

Benefits of ICT adoption and use in regional general medical practices: a pilot study

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Abstract

This paper presents a pilot study of benefits derived from information and communications technology (ICT) adoption and use in medical practices in regional Australia. The study involved 122 regional medical practitioners. The results show that like the more general small business sector, the perception of certain benefits is associated with the size of the practice (in terms of employee levels) and/or the gender of the respondent practitioner. The data also showed that the level of skill of certain software used within the practice was significantly associated with the level of perceived benefit derived from ICT adoption and use.

Keywords (MeSH):

Information Systems; Information Management; Technology; Communication; Utilisation; General Practice

Introduction

The use of information and communications technology (ICT) in medical practices is by no means a new phenomenon (see for example Ammenwerth et al. 2003; Waring & Wainwright 2002; Shohet & Lavy 2004; Catalan 2004). A recent study of Australian general medical practitioners (Henderson, Britt & Miller 2006) showed that 89.9% of practices used a computer for billing and accounting, 85% of GPs indicated that they prescribed electronically, 73.8% ordered tests electronically, while only 29.5% of practices had fully automated their patient records. The study concluded that despite the physical presence of computers, many GPs were reluctant to fully embrace the technology.

While studies concerned with ICTs and GPs provide useful data on the use of these technologies in general practice, a closer examination shows that many have failed to examine their findings from the wider SME (small and medium sized enterprises) literature. Many of these 'wider' studies have shown that, amongst other things, business size, gender, and IT skills

are associated with the perception of benefits derived from ICT use.

This study has a twofold purpose. Firstly, it examines the perception of benefits derived from ICT adoption. Secondly, the study aims to determine whether the size of the practice, the number of patients treated, the gender of the practitioner or the level of computing skills of the practitioner are associated with the perception of benefits.

The paper begins by examining the nature of benefits derivable from ICT adoption and use, both from a general SME perspective as well as from a medical perspective. The paper then examines the findings of SME studies, particularly the role of business size, gender and computer skills in the perception of benefits derived from ICT adoption and use. This is followed by a study of 65 medical practitioners from two regional locations in NSW, Australia.

Benefits of ICT adoption (SMEs)

There have been many studies concerned with the benefits derived from ICT adoption. Some of these studies (MacGregor 2004) have shown that benefits are often intangible; that is, they are

often not realised by owner/managers at the time of adoption. The following section examines some of those findings.

Studies by Poon & Swatman (1997) and Abell & Lim (1996) found that SMEs benefited in their ability to reach new customers and new markets through the use of ICT. This finding has been supported in more recent studies (Vescovi 2000; Ritchie & Brindley 2000; Sparkes & Thomas 2001; Raymond 2001; Quayle 2002).

Earlier studies found that other benefits reported by SME operators included:

- lowering of administration costs (Poon & Swatman 1997; Abell & Lim 1996),
- reduced lead time (Abell & Lim 1996),
- increased sales (Abell & Lim 1996),
- improved relations with business partners (Poon & Swatman 1997)
- improved quality of information (Poon & Swatman 1997; Abell & Lim 1996).

A recent study by Quayle (2002) found that benefits derived from ICT use, as reported by SME owner/managers, included reduced administration costs, reduced production costs, reduced lead time, reduced stock, improved marketing and improved quality of information, while Tetteh and Burn (2001) found the adoption of ICTs substantially increased internal efficiency.

As noted previously, many of the benefits enjoyed by small businesses are intangible. Woerndl, Powell and Vidgen (2005) found that many small businesses involved in ICT use had expanded their activities beyond those performed prior to its adoption. Stockdale and Standing (2004) found that benefits included changes in business methods and costs, enhanced levels of communication, stimulated competition and reduced transaction costs. Hurwitz Group (2000) concluded that ICT adoption led to greater potential for partnerships, while Brunn, Jensen and Skovgaard (2002) showed that ICT use led to flexibility in administration and communication.

