Investigating the Adoption and Use of Information Technology by General Practitioners in Rural Australia and Why This is Less Than it Might Be

Patricia Everitt 1
Arthur Tatnall 2

1 School of Information Systems
2 Graduate School of Business
Victoria University
Melbourne, Australia

Abstract
Over a long period of time much research and development has been done on the use of Medical Information Technology, and many products have been developed for use by General Practitioners. However, despite this development effort, reluctance on behalf of GPs to use IT continue, particular with those GPs working in rural areas. This paper discusses adoption of IT by rural GPs and the methodological framework used in the research. It seeks to compare two theories of innovation that may assist in building a model of the socio-technical factors that act to enable, and to inhibit GPs’ uptake of technology.

Keywords
Information technology adoption, innovation diffusion, innovation translation, general practitioners, rural areas

INTRODUCTION
Continuing increases in health costs, complexity of health delivery and amount of medical information available to medical practitioners has increased the need for finding better ways of managing medical practice. Although hospitals are also experiencing these problems it is onto general practitioners (GP) that much of the information management burden falls. Many GPs are examining ways that information can be better managed, and various types of information management systems are becoming an important focus of their work. While one might expect that, being highly educated professionals, most GPs would be at the forefront of the information management revolution, our research shows that particularly in rural Australia this is not entirely the case.

The table below (Figure 1) represents the main uses for computers that were identified by a recent study of over 1200 GPs from across Australia (General Practice Computing Group 2001).

<table>
<thead>
<tr>
<th>Use of computers</th>
<th>Level of usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative functions</td>
<td>85%</td>
</tr>
<tr>
<td>Clinical functions</td>
<td>76%</td>
</tr>
<tr>
<td>Script writing</td>
<td>60%</td>
</tr>
<tr>
<td>General referral letters</td>
<td>57%</td>
</tr>
<tr>
<td>Receiving results electronically and running recall systems</td>
<td>57%</td>
</tr>
</tbody>
</table>

Figure 1: Types of use of Computers by GP in Australia

It appears that slow uptake has continued to some degree in all areas of general practice despite continued support and promotion of computer use. The Commonwealth Department of Health and Aged Care, along with the General Practice Computing Group (GPCG), also reports that general practitioners in Australia are still being encouraged, via their Divisions of General Practice, to adopt electronic information systems to enhance clinical and practice management. However Richards et al. (1999) note that “The adoption of computers by Australian general practitioners has been slow in comparison with other English speaking countries”.

It is clear that over a long period of time much research and development has been done on the use of medical Information Technology, and many products have been developed for GPs. Despite this however, reluctance on behalf of GPs to use IT continues and appears to becoming a fact of life for much of the profession. This paper discusses the current level of adoption and use of IT by GPs working in rural areas. It describes the research situation and the methodological framework used in the research, seeking to compare two theories of innovation adoption that may assist in building a model of the socio-technical factors that act to enable, and to inhibit GPs’ uptake and use of information.
It contrasts two approaches to technological innovation in researching the adoption and use of information technology by rural GPs in the hope that it may add to the body of knowledge which already exists both at a theoretical level, within the medical profession and by government. In regard to the theoretical approach being taken there has been search for a seamless design approach to research in IT for several decades, and often the methodology for IT research has been transferred from science. This has not always been successful as these approaches imply that the scientific method produces reliable knowledge because consistency, dependability, and regularity are the benchmarks for science. However according to Latour (1987) despite the fact the scientists aim to subscribe to morally and technically efficient methods that are impersonal and objective with results that are open to everyone, research seldom happens in this manner because science reacts to social pressures – just like any other ordinary and mundane system of action.

For over two decades GPs have been encouraged to use IT, but very little still is known about the exact way that GPs use IT and the reasons that they use it in the manner that they do. Research on how GPs use IT has concentrated on providing baseline data to inform about future initiatives and very little information exists about the actual process GPs pass through in decision-making about IT or about the barriers to use. The reported study is seeking to provide a means of classifying individual GPs according to various socio-technical factors that may represent their reasons for adoption or non-adoption of Information Technology. The GPCG study (2001) recommends increased training and technical support and, more importantly in relation to this research, increased research on the role of computers in the doctor-patient-computer triad. In investigating the socio-technical relationships between GPs and IT, this research addresses such concerns by a series of interviews and discussions within the Central Highlands Division of General Practice and the Bendigo Division of General Practice in Victoria. This material will be analysed using two methodological frameworks as described later.

