

AN EXAMINATION OF PATIENTS' PRIVACY CONCERNS AND INTENTION TO USE MEDICAL IMAGE EXCHANGE CENTER IN TAIWAN

I-Chiu Chang, National Chung Cheng University, 168, University Rd., Min-Hsiung ChiaYi, Taiwan, ROC, Phone: +886-5-2720411, E-mail:misicc.pig@gmail.com

Hsiao-Ting Tseng, National Chiao Tung University, Management Building 2, 1001 Ta Hsueh Road, Hsinchu, Taiwan 300, ROC, Phone: +886-3-5712121, E-mail:appleapple928@gmail.com

Won-Fu Hung, Wu Feng University, 117, Sec 2,Chiankuo Rd, Minhsiung, Chiayi County, Taiwan, ROC, Phone:886-5-2267125, E-mail: wonder@wfu.edu.tw

Hsin-Ginn Hwang, National Chiao Tung University, Management Building 2, 1001 Ta Hsueh Road, Hsinchu, Taiwan 300, ROC, Phone: +886-3-5712121, E-mail:hghmis@iim.nctu.edu.tw

ABSTRACT

The Image exchange center (IEC) was established by Taiwan DOH in 2009 to accelerate the adoption of EMR. Do patients accept the IEC? The primary purpose of the study is to examine patients' information privacy concerns (IPC) and their intention to use Medical IEC.

Keywords: Information Privacy Concerns, Trust, Medical Image Exchange, Taiwan, Moderator

INTRODUCTION

Medical Image Exchange Center (IEC) is a typical HIE organization providing a national level public service in Taiwan. In the future, the medical image exchange will provide patients quick, convenient and high quality medical images electronically.

Patient information privacy protection is always the major concern in the development of Health Information Exchange (HIE). Some countries have established Regional Health Information Organizations (RHIOs) and HIE is one of their activities, example being the Indianapolis Network for Primary Care in central Indiana and Memphis in western Tennessee in USA and Electronic Child Network (eChin) in Canada. According to McGraw et al. (2009), based on the Health Insurance Portability and Accountability Act (HIPAA), some national level HIE operations could develop more stringent systems to ensure patient privacy and control access patients medical records. And Taiwan is an instance.

The overall purpose should be to promote public interest and provide safe and efficient medical service with legitimate use of medical images. For a better understanding of patient information privacy protection, we should know more about patients' information privacy concerns.

LITERATURE REVIEW

Concerns for information privacy (CFIP)

Smith et al. (1996) developed and validated an instrument that identified and measured the primary dimension of individual's concerns about organizational information privacy practices, named concern for information privacy (CFIP). CFIP is widely cited. Since Stewart & Segar (2002) validated the relationship between CFIP and usage intention, many studies examined that relationship and had different results. Four constructs of CFIP have different impacts on intention in different setting in previous studies (Stewart & Segars, 2002; Bellman et al., 2004; Ellen, 2006; Hung, 2006; Van Slyke et al., 2006; Korzaan & Boswell, 2008) Therefore, we estimated that between these four constructs and patients' intention to use IEC, there might have moderator exists. Milne and Boza (1999) indicated that consumers' sensitivity towards personal information being collected and used by direct marketing firms, as well as their trust in these firms, may well determine the level of consumer concern, and ultimately, the efficacy of future healthcare delivery. It is important for policymakers to understand consumer attitudes towards personal medical information used in direct marketing efforts (Rohm & Milne, 2004). Therefore, in this study, we employed "trust" as a moderator to examine CFIP in IEC setting.

An individual's attitude about privacy will not necessarily be predictive of that person's behavior within a different context (McMillen, 2004). Most papers discussed about CFIP are in Western countries (e.g. US) and in e-commerce, seldom case is discussed CFIP about Taiwanese and in healthcare field. In IEC setting, the professional ones are physicians. Due to Confucianism, Taiwanese may follow physicians' orders. And Taiwanese always like to inquiry other people's privacy (Peng, 2003). Therefore, in this study, we want to examine whether Taiwanese's concerns for information privacy in IEC setting fit previous studies or not.

