

Health Knowledge Effects

An Integrated Community Health Promotion Platform

I-Chiu Chang, PhD, Chih-Yu Lin, PhD, Hsiao-Ting Tseng, PhD, Wen-Yu Ho, MBA

The Taiwanese government subsidizes healthcare providers offering preventive medicine to patients to help reduce the threats of chronic sickness and halt skyrocketing medical expenditures. Usually, nurses are the primary workers who perform community health promotion; however, because of the chronic shortage of working nurses, many Taiwan hospitals have closed wards and deferred the responsibility of promoting primary prevention. With a community health promotion platform integrating interactive response features and Web sites for community patients and hospital staff, a case hospital efficiently sustained the community health services. The objective of this study was to assess the impact of the integrated community health promotion platform for conducting education. Fifty-four patients/residents were invited to join a quasi-experiment of health education, and a follow-up survey was conducted to assess the acceptance of the community health promotion platform from both the experimental group of learners/users and the hospital staff. The results showed that the community health promotion platform was effective in improving participant health awareness. The experimental group outperformed the control group, with higher posttest scores and longer knowledge retention. Furthermore, users indicated a high acceptance of the community health promotion platform.

KEY WORDS: Community health promotion, Computer-assisted learning, Health promotion, Interactive response system, Patient health education

The United States has more than 162 million patients suffering from seven common chronic diseases, and approximately 48% had large treatment expenditures.¹ Similarly, 42.6% of Taiwan National Health Insurance (NHI) funds were spent on treating chronic diseases.² Many chronic

diseases are attributed to insufficient health education regarding diet, exercise habits, and environmental issues. The “Ottawa Charter” of 1986 indicated the importance of strengthening community actions to achieve better health for patients. The charter proposed one way to promote health is to advocate health knowledge³ at the primary level of preventive medicine.

Several countries have enforced health information policies to protect the health of their people.⁴⁻⁸ The Taiwanese government also developed related health policies for preventive medicine.⁹ Currently, Taiwan healthcare providers are subsidized to offer community health promotion (CHP) services to patients in hopes of reducing threats of chronic sickness and to halt skyrocketing medical expenditures. Nurses are usually the major workforce of the community health service. However, because of a chronic shortage of working nurses, hospitals in Taiwan had to close wards and reduce bed numbers.¹⁰ Overtime¹¹⁻¹³ work was the primary reason for the nurse shortages, which prompted a group of 200 to 300 nurses and their family members to protest at the Department of Health in hopes of relieving the plight of the nurses.¹⁴ Under these circumstances, the majority of Taiwanese hospitals would defer the responsibility of CHP to preserve the labor resources of nurses.

Similar to the adoption of rapid progressed information technology (IT) by other organizations, hospitals also use IT in their operations and management to implement strategies and achieve goals.¹⁵⁻¹⁹ Many studies using IT in healthcare focused on electronic medical records and computer-assisted learning systems to strengthen community health education, showing positive results.²⁰⁻²² Carter et al²³ suggested that education for patients should focus on disease prevention and existing abilities maintenance,²⁴ and several studies used IT tools to help patients do so.^{25,26} The majority of studies focused on the design of health curricula²⁷ or teaching methods²⁷⁻²⁹ and were based solely on the learners’ or teachers’ viewpoint.^{29,30} However, participants in community promotion activities are mostly elderly,^{31,32} and an easy and interactive information system³³ may provide effective health education. This study introduced solutions to provide effective results and overcome the shortage of labor by integrating the needs of learners, teachers, and administrators simultaneously while adopting information systems in healthcare education. Meanwhile, evaluation of the information system is assessed to serve as a reference for promoting community services at the primary level of preventive medicine.

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METHODS

Case Background

The case hospital is a branch of a medical center that was a pioneer in establishing electronic medical records (EMRs) in Taiwan and has a well-developed infrastructure for IT. The area served by the case hospital has a senior population (15.09%) ranked second nationwide and is close to a town with a senior population greater than 20%. The case hospital has 429 beds and employs 51 physicians, 195 nurses, 49 medical technologists, and 125 administrative personnel, and 165 of them were recruited to participate in the health promotion program. Before any electronic information systems were available, the education team, which is the core and largest team of the health promotion program, consisted of more than 30 nurses, 12 medical technologists, and 12 administrative personnel to deliver the community education services. To downsize the education team and provide holistic care for its patients/residents in the community at the same time, the case hospital reengineered the community medical department and developed a CHP platform.

The community patients/residents were recruited through local borough chief and officers excluding patients of the case hospital because they might have healthcare knowledge while visiting the case hospital. Participants older than 50 years with a minimum elementary education background were invited and randomly assigned to experimental and control groups. In total, 54 residents were in the experiment. Those who had high blood pressure and valued self-health management had stronger intentions to join the CH program. Therefore, the sample might not represent the residents older than 50 years of the community.