BACKGROUND

The first computer policy for Australian GPs was developed in 1978 and related to the use of IT in generating medical record systems. Then in 1985 the Computer Assisted Practice Project was launched. Its principle objective was to study the effects of the introduction of computerised patient record systems. A National Computer Committee was formed in 1986 as an Advisory Board for this project. A computer fellow was appointed to oversee, guide and advise GPs in all matters relating to the use of IT. The Royal Australian College of General Practitioners (RACGP) soon also involved themselves, and in 1988 the second RACGP Standards for Computerised Medical Record Systems was released. In this document GPs expressed their views to the computing industry. In 1992 the Australian Medical Association (AMA), the RACGP and the Commonwealth Government negotiated a strategy for information management and technology. This strategy flagged this issue as a major one to be addressed.

Throughout the 1990s the pattern of support accelerated with quiet calls for evidence to show the results of all this input. Humphreys (1998) argued that some of the value of health services to rural communities may include: employment multipliers, psychological ‘security blanket’, and social justice. In short, general practitioner services may be seen by the community as something they must have, although reasons for that need are not strictly health-related. In a study commission by the Commonwealth Department of Health and Aged Care (1999) it was stated that: “Although is can be argued that the use of computers has contributed to the more effective management of information at population level, there is little direct evidence that the general use of computers improves efficiency at individual practice level”

Added is this, the use of IT by GPs reflects the patterns of use in small business (Burgess, Darbyshire, Sellitto, Tatnall and Wenn 2003) and it seems that if GPs do use IT then in many cases it is for perceived cost savings rather than for adding value (Burgess and Trethowan 2002).

Health Costs and Uptake of IT

Australia spends a figure equivalent to approximately 8.5% of gross domestic product on health services (DeLooper and Bhata 2001). In 1998-1999 this represented a figure of over $30 billion on health services. Even a small percentage saving in the cost of health services as a proportion of GDP can translate to huge monetary savings. The effective use of IT can potentially help to save lives that may otherwise be lost, improve delivery of medicines, lower the cost of public health and improve business efficiency (Krasner 2001; Moczygembe 2001; The Health Care Manager 2001).

One way that the Commonwealth Government has sought to organise general practitioners into groups, both to improve delivery and to control costs, is the creation of Divisions of General Practice.
Australian Divisions of General Practice

Australian Divisions of General Practice Ltd. (ADGP) is the peak national body representing 121 Divisions of General Practice across Australia. It was established in 1998 after a Commonwealth Government General Practice Strategy Review recommendation that it be funded as the national organisation of Divisions. The first local Divisions were established in 1992 and about 94% of GPs are now members of a local Division of General Practice. The objectives of ADGP are to:

- ensure that there is communication with Divisions of General Practice, directly or through State Based Organisations;
- represent Divisions of General Practice across Australia;
- be the voice of Divisions of General Practice to the Commonwealth of Australia;
- support Divisions of General Practice across Australia;
- advocate for Divisions of General Practice;
- inform the public about issues affecting General Practice;
- promote the exchange of skills, information and ideas between Divisions of General Practice.

ADGP is one of Australia’s largest representative voices for General Practitioners. As part of ADGP’s representation program, grass roots GPs sit on approximately 60 key decision-making bodies in the health sector, having direct input into general practice financing, GP workforce and training, clinical practice and practice management and other key issues influencing the future of General Practice.

ADGP also coordinates a number of national programs through Divisions of General Practice to improve the health of all Australians. ADGP’s programs cover a broad range of primary care issues including immunisation, youth health and practice nursing. These programs aim to strengthen primary health care to better meet the needs of the Australian community. Where appropriate ADGP works collaboratively with other organisations such as the Pharmacy Guild, to develop and coordinate a program. Many of the programs are overseen by committees made up of GPs from Divisions and other stakeholders such as academics, allied health professionals and consumers. ADGP also works closely with the State Based Organisations and Divisions in implementing national programs to ensure they meet the local needs of their communities.