Medical Image Exchange in United States

In U.S., there are two success stories of medical images exchange adoption in the U.S.: The implementation of DIN-PACSI, II, III in U.S. military to exchange medical images between the U. S. military hospital system. The other is in the Veterans Health Administration, which over 160 hospitals and has achieved universal use. In U.S., medical images exchange is part of EHR. EHR are transferring between disparate hospitals. Despite there are many potential benefit in quality improvement (McGlynn et al., 2003) and cost reduction (Schoen et al., 2004), but rates of HER use in U.S. hospitals were low (Jha et al., 2006). Only a small minority of U.S. hospitals and other providers engage in EHR (Chaudry et al., 2006). In the U.S., they sharing of medical images between providers has been organized around Regional Health Information Organizations (RHIOs) (Jha et al, 2008) and there is only a small number (fewer than a dozen)

have begun to exchange medical images, total population involved less than 1 percentage of U.S.(Adler-Milstein et al., 2007). And the critical factor in their long-term success is financial sustainability of RHIOs, remains unknown (Jha et al., 2008).

Medical Image Exchange in Taiwan

Patient in Taiwan have three choices when they are asked for medical images: re-examination, traditional way, Resource Sharing and IEC. Compare to Resource Sharing and IEC, traditional way is more inconvenient and waste patients' time and money (DOH, 2004).

IEC cover four medical channels: outpatient, hospital, referral and emergency. IEC is responsible for image indexing, and operation of exchange of reports. National Health Insurance bureau (NHI) provides for medical image exchange support measures and audit services and supervision implementation of medical image exchange operations by hospitals. Physicians use the Healthcare Certification IC card (HCIC) and patients' National Health Insurance IC card (NHIIC) to log on the exchange system with physician order entry system or directly, and access reports (including thumbnails). Physicians can download images through the integrated physician order entry system. In these processes, patient's privacy is fully protected as their consent is necessary. At present there are three basic authentication control mechanisms: medical personnel's HCIC, medical institution's HCIC and server authentication. When necessary, certified with patient's NHIIC, the use of authentication vary due to timing. However, inevitably, when such certification cannot be implemented, but the need for medical image is urgent, medical image exchange request by simple authentications (signature, witness by others) is accepted. In IEC, patients don't need to pay any fees, it is completely free and it can reduce clinical decision making time of physicians and patients. What patients should do is to sign the consent to help medical staffs to collect your medical images and medical staffs will process the following related matters (such as avoid errors, protect information security of these medical images).

No matter what choices you make, privacy is an important consideration for you to make a decision. A public's health records are regarded as personal and private information. Medical institutions and medical practitioners have obligations to protect privacy of medical information. However, the scope of privacy protection is limited by considerations of public interest.

RESEARCH MODEL AND HYPOTHESES

According to prior empirical results as previous researches (Stewart & Segars, 2002; Chellapa & Sin, 2005; Dinev & Hart, 2004; Stone et al., 1983) there are four constructs of concern for information privacy that are believed to have a negative association with patients' intention to

use IEC. We also added trust as a moderator between CFIP and intention (Rohm & Milne, 2004). Based on background of this research and results of factor analysis, the framework of this research is shown as Fig. 1.

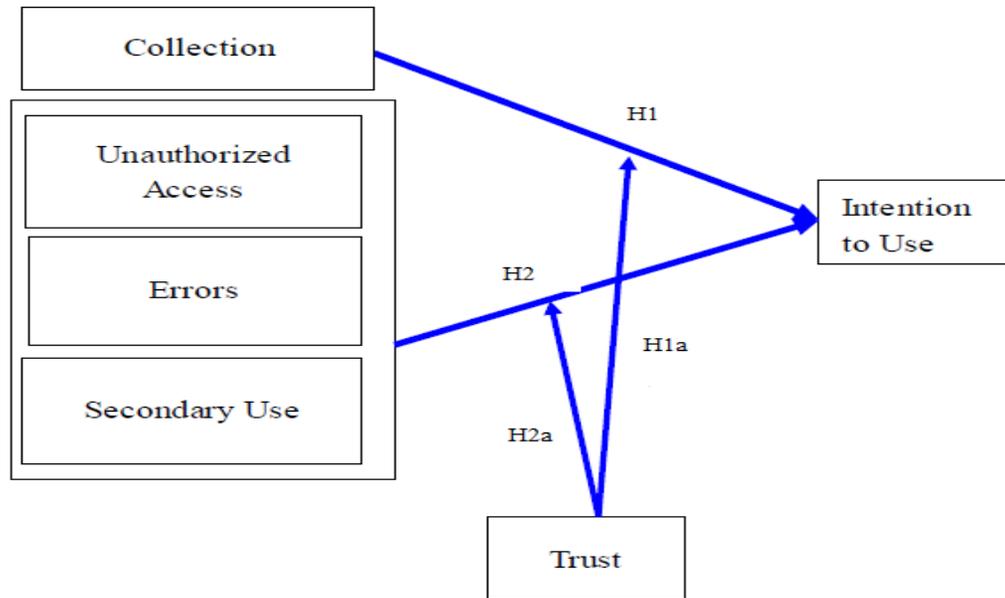


FIGURE1. Research Framework.

