uses, and associated benefits of using computer and Internet technologies, challenges are also apparent in their use as a clinical resource. The incorporation of evidence based clinical guidelines, to assist GP's in making health care decisions for specific patients (Jackson & Feder, 1998) is beneficial. However instantaneous access to such information at the time it is required, usually during a consultation, can be difficult. Other barriers include: the limited access to the technology and cost of computer resources in the clinical setting for some GP's; the difficulty associated in learning or using Internet software programs and search engines; poor organization of the search resources and clinical information on the Internet; the variable quality of medical and clinical information; and time pressures and knowledge decline (Westberg & Miller, 1999). Of these none are more apparent as concerning issues for GP's than those of quality of information, time to access relevant information when its clinically required, management of the vast amount of medical information available/required, and the attitude of general practitioners to the use of the Internet.

1.2 The changing provision of health care

There have been many changes in the way in which health care is provided and managed with the acceptance and use of the Internet technologies. Firstly, the

open accessibility of medical information on the WWW has given rise to an increase of the occurrence of patients presenting GP's with information obtained via the Internet (Cooling, Kidd, & Sloggett, 1997). Whilst the WWW medical sites have the potential to educate the general public and result in better-informed patients, it also requires the GP to be familiar with such patient information sources, the quality of which may be problematic. Additionally, the effect of the use of questionable medical information from unevaluated sites is a potential health hazard. It is evident that medical practitioners now require new information management skills to effectively keep up with the frequently developing body of knowledge on the Internet. In addition to this, a follow on affect on the general health of the population may result from the use of this new source of information. It is generally accepted that a better-informed patient will promote a better level of understanding of his or her own conditions and health. This may ultimately lead to better health for individuals, and collectively have an impact on public health. This may have implications for countries using centrally managed health care services as conflicts between patient expectations and available resources arise (Coiera, 1996).

Secondly, the 'virtual physician' handling on-line consultations, may result in changes to the management and delivery of health care (Towle, 1998), although the medico-legal implications of such consultations are fraught with difficulty ("The brave new world of telemedicine", 2001). Thirdly, communication within the medical community, and between GP's and their patients is traditionally through consultation, telephony or paper-based, however the use of the Internet technologies can provide for electronic communications, in particular using e-mail. Fourthly, front line assessment and treatment were once exclusively the responsibility of General Practitioners (GP's), however a shift in paradigm is occurring as pharmacists in

Australia are now playing a more active role in primary health care (RACGP & Pharmaceutical Society of Australia Ltd, 1994; Ruth, Hodge, & Murphy, 1994; Westberg & Miller, 1999). Lastly, the advancement in technologies has seen a widening availability of electronic access to health information. The Internet and touch screen kiosks are becoming accessible in all manner of places such as pharmacies and shopping malls. Also with the advent of digital television there are investigations underway to evaluate possible links between health outcomes and access to digital information (Nicholas, Huntington, & Williams, 2000).

It should be noted that the terms Internet and WWW are often used interchangeably, although strictly speaking the Internet is the medium of communication (the technology) and the WWW refers to the material contained amongst the technology components. For the purposes of this thesis the term *Internet* is used to incorporate both the technology and the material since they are both inherent to the delivery of information.

1.3 Layout of Thesis

Chapter 2 gives an overview of the types of health and medical information available on the Internet and the applications to which the technology and information can be applied to in primary care.

Chapter 3 examines information retrieval applications. It discusses the major uses of the Internet in general practice as a clinical information resource. It looks at the information needs of GP's and discusses in detail the issues of patient information and education (including reference to community pharmacy involvement); electronic communication; continuing medical education (CME); and

access to clinical research information. It concludes with a discussion of the necessity for information management.

Chapter 4 reviews the issues of use of the Internet in primary care, in practical terms. It covers briefly those barriers applicable to patient-centred information, being security, privacy and standards. It then goes on to describe, in greater detail, the barriers to clinical information retrieval. The major issues discussed are time critical factors, skills, quality, attitude, clinical governance and cost/benefit analysis.

Chapter 5 looks at the situation in Australia and examines government policy directives in the area of e-health. Previous research undertaken in the area of computerisation and the Internet is discussed and current projects outlined. Further a presentation and discussion of the hypotheses of the research are made.

Chapter 6 discusses the background to the research design, methodology and statistical analysis used in this research. Further it describes the materials and methods of this particular research project in regard to each of these statistical procedures.

Chapter 7 gives the results of the general practitioner and pharmacy questionnaires used in the survey. It describes the results in terms of demographics, computer and Internet usage, patient information, clinical resource use, barriers in the use of the Internet, and related attitudes to the Internet for clinical support. Each section is described and the results discussed.

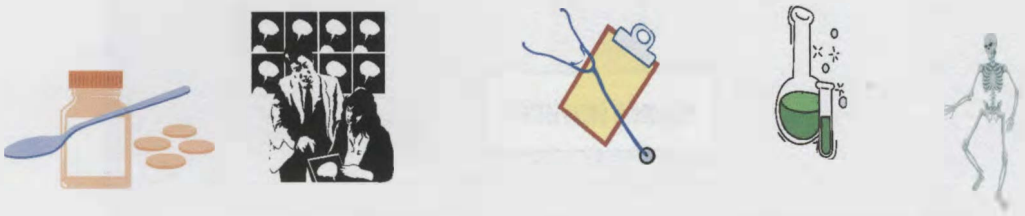
Chapter 8 contrasts the results with current knowledge and previous findings. It examines the trends and possible future directions of the use of the Internet in clinical practice.

CHAPTER 2. MEDICAL INTERNET APPLICATIONS

2.0 Information applications via the Internet

Computers are used to varying degrees by general practitioners around the world (Kidd, 1999, p.2). Currently in Australia, this is mostly in terms of accounting systems, although increasingly more practices use computerised prescription printing and a few use computers for electronic medical record keeping (Nori & Gunn, 1998). This is a trend seen worldwide as reminder systems and prescription-issuing programs are popular and lead to some cost savings (Mitchell & Sullivan, 2001). Further discussion of studies of computer use in Australian general practice is given in chapter five. The GP has access to a multitude of information in electronic form due to the increase in popularity of multimedia applications and with access to the Internet increasing. This chapter gives an overview of the potential uses of the Internet in relation to primary care. Specific applications in relation to information acquisition, rather than patient data centred uses, are dealt with in more detail in chapter three.

Figure 1 shows the possible general practice Internet applications. These applications have evolved from the accessibility of information and the potential uses of the technology itself.

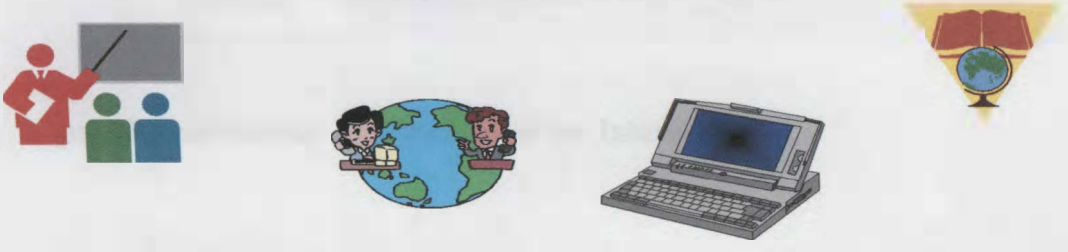


Peer Contact Clinical Guidelines Research

Drug Information Diagnostic

Data Transfer

World Wide Web



Continuous Electronic

Education Telemedicine Expert Systems Medical Records

Figure 1. Applications of the Internet in General Practice

For the purposes of this thesis, the information available using the Internet has been delineated into clinical information and patient-centered information. An organizational representation of the information applications for general practice is given in Figure 2. Many categorizations can be made, however the two categories chosen give an overall view of the issues and is based upon the information retrieval issues that are addressed in this study.

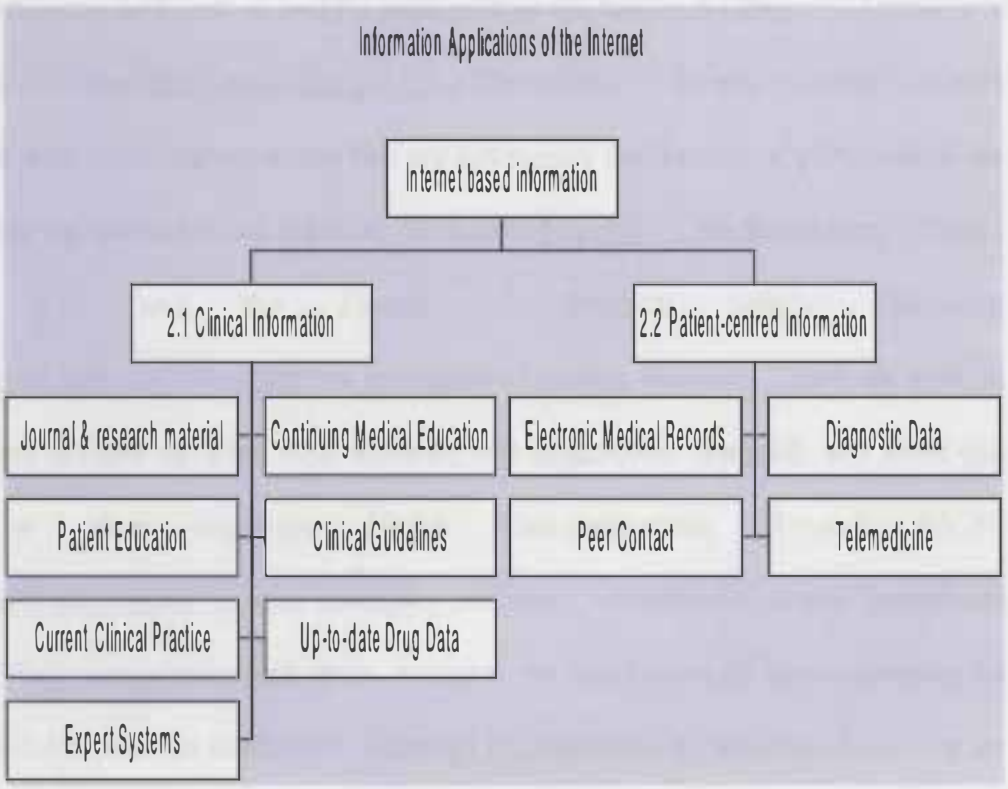


Figure 2. Information Applications of the Internet

2.1 Clinical Information

This section describes the clinical information applications, which encompass journal and research material, continuing medical education, patient education, clinical guidelines, current clinical practice, up to date drug information, and expert systems.

2.1.1 Journal and Research Material

There are several medical journals published on-line, including the British Medical Journal (BMJ) http://www.bmj.com, the Medical Journal of Australia (eMJA) http://www.mja.com.au/, and the Journal of the American Medical Association (JAMA) http://www.ama-assn.org/public/journals/jama. Each of the journals contains the last six years of the concurrently printed magazine. Articles

prior to this can be found on archive sites such as the National Library of Medicine's Medline database http://www.nlm.nih.gov/. The demise of the paper-based journal is possible with more sites evolving that are not simply duplication of publications but are purely on-line reference material. Medscape http://www.medscape.com/ (Tanne, 1999, p.1) and the Journal of Medical Internet Research http://www.jmir.org/index.htm are examples of on-line journals. There are also an increasing number of sites with research and educational material, and front-end links to other databases. Health Communications Network (HCN) http://www.hcn.net.au/ is one example, and most tertiary educational institutions library Web sites contain such links. Arguably the best known of these resources for the medical profession is Medline, although evidence based guidelines databases are also evolving, for example the Cochrane Library Database.

2.1.2 Continuing Medical Education (CME)

Continuing medical education (CME) is "*any and all the ways by which doctors learn after formal completion of their training*" (Davis, 1998). It is used to review doctors' skills, improve clinical performance and assess informational needs. Its delivery has mainly comprised of individual medical education programmes designed to maintain professional competence. These programmes are usually undertaken in an episodic manner rather than as structured monthly or bi-monthly occurrences. Continuing medical education has historically been out of professional interest and integrity, although some may now add public, political and managerial concerns to this (Richards, 1999). In recent years CME has altered its educational focus driven by varying expectations of both governments and patients, medical methodologies and the theoretical based upon which medical knowledge is used (Cantillon & Jones, 1999). The introduction of electronic communications and the

Internet technologies have given rise to multimedia computer aided learning and access to alternative methods of information delivery such as on-line medical journals and specific document handling sites.

There is recognition that *learning*, not teaching, is the key factor in changing doctors' practices (Cantillon & Jones, 1999). Sibley, (cited in Harper, 1986, p.171) found that "*informational input in the form of continuing medical education was found to increase knowledge but not to alter the quality of clinical practice*". For this reason the move towards evidence based practice was made. Perhaps Web learning will be more prominent in the future if it can be proven to be useful. One Sydney University is ambitiously attempting this with a new graduate program structured entirely around multimedia Web documents as the teaching basis (Coiera, 1998b, p.1). There is a general trend in the literature to acknowledge the new basis required for CME and to move away from episodic activity and assessment/accreditation. The current thinking is edging towards a multi-professional learning approach (Campbell & Johnson, 1999), and linking performance with outcomes in the practical clinical practice environment.

2.1.3 Patient Education.

Increasingly the general public is more inclined to search out information and to question their GP regarding their own health problems. Much of this material is acquired from the Internet (Williams et al., 2001). In a survey published in 1999 it was reported, "*27% of women and 15% of male Internet users say they access medical information weekly or daily*" (Eysenbach, Sa, & Diepgen, 1999). Many sites such as HCN contain consumer health information and on-line brochures. Previously consumer health and medical information would have required a visit to a library, however it is now possible to access worldwide medical information without leaving

home. Interestingly the National Library of Medicine has an experimental site that is collating a pictorial view of the anatomy of the human body, called the Visible Human Project (n.d.). This project is designed to create a common point of reference for the study of human anatomy. It is based on electronic images, constituting a library of volumetric data to represent a complete normal adult male and female using cryo-sectioning, and radiological investigation techniques including magnetic resonance imaging (MRI) and computerized tomography (CT) scanning. Significantly, this site is accessible to both the general public and the medical profession.

2.1.4 Clinical Guidelines.

With the increased focus on evidence based medicine, the use of the latest clinical guidelines is important. The evidence based medicine paradigm was introduced to prevent variations in clinical practices between health care providers. Access to research information is sufficient for specific case studies; however formulating clinical guidelines from collation of all the research is not possible by the individual GP. Hence there are also a growing number of sites devoted to helping the general practitioner, like the US web site, http://www.medmatrix.org/index.asp that contains a matrix of clinical information, and sites such as the Cochrane Library database http://www.cochranelibrary.net/ containing evidence based guidelines. Whilst there are many articles on the use of evidence-based practice, not all GP's share the fundamental assumptions of its usefulness (Tomlin, Humphrey, & Rogers, 1999).

2.1.5 Current Clinical Practice

Aside from the specific area of evidence-based medicine, clinical practice guidelines are produced by government organisations for most countries. In the US,

for instance, the government Agency for Healthcare Research and Quality (*Clinical practice guidelines*, n.d.) has created a site accessible by both GP's and the public containing clinical practice guidelines.

The issue of any link between clinical performance and health outcomes is a contentious one, although it is thought that basing practice on evidence will improve patient care (Barton, 2001). Although accepted standards of management for given diseases are prevalent, a significant link has not been established to suggest that variations in clinical performance adversely affect a patient's health (Harper, 1986, p.173). Indeed, trying to measure the use of published medical research via the Internet or any other delivery method, and its causal effects in the clinical outcomes of patients, is a very difficult task and is certainly outside the scope of this research project.