Divisions of General Practice were established to deal with nationally identified issues including:

- erosion of the GPs’ position in the health care system,
- falling remuneration for GPs,
- GP isolation and frustration.

In addition to these issues of concern to Governments is the need to better manage the health care dollar. Divisions thus provide a network to address these issues at local, State and National levels. They also enable GPs to improve primary health care in the community and work with other health providers.

General Practice Divisions Victoria (GPDV) is the peak body for divisions of general practice in Victoria and clearly reflects the national agenda and history but with a state focus. As part of the Commonwealth Government’s General Practice reform agenda, GPDV seeks to empower GPs through divisions to improve the quality and organisation of general practice.

The on-going study reported in this paper investigates the adoption of IT by GPs in the Central Highlands Division of General Practice (CHDGP), and anchors this in relation to the overall Australian scene by reference to the neighbouring Bendigo Division of General Practice.

Central Highlands Division of General Practice (CHDGP)

CHDGP commenced formal operations in November 1993 and established its offices in January 1994. It is one of 123 such Divisions around Australia and is primarily funded by the Commonwealth Department of Health and Aged Care to link General Practitioners with each other and to link GPs with their communities to improve health outcomes. This Division’s operations are managed by a Board of Directors made up of six elected GPs. The Division operates as a company limited by guarantee.

Central Highlands Division of General Practice stretches from Melton, Bacchus Marsh and Sunbury up to Kyneton, Castlemaine and Daylesford and across to Kilmore, Seymour and Wallan. It includes the towns of Gisborne, Lancefield, Romsey, Woodend and Riddells Creek. There are 150 GPs practising in this Division, about thirty of whom are part-time. This division has a very active Information Technology/Information
Management (IT/IM) program providing support for a Medical Director and for a lighthouse IT/IM program. It provides Practice-Based Clinical Software Training for GPs and actively encourages the use of computers in General Practice.

**Bendigo Division of General Practice**

The Bendigo Division of General Practice was founded in October 1993 by a Commonwealth Grant and is registered as an Incorporated Association. It is governed by a Committee of Management of 5 and is managed by a full-time Chief Executive Officer and a full-time staff equivalent of 5.15. Bendigo Division has 35 practices and 98 GPs. It encompasses the City of Greater Bendigo area and its many hospitals and health-care facilities. Since its inception the Division has undertaken work in areas identified by members as ‘areas of need’. The Division has a long commitment to community education and to adolescents. As is the case with all divisions, Bendigo has an active support program for IT/IM in place for the use of practices.

**METHODOLOGICAL FRAMEWORK**

The most common approach to studies of the adoption of IT has been to use a diffusion model based on the work of Everitt Rogers (Rogers, Daley and Wu 1980; Rogers and Kincaid 1981; Rogers 1995). This involves what is essentially a stage approach that also relies on the characteristics and attributes of the innovation to affect the rate of its adoption. “In diffusion theory the existence of an innovation is seen to cause uncertainty in the minds of the potential adopters” (Rogers 1995). Rogers argues that potential adopters will seek to alleviate that situation and that this drives adoption (or non-adoption) decisions.

**Innovation Diffusion**

Traditionally innovation diffusion has been seen as the guiding light in explaining adoption of IT and has had a lot of success in describing how innovations travel through large populations and in the process are either adopted or rejected. According to Rogers (1995) this explanation proposes that how people perceive change is important. If the idea seems new to the potential adopter then it is considered to be an innovation. The prime concern using this approach to explanation is to identify the factors that affect the speed of the adoption.

Another tenet of this theory is that anything new causes uncertainty and so there is a lack of predicability. Therefore people will seek information to change that situation. Diffusion could be considered to be a process of information exchange aimed at reducing uncertainty. “The new ideas upon which an innovation is based are communicated over time, through various types of communication channels, among members of a social system. There are thus four main elements of any theory of innovation diffusion: characteristic of the innovation itself, the nature of the communication channels, the passage of time, and the social system through which the innovation diffuses” (Rogers 1995). Diffusion is considered to be an information exchange process amongst members of a communicating social network particularly concerned with the characteristics of the innovation. Rogers (1995) outlines five important characteristics which affect diffusion. These characteristics are:

- **Relative advantage** – the innovation appears to be better than what was previously available.
- **Compatibility** – it matches what people already know.
- **Complexity** – people can understand it.
- **Trialability** – something people can try in a limited way.
- **Observability** – potential adopters are able to see the results.