Concern of collection is that extensive amounts of personally identifiable data are being collected and stored in IEC. Unauthorized access use reflects patients' concerns regarding whether medical images about patients are available to people not properly authorized to view or work with this medical images. Concerns regarding errors relate to patients' concerns about transmission distortion of medical images. Secondary use pertains to concerns that medical images are collected from patients for one purpose but is used for another, secondary purpose without authorization from the patients.

The propensity to trust is a personality trait that moderates the effect of trustworthiness attributes on the formation of trust (Mayer et al., 1995). This moderation effect acts positively in the sense that the higher the level of trust propensity, the greater the impact on the trust. Some possible hypotheses for this group of factors are:

H1: Patients' information privacy concerns about collection of information by medical staff will have negative effect on patients' intention to use IEC.

H2: Patients' information privacy concerns about unauthorized access, errors, secondary use of information by medical staff will have negative effect on patients' intention to use IEC.

H1a: Patients' trust in medical staffs will moderate the effect on patients' information privacy concerns of medical staffs' collection on patients' intention to use IEC.

H2a: Patients' information privacy concerns about unauthorized access, errors, secondary use of information by medical staff will have negative effect on patients' intention to use IEC.

METHODOLOGY

Instrument Development

Measurement items were adapted from prior validated questionnaires (Smith et al., 1996; Gefen, 2000) and modified based on healthcare context. Seven point Likert scale (1 point - strongly agree, 7 points - strongly disagree) was utilized to measure the perceptions of respondents. The questionnaire consists of two parts. The first part is the demographic data of respondents. The second part is focuses on the CFIP, trust and usage intention. An expert panel comprised of two professors specialized in healthcare information management and two physicians experienced in medical images were held to validate and modify the content of the questionnaire. Finally, a pilot test by 30 patients was also conducted to ensure the correct meanings of sentences in the questionnaire.

The methodology of the research is survey. Multiple items were used for measuring the research variables using a seven-point Likert scale. A self-administered survey was used to collect data. Three hundred and fifty patients participated in the survey. Response rate is 100%. As a result, 323 responses were retained for the subsequent analyses.

Sample and Data Collection

The subjects of this study are patients in Taiwan. A total of 350 questionnaires was sent to hospitals. Totally, 348 questionnaires were collected. The responded questionnaires were further reviewed based on the criteria that the collected questionnaires must not consist of missing values to determine whether they were valid samples. After the screening, 323 questionnaires conformed to the criteria resulting in a valid response rate of 92.2%.

RESULTS

Demographic Data Analysis

Most respondents were in the age group of 20-39 years old (65.4%). Most of them are university/college students (36.8%) and master or higher (33.1%). Most of the participating patients have medical image experience (60.1%) and most of their medical image experience is for more than one year (27.9%).

Descriptive statistics for CFIP

On average, concerns about collection (mean: 3.91) is higher than concerns those about unauthorized access (mean: 2.44), errors (mean: 2.41) and secondary use (mean: 2.21).

Measurement Model

The variance inflation factor (VIF) and tolerance value were examined to detect multicollinearity. In this research, tolerance values are 0.922, 0.336, 0.323 and 0.368 and VIF values are 1.084, 2.973, 3.098 and 2.714. Tolerance values that are greater than 0.10 and VIF values not exceeding 10 indicate that problems of high multicollinearity are not present (Tabachnick & Fidell, 1983). Therefore, in this research, multicollinearity problem is not considered.