System Design and Implementation

The major goals of the CHP platform are to provide effective community health education while obtaining little manpower from the case hospital to sustain the community health services. With the aforementioned well-developed EMR infrastructure, the information system department of the case hospital integrated an interactive response system (IRS) and Web sites to serve learners (patients), teachers, and support staff. The prototype systems development method was adopted to allow user feedback during iterative modification in developing the CHP platform. The popular general-purpose scripting language hypertext preprocessor (PHP; Zend Technologies, Cupertino, CA), and open-source database MySQL (Microsoft, Redmond, WA) were used to implement the platform. To conduct community health education, the staff used the Web site CHP platform to access the information and knowledge of diseases such as diabetes or hypertension from the health information database and displayed the learning results using IRS on an interactive whiteboard. The learners used IRS as a classroom

interactive technology tool to provide feedback through in-class quizzes and to respond to pretest and posttest questions. The teachers can modify his/her flow of teaching immediately according to the class responses. The IRS database then records the data of learner responses for later analyses. The system architecture is shown in Figure 1.

System Evaluation

Fifteen male and 12 female participants were assigned to the experimental group taught by an interactive lecture with IRS, and six male and 21 female participants were in the control group taught by traditional classroom lecture with PowerPoint (Microsoft, Redmond, WA) as visual aids. Two classes for each of the three health education programs (sports, diet, and medication) were conducted for both groups. To avoid noise factors caused by different teaching styles, both groups were taught by the same teacher with the same content throughout the program. Learning effects were measured objectively by comparing the learning scores of each program. Items of the knowledge tests were from the project of "Elderly Health Promotion Plan" supported by the Health Promotion Administration (HPA), Ministry of Health and Welfare. The reliability and validity are ensured by the HPA. The sequence of knowledge tests is shown in Table 1. Pretests of sports, diet, and medication are denoted as S1, S3, D1, D3, M1, and M3; posttests were denoted as S2, S4, D2, D4, M2, and M4. Moreover, preserving memory of the acquired knowledge of the three programs is denoted as S21, S41, S22, S42, D21, D41, S23, S43, D22, D42, M21, and M41 after the programs were conducted. The entire community education program lasted for 4 weeks. The learning effect for the experimental group of the sports class can be obtained by subtracting scores of pretest from the posttest ($S2 - S1$) in the week 1 class, and the knowledge retention is indicated by scores of S21, S22, and S23 in the classes of weeks 2 to 4, respectively. The details of the testing process are summarized in Table 1.

Other than being objectively evaluated in terms of Web site education effectiveness, user satisfaction with the CHP platform Web sites and IRS was assessed by distributing questionnaires to hospital staff and IRS learners. Both questionnaires were developed based on prior literature related to system satisfaction measurements. An expert panel consisting of two academic professors from information systems and the CHP field, two experienced administrators in CHP, and an information system developer skilled in user interface was invited to review the platform architecture and questionnaire structure. All items in both questionnaires were assessed using the Likert five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The staff questionnaire contained two parts: the respondent demographics, such as occupation, gender, age, work experience, and education level, and 12 questions