Benefits of ICT adoption (medical practices)

As noted above, the adoption and use of ICT within the healthcare sector is not entirely a new phenomenon. Studies of the National Health Service (NHS) in the UK by Gallagher (1998) noted that benefits included the ability to

undertake strategic planning and better manage the healthcare environment. Rees (1998), in a similar study, noted that the use of ICT appeared to enhance efficiency. Pullen, Atkinson and Tucker (2000) showed that costs were better managed using certain forms of ICTs. These studies are supported by the findings of Nelson and Alexander (2002). It is interesting to note, however, that despite the apparent benefits, the approach to the design of ICT inclusions has been questioned by several authors who noted that many fail to fully account for all the stakeholders of the enhanced system (Waring & Wainwright 2002; Shohet & Lavy 2004; Gelnay 2002).

Other benefits noted in the literature include:

- contacting other clinicians regarding patient care (Qavi, Corley & Kay 2001; Baldwin, Clarke & Jones 2002)
- elimination of redundancy in patient care (Pelletier-Fleury et al. 1999)
- enhancements to the effectiveness of the practice (Andersson, Vimarlund & Timpka 2002)
- control of economic demands (Prop 2000)
- improved patient care (Leung et al. 2003)
- order entry of consumables by the practice (Ash et al. 2004).

The impact of business size on the adoption and use of ICTs

Many studies have examined the impact of business characteristics in the adoption and use of ICTs. Several studies (Fallon & Moran 2000; Matlay 2000; Matlay & Fletcher 2000; Culkin & Smith 2000; Riquelme 2002) have found that the adoption of IT is significantly associated with business size (in terms of either the number of employees or turnover). Culkin and Smith (2000) suggest that larger SMEs are by nature inherently more complex and thus decisions concerning IT acquisition require more detailed examinations of the impact of IT. Larger SMEs tend to adopt more sophisticated systems and very often are more likely to 'computerise' far more of their business than smaller SMEs. Similarly, studies by Blackburn and Athayde (2000) and MacGregor and Vrazalic (2006) found significant links between the level of Internet adoption and the business size (defined in terms of the number of employees).

The impact of computer skills on the adoption and use of ICTs

The level of computer skill also appears to have an impact on the adoption and use of ICTs. Studies in Singapore (Yap, Soh & Raman 1992; Thong, Yap & Raman 1996) and Australia (MacGregor & Bunker 1996; MacGregor, Bunker & Waugh 1998) have shown that the level of IT skill within an SME is a strong determinant of the type of IT acquired as well as the ongoing success of that IT. More recently, studies in Australia and the UK (Tetteh & Burn 2001; O'Donnell et al. 2001) have concluded that successful ICT adoption is associated with the level of IT skill within the SME.

The impact of gender on the adoption and use of ICTs

Early studies (Gilroy & Desai 1986; Meier & Lambert 1991) found that males were less anxious about using computer technology than females. In later studies, both Shade (1998) and Sheehan (1999) found that females were more concerned with privacy and security issues and subsequently more cautious about using the Internet. Where the adoption and use of ICT is concerned, a study of 112 SMEs in Spain (Perez, Carnicer & Sanchez 2002) found that small businesses with female managers were significantly more concerned with the difficulty of using the technology than were their male counterparts. The study also cited the cost of the technology and changes to work procedures as being of more concern to female managers. In a recent study of 350 Swedish SMEs, MacGregor and Vrazalic (2006) found that ratings by male respondents of all 11 possible benefits were significantly higher than those of their female counterparts.

Methods

Following an analysis of both general SME studies as well as previous medical studies, 17 benefits of ICT adoption and use in general practice were identified. A series of interviews were conducted with representatives of the Illawarra Division of General Practice to determine the appropriateness of the benefits to the GP community. All benefits were considered relevant and no others were forthcoming. These interviews also explored the notions of business size and expertise in the use

of IT. The notion of business size was considered to be both a function of the number of staff as well as the number of patients treated per week. Five categories were nominated for the numbers of staff, while six categories were nominated for the numbers of patients treated (see Appendix A). Seven different IT uses were determined. A 5-point Likert scale was used to examine the importance/non-importance of the 17 benefits (see Appendix A for details of the interview questions).

A questionnaire was then developed (see Appendix B). Respondents were asked the size of the practice both in terms of staff and in terms of the average patient numbers per week, to rate their level of skill in each of the seven IT uses and to rate the 17 benefits across the 5-point Likert scale.

Six hundred and ninety questionnaires were distributed by mail to all GPs in the Illawarra, Hunter, Rockhampton, Ballarat and SE NSW Divisions of General Practice.

Results

Responses were obtained from 122 GPs, giving a 17.7% response rate. Table 1 provides the profile of respondents.

