Understanding Resistance towards Electronic Patient Health Data in South Australian Family Practice

John Knight, Margaret Patrickson, Bruce Gurd

International Graduate School of Business, University of South Australia, Adelaide, Australia

Abstract

This paper reports the results from a survey of 131medical practitioners in South Australian General Practice concerning adoption of a computerised system for storing and potentially amalgamating health information from several practices. Practitioners were primarily influenced by the positively perceived potential for such technology use to improve patient health and well-being outcomes and secondarily by the negatively perceived potential for unwanted change in the status, control and autonomy of their professional role. Practitioner attitude reflected how they resolved the competing influences. The data suggest that strategies for implementing such systems should address individual perceptions by increasing belief in the potential for patient improvement or by decreasing belief of the inevitability of unwanted role change.

Keywords:

Medical informatics, Family practice.

Introduction

This paper explores potential adoption of amalgamating Health Informatics (HI) technology by South Australian practitioners in general practice medicine (GPs). General Practice in South Australia mostly operates as solo practices, partnerships or incorporated bodies averaging 2.5 GPs each and, estimated to see 85 percent of healthcare consumers annually, is integral to delivering any comprehensive, coordinated and continuing healthcare strategy to the wider health system [1-3]. Within this scenario, HI is promoted by all levels of government as an emergent interdisciplinary label for the application of computers to improving the efficiency and effectiveness of healthcare management [4]. Yet implementing HI systems requires adoption of electronic patient records and potentially the need to reengineer traditional workflows and disrupt existing business and clinical processes [5].

Previous to this study, Australian Governments had targeted GPs with funding initiatives to increase the use of computers in general practice medicine [1]. Nowadays almost all practices have at least one computer, and some are seen to have designed their processes to increase the use of technologically supported systems in order to increase practice income [6]. Nonetheless a study between 2003 and 2005 reported that some Australian GPs who had access to computers and clinical software chose not to use them, and only a third kept all patient data in an electronic format [6]. Other findings indicate HI systems that are viewed as improving diagnostics, reproducing accepted models of clinical reasoning or providing immediate patient benefit have been adopted, while those aimed at improving the overall efficiency and effectiveness of healthcare appear to be have been resisted [7-9].

Understanding why people accept a particular innovation remains a challenging and complex issue, and medical practitioners have been cited as classic examples of 'professional' populations where understanding decisions of what innovations are adopted and when has been especially problematic [10, 11].

Method

The purpose of this study was to test tentative hypotheses from an earlier qualitative enquiry. Directed at a small sample of GPs to try and capture potential reasons why they tend to resist (or not) adoption and implementation of HI systems, findings suggested sources of GP resistance stemmed from deeply held GP beliefs, feelings, anxieties and values that could be challenged by such technology adoption [4]. The importance attached to forces pushing for resistance reflected GP beliefs about their professional and organisational role and the use of technology in their workflow. Findings also suggested motivation for adoption reflected GP belief in the efficacy of the technology to improve health outcomes of their patients and the wider population. The importance attached to forces pushing for adoption reflected the perceived relevance to the GPs' role of such potential for improvement. Strategies aimed at increasing such technology uptake by providing financial incentives enhanced any motivation to adopt, particularly within the practice boundary. However, perception of change needed in environmental antecedents which impacted the GP's relationship with their patient was seen as undesirably changing the GP role in the delivery of healthcare.

These data led the authors to formulate a series of hypotheses about the relationships between these forces influencing GP intention, rewritten as five main hypotheses (Table 1). Testing these hypotheses formed the basis for a questionnaire distributed to a representative sample of GPs, and the findings are

presented in this paper. Drawing from literature and based on the recurrent themes, propositions and hypotheses derived from the qualitative study, a 'concern' dictionary was developed to test the hypotheses and explore potential strategies to reduce resistance. The resultant conceptual model (Figure 1) frames the hypotheses and reflects the view that GP resistance towards new HI technology adoption is the outcome of the perceived advantages (or otherwise) of potential changes in valued antecedents associated with their role.

