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# Health informatics: moving from technics and the fragmentation of knowledge to a socio-political understanding of the design and diffusion of computerised health records (CHRs) among general practitioners (GPs)

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# Health Informatics: Moving from Technics and the Fragmentation of Knowledge to a Socio-Political Understanding of the Design and Diffusion of Computerised Health Records (CHRs) among General Practitioners (GPs)

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"The fragmentation of knowledge may lead to an incapacity or unwillingness to examine technical questions in a wide social context, with a failure to connect and, overall, an inability to comprehend what is going on." (Jones, 1982: 174)

## DECLARATION

This thesis is submitted in accordance with the regulations of the University of Wollongong in fulfilment of the requirements for the award of a Doctor of Philosophy. It does not incorporate any material previously published or written by another person except where due reference is made in the text. The work described in the thesis is original work and has not been previously submitted for a degree or diploma in any university.

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David Bomba
August, 1999

# ABSTRACT

This thesis is a study of the design and diffusion of Computerised Health Records (CHRs) among General Practitioners in Australia and Sweden. CHRs are essentially a social (de)construction of meanings and artifacts by actors in social networks through time. These social networks can further be conceptualised as networks of actors belonging to various language or discipline trees, for example, health informatics. Conflict over ascribed meaning is therefore inherent in any political process of social change as not all actors are homogenous. Thus, conflict between actors and actor networks is reflective of the continuing struggle to gain control over the meaning and organisation of society, social structure. Artifacts can be seen as the physical manifestation and imposition of this power struggle. A socio-political approach is therefore, a philosophical term used to describe the afore-mentioned process; technical issues are social, political, economic and legal issues.

CHR design and diffusion is not just a technical design issue confined to a computer programmer's or general practitioner's desktop but encompasses a multitude of broader social design concerns which are inherent reflections upon the political motivations of the actors involved who shape and diffuse the technology in networks. A greater merging of macro and micro sociological views of technology and health is still needed within the health informatics field to form a more holistic view of events. Furthermore, CHR diffusion and health informatics need to be viewed and understood as belonging to a more broader landscape of the theories of technology, epistemology and society. The development and diffusion of CHRs (or lack of) are not only a reflection upon the motivations and attitudes of the actors within a social system but upon government policy and funding.

A socio-political approach to CHR design and diffusion among General Practitioners (GPs) is an attempt to try and move away from studying technology just as the design and diffusion of an independent technical or medical artifact but to position the process of design and diffusion within a broader social, political, economic and legal framework in order to help understand the interrelationship between health, technology and society. Therefore, health informatics rather than medical informatics is more reflective of this broader shift in thinking.

The comparative study reported was undertaken so as to verify the state of adoption of CHRs among GPs in Australia and Sweden. Responses were gained from a mailout questionnaire to random samples of GPs in both countries (N=600/country). This comparative study is a unique contribution to the health informatics literature, which adds to the existing body of knowledge about CHR design and diffusion, by way of a cross-cultural comparison of GP adoption rates. As a result, some concluding comments and recommendations are offered to assist in the understanding of high and low diffusion rates of CHRs among GPs and the implications for health policy and the formulation of information technology adoption strategies. The main findings of the survey conducted indicate that there has been a high rate (72%) of diffusion of computers and CHRs among GPs in Sweden and a low rate (14%) of diffusion among GPs in Australia.

Moreover, use of computers by Australian GPs is still predominantly confined to front desk type applications (e.g. accounts/billing, word processing) as opposed to clinical CHR use (e.g. patient notes, script writing, recall and referral, test ordering). In Sweden, CHR adoption can be seen as more of a result of direct funding availability (a type of authority decision) mandated by governments (local and national) while in Australia the decision to adopt CHRs is more of an individual optional or collective group practice decision.

Results from the survey data indicate what can be called an attitude-behaviour paradox. In the Swedish survey, among the non-users, a positive attitude is associated with an intention to adopt in the near future (within the next 3 years). In the Australian survey, even when the non-users indicate to having a positive attitude they have no intention of adopting CHRs. This finding supports the general belief that new knowledge and attitudes by themselves are not necessarily sufficient to bring about a change in behaviour. Other socio-political reasons need to be considered rather than just behavioural or technical reasons alone. A lack of computer literacy and training was cited as a key barrier to the adoption of CHRs by GPs across both survey samples. The mean year for GP medical education completion for the Australian and Swedish GPs surveyed was 1974 and 1977 respectively. Very few had to undertake any computer related subjects as part of their medical education. A need also exists to clarify social, legal, economic and political debates over a CHR standard, CHR ownership, CHR legal status, stakeholder access rights and responsibilities as well as GP loss of power issues and government funding models.

This research has important implications for public health policy as well as theoretical debates about the process of technology design and diffusion. The health of nations is as equally important as the wealth of nations. Health care provision and research can be seen to underpin the economic well-being of human existence. The design and diffusion of CHRs in primary health care offers an opportunity for changing the organisation and process of health care activities, however, there will always be associated consequences as a result of such change. Epidemiology research in Australia at the general practice level represents a relatively under utilised resource which could be used to help shape the debate over public health policy. The adoption of CHRs can be seen as an opportunity for helping to change this situation at the practice, as well as regional and national levels.

The diffusion framework as advocated by Rogers (1995) needs careful reinterpretation and repositioning to reflect changes which have occurred in the social structure of society. Traditional classical diffusion thinking is bound up in its historical roots of social anthropology and rural sociology reflective of the 1930s and 1940s. Classical technology diffusion studies treated social networks more as closed measurable systems in which actor relationships were identifiable. Essentially, social diffusion networks need to be seen as open systems, consisting of both physical and electronic social networks in which actor relationships are not necessarily identifiable and obvious. The focus therefore is not so much upon the spread of the artifact itself, as in past diffusion studies, but more on the spread of information about the artifact and how it is

communicated among actors. Therefore, theoretically, CHR diffusion among GPs should be posited in an information and communication network context. Criticisms of classical diffusion thinking need to be taken into account, especially when designing further diffusion research studies.

## ACKNOWLEDGMENT

I would like to thank all who were involved and who supported me over the past four years, especially for the help received in bringing this PhD project to fruition from both the School of Information Technology and Computer Science, Wollongong University, Australia, and the Department of Public Health and Caring Sciences, Section of Family Medicine, Uppsala University, Sweden. Also, special thanks to the support received from my supervisor, Professor Joan Cooper. I would also like to thank my parents for their continued support throughout my educational journey and everyone else who may have contributed in some shape or form to my learning experience.

Being able to do a PhD can be seen as both a great privilege and a burden which has been granted to me by the political gatekeepers of epistemology in society. Choosing which path to take is not a case of deciding whether to go left or right or down the centre. It is a case of asking why the paths exist, how they came into existence and who constructed them in a particular way in the first place. Reflective praxis is essentially the hallmark of research which often pushes and confronts established canons of traditional thinking. Ultimately, choosing which path to take is the one which (n)either imitates established dogma or the one you (de)construct yourself.

My greatest insights have come as results of travels outside of my own disciplinary, organisational, linguistic, social and cultural boundaries. As such, chance really does favour the prepared mind.

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| | |
|---|---|
| ACHRI | Australian Computer Health Records Institute |
| ACS | Australian Computer Society |
| AIDS | Acquired Immune Deficiency Syndrome |
| AMA | Australian Medical Association |
| ANSI | American National Standards Institute |
| APAMI | Asia Pacific Association for Medical Informatics |
| ASTM | American Society for Testing and Materials |
| CAPP | Computer Assisted Practice Project |
| CASE | Computer Aided Software Engineering |
| CD-ROM | Compact Disk Read Only Memory |
| CEN | Comite Europeen de Normalisation |
| CHR | Computerised Health Record |
| CMR | Computerised Medical Record |
| CPR | Computerised Patient Record |
| DRG | Diagnosis Related Group |
| DNA | Deoxyribonucleic Acid |
| EDI | Electronic Data Interchange |
| EFMI | European Federation for Medical Informatics |
| EHR | Electronic Health Record |
| EMR | Electronic Medical Record |
| EPR | Electronic Patient Record |
| ESPRIT | Commission of the European Communities: Telecommunications, Information Industries and Innovation |
| GDP | Gross Domestic Production |
| GP | General Practitioner |
| GPASS | General Practice Administration System for Scotland |
| GUI | Graphical User Interface |
| HELINA | Health Informatics in Africa |

| | |
|---|---|
| HIANSW | Health Informatics Association of New South Wales |
| HIC | Health Insurance Commission |
| HISA | Health Informatics Society of Australia |
| HIV | Human Immunodeficiency Virus |
| HL7 | Health Level Seven |
| IBM | International Business Machines |
| ICD-9-CM | International Classification of Diseases Clinical Modification of the Ninth Revision |
| ICD-10 | International Classification of Diseases Tenth Revision |
| ICPC | International Classification of Primary Care |
| IEEE | Institute of Electrical and Electronical Engineers |
| IFIP | International Federation for Information Processing |
| IMIA | International Medical Informatics Association |
| ISO | International Standards Organisation |
| IOM | Institute of Medicine |
| IT | Information Technology |
| ITU | International Telecommunications Union |
| KAP | Knowledge Awareness and Practice |
| LAN | Local Area Network |
| MED | Medical Electronic Desktop |
| MEDINFO | World Congress on Medical Informatics |
| MUMPS | Programming language, also called M |
| NCEPH | National Centre for Epidemiology and Population Health |
| OECD | Organisation for Economic Cooperation and Development |
| PC | Personal Computer |
| POR | Problem Oriented Record |
| RACGP | Royal Australian College of General Practitioners |
| RCC | Read Clinical Classification |
| SIG | Special Interest Group |
| SNOMED | Systematised Nomenclature of Human and Veterinary Medicine |

| | |
|---|---|
| Spri | Swedish Institute for Health Services Development |
| SPSS | Statistical Package for the Social Sciences |
| TAM | Technology Acceptance Model |
| TQM | Total Quality Management |
| UK | United Kingdom |
| UMLS | Unified Medical Language System |
| UN | United Nations |
| USA | United States of America |
| WG | Working Group |
| WHO | World Health Organisation |
| WONCA | World Organisation of Family Doctors |
| WWW | World Wide Web |

# LIST OF SPECIAL TERMS AND DEFINITIONS

*Actor*: can be an inanimate (e.g. a computer, a book) or animate (e.g. a human being) or inanimate intangible (e.g. an idea, information). These ideas stem from the works of Latour and Woolgar (1979), Latour (1987, 1993) which advocate a tracking of the actors and texts approach to science and technology studies.

*Artifact*: often the physical manifestation of the social (de)construction of technology by actors. The artifact in turn becomes an actor within social structure since it embodies the meaning given to it by the actors who shaped and (de)constructed it in the first place. The change from a paper based patient record artifact to a CHR artifact is an example of this (de)(re)construction of artifacts to reflect a change in paradigm belief about health care processes. The CHR thus becomes an actor since it changes the information and communication behaviour of other health care actors directly and indirectly, e.g. GPs, staff and nurses.

*Change*: an on-going dynamic process of social (de)construction and (re)organisation of social structure by various actors and actor networks; conflict is inherent in such a process since actors and actor networks are not homogenous and the (re)distribution of power is not symmetrical.

*Communication*: "a process in which participants create and share information with one another in order to reach a mutual understanding." (Rogers, 1995: 5)

*Computerised Health Records (CHRs):* a reinterpretation or (de)(re)construction of the traditional patient record manifested through computer technology with significant associated changes and consequences for the reorganisation of health care and actor relationships. CHRs are the building block for a different health care paradigm.

*Diffusion*: "the process by which an innovation is communicated through certain channels over time among the members of a social system." (Rogers, 1995: 5)

*DRGs*: Diagnosis Related Groupings, for example, cardiovascular disease, cancer, stroke, asthma, respiratory, diabetes, arthritis, etc. Developed for the hospital environment, an American technology adopted by different countries and remodified to suit local settings.

*Epidemiology*: "may be viewed as based on two fundamental assumptions: first, that human disease does not occur at random, and second, that human disease has causal and preventive factors that can be identified through systematic investigation of different populations or subgroups of individuals within a population in different places or at different times." (Hennekens and Buring, 1987: 3)

*General Practice CHR Information Management System*: refers to the construction and use of technology to collect, store, process, and retrieve patient health information as well as practice and administrative information in the delivery of primary health care.

*General Practice*: an organisational structure which provides primary, continuing and comprehensive patient care to individuals, families and communities.

*General Practitioner (GP):* a significant primary health care actor, gatekeeper, who shapes the meaning of health, through the patient record, and thus the process of health care through time. Traditionally, endorsed by a medical degree. Synonymous with family practitioner/family physician.

*Health*: "... a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity, is a fundamental human right and that the attainment of the highest possible level of health is a most important world-wide social goal whose realisation requires *action of many social and economic sectors in addition to the health sector*". (World Health Organisation, 1978)

*Health Economics*: the application of economic principles and theories applied to health care. Health is seen more as a production line process (inputs, processes, outputs) which can be quantified.

*Health Informatics*: as adopted by the WHO is "... an umbrella term used to encompass the rapidly evolving discipline of using computers, networking and communications - methodology and technology - to support the health related fields, such as medicine, nursing, pharmacy and dentistry". (Mandil, 1993: 4)

*Informatics*: "... the methodology and technology of computing and communications as applied to information". (Mandil, 1993: 4)

*Information*: a social (de)construction by actors in social networks who wish to control power relations either to reduce uncertainty or create uncertainty, e.g. the patient record.

*Innovation*: "an idea, practice, or object that is perceived as new by an individual or another unit of adoption." (Rogers, 1995: 11)

*Macro/Micro Lens*: a conceptual construction for viewing CHR developments from both a holistic and a specific, localised standpoint. The micro is the macro and vice versa. The micro can be considered the atomistic or technical black box view which in turn is a reflection upon a broader macro or holistic view of society at a certain point in time and place, social structure.

*Medical Informatics*: similar in meaning to health informatics but less reflective of a more holistic view of medicine as being part of health; still often used synonymously with health informatics.

*Networks*: refers to both the physical and electronic relatedness and organisation of and between actors within social structure.

*Nursing Informatics*; *Dental Informatics*: these are being subsumed by the more generic term health/medical informatics. They can be considered as subsets of the larger set health informatics.

*Paradigm*: an overall philosophical approach and belief, a framework used to describe and position a set of ideas, issues, processes and concepts. This differs from a theory since a theory attempts to give a more deductive (or inductive) and hypothesised explanation for some specific perceived occurrence or behaviour. This thesis advocates a more holistic health care paradigm for understanding CHR design and diffusion among GPs rather than a medical or technical approach.

*Patient Record*: a socially constructed technology by actors for the organisation of health care. The patient record can be considered as the documentational building block for longitudinal health care and medical practice. Hence, it is a fundamental information and communication technology in health care.

*Power*: a concept associated with the ideas of social control by actors and actor networks, centrality and dispersion of control, status quo, gatekeepers, change and conflict over the (re)organisation of social structure. Technology is a manifestation of the power process, constructed by actors to entrench and maintain the status quo or deconstructed by actors to challenge and change the status quo, meanings and the creation of different social paradigms and social structures.

*Primary Health Care*: "primary care is the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing sustained partnership with patients, and practicing in the context of family and community." (Van Bemmel et al., 1997: 159)

*Social Structure*: a concept used to describe social relations, the contextual setting which includes both the macro and micro views of society, politics, ideology, economics, law, religion and technics. The context within which both physical and electronic actor networks are embedded, often manifest through some organisational setting e.g. a computer, a general practice, a company, a government, a professional body and society.

*Socio-Politics*: is not a theory but a paradigm, the ideas and philosophical beliefs centre around the interrelationship between sociology, politics, conflict, power, control and technology. These can further be scaled down into further issues (micro), e.g. technics, or scaled up into broader issues (macro), e.g. ideology, theology, epistemology and national policy.

*Sociology of Technology*: a philosophical and literary movement, belonging to the late 20th century. The term is, due to the diversity of all positions associated with it, impossible to define precisely. There is no common body of doctrine to which all sociology of technology authors subscribe to. The sociology of technology area encompasses various views of technology, for example, Marxist, utilitarian tool based

views, social shaping, social constructivist, actor network, structuralist and ethnographic perspectives.

*Technology Diffusion*: an information and communications process among actors in social networks which shapes the decision of actors to adopt or reject technology and ideas. The degree of adoption or rejection can be considered to lie somewhere on a spectrum between adoption and rejection, thus allowing for partial adoption/rejection.

## PREFACE

The purpose of this preface is mainly to serve as a guiding map of the thesis chapters, ideas and structure. The approach and structure of this thesis departs from the traditional orthodoxy of a science based thesis structure. Rather than pursuing and adding to the fragmentation of scientific knowledge, a more holistic book like format has been adopted which attempts to both critique and link existing knowledge from a variety of fields. The study is divided into fourteen chapters. *Chapters 1 - 10* set the study of CHRs within a broader socio-political background of actors and conflicts. This canvasses a variety of perspectives: historical, legal, social, cultural, political, economic, health, theoretical, design and methodological issues. The diffusion framework of Rogers (1995) is presented both as a thought provoking guide and as a model open for discussion and deconstruction. *Chapter 11* provides a justification and outline of the original research design approach. The methodological approach is derived from an extensive literature analysis, formal and informal interviews with GPs, practice visits, observation and a detailed exploratory study of CHR adoption among GPs in Australia by way of a comparative study with Sweden, a country identified as having a long standing tradition in technology adoption and health care research. The overall aim is to synthesise existing ideas and compare some of the survey findings to the diffusion framework of thought advocated by Rogers (1995). Technology design and diffusion is essentially seen as a social and political process. *Chapter 12* provides an analysis and discussion of the comparative study undertaken between Australian and Swedish GPs with reflections upon the design, method and limitations of the study. The findings are discussed from a descriptive standpoint with an emphasis on the similarities and differences between the two sample groups rather than just from a statistical standpoint. Further journal papers could be published based on further statistical analysis of the data but this was not the central aim of this thesis work. *Chapter 13* draws together some of the key themes associated with managing information technology (IT), social diffusion networks and looks at the idea of IT diffusion strategy from global (international) and local (national, regional) perspectives. Concluding comments and recommendations both for policy and further research are offered in *Chapter 14* in order to help understand not just high and low rates of CHR adoption among GPs but also IT diffusion within society. At a practical (application) level, the aim is to raise the awareness amongst all health care providers of the issues involved. The conclusions can serve as guidelines for the establishment and on-going development of strategic plans and policy at the National (HISA, RACGP, AMA), State, Regional and Divisional levels of General Practice (for example, The Illawarra Region of New South Wales, Australia) and Health Informatics communities in Australia. By adopting a holistic approach to CHR design and diffusion research, a more meaningful interpretation of the *process*, *issues* and *actors* involved can be achieved which ultimately has both theoretical and practical application.

Keywords and ideas: Technology Diffusion, Health Informatics, Computerised Health Records, Sociology of Technology, Social Diffusion Networks, Information Technology Management

# CHAPTER ONE

# FRAMING THE RESEARCH PROBLEMS

> Despite the benefits that technology has brought to the mechanics of research, it is important to remember that the most crucial aspect of a research project, asking a good question, is still very much dependent on the critical faculties of the researcher. (Silagy, 1996: 346)

## Statement of the research problems

Health is a complex social phenomenon. Health is not just about medicine or the practice of medical methods by doctors. Health is much broader than just medicine, inextricably related to political, economic, legal, environmental and social issues through time. Evidence of this argument is provided by the World Health Organisation's (WHO) definition of health:

> ... a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity, is a fundamental human right and that the attainment of the highest possible level of health is a most important world-wide social goal whose realisation requires *action of many social and economic sectors in addition to the health sector*. (World Health Organisation, 1978)

From the outset, this implies a broader approach to the study of health which goes beyond traditional disciplinary boundaries. Health is not the exclusive domain of medical practitioners. Thus, it is argued that health informatics rather than medical informatics is more reflective of an umbrella term which tries to embrace a multidisciplinary approach to the study of health and health care provision. This is not to say that a multidisciplinary approach is not without problems, such that confusion can develop if there is no sense of the bigger political picture. As such, health informatics as a movement or as an inter-related body of thought and literature, needs to be analysed and defined within a more understandable socio-political paradigm. In order to investigate this situation, the following questions given in Figure 1-1 were formulated.

Figure 1-1 Research questions

| |
|---|
| (1) What is a Computerised Health Records (CHR) system?<br>(2) What is an appropriate theoretical framework or paradigm for understanding CHR design and diffusion among General Practitioners (GPs)?<br>(3) How can high and low rates of CHR adoption among GPs in different countries be explained? |

**Why is the design and diffusion of CHRs among GPs an important area of study?**

Research into the design and diffusion of CHRs among GPs is an important area of study for several reasons. GPs can be considered as the main point of primary patient health care in most health systems around the world and therefore GPs can be seen as the gatekeepers of health information, both locally and nationally (General Practice Strategy Review Group, 1998). This health information is presently an under-utilised information resource in Australia and is generally buried away in hand written files stored in various isolated paper card file systems at disparate GP sites. The use of CHRs in General Practice could lead to new processes and ways of looking at health care, for example: epidemiological research; analysis and tracking of disease trends through database queries; prescription pattern monitoring; calculation of patient and health treatment costs; and providing greater scope for teleconsultations.

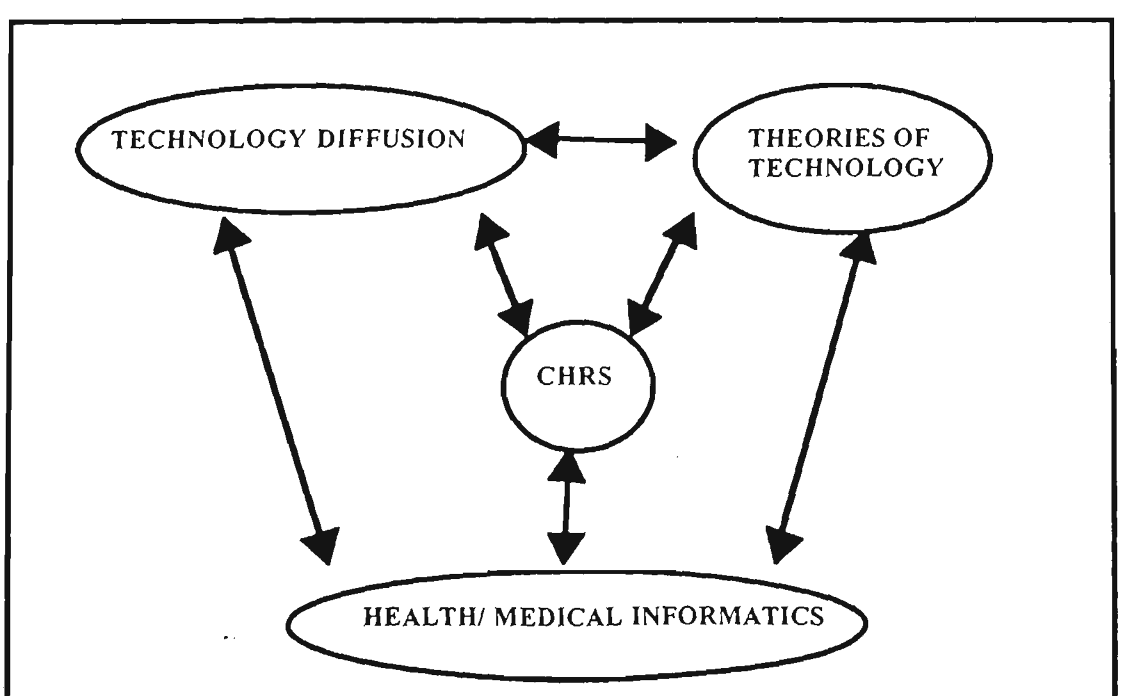
Essentially the purpose and need for the study is based on the belief that CHRs underpin all future health informatics related activities. Thus, there is a need to examine the CHR design and diffusion process in order to consider the possible consequences of wider CHR design and diffusion from a more socio-political perspective rather than

from a technical or artifactual fixated view. Technology should not be seen as a simple remedy or a panacea for short term problem resolution and cost cutting in health care.

From the very outset, any attempt to try and locate the precise disciplinary home of this research is futile. The conceptual section and design of this thesis has been an ambitious task, based on an underlying philosophy that an issue, in order to be fully comprehended, needs to be studied using a multidisciplinary approach. It could very easily have been confined to a black box study of CHRs, technics. This approach would have failed to give CHR design and diffusion a wider social context of understanding.

Figure 1-2 seeks to illustrate the conceptual and research domain of this thesis and further serves as a navigational aid for the reader showing how technology thinking needs to be applied to CHRs and health/medical informatics, also, Figure 1-2 depicts the meeting between various subject fields and authors. This serves as a guide to the literature reviewed.

Figure 1-2 Conceptual framework



**An actor relatedness chart of the literature: a family tree**

One possible methodological approach is to identify and examine the key actors and their topics, motivations and relationships within a broader social, literary and network structure or model. The work of Valente (1995) is informative in this respect. Therefore, the idea for the development of an actor relatedness chart could be a helpful methodology for understanding literature. Tables could be constructed to include such information as author, year, sex, country, organisation and some taxonomical classification for the type or category of the literature. Spreadsheet-like tables could thus be useful for analysing and interpreting the data at a later stage. For example, a researcher may want to know if there are more men than women writing about a certain topic from certain countries and organisations. This information can help group actors into a more understandable socio-political context. Such an approach to examining the literature may help to position various actors, their relatedness to other actors and provide some indication of actor motivations and thinking within a greater schema of development.

Another way to conceptualise this could be through the construction of a tree diagram, similar to the idea of a family tree in genealogical research. This is one way of trying to track the historical emergence or progression of actors and ideas in the literature. It must be mentioned that there are possible methodological limitations to this approach in that it is a literary approach and not one which tries to relate all actor network connections, i.e. both formal and informal, despite the obvious appeal of such a methodology. The problems with such a method lead into a bigger problem to be discussed in further

chapters; a problem that is commonly faced by diffusion researchers using a classical diffusion model when trying to map contemporary social network connections.

The purpose of the literature review is not only to synthesise the growing volume of health informatics material but, as mentioned, to identify the key actors and literatures which relate to the issues surrounding General Practice, CHRs, technology design, diffusion and theory. This can allow for a more integrated view and permit connections to be made between various actors and literatures in order to make sense of what has been accomplished in the past and to locate where health informatics may be heading in the future. This is seen as vital to any future understanding of the area and for the development of health policy and information technology (IT) strategic plans. Therefore, management and implementation of this change or diffusion process must be given careful consideration and study by way of a broader awareness of the connections between a variety of literatures and actors.

Examination of the literature produced during the last few decades reveals that a number of key figures in the health/medical informatics literature(s) have written about various aspects of computerisation in the health care setting. These can be considered as the opinion leaders and change agents (this terminology is adopted from Rogers, 1995: 37) within the health/medical informatics field; but by the same token they are also the gatekeepers of change and information flow within this area, through such media as editorial commentaries in journals and books, conference paper review committees, and so on. These include: Ball (1995), Collen (1995), Dick and Steen (1991), Greenes and

Shortliffe (1990), Greisser et al., (1980), Gremy et al., (1981), Lindberg (1986), Mandil et al., (1988), Moidu (1993a), Peterson H. et al., (1988), Rector et al., (1992), Reinhoff (1989), Safran et al., (1996), Shortliffe et al., (1990), Slack (1998), Stead (1987), Van Bemmel (1984), Waegemann (1995), Weed (1969) and Westin (1976) to name but a few. More recent authors from the Asia Pacific region include: Bolton and Gay (1995), Bridges-Webb et al. (1993), Brittain (1996), Cacek (1994), Crampton (1990), Douglas and Saltman (1991), Hannan (1991), Hovenga et al. (1996), Jayasuriya and Southon (1996), Liaw (1996), Lun and Goh (1993), Miller and Britt (1993) and Walker (1993) to name but a few.

Within the technology diffusion literature Rogers (1995) stands out as a seminal author who has tried to piece together a large variety of diffusion studies and is often associated with supporting the development of the classical model of diffusion thinking and the S-shaped curve. Some key figures in what can loosely be characterised as the sociology of technology literature include: Bijker and Law (1992), Callon and Law (1989), Collins and Pinch (1982), Foucault (1970), Giddens (1984), Hughes and Mayntz (1988), Kuhn (1970), Latour and Woolgar (1979), Law (1991), MacKenzie and Wajcman (1985), Mumford (1987), Winner (1977) and Woolgar (1991) to name but a few.

The field categories and authors given earlier should not be seen as an exhaustive list or as sole authorities on the issues; rather, they serve as a guide for the reader and researchers to follow, since essentially there are issues within issues which cross over to form an inter-related picture of events, the CHR story as perceived by the author of this

thesis. This categorisation is nevertheless a subjective judgement based on the author's understanding of the literature. More names can be added to the list as the web is untangled. Thus, the rather ambitious aim underlying this thesis as evidenced in the literature review, is to identify some key themes and ideas which relate to the works of various disciplines and authors. The purpose therefore is to try and introduce a sociology of technology and diffusion view to the health informatics literature. This will be a unique contribution to knowledge.

# CHAPTER TWO

# TECHNOLOGY THEORY

## The conceptual and research domain of this study

In Badham's (1986) analysis of industrial society the meaning of technology is often historically embedded in notions of progress, rationality, industrialisation and modernity. This can be seen as a pro-technology or pro-innovation bias in that technology must diffuse rather than be rejected which can further spiral down to an individual-blame bias, the individual being the problem rather than the technology or the system and therefore rejection is never seen as a valid social response equal to acceptance (Rogers, 1995: 100, 114). This bias towards the adoption of technology is often emphasised by a focus on the benefits of technology, in which human processes are often described through mechanical, robot and computer-like metaphors. Less attention is given to the idea that windows of opportunity, the benefits of mechanics and technology, can also very easily be turned into cages of long term confinement, thinking and social control. The innovativeness-needs paradox would indicate that the individuals in most need of the benefits of a particular technology are usually the last to adopt which only serves to further widen the socioeconomic and equality gaps between people (Rogers, 1995: 275). This can be seen as horizontal adoption of technology among alike members (for example, based on wealth, education, profession) in a social system as opposed to vertical adoption between different social networks.

The theoretical framework for understanding the design and diffusion of CHRs is depicted in Figure 2-1, as constructed by the thesis author. In Figure 2-1, it is assumed,

first, that there is no one right way or recipe for studying technology and computerised health records, or any kind of technology for that matter. For this reason a combination or synthesis of views and disciplines has been attempted in this study. In Figure 2-1, the numeral 1 denotes the broader macro view of society, conceptualised as social structure, an idea adopted from the work of Giddens (1984) and Parsons (1969) on social reality. The numeral 2 denotes the organisational micro sociological structures and actors, e.g. general practice environments, hospitals, health clinics, etc. As such, the merging of the macro and micro frames of meaning is characterised in this thesis as an historical conflict between actors with different frames of referential meaning. This is denoted by the idea of a socio-political paradigm of understanding. This philosophical position was shaped by the comments listed in Appendix 1.

Figure 2-1 Frames of meaning

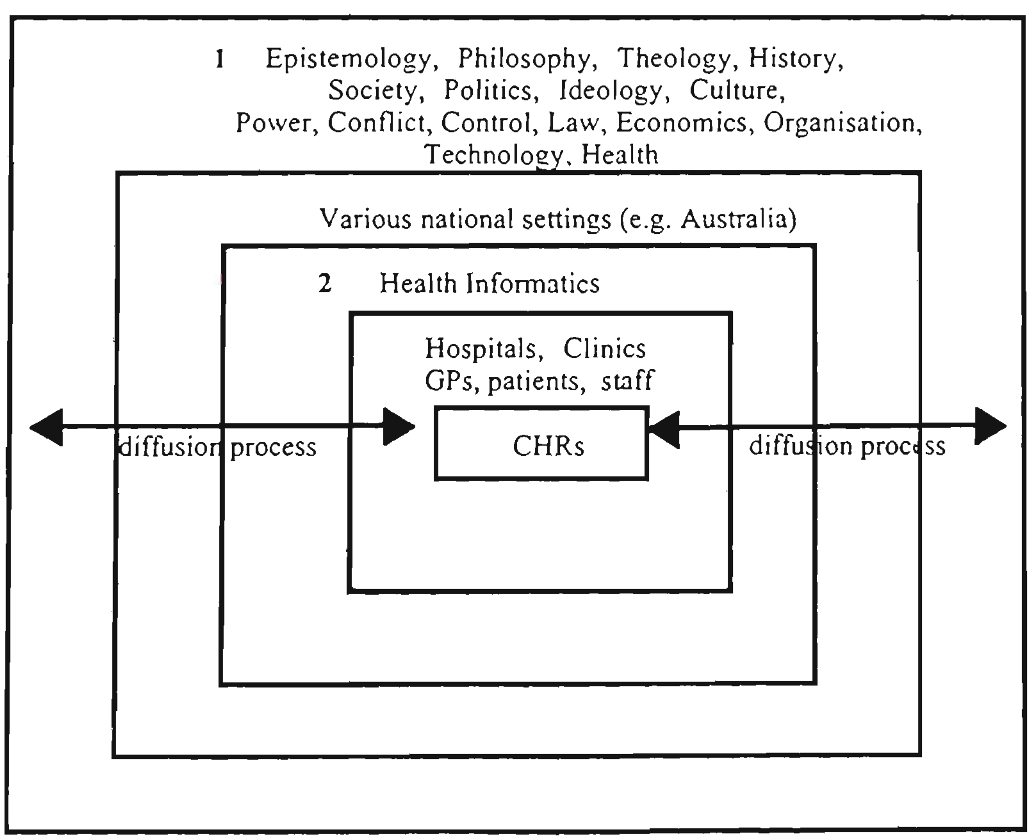


Figure 2-1 is essentially grounded in social constructivist thinking (Bijker et al., 1987, 1995; Bijker and Law, 1992) about technology design and diffusion. It is acknowledged that within the loosely identified area, the sociology of technology, there exist conflicts and paradoxes over prescribed meanings of technology and social reality (see, for example, MacKenzie and Wajcman, 1985). Furthermore, D. MacKenzie (1996) argues that there is a difference between social shaping thinking about technology and social constructivist thinking, which is captured in the idea, "contingency of design", that is in how things can be designed differently, for example, houses, bicycles, cups, bridges, windows. At times this interpretation may appear confusing since it implies a certain neutrality in technology, design independence, which is not necessarily the case. Winner (1980) can be seen as one who argues that technological design, for example, bridge building, is inherently political which suggests that technology is not neutral but embodies the motivations of the designer(s) involved. When more heterogenous designers are involved in the shaping/design process the result can be reinterpreted as MacKenzie's shaping or contingency of design thinking.

It is acknowledged that Figure 2-1, contingent on this thesis author's thinking, is by no means an exhaustive framework. Categories or concepts may be added or reshaped, but it serves as a conceptual starting point for understanding the social (de)construction, design and diffusion of CHRs. As indicated, this can be visualised as an infinite number of frames of meaning (see, for example, Collins and Pinch, 1982). The frames are within each other, a merging of the macro and micro, windows within windows; each frame being representative of meaning or layers of social context used to view and explain

CHR design and diffusion. These can be added or the frames themselves may be translated and transposed into actor networks (see, for example, Callon and Law, 1989) and actor relatedness trees (see, for example, Latour, 1993). This may be useful in helping to group actors within disciplinary and language (discourse) trees. The macro/micro lens, denoted by numerals 1 and 2 in Figure 2-1, is essentially derived from the "seamless web" metaphor (Bijker and Law, 1992), Callon and Latour (1981) and Archer's (1995) morphogenetic approach to social reality. All advocate a merging of micro and macro social structures.

An approach that can traverse between the macro and the micro frames of meaning would thus appear to have great utility for understanding events. This idea is based in the thinking that the laboratory setting is a reflection of both the macro and micro developments in society (Latour and Woolgar, 1979; Latour, 1987). In this case the GP practice can be viewed as the macro and micro of health care in society. The GP setting and its actors are also situated in time and place who in turn reflect the political, economic and sociological structure of the larger society but at a more localised frame of meaning. In essence, the macro is the micro, thus, these concepts are one and the same but yet provide for different frames of meaning magnification of social structure and organisational issues.

The diffusion process shown in Figure 2-1, should be seen as both a local (micro) and global (macro) process occurring among actors in different frames of meaning, at one and the same time. Therefore, it involves the communication of information about artifacts

and the adoption or rejection of artifacts themselves, for example, CHRs. Inherently, this embodies the ideas of change, conflict and social (re)organisation which arise as a result of a clash between actors with different frames of meaning. This interpretation is historically developed from the thinking of Marx and Hegel about social development, hegemony, and the dual dialectic, contradiction (conflict) and meaning resolution (conflict resolution), or more recently in technology debates as closure and stabilisation (see, for example, Bijker 1995). This has also more recently been reinterpreted into organisational and class politics, the politics of difference, and the battle over the control of economic modes of production and markets (see, for example, Winner, 1977; Zuboff, 1988; Milner, 1996). The social (de)construction of CHRs can also be explained as a development within a more competitive market framework; information as a commodity which gives competitive economic advantage and reduces uncertainty (e.g. Arrow, 1980; Porter, 1980, 1985, 1990; Porter and Millar, 1985; Lamberton, 1990).

The idea of "frames of meaning" is essentially derived from Bijker et al. (1987: 172) who uses the term "technological frame" to represent "... the *interaction* of various actors ...". Hence, as used here, this frame is representative of the negotiation space or (de)construction space, of meaning between actors and actor networks in different meaning frames. This builds upon the idea of actor networks within different meaning frames (Bijker et al., 1987; Callon and Law, 1989). For example, GPs are essentially actors in organisational and social networks, formal and informal, for example, the general practice; or professional bodies, for example, the Australian Medical Association (AMA) and the Royal Australian College of General Practitioners (RACGP). All

attempt to shape the meaning and artifactual form of patient records with other actors both within meaning frames and between actors within other meaning frames, for example, government administrators, policy planners, strategists, third party insurers, patients, nurses, pathologists, pharmacists, radiologists, CHR vendors, and others.

Conflict is therefore inherent in this negotiation of meanings and artifact translation process. This creative disruption is perceived as benefiting some groups of actors more than others, and as a destabilisation of the status quo. Some perceive a possible gain in power over other actors while some perceive a loss in power, hence, the utility of a socio-political paradigm of understanding CHR diffusion and non-diffusion. Technical black box design, translation and diffusion is a socio-political process among various actors.

**Theories of technology and society: from the sociology of literature to the sociology of technology**

Literature, and theories of literature, more so the sociology of literature, that is the positioning of literature within a broader sociological context, can be seen as a philosophical and literary approach taken to studying literature and knowledge (see, for example, Berger and Luckman, 1966). Two key and contrasting perspectives exist, for example Derrida (1967), who advocates a textual analysis of literature, a focus on language, rather than a contextual analysis (text, author(s) and society) as advocated by Foucault (1970) and Marx (1876).

The sociology of technology approach reinterprets the sociology of literature thinking and essentially posits such thinking within a broader sociology of technology framework, since it is argued that the sociology of literature is a study of the sociology of technology. Literature is technology and this technology is embodied within technological artifacts embedded in a social framework of actors and actor networks. Therefore, an analysis of literature is a historical analysis of technology and technological artifacts, for example books and ideas, within a sociological context or system of social networks and actors. Just as there are various ways of studying literature there are also various ways of studying technology, but with the important conceptual thread that literature is technology, a communication technology.

For this reason, the study of history is also a study of the history of technology and its spread and change through time in various social systems. It can therefore also be considered as an anthropological study, the (de)construction of technology and technological artifacts through time grounded in the historical canons of social anthropology in which social change can be interpreted as a study of technology diffusion. The repositioning of social anthropology and ethnography can therefore be seen as reinterpreting these ideas as the social and historical (de)construction of technology, technological artifacts, technological systems, actors and technology diffusion. A sociology of technology approach can be utilised to help understand technology diffusion and social change as a process occurring within and between various social networks. This resulting social and technical structure has also been more recently translated into an information and communications structure.

More recent thinking about the ideas of technology and technology diffusion further interpret and posit technology more within an information and communications system perspective with an emphasis on the political context of systems design (Checkland and Howells, 1998). This essentially tries to deal with the questions of what is information and how information spreads; hence, the growing interest in the convergence of telecommunications, computing and the media. This inherently embodies thoughts about economic modes of production and the creation of markets - information markets. The thread which ties this all together is social (de)constructivist thinking within the philosophy of the sociology of technology. In time, the sociology of technology may become the sociology of information and communication of which social organisational theories (economic, theological, ideological) will be significant streams of thought. Wennerholm (1998) for example, conceptualises this as the meeting between organisational theory and sociology. Technology as such is interpreted as being reflective of the theories for organising society.

The work of Karl Marx (1876) stands as an important reflection upon the relationship between the concepts of ideology, politics, economics, technology and society. The work of Brewer (1984) is informative in helping to understand the work of Marx. Essentially, Marx constructed a framework of thought about the organisation of society and the associated modes of economic production. Important to this concept is the idea of hegemony, i.e. the constructed dominance of one social class over another, the capitalist exploiting the worker and the resultant class conflict. Technology in a Marxist

schema, can be seen as a capitalist construction, thereby reflecting a certain ideological position about entrenching the dominance of the capitalist (and capitalist economics) over the worker. Viewed in this way, capitalism is essentially based on a system or relationship of exploitation and power. Hence, Marxist history is a reflection upon the conflict between social classes over the control of modes of production and the distribution of wealth in society. This account of change through conflict is known as *historical materialism,* which seeks to explain the basis of all human activity. Many variations upon Marxist thought have developed over time and social constructivist thinking about technology could be considered to be one such hybrid construction between what can be characterised as post-structuralist thought and Marxism.

Social constructivist based theories of technology can essentially be seen to have their foundation in literary theory. Marxist (literary) theories have essentially been applied to technology, as may be indicated in the following statement if, one simply substitutes the term technology for literature: "all Marxist theories of literature [technology] have a simple premise in common: that literature [technology] can only be properly understood within a larger framework of social reality." (Forgacs, 1993: 167). This would also indicate that literature can be viewed as technology itself. It also implies that there exist other non-Marxist theories of technology. Essentially, such theories view technology as having a self dynamic, operating outside of society, i.e. technology determines itself along some predetermined evolutionary path. Such theories of technology imply set linear trajectories and are described in literature by the term *technological determinism* (Jones, 1982: 210). This may even be considered as an extension of religious

deterministic thought applied to technology, i.e. technology follows a predetermined path set by some creator. Modern theories of technology can be taxonomised as swinging somewhere between the spectrum of technological determinism and social determinism.

Social constructivist theories of technology can further be seen as an extension of post-structuralist thinking about technology, that is technology has no absolute meaning; rather, meaning is pluralistic and constructed, as distinct from structuralist thinking about technology which advocates a more definitive scientific truth about technology. In the context of technology, a Derridian approach would advocate an examination of the symbolism of technology itself; Foucault however, would take a more contextual approach, i.e. examining the ideas and motivations behind the construction of technology within a social context, essentially situating technology within a broader schema of understanding. The emphasis is on seeing technology as part of a totality of social practice. The application of Foucault's ideas upon technology discourse indicates that discourse itself, about technology, limits the meaning of what technology could mean. This would indicate that discourse and rhetoric also changes over time to reflect shifts in thinking and power. Technology can therefore be considered as a manifestation of this power struggle over the control and organisation of society by various groups and actors. This is somewhat of an extension upon the hegemonic relationship of conflict as proposed by Marx in that there are many groups rather than just two groups or classes. These groups can be seen as networks of actors who influence each other both formally and informally. This conceptualisation provides the basis for a socio-political approach

to understanding the power struggle between actors over the control of information and communication technology.

**Technology as a social (de)construction**

Change is a struggle for the redistribution of power among actors in a social network; new actors come on the scene while old actors try to maintain and entrench existing dominant systems of power and behaviour. CHRs are a fundamental paradigm shift in thinking and threaten existing modes of work practice behaviour and power structures. Therefore, the widespread diffusion of CHRs can also be considered as potentially disequilibriating to the status quo. Essentially, CHRs can be seen as a catalyst for the reorganisation of the status quo within health care.

In essence, CHRs can be viewed as a social construction reflecting the political, economic, ethical, social and legal values of actors in a social network or society at a particular point in time. Hence, the technology is symbolic of the embodiment of these ideals and not just a neutral tool to be used. It must be acknowledged that CHRs may be put to uses never envisioned by actors at the design stage, but this can be considered as the novelty process of innovation diffusion and change. Otherwise we would live in a very predictable world with zero entropy. Thus, the deconstruction of what CHRs mean also occurs in order to reflect changes in thinking about health care and to reposition the value of CHRs accordingly. Meanings are essentially socially (de)constructed and entrenched through technological artifacts.

It may well be argued that CHRs are both a threat and an opportunity for GPs to either increase or decrease their personal and professional self interest. This will be a reflection upon how GPs shape the debate over CHRs both collectively and individually. The outcome of this is hard to predict as some actors are more vigilant and powerful than others in looking after their own self interest. More interesting is the interaction that takes place among actors, especially when those actors cross disciplinary and market boundaries as a result of converging interests and motivations. From a network point of view, the crossing of market boundaries represents a communication interaction between actors from different networks, and a gradual convergence or closer integration of various actor networks in a global network system.

At a theoretical level, the question arises as to whether actors can also be inanimate objects? By the very definition and discussions given earlier, the answer is yes. CHRs are actors by the inherent ideals they embody as a result of the shaping and design process by other actors. As an artifact, CHRs influence the restructuring of GP behaviour both directly and indirectly just as a church or castle influences behaviour and embodies symbolic ideas of its time. A church or castle may be put to different uses over time leading to, a realignment in thinking. It may be reconstructed and changed or even destroyed, but it still remains a highly symbolic and dominant structure in society, physically or conceptually, just like a CHR system in a GPs office.

In time, the euphoria about CHRs should be tempered by a healthy dose of optimistic pessimism. The key issues tend to fall more within, or rather between, the political,

legal, economic and social realms rather than just being issues of technics. For technical issues are also political, legal, economic and social issues. They are one and the same. Debates that focus purely on the technical aspects of technology distort the debate about technology and portray technology in a very simplistic manner - which is not the case. Thus, technical portrayals of technology limit the meaning of technology and how people think about technology.

The conceptualisation of technology as information has great utility since the transfer of technology can thus be seen as the communication (transfer, processing and evaluation) of information to try and reduce uncertainty (Eveland, 1986). This view of technology is not widely identified. Hence, the spread of CHRs among GPs can be conceptualised as the spread of information (effectiveness of communication) about the idea of CHRs among actors in particular networks rather than just the artifact itself. Trying to track the spread of information itself or the impact it has on a GP's thinking can pose problems since it cannot be easily observed unlike the adoption or non adoption of the artifact which can be empirically measured by a survey or observation. Rogers (1995:18) claims that:

> Diffusion investigations show that most individuals do not evaluate an innovation on the basis of scientific studies of its consequences, although such objective evaluations are not entirely irrelevant, especially to the very first individuals who adopt. Instead, most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from individuals like themselves who have adopted the innovation.

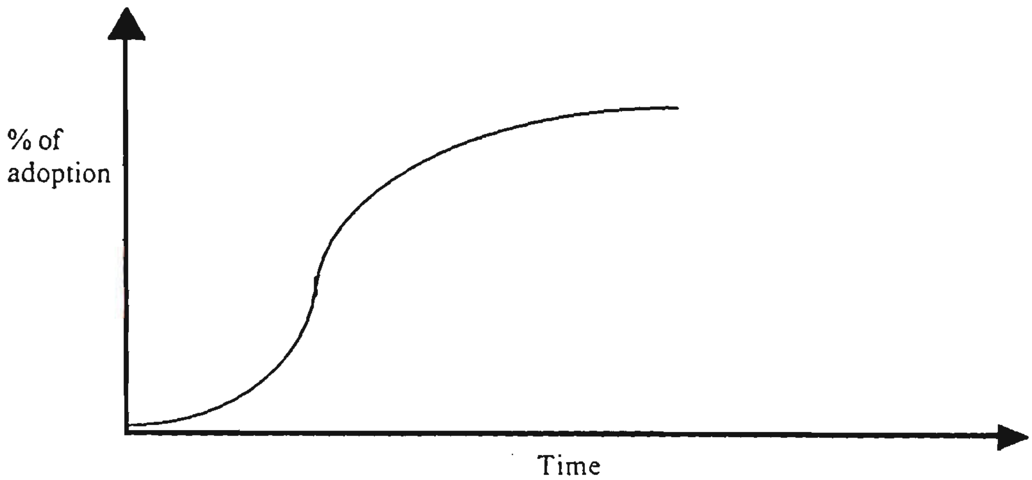
This would strongly suggest a social orientation to understanding technology diffusion and the actual adoption/rejection process. The process of adoption and rejection may have more to do with concepts of imitation, herding, propaganda and social groups.

Diffusion could also be considered as a study of the creation, shaping and spread of propaganda (see, for example, Chomsky and Herman, 1988) about an idea within and between actor networks. Therefore, a coupling of the literature, of health informatics with those of technology diffusion and the sociology of technology can provide for a greater theoretical and practical understanding of CHR diffusion.

**CHRs in a diffusion context**

Through the work of Rogers (1995) we can begin to think about *what* happens, the rate of technology diffusion (as depicted by the S-shaped curve in Figure 2-2) and *why* the rate of technology diffusion may vary in different social systems but not necessarily *how* the process of technology diffusion actually happens beyond giving some common characteristics. It would be somewhat optimistic, given current knowledge, to think that there exists a general unifying pattern of diffusion which serves to explain *what* happens, *how* it happens and *why* for all cases. Therefore, given that there will be varying rates of diffusion, research needs to go beyond just tracking developments on the S-shaped curve to actually seek a more broadly based social understanding of the process itself. This can be characterised as giving the S-shaped curve a social and political context. Thus, the aim of studying CHRs is to give CHR design and diffusion (among GPs) a socio-political context of understanding. For if the process can be more meaningfully understood then the rate of diffusion itself can be influenced or altered according to given needs. The S-shaped curve in Figure 2-2 may therefore be shifted more to the left or to the right.

Figure 2-2 The S-shaped curve




The S-shaped diffusion curve advanced by Rogers (1995) is representative of four main elements: an innovation, time, communication channels and a social system. This characterisation serves as a useful theoretical construct for helping to stimulate thinking and criticism about the diffusion process. Some innovations diffuse rapidly while others diffuse very slowly. Why is this the case? Based on past research work, Rogers has (1995) identified five general attributes which serve to explain the rate of adoption: relative advantage, compatibility, trialability, observability and complexity.

He defines them as follows:

- Relative Advantage: "... is the degree to which an innovation is perceived as being better than the idea it supersedes." (Rogers, 1995: 212)
- Compatibility: "... is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters." (Rogers, 1995: 224)
- Complexity: "... is the degree to which an innovation is perceived as relatively difficult to understand and use." (Rogers, 1995: 242)

- Trialability: "... is the degree to which an innovation may be experimented with on a limited basis." (Rogers, 1995: 243)
- Observability: "... is the degree to which the results of an innovation are visible to others." (Rogers, 1995: 244)

The five general attributes mentioned by Rogers can be problematic, what is not clear is the degree of interdependency of these characteristics and how this influences an actor to adopt or reject an innovation. For example, given that the terms high and low can be defined, what would be the outcome if an innovation that has a readily perceived high relative advantage, low compatibility, high trialability, is difficult to observe but has low complexity? Is it possible for adoption to take place because of just a single characteristic and is it also possible that other characteristics of adoption could be added to the model offered by Rogers? In fact, could the diffusion process be conceptualised in a totally different way?

Some authors who have tried to test the work of Rogers by looking at personal computer diffusion for example, include Brancheau and Wetherbe (1990) who looked at the diffusion of spreadsheet software in twenty-one companies. Their results indicate that varying rates and patterns of diffusion exist, for example, linear, dual sigmoidal and the S-shape curve. Heikkilä (1995) also obtained similar findings in his analysis of personal computer diffusion in two business units of an international Finnish corporation. This does suggest that the pattern of diffusion may not be as fixed as Rogers argues.

Shires (1986: 167-169) argues that the growth of North American physician computing parallels the growth of information databases (e.g. Medline) generally and tries to incorporate the adoption of information about an idea which occurs before actual adoption of the innovation. Rogers (1995: 198-201) accounts for this as the rate of knowledge-awareness which precedes the rate of actual adoption in which innovators and early adopters are seen to have far shorter innovation-decision periods between knowledge-awareness and actual adoption as opposed to late adopters and laggards. Shires also indicates, the adoption of other significant technologies may need to be plotted as well to try and show a wider contextual trend. Instead of starting at time zero and percentage of adoption zero, Shires (1986: 168) argues that there is already an "... initial high degree of acceptance ... related to a specific group of innovators ...". This is an important point, since it indicates a pro-active role on behalf of some actors to adopt whether it be to set the trend for adoption or based on some other motivation such as perceived competitive advantage, market domination, etc. Shires further incorporates the role of various actors at different stages of the adoption curve, for example, innovators, realists and the professionally trained. After an initial slump some of the innovators pull out and move on, the realists remain to agitate for further change, they are left to deal with the difficulties and problems with the technology. As Shires (1986: 168) states:

> consequently, the degree of acceptance fell during this period, until one of three things happened. These were; that the highly competitive database vendors corrected the difficulties identified by the realists; secondly, that the realists became more accepting of the problems and learned how to deal with them; and thirdly, the realists were in turn replaced by a group of professionally trained users who were much more accepting of the constraints required to access the databases, appreciating that the information they were seeking was unavailable to them from any other source.

# CHAPTER THREE

# DEFINING THE PATIENT RECORD

## The patient record as a social (de)construction

The patient record is often defined in various national and state health and patient record legislations, for example, Health Act, Health Services Act, etc. Generally, the patient record can be seen as a set of documents created by health care workers during the provision of health care to a patient. Thus, conceptually, the patient record should be considered as a socially constructed technology, existing within a larger system of health technologies and actors.

The term GP can be seen to specify a medical practitioner who is involved in the creation and shaping of the patient health record. But clearly, the GP is somewhat more and must be considered to be a specialised type of medical health care worker within the primary health care field. The term primary health care has for example been defined in the following way:

> primary care is the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing sustained partnership with patients, and practicing in the context of family and community. (Van Bemmel et al., 1997: 159)

Since several terms exist in the literature which are often used interchangeably to describe the functions of a GP, this can lead to some confusion in meaning and classification. For the purposes of this thesis therefore, at a generic level the term GP can be used interchangeablely with the terms family practitioner/physician, as is the practice of the World Organisation of Family Doctors (WONCA, 1991). The key point

here, as Strasser (1992) indicates, is that despite some variances it is the GP who is generally the main information gatekeeper in health care systems worldwide, not just of the patient health record at the micro level but of the entire macro level health system.

Dickinson (1991) indicates that in Australia, 80 to 85% of the population will visit their GP within any given year. This represents a significant position of power within the health care system. Hence, the meaning of health is to a large extent a reflection upon the (de)constructions made by GPs through their health care records over time, for example, identification of novel types of diseases, classification of diseases, disease trends, etc. This is the basis for a macro-micro view of health care since, what essentially happens at the micro level within the GP practices is the basis for shaping macro level health policy developments, allocation of resources and so forth. Macro level health policy in turn feeds back into shaping micro level GP activities, for example, availability of funding and grants for research. Health can be likened to a story which changes through time by the (re)interpretations made of health information derived from patient records. More actors wish to be able to both understand the health story and shape the meaning of the story itself. This leads to conflict as different interpretations arise and traditions are challenged.

Historically, the patient record has been the documentational building block for health care and medical practice as attributed to Hippocrates, 5th century B.C. (Van Bemmel et al., 1997). The patient health record as such can be considered as a minimum documentational practice. This minimum standard is set by governments through

legislation thus, making the record a legal document. Traditionally, these have been centred upon a paper-based paradigm of health care, despite patch-work revisions to legislations designed to be more reflective of contemporary needs and times. This is reflective of a wider process of change within society, in that the process of law making, both case law and government legislation, is traditionally slow and conservative, much like the medical profession.

Computerisation of the patient record is an attempt to move from a paper based paradigm of health care provision to a computerised or electronic based paradigm. This fundamental change is not without problems and consequences. Simplified views of change in health care as being merely a technologcial issue are misleading as has been pointed out by some authors (see, for example, Keen, 1991; Jayasuriya and Southon, 1996). Furthermore, Linnarsson (1993) indicates that the computerisation of the patient record needs to be seen as much more than just the simple automation of a manual process. The process of change has many legal, political, health, economic, organisational, technical and social implications and barriers, demonstrated by the work of M. Berg (1997), who examined the rationalisation of medical work practices. This is a major change in the fabric of society, an alteration in the organisation of social structure, funding mechanisms, divisons of labour, and the way organisations operate; a GP practice being an example of one such organisational structure. Political conflicts are inherent in any change to the status quo, some actors maintain or gain in power while others lose in power, or worse, are made redundant. The larger and more complicated the organisational and social structure, the more difficult change and conflict management

can become. Arguments that try and portray computers as merely tools or mechanisms for information storage and retrieval of health data (see, for example, Biscoe, 1986) are misleading; even more so are those which continue to perpetuate such thinking (see, for example, Feeney, 1996).

**What is a Computerised Health Records (CHR) system?**

The actual meaning of CHRs should be reflective of a socio-political process through time, (de)constructed by actors who have an interest or stakehold in CHRs. For this reason various individuals and organisations have attempted to define and shape the debate over CHRs. A key organisational actor has been the Institute of Medicine (IOM) in the United States of America. The IOM (1991) defines the Computer-Based Patient Record in the following way:

> an electronic patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids.

This definition is a rather ambitious, broadly ranging ideal. It does not necessarily exist in practice, despite systems which may try to approximate this ideal. There is also a tendency to focus on clinical systems rather than on a more holistic organisational or practice management system which also includes non-clinical components such as accounting and budget management. This will come under greater scrutiny in coming years, especially in health care systems where GPs operate, or may be encouraged to operate, as private business entities.

The IOM has also further recommended a number of technical functions and CHR attributes which are deemed to be essential to a comprehensive CHR system. This includes: "(1) databases and data management systems, (2) workstations, (3) data acquisition and retrieval, (4) text processing, (5) image processing and storage, (6) data exchange and vocabulary standards, (7) system communications and network infrastructure, (8) system reliability and security and (9) linkages to secondary databases" (IOM, 1997: 179). This leaves plenty of scope available for the validation and testing of these "essentials", especially whether GPs actually believe that the CHR is an essential technology for health care in the future.

**Limitations: in search of meaning and the mythical CHR holy grail**

Despite such developments as Deep Blue in the game of chess and the ever persistent obsession with The Turing Test (a machine mimicking a human being without a human being knowing it is a machine), it would appear that such endeavours face certain limitations (Bolter, 1984). Essentially, human traits and thought processes are difficult to transcribe into machines as expert systems and artificial intelligence researchers have discovered. Expectations in these fields have failed to live up to their early claims mainly due to overly optimistic and unrealistic beliefs. As such, CHRs should not necessarily be seen as expert systems or labour displacing, but rather more so as decision support systems (see, Weaver, 1991). Nevertheless, classification of CHRs is problematic since meanings are socially (de)constructed by a variety of actors with vested interests.

# CHAPTER FOUR

# SOCIO-LEGAL ASPECTS OF PATIENT RECORDS

## Problems with defining a computer based patient record

A plethora of terms has been used somewhat interchangeably and synonymously to describe the computer based patient record. At a generic level of discussion this may appear to be superfluous but distinctions between the terms do exist and point to a particular long term view and taxonomy of ideas. This is evidenced, for example, by the five levels of computerisation for patient information systems as advocated by the Medical Records Institute (USA) as captured by Table 4-1.

Table 4-1 Levels of computerisation for patient information systems

| | |
|---|---|
| Level 1 | Automated Medical Records |
| Level 2 | Computerised Medical Records |
| Level 3 | The Electronic Medical Record |
| Level 4 | Electronic Patient Record |
| Level 5 | The Electronic Health Record |

Source: Medical Records Institute (http://www.medrecinst.com/resources/levels.html)

The explanations given for each level are not altogether clear and at times seem to be contradictory and overlapping. According to Table 4-1, the IOM's definition, stated earlier in Chapter Three, of a Computer-Based Patient Record would appear to be the same as the Medical Records Institute Level 4 definition for the Electronic Patient Record. Furthermore, to add to the confusion, the American Health Information Management Association has classed document imaging systems as being within Level 3

while the Medical Records Institute classes this within the Level 2 category (http://www.medrecinst.com/resources/levels.html). This ambiguity in the use of terms is an indication of a meanings formulation and negotiation process, in which various actors (e.g. individuals, institutions) are attempting to shape the direction and meaning of a technology which has yet to be fully accepted and developed. The Level 5 Electronic Health Record is defined as "a computer-stored collection of health information about one person linked by a person identifier." (http://www.medrecinst.com/resources/levels.html). It should not go unnoticed therefore, that the concept of a unique patient identifier is seen as an eventual central concept in the future development of this technology.

The concept of unique identifiers has met with mixed approval internationally. In Australia, the attempted introduction of the Australia Card in 1987, a unique identifier, was widely resisted despite its eventual introduction through a backdoor tax file number instead. This is a unique identifier by another name since it can be matched with other identifiers such as the Medicare Number, used in health, and the drivers license number to form a universal identifier, thus giving the ability to match data from various disparate record sources. A somewhat more complicated process, but feasible, nevertheless. The social and ethical acceptance/resistance to this type of behaviour (data warehousing, datamatching, data profiling, use of smart cards) is of much concern and debate since it is perceived by some to be a precursor to a growing surveillance and control society (see, for example, Huxley, 1932; Orwell, 1954; Beniger, 1986). Clarke (1988) describes this systematic monitoring of human actions or communications as dataveillance and further

argues that this type of activity is becoming the dominant means of monitoring individuals and populations. For example, in Sweden a unique identifier attributed to an individual at birth and subsequently used whenever dealing with organisational authorities in society for referencing information, public and private has historically been ingrained into the culture of the society and is seen as an acceptable technology. This is a longitudinal birth to death technology utilised within another birth to death technology, the patient (CHR) record which would suggest that Sweden can be considered as a functional information surveillance and control society by modern day standards (Flaherty, 1989). Regulation through legislation and an enforcement body have been developed to protect against abuse and infringement of personal integrity, e.g. the Data Act and the Data Inspection Board. Anyone wishing to keep sensitive files about individuals in a records system needs to have permission from the Data Inspection Board to do so. This is a type of licensing system similar to the drivers licence (Spri, 1996).

There may also be a perceived problem with the actual usage of the terminology itself: Computerised Patient Records (CPRs), Electronic Patient Records (EPRs), Electronic Medical Records (EMRs), Computerised Medical Records (CMRs), Electronic Health Records (EHRs) and Computerised Health Records (CHRs). Some of the terms may be perceived as implying an alignment of ownership and responsibility rights to the *patient* (e.g. EPR, CPR) or *medical doctors* (e.g. EMRs, CMRs). Therefore, a more holistic term should be adopted rather than a term which may be perceived as ascribing ownership rights to a particular person or group (e.g. EHRs, CHRs). The basis for this argument is

that health care delivery needs to be seen as a shared process, not one just confined to the realms of a single actor (e.g. GP, patient, staff, hospital, pathology, pharmacy, specialist, insurer, government, or researcher).

The term CHRs is adopted in this thesis primarily because the electronic patient record is computer based and will remain so for the foreseeable future. The EHR is the CHR of today. EHRs imply a vision possibly beyond a computer based patient record. This may be somewhat overly optimistic and deterministic. Hence, CHRs can be perceived as embodying a more holistic and shared view of patient information, with the focus being on the idea of *health* rather than *patient* or *medical doctor*. A principle right may exist in the idea that information should belong to the patient but this may be in principle only. Legislation and organisational policies may simply override this principle. This is a key point which needs to be examined. This principle may be open to debate as more actors wish to have access to patient information in an electronically networked environment where information can be viewed, added, updated and changed. Thus, as Amatayakul and Wogan (1992: 63) indicate:

> The medical record is a peculiar type of property because a distinction is made between ownership of the record itself and the information contained in the record. The institution responsible for creating the record owns the record itself (that is, the record media, the paper, the computer disk, or tape). However, the patient has an ownership right in the *information* contained in the record. It is generally conceded that the patient owns the information in the record, as distinct from the record itself.

This interpretation has been under some degree of review, especially with regard to access rights and ownership of the patient record and patient information contained therein. In an important decision handed down by the Supreme Court in New South Wales, Australia; Breen vs. Williams, (Australian Law Making Directory, 1995: 87), the

ruling upheld that it is the doctor who owns the patient information and controls access to the information, therefore extinguishing patient access and ownership rights. This decision was further upheld by the High Court of Australia on appeal. The decision goes against the spirit of the ideas of patient rights and the freedom of information. This decision can be interpreted as the maintenance of the status quo, with the legal profession protecting the medical profession, a decision which was welcomed by the Australian Medical Association (J. Scott, 1994).

**The case of Breen v. Williams (1994)**

The important points of this case are shown in Figure 4-1.

Figure 4-1 Key rulings

(1) "There was no implied term in a contract between the doctor and a patient that the latter could have direct access to the information in the original material of the doctor's file on the patient.
(2) (by majority) A patient does not have any proprietary right and interest in the actual information contained in the records of his or her doctor.
(3) (by majority) No common law right of access to medical records arises from the International Covenant on Civil and Political Rights as the principles of that instrument, even if applicable, have not been incorporated into local law.
(4) (by majority) There is no innominate common law right in a patient to have direct access to his or her medical records kept by the patient's doctor.
(5) (by majority) A doctor's obligation to provide information to a patient concerning medical procedure does not give rise to an affirmative obligation to give the patient access to information about the patient in the doctor's records.
(6) (by majority) Though for some purposes the relationship between a doctor and patient is a fiduciary one which can give rise to applicable fiduciary duties, the relationship does not generate in a patient right to inspect the doctor's notes and records about the patient." (Australian Law Making Directory, 1995: 87)

Therefore, this ruling stands in contrast to the thinking advocated by Amatayakul and Wogan (1992: 63) who assert that

> ... a physician in private practice owns the physical record, but not the information in the record. Therefore, the physician cannot refuse the patient's request to forward information to another provider because, for example, the patient has not paid the physician's bill.

The ruling handed down in the Breen vs. Williams case goes against the idea of a shared patient record ideal since the information is seen as an economic advantage held by one physician over another and somewhat of a disadvantage if shared with other doctors or health care providers, as is further evidenced in the passage below:

> Justice John Bryson said doctors owned the notes they made about patients and such records were an economic advantage to the doctor in relation to further consultations with the patient. (J. Scott, 1994: 7)

Alternatively, if there is an economic advantage to be made from sharing the patient record information, physicians may be willing to share patient information. Consequently, court rulings such as the Breen vs Williams case can be seen as a possible reason for the resistance to computerise paper-based patient records in General Practice in Australia. It could be perceived as the first step in losing power and control over patient information in a growing electronically networked environment by helping to set up the means, that is the technology, by which government administrators and other actors may then demand the greater sharing of patient information and further information about practice operations. This is confirmed by Spri's claim that "today the patient record is used more and more as a planning instrument to steer and follow up the entire care process" (Spri, 1996: 12). Therefore, GPs in Australia may perceive this as a threat to their economic livelihood, since it could lead to a reduction in revenue through greater accountability in relation to the expenditure of public health care money on prescriptions, the ordering of tests and so forth. Presently, the publically funded

Australian Medicare System can be seen as a cash cow for GPs who engage in bulk billing practices since there are no limits to the amount of patients a GP can see, there is no ceiling or limit per GP. The more patients a GP can see the more money a GP can make.