2.1.6 Up-to-date Drug Information

Since drug therapy is one of the primary activities in current treatment by general practitioners, the latest information on pharmaceuticals, interactions and contra-indications is essential. MIMS ™ is the most commonly used database of drug information in Australia. This is published in text form bi-monthly, available through prescribing computer program updates, from a variety of software producers, on a monthly basis, and on-line daily on http://www.mims.com.au/. The British National Formulary in the UK is a similar source of information. Another important database is Micromedex, which concentrates on drug/drug and drug/condition interactions, which is available through some pharmacy software distributors and on-line at http://www.micromedex.com/. Out of date drug information has the potential for inadvertent harm to the patient, plus time-consuming administration in the correction of prescription information.

2.1.7 Expert Systems

Expert systems are software based clinical decision systems and due to the vast databases of medical knowledge required, are not readily available on the Internet. There are however a few being developed, such as Interactive Patient ™ (n.d.), which allows a simple question and answer technique to be employed for diagnosis of a specific condition. This brings into question as to whether or not the doctor/patient relationship is in jeopardy. When a patient attends a consultation, does modern medicine see the person or does it see another potentially interesting case of disease? The increasing integration of knowledge bases, possibly linked over the Internet, could change the face of clinical problem solving in medical consultations significantly in the future (Hogarth & Hutchison, 1996, Ch 6, p. 4). However this has the potential to create problems of conflict between electronic diagnoses and human observational diagnoses by the health professionals.

2.2 Patient Centred Information

The second type of information that can utilize the Internet technology is patient based information. This includes electronic medical records, diagnostic data, peer contact and telemedicine.

2.2.1 Electronic Medical Record (EMR).

Central to general practice is the task of recording patient information (Bolton, 1995). From the perspective of the GP, computers are progressively being used for recording patient clinical data as electronic medical records (Hannan, 1996), however we are a long way from the 'paper-less' medical practice. Currently EMR usage is restricted to internal use by general practitioners for recording demographics, consultation/contact records, repeat prescribing, target monitoring,

recalls and some morbidity (disease) coding (O'Mahony, 1998, p. 2). In hospitals the EMR typically holds administrative data, demographics and test results. Each EMR system stands alone with no shared access available to the health care providers outside the hospital environment. This ultimately causes increased healthcare costs, lowers health standards and creates duplication of effort with reentry of data into each medical records system. General practitioner services are often far removed from their counterpart's specialized and hospital based services (Harper, 1986, p.192), consequently this erodes learning between the two and propagates a lack of continuity of care and understanding for the patient. Feedback on problems or treatment, most often in written form, sent from one site of care to another can take days or weeks to be transferred. Bolton, (1997) in 1997, suggested that the Internet might be a good '*universal platform*' upon which to develop information systems. Such a platform would enable clinical information databanks to be created to collate '*disparate information sources*', thereby reducing the costs and complexities of individual GP's computing systems and increasing communication speeds.

The advantage of medical records over the Internet is primarily the access by multiple service providers, potentially leading to a better continuity of care and removal of duplication of history recording. Also significant delays in emergency treatment and repetition of tests and diagnoses could be avoided if the medical history of a patient were readily available to all potential health care providers for the patient. Another advantage of EMR that would have a significant impact on clinical research is the collation of patient disease and treatment information. Previously clinical research based on manual patient records would take up to six months to elicit from paper charts. The same information can be collated electronically in a matter of minutes. This has implications not only for the health of the patient, but

also in the management (costs factors) of the health services provided (O'Mahony, 1998, p.1).

In using EMR the issues of security and storage are paramount, as are the vulnerability of such systems to misuse. Much work in this area has been undertaken in New Zealand, and has produced the New Zealand Intranet Privacy Impact Assessment (Carter, 2000). In addition the potential use of the Internet for EMR, the use of electronic recording is not without its own computer data challenges. These are in the form of the choice of which disease (mortality and morbidity) coding system to employ and enforcing uniformity on the type of medical and health information that should be recorded. Whilst EMR's via the Internet is in its infancy because of the multitude of unresolved issues surrounding it, some trials have been initiated and countries such as the UK, New Zealand and the US have created national strategies towards the implementation of integrated health records (Mount, Kelman, Smith, & Douglas, 2000). One example of an EMR trial is the Columbia-Presbyterian Hospital experiment (Hogarth & Hutchison, 1996, Ch 3, p.2), which uses a Web browser to access an Internet medical record. The hypertext screen used also incorporates links to subject directed Medline searches. Alternative evolving technologies, in particular smart cards, may be a viable alternative to the shared EMR, which is still dogged by physical, legal and ethical unresolved issues.

2.2.2 Diagnostic Data.

Patient diagnostic data refers to pathology and radiology test results. The traditional methods used to transfer information from the specialist or laboratory is by printed result sheets. These result sheets have to be reviewed by the GP and then pasted into a manual record or retyped onto a computer record. In Australia it is becoming more popular, and accounts for some of the increase in computerisation of

general practices, to transfer pathology test results over data links via modems. Direct transfer from the laboratory to the practice minimizes the delay in obtaining the results and reduces the amount of clerical work required by the practice. E-mail and direct access via the Internet can also be used to transfer such results.

2.2.3 Peer Contact

The peer contact support between medical practitioners has been opened up with the introduction of electronic communications. This can be achieved by using e-mail, newsgroups and feedback/commentary on research on-line. E-mail is a most basic use of the Internet, yet is simple and powerful. Contacting experts across the country and the world is now possible, and this contact can be established in minutes. This is an important benefit of e-mail as there is some evidence that peer contact is a significant factor in clinical decisions (Williams & Maj, 2001). Harper (1986, p.171-172) cites Menzel and Katz's research that found that "*in a study of innovative clinical behaviour, the prescribing of a new drug related to a doctors' association with other doctors and the clinical behaviour of colleagues*". The use of communication technology, such as the Internet, increases the ability of practitioners to contact and consult colleagues on clinical treatment practices.

The latest methods of information transfer can also ensure that the most current treatments are disseminated more rapidly than by traditional means and therefore can be implemented sooner, hopefully to the benefit of the patient. E-mail may also become a viable alternative in transferring patient information between specialists, hospitals and general practitioners.

2.2.4 Telemedicine.

Telemedicine enables remote access to medical services that would otherwise not be available (Pradhan, 1996, p.183) using video-conferencing, email, and on-line transfer and viewing of diagnostic x-rays and pathology slides. Whilst the worldwide technology network allows fast transmission of text, the speed for large graphics files is inadequate for on-line interaction. Dedicated, direct lines of greater bandwidth are required. This is not so say that the use of the Web for distance consultation is not possible or useful, as Johnston, Goel, Birthwistle and Hirst (1998, p.1) have demonstrated the transfer of clinical images via the Web, for confirming diagnosis and treatment can affect the patient outcome considerably. In a recent interview Professor Peter Yellowlees, the Director of the Centre for Online Health at the University of Queensland said that Australia is at the forefront of Telemedicine. This position has been a result of the House of Representatives committee investigation and recommendations to formulate the Health On Line policy to "*increase Australia's' international competitiveness*" in the area of e-health (*Health on line. Inquiry into health information management and telemedicine*, 1997). Telemedicine is an important technological advance for Australia due to the vast geographical area of the continent, particularly for remote and rural locations. One example of its current use is long distance consultation for ultrasounds ("The brave new world of telemedicine", 2001).

Telemedicine should not be confused with the popular term *Cybermedicine*. Both use the Internet technologies, however Telemedicine uses information exchange primarily for diagnostic and curative medicine whilst Cybermedicine is the global exchange of information focusing on management, prevention and public health care issues (Eysenbach et al., 1999).

As described in this chapter there are many potential uses of the Internet in primary care and clinical practice. The next chapter examines, in greater detail, the use of clinical information retrieval via the Internet by both patients and general practitioners.

CHAPTER 3. INFORMATION RETRIEVAL APPLICATIONS

The need for information comes from both clinicians and patients. This chapter discusses the issues from both perspectives. This encompasses

- Patient information and education
- Electronic communication
- Continuing medical education
- Clinical reference information.

Each issue is examined with regard to its application within the Internet environment. The section concludes with a summation of the need for information management as a consequence of these applications.

3.0 Information Needs

Needs analysis, through various studies, has shown that GP's require information during the course of consultations in addition to their own current knowledge (Ely, Burch, & Vinson, 1992; Timpka & Arborelius, 1990). As Smith (1996) points out "*the rate of change of medical knowledge has accelerated*" which means that without updating their knowledge and information sources regularly, the GP may not be able to practise quality medicine. Whilst there are many differing sources of information to support the GP, evidence suggests that colleagues and desk reference material are the most popular (Ely et al., 1992; Westberg & Miller, 1999), although out of date texts and the time to access relevant printed journal information limits their usefulness. Additionally the Internet itself has had an impact on the GP's

need for information, as ever increasing numbers of patients present them with Internet acquired medical information. In Australia in 2000 it has been reported that 96% of GP's have, at sometime, been presented by patients with such information (Williams et al., 2001). The easy accessibility of Internet based patient information has created interpretation problems for patients. As Williams, Maj and Shaw (2001) point out it is becoming a significant issue in Australia, with pressure on practitioners "*to become familiar with patient appropriate sites*". Mostly GP's are ill prepared to cope with this barrage of web-based information from their patients (Jadad, 1999). It is therefore important to look at the evolving issue of Internet acquired patient information.

3.1 Patients Information and Education

With the wide spread availability and use of the Internet, the general public has access to web based medical and health information, previously not easily accessible. Increasingly patients, family or friends will search the Internet for health related information (Adkins, 1997; Health On the Net Foundation, 1998; Sims, 1998). There is a plethora of on-line resources, however access to web pages that are of verifiable quality can be problematic (Larkin, 2000). Indeed as Williams, Maj and Shaw (2001) found in a recent study "*the general public whilst having the ability to retrieve information, only select appropriate and useful information (as assessed by primary care providers) approximately 50% of the time*".

The Internet empowers the general public, as individuals, by giving them the same access as medical professionals to sources of clinical information. This information may be used for self-diagnosis or in conjunction with anonymous web-based diagnosis, possibly leading to a person to seek or initiate self-treatment

options. There are numerous sites now available for on-line consultations such as The Doctor Online (*The Doctor Online*, n.d.). Potential consequences of this can be both detrimental and beneficial. Inaccurate and inappropriate use of the information may be detrimental to the patient (Coiera, 1998a), as may be access to pharmaceutical products that may be restricted in the country under consideration (Wake & Lisgarten, 2000). However positive outcomes may include reinforcement of clinical decisions and potentially a better-informed general public leading to higher treatment compliance (Ruth et al., 1994). Sheppard (1999) is of the opinion that "*patients require access to good quality, evidence based information so they can take an active part in decisions about their health care*". However, despite this possible sharing of information trend, there is still some reticence by the medical profession to share more information than they deem necessary with patients (Ruth et al., 1994). Also, this situation might be seen as challenging of the authority of the health care provider. From the patients' perspective, one study concluded that a lack of suitable information from local health care providers has created a need for alternative sources of objective medical advice (McLellan, 1998). Indeed Ferguson (1998) tells us "*The insightful article by Spielberg suggests that patients may turn to the net because there is something inherent in traditional office based medical practice that leaves them 'wanting more'*". In response to the increasing access to medical journal information by the general public, The Journal of the American Medical Association provides both a printed and Internet Patient Page specifically for the general public. This Patient Page is used to assist the public in the use of medical information (American Medical Association, 1998; Kane & Sands, 2000). Whilst the more informed GP may welcome the initiative of patients to search for and request information, many are not comfortable with this shift in the knowledge

base. Patient access to electronic information, whether accepted or liked by medical practitioners, should be carefully considered, and is a phenomenon that should be heeded (McLellan, 1998). One result of the availability of this data via the Internet may be a better-informed general public who may present medical information relevant to their condition to the GP. Consequently there is now a need for GP's to be conversant with Internet based patient accessible medical information (Clearihan, 1999). As the roles and responsibilities of the health care providers are challenged, there is little doubt that the doctor/patient relationship will alter due to the use of the Internet (Carlile & Sefton, 1998; Jadad, 1999).

In Australia, as in other Westernised countries, the community pharmacist is the link between general practitioners and the general public in terms of primary health care. It is generally recognised that pharmacists can be called upon to provide initial health management guidance in addition to providing *"independent medication advice"* (Chen & Britten, 2000). In the future there may also be a shift in emphasis from pharmacists being information providers to information interpreters (Sclavos, 2000). In effect pharmacists are therefore also expected to maintain up to date knowledge of products and their efficacy. Similar to general practitioners such information is readily available via the Internet, to both pharmacists and the general public. On-line pharmaceutical databases include PharmInfo (*PharmInfoNet*, n.d.), and Electronic Medicine Compendium (*Electronic Medicines Compendium*, n.d.). It should be noted that most of the Data Sheets and Summaries of Product Characteristics are specific to the country of origin (Wake & Lisgarten, 2000). There are however sites such as InteliHealth (*InteliHealth*, n.d.) that are patient based and searching can be done by brand or generic name. Many of these sites are expanding to include links to disease and condition information. Pharmacy information

gateways have also been created, such as Pharmacy Web Australia (*Pharmacy Web Australia - the Australian pharmacy Internet directory*, n.d.), PharmiWeb (*PharmiWeb: The heart of Healthcare on the Web*, n.d.), and InPharm.com (*InPharm.com - Pharmaceutical Industry Information*, n.d.). These gateways provide an authentic source of links to other Internet sources of information. Recent issues of journals such as the Pharmaceutical Journal PJ Online (*PJ Online (The Pharmaceutical Journal)*, n.d.) and the Australian Pharmacist Journal (*Australian Pharmacist Journal*, n.d.) are also available on-line.

3.2 Electronic Communication

A shift in provision of some primary health care services may have resulted from the use of electronic communications. It may encourage more efficient communication between primary and secondary health care providers, and between patients and GP's. Currently, requests for electronic sources of information, such as known health web sites, email communication and discussion of Internet health information, are made by nearly one third of patients in the US (Ferguson, 2000). It is possible that electronic communication such as patient initiated e-mail and online consultations may become important in the future. Location and time do not restrict such electronic consultations. Indeed the impersonal, and possibly anonymous, nature of such encounters may be less intimidating, particularly for consultations regarding conditions of a more personal nature such as sexually transmitted diseases. However, there are limitations to on-line and e-mail consultations, due to issues such as payment for service, time, and the appropriate ways to employ the technology. Furthermore, the important medico-legal and ethical implications of such communications are problematic and are currently under discussion both topically and in law ("The brave new world of telemedicine", 2001). Despite these factors, on-

line consultation services are available. One such service is Doctor Global, which offers "*one-to-one internet medical consultations*" (*Doctor Global*, n.d.), where individual practitioners set their own fees and use a credit card 'payment gateway' to secure payment prior to consultation. One possible result of the use of electronic communication may be that the nature of the relationship and interaction between the physician and their patients will change. As McLellan (1998) points out, "*Knowledge is power and power changes relationships. As ways of communicating change, and patients accrue more and more information, especially of the type that used to be only in the hands of professionals, the patient-physician relationship is bound to be affected*". As demand for this mode of communication between the medical profession and the general public expands, more attempts to shape the format and procedures for such communication will develop. Two sources of currently available guidelines are those from the American Medical Informatics Society (Kane & Sands, 2000) and the Medical Defence Union (Brown, 1999).