Table 1- Hypotheses concerning GP resistance towards new HI technology adoption

H₁: *There is a direct positive relationship between the potential for new HI technology to undesirably change their role (C1) and emergent GP resistance to adopting new HI Technology (DV)*

H2: *There is an indirect negative relationship between the potential for HI technology to improve patient outcomes (C2) and emergent GP resistance to adopting new HI Technology (DV).* **H2a:** *There is a direct negative relationship between GP perceptions of the potential for HI technology to improve patient health and well-being outcomes (C2) and the potential for undesirable change to the GP role (C1).*

H3: *There is an indirect positive relationship between the context in which they perform their role (C3) and emergent GP resistance towards adopting new HI Technology (DV).* **H3a:** *There is a direct positive relationship between GP perceptions of the context in which they perform their role (C3) and the potential for undesirable change to the GP role (C1).*

H4: *There is an indirect negative relationship between the influence of incentives on HI technology adoption decision-making (C4) and emergent GP resistance to adopting new HI Technology (DV).* **H4a** *There is a direct negative relationship between GP perceptions of the influence of incentives on HI technology adoption decision-making (C4) and the potential for undesirable change to the GP role (C1).*

H5: *There is an indirect positive relationship between the attributes of a GP role (C5) and emergent GP resistance to adopting new HI Technology (DV).* **H5a:** *There is a direct negative relationship between GP perceptions of the attributes of a GP role (C5) and the efficacy of new HI technology (C2).* **H5b:** *There is a direct negative relationship between GP perceptions of the attributes of a GP role (C5) and the role context (C3).* **H5c:** *There is a direct negative relationship between GP perceptions of the attributes of a GP role (C5) and the influence of incentives to adopt new HI technology (C4).* **H5d:** *There is an indirect positive relationship between GP perceptions of the attributes of a GP role (C5) and the potential for undesirable change to the GP role (C1).*

Anticipated to underpin GP resistance, measurement of change to the GP role focused on the perceived potential for change to their autonomy, control, status and relationship with their patient. Measuring context antecedents focused on collecting information on the extent to which perception of the environment (such practice characteristics as the number of practice GPs and nurses and the current use of clinical and billing software) influenced GP resistance. Anticipated as a positive force for adoption, measurement of the potential for HI technology use to underpin improved patient health and well-being outcomes focused on the relevance of improvement in different patient populations. The survey also sought to measure the influence of incentives and what modifications in existing strategies might potentially improve the penetration of HI technology use in GP practice. This included the extent to which incentives were seen to address the value of the GP role, data, participation in policy decision-making and patient attitude toward GP use of such technology. The survey also encompassed individual and role attributes that in combination

potentially ameliorated or exacerbated GP perceptions of other influences (such as their self-perceived professional, technological and innovative traits). Interview content had indicated experience as a GP and hours worked per week on direct patient care were potentially influential, while literature on professionals and technology adoption studies suggested alignment with professional organisations, age and gender may be relevant to GP attitude [12, 13].
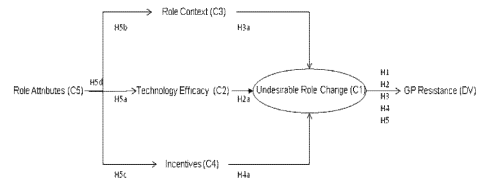

Figure 1- Theoretical Model of Forces of Influence on GP Resistance

Pre-testing the instrument resulted in rewording of ambiguous questions, alternate shading to better differentiate questions and an indication of the estimated GP time commitment being added to the survey introduction. Respondents were targeted from member practices of three South Australian Divisions of General Practice. This gave a potential sample size of 650 GPs from 210 practices. Questionnaires were distributed resulting in a return rate of 131 usable replies (20.15%). The sample demographic profile was found to roughly reflect both the South Australian and Australian GP population.

Data Analysis and Results

Data analyses were performed using the statistical computer program SPSS (version 16) for Windows. Factor Analysis was performed to reduce each construct of items to fewer factors, to make the data set more manageable and to facilitate testing a theoretical model with valid variables [14]. Principal Axis Factoring was chosen because the aim was to describe structure and using Squared Multiple Correlations provides more accurate estimates of initial communalities [15]. Only factors with eigenvalues >1 were extracted and only items correlating at >0.4 with the factor were considered. The single factors extracted were transformed into new variables.

The endogenous construct readily transformed to one factor. To avoid confusion for the sample, the item scale used reflected a high score for intention to adopt new HI technology. By reverse scoring all other items, a high score in the subsequent factor indicated an intention to *not* adopt. Examination of the case-wise diagnostic statistics identified 28 cases (21.9%) showed more intention to resist than take-up new HI technology. The constructs of influence seen to underpin GP motivation to adopt new HI technology also readily transformed to single factors. A high score in the subsequent Technology Efficacy Factor indicated a strong belief in the potential of HI technology to improve patient outcomes. A high score in the Incentives Factor indicated a strong belief in the positive influence of financial incentives on GP adoption.