In Australia, since GPs predominantly operate in private practice as opposed to direct public employment by the Federal Government, they are not covered by the Freedom of Information Act (1982) or the Privacy Act (1988) (O'Connor, 1996; G. MacKenzie, 1996). Both of these Acts only cover the public sector, i.e. Commonwealth Government Departments and their agencies. Leading up to the Federal Election in 1997 the Liberal National Coalition, then in opposition, contemplated extending the Privacy Act to cover both the public and private sectors. This could have lead to greater legislative controls over the collection, storage, handling, access and dissemination of personal information, but this did not occur after the opposition was elected to government. The Prime Minister, John Howard, after reconsidering the initial proposal, claimed that this would be an unnecessary red tape impost on the business sector (Van Leeuwen, 1997).

The Breen vs Williams case is therefore a significant test case in the historical landscape of patient record ownership and access rights issues in Australia. Doctors effectively have the right to refuse patient access to their medical files since the doctors own the notes they make about patients. Furthermore, "... the judgement supported the AMA's belief that medical records were the intellectual property of doctors." (J. Scott, 1994).

This would suggest a movement towards the idea of ascribing copyright protection to the patient/doctor record similar to the protection ascribed to the author of a book.

**Custodial responsibilities**

Another line of thought worth pursuing would also be to see if doctors were responsible for the medical records they kept and could therefore be held liable for any mistakes, deletions, and inaccuracies contained in the patient record, or the very loss of the record itself, since the doctor is deemed to own the record which may give rise to fiduciary duties on the doctor's behalf. Ownership does not necessarily mean that the doctor is not therefore responsible for the patient record. The doctor as such could be seen as having a fiduciary duty to look after the record and breaking this duty of care may have legal implications, for negligence. The CHR may also further help in the accountability, transparency and documentation process, which could be viewed as another reason why GPs may resist adopting CHRs since cases of negligence could become more transparent.

Many legal issues surround patient documentation, medical records and the (re)disclosure of health information (see, for example, Brandt, 1993; R. Scott, 1994; Roach, 1994). The computerisation of paper based records further serves only to open up a host of ownership and liability questions which may need to be tested in the courts in the years to come as cases present themselves. The CHR will itself need to be tested in a court of law to see whether it has the same legal standing as a paper based record. This is somewhat of a difficult issue to resolve since CHRs are a fundamental change in

information management, collection, storage, handling and distribution. Therefore, this implies some consequential and major changes to existing laws. Violation of a patient's rights may thus also need to be reviewed in a computerised environment and notions of crimes against patients, since a computer- related patient crime is distinctly different in process from more traditional forms of crime defined in existing laws.

In a computerised environment, there may also be a need to differentiate between the possible *types of records* which may be created as a result of using CHRs. This again has many legal, economic, political, health, organisational, technical and social implications. The patient record could become a source of information commodification for sale. Some doctors could see this as an opportunity to generate extra revenue as could patients offering to sell their information, depending on who owns the information in the first place. A royalty split could be envisioned between the doctor and the patient. The types of records which could be (de)constructed could possibly be broken down into the following categories (Table 4-2).

Table 4-2. Types of records

| Type | Description |
|---|---|
| Primary | The actual patient record used for health care provision, the CHR. This is the original. |
| Secondary | A subset record of the primary record (CHR) which may or may not be devoid of personal identifiers e.g. name, address, etc. |
| Derivatives | Other aggregated or non aggregated types of records and information products, e.g. epidemiological, insurance, political. |

In an environment where the "circle of confidentiality" is widening (Greisser et al., 1980: 11), scope exists for work to be conducted on various issues, not only patients' rights but the rights and responsibilities of all other health care providers (GPs being one such group) who (de)construct and access patient record information. The boundaries of these issues are not clear and need to be negotiated and debated. Possibly, rather than thinking about patient records in terms of proprietary rights, Greisser et al. (1980: 22-23) argue that a more *custodian* like model needs to be developed where the rights and responsibilities are shared by the stakeholders involved, possibly through an information or patient contract, for example. At first, this may appear to be an attractive development as the liability of risk for any one group becomes a shared risk which in turn may suggest that new risk insurance products might need to be developed. In terms of litigation, a very tangled web may develop and identifying the guilty party in an infringement may be harder in a shared model. But at least in such a situation there would be a contract between the doctor and patient which, in theory, could therefore give the patient a possibility to demand more legal and economic rights. It could also work the other way where patients may sell their information out of economic desperation, or be forced into selling, with possibly disastrous social consequences. GPs could also end up constructing derivative products from the records of patients having various conditions which they could then on-sell to insurance companies, employers, political parties and the like (e.g. information products relating to patients with AIDS, HIV, mental illness, alcohol and drug abuse problems etc.). Kluge (1994) has alluded to the fundamental epistemic and ontological changes in the role of the patient

record in health care delivery and the consequences of (un)ethical use of patient health data.

Donaldson and Lohr (1994) explore some of the various controversies which may arise as health database organisations develop. Ultimately, governments may have to step in and legislate what is socially acceptable and unacceptable with respect to appropriate use of health care information. Otherwise, it is quite possible to envisage a scenario where the health care sector may be reduced to a buyers and sellers market, characterised by information factories and warehouses (hospitals, GP practices, clinics, third party operators).

**A growing surveillance and control society**

Studies of technology have gradually shifted from utopian views of the subject matter (for example, Wells, 1905) to more reflective and social based explanations of the topic. The best known authors of the past who began to allude to alternative scenarios of technology based societies and the dangers of technology, as a manifestation of wider social developments, include Huxley (1932) and Orwell (1954).

While privacy is a more broader encompassing concept, including the freedom from surveillance, confidentiality can be seen as applying "... to situations in which information has been imparted to another person in circumstances where the confidant is aware of the special nature of the communication." (Tucker, 1992: 5). The concept of confidentiality essentially helps to classify information according to the way it is

communicated. One particular corner-stone of medical practice is the Hippocratic Oath (doctor-patient confidentiality), which gives stability to the foundation of medicine as an acceptable social discipline and practice. For this reason the social (de)construction of medicine can be viewed as the social (de)construction of processes (for example, documentational) which change through time, along with the meaning of medicine as is evidenced by the development of computers and CHR design and diffusion of late.

An information and communication based society offers new possibilities for electronic surveillance not previously possible through computer and telecommunication networks. Therefore, issues of privacy, surveillance and telematic security take on more prominence as a balance is sought between the needs of society and the needs of the individual. Patient information transmitted over telecommunications networks presents new threats, risks and vulnerabilities as opposed to paper records processes, which nevertheless also have security problems.

Hence, the issue of protecting patient information from being uniquely identified must remain a central concern when a more distributed patient record is able to be viewed by many health care providers. Unique identifiers may need to be removed or encrypted when personal and aggregated data is communicated through the health care system, otherwise, problems may occur whereby patients are discriminated against by insurers because of their health status, e.g. being HIV positive. Therefore, various aspects of information security need to be considered when handling patient information, this

includes, availability, integrity and confidentiality. These aspects need to be fundamental considerations in any CHR design approach and not an after thought.

Patient confidentiality is seen as a philosophical corner stone in the GP setting as evidenced by the Hippocratic Oath, whether this be in a paper or electronic based environment. If this doctor-patient confidentiality is eroded due to a widening circle of confidentiality then the basis and meaning of health and medicine, what patients can expect, may need to be reviewed and premised on a different belief altogether.

**Privacy protection**

Fundamental to this whole idea of information sharing is the concept of the right to privacy and self determination, despite there being no such recognised general right to privacy in Australian law (Tucker, 1992). Hardie (1994) provides an account of the Eleven Information Privacy Principles embodied within the Australian Privacy Act (1988) and the relevance of these principles for health information systems. Movement towards the ideal of a general right to privacy can be traced back to the UN's General Declaration on Human Rights, 1940s, and the International Covenant on Civil and Political Rights, 1960s, and through the initiatives of the OECD during the 1980s. Hence, this points to the importance of developing national privacy and freedom of information legislation and also appropriate regulatory bodies to oversee adherence to these laws. For example, Sweden has a long standing Data Protection Act, introduced in 1973, and an associated Data Inspection Board (Greisser et al., 1980: 147). Table 4-3

provides an overview of some international legislative developments in data protection and privacy.

Table 4-3 Legislation relating to data/privacy protection

| Country | Year of Introduction |
|---|---|
| Hesse (State within the Federal Republic of Germany | 1970 |
| Sweden | 1973 |
| USA | 1974 |
| Federal Republic of Germany | 1977 |
| France | 1978 |
| Denmark | 1978 |
| Austria | 1978 |
| Norway | 1978 |
| Australia | 1988 |
| New Zealand | 1993 |

Source: Greisser et al. (1980: 147) and Hardie (1994)

It can also be argued that a more sector specific approach to the development of health information privacy legislation (see, for example, New Zealand's Health Information Privacy Code, issued by the Privacy Commissioner, 1994) needs to be adopted, with the associated development of appropriate supervisory bodies to oversee these standards, as opposed to just relying on national privacy legislation. For example, in Australia, above and beyond just having a Federal Privacy Commissioner, a more sector specific Health Privacy Commissioner and regulatory body may need to be developed and implemented, especially if the existing privacy legislation is not extended to cover the private sector. Developments in health informatics suggest that this idea needs to be given serious consideration as the circle of confidentiality widens in a growing information network. As such, central to this networked environment is the legal

standing of CHRs and the associated rights and responsibilities of stakeholders. Otherwise, the fall-out from a free for all rush to obtain sensitive patient information may have disastrous consequences. In such a scenario, health information warehouses could become a standard practice (the existing situation in the USA is evidence of this for organisations already exist who collect patient information for sale and resale, (e.g. the Medical Information Bureau) and to package and repackage patient information for sale to anyone who is willing to pay, e.g. employers, insurers. Hence, the view of patient information as a market commodity is slowly gaining ground as the perceived uses and value of patient information increase in a competitive market culture.

Information supermarkets not unlike the physical supermarkets of today, could eventually develop which would sell all types of information products, in essence derived from individual records relating to, for example, health, tax, police, banking, education, telephone use, etc. Almost any organisation or individual who keeps records about other individuals would become a target/source for the information supermarket. This scenario could add another frame of meaning to the idea of an information economy; hence, the need for appropriate legislation to regulate such behaviour. Lack of policy vision or legislation can be a signal to market actors that a *laissez faire* attitude is acceptable.

**The changing meaning of the patient record in a computerised environment**

As illustrated by previous discussions, a reassessment of the structure and meaning of the patient health record is needed for the computer environment. A paper based record

and structure is conceptually different in a computerised environment. The motivations for CHRs are significantly different from those behind keeping paper records. The patient record in a computerised environment is perceived in a different way; it is not the patient record as perceived in a paper environment. Rector et al. (1992: 59) argue that:

> the design of many existing electronic medical records derives, implicitly or explicitly, from support for the use of aggregated data for research, audit, finance, or planning. We maintain that such designs are inappropriate for a record for clinical use and, ultimately inadequate. While the use of aggregated data presents important requirements to any medical record system, clinical information, as it is generated and used during patient care, is the only sound basis for a model of the medical record.

This is a significant point. It indicates a tension between the motivation behind having CHRs and the motivation behind keeping patient records in the first place. The use of CHRs restructures existing patient records in that information can be sorted and organised differently to that of paper records; but this is not to say that CHRs cannot be designed to support patient care, as Rector et al. suggest.

Rector et al. (1992) go on to suggest that prescriptive approaches, such as Weed's (1969) Problem Oriented Medical Record (POR), are inappropriate for CHR design. Rather a more descriptive approach is advocated, for example, in a doctor-patient encounter, the focus should be on what is said rather than what the doctor should have to do, as determined by the structure of the patient record. Historically, patient record structure is most often based on the POR, attributed to Weed (1969). As suggested, the focus and structure of Weed's system is upon problems and problem lists. It is significant to point out that "a major goal of Weed's work was to facilitate computerization of medical records ..." (Rector et al., 1992: 63). Despite the initial

appeal of such an approach, Weed's system is not unproblematic, for the very idea of defining what a problem actually is, rather than what it appears to be, complicates matters. For example, what may be diagnosed as a problem of chest pain may really be a heart attack. Therefore, a prescriptive approach to problems may detract from a more descriptive way of thinking not just about the problem but health in general. But this is the difficulty faced by any taxonomy in that prescriptive approaches do not necessarily describe what is actually happening. Debate over an appropriate structure has been continuing over the years, as have the wars over coding and the use of a standardised data dictionary for medicine. Many variants have developed as a result, for example, Systematised Nomenclature of Human and Veterinary Medicine (SNOMED), International Classification of Diseases Clinical Modification of the Ninth Revision (ICD-9-CM), International Classification of Diseases Tenth Revision (ICD-10), Unified Medical Language System (UMLS), Read Clinical Classification (RCC), and the International Classification of Primary Care (ICPC). Cimino (1995) advocates the need for a universal coding system.

Weed (1991) himself calls for a fundamental restructuring of the patient record by placing greater emphasis upon the idea of knowledge coupling, i.e. bringing disparate medical knowledge domains together in real time applications. Linnarsson (1993) argues that a structured and standardised CHR, consisting of a patient database, a data dictionary and a medical knowledge base, is needed. The key which links this all together is a standardised data dictionary or vocabulary; hence the coding wars, and the quest to develop a widely excepted nomenclature for medicine. Otherwise, without a common

standard of classification, a host of disparate systems will continue to develop, making it much more difficult to conduct any form of national audits or comparisons. It would be like trying to compare apples with oranges.

Some digression into history is needed to understand where the CHR is today and how the idea (d)evolved. According to Peterson and Gerden-Jelger (1988) the first use of computers to store patient data occurred during the 1950s in the USA. The potential role of computers in medical practice has been accepted ever since the early 1960s (Best, 1962). Collen (1974, 1995) provides a seminal account on the historical development of medical informatics in the USA as well as hospital computer systems, of late, more commonly referred to as hospital information systems. Makanjuola (1993: 71) indicates that "these systems were initially developed most prominently in the laboratory services" and experimentation in the hospital environment during the 1960s gave way to greater use of computerised medical records in hospitals during the 1970s. With the advent and proliferation of personal computers in the 1980s and a gradual move away from cost heavy, centralised mainframe systems, it can be argued that similar types of experimentation slowly began to occur in smaller scale health centres and General Practice environments with cheaper personal computer systems. Jayasuriya (1993) concurs, arguing that computing has typically focused on hospitals and that there is a need to focus more attention on community based information systems to avoid the development of fragmented and uncoordinated systems. Likewise, more attention at the macro level has been placed upon the idea of developing national health information systems.

Moidu (1993b: 39) argues that this should be through a micro scale, bottom up approach, the reasoning being that "the weakness of the National Health Information Systems is due in part to the lack of attention to the information infrastructure at primary health care centres, the site of the first and perhaps the most numerous encounters between the patient and the health care system." One problem, with the bottom- up approach, alluded to by Jayasuriya (1993), is that it could lead to a wide disparity of incompatible systems being developed at various primary care centres which a more standardised, national top-down policy approach could overcome. As mentioned, development of a national health information system also implies an associated development of a national information and (tele)communications infrastructure, i.e. the information and communication technology which allows for the collection, storage, processing and dissemination of information among health care actors and others. Whether a top-down (macro) or bottom-up (micro) approach is more appropriate is debatable, but for a more coordinated national approach to health care, a standardised, top-down approach would appear to be preferable.

It is of interest to reflect for a moment upon the diffusion of hospital information systems, to see if any similarities/differences can be drawn to the development and diffusion of CHRs in General Practice settings. Will the development of hospital information systems reflect similar patterns of development and diffusion in General Practice environments? Over the past decades, varying degrees of computerisation have existed in hospital settings. This would therefore point to varying rates of diffusion,

indicating that the process of diffusion is not uniform but rather differential. As Makanjuola (1993: 71) states, " initially, systems were developed in a piece-meal fashion to cater for individual institutions' needs. Nowadays, standardised systems are available also, which can be easily adapted to any institution's requirements." Whether a standard system can be easily adapted is debatable, a situation which resounds of the *adapt* versus *adopt* argument in system design where systems are either designed around the users' needs and wants or the users have to adapt to a standard system.

The experience to date of Australian GPs with CHR diffusion appears to have some similarities with, for example, the general Nigerian experience with computer diffusion. Adelakun (1993: 94) states that the biggest problem for diffusion seems to be the overall costs involved in the purchase of hardware, software, peripherals and on-going maintenance. It is not just the purchase of a computer but also the various associated extra on-going costs that need to be taken into account, i.e. the hidden costs, such as printers, peripherals and maintenance (O'Toole, 1988). The big picture costs seem to take on a snowball effect over time, from a single PC to a multi user Local Area Network (LAN) system. Hence, GPs may be suspicious of the hard sell by computer companies wanting to sell their merchandise. Another suggestion which can be adopted from Adelakun (1993: 97) is that the Federal Government develop software, in this case in conjunction with GPs, to be "... sold at a low price or it could be distributed free (public domain)." This is similar to the experience of the USA's Department of Veterans Affairs which developed an integrated public domain hospital computer program, written in the MUMPS programming language, which included a medical records

component (Houser, 1985). One major benefit is that the software is hardware independent and can be customised using the Department's of Veterans Affairs software tools to suit various local settings, as illustrated by the Egyptian (Ibrahim and Elhattab, 1993) and Nigerian experiences (Daini et al., 1993). Nevertheless, a certain amount of source dependency is still evident. People need to learn from the source how to use the software. Otherwise, funding for CHRs is generally at the GP's expense, unless some sort of contribution can be gained from drug companies, for example. Other funding possibilities include cost sharing through some joint project grant/donation schemes from government, professional bodies (e.g. AMA, RACGP, HISA), CHR software developers and GPs themselves.

# CHAPTER FIVE

# MEDICINE, HEALTH AND TECHNOLOGY

## Some interpretation of history and epistemology: what is the philosophy of medicine?

The concept and practice of medicine, as recorded and interpreted in traditional annals of history, can be traced back to the ancient Greeks. History indicates that Hippocrates ($5^{th}$ century B.C) is regarded as being the founder of medicine (Van Bemmel et al., 1997). It has been acknowledged that Hippocrates looked at the concept of human disease from a more holistic standpoint, which relates to both the external and internal environments of an individual (Agreus, 1993). Thus, it can be agued that what Hippocrates was really referring to was health rather than just medicine. This more holistic viewpoint can be seen in the existing definition of health given by the WHO as presented in the beginning of Chapter One.

Agreus (1993: 12-22) following Talley (1986) provides an interesting historical account of the development of epidemiology and the concept of dyspepsia. The actual meaning of dyspepsia is somewhat arbitrary at this stage as the following story told in a simplified way, will try to demonstrate.

> ... in the $16^{th}$ century, the Royal College of Physicians still accepted Galen's (131-200 A.D) classical teaching that food was concocted in the stomach, and that the diaphragm acted as a partition to protect the heart from resulting vapours. Dyspepsia was thought to result from too little innate heat or too much food. (Agreus, 1993: 12-13)

In the $17^{th}$ century, "most physicians still believed in magic, evil spirits and mythology as a cause of illness ... the scientific paradigms totally changed in the $18^{th}$ and $19^{th}$ century, and physiological studies on gastrointestinal tract were performed." (Agreus,

1993: 15). Much contradiction continued during this time, dyspepsia was "classified as either a dietary or a moral problem in the middle of the 19th century, not far from the theories of the ancient Greeks." (Agreus, 1993: 15). With the discovery of X-rays and the development of the gastroscope in the 1930s dyspepsia was reinterpreted due to the diagnostic possibilities offered by these medical technologies. In 1945 the term "non-ulcer dyspepsia" was introduced into the medical literature and more recent terms such as "helicobacter pylori" have also been added. (Agreus, 1993: 15)

The key ideas of this story are significant. Essentially, the meanings of dyspepsia have changed through time but more so as a result of the construction of a number of medical technologies, e.g. the gastroscope and X-rays. This supports the arguments of O. Berg (1997) that medical practice and its problems are inextricably linked with the emergence of different medical artifacts and that disease definitions change, which in turn shape the way medicine is practiced. What is to say that different technologies could not have been constructed, or discovered which would, or could, lead to totally different interpretations of dyspepsia? Therefore, the idea and meaning of dyspepsia have been socially (de)constructed by medical actors and their artifacts through time and different terms have been constructed to reflect the different interpretations and meanings of the idea, e.g. non-ulcer dyspepsia and helicobacter pylori. This would suggest a close association between technological artifacts and the subsequent meanings which are constructed for disease and illness. One can begin to question the expertness of medical knowledge since, essentially, medicine and the meanings given to disease are a social (re)construction which reflect the wider developments and concerns in society at

particular points in a time continuum (see also, Rifkin and Martin, 1998; Dingelstad et al., 1996).

Similar arguments have been presented by Latour and Woolgar (1979) about microscopes in the laboratory. The artifacts inherently reflect the meanings that are constructed for the ideas and vice versa. The idea could not have been derived without the artifact. This may also indicate why the rise of alternative medicine should be seen as an equally valid construction of the meaning of medicine, as opposed to traditional clinical based medicine; something that the traditional medical profession may see as a threat to their power base by another group of actors who challenge established medical thought and practice. Hence, conflict over meanings is an inherent manifestation within society. Deconstruction of traditional meanings can lead to a disequilibrium or entrenchment in the status quo as actors struggle to reposition themselves as different epistemological paradigms emerge.

This is an important conceptual and epistemological point which needs greater discussion since it is the basis for the (de)construction of epistemological thought in society through time. This can be conceptualised as the continual attempt by actors to try and demystify the unknown, or reposition the known, in order to give meaning to phenomena and what is perceived as social structure. Therefore, by definition, since everything is founded on human perceptions of the world, there can never really be established canons of tradition. This is really only a pretence fabricated by dominant actors and groups (e.g. the Church, the medical profession, etc.) to maintain power and

status in society. Scientific and medical rationalism is therefore seen as scientific, entrenched by empiricism, experiments and technics, only so long as people believe and perceive it that way (Kuhn, 1970). Literature, information, education and the media therefore take on more of a propaganda role for controlling society, through television, radio, newspapers, magazines, books and journals (Fiske, 1987, 1989). These are some of the very issues explored by authors such as Foucault (1970, 1980), Habermas (1971) and Law (1991) who have looked at the issues of knowledge, technology, cultural criticism and power structures in society. The work of McLuhan (1964) and the idea of the "global village" can be coupled with this thinking. The control and ownership of the media are issues of significance in a global control power structure. Wirten (1998: 27) indicates that eight media conglomerates basically control most of the publishing which occurs in the world today, of which four are entirely privately held.

From a socio-political approach based on game theory, the work of Morrow (1990), for example, can be informative. Research work which attempts to challenge tradition and disciplinary actors and boundaries, or what is perceived to be tradition, will have to use a certain amount of what has been established as tradition by the scientific method and scientific empiricism in order to be accepted or infiltrated into empirical rationalist circles and disciplines. Otherwise, the research is preaching to the already converted and only following and helping to entrench a certain dogmatic tradition. For example, this can be seen in the selection process of journals a researcher selects to publish in and which conferences one attempts to diffuse one's ideas within. The editors, reviewers (censors) and scientific committees play a very crucial role here since they are the

gatekeepers of epistemology in their field. They decide whether a certain research idea will be published (diffused) or not, based on their subjective perceptions whether the ideas threaten or maintain the status quo, much like judges and juries where the lawyers argue in order to try and persuade the judge and jury to see events in a certain way. The work of Martin (1988) on the concept of intellectual suppression is informative in this respect. History is filled with what can be seen as socio-political struggles which reflect this inherent hegemonic tension, e.g. strikes, protest rallies, civil wars, revolution, national and world wars. Copernicus and his idea of a heliocentric universe is a classic example of an epistemological conflict and struggle against the Church, the established authority on epistemology at that time in society. Therefore, knowledge creation, as with research creation, has a socio-political diffusion context. It does not just happen in a socio-political vacuum; there are reasons for and against its diffusion and creation. More recent trends of the 1980s and 1990s seem to indicate that economic rationalist paradigms adopted by governments dictate what is possible and what is not. For example, this doctoral dissertation would not have been possible without financial assistance, directly and indirectly. This also has an influence on the methodological design adopted as well as access to resources. Discussion of these issues is often neglected in scientific doctoral dissertations, but something that is encouraged in the humanities (see, for example, Tjora, 1997; Wirten, 1998). Greater emphasis needs to be placed on a more descriptive style of explaining and positioning research problems within a wider socio-political context.

Kuhn (1957, 1970) discusses the tension between scientific tradition and change. Winner (1977, 1980, 1991), Mumford (1984, 1987), MacKenzie and Wajcman (1985) also examine technics, system design, civilisation and the myths which have built up around the scientific tradition and machines. Hughes (1988) extends this thinking about technical developments as being part of a larger system of technical development in society, what Rogers (1995) essentially refers to as technology clusters. This is also referred to as socio-technical thought, conceptualised as technical issues being social issues and vice versa (Bijker, 1995). It is argued that technology is essentially a social construction and not some mystical self determining technical phenomenon.

Some clarification in regards to terminology needs to be made at this point. It is argued in this thesis that a socio-political approach is a more reflective umbrella term for the process of (de)construction of technology design and diffusion. The terms socio-economic or socio-technical may be considered as part of this genre but they are considered more as subsets of the broader term socio-politics. This is based on the reasoning that political ideology shapes, and in turn is itself shaped by social structure and the modes of economic production people engage in. This is based on the political thinking attributed to Marx, but importantly political ideology in this context is not seen as an independent variable determining social structure and economic modes of production.

## Chronology of some selective CHR developments

The Figures 5-1 and 5-2 provide a chronological arranged selection of some key studies, conferences and reports which have contributed to the CHR debate at the international and at the Australian level.

Figure 5-1. Global developments

* Micros for GPs scheme in the UK, established in 1972 by the UK Government

* The First Medical Informatics Conference, MEDINFO, was held in 1974 in Stockholm, Sweden, sponsored by The International Federation for Information Processing (IFIP)

* The International Medical Informatics Association (IMIA) was established in 1978

* The Institute of Medicine (1991) published *The Computer-Based Patient Record - An Essential Technology for Health Care*. Dick, RS., Steen, EB., (Eds.) National Academy Press. Washington DC.

Figure 5-2. Australian reports, discussion and issues papers, CHR developments and GP studies

* Royal Australian College of General Practitioners (1985) *The Vision of General Practice Now and in 1995*. Arthur Anderson and Co. Melbourne

* Andersen et al., (eds.) (1986) General Practice in Australia

* Crampton, M., Lord, T. (1988) *Standards for Computerised Medical Records Systems*. Royal Australian College of General Practitioners

* O'Toole, C. (1988) *Computerised Medical Records*. Thesis. Deakin University. Australia.

* Crampton, M. (1990) Survey of RACGP Members' Use and Attitudes Towards Medical Practice Computing. In *RACGP 1990 Computer Conference*, Sydney

* MacIsaac, P., Lord, T., Crampton, M., Kidd, M., Farish, M., Caeilli, J. (1990) *Computer Assisted Practice Project (CAPP) Report*. The Royal Australian College of General Practitioners

* Douglas, R., Saltman, D. (1991) *W(h)ither Australian General Practice?*. National Centre for Epidemiology and Population Health. Canberra.

* Walker, D., Crampton, M., Kidd, M., Adkins, P., Carson, N., Cesnik, B., Coffey, G., Cooper, B., Elderfield, H., Falherty, G., Frank, O., Hickson, N., Liaw, T., Lord, T., MacIsaac, P., Pradhan, M., Ravet, J., Saltman, D., Talty, T. (1991) *Health Information Issues in General Practice in Australia: NCEPH Discussion Paper Number 2*. National Centre for Epidemiology and Population Health; The Australian National University. Canberra

* Commonwealth Department of Health, Housing and Community Services (1992) *A Healthy Future - Guidelines for Demonstration Practice Grants*. AGPS. Canberra

* National Health Strategy Unit (1992) National Health Strategy: The Future of General Practice. Issues paper , no. 3. Melbourne

* Commonwealth Department of Human Services and Health (1993) *Improving Information Management in General Practice; A Discussion Paper*. AGPS. Canberra

* Divisions of General Practice established in Australia (1992) by the Federal Government for the gradual devolution of health care to a more local and regional level, district health area services, hospitals and GPs, approximately 115 GP Divisions of General Practice exist around Australia

* Bridges-Webb et al., (1992, 1993) Morbidity and Treatment in General Practice in Australia

* Cacek, J. (1994) *A Survey of the Attitudes of Australian General Practitioners to Computerisation of Medical Records*. Masters Thesis. Department of Community Medicine, Monash University. Australia

* MacIsaac, P., Crampton, M., Kidd, M. (1994) *Computer Assisted Practice Project 1986-1993*. The Royal Australian College of General Practitioners. South Melbourne. Victoria

* Bolton, P., Gay, G. (1995) Review of Computer Usage Among RACGP Members

* Commonwealth Department of Health and Family Services (1996) *General Practice in Australia: 1996*.

* AC Nielsen Report (1998), *A Study into the Levels of, and Attitudes Towards Information Technology in General Practice*

* General Practice Strategy Review Group (1998) *General Practice: Changing the Future Through Partnerships*

* Commonwealth Department of Health and Aged Care (1999) *The Australian Coordinated Care Trials*. Publications Production Unit (Public Affairs, Parliamentary and Access Branch). Canberra

### Some comments about the Australian scene

The General Practice Strategy vision in Australia began in the 1980s and has gradually gained greater recognition and relevance as a vehicle for health reform. This has mainly involved negotiations between the AMA, RACGP and the Federal Government. It would appear that a great number of discussion papers, reports, and studies have been published since 1991. The main impetus for this sudden movement would appear to be a series of overseas events, primarily the work of the IOM and their landmark study into the computer-based patient record. The only publication work of any significance in this context before this time were the RACGP study (1985) and the CAPP (1986-

1990) project. These spawned the work of O'Toole (1988), Crampton and Lord (1988) and the Crampton (1990) RACGP survey. It must be noted that, despite chronological appearances, some of the work may have been stimulated by events in the USA prior to publication of the IOM's report in 1991. This also needs to be seen in the broader context of initiatives which took place in the UK and Europe such as the work of IFIP and IMIA and, prior to the work of the IOM, the work of Greisser et al. (1980) on data protection in health information systems. Another significant initiative was the UK Government's "Micros for GPs" scheme, established in 1972, which, after a long period, received an injection from the government of 24 million pounds in 1989, to allow GPs to purchase computers and software (O'Toole, 1988; Roberts, 1991). Tied into this initiative was the Government supported development of Read Codes, to try and structure the clinical input of medical terms used by GPs in their computer systems (Read and Bensen, 1986) to allow analysis of clinical data, (un)aggregated, so as to help in health service planning, epidemiological research and auditing.

The RACGP (1985) study revealed that 54% of the RACGP respondents viewed computers as having some potential to improve practice management but not clinical records. Only 19% agreed that computerising patient records would improve the quality of patient care and only 14% supported the sharing of information among other health care actors. Also of interest was that only 20% of RACGP respondents agreed that patients had a right to see their entire record.

O'Toole (1988) provides an initial attempt to document the field of medical record computing in Australia from a GP's point of view. O'Toole argues that the generalist practitioner of the 1980s faces a situation of growing information overload relative to practitioners in previous periods. This tension is characterised as the generalist-specialist dichotomy with ever increasing levels of specialisation and the fragmentation of knowledge. One attempt to try and deal with this information processing dilemma is through the use of computer technology. Indeed, somewhat optimistically, O'Toole argues that the computer is the answer to these problems.

The Computer Assisted Practice Project (CAPP) represents one of the largest attempts to explore computer implementation and use issues in General Practice Australia. It is from this study that a number of various spin-offs continue to have relevance even to the present day, e.g. computerised prescribing, computer age/sex/disease registers, computerised drug databases, attitude surveys, coding and standards issues. Conducted over a five year period (1986-1990) the CAPP study primarily consisted of a number of sub-projects. In essence, 22 general practices across Australia were evaluated for their use of a practice computer system, (*Medrecord*), and their opinions and experiences were analysed using both qualitative and quantitative methods. The project showed that computerised accounting and medical records achieved a high level of acceptance among doctors, staff and patients. This was followed up by a report in 1994 by the RACGP which extended the project timeline (1986-1993) and focused somewhat more on the usage and problems surrounding computer records. The main problems identified centred around data entry, accidental data loss and presentation.

Also of significance was the national survey of computer use among RACGP members by Crampton (1990). The basic finding was that 41% of GPs used a computer in their general practices for such activities as accounts, billing, word processing, but only 2% used computers for clinical purposes. Younger GPs and those in group practices were more likely to use computers. Also, cost had a bearing on the attitudes of GPs towards use of computers.

Other relevant surveys which have looked at various aspects of computerisation in General Practice in Australia include the work of Douglas and Saltman (1991), Liaw (1992), Fry (1993), Cacek (1994) and Bolton and Gay (1995). The Cacek, Bolton and Gay results will be discussed further in Chapter Twelve. In the Douglas and Saltman (1991) study of 1900 GPs, respondents indicated they used computers mainly for front desk type applications such as accounts (34%) or wordprocessing (33%) while only 5% used the computer for recording clinical information. Furthermore, many GPs were found to be using traditional, paper based 8" x 5" cards and less than half were using any accredited medical records system at all.

Although slight variations exist among the studies it is generally accepted that 40-50% of general practices have computers but only around 2-10% use them for clinical purposes. By comparison over 60% of GPs in the Netherlands and the UK are said to be using CHRs (Hayes, 1993; Miller and Britt, 1993).

The work of Bridges-Webb et al. (1992, 1993) is also relevant in relation to discussions of morbidity and treatment in Australian general practice with the aim of trying to introduce epidemiological research to the general practice audience and to show how the use of computerised medical information systems can aid in this process. The main focus of the studies is the idea that the data gathered may be used to analyse prevalence of disease and thus help in the evaluation of health needs and services by tracking morbidity patterns over time.

**Why the paradox: decreased size, increased speed, portability and decreasing cost?**

It has been argued in the past by various authors (e.g. Engelbrecht, 1986) that the cost of computers, CHR systems and peripherals has been prohibitive and that the purchase of such a system is a large capital investment in the GP setting. This was the argument in the 1980s and still seems to be the same argument in the 1990s, despite the decrease in cost of personal computers and the increase in speed, memory, and portability. This would indicate that there must be more to adoption or non-adoption than just the issue of cost. Engelbrecht (1986) and Koyama (1986), for example, have suggested that the problem is also one of ergonomics and the way information is presented on the screen to the user. Others suggest that a combination of human resource issues such as computer training, support and lack of a national informatics policy/strategy are major barriers (Mandil et al., 1988; Byass ,1993). Walker (1993) further suggests that the problems are associated with the entering of data at the source and the time taken to do this, which are seen to be foreign and distracting to GPs. Also, problems with hardware and software, breakdowns, obsoleteness, and the extra effort required in learning how to use a

computer and the software need to be considered. This too would indicate that the design and diffusion puzzle is something more complex than just a cost issue.

### Health economics

Ever since the 1980s, and especially in the 1990s, health care has come under closer economic scrutiny and reform in such societies as the United Kingdom, Sweden, Germany, Netherlands and The United States of America. The term health economics is reflective of this approach (see for example, Haraldson, 1987; Sundberg, 1992, 1996; Spri, 1996). This approach to health care has a number of significant implications: health is essentially reduced to a market system, the buying and selling of health care products among actors (e.g. GPs, patients, hospitals); of the development of contracts between purchasers and providers; cost reduction measures; greater auditing; and standardisation of reporting and competition. The growing push by governments for economic reform, cost capping and changes in health systems is also perceived by some as a threat to the quality of health care (see for example, Calltorp, 1989). The concept of Diagnosis Related Groupings (DRGs), an American developed idea stemming from the 1960s, is part of this genre (Spri, 1989; Fetter, 1991). Essentially DRGs and various derivatives, such as case mix (see, for example, Hovenga, 1995) are an attempt to measure the cost of inputs and outputs of health care production, delivered care, within the hospital environment. Ljunggren (1998) provides a useful account of how this has affected perceptions of the quality of health care in Sweden, concluding that implemented changes in health care have negatively affected patient experiences of received care.

It can be argued that what the DRG is for the hospital system the CHR is for the health care system. It therefore, follows that the diffusion of CHRs may be a vital part of the health economics approach in trying to control the production costs of health care. Without the widespread adoption and use of CHRs, trying to control the process and cost of health care will continue to be difficult. In some ways, a health economics approach is one way of trying to demystify the health care process by finding out what is actually happening and where public money is being spent through the use of empirical data. Using only quantitative methods does have limitations however, and would therefore suggest the use of a combination of qualitative and quantitative approaches to understanding health care. Otherwise the whole process may become a political exercise justified solely through empiricism and econometrics. Having a *whole bunch* of numbers and econometric formulas can become very meaningless unless they are interpreted within a broader socio-political context, coupling the numbers with the reasons for why, how and by whom they are constructed and interpreted for in the first place. Table 5-1 offers some selected rates of expenditure on health as a percentage of Gross Domestic Production (GDP) in different countries for 1995.

Table 5-1. Cost of health care

| Country | % of GDP |
|---|---|
| Australia | 8.4 |
| UK | 6.9 |
| USA | 14.5 |
| Germany | 9.6 |
| France | 9.9 |
| Netherlands | 8.8 |
| Sweden | 7.7 |

Source: Compiled from OECD Health Data 1996

As previously mentioned, numerical approaches only present one view of events and must therefore be interpreted in their broader social and political context. One should also be careful about comparing numbers since it may be like trying to compare apples with oranges due to the differing political, ideological, cultural, economic, legal, accounting, health ideals, population sizes and other standards. For example, a high rate of health care expenditure may be reflective of a political and social philosophy that health care is an important ideal worth supporting despite the cost, in which case it may not be regarded as important that it is too high compared to other countries or that it is a cost burden on society. This type of argument is apparent in Berleen et al. (1992). It can also be argued that health care is a social obligation for governments and employers, irrespective of the costs involved in looking after the work force, as due return for the controlled engagement and use of labour in the pursuit of organisational profit. National priorities and cost cutting are thus socio-political constructions by societal actors as issues which are deemed to be in need of attention, for example, health, privacy, automobile safety, consumer protection, pollution levels and the environment. Similar concepts exist in the telecommunications field such as the idea of universal service for all citizens irrespective of geographic location and cost and can be seen as the original philosophy behind the Australian Medicare System to provide comprehensive health care for all Australians. This ideal has of late come under attack as more economic and cost cutting approaches are being applied to health and other areas. Health is being made to appear as a growing, unsustainable economic burden for the state; changes are therefore being advocated to control rising health care costs.

Confusion also exists in the idea that economic progress equates to social progress, or vice versa. Fundamental to all socially based concepts of health is the health of a population. Without a healthy population all else is somewhat superfluous. This is also a reason why automation has been so prolific in the past since machines are not as susceptible to health problems and variance as people. The very definition or conceptualisation of health also needs careful attention. Following along the lines of the WHO's idea of health, it can also be conceptualised as having a cultural and educational component that is education and cultural activities are a part of health and well being. In Sweden, for example, health and social work is the single largest industry in the country, employing some 819 000 people (Statistics Sweden, 1997: 332). Careful analysis of the literature also reveals that health is organised and administered in a decentralised way through bodies called *Landstinget* which are situated in each of the twenty-five Counties (län). Sweden has three levels of administration: State (1), County (25), Community (288+). *Landstinget* amongst other things is responsible for coordination of health, culture and education in the respective County. This can be interpreted as evidence of having a broader social based conceptualisation of health. Health is not just a physical manifestation or the absence of disease, but also a state of social, educational, cultural and economic well being. The main danger in CHR design and diffusion is that CHRs could be used as a means to reduce cost of care and thus the standard of health care received by patients. Careful consideration is therefore needed in this respect. A greater sociology of health approach is needed within health economics (Ashmore et al., 1989). The design and diffusion of CHRs do represent an opportunity for the process of health care to become more transparent and accountable through improved documentation and

access to information but this should not occur at the cost of decreased patient health care. Otherwise, the whole economic system will suffer as indicated by Shortliffe et al., (1992: 285), "Savvy leaders in the private sectors are quite aware that their future success depends on a healthy and productive work force." Therefore, the design and diffusion of CHRs can further be considered to have bearing on economic and market policy and should not be seen in isolation from other issues. With respect to GP demand and supply issues, more competitive practices may be instigated by the push for CHRs which could lead to a rationalisation of GP numbers and resource allocations. Non-adopters may be squeezed out of the market place by actors adopting more competitive practices. This then prompts the questions:

- what is a socially acceptable minimum standard of health care?
- will GP rationalisation be an outcome of using more competitive practices, government cost capping and what the market will sustain at certain points in time?
- do people want to live in a society with a health care system which is continually under the microscope of outcomes management?

**Primary health care: why is it so important?**

The concept of primary health care, to provide an acceptable state of well being to the population, was described in the 1978 Alma Ata Declaration, but this is not to say that other interpretations of health do not exist. In the declaration is a plan of action for the delivery of health care, including a section on the role and flow of information (article 108), which has been adopted by many Member States of the WHO, including Australia and Sweden (WHO, 1978). Primary health care appears to be a key feature of many

health care systems in both industrialised and developing nations. This often involves a centralised top-down structure: a ministry of health which includes administrators, policy makers and strategists, hospitals (public and private), and primary health care centres, i.e. regional health centres/clinics, including generalist and specialist practice. Staffing patterns vary as do locational settings and modes of delivery, e.g. mobile units, telemedicine. Central to this whole system and the delivery of national health care services, however, is the need for information and procedures for handling the collection, storage, retrieval and dissemination of information by various actors (planners, administrators, strategists, policy makers, nurses, GPs, patients, etc.). In such a context, CHRs present actors with a variety of opportunities and threats requiring choices about what the technology is to mean and how it is to be shaped, accepted and diffused and which, when adopted on a wider scale, will restructure the way GPs work, from their existing modes and patterns of work behaviour, paper based patient records, to a different way of not just storing patient records but to a different way of working and looking at health care delivery.

The deployment of computer technology in general presents these actors with a number of choices, for computers are perceived as having the potential to transform society just as Guttenberg's printing press did in the 16$^{th}$ century. This has many implications far beyond the health care setting. The very processes of society can be changed, e.g. processes of learning, information evaluation, work, economic production, politics, war, religion, ideology, etc. This transformation has been characterised in the literature under many labels. Beniger (1986: 4-5) provides a useful overview of those which have been

used by various authors over the decades in order to describe this transformation, e.g. the information age, the information economy and the information society. There exist many critics and proponents of this paradigm (e.g. Porat, 1977; Machlup, 1980; Toffler 1980; Eliasson, 1990; Lamberton, 1990; Forester, 1992; Kling, 1995 and Webster, 1995, to name but a few). Also, bound up within the information revolution thinking are interesting questions or debates over both the relationship between technology and society and the role of technology in society and whether the computer is more than just a neutral tool to be used for economic production in one way or another by human actors, as it is portrayed in much of the technical and medical informatics literature.

Some authors (e.g. Winner, 1980), as mentioned earlier in Chapter Two, argue that technology is inherently political, such that, it embodies certain design and living ideals, for example, bridges, bicycles, cups, computers. These all represent an attempt to organise and structure human behaviour and production. Therefore, the computer can effectively be seen as an actor itself, entrenching a habitual pattern of behaviour over time within a schema or network of actor relationships, despite it being an inanimate object in social structure.

# CHAPTER SIX

# MEDICAL INFORMATICS VERSUS HEALTH INFORMATICS

## The origin of medical informatics

From an international perspective it is important to look at the role of the WHO. The WHO is an agency of the United Nations (UN) responsible for health matters since 1948. In 1979, the WHO indicated the shortcomings of national health information systems in developing countries (WHO, 1979). In 1988, it published a report on informatics and telematics in health (Mandil et al., 1988). The report basically emphasises the need for national informatics policy and strategy rather than a *laissez faire* approach to the issue. The report itself can be interpreted as a vision statement with a very pro-technology bias with some mention of social issues. The WHO has also engaged in a year 2000 document series, "Implementation of the Global Strategy for Health for All by the Year 2000" (WHO, 1993). These year 2000 documents seem to be characteristic of the late 1980s and 1990s. As to how much utility these documents actually have is open to debate, the health for all vision by the year 2000 seems to be somewhat optimistic in its forecasts.

In 1974, the First World Medical Informatics Conference, MEDINFO, was convened by the International Federation for Information Processing (IFIP). The conference was held in Stockholm, Sweden (Anderson and Forsythe, 1974). The conference proceedings provide interesting insights into the sentiments and thinking at that time about medical informatics. It is evident that the issues and problems faced with the introduction of computers in the 1950s and 1960s seem to be the same type of problems and issues still

being discussed in the 1990s, for example, implementation experiences, trends, policies for computer introduction in health settings, management tactics for the introduction of computers, security, confidentiality, surveillance and education. Though the times and situations have changed, along with the social structure, the themes appear to be recurring.

In 1993, the First International Conference on Health Informatics in Africa, HELINA 93, was convened by IMIA and co-sponsored by The WHO in Nigeria (Mandil et al., 1993). The conference proceedings provide both a situational report of developments in Africa and elsewhere which follow on the vision advocated in the 1988 WHO report (Mandil et al., 1988). As indicated in the keynote address given by Mandil (1993: 3-8) the main health informatics lessons and experiences to date "... are many and varied: political, managerial and technical." (Mandil, 1993: 7). Basically Mandil argues that: technology is appropriate for developing countries; success stories outweigh failures; there is a need for national policy and strategy as well as a need for training and skills development. Other relevant work which has been conducted on the state of computing and health informatics in developing countries includes Mandil (1983), Kholy and Mandil (1984) and Forster (1990). As evidenced by the convening of HELINA 93, health informatics is not just an area of interest to developed nations but can be seen as a theme unifying all nations, developed and developing, in the pursuit of better health care.

**Computers and CHRs in health care: push, pull or neither?**

As mentioned, from the 1950s to the 1980s, greater computer experimentation occurred in various hospital health settings. With the advent of the personal computers in the 1980s, experimentation possibilities grew in smaller scale decentralised health care settings such as health clinics and general practices. This represented a marked shift from cost heavy centralised mainframes and mini-computers to more decentralised personal computer systems. The 1990s have as such seen a greater worldwide focus on personal computer CHR diffusion mainly from an economic and information management standpoint, i.e. the push for health outcomes, measures, DRGs, comparative indicators, cost cutting, hospital restructuring, hospital mergers, service centralisation and health economics. As indicated before, the main problem with these economic approaches is that they are often too economically deterministic and quantitative, just numbers without a social context. Such econometric demand and supply approaches essentially diminish health to a stochastic process. Health is reduced to a production line model (inputs, processes, outputs and outcomes), somewhat distant from the philosophical ideal advocated by the WHO in which health is both a qualitative and quantitative research concept and activity.

The economic discourse and rhetoric of health begins to focus more on episodes, quality, efficiency, improvement, productivity, competition, economies of scale, etc. Comparative analysis itself can become a justification for rationalisation and playing off health institutions against each other through pursuit of variance discrepancies.

Standardisation of variance without a detailed analysis of case by case situations can be both beneficial and harmful. It may lead to greater cost savings in resource utilisation and reduction of waste and fraud, but it may also lead to a decline in the overall quality of care given by health providers due to loss of funding. For these reasons therefore, the diffusion of information gathering systems such as CHRs may be resisted by those who have the most to lose, thus serving as another possible explanation for low rates of diffusion. If health is to follow a more economically deterministic path, this should be debated more widely and either established as a national priority and balanced against other health ideals. It would appear that the pendulum has swung in favour of economic determinism of late.

A more balanced approach is required which satisfies socio-economic ideals rather than sacrificing one for the other. For this reason serious consideration must be given to the future direction of health: will health (as with privacy) be considered as a fundamental social human right or will it be an economic privilege afforded only to those who can pay for it?

The work of Jeffreys and Sachs (1983) can be seen as a pioneering piece of literature on the status of general practice and provides stimulus for thought not only about the historical progression of general practice in Great Britain but also upon the strategies employed by GPs to advance their standing and profession in society (this approach may also be useful to researchers thinking about examining the historical development of the health care sector in any national context). The book takes a sociologically based

approach to the discussion of issues confronting GPs and coming changes in general practice (based primarily on data gathered in the 1970s) for the 1980s and 1990s. This approach seems somewhat dated however and raises questions about the currency of the results and their application. This is a worry confronting many researchers conducting long term projects, hence the push to publish interim results.

The material in the Jeffreys and Sachs (1983) study is primarily derived from a twelve year longitudinal project (1970 - 1982), based on interviews and observation, of a number of selected general practices in Great Britain. The research was funded by the Department of Health and Social Services as a response to the monopoly position of hospitals and the uncertain (diminishing and subservient) position of GPs in the health system during the 1960s and 1970s. This dominance of hospitals and hospital specialists over GPs, can be characterised as the specialist-generalist dichotomy, a conflict which continues today.

The work of Jeffreys and Sachs (1983) looks mainly at the changes in organisational work forms in general practice (i.e. from family solo practice to more business-team health centre practices) and the relationships/conflicts between various health care actors (GPs, hospitals, health visitors, nurses, social workers, patients, etc.). Surprisingly, the one major identified deficiency in this work is that there is not a single mention or chapter on the future role and influence of technology in general practice or the associated change implications this could have upon organisational behaviour and (patient) information management practices of GPs. This may be reflective of an

educational or sociological bias on behalf of the authors. Despite the fact that the authors do try to position events in the broader spectrum of social changes during the 1960s and 1970s, they fail to make any significant mention of technology. It may be argued that it was outside the scope of the project; in which case one would have to question the relevance of the results for guiding health policy planners and strategists. It may well have been an oversight or insignificant at the time. Possibly computers (personal computers in particular) were not seen as figuring in the grander scheme of society in the 1960s and 1970s since PCs did not really take off until the 1980s. Nevertheless, despite this obvious gap, the approach taken by the authors is commendable and also serves to highlight the difficulties in trying to study issues of politics, conflict, human behaviour and change. This is one of the challenges confronting researchers conducting qualitative social research. Interpreting the results can be a messy process and the results may not always be as easily tabulated and understood as those of a more quantitative character. Therefore, the value of this book must be in the reflection and admissions the authors make about the experiences and lessons learnt from undertaking social research.

**A landmark study: trying to pull it altogether**

The Institute of Medicine (IOM) published what can be considered to be a landmark study in 1991, setting the stage for nation-wide adoption of CHRs in the USA. It proposed a very ambitious time frame of ten years for national CHR adoption, surely somewhat optimistic given the legal minefield required to reform legislation across states in order to realise such a utopian vision but desirable nonetheless. The committee

basically argued that the CHR is an essential technology for health care in the future and concluded by handing down seven specific recommendations for implementation. The IOM's recommendations addressed issues of standards, coordination, support, legislation, costs, education and training. The IOM's work on the CHR stands as a seminal piece of literature in that it attempted to take a more comprehensive view of CHR design, development and diffusion. This may be attributable to the army of people involved and the wide cross section of representation on the various subcommittees (use, technology, strategy) which made up the study.

This broader approach to research is admirable in that it departs from the traditional fragmented and specialised approaches of past studies of technology. A broader (political, economic, social, legal) contextual framework is advocated so as to position events in a more comprehensive way. It also needs to be noted that funding for the IOM's work was a mix of public and private sector contributions, a reflection of the joint interest in CHRs. Of particular interest are the various legal ramifications of adopting and implementing CHRs outlined in Appendix B of the IOM's report. Issues of ownership, access, responsibility, privacy, admissibility and liability are yet to be fully resolved, as is the very legal status of CHRs themselves. This last section of the IOM's work raises more questions than it answers and actually paints a very daunting picture for the nation-wide adoption of CHRs. The legal issues alone may be the biggest barrier to nation-wide adoption in the USA, especially in a country which has fifty State Legislatures. It may well be that countries with less legislative bureaucracy may have more opportunity for faster adoption than in the USA. As such, it would appear that

Australia, with only eight states and territories, is placed in a more favourable position to diffuse CHRs nation-wide.

As a follow up, "Aspects of the Computer-Based Patient Record", edited by Ball and Collen, was published in 1992. This book is essentially a companion volume to the IOM's work in 1991. Its contents are the detailed papers that the IOM used in their subcommittee deliberations in 1991. Unlike the IOM's original work, the accompanying book has a more technology oriented focus. It delves deeper into the design aspects and data elements required by a comprehensive CHR system, hence the title of the book. The book may be of more use to designers and programmers of CHRs but, nevertheless, it is also relevant to administrators and policy planners since technical issues have accompanying social, legal, economic and political implications (and vice versa), whether people realise it or not, for example, privacy considerations.

The book itself also needs to be seen in the context of health care reform as it was at that time. One can also argue that the work was part and parcel of the continuing political momentum generated after the IOM's work in 1991 such that more follow up information was needed to keep the debate alive. The development and diffusion of CHRs can be likened to the efforts to land on the moon in the 1960s. In this case, as Dick (1992: 302) indicates: "clearly, the principle challenges are behavioural and sociopolitical rather than technical." This links with the work of Rogers (1995) who treats diffusion more as a behavioural science therefore implying the importance of the

need to examine the behaviour, habits, motivations, attitudes and beliefs of various actors within a social system.

The study of (technology) CHR design and diffusion among GPs can therefore be viewed as a study of human (GP) behaviour and habits. Thus, the research focus can also be reinterpreted to: how can GP behaviour and paper record keeping habits be changed to something different without causing unacceptable levels of social fear and stress?

Many years have passed since the publication of the IOM's work, which begs the question: just how successful was the IOM's work in advancing CHR development and diffusion? It may well be that the IOM's work has had more influence at an international level in raising the awareness and profile of CHRs. But in the USA itself, from an implementational level, the IOM's 10 year nation-wide adoption plan is overly optimistic. Forecasting is a very risky activity which has another salient role beyond just trying to predict the future, in that the very making of a forecast in the first place is an attempt to influence the thinking and behaviour of society towards a certain technological direction. Nevertheless, those who make forecasts should also be historically judged and held responsible for their forecasts.

**How has health/medical informatics developed as an organised system of thought?**

The development of health/medical informatics can be evidenced and understood through the growing number of professional and international organisations advancing the

development of the field through a variety of publications and forums. Waegemann (1995) provides an international directory of organisations pursuing various aspects associated with health/medical informatics and CHRs. The Medical Informatics Yearbooks and the Medical Informatics Handbook (Van Bemmel et al., 1997) are also valuable historical resource guides in this respect, as are a number of other national resources, for example, the edited work of Hovenga et al., (1996) which provides an overview of the health informatics field.

The International Medical Informatics Association (IMIA) also plays an important role. IMIA was initially established in 1978 as a Special Interest Group (SIG) of The International Federation for Information Processing (IFIP) until 1989 when it gained status in its own right. It has many national and corresponding institutional members, links to The WHO and many other SIGs. IMIA also organises the tri-annual World Congresses on Medical Informatics, MEDINFO (Van Bemmel et al., 1997). Figure 6-1 is an example of a list of some national and regional organisations involved in health/medical informatics activities.

Figure 6-1. National and regional organisations

* European Federation of Medical Informatics (EFMI). Founded in 1976 to enhance cooperation on a European basis.

* Health Informatics Society of Australia (HISA). Formed in 1993 with a number of affiliate state groups. Has been quite active in hosting national conferences (HIC) over the years. HISA is a special interest group of the Australian Computer Society (ACS). HISA is also a member of the Asia Pacific Association for Medical Informatics (APAMI) and HISA is the official Australian representative to IMIA.

* Royal Australian College of General Practitioners (RACGP). The RACGP has affiliations with the Primary Care Informatics Group of IMIA (WG 5) since the focus of this group is on primary practitioners. The RACGP has been running Computer Conferences since 1978.

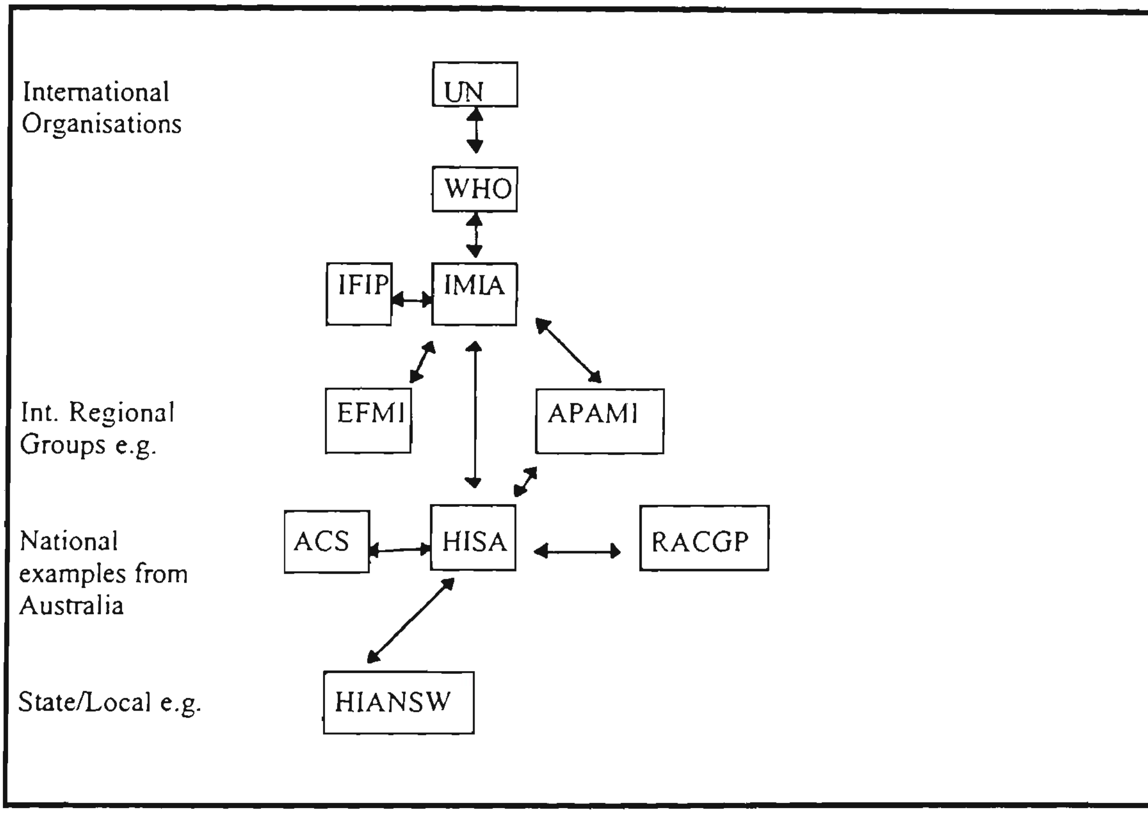
* Swedish Society for Medical Information Processing. Created in 1967, the society was responsible for organising the first MEDINFO' 74 in Stockholm.

* Spri (The Swedish Institute for Health Services Development). A research body focusing on health care issues in Sweden. Financed by the Swedish Government and The Federation of County Councils. Spri also has the largest repository of information resources in Sweden for the health care area. Relevant Spri studies include the following:

1. User Requirements on Electronic Health Care Records (1997).
2. Computer supported patient records - distribution, market situation and system survey (1995). This report indicated that over 80% of all patient records in primary care were computer supported. Twenty-seven different record systems were identified in the Swedish market of which only five had a large distribution.
3. Medical decision support systems (1995).
4. Information and record structure in Swedish health care in a computerised record (1995). Describes a common information and record structure, based on two reports: "Health Care Information Framework" and "European Health Care Record Architecture" produced by CEN TC 251 (The European Standardisation body's Technical Committee for Medical Informatics). This is the basis for a future European standard.
5. Computerised record handling at Ystad hospital - a follow-up (1994). This report records the experience with implementing a computerised patient record system.
6. Computerised record keeping in Swedish hospitals, progress report (1994). This report indicated that 70% of the County Council hospitals planned to have a large scale introduction of computer supported record keeping before 1999.

The diagram depicted in Figure 6-2 below serves as an example of how health/medical informatics information can pass from international organisations to more localised groups within Australia and vice versa. It does not show all the organisations involved in health/medical informatics activities in various other nations.

Figure 6-2. Overview of some organisations involved in health/medical informatics




**Health/Medical informatics: health or medical?**

In 1992 IMIA, in cooperation with Schattauer Verlag, initiated publication of an annual Medical Informatics Yearbook. This was based on an idea from Collen and Ball (Willems, 1992: 7). Essentially, these publications contain reprinted articles, selected by an editorial committee, from international journals focusing upon medical informatics issues. The basic purpose is to advance medical informatics thought as a

multidisciplinary movement, thus to provide a forum for building links across disciplinary and professional as well as cultural boundaries.

The 1992 Yearbook articles had a very medical, engineering and computing orientation marking some attempt to move beyond just clinical medicine and to present a more extended view of events. At the time, this approach may have seemed broader but in today's terms it would be very narrow indeed compared to the growing breadth of material and disciplinary views as evidenced in the last MEDINFO 95 and 98 Conference Proceedings. The Yearbooks are themselves an example of trying to diffuse information to a wider audience in a more integrated way. The books also serve as a useful (historical) reference guide for information about IMIA, the Working Groups, and the national member societies. IMIA has a number of Working Groups as (detailed in Table 6-1 below) which also hold their own focus group conferences and meetings throughout the year. Both Australia (through HISA) and Sweden (through the Swedish Society of Medical Information Processing) are members of IMIA and the various Working Groups.

Table 6-1. IMIA working groups

| Working Group (WG) | Focus |
|---|---|
| WG 1 | Information Science and Medical Education |
| WG 4 | Data Protection in Health Information Systems |
| WG 5 | Primary Health Care Informatics |
| WG 6 | Coding and Classification of Health Data |
| WG 7 | Biomedical Pattern Interpretation |
| WG 8 | Nursing Informatics |

| | |
|---|---|
| WG 9 | Health Informatics for Development |
| WG 10 | Hospital Information Systems |
| WG 11 | Dental Informatics |
| WG 13 | Organizational impact of Medical Informatics |
| WG 14 | Health Professional Workstations |
| WG 15 | Assessment and Quality Development in Health Informatics |
| WG 16 | Standards in Health Informatics |
| WG 17 | Computer-Based Patient Records |

Source: Van Bemmel et al., 1997: 550

Of particular interest to the medical informatics movement has been the growing focus on health information security and privacy issues. In the literature this can be tracked back to the work of Westin (1976) and to the work of IMIA's Work Group 4 which examined data protection in health care, edited by Griesser et al., (1980). More generally, the issue of privacy has been addressed by the seminal works of Westin (1976) and Flaherty (1989). Also, in 1980, the Organisation for Economic Cooperation and Development (OECD) released "Guidelines for the Protection of Privacy and Transborder Data Flows of Personal Information". These guidelines were developed in response to the growing concern over international data flows and set out eight general information privacy principles relating to the collection, storage and use of personal information.

As mentioned in Chapter Two, in 1988, Australia developed its own Privacy Legislation based on the OECD model which included Eleven Information Privacy Principles. Also worth noting, was the development of the OECD Guidelines (chaired by Michael Kirby, President of the Court of Appeal, Supreme Court of New South Wales, Australia) for the Security of Information Systems, adopted in 1992. Overall, these guidelines

attempted to provide a framework for the security of all information systems in both the public and private sectors. Of particular interest to this research is to ascertain what level of awareness GPs actually have of security and privacy issues and how this relates to published guidelines and diffusion thinking.

**Health informatics as an academic (multi)discipline**

Some authors suggest that there is a distinction between the ideas of health informatics and medical informatics (Lincoln and Korpman, 1980; Shortliffe et al., 1990; Hannan, 1991; Coiera, 1994) while others use the terms synonymously. Other terms also in the literature include nursing informatics and dental informatics. These latter terms appear to have been subsumed as branches within the area of health/medical informatics. Interestingly enough though, medical informatics seems to have grown out of the nursing informatics movement of the 1970s which is now being transformed into health informatics (Cesnik, 1996: 11). This transformation can also be interpreted as the gradual feminisation of traditional male domains, medicine and computing. Hence, health informatics is reflective of a more gender encompassing orientation to health care rather than medical informatics.

Lincoln and Korpman (1980) argue that the focus of health informatics should be upon the cognitive processing of information and communication in medical tasks, which utilises the application of information technology to these tasks. In the Medical Informatics Yearbook (1992: 13), medical informatics is stated to mean "... the application of information science and information technology in the fields of medicine, health care, and biomedical research." Since the definitions appear to be the same, why

the different terms? It could imply that health informatics is a subfield of the larger field, medical informatics, or vice versa. If a socio-political approach is used as a basis for explanation, this may reflect a power struggle between various actors trying to establish themselves as the dominant actors in a particular movement, health informatics, by using delineating rhetoric to position themselves amongst other competing actors. By using the terms synonymously, actors are able to position themselves at first within both camps and therefore establish a greater positioning as unifiers over delineating actors whose position in a greater power struggle may be weakened by appearing to be isolationist. Confusion can be a useful strategy in the initial process of the (re)construction of the meaning of medical informatics. The term health informatics is therefore a manifestation of this reinterpretation.

If health informatics is to develop as a discipline and a body of thought (Greenes and Shortliffe, 1990; Hovenga et al., 1996) a broader understanding of CHR diffusion is needed, i.e. a broader contextual positioning of CHRs within existing thinking. This implies a multidisciplinary approach in order to try and draw actors and disciplines together rather than just continuing the fragmentation of knowledge by creating another academic discipline.

An important aspect of health informatics is the development and diffusion of literature/technology reflecting a multidisciplinary approach. From an institutional focus there is a need to develop health informatics literature repositories, libraries, information management methods and educational resources (Matheson and Cooper, 1982; William

and German, 1989; Hovenga et al., 1996). Also central to this is the need to engage more actors in health informatics pursuits. Electronic resources (e.g., online texts, bibliographic databases, the WWW, etc.) have provided another alternative for information creation and diffusion in conjunction with traditional paper based methods (e.g., libraries, books, journals, etc.).

The role of technology in library science has gained a great deal of attention, especially the role of the electronic library (electronic books and journals) and its position in relation to traditional libraries (Alcock, 1996). This is part of the wider general debate and power struggles taking place in society over labour and capital: work (e.g. telecommuting, electronic commerce, EDI), education (e.g. tele-education, virtual classrooms and faculties), health (e.g. telemedicine, CHRs, virtual hospitals, practices), government (e.g. electronic voting), community (e.g. electronic networks and telecottages). If the information revolution, generally a concept applied to industrialised countries, has foundation, and there does appear to be a continuing exponential growth in the production and dissemination of information, then problems characterised as information ownership and overload (Branscomb, 1994) assume greater relevance and need to be analysed more critically in a digital environment.

