

---

**DECISION SCIENCES INSTITUTE**

A Framework for Diabetes Self-care Efficacy in Evaluating Personal Health Record

Elisa Lin

Chiao Tung University, Taiwan  
Email: [elisa.iim01g@nctu.edu.tw](mailto:elisa.iim01g@nctu.edu.tw)

Hsin-Ginn Hwang

Chiao Tung University, Taiwan  
Email: [hghmis@nctu.edu.tw](mailto:hghmis@nctu.edu.tw)

Ming-Ling Sher

Chung Cheng University, Taiwan  
Email: [r8843003@ms55.hinet.net](mailto:r8843003@ms55.hinet.net)**ABSTRACT**

This study attempts to develop a diabetes self-efficacy conceptual model and presents the diabetes PHR self-efficacy scale (DPSES) as an assessment of using PHR application in diabetes self-care field. A convenient sampling was applied and a total of 57 valid data were collected and analyzed to yield a three-factor structure PHR diabetes self-efficacy model. The DPSES captures the diabetes self-efficacy concept as a tool for evaluating the patient-oriented benefits in using PHR for the purpose of diabetes self-management. Related findings and the results of the instrument are discussed in this study.

**KEYWORDS:** Diabetes self-care, Personal Health Records, and Self-efficacy

**INTRODUCTION**

Diabetes is a major and growing health care problem. With it accounts for a vast burden of morbidity through multiple complications. Self-care is an important mechanism by which self-efficacy influences such lifestyle choices as diet and exercise. The strength of self-efficacy belief is of importance as a diagnostic strategy for diabetes self-management education aimed at the improvement of health outcomes (Maibach & Murphy, 2001). Diabetes management depends heavily on behavioral self-regulation. Bandura's self-efficacy theory is an optimal strategy to facilitate diabetes self-care to achieve these lofty treatment goals and actualize the holistic healthcare concept.

As the dramatic information technology evolution in health care, the personal health record (PHR) is seen as a possible solution for coping with the cumbersome psycho-behavioral complexity of diabetes self care. PHR is also a new healthcare paradigm to develop the patient-centered information systems. However, there still remain few instruments available to assess the benefits of using PHR. Thus, this research serves self-efficacy viewpoint to develop an instrument for assessing PHR benefit on the diabetes self-care.

**LITERATURE REVIEW****Diabetes Self-care**

Diabetes is a self-care intensive illness in which patients must maintain constant vigilance for symptoms that signal hypo- or hyperglycemia, the activity daily life (e.g., nutrition, physical activity) most affecting the wellness and quality of life are controlled by the patients (Glasgow et al., 1999; Gonder-Frederick, Cox, & Ritterband, 2002; McCaul, Glasgow, & Schafer, 1987). The major goal of contemporary diabetes treatment is to keep blood glucose levels in a normal range through the use of medication, blood glucose monitoring, diet therapy, and exercise to decrease the long-term complications of chronic hyperglycemia. Furthermore, the diabetes must perform multiple self-care behaviors such as foot-care regimen, regular aerobic exercise, and frequent medical appointments on a daily basis for the remainder of their life spans after diagnosis.

Self-care is a term generally implies an approach to acquire needed health service and refers to activities that individuals undertake in promoting their health status, preventing occurrence of disease, and adapting to their irreversible illness condition. A definition of self-care in a World Health Organization (WHO) publication emphasizes “the unorganized health activities and health-related decision-making by individuals, families, neighbors, and colleagues (Ward, 1990)”. Although it is technologically possible to normalize diabetic blood glucose levels, actually seldom patients achieve this goal. Thus we need to recognize the psychological and social factors involved in the process of diabetes self-management is a critical factor in helping patients to improve their coping with the daily demands of self-regulation. The diabetes need a comprehensive approach to communicate with health-care providers regarding adherence issues and cope with emotional responses (e.g., diabetes burnout) (Frohna, Frohna, Gahagan, & Anderson, 2001; Glasgow & Eakin, 1998; Glasgow et al., 1999; Glasgow et al., 1992; Polonsky, 1999)

### **Self-efficacy**

Self-efficacy is a construct derived from social cognitive theory (Bandura, 1986) positing a triadic reciprocal causation model in which behavior, cognitions, and the environment all influence each other in a dynamic fashion (Bandura, 1977). When applied to health, the theory suggests that patients are empowered and motivated to manage their health problems when they feel confident in their ability to achieve this goal (Maibach & Murphy, 2001). Self-efficacy has also assumed an increasingly important role in health promotion practice and researches independent of its original theoretical context (Garland, Weinberg, Bruya, & Jackson, 1988; Rosenstock, Strecher, & Becker, 1988; Strecher & DeVellis, 1986).

