

DEVELOPING AND PILOT EVALUATING A SMARTPHONE-AND-PALM-BASED EVALUATION SUPPORT SYSTEM IN HOME CARE

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Abstract: The purposes for this study were to develop a smart-phone-based evaluation support system based on an international standardized form for home care and to evaluate users' perceived ease of use and usefulness of the systems in terms of Davis' Technology Acceptance Model (TAM). The system was composed of two key components: smart phone and personal computer (PC). The Taiwan version of Minimum Data Set Home Care (MDS-HC) from Resident Assessment Instrument Home Care (RAI-Home Care) assessment manual was used to design the Smart-phone evaluation form. 5 home care nurses and 4 social workers in the hospital, who had ever served in home care evaluation, were invited to examine the new systems and answered the TAM questionnaire. The results showed that the PDA systems included as many 262 information items inside 63 screens under 18 categories. The results supported the potential for using smart-phone-and-palm-based evaluation support system in home care. Overall, most of the subjects agreed with that the systems were easy to use and useful for the home care evaluation.

Introduction

Home care has been a booming care delivery section and caught many hospital administrators' attention in Taiwan. However, most of the data collection and nursing evaluation efforts were still paper-based [1]. Nevertheless, handheld or palm-based computing technology, commonly known as personal digital assistants (PDAs), are having a tremendous impact in many personal, educational, and business settings. The potential is particularly compelling for healthcare [2]. The PDA may even enhance the efficiency of the patient assessment process through the provision of more comprehensive digital data for research, clinical, and administrative needs [3]. The intention of this project was to develop a smart-phone-based evaluation support

system based on an international standardized form for home care. To evaluate the ease of use and usefulness of this system, the Davis' Technology Acceptance Model (TAM) [4] was adopted.

Materials and Methods

Development of the New Smart-phone Systems

The Palm-based Treo 600 smart-phones were used for the systems coded by NS Basic for Palm 4.4.1. The Grid Snow-crystal-like information representation approach, a Workflow-enhanced version of effective interface design principles for PDAs [5] was used to design the PDA systems. The PC server was designed in VB 6.0 with Winsock module. The Taiwan version of Minimum Data Set Home Care (MDS-HC) from Resident Assessment Instrument Home Care (RAI-Home Care) assessment manual was used to design the Smartphone evaluation form [6]. The structure of the systems is showed in Figure 1.

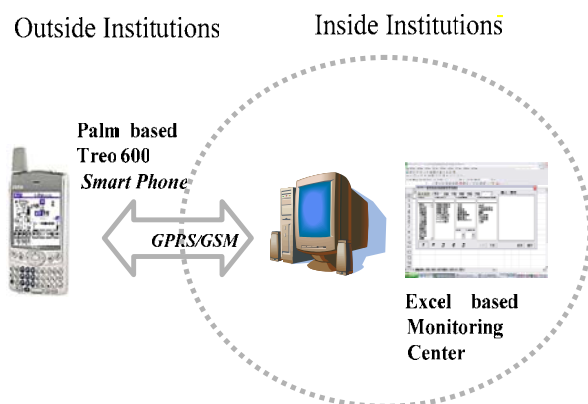


Figure 1: The structure of the systems

Subjects

5 home care nurses and 4 social workers, who were the expertise in the field of the home care were invited for the evaluation. They generally take care of 25-30 new cases per month.

Questionnaire Design and Analysis

The TAM questionnaire was validated by one expert scholar and one experienced home care giver. It consists of 21 questions on the “Perceived Ease of Use” and 16 questions on the “Perceived Usefulness of System.” Among the 21 Ease-of-Use questions, 7 were related to the “interface,” such as the font size and the data entering, 13 were related to the “use of system,” such as the easiness to learn and the easiness to use, and 1 was about the “overall ease of use”. Among the 16 Usefulness-of-System questions, 5 were about the “content usability,” such as the data completeness and the reassurance of the work needs, 10 on the “efficiency improvement,” such as the quicker and easier evaluation, and 1 on the “overall usefulness of systems.” A 5-point Likert scale was used for all questions in which 1 meant “fully agreed,” and 5, “fully disagreed.”