3.3 Clinical Reference Information

Few GPs' would dispute that the vast array of information presented to them on a daily basis, together with the need to keep abreast of new research and clinical information, is somewhat daunting, if not frustrating, to manage. It is not surprising that the term 'information overload' is being used to describe the current state of general practice information (Delamothe, 2000). Access to relevant information, at the time it is required, is essential to the practice of quality primary care medicine. The usefulness of journals and reference material is diminished if there is no fast easy method to access it. The inexperience in information location and research of medical practitioners attempting to access information compounds the problem. Whilst the Internet is a global source of information, to date it has not been easy to

use by non-experts for access to clinical information (Lowe, Lomax, & Polonkey, 1996). Hibble (1998) suggests that the large amount of information is an advantage however "*in unmanageable forms does little to aid decision making*".

There is little doubt that unmet information needs can potentially compromise patient care and affect clinical performance (Westberg & Miller, 1999). During a typical consultation there arises one question per fifteen patients that require further investigation and information gathering by the GP (Ely et al., 1992). Smith (Smith, 1996) and Westberg (1999) suggest that the preferred primary source of such information is from medical colleagues. Further to this if additional clinical information is required this is generally obtained from journals and standard reference texts, which takes time. However search times may diminish as more traditional reference texts become available in electronic format such as CD Rom and on-line

Further, there is increasing pressure to base best practice on evidence based medicine (Petersen, 1999). The introduction of the Internet has made access to research evidence much less complicated. The use of evidence based databases, accessed via the Internet, such as the Cochrane Library is increasing. These databases provide systematic reviews and critical appraisals of primary research. Despite this, the lack of awareness of, and access to, these databases have been a barrier to the general use of such evidence based medical resources (Young & Ward, 1999). There are currently projects undergoing evaluation such as ATTRACT (Brassey, Elwyn, Price, & Kinnersley, 2001) that provide evidence based searches and summaries of the literature (with a six hour turnaround time) on behalf of the GP. Rapid access to such information is greatly enhanced by use of the Internet technologies. It is interesting to note that whilst there has been some opposition to

medical publishing on the Internet (Kiley, 1999a), the statistics on worldwide Internet access to electronic medical journals are not insignificant. The BMJ's printed circulation is in the order of 115 000 per week primarily in the UK, however approximately 100 000 electronic accesses are made per week mostly from outside the UK (Delamothe & Smith, 2000).

3.4 Continuing Medical Education (CME)

With the expanding volume of medical research and literature, the introduction of new medical technologies and with the demand for quality and outcomes in medical care, CME will become increasingly important. As times change and technology progresses, Towle (1998) suggests that the medical profession will need to be educated in "*not only the theoretical basis of medicine but also the scientific basis of clinical practice*". The methods of information access will shift from memorising vast quantities of facts, to possessing the ability to access, analyse and apply up to date information, obtained from electronic sources. Also as changes occur in clinical practice resulting from the advent of evidence based medicine, so too the culture surrounding medical education will have to adapt to embrace the use of new technologies for learning (Campbell & Johnson, 1999). This use of technologies, such as the Internet, also applies to continuing professional development as distinguishable from CME. The use of the Internet as a tool in CME has the advantage of being available remotely and provides self paced learning schedules. This is in contrast to the more traditional methods of education delivery such as seminars and lectures. The Internet technology also offers GP's electronic communications, information access, and information sharing, promoted via discussion groups (Roberts & Fox, 1998). Despite the availability of tools such as

bulletin boards, one possible disadvantage in the use of computer-based education is the lack of personal professional contact.

Whilst resources for CME in the richer, developed Western society are freely available, doctors in developing countries suffer from lack of access to up to date medical information (Groves, 1996). The Internet is seen as a great equaliser in access to information, however the exception to this is in developing countries where access is restricted or non-existent. These inequalities are being addressed (Edejer, 2000; Godlee, Horton, & Smith, 2000) and one example is that of a non-real time system called SatelLife (Groves, 1996) that keeps remote areas up to date with information and e-mail. There are other collaborations to further access to developing countries such as the work being undertaken by the World Health Organisation (WHO) and the Cochrane Collaboration Consumer Network (Mayor, 2000).

3.5 Information Management

It is evident that in consideration of only the four areas discussed above (patient education, electronic communication, clinical referencing and CME), information management is an onerous task. With the rapid advancement of medical research and biomedical literature the GP needs additional skills in information management in order to keep up to date and to find relevant solutions (Westberg & Miller, 1999). Each consultation comprises of obtaining, analyzing and recording information in the form of patient records, diagnostic results, public health, the health care system and published information. As Coiera (1998b) comments that "*Just as the ability to suture doesn't make one a surgeon, the ability to surf the Web does not imply that one understand the principled use of information*". There is little doubt

that the Internet technologies can provide access up to date information and as Fraser (Fraser, Kohane, & Long, 1997) suggests that the Internet can create integrated systems to manage information. Indeed many separate GP groups, particularly in the UK, have developed centralised information services relevant to their geographic area (Lyons & Khot, 2000; Wilson, 1999). Although the quality and format of the information received from local services was found to be less than satisfactory, with little understanding from the information providers as to the value of promoting their services and sharing information openly (Carnell, 2000). Development of these 'electronic' or 'virtual' libraries is a popular solution to information collation from various local sources. Lipman (2000) suggests that despite our preoccupation with clinical intervention based on valid findings, the information on research evidence only reaches general practice very slowly. Since the Internet also provides access to collated sources of information such as the Cochrane Database it could assist in such challenges. Also our enthusiasm to disseminate large volumes of information has meant that for clinicians to find what they need, when they need it, requires further management (Gray, 1998). It is evident that use of the Internet could alleviate such problems, and the cost-effectiveness of the technology makes it a good alternative method of delivery. Ultimately most questions generated by doctors can be answered from electronic sources, although at present the attitude towards the use of this technology, and time factors appear to be significant deterrents in its use (Smith, 1996). Also whilst there are a large number of good quality credible healthcare resources accessible using the Internet they contain both information and misinformation (Wilson, 1999). For this reason Delamothe (2000) tells us that doctors gravitate to sites known to them as their references on the Internet. Indeed Westerg (1999) suggests that it is an accepted strategy to locate and use "anchors" of

known quality and familiar sites, a view supported by a recent study by Williams et al (2001).

Finally, it has been suggested (Gray, 1998) that this task of knowledge and information management is beyond the individuals' capability in clinical practice and should be managed in the same collective manner as other resources. So whilst we may have methods to collate and access information perhaps we do not yet have the ability to use if effectively.

CHAPTER 4. INFORMATION ISSUES

In the preceding chapters we differentiated between patient and clinical information retrieval applications, similarly the issues relating to the use of each type of application information can be differentiated. Medical information is subjected to problems of currency, authenticity, convergence, time critical factors and human reticence, whilst patient information is concerned with security, privacy, and lack of standards, portability and accessibility. These challenges are by no means exhaustive, however they do encompass the majority of the current, mainly unresolved issues. It should be pointed out that many of these challenges, particularly in relation to patient data, are not new, however they have become prominent once more with the use of advanced communication systems such as the Internet. Mitchell and Sullivan (2001) in a recent review of the literature of computer use in general practice, found that whilst there was a positive view to computer use by both patients and practitioners, the main concerns were regarding privacy, the doctor patient relationship, costs, time and training requirements. This research, whilst acknowledging the patient centered information issues, is primarily concerned with the use of clinical information. Hence there is an introductory section on the issues as they relate to patient centered information and a more detailed discussion of the issues relating to clinical information in the latter part of the chapter. A chart of the issues to be discussed is given in Figure 3.

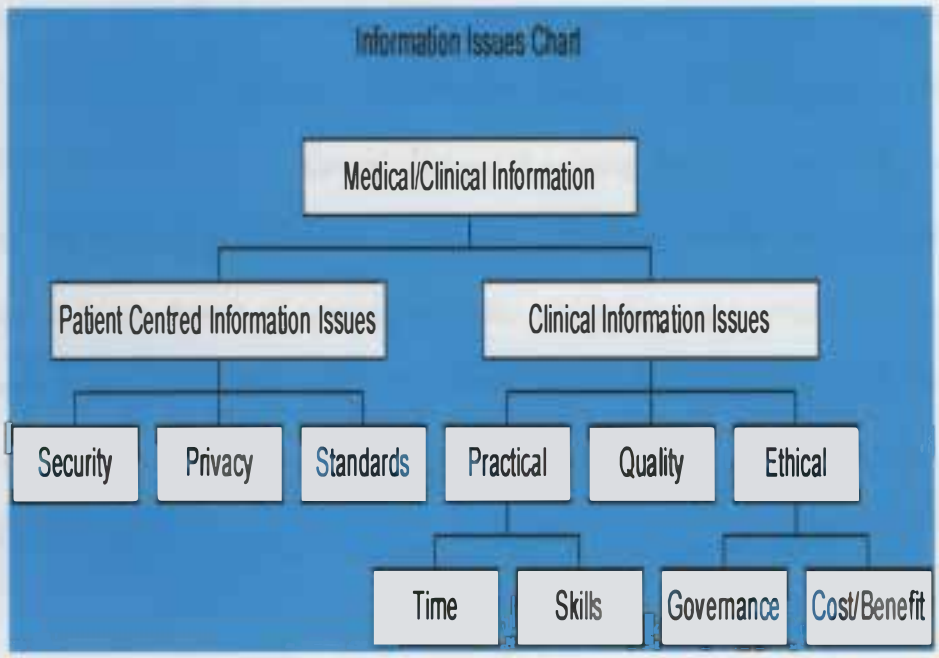


Figure 3. Information Issues Chart

4.1 Patient Centred Information Issues

4.1.1 Security

The security of patient information, as distinct from privacy, is a general computer data issue. A patients' medical record is potentially more important than other forms of data kept on individuals. As computer professionals we can readily specify the issues and purport to have the answers, however practically and in terms of costs, the situation is not straightforward. In chapter eight of Hogarth & Hutchinson's *An Internet Guide for Health Professionals* (1996, p.1-2), they point out that it is easy to impersonate a doctor and retrieve a few records from the medical records department, or a few hundred records on a floppy disk. (Further points to provide discussion, although not providing solutions, can be found in Ross Anderson's (1996, p. 5) 9 principles of data security in the paper on clinical system security.) The issue of security and privacy will be prominent in the public

perception as Australia follows New Zealand and proposes an integrated electronic health record policy (Mount et al., 2000). As Stevens (April 1998) warns from the New Zealand trials "*The substantial changes to existing medical records systems will place a vast amount of additional information about the health care of identifiable individuals in the hands of various agencies which have not previously had such information in any useable form.*" This sort of experiential comment will no doubt place increased pressure on strategists to ensure that Australia is well prepared for the shift in power.

4.1.2 Privacy.

The privacy debate is not new for the medical profession. Like the security issues it becomes more evident with the use of computers and the Internet. Issues of access, modification rights and ownership are important, mainly unresolved questions, as is patient access to personal records. When the patient's GP is the only person accessing them, the problem is greatly simplified. This becomes significantly more complex once records are to be shared for the 'greater good' of the patient. Therein lies the bipolar question of the rights of individuals versus the public good (Mount et al., 2000). Issues of responsibility for keeping the record up to date, and location of storage need to be considered. Some sources such as IBM, (cited in O'Mahony, 1998, p.4) advocate the answer to be in a centrally located record repository, accessed by authorized personnel and using cryptographic functions to address confidentiality, integrity and authentication. The theory itself is non-trivial and the application of it highly specific and complicated. Perhaps the answer lies in Virtual Private Networks, which are private computer networks managed and operated by public telecommunications providers or public carriers of a country (Halsall, 1996, p.480). Privacy issues must be addressed and resolved, and the needs

of the health care providers and patients satisfied. These are issues that are far outside the scope of this research to attempt to answer – they are issues of community and professional responsibility.

4.1.3 Lack of Standards

The lack of standards in recording techniques and structure of clinical records, both within Australia and worldwide, are a huge obstacle to the introduction of shared electronic patient data. This also impacts portability of information between systems. To date some progress has been made, by private enterprise, in finding practical solutions to security issues and standardization in health care and one such company is the US based Healtheon http://www.healtheon.com/. Much of this type of investigation and research is still being tested and evaluated. Record sharing over the Internet is still fraught with difficulty and disorganized theory. However, attempts to create integrated health records in the US, Europe and Australasia will ine itably create or enforce some standardization before implementation of such systems can take place.

4.2 Clinical Information Issues – Barriers to the Internet Solution

This section discusses in detail the issues surrounding the access to and use of clinical information available via the Internet in general practice. There are numerous, distinct issues in relation to the use of the Internet in clinical practice. These issues generally create and underlie the 'non-use' of the technology and its associated information, as a clinical resource. Each aspect is discussed in detail with a view to possible solutions and current work in the area.

The barriers can be classified as follows: -

1) Time issues – which encompass time constraints of the practitioner, variations in access time associated with the technology, and time critical delivery of information

2) Skills – including computer and navigation skills of the user, ability to filter information, and information management

3) Quality – incorporating the issues of currency, authenticity, convergence, and quality and reliability evaluation

4) Attitudes – the attitude towards the technology and use of it, human reticence, and technology as only one solution

5) Clinical governance – the delivery of quality clinical practice, accountability and the legal ramifications

6) Cost versus benefits – individual and public health costs in relation to health outcomes.

Each of these items contributes in creating considerable limitations to the use of the Internet within the restraints of the limited consultation period. A discussion of each of these issues is presented below.

4.2.1 Time critical

There are three main time critical factors: - practitioners time restraints; technology access times; and critical time deadlines for information.

According to Sullivan (1995), a typical consultation lasts approximately 5-10 minutes, and using a computer can assist in clinical performance although it increases the consultation time. With the current use of technology one might reasonably expect a further increase in the duration of the consultation when access

to the Internet is incorporated into it. Indeed as Hibble (1998) points out "*the issue of making information easily accessible and usable at the point of clinical contact indicates an electronic medium*". However, a lack of time with which to devote to additional learning and the time taken in Internet searching are common problems particularly during a patient/doctor consultation (Wilson, 1999). However this variation in time is affected by several factors including modem speed, Internet service provider (ISP), Internet traffic, page faults, etc. The performance of the technology, its reliability and speed of access are critical issues in relation to obtaining a reasonable quality of service. Until the limitations of access speed in the transfer of large amounts of data are solved the response times of the Internet will be an on going problem. With the present technology this speed can only be achieved by increasing the bandwidth, using compression and signal overlapping. Berners-Lee (1997) the Director of the World Wide Web Consortium (W3C) suggests we are in a catch '22' situation and that if access times were faster this would encourage increased frequency of use of the Internet, which eventually would result in a regression of speed once more.

The user expectations and the situation, in which the technology is used, be it in real-time or mission critical, are also factors to take into consideration. All of these issues are considerable handicaps in the use of the Internet within the constraints of the limited consultation period. Adkins (1997) points out that "*timeliness of information is vital for efficiency in general practice*" and this applies to patient associated reports as well as reference material. Currently it is impossible for medical practitioners to keep up with the latest information in its printed form and it remains to be seen as to whether or not this problem is alleviated by using methods of electronic delivery.

