Exploring Information Technology Adoption By Family Physicians: Survey Instrument Valuation

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ABSTRACT

As the information needs of family physicians become more complex, there will be a greater need to successfully implement the technologies needed to manage that information. The ability to stratify primary care physicians can enable the implementation process to be more efficient. This research tested a new instrument on 101 family physicians, and was able to stratify physicians into high, intermediate, and low information technology (IT) usage groups. It is expected that this stratification would allow managers of IT implementation to target specific adoption strategies for each group. The instrument is available from ddixon@julian.uwo.ca.

INTRODUCTION

In the current period of healthcare reform, family physicians and other healthcare providers and organizations are finding information technologies increasingly prevalent. Due to the intensive information needs of family practice and current changes in medical practice[1], family physicians could expect to see a rise in the use of information technology.

The change towards the adoption of IT appears to be related to healthcare organizational change[2]. It is unclear if one acts as an antecedent, an enabler, or if they both appear concurrently. With the organizational changes currently occurring in Ontario and other geographical areas, the prevalence of IT can be expected to increase. A 1994 report predicted that there would be an increase in Canadian healthcare-related spending for IT by both hospitals and primary care physicians[3].

Implementation of IT involves the interaction of people and technology. In healthcare organizations, where people have been exposed to IT and organizational changes, they adopt a flight or fight response, making IT implementation difficult and often unsuccessful[4]. Ultimate success of the IT appears to depend on how well people are managed not just the apparent success of the technology[2]. The ability to identify and affect peoples' attitudes and behaviors towards IT will likely allow more successful adoption of the IT[2].

This study attempted to differentiate family physicians' IT-related behaviors according to their views and attitudes towards IT. As well, the relationships of potentially contributory demographic variables (busyness of practice, years in practice, and gender) were explored as they related to IT adoption behaviors.

LITERATURE REVIEW

Currently, the majority of health technology research is based on organizations, such as hospitals, outpatient clinics, and large family or multi-specialty offices. In the United States, health maintenance organizations (HMO) are also included. Literature was selected using a number of indexed and non-index terms. Literature databases for medicine, sociology, psychology, education, and business were searched for relevant articles. On reviewing the literature, it appears that hospitals and larger clinics form the leading edge of IT implementation. There were few references relating to adoption of IT by family and general practitioners in solo or small clinic settings.

For implementation success, implementation of an innovation requires attention to several people and organizational issues[5]. What is known about factors affecting the adoption of IT by primary care physicians is sparse. Much of the research has focused on factors affecting physician adoption of IT in hospital or HMO settings[2-4]. Because of the paucity of studies in primary care, more general models of the attitudes contributing to the processes of implementation were reviewed and incorporated in the Information Technology Adoption Model (ITAM)[6,7].

The ITAM was developed to provide a framework to explain the adoption of IT by primary care

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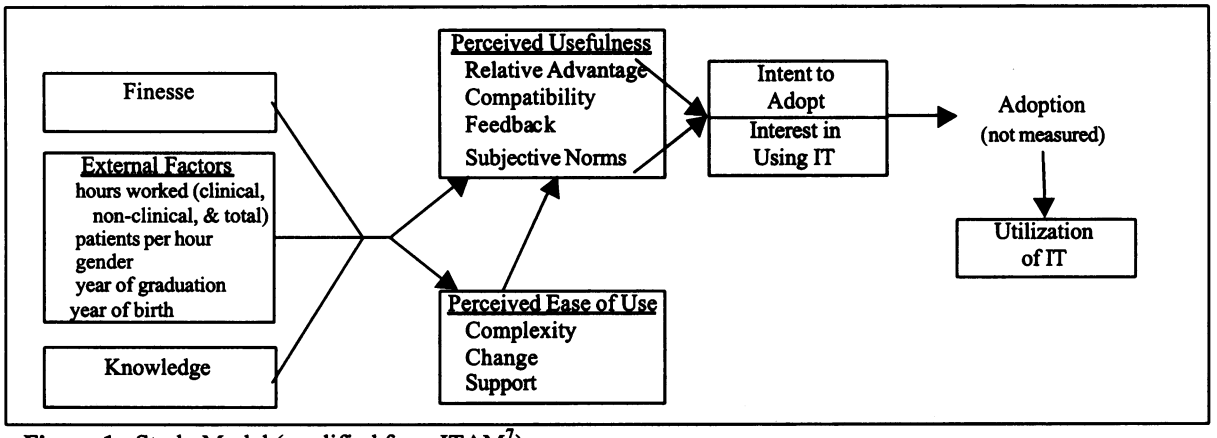

Figure 1: Study Model (modified from ITAM[7])

physicians. This model provides a structure to organize implementation techniques as well as to identify areas for evaluation. The ITAM was simplified for the purpose of this study, since not all elements in ITAM could be selected for study. The study model is shown in Figure 1.