This is important since working and living in such a society will require more emphasis not just on computers but on human information processing, filtering and evaluation abilities, and especially critical thought. The ideal will be to find an acceptable balance between technology and human involvement through an awareness of the limitations of

both human and computer abilities. All of which have major future pedagogical implications, as is evidenced by institutional moves to experiment with various modes of flexible electronic delivery, open learning, tele-education, tele-surgery, virtual faculties and so forth.

One strategy for overcoming computer fear and developing awareness is through greater exposure (Moidu, 1993b; Valente, 1995). Moidu (1993a) gives a detailed account of a four year undergraduate informatics education and training plan for the Health Sciences at the Chicago Medical School. Others who have written about medical/health informatics education include Reinhoff (1989), Hanmer (1989), Greenes and Shortliffe (1990). Furthermore, Moidu (1993a: 118) states that "the physicians of tomorrow need to be trained for this change with a curriculum that incorporates education about medical data, clinical decision making, information systems, using communication networks, and processing knowledge." As indicated in a report by the Association of American Medical Colleges in 1984, more emphasis needs to be placed on self directed study and problem solving rather than lectures (Association of American Medical Colleges, 1984). Institutes or departments need to be created and health informatics professors appointed to carry out these roles. This is slowly being evidenced by the introduction of Medical/Health Informatics Departments in various universities in such countries as Sweden, Netherlands, Germany, USA, UK and Australia. In Australia for example, Newcastle University and Monash University have both introduced health informatics curricula and departments.

Health/Medicine are essentially human based activities in which technology plays a supporting role in the doctor-patient encounter. Hence, the course design at Linköping University in Sweden for example, is based more around developing communication and people skills such as interviewing techniques, group work and problem-based learning. First and foremost, a doctor needs to know how to deal with people as well as medical methods and information processing. Technology can be designed and constructed to aid in these activities but it cannot replace the human element of interaction involved in the encounter process. This is an important philosophical point since it places technology within a human based focus and not the other way around, a technology based focus.

# CHAPTER SEVEN

# CHRS AND GPS IN A SOCIO-POLITICAL CONTEXT

> Predicting the potential consequences of any new technology is an extremely complex problem. Simply forecasting the direct costs of new technology can be hard, and that is the easiest step. Understanding how the technology will interact with ongoing routine practices and policies is even more difficult. Imaging how the technology will lead to long-term changes in how people work, treat one another, and structure their organizations is harder still. (Sproull and Kiesler, 1992: 1)

## Setting the socio-political battlefield

General Practice in Australia has been described as a black hole, "so big and impenetrable is this black hole that those charged with the job of analysing the nation's health needs at a grassroots level are practically working in the dark." (Leech, 1998: 42). The cost of health care in Australia (GP visits, prescriptions, pathology tests, radiology and specialist visits) is estimated at approximately $7.5 billion and the problem of trying to collect some form of structured information about these events is further exacerbated in that "less than 10% of GPs have PCs on their desks." (Leech, 1998: 42).

This makes the collection of paper based records difficult to coordinate. Despite the subtle end note to computerise, the experience provided from the *Micro's for GPs* prescription scheme in the UK in the 1980s indicated that GPs or practice staff perceived no significant differences after computerising but that 70% of respondents perceived that the computer was of some use (Jones, 1987). The significance of these findings is associated more with the difficulty faced in trying to change established preconceptions and habits. Nevertheless, 80 to 90% of GPs in the UK are reported to keep computerised records as opposed to about 5% in Australia (Simicevic, 1993).

As a response to the signalled change in health care by the Australian Government through the Federal Health Minister, Dr Wooldridge, the AMA and the RACGP have engaged in their own counter-attack strategies over the years by demanding pay rises and patient co-payments in return for implementing computers for prescribing, and generally prescribing cheaper drugs (Dunlevy, 1996). In the light of budget cut-backs, demands for a pay rise may seem misplaced, but understandable in the context of professional bodies trying to keep faith with their members. As reported by Bridges-Webb (1992) and Dunlevy (1996) problems of overservicing and GP oversupply have only served to exacerbate the situation; furthermore "the establishment of guidelines for the number of ultrasounds carried out on pregnant women could also save Medicare millions." These brief narratives set the tone of the battle over health care reform in Australia.

The impact (foreseen and unforeseen) of computers and CHRs on power relationships is not fully known but can be characterised through a number of political conflicts between a variety of actors, not necessarily just in the health care system. At the macro scale, CHRs could be viewed as a battle over the political control of health expenditure and more importantly, health/patient information i.e., the commodification of information generally and the rationalisation of health care (e.g. reduction of hospitals, GPs, drug prescriptions, test ordering). Thus, it is not completely without foundation, as indicated by some authors (for example, Opit, 1987) that health care actors such as GPs, may hold the suspicion that the collection of information by other actors, for example, the Government, constitutes a form of surveillance and spying on their

activities. Moreover, this can be perceived as a diminution of their monopoly position in health care and their professional status in society.

The Australian Health Care system (Medicare) should not be seen as a bottomless money pit for GPs. Therefore, the Government should make GPs more accountable as to how public money is spent. CHRs represent an opportunity to gain greater control over the management of the health care system. Both Government and GPs are aware of this situation and any action to review or audit the way GPs work, e.g. prescribing patterns, can act as a double edged sword. Past and present sentiments reflect this tension, as Drury (1981: 259-261) states, himself a GP, "most of us face some difficulty with the word 'audit' and its implication of outside supervision and loss of 'independence'."

There is a less reported irreconcilable difference between the use of CHRs for expenditure control on one side by government and revenue generation by GPs on the other, namely opportunistic GP recalls and referrals. If the aim of CHRs is to gain greater control over health care expenditure then the use of CHRs for revenue generation is somewhat paradoxical and self defeating. This may be seen as a rhetorical battle but GPs buying into the CHR argument without full consideration of the implications in the long run could be helping in their own political and economic deflation.

Another battle facing GPs is the growing number of patients who now have greater access to health/medical information as a result of the proliferation of access to the

WWW and who therefore have an opportunity to become more aware and informed in diagnosing their own problems. Hence, the traditional hegemony that has existed in the doctor-patient relationship is also being slowly redrawn, which may ultimately lead to a decrease in doctor authority and a greater equalisation in the doctor-patient relationship. Indeed, some authors such as Fitton and Acheson (1979) and Tate (1983) have argued for more equality in the doctor-patient relationship, with Fitter (1986: 78) characterising this process as the "democratisation of health care".

The increasing use of the WWW does open up some interesting scenarios for thought and debate, not the least of which may be problems that could arise from self misdiagnosis. For example, a scenario could be envisioned in which GP numbers gradually decrease as patients diagnose themselves through the use of online decision support systems. Patients may even be able to attend virtual hospitals and virtual GP practices irrespective of geographical location. A patient in Australia may *go* to a virtual GP office in Sweden, or elsewhere, for a teleconsultation. This raises some thought provoking questions about the future of telemedicine, not the least of which is the puzzle over remuneration in a global health care system. Maybe the WHO would need to take on a more prominent role in managing and administering such a global scheme. But if health systems are privatised and governments withdraw from subsidising health care, this would then have implications for patients, GPs and all other health care providers. In such a scenario, GPs would be seen as economic actors operating in an open competitive global market in which case, the rationalisation of GPs may be dealt with by market practices, welcomed by those who can best cope and adapt to the

changes and opposed by those who do not, and drop out. Patient access to health care may then become a question of money, much like access to computers, telecommunications and the WWW. Some serious social tension could develop between those who can afford to pay and those who cannot, which could lead to a rationalisation and reorganisation of power on a larger scale.

An important question that also needs to be addressed is not just how data can be stored and retrieved using CHRs, but more importantly, how will this information be used and by whom? For example, hospitals and GPs may publicise the differences in outcomes between each other to try and attract more patients, so leading to the creation of a more competitive market environment. But how will this impact on the quality of care and the value of patient information? If health care is reduced to *outcomes*, will the *process* of health care eventually suffer? Figure 7-1 provides a possible matrix of outcomes.

Figure 7-1. Matrix of possibilities arising from the diffusion of CHRs

| | |
|---|---|
| Reduced costs and increased value of health information | Increased quality of health care |
| No change (marginal) | No change (marginal) |
| Increased costs and no increase in value of information | Reduced quality of health care |

The three main scenarios, as depicted in Figure 7-1 above, may be posited as follows: CHRs help to entrench and further both the power and economic potential of GPs as

key actors in the health care system. Alternatively, the diffusion of CHRs in General Practice may be instrumental in forcing GPs to be more accountable to government and less autonomous. The third option is that there will be little or no change in the existing situation. It is important to note however, that Figure 7-1 is presented to stimulate thought rather than being a definitive depiction.

**The big picture: where is it all heading?**

Developments at the macro or big-picture level need to be monitored in relation to developments at the micro level. Authors such as Wells (1905), Orwell (1954), Bell (1973), Huxley (1979), Naisbitt (1982) and Toffler (1980, 1990) have all tried their hand at social and megatrend forecasting. The concept of the *information superhighway* has gained momentum from within the USA more so in the early 1990s than previously. This presents both opportunities and threats for all actors in society, as do mergers and various cross media ownership arrangements between newspapers, radio stations, television stations, cable television, publishing houses, telecommunications operators, computer companies, banks, etc. This convergence between markets and industries is forming new organisational actors who have interests in all types of profit making activities and commodities, in which government hopefully acts as a public interest regulator rather than as a private industry servant.

In a converging environment, not just nationally but globally, the concept of an information economy founded on an information and communication technology infrastructure (the field of IT is often characterised as the convergence between

computing, telecommunications and media) has utility for helping to understand what may be happening. A monopoly on both information and the means to distribute that information raises very important questions (political, economic, social, legal) about the changing structure and organisation of society and the relationship of public and private sectors to each other.

Ownership of both the content and carriage could result in some actors effectively being in a position to create and own *information supermarkets*. The exact shape and form that an information supermarket may take is open to debate. But issues of control, equity, access, ownership and individual rights need to be addressed. Essentially, developments of such a magnitude, where the economic modes of production shift or supplement existing modes of production, offer different actors (for example, Bill Gates and Rupert Murdoch) the potential to reorganise, re-position or entrench the status quo. In such a scenario, there exists the possibility for a realignment of political, economic, legal and social modes of behaviour and production.

The modern day rhetorical weapon against monopolies is the idea of competition, the opening up of monopoly markets to other suppliers (for example, American Telephone & Telegraph in 1982, Telecom Australia in 1996, the National Health Service in the UK). This is something of an interesting social and economic experiment in that many paradoxes exist: how does a regulator encourage competition (divergence) in a converging environment and does this work in all sectors?

# CHAPTER EIGHT

# TECHNOLOGY DIFFUSION

## CHR Diffusion

There is some literature pertaining to the attitudes of Australian GPs towards computerisation. The work of Crampton (1990) and Cacek (1994) provide for a good starting point. According to Cacek (1994: 1) 50% of Australian practices use computers for accounting and other functions. Cacek further argues that there is a discrepancy between potential and actual use of computers among GPs in Australia. The reasons are not altogether clear, although many anecdotal views are expressed.

High adoption rates of computers and CHR usage have been common among GPs in such countries as the UK, Sweden, Germany, Netherlands and Canada (Shires, 1986; Szecsenyi et al., 1992; Hayes, 1993; Vlug and Van der Lei, 1995). Low adoption rates exist for Australia, New Zealand, Singapore and elsewhere (Bolton and Gay, 1995). Why is this the case? Literature does provide for some illumination of why some countries have achieved a higher adoption rate, such as the Netherlands and Sweden (Houwink 1995; Bomba et al., 1995). Primarily, this has been achieved through a range of programs mostly coordinated between governments, various representative professional bodies, GPs and direct financial incentive and reimbursement schemes for the purchase of software and/or hardware as well as grants for research and pilot programs.

Also worth noting is the high diffusion rate of computers and CHRs among Scottish GPs. Scotland can be considered unique in that it has a national standard software program known as the General Practice Administration System for Scotland (GPASS) which would appear to place it in a favourable position to collect primary health care data on a national scale (Taylor et al., 1990, 1991). The Scottish experience may offer some valuable insight and learning experiences not only into how a higher diffusion rate can be achieved but also into the challenges faced once a higher diffusion rate has been achieved, such as maintaining the quality or completeness and accuracy of computerised patient data. Even so, the results from a Scottish study into morbidity data indicates that only 75% of the highly computerised general practices surveyed were found to have kept what were regarded to be complete and highly accurate data records (Whitelaw et al., 1996). Although there is always the danger of generalising from such results, this finding may have important general implications for health informatics though especially in relation to the positive correlation between CHRs and the improvement in the quality of health care data as compared to traditional paper record keeping practices. It becomes obvious that such concepts as quality and improvement are relative terms and are dependent upon how they are interpreted. That is to say that CHRs will not miraculously solve all the existing patient record keeping problems and it needs to be acknowledged that different problems will present themselves with the implementation of computers and CHRs as well as the resurfacing of old problems in different ways. Hence, the adoption or lack of adoption of CHRs are both an acknowledgment of the benefits as well as the problems faced with implementing and using this technology.

What exactly does improvement in health care mean, let alone improvement in general, and are we really talking about change rather than improvement? If so, change by whom and for what reasons? The idea of improvement has connotations of something better than what presently exists. Often this is tied into ideological and political arguments and has been a dominant element in the rhetoric of economic progress and industrialisation over the centuries. Is it progress or in some way an improvement in the human condition to have landed on the moon? Is it an improvement to have designed and built nuclear power stations? Is it an improvement in human health to have discovered penicillin? What one can learn from this is that each development brings with it a set of different consequences and problems e.g. nuclear waste disposal, penicillin is not target-specific, rather it is like a bomb going off in the human body, which to a large extent kills everything around. Landing on the moon is an activity which employed many people and attracted vast sums of research money, which could have been used for other purposes.

There are alternative choices in the social construction of any technology. The study of technology and the process of technology (de)construction needs to go beyond simplistic value laden portrayals of the *good* of technology. This implies that society as a unifying and descriptive concept of actor relations and interaction, does not follow some predetermined trajectory as misinterpretations of Darwin's idea of human evolution may imply. Such socially constructed technologies as DNA fingerprinting, splicing, manipulation, cloning and mapping of the Human Genome are all chosen social and political objectives whereby technologies are shaped and designed by actors who in

turn can change, create and control human social interaction and organisation in an alternative way. This is exactly the point argued by Bijker and Law (1992) in "Shaping Technology/Building Society: Studies in Sociotechnical Change". Other prominent literary authors and activists such as Sartre (1975) have long argued about the right of self determination. Therefore, the concepts of power, control, technology, information, conflict and actors in social networks serve as more useful discourse descriptors of the process of technology (de)construction, situated technology, and thus our understanding of societal change rather than a focus on the technology itself.

There have also been increasing calls for cost benefit analyses to evaluate the implementation of computers and CHRs from more economic and stochastic standpoints. In this respect, cost benefit analyses can be very problematic in that they can often fail to measure non-monetary gains or for that matter non-monetary costs, such as improvements in processes, quality, organisation, time taken to learn to use a computer and a CHR system, etc. It could be argued that an increase in profit or output is evidence of improvement. The problem with this line of thinking is that if the reverse was to occur, that is, no increase in profit or output, does this automatically mean that no improvement occurred? Maybe there is the perceived potential for improvement and change to occur but it may not be obvious how to make this occur. Hence, a cost benefit analysis may not always give an accurate reflection of events. Rather it may serve to provide evidence of a version of events decided upon beforehand by variously motivated actors. This then leads into the questions: Is the health of a population indicated by a simple measure of reduced mortality rates and morbidity levels and just how should one

measure improved quality in health care over time? Who is to decide what is or is not an appropriate measuring unit? In the Scottish studies mentioned earlier in this Chapter, the research could have been devised to give other results if, say, different measures of completeness and accuracy were used for computerised patient record data. Therefore, a cost benefit analysis should only be seen as one possible method of evidence creation and shaping amongst others on which to base decisions. Nevertheless, there is some evidence to show that investments in computers in primary health care are investments in improved health care (Moidu et al., 1992). Some questions to ponder upon include: how would we rate health care if the measuring unit was based on the longevity of the population or is evidence of a growing elderly population an indication of improved health care delivery? Could this be attributable to investments in computers and CHRs?

Strategies and projects for increasing the rates of CHR adoption have also been offered by other authors (see for example, MacIsaac et al., 1994; Liaw, 1996; Bomba, 1997). Importantly, what are seen to be barriers to the diffusion of technology are not just technical but need to be seen as ranging across a spectrum of issues from social, economic, political to organisational (Linnarsson, 1993). More recently, M. Berg (1997) has argued that failure to diffuse or stabilise a technology can be attributable to the failure to localise a particular technology within an organisational setting. As earlier work by Moidu (1992) suggests, implementation should be preceeded by a study of the organisational setting and the development of an explicit diffusion strategy which involves the users. This would indicate that there is great scope for more socially oriented joint stakeholder types of studies and explanations for understanding CHR

design and diffusion among primary health care practitioners such as those conducted by Jeffreys and Sachs (1983).

Other authors in the past as McDonald and Tierney (1988) have also indicated the importance of the future role of CHRs in the provision of health care and medical practice. CHRs are the information and communication centre piece of the health informatics vision. The importance of CHRs is evidenced in the IOM's report in 1991. Hence, since CHRs are seen to be the basic foundational building block for all else to follow, it makes sense that close attention should be given to research into CHR diffusion in health care settings as well as other possible information and communication technologies. A socio-political approach allows for this elucidation.

**Some selective diffusion experiences with other technologies: the utility of a diffusion framework of thought**

An interesting study which could have been posited within a diffusion framework is the work of Ljunggren (1998) and her study of DRGs in the Swedish health care system. Overall, Ljunggren's work is an example of a study which attempts to explain the story of DRGs from a more socio-political stance, involving history, politics, sociology and the various actors (government, councils, staff and patients). Ljunggren's work can be considered a diffusion study utilising a socio-political approach, despite it not being located as such, since it deals essentially with how an organisational artifact or system, DRGs, can be (de)constructed, (re)diffused, both locally and nationally across boundaries and the problems associated with this change process. It could be interesting to compare the study of the shaping and diffusion of DRGs both from a national and

international perspective, that is how DRGs developed and diffused, with the (de)construction and (re)diffusion of CHRs. However, this implies a much longer time frame that is outside the scope of this thesis but nevertheless the basis for a longitudinal research project.

An example from Kenya which deals with e-mail offers some insight into the problems of diffusion research. Ochuodho (1993: 194) states that,

> the key requirements for e-mail are summarized in their order of priority as: infrastructure, championship and motivation, management support, enabling governmental policy, availability of expertise, good planning and management, maintainability and sustainability, equipment and software (preferably mainstream), and existence of a critical mass of users. We re-emphasize that the non-availability of funds which is usually claimed as the main drawback to most projects in Africa is only secondary here ... the real key requirement for e-mail to take off in any place is motivation and championship. There must be a group or individual who fully comprehends the opportunities offered ...

In order to balance this somewhat technological bias, Ochuodho (1993: 194) also mentions some of the vulnerabilities, problems and consequences associated with email: "... abuse, difficulty to assure security, confidentiality and anonymity, and a lack of *physical* inter-personal association."

Another case study of a diffusion experience provided in Rogers (1995: 327-330) is that of the French Minitel teletext system in the 1980s. This study is worth mentioning since diffusion of teletext systems elsewhere in the world has generally been unsuccessful. Essentially, in order to achieve a high level of diffusion a direct strategy was used, with the French Government deciding to give these systems away for free to heavy telephone users. The strategy was seen as successful, and "within a dozen years,

more than 6.0 million French households (about 25 percent of all telephone subscribers) had adopted the Minitel videotext system." (Rogers, 1995: 327).

Another application of diffusion thinking to the idea of transnational diffusion can be found in Wirten's (1998) idea of transnational editing (the case of Harlequin Enterprises). Wirten's work can be considered a diffusion study, despite it not being located as such, since it deals essentially with how cultural artifacts (Harlequin books) are changed and sold in a global market. It serves as an example of localised diffusion strategies occurring within the larger schema of global diffusion. Texts are altered to suit local cultural settings.

Another interesting application of diffusion thinking can be linked to the idea of technophobia or computer-phobia and may be found through interpreting Flykt's (1998) study of threats, human fear and aversive contexts. His work can be considered a diffusion study, despite it not being explicitly located in this domain. He essentially tries to show how fear, as a concept, is learned or biologically ingrained in people. It could also be argued that it may be misguided to think that the actual process of cognition, learning and decision making can be rationalised through the continual attempted perpetuation of the scientific method, utilising measuring instruments, models and empiricism. The area of behavioural and clinical psychology is evidence of a field filled with controversy, interesting paradoxes and contradictions about human behaviour: learning, experience, memory, perception, emotions, decision making, etc. (see for example: Skinner, 1974; Peterson & Beach, 1967; Brehmer, 1980; Cohen, 1981;

Flykt, 1998; Kuylenstierna, 1998). It also serves to highlight some broader design and methodological problems, such as just how do researchers know that what they are trying to observe is actually what they observe? For example, how does a researcher know that measuring the electrical activity of sweat glands through skin reactions is actually a valid approach to or measure of fear? Similarly, there may be various ways of trying to investigate and measure CHR diffusion among GPs. But how does a researcher determine whether a constructed diffusion study actually investigates or measures diffusion? To a large extent this is influenced by the researcher's conceptualisation of diffusion which may or may not represent perceived reality. Cognitive and psychological models of technology adoption have also been offered in the past as explanations for adoption, for example, Ajzen and Fishbein (1975), which can further be traced to The Theory of Reasoned Action, offering causal explanations for a link between attitude and adoption behaviour.

**Everett Rogers: Diffusion of Innovations**

A key author in the innovation diffusion literature is considered to be Everett Rogers (1995). The link between technology diffusion and CHRs is mentioned in the IOM's (1991: 98) work and makes reference to the work of Rogers. Since the focus of this thesis is on the diffusion of CHRs among GPs, the work of Rogers (1995) will be used to examine the research results gained as a comparative framework for understanding. The work of Rogers (1995) can be regarded as the traditional canon of thinking about diffusion. The work of Rogers stands out as a seminal piece of literature in that it takes a more multidisciplinary view of diffusion. Evidence of this lies in the broad cross section

of literature included in his taxonomy of the diffusion literature (Rogers, 1995: 443-444). This more holistic approach to diffusion thought is commendable for its attempt to establish links between published work from different disciplines. It is evident of a broader contextual (political, economic, social, legal) framework of thinking and should serve as a starting point for diffusion researchers. The importance of diffusion as a concept gaining greater recognition over the years can be thus seen in Table 8-1 below, this is based on a tracking of the literature by Rogers. The growth in diffusion publications can itself be seen as following the S-shaped curve over time.

Table 8-1. Growth in diffusion literature

| Year | No. of publications |
|---|---|
| 1962 | 405 |
| 1971 | 1500 |
| 1983 | 3085 |
| 1995 | 4000 |

Source: Rogers (1995: xv)

Similarly, this same analysis can be used to analyse the growth of medical informatics publications (note: medical informatics was used instead of health informatics since medical informatics has existed longer historically). Table 8-2 below shows the number of hits, articles found in the Medline Database for particular periods, matching the search terms. The inception of the Medline Database began in 1966.

Table 8-2. Medline search results

| Year | Medical Informatics | Patient records |
|---|---|---|
| 1966-1975 | 2 | 24 |
| 1976-1979 | 8 | 63 |
| 1980- | 29 | 112 |

| | | |
|---|---|---|
| 1985 | | |
| 1986-1991 | 303 | 206 |
| 1992-1997 | 580 | 412 |

Source: Compiled from a search of the Medline Database.

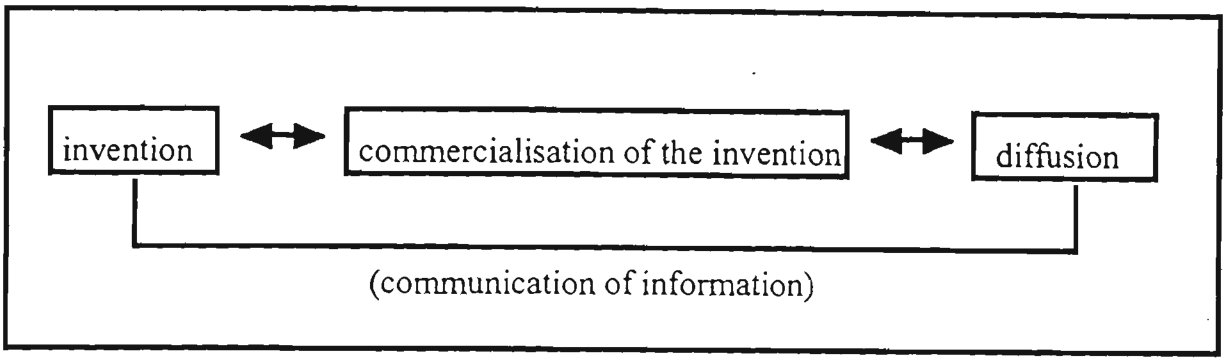
The results would indicate that medical informatics has had a slow rate of diffusion over the years in terms of the number of publications in existence dealing with this concept. Medical informatics is still in its early stages of diffusion on the S-shaped curve, yet to really take off, but may gain more momentum under the umbrella of health informatics in years to come.

**Deconstructing the S-shaped diffusion curve**

It is interesting to note that Rogers (1995) uses the term *diffusion of innovations* rather than *technology diffusion*, suggesting that innovation is considered as a distinct body of thought in itself seperable from the study of just technology and technology diffusion. Nevertheless, innovation inescapably deals with theories of technology and technology diffusion. This slight perceptual distinction may be confusing at first but on closer analysis, Rogers appears to use the words innovation and technology interchangeably. This is further reinforced when looking at the definition for innovation given by Rogers (1995: 132) for this is interchangeable with a definition for technology, "an idea, practice, or object that is perceived as new to an individual or another unit of adoption." This ambiguity may also imply a direct attempt to reposition earlier diffusion thought into a more integrated framework of innovation thought. This is somewhat evidenced by the innovation-development process which embodies diffusion thought and involves

people engaged in problem identification, research, development, adoption and consequences research (Rogers, 1995: 133). This can be seen in a more simplified form in Figure 8-1.

Figure 8-1. The innovation process




It is argued in this thesis that the innovation process, which embodies diffusion thought, should be interpreted as one stream of thought within an even wider corpus of society and technology studies rather than being a separate independent categorisation which just subsumes diffusion. As such, innovation does not necessarily fit neatly into any one particular discipline of thought but essentially tries to deal with a broader conceptualisation of the theories of technology and society. Table 8-3 offers a selection of some key technology diffusion studies, it is by no means an exhaustive list.

Table 8-3. Diffusion studies

| **Year** | **Author** | **Area/study** |
|---|---|---|
| 1903 | Tarde | imitation<br>social status |
| 1943 | Ryan and Gross | hybrid corn seed diffusion |

| | | |
|---|---|---|
| 1959 | Menzel, Coleman & Katz | medical drug diffusion |
| 1960 | Deutschmann & Danielson | news diffusion |
| 1964 | Berelson and Freeman | family planning diffusion<br>KAP surveys |
| 1969 | Bass | marketing forecast model |
| 1972 | Charters & Pellegrin | educational innovation<br>re-invention |
| 1977 | Danziger | computer data processing<br>re-invention |
| 1986 | Shires | information<br>databases/computers |
| 1990 | Brancheau & Wetherbe | spreadsheet diffusion |
| 1995 | Heikkilä | computer diffusion |

Source: Compiled from Rogers (1995) and Heikkilä (1995)

Diffusion research can be seen as gradually moving from being applied in such areas as anthropology, rural sociology, medicine, family planning, education to more computer-related innovations such as spreadsheets, databases, email, Internet, etc. Rogers (1995) identifies Tarde (1903) and his idea of imitation as an entry point into diffusion studies. This selection of a starting point needs to be seen as somewhat arbitrary since it can be argued that the idea of imitation can be tracked back even further to the Greeks and Romans, conceivably even further. For example, in the area of poetry, the Romans used imitation as a method of copying the Greeks when constructing their own poetry and literature which in turn has been imitated, (de)constructed and reconstructed, by others and so on through time till the present day (Olsson and Algulin, 1995: 152). Therefore, it can be argued that diffusion as a process has always existed in society, but it was not

called diffusion until quite recently. Hence, diffusion is not a new idea, it has just been reinterpreted in a more modern day discourse as being diffusion rather than imitation. Kim (1997) provides an interesting account of the imitation versus innovation argument, technological learning, as applied to the development of South Korea from a relatively agrarian based society to a modern day industrial society. Technological learning may therefore be seen as a knowledge-building process involving a range of information-seeking behaviour, individually or as an organisation, with the aim of reducing uncertainty about an innovation and its consequences.

The history of diffusion research, according to Rogers (1995), shows Ryan and Gross (1943) as significant contributors to early diffusion thinking. Ryan and Gross looked at the spread of adoption of hybrid corn seed among two farming communities in Iowa. What was significant about their approach was that they utilised a quantitative survey approach based on structured survey interviews. Up until that point, diffusion studies had mainly employed qualitative anthropological approaches, for example, ethnographic studies. It is also interesting to note that the Ryan and Gross investigation sought to ascertain what role social factors played in economic decisions. This is interesting since it indicates a belief that economic decisions alone do not necessarily explain decision making and more sociological or socio-economic based explanations may be appropriate.

Rogers' (1995: 31-35) analysis of the Ryan and Gross study highlights a few controversies associated with diffusion thinking. Rogers advocates a sociometric, approach, "obtaining and analyzing quantitative data about communication patterns

among individuals in a system by asking each individual to whom he or she is related" (Rogers 1995: 34). Rogers notes that one of the limitations in the study conducted by Ryan and Gross was that they did not ask respondents about which other farmers they obtained information from about hybrid corn seed. Others have also criticised the study on this point, "information was simply collected from all community members as if they were unrelated respondents in a random sample" (Katz In Rogers, 1995). Ryan and Gross themselves acknowledged their belief that diffusion in the two Iowa communities was based upon interpersonal network exchanges and that diffusion is fundamentally a social process. This interpretation of events needs careful analysis since it may be problematic for future diffusion studies on several fronts. Firstly, it needs to be pointed out that the Ryan and Gross study was based on two rural and somewhat isolated communities in the early 1940s. The communities are considered as somewhat closed and understandable systems and mapping social links between farmers may have been more possible. This line of thinking is rather problematic for contemporary diffusion studies in the 1990s and beyond. The main reason being that actors are situated in more open information and communication flow systems involving a range of links and channels. These are difficult to determine since information about an innovation may come from a multitude of information channels and not just from other human actors in a mappable social network. This is especially problematic in the case of electronic networks since electronic communities may exist in which actors exchange information without any visible or physical link between the actors. Essentially, actors can be at opposite ends of the globe and still be part of a social network. Therefore, the idea of social networks or the idea of diffusion as a social process needs careful interpretation

since an electronic network of actors as a social community is not elaborated upon beyond the idea of the invisible college (Rogers, 1995: 35). Consequently, trying to map the social network links between actors in contemporary diffusion studies may be difficult. Not only does one have to try and determine formal and informal links but electronic links as well. This would indicate that a sociometric approach to future diffusion studies will have problems since one can no longer really study a group of actors as operating in a closed system. Social networks are situated within an array of other social networks and thus comprise of a complex web of formal, informal and electronic connections.

In a physical social network, formal and informal links may be more obvious as in an organisational structure or rural farming community for example, but in an electronic social network, links may be both formal and informal and far less visible and obvious. This has also given rise to both electronic information surveillance and communication security as responses to the problem of controlling and tracking network access and connections between actors communicating in an information space. It is also debatable as to whether the concepts of heterophily and homophily, as proposed by Rogers (1995: 18-19), are as relevant in an electronic social network compared to a physical social network. People with similar characteristics, for example, age, sex, race, described under the term homophily, may group together more in a physical social network than they may in an electronic network where awareness of who/what you are may be somewhat difficult to determine. Examples of this can be seen in electronic mail, electronic discussion groups and electronic chat forums where people can operate under

a fictitious name and even impersonate members of the opposite sex. This also has implications for traditional social and power relations within society. Exchanging information or expressing views more remotely and anonymously within an information space is markedly different than, for example, a face to face meeting between a worker and the president of a company. Electronic mail can be seen as one such social experiment in information space which challenges traditional power structures. It is also conceivable however, that it may also entrench existing power structures by providing greater covert ability to survey the communications of other actors without their knowledge. Some of these themes were reflected in the 1995 IMIA Working Group 4 Conference, "Communicating Health Information in an Insecure World".

Hybrid corn seed, developed by agricultural scientists at Iowa State University, proved to be a revolution in farming productivity and agricultural technology between its release in 1928 and until 1950. All but two farmers in the Ryan and Gross (1943) study ended up adopting hybrid corn seed with the diffusion process following an S-shaped curve over time. According to Gross (1942), the innovators had large farms, high incomes, and more years of formal education than the late adopters. There was a significant time lag between awareness, adoption, trialing, experimentation and full adoption, on average, about nine years (Rogers 1995: 33). This would signify that adoption is not just a simple dichotomy between adopting or not adopting but rather a process of incremental adoption and learning over time and therefore, resistance lowering. Furthermore, the important information channels for earlier adopters were salesman; late adopters,

however, relied more upon neighbours and "... farmer-to-farmer exchange of their personal experiences with hybrid seed was at the heart of diffusion." (Rogers 1995: 34).

It is tempting to think that there could be a parallel between the diffusion of hybrid corn seed among farmers and the diffusion of CHRs among GPs. One needs to remember that diffusion studies are themselves situated in time and place. Similarities may exist but significant differences in both the specific locality and the broader socio-political landscape may negate any parallel. It may be the case that CHRs are a revolution for GP information management and health care provision, having an economic advantage that has not yet been fully perceived but by the same token this also implies that there may be economic disadvantages for some GPs as well. The widespread adoption of CHRs may also have consequences not considered by GPs, whether they be anticipated or not, for CHRs may be put to undesirable uses as yet not even contemplated. Nevertheless, from a more holistic standpoint, the adoption of CHRs by GPs needs to be considered as being an inherent sociological and political process which does not necessarily occur within static social network boundaries.

Careful interpretation also needs to be given to the idea of *new* as used by Rogers (1995: 35) in his definition of diffusion, for this is the basis on which the diffusion model put forward by Rogers is founded. As used by Rogers, *new* somewhat implies a rejection of the past historical and political landscape. It implies that something has just suddenly, almost spontaneously come into being. This is inaccurate; for example, in the hybrid corn seed study by Ryan and Gross (1943), hybrid corn seed did not just come into

existence because scientists accidentally discovered it in their laboratories. It was motivated by a greater economic and political want for the production of corn. Therefore, newness or innovation is somewhat of a matter of perception, essentially a reinterpretation which may or may not involve re-invention which can then result in alternative or the perception of new ideas, production processes and technological artifacts. Hence, the innovation process needs to be posited in a broader socio-political context and not as operating outside of society as some type of independent process.

**Rethinking the relationship between invention, innovation and diffusion**

The focus on diffusion can be one way of reconceptualising our understanding of ideas, for instance, invention and diffusion are concepts within the innovation process, also a technology can continue to be shaped by actors (users, designers) and also changed while diffusing. Rogers (1995: 17) calls this process "re-invention", change while adopting which may occur through user feedback or through novel ways of using the technology differently. As such, the process of adoption need not be a passive process of implementation of an idea or artifact, it involves a great deal of communication and information exchange, uncertainty reduction among actors (Rogers, 1995).

For an overview of innovation literature, Sneep (1992: 3) provides a brief account of some key works and the associated actors involved. It is obvious that a varied number of perspectives on the topic exist, for example, Schumpeter (1939), Von Hippel (1988), Porter (1990) and Rogers (1995). Some confusion exists as to how all the various perspectives fit together, not to mention how management of the innovation process can

be achieved. Either the perspectives offered are too narrow, technologically deterministic or the opposite, too broad. A more recent stream of thought, social constructivism, focuses more on the actors involved in the process of innovation diffusion. Sneep (1992: 9) also offers the idea of strategic choice, a theory which adopts another perspective upon the actor interaction approach:

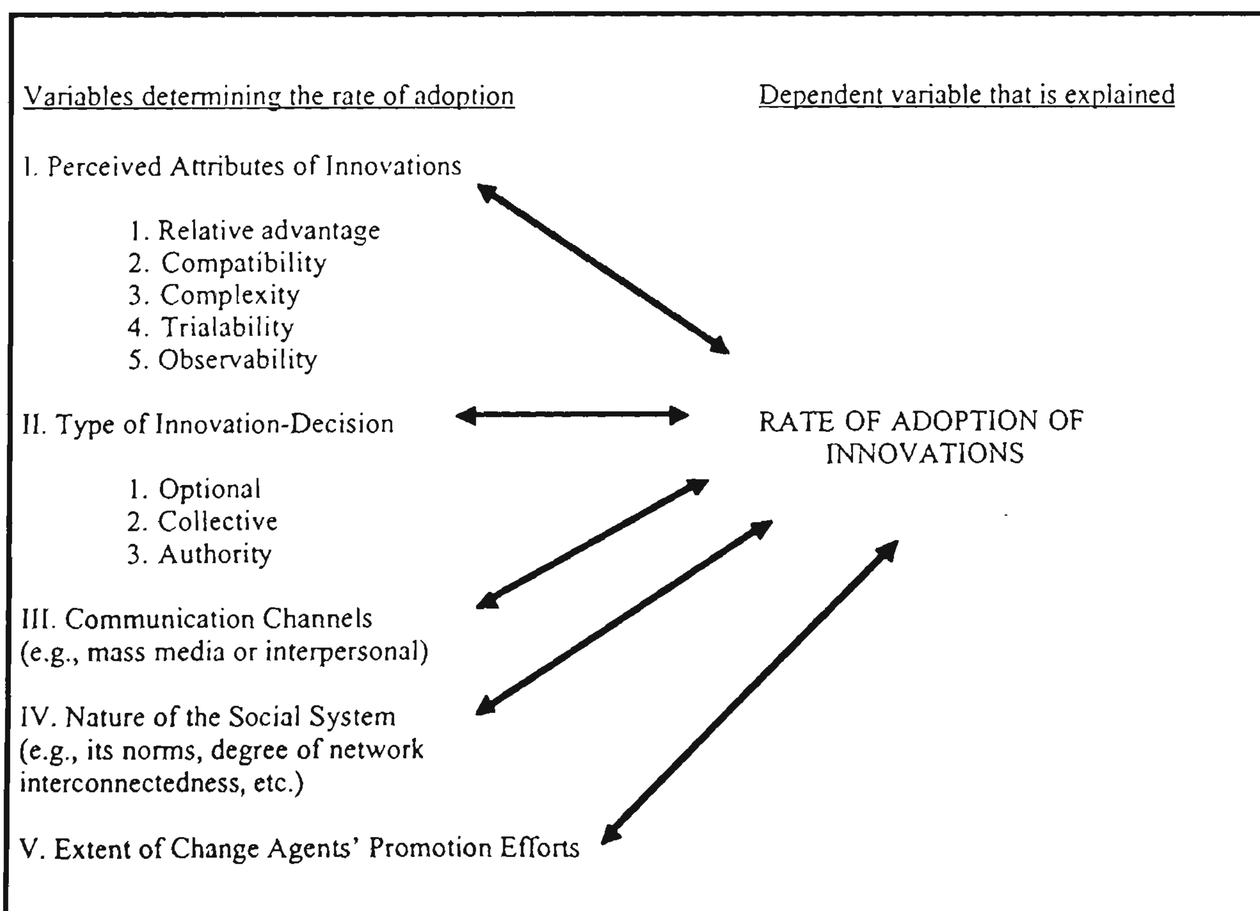
> The strategic choice view draws attention to individuals, their interactions, social constructions, autonomy, and choices, as opposed to the constraints of their role incumbency and functional inter-relationships in the system. Both the environment, and structure are enacted to embody the meanings and action of individuals, particularly those in power.

The strategic choice theory somewhat resonates of an optimistic pro-managerialist view of the world with managers as "energizing forces that shape the organizational world" (Astley and Van de Ven, 1983). This detracts from the complexity involved and rather over-simplifies the situation to one that can be managed. Nevertheless, the utility of strategic choice theory is in the idea of having a degree of choice at various environmental levels, macro, meso and micro (Sneep, 1992: 9). The idea of levels is always problematic but it can have utility if interpreted as more of a viewing lens capable of zooming in and out of various contexts at various scales. Therefore, in order to try and possibly manage the innovation diffusion process, a manager may need to develop such a conceptual skill. Sneep (1992: 11) hence defines innovation management in the following way:

> the ability of people - who are involved in processes, dealing with the creation, or development of new markets, or new organizations; or the creation, development, or implementation of new organization systems, or new production processes; or the creation, development, or market introduction of new products - to direct and control the factors, that drive these processes, and the patterns through which these processes proceed.

Individuals who can think more abstractly may be able to anticipate the potential (dis)advantages and consequences of new innovations long before they are observed. This would include an ability to forecast and speculate about market developments (see for example, Martino, 1983; Schnaars, 1989, 1998). The work of Rogers (1995) provides a conceptual framework (Figure 8-2) for helping to anticipate the rate of adoption of an innovation within a social system. Furthermore, not only may the rate of adoption be anticipated but adopters may be classified into categories: innovators, early adopters, early majority, late majority and laggards (Rogers, 1995: 262). As Rogers indicates, these five adopter categories are ideal type conceptualisations with a bias towards adoption since non-adopters are not included.

Figure 8-2. Variables determining the rate of adoption of innovations




Source: Rogers, 1995: 207

Rogers (1995: 36) places special emphasis on the role of communication channels and states that "mass media channels are more effective in creating knowledge of innovations, whereas interpersonal channels are more effective in forming and changing attitudes toward a new idea, and thus in influencing the decision to adopt or reject a new idea." Greater awareness of the roles and relationships between change agents, innovators and opinion leaders needs to be acknowledged for this may be one and the same person or it may be three different people. Conflicts of interest may arise as a result of the fact that innovators who may be agitating for change and the adoption of an innovation may be the same ones who have the most to gain from any wider adoption and change. By the same token, rejection may be seen as a response by those who have the most to lose from the greater diffusion of an innovation. The promotion efforts and the motivations of change agents need to be carefully scrutinised. Within this more descriptive socio-political context the innovation-decision making process can be more transparent rather than being seen as just occurring as an independent process.

**Social diffusion systems and networks**

Berkowitz and Wellman (1988) advocate a network approach to understanding social structure. Diffusion can thus be seen as a special type of information and communication learning process among actors within social networks in which the novelty of communicated information "... in the message content gives diffusion its special character ..." (Rogers, 1995: 6). From a macro policy and economic viewpoint, Freeman (1987) approaches networking from the perspective of a national system of

innovation. Diffusion of technology is seen as a network activity of relationships and cumulative learning processes between institutional actors in various social networks, both in the public and private sectors who ultimately shape and diffuse technology.

Shaw (1992) examined thirty-four medical equipment innovations in the UK and argued that networking can be seen as a management strategy. This implies that the process can be managed and shaped:

> networking is interpreted as the management of the relationship between activities, resources and actors in the network in the creation, development, design, manufacture, marketing and re-innovation of these innovations. (Shaw, 1992: 127).

Close integration and information feedback activities between marketing, design, production and distribution are vital. Another relevant insight is provided by Hakansson (1987) who argues that technical development of a product must be seen as part of an overall development process within a network. For example, Imai et al., (1985) indicated that the Japanese model of product development relies heavily on information sharing as a method of group learning.

According to Heikkilä (1995: 14-16) the decision to adopt is "... weighted against the costs of adaptive learning ...", such that the forgone opportunities or earnings lost while trying to learn "... alternative ways of accomplishing work activities". Heikkilä views the diffusion process as a learning intensive activity performed both by individuals and organisations:

> ... diffusion is based on different logic in different phases. The pioneer adopters acquire more information about the new, uncertain technology by trial and error to find its applicability to specific domains. After the initial phase, the diffusion divides into obligatory adoption,

> commitments, and herding. When committing the potential adopters discuss, decide and commit to a solution within a department or peer group. (Heikkilä, 1995: 29).

This further implies a somewhat evolutionary learning based model, one based on trial and error to find an optimum use and that since adoption takes place in peer groups or in separate departments, "... the traditional time distribution of adopter categories is flawed." (Heikkilä, 1995: 29). These findings help support that argument that the adoption categories offered by Rogers (1995) can be seen as too idealised. This dilemma can be characterised as a problem inherent in diffusion studies which try to group adopters into distinct categories. This type of approach may become an exercise in oversimplification of a complex process, using an over-rationalised view of the issue. Therefore, it follows that the adoption of CHRs among GPs will vary from GP to GP and practice to practice, region to region, country to country. For example, within a specific GP Division in Australia, there may be pioneers (other GPs in the Division) many years after the first GP or pioneers(s) initially adopted CHRs, since different ways of interpreting and using the technology may be found. These same late adopters may then become innovators in that an adopter may be both a late adopter and an innovator at the same time. This serves to highlight the problem of trying to classify adopters into categories as proposed by Rogers (1995) and should only be seen as idealised constructs.

# CHAPTER NINE

## THE CHR DESIGN PROCESS

It is not the purpose of this thesis to present a design approach or methodology for constructing CHRs, but to review some of the ideas involved. The design and (de)construction of CHRs should fundamentally be negotiated and worked out between the various users and stakeholders involved. A review of some system design literature would strongly suggest that a survey of the attitudes of the users and non-users is required in any system design approach (Lif, 1998; Davis F., 1993; Linnarsson, 1993; Moidu, 1993b; Timpka, 1989).

The concepts of data and information are problematic ideas especially in the field of information systems design (see for example, Checkland and Howell, 1998). Some treat the concepts as being one and the same, while others distinguish (with difficulty) between the ideas. Is there a difference between health data and health information? Does data become information when placed in a meaningful context? For example, patient data becomes patient information when placed in a patient record, that is, the process of organising and categorising the data in some type of larger schema, for example, Weeds (1969) POR, which provides context and thus meaning within some organisational setting.

What does the concept of data mean? Is it just a process of transformation from the meaningless to the meaningful? Theoretically, if data is essentially letters, numbers and symbols, even this is problematic for it implies that letters, numbers and symbols

already have an established meaning within some social schema of understanding otherwise they could not be understood or recognised in the first place, for example, the alphabet or the numerical counting system. A name means little unless it is the name appearing on a patient record along with other data (age, address, medical history, etc.). So it is the relationship between the way the data elements are organised in a patient record that gives the patient record some meaning and thus can be considered as information. Nevertheless, data in the GP setting is essentially derived from a shared or communicated discourse between the patient and GP.

**The GP encounter**

A functionality gap exists between what CHRs should be able to do and what they can actually presently do in practice. (Re)design would essentially involve a deconstruction of the existing process of the GP consultation or encounter episode. This needs to involve case studies, practice visits and interviews in order to observe what actually happens. This is fundamentally difficult since the consultation between the GP and patient tends to be embedded in a relationship of confidentiality. A third party researcher trying to observe events may compromise this trusted relationship and hence, this could be seen as unethical since the researcher may hear and see things which should remain between the doctor and patient. Patient and doctor consent would thus need to be obtained. This problem is inherent in any social research which attempts to examine human situations involving a high degree of trust and confidentiality, for example, those of doctors, lawyers or psychiatrists. The GP may have to conduct the research himself/herself but this is also problematic and possibly unethical. How can a GP be an

observer of their own behaviour in an episode of care while also concentrating on the patient?

Nevertheless, if it were possible to conduct an extensive analysis of a GP practice and the encounter episodes, a conceptual approach based on an information and communication model of general practice would need to include the following elements as shown in Figure 9-1. The work of Lif (1998), Tjora (1997), Linnarsson (1993), Timpka (1989), and Tan (1995) were helpful in formulating this approach.

Figure 9-1. Elements of an approach to CHR design

- Modeling the information needs and flow of the practice itself between GP, patients, staff and external contacts (e.g. Medicare, other GPs, etc.). This could be captured through direct observation and interviews with the various practice actors. Essentially, the task is to determine who needs what information, where, when and why.
- The actual unit of analysis would be the GP-patient encounter itself. This implies an analysis of the interaction and the decision making process and the actual discourse between the GP and patient and the resulting documentational behaviour by the GP.
- Trying to model the cognitive decision making process of the GP can be somewhat problematic as is generally the case with any attempted social deconstruction of human expert or professional thinking. Observed behaviour may give no indication of what is actually happening in the GP's mind; nor may the GP want anyone to know.
- After a conceptual model has been developed the researcher would need to try and verify the model with the GP and the other practice actors. This evaluation and feedback process is important in making needed changes to the model.
- Any approach needs to situate the modeling process in a schema of organisational politics. Since differences in power relationships exist, exchanges between the GP and patient are not necessarily as symmetrical as those with other members of staff, so a more asymmetric model may better reflect the encounter since it is the patient who is seeking professional advice from the GP which may or may not be moderated by the patient's own knowledge.
- Conducting the research project itself may be treated with suspicion since the motivation for the research may not necessarily be clear. Staff may perceive it to be a threat to existing power relations as well as a threat to their very existence. Hence, resistance may be encountered.

## Information and communication flow between actors in an organisation

In Sweden, much as in Australia, patient contact with GPs can be through a health centre or clinic, private practice or hospital emergency. In Sweden it is predominantly through a health centre as there is only a small number of private practice GPs in the country. In Australia the main contact is through a private GP or health clinic. In the Swedish context, Sandblad et al., (1986: 104) describes the information flow process well:

> patients call the primary care centre by telephone and are connected to a person, most often an experienced nurse, responsible for the first contact with the health care system. The nurse makes, in dialogue with the patient, a preliminary evaluation of symptoms and of the status of the patient. She can give the patient advice, refer her or him to other health care units or set up an appointment at a time adjusted to the needs of the patient and to the care resources available. During this contact the nurse collects a lot of information from the patient, utilizes different sources of information such as the medical records, appointment lists, time schedules for the physicians, laboratories, investigation rooms, etc. She also produces information, e.g. notes to be added to the medical record, appointment information and a lot more.

The Australian system follows along the same general lines albeit with some important differences; the first contact person is usually the receptionist rather than a practice nurse, or for example, it may even be the GP himself/herself. Usually, the receptionist can act as a sort of filter but he/she may not necessarily be a practice nurse. Having an extra practice nurse in private practice can be seen as another expense and so the private practice is often a streamlined organisation consisting either of a sole GP or other GPs and a receptionist who may or may not have a nursing background. This itself calls into question the role and value of the practice nurse. In the Swedish system, the receptionist, who may also be the practice nurse, deals more with the patients who turn up at the practice waiting room. The flow of information in general parctice needs to be considered during information system design (see, for example, Telecom Laboratories, 1992). Essentially, who communicates what information to whom, why and how.

**GPs and health records: paper versus the computer**

Can a fully paperless GP CHR system exist in practice? Possibly, some interim medium between computer and paper is more realistic as much skepticism now surrounds the idea of the paperless office. For instance, prescriptions and referral letters still have to be printed out, however, EDI may or may not resolve this situation of data interchange between a GP and a pharmacist, specialist, pathologist, hospital, or health insurance office. Despite very optimistic and somewhat highly pro-technology views (for example, Waegemann, 1992, Gates, 1995) consideration needs to be given to the consequences and inherent problems associated with such changes. For example, converting paper record systems, which may involve handwritten notes, shorthand and even personalised classifications may be a slow, laborious and time consuming process despite having the electronic image bridging technologies advocated by Waegemann (1992). The dilemma with handwritten notes is not just a transcription problem complicated by illegible handwriting but is even more complicated if the only person who can read the handwritten notes is the GP who made them, assuming that even they can!

It is often stated that computerisation of patient records will solve many information handling problems. This is not a new idea and has been proliferating for many years ever since hospitals started experimenting with computer systems. Thus, careful consideration must be given to the problems and consequences of computerisation. Simply trying to automate existing manual processes is not the answer, as others concur

(Sandblad et al., 1986: 104; Linnarsson, 1993). Figures 9-2, 9-3 and 9-4 are an attempt to try and outline some of the basic arguments for and against computerising patient records.

Figure 9-2. Advantages of paper records

- Historically, the dominant social technology for organising patient records,
- The medical record can consist of various documents of different shapes, sizes and colours,
- Allows for an overview of several pages at one time as well as rapid browsing,
- Has the intrinsic look and feel comfort similar to other paper based technologies, for example, books, magazines, journals and newspapers,
- Is highly portable; portability may not be as critical a factor in a GP practice environment as in a hospital (in a hospital environment a terminal would have to be available at each bedside for patient record recall instead of the usual paper charts). From a security perspective this portability aspect of the paper record could nevertheless, also be seen as a problem.

Figure 9-3. Arguments for CHRs

- Foundational building block for all other health initiatives and changes, for example, telemedicine and EDI,
- The CHR is a fundamental paradigm shift and is perceived to be a more efficient way for GPs and other health professionals to work and communicate,
- Costs will decrease; less test ordering and duplication; less over servicing, waste and greater fraud reduction,
- Greater accountability, productivity gains, quality and efficiency in health care,
- Reduced storage space by not having to store paper records in filing cabinets.

Figure 9-4. Arguments against CHRs

- CHRs are not essential,
- No real improvement to the process or delivery of health care; more paper rather than less,
- Costs will not decrease ,
- No greater accountability, just a continuation of existing problems,
- CHRs are a threat to GP control over patient information and revenue,
- Productivity gains may not be so great, take time to realise and learn, may even result in a computer productivity paradox, more time needed to do the work rather than less,
- CHRs encourage computer dependency to carry out work tasks.

## Further CHR design considerations

> In most cases when computers are introduced in a work situation, the purpose is said to be to improve effectiveness, to solve problems, to achieve better care for the patients, and other types of positive criteria. If different projects are analyzed in detail, it can often be seen that such criteria are not fulfilled. This is perhaps not so much a reflection of lacking ambition, but of the difficulties involved in development of effective information systems. (Sandblad et al., 1986: 100)

Technology management can be a highly complex information and project management exercise. This complexity may be captured in the approach taken to information systems design. The word "system" in this context is used to represent the generic idea(s) behind technology and project management. There still exists a divide between the idea of designing systems around the people (users) or having the people fit to the system. The literature on this topic does seem to favour a more human centred orientation to design, if a system is to have a greater probability of adoption by the users (Checkland, 1981; Mumford, 1984, 1987; Checkland and Scholes 1990; Walsham et al., 1990; Braa et. al., 1993; Bijker et al., 1987; Bijker and Law 1992; Bijker, 1995). This follows the broader idea of designing information systems in a social and around user/actor information needs and wants, participation and mutual learning, rather than in some social vacuum or solely by software programmers. This suggests both an interactive and iterative methodological approach based on some combination of user interviews, case studies, delphi surveys and prototyping so as to match the users' information needs and wants to the actual system design. The iterative aspect of this process is fundamental to translating the perceived communicated meanings between actors into what is required. Another problematic but important aspect to consider is that user needs and wants change over time so that information systems need to be designed in a flexible way to allow for future change. This suggests a somewhat ironic picture in that some negotiated standardised approach is needed but at the same time it

must be flexible enough to accommodate change and possible organisational variation. Thus, from a technology or project management point of view, the process of information system design can be conceptualised as one of managing a complex mix of the interaction between people (actors), technology, strategy and change. The information system artifacts (the visible technology) can then be interpreted as being representative of the inherent trade-offs and negotiations between actors in a social system.

Moidu's (1993b: 42) approach to system analysis and design "... is to first get quantitative and qualitative data through a questionnaire study of end-user groups, it provides an empirical base of the end user attitudes, apprehensions and shared functional characteristics that may be later verified by an on-site analysis." Problems of observer bias are also mentioned "... it is not that the questionnaire would have no bias, but the end-user participation provides a range of views to guide the site investigation and ensures end-user participation". Several interesting issues are alluded to in this quotation. Rather than trying to declare that research is in some way purely objective, a more open acknowledgement of bias should be advocated as is the case with most action based research where the researcher(s) actively seek to change events. Again, some of the key issues are not examined, for it seems rather to be assumed that "end user participation" will take place and there is no real examination of such central issues as: varying degrees of power, control and conflict among users/actors in the organisation or social setting.

Questionnaires provide a more anonymous approach to identifying perceived problems associated with technology diffusion. As a result actors may be more willing to express views and attitudes which may be in direct conflict with other actors and existing power structures. This also puts the researcher directly in the spotlight as the gatekeeper of actor information (for example, mailing lists) and confidentialities. Thus the issue of bias becomes an inherent problem for any researcher as other actors may treat the researcher and his/her research with suspicion, leaning for example, towards an alignment with particular actors whether management, government or a competitor.

Other approaches to studying information systems may be to try and determine why some systems succeed while others fail. The work of Sauer (1993) is helpful in this respect. Previous work by Sandblad et al., (1986: 100-101) indicates some general aspects of failed systems namely, the urge to computerise just for the sake of computerising; systems devoid of work needs and context; trying to implement a general rather than a specific tailored system; poor interface design; lack of communication with the users; poor understanding of requirements and work processes. All these issues need to be taken into account when designing future CHR systems.

**Does a standard approach to information system design have utility?**

This basically implies that a standard approach is set, irrespective of geographical variation. This goes against the philosophy of designing systems around users' wants and needs. A standard is simply imposed and the people are made to adopt the technology. How successful has this been? Such approaches may have more to do with

marketing and advertising products over time and manipulating peoples' attitudes and behaviour through propaganda, control of information channels, information flow and media. This raises the question as to what role marketing and advertising play in the diffusion of technology? This would indicate that perception plays an important role in the process of technology diffusion (Rogers, 1995), which can further be interpreted as a conflict between actor motivations and conflicting information (propaganda) diffusion systems.

**Conceptual design methods**

A variety of conceptual methods are offered by Greisser et al., (1980) which may be of use to CHR designers; these are essentially founded on a custodian model of health care data within a growing network environment. More recent work on user requirements of an electronic health care record are also offered by Peterson et al., (1997). The work of Lif (1998) also offers a range of methods for modelling, user interface design and evaluation with a primary focus on designing information systems around user needs.

Additionally, a number of commercial Computer Aided Software Engineering (CASE) programs are available to help in system development, for example, Medical Electronic Desktop (MED) developed by JAM Software of Australia.

Another useful design technique is the use of an information flow matrix (Greisser et al., 1980: 38-39). The idea is that a matrix can be constructed to encompass all stakeholders and their required information/data needs and levels of access to CHR information/data:

data acquisition, data handling, data retrieval (Greisser et al., 1980: 42,43,45). A range of guidelines are offered for maintaining data integrity, audit controls, responsibilities of the data originator, keeper and user (Greisser et al., 1980: 46-55). A strong emphasis is also placed on the development of organisational policy with respect to the former issues and the application of risk analysis methods (Greisser et al., 1980: 57-119).

Future design of CHRs will need to include provisions for the following actors and stakeholders as shown in Figure 9-5 below.

Figure 9-5. CHR stakeholders

| |
|---|
| Physicians/Clinicians (GPs, specialists ...) |
| Nurses |
| Hospital and Record Administrators |
| Patients |
| Third Party Payers/Insurers |
| Health Care Researchers |
| Policy Planners |
| Other ( programmers ...) |

In a CHR environment it would appear that levels of access can be structured to give greater control over access rights as opposed to records held in paper repositories. But the key question is whether privacy overall will be safeguarded more in a networked environment or less? Authorised users can still misuse the system.

Computer systems for GPs have generally focused on single purpose applications, for example, prescription writing, accounts/billing and as such have limited use in the overall schema of the GP practice environment. Improvements need to be made in CHR design,

integration and user interface otherwise low frequency of adoption and use will continue and only entrench the attitudes of non-computerised GPs that computers will never play a significant role in their practices.

It is essential that GPs and other health care providers are directly involved in the design of CHRs. Participation in the design may appear to be a healthy pre-requisite but it does not canvass issues of power relationships between the various actors and how this influence may suppress or encourage action. For example, computer programmers may be very proficient in C++ programming but may have very little knowledge of the primary health care setting. They may therefore lean towards a standardised generic approach to GP office management. This approach is ill advised because the GP practice is unique and requires careful analysis. At present, some evidence exists that suppliers of electronic patient record systems do not meet user requirements, a point well shown in a Swedish survey conducted in 1994 which identified 27 different suppliers of which only a few were deemed able to meet reasonable user requirements (Spri, 1997: 15). But one should not jump to conclusions from just these findings. Such results may indicate a mismatch between system developers and system users and could therefore indicate that systems are still being designed in isolation from the users. It could also be argued that systems are being rejected by users, whether or not they are participating in the system design, because they have the most to lose in an econometric driven health care system. Why would they participate in their own demise or loss of income? This is not dissimilar to past experience with automation in factories where Luddites strongly resisted the introduction of machines that would make them redundant.

A major initiative by Spri was a project in 1996 to standardise CHR requirements, the report advocated a process orientated approach and adherence to European Standards towards conforming to the Good European Health Record. This is understandable since Sweden is a member of the European Union and it would be foolhardy to try and develop a Swedish standard which does not meet standards set by the European Standards Organisation (CEN). This may have implications for Australia to develop a similar core CHR. Attempts by the RACGP, IBM and the Medical Software Industry in Australia to develop a core standard exist (Medical Software Industry Assoc. and RACGP, 1996; IBM Consulting Group, 1997). Another problem that needs consideration is nomenclature; despite CHR diffusion, institutions can still develop and use their own terminology within the records for diseases. From an administrative point of view this can make for some difficulty when collecting data from GPs and hospitals. A standard nomenclature is advocated but this is somewhat difficult to achieve due to variance in human thinking and behaviour. More over, trying to standardise human thinking and behaviour can be perceived as a dangerous trend towards an information control society, one way of thinking.

### Graphical interface

The object-oriented user interface seems to be the present trend in computing, using a desktop analogy of folders and files, icons, pick and click, instead of command line or menu based interfaces. This idea stems from the original research work conducted at the Xerox Palo Alto Research Center, California, in the 1970s known as the Xerox Star user

interface which emerged in 1981 (Verplank, 1986: 113). Most systems presently have adopted the object oriented desktop interface, for example, Windows 95 and 98.

From the outset, voice interface technology would seem to be an attractive option over existing, hands-on interface designs and CHRs. Voice interface technology can be characterised as a technology in construction and development, a slowly diffusing technology. Many actors have come and gone in this field over the years. For a more detailed account of the various problems faced in this area refer to Hill (1986: 131-146). The field of voice interface technology to the uninitiated may appear to be an exercise in technics but this is misleading, for just like the study of CHRs, voice interface technology is a coming together of a complex mix of linguistics, psychology, communication theory, sociology, technology, artificial intelligence, law and innovation diffusion. Furthermore, it can be thought of as belonging to a technology cluster (Rogers, 1995) along with CHRs and other similar technologies yet to be developed.

**Implementation and evaluation**

The RACGP and AMA (1998) have published guidelines for the implementation of computers in general practice and codes of practice for medical records (RACGP, 1998). Evaluation is more difficult, benefits may be indirect and intangible, especially in the case of the evaluation of information management systems such as CHRs. Despite the setting of objectives, assessments of success or failure are judgements which can be very subjective. A macro/micro approach (Figure 9-6) has utility in that a more socio-political based assessment of the overall picture can be made.

Figure 9-6. Macro/micro lens for CHR strategy and planning

| |
|---|
| **Macro.**<br>Need to consider the international, national, and organisational settings, standards, costs, government policy and regulation, the actors involved, power relationships, motivations, conflicts and how technology can rearrange or entrench existing market structures of behaviour and control.<br><br>**Micro.**<br>User abilities, training, support, existing organisational resources, software, hardware, etc. |

By way of example, Bäckman et al., (1986) present an account of a successful way for the management of projects in the primary health care field in Sweden. Basically, a government fund was established in 1982 of 55 million Swedish Crowns for the development of projects during the period 1983-1987. Project justification was tied into arguments for the need for competitiveness, growth, creation of employment opportunities and sustaining the Swedish welfare state through technological development. Unions and employers were seen as essential actors in the whole process. The key to the whole process, as argued by Bäckman et al., was the adoption of an appropriate methodology that would help initiate change and encourage the adoption of a new system. This was essentially tied into a stakeholder model and involved an analysis of the staff, operations, technology and the organisation before, during and after the change process. A consultant was used to orchestrate and evaluate the projects.

As has been argued in this chapter, the design of information systems is not an activity lacking ambition but rather an underestimation of the social and political difficulties faced. These issues are in need of greater acknowledgment not only in the design of CHR systems but information systems in general.

# CHAPTER TEN

# GPS AND CHR ADOPTION/REJECTION

## CHR adoption/rejection as an evolutionary learning process

There is need for a greater integration and review of human learning theories. This may well help to elucidate upon CHR adoption and rejection issues. The literature relating to learning theory is still heavily based in the canons of classical conditioning, the work of Pavlov in the 1800s, and operant conditioning (Skinner, 1974), a benefits incentive model. Flykt (1998) breaks this down into associative and non-associative learning processes. There also exist other interpretations, but learning theory, by and large, seems to be steeped in the behaviouralist tradition. This thinking seems to indicate a continuum, ranging from biological to psychological determinism. It can be argued that these views are deficient and that, there is a need to position learning again within a wider social context. The resultant social learning theory may offer more understanding than cognitive or biological based models. Furthermore, in a diffusion framework, the idea of differential conditioning can be interpreted as the differential rate of the adoption of technology and learning among actors underpinning the S-shaped curve. Classical conditioning could be interpreted as directed adoption strategies (for example, regulation) while operant conditioning could be interpreted as indirect adoption strategies (for example, incentive schemes). It would seem quite a stretch of the imagination to think that the act of technology adoption or rejection is somehow biologically encoded in some human beings, e.g. in the neurons, brain structure, DNA and not in others. Therefore, socio-political based explanations would seem to be more appropriate.

If a social system design perspective is adopted to human learning, organisations, actors and work tasks, the world social structure can essentially be conceived of as a big evolutionary learning system. This idea is in part based on an interpretation of Darwin's theory of biological evolution in which organisms are continually adapting and readapting, learning to changes in their social system. The difference in usage here is that evolution is not seen as a biologically deterministic process but as a social process, involving a biological component. More recent interpretations indicate that:

> Diffusion models portray society as a huge learning system where individuals are continually behaving and making decisions through time but not independently of one another ... Everyone makes his own decisions, not just on the basis of his own individual experiences, but to a large extent on the basis of the observed or talked about experiences of others. (Hamblin In Rogers, 1995:331).