4.2.2 Skills

If access is attainable in a suitable time frame, there exists the added challenge, to most GP's, of filtering information (Adkins, 1997). The ability to be able to quickly and efficiently sift through information for the appropriate and relevant material is a skill that requires practice. It has been noted by Dawes (2000) that in practical terms the frequency with which practitioners can search, select, acquire and appraise information is low, even with the use of electronic techniques such as the Internet search engines. It "*has proven too difficult alongside the competing demands of clinical practice*" (Barton, 2001). This knowledge is also not shared with peers causing a massive duplication of effort and adding pressure to an already time constrained area of health care delivery (Dawes & Goodwin, 2000). Additionally, a lack of appropriate skills in navigation of the Internet, which can be overcome by training and practice, can be frustrating, time consuming and requires persistence (Wyatt, 1997). Collectively the vast amount of research and other relevant material has to be managed by the individual user (Kidd, 1999, p.3). Selective reading is essential and the lack of structure of the data on the Internet presented is a potential compounding problem.

4.2.3 Quality

There are numerous aspects that make up overall quality. Currency of data and authenticity are important factors, in addition the convergence of information presentation, and quality and evaluation techniques used to assess the actual material are to be considered.

i) Currency.

Currency of information is important from both a legal and an ethical viewpoint. Currency is a basic issue in regard to the accumulating amount of medical

knowledge. Bearing in mind that medical practitioners rely on information to diagnose and treat patients, and that the patients themselves are becoming more 'informed' about their own health status, basing treatments on non-current thinking can potentially be damaging to the medical service provider. Use of non-current, or the lack of awareness of, the latest information can be legally damaging to the GP and may not fulfill the ethical 'duty of care' that is inherent in medical practice. A recent case in Western Australia ("The brave new world of telemedicine", 2001) highlights the issue of legal action which was taken by a patients' family after a GP did not know that a treatment available overseas was also available locally. Philosophically speaking, in view of medical litigation cases, it is worth retaining a realistic view of the medical profession – they are not magicians and the Hippocratic oath does not demand that they cure everything, only that 'first, do no harm' (Coiera, 1998c, p.1). Such points of law and ethics are increasingly being tested in relation to the medical profession.

ii) Authenticity

It is increasingly difficult to be certain that information being accessed is authentic. The nature of the Internet advocates freedom of information, which means that anyone can create a web page with information that may or may not be authentic. Additionally the threat of malicious damage by changing a source of information is potentially dangerous. There are no readily available answers to these security issues. Coiera (1998a, p2) suggests that 'recognition markers' be placed on documents, ultimately creating an immune system for the Internet to limit the spread of misinformation. Other methods suggested are electronic content based labeling by self or peer review (Coiera, 1998c, p. 2-5), and kitemarking (Delamothe, 2000)

however information already available on the Internet poses a backwards incompatibility problem which is as yet unresolved.

iii) Convergence.

Convergence relates to similarity within different environments. With regard to Web pages this means accessibility, presentation and consistency. Whilst there are many guides to help the novice practitioner get started on the Internet, the WWW lacks suitable navigation tools for searching and accessing medical information. [Two examples of these guides are - Guide to the Internet published by the British Medical Journal (Pallen, 1996) and An Internet Guide for the Health Professional (Hogarth & Hutchison, 1996)]. There is a lack of uniformity; the current search engines available are not easy to use for in-depth medical searches and they do not select on content. It is common to initiate a search on a particular subject only to be presented with a multitude of matching pages. The requirement for more specific tools is obvious, and adapted search tools such as Medical World Search (Hogarth, 1998, p.3) show how this may be achieved in the future. Progress is being made however with the development of sites to help in the access to medical and biological research material. E-biomed ™ (Delamothe, 1999) is one such site that is attempting to create an all-encompassing database with a friendly front-end. Research is also underway to investigate web content searching using META tags and search engines designed specifically for medicine. This issue also has implications for patient acquiring Internet information (Kidd, 1999, p.2).

The use of the Internet as an information delivery method also has inherent problems. As described by Hogarth (1998, p.2), the issues of information discovery (searching), presentation and interactive user interfaces are not peculiar to the medical field, they are existing issues related to the use of the World Wide Web.

Presentation opportunities using the Internet are more varied and far richer than those of traditional methods of information distribution. The use of 3D graphics as used by Eye Simulator (Hogarth, 1998, p.4-5), show how graphical representation of information can be used as a learning tool in situations where textual descriptors are inadequate.

iv) Quality and reliability evaluation

Quality is a significant concern to practitioners and the general public, as increasing numbers of consumers access the wealth of health sites. The reliability of Internet sources is problematic especially for the general public (Gottlieb, 2000). There are two directions from which to approach the issue of quality, firstly from the perspective of the web site development itself and secondly from the consumer assessment of the information presented. In relation to the first perspective, responsibility lies with the provider of the information, and bodies such as the American Medical Association have developed principles to govern web-site development (Winker et al., 2000). Unfortunately there is no enforcement of these principles. Endorsement by professional bodies and pre-evaluated health gateways are still the principal indicators of web site reliability. From the second perspective, that of the consumer, there exist quality appraisal tools providing guidelines to assess the quality of health information found on the Internet (Kiley, 1999b). The criteria for quality assessment are based predominantly on the currency of information, source reliability, accessibility, availability, disclosure of authors, and content and design (McLellan, 1998; Wyatt, 1999). Despite the existence of assessment tools, one current viewpoint is that it may not be possible to rate the quality of Web sites on an overall scale (Eysenbach & Diepgen, 1998). Indeed as Delamothe points out *'rating the quality of medical websites may be impossible'* (2000). Despite this view,

the Health on the Net Foundation have also produced guidelines in the form of a Code of Conduct (HONcode) relating to medical and health Web sites (Health On the Net Foundation, 1997). There exist numerous rating schemes and suggestions for addressing this issue specifically for health information available to consumers (*DISCERN*, n.d.; Kim, Eng, Deering, & Maxfield, 1999; Sims, 1998). One result of these issues is that web users tend to use a small number of pre-selected sites of known quality. The current situation is that '*our shorthand way of dealing with the information overload that already exists is to develop loyalty to brands. We gravitate to products that reliably give us what we want. The pattern of use on the World Wide Web suggests that this is also happening in cyberspace.*' (Delamothe, 2000).

Lack of perceived quality is also a contributing factor to the lack of use of the Internet by practitioners. Whilst there exist guidelines for accessing best practice information (Kibble, Smith, La Vallee, Bailey, & Bard, 1997), it has been suggested that it is not sufficient to rate them on accountability of source alone, and that content quality and likely impact of the information should form part of the assessment (Wyatt, 1997). This view is supported by Griffiths and Christensen (2000) who raised questions about the validity of current website evaluation techniques (Kim et al., 1999) correlating to the quality of the content therein.

Lastly the reliability of the source of information is a major concern in the quality debate. There are attempts to directly address it by using health information 'gateways', which are portals for selecting information that meets certain criteria. The American Medical Association has developed a 'supersite' www.medem.com to provide a reliable source of information for patients (Charatan, 1999a). Additionally the use of national evaluated health information gateways with 'sign posting' to recognizable sources will assist in quicker and more reliable access to quality

information (Gann, 1999; Kiley, 1999b). These gateways, such as the US based web site Healthfinder (n.d.), the Australian based web site HealthInSite (n.d.), the European based web site NetDoktor (n.d.), the UK based sites OMNI (n.d.) and NHS Direct Online (n.d.), all offer free access to catalogues of health and medical sites, and current, quality assured information, particularly on chronic conditions.

4.2.4 Attitude

As human beings we all possess some innate dislike of change. The new wave of medical practitioners will be computer literate, however the greater challenge is with current practising clinicians (Coiera, 1998c, p.1). Additionally the medical profession tends to be a conservative group who do not readily take on board unproven new ideas. The Internet to most GP's is still unproven for clinical practice.

As was seen in the prior discussion on patient information, increased access to Internet acquired medical information by patients has resulted in the need for health providers to also be familiar with such sources. The medical profession may not always readily accept the relatively new phenomena of easy patient access to information and there is generally a negative attitude towards patients bringing medical data to a consultation (Johnson, 2000). Globally, information obtained from the Internet and presented to practitioners is seen as a nuisance (Johnson, 2000; Pemberton & Goldblatt, 1998). In a survey undertaken by Forrester Research, it was found that doctors believe that "*consumer oriented health web sites were also considered a nuisance and time wasting, particularly when doctors were requested to read print-outs produced by patients*". There is perhaps greater acceptance, by doctors, of patient support groups on the Internet. Such groups provide an easily accessible forum to link patients with similar conditions (Ferguson, 2000). Patients in groups tend to know their own disease in great detail and they can be great allies to

the medical profession rather than a threat. Of particular value are the readily available, Internet based, patient narratives (McLellan, 1998).

Lastly it should not be overlooked that the technological solution is not necessarily the best or only solution. The human factors in consulting with colleagues eg. "*guidance, psychological support, affirmation, commiseration, sympathy, judgement and feedback*" (Smith, 1996) may be significant factors, which the use of technology and passive Internet solutions are unable to provide at present. All these issues collectively make it difficult to persuade GP's to use the Internet as a source of reference or clinically at all.

4.2.5 Clinical Governance and Performance

Rosen (2000) talks of clinical governance and its recognition as an important facet of medical practice. Much of the discussions revolve around the issue of measuring clinical performance and effectiveness, and from this comes an increasing pressure to base best practice on evidence based medicine (Glanville, Haines, & Auston, 1998). The introduction of the Internet has made access to research evidence vastly less complicated. However, the collation time for individuals to review the body of information is prohibitive, hence the development of resources such as The Cochrane Library. In future, definitions of 'good practice' may include the ability and occurrence of GP's to provide their patients with current on-line sources of information. Indeed Pemberton (1998) suggests that doctors be encouraged to provide pre-emptive offers of patient Internet information for discussion. This would help inform patients of the variable quality and integrity of information available via the Internet. There is also recognition that with the evolution of IT there has been a need to "*equalize the relationships between health professionals and lay people*" (Eysenbach, 2000). The Internet can assist in the shift

in responsibility to improve the ability of patients to help themselves and to make informed choices. This would result in some change in the costs of health systems. One study (Howie, Heaney, Maxwell, Walker, & Freeman, 2000) suggests that developing a 'consultation quality index' (CQI) to measure the quality of care using core values in general practice. The core values were measured using proxies of consultation length, how familiar the patient is with the doctor and the 'patient enablement' as outcomes.

There is little doubt that unmet information needs can potentially compromise patient care and affect clinical performance and Williamson, (cited in Westberg, 1999) reports that primary care providers need assistance in meeting their information needs. It was concluded by Sullivan & Mitchell (1995) "*using a computer in the consultation may help improve clinician performance but may increase the length of the consultation*". The fact remains that patients' most certainly prefer information from their own doctor (Ferguson, 2000), and that this will help in compliance and management of their own disease. Additionally there is currently significant discussion regarding the efficacy of the Internet (use of) in clinical performance. Adkins (1997) suggests "*electronic access to pharmaceutical drug database means better information management and also the potential to improve the quality of care*". Currently in Australia computer software programs available for prescription printing primarily provide this facility, and most updates to drug databases are delivered to the GP by computer media (CD Rom or diskette) rather than via the Internet, although the Internet would appear to be a more direct and cost effective method of software update delivery.

4.2.6 Cost Versus Health Benefits.

Lastly there are other factors, not readily addressed in the most recent literature, relating to the use of technology and its introduction into clinical practice, that of maximizing benefits whilst containing costs incurred. There are two differential factors in investigating the cost benefit issues in relation to the use of the Internet in clinical practice. The first is the cost of production and accessing information via the new communication technologies, and the second is the cost to benefit ratio of using such technology. As previously mentioned measuring the benefit of using information-based systems on clinical outcomes is extremely difficult. Other methods of incorporating the technology such as Telemedicine can be more easily assessed. Covvey and McAlister (1980, p.84-89) refer to cost-benefit as purely financial and use cost-effectiveness to relate costs to effective medical practice. The reality today is that computerisation and increased use of technology does not promote cost savings in other areas. However, in regard to EMR nationally, it is proposed that it would reduce the costs of epidemiological research, promote better resource allocation and management, and provide the ability for analysis of outcomes and costs benefits of interventions, monitoring and disease registers (Mount et al., 2000).

Containing costs whilst maximizing benefits results in strict care management. Frisse (1999) suggest that whilst this is "*effective in its ability to attenuate the rate of cost increase (it) is associated with a concomitant degree of administrative overhead that is often perceived by providers and patients alike as a major source of cost and inconvenience*". Whilst the US has strong advocates for universal health insurance or compulsory membership of health maintenance organizations (HMO), other countries have a stronger focus on the 'state' care of its

population. Regardless of the type of benefit scheme used there is universal consensus that IT should be deployed more in the cost of health management solutions (Frisse, 1999). The medical profession has been reluctant to adopt proven 'value-chain' strategies as used in business vision and management structures. Porter and Millar (1985) write in the Harvard Business Review about how IT is transforming industry processes and products by the use of information as well as computerization. The strategic significance of this is explained in the transformation of the value-chain, which is a concept of technological and economic activities as applied to the business and professional tasks. Whilst computerization has been focused on educational research and information delivery, the strategic use of technology from a cost benefit viewpoint has been mainly ignored. Effective business practices and measurement of the value of IT, computers and the Internet needs to take place in order to incorporate them effectively into clinical practice. As Frisse (1999) points out health care delivery is not far removed from other organization business perspectives and aims. The supply and demand resource matching issues are the same. In addition the 'goods and services' access, location and time are important, as are the real time resource allocation problems. Poorly performing companies are lacking in some way or other, yet state health services continue to get propped up. Perhaps a review and new perspectives on health care strategies in view of IT are needed.

Lastly, the evaluation of health costs is commonly measured in economic gains rather than in term of 'quality of life'. This method is usually used to justify expenditure by governing bodies. However the role of IT and information in the clinical setting should be added to clinical consultations rather than merely economic ones as with the disorganized facilities available on the Internet. However the huge

potential of this resource means we should be aiming to improve our understanding of its role in health care, not merely its economic advantage (Heathfield, Pitty, & Hanka, 1998).

The issues of quality, timeliness, information management and attitude make use of the Internet in the clinical setting as a reference resource difficult to master.

CHAPTER 5. THE AUSTRALIAN PERSPECTIVE

5.1 Australian Research

Over the preceding three years the Australian government has embarked upon formulation of strategies for computerization and electronic communications specifically for health and primary care. These initiatives include both general practice and pharmacy. The size of the Australian continent and the remoteness of parts of the country make the Internet and facilities such as Telemedicine potentially extremely useful to Australia. The government policy development was prompted by the fact that Australia has been slow to investigate and make use of these resources. Marshall & Belkin (1995, p55) showed that there is a "*desperate need for promotion and education*" within the Australian scientific community with regard to the Internet, if effective collaboration and interaction with peers is to be achieved. Also in 1998 Nori and Gunn (1998) reported, "*the worldwide trends in information technology have been slow to penetrate Australian general practice*". The introduction of the Internet technologies into the medical arena is now increasingly being referred to as *e-health.*

At the commencement of this research only three Australian Internet sites had published interests in Medical Informatics. One of the original sites was that of the Health Informatics Society of Australia (HISA) established in 1995 and available at http://www.hisa.org.au/. Likewise there were very few Australian sites that were depositories for biomedical and health information. One of the first and most comprehensive was, and still is, the Health Communications Network at

http://www.hcn.net.au/. This site contains links to related resources, information on Australian health issues, and has developed an online knowledge resource database. Another site with a specific modus operandi of education in medical informatics is The Centre for Medical Informatics at Monash University, Melbourne http://wwwcmi.med.monash.edu.au/mdcomp.htm. Cesnik (n.d., p.4) the Director of the Centre, points out that with the increasingly sophisticated technology in the medical informatics field there is an increasing requirement for the discipline to be addressed. A similar search of Medical Informatics on the Internet today reveals many more Australian sites have been developed. More importantly there are now several educational institutions that have established departments and courses in medical and health informatics, such as the University of Queensland and the University of Wollongong. This rise in the interest in Medical Informatics has been a driving force in the attraction of funding for research in this area. Four years ago few research projects were investigating this field, yet in 2001 many universities and private enterprise are developing systems and undertaking research projects such as this study. Many of these projects have been created because of the government push to computerize primary health care providers in Australia. One such project is being undertaken in the Illawarra region (*A study of computerisation trends among GP's in the Illawarra and patient reactions*, n.d.). Also other projects have been initiated due to the focus on integration and networking of health care (*IDGP Smart IDs project*, n.d.; *Intelligent systems: Health and Medical Informatics*, n.d.). Further research is being undertaken in the areas of medical knowledge delivery, formal modeling and knowledge representation at LaTrobe University (*Medical Informatics*, n.d.). Private companies are also providing resource pages and links such as CMS Medialink Medical Resources Index (Cundle Management Services, n.d.) and Medicine

Australia (*Medicine Australia*, 2000). Also, usefully, there are link sites for medical informatics nationally and worldwide such as http://www.itacs.uow.edu.au/research/health informatics/medinfolinks.html.