These studies emphasize on that patients' daily self-care regimen is more difficult than the diagnosis. Adherence to treatment is low according to data in the literature (Brownlee-Duffeck, 1987; Funnell & Anderson, 2000; Robiner & Keel, 1997) and inadequate control of the disease may lead to acute and chronic complications in several organs, such as the kidneys, eyes and heart, and in the circulation (Hayden, 1998; Shamoan et al., 1993). Therefore, with the importance of keeping good glucose control, the role self-efficacy plays in diabetes self-care is the key factor in successfully achieving behavioral goals.

### **Personal Health Record**

There is no uniform definition of PHR (NCVHS, 2006) and the authors attempt to depict it from many studies as below. The concept of PHR includes any internet-accessible application that enables a patient to create, review, annotate or maintain a record of any aspects of their health condition, medication, medical problems, allergies, vaccination history, visit history, or communications with their healthcare providers (Markle Foundation, 2003; Sittig, 2002).

The Markle Foundation (2003) describes PHR as an electronic application through which individuals can access, manage and share their health information in a private, secure, and confidential environment. The Foundation also recommends that an ideal PHR must have the following attributes: each person controls his or her own PHR, contains information all over one's entire lifetime, accessible at any time and anywhere, private and secure, transparent, individuals can trace who accessed each piece of data, and permits easy exchange of information across the health care system (Markle Foundation, 2004).

The American Health Information Management Association (AHIMA, 2005) also describes PHR as an electronic, universally available, lifelong resource of health information needed by individuals to make health decisions, individuals own and manage their information in their own PHR which comes from both healthcare providers and the individual, the PHR is maintained in a secure and private environment, with the individual determining rights of access, and the PHR will not replace the legal record of any provider.

PHR seems to have the potential to facilitate the interaction of health care continuum, empower patients to get involved in their own health, increase the relationship between physician and patient through the integrated mechanism to tailor and canalize the information to fit personal health needs (Houston & Ehrenberger, 2001; Tang, Ash, Bates, Overhage, & Sands, 2006) With PHR, patients with chronic illnesses will be able to track their diseases in conjunction with their providers, promoting earlier interventions when they encounter a deviation or problem (Tang et al., 2006). A survey reported more than 72% respondents are eager for the new functionalities PHR offer (McInturff, 2005).

Based on several previous studies (Endsley, Kibbe, Linares, & Colorafi, 2006; Markle Foundation, 2004; Pratt, Unruh, Civan, & Skeels, 2006; Sprague, 2006; Tang et al., 2006; Ueckert, Goerz, Ataian, Tessmann, & Prokosch, 2003; Win, 2006), PHR offer a number of potential benefits to patients, primary care physicians and other healthcare providers. These benefits include: 1) Empowerment of patients; 2) Improved relationships between patients and health providers; 3) Increased patient safety; 4) Improved quality of care; 5) More efficient delivery of care; 6) Better safeguards on health information privacy; and 7) Cost saving.

## **HYPOTHESES/MODEL**

The survey methodology was adopted in this study. The seven-factor structure derived from PHR's benefits (Markle Foundation, 2004) to this research framework and attempted to analyze what the conceptual model of diabetes self-efficacy is within PHR context. From the review of researches, the Diabetes PHR Self-Efficacy Scale (DPSES) was proposed with empowerment, patient-provider relationship, patient safety, and quality of care, efficient care, privacy, and cost saving constructs.

## **METHODS**

Prior to the survey, an expert panel was conducted after the draft questionnaire to serve as a content validity test. For the purpose of content and preface validity, the instrument is administered on ten participants who have been involved in more than two weeks patient education and familiar with diabetes self-care context, including an with four MIS professors, five Certified Diabetes Educators (CDE), and a metabolic physician were invited to participate in panel evaluation. The expert panels were conducted to get maximum feedback for designing the scale.