Factor correlation showed all five factors to have the anticipated significant relationship with GP intention to resist. The results also suggested the relationship between role attributes with GP resistance may be fully mediated by the perceived potential for undesirable role change as hypothesised. However, the influence of GP belief in the technology efficacy and the influence of financial incentives were at best partially mediated by the perceived potential for undesirable role change, while the influence of GP's context was not mediated at all. Also, the anticipated influences of both GPs' context and role attributes were reversed. It is noteworthy that the correlation between GP intention to resist and technology efficacy and undesirable role change were of similar strength, casting doubt on the anticipated mediating effect of undesirable role change on all other influences. Thus factor correlations supported the hypothesised significance (albeit not always the pathway) of relationships between the original constructs of influence and GP intention to resist in H_1, H_2, H_3, H_4 and H_5. However the anticipated mediation of the GPs' role attributes relationship with GP intention to resist by the GP context (H_{5b}) and financial incentives (H_{5c}) was not supported, nor was the anticipated mediation of the GP context influence on GP resistance by the potential for undesirable role change (H_{3a}) supported. Yet a significant relationship between financial incentives and belief in technology efficacy had not been hypothesised.

A series of ANOVAs were carried out to examine the effect of the categorical variables on the derived factors. The F-values showed solo GP status, accreditation, practice nurses employed, experience as a GP and AMA membership all had significant relationships with GP intention to resist adoption. On the other hand, none of the categorical variables had a significant relationship with GP context and incentives, while hours worked, gender and practice designation had no significant relationship with any of the factors or with GP intention.

Analysis to determine whether the derived factors were predictive of GP intention to resist utilised Exploratory Factor Analysis through multiple regression. The first model with all categorical measures of attributes showed their coexistence had the effect of suppressing the previously identified significance of some of the relationships with GP intention. While not disproving the significance of the relationships per se, this highlighted they were only significant outside of the regression model. Nonetheless, this appeared to illustrate the individual and practice attributes did not have significant individual or collective direct relationships with GP intention and were more likely, singularly or together, to indicate a moderating influence(s) on the relationships of the derived factors with GP intention. The addition of Role Context as a predictor predicted the DV significantly better, and addition of Incentives as a predictor explained 33.3% of the variance in GP intention. This model also suggested the relationship between Role Context and GP intention may in some manner be mediated by the influence of Incentives, which was tested through mediated regression [16]. Yet this relationship was not clearly supported by this sample. Even so, it seems conceptually reasonable that the influence of GP consultation type range and frequency on GP intention to resist adoption was, for some GPs at least, impacted by incentive strategies that attempted to increase GP

adoption of new HI technology. It is noteworthy that the complete loss of significance of the range and frequency of their consultation types in this model, meant there was no evidence of direct influence on GP intention in the presence of the other factors. While the addition of Role Attributes as a predictor predicted GP intention significantly better, the anticipated significance of the direct and indirect Role Context relationships with GP resistance were not supported by this sample. Thus Hypotheses H_3, H_{3a} and H_{5b} were not supported wholly or in part. The addition of Technology Efficacy as a predictor suggested belief in the efficacy of the technology may in some manner mediate the influence of both incentives and role attributes on GP adoption intention. Mediated regression suggested the influence of Incentives was only partially mediated by Technology Efficacy. While this relationship had not been hypothesised it seems conceptually reasonable that for at least some GPs, belief (or not) in the potential of new HI technology to improve patient outcomes would mediate the impact of financial incentives on GP intention. Mediated regression also showed the influence of Role Attributes on GP intention was partially mediated by Technology Efficacy. Hypothesis 5a was therefore supported for this sample.

The addition of the perceived potential for undesirable role change as a predictor to the model represented all the constructs and the categorical variables and explained 65.2% of the variance in GP intention to resist adoption ($F_{(21, 97)} = 8.658$, $p<.001$). This also suggested the influence of Role Attributes on GP intention was in some way mediated by Undesirable Role Change, while testing showed Role Attributes was partially mediated by Undesirable Role Change, showing Hypothesis H5d was supported. However there was no change in the significance of Technology Efficacy relationship with GP intention, so Hypothesis H2a was not supported. Similarly, there was no change in the significance of Incentives relationship with GP intention, so Hypothesis H4a was not supported. A summary of how the study hypotheses were either supported or not by these regression results can be seen in Table 2.