It can be speculated that adoption of a CHR system by GPs may be seen as an evolutionary learning process (see, for example, Walker, 1997). This idea implies that adoption may follow a more staged than outright full adoption and use learning path. For example, one evolutionary learning path, not necessarily sequential, to full CHR adoption and use, may progress along the following: from computer adoption to word processing, appointments scheduling, accounts/billing, spreadsheet and database use, prescription writing, setting up an age/sex/disease register, electronic mail use, World Wide Web searching, EDI, to full CHR adoption and use. This only serves as an example and is by no means an exhaustive list, for example, computer games could also be included. Ochuodo (1993: 194) partially supports this thinking by stating that "E-mail is an effective way to promote computer literacy ...". The idea implies partial, staged and modular adoption leading up to adoption and use of a fully integrated CHR system rather than full outright use and adoption. Nevertheless, outright adoption may

occur for some GPs which may then follow a modular use process through time in order to learn how the components of an integrated CHR system work and fit together. Thus, learning may occur in parallel or sequentially and be moderated by the talked about experiences of others. It also needs to be acknowledged that GPs may start at different stages and follow different evolutionary learning paths altogether, reflecting their personal experiences. As indicated, the evolutionary path example presented is not necessarily an ordered sequence of learning episodes nor linear in trajectory. It may not occur at all.

Other authors indicate that a computerised GP accounting system can be the basis for a general patient register which can make possible the use of patient demographics and also foster in the development of age/sex/disease registers (Kidd et al., 1994; Hoskins and Fardy, 1994; Hall, 1992). Hoskins and Fardy (1994: 170) for example, claim that:

> this project demonstrated that a computerised age/sex/disease register can be set up in a general practice and does assist GPs in their work. This was particularly evident in the area of health promotion where, by identification of sub-groups within the practice population, focused preventative care was possible.

Further discussion indicated how this new found information can easily become an ethical conflict between real health promotion activities on the one hand and outright money making on the other, despite recall reminders being an accepted practice approved by the RACGP and the Health Insurance Commission in Australia. This was demonstrated by the eagerness of one particular GP in the practice who wished to capitalise on this situation by personally telephoning and inviting patients to come in for an influenza vaccination. In the final analysis this proved to be a far more effective

method for acceptance than reminder notices (Hoskins and Fardy, 1994: 170). This personal touch is concurred with by Gillam (In Hoskins and Fardy 1994: 170) as being "more effective in affecting behavioural change ...". This would indicate that GPs could learn very quickly to adopt and use CHRs if shown how the technology can be utilised to make money.

An interesting twist upon CHR adoption/non-adoption could be Spencer's (In Olsson and Algulin 1995) reinterpretation of Darwin, crudely known as *survival of the fittest* thinking. This interpretation may imply that only those GPs who adopt and learn to use CHRs effectively and competitively will survive in the GP market place. This interpretation is reflective of a more competitive advantage way of thinking as characterised by Porter (1980, 1985, 1990). Tension and conflict among actors (national, organisational, individual) is thus inherent in a competitive system as some actors wish to gain a competitive advantage in order to disadvantage others, a type of competitive annihilation. This is generally reflective of a capitalist system which encourages profit maximisation and cost reduction. The hegemonic dialectic of class division has taken on a very individual *survival of the fittest* interpretation. Profit maximisation therefore becomes a function of information maximisation, that is of, a GP being able to collect, store, retrieve, analyse and utilise patient information for economic gain.

**A look at some GP (CHR) systems**

These systems, as shown in Table 10-1, are often originally designed by GPs themselves and then gradually commercialised. This is one way of trying to overcome

the third party information analysis and system design problem mentioned earlier but there are inherent individual bias problems with this self analysis approach to information system design. Furthermore, the systems themselves need to be considered as being in different stages of evolution. None of these systems really represents a fully integrated CHR gold standard, as yet.

Table 10-1. Comparison of some existing (CHR) programs

| | JOURNAL III | DOCTOR'S DESKTOP | MEDICAL DIRECTOR |
|---|---|---|---|
| Company | Sysdeco Profdoc | MediMin Pty Ltd | Medical Director Australia Pty Ltd |
| Originator | Kjell Hove | David Baker | Frank Pyefinch |
| Country of Origin | Version 1 : Norway<br>Versions 2 & 3: Sweden | Australia | Australia |
| Cost | 1 licence: 7500 SEK<br>service & support: 2200 SEK/year * | single user: $500<br>network version: additional $480<br>additional doctors: $380 each | The actual program is given away at no cost but a charge is made for the drug database updates ($150/update/year) |
| Number of versions | 3 (version 4 in 2/3 years) | several | several |
| Platform | v2: DOS<br>v3: Windows 95 | Windows 95 | earlier versions: DOS<br>later versions: Windows 95 |
| Requirements | PC Pentium<br>16 KB RAM | PC Pentium<br>16 KB RAM<br>CD-ROM | PC Pentium<br>16 KB RAM<br>CD-ROM |
| Problems | Does not allow for custom design of reports: no query facility, no English version (yet) | Limited query features | Limited query tools<br>Primarily a script writing program. |
| Disease code | ICD10 | - | - |

* 1 Australian Dollar = 5 Swedish Crowns (approx. in 1998)

**Human-computer interaction**

Analysis of the interaction process is not new (see for example, Bales, 1950). Previous studies have looked at various process aspects of human computer interaction, usage styles, interface design, training, skills, variance in medical practice among practitioners, productivity, and patients' attitudes to the use of computers in general practice. The doctor-patient relationship is considered to be very important and concerns have been raised over whether computers are seen to depersonalise or interfere with the doctor-patient relationship thereby further exacerbating both patient and doctor anxiety. This line of thinking opens up speculation about possible explanations for the low adoption rates of computers and CHRs among GPs also including possibilities that CHRs challenge traditional GP training and skills, generating resistance to having to adopt new skills and the need for more learning and training. An analysis of the literature reveals that numerous authors have been trying to address these very issues, for instance, Fitter and Cruickshank (1982, 1983); Fitter et al., (1984); Fitter (1986); Brownbridge et al., (1984, 1985) and Heikkilä (1995).

The dilemma of the productivity paradox is also worth considering as to whether or not computers have improved human productivity (see for example, Rice and Bair, 1984). The meaning of productivity is also somewhat problematic. The general notion is that people are able to do more in less time than previously but this is a very simplistic idea since productivity as a concept is inevitably tied into other ideas, e.g. quality, standards, technology, information and management. Essential to the idea of

productivity is the need for the structuring and ordering of behaviour. As stated by Fitter (1986: 71), "... there is accumulating evidence that the computer provides structure to the consultation." Hence, the move towards greater office automation (Tapscott, 1982) and the popularity of decision support systems. The greater diffusion of computers has resulted in a wider range of impacts on organisational structures. This only hightens the need for future consequences research on the impacts of CHRs.

**Moving towards a CHR gold standard**

Is there an ideal CHR and if so, what would the ideal CHR look like? The search for an ideal CHR system is somewhat never-ending. Given present knowledge, a comprehensive and integrated CHR serves only as a speculative illustration and is by no means the last word on CHRs nor ever an exhaustive list of possible modules or components. Theoretically, the shape and design that an ideal CHR system might take is a result of a socio-political process among the actors/users involved who attempt to shape and (de)construct the meaning of what a CHR should be.

The present ideal of a CHR system for GPs would be an integrated system of modules or components working together in one software package possibly on a client server architecture, standalone or laptop PC utilising a GUI interface. Possibilities exist for other input devices such as voice interface technology and allowance for external drives (for example, Zip Drive, CD-ROM hook-up if not already included internally, etc.). A reader interface for smart card applications is also a possible future option. A GP Office software package may contain the following modules or access to other software

modules. For example, if a GP wanted to switch from the GP Office environment to word processing they could easily just click on an icon which would allow them to access word processing software automatically without having to quit the GP Office environment or to open another window. This could be conceptualised as a tailored operating system for GPs, the GP Office environment so, instead of Windows 95 or 98, for example, there would be a GP Windows or GP Office operating system, tailored for GPs. It is acknowledged that this would be a costly and timely endeavour which would be shaped through time. Priorities for certain functions may change and take precedence over others. This will inevitably be a reflection upon the actors involved and what is considered to be of more importance at given times as suggested in Figure 10-1.

Figure 10-1. CHR component modules

- patient database
- a standardised data dictionary for disease coding, e.g. ICD-9-CM, ICD-10, SNOMED, Read, ICPC (efforts are under way to link these coding systems)
- a database query language for analysing the patient database and producing custom reports
- appointments/scheduling module
- accounts and billing module (allowing for an audit and overview of day end accounts, incorporating month end reporting procedures and general revenue and expense summaries, e.g. salaries, etc.)
- e-mail access module
- WWW access via an Internet browser to GP discussion groups, knowledge databases, etc.
- access to a drugs interaction database
- prescription writing module
- other support tools (e.g. drug alerts)
- access to a literature search database, e.g. Medline (this may be combined with the WWW access module)
- patient pamphlet or education module (this would allow for a quick printout of information about a particular health issue that can be given to the patient, e.g. diabetes, HIV, blood pressure, pap smears, etc.
- EDI access with an insurance provider module (e.g. Med-E-Claims)
- EDI access with a pathology lab, radiology, pharmacy, etc.
- EDI connection to hospital(s) for exchange of patient admission and discharge information

It should be noted that all the EDI issues mentioned in Figure 10-1 are of significance since EDI can be seen as a technology which may lock GPs into relationships with particular service providers, e.g. pharmacists, pathologists. This supply chain structure could be seen as either favourable or unfavourable, depending on the perspective taken

and has implications for future organisational structures, security and relationships between various health care actors. The works of Ramamurthy and Premkumar (1995), Premkumar et al., (1994) and Ratnasingham (1997) are informative with respect to the implications of wider EDI diffusion and organisational security. Similarly, studies of EDI resistance are also informative, Emmelhainz (1990) argues that organisations with low awareness and knowledge of EDI tend to postpone EDI adoption until there is only one type of standard in an industry. This could also be the case with CHRs and should be investigated further.

# CHAPTER ELEVEN

## HOW CAN HIGH AND LOW RATES OF CHR ADOPTION AMONG GPS IN DIFFERENT COUNTRIES BE EXPLAINED?

Epidemiology can be a useful metaphor for understanding and conducting a CHR diffusion study. The study of CHR diffusion among GPs shares many characteristics with the goals of epidemiology studies. Firstly, epidemiology can be characterised as the study of disease and disease trends within human populations. The underlying assumptions of this discipline are

> ... first, that human disease does not occur at random, and second, that human disease has causal and preventive factors that can be identified through systematic investigation of different populations or subgroups of individuals within a population in different places or at different times. (Hennekens and Buring, 1987: 3)

By analogy, CHR diffusion can be seen as a process that does not just occur at random (i.e. there are reasons for the occurrence) and CHR adoption can be both prevented and encouraged by understanding how adoption/rejection may occur through some type of diffusion investigation. This can, for example, involve a comparative study of GPs in different countries. Therefore, at a conceptual level, the study of CHR diffusion among GPs shares some of the same goals as epidemiological studies. These basic components include: quantification of disease frequency, distribution patterns of a disease and its possible determinants (Hennekens and Buring, 1987: 3).

The work of Agreus et al., (1993, 1995), Eriksson et al., (1997), Sandvik and Hunskaar (1990) have been helpful in understanding both the issues and approaches involved in designing epidemiological studies, presenting results and how they may be adopted for a CHR diffusion study among GPs in Australia and Sweden. On close inspection, the

diffusion thinking of Rogers (1995) is also influenced by earlier thinking about epidemiology and the work of Bailey (1957). The S-shaped diffusion curve can be seen to centre around the idea of contamination, the idea that the diffusion process is itself "... similar to that of an unchecked infectious epidemic ..." (Rogers, 1995: 259).

According to Rogers (1995: 259) information exposure is the most important explanation for diffusion. Valente (1995) carries this argument further and argues that exposure (contagion) is not enough but rather that the focus needs to be on the frequency of exposure. Valente argues that this is a more useful explanation of diffusion and adoption. The more times a person is exposed to the idea or technology the more likely he/she is to make a decision to adopt or reject.

The issue of causality in research needs to be clarified. Causal explanations can be highly problematic, therefore the idea of a possible association between variables is more useful as an argumentative construct since it provides a broader frame of reference for explanation and understanding. The search for causal relationships between variables is characteristic of the North American research tradition, often pursued through more quantitative and empirical based methods, in order to arrive at generalisations, as evidenced in the work of Rogers (1995) and is also indicated in the quotation from Hennekens and Buring (1987) stated earlier.

European and Scandinavian research traditions seem to advocate more broadly based contexts of understanding events through a combination of qualitative and quantitative

methods. For example, case studies can be used to try and gain an in-depth view of one entity or event rather than a generalisable view, but can also be used to supplement quantitative work. Both approaches have some value and relevance for the study of CHR diffusion among GPs. Therefore, a combination between these somewhat polarised research traditions would appear to be a useful approach to adopt, in other words a descriptive empirical approach interpreted in a more holistic way. This is an underlying motivation behind the design of a CHR diffusion survey. Furthermore, a comparative study between a European or Scandinavian country and Australia is likely to provide an interesting study not only of similarities and differences between research traditions but also of cultural, social, political, legal, medical and economic traditions as well. This is exemplified by the work of Straub (1994) who looked at the effect of culture on the diffusion of e-mail and fax in Japan and the USA. Greater recognition needs to be given to the role of culture in social theory (Archer, 1996).

Gefen and Straub (1997) also examined gender differences in the adoption and use of e-mail through a cross-sectional survey instrument. Gefen and Straub argue that gender needs to be added to an IT diffusion model since gender differences may be related to beliefs and use of computer-based media. Gender differences can further be seen as aspects of cultural differences between people, thus indicating a greater need for cross-cultural technology adoption studies. The findings of the Gefen and Straub study indicate that men and women differ in their perceptions but not in the use of e-mail. This work adds to the Technology Acceptance Model (TAM) proposed by Davis et al., (1989) and F. Davis (1993). The Davis causal model correlates system use with

perceived ease of use and perceived usefulness. The model hypothesises that actual use is affected by behavioural intentions which are further moderated by attitudes towards use. This warrants the question as to whether there is a connection between perception, attitude, belief and motivation on the one hand and behaviour on the other? The meanings of the terms can be problematic as the ideas can be used synonymously. Figure 11-1 may serve as an example for drawing some distinctions between the concepts.

Figure 11-1. Concepts: perception, attitude, belief, motivation and behaviour

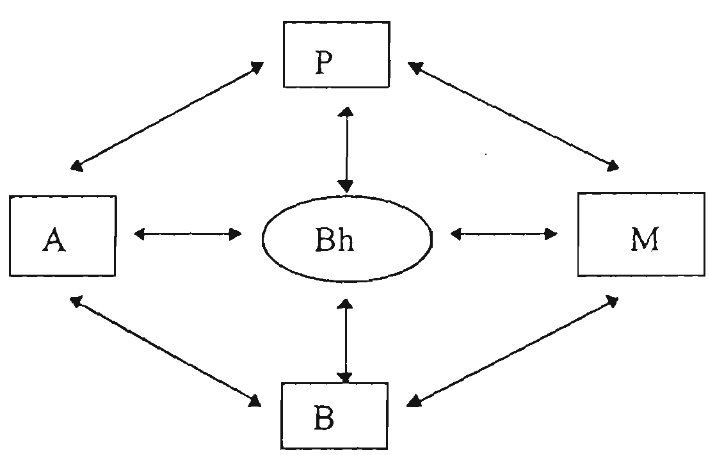
Perception [P]: This box is a computer

Attitude [A]: I like computers

Belief [B]: The computer is always right

Motivation [M]: By using a computer I can make better decisions

Behaviour [Bh]: I use a computer for my work



Studying human behaviour, perceptions, attitudes, motivations and beliefs can only ever be a subjective exercise evaluating a limited version of perceived reality rather than the reality itself. This is evidenced by the many approaches to research in various disciplines along with their associated taxonomies and debates; each seeks to validate a certain version of reality through certain methodologies, for example, those of the natural sciences versus those characterised of the social sciences. Behavioural psychology is littered with conflicting findings and appears to be a highly problematic field of study (e.g. environment versus nurture arguments and various combinations of the two as explanations for human behaviour). Researchers who have investigated varying aspects of behaviour include, for example, Ajzen and Fishbein (1975). The Davis et al (1989) and F. Davis (1993) TAM model is essentially an extension of Ajzen and Fishbein's thinking. However, such behavioural studies often suffer from problems of causality fixation, that is trying to prove that there is a link between variable A and variable B through some type of quantitative validation. These types of studies are often devoid of a socio-political context.

A dilemma shared by both the social and natural science domains is the notion of objectivity or neutrality in research. Essentially, this can be seen as somewhat of an ideal perpetuated in order to bestow scientific and impartial standing upon research findings, almost as if to say that the research results or the research itself operates outside of a socio-political context or within a vacuum. This fallacy is an important philosophical issue requiring confrontation and acknowledgment by all researchers.

Research is inherently subjective, embedded in historical traditions of time and place. To adopt a simple causal explanation such as attitude causes behaviour or information exposure causes diffusion is both too simplistic and misleading. A positive attitude towards technology may or may not be a condition or predisposition for technology adoption. This view negates the idea that attitudes and behaviour are situated in a changing social context with many other variables at play which may or may not, in combination, influence attitudes and behaviour. This view in statistics is captured by the idea of confounding variables, i.e. other variables than those considered, may contribute to the result. Therefore, from a somewhat idealistic point of view, evaluation of perceived benefits of a technology, or a technological cluster, should be conducted before, during and after diffusion, once a critical mass of adopters, can be identified. Otherwise, a much too positivistic bias may be given in a study of just perceived benefits before or after adoption has taken place. Furthermore, attitudes and perceptions may also change or become more entrenched during the process of diffusion which suggests the need for longitudinal studies as a basis for conducting further research, especially in the case of technology diffusion where it may take years or decades before a critical mass is reached and a post-diffusion study can be conducted to compare results with pre-diffusion.

A study of a perceived benefits before, during and after may also help to temper original enthusiasm and idealism about a technology with real experience of a technology. This can be seen as trying to match the rhetoric about a technology with actual experience and practice. Nevertheless, a problem with this approach is that it negates the idea that

diffusion is an on-going historical process, a ball already in motion, and not a static start-stop process. This thinking could lead to a state of research paralysis, for one has to start somewhere otherwise one could never research anything since everything is already historically in motion.

**Justifying the research design structure**

As indicated in Chapters Nine and Ten, systems design literature would strongly suggest the need for a survey of the attitudes of the users and non-users in any information system design approach (Lif, 1998; Davis F., 1993; Linnarsson, 1993; Moidu, 1993b; Timpka, 1989). This should be considered as both a pre and co-requisite, i.e. surveys are required before, during and after diffusion. It is acknowledged that this categorisation may be difficult to determine since the diffusion process is historically on-going and really has no starting or finishing points as such, but only perceptual constructs determined by the researcher can exist for these before, during and after points. The work of Rogers (1995) supports the need for attitude and perception survey work especially the need for longitudinal moving picture studies as opposed to one-off snap shot diffusion studies. Similarly, as does survey work carried out in epidemiology (see for example, Agreus et al., 1993).

The works of Howie (1989), King et al., (1994), Yin (1994), McConway (1994), Axford et al., (1996) and Neuman (1997) are informative in regards to the issues involved in the design of social inquiry studies and statistical analysis. There appears to be intrinsic value in combining quantitative and qualitative approaches in research design as

advocated by Gable (1994), Kaplan and Duchon (1988). Quantitative approaches help to identify trends and patterns primarily through numerical data capture (e.g. a survey), whereas qualitative approaches help to obtain more in depth information (e.g. through discourse analysis, interviews, observation, focus groups, case studies). There are advantages and disadvantages with both approaches; qualitative approaches cannot be generalised beyond the cases or event studied, while quantitative approaches may not be able to capture the complexity of a problem investigated through empiricism leading to oversimplification of complex issues which require a supplementary qualitative approach.

The motivation for conducting a survey is essentially to test the validity of findings in previous Australian studies and to see whether anything has actually changed since the studies conducted by the RACGP (1985), Crampton (1990), Cacek (1994), Bolton and Gay (1995). The focus of the study is mainly upon CHRs but the term CMRs has been used in the survey both for historical reasons and because it is perceived as being a more readily identifiable term among GPs. A comparative study was deemed appropriate, since diffusion is both an international and national process with the belief that this comparison would help in exploring some of the reasons for high and low rates of CHR diffusion among GPs. The results gained were thus perceived to be valuable both in helping to understand the Australian diffusion experience to date and aiding in the formulation of policy and strategies for managing the CHR diffusion process.

Sweden was chosen as an appropriate country for comparison mainly for its reputation as a country known for its high rate of adoption of (computer) technology and its long standing tradition in medical informatics, and more recent moves to position past medical informatics thinking under the rubric of health informatics.

The design of the actual research was ultimately influenced by a number of factors such as access to GPs and by the nature of the question under investigation (i.e. to ascertain and verify the state of CHR diffusion among GPs in Australia with comparison to a country with a higher rate of diffusion). It was postulated that, (a) Australian CHR diffusion may follow the same patterns of adoption and growth as seen in the Netherlands and Sweden, but that (b) different contextual reasons were responsible for the CHR diffusion rates among GPs in these countries. This implied a quantitative rather than a qualitative approach since a large sample size was desired and this approach offered more scope for cross cultural application and contrast. Results could thus be more readily compared with situations in other countries. Also, the results from a quantitative study could be more generalisable than those from a qualitative study thereby offering greater potential for future longitudinal or trend analysis using the same survey instrument.

Generally, a number of studies dating from the late 1960s mainly originating in and around the east coast of the USA and occurring in the biomedical literature have looked at the awareness and attitudes of various health care actors towards computers. Their motivation usually seems to be a perceived opportunity to use computers to improve

the status and practice of medicine (Barnett and Greenes, 1967; Startsman and Robinson, 1972; Friedman and Gustafson, 1977; Melhorn et al., 1979; Schwartz, 1980; Teach and Shortliffe, 1981; Saltz et al., 1985; Singer et al., 1983; Moidu and Wigertz , 1989).

The original research project consisted of four distinct sub projects: a quantitative survey of CHR use among GPs in Sweden; a quantitative survey of CHR use among GPs in Australia; a qualitative study of an Australian GP practice before, during and after CHR implementation to be compared with the results of a published qualitative study of a Swedish GP practice before, during and after CHR implementation. In the end, the qualitative component had to be abandoned because of the difficulty of obtaining access to a suitable GP practice willing to participate in the study, ostensibly on grounds relating to maintaining patient information confidentiality. In the already published Swedish study, it was later noted that the study was conducted by the GP who owned the practice. This illustrates the difficulty of an outsider trying to study General Practice in Australia and suggests that close relationships with GPs are needed to perform such a study. It should also be acknowledged that most research about General Practice and CHR issues in Australia has often been conducted by GPs themselves, for example, Crampton (1990, 1995), Bolton and Gay (1995), Liaw (1992, 1996) and Cacek (1994).

At a theoretical level, instead of just testing a particular theory or set of hypotheses, this thesis attempts to merge the empirical data gathered with the analytical to provide a

more descriptive empirical and interpretive approach for analysing and explaining technology diffusion and the research data. Existing knowledge about diffusion thinking, as offered by Rogers (1995), was used as a comparative framework for interpreting the results obtained from within the selected philosophical perspective that technology diffusion needs to be seen as a socio-political process.

### The questionnaire

Research showed that past studies in Australia had utilised quantitative approaches successfully (Crampton 1990, 1995; Cacek 1994; Bolton and Gay 1995). A multiple-methods approach utilising both quantitative and qualitative aspects was considered in the original research design proposal and some aspects were utilised for preliminary data gathering and trialing, for example, field visits and interviews with GPs.

Low response rates are often also a problem faced by researchers conducting questionnaire based studies. In this case all possible effort was made in gaining an acceptable response rate in the vicinity of 20-30% (Moser, 1971). The questionnaire was developed from preliminary research and interviews in Australia and with various medical practitioners in Sweden. This process involved several iterations of refinement and trialing before a satisfactory questionnaire was developed for distribution. Responses were sought for questions relating to demographic data, educational background and training, computer use/non use, adoption barriers, computer security awareness, software/hardware platforms, as well as present and possible future trends in the use of CHRs. The questionnaire comprised a common section for all respondents

and then two nested sections, one for those GPs who were CHR users and another for those who were non-computerised. Both open-ended and closed questions were included with space available for comments where needed.

The design of the questionnaire included a coding schema for easier transcription of response data into a spreadsheet and imported subsequently into SPSS for further data analysis. All mail-out questionnaires were accompanied by covering letters and prepaid return address envelopes. The questionnaire itself was originally drafted in English and then translated into Swedish. Informal discussions with GPs during the piloting stage indicated that Swedish GPs would be more inclined to respond in their own native language rather than in English despite the fact that English is commonly understood among Swedish medical professionals. Copies of the questionnaires are included as Appendix 2 and 3.

### Sample selection

The process of sampling can take various forms, random, non-random or some combination of the two. A random survey of GPs was chosen as being an appropriate approach. This was based on the experience of other researchers (Crampton, 1990, 1995; Cacek 1994; Bolton and Gay, 1995).

The Swedish GP sample and mailing list was made available courtesy of the Department of Family Medicine, Uppsala University. The survey was sent to a random computer generated sample of GPs in Sweden (N=600). The first and only mailing was conducted

in November 1994 for return before mid December. A 50% (n=298) response rate was gained and there were no follow up or reminder notices to increase the response rate.

The Australian mailing list was made available courtesy of the Commonwealth Department of Human Services and Health. A random computer generated sample was provided and the state of New South Wales was also randomly chosen for sampling (N=600). The first and only mailing was carried out in November 1995 for return before mid December. A 49% (n=293) response rate was gained and there were no follow up or reminder notices to increase the response rate.

# CHAPTER TWELVE

# HEALTH SYSTEMS

## A brief overview of the United Kingdom (UK), Australian and Swedish Health systems

Generally, governments are involved in the management of health care resources, costs, outcomes and equity issues. However, these may all be interpreted differently, for example, equity may be seen as the redistribution of health care costs as opposed to accessibility to health care services. Health systems and health policy are often reflective of a complex historical and political mix of changes to the organisation of funding arrangements and responsibilities between various levels of government (e.g. national, state and local), for example, the Australian Health Care System. The Australian Health Care system can be described as reflective of a philosophical position located somewhere between the UK National Health Service and the USA Health System, with a gradual movement away from government funding and public health insurance to a more privatised system based on individual private health insurance (Australian Institute of Health and Welfare, 1992; 1994; Bates, 1983).

It would appear that the UK, the Swedish and Australian health systems share some common features but also have some distinct variations. It becomes evident that the more health systems devolve from a centralised system to a more decentralised regional/local system the more variation and experimentation in budget devolution and patient needs-assessment planning is evident across Counties in Sweden, the UK or across States and GP Divisions in Australia.

The health care system in the UK is based on a system of care provided by GPs who can be seen as private contractors paid by the National Health Service, just as GPs in Australia are paid by the Australian Health Insurance System (Medicare). Experimentation with the idea of purchasers and providers is evident in both the UK and Swedish health care systems where local councils purchase health care services from their regional and national organising bodies in order to tailor provisions to the specific health care needs of their respective communities. GPs are essentially given a budget to work with in order to try and buy the health services required for their patients. This can be problematic since patient needs will vary, for example, between rural and urban areas. However, problems of definition and classification over what constitutes rural areas serves to add more complexity to the problem, especially since government funding formulas are tied into such definitions (see for example, Nichol, 1990). DRGs can be seen as a manifestation of this attempted tailoring process at the hospital level.

The Swedish Health Care System, makes use of a patient registration list system by which a list of patients (about 2000/GP, variations do occur) is assigned to each district GP. The Swedish system has experimented (1994/95) with the house doctor system (a patient could choose which GP they wished to belong to) but with only mixed success in that some GPs had excessive lists while others had diminishing list numbers. Some counties have adopted the system (e.g. Uppsala) while others have reverted back to the old district doctor list system.

The UK and Swedish systems can be characterised as systems in a state of continuing flux; the Australian system is one facing mounting economic pressure to change. The cost of the publicly funded Medicare System in Australia is rapidly escalating well over $7.5 billion (Leech, 1998: 42). This can be seen as a problem arising from an over-supply of GPs leading to over-servicing and outright rorting of the system, by GPs. As indicated, this problem is escalating as more medical doctors are pumped out of educational institutions every year leading to a mismatch between supply and demand. This over-supply of GPs places more of an economic burden on the National Medicare health bill that taxpayers eventually have to help fund (through a levy on taxable income) since more medical doctors equates to greater consumption of various medical services. Hence, both GP over-servicing behaviour and supply need to be changed. This would suggest some form of direct regulatory strategy from the Government. There is predominantly an imbalance between rural and city areas in that there is an over-supply of GPs in large city areas and an under-supply in smaller rural regions (Shepherd, 1995).

Historically, rural areas in Australia have been disadvantaged in terms of access to health services (see for example, Humphreys, 1988; Humphreys and Weinand, 1991). This stems in part to the fact that political, legislative and economic power in Australia is generally located in the National and State capitals rather than at the Local government levels. Thus, health budget devolution to local government can be viewed as an attempt to try and re-address part of this power imbalance. Financial responsibility is shifted over to local government, but this does not necessarily address the need for more revenue to fund increasing demand for health care services.

Good health and equal access to health services for everyone are the goals of both the Australian and Swedish health care systems as articulated through national policy and a range of legislations including the National Health Act, the Health Insurance Act and the Medicare Levy Act in Australia and the Health and Medical Services Act in Sweden. A fundamental principle of both systems is public sector responsibility to provide and finance health services for the entire population. In Sweden, the responsibility and operational management for health care services rests primarily with the local County Councils who have the power to levy taxes to raise the finances required to run these services. This is a reflection of the Swedish Welfare State ideology and also a reason for the generally high tax regime used to fund social services. The Australian Health Care system is administered by the Federal Government in conjunction with the respective State Governments (who are responsible for public hospitals) through funding grants and the Medicare Levy. The history of Australian welfare programs has been one of targeted welfare rather than universal social programs as in Sweden. Hence, GPs in Sweden operate mainly under a public umbrella health care system funded by the County Councils while GPs in Australia mainly operate as private businesses within a public system. They thus receive minimal direct financial assistance with CHRs. Table 12-1 provides an overview of some key features of the Australian and Swedish health systems.

Table 12-1. Overview of health systems and the CHR diffusion process

| | Australia | Sweden |
|---|---|---|
| Key features of health system | | |
| | | |
| Funding | Centralised (national) funding system, Medicare, gradual movement to privatised system | Mainly Local Councils levying their own taxes |
| GP/Patient allocation process | Individual choice, patient can choose a GP | Patient registration list based on place of residence, patient has little choice of selecting a GP |
| Type of GP organisational structure | Private business operator in solo or partnership practice | Large public group practices |
| Main difference in the CHR diffusion process | Minimal direct financial assistance with CHRs | Direct financial funding scheme from Swedish Government and County Councils |

**Survey findings and discussion**

"It is perhaps easiest to begin by stating what statistics is not. Statistics first of all is not a method by which one can prove almost anything one wants to prove." (Blalock, 1979: 3). Statistical testing and presentation of the data only provides for one level of analysis and reporting. It is by no means the definitive statement about CHR diffusion among GPs in Australia and Sweden. As discussed earlier, the work of Gefen and Straub (1997) suggests that gender may be an important variable in the process of technology diffusion. It is therefore hypothesized that men and women perceive CHRs differently which influences their decision to adopt or not to adopt

the technology. Gender could be a crucial element not just in CHR diffusion among GPs but also an attribute that may need to be added to the diffusion model proposed by Rogers (1995: 207) as discussed in Chapter Eight, Figure 8-2. It was predicted that more male GPs were using computers and CHRs than female GPs. The results in this Chapter are therefore presented and discussed from a more descriptive and gender encompassing socio-cultural standpoint. However, as with any analysis, "The best data analysis comes not from keystrokes and printouts, but from spending time thinking." (Axford et al., 1996: 361). For an overall breakdown of results (males and females together), the Swedish Results are included as Appendix 4 and the Australian Results as Appendix 5. Also, a comparative overview of the results can be found in Appendix 6.

It has generally been claimed in previous studies, RACGP (1985), Crampton (1990), Bolton and Gay (1995), that the adoption rate of CMRs by GPs in Australia has been low, ranging from 2% to around 8%, with computerisation levels to be around 40% (Bolton and Gay, 1995). This is in contrast to the UK where 50% of primary practitioners use the computer for clinical notes and 90% of primary care practitioners work in computerised practices (Hayes, 1993). For Singapore, the adoption rate is said to be somewhere between 30-50% (Lun and Goh, 1993).

The main findings of the survey conducted indicate that there has been a high rate (72%) of diffusion of computers and CMRs among GPs in Sweden and a low rate (14%) of diffusion among GPs in Australia. Moreover, use of computers by Australian GPs is

still predominantly confined to front desk type applications (e.g. accounts/billing, word processing) as opposed to clinical CMR use (e.g. patient notes, script writing, recall and referral, test ordering). On further analysis, only 16% of the Australian computer user respondents (14% overall) indicated that their main computer use was for patient records as opposed to 93% of the 72% of Swedish respondents. This means that of the 14% of Australian respondents who do use computers only 2% use them specifically for clinical purposes while the rest of the 12% make some use of CMRs but it was not considered to be their main use. This supports the more general findings of the survey work conducted by Cacek (1994) who found that of the 35% of Australian GPs using a computer, 78% were using computers for word processing and 63% for financial management. For further discussion of these results see Chapter Five, pages 58 - 62.

Findings further indicate that the high rate of diffusion in Sweden has mainly been achieved by direct financial funding schemes from the Swedish Government and County Councils. Furthermore, 80% of the Swedish respondents indicated a strong belief that CMRs will be an essential technology for health care in the future as compared to only 55% of Australian respondents. This finding supports the idea that perceived belief about a technology could be an important characteristic in the adoption process, hence a possible extension of the 5 characteristic model of adoption as proposed by Rogers (1995: 207). Nevertheless, Rogers (1995) does capture this thinking in the ideas of homophily and heterophily used to describe actors in similar or different social network groupings based on belief, education, social status, etc. Therefore, the relationship between belief and adoption/non adoption needs to be investigated further. It may well

be that belief, above all else, influences an actor to want to adopt. Nevertheless, it may also be the case that there is no generalisable association between belief and actual adoption since availability of funding may in fact be the key adoption factor, therefore availability of funding may also need to be added to the adoption model proposed by Rogers (1995).

Among GPs who are CMR users, results from both samples support the claim that CMRs are helping to improve the way GPs work (Australia 82% and Sweden 69%) but the consensus is less than overwhelming. Both samples indicated improvements in the following areas: having increased quality control over patient information (as opposed to hand written notes); faster access to patient records; and easier access to patient information when dealing with telephone enquiries. These can be considered as relative advantage attributes of CMRs (Rogers, 1995: 216), or even long term economic advantages, due to savings in time, effort and organisation (whether of information or staff). Overall, 92% of Australian respondents still process patient records manually while 95% of the Swedish respondents process records electronically using a computer. Only one respondent in Sweden indicated keeping hand written patient records. Table 12-2 provides a comparative view of beliefs and adoption rates.

Table 12-2. Beliefs and CMR adoption rates

| | AUSTRALIA (NSW) N=293 | | | SWEDEN N=298 | | |
|---|---|---|---|---|---|---|
| | Total | Males | Females | Total | Males | Females |
| Q1* Q15<br>% of GPs who believe CMRs are an essential technology for health care in the future | 55<br>n=158 | 73<br>n=115 | 27<br>n=43 | 80<br>n=236 | 61<br>n=144 | 39<br>n=92 |
| Total responses<br>Missing | 286<br>7 | | | 294<br>4 | | |

| | Total | Males | Females | Total | Males | Females |
|---|---|---|---|---|---|---|
| **Q1 * Q24**<br>% of GPs who use CMRs | **14**<br>n=42 | 90.5<br>n=38 | 9.5<br>n=4 | **72**<br>n=215 | 57<br>n=123 | 43<br>n=92 |
| Total responses<br>Missing | 292<br>1 | | | 298<br>0 | | |
| **Q1 * Q34**<br>% of GP CMR users who believe CMRs have improved work practices | **82**<br>n= 36 | 94<br>n=34 | 6<br>n=2 | **69**<br>n=140 | 59<br>n=83 | 41<br>n=57 |
| Total responses<br>Missing | 44<br>249 | | | 204<br>94 | | |

Statistical testing indicated significance at the .05 level for cross-tabulation of Q1*Q24 in the Australian sample, as can be seen in Table 12-3. This is the only response which supports the hypothesis that a relation exists between gender and CMR use. Nevertheless, no such relation was found in the Swedish sample. Furthermore, no other correlations between belief about CMRs and gender were found to be significant in either sample.

Table 12-3. Tests of significance for Q1*Q24

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 8.366[b] | 1 | .004 | | |
| Continuity Correction[a] | 7.327 | 1 | .007 | | |
| Likelihood Ratio | 9.974 | 1 | .002 | | |
| Fisher's Exact Test | | | | .003 | .002 |
| Linear-by-Linear Association | 8.337 | 1 | .004 | | |
| N of Valid Cases | 292 | | | | |

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expect count is 11.79.

There are also similarities between the makeup of GPs in both the Swedish and Australian samples, especially in relation to employment status, 77% of respondents in both samples regard themselves as being employed full time and 23% of respondents

regard themselves as being employed part time! The male to female ratio in Australia was 72:28 while the Swedish ratio was 60:40. Hence, GPs tend to be male, employed full time and are aged in their mid forties (Australia: mean = 45 years, standard deviation = 5.6 years; Sweden: mean = 46 years, standard deviation = 10.5 years). In Sweden GPs tend to cluster to form group practices more than in Australia (Sweden, mean = 5, s.d. = 2: Australia, mean = 3, s.d. = 2) where GPs predominantly operate more in solo or partnership practice. In fact 50% of the respondents in Australia operated in practices with three or less members. The most obvious difference between the two samples is in the type of practices. In Sweden 92% of GP respondents are predominantly in public practice while 95% of GP respondents in Australia are in private practice. Furthermore, the numbers of staff employed per practice was significantly higher in Sweden (mean = 18, s.d. = 13) than in Australia (mean = 5, s.d. = 5), reflective of the larger public service and pro-government employment policies in Sweden versus cost controlled and profit oriented operations in Australia.

The claim that in both Australia and Sweden the trend is towards the clustering of GPs with other allied practitioners (for example, dentists) in one centre or practice (Jeffreys and Sachs 1983: 174-190; Fitter 1986: 74-75) is also supported by the survey. In Sweden this is seen to aid cooperation and the sharing of medical resources among primary care practitioners while in Australia this move is not merely for cooperation but more importantly to create super clinics which achieve greater economies of scale, throughput and returns. In this scenario, over-servicing by GPs could become a problem, especially under the publicly funded Medicare system. Australian respondents also

indicated seeing a lot more patients per week (mean = 132, s.d. = 73) than GPs in Sweden (mean = 63, s.d. = 19). This can be seen as a further reflection of the attitude that primary health care is more of a business so that throughput becomes a measure of financial return. This is clearly opposed to that of sharing among public sector GPs in Sweden who have a set list of patients for their area for each of whom they are paid a set amount from the public purse. Nevertheless, patients more so in Sweden than in Australia also have to make a co-payment when visiting the GP which may act as a deterrent for patients from seeing a GP. Greater application of compulsory co-payments in the Australian GP scene could be worth investigating further but not as another revenue stream for GPs on top of the already existing Medicare payment. Instead, the patient co-payment could be used to help pay for the Medicare payment which in turn would be a contribution to helping to reduce the Australian Medicare bill.

The non-computerised samples offer some distinct differences in GP attitudes. In the Australian sample, of the overall non-computerised respondents (86%), 63% believe CMRs will improve the way GPs work but 67% do not plan to implement CMRs within the next 3 years. This is somewhat similar to the "KAP-gap" (Knowledge, Attitudes, Practice) problems of family planning diffusion surveys carried out in Third World countries during the 1960s in that there is a relatively high level of favourable attitudes but a relatively low rate of adoption (Rogers, 1995: 71). This may be due to a combination of a low degree of observability of the long term benefits and socio-political drawbacks such as gradual loss of ownership of, power and control over patient data. Surprisingly, follow-up questions indicated that 65% did not feel that they had a

problem managing patient health records which may, if answered truthfully, account for why non-computerised GPs felt that they did not need to computerise. This supports the findings of Cacek (1994) which showed that GPs considered their manual systems as adequate and saw little benefit from having CMRs. This is clearly the case with a significant number of Australian GPs who are obviously not convinced of the benefits of CMRs over paper records. This type of rejection is explained by Rogers (1995) as a combination of active (CMRs as an innovation are considered but rejected) and passive rejection (CMRs as an innovation are never really considered). It is not surprising then that 77% indicated that they have taken no planning steps towards implementing CMRs whatsoever. Respondents indicated that they were concerned over lack of software standards and data portability between software systems. These add further reasons as to why GPs are reluctant to computerise, namely fear of choosing software that may become obsolete or incompatible with other systems. There was also some concern over the problem of converting from paper to computer and the amount of time, cost and effort involved in such an endeavour especially if there was no support involved.

In contrast, 68% of the Swedish non-computerised respondents indicated they were having problems managing their patient records and that CMRs were perceived as helping to resolve these problems. Within the Swedish non-computerised sample (28%), 72% believe that CMRs will improve the way GPs work and 90% plan to introduce CMRs within the next three years. Table 12-4 provides a comparative view of non-computerised attitudes of GPs towards CMRs.

Table 12-4. Non-Computerised attitudes towards CMRs

| | AUSTRALIA (NSW) N=293 | | | SWEDEN N=298 | | |
|---|---|---|---|---|---|---|
| | Total | Males | Females | Total | Males | Females |
| **Q1*Q24**<br>% of non-computerised respondents | **86**<br>n=250 | 69<br>n=172 | 31<br>n=78 | **28**<br>n=83 | 68<br>n=56 | 32<br>n=27 |
| Total responses<br>Missing | 292<br>1 | | | 298<br>0 | | |
| **Q1*Q42**<br>% of non-computerised respondents who have problems managing patient records | **35**<br>n=93 | 73<br>n=68 | 27<br>n=25 | **68**<br>n=56 | 68<br>n=38 | 32<br>n=18 |
| Total responses<br>Missing | 268<br>25 | | | 82<br>216 | | |
| **Q1*Q41**<br>% of non-computerised respondents who believe CMRs will improve the way GPs work | **63**<br>n=164 | 73<br>n=119 | 27<br>n=45 | **72**<br>n=55 | 71<br>n=39 | 29<br>n=16 |
| Total responses<br>Missing | 259<br>34 | | | 76<br>222 | | |
| **Q1*Q43**<br>% of non-computerised respondents who plan to implement CMRs within the next 3 years | **33**<br>n=82 | 72<br>n=59 | 28<br>n=23 | **90**<br>n=71 | 66<br>n=47 | 34<br>n=24 |
| Total responses<br>Missing | 246<br>47 | | | 79<br>219 | | |

In both samples there were some respondents who indicated that they kept no backup records or had no disaster recovery plan for patient records. In the case of keeping backups, Australian respondents (81%) were found to be more guilty of this than Swedish GPs (19%). This is attributable to the fact that Australian GPs are predominantly non-CMR users and do not keep paper based backup records. Nevertheless, both samples overwhelmingly consider themselves as responsible for the accuracy of patient information contained in patient records. Again, ideological differences become apparent in that of the Australian sample, 95% believe that it is the GP who owns the patient record while 44% of the Swedish respondents believe that the

Government owns the patient record. Clearly, GPs feel that they are responsible in some way for the patient information but interestingly Australian GPs, much more than their Swedish counterparts, do not seem responsible enough in protecting this valuable resource. A legal precedent may yet be set in this area, along with the testing of the validity of CMRs in the courts. Legislation is traditionally based around a paper based paradigm rather than an electronic one. Only 3% of Australian respondents indicated that they thought the patient owned the information and no respondents thought that the government owned the information. Swedish responses more strongly favoured a model of joint ownership of patient information between government, GPs and patients than did the Australian sample. This may be linked to the funding mechanisms for CMRs, since 88% of the Australian respondents indicated receiving no government help with computerisation as opposed to 77% of Swedish respondents who did receive financial help to computerise from central and local governments. Table 12-5 provides a comparative view of general security, responsibility, ownership and support issues among all GPs surveyed.

Table 12-5. General security, responsibility, ownership and support issues among all GP respondents

| | AUSTRALIA (NSW) N=293 | | | SWEDEN N=298 | | |
|---|---|---|---|---|---|---|
| | Total | Males | Females | Total | Males | Females |
| **Q1*Q19a**<br>% of all GPs who have no backup records | **81**<br>n=226 | 71<br>n=161 | 29<br>n=65 | **19**<br>n=54 | 65<br>n=35 | 35<br>n=19 |
| Total responses<br>Missing | 279<br>14 | | | 284<br>14 | | |
| **Q1*Q19d**<br>% of all GPs who have no disaster recovery plan | **90**<br>n=158 | 75<br>n=119 | 25<br>n=39 | **91**<br>n=32 | 72<br>n=23 | 28<br>n=9 |
| Total responses<br>Missing | 176<br>117 | | | 35<br>263 | | |

| | Total | Males | Females | Total | Males | Females |
|---|---|---|---|---|---|---|
| **Q1*Q22**<br>% of all GPs who consider themselves responsible for accuracy of patient information | **98**<br>n=286 | 71<br>n=204 | 29<br>n=82 | **99**<br>n=287 | 60<br>n=173 | 40<br>n=114 |
| Total responses<br>Missing | 292<br>1 | | | 291<br>7 | | |
| **Q1*Q23**<br>% of all GPs who believe they own the patient record | **95**<br>n=275 | 72<br>n=198 | 28<br>n=77 | **14**<br>n=37 | 62<br>n=23 | 38<br>n=14 |
| Total responses<br>Missing | 289<br>4 | | | 264<br>34 | | |
| **Q1*Q21**<br>% of all GPs who have received Government help with computerisation | **12**<br>n=34 | 71<br>n=24 | 29<br>n=10 | **77**<br>n=216 | 60<br>n=130 | 40<br>n=86 |
| Total responses<br>Missing | 276<br>17 | | | 280<br>18 | | |

Computer using respondents indicated having had a wide range of computer experience. Despite the low use of CMRs among respondents in Australia, experience with CMRs was longer (mean = 44 months, s.d. = 41 months) as compared to Sweden (mean = 25 months, s.d. = 23 months).

The general software/hardware trend is towards PC Windows based platforms with software that integrates CMRs with other functions, e.g. accounts/billing, appointments scheduling, word processing, electronic mail, etc. The potential for a *GP Office* like software is apparent. In the Australian sample, computers being used solely as standalone workstations were as common as those in a multi-user network configuration. In Sweden, however, 97% of respondents had their computers set up in a multi-user network configuration. This may be a reflection upon the larger staff and GP numbers needing to share computers in a practice. The password remains the most

common form of security protection in both samples. Table 12-6 provides an comparative overview of computerised GPs.

Table 12-6. Computerised GPs

| | AUSTRALIA (NSW) N=293 | | | SWEDEN N=298 | | |
|---|---|---|---|---|---|---|
| | Total | Males | Females | Total | Males | Females |
| Q1*Q32<br>% of computerised GPs who use a coding scheme to classify patient morbidity (e.g. ICD-10, etc) | **19**<br>n=9 | 100<br>n=9 | 0<br>n=0 | **89**<br>n=185 | 55<br>n=101 | 45<br>n=84 |
| Total responses<br>Missing | 48<br>245 | | | 209<br>89 | | |
| Q1*Q35<br>% of computerised GPs who follow some type of patient information management guidelines or practice | **25**<br>n=11 | 100<br>n=11 | 0<br>n=0 | **75**<br>n=147 | 58<br>n=85 | 42<br>n=62 |
| Total responses<br>Missing | 44<br>249 | | | 195<br>103 | | |
| Q1*Q36<br>% of computerised respondents indicating that passwords are their main form of computer security | **98**<br>n=34 | 91<br>n=31 | 9<br>n=3 | **94**<br>n=186 | 56.5<br>n=105 | 43.5<br>n=81 |
| Total responses<br>Missing | 38<br>255 | | | 198<br>100 | | |
| Q1*Q39<br>% of computerised GPs who encrypt their patient database | **27**<br>n=11 | 82<br>n=9 | 18<br>n=2 | **33**<br>n=51 | 61<br>n=31 | 39<br>n=20 |
| Total responses<br>Missing | 41<br>252 | | | 156<br>142 | | |
| Q1*Q40<br>% of computerised GPs who have outside dial-in access to their patient database | **24**<br>n=10 | 90<br>n=9 | 10<br>n=1 | **13**<br>n=26 | 69<br>n=18 | 31<br>n=8 |
| Total responses<br>Missing | 42<br>251 | | | 196<br>102 | | |

Within both samples, very few had to undertake any computer-related subjects as part of their medical education. This may well be attributable to the fact that desk-top computers were not around nor as accessible when the majority of respondents were

undergoing their medical education (the mean year of medical education completion in the Australian sample was 1974, s.d. = 10 years; and in Sweden 1977, s.d. = 6 years). Nevertheless, this would indicate that there is no predisposition to adopt CMRs by having undertaken computer-related subjects at university and subsequent later CMR adoption. The Swedish results would indicate that high CMR adoption is possible without there necessarily being an association between computer use at university and CMR adoption. In the Swedish case the decision to adopt CMRs is more of a result of direct funding availability (a type of authority decision) from the government while in Australia the decision to adopt CMRs is more of an individual optional or collective group practice decision.

The most common sources of information about keeping up to date about computers was through colleagues, journals and conferences. It is interesting to note that journals preceded colleagues in the Australian sample (51%:18%) while in the Swedish sample it was the reverse (26%:48%). This is significant since according to the innovation-decision process model presented by Rogers (1995: 197), mass media awareness is considered to be the main communication channel for creating knowledge awareness. In this model, persuasion to adopt occurs at a more interpersonal level usually after mass media knowledge awareness has taken place. The Australian sample responses would appear to support this model but the results from the Swedish sample suggest that mass media channels do not play such a key role in knowledge awareness and that from the outset interpersonal communications with colleagues are more significant in the formulation of attitudes. This would also indicate a more collective based decision-

making process among the Swedish sample as opposed to a more individualised process in Australia. This is possibly a significant point worthy of follow up since more respondents in the Swedish sample have adopted CMRs; hence, the innovation-decision process model proposed by Rogers may need to be modified. Future studies may wish to follow up on this aspect by including another, more specific follow up question about how respondents found out about CMRs in the first place rather than just about computer developments (e.g. mass media, interpersonal or other).

In the context of spatial diffusion, another question worth pursuing may be to see if proximity to colleagues plays a role in persuasion to adopt or reject; for example, do the colleagues from whom information was received work within the same practice, live in the same city, or elsewhere. Furthermore, this implies that word of mouth can be seen as an important form of communication among GPs, possibly more so than mass media communication channels when considering making a decision to adopt or to reject. In Australia, this could be attributable to internalising something a GP may have read in a journal and then testing that information with colleagues prior to either accepting or rejecting information and ideas. It could also point to a mistrust of mass media sources and preference for reliance on the opinions and experiences of colleagues. Thus, face to face communication, conferences and workshops must be considered as an important part of the process of communicating information to others. The slow rate of CMR adoption in the Australian sample could further be interpreted as a possible mismatch between perceived complexity of the innovation by GPs and the communication channel selected to convey information. CMRs may be perceived by GPs as a highly complex

technology. Therefore, interpersonal communication may be more important in communicating information about a technology which may be perceived to be complex rather than communicating the information through mass media channels.

Results would suggest that financial investment or reimbursement for the purchase of computer equipment would benefit some GPs but there would still be some who would not know what to do with the technology even if they had a computer on their desk. A computer on a GP's desk needs to be seen as more than just a symbolic ornament. A decision to adopt could, for example, be reflective of a perceived need to keep up with the latest fashion and as a status symbol in giving the appearance of being modern and keeping up to date with the times, that is, as a form of passive rather than active adoption. This may reflect a lack of computer literacy and knowledge about what computers can do since this was the second most important barrier indicated in both surveys. GP respondents in Sweden indicated that the lack of a CMR software standard among GPs was their main barrier to adoption while Australian respondents indicated that cost was the major inhibiting factor. The results therefore support the conclusions of another Australian study (Bolton and Gay, 1995) that "non computer users do not know enough about the benefits of computerisation to make an informed decision about computerising" and that cost was a "high priority". Rogers (1995: 167) concurs with these, indicating that an individual may not know enough about an innovation for it to be regarded "... as relevant to the individual's situation, and as potentially useful ... the individual's attitudes or beliefs about the innovation have much to say about his or her passage through the innovation-knowledge process." This further supports the

conclusions of Moidu (1993b: 44) that "training is a crucial factor for dispelling fears in the transfer of technology particularly when the end-users have a high interest but a low level of awareness." Hence, information and knowledge about CMRs is needed so that an environment of persuasion is created in which adoption can take place. More difficult to determine is whether an individual need for a CMR precedes the technology or whether knowledge of CMRs creates a need for the technology. It is also of interest to note patient reactions to GP computer use. Fitter (1986: 73) for example, indicates that "... studies suggest that the overall impact on patients is small ... patients experiences in computer use have more positive attitudes towards doctors using computers." This would seem to be reflective of a wider technology conditioning process occurring in society.

Another barrier to adoption that arises from the qualitative responses is finding the time to transfer over from a paper based patient records system to a CMR system, especially the laborious task of having to enter patient information into the CMR system. This can be somewhat difficult to overcome since trying to scan hand written notes on a card file, which may only be legible to the GP, is not really an option. It implies a longer term phasing-in process, possibly associated with patients' visits to the GP. As each patient comes to see the GP their paper records can gradually be transferred to the computer.

Careful consideration needs to be given to the argument that cost is a major barrier to adoption. Certainly, cost is an issue and past research has indicated that adopters

underestimate the actual cost of adoption (O'Toole, 1988; Heikkilä, 1995), but is it the barrier that we are led to believe? It may well be that the perceived benefits do not outweigh the perceived costs involved for it would follow that GPs would pay if the advantages were equal to or greater than the cost. A secondary line of thought, therefore, may be that cost is used as a strategy to divert attention from the real issue and that the perceived cost of having to learn something new outweighs any potential monetary benefit from using CMRs. Time sunk into learning to use computers and CMRs cannot necessarily be quantified but still counts as a perceived cost of adoption. This highlights some of the problems with conducting cost-benefit analyses since not all benefits or costs can be quantified; there may be qualitative benefits which in subtle ways may influence the overall process of work but are not directly connected with improvement, e.g. improved appearance and quality of patient records, improved editing capability, time-saving and improved data security. Benefits and costs are therefore essentially a matter of perception. The danger in just using a cost-benefits analysis to justify the use or non-use of CMRs on a quantifiable basis is open to serious limitations and critique.

Results from the survey data indicate what can be called an attitude-paradox. In the Swedish survey, among the non-users, a positive attitude is associated with an intention to adopt in the near future. In the Australian survey, even when non-users indicate a positive attitude they have no intention of adopting. Therefore, a positive attitude is not sufficient for adoption but may only be desirable. This finding supports the general belief that new knowledge and attitudes by themselves are not sufficient to bring about a change in behaviour. Other socio-political reasons need to be considered rather than just

behavioural or technical reasons. The survey work shows a need to clarify legal, social and political debates over CMR ownership, CMR legal status, stakeholder access rights, responsibilities, GP loss of power issues and funding models.

**Limitations and suggestions**

Mention needs to be made of the limitations of this study and the limitation of using a survey as a research methodology. Limitations help to understand and locate some of the survey findings in a more meaningful context as well as to help other researchers with the design of future diffusion surveys.

One key point needs to be made before undertaking a mail-out survey: the investigator(s) need to know that a mailing list sample can be compiled from a comprehensive list of the target population. This is not to say that a sample cannot be composed without a list of the relevant population but it may have implications for both the design methodology and the feasibility of the project. There may be a cost involved or the actual mailing list may not be available to the public ( i.e., it may be seen as a closely held organisational asset).

Respondents may have a vested interest in responding to the survey and hence distort the picture of events. If possible, it would be worthwhile to investigate the non-respondents and the reasons for their non-response. Some GPs may well be reluctant to disclose they are non-computerised because they perceive the survey to have a positive bias towards computers and CMR usage. Those who are computerised, therefore, may

well be more inclined to respond in order to promote CMR adoption. A different target audience could yield a different perspective, for example, instead of GPs who may or may not have a vested interest in CMRs, a survey of practice patients or the general public could be useful in order to ascertain another picture as to the state of computer and CMR usage among GPs since they could be seen as a more objective third party.

The actual sample selection itself can be an issue, random or non-random; it could be more informative to stratify or target a particular sample population in a particular geographic area, for example, survey only particular postcodes, or rural areas versus large urban centres. This may lead to a greater awareness of spatial diffusion issues but the researcher(s) need to confront the problematic issues of trying to classify and determine what exactly constitutes "rural", "city", "small" and "large". As such, this was not examined in the survey.

Generalisability of the results gained can also be an issue, in this case, are the results generalisable for Australia and Sweden or do they just apply to the unique sample gained? It could well be that the level of adoption in NSW is very high compared to the rest of Australia thus bringing the national adoption rate down. It could also be argued that the results gained for NSW may not be generalised for the whole of Australia.

A further limitation with using surveys is that an in-depth picture may not be gained, for example, identification of the adoption barriers tells little about the way those

barriers work. Future surveys may well need a greater nesting of follow-up questions about particular barriers to gain more information, or even a two or three stage survey.

Sampling error can also be an issue, for example, there is no way of telling whether someone else other than the GP actually filled out the survey. GPs themselves may not actually have answered the survey, it may have been another member of staff or the secretary. In order to overcome this problem, future survey designs may wish to utilise telephone interviews or stratify mail-out surveys into responder categories, for example, secretaries, nurses, GPs, specialists, dentists, other. This opens up scope for conducting a more broader based survey of various health care actors rather than just GPs.

Home computer adoption was not examined, future research may wish to include questions about home computer usage as this could have some bearing on computer use in the workplace. Also, a question about GP income levels may need to be included to see if there is an association with computer and CMR adoption. The work of Bolton and Gay (1995) indicates a possible association between income level, practice size and CMR adoption. Larger practices with high incomes tended to adopt CMRs more readily.

It should not be assumed that the adoption of CMRs will bring only beneficial results for all GPs. Rogers (1995: 412) mentions the difficulties with trying to measure consequences but nevertheless offers a possible classification schema for analysing consequences, (1) desirable versus undesirable, (2) direct versus indirect, (3) anticipated

versus unanticipated. To try and overcome a possible inherent CMR bias in the GP survey, question 34, or a separate nested section, could also have included other follow up questions concerning why respondents may have thought that CMRs had not improved the way they work, for example, do respondents perceive CMR adoption as encouraging technology dependency? Also, questions about whether the respondent had experienced any unexpected consequences or problems as a result of using CMRs. The inclusion of such questions is by no means definitive, they serve more to act as pointers, helping to gain an indication of issues worthy of incorporation in future research. Possibilities may include an investigation of a GP practice using CMRs, the expected and unexpected consequences of such use and any perceived competitive advantages and disadvantages over other GPs. Also, of interest as a case study may be any GP practices which have adopted CMRs and then discontinued their use and the reasons for this decision.

Interviews are a more time intensive alternative to mail-out surveys but they offer possibilities for more control and the verification of the sample and results. A smaller sample may be obtained and needed since interviews may be harder to achieve as GPs are busy people and finding time to do interviews can be a big problem. Interviews may be more useful when conducting specific or comparative case studies of general practices rather than broader based diffusion studies. An obvious advantage is that interviews allow for the possibility of a more in-depth understanding of an organisational setting, its actors and work processes. This is to a large extent, also dependent upon the skills of the interviewers, their ability to draw out information and knowing when to follow up

on information through supplementary questions which may be outside the interview guidelines.

Errors can also creep into the survey due to problems and disagreements over definition and differences in what the respondents actually use their computers for as opposed to perceived use. Respondents may, for example, equate computer usage with CMR usage, hence resulting in an over representation of CMR usage. This also suggests another limitation in that self administered questionnaires about computer usage can also be somewhat problematic in that users may base their answers on what they think they may do or would like to do rather than on what they actually do in practice. Hence, the possible need for further follow-up through observation and interviews. This itself can also be problematic since the person(s) under observation or interview may change their behaviour due to the researcher's presence. It is not beyond the realms of possibility that interview (or questionnaire) respondents may give false or misleading answers, especially if they are resistant to the introduction or adoption of a particular technology.

As mentioned earlier in the literature review, researcher bias whether the researcher is aware of it or not, for example, the questionnaire itself and how particular questions are worded or structured carries with it inherent politics of change. It is conceivable that a questionnaire can be designed to elicit certain responses and therefore support or refute certain claims through selective distortion. It needs to be noted that the researcher is actively engaged in trying to institute change, support or refute a given situation irrespective of whether this be in the natural sciences or the social sciences. Hence, the

researcher is not or cannot be a neutral actor. The researcher is situated within a larger context of political ideology, economic modes of production, tradition, social relations, beliefs and change. This active pursuit of research can manifest itself through conference presentations, journal articles, books, doctoral dissertations, etc. Therefore, the notion that research is conducted independently of other activities is somewhat of a distortion of reality. All research is inherently socio-political, it does not just occur without a reason, certain choices are made throughout the whole research process, for example, topic selection, theory, methodology and presentation of results, etc. These issues and dilemmas are more openly acknowledged by action based researchers (see, for example, Rapoport, 1970) who have argued for the greater inclusion and discussion of the issues of ethics, access to resources, funding, reliance on established traditions of scientific thought and goal setting in research. Research findings may or may not be verified by other actors, independence then becomes a matter of interpreting the positioning of other actors within networks and the links between various network actors across disciplines and institutions. This is the basis behind the idea of developing an actor relatedness chart as described in Chapter One as a possible methodological means of analysis. This may help future researchers to understand and position their research in relation to other actors in an area or discipline. Nevertheless, the difficulty lies in the ability to accurately track and trace the links not just between actors in a discipline network but between discipline networks. Therefore, an actor relatedness chart of a multidisciplinary study can be difficult to conduct since there may be many informal connections that cannot be traced through the literature, this is more of a form of tacit knowledge gained from informal investigation and discussion.

Another problem or limitation which should be considered when conducting comparative studies between countries is the inaccessibility of some literature due to the fact that it is written in another language which the researcher does not know. For example, there were several articles and books written in Swedish about various issues relating to CMRs in Sweden. Either a translator with a high level of fluency in both English and Swedish had to be found to help with a rough translation (note: translation is not an exact process, some words or phrases do not have an English equivalent) or the research investigator in this case had to learn the language which became a very time dependent activity by attending Swedish language classes. Upon reflection, the latter option appears to have been a more rewarding process in the long run both for the researcher and for the possibilities of conducting longitudinal research instead of a one-off research project in Sweden. This has also helped to build up a network of research contacts within Sweden. Therefore, language can act as a communication enabler or barrier for the greater diffusion of information among researchers. This is evident in the work of Wennerholm (1998) which was a translation, French to Swedish, of selected works by Latour. Also, some medical informatics notes and conference proceedings in Europe during the 1980s (see, for example, Gremy et al., 1981) in which proceedings were a collection of papers written in French, German and English. No language standard was adopted. This is slowly changing and English appears to be prevailing as the international standard for conference paper presentations and proceedings but it still remains a problem when it comes to books and local journal publications. It must also be acknowledged that the standardisation of language and the issue of standards in general is

also tied into political arguments about national sovereignty and the imposition of one culture's technology over another. It can be considered for some countries as a loss of sovereignty to have to communicate and think in English. Thus, long standing actors who have a tradition in the English language could be perceived as having an inherent competitive advantage in business, trade and politics over those who do not communicate in English. But at the same time this can also be a disadvantage at the local level where English is not accepted. This dilemma is evident in world politics today.

# CHAPTER THIRTEEN

# THE ROAD AHEAD IN AUSTRALIA

> The classic centralised systems of state based health care where policy decisions percolate down to the periphery of the health care system, are being replaced by regionalised systems where much health policy is made at a local level in response to the stated needs of the communities. This devolution of policy and control represents an enormous challenge for health informatics systems in the next decade. Indeed it could be argued that for such a diffusion of health policy and power to be successful, health information systems have to play a major part in providing the glue that holds these regional health care systems together. (Ranson, 1996: 372)

## How can the CHR adoption rate among GPs in Australia be managed?

From a national perspective, the perceived future potential of CHRs needs to be weighed up against the cost of changing existing patterns of learned social behaviour and work practices. Just what is worth targeting for change is a decision to be made not just by national policy planners but also by members of society and the users of CHRs in a health system. If CHRs can help improve the process of health care and, in turn, the health of human beings, then the use of CHRs could have direct bearing on life expectancy issues which is a worthwhile pursuit. Proving this connection is the difficult part which may become clearer as more health informatics research findings come to light over the next few decades. To say that CHRs function as an independent factor on health is somewhat of a distortion and denies other influences which may act in concert to produce a particular health outcome. Causal relationships, focusing on one factor alone, have always been problematic and debateable as can be seen in the argument that smoking causes heart disease, other factors such as environment, diet, blood pressure, cholesterol, body weight and genetic makeup may all play a role in confounding the health outcome. Therefore, the diffusion of CHRs among GPs needs to be considered in a totality as the diffusion of a technological system within an already existing health

system consisting of complex interrelations between GPs, patients, government and other health care actors.

If after careful consideration, CHRs are perceived to offer a distinct opportunity for changing the management of patient record information, will GPs who fail to make the switch from paper record management to CHR management become redundant and threatened by those who do? Reliance on old habits is at odds with the risk of trying something different, it implies an abandonment of the familiar and the gradual acceptance and learning of something different. Before this can occur it must be recognised that the adoption of an alternative technology will be an improvement upon existing technologies; whether it actually is or not, of course is only a matter of perspective. Unless this perceptual acknowledgment is made in the mind of the GP, resistance will continue to occur despite incentives for change.

To try and move from awareness to actual adoption, diffusion of information has to occur on several fronts and through a carefully managed and coordinated way engaging many different actors who have a view of both the macro and micro picture of CHR development, issues, conflicts and motivations. The various fronts on which this must proceed includes: greater information flow through journals, conferences, media, panel discussions, debates, education, training, research, incentives, standards, policy formulation and planning. This involves many different disciplines: the (re)creation and merging of journals, courses, degrees and organisations so as to reflect this reorientation or change in thinking and health informatics. Thus, not only does the landscape of health

informatics change over time, as played out by the various actor conflicts, but the very meaning of health informatics itself.

**Future trends**

Technology needs to be seen as an organisational construct. Technology reflects organisational management practices and work behaviour. Changes to individual work practice behaviour therefore needs to be seen as following broader changes in organisational management within society, nationally and internationally.

Globally, there has been a greater move towards competition, privatisation and reregulation of markets, for example, banking, airlines, telecommunications and education, health being one such market sector experiencing pressure to change. Patient records are presently held in paper based form by most GPs in Australia. The value of this information (both clinical and administrative) is steadily increasing as more actors wish to access this information because it offers the possibility for new means of analysis and commodification. This process is furthermore a reflection upon the greater struggle for power and control over the health care system.

Both systems in Australia and Sweden are under pressure due to rising costs and diminishing tax base revenues to fund health services. As a result, more economic rationalist, cost cutting principles are being applied to managing health care. As Ranson (1996: 363) indicates, "the economic pressures now placed on health care resources allocation and national and international health care budgets have been considerable."