Responses from all panelists are pooled and the number indicating "essential" and "useful but not essential" for each item is determined. In validating a test, a content validity ratio (CVR)

value is computed for each item. We adopted the minimum CVR (Lawshe, 1975) .62 to retain or eliminate the items for our further tests. We dropped out two constructs (patient safety and privacy safeguard) in the expert panel evaluation and yielded 23 items for the pretest. Next, we invited five diabetes educators to participate the pretest and they confirmed all items retained by the expert panel except one item was modified for semantic confusion. Those items that fit five constructs (empowerment, patient-physician relationship, quality of care, efficiency of care, and save money) were retained, yielding 23 items for field survey. Convenient sampling method was used to recruit participants (over 18 year-old) from voluntary outpatients with diabetes and their caregivers including physicians, CDE, therapists, and the diabetes' families in the department of endocrinology and metabolism in five hospitals in south Taiwan. Structured questionnaires were administered to the participants. A total 60 participants got involved in the study. After dropping some invalid and inadequate responses, the total valid responses were 57. The SPSS 16.0 was used for processing the data analysis. All of the respondents in the sample aged from 20 to 69. Approximately 58% of the respondents are female, and 42% are male. 31.6 % participants have experienced diabetes care for 2~5 years, and 26.3 % for 6~10 years. The diabetes patient accounts for 35.1% respondents in this survey and the rest part is diabetes care provider.

## RESULTS

The questionnaire was used to capture latent variables were measured on a 7-point Likert scale anchored by 1 (absolutely disagree) to 7 (absolutely agree). Next, exploratory factor analyzed the 23-item instrument to examine the dimensionality of the construct. In the quest for a stable structure, we took an iterative procedure that began with submitting the items to a factor analysis with varimax rotation. Hair et al. (2006) suggest that item loadings above 0.30 are considered significant, over 0.40 are more important, and exceed 0.50 are considered very significant.

To examine the most significant loadings in interpreting the factor solution, the authors decided to use a cut-off point of 0.50 for item loadings. The process went on until reaching a meaningful factor structure. The factor analysis reveals three factors with eigenvalue over 1 to filter the items.

Table 1 shows that there are three factors explaining 77.89 % of the variance in diabetes PHR self-efficacy.

Table 1 Principal components analysis with varimax rotation

|     | Component |          |          |
|-----|-----------|----------|----------|
|     | Factor 1  | Factor 2 | Factor 3 |
| Q20 | .825      |          |          |
| Q19 | .785      |          |          |
| Q18 | .782      |          |          |
| Q21 | .770      |          |          |
| Q17 | .742      |          |          |
| Q10 | .733      |          |          |
| Q11 | .725      |          |          |
| Q16 | .671      |          |          |
| Q1  | .598      |          |          |
| Q6  |           | .864     |          |
| Q7  |           | .784     |          |

|                    |        |        |        |
|--------------------|--------|--------|--------|
| Q8                 |        | .722   |        |
| Q5                 |        |        | .842   |
| Q4                 |        |        | .732   |
| Q12                |        |        | .725   |
| Variance explained | 37.916 | 20.879 | 19.096 |

With the result of factor analysis, the authors renamed the three factors as quality of diabetes self-care, physician-patient relationship, and empowerment respectively, and 15 items are remained in the end of factor analysis.

## DISCUSSION AND CONCLUSIONS

The results of the research depict three dimensions of diabetes PHR self-efficacy (empowerment, patient-physician relationship, and quality of diabetes self-care) and provide the psychometric properties of the 15-item instrument. Coping with one's diabetes requires the specific behaviors to be carried out many times a day to achieve homeostatic metabolic control. Most of the information system evaluation researches focused on user's satisfaction, perceived usefulness, user's acceptance, ease of use, and diffusion of innovation issues to construct identification or measurement of IS efforts. In this study, we moved our strides to the nature of the diabetes' need of self-care from using PHR, and also expected the PHR will be a new paradigm of diabetes education.