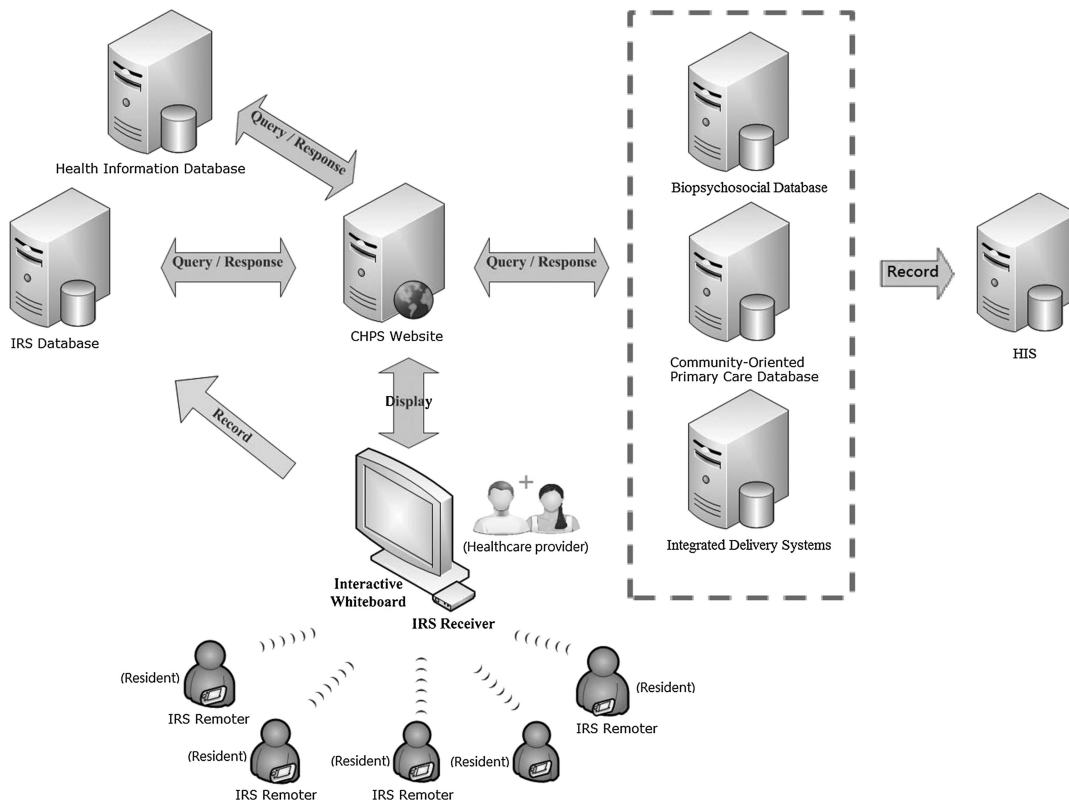


FIGURE 1. System architecture.

for measuring their satisfaction³⁴ regarding content, accuracy, format, ease of use, and timeliness in using the Web site. The questionnaire for learners included 4 constructs of the IRS as follows: (1) perceived usefulness, (2) perceived ease of use, (3) total satisfaction containing items modified from Wang³⁵; and (4) perceived enjoyment containing items modified from Agarwal and Karahanna.³⁶

RESULTS

The experimental group outperformed the control group with higher posttests scores and longer knowledge retention. The survey showed high acceptance of the CHP platform from both the experiment group learners/users and staff.

Effects of the Health Education Programs for Learners

All the 54 subjects took the three education programs and went through each stage of knowledge tests. In other words, the sample sizes for pretest, posttest, and preserving memory test for each group were the same. In total, the experimental group had better performance than the control group did in three programs. However, some of the differences were not significant.

The experimental group significantly outperformed the control group in knowing less, learning more, and retaining more of sports-related health information. The experimental group knew less with the pretest mean scores of 25.92 less than did the control group and learned more with the post-test mean scores of 19.26 more than did the control group. Similar materials were retested in the following weeks to

Table 1. Details of Experimental Framework

Group	Sports		Preserving Memory	Diet		Preserving Memory		Medical Therapy		Preserving Memory		
	Pretest	Posttest	Sport	Pretest	Posttest	Sport	Diet	Pretest	Posttest	Sport	Diet	Medical Therapy
Experimental	S1	S2	S21	D1	D2	S22	D21	M1	M2	S23	D22	M21
Control	S3	S4	S41	D3	D4	S42	D41	M3	M4	S43	D42	M41

show subjects' preserving memory of the taught healthcare information. The experimental group had mean scores of 18.52, 14.08, and 24.44 significantly higher than did the control group in the following 3 consecutive weeks, respectively. Meanwhile, the experimental group significantly learned more by gaining higher mean scores of 17.59 than did the control group in the posttest of diet education program. The better performance of the experimental group indicates that the IRS can improve the effectiveness of learning health promotion education. Details of the scores for different tests for different groups are summarized in Table 2.

User Satisfaction With Community Health Promotion Platform Web Site and Interactive Response System

Staff users of the CHP platform Web site included physicians, nurses, medical technologists, and administrative personnel participating in the CHP. A total of 165 questionnaires were mailed out, and 141 were returned. The majority of respondents were female (66.0%), older than 30 years (67.4%), and nurses (39.0%) who had work experience of less than 10 years (77.3%). The reliability of the questionnaire was measured by Cronbach's α . The α value was .901, indicating that this questionnaire has high internal consistency. The average score of all items in the staff questionnaire was 4.3, which demonstrated that most staff was satisfied with the Web site. The information content and ease of use of the Web site were the least and most satisfied dimensions with average scores of 4.18 and 4.44, respectively. Meanwhile, for the CHP platform, the education team was shown to deliver community health education services with one-half of the nurses from the original workforces. The other half of the nurses were then assigned to perform other levels of preventive medicine.

The learners in the experimental group were asked to complete the IRS user satisfaction questionnaire and responded with an average score of 4.74 for all items. The least and most satisfactory constructs were the ease of use and perceived enjoyment of IRS, with average scores of 4.32 and 4.89, respectively. Results of the descriptive statistics of the user satisfaction for the Web site and IRS are summarized in Table 3.