Tests of Hypotheses

Hypothesis 1 and Hypothesis 2 are discussed the relationship between user factor, environmental factor and patients' intention to use IEC. Hypothesis 1a and Hypothesis 2a are discussed the relationship after moderated by trust. Hypothesis 1 and Hypothesis 2 were supported by data. As we found out in factor analysis and hypotheses tests, we can find out that unauthorized access, errors and secondary use these three factors are not easy for patients' to identify each other. The reasons we will discuss later. Therefore, we follow the research finding to refine this research model to fit patients' information privacy concerns in IEC setting (as shown in Fig. 2)

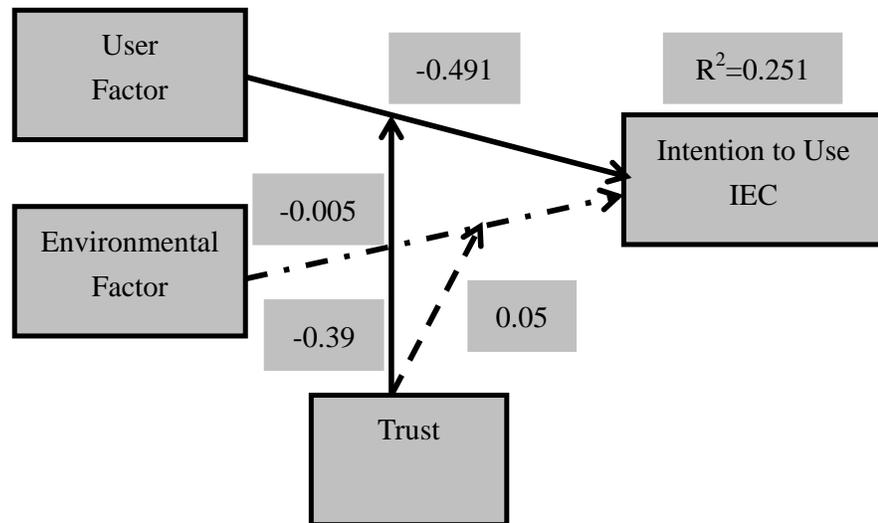


FIGURE 2. Modified Research Model.

After refined this research model, R^2 is 0.251, the conclusions and reasons will discuss later.

DISCUSSION AND CONCLUSIONS

Patients Do Have Information Privacy Concerns about Their Medical Images

This research examines patients' information privacy concerns on collection, unauthorized access, errors and secondary usage when their medical image information is stored in IEC. Therefore, we use the theory of CFIP (Smith et al., 1996) as the theoretical foundation to examine patients' information privacy concerns about medical image exchange, and to discuss whether patients' privacy concerns affect patients' intention to use IEC. Therefore, we modified CFIP into two variables: user factor and environmental factor, after being modified, R^2 is 0.251. Through after interviews, it was found that the low R^2 is explained by patients' trust in physicians and in government, and cost and convenience. Due to reasons deduced from after interviews, we can know that there still are other important factors that influence patients' intention to use IEC, such as free (cost) and convenience. These factors have more direct influence than information privacy concerns. When we interviewed our research subjects, most showed their attitude toward privacy as if it doesn't matter. Most of them know privacy is important, but compared with information privacy concerns, loyalty to physicians/ hospitals and trust in physicians/ hospitals/ governments and free to use are the more powerful incentives for them. Under such incentives, they are willing to give up privacy. The Taiwanese culture is based on Confucianism. Education in Taiwan does not focus on issues about privacy because Taiwanese believe in Confucianism, and Confucianism is contrary to the concept of privacy (Liu, 2000, Hofstede, 2001; Hofstede, 2005). This corresponds to Confucius's ideas. The boundary line of privacy is "no evil", it is a fuzzy principle for our Confucianism to follow (Tsai, 2004; Xu et al., 2008). Therefore, patients have a fuzzy view of the importance of privacy. But because of the unclear of privacy, it doesn't affect patient's behavioral intentions. So, it matches results of this research that the Taiwanese have high information privacy concerns but are still willing to use this free, convenient government sponsored facility, i.e. IEC.

Conclusions

With the success of IEC, costs of patients and medical institutions can be reduced to achieve a win-win situation for all. Patients believe medical care services protect their information privacy and, therefore, medical care service should maintain trust to keep the ideal physician-patients relationship. Suggestions are offered to the government that patients trust government's decision and policy and, therefore, the government should encourage public to use IEC more positively. And Patients do concern about collection, unauthorized access, errors and secondary use of their medical information, therefore, government should strengthen

policy and information security about patients' medical information to keep patients' trust. Through this research, the academia can understand the impact of IEC implementation on patients' privacy concerns, and this research can be a reference for future researchers. This research shows that there are still other factors that affect patients' intention to use IEC. This research shows the direction in limitation section for the academia to find the other factors between CFIP and intention to use IEC in healthcare field.