**Innovation Translation (from actor network theory)**

An alternative view has been suggested as more appropriate for the field of IT research because it has been suggested (Tatnall and Gilding 1999) that many complex social factors are involved in the interaction of society and technology and that any process of technological adoption in such an environment must inevitably involve a set of complex negotiations between all those involved. It was further argued that any adoption of IT would involve the product to be adopted being translated from the originally proposed form to a form suitable for actual use. Latour (1986; 1996) has suggested the core of this approach is translation “the means by which one entity gives a role to another” (Singleton and Michael 1993).

This suggests that innovation thought has become more process-oriented and is now viewed as incremental (evolutionary) depending far more on the accumulation of understanding about the system within which the technology itself is only a part. Thus innovation is seen as a result of the growth in our technological learning, organisational learning and social understanding. We argue that traditional theories, such as innovation diffusion (Rogers 1995), that seek to explain uptake of new ideas (in this case IT) are more applicable to large scale...
adoptions. It has also been suggested that these traditional theories do not go far enough in their explanation. Tatnall (2002) has also suggested that not all innovations are adopted for the ‘right’ reasons; the reasons that might be suggested by the innovation diffusion theory, or are changed in some way in the process of uptake. This explanation posits a process of translation and suggests it is not the properties of the innovation that propel it along in the adoption process but the networks that are formed to support its uptake.

Actor-network theorists suggest that a useful method of examining activity such as uptake of an innovation is for researchers not to view players in the scene as separate from the subject but to view them as part of a network. Uptake of innovation takes place within a network and Law (1994) writes that “actor-network theory (ANT) … tends to tell stories, stories that have to do with the processes of ordering that generate effects such as technologies, stories about how actor-networks elaborate themselves, and stories which erode the analytical status of the distinction between the macro and micro-social”.

Actors in networks can be human or non-human. Latour (1986) describes actors as any entity able to associate texts, humans, non-humans and money. In associating these entities there has to be some sort of ordering or drawing together; this is a political process and is continuous. It may result in many networks that overlap, but in explanation all actors are treated with equality. The success of adoption, according to this explanation, is in getting the actors to pull together in being able to stabilise the network by talk or by Machiavellian tactics. This will create a resilient network that should be self-sustaining. “This means that ANT does not distinguish between social or technological and sees properties as network effects rather than innate characteristics of an entity.” (Tatnall and Gilding 1999). Latour (1992) claims several advantages of this approach.

- respect to the actors and their individual differences,
- it allows for all entities,
- it pays respect to the outcomes,
- failures have the same explanations as successes so no hierarchy of dominance is produced,
- all links in the network are accounted for,
- when information is translated from one form to another it can still be credited to its origins.

Innovation diffusion and innovation translation are based on very different philosophies as Figure 2 below shows. It may be that they both have a part to play in explanation but we suspect that in the end actor-network theory will offer a deeper and more complex explanation of IT adoption by GPs.

<table>
<thead>
<tr>
<th>Innovation Diffusion</th>
<th>Innovation Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation</td>
<td>A technology perceived to be new by the potential adopter.</td>
</tr>
<tr>
<td>Communication</td>
<td>Communication channels can be categorised as cosmopolite or localised, and mass media or interpersonal. Innovations are transferred through these channels.</td>
</tr>
<tr>
<td>Time</td>
<td>Speed of decision to innovate, earliness of adoption and rate of adoption are important.</td>
</tr>
<tr>
<td>The social system</td>
<td>Homophily vs. Hetrophily. Sharing of interests of human actors.</td>
</tr>
<tr>
<td>The technology</td>
<td>Changes are made to the form and content of the technology as a result of experiences during implementation (re-invention).</td>
</tr>
<tr>
<td>Socio-technical stance</td>
<td>The social system and the technology are separate. Diffusion is the adoption of technology by a social system. Technology transfer requires the bringing together of social and technical elements.</td>
</tr>
</tbody>
</table>