In the TAM study, all subjects were asked to take home the new PDA systems and read the training materials one day before the TAM survey would be made. After that they were modified from real cases and represented various types of home care evaluation, then the subjects to simulate work using the new systems. And subjects were then asked to answer all the TAM questions immediately.

The survey was made in 3/2005. The results were analysis using Excel 2000.

Results

The New Smart-phone Systems

The smart-phone system was composed of 63 screens, organized under 18 categories with 262 information items. The part of structure of the smart phone systems is shown in Figure 2. The initial screen and functional screen are shown in Figure 3 and Figure 4. The sample screen shots of various categories are shown in Figure 5. The Grid snow-crystal structure in Figure 2 highlights the flexibility and efficiency of system structure that the users could easily change to and from any screen in an effort of no more than 2 tapping. The structure in Figure 2 also implies the flexibility of expanding the systems by adding extra new screens within each branch of structure. The interface of the system was specially designed to assure its ease of use.

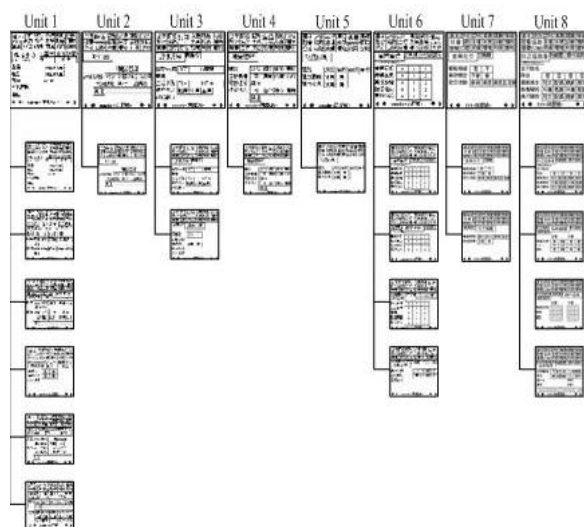


Figure 2: The Structure of the Smart-phone Systems

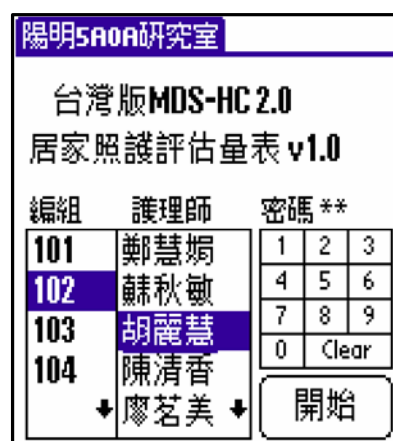


Figure 3: The Initial Screen of the Smart-phone System

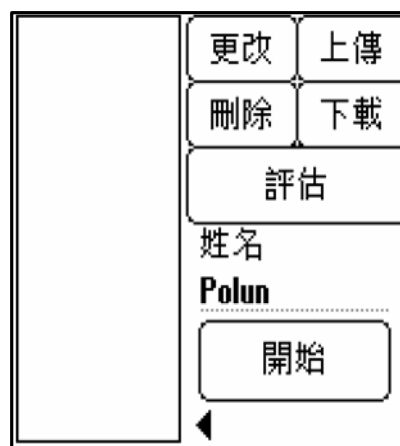


Figure 4: The Functional Screen of the Smart-phone System

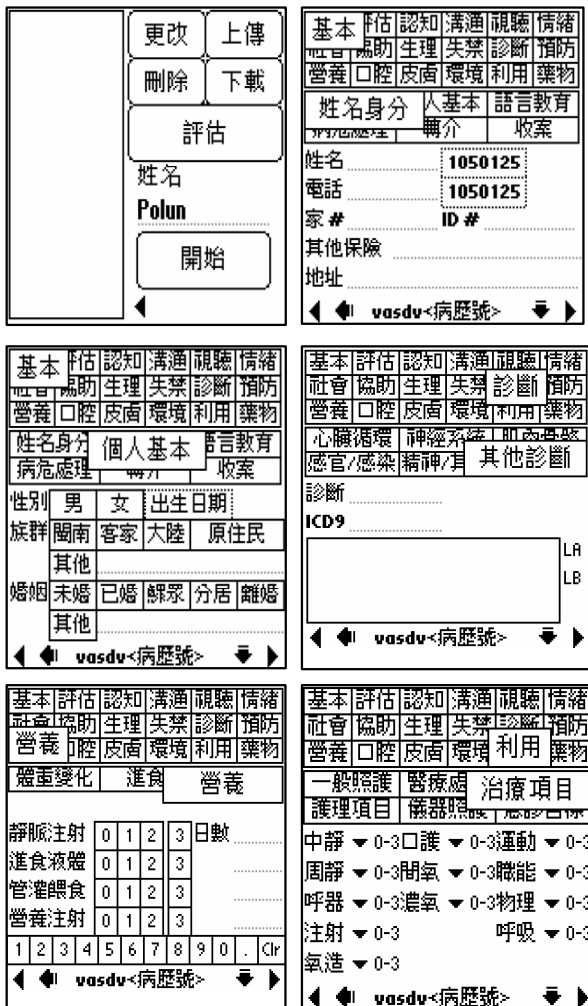


Figure 5: The Selected Representative Screen Shots in Each Category for the Systems

The Evaluation of User's Acceptance of New PDA Systems for the Home Care

As shown in the Table 1, the subject nurses were aged around 40 and college-educated, compared to 30 and university- educated for the social works. All were female, competent enough in information processing but less skillful with smart-phones.