REFERENCES

- Adler-Milstein, J., McAfee, A., Bates, D.W., Jha, A.K.(2007). The State of Regional Health Information Organizations: current activities and sources of funding, *Health Affairs*, 27(1), 60–69.
- Bellman, S., Johnson, E. J., Kobrin, S. J., & Lohse, G. L. (2004). International differences in information privacy concerns: A global survey of consumers. *The Information Society*, 20, 313-324.
- Chaudhry, B., Wang, J., Wu, S.(2006). Systematic review: impact of health information technology on quality, efficiency, and costs of medical care, *Ann. International Medicine*, 144(10), 742–752.
- Chellappa, R. K., & Sin, R. (2005). Personalization versus privacy: an empirical examination of the online consumer's dilemma. *Information Technology and Management*, 6, 181-202.
- Department of Health, Executive Yuan, R. O. C. (Taiwan)
http://www.doh.gov.tw/EN2006/index_EN.aspx
- Dinev, T., & Hart, P. (2004). Internet privacy concerns and their antecedents measurement validity and a regression model. *Behavior & Information Technology*, 23, 413-422.
- Hofstede, G. (2001). *Culture's Consequences: Comparing values, behaviours, Institutions, and organizations across Nations*. (2nd ed.). Sage: Thousand Oaks.
- Hofstede, G. (2005). *Cultures and Organizations: Software of the Mind*. London: McGraw-Hill.
- Hung, W. F. (2006). Health consumers' internet privacy concerns and their antecedents over different types of information, unpublished.
- Jha, A.K., Ferris, T.G. Donelan, K.(2006). How common are electronic health records in the United States? A summary of the evidence, *Health Affairs*. 25 (6), 496–507.

- Korzaan, M. L., & Boswell, K. T. (2008). The influence of personality traits and information privacy concerns on behavioral intentions. *Journal of Computer Information Systems*, 48, 15-24.
- Liu, M. H. (2000). Civics education in Taiwan: Values promoted in the civics curriculum. *Asia Pacific Journal of Education*, 20, 73-81
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An integrative model of organizational trust. *The Academy of Management Review*, 20, 709-734.
- McGraw, D., Dempsey, J., X. Harris, L., & Goldman, J. (2009). Privacy as an enabler, not an impediment: Building trust into health information exchange. *Health Affairs*, 28, 416-427.
- McGlynn, E.A., Asch, S.M. & Adams, J. (2003). The quality of health care delivered to adults in the United States, *The New England Journal of Medicine*, 348, 2635–2645.
- McMillen, D. (2004). Privacy, confidentiality, and data sharing: Issues and distinctions. *Government Information Quarterly*, 21, 359-382.
- Milne, R., & Boza, M. E. (1999). Trust and concern in consumers' perceptions of marketing information management practices. *Journal of Interactive Marketing*, 13, 5-24.
- Peng, S. Y. (2003). Privacy and the construction of legal meaning in Taiwan. *International Lawyer*, 37, 1037-1054.
- Rohm, A. J., & Milne, G. R. (2004). Just what the doctor ordered: the role of information sensitivity and trust in reducing medical information privacy concern. *Journal of Business Research*, 57, 1000-1011.
- Ross, E. A. (2006). An examination of the concern for information privacy in the New Zealand regulatory context. *Information & Management*, 43, 322-335.
- Schoen, C., Osborn, R., Huynh, P.T. (2004). Primary care and Health Affairs. (Millwood) *Suppl Web Exclusives* (July-Dec 2004) w4-487-503.
- Stone, E. F., Gardner, H. G., & McClure, S. (1983). A field experiment comparing information privacy values, beliefs and attitudes across several types of organizations. *Journal of Applied Psychology*, 68, 459-468.
- Tabachnick, B. G., & Fidell, L. S. (1983). *Using Multivariate Statistics*. (7th ed.). New York: Harper & Row.
- Tsai, D.F.C. (2001). How should doctors approach patients? A Confucian reflection on personhood. *Journal of Medical Ethics*, 27, 44-50.

- Van Slyke, C., Shim, V J. T., Johnson, R., & Jiang, J. (2006). Concern for information privacy and online consumer purchasing. *Journal of the Association for Information Systems*, 7, 415-444.
- Smith, H. J., Milberg, S. J., & Burke, S. J. (1996). Information privacy: measuring individuals' concerns about organizational practices. *MIS Quarterly*, 20, 167-196.
- Stewart, K. A., & Segars A. H. (2002). An empirical examination of the concern for information privacy instrument. *Information Systems*, 13, 36-49.
- Xu, Z., Tang, L., & HE, C. (2008). Drama author's concept of privacy and Confucian philosophy. *Journal of Jining University*, 29.