The users' finesse was their ability and willingness to transfer knowledge and skills from one task to another. Knowledge was used as a proxy measurement for the individuals' breadth and depth of knowledge. Breadth referred to the spectrum of knowledge areas the individual maintained, while depth referred to the amount of knowledge the individual knew in each area.

Perceived usefulness described the perceptions of the individual to the innovation. It has been found to influence an individual's adoption behaviours[8]. Perceived usefulness included items such as relative advantage, compatibility, feedback, and subjective norms. Perceived ease of use described the individual's perception of how easy the innovation is to learn and use. This included support, complexity, and change.

The study model, like the ITAM, postulates that the users' perceptions lead to adoption behaviors. Because the current study was not a longitudinal study capable of ascertaining the process of adoption, the person's intent to use IT and their interest in using IT were used as proxy measurements as suggested by the theories described above. From the ITAM, adoption leads to continued usage, outright rejection, or a decision by the individuals to alter their capabilities. In this cross-sectional study, respondents were asked to indicate their current usage of IT.

It was hypothesized that physicians with high, intermediate, and low levels of IT use would differ with regard to their characteristics and attitudes towards IT.

METHODS

The survey instrument was developed from the constructs used in the ITAM. Twelve items have been previously developed and validated[6]. Remaining items for perceived usefulness and perceived ease of use constructs were piloted in a hospital IT implementation[9]. A copy of the survey instrument can be obtained from the authors (ddixon@julian.uwo.ca).

This study took a random sample of practicing general and family physicians in the London and the adjacent four county area. Physicians were selected from the mailing list of all primary care physicians practicing in that area which is maintained by the Thames Valley Family Practice Research Unit in London, Ontario. For sampling, physicians were stratified by the author into three groups. This stratification was based on participation in the FERN mail list. FERN was a computer-based academic list that allows discussion of clinical problems. FERN-D was a subgroup of FERN that required interested physicians to actively participate in a more structured case discussion for Continuing Medical Education credits. Membership in FERN-D was voluntary.

A total of 187 physicians were selected. For sampling only, non-members of the FERN list were selected as low use physicians. Member of FERN-D were selected as high use physicians, and remaining FERN members were selected as intermediate use physicians. A modified Dillman's Total Design method for mail surveys was followed[10].

Sampling groups were not used after sampling was completed. Physicians were stratified into new groups according to their self-reported IT use. The physicians showing the highest third of IT usage were stratified to the high use group. The physicians with intermediate and low thirds of IT usage were stratified to the intermediate and low use groups respectively.

ANOVA analysis was conducted for all variables except gender for which chi-squared statistics were used. The Tukey HSD post-hoc test was used to identify significant inter-group differences at p=0.05.

RESULTS

A total of 101 (54%) of surveys were received. Chi-squared analysis was done comparing respondents and non-respondents for six demographic characteristics. No significant difference was found for gender (p=0.07, although not significant, females were more likely to respond), graduation year (stratified groups, p=0.61), practice type (p=0.76), urban location (p=1.00), full-time status (p=0.91), or CCFP designation (p=0.10). This indicates that the respondents were not significantly different from the non-respondents.

In Table 1, the center column shows the group means, and the left-hand column lists the results of the ANOVA analysis comparing the three groups. The results of the Tukey HSD post hoc test are shown in the right-hand column of Table 1. A cross-tabulation for gender and usage group, also shown in Table 1 was analyzed and found not to be significant (df 2, p=0.592).

It was found that usage of IT showed significant differences among groups for intent, interest, perceived usefulness, perceived ease of use, finesse, and knowledge (all p<0.001). Of the demographic variables, only non-clinical hours showed a significant difference between usage groups (p=0.013).

DISCUSSION

When analyzing the inter-group differences seen in Table 1, one can discriminate among physicians in the three self-report IT usage groups. Significant differences among groups were seen for the main variables of the study model (intent to use IT, interest in using IT, perceptions of usefulness and ease of use of IT, finesse, and knowledge). All but two of the variables (intent to use IT and perceived ease of use) were able to discriminate among physicians with high use, intermediate use, and low use of IT. In all cases, the mean values showed a direct linear relationship,