While the response rate was lower than expected it still fell within acceptable statistical boundaries so that further analysis could proceed.

An examination of Table 1 shows that 56.6% of the respondent practices were either one- or two-doctor practices. This is higher than the national average, but is close to the average for non-metropolitan general practices. Seventy point five percent of respondents indicated that they saw more than 90 patients per week, with 27.9% seeing more than 150 patients per week.

There were 27.9% female GPs among the respondents. This is higher than the Australian government figures of 23.5% (Australian Government Department of Health & Ageing 2006).

With the exception of IT skills specifically aimed at generating invoices, over two-thirds of the respondents indicated that they had an average or higher level of IT skills with all the software types tested. This suggests that the

Table 1: Profile of respondents

1-2 person practice	18	<30 patients per week	6
3-5 person practice	50	30-60 patients per week	13
6-10 person practice	29	61-90 patients per week	17
11-20 person practice	18	91-120 patients per week	28
>20 person practice	5	121-150 patients per week	24
	Missing 2	>150 patients per week	34
Male respondent	88	Female respondent	34

SKILL		VERY POOR	POOR	AVERAGE	GOOD	VERY GOOD
Word Processing	4 missing	5	13	46	41	13
Spreadsheet	3 missing	29	35	21	28	6
Data Entry	3 missing	12	25	35	33	14
Generating Invoices	6 missing	31	34	21	18	12
Internet Email	2 missing	2	8	21	58	31
Internet Information Retrieval	2 missing	2	6	24	53	35
Medical Software	4 missing	5	5	20	49	39

responses obtained from the survey were from well-informed respondents who were familiar with the use of computer technology.

Both the ratings of benefits and the rating of ICT skills were tested for internal consistency. The Cronbach’s Alpha for the benefits was .942, while for the ratings of ICT skills, it was 0.884.

A weighted average technique was applied to the benefits in order to determine the overall ranking of importance (see Table 2).

Table 2. Frequency and ranking of benefits of ICT adoption and use

BENEFIT	NEITHER					RANK
	VERY UNIMPORTANT	UNIMPORTANT	IMPORTANT NO UNIMPORTANT	IMPORTANT	VERY IMPORTANT	
Information storage and retrieval	5	2	15	40	55	1
Streamlining accounting and billing	7	4	10	48	50	2
Disease management	13	6	20	56	24	3
Improvement in the way the business is operated	10	6	17	68	16	4
Adding to the skills of the practice	11	7	33	45	24	5
Improvement to business efficiency	13	14	18	52	22	6
Communication with other medical organisations	14	12	38	42	14	7
Communication with fellow GPs	18	16	29	41	16	8
Communication with hospitals	19	15	30	42	11	9
More time on patient care	23	11	40	31	14	10
Allowing the business to expand	22	19	32	35	12	11
Reduction of costs	20	14	30	35	7	12
Reducing the importance of remoteness in the provision of medical care	27	17	32	29	12	13
Ordering drugs	27	19	36	25	11	14
Reduction of the overall workload	27	15	37	29	6	15
Communication with general practice business suppliers	31	23	38	21	5	16
Expanding the patient/customer base by broadening the area of coverage	41	21	36	19	2	17

An examination of Table 2 shows that eight of the 17 benefits had a mean frequency rating of three or above. This would suggest that, for the Australian regional general practitioners, the benefits derived from adoption and use of ICT were lower than in previous studies, be they general SMEs or medical practices. Only two benefits had an average rating in the very important range. These were information retrieval and storage and streamlining billing and accounting functions. While these may be achievable through ICT use, they are equally achievable through non-ICT methods. It is interesting to note that only one of the top five ranked benefits is medical.

Of particular interest were the lower ranking benefits. Unlike much of the literature, concerning both general SME use of ICTs and medical use of ICTs, the adoption and use of ICT in regional Australian medical practices appeared not to have reduced costs or workloads, nor had it had any apparent benefit in terms of communication with suppliers, reduction of concerns regarding remoteness nor expanding the patient base of the practice.

A series of linear regressions was applied to each of the benefits to determine whether any of the factors (business size, gender, IT skills) was associated with the ratings of the benefits. Linear regressions were used to compensate for the possibility that some of the factors (business size, gender, IT skills) may, themselves, be mutually dependent.