Governments of today are more interested in outcomes and cost reduction (Feinglass and Warren-Salmon, 1990, K. Davis, 1993). This provides the political impetus for a gradual movement towards the privatisation of publically managed health care systems. Nevertheless, information systems that allow for greater accountability and evaluation represent a means for governments to exercise more control over health care services and costs. For this reason the introduction of computers, CHRs, financial and information management systems can be seen as a prominent part of gaining greater control over and accountability for how public money is spent on health care. Consequently, at a political level, it can well be argued that CHRs represent a means of obtaining greater control of information by governments in the health care sector. Not surprisingly, GPs in Australia may see this as a loss of control at two levels over: (a) revenue and (b) their operational information at the practice level and thus be loath to adopt any technology which rearranges the balance of power in favour of the government or other stakeholders. Therefore, GPs need to empower themselves by actually using CHRs to their advantage by being able to analyse the information they capture in their practice settings in order to try and shape health policy debate and development. Epidemiological research in general practice offers such an opportunity.

Health systems in Australia and Sweden are both under greater scrutiny than ever before as more emphasis is being placed on cost reduction as evidenced through the use of such terms as performance, competition and quality. This is the rhetoric that is being used to try and institute change. Sweden faces pressure to move to a more market orientated health system rather than reliance on fixed annual allocations to GPs and hospitals.

Payment would be made according to outcomes or performance. The small but growing number of private GPs in Sweden is itself a reflection of changing economic conditions in Sweden and the desire to create more competition between GPs so as to reduce costs for services rendered while maintaining or improving quality. Evidence of this economic experimentation can be seen in the shift towards patients being able to choose a GP where previously they were allocated a GP, but this move is still in a state of flux within Counties. Such changes could marginalise and effectively squeeze unpopular or inefficient GPs out of a job, possibly those not using computers or CHRs. Greater competition between the public and private sectors is being encouraged both in Australia and Sweden.

The significance of information and (tele)communications systems within health care cannot be overlooked. In the USA, Schneider et al., (1992) argue that telemedicine could save billions of dollars within the USA health system by using the telecommunications system to exchange health information between various health care providers. Nevertheless, some caution is advocated as Brittain (1996) and Warden (1993) indicate since millions have been wasted on IT projects in the past with little or no return. Caution may also be important in explaining the slow take up rate of CHRs among GPs in Australia.

In Australia, the telemedicine vision (Watson, 1989; Brauer, 1992; Crowe, 1993; Allen, 1994) can be characterised by a growing number of pilot and experimental projects. Pradhan (1996) provides a useful overview of the area and some of the issues

surrounding the use of telemedicine. The development of the Health Communications Network in Australia is also a step towards trying to increase the significance of telecommunications in health care but the shape of this vision is yet to fully materialise. EDI also represents another developing area for health data communications exchange. The development of a national health information and communications network in Australia is at this stage a vision. As has been argued, in order for further developments to occur in health care, the foundational building blocks firstly need to be accepted, that is, CHRs. Without an acceptance of this foundational building block in primary health care, everything else is likely to be somewhat superfluous and a little premature.

**Policy implications**

In terms of policy and program recommendations for encouraging CHR adoption, based on the survey results presented in Chapter Twelve, it becomes obvious that there is no one simple solution to the problem of increasing the rate of CHR adoption among GPs without carefully considering the possible consequences and examining the environment within which they are to be diffused. The following are some options and initiatives that may be helpful to policy planners, IT managers, coordinators and strategists.

Greater focus needs to be placed upon social network analysis, research, design, marketing, situational implementation, training and policy. Co-ordination between government and the various professional medical bodies is essential. Education, information, training and support initiatives are vital for the proliferation of CHRs among GPs. In a market economy, the reality is that there has to be some form of

financial incentive for GPs to computerise, for example, an increase in the Health Insurance Commission's computer rebate for electronic medical claims lodged by GPs under Medicare.

The present day plight of the GP can be seen as a political struggle for economic power among an array of health care actors. From the outset, a cautious approach must be advocated to any radical changes in the health care system. The consequences of ill thought policy and strategy could have disastrous effects both on patients and the labour market.

In Australia, GPs have a very special standing in that they essentially are the primary health care information gatekeepers (Strasser, 1992). But the role of the secretary or practice nurse should not be underestimated and is part of the greater struggle between labour divisions and the standing of professions, especially if the secretary/ practice nurse filters patient and GP contact. GPs are often the first point of call for patients seeking entry into the health care system. Furthermore, it is the GP who has the power to refer a patient to a specialist (Pasad and Schattner, 1991). Perhaps greater thought needs to be given to the political and economic blocking utility of this power in a greater political labour struggle between specialists and GPs (i.e. is the referral really essential?). CHRs can give GPs a more proactive role and greater leverage over patient information in the health care system. In the future, a pricing-reimbursement system may need to be developed by GPs for aggregated (patient) information products developed by the GP for consumption by governments and other interested parties. This could represent a

whole new market and income stream waiting to be tapped whereby GPs and CHRs are the key infrastructural actors, essentially the opening up of a health information market within a broader information economy. Again, epidemiological research based on the GP practice population using CHRs offers such an opportunity.

For CHRs to be marketed successfully to GPs they need also to be seen as more than just an automated version of the existing manual paper records process. An integrated software system approach needs to be advocated, CHRs need to be seen as part of an integrated system, a *GP Office* software approach, which links other functions such as accounts/billing, appointments scheduling, prescription, drug interaction database, email, Internet access, etc. But essentially, the future lies in promoting the idea of GPs being able to conduct their own internal practice audit and the ability to generate practice statistics both as an aid in spotting disease trends and for opportunistic revenue generation through patient reminders and recalls (e.g. pap smears, immunisation, chronic care cases). GPs would have the ability to effectively *mine* their practice population database for information that was previously difficult to access due to the physical nature of patient records being held in paper form. With the computerisation of patient records GPs can then utilise software capabilities to produce practice statistics and/or queries about their practice population. It is the view of this thesis writer that this database query feature is underdeveloped and undersold at present. As Fitter (1986: 77) concurs, "...computers could be used to increase patient awareness or to increase the doctors' managerial control over the practice." If GPs can be made to see that they can generate opportunistic revenue through patient reminders and patient recalls then they

may be more willing to invest in the purchase of computer equipment and computer medical records software.

To achieve a higher rate of CHR diffusion among GPs, ultimately the GPs themselves have to take a pro-active role among members of their own medical community. GPs need to become self diffusers of the technology to other GPs within their social networks if a higher rate of adoption is to be achieved. Early adopters need to act as facilitators for other GPs. Computer training workshops can act as a starting point for information exchange and networking. They also provide a forum for GPs to be directly exposed to the technology in a non-threatening environment among their peers. Such simple exposure to CHRs can lessen the distance and fear GPs may have about CHRs. Training and support need to be on-going; hence, having GPs, technical staff or consultants to offer advice and assistance is critical for the whole process to work. Ideally, at the local network or GP Divisional level staff who have an understanding for both computing and medicine would be invaluable in such roles. This also highlights the importance of developing educational programs at tertiary level both to include computing in medical degrees and to establish health informatics as a discipline in its own right.

Standards reflect the socio-political environments that they are created and shaped within as is evidenced by the various computing and communication standards in existence around the world today and the various standards bodies (for example, CEN, ANSI, IEEE, ASTM, ESPRIT, ISO, ITU). For long term national health gains to be

made, even future global gains, desired health outcomes need to be clearly predefined in order to avoid the problem of continually shifting goal posts in an environment characterised by rapid change. Standards can, in a way, act as a retardant to rapid change and divergence, allowing for a continuity of the past with the present and the future. If McLuhan's (1964) *global village* is ever to be achieved and the equality gaps between rich and poor nations are to be narrowed, international organisations such as the WHO will need to take on a more significant leadership role. However, member nations will need to have an equal stakehold in shaping world health policy objectives. Otherwise, a continuance of disparate health systems and goals will continue.

Standards can represent a significant means of control over work practice behaviour in health care (IOM, 1994; Hannan, 1991, 1994; Ranson, 1996). The problem with standards as indicated by O. Berg (1997: 1083), is that "... protocol also contributes to the widespread illusion of the single answer" of doing things. This can be seen as the convergence-divergence dilemma. If no standards exist, a completely different technology and health strategy needs to be adopted for operation in a short term dynamic market environment, in which actors maximise their gain. This may maximise the economic return for some actors and eliminate others due to the adoption or non adoption of competitive practices (e.g. use of CHRs) thereby having an impact on labour market policies and employment levels. This can be a difficult balancing act for governments to achieve having to consider national public health interests on the one hand as well as individual economic interests on the other. Cynics may argue that having a healthy national population is a major cost burden and therefore should not necessarily

be a government objective, despite rhetorical claims, since this would place a growing economic burden on the government to fund the increased utilisation of health care services by a growing elderly population needing greater home and hospital nursing care.

### The Illawarra Care Net Trial, NSW, Australia

This is a local Australian initiative within NSW, commenced in 1997, and funded by the Australian Commonwealth Department of Health and Family Services and the NSW Department of Health with the involvement of the Illawarra Area Health Service and the Illawarra Division of General Practice (Commonwealth Department of Health and Aged Care, 1999). It is an example of the devolution of health planning and financing from a national level to a more regional level, with the Illawarra region being able to tailor their expenditure to the specific needs of the local population base. It basically aims to establish a coordinated care plan and a body to administer the purchase of health care services from various providers, for example, GPs, pathology, radiology, for a target population. Such a change also implies movement towards working with a set pool of funds to manage regional health as opposed to an uncapped health cost model. This would indicate that an underlying minimum health data set will be required in order to be able to collect comparable data from all service providers.

The idea of the trial is to track over a six month period two groups, an active group of 1200 trial patients and a control group of 600 patients, in order to monitor morbidity and use of health services. The patient recruit group is made up of identified individuals who are considered to be at risk, for example, Illawarra residents aged over 65 years who

are at risk of falling or individuals identified as having a complex mix of medical conditions such as diabetes, poor sight, renal disease, high blood pressure and social living problems. The central purchasing body will use pooled funds to purchase health services for the trial group of patients. It is important to note that the recruits to this trial can choose their own GP and the GP also has to agree to their own and the patient's participation in the trial.

The key to the success of this trial relies on the localised diffusion or implementation of an overall information system architecture, based on a central intranet site containing the electronic patient health records, which will be maintained by a central body who will collect the information from the various health service providers. This will generally require the acceptance and diffusion by a trial group of health service providers and patients of computer systems connected to the existing telecommunications infrastructure. This would indicate a strong need for an educational and support component within the trial project, as the results from the survey work presented in Chapter Twelve have indicated. Lack of computer literacy and knowledge were identified as being one of the main barriers to adoption across both sample groups. There will be GPs who have undoubtedly never used computers and CHRs before. As an incentive for GPs to participate in the trial, computers and Medical Director software will be supplied by the trial administrators in return for the needed health information.

Enticing GPs and other health service providers to participate will be an interesting process to follow. The trial implies development and testing of various health care

plans, linked to expenditure accounts and budget tracking modules as well as forecasting, projection and evaluation modules. This indicates a need to cost out various episodes of care, employing both average costs and substitution variance costs. The quantification process may prove to be highly contentious as qualitative health process inputs will be difficult to quantify and fully factor into an econometric model for health care service and well being. Furthermore, this also has implications for individual health service providers, some will be more expensive than others, and this may create an inevitable health service provider squeeze in the market in order to bring costs down. For example, GPs may have to compete against each other for patient service provision as delegated by the regional care body. Problems may arise in that cheaper health service providers may not necessarily provide better health care, but then neither may more expensive health care providers. A national minimum standard of health care may need to be established. Determining what actually constitutes a measure of improved or better health care will remain a problematic area for many years to come, however, health care outcomes need to be looked at closely as more than just quantitative measures of return on services. Empiricism and econometric health modeling have limitations and only provide for one possible way of attempting to look at health care.

A convergence between the ideas of national health policy, social policy and competition policy is an experiment which may have serious long term consequences, that is movement away from government funding for health and greater movement toward private health insurance and coverage, private hospitals, etc. In this user-pays based system, issues of access and equity may result in a less than egalitarian society

with only those able to pay being able to access and use the health system not un-like trends in telecommunications, education and the legal system. The re-election of the Australian Liberal-National Coalition in 1998 has prompted a push to restructure the tax system by way of introducing a goods and services tax otherwise also known as a consumption tax. This can be seen as an attempt to generate greater tax revenues for the Commonwealth Government, a move which could be interpreted as justifying the retention of a national health care system such as Medicare.

**Strategy and IT management**

IT as an area of study, both from a theoretical and practical point of view, is being given more recognition and importance in management literature. The problem is that the characterisations of technology have often been from a tool-based point of view, that is grounded in very object fixated and technologically deterministic arguments, e.g. technology as having its own self dynamic. These models often fail to examine in any great depth the actors who shape, construct and diffuse technological systems within a broader socio-political context.

Arguments that view technology as strategic weapons (see, for example, Porter, 1980; Harris et al., 1983) miss the point somewhat by considering technology solely through an economic competitive viewing lens. Nevertheless, it could be argued that the development of technology as a strategic weapon is itself a social response to a market or political need and therefore a socio-political construction. But more often, in the strategic and competitive weapons thinking technology is viewed as an object or tool to

be used in some way to gain advantage over other competitors, therefore by implication, disadvantaging others, for example, through automation and computerisation of work processes. This view currently predominates in the management literature and in much economic rationalist thinking. Technology is seen as the management of competitive tools for reducing organisational costs and gaining market power and profit in a global capitalist system by macro and micro economic actors alike (Drucker, 1973; Porter, 1985; Ansoff, 1987; Mintzberg, 1987).

More holistic approaches to studying not just technology but IT are advocated. Ulhoi (1992: 23) notes the micro-macro dilemma by stating that studies either tend to be too atomistic, for example, how a particular technology works, or too descriptive, concerned with what may happen but little discussion as to how it will happen. Therefore, a more integrated micro-macro view of CHRs within a socio-political framework of understanding has been advocated in this thesis.

Strategy and IT management are about planning for changes in the broader socio-political and economic environment. Legislative outcomes both as a result of the political process and through the courts play a significant role in shaping market structures and practices. The process of planning is just as important as the methods used for trying to accurately predict what may happen in the future through technology forecasting and attempting to pick technological winners. This may suggest the relevance of the tendency towards adopting probabilistic and game theoretic models for organisational planning and strategy development (Boden et al. 1990). Essentially planning (both long

and short term) and managing change needs to be seen as an on-going interactive learning process, it does not just start and stop, the formulation of the plan itself does not take place in a social vacuum. There are many actors to consider and the formalised plan should not be seen as un-changeable. As Suchman (1987) concurs, plans themselves need to be seen as situated in time and place. Accordingly, plans need to be periodically reviewed and modified to be reflective of perceived changes in the social, political, economic and legal environment. Such an approach is more in line with a contingency based approach to planning (McConkey, 1987). Planning for uncertainty rather than certainty may thus be more advisable. The difficulty lies in developing methods for coping with sudden change, in the case of GPs and CHRs, methods or processes for gradually changing habitual patterns of learned work practice behaviour.

Change can occur at different rates as is readily illustrated by the diffusion of CHRs in various countries, for example, Australia and Sweden. There are time lags between the idea of adopting and the achievement of actual widespread adoption and how this happens. The conventional S-shaped diffusion curve offered by Rogers (1995) is useful as a vehicle for provoking and structuring thinking about the diffusion process. Rogers essentially offers one insight or framework for helping to understand the diffusion process and therefore can provide a starting point for the discussion of strategy and IT planning. By the same token, an awareness of the limitations of Rogers' thinking is also important. This is a problem faced by any universal explanation for the diffusion process since it cannot account for all cases and therefore competes with other explanations. Varying patterns of diffusion have also been found to exist, see for

example, Brancheau and Wetherbe (1990). Heikkilä (1995) found a double S-shaped diffusion curve, dual sigmoidal, rather than a single S-shaped curve. These findings are strongly associated with the perspective or unit of analysis taken for studying the diffusion process, that is, the individual, organisation or nation state.

Management of the diffusion process, or the rate of change, is what managers seek but this can be problematic since the patterns of diffusion vary and can be unpredictable. Assessments based on analogies with the diffusion of other technologies (or their systems), for example, the telephone, television, computers, electronic mail, fax, mobile phones and the Internet, are in no way guarantees that an associated technology or its artifacts will diffuse in the same way. Arguments about technology push and market pull (see, for example, Nelson, 1969; Dosi et al., 1988) can be somewhat problematic depending on the interpretation of this argument. The tension between technological determinism and market determinism is evident in this continuum of thought. What is not so obvious is the motivations and conflicts which underpin this way of thinking, in that technology (systems) and markets all develop in a socio-political context involving an array of actor motivations and conflicts.

Another more recent trend has been to view technology as both the organisation of information and knowledge. The distinction between these two terms is not always easy to identify, resembling the problematic dichotomy between data and information. This is evident in such ideas as the information society, knowledge workers and knowledge capital and how these ideas may be measured and quantified in the balance sheet of a

company. The role of the knowledge base of an organisation is seen to be vital to the technological performance of an organisation:

> the organisation ... can be seen to play a filtering role as knowledge passes to, from, and within the knowledge base. Strategy and the knowledge base are also interdependent. Knowledge is a prerequisite for the formulation of strategy. In turn, strategy may call for changes in the structure and content of the knowledge base. It is through the firm's organization and its decision making processes that the knowledge base is articulated into revealed technological performance. (Ulhoi, 1992: 21).

This is particularly so in an information or knowledge based economy. Identification and evaluation of alternative ways of doing things, for example, through scenario modelling, delphi studies and attitudinal surveys, is important for shaping the on-going formulation and reformulation of strategic IT plans and policy. This implies that conflict will occur as different actors, with different frames of reference and knowledge bases of the world and its reality clash. Negotiation serves as a means for trying to mediate this process.

# CHAPTER FOURTEEN

# CONCLUSIONS AND RECOMMENDATIONS

> "Politicians, priests and psychiatrists often face the same problem: how to find the most rapid and permanent means of changing a man's belief." (Sargant, 1959: 13)

A mass diffusion strategy should be based on local experiences, hence, the utility of applying a social diffusion network model to the Divisions of General Practice in Australia. An overall diffusion strategy should allow for the development of separate, explicit strategies appropriate to various local settings, for example an Illawarra Division of General Practice IT Strategic Plan, so as to take account of different rates and patterns of diffusion occurring in and between the various General Practice Divisions rather than just thinking about diffusion from a single national perspective. Theoretically, this implies a diffusions within diffusion model rather than just a single S-shaped diffusion curve. Coupling this idea with social network thinking should help to elucidate further the diffusion process.

As the Australian survey findings showed, a high awareness and favourable attitudes towards CHRs are not necessarily associated with the action to adopt as can be seen in the case of the Australian non-computerised respondents. This may in part be due to the fact that such individuals do not consider their existing paper record management practices as a problem. The Australian results may further be associated with perceptions of possible undesirable consequences following from the adoption and implementation of computers in the minds of GPs. On the other hand, the Swedish results demonstrate a different situation altogether as can be seen from the Swedish non-

computerised respondents where a high level of awareness and favourable attitudes are associated with an intention to adopt (see Table 14-1.)

Table 14-1. Summary of key results

| | AUSTRALIA (NSW) N=293 | SWEDEN N=298 |
|---|---|---|
| % of GPs who believe CMRs are an essential technology for healthcare in the future | 55% | 80% |
| Rate of diffusion of computers and CMRs among GPs | 14% | 72% |
| % of GPs who use computers for patient records | 16% (of 14%) | 93% (of 72%) |
| % of GP CMR users who believe CMRs have improved work practices | 82% (of 14%) | 69% (of 72%) |
| % of non-computersied respondents who have problems managing patient records | 35% (of 86%) | 68% (of 28%) |
| % of non-computersied respondents who believe that CMRs will improve the way GPs work | 63% (of 86%) | 72% (of 28%) |
| % of non-computerised respondents who plan to implement CMRs within the next 3 years | 33% (of 86%) | 90% (of 28%) |

Note: These summary results combine Tables 12-2 and 12-4.

The adoption behaviour of GPs is not always understandable or predictable. The paradoxical finding between the Australian and Swedish study demonstrably shows that a positive belief about CHRs does not necessarily correspond to actual adoption. This can further be described as a discrepancy problem between attitude and practice, that is, between rhetoric and action. Direct interventionist strategies such as standards setting, reimbursement schemes, training programs and the offering of grants can only

provide a partial means for controlling the work practice behaviour of GPs. Essentially, "Belief in one's own system is essential to its success and sometimes such belief is achieved only by an almost conscious effort at self-persuasion." (Arnold, 1992: 14)

The results from the Swedish study support the argument that the process of diffusion can be controlled at least to a certain extent. In Sweden, a direct financial incentive has been provided by the governing bodies at the County Council level for GPs to adopt CHRs. This can be interpreted as a direct policy initiative to computerise GPs, whether they like it or not, similar to the "Micros for GPs" scheme in the UK, also a type of forced regulatory obligation. In return the Councils expect standardised monthly aggregated reports from the GPs in order for them to be paid. The Swedish result is even more interesting in that, despite being forced to computerise, GPs still have a positive attitude towards CHRs. This may be interpreted as reflecting upon a deeper belief that the adoption of CHRs is an improvement upon past work practices. This also implies the possibility that the appropriate unit of analysis of the diffusion process may be the work or activity task itself situated in a group context, that is, not necessarily the number of GPs using computers and CHRs, but the number or groups of GPs conducting their work in a particular way, which may or may not involve the use of computers and CHRs.

Heikkilä (1995: 30) concurs with these ideas and argues that "... the willingness to adopt is more dependent on the adopter-technology fit, and the sustained use is more dependent on the task-technology fit", with the peer group serving as the reference

group. Therefore, supportive strategies and guidelines which help to encourage the learning processes among GPs are vital to the idea of decentralised diffusion of CHRs within GP Divisions or networks.

**Diffusion and implementation strategy suggestions for Australia**

One of the key research concerns for this study was to test the validity of previous Australian studies and measure any changes in outcomes. The research results support previous studies conducted since the mid-1980s and suggest few significant changes have occurred.

Initiatives and directives for structural change should come from national organisations but most of all they should reflect a coordinated effort based on local experiences. Lack of leadership and macro policy vision at the national level can only lead to confusion at the various regional and local grassroots levels and a multitude of disparate systems and approaches developing. This is not to deny room for experimentation to see what works and what does not, but the essential element that is required are individuals who can make sense of the various fragments of knowledge in order to form the bigger picture. More communication between national, state and regional organisations is needed to report and update on current events and initiatives. There is thus a resultant need for a new and specific national overarching CHR Institute to be formed with representation from all interested stakeholders. Representatives from this new body would also be involved at the international level and be represented on international (informatics)

bodies, for example IMIA, so that information about developments can both be filtered top-down and bottom-up in a more coordinated way.

The establishment of an Australian CHR Institute (ACHRI) would be a move towards greater coordination of resources, projects, research, tracking and reporting of results that would enable research to build on existing projects and literature in a more coordinated way rather than continuing to perpetuate the existing situation of isolated islands of initiative and activity.

Key actors such as the Federal Minister for Health and Aged Care should be targeted to facilitate the advancement of CHRs and the establishment of the ACHRI. This does not necessarily imply that the ACHRI should be a government body, for it may have a government reporting function but representation in the ACHRI would come from various groups, as shown in Figure 14-1. It should be noted this is not an exhaustive list.

Figure 14-1. Representatives in the ACHRI

Federal, State and Regional Health Area Organisations,
HISA, RACGP, AMA,
Health Insurance Commission,
Consumer and Patients' Rights Groups,
Standards Australia,
CHR Vendors,
Others, e.g. nurses, researchers, specialists, policy planners, strategists, hospital administrators, pharmacists, private insurers, etc.

**Policy recommendations**

There is a long standing need to decide upon a national standard for an integrated CHR and practice management software for GPs and to encourage other health providers to adopt the same standard. The national standard should fit into the general development of a future health communications infrastructure between GPs, hospitals, pathology, insurers, government and other health care providers. The Australian Coordinated Care Trials presently being conducted of which the Illawarra Care Net Trial is one of the largest, are attempts to experiment with CHR use in a more comprehensive and coordinated way.

The following are some basic fundamental CHR design standard suggestions and recommendations. These have been developed from a comprehensive review of existing research in this area (see Chapter Nine for a detailed discussion) and the results of the GP surveys conducted in Australia and Sweden (see Chapter Twelve). Detailed statistical analysis of the survey questions related to design issues (Q25 -40) have been included in Appendixes 4 and 5.

- Need for an integrated system, must meet GP (and other stakeholder) needs and cater for patient confidentiality/privacy, must be an easy to use GUI, screen displays should be easy to read and not cluttered with too much information.

- CHR use should not interfere with the physician-patient encounter, the CHR system should have appropriate security features built into the design (e.g. encryption, passwords, audit logs).

- The system must include a comprehensive query and statistical generation component so that GPs are able to interrogate the practice population database. If a CHR standard cannot be agreed upon, a standard should be encouraged, *de facto*, or, at least, a minimum data standard should be established for the transmission of health data (e.g. HL7) and security (e.g. use of public and private key encryption).

National Health Policy should specifically address and indicate the importance of CHRs in its vision for a reformed health care system. There is a need to develop uniform national legislation for CHR use. Issues of privacy, confidentiality, ownership, responsibility, access, breaches and liability need to be clarified and reviewed. The possibility of introducing sector specific health CHR legislation or the extension of the Australian Privacy Act to cover the private sector should be considered. This way private health providers, including GPs, would be covered under the legislation.

A comprehensive national health data dictionary could be a valuable public resource but this has social implications beyond the mere collection and retrieval of health information. Issues of centralisation, control, ownership and confidentiality are inevitably associated with such developments. Function creep can become a major problem as systems originally designed for one purpose can be extended to encompass

other functions not necessarily justified or obvious at the design stage, for example, the linking of various government databases using a unique personal identifier. The creation of a national DNA database would have far reaching social consequences other than just being a technology designed for evidence gathering and crime prevention. Efforts to develop a standard GP Data Dictionary can also be considered important and this should be a subset of the greater national health data dictionary. Careful thought will be required to determine what data elements are needed both now and in the future, in order to accommodate all stakeholders involved. Nevertheless, a careful balance through legislation and policy will need to be constructed and negotiated among various actors in order to preserve the information needs of the individual for privacy and the information needs of the state.

The following are some specific recommendations for GP Divisions in Australia:

- GP Divisions need to be treated as social diffusion networks.

- Establish pilot GP Practice success centres within Divisions, these could be regarded as centres of excellence.

- Target technology champions and opinion leaders as the key information diffusers within GP Divisions; these may be the pilot success centre GPs. Each success centre can further act as a regional support site for interested GPs to visit.

- Enlist technology diffusion mediators and facilitators. These individuals should ideally have a broader awareness of health policy, health informatics, technology diffusion and an understanding of the GP setting in Australia.

- Set up a national GP IT "help centre" which GPs can call toll free when needing help and advice with CHRs; this could be one of the functions of the ACHRI.

- A higher level of peer reviewed publication in journals as well as periodic reports and updates from the new body, ACHRI. Target journals would include: *Australian Medical Journal* , *Informatics in Health Care Australia* and *Australian Family Physician*.

- A wider mass media strategy is desirable (television, radio, newspapers, WWW) so as to create greater awareness of the ACHRI and its role and activities. The ACHRI should not function as the sole preserve of a few power elites but rather as a national public information and knowledge resource.

- Sufficient conference forums presently exist at the national level for general health informatics and information diffusion. What is needed is greater consolidation of the various initiatives, research findings, clinical trials and so on in order to provide a greater sense of direction. Otherwise, islands of uncoordinated, disparate research will proliferate. There is also a need for the development of a directory of past efforts, as well as existing on-going research into CHRs, both within Australia and

internationally. This could be a home page on the WWW, which would be easier to update and change than a book.

- Computer and CHR education, information dissemination, debate, training and support are vital within the 115 GP Divisions in Australia. There is a need to develop and integrate computing and statistical competencies into future medical training qualifications and programs. This would allow for more and better epidemiological studies by GPs operating at the practice level.

- Greater involvement of professional bodies such as HISA, RACGP and the AMA.

- Need for financial incentive schemes for GPs to computerise, for example, the electronic Medclaims $500 rebate from the Australian Health Insurance Commission should be increased; special accelerated tax write downs for GPs on the purchase of hardware and CHR software may also need to be considered.

- Financial incentives from Government, RACGP, AMA, HISA, industry and other possible stakeholders. Financial support (public and private) to encourage CHR development and diffusion is important and cost sharing among stakeholders should be encouraged. As a start, financing issues should be addressed by GP Divisions within their IT strategic plans, i.e. how to obtain sources of funding through, for example, collaborative grant applications. Without reasonable financial support, CHR development and diffusion in Australia will remain minimal for some time to come.

Voluntary adoption may be preferable to mandated adoption. The key is to create an environment in which GPs will voluntarily adopt without direct coercion. The alternative is for the Federal Government to regulate CHRs as a national standard for GPs, which would undoubtedly create some dissent.

- Greater visibility of pilot projects documenting CHR adoption before, during and after implementation. These can be written up as case studies. This allows for verification of the rhetoric about CHR technology against social reality and current practice, for example, costs, benefits, design problems, unintended consequences, loss of power issues and general practice impact studies.

- Greater collaboration between GPs, researchers, professional bodies, local area health services and government needs to be encouraged especially in grant proposal applications.

**Recommendations for further research**

As a means of guidance for further thought and research some key general questions are offered for researchers who may be contemplating research in the areas of health informatics, CHRs and technology diffusion.

- How does technology gain general acceptance among a target audience?

- What are the motivations behind technology construction and diffusion?

- What approach or interpretation can be taken to help understand human knowledge about technology and society?

  What are the attitudes of the existing users and non-users towards technology?

- How do users actually make use of the technology (comparing intended use with actual use)?

- What implications do research results have for policy formulation and technology adoption/rejection strategies?

- Are diffusion strategies portable across national boundaries and can they be modified to suit local settings?

- What should be the future role of government in health care and technology diffusion, intervention or withdrawal?

- What is the role of standards organisations and professional bodies in technology diffusion?

- What is the role of patients' rights groups within health care and do adequate organisations and forums exist?

The points which follow are also some more specific ideas for further follow-on investigation:

- Further studies and validation of research findings using surveys, case studies, direct observation and interviews, possibly in other countries as well as in Australia.

- A repeat study in 10 years time to see if changes have occurred in the take up rate of CHRs among GPs in Australia (trend analysis).

- Evaluation and benchmarking of CHR software systems, implementation strategies, research methodologies and design.

- Studies among other medical practitioners (for example, specialists, dentists) and their adoption of computers and CHRs.

- Case studies of technology champions, opinion leaders, early adopters, late adopters, laggards, non-adopters, mediators and facilitators within social networks.

- CHR information dissemination and acceptance strategies, both theoretical and practical.

- Alternative communication models, interpersonal versus mass communication, theories and methods. These will need to focus on the information flow among actors

in social networks rather than on just the artifact itself and in open as well as closed information systems.

- Technology assessment (from social, ethical, legal, political, technical, economic standpoints) in health care, for example, General Practice impact studies.

- Telemedicine and information security, health telematics, especially with regard to the transmission of patient information over public telephone networks.

- Industry development trends and global trends, for example, voice recognition technology, telemedicine and teleconsultation.

- CHR and Smart Card technology convergence: medical records on a smart card.

- Electronic multimedia health care records whereby database elements may be both graphic, text and audio. For example, an X-ray image could be a data element.

**Three key future projects stemming from this thesis work**

(a) The development of a social network model for the Illawarra Division of General Practice identifying existing CHR users, non users and the information flow connections among GPs.

(b) In collaboration with GPs and other interested health care actors, to design a Web based CHR system. This will need testing, prototyping and subsequent trial implementation in a GP practice. It may even be a project which could be undertaken by final year School of IT and Computer Science student(s).

(c) Commercial possibilities include the design of computer education workshops about the World Wide Web and CHR use for GPs. These could be run by academic as well as other educational organisations, modules could be developed and tailored for GPs or other allied health professionals. This in turn would provide an ideal situation for networking with GPs and realising projects (a) and (b) mentioned earlier.

**Epilogue**

The central thesis posited is that the diffusion/non-diffusion of CHRs among GPs in Australia needs to be seen fundamentally as a socio-political process which is reflective of changes in political, economic, social, legal and behavioural values rather than just being a technical implementation exercise. Successful adoption strategies drawn from countries with a high rate of adoption, such as Sweden, can act as useful models for devising home grown plans. The caveat is that it is still necessary to carefully examine the attitudes of GPs (the main users) towards CHRs from an international, national and divisional level and to monitor how GPs actually use the technology when adopted.

CHRs represent a fundamental organisational and work practice change from paper based patient to computerised medical record keeping. The implications of this go far

beyond sole record keeping practices alone. CHR adoption can occur if the diffusion process is managed by the key actors involved. This implies that GPs both fully understand and accept the benefits and possible future social dilemmas resulting from the adoption of CHRs. The vital link in this whole transition, is the need to have appropriate support incentives and mechanisms available to mediate this fundamental shift in work practice and thinking. Furthermore, the information-needs and wants of the various key actors (government, GPs, staff, patients, designers, researchers and others) need to be reasonably resolved, such as, ownership, access, control, standards, education, training and cost.

At a theoretical level, this work has endeavoured to consider how social constructivist thinking and the work of Rogers (1995) can be applied to understanding the process of design and diffusion of CHRs among GPs within the context of existing health informatics literature so as to link both theory and practice in a more integrated way.

What the current work has achieved is to provide some unique insights into the diffusion of CHRs among GPs in Australia and Sweden. This was only possible by traversing various bodies of literature, from diffusion and innovation to theories of technology and health/medical informatics. For this reason this thesis work is unique in that it goes outside the existing discipline boundaries of health informatics to provide a broader socio-political perspective upon the diffusion of CHRs among GPs.

Technology diffusion is an information and communications exchange process among actors in social networks through time. The wider adoption of CHRs among GPs in Australia will occur when the communicated needs and wants of a critical mass of stakeholders are met.

## REFERENCES


AC Nielsen (1998) *A Study into the Levels of, and Attitudes Towards Information Technology in General Practice.* Vol 1 & 2, prepared for the General Practice Branch of the Commonwealth Department of Health and Family Services. AC Nielson Research. Sydney.

Adelakun, O. (1993) Economic Problems in the Implementation of Hospital Information Systems (HIS) in Nigeria: A Practical Experience. In Mandil SH., Moidu K., Korpel M., Byass P., Forster D., (Eds), *Health Informatics in Africa: HELINA 93.* Excerpta Medica: IMIA-WHO. pp. 94-98.

Agreus, L. (1993) *The Abdominal Symptom Study: An Epidemiological Survey of Gastrointestinal and Other Abdominal Symptoms in the Adult Population of Östhammar, Sweden. Doctoral Dissertation.* Department of Family Medicine, Uppsala University. Sweden.

Agreus, L., Svärdsudd, K., Nyren, O., Tibblin, G. (1993) Reproducibility and Validity of a Postal Questionnaire. *Scandinavian Journal of Primary Health Care.* 11: 252-262.

Agreus, L., Svärdsudd, K., Nyren, O., Tibblin, G., (1995) Irritable Bowel Syndrome and Dyspepsia in the General Population: Overlap and Lack of Stability Over Time. *Gastroenterology.* 109: 671-680.

Ajzen, I., Fishbein, M., (1975) *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research.* Addison-Wesley Publisher. Colorado.

Alcock, CA. (1996) *Libraries in an Information Society: Online Databases and Access to Information.* Doctoral Dissertation. University of Wollongong.

Allen, A. (1994) Evaluating Telemedicine: The Cooperative Model. *Telemedicine Today,* 2(1): 8-9.

Amatayakul, MK., Wogan, MJ. (1992) Record Administrators' Needs for Computer-Based Patient Records. In Ball, M., Collen, M. (Eds.) *Aspects of the Computer-Based Patient Record.* Springer-Verlag. New York.

Andersen A., Bridges-Webb C., Chancellor A., (1986) *General Practice in Australia.* Sydney University Press. Sydney.

Anderson, J., Forsythe, JM. (Eds.), (1974) *Medinfo 74.* International Federation for Information Processing. North-Holland/ American Elsevier.

Ansoff, HI. (1987) Strategic Management of Technology. *Journal of Business Strategy.* 7: 28-39.

Archer, M. (1995) *Realist Social Theory: The Morphogenetic Approach.* Cambridge University Press. Cambridge.

Archer, M. (1996) *Culture and Agency: The Place of Culture in Social Theory.* Cambridge University Press. Cambridge.

Arnold, G. (1992) *Brainwash: The Cover-Up Society.* Virgin Books. London.

Arrow, K. (1974) *The Limits of Organization.* W.W. Norton & Company. New York.

Arrow, K. (1980) The Economics of Information. In Dertouzos, M., Moses, J. (Eds.) *The Computer Age: A Twenty-Year View.* MIT Press. London.

Ashmore, M., Mulkay, M., Pinch, T. (1989) *Health and Efficiency: A Sociology of Health Economics.* Open University Press. Milton Keynes.

Association of American Medical Colleges (1984) *Physicians for the Twenty-First Century: The General Professional Education of the Physician Report.* Association of American Medical Colleges. Washington D.C.

Astley, WG., Van de Ven, AH. (1983) Central Perspectives and Debates in Organizational Theory. In Geschka, H., Huber, H. (Eds.) *Innovation Strategies: Theoretical Approaches - Experiences - Improvements.* Elsevier Science. Amsterdam.

Aungles, S., Parker, S. (1989) *Work, Organisations and Change: Themes and Perspectives in Australia.* Allen and Unwin, Sydney.

Australian Institute of Health and Welfare (1992) *Australia's Health 1992.* Australian Government Publishing Service. Canberra.

Australian Institute of Health and Welfare (1994) *Australia's Health 1994.* Australian Government Publishing Service. Canberra.

Australian Law Making Directory (1995) July: 87.

Axford, R., Grunwald, G., Hyndman, R. (1996) Information Technology in Research. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview.* Churchill Livingston. Australia.

Backer, T., Rogers, E., Sopory, P. (1992) *Designing Health Communication Campaigns: What Works?* Sage. California.

Badham, R. (1986) *Theories of Industrial Society.* Croom Helm. London.

Bailey, N. (1957) *The Mathematical Theory of Epidemics.* Hafner. New York.

Bales, RF.(1950) *Interaction Process Analysis.* University of Chicago Press.

Ball, M. (1995) *Nursing Informatics: Where Caring and Technology Meet.* 2nd Edition. Springer. New York.

Ball, M., Collen, MF. (Eds.) (1992) *Aspects of the Computer-Based Patient Record.* Springer. New York.

Ball, M., Douglas, D., Albright, J. (Eds.) (1995) *Healthcare Information Management Systems: A Practical Guide.* Second Edition. Springer. New York.

Barnett, G., Greenes, R. (1967) Interface Aspect of a Hospital Information System. *Annals of New York Academy of Sciences.* 161: 757-768.

Bass, F. (1969) A New Product Growth Model for Consumer Durables. *Management Science,* 13 (5): 215-227.

Bates, EM. (1983) *Health Systems and Public Scrutiny: Australia, Britain and the United States.* Croom Helm. London.

Bell, D. (1973) *The Coming of the Post-Industrial Society: A Venture into Social Forecasting.* Basic Books. New York.

Beniger, J. (1986) *The Control Revolution: Technological and Economic Origins of the Information Society*. Harvard University Press. Cambridge.

Benson, T. (1993) The Rise of Clinical Computing. *The British Journal of Healthcare Computing*. March: 35-39.

Berg, M. (1997) *Rationalising Medical Work: Decision Support Techniques and Medical Practices*. Doctoral Dissertation. Mastricht University, MIT Press, Cambridge.

Berg, O. (1997) Problems and Promises of the Protocol. *Social Science and Medicine*. 44: 1081-1088.

Berger, P., Luckman, T. (1966) *The Social Construction of Reality - A Treatise in the Sociology of Knowledge*. Penguin Books. London.

Berkowitz, SD., Wellman, B. (Eds.) (1988) *Social Structures: A Network Approach*. Cambridge University Press. New York.

Berleen, G., Rehnberg, C., Wennström, G., (1992) *The Reform of Health Care in Sweden*. Spri Report No. 339. Spri, Stockholm. Sweden.

Best, WR. (1962) The Potential Role of Computers in Medical Practice. *Journal of the American Medical Association*, 182: 994 - 1000.

Bijker, W. (1995) *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change*. MIT Press. Cambridge.

Bijker, WE., Hughes, TP., Pinch, T. (Eds.) (1987) *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. MIT Press. Cambridge.

Bijker, WE., Law, J. (Eds.) (1992) *Shaping Technology/Building Society: Studies in Sociotechnical Change*. MIT Press. Cambridge.

Biscoe, G. (1986) Resistance to Computers. Conference Proceedings. *South East Asian Nursing Conference (SEARNC)*. Melbourne.

Blalock, H. (1979) *Social Statistics*. McGraw-Hill International Editions. Washington.

Boden, M. Gibbons, M., Metcalfe, JS. (1990) Technology and Knowledge: The Strategic Dimension. In Khalil, T., Bayraktar, B. (Eds.) *Management of Technology II. The Key to Global Competitiveness*. Industrial Engineering and Management Press. Georgia.

Bolter D. (1984) *Turing's Man: Western Culture in the Computer Age*. University of North Caroliina Press. Chapel Hill.

Bolton, P., Gay, G. (1995) Review of Computer Usage Among RACGP Members. *Australian Family Physician*, 24 (10): 1882-1885.

Bomba, D. (1997) Australian General Practitioners and Computerised Patient Records. *APAMI - HIC 97 Conference Proceedings*, Sydney.

Bomba, D., Cooper, J., Pettersson, C. (1995) The Swedish Experience: Doctors and Electronic Patient Health Records (EPHRs). *HIC 95 Proceedings of the Health Informatics Conference*, Adelaide.

Braa, J., Monteiro, E., Vemund, R., Eline, V., Kari, A. (1993) Experiences from Scandinavian Health Informatics: Lessons for African Systems Development? In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.) *Health Informatics in Africa: HELINA 93*. Excerpta Medica. Amsterdam: 161-165.

Brancheau, JC., Wetherbe, JC., (1990) The Adoption of Spreadsheet Software: Testing Innovation Diffusion Theory in the Context of End-User Computing. *Information Systems Research*. 1(2): 115-143.

Brandt, M. (1993) *Maintenance, Disclosure, and Redisclosure of Health Information*. American Health Information Management Association.

Branscomb, AW. (1994) *Who Owns Information?: From Privacy to Public Access*. Basic Books: New York.

Brauer, G. (1992) Telehealth: The Delayed Revolution in Health Care. *Medical Progress Through Technology*, 18(3): 151-163.

Brehmer, B. (1980) In One Word: Not From Experience. *Acta Psychologica*, 45: 223-241.

Brewer, A. (1984) *A Guide to Marx's Capital*. Cambridge University Press, New York.

Bridges-Webb, C. (1992) General Practitioners and Over-Servicing. *Medical Journal of Australia*, 156: 140-141.

Bridges-Webb, C., Britt, H., Miles, D., Neary, S., Charles, J., Traynor, V. (1992) Morbidity and Treatment in General Practice in Australia 1990-1991. *The Medical Journal of Australia*, Supplement, Oct.

Bridges-Webb, C., Britt, H., Miles, D., Neary, S., Charles, J., Traynor, V. (1993) Morbidity and Treatment in General Practice in Australia. *Australian Family Physician*. 22, March.

Brittain, M. (1996) National Strategy for Information Management. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview*. Churchill Livingston. Australia.

Brownbridge, G., Fitter, M., Sime, M. (1984) The Doctor's Use of a Computer in the Consulting Room: An analysis. *International Journal of Man-Machine Studies*, 21: 65-90.

Brownbridge, G., Herzmark, G., Wall, T., (1985) Patients Reactions to Doctors' Computer Use in General Practice Consultations. *Social Science and Medicine*, 20: 47-52.

Byass, P. (1993) The Impact of Portable Technology on Health in Africa: Recent Progress and Future Potential. In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.) *Health Informatics in Africa: HELINA 93*. Excerpta Medica. Amsterdam: 155-160.

Bäckman, L., Wiberg, A., Ullstad, C. (1986) New Ways to a Human Use of New Technology: The Work Environment Fund's Development Programme. In Peterson, HE., Schneider, W. (Eds.) *Human-Computer Communications in Health Care*. Elsevier Science Publishers: IFIP-IMIA: 201-217.

Cacek, J. (1994) *A Survey of the Attitudes of Australian General Practitioners to Computerisation of Medical Records*. Masters Thesis. Department of Community Medicine, Monash University. Australia.

Callon, M., Latour, B. (1981) Unscrewing the Big Leviathan, or How Do Actors Macrostructure Reality? In Knorr-Cetina, K., Cicourel, A. (Eds.) *Advances in Social Theory and Methodology toward an Integration of Micro- and Macro-Sociologies*. Routeledge and Kegan Paul. London: 277-303.

Callon, M., Law, J. (1989) On the Construction of Sociotechnical Networks: Content and Context Revisited. *Knowledge and Society: Studies in the Sociology of Science Past and Present*, 8: 57-83.

Calltorp, J. (1989) The "Swedish Model" Under Pressure - How to Maintain Equity and Develop Quality? *Quality Assurance in Health Care*, 1(1): 13-22.

Cesnik, B. (1996) History of Health Informatics. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview*. Churchill Livingston. Australia.

Charters, WW., Pellegrin RS., (1972) Barriers to the Innovation Process: Four Case Studies of Differentiated Staffing. *Educational Agricultural Quarterly*, 9: 3-4.

Checkland, P. (1981) *Systems Thinking, Systems Practice*. John Wiley. New York.

Checkland, P., Scholes J. (1990) *Soft Systems Methodology in Action*. John Wiley. New York.

Checkland P., Howell S. (1998) *Information, Systems, and Information Systems: Making Sense of the Field*. Wiley and Sons. Chichester.

Chomsky, N., Herman, S. (1988) *Manufacturing Consent*. Pantheon Books. New York.

Cimino JJ., (1995) Coding Systems in Health Care. *1995 Yearbook of Medical Informatics: The Computer Based Patient Record*. IMIA. Geneva.

Clarke, R. (1988) Information Technology and Dataveillance. *Communications of the ACM*, 31(5): 498-512.

Cohen, L. (1981) Can Human Irrationality be Experimentally Demonstrated? *Behavioural and Brain Sciences*, 4: 317-370.

Coiera, E. (1994) Medical Informatics. *Medical Journal of Australia*, 160: 438-440.

Collen, MF. (1995) *A History of Medical Informatics in the United States 1950 to 1990*. American Medical Informatics Association. U S A.

Collen, MF. (Ed.) (1974) *Hospital Computer Systems*. Wiley: New York.

Collins, H., Pinch, T. (1982) *Frames of Meaning: The Social Construction of Extraordinary Science*. Routledge & Kegan Paul. London.

Commonwealth Department of Health, Housing and Community Services (1992) *A Healthy Future - Guidelines for Demonstration Practice Grants*. AGPS. Canberra.

Commonwealth Department of Human Services and Health (1993) *Improving Information Management in General Practice; A Discussion Paper*. AGPS. Canberra.

Commonwealth Department of Health and Family Services (1996) *General Practice in Australia: 1996*. AGPS. Canberra.

Commonwealth Department of Health and Aged Care (1999) *The Australian Coordinated Care Trials*. Publications Production Unit (Public Affairs, Parliamentary and Access Branch). Canberra.

Cooper, RB., Zmud RW. (1990) Information Technology Implementation & Research: A Technological Diffusion Approach. *Management Science*, 36(2): 123-139.

Cortrill, D., Rogers, E. (1990) A Co-Citation Analysis of the Research Traditions of Technology Transfer and Diffusion Innovation. In Williams, F., Gibson, V. (1990) *Technology Transfer*. Sage Publications. California.

Crampton, M. (1990) Survey of RACGP Members' Use and Attitudes Towards Medical Practice Computing. In *RACGP 1990 Computer Conference*, Sydney.

Crampton, M. (1995) The Computer on Your Desk: General Practice Computing in the 1990s. *Australian Family Physician*. 24(3): 296-297.

Crampton, M., Lord, T. (1988) *Standards for Computerised Medical Records Systems*. Royal Australian College of General Practitioners.

Crowe, B. (1993) *Telemedicine in Australia*. Australian Institute of Health and Welfare, Canberra.

Daini, OA., Makanjuola, ROA., Ojo, JO. (1993) A Hospital Information System in a Nigerian Teaching Hospital. In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.) *Health Informatics in Africa: HELINA 93*. Excerpta Medica. Amsterdam: 86-89.

Danziger, J. (1977) Computers, Local Governments and the Litany to EDP. *Public Administration Review*, 37: 28-37.

Darwin, C. (1859/1975) *On the Origin of Species*. Harvard University Press. Cambridge.

Davis, FD., Bagozzi RP., Warshaw, PR. (1989) User Acceptance of Computer Technology: A Comparision of Two Theoretical Models. *Management Science*, 35(8): 982-1003.

Davis, FD. (1993) User Acceptance of Information Technology: System Characteristics, User Perceptions and Behavioural Impact. *International Journal of Man-Machine Studies*, 38(3).

Davis, K. (1993) Health Care Reform in the United States. The Contribution of Health Services Research to the Debate. *Annals of the New York Academy of Science*, December 31, 703: 287-90.

Department of Human Services and Health (1993) *Improving Information Management in General Practice; A Discussion Paper*. AGPS. Canberra.

Derrida J. (1967) *Of Grammatology*. Minuit. Paris.

Deutschmann PJ., Danielson WA., (1960) Diffusion of Knowledge of the Major News Story. *Journalism Quarterly*, 40(1): 27-35.

Dick, R. (1992) A Bold Vision: The Computer-Based Patient Record Institute. In Ball M., Collen, M. (Eds.) *Aspects of the Computer-Based Patient Record.* Springer. New York.

Dick, R., Steen, E. (Eds.) (1991) *The Computer-Based Patient Record - An Essential Technology for Health Care.* Institute of Medicine, National Academy Press. Washington, DC.

Dickinson, J. (1991) Validity of Measurements and Research. *Australian Family Physician*, October, 20(10): 1491-1494.

Dingelstad, D., Gosden, R., Martin, B., Vakas, N. (1996) The Social Construction of Drug Debates. *Social Science & Medicine.* 43 (12): 1829-1838.

Donaldson, M., Lohr, K. (Eds.) (1994) *Health Data in the Information Age: Use, Disclosure, and Privacy.* Institute of Medicine. National Acdemy Press. Washington, DC.

Dosi, G., Freeman, C., Nelson, R., Silverberg, G., Soete, L. (Eds.) (1988) *Technical Change and Economic Theory.* Pinter. London.

Douglas, R. (1993) The GP and the Public's Health. *New Doctor*, Summer: 4-7.

Douglas, R., Saltman, D. (1991) *W(h)ither Australian General Practice?.* National Centre for Epidemiology and Population Health. Canberra.

Drucker, P. (1969) *The Age of Discontinuity.* Heinemann. London.

Drucker, P. (1970) *Technology Management and Society.* Harper and Row, New York.

Drucker, PF. (1973) *Management; Tasks, Responsibilities, Practices.* Harper & Row. New York. Elsevier Science Publishers: IFIP-IMIA: 99-110.

Drucker, PF. (1993) *Post-Capitalist Society.* Harper-Collins. New York.

Dunlevy S. (1996) Patient Charge to Fund GP Deal. *Daily Telegraph.* Australia.

Eliasson, G. (1990) *The Knowledge Based Information Economy.* The Industrial Institute for Economic and Social Research. Sweden.

Emmelhainz, MA. (1990) *Electronic Data Interchange: A Total Management Guide.* Van Nostrand Reinholm. New York.

Engelbrecht, R. (1986) Experiences in Designing Human Computer Interfaces for Doctors' Office Computers. In Peterson, HE., Schneider, W. (Eds.) *Human-Computer Communications in Health Care.* Elsevier Science Publishers: IFIP-IMIA: 219-233.

Eriksson, M., Cnattinguis, S., Svärdsudd, K., Tibblin, G. (1997) Factors Associated With the Birth Weight in Sweden: The Study of Men Born in 1913. *Journal of Epidemiology and Community Health.* 51: 19-23.

Evans D. (1995) *How to Write a Better Thesis or Report.* Melbourne University Press. Victoria.

Eveland, JD. (1986) Diffusion, Technology Transfer and Implications: Thinking and Talking about Change. *Knowledge*, 8(2): 303-322.

Faresjö, T., Svärdsudd, K., Tibblin, G. (1997) The Concept of Status Incongruence Revisited: A 22 Year Follow-Up of Mortality for Middle-Aged Men. *Scandinavian Journal of Social Medicine*. 25(1): 28-32.

Feeney, P. (1996) Preparing Staff for Information Technology. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview*. Churchill Livingston. Australia.

Feinglass, J., Warren-Salmon, J. (1990) Corporatisation of Medicine: The Use of Medical Management Information Systems to Increase the Clinical Productivity of Physicians. *International Journal of Health Services*, 20(2): 233-252.

Fetter, R. (1991) *DRG. Their Design and Development*. Health Administration Press. Ann Arbor. Michigan.

Fiske, J. (1987) *Television Culture*. Methuen. London.

Fiske, J. (1989) *Understanding Popular Culture*. Routeledge. London.

Fitter, M. (1986) Evaluation of Computers in Primary Health Care: The Effect on Doctor-Patient Communications. In Peterson, HE., Schneider, W. (Eds.) *Human-Computer Communications in Health Care*. Elsevier Science Publishers: IFIP-IMIA 1986: 67-80.

Fitter, M., Brownbridge, G., Garber, J., Herzmark, G. (1984) A Human Factors Evaluation of the IBM Sheffield Primary Care System. In *Proceedings of the 1st IFIP Conference on Human-Computer Interaction (Interact 84)*. Elsevier: Amsterdam.

Fitter, M., Cruickshank, P. (1982) The Computer in the Consulting Room: A Psychological Framework. *Behaviour and Information Technology*, 1: 81-92.

Fitter, M., Cruickshank, P. (1983) Doctors Using Computers: A Case Study. In Sime and Coombs (Eds.) *Designing for Human-Computer Communication*. Academic Press, London.

Fitton, F., Acheson, HW. (1979) *The Doctor Patient Relationship*. HMSO, London.

Flaherty, D. (1989) *Protecting Privacy in Surveillance Societies*. The University of North Carolina Press. Chapel Hill.

Flykt, A. (1998) *A Threat Imminence Approach to Human Fear Responding: Direction of Threat, Aversive Contexts, and Electrodermal Responses*. Doctoral Dissertation. Department of Psychology, Uppsala University. Sweden.

Forester, T. (1992) Megatrends or Megamistakes: What Ever Happened to the Information Society? *The Information Society*. 8: 133-146.

Forester, T. (Ed.) (1989) *Computers in the Human Context : Information Technology, Productivity and People*. Basil Blackwell. Oxford.

Forgacs, D. (1993) Marxist Literary Theories. In Jefferson, A., Robey, D. (Eds.) *Modern Literary Theory*. 2nd Edition. B.T. Batsford Ltd. London.

Forster, ML. (1990) *Health Informatics in Developing Countries*. Doctoral Dissertation. London School of Economics and Political Science, Department of Information Systems, London.

Foucault, M. (1970) *The Order of Things: An Archaeology of Human Sciences.* Tavistock. London.

Foucault, M. (1980) *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977.* Gordon, C. (Ed.) Harvester Press. Brighton.

Freeman, C. (1987) *Technology Policy and Economic Performance - Lessons from Japan.* Pinter Publishers. London.

Friedman, RB., Gustafson, DH. (1977) Computers in Clinical Medicine: A Critical Review. *Computers in Biomedical Research.* 10: 199-204.

Friis, H., Bro, F., Eriksen, NR., Mabeck, CE., Vejlsgaard, R. (1993) The Effect of Reinbursement on the Use of Antibiotics. *Scandinavian Journal of Primary Health Care.* 11: 247-251.

Fry, F. (1993) IPC Survey Results. *Australian Family Physician.* 22(2): 87.

Gable, GG. (1994) Integrating Case Study and Survey Research Methods: An Example in Information Systems. *European Journal of Information Systems*, 3(2): 112-126.

Gates, B. (1995) *The Road Ahead.* Viking: New York.

Gefen, D., Straub, DW. (1997) Gender Differences in the Perception and Use of E-mail: An Extension to the Technology Acceptance Model. *MIS Quarterly*, 21(4): 389-400.

General Practice Strategy Review Group (1998) *General Practice: Changing the Future Through Partnerships.* Commonwealth Department of Health and Family Services. Canberra.

Gibson, SE., Rose, MA. (1986) Managing Computer Resistance. *Computers in Nursing*, 4(5): 201-204.

Giddens, A. (1984) *The Constitution of Society: Outline of the Theory of Structuralism.* University of California Press. Berkeley.

Greenes, R., Shortliffe, E. (1990) Medical Informatics: An Emerging Academic Discipline and Institutional Priority. *Journal of the American Medical Association*, 263 (8): 1114-1120.

Greisser, GG., Bakker, A., Danielsson, J., Hirel, JC., Kenny, DJ., Schneider, W., Wassermann, AI. (Eds.) (1980) *Data Protection in Health Information Systems, Considerations and Guidelines.* North -Holland Publishing Company. Amsterdam.

Gremy, F., Degoulet, B., Barber, B., Salamon, R. (Eds.) (1981) *Medical Informatics Europe 81.* Springer. Heidelberg.

Gross, N. (1942) *The Diffusion of a Culture Trait in Two Iowa Townships.* Masters Thesis. Iowa State College. Iowa City. USA.

Habermas, J. (1971) *Knowledge and Human Interest.* Translated by Shapiro, J. Beacon Press. Boston.

Habermas, J. (1987) *The Theory of Communicative Action.* Polity Press. Cambridge.

Hakansson, H. (1987) *Product Developments in Networks, Industrial Technological Development: A Network Approach.* Croom Helm. London.

Hall, L. (1992) *Development of a Computerised Preventative Care Programme for Use in a General Practice.* Department of Community Medicine, Monash University, Melbourne. Australia.

Hanmer, LA. (1989) The Postgraduate Medical Informatics Programme at the University of Cape Town. *Methods in Information Medicine.* 28, 4: 321-323.

Hannah, KJ., Ball MJ., Edwards M., (1998) *Introduction to Nursing Informatics.* 2nd Edition. Springer. New York.

Hannan, T. (1991) Medical Informatics - an Australian Perspective. *Aust NZ Med.*, 21: 363-378.

Hannan, T. (1994) Are We Following the Correct Path in Health Informatics in Australia? *HIANSW 3rd Annual Conference.*

Haraldson, M. (1987) *To Cure and To Cure: A Linear Programming Approach to National Health Planning in Developing Countries.* Department of Economics, Uppsala University. Sweden.

Hardie, D. (1994) Health Information and the Information Privacy Principles. *Informatics in Healthcare, Australia,* May, 3(2).

Harris, JM., Shaw, RW., Summers, WP. (1983) The Strategic Management of Technology. *Planning Review.* 11: 28-35.

Hayes, G. (1993) GP Computing - the UK Scene, Present and Future: Achievements and Incentives. *Proceedings of the RACGP 7th Computer Conference*, Melbourne, 15-19.

Heikkilä, J. (1995) *The Diffusion of a Learning Intensive Technology into Organisations: The Case of Personal Computing.* Helsinki School of Economics and Business Administration. Helsinki.

Hennekens, C., Buring, J. (1987) *Epidemiology in Medicine.* Little, Brown and Company. Boston.

Hill, DR. (1986) Voice as a Computer Input and Output Medium in the Health Care Context. In Peterson, HE., Schneider, W. (Eds.) *Human-Computer Communications in Health Care.* Elsevier Science Publishers: IFIP-IMIA: 131-146.

Hoskins, A., Fardy, J. (1994) Implementing a Computerised Age/Sex/Disease Register in General Practice: Given Resources, Any GP Can Do It. *Informatics in Healthcare Australia.* 3(4): 169-171.

Houser, WR. (1985) Riding the VA MUMPS Underground Railroad: The Evolution of the Veterans Administrations Decentralized Hospital Computer Program. *MUG Quarterly.* 14 (4): 3-18.

Houwink, P. (1995) The Role of Users and Usergroups in the Continuing Development of Medical Record Systems for Family Physicians. *MEDINFO95 Conference Proceedings*: 310-312.

Hovenga, E. (1995) *Casemix, Hospital Nursing Resource Usage and Costs.* Doctoral Thesis. University of New South Wales. Sydney.

Hovenga, E., Kidd, M., Cesnik, B. (Eds.), (1996) *Health Informatics: An Overview.* Churchill Livingston. Sydney.

Howie, J. (1989) *Research in General Practice.* Second Edition. Chapman and Hall, London.

Hughes, TP. (1983) *Networks of Power: Electrification in the Western World 1880 - 1930.* Johns Hopkins University Press. Baltimore.

Hughes, TP., Mayntz, R. (Eds.), (1988) *The Development of Large Technical Systems.* Westview Press. Boulder, Colorado.

Humphreys, JS. (1988) Social Provision and Service Delivery: Problems of Equity, Health and Health Care in Rural Australia. *Geoforum*, 19(3): 323-338.

Humphreys, JS., Weinand, HC. (1991) Health Care Preferences in a Country Town. *Medical Journal of Australia*, 154: 733-737.

Huxley, A. (1932/1979) *Brave New World.* Harper and Row. New York.

Hägerstrand, T. (1953/1967) *Innovation Diffusion as a Spatial Process.* Translated by Pred, A. University of Chicago Press. Chicago.

IBM Consulting Group (1997) *Development of Functional Requirements Specifications and a Technical Framework for Clinical and Administrative General Practice Computer System.* Report prepared for the Department of Health and Family Services. Canberra.

Ibrahim, AS., Elhattab, O. (1993) An Integrated Hospital Information System for the National Cancer Institute in Cairo, Egypt: An Experience to be Shared. In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.) *Health Informatics in Africa: HELINA 93.* Excerpta Medica. Amsterdam: 76-81.

Imai, K., Ikujiro, N., Hirotaka, T. (1985) *Managing the New Product Process. How Japanese Companies Learn and Unlearn the Uneasy Alliance- Managing the Productivity - Technology Dilemma.* In Clar, KB., Hayes, RH., Lorenz, C. (Eds.) Harvard Business School Press. Boston.

Institute of Medicine (1991) *The Computer-Based Patient Record - An Essential Technology for Health Care.* Dick, RS., Steen, EB., (Eds.) National Academy Press. Washington DC.

Institute of Medicine (1997) *The Computer-Based Patient Record - An Essential Technology for Health Care.* Dick, RS., Steen, EB., Detmer DE., (Eds.). Revised Edition. National Academy Press. Washington DC.

Institute of Medicine. (1994) *Health Data in the Information Age: Use, Disclosure, and Privacy.* Donaldson, MS., Lohr, KN. (Eds.) National Academy Press. Washington DC.

International Medical Informatics Association Working Group 4 (1995) *Communicating Health Information in an Insecure World.* Helsinki.

Jayasuriya, R. (1993) *Computerised Community Health Information Systems: Current Developments in NSW.* University of Wollongong Press, NSW Community Health Accreditation and Standards Program, Sydney.

Jayasuriya, R., Southon, G. (1996) Information Technology Management. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview*. Churchill Livingston. Australia.

Jefferson, A., Robey, D. (1993) *Modern Literary Theory: A Comparative Introduction*. 2nd Edition. B.T. Batsford. London.

Jeffreys, M., Sachs, H. (1983) *Rethinking General Practice: Dilemmas in Primary Medical Care*. Tavistock Publications. London.

Jones, B., (1982) *Sleepers, Wake! : Technology and the Future of Work*. Oxford University Press. Melbourne.

Jones, B. (1987) Micros for GPs Scheme: The Outcome. *Conference Proceedings of the RACGP 5th Computer Conference*, Melbourne: 14-18.

Joseph, RA. (1987) *Symbolic Politics in the High Technology Debate in Australia*. Doctoral Dissertation. University of Wollongong.

Kaplan, B., Duchon, D. (1988) Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study. *MIS Quarterly*. 12(4): 571-586.

Keen P. (1991) *Shaping the Future: Business Design Through Information Technology*. Harvard Business School Press, Boston.

Keynes, J. (1930) *A Treatise on Money: Vol 1. The Pure Theory of Money*. Harcourt, Brace. New York.

Kholy, AE., Mandil, SH. (1984) The Relevance of Microcomputers to Health Improvement in Developing Countries. *Information and Management*. 8: 177-182.

Kidd, M., Carson, N., Crampton, R., Cesnik, B., Bearman, M. (1994) New Technology in Primary Care: Benefits, Problems and Advice. In Fry, J., Yuen, N. (Eds.) *Primary Care and Family Medicine*. Radcliffe Medical Press, Oxford.

Kim, L. (1997) *Imitation to Innovation: The Dynamics of Korea's Technological Learning*. Harvard Business School Press: Boston.

King, G., Keohane, R., Verba, S. (1994) *Designing Social Inquiry: Scientific Inference in Qualitative Research*. Princeton: Princeton University Press.

Kline, SJ., Rosenberg, N. (1986) *An Overview of Innovation, The Positive Sum Strategy*. National Academy Press. Washington DC.

Kling, R. (Ed.) (1995) *Computerization and Controversy : Value Conflicts and Social Choices*. 2nd Edition. Academic Press. San Diego.

Kluge, E. (1994) Health Information, Privacy, Confidentiality Ethics. In Barber, B., Bakker, A., Bengtsson, S. (Eds.) Caring for Health Information: Safety, Security and Secrecy. *International Journal of Bio-Medical Computing*. Elsevier Science. Ireland.

Koyama, T. (1986) Human Computer Interfaces in Medical Consultation Systems. In Peterson, HE., Schneider, W. (Eds.), *Human-Computer Communications in Health Care*. Elsevier Science Publishers: IFIP-IMIA: 241-246.

Kuhn, T. (1957) *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought.* Harvard University Press. Cambridge.

Kuhn, T. (1970) *The Structure of Scientific Revolutions*. Second Edition. Chicago University Press, Chicago.

Kuylenstierna, J. (1998) *Task Information and Memory Aids in the Learning of Probablistic Inference Tasks*. Doctoral Dissertation. Department of Psychology, Uppsala University.

Lamberton, DM. (1990) *Information Economics : 'Threatened Wreckage' or New Paradigm?* CIRCIT. South Melbourne, Victoria.

Latour, B. (1987) *Science in Action: How to Follow Scientists and Engineers through Society.* Harvard University Press. Cambridge.

Latour, B., Woolgar, S. (1979) *Laboratory Life: The Social Construction of Scientific Facts*. Sage. Beverly Hills.

Latour, B. (1993) *We Have Never Been Modern.* Harvester Wheatsheaf. London.

Law, J. (1991) *A Sociology of Monsters: Essays on Power, Technology, and Domination*. London: Routledge.

Law, J. (1994) *Organizing Modernity.* Oxford: Blackwell.

Leech, G. (1998) Beachhead for Data on Black Hole Opening Wide for GPs. *The Weekend Australian*, April 4-5: 42.