Figure 2: Innovation diffusion versus innovation translation - adapted from McMaster et al. (1997)

ANT has been applied to information systems research because it is claimed that it allows a finer-grained analysis of information systems than other interpretive approaches that treat information systems as essentially similar (Monteiro & Hanseth 1996). It is thought that a theory of innovation in information technology should give an account of what is actually going on both politically and technically. This may be because a large percentage of computer-based information systems are generally acknowledged to provide less than satisfactory service to end-users and to fall short of their original objectives. ANT would seek to understand this situation at a very personal level and to examine the capacity of actors to negotiate and trade off within the network. Thus
according to Callon (1986) “Our object, then, is to trace the interconnection built up by technologists as they propose projects and then seek the resources required to bring these projects to fruition”.

ANT has been criticised as going too far down the line of flexibility, in other words one could go on and on exploring networks. The solution to this might be in restricting the networks by exploring, for example, political networks or economic networks (Underwood 1998). However Bijker, Hughes et al (1987) offer the notion of heterogeneous entities which raise the question of associations and of how strong or weak they are. By doing this networks can be used to describe shifting alliances of actors; so the network is not a fixed thing.

INFORMATION TECHNOLOGY/MANAGEMENT IN GENERAL PRACTICE

It is not possible to consider IT in General Practices without considering the role of the General Practice Computing Group (GPCG). The GPCG is the peak body for general practice computing - providing a strategic and co-operative approach to Australian GP informatics. Established by the profession in 1997 and funded by the Commonwealth Department of Health and Aging, the group focuses on the effective use of information management and technology for clinical and administrative purposes. It is sponsored by the Royal College of General Practitioners and is based in Canberra.

In General Practices information management focuses of the better management of information that can assist in promoting improved clinical, patient and practice outcomes. Information management in general practices can provide additional functionality that may be available and not being used such as:

- Electronic data availability and exchange (eg on-line pathology/radiology ordering and reporting).
- Patient information databases that include patient age, sex and disease; recall and reminder systems.
- Practice administration and management such as electronic staff rosters/pays, billing and claiming; stock ordering on-line; GST statements.
- Contribution to research activity such as adverse drug reporting; electronic contributions to approved clinical research activities.
- Electronic diagnosis and treatment support such as drug-drug interaction alerts; patient medication and clinical histories.

A situation analysis carried out by the GPCG (2002) suggests that Information Management in General Practice should focus on the better management of information that can assist in promoting improved clinical, patient and practice outcomes. The change management required to promote this agenda can be broken down into the following challenges:

- Insufficient information has been passed to stakeholders (Micro).
- Communications are not yet adequately coordinated (Micro).
- Specific messages are still being targeted for each audience (Micro).
- Little understanding of the impact of Information Management in General Practice on target groups. IM is seen to be driven by Information Technology rather than GP Business Needs (Macro).
- Modest buy-in and support from stakeholders (Macro).
- Opinion leaders need to communicate the benefits to key stakeholders (Macro).

But all of this assumes that the technology will be used by General Practitioners, hence this research project to identify and model IT adoption by rural GPs.

CONCLUSION

All the research and development that has been done on the use of Medical Information Technology and the many products that have been developed for use by General Practitioners are waste unless GPs make use of this technology. Several studies have identified a reluctance on behalf of GPs to use IT, and this is particular the case with those GPs working in rural areas. While a number of different groups, including the Commonwealth Government have acted to promote the use of IT by General Practitioners, this has not been entirely successful, which is a pity as IT has the potential both improve the quality of service and to reduce costs.

Research into the reasons for non-adoption of IT by rural GPs is thus important and this project seeks to identify reasons for this non-adoption. Innovation theories should play a part in any study of technological adoption, and this study compares two such theories: innovation diffusion and innovation translation. The ultimate aim of this
project is to develop a model that will enable the process of innovation, with particular reference to rural GPs, to be seen more clearly and better understood. This will then enable better implementation strategies to be devised.

REFERENCES


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