A primary contribution of this study is to establish an instrument for assessing the diabetes self-efficacy by using PHR and construct the self-efficacy conceptual model by using PHR. The research adapted the benefits of PHR to quest what are the factors forming diabetes self-efficacy conceptual model by using PHR. The authors view patient's demand on HIT as an important concept for PHR's development and adoption, and this research findings create a possible strategy for healthcare industry practitioners to figure out the appropriate business model to make PHR into practice.

The nature of respondents (diabetes patients and their healthcare providers) is a limitation in this study. However, our literature review shows self-care concept involving the health-related decision-making by patients, families, neighbors, and self-care colleagues, that's the reason we combined those population as possible as we could to investigate the conceptual of diabetes self-efficacy. The DPSES measures the perceived concept of diabetes PHR self-efficacy, not the real experience of using PHR. However, it is definitely a worthwhile starting point to evaluate the PHR's benefits in diabetes education.

Nowadays the definition of PHR is still evolving. It is an exploratory study of diabetes PHR self-efficacy. Translating health knowledge into behaviors remains a challenge in health promotion domain (Rimal, 2000). There are ample studies that self-efficacy intervention can increase our perceived ability to exert health behaviors. Given that diabetes is rooted in morbid dietary habits and sedentary lifestyle, behavioral modification is useful to enhance diabetes self-care behaviors and personal health management.

PHR is perhaps the holy grail (Rissel, 2001; Tang & Lansky, 2005) in the realm of health promotion, a 2005 annual survey of the Palo Alto Medical foundation (PAMF) showed that one-fifth of respondents reported that they had changed their health behavior (Tang et al., 2003;

---

Tang & Lansky, 2005). This research results reveal an instrument for assessing PHR's benefits to support the diabetes for facilitating their diabetes self-efficacy to exert self-care behaviors. More related psychosocial researches upon the information technology to improve the quality of diabetes care are expected.

## REFERENCES

- AHIMA. (2005). The Role of the Personal Health Record in the EHR. *Journal of AHIMA*, 76(7), 64A-D.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.
- Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. New Jersey: Prentice Hall.
- Brownlee-Duffeck, M. (1987). The Role of Health Beliefs in the Regimen Adherence and Metabolic Control of Adolescents and Adults with Diabetes Mellitus. *Journal of Consulting and Clinical Psychology*, 55(2), 139-144.
- Endsley, S., Kibbe, D. C., Linares, A., & Colorafi, K. (2006). An introduction to personal health records. *Fam Pract Manag*, 13(5), 57-62.
- Foundation, M. (2003). *Connecting for Health-A Public-Private Collaboration: The Personal Health Working Group, Executive Summary*.
- Foundation, M. (2004). *Connecting Americans to Their Healthcare: Final Report. Connecting for Health*.
- Frohna, J. G., Frohna, A., Gahagan, S., & Anderson, R. M. (2001). Tips for communicating with patients in managed care. *Seminars in medical practice*, 4(2), 29-36.
- Funnell, M. M., & Anderson, R. M. (2000). The Problem With Compliance in Diabetes (Vol. 284, pp. 1709-1709): *Am Med Assoc*.
- Garland, H., Weinberg, R., Bruya, L., & Jackson, A. (1988). Self-efficacy and endurance performance: a longitudinal field test of cognitive mediation theory. *Revue internationale de psychologie appliquee*, 37(4), 381-394.
- Glasgow, R. E., & Eakin, E. G. (1998). Issues in diabetes self-management. *The Handbook of Health Behavior Change*, 435-461.
- Glasgow, R. E., Fisher, E. B., Anderson, B. J., LaGreca, A., Marrero, D., Johnson, S. B., et al. (1999). Behavioral science in diabetes. Contributions and opportunities. *Diabetes Care*, 22(5), 832-843.
- Glasgow, R. E., Toobert, D. J., Hampson, S. E., Brown, J. E., Lewinsohn, P. M., & Donnelly, J. (1992). Improving self-care among older patients with type II diabetes: the "Sixty Something..." Study. *Patient Educ Couns*, 19(1), 61-74.
- Gonder-Frederick, L. A., Cox, D. J., & Ritterband, L. M. (2002). Diabetes and behavioral medicine: The second decade. *Journal of Consulting and Clinical Psychology*, 70(3), 611-625.
- Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (2006). *Multivariate data analysis*, (six ed.): Englewood Cliffs, NJ: Prentice-Hall.
- Hayden, M. R. (1998). Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UDPDS 33). *Lancet*, 352, 837-853.
- Houston, T. K., & Ehrenberger, H. E. (2001). The potential of consumer health informatics. *Semin Oncol Nurs*, 17(1), 41-47.
- Lawshe, C. H. (1975). A QUANTITATIVE APPROACH TO CONTENT VALIDITY 1. *Personnel Psychology*, 28(4), 563-575.