Table 2- Summary of support for Hypotheses

H_1	F_1, DV	Yes
H_5	F_5, DV	Yes
H_2	F_2, DV	Partially
H_3	F_3, DV	Partially
H_4	F_4, DV	Partially
H_{5a}	F_5, F2	Partially
H_{5d}	F_5, F_1	Partially
H_{2a}	F_2, F_1	**No**
H_{3a}	F_3, F_1	**No**
H_{4a}	F_4, F_1	**No**
H_{5b}	F_5, F_3	**No**
H_{5c}	F_5, F_4	**No**

In order to establish whether a more parsimonious representation of relevant predictive factors of influence on GP resistance could be identified, hierarchical linear regression was performed with only factors that had a significant individual relationship with GP intention in the presence of the other factors. This excluded the Role Context Factor and the categorical individual and practice attributes as predictive variables. The subsequent model ($F_{(4, 122)} = 44.772$, $p<.001$) explained 59.5% of the variance in GP intention. Although not predicting GP intention as accurately as the model with all the constructs and categorical variables, this model was seen to represent the key common factors influencing GP attitude formation and identified the potential for HI technology to improve patient outcomes as statistically the most important factor in predicting GP intention to resist adoption. Although not statistically significant, the negative β-weight of the Technology Efficacy and the positive weight of Undesirable Role Change was seen to increase, giving the net effect of widening their relative impact on GP intention to resist. This could arguably be the outcome of change in the influence of Incentives on GP resistance in the presence of the categorical variables. This suggested the range and frequency of consultation types in combination with individual and practice attributes may be more appropriately seen as indicators of a moderating influence on the relationship between Incentives and GP resistance. Thus, moderation of the Incentives Factor and GP resistance relationship may be indicated by different combinations of individual and practice attributes for different GPs. Also, the anticipated indirect relationship between the Role Attributes and Undesirable Role Change Factors emerged as a significant direct relationship. While not hypothesised, the study showed a direct relationship between Role Attributes and GP resistance was probable.

Discussion

It seems conceptually reasonable that the potential perceived for undesirable changes to the GP role would be a barrier to GP adoption, while resistance would be abrogated by belief in the potential of the technology to improve patient health outcomes. Also, that GP use of HI technology and the propensity to use technology would be influence the perceived desirability of any potential for technologically facilitated change to their role. It finally seems reasonable that the influence of incentives targeted at increasing GP uptake of new HI technology on attitude formation would be moderated by the range and frequency of consult types in combination with other individual and practice attributes. This thinking is represented in the modified research model (see Figure 2).
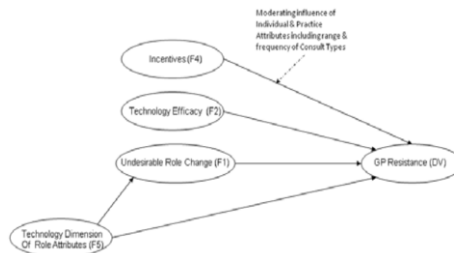

Figure 2- Most parsimonious hypothesised Model.

The role attribute construct supported the focus of [13] and others, regarding the importance of the current use of technology in understanding new technology adoption, yet it was GP use of and propensity to use such technology compared to other GPs that became significant. Similarly, the Role Context Construct became exclusively a measure of the GP consultation types as a consistent indicator of resistance, with Factor Analysis excluding perceptions of the healthcare system, profession and practice context antecedents. Although this may be seen to reflect inappropriately formulated questionnaire items, it also confirmed consistent themes uncovered in this research:

- Unlike extant literature concerning adoption of new technology with non-professionals [13], GPs did not generally see mastering the use of computers for data entry in the practice of medicine as a barrier to adoption, particularly if use was evidence-based.

- The autonomous nature of the GP role in an environment of demand for their services essentially means any change in their workflow must be voluntary.

- The GP did not spend time considering the potential for change unless they believed they could exert some immediate control over change outcomes.

- The smaller the practice, the more likely practice attributes could be seen as an indicator of GP attributes. Hence the more important it is to address individual GP concerns over practice uptake of change.

Conclusion

The poor uptake of HI technology by GPs may simply reflect the ineffectiveness of past and existing strategies and challenges contemporary thinking in aiming to design generalised models of technology adoption behaviour. Considering an individual's interaction with the system and context makes this change behaviour more comprehensible and supports the thinking of [17, 18] when they cite the importance of understanding individual, system and context interactions.

These findings indicate anticipated change to role or valued contextual antecedents were potentially powerful inputs to emergent resistance. Thus adoption strategies should consider the collective influence on GP perceptions of individual and practice attributes (such as the range and frequency of consultation types, current GP use of HI technology and current practice implementation and use of HI technology). Such focus

would better emphasise the relevance of patient populations potentially benefiting from such technology adoption and be more likely to overcome belief of the inevitability of undesirable change to the GP role. Effective strategies to overcome resistance to HI technology diffusion should thus emphasise benefits to the GPs' patient rather than change to their role.