For brevity, only those regressions that showed a statistically significance are shown.

Table 3: Regression table for improvement to business efficiency

DEPENDANT VARIABLE: Improvement to business efficiency

	BETA	PVALUE
Use of medical packages	.226	.047
R squared		.233
Adjusted R squared		.163
p value for the complete regression table		.001

An examination of Table 3 shows that there is a significant association between the level of ability with the use of medical packages and the perception that ICTs improve business efficiency.

The positive Beta value shows that the higher the level of ability with medical packages, the greater the perception that ICTs do benefit the practice in terms of improvement to business efficiency. As the use of ICTs would normally include medical packages, this result would be expected. It is interesting to note that business size is not associated with improvement to business efficiency, as might have been expected. A number of studies, albeit in the general SME literature (see Fallon & Moran 2000; Blackburn & Athayde 2000) have suggested that one of the benefits of ICT adoption, particularly for larger SMEs is improvement to internal efficiency. The current study does not support those previous findings.

Table 4: Regression table for enabling more time to spend on patient care

DEPENDANT VARIABLE: Enabling more time to spend on patient care

	BETA	PVALUE
Gender	.251	.007
R squared		.170
Adjusted R squared		.095
p value for the complete regression table		.019

Table 4 provides an interesting result. The only factor associated with the benefit enabling more time to spend on patient care was gender. The positive Beta value suggests that female GPs place a higher level of importance on this benefit as an outcome of ICT adoption and use, than do male GPs. In one respect, the results support earlier findings (Boerma & van den Brink-Muinen 2000, van den Brink-Muinen, Bensing & Kerssens 1998) that showed that female GPs normally allocated more time to patients than male GPs. However, these same studies also showed that female GPs were less technically minded and used far less technology than their male counterparts.

Table 5: Regression table for improvement in the way the business is operated

DEPENDANT VARIABLE: Improvement in the way the business is operated

	BETA	PVALUE
Use of medical packages	.289	.013
R squared		.210
Adjusted R squared		.139
p value for the complete regression table		.003

Table 5 provides a very similar finding to that shown in Table 3. As might be expected, those who had a higher perceived level of ability with medical packages saw higher benefits derived from ICT adoption by way of improving the way the business was operated. Conventional wisdom might have suggested that ICT adoption would have benefited larger practices more than smaller ones. Again, the data showed no association between business (either in terms of personnel or patient numbers) and the benefit improvement to the way the business is operated.

Table 6: Regression table for allowing the business to expand

DEPENDANT VARIABLE: Allowing the business to expand

	BETA	PVALUE
Gender	.256	.003
R squared		.238
Adjusted R squared		.169
p value for the complete regression table		.001

Table 6 provides an interesting and unexpected outcome. While expansion of the business was rated the lowest of all of the benefits (see Table 2), the data in Table 6 shows a highly significant association between the gender of the respondent GP and the perception of importance of that benefit. Again, the positive Beta value shows that female GPs see this benefit as being more important than do male GPs. The level of significance ($p=.003$) shows that while females see some merit in this benefit, the males saw absolutely none at all.

Table 7: Regression table for information retrieval and storage

DEPENDANT VARIABLE: Information retrieval and storage

	BETA	PVALUE
Use of medical packages	.327	.005
R squared		.235
Adjusted R squared		.165
p value for the complete regression table		.001

The results in Table 7 are again similar to the results in Tables 3 and 5. As might be expected, those respondents who had a higher level of skill in the use of medical packages, also found greater benefits in terms of information retrieval and storage. Again, previous studies in the wider SME sector have shown that this benefit is significantly associated with business size; the larger the business, the more importance is placed on the benefit by respondents. No such association was found in the current study.

Table 8: Regression table for communication with fellow GPs

DEPENDANT VARIABLE: Communication with fellow GPs

	BETA	PVALUE
Practice size staff	.192	.035
Gender	.218	.015
R squared		.197
Adjusted R squared		.124
p value for the complete regression table		.005

While the association between communications with fellow GPs and the size of the practice (in terms of personnel) was expected, the association with gender was unexpected. Again, the positive Beta value shows that female GPs rated the importance of this benefit higher than the males. This result is contrary to earlier findings (see Boerma & van den Brink-Muinen 2000; van den Brink-Muinen, Bensing & Kerssens 1998).