- Maibach, E., & Murphy, D. A. (2001). Self-efficacy in health promotion research and practice: conceptualization and measurement. *Health Education Research*, 10(1), 37-50.
- McCaul, K. D., Glasgow, R. E., & Schafer, L. C. (1987). Diabetes Regimen Behaviors: Predicting Adherence. *Medical Care*, 25(9), 868-881.
- McInturff, B. (2005). Public Opinions Strategies. Key findings from focus groups and two national surveys conducted on behalf of the Markle Foundation, the Robert Wood Foundation, and Connecting for Health. Presented October, 11, 2005.
- NCVHS. (2006). Personal Health Records and Personal Health Record Systems.
- Norman, C. D., & Skinner, H. A. (2006). eHealth Literacy: Essential Skills for Consumer Health in a Networked World. *Journal of Medical Internet Research*, 8(2).
- Polonsky, W. H. (1999). *Diabetes Burnout*: McGraw-Hill/Contemporary.
- Pratt, W., Unruh, K., Civan, A., & Skeels, M. M. (2006). Personal health information management. *Communications of the ACM*, 49(1), 51-55.
- Rimal, R. N. (2000). Closing the Knowledge-Behavior Gap in Health Promotion: The Mediating Role of Self-Efficacy. *Health Communication*, 12(3), 219-237.
- Rissel, C. (2001). Empowerment: the holy grail of health promotion? (Vol. 9, pp. 39-47): Oxford Univ Press.
- Robiner, W., & Keel, P. K. (1997). Self-Care Behaviors and Adherence in Diabetes Mellitus. *Semin Clin Neuropsychiatry*, 2(1), 40-56.
- Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social Learning Theory and the Health Belief Model. *Health Education & Behavior*, 15(2), 175.
- Shamoon, H., Duffy, H., Fleischer, N., Engel, S., Saeger, P., & Strelzyn, M. (1993). The Effect of Intensive Treatment of Diabetes on the Development and Progression of Long-Term Complications in Insulin-Dependent Diabetes Mellitus. *The New England Journal of Medicine*, 329(14), 977-986.
- Sittig, D. F. (2002). Personal health records on the internet: a snapshot of the pioneers at the end of the 20th Century. *International Journal of Medical Informatics*, 65(1), 1-6.
- Sprague, L. (2006). Personal Health Records: The People's Choice? NHPF Issue Brief, 820, 1-13.
- Strecher, V. J., & DeVellis, M. E. (1986). The Role of Self-Efficacy in Achieving Health Behavior Change. *Health Education & Behavior*, 13(1), 73.
- Tang, P. C., Ash, J. S., Bates, D. W., Overhage, J. M., & Sands, D. Z. (2006). Personal Health Records: Definitions, Benefits, and Strategies for Overcoming Barriers to Adoption (Vol. 13, pp. 121-126): Am Med Inform Assoc.
- Tang, P. C., Black, W., Buchanan, J., Young, C. Y., Hooper, D., Lane, S. R., et al. (2003). PAMFOnline: Integrating EHealth with an Electronic Medical Record System. AMIA... Annual Symposium proceedings [electronic resource], 2003, 644.
- Tang, P. C., & Lansky, D. (2005). The Missing Link: Bridging The Patient-Provider Health Information Gap. *Health Affairs*, 24(5), 1290-1295.
- Ueckert, F., Goerz, M., Ataian, M., Tessmann, S., & Prokosch, H. U. (2003). Empowerment of patients and communication with health care professionals through an electronic health record. *International Journal of Medical Informatics*, 70(2-3), 99-108.
- Ward, W. B. (1990). *Advances in Health Education and Promotion*: JAI Press.
- Win, K. T. (2006). Web-based personal health record systems evaluation. *International Journal of Healthcare Technology and Management*, 7(3), 208-217.