Financial incentives would more likely be effective in changing GP practice behaviour for example, if uptake was within the realm of GP control and they addressed such specific concerns as the potential for incurring unremunerated practice costs. A situation could then be created where the forces for adoption were stronger than the forces for resistance. However this research suggested certainty about unwanted outcomes could raise the impact of factors that encourage rejection and stategies would be less effective if non-adoption, resistance or rejection was predicated on GP perception that implementation would lead to fundamental change to their role. Then, a strong motivation to move away from adoption would likely underpin an imbalance of forces favouring resistance. Adoption can then be seen as the outcome of the relative strengths of opposing forces, not simply a consequence of diffusion.

This research was directed towards understanding the reasons for GP resistance as the identified gap in the existing body of knowledge [19]. It is anticipated this research provides theoretical grounding and empirical evidence for the direction of future investigations into acceptance of technological innovation in different contexts and settings, particularly by the medical professional in a healthcare context. The exploratory nature of this research uncovered GP and practice attributes of potential influence, yet their significance to GP resistance was neither proved nor disproved. This allows for future research to theorise different combinations of individual and practice attributes as potentially indicative of moderating influences on the process of GP attitude formation.

Acknowledgements

References

[1] AMWAC Report. The General Practice Workforce in Australia: Supply and Requirements to 2013. Sydney: New South Wales Health Department; 2005 [updated 2005; cited 2006 October 28th]; Available from: http://www.healthworkforce.health.nsw.gov.au/amwac/pdf/gp_2005.pdf.

[2] Commonwealth of Australia. General Practice in Australia: 2004. Canberra: Commonwealth Department of Health and Ageing; 2005 [updated 2005; cited 2006 November 8th]; Available from: http://www.health.gov.au/internet/wcms/publishing.nsf/Content/pcd-publications-gpinoz2004.

[3] Britt HC, Miller GC, Charles J, Pan Y, Valenti L, Henderson J, et al. General practice activity in Australia 2005-06. Canberra: Australian Institute of Health and Welfare; 2007 [updated 2007; cited 2007 6th June]; Available from: http://www.aihw.gov.au/publications/index.cfm/title/10377.

[4] Knight J, Patrickson M, Gurd B. Understanding GP Attitudes Towards A Data Amalgamating Health Informatics System. electronic Journal of Health Informatics. 2008;3(2):e12.

[5] Ford EW, Menachemi N, Phillips MT. Predicting the Adoption of Electronic Health Records by Physicians: When Will Health Care be Paperless? JAMIA. 2006 January 1, 2006;13(1):106 -12.

[6] Henderson J, Britt HC, Miller G. Extent and Utilisation of Computerisation in Australian General Practice. Medical Journal of Australia. 2006;185(2):84 - 7.

[7] Arroll B, Pandit S, Kerins D, Tracey J, Kerse N. Use of information sources among New Zealand family physicians with high access to computers. J Family Practice. 2002 August;51(8)

[8] Bolton P, Mira M, Kennedy P, Lahra MM. The quality of communication between hospitals and general practitioners: An assessment. J Qual Clinical Practice. 1998;18(4):241 - 7.

[9] Walsh SH. The clinician's perspective on electronic health records and how they can affect patient care. BMJ. 2004 May 15, 2004;328(7449):1184 -7.

[10] Frambach RT, Schillerwaett N. Organizational Innovation Adoption: A Multi-level Framework of Determinants and Opportunities for Future Research. J Bus Res. 2002;55(2):163 - 76.

[11] Davis FD, Bagozzi RP, Warshaw PR. User Acceptance of computer technology: a comparison of two theoretical models. Management Science. 1989;35(8):982 -1003.

[12] Mintzberg H. Structure in 5's: A Synthesis of the Research on Organization Design. Management Science. 1980;26(3):322 - 41.

[13] Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: Toward a unified view. MIS Quarterly 2003;27(3):425 - 78.

[14] Coakes SJ, Steed LG. SPSS Analysis without Anguish: Version 14 for Windows. Milton, Queensland: John Wiley & Sons; 2007.

[15] Tabachnick BG, Fidell LS. Using Multivariate Statistics. New York NY: Harper Collins; 1996.

[16] Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. J Pers Soc Psychol. 1986;51:1173 - 82.

[17] Kaplan B. Evaluating informatics applications-some alternative approaches: theory, social interactionism, and call for methodological pluralism. Int J Med Inform. 2001;64(1):39 - 56.

[18] Markus ML. Power, Politics, and MIS Implementation. Communications of the Association for Computing Machinery. 1983;26:430 - 44.

[19] Pare G, Sicotte C, Jacques H. The Effects of Creating Psychological Ownership on Physicians' Acceptance of Clinical Information Systems. JAMIA. 2006 Dec 16, 2005;13(2):197 - 205.