Table 9: Regression table for communication with other medical organisations

DEPENDANT VARIABLE: Communication with other medical organisations

	BETA	PVALUE
Practice size staff	.193	.036
Use of medical packages	.254	.031
R squared		.179
Adjusted R squared		.105
p value for the complete regression table		.102

The results in Table 9 are similar to those found in Tables 3, 5 and 7. As would be expected, those who had a higher level of skill with the use of medical packages saw a greater benefit from communication with other medical organisations. However, unlike the earlier findings, the positive Beta results show that it is the larger practices (in terms of personnel) that saw a greater benefit compared to the smaller ones.

Table 10: Regression table for adding to the skills of the practice

DEPENDANT VARIABLE: Adding to the skills of the practice

	BETA	PVALUE
Practice size staff	.212	.011
Gender	.183	.024
Use of medical packages	.331	.002
R squared		.332
Adjusted R squared		.272
p value for the complete regression table		.000

Table 10 shows the associations with the benefit ‘adding to the skills of the practice’. Although two of the associations in Table 10 (practice size and level of skill with medical packages) were expected, the third association, with gender, was unexpected. Again, the positive Beta value shows that female GPs rated this benefit as being more important than the males. A number of studies (Sandberg 2003, Verheul, Risseuw & Bartelse 2002) have noted that females tend to be more conscious of their staff than males, however, similar studies (Boerma & van den Brink-Muinen 2000; van den Brink-Muinen, Bensing & Kerssens 1998) found that females tended to be more anxious with technology.

Discussion

This study has shown that while the adoption rate of ICTs within regional general practices is high, GPs have not been able to derive the same benefits from ICT adoption that other SMEs have done. Indeed, only 6 of the 17 benefits had a mean greater than three on a 5-point Likert scale. Typically, this would be explained by claiming that general practices are intrinsically different to other SMEs, because GPs are professionals providing a medical service. However, the current study shows that the benefits that have been gained by GPs who are successful ICT adopters are not in the medical sphere but in the business sphere. Of the six benefits that were highly rated, only disease management was a clinical benefit; all the others are business benefits. When adopting ICT, GPs need to be more aware of the potential business benefits or they are unlikely to achieve them.

There may be a perception among GPs that ICT only provides benefits for practices with large numbers of patients, and hence a greater need for computerised medical records and the like. The current study shows that this is not the case. Practices with small numbers of patients can still gain from ICT use. Similarly, some GPs may think that ICT adoption is better suited to large practices where a larger staff needs ICT to communicate and streamline business activities. Once again, the current study shows that this is not true; ICT can benefit practices of all sizes.

A recent UK study (Keddie & Jones 2005) concluded that much of the literature on ICT use in medical practices was little more than an assessment of the software, without due consideration to training medical users as to the best implementation strategies. While not explicitly examined in the present study, our results support this observation and we would suggest that GPs should focus on the adoption strategies that are to be found in the SME literature, rather than focussing on specifically medical issues.

The results of the study have clearly shown that skill with medical packages has a positive impact on the perception of some benefits derived from ICT adoption. GPs who lack these skills may either be slow to adopt ICT or may not perceive the benefits of ICT adoption because they do not

understand its technological possibilities. Our results suggest that developing such ICT skills among GPs may lead to a greater understanding of the potential benefits and hence improved business practices. While this study found the strongest association between perceived benefits and skill in the use of medical packages, our previous studies suggest that increased skill in any area of ICT use may increase the perception of benefits of ICT adoption in the practice. GPs would therefore gain a greater understanding of the benefits of ICT use by developing whatever ICT skills they can, but particularly skills with medical packages.

Of particular interest are the findings that female GPs gained greater benefit from ICT adoption and use than male GPs for certain benefits, including 'adding to the skills of staff', 'more time on patient care', 'allowing the business to expand' and 'communication with fellow GPs'. It is difficult to believe that male GPs would not see these benefits as being intrinsically of value, and yet male GPs do not see that ICT has produced these benefits in their practices. Knowing that these benefits are being achieved by female GPs may cause them to adopt the strategies used by female GPs in their adoption of ICT, and hence gain these benefits as well. Alternatively, knowing that these benefits are achievable may lead male GPs to reassess whether ICT adoption has in fact provided these benefits in their practices without their noticing.