Leedy, P. (1993) *Practical Research: Planning and Design.* 5th Edition. Macmillan, New York.

Liaw, S. (1992) *How is Information Managed in General Practice?* Study for the RACGP (South Australian Faculty).

Liaw, S. (1996) Decision Support in General Practice - How IT May Happen. *HIC 96 Proceedings of the Health Informatics Conference*, Melbourne.

Lif, M. (1998) *Adding Usability: Methods for Modelling, User Interface Design and Evaluation*. Doctoral Dissertation. Faculty of Science and Technology, Uppsala Unversity. Sweden.

Lincoln, TL., Essin, DJ., Ware, WH. (1993) The Electronic Medical Record: A Challenge for Computer Science to Develop Clinically and Socially Relevant Computer Systems to Coordinate Information for Patient Care and Analysis. *The Information Society.* 9: 157-188.

Lincoln, TL., Korpman, RA. (1980) Computers, Health Care and Medical Information Science. *Science* 210: 257-263.

Lindberg, D. (1982) Diffusion of Medical Information Systems Technology in the United States. *Journal of Medical Systems*, 6(3): 219-227.

Lindberg, D. (1986) Medical Informatics/Computers in Medicine. *Journal of the American Medical Association*, 256: 2120-2122.

Linnarsson, R. (1993) *Methods, Design and Components for a Computer-Based Patient Record to Promote Quality Care in General Practice*. Doctoral Dissertation. Department of Biomedical Engineering, Medical Informatics, Faculty of Health Sciences. Linköping University, Sweden.

Ljunggren, B. (1998) *Quality of Health Care: Patient and Staff Perspectives: A Study of Changes 1992-1996 with Special Reference to Diagnosis Related Groups*. Doctoral Dissertation. Department of Public Health and Caring Sciences, Caring Sciences, Uppsala University. Sweden.

Lun, K., Goh, L. (1993) GP Computing; The Singapore Scene: Present and Future. *Proceedings from the 7th RACGP Computer Conference,* Australia.

Machlup, F. (1980) *Knowledge: Its Creation, Distribution, and Economic Significance*. Vol 1. Princeton University Press. Princeton.

MacIsaac, P., Crampton, M., Kidd, M. (1994) *Computer Assisted Practice Project 1986-1993*. The Royal Australian College of General Practitioners. South Melbourne. Victoria.

MacIsaac, P., Lord, T., Crampton, M., Kidd, M., Farish, M., Caeilli, J. (1990) *Computer Assisted Practice Project (CAPP) Report*. The Royal Australian College of General Practitioners.

MacKenzie, D. (1996) *Knowing Machines: Essays on Technical Change*. MIT Press. Cambridge.

MacKenzie, D., Wajcman, J. (1985) *The Social Shaping of Technology*. Open University Press, Milton Keynes.

Mackenzie, G. (1996) Medico-Legal Issues. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview*. Churchill Livingston. Australia.

Mahajan, V., Muller, E., Bass, F. (1990) New Product Diffusion Models in Marketing: A Review and Directions for Research. *Journal of Marketing*, 54: 1-26.

Makanjuola, R. (1993) Hospital Information Systems. In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds) *Health Informatics in Africa: HELINA 93*. Excerpta Medica. Amsterdam: 71-75.

Mandil, S., Beck, R., Chaves, E., Kaihara, S., Rodrigues, RJ., Khalid Bin Sahan, A., Peel, V., Protti, D., Sabbatini, Rme., Towle, WJ. (1988) *Informatics and Telematics in Health: Present and Potential Uses*. World Health Organisation. Geneva.

Mandil, SH. (1983) *A Review of the Master Plan for Computer Support to the Ministry of Public Health, Thailand*. WHO, Division of Information Systems Support. Report #ISS/83/38.

Mandil, SH. (1993) A Global Perspective of Informatics in Health in Developing Countries. In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.) *Health Informatics in Africa: HELINA 93*. Excerpta Medica. Amsterdam: 3-8.

Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.), (1993) *Health Informatics in Africa: HELINA 93*. Excerpta Medica. Amsterdam.

Martin, B. (1988) The Issue of Intellectual Suppression. *Philosophy and Social Action*, Vol. 14, (1), January-March: 3-13.

Martino, J. (1983) *Technological Forecasting for Decision Making*. Second edition. North-Holland: New York.

Marx, K. (1876) *Das Capital*. Band 1. English Edition (1976) Penguin. Harmonsworth.

Masuda, Y. (1985) Parameters of the Post-Industrial Society: Computopia. In Forester T. (Ed.) *The Information Technology Revolution*. Basil Blackwell, Oxford.

Matheson, NW., Cooper, JD. (1982) Academic Information in the Academic Health Services Centre; Roles for the Library in the Information Management. *Journal of Medical Education,* 57: 1-93.

May, T. (1997) *Social Research : Issues, Methods and Process*. Second Edition. Open University Press: Buckingham.

McConkey, DD. (1987) Planning for Uncertainty. *Business Horizons*. 30: 40-45.

McConway, K. (1994) *Studying Health and Disease*. Open University Press, Buckingham.

McDonald, CT., Tierney, WM. (1988) Computer Stored Medical Records; Their Future Role in Medical Practice. *Journal of the American Medical Association,* 259: 3433-3440.

McLuhan, M. (1964) *Understanding Media: The Extensions of Man*. McGraw-Hill. New York.

Medical Software Association & RACGP (1996) *Standards and Accreditation for General Practice Information Systems Scoping Project*.

Melhorn, JM., Legler, WK., Clark, GM. (1979) Current Attitudes of Medical Personnel towards Computers. *Computers in Biomedical Research*. 12: 327-334.

Menzel H., Coleman J., Katz E., (1959) Dimensions of Being Modern in Medical Practice. *Journal of Chronic Diseases*, 9(1): 20-40.

Menzel H., Katz E., (1955) Social Relations and Innovation in the Medical Profession: The Epidemiology of a New Drug. *Public Opinion Quarterly*, 19: 337-353.

Metcalfe, D. (1984) The Computer in General Practice. *Journal of Medical Engineering and Technology*, 8(2): 53-55.

Metsemakers, J., Hoppener, P., Knottnerus, J., Kocken, R., Limonard, C. (1992) Computerized Health Information in the Netherlands: A Registration Network of Family Practices. *British Journal of General Practice*, 42: 102-106.

Miller, G., Britt, H. (1993) Data Collection and Changing Healthcare Systems: United Kingdom. *The Medical Journal of Australia*, 159: 471-479.

Milner, A. (1996) *Literature, Culture & Society*. University College London. Great Britain.

Mintzberg, H. (1987) Crafting Strategy. *Harvard Business Review*. 4: 6-75.

Misa, T. (1994) Retrieving Sociotechnical Change from Technological Determinism. In Marx, L., Smith, M. *Does Technology Drive History?* MIT Press, Cambridge.

Moidu, K. (1992) *Computer-Based Support for Maternal and Child Care at a Primary Health Centre: Demonstration of an Essential Data Set Based Application Software to Support Care Providers and Health Outcomes Research.* Doctoral Dissertation. Linköping University. Sweden.

Moidu, K. (1993a) Informatics in Health Education and Education in Health Informatics. In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.) *Health Informatics in Africa: HELINA 93.* Excerpta Medica. Amsterdam: 118-121.

Moidu, K. (1993b) Informatics in Support of Primary Health Care Management. In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.) *Health Informatics in Africa: HELINA 93.* Excerpta Medica. Amsterdam: 39-45.

Moidu, K., Singh, AK., Wigertz, O., Trell, E. (1992) Computers in Primary Health Care: A Cost Effectiveness Study. In Lun, KC., Degoulet, P., Piemme, T., Reinhoff, O. (Eds.) *Proceedings of the 7th World Conference on Medical Informatics MEDINFO 92.* North-Holland. Amsterdam. 2: 1203-1208.

Moidu, K., Wigertz, O. (1989) Computers and Physicians: An Appraisal Study. *Medical Informatics*, 14(1): 63-70.

Moore G., Benbasat I., (1991) Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, 2(3): 192-220.

Morrow, J. (1990) *Game Theory for Political Scientists.* Princeton University Press, NJ.

Moser, CA., Halton, G. (1971) *Survey Methods in Social Investigation.* Heinemann Educational Books Limited. London.

Mumford, E. (1984) Researching People Problems: Some Advice to a Student. In Mumford, E. (Ed.) Research Methods in Information Systems. *IFIP Conference Proceedings*, Manchester. North Holland.

Mumford, E. (1987) Sociotechnical System Design: Evolving Theory and Practice. In Bjerknes, G., Pelle E., Kyng M., (Eds.) *Computers and Democracy: A Scandinavian Challenge.* Aldershot. England.

Naisbitt, J. (1982) *Megatrends - Ten New Directions Transforming Our Lives.* Warner Books, New York.

National Centre for Epidemiology and Population Health (1993) *Health Information Issues in General Practice Australia: NCEPH Discussion Paper number 2.* The Australian National University. Canberra.

National Health Strategy Unit (1992) *National Health Strategy: The Future of General Practice.* Issues paper , no. 3. Melbourne

Negroponte N. (1995) *Being Digital.* Knopf. New York.

Nelson, R. (1969) *Technology, Economic Growth and Public Policy.* Brookings Institution: Washington.

Neuman, W. (1997) *Social Research Methods.* Third Edition. Allyn and Bacon. Boston.

Nichol, W. (1990) What is Rural? Centre for Rural Welfare Research, Wagga Wagga, Charles Sturt University. *Rural Welfare Reserach Bulletin*: 4: 4-5.

Norgaard, L. (1996) *The Development of Patient Medication Records in Denmark: A Social Constructivist Perspective*. Doctoral Dissertation. The Royal Danish School of Pharmacy, Department of Social Pharmacy. Copenhagen. Denmark.

O'Connor, D. (1996) Health Consumer Issues. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview*. Churchill Livingston. Australia.

O'Toole, C. (1988) *Computerised Medical Records*. Thesis. Deakin University. Australia.

Ochuodho, SJ. (1993) Electronic Networking and Delivery of Health Service: The Kenyan Experience. In Mandil, SH., Moidu, K., Korpel, M., Byass, P., Forster, D. (Eds.) *Health Informatics in Africa: HELINA 93*. Excerpta Medica. Amsterdam: 194-198.

OECD (1980) *Guidelines for the Protection of Privacy and Transborder Flows of Personal Data*. Organisation for Economic Co-operation and Development, Paris.

Olsson, B., Algulin, I. (1995) *Litteraturens Historia i Världen*. Nordstedts, Stockholm. Sweden.

Opit, LK. (1987) How Should Information on Health Care be Generated and Used? *World Health Forum*. 8:409-438.

Orwell, G. (1954) *Nineteen Eighty-Four*. Penguin Books in association with Secker & Warburg. Harmondsworth.

Parsons, T. (1969) *Politics and Social Structure*. Free Press. New York.

Pasad, R., Schattner, P. (1991) General Practitioner Referrals to Specialists. *Australian Family Physician*, 20: 1147-1160.

Pavlov, IP. (1902) *The Work of the Digestive Glands*. Translated by Thompson, WH. Charles Griffin. London.

Peterson, C., Beach, L. (1967) Man as an Intuitive Statistician. *Psychological Bulletin*, 68: 29-46.

Peterson, HE., Gerden-Jelger, U. (1988) The History of Hospital Information Systems. In Bakker, AR., Ball, MJ., Scherrer, Willems, JR. *Towards New Hospital Information Systems*. North-Holland: Amsterdam.

Peterson, S., Eriksson, M., Tibblin, G. (1997) Practice Variation in Swedish Primary Care. *Scandinavian Journal of Primary Health Care*. 15: 68-75.

Porat, M. (1977) *The Information Economy: Definition and Measurement*. Office of Telecommunications, U.S Department of Commerce. Washington DC.

Porter, ME. (1980) *Competitive Strategy, Techniques for Analyzing Industries and Competitors*. The Free Press. New York.

Porter, ME. (1985) *Competitive Advantage. Creating and Sustaining Superior Performance*. The Free Press. New York.

Porter, ME. (1990) *The Competitive Advantage of Nations.* Billing & Sons Ltd. Worcester.

Porter, M., Millar, V. (1985) How Information Gives You Competitive Advantage. *Harvard Business Review.* July/August.

Postman, N. (1992) *Technology: The Surrender of Culture to Technology.* Knopf. New York.

Pradhan, M. (1996) Telemedicine. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview.* Churchill Livingston. Australia.

Premkumar, G., Ramamurthy, K., Nilikanta, S. (1994) Implementation of Electronic Data Interchange: An Innovation Diffusion Perspective. *Journal of Management Information Systems*, 11(2): 157-186.

Privacy Commissioner (1994) *Health Information Privacy Code 1994.* New Zealand.

Ramamurthy, K., Premkumar, G. (1995) Determinants and Outcomes of Electronic: Data Interchange Diffusion. *IEEE Transactions on Engineering Management*, 42(4): 332-351.

Ranson, D. (1996) Research, Public Health and Policy Development. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview.* Churchill Livingston. Australia.

Rapoport, R. (1970) Three Dilemmas in Action Research. *Human Relations*, 23(6): 499-513.

Ratnasingham, P. (1997) EDI Security-Re-Evaluation of Controls and its Implications on the Organizations. *Computers & Security*, 16: 650-656.

Read, J., Bensen, T. (1986) Comprehensive Coding. *British Journal of Health Care Computing*, 3: 22-25.

Rector, A., Nowlan, W., Kay, S. (1992) Foundations for an Electronic Medical Record. In *Yearbook of Medical Informatics 1992.*

Regan, B. (1991) Computerised Information Exchange in Health Care. *The Medical Journal of Australia.* Vol. 154, January.

Reichertz, PL. (1986) The Need for Alternative Design of Computer Systems for Improved Human Computer Communication. In Peterson, HE., Schneider, W. (Eds.) *Human-Computer Communications in Health Care.* Elsevier Science Publishers: IFIP-IMIA: 85-97.

Reinganum, J. (1981) On the Diffusion of New Technology: A Game Theoretic Approach. *Review of Economic Studies*, 48: 395-405.

Reinhoff, O. (1989) Health Informatics Education in the Third World. *Methods in Information Medicine*, 28(4): 270-272.

Reinhoff, O., Abrams, M. (Eds.), (1980) *The Computer in the Doctor's Office.* Conference Proceedings. IFIP-IMIA. Hannover.

Rice, R., Atkin, C. (1989) *Public Communication Campaigns*. Second Edition. Sage. California.

Rice, R., Bair, J. (1984) New Organizational Media and Producitvity. In Rice, R. (ed.) *The New Media*. Sage Publishing. New Berry Park, California

Rifkin, WD., Martin, B. (1997) Negotiating Expert Status: Who Gets Taken Seriously. *IEEE Technology and Society Magazine*, 16(1): 30-39.

Roach, W. (1994) *Medical Records and the Law*. Second Edition. Aspen Publication. Gaithersburg.

Roberts, J. (1991) General Practice: Feeling Fine, Getting Better. *British Medical Journal*: 302.

Rogers, EM. (1995) *Diffusion of Innovations*. 4th Edition, The Free Press, New York.

Romano, C. (1990) Diffusion of Technology Innovations. *Advances in Nursing Science*, 13(2): 11-21.

Romano, C. (1990) Innovation: The Promise and the Perils for Nursing and Information Technology. *Computers in Nursing*, 8(3): 99-104.

Rosenberg, N. (1982) *Inside the Black Box: Technology and Economics*. Cambridge University Press. Cambridge, New York.

Roszak, T. (1986) *The Cult of Information: The Folklore of Computers and the True Art of Thinking*. Pantheon Books. New York.

RACGP (1998) *Code of Practice for the Management of Health Information in General Practice*. RACGP. Melbourne.

RACGP & AMA (1998) *Principles for Implementation of Computerisation in General Practice: A Plan for the Next Three Years*. RACGP & AMA Australia.

Royal Australian College of General Practitioners (1985) *The Vision of General Practice Now and in 1995*. Arthur Anderson and Co. Melbourne.

Ryan, B., Gross, C. (1943) The Diffusion of Hybrid Seed in Two Iowa Communities. *Rural Sociology*, 8: 15-24.

Safran, C., Rind, D., Citroen, M., Bakker, AR., Slack, WV., Bleich, HL. (1995) Protection of Confidentiality in the Computer-Based Patient Record. *MD Computing*, 12: 187-192.

Safran, C., Rind, DM., Sands, D., Davis, RB., Wald, J., Slack, WV. (1996) Development of a Knowledge-Based Electronic Patient Record. *MD Computing*, 13(1): 46-54.

Sahlin, U. (1997) *Medicin På Nätet*. Centraltryckeriet AB. Borås.

Saltz, CC., Saltz, J., Rabkin, M. (1985) Perceptions and Knowledge of Medical Students Regarding Computer Applications in Medicine. *Journal of Medical Education*. 60: 726-728.

Sandblad, B., Lind, M., Schneider, W. (1986) Requirements for Human Computer Interfaces in Health Care. In Peterson, HE., Schneider, W. (Eds.) *Human-Computer Communications in Health Care*.

Sandvik, H., Hunskaar, S. (1990) Doctors' Characteristics and Practice Patterns in General Practice: An Analysis Based on Management of Urinary Incontinence. *Scandinavian Journal of Primary Health Care*. 8: 179-182.

Sargant, W. (1959) *Battle for the Mind: A Physiology of Conversion and Brain-Washing*. Pan Books. London.

Sartre, J.P. (1975) *Existentialism and Humanism*. Translated and introduced by Philip Mairet. Eyre Methuen. London.

Sauer, C. (1993) *Why Information Systems Fail: A Case Study Approach*. Alfred Waller. Henley-on-Thames.

Schmookler, J. (1966) *Invention and Economic Growth*. Harvard University Press. Cambridge.

Schnaars, S. (1989) *Megamistakes: Forecasting and the Myth of Rapid Technological Change*. Collier Macmillan. London.

Schnaars, S. (1998) *Marketing Strategy: Customers and Competition*. Second Edition. Free Press. New York.

Schnieder, M., Mann, N., Schiller, A. (1992) *Can Telecommunications Help Solve America's Health Care Problems?* Arthur D. Little. Boston.

Schumpeter, JA. (1939) *Business Cycles*. McGraw-Hill. New York.

Schumpeter, J. (1934) *The Theory of Economic Development*. Harvard University Press, Cambridge.

Schumpeter, JA. (1950) *Capitalism, Socialism, and Democracy*. Harper and Row. New York.

Schwartz, B. (1980) Analysis of Physicians' Subjective Attitudes Concerning EDP Applications in Physician Practices. In *Proceedings of IFIP-IMIA Conference on the Computer in the Doctor's Office*, Rienhoff, O., Abrams, ME. (Eds.) North-Holland, Amsterdam: 87-99.

Scott, J. (1994) Judge Rules Doctors Can Refuse Patients File Access. *The Australian*. October 11: 7.

Scott, R. (1994) *Legal Aspects of Documenting Patient Care*. Aspen Publication.

Shannon, C., Weaver, W. (1949) *The Mathematical Theory of Communication*. University of Illinois Press. Urbana.

Shaw, B. (1992) Networking as an Innovation Strategy. In Geschka, H., Huber, H. (Eds.) *Innovation Strategies: Theoretical Approaches - Experiences - Improvements*. Elsevier Science. Amsterdam: 127-140.

Shepherd, J. (1995) Whither Rural Practice. *Medical Journal of Australia*, 162: 232.

Shires, DB. (1986) The Use of Personal Computers by Canadian Physicians to Access Medically Relevant Databases. In Peterson, HE., Schneider, W. (Eds.) *Human-Computer Communications in Health Care*. Elsevier Science Publishers: IFIP-IMIA: 167-173.

Shortliffe, E., Perrault, L., Wiederhold, G., Fagan, L. (1990) *Medical Informatics - Computer Applications in Health Care*. Addison Wesley, Sydney.

Shortliffe, EH., Tang, PC., Amatayakul, MK., Margret, K., Cottington, E., Jenks, S.F., Martin, A., MacDonald, R., Morris, T. Q., Nobel, J. J. (1992) Future Vision and Dissemination of Computer-Based Patient Records. In Ball, M., Collen, M. (Eds.) *Aspects of the Computer-Based Patient Record.* Springer. New York.

Silagy, C. (1996) Research in Health Care. In Hovenga, E., Kidd, M., Cesnik, B. (Eds.) *Health Informatics: An Overview.* Churchill Livingston. Australia.

Silverberg, G. (1990) Adoption and Diffusion of Technology as a Collective Evolutionary Process. In Freeman, C., Soote, L. (Eds.) *New Explorations in the Economics of Technical Change.* Pinter Publishers, London: 177-192.

Silverman, D. (1985) *Qualitative Methodology and Sociology.* Gower Publishing. Aldershot, Hants, England.

Simicevic, D. (1993) Pushing GPs into the Computer Age. *The Sydney Morning Herald.* Australia.

Singer, J., Sacks, HS., Lucente, F., Chalmers, TC. (1983) Physician Attitudes toward Applications of Computer Data Base Systems. *Journal of the American Medical Association*, 249(12): 1610-1614.

Skinner, B. (1974) *About Behaviorism.* Vintage Books. New York.

Skurka, M. (1994) *Health Information Management in Hospitals, Principles and Organization for Health Record Services.*

Slack, WV. (1998) *Cybermedicine: How Computing Empowers Doctors and Patients for Better Health Care.* Jossey-Bass. San Francisco.

Smith, A. (1776/1977) *An Inquiry into the Nature and Causes of the Wealth of Nations.* Cannan, E. (Ed.) University of Chicago Press. Chicago.

Sneep, CAG. (1992) Innovation Management in a Theoretical Perspective. In Geschka, H., Huber, H. (Eds.) *Innovation Strategies: Theoretical Approaches - Experiences - Improvements.* Elsevier Science. Amsterdam: 3-14.

Snow, CP. (1993) *The Two Cultures.* Cambridge University Press: London.

Spencer, H. (1881) *The Principles of Biology.* 2 Volumes. Appleton. New York.

Spri (1989) *Vad Kostar Patienten*? Spri Report No. 262. Spri, Stockholm. Sweden.

Spri (1996) *User Requirements on Electronic Health Care Records.* Spri. Sweden.

Spri (1997) *Vad Gör Spri*? Spri. Sweden.

Sproull L., Kiesler S. (1992) *Connections: New Ways of Working in the Networked Organization.* MIT Press. Cambridge, Massachusetts.

Startsman, TS., Robinson, RE. (1972) The Attitude of Medical and Paramedical Personnel to Computers. *Computers in Biomedical Research.* 5: 218-227.

Statistics Sweden (1997) *Statistical Yearbook of Sweden.*

Stead, WW. (1987) What is Medical Informatics? *MD Computing*, 4: 14.

Strasser, R. (1992) The Gatekeeper Role of General Practice. *Medical Journal of Australia*, 156: 108-110.

Straub, DW. (1994) The Effect of Culture on IT diffusion: E-Mail and Fax in Japan and the US. *Information Systems Research*, 5(1): 23-47.

Suchman, LA. (1987) *Plans and Situated Actions: The Problem of Human-Machine Communication*. Cambridge University Press. Cambridge.

Sundberg, G. (1992) *The Demand for Health and Medical Care in Sweden*. Department of Economics, Uppsala University. Sweden.

Sundberg, G. (1996) *Essays on Health Economics*. Department of Economics, Uppsala University. Sweden.

Szecsenyi, J., Buschorn, A., Kochen, M. (1992) General Practitioners' Attitudes Towards Future Developments in Practice Computing - A Representative Survey in the North of Germany. *Family Practice*, 9(3): 357-361.

Talley, N. (1986) Dyspepsia and Non-Ulcer Dyspepsia: An Historical Perspective. *Medical Journal of Australia*, 145: 614-618.

Tan, J. (1995) *Health Management Information Systems: Theories, Methods, and Applications*. Aspen Publication.

Tapscott, D. (1982) *Office Automation: A User Driven Method*. Plenum Press, New York.

Tarde, G. (1903) *The Laws of Imitation*. Translated by Parsons EC., (1969). New York.

Tate, P. (1983) Doctors' Style. In Pendleton and Hasler (Eds.) *Doctor-Patient Communication*, Academic Press, London.

Taylor, F. (1967) *The Principles of Scientific Management*. Norton, New York.

Taylor, MW., Milne, R., Taylor, RJ., Duncan, R. (1991) The State of General Practice Computing in Scotland and the Characteristics of Computerised Practices: A Survey of 948 Practices. *Health Bulletin*, 49(4):250-8.

Taylor, MW., Ritchie, LD., Taylor, RJ., Ryan, MP., Paterson, NI., Duncan, R., Brotherston, KG. (1990) General Practice Computing in Scotland. *British Medical Journal*, 300(6718):170-2.

Teach, RL., Shortliffe, EH. (1981) An Analysis of Physician Attitudes Regarding Computer Based Clinical Consultation Systems. *Computers in Biomedical Research*. 14: 542-558.

Telecom Laboratories (1992) *Information Flows in General Practice*. Telecom Australia.

Thorell, B., Svärdsudd, K. (1990) Well-Being Among 50-Year-Old People. *Scandinavian Journal of Primary Health Care*. 8: 157-163.

Timpka, T. (1989) *Design of Computer-Based Decision Support for General Practitioners*. Doctoral Dissertation. Departments of Medical Informatics, Social and

Preventive Medicine, and Computer and Information Science. Linköping University, Sweden.

Tjora, AH., (1997) *Caring Machines: Emerging Practices of Work and Coordination in the Use of Medical Communication Technology*. Doctoral Thesis. Faculty of Social Sciences and Technology Management, Norwegian University of Science and Technology.

Toffler, A. (1980) *The Third Wave*. Collins. London.

Toffler, A. (1990) *Powershift: Knowledge, Wealth and Violence at the Edge of the 21st Century*. Bantam. New York.

Tucker, G. (1992) *Information Privacy Law in Australia*. Longman Professional, Melbourne.

Ulhoi, JP. (1992) The Technological Innovation Management - Strategic Management Relationship: A Theoretical Perspective. In Geschka, H., Huber, H. (Eds.) *Innovation Strategies: Theoretical Approaches - Experiences - Improvements*. Elsevier Science. Amsterdam: 15-25.

Valente, T. (1995) *Network Models of the Diffusion of Innovations*. Hampton Press. Creshill. New Jersey.

Van Bemmel, J., Musen, M., Helder, J. (Eds.) (1997) *Handbook of Medical Informatics*. Springer. Heidelberg.

Van Bemmel, JH. (1984) The Structure of Medical Informatics. *Methods in Information Medicine*, 9:175-180.

Van Bemmel, JH., McCray, AT. (Eds.) (1993) *Yearbook of Medical Informatics 93: Sharing Knowledge and Information* . IMIA-Schattauer. Rotterdam: 5.

Van der Lei, J. (1991) Use and Abuse of Computer-Stored Medical Records. *Methods in Information Medicine*, 30: 79-80.

Van der Lei, J., Duisterhout, J., Westerhof, H. (1993) The Introduction of Computer Based Patient Records in the Netherlands. *Annals of Internal Medicine*, 119: 1036-1041.

Van Leeuwen, H. (1997) Howard Scraps Privacy Plan for Private Sector. *The Australian Financial Review*. March 24.

Verplank, WL. (1986) Graphics in Human-Computer Communication: Principles of Graphical User-Interface Design. In Peterson, HE., Schneider, W. (Eds.) *Human-Computer Communications in Health Care*. Elsevier Science Publishers: IFIP-IMIA: 113-130.

Vlug, AE., Van der Lei, J. (1995) Postmarketing Surveillance with Computer-Based Patient Records. *MEDINFO95 Proceedings Conference*, Canada: 327-330.

Von Hippel, E. (1988) *The Sources of Innovation*. Oxford University Press. New York.

Waegemann, P. (1992) *Strategy for Information and Image Management in the 1990s*. Medical Records Institute. Newton MA. USA.

Waegemann, P. (1995) *International Directory of Organizations: Standards and Developments in the Creation of Electronic Health Records*. Medical Records Institute. Newton MA. USA.

Walker, D. (1993) To Succeed, Computers Need to Become Irresistible. *Informatics in Healthcare Australia*, 2(5): 5-6.

Walker, D. (1997) Health Informatics in Australia. *Informatics in Healthcare Australia*, 6(4): 135-138.

Walker, D., Crampton, M., Kidd, M., Adkins, P., Carson, N., Cesnik, B., Coffey, G., Cooper, B., Elderfield, H., Falherty, G., Frank, O., Hickson, N., Liaw, T., Lord, T., MacIsaac, P., Pradhan, M., Ravet, J., Saltman, D., Talty, T. (1991) *Health Information Issues in General Practice in Australia: NCEPH Discussion Paper Number 2*. National Centre for Epidemiology and Population Health; The Australian National University. Canberra.

Walsham, G., Symons, V., Waema, T. (1990) Information Systems as Social Systems: Implications for Developing Countries. In Bhatnagar, SC., Bjorn-Andersen, N. (Eds.) *Information Technology in Developing Countries*. North-Holland: 51-61.

Warden, J. (1993) The Wessex Fiasco. *British Medical Journal*, 306: 1292.

Warneminde, M. (1994) Police, Public Servants Charged. *The Sun-Herald*. Feb. 13.

Watson, D. (1989) Telemedicine. *Medical Journal of Australia*, 151(2): 62-66.

Weaver, RR. (1991) Assessment and Diffusion of Computerised Decision Support Systems. *International Journal of Technology Assessment in Health Care*, 7: 42-50.

Weber, R., Perkins, D. (1989) How to Invent Artifacts and Ideas. *New Ideas in Psychology*, 7: 49-72.

Webster, F. (1995) *Theories of the Information Society*. Routledge. London.

Weed, L. (1969) *Medical Records, Medical Education and Patient Care*. Case Western University Press. Cleveland.

Weed, L. (1991) *Knowledge Coupling: New Premises and New Tools for Medical Care and Education*. Springer-Verlag. New York.

Wells, HG. (1905) *A Modern Utopia*. Thomas Nelson & Sons. London.

Wennerholm, E. (1998) *Artefaktens Återkomst: Ett Möte Mellan Organisationsteori och Tingens Sociologi*. Stockholm Nerenius & Santerus. Sweden.

Westin, AF. (1976) *Computers, Health Records and Citizen Rights*. Washington DC: National Bureau of Standards.

Whitelaw, FG., Nevin, SL., Milne, RM., Taylor, RJ., Taylor, MW., Watt, AH (1996) Completeness and Accuracy of Morbidity and Repeat Prescribing Records Held on General Practice Computers in Scotland. *British Journal of General Practice*, 46(404):181-6.

Willems, JL. (1992) Preface. In Van Bemmel, JH. and McCray, AT. ( Eds.) *Yearbook of Medical Informatics 92: Advances in Interdisciplinary Science.* IMIA-Schattauer. Rotterdam: 7.

William, JW., German, OS. (1989) Health Science Information Management and Continuing Education of Physicisians. *Annals of Internal Medicine.* 110: 151-160.

Williams, F., Gibson, VD. (1990) *Technology Transfer.* Sage Publications. California.

Winner, L. (1977) *Autonomous Technology: Technics-Out-Of-Control as a Theme in Political Thought.* MIT Press. Cambridge.

Winner, L. (1980) Do Artifacts Have Politics? *Daedalus* 109 (1): 121-136.

Winner, L. (1991) Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology. In Pitt, C., Lugo, E., (Eds.) *The Technology of Discovery and the Discovery of Technology: Proceedings of the 6th International Conference of the Society for Philosophy and Technology.* Blacksburg, VA: Society for Philosophy and Technology: 503-519.

Wirten, E. (1998) *Global Infatuations, Explorations in Transnational Publishing and Texts: A Case of Harlequin Enterprises and Sweden.* Doctoral Dissertation. Department of Literature Section for Sociology of Literature, Uppsala University. Sweden.

WONCA (1991) *The Role of the General Practitioner/Family Physician in Health Care Systems.* World Organisation of Family Doctors. Melbourne.

Woolgar, S. (Ed.) (1991) *Knowledge and Reflexivity: New Frontiers in the Sociology of Knowledge.* Sage Publications. London.

World Health Organisation (1978) *Primary Health Care: Report of the International Conference on Primary Health Care, Alma-Ata.* WHO. Geneva.

World Health Organisation (1979) National Health Information Systems in Southeast Asia. *WHO Chronicle.* 33: 177-179.

World Health Organisation (1993) *Implementation of the Global Strategy for Health for All by the Year 2000*, Second Evaluation, 8th Report on the World Health Situation. Geneva.

Yaghmaie, F., Jayasuriya, R., Rawstorne, P. (1998) Computer Experience and Computer Attitude: A Model to Predict the Use of Computerised Information Systems. In Cesnik, B., McCray, A., Scherrer, J. *Proceedings of the World Medical Informatics Conference,* Seoul. IOS Press: Amsterdam.

Yin, RK. (1994) *Case Study Research: Design and Methods.* 2nd Edition. Sage Publications.

Zuboff, S. (1988) *In the Age of the Smart Machine - The Future of Work and Power.* Basic Books. New York.

## APPENDIX 1. SOME PERSONAL COMMENTS FROM GPS AND OTHERS

These selective comments and anecdotes, through their deficiencies and strengths in thinking, spurred on the shaping of the philosophical base of this thesis.

"It is generally agreed, world wide, that the computerised patient health care record will become the central component of an efficient health care system. Before this can be realised many questions must be answered. This will require ongoing research and development projects"
(Walker et al. 1991: 42)

"Many general practitioners are not interested in computers, but there is a general impression of increasing acceptance of computers and associated technology. Of those general practitioners who seem interested, most agree that a billing system is probably worth buying. Few are interested in computerising their medical records. Prescription generation is attracting some interest."
(Walker et al. 1991: 49)

"Information technology is a tool ... the general practice of the future is hard to visualise, but it is certain that information technology will challenge and change accepted methods of practice. Any such changes must be brought about by the profession and its representatives."
(Crampton In Walker et al. 1991: 78)

"There is a case for at least some records remaining the property and perspective of a Doctor. I see all sorts of problems with immutable patient records for life. Direct links with HIC [Australian Health Insurance Commission] will be resisted by most general practitioners."
(Elderfield In Walker et al. 1991: 79)

"... for the sake of our patients and the public we should not be overly concerned with the details of technology but with the broader issues which will shape the nature of general practice in the twenty first century."
(MacIsaac In Walker et al. 1991: 80)

"While I must believe the assurance of the authors that these developments are technologically likely and rapidly occurring, may I remind them of the disastrous problems which may arise when scientific and technological ability outstrips the social developments necessary to use them wisely and ethically. Time must be taken to develop the human resources and organisations which can make IT a boon rather than a nightmare. Enthusiasm for the beauty and power and efficiency of the technology itself can obscure awareness of its social implications. In short, how much do we want of this brave new world ?".
(Anonymous In Walker et al. 1991: 81)

"Information technology is a tool and should be regarded in the same light as the stethoscope".
(Anonymous In Walker et al. 1991: 3)

"In summary, if there is no focus on information management, the current situation will deteriorate. This will probably result in less than optimal care with possible litigation consequences."
(Department of Human Services and Health 1993: 17)

"Many GPs confess to technophobia and a fear of new tools such as computers."
(Department of Human Services and Health 1993: 20)

"For many GPs, concerns about breaches of patient confidentiality through using technologies such as faxes and computers act as a barrier to better information management."
(Department of Human Services and Health 1993: 20)

"In summary, the barriers experienced by GPs differ, and therefore, a series of choices is required to move forward. To overcome some of the reported blocks requires education and an attitude change, while other barriers need incentives or positive options to encourage behavioural change among GPs."
(Department of Human Services and Health, 1993: 20)

"Jones points out that one of the reasons that the Micro's for G.P.'s scheme got going in England was because the Department of Health wanted to *get hooks on some of the information that was available in general practice.*"
(Jones in O'Toole, 1988: 9-3)

"The rate of adoption of an innovation typically approximates an S-shaped curve over time. At first, the number of adopters of the new idea are relatively few per unit of time. Then, when about 15% or 20-25% of the members of a system adopt, the rate of adoption *takes off* and the number of adopters per unit of time begins to increase rapidly."
(Backer et al., 1992: 9)

# APPENDIX 2. RESEARCH QUESTIONNAIRE IN ENGLISH PLUS COVER LETTER

Date

Dear Dr Joe Blogs,

By way of introduction my name is David Bomba and I am a PhD candidate at the University of Wollongong with the Information and Communication Technology (IACT) Department. I'm involved in a major research project which is being undertaken here in NSW and your cooperation would be appreciated in helping to make the project a success. The aim of the survey is to examine the attitudes and perceptions of NSW General Practitioners towards the use of Computerised Medical Records (CMRs).

All information provided will be kept strictly confidential and anonymous and will only be used to produce summary statistics. While your contribution is keenly sought, participating in the survey is voluntary.

**How you can help.**

Please read each question carefully and select the answer from the categories provided to give the answer that best fits you. A reply paid envelope has been provided for your convenience. **Please return the questionnaire by the 15th of December 1995.**

This major research project is being conducted as part of a PhD supervised by Professor Joan Cooper in the IACT Department at the University of Wollongong.

If you have any enquiries regarding the conduct of the research please do not hesitate in contacting the IACT Department:

Tel: 42 21 3606
Fax: 42 21 4170
email: d.bomba@uow.edu.au

Yours sincerely

David Bomba
(Associate Lecturer)

Office use only

## GENERAL PRACTITIONER AND PRACTICE PROFILE

1. Gender?

   1 ☐ Male
   2 ☐ Female

2. What is your age? ____ year

3. Are you a full time GP?

   1 ☐ yes
   0 ☐ no

4. Are you a private or public practicing GP?

   1 ☐ private
   2 ☐ public

5. How many GPs are there in your Practice? ____

6. How many staff members does your Practice employ? ____

7. Approximately how many patients do you see a week? ____

## EDUCATIONAL AND TRAINING SUPPORT

8. What university did you graduate from? ______________________ 17

9. In what year did you finish your university education? 19____ 19

10. Did you make use of a computer while at university?

- 1☐ yes
- 0☐ no 20

11. Did you have to take any computer related subjects as part of your university medical education?

- 1☐ yes
- 0☐ no 21

12. Are you a member of any medical society, professional institution or organisation?

- 1☐ yes
- 0☐ no 22

If yes
which one/s: ______________________ 23

Do these organisations provide for on going training and education in the use of computers?

- 1☐ yes
- 0☐ no
- 9☐ don't know 24

13. Rank in order of importance (1 to 4 if applicable, where 1 is the most common and 4 being the least common) your most common way of keeping up to date about computer and technological related developments in your field as a GP.

- 1☐ journals
- 2☐ colleagues
- 3☐ functions/conferences
- 4☐ other, please specify: ______________________ 25

14. In your opinion, do you consider technophobia to be a wide problem among GPs in Australia?

- 1☐ yes
- 0☐ no 26

If yes, why?: ______________________ 27

## GENERAL QUESTIONS

15. In your opinion, do you believe the following statement to be true or false.

"The computer based patient record is an essential technology for health care in the future."

1☐ true 28
2☐ false

If false, why?: ______________________________ 29

16. From the following list indicate 1 to 3 (where 1 is the most important and 3 being the least important) what the 3 main barriers are/have been to the implementation of CMRs in General Practice in your region.

1☐ financial outlay
2☐ technophobia
3☐ lack of computer literacy among GPs
4☐ computers not being user friendly to GPs
5☐ lack of policy vision and Government help
6☐ privacy/security concerns
7☐ lack of a CMR software standard 30
8☐ other, please specify:

______________________________

17. How are/were these barriers overcome?

______________________________

______________________________ 31

18. How do you presently manage patient records?

1☐ manually (hand written notes)
2☐ type write (via dictaphone)
3☐ electronically by computer
4☐ all the above, why: ______________________________ 32

19. Do you keep backup copies of patient records?

1 ☐ yes
0 ☐ no

If yes, in what form?

1 ☐ paper
2 ☐ electronic

If electronic, what medium?

1 ☐ hardisk
2 ☐ tape

and how often? (e. g. 1/week) ______________________

If no, do you have a disaster recovery plan or policy?

1 ☐ yes
0 ☐ no

20. Do you have an employee confidentiality contract stating the Practices position on security and privacy of patient information?

1 ☐ yes
0 ☐ no

21. Has the Government or County Council provided any incentives for change in helping to proliferate CMRs among GPs?

1 ☐ yes
0 ☐ no

If yes, what has/is the Government or County Council done/doing?

______________________

22. Do you consider yourself responsible for the accuracy of patient information held in your records?

1 ☐ yes
0 ☐ no

23. Who owns patient information?

1 ☐ doctor
2 ☐ patient
3 ☐ County Council/Government
4 ☐ other, please specify: ______________________
0 ☐ no one

24. Do you presently use CMRs in your Practice?

1 ☐ yes
0 ☐ no **if no - go to page 7**

33 34 35 38 39 40 41 42 43 44 45

**COMPUTERISED ONLY**

25. What type of computing hardware do you use?

1 ☐ IBM or Compatible
2 ☐ Apple Macintosh
3 ☐ other, please specify: ____________________ 46

26. What type of operating system do you use?

1 ☐ DOS/Windows
2 ☐ UNIX
3 ☐ Macintosh
4 ☐ other, please specify: ____________________ 47

27. Is/are your computer/s configured as:

1 ☐ single user
2 ☐ multi-user Network 48

28. For what main reason/s did you computerise?

____________________

____________________ 49

29. Rank in order of importance (1 to 8, where 1 is the most important and 8 being the least important) for which you use your computer for:

1 ☐ accounts/billing
2 ☐ wordprocessing
3 ☐ recall of patients for prevention checks
4 ☐ statistics
5 ☐ appointments
6 ☐ patient health/medical records
7 ☐ literature searches
8 ☐ electronic mail
9 ☐ other, please specify: ____________________ 50

30. What CMR software do you use (give name and supplier)

____________________ 52

31. Why did you choose this software?

____________________

____________________ 53

32. Do you make use of any read codes or coding scheme for patient diseases?

1☐ yes 54
0☐ no

If yes, which one? ______________________________ 55

33. How long (in months) have you been using CMRs?

__________ months 58

34. Have CMRs improved the way you work?

1☐ yes
0☐ no 59

If yes, how? ______________________________ 60

35. Do you follow any specific ethical code of practice, law or guidelines as how you should handle patient information when using CMRs?

1☐ yes
0☐ no 61

36. What methods of information/computer protection do you use against unauthorised access to patient information?

1☐ password
2☐ other, please specify: ______________________________ 62

37. Who decides on access rights to patient information in your Practice?

______________________________ 63

38. Do staff/employees have access to all of a patients CMR or just certain views?

1☐ all
2☐ certain views 64

39. Is the database patient information encrypted in any way?

1☐ yes
0☐ no 65

40. Are there any outside communication lines to the patient database?

1☐ yes
0☐ no 66

**NON COMPUTERISED ONLY**

41. Do you think CMRs will improve the way GPs work?

1 ☐ yes
0 ☐ no 67

42. Does your Practice presently have a problem managing patient health records?

1 ☐ yes
0 ☐ no 68

43. Do you plan to have a CMR system within the next 3 years?

1 ☐ yes
0 ☐ no 69

44. Where does the CMR rank among your information system priorities?

1 ☐ as number 1
2 ☐ as number 2
3 ☐ as number 3
4 ☐ top 5
5 ☐ top 10
6 ☐ does not rank 70

45. Has your Practice taken any planning steps towards implementing CMRs in the future?

1 ☐ yes
0 ☐ no 71

If yes, what is or has been done? ______________________________ 72

46. What do you consider to be your biggest CMR challange?

______________________________________________________ 73

47. Do you have a preference for any specific CMR supplier?

1 ☐ yes
0 ☐ no 74

If yes, which supplier? ______________________________ 75

## APPENDIX 3. RESEARCH QUESTIONNAIRE IN SWEDISH PLUS COVER LETTER

Uppsala i december 1994

Bästa kollega!

Den här gången rör förfrågan till det allmänmedicinska nätverket synen på datorbaserad journalföring. Sverige är förmodligen det land i världen där datoriseringen av journalföring i primärvården (och all vård över huvud taget) hunnit längst. Det är i det läget synnerligen intressant att jämföra situationen i Sverige med andra länder, t. ex. Australien, där en mycket liten andel av primärvårdsmottagningarna är datoriserade.

Vi har hos oss i Uppsala en gästforskare, David Bomba, från Wollongong University i Sidneyområdet i Australien, som tillsammans med oss gör en undersökning av svenska och australiska allmänläkares syn på datorbaserad journalföring, förväntningar, tvivel, synen på integritet, sekretess, utbildning och träning. David sysslar med medicinsk informatik, dvs konsten att presentera medicinsk information på ett sådant sätt att medicinska beslut underlättas. Dit hör definitivt frågor kring tillgänglighet, lagring och presentation av journaldata, vare sig man använder pappers- eller datajournaler.

Det här frågeformuläret utgör den svenska delen av undersökningen. Samma frågeformulär i engelskspråkig tappning kommer att användas i Australien under våren 1995. Frågeformuläret har konstruerats på basen av ett 20-tal intervjuer med allmänläkare.

Vi hoppas att Du vill ta Dig tid att besvara frågorna och skicka tillbaka enkäten i det bifogade svarskuvertet, helst före den 19 december. Som vanligt kommer svaren enbart att publiceras i sammanställd form och man kommer inte att kunna identifiera enskilda svarande. Du kommer också att få en sammanställning av resultatet Dig tillsänd, så fort resultaten är klara, i första hand den svenska delen, men så småningom också jämförelsen med Australien.

Hjärtliga hälsningar!

Kurt Svärdsudd David Bomba

Ifylles ej

**BAKGRUNDSDATA**

1. Vilket är Ditt kön? 3

   1☐ Man
   2☐ Kvinna 4

2. Hur gammal är Du? ____ år 6

3. Arbetar Du heltid som allmänläkare?

   1☐ ja
   0☐ nej 7

4. Arbetar Du som privatpraktiker eller offentliganställd?

   1☐ privatpraktiker
   2☐ offentliganställd 8

5. Hur många allmänläkare arbetar på Din arbetsplats (antal personer)?____ st 10

6. Hur många övriga sjukvårdsanställda finns på Din arbetsplats? ____ st 12

7. Ungefär hur många patienter har Du per vecka? ____ st 15

## UTBILDNING, TRÄNINGSSTÖD

8. Vid vilket universitet tog Du Din läkarexamen? ________________ 17

9. Vilket år tog Du Din läkarexamen? 19___ 19

10. Använde Du datorer under Din utbildning?

1☐ ja
0☐ nej 20

11. Ingick någon datautbildning i Din medicinska grundutbildning?

1☐ ja
0☐ nej 21

12. Är Du ansluten till någon medicinsk förening, medicinskt sällskap eller annan professionell organisation?

1☐ ja
0☐ nej 22

Om ja

vilken/vilka: ________________ 23

Anordnar den/de någon datorutbildning?

1☐ ja
0☐ nej
v☐ vet ej 24

13. Ranka i betydelseordning på vilket sätt Du håller Dig informerad om data- och teknologisk utveckling inom Ditt område (1 är det mest vanliga sättet och 4 det minst vanliga)

1☐ artiklar
2☐ kollegor
3☐ konferenser
4☐ annat, vad: ________________ 25

14. Tror Du att teknikrädsla/aversion är ett problem bland allmänläkare i Sverige?

1☐ ja
0☐ nej 26

Om ja, varför: ________________ 27

## ALLMÄNNA FRÅGOR

15. Anser Du följande påstående vara rätt eller fel?

"Databaserade journaler är nödvändigt inom framtidens hälso- och sjukvård."

1 ☐ rätt
2 ☐ fel

Om fel, varför: ____________________

28
29

16. Gradera på nedanstående lista tre huvudinvändningar (1 till 3, där 1 är den viktigaste och 3 den minst viktiga) mot att införa databaserad journalhantering.

1 ☐ kostnad
2 ☐ teknikrädsla/aversion
3 ☐ brist på kunskap bland allmänläkare om hur datautrustnin fungerar
4 ☐ datorer är inte användarvänliga för allmänläkare
5 ☐ avsaknad av strategi och stöd från huvudmän
6 ☐ tystnadsplikt/sekretess betänkligheter
7 ☐ avsaknad av standardiserad programvara för datorbaserad journalföring
8 ☐ annat, vad:

____________________

30

17. Hur har dessa barriärer överbryggats?

____________________

____________________

31

18. Hur handhar Du för närvarande patientjournaler?

1 ☐ manuellt (handskrivna anteckningar)
2 ☐ maskinskrivet via diktafon
3 ☐ elektroniskt via dator
4 ☐ alla ovanstående alternativ, varför: ____________________

32

19. Tar Du/ni kopior av journalerna?

1 ☐ ja
0 ☐ nej

Om ja, i vilken form?

1 ☐ papper
2 ☐ elektronisk

Om elektronisk, på vilket medium?

1 ☐ hårddisk
2 ☐ tape

Hur ofta görs denna backup? ______________________________

Om nej, har Du/ni någon policy för hur ni hanterar en eventuel katastrof-situation vid journalförlust?

1 ☐ ja
0 ☐ nej

20. Har Du/Ni något speciellt kontrakt med de anställda som fastställer mottagningens syn (bestämmelser) på säkerhet och sekretess beträffande patientinformation?

1 ☐ ja
0 ☐ nej

21. Har landstinget vidtagit några åtgärder för att sprida användningen av datorbaserad journalföring bland allmänläkare?

1 ☐ ja
0 ☐ nej

Om ja, vad har landstinget gjort? ______________________________

22. Anser Du Dig själv ansvarig för riktigheten i journalerna?

1 ☐ ja
0 ☐ nej

23. Vem äger patientuppgifterna?

1 ☐ doktorn
2 ☐ patienten
3 ☐ landstinget
4 ☐ annan, vem? ______________________________
0 ☐ ingen

24. Använder Du för närvarande databaserade journaler på Din mottagning?

1 ☐ ja
0 ☐ nej **om nej - fortsätt på sidan 7**

33 34 35 38 39 40 41 42 43 44 45

## BESVARAS ENDAST AV DATORISERADE MOTTAGNINGAR

25. Vilken datorhårdvara använder Du?

1☐ IBM eller kompatibel
2☐ Apple Macintosh
3☐ annan, vad? ________________ ☐ 46

26. Vilket operativsystem använder Du?

1☐ DOS/Windows
2☐ UNIX
3☐ Macintosh
4☐ annat, vad? ________________ ☐ 47

27. Är Din dator konfigurerad för:

1☐ ensamanvändare
2☐ flera användare i nätverk ☐ 48

28. Vad var huvudanledningen till att ni datoriserade journalerna?

________________

________________ ☐ 49

29. Ranka, i betydelseordning (1 till 8 där 1 är mest betydelsefull och 8 minst), vad Du som allmänläkare använder datorn till:

1☐ fakturering/ekonomi
2☐ ordbehandling
3☐ minneslista för att kalla patienter till preventionskontroller
4☐ statistik
5☐ tidbokning av besök
6☐ journalhantering
7☐ litteratursökning
8☐ elektronisk post
9☐ annat, vad? ________________ ☐ 50

30. Vilken mjukvara för journalhantering använder Du? (ange programvarunamn och leverantör)

________________ ☐☐ 52

31. Varför valde Du den?

________________

________________ ☐ 53

32. Använder Du diagnoskoder?

1☐ ja
0☐ nej

Om ja, vilken? ______________________________

33. Hur många månader har Du använt datoriserat journalhanteringssystem?

__________ månader

34. Har datorjournalhanteringssystemet förbättrat Ditt arbetssätt?

1☐ ja
0☐ nej

Om ja, hur? ______________________________

35. Följer Du någon etisk kodex, lag, rekommendation eller praxis för hur patient uppgifter skall hanteras när man använder datajournalhanteringssystem?

1☐ ja
0☐ nej

36. Vilket skydd finns mot att icke auktoriseradeanvändare kan nå patient-information i datorerna?

1☐ lösenord
2☐ annat, vad? ______________________________

37. Vem på Din mottagning bestämmer över tillgängligheten?

______________________________

38. Har andra anställda än läkare tillträde till patienternas hela datajournal eller bara vissa avsnitt?

1☐ hela
2☐ delar

39. Är patientdatabasen krypterad?

1☐ ja
0☐ nej

40. Kan patientdatabasen nås utifrån?

1☐ ja
0☐ nej

54 55 58 59 60 61 62 63 64 65 66

**BESVARAS ENDAST AV *EJ* DATORISERADE MOTTAGNINGAR**

41. Tror Du att databaserade journaler kan förbättra allmänläkarens arbetssätt?

1☐ ja
0☐ nej

☐ 67

42. Har Din mottagning för närvarande några journalhanteringsproblem?

1☐ ja
0☐ nej

☐ 68

43. Planerar Du/ni att införa databaserad journalhantering inom de närmaste 3 åren?

1☐ ja
0☐ nej

☐ 69

44. Var på nedanstående rankingskala finns önskemål om införande av databaserad journalhantering?

1☐ som nr 1
2☐ som nr 2
3☐ som nr 3
4☐ bland de 5 högsta
5☐ bland de 10 högsta
6☐ inte alls

☐ 70

45. Har Din/er mottagning börjat planera införande av databaserad journalhantering i framtiden?

1☐ ja
0☐ nej

☐ 71

Om ja, vad har gjorts? ______________________________

☐ 72

46. Vad blir den största utmaningen med databaserad journalhantering?

______________________________

☐ 73

47. Föredrar Du/ni någon speciell dataleverantör?

1☐ ja
0☐ nej

☐ 74

Om ja, vilket märke? ______________________________

☐ 75

## APPENDIX 4. RESULTS: SWEDEN

Note: Qualitative responses are not shown for the following questions:
Q8, Q17, Q28, Q30, Q31,Q37 and Q46. These are discussed in the body of the thesis.

## SECTION 1. GENERAL PRACTITIONER AND PRACTICE PROFILE

### Q1 Gender?

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| B1 | 298 | 0 |

**B1**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 179 | 60.1 | 60.1 | 60.1 |
| | 2.00 | 119 | 39.9 | 39.9 | 100.0 |
| | Total | 298 | 100.0 | 100.0 | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=Male; 2.00=Female**

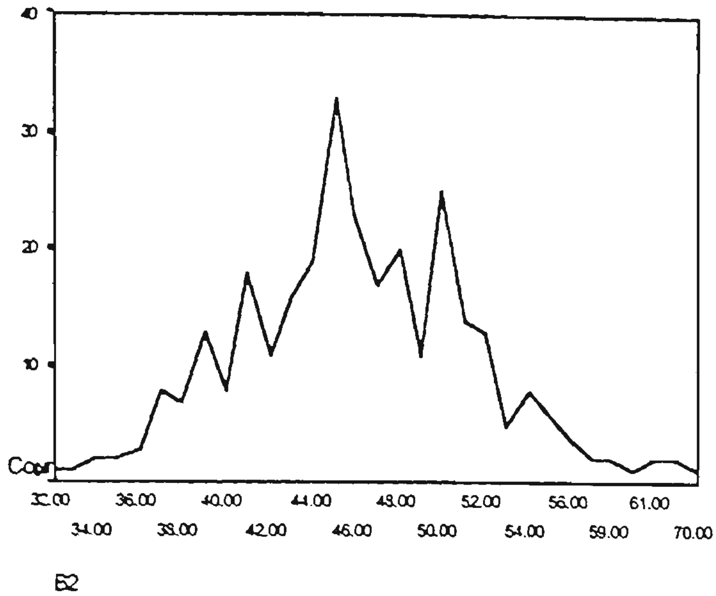
### Q2. What is your age (years)?

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| B2 | 298 | 0 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| B2 | 298 | 32.00 | 70.00 | 46.1879 | 5.6424 |
| Valid N (listwise) | 298 | | | | |




## Q3. Are you a full time GP?

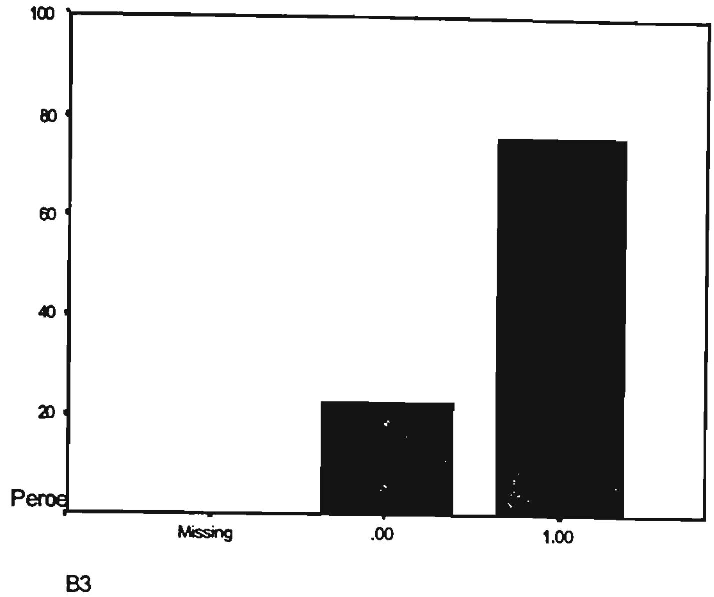
**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| B3 | 297 | 1 |

**B3**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 69 | 23.2 | 23.2 | 23.2 |
| | 1.00 | 228 | 76.5 | 76.8 | 100.0 |
| | Total | 297 | 99.7 | 100.0 | |
| Missing | System Missing | 1 | .3 | | |
| | Total | 1 | .3 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=Not full time; 1.00=Full time**




## Q4. Private or public practicing GP?

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| B4 | 290 | 8 |

**B4**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 24 | 8.1 | 8.3 | 8.3 |
| | 2.00 | 266 | 89.3 | 91.7 | 100.0 |
| | Total | 290 | 97.3 | 100.0 | |
| Missing | System Missing | 8 | 2.7 | | |
| | Total | 8 | 2.7 | | |
| Total | | 298 | 100.0 | | |

**1.00=Private; 2.00=Public**

## Q5. Number of GPs in your Practice?

**Statistics**

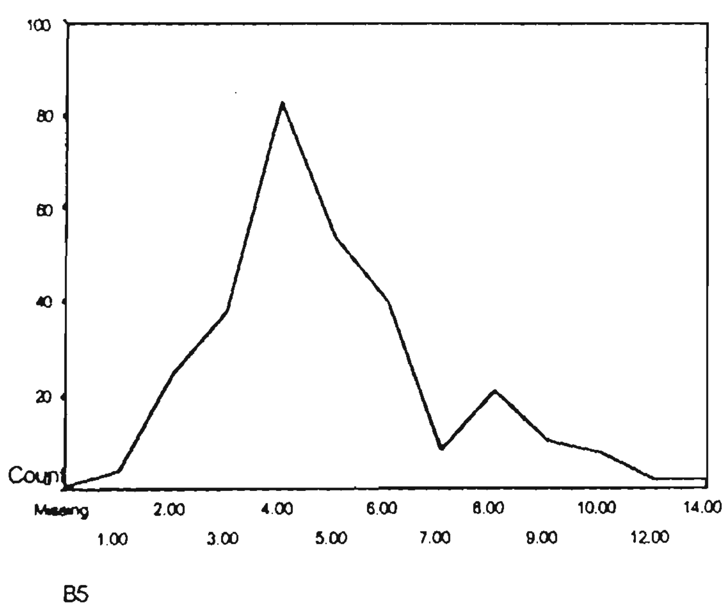
| | N | |
|---|---|---|
| | Valid | Missing |
| B5 | 297 | 1 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| B5 | 297 | 1.00 | 14.00 | 4.9562 | 2.1937 |
| Valid N (listwise) | 297 | | | | |

**B5**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 4 | 1.3 | 1.3 | 1.3 |
| | 2.00 | 25 | 8.4 | 8.4 | 9.8 |
| | 3.00 | 38 | 12.8 | 12.8 | 22.6 |
| | 4.00 | 83 | 27.9 | 27.9 | 50.5 |
| | 5.00 | 54 | 18.1 | 18.2 | 68.7 |
| | 6.00 | 40 | 13.4 | 13.5 | 82.2 |
| | 7.00 | 9 | 3.0 | 3.0 | 85.2 |
| | 8.00 | 21 | 7.0 | 7.1 | 92.3 |
| | 9.00 | 11 | 3.7 | 3.7 | 96.0 |
| | 10.00 | 8 | 2.7 | 2.7 | 98.7 |
| | 12.00 | 2 | .7 | .7 | 99.3 |
| | 14.00 | 2 | .7 | .7 | 100.0 |
| | Total | 297 | 99.7 | 100.0 | |
| Missing | System Missing | 1 | .3 | | |
| | Total | 1 | .3 | | |
| Total | | 298 | 100.0 | | |



## Q6. Number of staff employed by practice?

**Statistics**

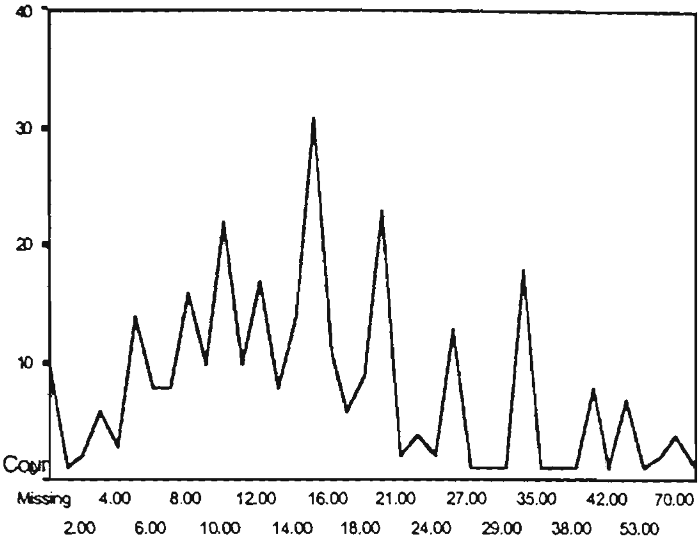
| | N | |
|---|---|---|
| | Valid | Missing |
| B6 | 288 | 10 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| B6 | 288 | 1.00 | 80.00 | 17.7326 | 13.0259 |
| Valid N (listwise) | 288 | | | | |

B6

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 1 | .3 | .3 | .3 |
| | 2.00 | 2 | .7 | .7 | 1.0 |
| | 3.00 | 6 | 2.0 | 2.1 | 3.1 |
| | 4.00 | 3 | 1.0 | 1.0 | 4.2 |
| | 5.00 | 14 | 4.7 | 4.9 | 9.0 |
| | 6.00 | 8 | 2.7 | 2.8 | 11.8 |
| | 7.00 | 8 | 2.7 | 2.8 | 14.6 |
| | 8.00 | 16 | 5.4 | 5.6 | 20.1 |
| | 9.00 | 10 | 3.4 | 3.5 | 23.6 |
| | 10.00 | 22 | 7.4 | 7.6 | 31.3 |
| | 11.00 | 10 | 3.4 | 3.5 | 34.7 |
| | 12.00 | 17 | 5.7 | 5.9 | 40.6 |
| | 13.00 | 8 | 2.7 | 2.8 | 43.4 |
| | 14.00 | 14 | 4.7 | 4.9 | 48.3 |
| | 15.00 | 31 | 10.4 | 10.8 | 59.0 |
| | 16.00 | 11 | 3.7 | 3.8 | 62.8 |
| | 17.00 | 6 | 2.0 | 2.1 | 64.9 |
| | 18.00 | 9 | 3.0 | 3.1 | 68.1 |
| | 20.00 | 23 | 7.7 | 8.0 | 76.0 |
| | 21.00 | 2 | .7 | .7 | 76.7 |
| | 22.00 | 4 | 1.3 | 1.4 | 78.1 |
| | 24.00 | 2 | .7 | .7 | 78.8 |
| | 25.00 | 13 | 4.4 | 4.5 | 83.3 |
| | 27.00 | 1 | .3 | .3 | 83.7 |
| | 28.00 | 1 | .3 | .3 | 84.0 |
| | 29.00 | 1 | .3 | .3 | 84.4 |
| | 30.00 | 18 | 6.0 | 6.3 | 90.6 |
| | 35.00 | 1 | .3 | .3 | 91.0 |
| | 36.00 | 1 | .3 | .3 | 91.3 |
| | 38.00 | 1 | .3 | .3 | 91.7 |
| | 40.00 | 8 | 2.7 | 2.8 | 94.4 |
| | 42.00 | 1 | .3 | .3 | 94.8 |
| | 50.00 | 7 | 2.3 | 2.4 | 97.2 |
| | 53.00 | 1 | .3 | .3 | 97.6 |
| | 60.00 | 2 | .7 | .7 | 98.3 |
| | 70.00 | 4 | 1.3 | 1.4 | 99.7 |
| | 80.00 | 1 | .3 | .3 | 100.0 |
| | Total | 288 | 96.6 | 100.0 | |
| Missing | System Missing | 10 | 3.4 | | |
| | Total | 10 | 3.4 | | |
| Total | | 298 | 100.0 | | |




B6

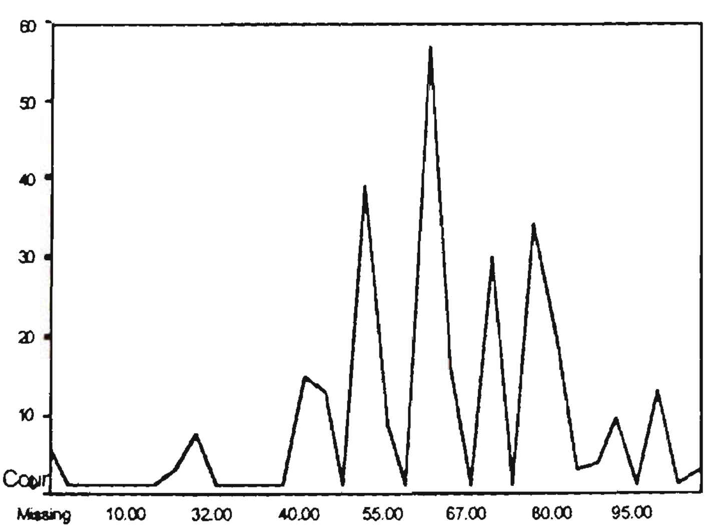
## Q7. How many patients do you see a week (approximation)?