Table 1: ANOVA Analysis of Physician Coding and Usage Groups

Independent Variable	ANOVA test		Means			Tukey HSD p-value[a]		
Dependent Variable	F statistic	P-value[a]	Low 1/3	Int 1/3	High 1/3	Low-Int	Low-High	Int-High
Use of IT group[b]								
Intent	13.21	<0.001	3.59	4.28	4.56	0.001	<0.001	0.330
Interest in Using IT	18.99	<0.001	3.01	3.73	4.21	0.001	<0.001	0.041
Perceived Usefulness	15.71	<0.001	3.06	3.52	3.94	0.010	<0.001	0.020
Perceived Ease of Use	23.59	<0.001	2.57	2.79	3.59	0.296	<0.001	<0.001
Finesse	23.33	<0.001	1.86	2.41	3.21	0.015	<0.001	>0.001
Knowledge	28.34	<0.001	2.45	4.03	4.90	<0.001	<0.001	0.024
Clinical Hours	0.39	0.676	40.99	38.76	41.12	0.742	0.998	0.713
Non-Clinical Hours	4.58	0.013	7.85	11.01	14.92	0.349	0.009	0.203
Total Hours	2.44	0.093	48.37	49.77	56.10	0.920	0.100	0.201
Patients per Hour	1.01	0.369	5.26	6.98	5.68	0.371	0.994	0.568
Grad Year (Medicine)	0.04	0.965	78.59	78.54	78.73	1.000	0.974	0.967
Year of Birth	0.05	0.949	52.45	51.86	52.45	0.958	1.000	0.960
Gender (Chi Squared)	df 2 (p=0.592)		25.8%	37.1%	29.4%	% female in each group		

[a] - p-values greater than 0.05 appear in grey type.
[b] - Individuals were stratified into high, intermediate, and low thirds using percentiles if IT Usage.

with means for the low-use group being lower than the intermediate-use group, which were lower than the high-use group.

For the demographic variables, only the number of non-clinical hours showed any significant difference among groups. A significant difference was found between the low and high-use groups, but not with the intermediate group. No significant differences were found for the remaining demographic variables, including clinical hours, total hours, number of patients per hour, gender, graduation year, and year of birth.

There was substantial support for the ability of the survey instrument to discriminate among physicians based on their self-reported usage. All of the attitudes and behaviors identified in the study model were successful in discriminating among low, intermediate, and high users of IT. This includes usage of IT, intent to use IT, interest in using IT, perceptions regarding the usefulness and ease of use of IT, finesse, and knowledge. The results strongly supported the hypothesis.

Due to its generalized theoretical development, it is expected that this instrument could be similarly useful with healthcare practitioners other than family physicians, in particular specialist physicians. It may also be useful for associated healthcare practitioners such as nurses, therapists, and others. Generalizability could also be studied for different medical settings such as HMOs, HSOs, hospitals, large outpatient and ambulatory clinics, and different health systems.

It is expected that use of the questionnaire to ascertain physicians' views on IT will allow researchers to identify and develop appropriate implementation strategies for family physicians. These strategies would ideally encompass a broad spectrum of physician capabilities and attitudes. Current strategies include techniques such as paper-based materials, media, academic detailing, champions, training, support, and feedback. Additional research is needed to understand the best stages and setting for successfully utilizing the strategies. For example, whether paper-based material is more successful in earlier or later implementation stages, or are champions successful in influencing IT adoption by urban physicians. Research is required into methods to evaluate the implementation success of a variety of techniques, used both individually and in combination.

For example, physicians with low finesse, and low perceptions of the ease of using IT in their practices may benefit from more general implementation techniques designed to change finesse and attitudes. These techniques, such as paper-based materials, media, and use of champions, tend to require few resources and less money from the implementation team. As the physicians' perceptions and finesse increase, more specific implementation techniques can be used. Although more costly and time-consuming, strategies such as training and equipment support would be expected to be more beneficial in increasing adoption behaviors by the physicians at this more advanced implementation stage. As IT is adopted, even more costly and time-intense techniques can be used to encourage and reinforce repeated usage. These techniques would include support and feedback as well as more intense training on the IT being implemented. By classifying and selecting the physicians most likely to benefit from specific techniques, a more rational use of limited implementation resources could be made.

The questionnaire could be further refined for specific IT innovations and used to assess and direct the IT implementation process. This may allow specific implementation strategies to be employed to maximize the adoption success of the IT. Both the diffusion of innovations[11] and the transtheoretical[12] models note that people at different adoption stages will be more responsive to different implementation techniques. The study instrument allows the implementation team to stratify physicians according to their knowledge, interest, and other characteristics. This may allow the implementation team to direct particular strategies to specific individuals. This instrument would also allow the implementation team to follow the changes in the physicians, and change the implementation strategies used as the physician evolves.

This study realized its objective in piloting a new survey instrument designed to discriminate among family physicians with different characteristics relating to IT. It was found to be reliable, and showed validity in discriminating among the physician groups. Although further research is required, the survey shows promise in becoming a tool to allow more efficient implementation techniques to be used to enhance the adoption of IT by family physicians.

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