Half of the subject nurses were aged 41-45; 75% of the social workers were aged 21-30; all of the subjects had more than college degree; 40% of nurses, compared to 75% of social workers, had worked in hospital for 4-10 years, and 60% for nurses had worked for more than 10 years. All of the subjects had attended home care no more than 10 years. 60% subject nurses had use computer none per day but 75% of the social workers had used more than once per day. 22% thought they were no skill and 78% were unskillful on the use of smart-phone.

The TAM survey results are shown in Table 2. Overall, more than half of the subjects perceived the smart-phone systems were easy to use and useful in the home care evaluation on more than 85% questions. All of the subjects were "Agree" or "Fully Agree" on questions of "Screen item allocation ok," "Response time

acceptable," "Easy to search related information". The social workers generally showed more conservative attitudes to the value of the systems.

Table 1: The Background Information of the Subjects

Category	Nurse (n=5)		Social Worker (n=4)	
	n	%	n	%
Age				
21-30	1	20%	3	75%
31-40	1	20%	1	25%
41-50	3	60%	0	0%
51+	0	0%	0	0%
Sex				
Male	0	0%	0	0%
Female	5	100%	4	100%
Education				
College	5	100%	0	0%
University	0	0%	3	75%
Graduate School+	0	0%	1	25%
Service Years in the Hospital				
1-3	0	0%	1	25%
4-10	2	40%	3	75%
10+	3	60%	0	0%
Service Years in the Home Care				
1-3	2	40%	2	50%
4-10	3	60%	2	50%
10+	0	0%	0	0%
Average User of Computer per Day				
None	3	60%	0	0%
Once	1	20%	1	25%
More than once	1	20%	3	75%
Smart Phone Experience				
Never user	0	0%	0	0%
No skill	1	20%	1	25%
Few skill	4	80%	3	75%
Skillful	0	0%	0	0%
Very skillful	0	0%	0	0%

Discussions and Conclusions

The results showed the potentially values of new smart-phone systems in home care evaluation. Overall, most of the subjects more than agreed with that the systems were easy to use and useful for the home care evaluation, and this study showed a preliminary promising potential for the use of smart-phone in the home care. The Smart-phone system has a great potential in both helping making a comprehensive home care evaluation and assisting the data and information exchanged between the agents and management center. This study did not only show the usefulness of smart-phone/PDAs for data collection at home care evaluation but also implied its even greater value to serve as a general-purpose, evaluation integration and documentation support tool for use in home care.