Conclusion

ICTs have the potential to capture and collate clinical data on patients, enabling a faster, more reliable and wide-ranging healthcare service, particularly for those patients in regional areas. Whilst this is a small study, the results suggest that, in regional Australia, the major benefits as seen by GPs are business oriented rather than clinically oriented. This raises concerns as to whether the adoption and use of ICTs within general practice in regional Australia has been undertaken with adequate consideration of strategies for ongoing use.

The results also suggest that the maximising of some benefits may be dependent on particular skills being 'in place', or that maximum benefits may only be achievable by specific practice sizes.

The results also point to differences existing between GPs themselves. While the current study has only examined gender differences, the increasing impact of computer use on medical services warrants further studies to be undertaken such that benefits derivable from ICT adoption and use can be maximised both for patients as well as the practitioners.

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Appendix A

Interview questions

How many equivalent full-time people work in your practice? 1-2 3-5 6-10 11-20 >20

How many clients/patients do you see on average in a week? <30 30-60 61-90
 91-120 121-150 >150

What is your gender? Male Female

Rate your ICT skills in the following areas:

TYPE OF ICT SKILL	VERY POOR	POOR	NEITHER GOOD NOR POOR	GOOD	VERY GOOD
Word processing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spreadsheet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Data entry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generating invoices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internet – email	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internet – information retrieval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use of software packages (e.g., Medical Director or MD)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In what ways has ICT contributed to the functioning/viability of your general practice?

CONTRIBUTION	NOT AT ALL MPORTANT	UN- IMPORTANT	NEITHER IMPORTANT NOR UN-IMPORTANT	IMPORTANT	VERY IMPORTANT
Expanding the patient/ customer base by broadening the area of coverage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvement to business efficiency (time saving/patient care)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduction of the overall workload and increased leisure time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enabling more time to be spend on patient care	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduction of business operating costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvement to the way the business is operated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Allowing the business to expand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information storage and retrieval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication with fellow GPs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication with other medical organisations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disease Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Streamlining of billing and accounting functions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adding to the Skills of the practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication with hospitals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering drugs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other communication with general practice business suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reducing the importance of distance (remoteness) in the provision of high quality medical care	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <i>please specify</i> _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix B Questionnaire

1. How many equivalent full-time people work in your practice? 1-2 3-5 6-10 11-20 >20

2. How many clients/patients do you see on average in a week? <30 30-60 61-90
 91-120 121-150 >150

3. How long have you practised in the Illawarra area? < 1 year 1-5 years 6-10 years
 11-20 years >20 years

4. What is your gender? Male Female

Please note: In this survey, Information and Communications Technology (ICT) is the technology (computers and software) required to convert, store, protect, transmit, and retrieve information.

5. Rate your ICT skills in the following areas:

TYPE OF ICT SKILL	VERY POOR	POOR	NEITHER GOOD NOR POOR	GOOD	VERY GOOD
Word processing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Spreadsheet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Data entry	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generating invoices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internet – email	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internet – information retrieval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use of software packages (e.g., Medical Director or MD)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. Does your practice employ an administrator with specific responsibilities for ICT related issues?
 Yes, in the practice Yes, the person is outsourced No

7. How would you rate the importance of the following factors in influencing your adoption of ICT?

FACTORS	NOT AT ALL MPORTANT	UN- IMPORTANT	NEITHER IMPORTANT NOR UN-IMPORTANT	IMPORTANT	VERY IMPORTANT
Pressure from patients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pressure from suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pressure from competing GPs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pressure from medical authorities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve information storage & retrieval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve communication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduce business costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve business efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve patient care/contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve capacity to support a systematic approach to disease management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Streamlining of billing & accounting functions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strengthen relations with business related partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Facilitates e-Commerce*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Keeping in touch with medical & other developments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generating prescriptions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Contact with hospitals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <i>please specify</i> _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*E-commerce consists primarily of the distribution, buying, selling, marketing, and servicing of products or services over electronic systems such as the Internet and other computer networks).

8. Rate the following barriers in introducing ICT in your general practice.

BARRIERS	VERY MINOR	MINOR	WAS NOT A BARRIER	MAJOR	VERY MAJOR
Access to skilled ICT staff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Financial resources and initial costs (hardware/software)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost of consulting services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
No time to keep up with ICT changes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Privacy & security concerns	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Location of your practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Resistance from employees	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <i>please specify</i> _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. In what ways has ICT contributed to the functioning/viability of your general practice?