DISCUSSION AND CONCLUSION

Although the Bureau of NHI in Taiwan subsidizes health-care providers to offer community services, the community and most hospitals may not benefit from the policy without access to appropriate IT to assist with the information management and overcome labor shortages. Using the CHP platform, the case hospital confirmed the positive results of prior studies by applying computer-assisted learning systems to strengthen community health education. Furthermore, the case hospital achieved an enormous improvement in effectiveness of conducting health promotion education activities by integrating IRS with longer knowledge retention. The health knowledge database with systematic analysis and statistics reports provides better management of the CHP activities, which allows the case hospital to downsize education team by half.

Limitations

Two research limitations were encountered. First, because of resource and time constraints, we are currently using the system to educate patient health promotion in one community. Therefore, feedback and performance of the system in this study cannot be generalized to other communities. Second, most research subjects in this study are illiterate community patients who are 50 years or older. It required longer than

Table 2. Details of Different Test Grades Between Groups for All Programs

Programs	Test	Experimental Group – Control Group	Mean Gap	T	P
Sport	Pretest	S1 – S3	-25.92	5.550 ^a	.000
	Posttest	S2 – S4	19.26	-2.618 ^b	.013
	Preserving memory 1	S21 – S41	18.52	-2.948 ^a	.005
	Preserving memory 2	S22 – S42	14.08	-2.107 ^b	.041
	Preserving memory 3	S23 – S43	24.44	-3.140 ^a	.003
Diet	Pretest	D1 – D3	-2.780	0.535	.595
	Posttest	D2 – D4	17.59	-2.774 ^a	.008
	Preserving memory 1	D21 – D41	8.52	-1.243	.220
	Preserving memory 2	D22 – D42	11.30	-1.496	.141
Medical therapy	Pretest	M1 – M3	2.96	-0.347	.730
	Posttest	M2 – M4	11.12	-1.911	.062
	Preserving memory 1	M21 – M41	8.71	-1.208	.233

^a $P < .01$.

^b $P < .05$.

Table 3. User Satisfaction for CHP

Construct	Item	Mean	SD	Average
Web site users satisfaction				
Content	Q1. The Web site provides the precise information you need.	4.24	0.61	4.23
	Q2. The information content meets your needs.	4.18	0.63	
	Q3. The Web site provides reports that conform to exactly what you need.	4.23	0.57	
	Q4. The Web site provides sufficient information.	4.26	0.63	
Accuracy	Q5. The Web site is accurate.	4.29	0.61	4.27
	Q6. You are satisfied with accuracy of the Web site.	4.25	0.64	
Format	Q7. You think the output is presented in a useful format.	4.26	0.66	4.29
	Q8. The information is clear.	4.31	0.62	
Ease of use	Q9. The Web site user is friendly.	4.36	0.67	4.40
	Q10. The Web site is easy to use.	4.44	0.67	
Timeless	Q11. You get the information that you need in time.	4.33	0.62	4.30
	Q12. The Web site provides up-to-date information.	4.27	0.69	
Total				4.30
IRS user satisfaction				
Perceived usefulness	Q1. The IRS system makes it easy for you to discuss questions with your teachers.	4.93	0.39	4.79
	Q2. The content provided by the IRS system is easy to understand.	5.0	0.0	
	Q3. It is easier to concentrate on the content when the IRS system is used.	4.93	0.27	
	Q4. The feedback from the IRS system allows the teacher to understand how well I have educated myself about the diseases.	4.85	0.46	
	Q5. I would like to request the teachers to use the IRS system as frequently as possible during the classes.	4.52	0.51	
	Q6. If a teacher uses the IRS system during classes, I will continue to use the IRS system.	4.52	0.51	
Perceived ease of use	Q7. The remote control function of IRS system is easy to use.	4.41	0.50	4.32
	Q8. The operation of the IRS system is stable.	4.22	0.51	
Perceived enjoyment	Q9. Using the IRS system during classes makes the class more interesting.	4.89	0.32	4.89
	Q10. The IRS system creates a more interactive environment in the class.	4.89	0.32	
Total satisfaction	Q11. As a whole, you are satisfied with the IRS system.	4.96	0.19	4.96
Total				4.74

expected to teach the experimental group how to use the IRS. Therefore, the results of the experimental group may be influenced by the technology revolution and may make the elderly feel depressed and anxious as indicated in a previous study.³⁷ Nevertheless, the effort was worthwhile for patients who had at least some health knowledge, and many had fun while learning. Future research should expand to other community education programs or focus on the education level of the rural-urban gap to make IRS applications in the health promotion field more diverse and rich.

Implications

Obtaining and retaining health-related information are the first step in increasing community residence awareness of health knowledge. Further integrating the CHP platform into hospital information systems not only can strengthen the holistic care of patients but also can create electronic personal health records to further monitor patient health behaviors. The IT used to enhance CHP may reduce the incidence of chronic diseases and the subsequent medical expenditure

on chronic diseases and long-term care. Therefore, this study suggests extending the design scope of IT by integrating the needs of patients and staff for positive results while conducting CHP activities.

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