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| B7 | 292 | 6 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| B7 | 292 | .00 | 125.00 | 63.2089 | 19.4373 |
| Valid N (listwise) | 292 | | | | |




B7

B7

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 1 | .3 | .3 | .3 |
| | 5.00 | 1 | .3 | .3 | .7 |
| | 8.00 | 1 | .3 | .3 | 1.0 |
| | 10.00 | 1 | .3 | .3 | 1.4 |
| | 14.00 | 1 | .3 | .3 | 1.7 |
| | 20.00 | 3 | 1.0 | 1.0 | 2.7 |
| | 30.00 | 8 | 2.7 | 2.7 | 5.5 |
| | 32.00 | 1 | .3 | .3 | 5.8 |
| | 35.00 | 1 | .3 | .3 | 6.2 |
| | 37.00 | 1 | .3 | .3 | 6.5 |
| | 38.00 | 1 | .3 | .3 | 6.8 |
| | 40.00 | 15 | 5.0 | 5.1 | 12.0 |
| | 45.00 | 13 | 4.4 | 4.5 | 16.4 |
| | 47.00 | 1 | .3 | .3 | 16.8 |
| | 50.00 | 39 | 13.1 | 13.4 | 30.1 |
| | 55.00 | 9 | 3.0 | 3.1 | 33.2 |
| | 58.00 | 1 | .3 | .3 | 33.6 |
| | 60.00 | 57 | 19.1 | 19.5 | 53.1 |
| | 65.00 | 16 | 5.4 | 5.5 | 58.6 |
| | 67.00 | 1 | .3 | .3 | 58.9 |
| | 70.00 | 30 | 10.1 | 10.3 | 69.2 |
| | 73.00 | 1 | .3 | .3 | 69.5 |
| | 75.00 | 34 | 11.4 | 11.6 | 81.2 |
| | 80.00 | 20 | 6.7 | 6.8 | 88.0 |
| | 85.00 | 3 | 1.0 | 1.0 | 89.0 |
| | 87.00 | 4 | 1.3 | 1.4 | 90.4 |
| | 90.00 | 10 | 3.4 | 3.4 | 93.8 |
| | 95.00 | 1 | .3 | .3 | 94.2 |
| | 100.00 | 13 | 4.4 | 4.5 | 98.6 |
| | 120.00 | 1 | .3 | .3 | 99.0 |
| | 125.00 | 3 | 1.0 | 1.0 | 100.0 |
| | Total | 292 | 98.0 | 100.0 | |
| Missing | System Missing | 6 | 2.0 | | |
| | Total | 6 | 2.0 | | |
| Total | | 298 | 100.0 | | |

## SECTION 2. EDUCATIONAL TRAINING AND SUPPORT

**Q8. University attended?**

## Q9. Finishing date of university education (19XX)?

**Statistics**

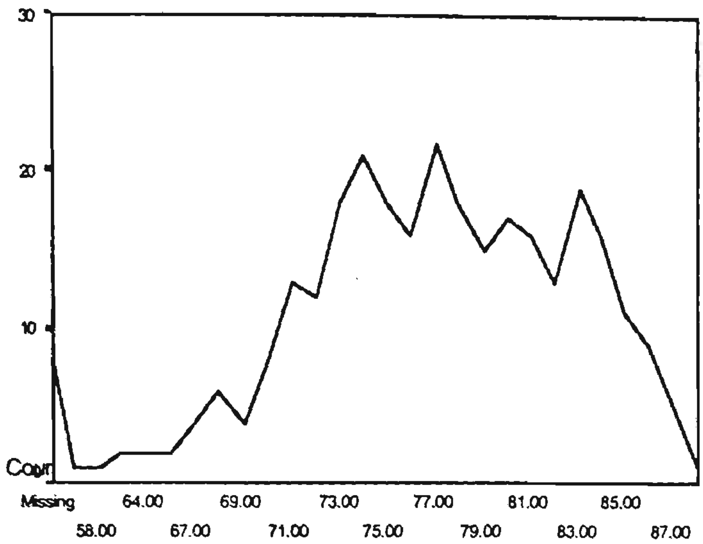
| | N | |
|---|---|---|
| | Valid | Missing |
| B9 | 290 | 8 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| B9 | 290 | 53.00 | 92.00 | 77.2069 | 5.6604 |
| Valid N (listwise) | 290 | | | | |

**B9**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 53.00 | 1 | .3 | .3 | .3 |
| | 58.00 | 1 | .3 | .3 | .7 |
| | 62.00 | 2 | .7 | .7 | 1.4 |
| | 64.00 | 2 | .7 | .7 | 2.1 |
| | 66.00 | 2 | .7 | .7 | 2.8 |
| | 67.00 | 4 | 1.3 | 1.4 | 4.1 |
| | 68.00 | 6 | 2.0 | 2.1 | 6.2 |
| | 69.00 | 4 | 1.3 | 1.4 | 7.6 |
| | 70.00 | 8 | 2.7 | 2.8 | 10.3 |
| | 71.00 | 13 | 4.4 | 4.5 | 14.8 |
| | 72.00 | 12 | 4.0 | 4.1 | 19.0 |
| | 73.00 | 18 | 6.0 | 6.2 | 25.2 |
| | 74.00 | 21 | 7.0 | 7.2 | 32.4 |
| | 75.00 | 18 | 6.0 | 6.2 | 38.6 |
| | 76.00 | 16 | 5.4 | 5.5 | 44.1 |
| | 77.00 | 22 | 7.4 | 7.6 | 51.7 |
| | 78.00 | 18 | 6.0 | 6.2 | 57.9 |
| | 79.00 | 15 | 5.0 | 5.2 | 63.1 |
| | 80.00 | 17 | 5.7 | 5.9 | 69.0 |
| | 81.00 | 16 | 5.4 | 5.5 | 74.5 |
| | 82.00 | 13 | 4.4 | 4.5 | 79.0 |
| | 83.00 | 19 | 6.4 | 6.6 | 85.5 |
| | 84.00 | 16 | 5.4 | 5.5 | 91.0 |
| | 85.00 | 11 | 3.7 | 3.8 | 94.8 |
| | 86.00 | 9 | 3.0 | 3.1 | 97.9 |
| | 87.00 | 5 | 1.7 | 1.7 | 99.7 |
| | 92.00 | 1 | .3 | .3 | 100.0 |
| | Total | 290 | 97.3 | 100.0 | |
| Missing | System Missing | 8 | 2.7 | | |
| | Total | 8 | 2.7 | | |
| Total | | 298 | 100.0 | | |



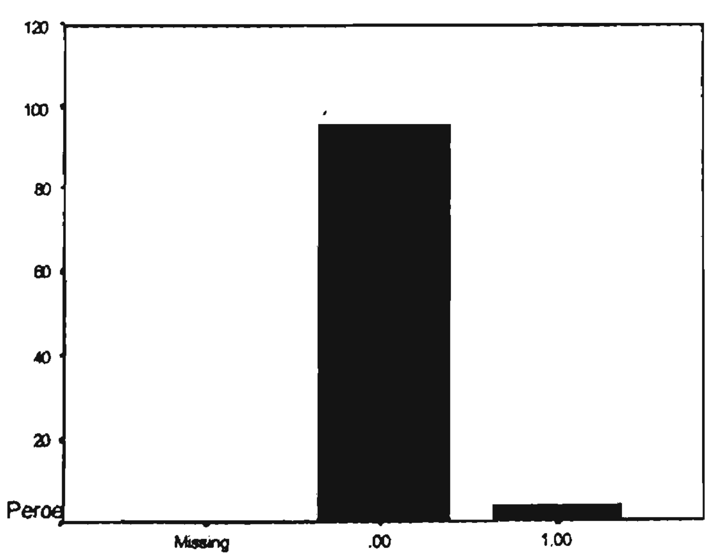

B9

## Q10. Did you make use of a computer while at university?

**B10**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 285 | 95.6 | 96.0 | 96.0 |
| | 1.00 | 12 | 4.0 | 4.0 | 100.0 |
| | Total | 297 | 99.7 | 100.0 | |
| Missing | System Missing | 1 | .3 | | |
| | Total | 1 | .3 | | |
| Total | | 298 | 100.0 | | |

Note: 0.00=NO; 1.00=YES



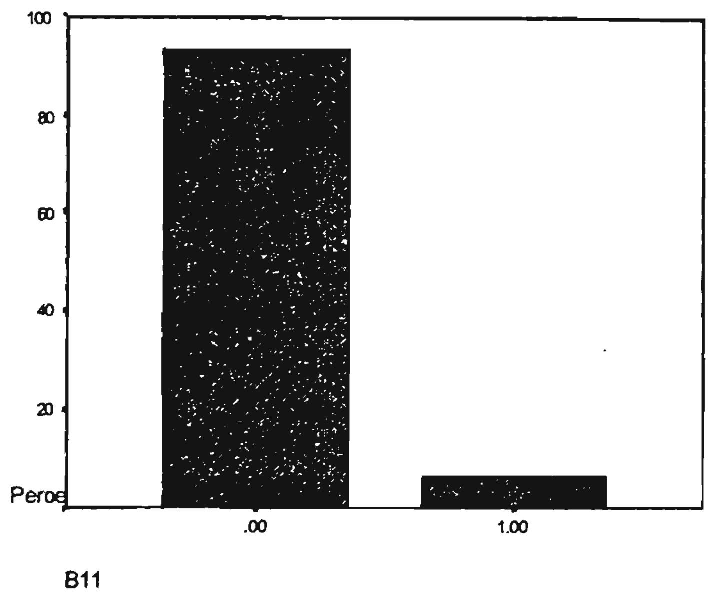

B10

**Q11. Did you have to take any computer related subjects as part of your university medical education?**

**B11**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 278 | 93.3 | 93.3 | 93.3 |
| | 1.00 | 20 | 6.7 | 6.7 | 100.0 |
| | Total | 298 | 100.0 | 100.0 | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**




**Q12a. Membership in a professional society?**

**B12A**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 27 | 9.1 | 9.1 | 9.1 |
| | 1.00 | 270 | 90.6 | 90.9 | 100.0 |
| | Total | 297 | 99.7 | 100.0 | |
| Missing | System Missing | 1 | .3 | | |
| | Total | 1 | .3 | | |
| Total | | 298 | 100.0 | | |

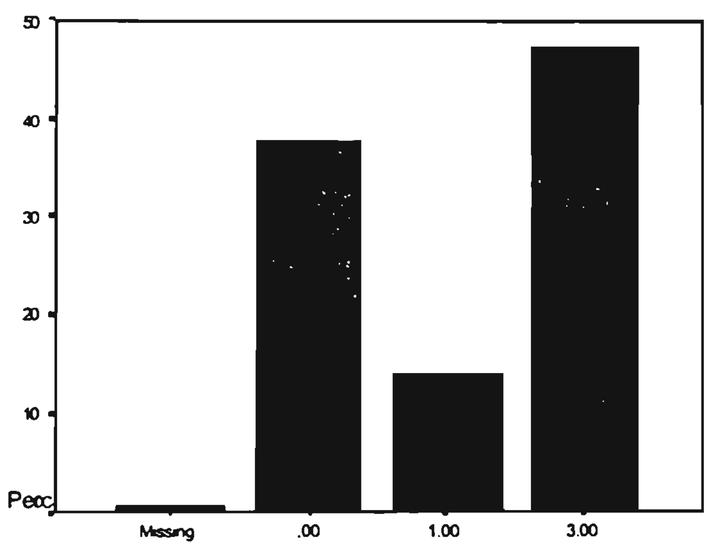
**Note: 0.00=NO; 1.00=YES**

**Q12b. Does the organisation in Q12a provide for on going training and education in the use of computers?**

**B12C**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 113 | 37.9 | 38.2 | 38.2 |
| | 1.00 | 42 | 14.1 | 14.2 | 52.4 |
| | 3.00 | 141 | 47.3 | 47.6 | 100.0 |
| | Total | 296 | 99.3 | 100.0 | |
| Missing | System Missing | 2 | .7 | | |
| | Total | 2 | .7 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES; 3.00=don't know**



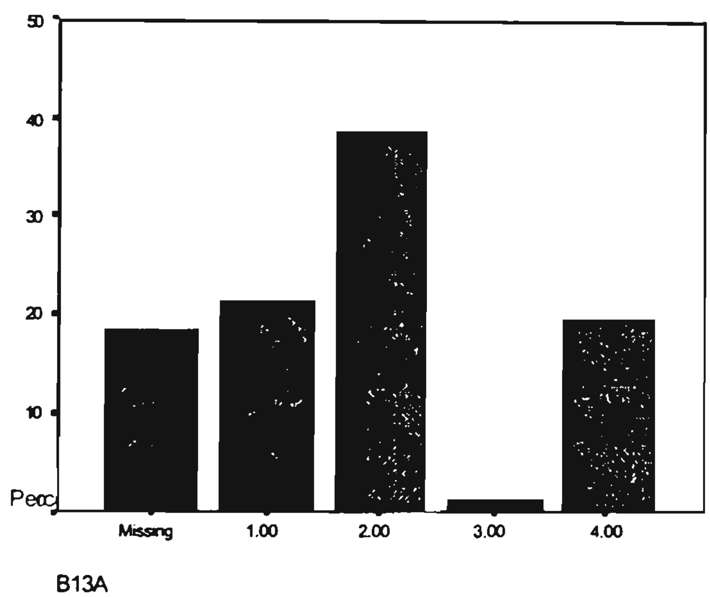

B12C

**Q13. Most common way of keeping up to date about computer and technological developments?**

B13A

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 64 | 21.5 | 26.3 | 26.3 |
| | 2.00 | 116 | 38.9 | 47.7 | 74.1 |
| | 3.00 | 4 | 1.3 | 1.6 | 75.7 |
| | 4.00 | 59 | 19.8 | 24.3 | 100.0 |
| | Total | 243 | 81.5 | 100.0 | |
| Missing | System Missing | 55 | 18.5 | | |
| | Total | 55 | 18.5 | | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=Journals; 2.00=Colleagues; 3.00=Functions/Conferences; 4.00=Other**




**Q14. In your opinion, do you consider technophobia to be a wide problem among GPs in Sweden?**

B14A

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 211 | 70.8 | 72.5 | 72.5 |
| | 1.00 | 80 | 26.8 | 27.5 | 100.0 |
| | Total | 291 | 97.7 | 100.0 | |
| Missing | System Missing | 7 | 2.3 | | |
| | Total | 7 | 2.3 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

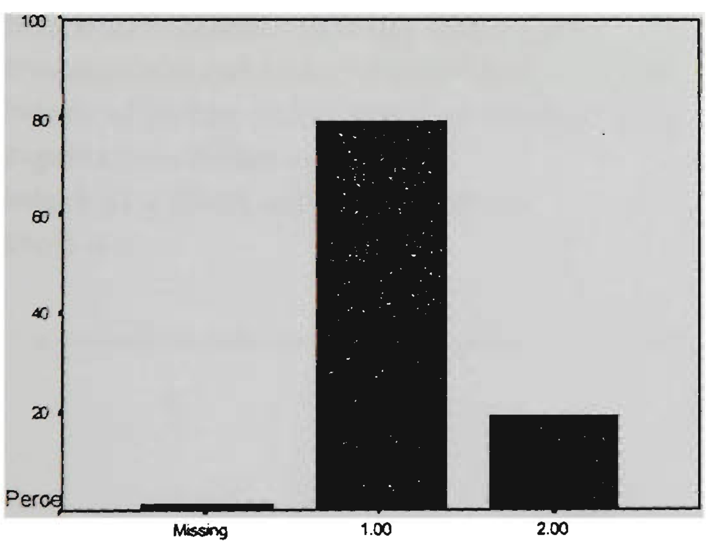
## SECTION 3. GENERAL QUESTIONS

**Q15. In your opinion, do you believe the following statement to be true or false, "The computer based patient record is an essential technology for health care in the future"?**

B15A

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 236 | 79.2 | 80.3 | 80.3 |
| | 2.00 | 58 | 19.5 | 19.7 | 100.0 |
| | Total | 294 | 98.7 | 100.0 | |
| Missing | System Missing | 4 | 1.3 | | |
| | Total | 4 | 1.3 | | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=TRUE; 2.00=FALSE**



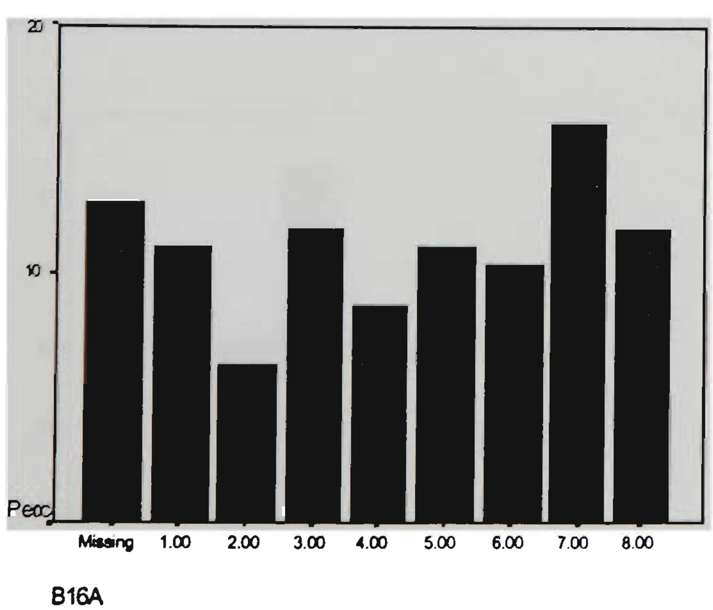

B15A

## Q16. Main barrier to the implementation of CMRs in General Practice?

**B16A**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 33 | 11.1 | 12.7 | 12.7 |
| | 2.00 | 19 | 6.4 | 7.3 | 20.0 |
| | 3.00 | 35 | 11.7 | 13.5 | 33.5 |
| | 4.00 | 26 | 8.7 | 10.0 | 43.5 |
| | 5.00 | 33 | 11.1 | 12.7 | 56.2 |
| | 6.00 | 31 | 10.4 | 11.9 | 68.1 |
| | 7.00 | 48 | 16.1 | 18.5 | 86.5 |
| | 8.00 | 35 | 11.7 | 13.5 | 100.0 |
| | Total | 260 | 87.2 | 100.0 | |
| Missing | System Missing | 38 | 12.8 | | |
| | Total | 38 | 12.8 | | |
| Total | | 298 | 100.0 | | |

**Note: Key**
**1.00=financial outlay**
**2.00=technophobia**
**3.00=lack of computer literacy among GPs**
**4.00=computers not being user friendly to GPs**
**5.00=lack of policy vision and Government help**
**6.00=privacy/security concerns**
**7.00=lack of a CMR software standard**
**8.00=other**



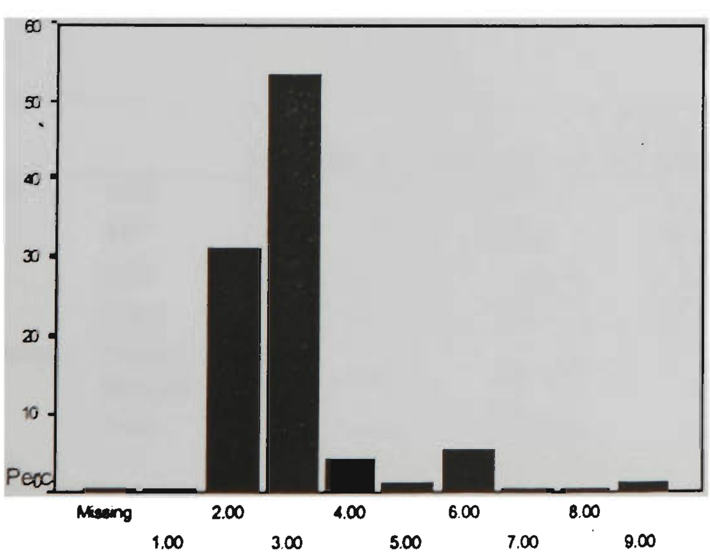

## Q17. Overcoming barriers?

**Q18. How do you presently manage patient records?**

B18

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 1 | .3 | .3 | .3 |
| | 2.00 | 93 | 31.2 | 31.3 | 31.6 |
| | 3.00 | 160 | 53.7 | 53.9 | 85.5 |
| | 4.00 | 14 | 4.7 | 4.7 | 90.2 |
| | 5.00 | 4 | 1.3 | 1.3 | 91.6 |
| | 6.00 | 17 | 5.7 | 5.7 | 97.3 |
| | 7.00 | 2 | .7 | .7 | 98.0 |
| | 8.00 | 2 | .7 | .7 | 98.7 |
| | 9.00 | 4 | 1.3 | 1.3 | 100.0 |
| | Total | 297 | 99.7 | 100.0 | |
| Missing | System Missing | 1 | .3 | | |
| | Total | 1 | .3 | | |
| Total | | 298 | 100.0 | | |

**Note: Key**
**1.00=manually (hand written notes)**
**2.00=type written (via dictaphone)**
**3.00=electronically by computer**
**4.00=all of the above**
**5.00=2.00+3.00+4.00**
**6.00=2.00+3.00**
**7.00=1.00+3.00**
**8.00=1.00+2.00+3.00+4.00**
**9.00=1.00+2.00**




B18

## Q19. Do you keep backup copies of patient records?

**B19A**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 54 | 18.1 | 19.0 | 19.0 |
| | 1.00 | 230 | 77.2 | 81.0 | 100.0 |
| | Total | 284 | 95.3 | 100.0 | |
| Missing | System Missing | 14 | 4.7 | | |
| | Total | 14 | 4.7 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

## Q19B. If YES, what form?

**B19B**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 47 | 15.8 | 20.5 | 20.5 |
| | 2.00 | 167 | 56.0 | 72.9 | 93.4 |
| | 3.00 | 15 | 5.0 | 6.6 | 100.0 |
| | Total | 229 | 76.8 | 100.0 | |
| Missing | System Missing | 69 | 23.2 | | |
| | Total | 69 | 23.2 | | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=paper; 2.00=electronic; 3.00=1.00+2.00**

## Q19C. If electronic, which medium?

**B19C**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 51 | 17.1 | 31.1 | 31.1 |
| | 2.00 | 98 | 32.9 | 59.8 | 90.9 |
| | 3.00 | 15 | 5.0 | 9.1 | 100.0 |
| | Total | 164 | 55.0 | 100.0 | |
| Missing | System Missing | 134 | 45.0 | | |
| | Total | 134 | 45.0 | | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=hardisk; 2.00=tape; 3.00=1.00+2.00**

*** Approximately 44% backup every day.**

**Q19D. Do you have a disaster recovery plan or policy?**

B19E

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 32 | 10.7 | 91.4 | 91.4 |
| | 1.00 | 3 | 1.0 | 8.6 | 100.0 |
| | Total | 35 | 11.7 | 100.0 | |
| Missing | System Missing | 263 | 88.3 | | |
| | Total | 263 | 88.3 | | |
| Total | | 298 | 100.0 | | |

Note: 0.00=NO; 1.00=YES

**Q20. Employee confidentiality contract?**

B20

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 164 | 55.0 | 59.9 | 59.9 |
| | 1.00 | 110 | 36.9 | 40.1 | 100.0 |
| | Total | 274 | 91.9 | 100.0 | |
| Missing | System Missing | 24 | 8.1 | | |
| | Total | 24 | 8.1 | | |
| Total | | 298 | 100.0 | | |

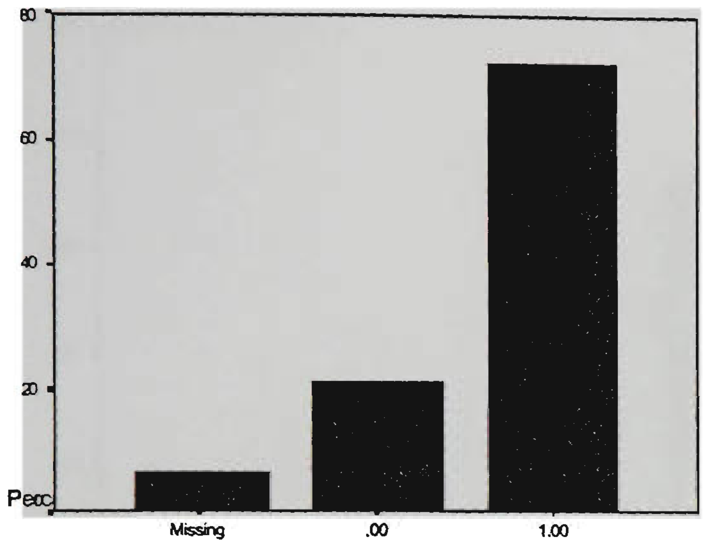
Note: 0.00=NO; 1.00=YES

**Q21. Has the Government or County Council provided any incentives for change in helping to proliferate CMRs among GPs?**

B21A

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 64 | 21.5 | 22.9 | 22.9 |
| | 1.00 | 216 | 72.5 | 77.1 | 100.0 |
| | Total | 280 | 94.0 | 100.0 | |
| Missing | System Missing | 18 | 6.0 | | |
| | Total | 18 | 6.0 | | |
| Total | | 298 | 100.0 | | |

Note: 0.00=NO; 1.00=YES



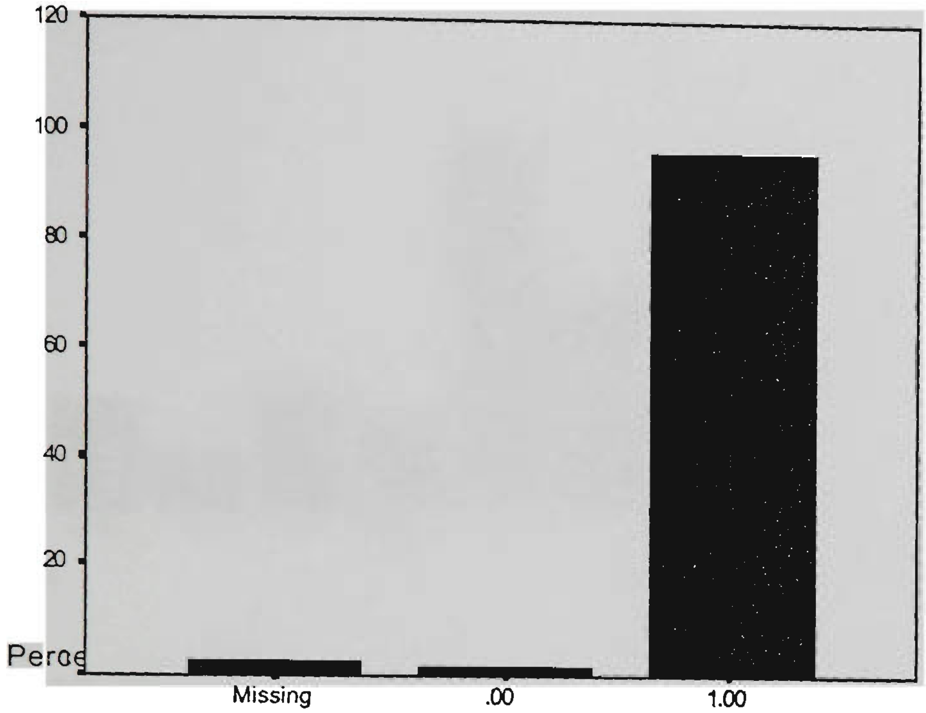

B21A

**Q22. Do you consider yourself responsible for the accuracy of patient information held in your records?**

**B22**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 4 | 1.3 | 1.4 | 1.4 |
| | 1.00 | 287 | 96.3 | 98.6 | 100.0 |
| | Total | 291 | 97.7 | 100.0 | |
| Missing | System Missing | 7 | 2.3 | | |
| | Total | 7 | 2.3 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**



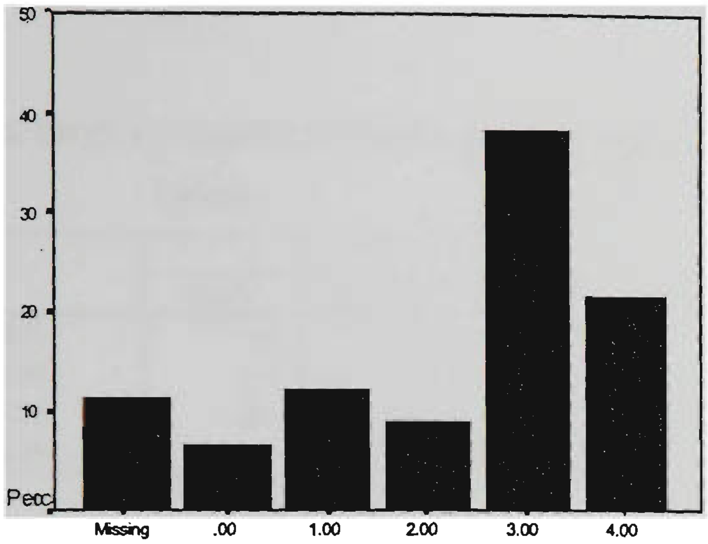

B22

**Q23. Who owns patient information?**

B23

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 20 | 6.7 | 7.6 | 7.6 |
| | 1.00 | 37 | 12.4 | 14.0 | 21.6 |
| | 2.00 | 27 | 9.1 | 10.2 | 31.8 |
| | 3.00 | 115 | 38.6 | 43.6 | 75.4 |
| | 4.00 | 65 | 21.8 | 24.6 | 100.0 |
| | Total | 264 | 88.6 | 100.0 | |
| Missing | System Missing | 34 | 11.4 | | |
| | Total | 34 | 11.4 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=no one; 1.00=doctor; 2.00=patient; 3.00=government; 4.00=other***
*** Many advocated a joint stakeholder type of model.**



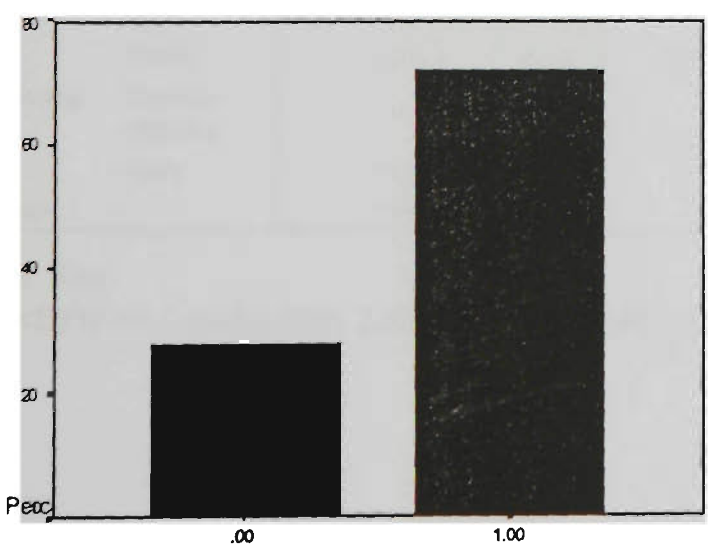

B23

**Q24. Do you presently use CMRs in your practice?**

B24

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 83 | 27.9 | 27.9 | 27.9 |
| | 1.00 | 215 | 72.1 | 72.1 | 100.0 |
| | Total | 298 | 100.0 | 100.0 | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**




B24

## SECTION 4. COMPUTERISED RESPONDENTS ONLY

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| B25 | 184 | 114 |
| B26 | 189 | 109 |
| B27 | 208 | 90 |
| B29A | 202 | 96 |

## Q25. Hardware platform used?

**B25**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 165 | 55.4 | 89.7 | 89.7 |
| | 2.00 | 2 | .7 | 1.1 | 90.8 |
| | 3.00 | 6 | 2.0 | 3.3 | 94.0 |
| | 4.00 | 2 | .7 | 1.1 | 95.1 |
| | 5.00 | 1 | .3 | .5 | 95.7 |
| | 6.00 | 1 | .3 | .5 | 96.2 |
| | 7.00 | 2 | .7 | 1.1 | 97.3 |
| | 8.00 | 4 | 1.3 | 2.2 | 99.5 |
| | 9.00 | 1 | .3 | .5 | 100.0 |
| | Total | 184 | 61.7 | 100.0 | |
| Missing | System Missing | 114 | 38.3 | | |
| | Total | 114 | 38.3 | | |
| Total | | 298 | 100.0 | | |

**Note: Key**
**1.00=IBM or Compatible; 2.00=Apple Macintosh; 3.00- 9.00=other**

## Q26. Operating system?

B26

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 142 | 47.7 | 75.1 | 75.1 |
| | 2.00 | 28 | 9.4 | 14.8 | 89.9 |
| | 3.00 | 1 | .3 | .5 | 90.5 |
| | 4.00 | 7 | 2.3 | 3.7 | 94.2 |
| | 5.00 | 3 | 1.0 | 1.6 | 95.8 |
| | 6.00 | 2 | .7 | 1.1 | 96.8 |
| | 7.00 | 2 | .7 | 1.1 | 97.9 |
| | 8.00 | 3 | 1.0 | 1.6 | 99.5 |
| | 9.00 | 1 | .3 | .5 | 100.0 |
| | Total | 189 | 63.4 | 100.0 | |
| Missing | System Missing | 109 | 36.6 | | |
| | Total | 109 | 36.6 | | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=DOS/Windows; 2.00=UNIX; 3.00=Mactinosh; 4.00- 9.00=other**

## Q27. Computer configuration?

B27

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 7 | 2.3 | 3.4 | 3.4 |
| | 2.00 | 201 | 67.4 | 96.6 | 100.0 |
| | Total | 208 | 69.8 | 100.0 | |
| Missing | System Missing | 90 | 30.2 | | |
| | Total | 90 | 30.2 | | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=single user standalone; 2.00=multi user network**

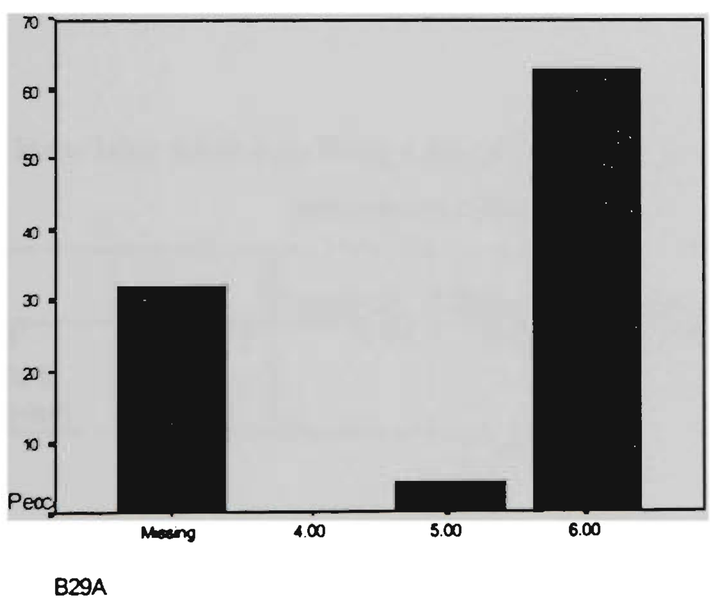
Q28. Reasons for computerisation?

Q29. Main use of computer(s)?

B29A

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 4.00 | 1 | .3 | .5 | .5 |
| | 5.00 | 13 | 4.4 | 6.4 | 6.9 |
| | 6.00 | 188 | 63.1 | 93.1 | 100.0 |
| | Total | 202 | 67.8 | 100.0 | |
| Missing | System Missing | 96 | 32.2 | | |
| | Total | 96 | 32.2 | | |
| Total | | 298 | 100.0 | | |

Note: 4.00=statistics; 5.00=appointments; 6.00=patient health records




Q30. CMR software used?

Q31. Reasons for choice of software?

**Q32. Use of a coding scheme for patient diseases (e.g ICD-10, Read Codes)?**

**B32A**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 24 | 8.1 | 11.5 | 11.5 |
| | 1.00 | 185 | 62.1 | 88.5 | 100.0 |
| | Total | 209 | 70.1 | 100.0 | |
| Missing | System Missing | 89 | 29.9 | | |
| | Total | 89 | 29.9 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

**Q33. How long have you been using CMRs (months)?**

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| B33 | 211 | 1.00 | 240.00 | 25.1517 | 23.1991 |
| Valid N (listwise) | 211 | | | | |

B33

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 5 | 1.7 | 2.4 | 2.4 |
| | 2.00 | 2 | .7 | .9 | 3.3 |
| | 3.00 | 5 | 1.7 | 2.4 | 5.7 |
| | 4.00 | 2 | .7 | .9 | 6.6 |
| | 5.00 | 1 | .3 | .5 | 7.1 |
| | 6.00 | 8 | 2.7 | 3.8 | 10.9 |
| | 7.00 | 4 | 1.3 | 1.9 | 12.8 |
| | 8.00 | 4 | 1.3 | 1.9 | 14.7 |
| | 9.00 | 4 | 1.3 | 1.9 | 16.6 |
| | 10.00 | 8 | 2.7 | 3.8 | 20.4 |
| | 11.00 | 7 | 2.3 | 3.3 | 23.7 |
| | 12.00 | 13 | 4.4 | 6.2 | 29.9 |
| | 13.00 | 5 | 1.7 | 2.4 | 32.2 |
| | 14.00 | 3 | 1.0 | 1.4 | 33.6 |
| | 15.00 | 6 | 2.0 | 2.8 | 36.5 |
| | 16.00 | 2 | .7 | .9 | 37.4 |
| | 18.00 | 9 | 3.0 | 4.3 | 41.7 |
| | 19.00 | 2 | .7 | .9 | 42.7 |
| | 20.00 | 15 | 5.0 | 7.1 | 49.8 |
| | 21.00 | 4 | 1.3 | 1.9 | 51.7 |
| | 22.00 | 2 | .7 | .9 | 52.6 |
| | 23.00 | 1 | .3 | .5 | 53.1 |
| | 24.00 | 21 | 7.0 | 10.0 | 63.0 |
| | 25.00 | 2 | .7 | .9 | 64.0 |
| | 26.00 | 3 | 1.0 | 1.4 | 65.4 |
| | 27.00 | 1 | .3 | .5 | 65.9 |
| | 28.00 | 4 | 1.3 | 1.9 | 67.8 |
| | 29.00 | 1 | .3 | .5 | 68.2 |
| | 30.00 | 10 | 3.4 | 4.7 | 73.0 |
| | 31.00 | 1 | .3 | .5 | 73.5 |
| | 32.00 | 5 | 1.7 | 2.4 | 75.8 |
| | 33.00 | 1 | .3 | .5 | 76.3 |
| | 34.00 | 1 | .3 | .5 | 76.8 |
| | 36.00 | 12 | 4.0 | 5.7 | 82.5 |
| | 38.00 | 3 | 1.0 | 1.4 | 83.9 |
| | 39.00 | 3 | 1.0 | 1.4 | 85.3 |
| | 40.00 | 7 | 2.3 | 3.3 | 88.6 |
| | 42.00 | 2 | .7 | .9 | 89.6 |
| | 43.00 | 1 | .3 | .5 | 90.0 |
| | 45.00 | 2 | .7 | .9 | 91.0 |
| | 48.00 | 8 | 2.7 | 3.8 | 94.8 |
| | 55.00 | 1 | .3 | .5 | 95.3 |
| | 60.00 | 2 | .7 | .9 | 96.2 |
| | 64.00 | 1 | .3 | .5 | 96.7 |
| | 66.00 | 1 | .3 | .5 | 97.2 |
| | 78.00 | 1 | .3 | .5 | 97.6 |
| | 84.00 | 1 | .3 | .5 | 98.1 |
| | 96.00 | 1 | .3 | .5 | 98.6 |
| | 108.00 | 1 | .3 | .5 | 99.1 |
| | 120.00 | 1 | .3 | .5 | 99.5 |
| | 240.00 | 1 | .3 | .5 | 100.0 |
| | Total | 211 | 70.8 | 100.0 | |
| Missing | System Missing | 87 | 29.2 | | |
| | Total | 87 | 29.2 | | |
| Total | | 298 | 100.0 | | |

## Q34-Q40.

**Statistics**

| | N Valid | N Missing |
|---|---|---|
| B34A | 204 | 94 |
| B35 | 195 | 103 |
| B36 | 198 | 100 |
| B38 | 212 | 86 |
| B39 | 156 | 142 |
| B40 | 196 | 102 |

## Q34. Have CMRs improved the way you work?

**B34A**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 52 | 17.4 | 25.5 | 25.5 |
| | 1.00 | 140 | 47.0 | 68.6 | 94.1 |
| | 2.00 | 12 | 4.0 | 5.9 | 100.0 |
| | Total | 204 | 68.5 | 100.0 | |
| Missing | System Missing | 94 | 31.5 | | |
| | Total | 94 | 31.5 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES; 2.00=other**

## Q35. Do you follow any specific ethical code of practice, law or guidelines as to how you should handle patient information when using CMRs?

**B35**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 48 | 16.1 | 24.6 | 24.6 |
| | 1.00 | 147 | 49.3 | 75.4 | 100.0 |
| | Total | 195 | 65.4 | 100.0 | |
| Missing | System Missing | 103 | 34.6 | | |
| | Total | 103 | 34.6 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

**Q36. What methods of information/computer protection do you use against unauthorised access to patient information?**

B36

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 186 | 62.4 | 93.9 | 93.9 |
| | 2.00 | 1 | .3 | .5 | 94.4 |
| | 3.00 | 1 | .3 | .5 | 94.9 |
| | 4.00 | 5 | 1.7 | 2.5 | 97.5 |
| | 5.00 | 1 | .3 | .5 | 98.0 |
| | 6.00 | 1 | .3 | .5 | 98.5 |
| | 7.00 | 1 | .3 | .5 | 99.0 |
| | 8.00 | 1 | .3 | .5 | 99.5 |
| | 9.00 | 1 | .3 | .5 | 100.0 |
| | Total | 198 | 66.4 | 100.0 | |
| Missing | System Missing | 100 | 33.6 | | |
| | Total | 100 | 33.6 | | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=password; 2.00- 9.00=other**

**Q37. Who decides on access rights to information in your practice?**

**Q38. Do staff/employees have access to all of a patients CMR or just certain views?**

B38

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 153 | 51.3 | 72.2 | 72.2 |
| | 2.00 | 48 | 16.1 | 22.6 | 94.8 |
| | 3.00 | 11 | 3.7 | 5.2 | 100.0 |
| | Total | 212 | 71.1 | 100.0 | |
| Missing | System Missing | 86 | 28.9 | | |
| | Total | 86 | 28.9 | | |
| Total | | 298 | 100.0 | | |

**Note: 1.00=All; 2.00=Certain views; 3.00=1.00+2.00**

## Q39. Is the database patient information encrypted in any way?

**B39**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 105 | 35.2 | 67.3 | 67.3 |
| | 1.00 | 51 | 17.1 | 32.7 | 100.0 |
| | Total | 156 | 52.3 | 100.0 | |
| Missing | System Missing | 142 | 47.7 | | |
| | Total | 142 | 47.7 | | |
| Total | | 298 | 100.0 | | |

Note: 0.00=NO; 1.00=YES

## Q40. Are there any outside communication lines to the patient database?

**B40**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 170 | 57.0 | 86.7 | 86.7 |
| | 1.00 | 26 | 8.7 | 13.3 | 100.0 |
| | Total | 196 | 65.8 | 100.0 | |
| Missing | System Missing | 102 | 34.2 | | |
| | Total | 102 | 34.2 | | |
| Total | | 298 | 100.0 | | |

Note: 0.00=NO; 1.00=YES

## SECTION 5. NON COMPUTERISED RESPONDENTS ONLY

## Q41-Q47.

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| B41 | 76 | 222 |
| B42 | 82 | 216 |
| B43 | 79 | 219 |
| B44 | 79 | 219 |
| B45A | 82 | 216 |
| B47A | 74 | 224 |

Q41. Do you think CMRs will improve the way GPs work?

B41

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 21 | 7.0 | 27.6 | 27.6 |
| | 1.00 | 55 | 18.5 | 72.4 | 100.0 |
| | Total | 76 | 25.5 | 100.0 | |
| Missing | System Missing | 222 | 74.5 | | |
| | Total | 222 | 74.5 | | |
| Total | | 298 | 100.0 | | |

Note: 0.00=NO; 1.00=YES

Q42. Does your practice presently have a problem managing patient health records?

B42

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 26 | 8.7 | 31.7 | 31.7 |
| | 1.00 | 56 | 18.8 | 68.3 | 100.0 |
| | Total | 82 | 27.5 | 100.0 | |
| Missing | System Missing | 216 | 72.5 | | |
| | Total | 216 | 72.5 | | |
| Total | | 298 | 100.0 | | |

Note: 0.00=NO; 1.00=YES

Q43. Do you plan to have a CMR system within the next 3 years?

B43

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 8 | 2.7 | 10.1 | 10.1 |
| | 1.00 | 71 | 23.8 | 89.9 | 100.0 |
| | Total | 79 | 26.5 | 100.0 | |
| Missing | System Missing | 219 | 73.5 | | |
| | Total | 219 | 73.5 | | |
| Total | | 298 | 100.0 | | |

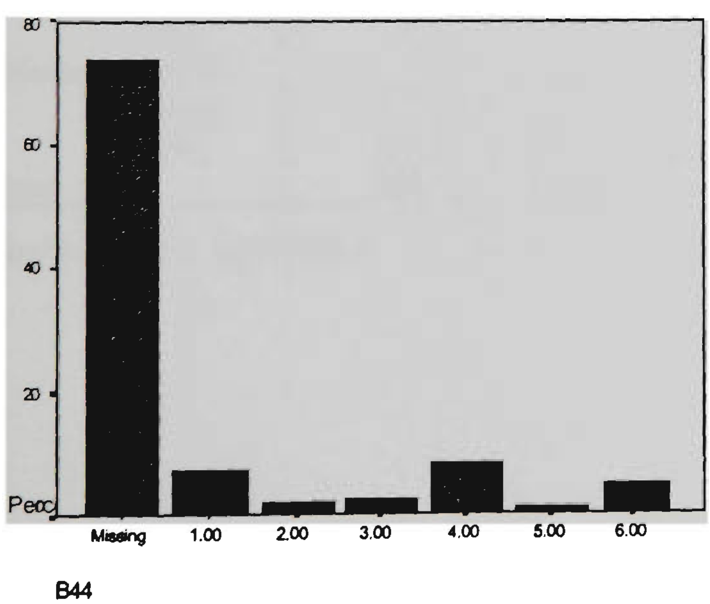
Note: 0.00=NO; 1.00=YES

**Q44. Where does the CMR rank among your information system priorities?**

B44

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 22 | 7.4 | 27.8 | 27.8 |
| | 2.00 | 6 | 2.0 | 7.6 | 35.4 |
| | 3.00 | 8 | 2.7 | 10.1 | 45.6 |
| | 4.00 | 24 | 8.1 | 30.4 | 75.9 |
| | 5.00 | 4 | 1.3 | 5.1 | 81.0 |
| | 6.00 | 15 | 5.0 | 19.0 | 100.0 |
| | Total | 79 | 26.5 | 100.0 | |
| Missing | System Missing | 219 | 73.5 | | |
| | Total | 219 | 73.5 | | |
| Total | | 298 | 100.0 | | |

**Note: Key**
**1.00=as number 1**
**2.00=as number 2**
**3.00=as number 3**
**4.00=top 5**
**5.00=top 10**
**6.00=does not rank**



**Q45. Has your practice taken any steps towards implementing CMRs in the future?**

B45A

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 29 | 9.7 | 35.4 | 35.4 |
| | 1.00 | 53 | 17.8 | 64.6 | 100.0 |
| | Total | 82 | 27.5 | 100.0 | |
| Missing | System Missing | 216 | 72.5 | | |
| | Total | 216 | 72.5 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

**Q46. Biggest CMR challenge?**

**Q47. Preference for a specific CMR supplier?**

B47A

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 59 | 19.8 | 79.7 | 79.7 |
| | 1.00 | 15 | 5.0 | 20.3 | 100.0 |
| | Total | 74 | 24.8 | 100.0 | |
| Missing | System Missing | 224 | 75.2 | | |
| | Total | 224 | 75.2 | | |
| Total | | 298 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

# APPENDIX 5. RESULTS: AUSTRALIA

Note: Qualitative responses are not shown for the following questions:
Q8, Q17, Q28, Q30, Q31, Q37 and Q46. These are discussed in the body of the thesis.

## SECTION 1. GENERAL PRACTITIONER AND PRACTICE PROFILE

### Q1 Gender?

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| Q1 | 293 | 0 |

**Q1**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 211 | 72.0 | 72.0 | 72.0 |
| | 2.00 | 82 | 28.0 | 28.0 | 100.0 |
| | Total | 293 | 100.0 | 100.0 | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=Male; 2.00=Female**

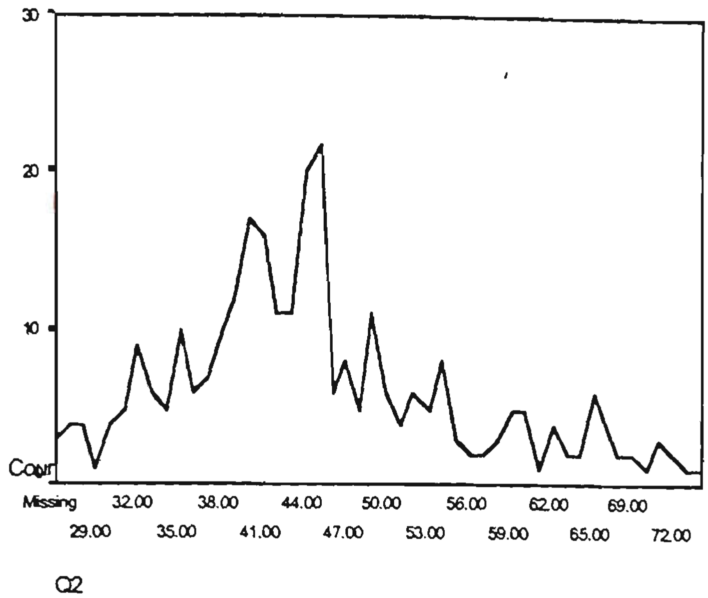
### Q2. What is your age (years)?

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| Q2 | 290 | 3 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Q2 | 290 | 27.00 | 79.00 | 45.4241 | 10.5093 |
| Valid N (listwise) | 290 | | | | |




## Q3. Are you a full time GP?

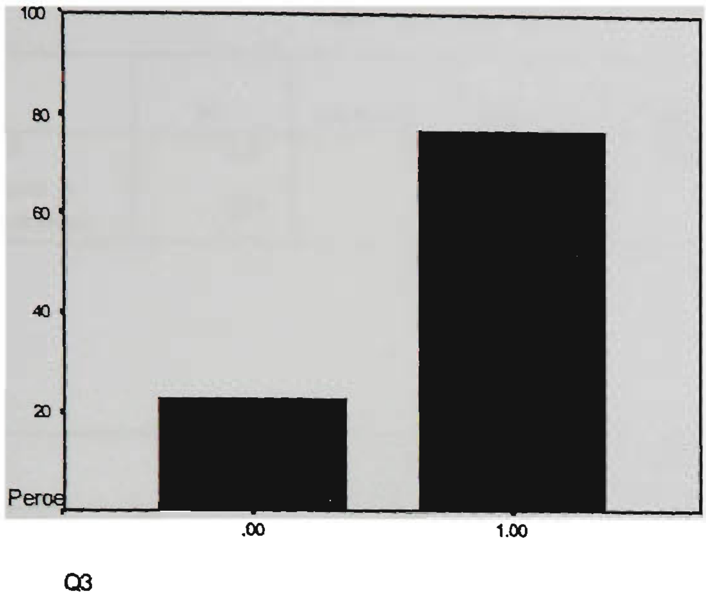
**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| Q3 | 293 | 0 |

**Q3**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 67 | 22.9 | 22.9 | 22.9 |
| | 1.00 | 226 | 77.1 | 77.1 | 100.0 |
| | Total | 293 | 100.0 | 100.0 | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=Not full time; 1.00=Full time**




## Q4. Private or public practicing GP?

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| Q4 | 282 | 11 |

**Q4**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 267 | 91.1 | 94.7 | 94.7 |
| | 2.00 | 15 | 5.1 | 5.3 | 100.0 |
| | Total | 282 | 96.2 | 100.0 | |
| Missing | System Missing | 11 | 3.8 | | |
| | Total | 11 | 3.8 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=Private; 2.00=Public**

## Q5. Number of GPs in your Practice?

**Statistics**

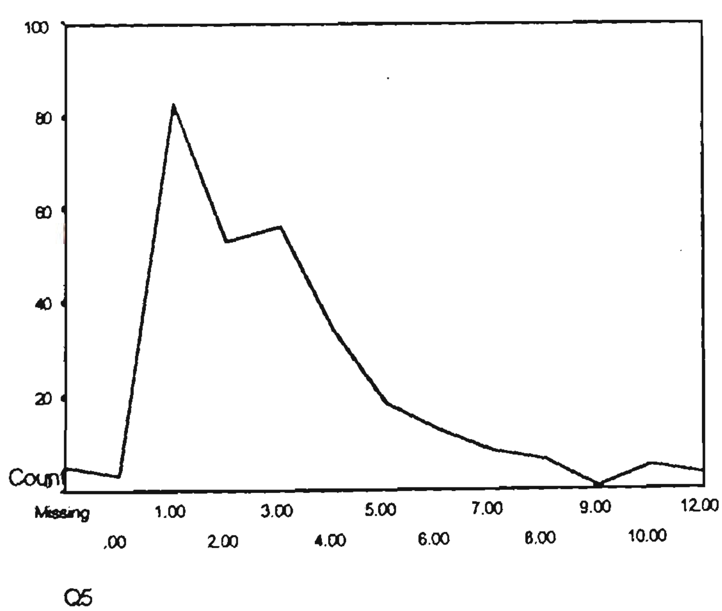
| | N | |
|---|---|---|
| | Valid | Missing |
| Q5 | 287 | 6 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Q5 | 287 | .00 | 12.00 | 3.1010 | 2.3115 |
| Valid N (listwise) | 287 | | | | |

**Q5**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 3 | 1.0 | 1.0 | 1.0 |
| | 1.00 | 83 | 28.3 | 28.9 | 30.0 |
| | 2.00 | 53 | 18.1 | 18.5 | 48.4 |
| | 3.00 | 56 | 19.1 | 19.5 | 67.9 |
| | 4.00 | 34 | 11.6 | 11.8 | 79.8 |
| | 5.00 | 19 | 6.5 | 6.6 | 86.4 |
| | 6.00 | 13 | 4.4 | 4.5 | 90.9 |
| | 7.00 | 9 | 3.1 | 3.1 | 94.1 |
| | 8.00 | 7 | 2.4 | 2.4 | 96.5 |
| | 9.00 | 1 | .3 | .3 | 96.9 |
| | 10.00 | 6 | 2.0 | 2.1 | 99.0 |
| | 12.00 | 3 | 1.0 | 1.0 | 100.0 |
| | Total | 287 | 98.0 | 100.0 | |
| Missing | System Missing | 6 | 2.0 | | |
| | Total | 6 | 2.0 | | |
| Total | | 293 | 100.0 | | |



## Q6. Number of staff employed by practice?

**Statistics**

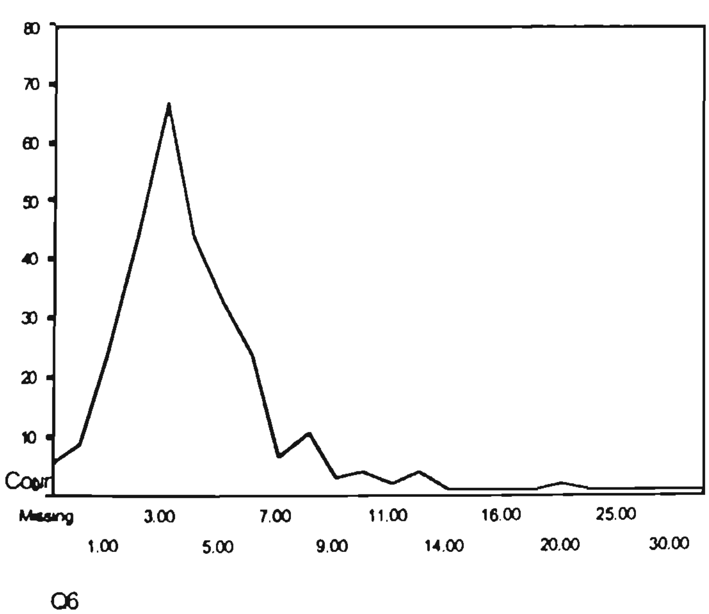
| | N | |
|---|---|---|
| | Valid | Missing |
| Q6 | 287 | 6 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Q6 | 287 | .00 | 40.00 | 4.5958 | 4.4975 |
| Valid N (listwise) | 287 | | | | |

Q6

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 9 | 3.1 | 3.1 | 3.1 |
| | 1.00 | 24 | 8.2 | 8.4 | 11.5 |
| | 2.00 | 44 | 15.0 | 15.3 | 26.8 |
| | 3.00 | 67 | 22.9 | 23.3 | 50.2 |
| | 4.00 | 44 | 15.0 | 15.3 | 65.5 |
| | 5.00 | 33 | 11.3 | 11.5 | 77.0 |
| | 6.00 | 24 | 8.2 | 8.4 | 85.4 |
| | 7.00 | 7 | 2.4 | 2.4 | 87.8 |
| | 8.00 | 11 | 3.8 | 3.8 | 91.6 |
| | 9.00 | 3 | 1.0 | 1.0 | 92.7 |
| | 10.00 | 4 | 1.4 | 1.4 | 94.1 |
| | 11.00 | 2 | .7 | .7 | 94.8 |
| | 12.00 | 4 | 1.4 | 1.4 | 96.2 |
| | 14.00 | 1 | .3 | .3 | 96.5 |
| | 15.00 | 1 | .3 | .3 | 96.9 |
| | 16.00 | 1 | .3 | .3 | 97.2 |
| | 17.00 | 1 | .3 | .3 | 97.6 |
| | 20.00 | 2 | .7 | .7 | 98.3 |
| | 24.00 | 1 | .3 | .3 | 98.6 |
| | 25.00 | 1 | .3 | .3 | 99.0 |
| | 26.00 | 1 | .3 | .3 | 99.3 |
| | 30.00 | 1 | .3 | .3 | 99.7 |
| | 40.00 | 1 | .3 | .3 | 100.0 |
| | Total | 287 | 98.0 | 100.0 | |
| Missing | System Missing | 6 | 2.0 | | |
| | Total | 6 | 2.0 | | |
| Total | | 293 | 100.0 | | |



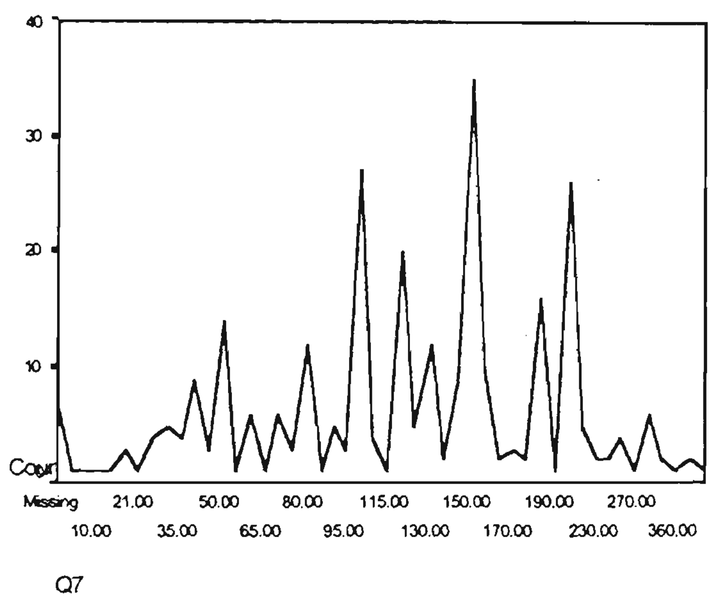
## Q7. How many patients do you see a week (approximation)?