5.2 Australian Government Policy Directives

The Australian government recognized that medical information management needed to be investigated further. To this end a House of Representatives Standing Committee inquiry into health and IT in Australia was initiated in 1997 (*Health on line. Inquiry into health information management and telemedicine*. 1997). The committee was responsible for investigating health information management and Telemedicine and were given specific terms of reference. These terms of reference included "*the potential of developments in information management and information technology in the health sector to improve health care delivery and to increase Australia's international competitiveness*" (*Health on line. Inquiry into health information management and telemedicine*, 1997). The terms of reference were to be investigated with particular focus on the potential of current projects; costs and benefits of telecommunication and computerization in general practice; ethical, legal and privacy issues associated with transfer of patient information; coding and dissemination standards; ability for Australia to become an international force in the marketing and development of the new technologies; and the implications on costs through the use of IT. The government looked closely at the use of new IT health technologies in order to gain international a competitive advantage through its use.

Following the committees' report, a Health On-Line conference was held in 1998. The published findings of this conference (Mount, 1998, p.10) found a need for the development of an *integrated health record and information system* (IHRIS),

highlighted the lack of agreement in health classification and noted the urgent requirement for standards, coding systems and system architecture definition. The report stated that the use of computerized health records would not progress until General Practitioners can see the clinical benefits of their use, and have become familiar with the concepts and comfortable with the technology.

A further directive was initiated in a 1998 budget health report, to increase the quality of services provided by general practice, and attempt to "*strengthen the role of general practice in the Australian health care system*" (Australian Government, 1998). To this end it was anticipated that $15 million would be spent over a three-year period, via the Practice Incentive Program (PIP), to encourage the use of information technology and improve information management. One off payments of approximately $3000 per GP, were given to general practices participating in the PIP, to assist in the transition to electronic information management (Wooldridge, 1999b). In 1999 the (Australian Government, 1999) report focused on new management strategies basing them on the development of quality in the health care system. These were

- Better coordination of health care services (leading to more efficient use of resources)
- Incentives for quality prescribing (to increase quality and promote cost savings)
- Investment preventative screening and health promotion
- To develop evidence bases for quality care (with the creation of the National Institute of Clinical Studies and best clinical practice promotion.

Additional objectives were listed at the official launch of Health *Online* (Wooldridge, 1999a) including

- Addressing security, data protection legal issues of online health transactions
- Development of standards, change management and training
- Tailored information and services for consumers
- Improved access to current practice information
- Cost savings through electronic data transfer for Medicare claims and electronic prescribing
- Export of Australian health services overseas

These issues indicate that the government recognizes the need for a vision for the future upon which to base national strategic policies. Coordination of services and communication is an important facet of these government objectives. Peer contact and liaison between general practitioners is to be actively encouraged. Current GP research projects and peer contact information research is listed on various educational sites around Australia such as http://som.flinders.edu.au/FUSA/GPNIS/Default.html. The Australian government has recommended working towards an *integrated health record* (IHR). Mount (Mount et al., 2000) points out that this is in contrast to a national electronic medical record. The intention in using an IHR is to produce a '*virtual integrated record based on the use of pointers to the locations of the individual components*". This would create the basis for an IHRIS health event summary. The principles of the intended model and the activities that it supports can be found in the second section of Mounts' article. Despite the strategic influence of the governments' wish to

promote the use of EMR (Mount et al., 2000), the purpose of setting up universal EMR's is being questioned as to whose interest it is in. "*Integrated electronic health records are increasingly seen as a way to achieve quality and continuity in treatment, fill the gaps in public health research and contain costs*" (Carter, 2000). For IHRIS to work 100% of health care providers, particularly general practitioners, would have to use EMR and have the ability to link electronically. Carter (2000) also points out though that there is a lack of recognition of the complexities involved with strategies to deliver better health care and cites the example of the Australian *Getting connected* project, which links the Health Insurance Commission (HIC), medical practitioners and pharmacies together. Its original aims were to assist in appropriate prescribing however it has progressed no further than an exercise in checking entitlement validity – another cost centered activity.

Ultimately for any government there will be a conflict of interest between the needs of the population and the economic viability of meeting those needs. There is further conflict when the government also has a desire to take advantage of the global economy and creates IT policy accordingly to support these economic strategies. If Australia is to become a world leader in the area of e-health, and the country is to profit from this in economic terms, then competitive advantage through the use of IT must be an important factor in its evolvement. Using business strategy models such as the Strategic Option Generator described by Callon (1996, p.149-158) should be considered.

5.3 Computer and Internet Usage

In Australia there is wide spread use of computers in general practice for a variety of applications, these include practice management, prescription printing and

to a lesser extent, patient clinical records (Bolton, 1995). Inherent in the government vision of IHRIS is the premise that each health care provider uses an EMR and that they are connected electronically. The production of computer-generated prescriptions is one aspect of patient treatment and drug management that is becoming particularly popular (Bolton, Usher, Mirs, Harding, & Prior, 1999; Cook, Schattner, & Pleteshner, 1999). The advantages of such computer-based systems include consistency, readability and the readily available pharmaceutical information. Indeed there are various reports that had such systems been in place medical errors would not have occurred (Bollen, 1996; Charatan, 1999b). However, Carlile (1998) suggests that in Australia the full potential of computers in clinical practice may not be yet be realised.

At the time of the Health On Line conference in 1998, it was reported that only between 1 and 10% use computers for clinical record keeping, with wider coverage for script writing and greater use for accounting management. This figure was more accurately assessed at the time by Mount (2000) as 7%. Various studies have made assessments of the level of Internet access in general practice in Australia and worldwide over the past few years. A study based in Australia in 1995 by Gutpa, Ward and Hayward (1997) reported that only 9% of GP's had Internet access at their practice, although knowledge of its use was undetermined in this study. This can be contrasted with the United Kingdom (UK) where Roscoe (1998) reported that a minimum of 24% of GP's are connected to the Internet. Some 70% of practitioners in the UK use some form of computerized records and prescription printing, and 80% use computers for consultations (Kidd, 1999, p. 6). The American Medical Association (AMA) reports that this figure is higher in the US with nearly 40% of doctors using the Web (Johnson, 2000). In a more recent Australian study, Young &

Ward (1999, p.4) question the best ways to support general practitioners with information technology. In this study they discovered that whilst 42% of GP's in New South Wales had access to the Internet at home only 14% had access at their workplace. Additionally only 4% of GP's had ever used the Cochrane Library database (being an example of an up to date clinical support resource). It is encouraging to note that in 2001 Williams reported that 75.6% of GP's in Western Australia now have Internet access at their place of work.

5.4 Hypotheses

In essence the current challenges create reluctance in the medical profession to adopt the Internet for clinical practice assistance. In fact the medical community only use it sparingly (Delamothe, 1999, p.1). It is an underlying assumption that the Internet is a valuable source of information, however it is not seen as being usable by the medical profession, and therefore has been slow to be adopted as a viable alternative to more traditional methods of information delivery. The potential of the Internet and its resources are understood, however the unresolved issues and human skepticism prevents the medical profession from rapidly embracing the unproven new technology. Purves (cited in Kidd, 1999, p.2) believes that computer assistance, if thoughtfully incorporated into consultations, will make clinicians more effective and efficient. This research investigates the usability of the Internet in medical practice as compared to more traditional methods of information dissemination.

Hypothesis 1: The Internet is a usable and useful tool for clinical support in general practice.

Johnston et al (cited in Kidd, 1999, p.4) found that clinical performance can be enhanced with the use of IT. The studies showed that IT did make a difference but

that currency of information was going to be an on-going issue. This evidence was inconclusive as far as convincing general practitioners to embrace the new technology with unquestioning fervor at that time, some 4-5 years ago in Australia. Young and Ward (1999, p.4) suggest that additional research is required on the impact of electronic evidence research. However this may be difficult when such a small percentage of the GP population use the available electronic resources.

Hypothesis 2: General Practitioners in Western Australia under utilize the Internet as a clinical support tool.

CHAPTER 6. RESEARCH DESIGN AND METHODOLOGY

6. 1 Research Methodology

Present day medical research and the ability to publish it, relies increasingly on statistical methods, as any review of published medical journal research indicates (Bland, 1987, pp.1-2; Matthews & Farewell, 1985, p.1). The use of descriptive statistics with statistical inference is often used in medical statistical research, where the conclusions resulting from a sample are inferences as pertaining to populations relevant to that sample (Colton, 1974, p.3). Detailed planning and location of bias are also integral to this type of research methodology (Moser & Kalton, 1971, pp. 41-52).

This research was in two distinct parts. To address the first hypothesis, a *critical evaluation* of the current methods of delivery and access to information for medical practitioners was undertaken. This encompassed traditional and electronic methods, and investigated the advantages and disadvantages of each of these methods. Additionally the research pinpointed, although did not attempt to solve, the issues surrounding the use of the Internet over other methods.

Further, in consideration of the second hypothesis, the study used a *statistical (social) survey* of general practitioners and pharmacists in Western Australia. The survey was in the form of anonymous questionnaires. This encompassed issues that include: the health professionals' use of clinical databases, email for peer contact, patient data transfer, access to information facilities and continued medical education. Additionally it examined attitudes, behaviour and practice in relation to

the Internet for clinical and patient information. Further qualification and validation of an appropriate qualitative design was sought from suitably qualified professionals at the ECU Graduate School. Questionnaire design and scaling information was obtained from various statistical references.

6.2 Survey Methods

The purpose of a survey is to provide descriptive information. Social surveys "*are concerned with demographic characteristics, the social environment, the activities or the opinions and attitudes of some group of people*" (Moser & Kalton, 1971, p.1). There are two general types of health survey – epidemiological and statistical or social. Epidemiology aims to explain links between actions and disease whereas statistical and social surveys are of a descriptive nature. As this research was not investigating links or causation of disease, a statistical survey method was chosen using mail questionnaires.

6.2.1 Mail questionnaires

Mail questionnaires are sometimes fated because of the problem of inadequate response rates, however due to cost and time constraints, and the geological diversity of the subject group, a mail survey for this study was the only realistic economic option. The anonymity of the questionnaires was important due to the subject group consisting of medical and health care professionals and the possibility of unwanted personal identification. Since the opinion of respondents was being sought, the discreet nature of the mail questionnaire assisted in controlling for undue outside influence by discussion with other practitioners. However, the assumption that the addressee was the respondent had to be made. (As each letter accompanying the survey questionnaire was personalized, and the fact that the

questionnaires were directed at the primary care providers possessing a high level of ethics, it was hoped to control for this type of issue.) Also it was important to the research that the impersonal nature of mail questionnaires gave the respondents an opportunity to make comments critically and more openly than in face to face interviews (Moser & Kalton, 1971, p.258). The questions were structured in a simple and straightforward manner, so that the problems associated with eliciting the correct information and avoiding misunderstanding would be minimised. Whilst anonymous mail questionnaires do not give an opportunity for follow up, sufficient space and encouragement to comment on the questions was included. Further research in this area is planned.

A low response rate was expected (as low as 10%) from the subject groups however the response rates were much higher, being 45.75% for the GP's sampled and 57.5% for the pharmacies sampled. This may have been due to several contributing factors such as the specific population; the currency and interest in the subject matter; and validation by ECU. Other significant influencing factors may have included the specificity of the questioning and limited length of the questionnaire. The covering letter attempted to overcome the prejudices associated with surveys by clearly explaining the purpose and origins of the survey and it was hoped this would also encourage responses.

6.3 Statistical Analysis.

The survey method is an example of statistical inference, and was employed in this research. The analysis of the data collected, relying on the mathematical theory of probability uses statistical inference to generate conclusions about the target population drawn from a survey sample. In regards to the target population

versus the sample population, to avoid bias, selective factors were considered. These included avoiding the use of an email survey, which whilst being an economically cheaper option would obviously create a bias in any sort of research on Internet use. Other factors were attempted to be controlled as detailed above in the section on mail questionnaires. Information on previous research statistics was sought. A study by Temple-Smith, Mulvey & Doyle (1998) showed that the best methods for soliciting information from GP's was by follow-up telephone calls. Whilst the study reported that higher rates of response were obtained by telephone prompts, incentives and result feedback, due to the restricted funding only personalisation of the covering letters was used in this survey.

This researcher is aware that in contrast to experimental methods, surveys deal with the observational studies of humans, however these can provide evidence of statistical associations between factors (Colton, 1974, p.271). Since this research was not attempting to support or disprove a hypothesis of association and causation, the philosophical issue of using a survey does not apply. The survey collected enumerated (or attribute) data. The results are nominal scale data (0-1) with proportions and percentages of attributes constituting the results and conclusions drawn from these.

6.4 Materials and Methods

Two questionnaires were developed to investigate the current level of use of computers and the Internet in general practice and pharmacy. In the GP questionnaire, the respondents were asked about their use of the Internet to access clinical information and their attitudes towards this medium of communication and information retrieval. Further information was sought regarding the use of clinical

reference information from all sources, and perceptions of their usefulness. Lastly patient Internet acquired information use and attitudes were sought. A shorter version of the questionnaire focusing on patient information aspects only was created for pharmacies. This was to compliment the GP survey and to investigate the community medicine aspects of patient Internet acquired information and its use. Both questionnaires can be found in Appendix A. Edith Cowan University (ECU) Ethics Committee approval for the study was applied for and granted (Appendix B).

Western Australia (WA) is approximately 2.5 million square kilometres in size, which represents one third of the total size of the Australian continent. There are approximately 2 million people spread throughout the state, and despite its size WA has a high population density in the Perth metropolitan area consisting of approximately 1.5 million (75% of the total WA population). The state has about 1800 GP's, and 450 pharmacy outlets. This study used an anonymous postal questionnaire that was mailed to 400 GP's and 400 pharmacies across the state.