There was one thing needing to observe that social workers in this study showed more conservative perception of smart-phone systems than nurses did. However, it was not clear what caused this difference. The sample size for subjects might not have been large enough to make the observation statistically meaningful. If this is the case, a new study with more subjects would

be suggested. As a matter of fact, only nurses were invited to evaluate the systems during the system development process. The involvement of potential users becomes critical to assure its acceptance by all users. Otherwise, it might indeed imply a real difference between the nurse and social workers in using smart-phone, such that we need to pinpoint more specifically the needs of these two different groups to ensure the effectiveness of smart-phone in medical care.

Table 2: Subjects' Perceptions on the overall Ease of Use and Usefulness of Systems

Question	Subjects "Agree" or "Fully Agree" with the Questions %		
	Nurse (n=5)	Social Worker (n=4)	Total (n=9)
Ease of Use			
Interface			
Font size easy to read	100%	75%	89%
Screen sizes meeting work need	80%	75%	78%
Screen item allocation ok	100%	100%	100%
Screen structure ok	100%	75%	89%
Easy to use 5-way function	100%	50%	78%
Easy data-entering by tapping	100%	75%	89%
Easy data-entering by hand-writing	80%	50%	67%
Easy to operate			
Easy to learn	60%	50%	56%
Difficult to learn	0%	75%	33%
Easy to use	60%	0%	33%
Difficult to use	0%	0%	0%
Easy to do home care evaluation	60%	50%	56%
Clear and easy interaction	60%	50%	56%
Difficult interaction	0%	0%	0%
Response time acceptable	100%	100%	100%
Easy to find information items	100%	50%	78%
Easy to search related information	100%	100%	100%
Easy to use up-load function	40%	0%	22%
Easy to use telephone function	20%	0%	11%
Making work easier	40%	25%	33%
Overall easy of use	80%	50%	67%
Usefulness			
Useful contents			
Good for complete data collection	40%	75%	56%
Easy to understand case's situation	60%	75%	67%
Good for learning home care evaluation	60%	100%	78%
Improving worker evaluation	60%	100%	78%
Improving research capability	80%	75%	78%
Improving efficiency			
Making evaluation quickly	100%	75%	89%
Making evaluation easier	100%	75%	89%
Less handwriting	60%	75%	67%
More time for case	40%	75%	56%
Saving evaluation time	60%	75%	67%
Improving efficiency by data-transfer fun	80%	25%	56%
Improving efficiency by telephone funct	20%	0%	11%
Improving efficiency	80%	25%	56%
Making work easier	80%	25%	56%
Alert-setting function helpful	80%	75%	78%
Overall usefulness	80%	50%	67%

However, a further study might need to be done to more subjects include other elder, less-IT-competent but could be more representative in using the systems in

various home care to see whether the results shown in this study were generally true. Subjects from other representative professionals, such as the team members of home care like physicians and home care givers, should be also invited in the study to predict the full value of smart-phone systems in home care evaluation.

References

[1] MU-JUNG C., JAMES C. C., CHUNG-FU L., POLUN C. (2005) : 'The Development of Smart-Phone-Based Home Care Evaluation Support System', Proc. of HEALTHCOM2005-7th International Workshop on Enterprise Networking and Computing in Healthcare Industry, Korea, 2005, p.267-268.

[2] TOOHEY M. J., MAYO A., (2003): ' Handheld technologies in a clinical setting: state of the technology and resources', AACN Clinical Issues, 14(3), pp.342-9.

[3] VANDENKERKHOF, E. G., GOLDSTEIN, D. H. , LANE, J., RIMMER, M. J., VAN DIJK, J. P., (2003). Using a personal digital assistant enhances gathering of patient data on an acute pain management service: a pilot study. Canadian Journal of Anaesthesia, 50(4):368-75

[4] DAVIS F. D., BAGOZZI R. P., & WARSHAW P. R. (1989): 'User acceptance of computer technology: A comparison of two theoretical models'. Management Science, 35, pp.982-1003.

[5] POLUN C., YUANN-MEEI T., SHIAO-CHI W., & YIING-YIING S., (2002) : 'The 3+1 snow-crystal-like information representation approach for the PDA-based application', The Journal of China Association for Medical Informatics, 15(1), pp.17-32.

[6] INTERRAI, Home Care. Available from: http://www.interrai.org/instruments/home_care.php, Access March 16, 20