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| Q7 | 286 | 7 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Q7 | 286 | .00 | 500.00 | 132.0035 | 73.4320 |
| Valid N (listwise) | 286 | | | | |



Q7

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 1 | .3 | .3 | .3 |
| | 8.00 | 1 | .3 | .3 | .7 |
| | 10.00 | 1 | .3 | .3 | 1.0 |
| | 15.00 | 1 | .3 | .3 | 1.4 |
| | 20.00 | 3 | 1.0 | 1.0 | 2.4 |
| | 21.00 | 1 | .3 | .3 | 2.8 |
| | 25.00 | 4 | 1.4 | 1.4 | 4.2 |
| | 30.00 | 5 | 1.7 | 1.7 | 5.9 |
| | 35.00 | 4 | 1.4 | 1.4 | 7.3 |
| | 40.00 | 9 | 3.1 | 3.1 | 10.5 |
| | 45.00 | 3 | 1.0 | 1.0 | 11.5 |
| | 50.00 | 14 | 4.8 | 4.9 | 16.4 |
| | 54.00 | 1 | .3 | .3 | 16.8 |
| | 60.00 | 6 | 2.0 | 2.1 | 18.9 |
| | 65.00 | 1 | .3 | .3 | 19.2 |
| | 70.00 | 6 | 2.0 | 2.1 | 21.3 |
| | 75.00 | 3 | 1.0 | 1.0 | 22.4 |
| | 80.00 | 12 | 4.1 | 4.2 | 26.6 |
| | 85.00 | 1 | .3 | .3 | 26.9 |
| | 90.00 | 5 | 1.7 | 1.7 | 28.7 |
| | 95.00 | 3 | 1.0 | 1.0 | 29.7 |
| | 100.00 | 27 | 9.2 | 9.4 | 39.2 |
| | 110.00 | 4 | 1.4 | 1.4 | 40.6 |
| | 115.00 | 1 | .3 | .3 | 40.9 |
| | 120.00 | 20 | 6.8 | 7.0 | 47.9 |
| | 125.00 | 5 | 1.7 | 1.7 | 49.7 |
| | 130.00 | 12 | 4.1 | 4.2 | 53.8 |
| | 135.00 | 2 | .7 | .7 | 54.5 |
| | 140.00 | 9 | 3.1 | 3.1 | 57.7 |
| | 150.00 | 35 | 11.9 | 12.2 | 69.9 |
| | 160.00 | 10 | 3.4 | 3.5 | 73.4 |
| | 165.00 | 2 | .7 | .7 | 74.1 |
| | 170.00 | 3 | 1.0 | 1.0 | 75.2 |
| | 175.00 | 2 | .7 | .7 | 75.9 |
| | 180.00 | 16 | 5.5 | 5.6 | 81.5 |
| | 190.00 | 1 | .3 | .3 | 81.8 |
| | 200.00 | 26 | 8.9 | 9.1 | 90.9 |
| | 220.00 | 5 | 1.7 | 1.7 | 92.7 |
| | 230.00 | 2 | .7 | .7 | 93.4 |
| | 240.00 | 2 | .7 | .7 | 94.1 |
| | 250.00 | 4 | 1.4 | 1.4 | 95.5 |
| | 270.00 | 1 | .3 | .3 | 95.8 |
| | 300.00 | 6 | 2.0 | 2.1 | 97.9 |
| | 350.00 | 2 | .7 | .7 | 98.6 |
| | 360.00 | 1 | .3 | .3 | 99.0 |
| | 400.00 | 2 | .7 | .7 | 99.7 |
| | 500.00 | 1 | .3 | .3 | 100.0 |
| | Total | 286 | 97.6 | 100.0 | |
| Missing | System Missing | 7 | 2.4 | | |
| | Total | 7 | 2.4 | | |
| Total | | 293 | 100.0 | | |

## SECTION 2. EDUCATIONAL TRAINING AND SUPPORT

### Q8. University attended?

### Q9. Finishing date of university education (19XX)?

**Statistics**

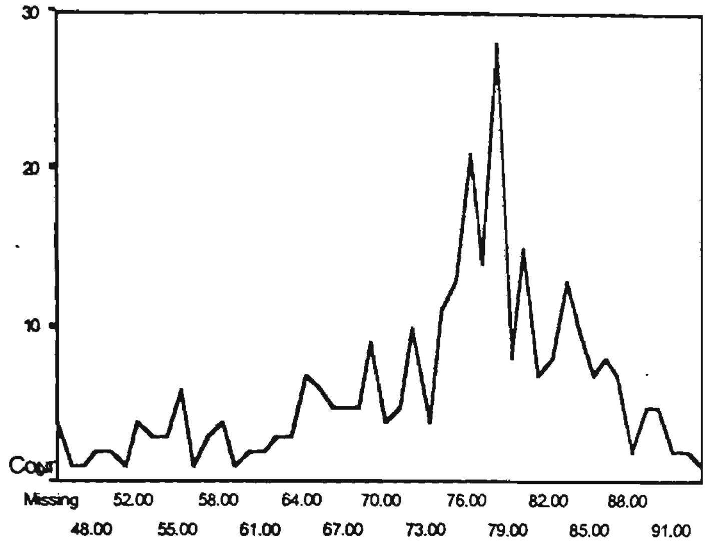
| | N | |
|---|---|---|
| | Valid | Missing |
| Q9 | 289 | 4 |

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Q9 | 289 | 39.00 | 94.00 | 74.3356 | 10.1903 |
| Valid N (listwise) | 289 | | | | |

**Q9**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 39.00 | 1 | .3 | .3 | .3 |
| | 46.00 | 1 | .3 | .3 | .7 |
| | 48.00 | 2 | .7 | .7 | 1.4 |
| | 50.00 | 2 | .7 | .7 | 2.1 |
| | 51.00 | 1 | .3 | .3 | 2.4 |
| | 52.00 | 4 | 1.4 | 1.4 | 3.8 |
| | 53.00 | 3 | 1.0 | 1.0 | 4.8 |
| | 54.00 | 3 | 1.0 | 1.0 | 5.9 |
| | 55.00 | 6 | 2.0 | 2.1 | 8.0 |
| | 56.00 | 1 | .3 | .3 | 8.3 |
| | 57.00 | 3 | 1.0 | 1.0 | 9.3 |
| | 58.00 | 4 | 1.4 | 1.4 | 10.7 |
| | 59.00 | 1 | .3 | .3 | 11.1 |
| | 60.00 | 2 | .7 | .7 | 11.8 |
| | 61.00 | 2 | .7 | .7 | 12.5 |
| | 62.00 | 3 | 1.0 | 1.0 | 13.5 |
| | 63.00 | 3 | 1.0 | 1.0 | 14.5 |
| | 64.00 | 7 | 2.4 | 2.4 | 17.0 |
| | 65.00 | 6 | 2.0 | 2.1 | 19.0 |
| | 66.00 | 5 | 1.7 | 1.7 | 20.8 |
| | 67.00 | 5 | 1.7 | 1.7 | 22.5 |
| | 68.00 | 5 | 1.7 | 1.7 | 24.2 |
| | 69.00 | 9 | 3.1 | 3.1 | 27.3 |
| | 70.00 | 4 | 1.4 | 1.4 | 28.7 |
| | 71.00 | 5 | 1.7 | 1.7 | 30.4 |
| | 72.00 | 10 | 3.4 | 3.5 | 33.9 |
| | 73.00 | 4 | 1.4 | 1.4 | 35.3 |
| | 74.00 | 11 | 3.8 | 3.8 | 39.1 |
| | 75.00 | 13 | 4.4 | 4.5 | 43.6 |
| | 76.00 | 21 | 7.2 | 7.3 | 50.9 |
| | 77.00 | 14 | 4.8 | 4.8 | 55.7 |
| | 78.00 | 28 | 9.6 | 9.7 | 65.4 |
| | 79.00 | 8 | 2.7 | 2.8 | 68.2 |
| | 80.00 | 15 | 5.1 | 5.2 | 73.4 |
| | 81.00 | 7 | 2.4 | 2.4 | 75.8 |
| | 82.00 | 8 | 2.7 | 2.8 | 78.5 |
| | 83.00 | 13 | 4.4 | 4.5 | 83.0 |
| | 84.00 | 10 | 3.4 | 3.5 | 86.5 |
| | 85.00 | 7 | 2.4 | 2.4 | 88.9 |
| | 86.00 | 8 | 2.7 | 2.8 | 91.7 |
| | 87.00 | 7 | 2.4 | 2.4 | 94.1 |
| | 88.00 | 2 | .7 | .7 | 94.8 |
| | 89.00 | 5 | 1.7 | 1.7 | 96.5 |
| | 90.00 | 5 | 1.7 | 1.7 | 98.3 |
| | 91.00 | 2 | .7 | .7 | 99.0 |
| | 93.00 | 2 | .7 | .7 | 99.7 |
| | 94.00 | 1 | .3 | .3 | 100.0 |
| | Total | 289 | 98.6 | 100.0 | |
| Missing | System Missing | 4 | 1.4 | | |
| | Total | 4 | 1.4 | | |
| Total | | 293 | 100.0 | | |



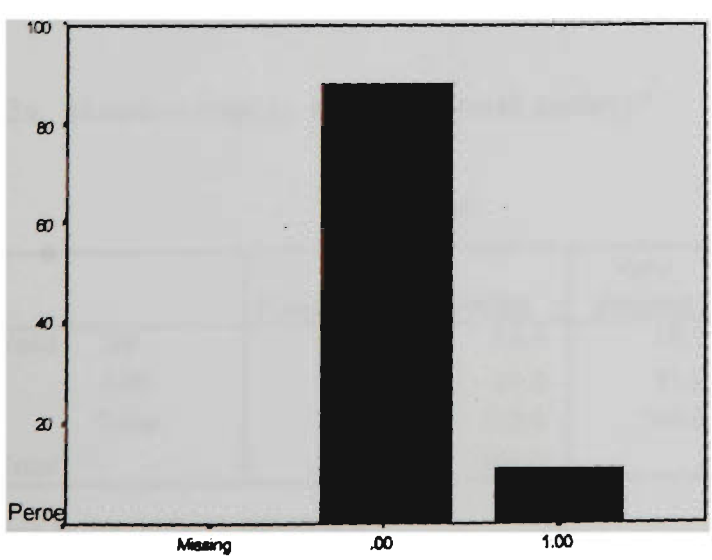

Q9

**Q10. Did you make use of a computer while at university?**

Q10

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 259 | 88.4 | 88.7 | 88.7 |
| | 1.00 | 33 | 11.3 | 11.3 | 100.0 |
| | Total | 292 | 99.7 | 100.0 | |
| Missing | System Missing | 1 | .3 | | |
| | Total | 1 | .3 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**



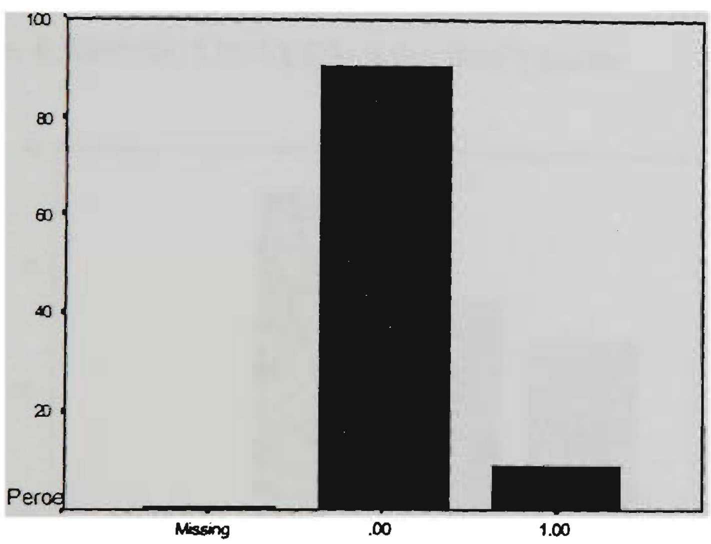

Q10

**Q11. Did you have to take any computer related subjects as part of your university medical education?**

**Q11**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 265 | 90.4 | 91.1 | 91.1 |
| | 1.00 | 26 | 8.9 | 8.9 | 100.0 |
| | Total | 291 | 99.3 | 100.0 | |
| Missing | System Missing | 2 | .7 | | |
| | Total | 2 | .7 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**




Q11

**Q12a. Membership in a professional society?**

**Q12A**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 53 | 18.1 | 18.1 | 18.1 |
| | 1.00 | 240 | 81.9 | 81.9 | 100.0 |
| | Total | 293 | 100.0 | 100.0 | |
| Total | | 293 | 100.0 | | |

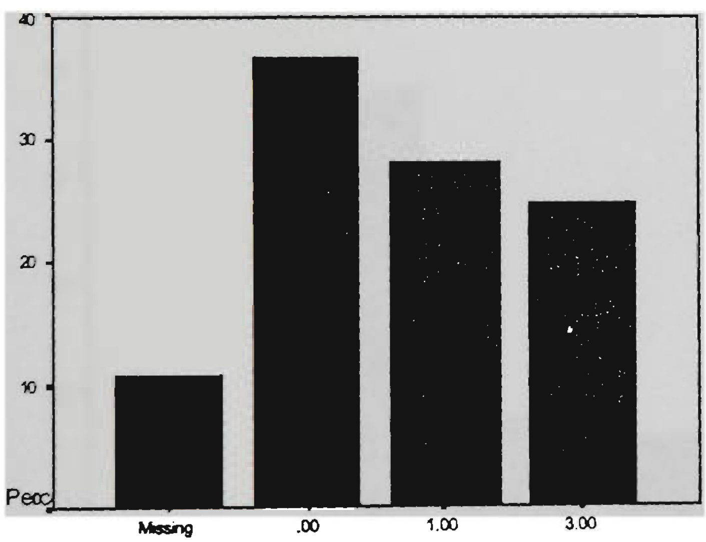
**Note: 0.00=NO; 1.00=YES**

**Q12b. Does the organisation in Q12a provide for on going training and education in the use of computers?**

**Q12B**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 107 | 36.5 | 41.0 | 41.0 |
| | 1.00 | 82 | 28.0 | 31.4 | 72.4 |
| | 3.00 | 72 | 24.6 | 27.6 | 100.0 |
| | Total | 261 | 89.1 | 100.0 | |
| Missing | System Missing | 32 | 10.9 | | |
| | Total | 32 | 10.9 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES; 3.00=don't know**



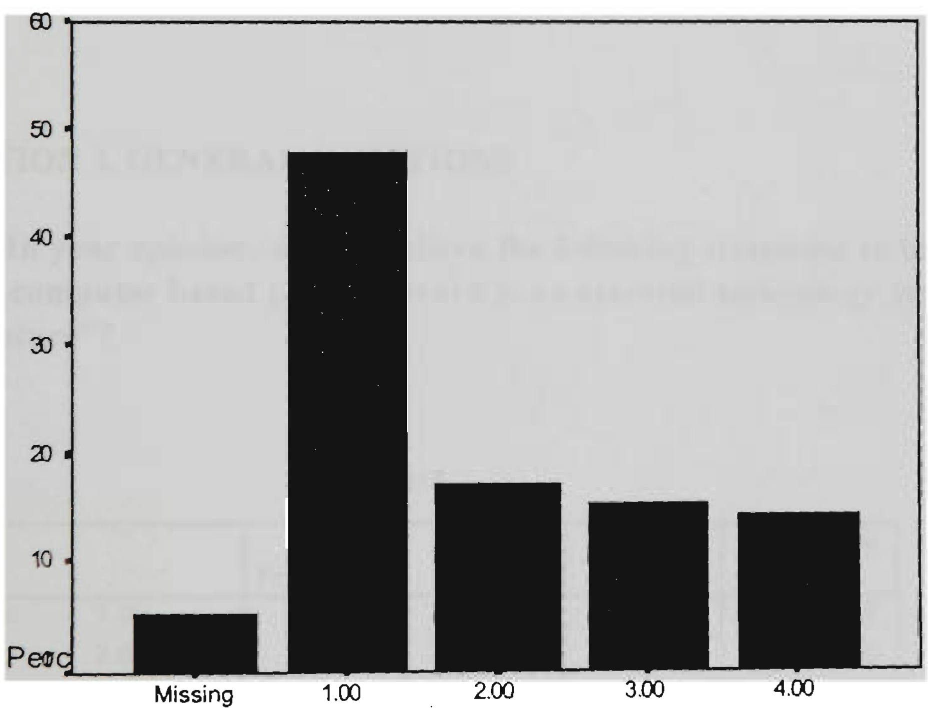

Q12B

**Q13. Most common way of keeping up to date about computer and technological developments?**

Q13

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 140 | 47.8 | 50.5 | 50.5 |
| | 2.00 | 50 | 17.1 | 18.1 | 68.6 |
| | 3.00 | 45 | 15.4 | 16.2 | 84.8 |
| | 4.00 | 42 | 14.3 | 15.2 | 100.0 |
| | Total | 277 | 94.5 | 100.0 | |
| Missing | System Missing | 16 | 5.5 | | |
| | Total | 16 | 5.5 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=Journals; 2.00=Colleagues; 3.00=Functions/Conferences; 4.00=Other**




Q13

**Q14. In your opinion, do you consider technophobia to be a wide problem among GPs in Australia?**

**Q14**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 142 | 48.5 | 50.4 | 50.4 |
| | 1.00 | 140 | 47.8 | 49.6 | 100.0 |
| | Total | 282 | 96.2 | 100.0 | |
| Missing | System Missing | 11 | 3.8 | | |
| | Total | 11 | 3.8 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

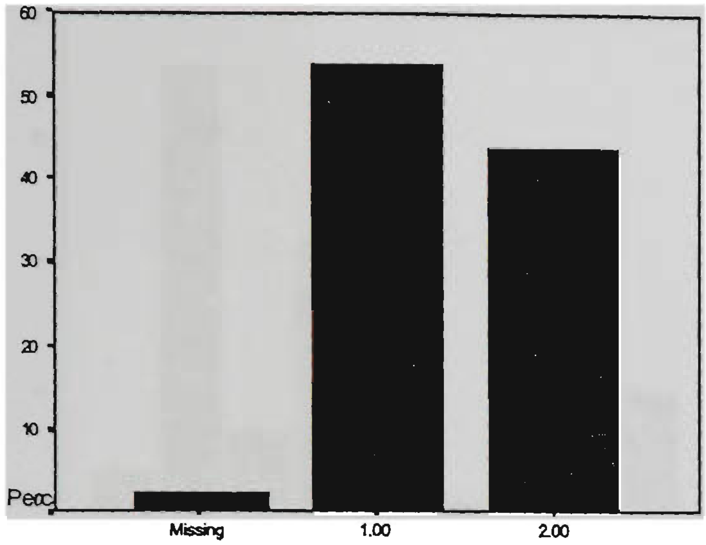
## SECTION 3. GENERAL QUESTIONS

**Q15. In your opinion, do you believe the following statement to be true or false, "The computer based patient record is an essential technology for health care in the future"?**

**Q15**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 158 | 53.9 | 55.2 | 55.2 |
| | 2.00 | 128 | 43.7 | 44.8 | 100.0 |
| | Total | 286 | 97.6 | 100.0 | |
| Missing | System Missing | 7 | 2.4 | | |
| | Total | 7 | 2.4 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=TRUE; 2.00=FALSE**



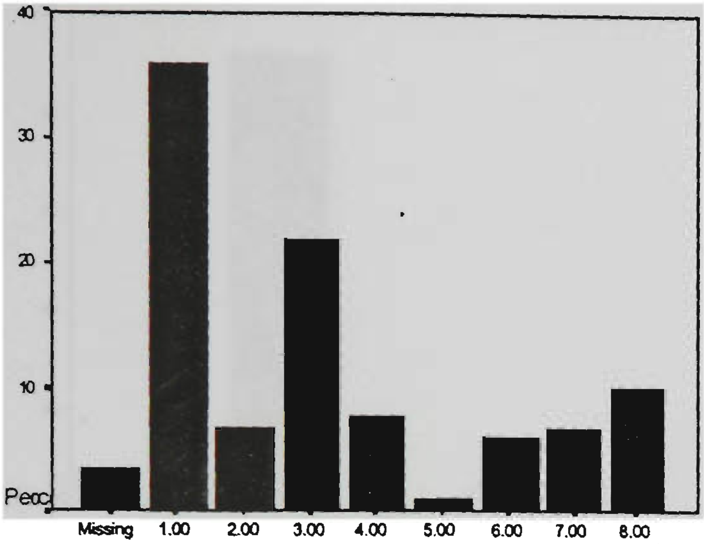

Q15

**Q16. Main barrier to the implementation of CMRs in General Practice?**

**Q16**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 105 | 35.8 | 37.1 | 37.1 |
| | 2.00 | 20 | 6.8 | 7.1 | 44.2 |
| | 3.00 | 64 | 21.8 | 22.6 | 66.8 |
| | 4.00 | 23 | 7.8 | 8.1 | 74.9 |
| | 5.00 | 3 | 1.0 | 1.1 | 76.0 |
| | 6.00 | 18 | 6.1 | 6.4 | 82.3 |
| | 7.00 | 20 | 6.8 | 7.1 | 89.4 |
| | 8.00 | 30 | 10.2 | 10.6 | 100.0 |
| | Total | 283 | 96.6 | 100.0 | |
| Missing | System Missing | 10 | 3.4 | | |
| | Total | 10 | 3.4 | | |
| Total | | 293 | 100.0 | | |

**Note: Key**
**1.00=financial outlay**
**2.00=technophobia**
**3.00=lack of computer literacy among GPs**
**4.00=computers not being user friendly to GPs**
**5.00=lack of policy vision and Government help**
**6.00=privacy/security concerns**
**7.00=lack of a CMR software standard**
**8.00=other**




Q16

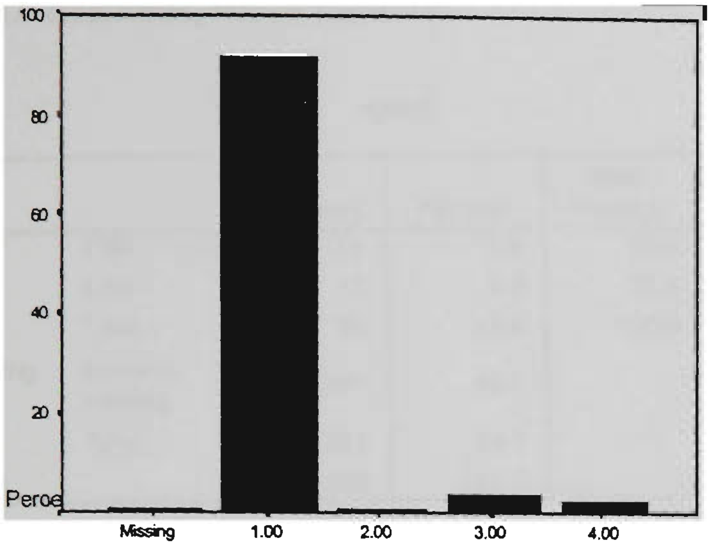
**Q17. Overcoming barriers?**

**Q18. How do you presently manage patient records?**

Q18

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 269 | 91.8 | 92.4 | 92.4 |
| | 2.00 | 2 | .7 | .7 | 93.1 |
| | 3.00 | 12 | 4.1 | 4.1 | 97.3 |
| | 4.00 | 8 | 2.7 | 2.7 | 100.0 |
| | Total | 291 | 99.3 | 100.0 | |
| Missing | System Missing | 2 | .7 | | |
| | Total | 2 | .7 | | |
| Total | | 293 | 100.0 | | |

**Note: Key**
**1.00=manually (hand written notes)**
**2.00=type write (via dictaphone)**
**3.00=electronically by computer**
**4.00=all of the above**




Q18

**Q19. Do you keep backup copies of patient records?**

**Q19A**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 226 | 77.1 | 81.0 | 81.0 |
| | 1.00 | 53 | 18.1 | 19.0 | 100.0 |
| | Total | 279 | 95.2 | 100.0 | |
| Missing | System Missing | 14 | 4.8 | | |
| | Total | 14 | 4.8 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

**Q19b. IF YES, what form?**

**19B**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 30 | 10.2 | 53.6 | 53.6 |
| | 2.00 | 26 | 8.9 | 46.4 | 100.0 |
| | Total | 56 | 19.1 | 100.0 | |
| Missing | System Missing | 237 | 80.9 | | |
| | Total | 237 | 80.9 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=paper; 2.00=electronic**

**Q19c. IF electronic, which medium?**

**Q19C**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 21 | 7.2 | 65.6 | 65.6 |
| | 2.00 | 11 | 3.8 | 34.4 | 100.0 |
| | Total | 32 | 10.9 | 100.0 | |
| Missing | System Missing | 261 | 89.1 | | |
| | Total | 261 | 89.1 | | |
| Total | | 293 | 100.0 | | |

**Notes: 1.00=hardisk; 2.00=tape**

**Q19D. Do you have a disaster recovery plan or policy?**

**Q19D**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 158 | 53.9 | 89.8 | 89.8 |
| | 1.00 | 18 | 6.1 | 10.2 | 100.0 |
| | Total | 176 | 60.1 | 100.0 | |
| Missing | System Missing | 117 | 39.9 | | |
| | Total | 117 | 39.9 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

**Q20. Employee confidentiality contract?**

**Q20**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 199 | 67.9 | 72.1 | 72.1 |
| | 1.00 | 77 | 26.3 | 27.9 | 100.0 |
| | Total | 276 | 94.2 | 100.0 | |
| Missing | System Missing | 17 | 5.8 | | |
| | Total | 17 | 5.8 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

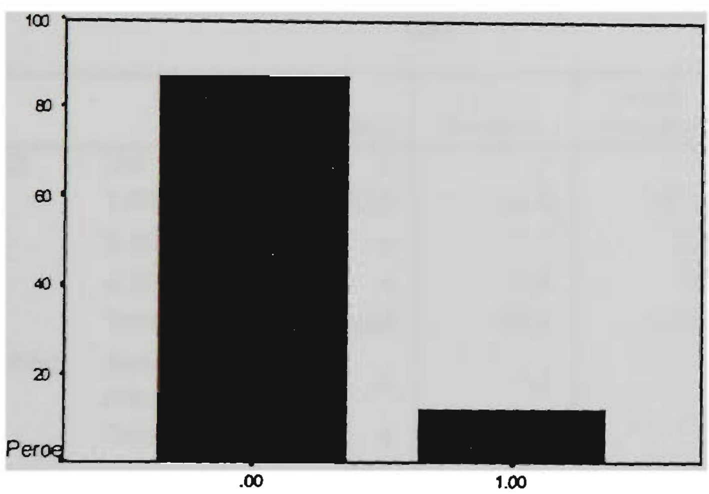
**Q21. Has the Government or County Council provided any incentives for change in helping to proliferate CMRs among GPs?**

**Q21**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 242 | 82.6 | 87.7 | 87.7 |
| | 1.00 | 34 | 11.6 | 12.3 | 100.0 |
| | Total | 276 | 94.2 | 100.0 | |
| Missing | System Missing | 17 | 5.8 | | |
| | Total | 17 | 5.8 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

Bar Chart




Q21

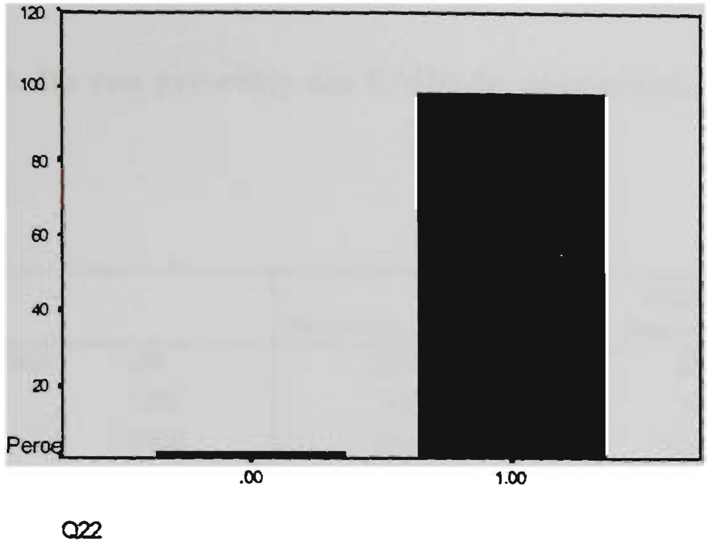
**Q22. Do you consider yourself responsible for the accuracy of patient information held in your records?**

**Q22**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 6 | 2.0 | 2.1 | 2.1 |
| | 1.00 | 286 | 97.6 | 97.9 | 100.0 |
| | Total | 292 | 99.7 | 100.0 | |
| Missing | System Missing | 1 | .3 | | |
| | Total | 1 | .3 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

Bar Chart



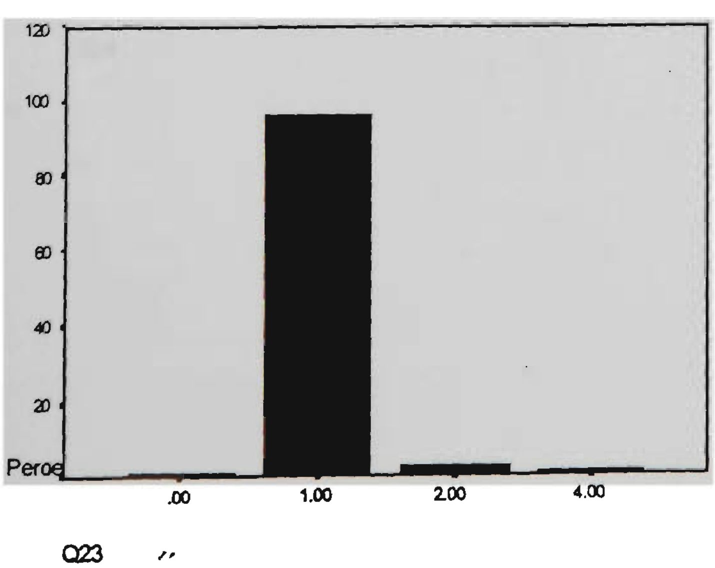

**Q23. Who owns patient information?**

Q23

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 2 | .7 | .7 | .7 |
| | 1.00 | 275 | 93.9 | 95.2 | 95.8 |
| | 2.00 | 8 | 2.7 | 2.8 | 98.6 |
| | 4.00 | 4 | 1.4 | 1.4 | 100.0 |
| | Total | 289 | 98.6 | 100.0 | |
| Missing | System Missing | 4 | 1.4 | | |
| | Total | 4 | 1.4 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=no one; 1.00=doctor; 2.00=patient; 3.00=government; 4.00=other**

Bar Chart



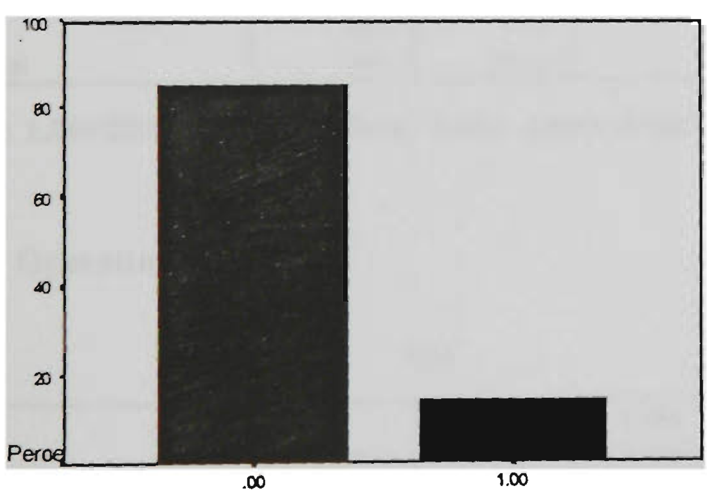
## Q24. Do you presently use CMRs in your practice?

Q24

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 250 | 85.3 | 85.6 | 85.6 |
| | 1.00 | 42 | 14.3 | 14.4 | 100.0 |
| | Total | 292 | 99.7 | 100.0 | |
| Missing | System Missing | 1 | .3 | | |
| | Total | 1 | .3 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

Bar Chart




Q24

## SECTION 4. COMPUTERISED RESPONDENTS ONLY

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| Q25 | 52 | 241 |
| Q26 | 51 | 242 |
| Q27 | 50 | 243 |

## Q25. Hardware platform used?

**Q25**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 46 | 15.7 | 88.5 | 88.5 |
| | 2.00 | 4 | 1.4 | 7.7 | 96.2 |
| | 3.00 | 2 | .7 | 3.8 | 100.0 |
| | Total | 52 | 17.7 | 100.0 | |
| Missing | System Missing | 241 | 82.3 | | |
| | Total | 241 | 82.3 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=IBM or Compatible; 2.00= Apple Macintosh; 3.00=other**

## Q26. Operating system?

**Q26**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 41 | 14.0 | 80.4 | 80.4 |
| | 2.00 | 3 | 1.0 | 5.9 | 86.3 |
| | 3.00 | 4 | 1.4 | 7.8 | 94.1 |
| | 4.00 | 3 | 1.0 | 5.9 | 100.0 |
| | Total | 51 | 17.4 | 100.0 | |
| Missing | System Missing | 242 | 82.6 | | |
| | Total | 242 | 82.6 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=DOS/Windows; 2.00=UNIX; 3.00=Mactinosh; 4.00=other**

**Q27. Computer configuration?**

**Q27**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 25 | 8.5 | 50.0 | 50.0 |
| | 2.00 | 25 | 8.5 | 50.0 | 100.0 |
| | Total | 50 | 17.1 | 100.0 | |
| Missing | System Missing | 243 | 82.9 | | |
| | Total | 243 | 82.9 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00= single user standalone; 2.00= multi user network**

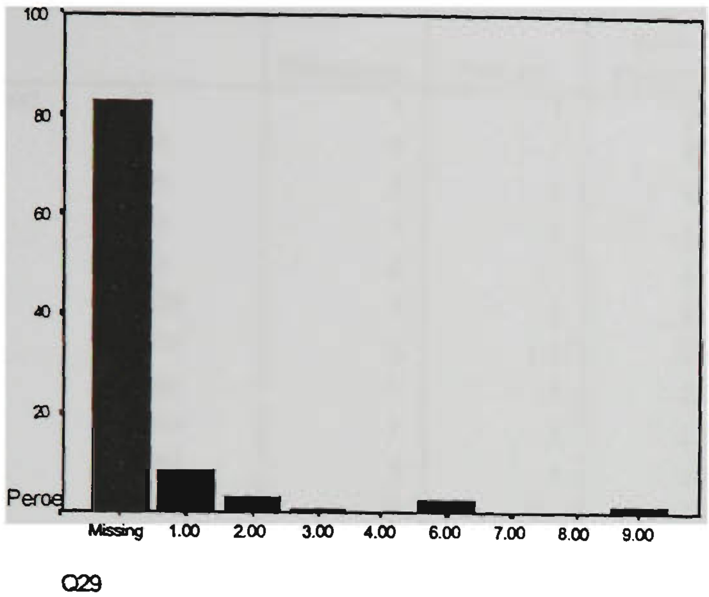
**Q28. Reasons for computerisation?**

**Q29. Main use of computer(s)?**

**Q29**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 24 | 8.2 | 48.0 | 48.0 |
| | 2.00 | 9 | 3.1 | 18.0 | 66.0 |
| | 3.00 | 2 | .7 | 4.0 | 70.0 |
| | 4.00 | 1 | .3 | 2.0 | 72.0 |
| | 6.00 | 8 | 2.7 | 16.0 | 88.0 |
| | 7.00 | 1 | .3 | 2.0 | 90.0 |
| | 8.00 | 1 | .3 | 2.0 | 92.0 |
| | 9.00 | 4 | 1.4 | 8.0 | 100.0 |
| | Total | 50 | 17.1 | 100.0 | |
| Missing | System Missing | 243 | 82.9 | | |
| | Total | 243 | 82.9 | | |
| Total | | 293 | 100.0 | | |

**Note: Key**
**1.00=accounts/billing**
**2.00=wordprocessing**
**3.00=recall of patients for prevention checks**
**4.00=statistics**
**5.00=appointments**
**6.00=patient health/medical records**
**7.00=literature searches**
**8.00=electronic mail**
**9.00=other**




**Q30. CMR software used?**

**Q31. Reason for choice of software?**

**Q32. Use of a coding scheme for patient diseases (e.g ICD-10, Read Codes)?**

Q32

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 39 | 13.3 | 81.3 | 81.3 |
| | 1.00 | 9 | 3.1 | 18.8 | 100.0 |
| | Total | 48 | 16.4 | 100.0 | |
| Missing | System Missing | 245 | 83.6 | | |
| | Total | 245 | 83.6 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

**Q33. How long have you been using CMRs (months)?**

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Q33 | 45 | .00 | 147.00 | 43.6667 | 40.9245 |
| Valid N (listwise) | 45 | | | | |

**Q33**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 1 | .3 | 2.2 | 2.2 |
| | 2.00 | 2 | .7 | 4.4 | 6.7 |
| | 3.00 | 2 | .7 | 4.4 | 11.1 |
| | 4.00 | 1 | .3 | 2.2 | 13.3 |
| | 6.00 | 2 | .7 | 4.4 | 17.8 |
| | 10.00 | 1 | .3 | 2.2 | 20.0 |
| | 12.00 | 3 | 1.0 | 6.7 | 26.7 |
| | 15.00 | 1 | .3 | 2.2 | 28.9 |
| | 18.00 | 1 | .3 | 2.2 | 31.1 |
| | 20.00 | 1 | .3 | 2.2 | 33.3 |
| | 24.00 | 8 | 2.7 | 17.8 | 51.1 |
| | 28.00 | 1 | .3 | 2.2 | 53.3 |
| | 36.00 | 5 | 1.7 | 11.1 | 64.4 |
| | 39.00 | 1 | .3 | 2.2 | 66.7 |
| | 40.00 | 1 | .3 | 2.2 | 68.9 |
| | 48.00 | 1 | .3 | 2.2 | 71.1 |
| | 60.00 | 1 | .3 | 2.2 | 73.3 |
| | 72.00 | 1 | .3 | 2.2 | 75.6 |
| | 84.00 | 2 | .7 | 4.4 | 80.0 |
| | 96.00 | 5 | 1.7 | 11.1 | 91.1 |
| | 120.00 | 1 | .3 | 2.2 | 93.3 |
| | 122.00 | 1 | .3 | 2.2 | 95.6 |
| | 144.00 | 1 | .3 | 2.2 | 97.8 |
| | 147.00 | 1 | .3 | 2.2 | 100.0 |
| | Total | 45 | 15.4 | 100.0 | |
| Missing | System Missing | 248 | 84.6 | | |
| | Total | 248 | 84.6 | | |
| Total | | 293 | 100.0 | | |

## Q34-Q40.

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| Q34 | 44 | 249 |
| Q35 | 44 | 249 |
| Q36 | 39 | 254 |
| Q38 | 36 | 257 |
| Q39 | 41 | 252 |
| Q40 | 42 | 251 |

Q34. Have CMRs improved the way you work?

Q34

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 8 | 2.7 | 18.2 | 18.2 |
| | 1.00 | 36 | 12.3 | 81.8 | 100.0 |
| | Total | 44 | 15.0 | 100.0 | |
| Missing | System Missing | 249 | 85.0 | | |
| | Total | 249 | 85.0 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

Q35. Do you follow any specific ethical code of practice, law or guidelines as to how you should handle patient information when using CMRs?

Q35

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 33 | 11.3 | 75.0 | 75.0 |
| | 1.00 | 11 | 3.8 | 25.0 | 100.0 |
| | Total | 44 | 15.0 | 100.0 | |
| Missing | System Missing | 249 | 85.0 | | |
| | Total | 249 | 85.0 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

Q36. What methods of information/computer protection do you use against unauthorised access to patient information?

Q36

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 34 | 11.6 | 89.5 | 89.5 |
| | 2.00 | 4 | 1.4 | 10.5 | 100.0 |
| | Total | 38 | 13.0 | 100.0 | |
| Missing | System Missing | 255 | 87.0 | | |
| | Total | 255 | 87.0 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=password; 2.00=other**

Q37. Who decides on access rights to patient information in your practice?

**Q38. Do staff/employees have access to all of a patients CMR or just certain views?**

Q38

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 20 | 6.8 | 55.6 | 55.6 |
| | 2.00 | 16 | 5.5 | 44.4 | 100.0 |
| | Total | 36 | 12.3 | 100.0 | |
| Missing | System Missing | 257 | 87.7 | | |
| | Total | 257 | 87.7 | | |
| Total | | 293 | 100.0 | | |

**Note: 1.00=All; 2.00=Certain views**

**Q39. Is the database patient information encrypted in any way?**

Q39

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 30 | 10.2 | 73.2 | 73.2 |
| | 1.00 | 11 | 3.8 | 26.8 | 100.0 |
| | Total | 41 | 14.0 | 100.0 | |
| Missing | System Missing | 252 | 86.0 | | |
| | Total | 252 | 86.0 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00= YES**

**Q40. Are there any outside communication lines to the patient database?**

Q40

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 32 | 10.9 | 76.2 | 76.2 |
| | 1.00 | 10 | 3.4 | 23.8 | 100.0 |
| | Total | 42 | 14.3 | 100.0 | |
| Missing | System Missing | 251 | 85.7 | | |
| | Total | 251 | 85.7 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

## SECTION 5. NON COMPUTERISED RESPONDENTS ONLY

### Q41-Q47.

**Statistics**

| | N | |
|---|---|---|
| | Valid | Missing |
| Q41 | 259 | 34 |
| Q42 | 268 | 25 |
| Q43 | 246 | 47 |
| Q45 | 259 | 34 |
| Q47 | 258 | 35 |

### Q41. Do you think CMRs will improve the way GPs work?

**Q41**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 95 | 32.4 | 36.7 | 36.7 |
| | 1.00 | 164 | 56.0 | 63.3 | 100.0 |
| | Total | 259 | 88.4 | 100.0 | |
| Missing | System Missing | 34 | 11.6 | | |
| | Total | 34 | 11.6 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

### Q42. Does your practice presently have a problem managing patient health records?

**Q42**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 175 | 59.7 | 65.3 | 65.3 |
| | 1.00 | 93 | 31.7 | 34.7 | 100.0 |
| | Total | 268 | 91.5 | 100.0 | |
| Missing | System Missing | 25 | 8.5 | | |
| | Total | 25 | 8.5 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

Q43. Do you plan to have a CMR system within the next 3 years?

**Q43**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 164 | 56.0 | 66.7 | 66.7 |
| | 1.00 | 82 | 28.0 | 33.3 | 100.0 |
| | Total | 246 | 84.0 | 100.0 | |
| Missing | System Missing | 47 | 16.0 | | |
| | Total | 47 | 16.0 | | |
| Total | | 293 | 100.0 | | |

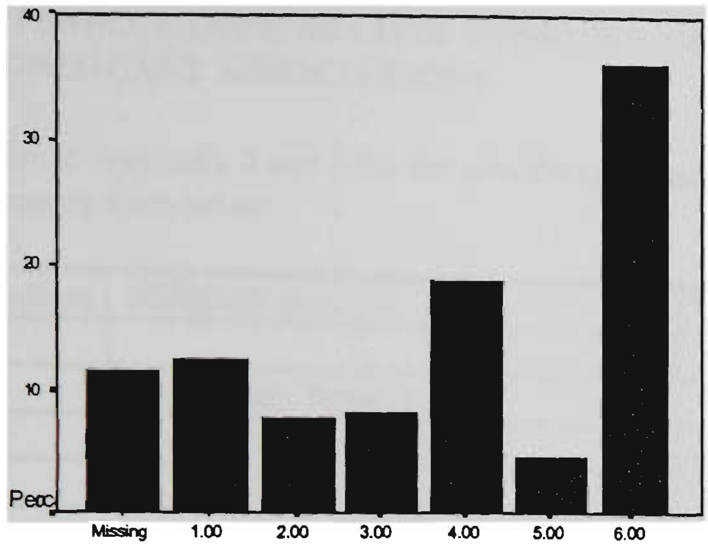
Note: 0.00=NO; 1.00=YES

Q44. Where does the CMR rank among your information system priorities?

**Q44**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 1.00 | 37 | 12.6 | 14.3 | 14.3 |
| | 2.00 | 23 | 7.8 | 8.9 | 23.2 |
| | 3.00 | 24 | 8.2 | 9.3 | 32.4 |
| | 4.00 | 55 | 18.8 | 21.2 | 53.7 |
| | 5.00 | 14 | 4.8 | 5.4 | 59.1 |
| | 6.00 | 106 | 36.2 | 40.9 | 100.0 |
| | Total | 259 | 88.4 | 100.0 | |
| Missing | System Missing | 34 | 11.6 | | |
| | Total | 34 | 11.6 | | |
| Total | | 293 | 100.0 | | |

Note: Key
1.00=as number 1
2.00=as number 2
3.00=as number 3
4.00=top 5
5.00=top 10
6.00=does not rank




Q44

**Q45. Has your practice taken any steps towards implementing CMRs in the future?**

Q45

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 199 | 67.9 | 76.8 | 76.8 |
| | 1.00 | 60 | 20.5 | 23.2 | 100.0 |
| | Total | 259 | 88.4 | 100.0 | |
| Missing | System Missing | 34 | 11.6 | | |
| | Total | 34 | 11.6 | | |
| Total | | 293 | 100.0 | | |

**Note:0.00=NO; 1.00=YES**

**Q46. Biggest CMR challenge?**

**Q47. Preference for a specific CMR supplier?**

Q47

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | .00 | 237 | 80.9 | 91.9 | 91.9 |
| | 1.00 | 21 | 7.2 | 8.1 | 100.0 |
| | Total | 258 | 88.1 | 100.0 | |
| Missing | System Missing | 35 | 11.9 | | |
| | Total | 35 | 11.9 | | |
| Total | | 293 | 100.0 | | |

**Note: 0.00=NO; 1.00=YES**

## APPENDIX 6. COMPARATIVE OVERVIEW OF RESULTS AND SOME SIGNIFICANT ASSOCIATIONS

Refer to Appendix 2 and 3 for the specific questions asked, questions only appear in summary form below.

| Question | SWEDEN (n=298) | AUSTRALIA, NSW (n=293) |
|---|---|---|
| | | |
| Q1 | 60:40 (male: female) | 72:28 |
| Q2 | mean=46 years; s.d.=10.5 | mean=45 years; s.d.=5.6 |
| Q3 | 77:23 (full time: part time) | 77:23 |
| Q4 | 8:92 (private: public)<br>*3% missing | 95:5<br>*4% missing |
| Q5 | mean=5; s.d.=2 (No. of GPs) | mean=3; std=2 |
| Q6 | mean=18; s.d.=13 (No. of staff) | mean=5; s.d.=5 |
| Q7 | mean=63; s.d.=19 (No. of patients/week) | mean=132; s.d.=73 |
| | | |
| Q8 | Various universities attended | Various universities attended |
| Q9 | mean=1977; s.d.=6<br>(Uni finishing date) | mean=1974; s.d.=10 |
| Q10 | 4:96<br>(Computer use at Uni; use :non use) | 11:89 |
| Q11 | 93: 7 (computer subjects at uni NO: YES) | 91: 9 |
| Q12a | 91:9 (membership: non membership) | 82:18 |
| Q12b | 38:14: 48<br>(comp. training; NO:YES: don't know) *1% missing | 41:31:27<br>*11% missing |
| Q13 | 26:48:2:24<br>(Update; Journal: Coll.: Conf.: Other)<br>*19% missing | 51: 18: 16: 15<br>*6% missing |
| Q14 | 73:27 (techno; NO:YES)<br>*2% missing | 50:50<br>*4% missing |
| | | |
| Q15 | 80:20<br>(CMR an essential tech TRUE: FALSE) *1% missing | 55:45<br>*2% missing |
| Q16 | 1. Lack of a CMR software standard<br>2. lack of computer literacy among GPs | 1. Financial outlay<br>2. lack of comp. literacy among GPs |
| Q17 | Qualitative data | Qualitative data |
| Q18 | 95% (type written and electronic patient records) | 92% (hand written notes) |

| | | |
|---|---|---|
| Q19a | 81:19 (backup copies; YES:NO)<br>*5% missing | 19:81<br>*5% missing |
| Q19b | 73% electronic backup<br>*23% missing | 46% (n=26)<br>*81% missing |
| Q19c | 31:60:9 (HD: tape: both)<br>*45% missing | 66:34 (n=32)<br>*89% missing |
| Q19d | 91: 9 (recovery plan; NO:YES) *88% missing | 90:10 (n=176) *40% missing |
| Q20 | 60:40 (employee. conf. contract. NO:YES)<br>8% missing | 72:28 *6% missing |
| Q21 | 23: 77 (incentives NO:YES)<br>*6% missing | 88:12<br>*6% missing |
| Q22 | 1: 99 (accuracy NO: YES)<br>*2% missing | 2: 98<br>*1% missing |
| Q23 | 8:14:10:44:25<br>(ownership; NONE: D: P: G: O)<br>*11% missing | 1:95:3:1:0<br>*1% missing |
| Q24 | 28:72 (CMR use; NO: YES) | 85:14<br>*1% missing |
| | | |
| Q25 | 90:1: 9 (IBM/Com: MAC: other)<br>* 38% missing | 89:8:4<br>*82% missing |
| Q26 | 75:15:10<br>(DOS/Windows: UNIX: MAC:other)<br>*37% missing | 80:6:8:6<br>*83% missing |
| Q27 | 3:97 (single: multi user)<br>*30% missing | 50:50<br>*83% missing |
| Q28 | Qualitative data | Qualitative data |
| Q29 | (main use of computer(s))<br>1% statistics<br>6% appointments<br>93% CMRs<br>(*32% missing) | 48% accounts/billing<br>18% wordprocessing<br>4% patient recall<br>2% statistics<br>16% CMRs<br>2% lit searches<br>2% email<br>8% other |
| Q30 | Qualitative data | Qualitative data |
| Q31 | Qualitative data | Qualitative data |
| Q32 | 11.5: 88.5 (Codes NO: YES)<br>*30% missing | 81:19<br>*84% missing |
| Q33 | mean=25 months; s.d.=23 months (CMR use) | mean=44 months; s.d.=41 months |

| | | |
|---|---|---|
| Q34 | 26:69:6<br>(CMRs improve work NO:YES: Other)<br>*32% missing | 18:82<br>*85% missing |
| Q35 | 25:75 (Guidelines NO:YES)<br>*35% missing | 75:25<br>*85% missing |
| Q36 | 94: 6 (password: other)<br>*34% missing | 90:10<br>*87% missing |
| Q37 | Qualitative data | Qualitative data |
| Q38 | 77: 23 (ALL: certain views only)<br>*30% missing | 56: 44<br>*88% missing |
| Q39 | 67: 33 (Dbase encrypted NO: YES)<br>*48% missing | 73: 27<br>*86% missing |
| Q40 | 87: 13 (Outside comms NO: YES)<br>*34% missing | 76: 24<br>*86% missing |
| | | |
| Q41 | 28: 72<br>(CMRs will improve work NO:YES)<br>*75% missing | 37: 63<br>*12% missing |
| Q42 | 32: 68 (problems managing patient info NO: YES)<br>*73% missing | 65: 35<br>*9% missing |
| Q43 | 10:90 (CMR within 3 years NO: YES)<br>*74% missing | 67: 33<br>*16% missing |
| Q44 | (CMR priority ranking)<br>28% No 1<br>8% No 2<br>10% No 3<br>30% top 5<br>5% top 10<br>19% does not rank<br>(*74% missing) | 14% No 1<br>9% No 2<br>9% No 3<br>21% top 5<br>5% top 10<br>41% does not rank<br>(*12% missing) |
| Q45 | 35:65 (planning steps NO: YES)<br>*73% missing | 92: 8<br>*12% missing |
| Q46 | Qualitative data | Qualitative data |
| Q47a | 80: 20 (CMR preference NO: YES)<br>*75% missing | 92: 8<br>*12 % missing |

Notes:
s.d.= standard deviation

Some Significant Associations.

Note: Not all associations presented are significant but some weak associations were found, significance was accepted at the 5% level (p<0.05).

**SWEDEN**

# Crosstabs

## Q15 * Q24

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| B15A * B24 | 294 | 98.7% | 4 | 1.3% | 298 | 100.0% |

**B15A * B24 Crosstabulation**

| | | | B24 | | |
|---|---|---|---|---|---|
| | | | .00 | 1.00 | Total |
| B15A | 1.00 | Count | 59 | 177 | 236 |
| | | % within B15A | 25.0% | 75.0% | 100.0% |
| | | % within B24 | 71.1% | 83.9% | 80.3% |
| | | % of Total | 20.1% | 60.2% | 80.3% |
| | 2.00 | Count | 24 | 34 | 58 |
| | | % within B15A | 41.4% | 58.6% | 100.0% |
| | | % within B24 | 28.9% | 16.1% | 19.7% |
| | | % of Total | 8.2% | 11.6% | 19.7% |
| Total | | Count | 83 | 211 | 294 |
| | | % within B15A | 28.2% | 71.8% | 100.0% |
| | | % within B24 | 100.0% | 100.0% | 100.0% |
| | | % of Total | 28.2% | 71.8% | 100.0% |

**Chi-Square Tests[d]**

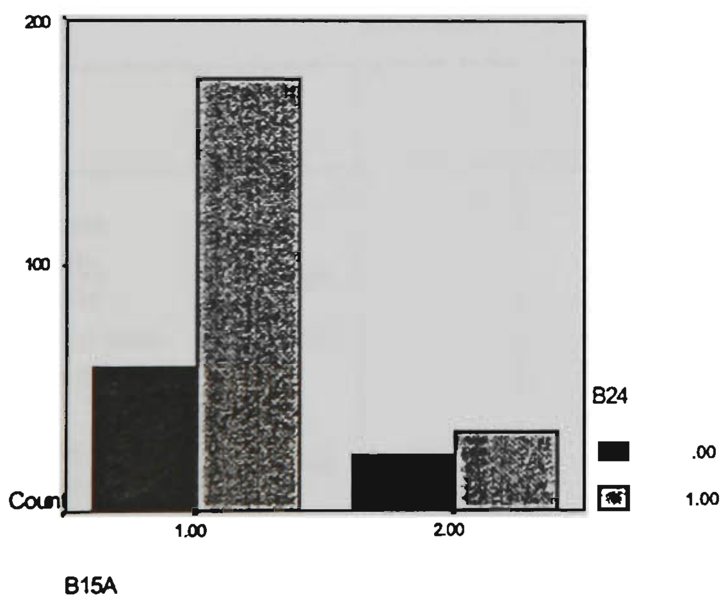
| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 6.165[b] | 1 | .013 | .015 | .012 |
| Continuity Correction[a] | 5.383 | 1 | .020 | | |
| Likelihood Ratio | 5.839 | 1 | .016 | .022 | .012 |
| Fisher's Exact Test | | | | .022 | .012 |
| Linear-by-Linear Association | 6.144 | 1 | .013 | .[c] | .[c] |
| N of Valid Cases | 294 | | | | |

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.37.

c. Cannot be computed because there is insufficient memory.

d. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.




# Crosstabs

## Q41 * Q43

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| B41 * B43 | 74 | 24.8% | 224 | 75.2% | 298 | 100.0% |

**B41 * B43 Crosstabulation**

| | | | B43 | | |
|---|---|---|---|---|---|
| | | | .00 | 1.00 | Total |
| B41 | .00 | Count | 5 | 14 | 19 |
| | | % within B41 | 26.3% | 73.7% | 100.0% |
| | | % within B43 | 71.4% | 20.9% | 25.7% |
| | | % of Total | 6.8% | 18.9% | 25.7% |
| | 1.00 | Count | 2 | 53 | 55 |
| | | % within B41 | 3.6% | 96.4% | 100.0% |
| | | % within B43 | 28.6% | 79.1% | 74.3% |
| | | % of Total | 2.7% | 71.6% | 74.3% |
| Total | | Count | 7 | 67 | 74 |
| | | % within B41 | 9.5% | 90.5% | 100.0% |
| | | % within B43 | 100.0% | 100.0% | 100.0% |
| | | % of Total | 9.5% | 90.5% | 100.0% |

**Chi-Square Tests**[d]

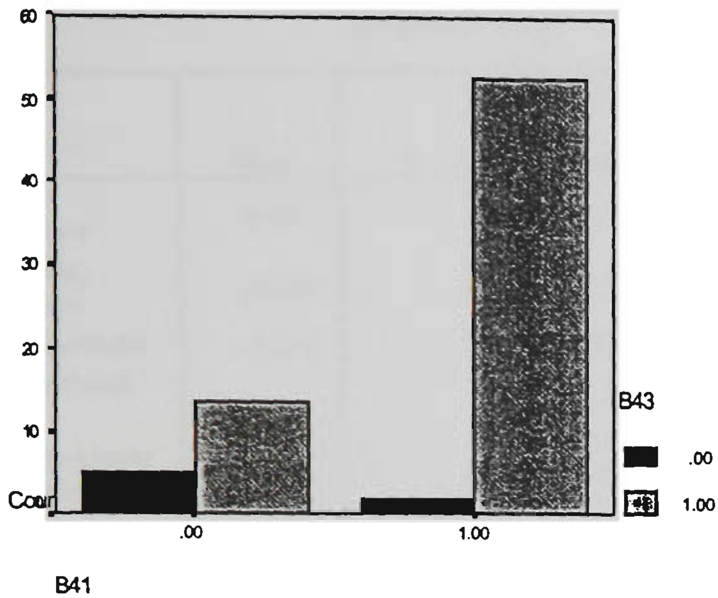
| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 8.481[b] | 1 | .004 | .010 | .010 |
| Continuity Correction[a] | 6.040 | 1 | .014 | | |
| Likelihood Ratio | 7.246 | 1 | .007 | .010 | .010 |
| Fisher's Exact Test | | | | .010 | .010 |
| Linear-by-Linear Association | 8.366 | 1 | .004 | .[c] | .[c] |
| N of Valid Cases | 74 | | | | |

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.80.

c. Cannot be computed because there is insufficient memory.

d. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.




# Crosstabs

## Q43 * Q45

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| B43 * B45A | 78 | 26.2% | 220 | 73.8% | 298 | 100.0% |

**B43 * B45A Crosstabulation**

| | | | B45A | | Total |
|---|---|---|---|---|---|
| | | | .00 | 1.00 | |
| B43 | .00 | Count | 6 | 2 | 8 |
| | | % within B43 | 75.0% | 25.0% | 100.0% |
| | | % within B45A | 23.1% | 3.8% | 10.3% |
| | | % of Total | 7.7% | 2.6% | 10.3% |
| | 1.00 | Count | 20 | 50 | 70 |
| | | % within B43 | 28.6% | 71.4% | 100.0% |
| | | % within B45A | 76.9% | 96.2% | 89.7% |
| | | % of Total | 25.6% | 64.1% | 89.7% |
| Total | | Count | 26 | 52 | 78 |
| | | % within B43 | 33.3% | 66.7% | 100.0% |
| | | % within B45A | 100.0% | 100.0% | 100.0% |
| | | % of Total | 33.3% | 66.7% | 100.0% |

**Chi-Square Tests**[d]

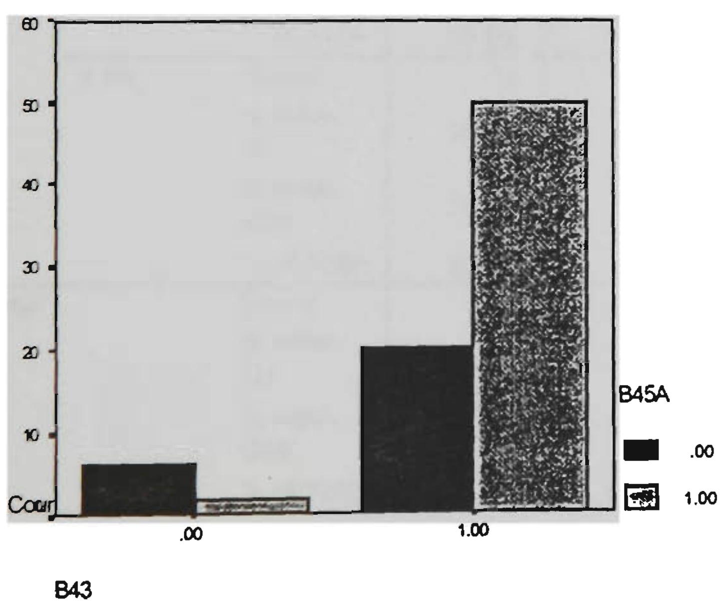
| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 6.964[b] | 1 | .008 | .015 | .015 |
| Continuity Correction[a] | 5.032 | 1 | .025 | | |
| Likelihood Ratio | 6.541 | 1 | .011 | .047 | .015 |
| Fisher's Exact Test | | | | .015 | .015 |
| Linear-by-Linear Association | 6.875 | 1 | .009 | .[c] | .[c] |
| N of Valid Cases | 78 | | | | |

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.67.

c. Cannot be computed because there is insufficient memory.

d. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.



AUSTRALIA

# Crosstabs

## Q1 * Q24

**Case Processing Summary**

| | Cases | | | | | |
|---|---|---|---|---|---|---|
| | Valid | | Missing | | Total | |
| | N | Percent | N | Percent | N | Percent |
| Q1 * Q24 | 292 | 99.7% | 1 | .3% | 293 | 100.0% |

**Q1 * Q24 Crosstabulation**

| | | | Q24 | | Total |
|---|---|---|---|---|---|
| | | | .00 | 1.00 | |
| Q1 | 1.00 | Count | 172 | 38 | 210 |
| | | % within Q1 | 81.9% | 18.1% | 100.0% |
| | | % within Q24 | 68.8% | 90.5% | 71.9% |
| | | % of Total | 58.9% | 13.0% | 71.9% |
| | 2.00 | Count | 78 | 4 | 82 |
| | | % within Q1 | 95.1% | 4.9% | 100.0% |
| | | % within Q24 | 31.2% | 9.5% | 28.1% |
| | | % of Total | 26.7% | 1.4% | 28.1% |
| Total | | Count | 250 | 42 | 292 |
| | | % within Q1 | 85.6% | 14.4% | 100.0% |
| | | % within Q24 | 100.0% | 100.0% | 100.0% |
| | | % of Total | 85.6% | 14.4% | 100.0% |

**Chi-Square Tests[d]**

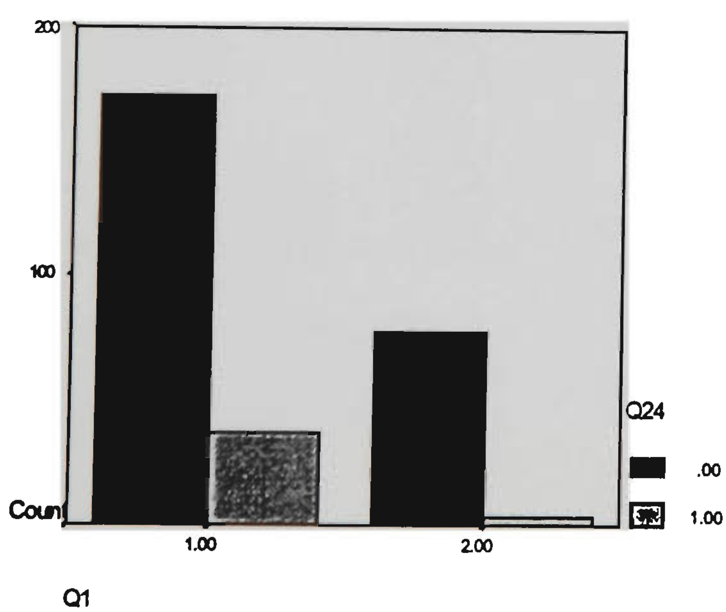
| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 8.366[b] | 1 | .004 | .005 | .002 |
| Continuity Correction[a] | 7.327 | 1 | .007 | | |
| Likelihood Ratio | 9.974 | 1 | .002 | .003 | .002 |
| Fisher's Exact Test | | | | .003 | .002 |
| Linear-by-Linear Association | 8.337 | 1 | .004 | .[c] | .[c] |
| N of Valid Cases | 292 | | | | |

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.79.

c. Cannot be computed because there is insufficient memory.

d. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.



# Crosstab

## Q15 * Q24

**Crosstab**

| | | | Q24 | | Total |
|---|---|---|---|---|---|
| | | | .00 | 1.00 | |
| Q15 | 1.00 | Count | 126 | 32 | 158 |
| | | % within Q15 | 79.7% | 20.3% | 100.0% |
| | | % within Q24 | 51.9% | 76.2% | 55.4% |
| | | % of Total | 44.2% | 11.2% | 55.4% |
| | 2.00 | Count | 117 | 10 | 127 |
| | | % within Q15 | 92.1% | 7.9% | 100.0% |
| | | % within Q24 | 48.1% | 23.8% | 44.6% |
| | | % of Total | 41.1% | 3.5% | 44.6% |
| Total | | Count | 243 | 42 | 285 |
| | | % within Q15 | 85.3% | 14.7% | 100.0% |
| | | % within Q24 | 100.0% | 100.0% | 100.0% |
| | | % of Total | 85.3% | 14.7% | 100.0% |

**Chi-Square Tests[d]**

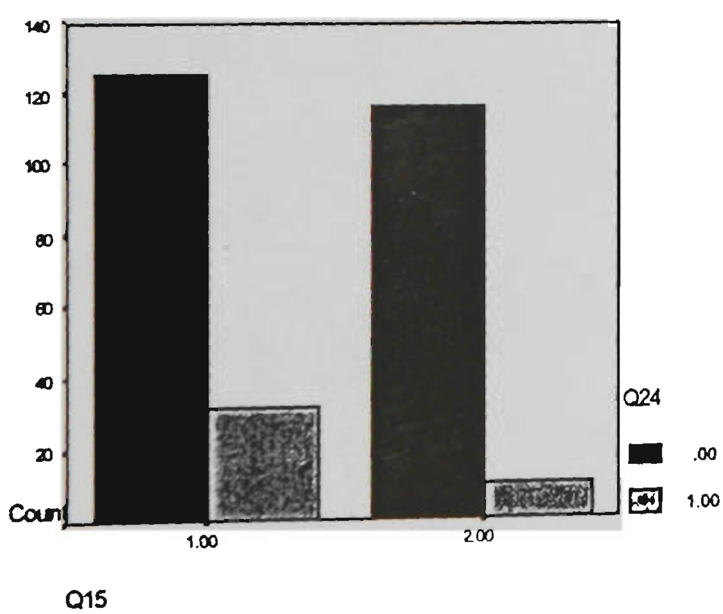
| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 8.587[b] | 1 | .003 | .004 | .002 |
| Continuity Correction[a] | 7.630 | 1 | .006 | | |
| Likelihood Ratio | 9.074 | 1 | .003 | .004 | .002 |
| Fisher's Exact Test | | | | .004 | .002 |
| Linear-by-Linear Association | 8.557 | 1 | .003 | .[c] | .[c] |
| N of Valid Cases | 285 | | | | |

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.72.

c. Cannot be computed because there is insufficient memory.

d. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.



## APPENDIX 7. LIST OF AUTHOR'S AWARDS AND PUBLICATIONS AND AWARDS (1994 -1998)

Awards

Silver medal for one of the best papers and presentations given by a young scientist. MEDINFO '98, Seoul, August 18 - 22, 1998. Details of the paper appear below.

Publications

Bomba D., (1998) A Comparative Study of Computerised Medical Records Usage Among General Practitioners in Australia and Sweden. In Cesnik, B., McCray, AT., Scherrer J. *MEDINFO '98*. Proceedings of the Ninth World Congress on Medical Informatics. Seoul. IOS Press. Amsterdam: 55-59.

Bomba D., (1998) Australian General Practitioners and Computerised Patient Records. *Informatics in Health Care Australia*, 7(1): 28-32.

Bomba DB. (1997) Australian General Practitioners and Computerised Patient Records. *Asia Pacific Association for Medical Informatics - Health Informatics Conference 97.* Conference Proceedings, Sydney.

Bomba D, Cooper J, Pettersson C. (1995) The Swedish Experience: Doctors and Electronic Patient Health Records (EPHRs). *HIC 95, Proceedings of the Health Informatics Conference*, Adelaide.

Bomba D., Cooper J., Miller M., (1995). Working Towards a National Health Information System in Australia. In Greenes et al. (Eds.) *MEDINFO' 95*. Proceedings. IMIA. p. 1633 [poster presentation]

Bomba D., Pacheko F., et al. (1995) Education Issues in Health Informatics. *Informatics in Health Care Australia*. July 4(3).

Bomba D., Morris S., Cooper J., et al. (1995) Australian Healthcare: A smart card for a clever country. *International Journal of Biomedical Computing*, 40: 101-105.

Bomba D., Cooper J., et al. (1994) IT and General Practitioners in Australia. *Proceedings of the Inaugural Conference of the Asia Pacific Association of Medical Informatics*, Singapore.

## APPENDIX 8. SUMMARY RESULTS OF THE STUDY OF GPS AND IT, CARRIED OUT BY AC NIELSEN (1998) FOR THE DEPARTMENT OF HEALTH AND FAMILY SERVICES, AUSTRALIA

Source: http://www.health.gov.au/pubs/gpit/index.htm

### A study into levels of, and attitudes towards information technology in general practice

General practitioners (GPs) in Australia are being encouraged to adopt electronic information systems to enhance clinical and practice management. Under the General Practice Strategy, which began in 1989, the Department of Health and Family Services funded a wide variety of relevant projects. A key goal of current policy is to ensure GPs have access to information resources and delivery systems needed to support clinical decisions based on best available evidence of efficacy and risk and/or a shared understanding of appropriate practice.

In late 1997, the Department offered funding for a survey of general practices to gauge current levels of the use of computers in general practice and to find out about the attitudes of GPs towards information technology. The aim was to obtain base-line data to inform future initiatives.

The research was carried out by AC Nielsen in October 1998. Volume one presents the quantitative research program: a screening survey; interviews with 108 GPs using computers for clinical tasks; and 109 interviews with GPs using computers for administrative tasks. Volume 2 presents the qualitative research program: 12 depth interviews with GPs using computers for clinical purposes; two groups and one mini group of GPs using computers for administrative purposes; 3 groups of GPs who were not using computers; and three depth interviews with key informants.

In summary, the quantitative research showed, in the screening survey, 31% of practices had computers. In general practices, a combination of administrative and clinical uses is common (74%). Nineteen per cent of practices are administrative users only; 7% are clinical users only. The most common administrative functions are patient registration, billing and financial management of practices. The most common clinical function is recall, with clinical notes the least common function. Fifteen per cent of doctors are clinical users. Seventy-nine per cent of practices have a facsimile machine and 19% have a modem.

The qualitative research showed clinical users consider computers offer benefits to doctors, patients and the government. Doctors are deemed to benefit via better information storage and retrieval, efficiency of storage space and time, more accurate records, improved drug management, improved legibility and presentation, better security and integration of clinical and administrative functions. Patients are seen to benefit from better prescribing, improved referrals (based on the patient summary) and access to computer-based patient education materials. The

government is believed to benefit from cost savings, control over doctors, control over 'doctor shoppers' and access to population health data. Doctors feel they have to move with the times, and this includes use of computers. Computers are seen to help manage the weight of information arriving in surgeries. Clinical users sense few adverse reactions from patients to use of a computer in the consultation. Problems with computerisation include: trauma of installation; lack of external support; lack of confidence in using computers; difficulty in achieving consensus in group practices; lack of government direction and support; a confusing purchase process; resistance from non-clinician staff; and a perceived unmet need for truly integrated software.

The reports should be of interest to researchers in the field of general practice, to GPs who are contemplating computerisation of their practices, to information technology professionals with a stake in general practice hardware and/or software and to policy makers.



Prepared by AC Nielsen Pty Ltd for General Practice Branch, Department of Health and Family Services, 23
February 1998.
URL: http://www.health.gov.au/pubs/gpit/index.htm

For further information contact Jenny Jefferson, email: jennifer.jefferson@health.gov.au

## APPENDIX 9. WEB REFERENCE SITES

Many developments are occurring in the area of flexible delivery and education. Already there exists numerous web sites for libraries, journals, virtual hospitals and CHR projects. Listed below are some useful web sites which were utilised in the course of this thesis work and which may also be of interest to other researchers, GPs and other allied health care professionals.

| Web Page Address<br>e.g. http:// | Description |
|---|---|
| www.nlm.nih.gov | National Library of Medicine, USA |
| www.nejw.org | New England Journal of Medicine |
| www.ama.assn.org/public/journals | Journal of the American Medical Association |
| www.rcgp.org.uk/publicat/journal/index.htm | The British Journal of General Practice |
| www.rcgp.org.uk/index2.htm | British Royal College of General Practitioners |
| www. bmj.com | British Medical Journal |
| www.thelancet.com | LANCET |
| www.nih.gov | American National Institute of Health |
| www.emrs.org/medweb | CHR web project |
| www.swedemedsoc.se | Swedish Medical Society |
| www.sos.se | Swedish Health Board |
| www.spri.se | Spri (Swedish Institute for Health Services Development) |
| www.kgab.se/mpn | Health miscellaneous |
| www.un.org | United Nations |
| www.who.int/whosis/ | WHO Statistics |
| www.who.int | World Health Organisation |
| www.lul.se | Landstinget (Swedish Administrative body at the County level responsible for health matters) |
| www.health.usyd.edu.au/chere | Health economics |
| www.medrecinst.com | Medical Records Institute |
| www.cpri.org/ | Computer-Based Patient Records Institute |
| www.hon.ch | Health/Medical informatics |
| www.ix.urz.uni.heidelberg.de | Health/Medical informatics |
| indigo.ie/~icgp/ | Health/Medical informatics |
| www.mihandbook.standford.edu | Medical Informatics Handbook |
| clinquery.bidmc.harvard.edu | Harvard Medical School |
| www.hum.auc.dk/i11 | Virtual Centre for Health Informatics |

| | |
|---|---|
| www.md.com.au | Medical Director Software |
| www.nceph.anu.au | National Centre for Epidemiology & Population Health |
| www.noie.gov.au | National Office for the Information Economy |
| www.health.gov/pubs/gpit/index | Department of Health & Family Services |
| www.pmrinc.com/ | Patient Medical Records Incorporated |
| www.emrs.org/medweb | A CHR project example |
| www.austlii.edu.au/do/sinodisp.pl/au/cases/cth/high_ct/unrep277.html?query=Breen%20Williams | Breen v. Williams, High Court Case |
| www.gp.org.au/ | Australian Divisions of General Practice |
| www.cundle.com.au/gen/gp/gp.html | Australian General Practice E-Mail Directory |
| hna.ffh.vic.gov.au/library/gp.html | HealthNet for General Practitioners Australia |
| www.nlm.nih.gov/pubs/cbm/confiden.html | Confidentiality of Electronic Health Data Bibliography |
| www.anu.edu.au/people/Roger.Clarke/DV/ACTHlthRecs.html | ACT to Legislate Access to Personal Health Records |
| www.comp.lancs.ac.uk/sociology/jlaw.html | Actor Network Resources |
| | |
| | |

Source: Compiled from Web searches and also from information contained in Sahlin, 1997.