Those surveyed represent 22% of the WA GP population and 89% of the pharmacy population. A covering letter, personally addressed and signed, was sent with the questionnaire outlining the objectives of the study, together with a return stamped addressed envelope. The School of Computing and Information Science, Faculty of Communications, Health and Science (CHS/SCIS) at ECU provided funding for postage and materials, however the absence of further funding meant that a database could not be purchased. This necessitated the development of an address database for GP's and pharmacists. The information was obtained from the current Yellow Pages phone book (Telstra Corporation Limited, 2000). The databases were created using Microsoft Excel software. After the completion of the database, a random digit table (Moore & McCabe, 1993, p.800-801) was used to select the 400-

target population for each study group. A method of sequentially selecting four consecutive numbers from the table was employed. As the labels for the GP and pharmacists record numbers were less than 9999 (the maximum of any four digits), each record was assigned multiple labels as multiples of the total number of records for each database, as suggested by Moore and McCabe (1993). The issue of incomplete sampling was overcome by re-sampling for those questionnaires marked 'Incorrectly addressed, Return to Sender'.

Data was collected from Oct 2000 to Dec 2000. The data analysis was performed using *SPSS 10.0 for Windows* (SPSS) data analysis software. The questionnaire results were entered into an Excel spreadsheet and then imported into SPSS. The data was then checked for accuracy and normal distribution. Following this the data was explored to check for normality, unusual values and outlier identification. Frequency counts and percentages were calculated, and pictorial descriptive statistics generated.

Most of the questions were discreet in nature however the questions relating to the use of clinical resources were collated in order to produce paired sample statistics, correlation and perform a T-test. The questions relating to traditional sources of information i.e. colleagues and printed matter of all types, were collapsed to give two variables on 'traditional' sources and their usefulness, which was used to compare with two 'electronic' sources and usefulness variables i.e. electronic, computer and Internet sources of information. The means of the questions used were calculated to produce the new variables, which were then used in the paired samples T-test. Prior to the test the variables were explored for normality using stem and leaf plots and histograms. The calculations also included analysis of the missing values.

CHAPTER 7. RESULTS

The following data is a selection of results from the preliminary study undertaken in Western Australia (WA) between October and December 2000 as described above.

The statistical information has been divided into the categories as shown in Figure 4.

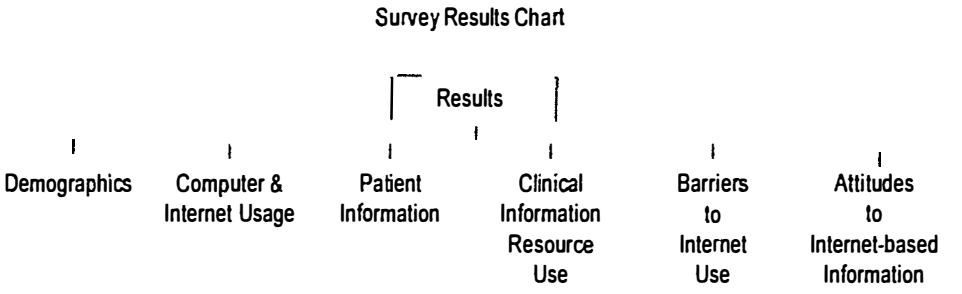


Figure 4. Survey results chart.

7.0 Response Rates

The response rate for GP's was 45.75% (183 out of 400), and 57.5% (230 out of 400) for the pharmacies.

7.1 Demographics

7.1.1 Survey Results

Demographically the respondents were divided by sex, location of practice, and age. Additionally the GP's were asked whether they were a solo practitioner or part of a group practice. Table 1 and Figures 5 and 6 give the demographic results.

Table 1. Demographic frequencies.

		General Practitioners	Pharmacists
Sex	Male	73.8%	76.5%
	Female	24.0%	23.5%
	Missing	2.2%	0.0%
Practice Type			
	Solo	18.6%	N/A
	Group	74.9%	
	Missing	6.6%	
Location			
	Metropolitan	67.8%	71.3%
	Country	26.2%	28.3%
	Missing	6.0%	0.4%

Figure 5. GP age groups.

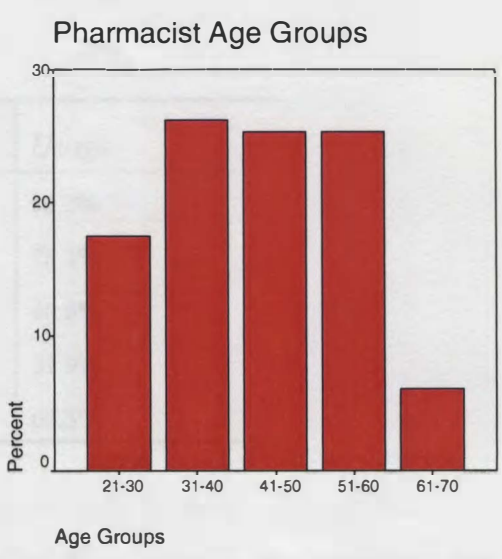


Figure 6. Pharmacist age groups.

7.1.2 Discussion

The percentages of country versus metropolitan respondents, in both the GP and pharmacist groups, are consistent with those of the general population in WA, where approximately 75% of the general population reside in the metropolitan area of Perth. Also the division of sex is very similar in both groups of professionals. The

age groupings suggest that for pharmacy the spread of age groups is fairly consistent between the different ages, which are in contrast to the GP's. The lower number in the 21-30 age group of GP's, in comparison to those of the pharmacists is to be expected because the training of GP's is some 5-6 years longer than for pharmacists.

7.2 Computer and Internet Usage

7.2.1 Survey Results

In WA 95.1% (174) of GPs have computers at their medical practice, and the general type of usage is given in Table 2. 100% of pharmacies have computers, as it has been a government requirement in Australia for over 10 years.

Table 2. Computer usage in general practice

Type of computer use	*Usage*
Practice Management	90.2%
Prescription Printing	78.1%
Patient Clinical Records	48.6%
Downloading Pathology/Radiology results	51.9%
Accessing the Internet	62.3%

Whilst 62.3% report using computers at their practice for accessing the Internet, 75.4% of practitioners have access to the Internet at their practice. Pharmacists report that 64.8% have Internet access at work.

It appears that for GP's, home usage of the Internet for accessing clinical information is higher than at work, although access rates to drug information are similar. For pharmacists accessing pharmacy related information from home is only slightly higher. Table 3 gives a comparison of the access percentages for each type of information for both GP's and pharmacists. (The pharmacist figures are given under

'drug information' as the questionnaire specified 'pharmacy related information' and did not specifically distinguish between drug and clinical information due to the nature of the profession specific questioning.) Email, whilst used at some time by approximately 60% of both subject groups, is used by pharmacists in a professional capacity more regularly than by GP's.

Table 3. Internet information type and access location

	General Practitioners		*Pharmacists*	
Information type / location	*Regularly / Often*	*Sometimes / Rarely*	*Regularly / Often*	*Sometimes / Rarely*
Clinical / home	30.6%	48.6%		
Clinical / work	14.8%	43.8%		
Drug / home	8.8%	50.8%	16.1%	57.3%
Drug / work	9.3%	32.8%	13.5%	43.1%
Email for work	19.1%	39.3%	35.2%	26.1%

Interestingly 54.1% of GP's and 58.7% of pharmacists also use the Internet at work for non-work related information.

Finally the GP's were questioned in regard to the purchase of computers and if this activity was associated with the Australian government Practice Incentive Program (PIP). Of the respondents 50.8% agreed, *"the PIP had expedited their decision to purchase computers for clinical consulting use"*, whilst 31.1% disagreed and 15.3% were 'neutral'.

7.2.2 Discussion

Most practices use computers primarily for patient accounting, although a significant percentage are also using them for prescription printing. Only half of the

total number of GP's uses computers for downloading pathology/radiology results and this figure is slightly less for clinical records use. Interestingly though a higher percentage of GP's use them to access the Internet. The low use of access for drug information is possibly due to current computer programs providing sufficient information particularly for prescription printing. However a few GP's commented that they used the Internet to clarify drug information if the drug was from overseas. The higher home usage by GP's to obtain clinical information suggests that for general practitioners there are significant barriers to using the Internet in a clinical setting. However one GP who is fully computerized, jokingly commented "*I am stuffed without my computer*", and another on the issue of Internet access to drug information said, "*could not work without it!*".

Access to pharmacy related information from the Internet does not appear to be greatly important for pharmacists. This may be due to the more developed nature of the computer software programs used in pharmacy, which provide the majority of the pharmaceutical information required. It is interesting to note that the use of email is popular for work related communication, although pharmacists use it with more regularity than the GP's.

7.3 Patient Information

7.3.1 Survey Results

The respondents were asked about the frequency with which patients presented them with Internet acquired health information. The outcome of this presentation was also inquired about. The pharmacists reported that 87.8% had been presented at least once, with information obtained from the Internet by customers. The majority was presented rarely 48.3% with this type of information and only

4.3% regularly or often. The full results are shown in Table 4 below. The reaction to this information was that 64.3% reported the information was discussed and deemed useful, whilst 20.4% reported that it was discussed but not usually relevant. Only 1.7% did not discuss or dismissed the information.

In the GP group, 96.8% had been presented by their patients with Internet information at some time, and of those, 11.5% are presented with such information regularly or often. The study found that 54.1% of GP's discussed this information and found it was relevant, whilst 28.4% discussed it but it was mainly irrelevant. Only 1.1% did not discuss the information presented. (16.4% gave no indication of the results of the presentation.)

Table 4. Occurrence of presentation of Internet acquired information and the outcome of its presentation

	Pharmacists	General Practitioners
Presented regularly/often	4.3%	11.5%
sometimes/rarely	83.5%	85.3%
Total	87.8%	96.8%
Outcome		
discussed/useful	64.3%	54.1%
discussed/not usually relevant	20.4%	28.4%

When questioned regarding if the respondents thought that "*the Internet is a useful tool in their customers' or patients' health management*", 58.7% of pharmacists agreed, whilst 15.7% disagreed. The statistics for the GP's on this question were that 48.1% agreed and 15.3% disagreed.

The liaison between the two professional groups was also investigated. The data given in Figures 7 and 8.

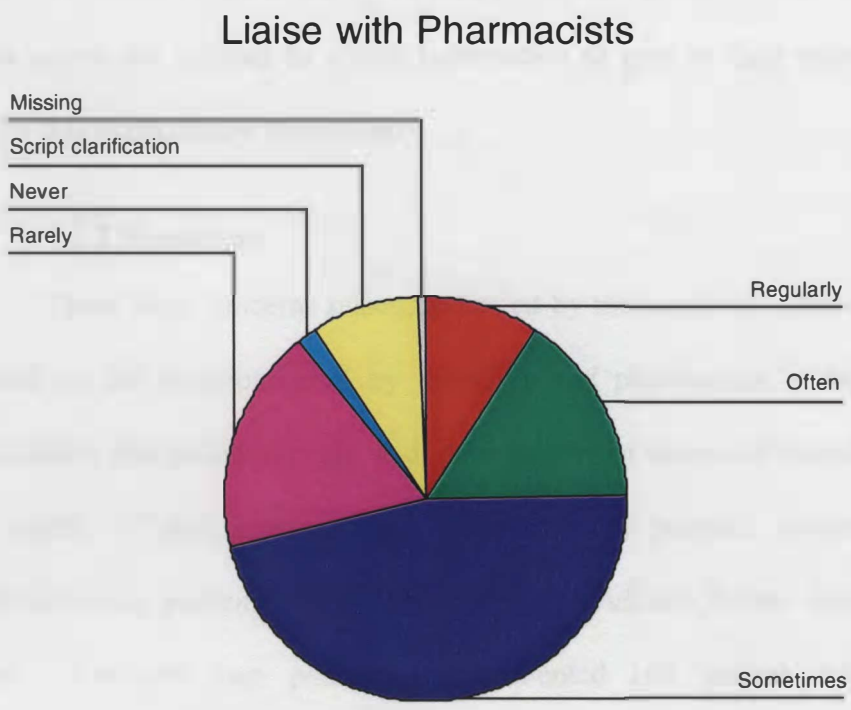


Figure 7. General practitioner liaison with pharmacists.

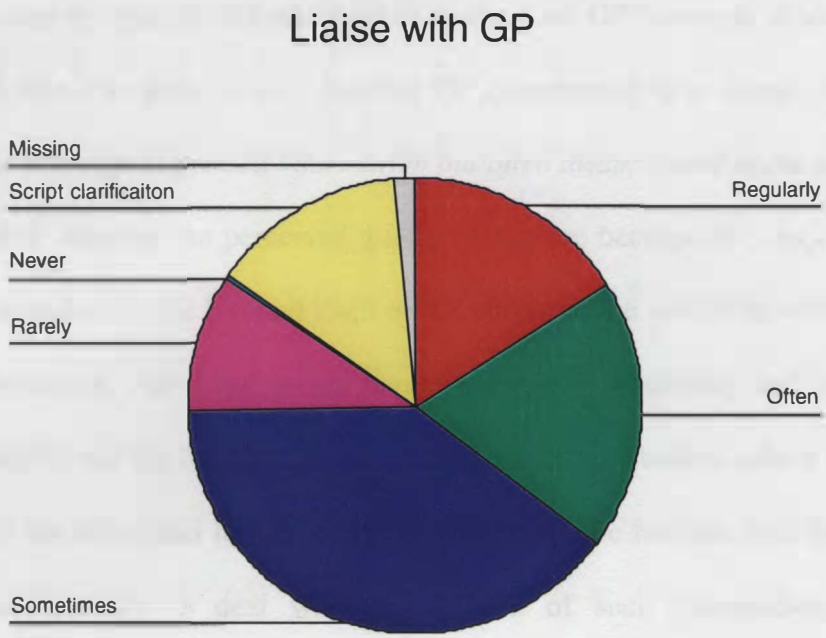


Figure 8. Pharmacist liaison with general practitioners.

Finally, use of the Internet by GP's for supplying information to patients was inquired about. A figure of 8.8% was obtained for practitioners who regularly or often access the Internet to obtain information to give to their patients, whilst for 43.7% this event occurs infrequently.

7.3.2 Discussion

There were concerns raised, indicated by the numerous additional comments written on the questionnaires, by the GP's and pharmacists, over the quality of information that patients access, and the reliability of source of this information. One GP wrote, "*I am concerned at the number of patients accessing irrelevant information or pushing me to investigate a condition further based on Internet trivia*". Likewise one pharmacist commented (on patient Internet acquired information) "*the authority of the sources is questionable*".

The use and retention of the information presented to the primary health care provider by patients are addressable issues. One GP "*scans it, discusses it with them and files it in their notes*". Another GP commented "*I'm always interested when a patient brings in printed information but often disappointed at the poor quality*". It is unclear whether the perceived quality issues are because of a lack of quality of the information on the Internet itself or the ability of the patient to select the appropriate information. All these issues create barriers to accessing and using information available via the Internet. These issues lead to the situation where responsibility lies with the individual health care provider to become familiar with patient appropriate sites in order to deal with presentation of such information. However most information is discussed and comments such as "*I read it quickly and use it as a starting point for discussion*", and that "*mutual discussion is encouraged*", show that

there is a reasonably positive attitude to the presentation of this information by some GP's.

In relation to the usefulness of the Internet in their customers' health management, comments from pharmacists such as "*unfortunately sometimes the information is misinterpreted or taken in the wrong context depending on the persons' particular ailment*" and "*it (the Internet information) maybe useful to give them an overview of the medical condition however it is not useful if they don't get input from their own GP or pharmacist*", shows the concern of the pharmacy community in the use of Internet acquired information. Further GP comments on this issue are listed in Appendix C and comments from pharmacists in Appendix D.

7.4 Clinical Information Resource Use

7.4.1 Survey Results

Questions on the use of various clinical sources of information and their usefulness were asked. The results are given in Table 5.