CONTRIBUTION	NOT AT ALL MPORTANT	UN- IMPORTANT	NEITHER IMPORTANT NOR UN-IMPORTANT	IMPORTANT	VERY IMPORTANT
Expanding the patient/ customer base by broadening the area of coverage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvement to business efficiency (time saving/patient care)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduction of the overall workload and increased leisure time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enabling more time to be spend on patient care	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduction of business operating costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improvement to the way the business is operated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Allowing the business to expand	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information storage and retrieval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication with fellow GPs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication with other medical organisations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disease Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Streamlining of billing and accounting functions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adding to the Skills of the practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication with hospitals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ordering drugs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other communication with general practice business suppliers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reducing the importance of distance (remoteness) in the provision of high quality medical care	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <i>please specify</i> _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. What were the disadvantages incurred through the introduction of ICT?

DISADVANTAGE	NOT AT ALL MPORTANT	UN- IMPORTANT	NEITHER IMPORTANT NOR UN-IMPORTANT	IMPORTANT	VERY IMPORTANT
Changes to routines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Resistance to usage by staff	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deterioration of relations with business partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Higher costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
On-going technical difficulties	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Software support was inadequate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Training for use of computers was inadequate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Reduced flexibility of work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Duplication of work effort	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Security	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <i>please specify</i> _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. How important is ICT training and support for your practice?

	NOT AT ALL MPORTANT	UN- IMPORTANT	NEITHER IMPORTANT NOR UN-IMPORTANT	IMPORTANT	VERY IMPORTANT
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. As a proportion of the total costs of operating your practice, what contribution would be made by ICT costs?

- 0-5% 5-10% 10-15%
 15-20% >20% >150

13. In terms of the following ICTs, identify which of these you envisage as becoming more important in the operation of your practice in the future.

Type of ICT importance will not change important	Will become un-important Will become somewhat more important	Will become less important Will become much more	Its Will become much more
TYPE OF ICT	WILL BECOME UNIMPORTANT	WILL BECOME LESS IMPORTANT	WILL BECOME MUCH MORE IMPORTANT
Telephone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mobile phone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fax	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pager	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Computer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internet – email	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internet – information retrieval	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Internet – billing HIC online	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E-commerce*	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Video-conferencing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other please specify _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*E-commerce consists primarily of the distribution, buying, selling, marketing, and servicing of products or services over electronic systems such as the Internet and other computer networks).

14. Do you believe that advances in adoption of ICT by GPs can facilitate improvements in aged care provision?
 Yes - Please go to Q15 No - Please go to Q16

15. In what ways can ICT adoption/usage facilitate better health care?

REASON	NOT AT ALL MPORTANT	UN-IMPORTANT	NEITHER IMPORTANT NOR UN-IMPORTANT	IMPORTANT	VERY IMPORTANT
Improve access to patient records	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improve networking in the care of patients (with specialists)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medication prescriptions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other please specify _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. Please indicate your agreement or disagreement with the following statements about the use of ICT in your practice and in the provision of health care generally.

STATEMENT	STRONGLY AGREE	AGREE	NEITHER AGREE NOR DISAGREE	DISAGREE	STRONGLY DISAGREE
ICT cannot replace face-to-face contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ICT is valuable in enhancing access to information I require in my practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ICT is valuable in enhancing the ability to keep up with developments in health care	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The technology is not sufficiently advanced to meet health care needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use of ICT significantly eases the burden of repetitive administrative tasks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use of ICT frees up the GP's time to concentrate on patient care	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ICT enables more efficient functioning of the practice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ICT undermines the quality of the doctor-patient relationship by depersonalising the patient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My practice is not making full use of the potential of ICT in enhancing patient care	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other please specify _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please add any comments in the box provided below relating to issues that you believe are important but that have not been included in this survey. Any additional comments that will facilitate further improvement in the questionnaire are also welcome.

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**THANK YOU FOR COMPLETING THIS QUESTIONNAIRE.
 YOUR RESPONSES WILL BE TREATED IN THE STRICTEST CONFIDENCE.**