The question of use and usefulness of electronic sources of information as compared to more traditional verbal and printed sources was investigated. A paired sample T-test was performed on the traditional and the electronic source variables. The stem and leaf diagrams showed that the variables were normally distributed and there were no outlying values. The variables were found to be positively correlated as described in Table 6. Additionally they were found to be significantly different at the 0.05% confidence intervals, as shown in Table 7.

Table 5. Sources of clinical information

Source of Information	*Accessed Regularly/Often*	*Accessed Sometimes/Rarely*	*Is source useful?*
Colleagues	63.4%	33.9%	86.3%
Printed Texts	54.1%	38.8%	84.1%
Electronic Texts	12.6%	59.0%	47.6%
Printed Journals	59.5%	36.1%	79.8%
Electronic Journals	8.2%	35.0%	29.5%
Government /Professional Body	27.3%	65.5%	57.9%
Printed Drug Info	31.7%	62.3%	60.1%
Internet Drug Info	1.6%	39.9%	18.0%
Computer Software	41.5%	29.0%	51.9%
Internet quality known sites	13.2%	49.2%	48.1%
Internet sites – other	14.8%	44.8%	37.2%

Table 6. Electronic versus traditional source correlation.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Electronic Source & Traditional Source	179	.501	.000
Pair 2	Electronic Usefulness & Traditional Usefulness	179	.595	.000

Table 7. Electronic versus traditional source T-test.

Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Electronic Source - Traditional Source	-1.110	.8002	-1.228	-.9918	-18.557	178	.000
Pair 2	Electronic Usefulness - Traditional Usefulness	-.8017	.9475	-.9414	-.6619	-11.320	178	.000

The GP respondents' use of the Internet during consultations was low with only 2.2% of GP's using it 'often' (and none 'regularly'), despite the relatively high level of access availability to GP's in Western Australia. 23.5% use it 'sometimes/rarely' and of those with Internet access 50.8% 'never' access it. The reasons given by the GP's for not accessing the Internet during consultations were most commonly because the Internet is "*too slow*", there is "*not enough time*" and it is "*too difficult to find what you want*". More definitively one GP points out that "*the time involved in doing so does not justify the dubious benefits*". A list of other comments written in relation to this issue is given in Appendix C.

7.4.2 Discussion

Printed texts, printed journals and colleagues are the favoured sources of clinical information, with a high level of *usefulness*. In contrast the electronic sources have a significantly lower access rate and less perceived *usefulness* of the information accessed. This observation is supported by the use of the T-test.

In relation to using the Internet for clinical support, one GP commented "*the current time pressures on consults places significant restrictions in the economic viability of using the Internet in consultations*". Most GP's reported that 'time' is the major factor in not using the Internet during consultations. This is both from the point of view of access time and (economically based) limited time with the patient. Another GP raised the issue that "*information management is not well taught to medical students and there is cultural resistance amongst GP's to involve themselves with IT. This is to the detriment of their patients*". Interestingly Internet use as a pharmaceutical resource for pharmacists is when "*occasionally a patient asks about a rare overseas drug*". Further pharmacist comments are given in Appendix D.

7.5 Barriers to Internet Use

7.5.1 Survey Results

The primary reason given by both pharmacists and GPs, for not accessing information regularly via the Internet at work, was reported as a lack of time to search for appropriate information. Whilst difficulty in retrieving appropriate information, the slowness of the Internet, the questionable quality of information, lack of searching experience, and the computer software being sufficient for their needs, all rated significantly. The tabulated results are given in Table 8 overleaf.

In regards to quality 67.7% of GPs agreed they "*would use the Internet more if medical the sites were already quality defined*", whilst only 4.9% disagreed. Also 87.4% of GPs agreed, "*the response time of the Internet, at the time of decision making, restricts the Internets' usefulness in clinical practice*", with only 1.6% disagreeing. Some comments made by GP's on the issue of barriers are given in Appendix C. Several pharmacists also commented on the risks in using the Internet

in relation to "exposure to viruses destroying system". A selection of other reasons reported by pharmacists is given in Appendix D.

Table 8. Reasons for not using the Internet regularly at work

Reason	*General Practitioner*	*Pharmacist*
Not connected	22.4%	31.7%
Cost prohibitive	3.3%	6.1%
Texts and journals sufficient	17.5%	N/A
Computer software sufficient	22.4%	33.9%
CD-ROMS sufficient	8.7%	N/A
Drug company information sufficient	7.1%	20.0%
Lack of experience in Internet use	18.6%	12.2%
Lack of relevant information on the Internet	6.6%	5.2%
Difficulty in retrieving appropriate information	24.6%	13.9%
Lack of time to search for and access information	43.7%	43.5%
Internet too slow	29.5%	N/A
Computer/Internet technology is unreliable	6.0%	N/A
Questionable quality of information accessed via the Internet	20.2%	17.0%
Lack of Web site quality assessment tools	9.8%	N/A
Not interested	3.3%	3.9%
Other reasons	8.2%	8.3%

7.5.2 Discussion

It is evident that there are numerous and varied reasons for the lack of use of the Internet in primary care service provision. The issues lay in several areas, firstly the lack of experience and difficulty in obtaining information, which can be addressed by training and practice. However the fundamental problems such as the quality and lack of appropriate information are more complex information issues.

Lastly the difficulty in obtaining data when it is needed, and the time aspects of access to the Internet are on-going technological issues.

7.6 Attitudes to Internet based information

7.6.1 Survey Results

Finally general attitudes to the Internet technology and its use in clinical and pharmacy practice were sought. For GPs, with regard to CME, it was reported that 48% agreed with the statement "*using the Internet for CME is useful?* whilst 10.4% disagreed. However, surprisingly 60.7% agreed, "*accessing clinical information in the Internet can improve clinical performance*" whilst only 6.6% disagreed. (Yet only 14.8% of GPs use it regularly.) In the GP group 54.1% agreed "*the Internet is a useful tool in clinical practice*", and 10.9% disagreed. For pharmacists 70% agreed "*the Internet is a useful tool for pharmacy related information*" and only 10% disagreed.

Lastly both groups were asked if they "*do not currently use the Internet for work purposes, did they think it would be useful to do so in the future?*" Table 9 shows the responses.

Table 9. Responses to Internet use for work purposes in the future.

	Pharmacists	General Practitioners
Definitely	22.2%	23.0%
Possibly	35.2%	26.3%
No	3.0%	5.5%

One pharmacist wrote that for future usefulness the Internet "*needs a good portal that is careful in their information and assistance*", and another suggested its usefulness would increase "*more so when we have good information on safe sites*". Additional comments from pharmacists can be found in Appendix D.

Many GP's made additional general comments on their attitudes to the Internet in general practice. One GP suggested that "*Medical Informatics is still very immature*" and that there is a "*significant stability problem with LAN's, the Internet and computers etc*". Also connection reliability and speed was mentioned by many GP's with comments such as "*the Internet needs faster more reliable connections e.g. ASDL, and easy access to sites that are reliable*". Additionally some GP's think that the government objectives and assistance do not match with comments such as "*the money from PIP is inadequate to create a decent system*". Also not all GP's think the Internet is a good resource with comments like "*the Internet is an over rated medium, certainly has lots of information, but using a recent text is much easier and quicker*", and "*the Internet is a great time waster. I enjoy surfing the net but I actually get information more quickly by reading a textbook*". Numerous GP's made final comments on the use of the Internet in clinical practice and these are listed in Appendix C.

7.6.2 Discussion

The results indicate that most practitioners and pharmacists agree that the Internet is potentially useful for many activities, however not at the present time.

CHAPTER 8. CONCLUSIONS

This research has given an overview of the possible application areas, and discussed the current and potential use of the Internet for primary care. Additionally it has reviewed the need for information with particular regard to patient information, electronic communication, clinical referencing and continuing medical education. Further, the requirement for alternative and enhanced information management was discussed. This is an important issue due to the information overload situation facing most GP's, which is a result of the increasing body of medical research and reference material available, and the introduction of new electronic information delivery methods. An assessment of the potential barriers, both physical and attitudinal, to the full adoption by GP's of the Internet was then made and discussed. Further, a description of the current state of usage, and the government primary health care objectives within Australia were presented. Lastly the research methodologies used were described and the survey results presented and discussed.

Since the location of Perth is geographically remote to the rest of Australia, and 25% of the WA population live outside the metropolitan area, the use of electronic communications, such as the Internet may make the Internet a useful technology. More extensive research is needed, possibly in other parts of Australia, to ascertain whether factors such as the remote geographical location of Perth and Western Australia may be an influencing factor in the use of the Internet. The development of Telemedicine will also be an important feature of the growing eHealth industry for Australia.

It is evident that better coordination of health care services would assist in achieving a continuous and complete health care system, by providing increased efficiency in the allocation of medical resources. This could be further enhanced by improved communication flow between the many health care providers, to the benefit of both patients and the health care system. The Internet in particular email could facilitate rapid progress in addressing these issues. Whilst the push to computerize general practices has been effective, the actual use of the technology by Australian GP's still lags behind those of other developed countries such as the UK. If the government is to achieve its objective of an Integrated Health Record and Information System (IHRIS) for Australia, then the percentage of GP's using EMRs will have to double. Also, whilst the access availability to the Internet in the work place for both the pharmacists and GP's is similar at approximately 70%, the IHRIS project would necessitate that 100% of primary health care providers are electronically connected.

Patient education and access to information are becoming important issues in personal health management. The results show that access to patient medical and health information from the Internet is occurring increasingly. There appears to be a reasonably high level of patient access to Internet information in WA. The high percentage of exposure to Internet acquired information presented to GP's and pharmacists, and level of relevancy, shows that some patients and pharmacy customers may be reasonably adept at retrieving information relevant to their conditions. Also, the high level of discussion generated between the health providers and patients, indicates an open attitude by the service providers towards the presentation of this type of information. These results show that the general population are only marginally more likely to show information to their GP than the

community pharmacist, and the percentages of discussion generated are roughly equal, however the usefulness of the information presented is lower in the GP group. This may be due to a number of factors including

- the type of information presented to the GP may be more difficult for the general public to interpret
- the accuracy of the medical information selected may be questionable
- the GP may be more stringent on the accuracy of the information than the pharmacist.

The general public whilst having the ability to retrieve information only select appropriate and useful information approximately 50% of the time. Further research is needed to ascertain the source of this problem and devise practical methods for the general public to assess information available via the Internet. If correct use of this information is to be made, and beneficial effects to be felt by the patient, then discussion between the general public and their primary health care providers should be actively encouraged.

The majority of GP respondents in the survey have a positive attitude to the use of the Internet for CME and for improving clinical performance. They also see it as a useful tool. However most see it as a 'future' resource when the issue of quality and access time are improved. Taking into consideration the clinical resource aspects of the Internet based information, increased accessibility to drug, clinical guidelines and evidence based databases, and the increasing use if the Internet for patient information, it can be seen that the Internet should be *useful* tool for clinical support. However in regard to the first hypothesis that **The Internet is a usable and useful tool for clinical support in general practice,** it cannot be concluded that it is, at

present, a *usable* tool. The barriers that exist to its use and the challenges that are apparent, particularly in quality assessment, preclude a definitive positive conclusion about its usability.

Using and accessing clinical information of all types is a central activity to general practice. The second hypothesis that **General Practitioners in Western Australia under utilize The Internet as a clinical support tool** is positively supported by the significant result obtained using the T-test in the comparison between access to electronic and traditional sources of information. The majority of West Australian GP's do not effectively access electronic information and utilise electronic information management. Further investigation is warranted to assess not only how to improve the ease of access to the information, but also as to whether education and training is needed, and indeed to assess the impact of the Internet on clinical processes and patient outcomes. Despite the benefits associated with on-line access to clinical information via the Internet and the use of email, questions remain on how to integrate these with normal clinical practice and thus make the Internet an effective and essential decision support system. The study has also shown that access to the Internet during consultations is rare, and from the comments made in the survey, is mostly due to the time constraints of consultations and access to relevant information of known quality. However, further investigation would be required to ascertain whether this is due to a lack of perceived need or if the logistical barriers, such as lack of time, concerns over quality or education and attitude, are to blame. Access to information is critical in the practice of modern medicine. The duty of medical practitioners to keep up to date with clinical practices is of paramount importance. The sheer volume of information, which shows no sign of abating, further complicates this situation. The use of the Internet to access clinical

information in organized ways may become essential to effective clinical practice. Augmenting the abilities of our health care providers to interact with electronic information will be vital if the Internet to fulfil its potential as a method of information delivery.

The multiplicity of potential applications for computer communications technology is vast. The Internet is only one use of the technology for medical informatics, although it may become a major player in the future. The Internet has the possibility to fulfill numerous needs, however at present the issues of security, validity, privacy of information, and access reliability and speed, hinder the insurgence of the Internet as the ultimate source of information and assistance in clinical practice. We are in an information revolution era. There is no shortage of information from all sources, particularly the Internet, however it is our ability to create methods of interaction with and accessibility to that information that will determine its effectiveness. Medical informatics is a means to an end. Its purpose is to find the best ways to handle information with the goal of providing the best possible healthcare. Most clinical support information is now available electronically, and it is the ability of the medical profession to adapt and make use of this new delivery form that will see them taking modern clinical practice through the new millennium.

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APPENDIX A

QUESTIONNAIRES

Coversheet and General Practitioner Questionnaire

Investigation into the use of the Internet for Medical Informatics.

By Trish Williams

Explanation to Potential Questionnaire Respondents

Introduction

My name is Trish Williams and I am conducting research into the use of the Internet to access medical/clinical information by General Practitioners, Pharmacists and the general public in Western Australia.

Your name has been randomly selected to obtain your valuable opinion on this important subject.

Explanation

If you agree to assist in this research would you please fill in the attached questionnaire and return it in the pre-paid envelope provided as soon as possible.

The questionnaires are purposely anonymous. No identifying information is gathered in the questionnaire, and hence individual respondents cannot be identified from the results. At the completion of the study, all the original materials will be destroyed by shredding.

Duration

The questionnaire takes approximately 5 minutes to fill in.

Your assistance in this research will be greatly appreciated. Should you require any further details, or have any questions regarding this research, please do not hesitate to contact the researcher Trish Williams (0412-322-999) or the research supervisor, Dr. S.P. Maj (Tel: 9370 6277).

Many thanks for your assistance and cooperation in this research.

Researcher: _____ 25th Sept 2000

Trish Williams

GP's use of the Internet for Clinical Information - a survey

Please circle your answers. There is space for comments if you wish to add anything, however additional comments are not necessary to complete the questionnaire.

1. Are you Male or Female? Age group (in years) Practice type. In what geographical area of Western Australia do you practice?	Male / Female 0-20 / 21-30 / 31-40 / 41-50 / 51-60 / 61-70 / 71+ Solo practitioner / Group Practice Metropolitan / Country
2. Do you liaise with pharmacists regarding prescribing information such as interactions, dosage etc.? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / / Never / Only to clarify prescription details
3. Do patients present you with information, obtained from the Internet, regarding their health or medications? **If so**, what usually happens? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / Never Not discussed / Deemed irrelevant / / Discussed but not relevant / Discussed and useful
4. Do you have any computers in your practice? If **Yes,** what are these computers used for? Please tick all that apply. Comments: _____ _____ _____ _____	Yes / No ____ practice management E.g. accounting, word processing, etc. ____ prescription printing ____ patient clinical record keeping i.e. electronic medical records ____ downloading pathology/radiology results ____ accessing the Internet
5. Is there Internet access at your practice? **If No, please go to question 12.**	Yes / No
6. Although you have access the Internet, do you use it at work for **non** clinical purposes? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / Never

7. Do you use the Internet to access *clinical* information at work? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / Never
8. Do you use the Internet to access *drug* information at work? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / Never
9. Do you use email for work?	Regularly / Often / Sometimes / Rarely / Never
10. Do you use the Internet to access information to give to your patients? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / Never
11. Do you access the Internet during the course of a consultation? **If not,** why not? (give reasons): _____ _____	Regularly / Often / Sometimes / Rarely / Never
12. Do you access clinical information via the Internet other than at work? E.g. at home? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / Never
13. Do you access drug information via the Internet other than at work? E.g. at home? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / Never

14. If you do **NOT** use the Internet *regularly* at work, why not? Please tick all that apply.	____ Not connected ____ Cost prohibitive ____ The texts and journals provide sufficient information ____ Your computer records/prescribing software provides sufficient information ____ The CD-ROM's available to you provide sufficient information ____ Drug company printed/verbal information is sufficient ____ Lack of experience/training in the use of the Internet and how to search the Web ____ Lack of relevant information available on the Internet ____ Difficulty in retrieving appropriate information ____ Lack of time to search for and access information ____ Internet is too slow ____ Computer/Internet technology is unreliable ____ Questionable quality of information accessed via the Internet ____ Lack of Web site quality assessment tools ____ Not interested ____ Other (please specify) _____
15. Sources of information.	What sources of clinical information to you use & how useful are they?
Colleagues	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Printed tertiary literature e.g. textbooks	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Electronic tertiary literature e.g. CD ROM's	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Journals - printed	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Journals – electronic via Internet e.g. eBMJ	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Government/ professional body supplied information	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Printed drug manufacturer information	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Internet based drug manufacturer information	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Clinical computer software applications and databases	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Internet sites (known quality) eg. Cochrane database,Medline	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use
Internet sites – other	Used: Regularly / Often / Sometimes / Rarely / Never Usefulness: Very Useful / Useful / Minimal Use / No Use

16. If you currently do **NOT** use the Internet for work purposes, do you think it would be useful to in the future? Comments: _____	Definitely / Possibly / Unsure / No
17. Please state whether or not you agree with the following statements: - a. You would use the Internet more if medical sites were already quality defined b. The response time of the Internet, at the time of decision making, restricts the Internet's usefulness in clinical practice. c. Accessing clinical information on the Internet can improve clinical performance. d. Using the Internet for CME is useful. e. The Practice Incentive Program prompted or expedited the decision to purchase computers for clinical consulting use. f. The Internet is a useful tool in your patients' health management. g. The Internet is a useful tool in clinical practice.	 Strongly Agree / Agree / Neutral / / Disagree / Strongly Disagree Strongly Agree / Agree / Neutral / / Disagree / Strongly Disagree Strongly Agree / Agree / Neutral / / Disagree / Strongly Disagree Strongly Agree / Agree / Neutral / / Disagree / Strongly Disagree Strongly Agree / Agree / Neutral / / Disagree / Strongly Disagree Strongly Agree / Agree / Neutral / / Disagree / Strongly Disagree Strongly Agree / Agree / Neutral / / Disagree / Strongly Disagree

Comments: _____

_____

_____

_____

_____

_____

_____

Thank you for your time and cooperation in answering this questionnaire. Please return this paper in the addressed envelope provided as soon as possible.

Pharmacist Questionnaire

Health and the Internet – A survey

Please circle your answers. There is space for comments if you wish to add anything, however additional comments are not necessary to complete the questionnaire.

Demographics

1. Are you Male or Female?	Male / Female
2. Age group (in years)	0-20 / 21-30 / 31-40 / 41-50 / 51-60 / 61-70 / 71+
3. What area of WA do you work in?	Metropolitan / Country

General

4. Do you liaise with general practitioners regarding drug and clinical information? Comments: _____	Regularly / Often / Sometimes / Rarely / Never / / Only to clarify prescription details
5. Do your customers present you with information from the Internet on their health or medications? Comments: _____	Regularly / Often / Sometimes / Rarely / Never
6. If customers present this type of information, what usually happens? Comments: _____	Not discussed / Dismissed as irrelevant / / Discussed but not relevant / Discussed and useful
7. Do you have access to the Internet at work? **If No, please go to question 11.**	Yes / No
8. Although you have access to the Internet at work, do you use it for pharmacy related information (i.e. drug/clinical information)? Comments: _____	Regularly / Often / Sometimes / Rarely / Never
9. Do you use the Internet to access non pharmacy related information at work? Comments: _____	Regularly / Often / Sometimes / Rarely / Never
10. Do you use email for work?	Regularly / Often / Sometimes / Rarely / Never

11. Do you access pharmacy related information via the Internet other than at work? Comments: _____ _____	Regularly / Often / Sometimes / Rarely / Never
12. If you do **NOT** use the Internet *regularly* at work, why not? Please tick all that apply.	____ Not connected ____ Cost prohibitive ____ Compulsory texts and dispensing software provide sufficient information ____ Drug company printed/verbal information sufficient ____ Computer illiterate ____ Lack of experience/training in the use of the Internet ____ Lack of appropriate information available on the Internet ____ Difficult to retrieve appropriate information ____ Lack of time to search for and access information ____ Questionable quality of information accessed via the Internet ____ Not interested ____ Other (please specify) _____ _____ _____ _____
13. If you do not currently use the Internet for work purposes, would it be useful to do so in the future? Comments: _____ _____	Certainly / Maybe / No
14. Do you think the Internet is a useful tool in your customers' health management? Comments: _____ _____	Strongly Agree / Agree / Don't Know / / Disagree / Strongly Disagree
15. Do you think the Internet is a useful tool for pharmacy related information? Comments: _____ _____	Strongly Agree / Agree / Don't Know / / Disagree / Strongly Disagree

Thank you for your time and cooperation in answering this questionnaire. Please return this paper in the addressed envelope provided as soon as possible.

APPENDIX B

ECU ETHICS COMMITTEE APPLICATION AND CLEARANCE

EDITH COWAN
UNIVERSITY
PERTH WESTERN AUSTRALIA
CHURCHLANDS CAMPUS

Pearson Street, Churchlands
Western Australia 6018
Telephone (08) 9273 8333
Facsimile (08) 9387 7095

26th September 2000

Human Research Ethics Committee

Ms Patricia Williams
PO Box 370
Joondalup 6919

Dear Ms Williams

Code: 00-99
Project Title: *An investigation into the use of the Internet in Medical Informatics*

Thank you for providing the amended interview and questionnaire coversheets as requested by the Human Research Ethics Committee.

I am pleased to advise that the proposal now complies with the provisions contained in the University's policy for the conduct of ethical research, and your application for ethics clearance has been approved.

Please note that your research proposal must be approved by the Research Students and Scholarships Committee before you commence any data collection. The Graduate School will inform you in writing as soon as your research proposal has been accepted.

Period of approval to 31st December 2000

With best wishes for success in your work.

Yours sincerely

ROD CROTHERS
Executive Officer

Attachment: Conditions of Approval

cc. Dr Paul Maj, Supervisor
Mrs Karen Leckie, Executive Officer, Graduate School
Mrs A Stevenson, Administrative Officer, HDC

APPENDIX C

GP SURVEY RESPONDENTS COMMENTS

Patient information.

Some of the additional comments from GP's in regards to the presentation of patient information are given below.

"Usually have a books worth."

"We discuss it, I will check my own sources and read theirs."

"Patients often being in downloaded information – much of which is anecdotal or plain wrong e.g. immunisation (anti) literature."

Discussed – a lot of info is unproven but patients think if it is on the net it must be true."

"Most information is misleading or wrong".

"Usually of little direct benefit but often discussion educative to the patient".

"There are usually 20/30/40 printed sheets. I take them home to read and then discuss with the patient."

"Sometimes the information is totally rubbish."

"Sometimes OK but usually too much information taken out of context or misinterpreted by the patient."

"Usually discuss with patient and interpret the data for them."

"Explain the meaning, sometimes I learn from the materials".

Clinical information resource use.

Below is listed some of the additional comments from GP's in regard to Question 11. Do you access the Internet during the course of a consultation? If not, why not?

> "Too difficult to find what you want and then payment may e required."
>
> "Haven't worked out how yet!"
>
> "Not familiar enough with how to do it."
>
> "Not needed. Prefer time alone to find and evaluate available information."
>
> "Too distracting form patient focus."
>
> "Takes too long to find needed information."
>
> "Its unreliable."
>
> "Dial up access too slow, maybe when ASDL installed."
>
> "Only 1 computer connected in the practice."
>
> "Do not have a permanent connection."
>
> "I am already too slow which costs me money. It would make me even slower".

Barrier to Internet use.

Various other reasons were given as to why the Internet is not used regularly at work in general practice. Listed below are some of these reasons.

"Other sources quickly and easily accessible i.e. texts, journals and colleagues."

"Generally useless and a waste of time."

"Risk of acquiring viruses."

General Overall Comments

Below are given some of the general comments that GP's gave at the end of the questionnaire.

On access: -

"We need high speed cable rollout."

"The whole of the Aboriginal Medical Service have computers except the doctors who are the main suppliers of the medical service!"

"Access time during consultation limits present use of Internet in clinical setting".

As a reference resource: -

"Internet mainly used as a reference resource from home."

"The Internet is really just an electronic library – you don't go to the library in the middle of a consultation, though you might look at a text book on your desk/shelf. The library gets searched later".

"Text books are not very useful as they are not often up to date".

"I personally dislike sitting at a computer screen for ages. There is enough distracting trivia with that beside the 'info superhighway'".

"The various sites providing information require a degree of persistence and therefore time to fully assess. The nature of general practice also means that problems are multifaceted and may require a number of different specialties to be accessed".

"Quality, quality, quality!"

"Access to appropriate information time consuming - poor indexing systems often, sites are of very variable quality".

"Time, time and quality. I still prefer to read journals and discuss with colleagues and attend meetings."

On time issues:-

"The Internet causes information overload and too easily distracts from more important time management issues."

"Access time not compatible with time available for consultation. Currently the remuneration available makes extra time required highly unprofitable – practice margins far too small."

"Give me the finance and sufficient time and I might use of at home, too busy otherwise."

"The current time pressures on consults due to the government medicare rebate policy places significant restrictions in economic viability of using the Internet in consultations. Information is often needed to be explained in the particular context of the patient and disease and therefore takes considerable time to 1st explain the condition, then explain the relevance or non relevance to that particular patient."

On cost:-

"I would like to stay connected to the Internet..... but cost and equipment needed is too expensive.... Suggest a PIP grant of $1000 per GP per year to cover costs".

"I started to computerise my practice before the PIP payments (six years before) because I saw it as the way of the future. Is has been a costly exercise!"

"1. If connection speed 10 times faster (500-1000 instead of 10 rate)

2. if permanent connection FREE (paid for by government)

3. if patient happy to pay for the service of looking up information or government paid me $12 a minute to look it up....NOT so attractive all of a sudden to the consumer or government if the GP doesn't subsidise this extra service ($120/hour / 60 = $2 minute). Wish GP's were paid $2 minute instead of a set amount so no pressure to push people faster in consultations – average consult would go from 5 to 15 minutes!!"

Skills:-

"My lack of use of the Internet is due to my inexperience with it and lack of training".

Legal:-

"Due to medico-legal concern we are not using clinical records on computer."

APPENDIX D

PHARMACIST SURVEY RESPONDENTS COMMENTS

Patient information.

Some of the additional comments from pharmacist's regards to the presentation of patient information are given below.

"Authority of source is questionable"

"Good tool and shows people are interested and respondent to information, can explain that the information may not be trusted etc. due to no references"

"Will review the information and discuss the relevance of the information"

"They're misinformed, don't get the full picture"

"Discussed but depends on situation as to relevance"

"Refer them back to prescriber. Discussed, relevant but not necessarily useful as patients can query their need for medications etc"

"Discussed objectively"

"Can go to same site ourselves and check it out

"Depends on what the info is and how relevant it is to the customer. That is usually why they come in to discuss it – for our professional opinion."

"Depends on the source though some sites are more reliable than others"

"We try to work out the value of the information to their particular condition"

"Too often unreliable or blatantly misleading"

Clinical information resource use.

Below is listed some of the additional comments from pharmacists in regard to the use of the Internet for pharmacy related information.

"(Never) CD discs and various reference books"

"Quite useful if you know how to extract the info needed"

"Where no other information source available"

"Use when needed"

"We would only use it if the information we are looking for was not available elsewhere"

Barrier to Internet use.

Various other reasons were given as to why the Internet is not used regularly at work in the pharmacy. Listed below are some of these reasons.

"Use appropriate to need"

"Too busy doing paperwork to cope extra demand"

"I have enough info. This is overload."

"On internet at home and often look in evenings"

"Too busy doing pharmacy work than wasting time on the Internet"

"Journals, texts & cd's are adequate"

"Do not want to risk to pharmacy records by virus"

"Teaching hospitals provide relevant information"

"Time"

"Not taken the time to learn yet"

"Too many possible 'hits' when you search"

Attitudes to Internet use

Below are some of the comments given by pharmacists on the usefulness of the Internet in pharmacy.

"Would require advisement on authoritative and easy to access sites."

"Might be more integration on the net between pharmacies in the future"

"Cost restraints would be a factor"

"Technology is not useful, only information, quality of information is a bit

more important than the medium"

"Only in exceptional circumstances where resources are not available in text or for new products"

"As I increase my experience and training"

"I doubt it – too insecure, too much time wasted, also wastes a phone call and ties up a phone line"

Usefulness in customers' health management

"Depends on what the source is."

"Again no system seem set up for pharmacist type information access, time constraints"

"Can be a double edged sword. i.e. access to Internet can provide useful accurate information but can also yield a load of rubbish"

"With the correct direction / assistance & proper counseling"

"Depends upon clients ability to understand info and see which is relevant"

"Maybe useful to give them an overview of the medical condition however not useful if they don't get input from their own GP or pharmacist"

"There are many good and reliable sites related to health topics"

"Provided it is correct information"

"Unfortunately sometimes the information is misinterpreted or taken in the wrong context depending on the persons' particular ailment"

"Not at present"

"As long as everyone involved uses it as a tool i.e. part of the complete picture"

"If used correctly a little knowledge is very dangerous though"

"With relevant counseling"

"With a reasonable amount of filtering of information by a health professional"

"In conjunction with a health professional - an informed patient is desirable"

"So people have the ability to interpret the information they get"

"Depends on quality of information"

"For information, not purchases"

"Customers cannot make informed decisions as to what is relevant to them"

"Allows search of drugs and information quickly and comprehensively"

"Yes, but we need medical professionals to help explain whether it is reliable or not"

Views of Internet as useful tool for pharmacy related information

"Yes, sources need to be clarified."

"Unsure of authority of sites"

"Not yet but maybe in the future"

"Great for researching journals, updates on wound-care etc"

"Just have to be able to know where to look and sieve thru info"

"Probably increasingly so, but time constraints would be a factor"

"Not at present"

"Not from reliable sources"

"As long as ethical sites"

"Not my area of experience. Feel that any information is useful"

"Yes – a list of valuable and reliable sites is imperative to save time wastage"

"I have read a lot about HOW TO use the Internet from the provider side, and have formed my own ideas, but NOTHING I have found in my time is any thing more than using the Internet just for the sake of it. There has been a rush to have 'internet presence' but none yet have added anything to it"

"Excellent up to the minute info available from the reputable providers"

"A wealth of information if you know where to look"