

Development and Evaluation of a Computer based Pharmaceutical Education System

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Abstract

In this paper the authors described a computer based pharmaceutical education information system (PEIS) based on an individual profile of his/her medication records and prescriptions. The PEIS has been developed and installed at Taipei Medical University Wanfang Hospital (TMUWFH) since July 2002. After evaluation on the system, we concluded that the PEIS can help most patients acquire necessary drug information easily, and have a much better understanding of the medication they are applying, the adverse drug reactions, and side-effects. And hence the system can improve patient safety, and lead to better treatment outcomes.

Keywords

Pharmaceutical information services, patient education, medical informatics

Introduction

According to a survey conducted by Taiwan Healthcare Revolution Foundation (THRF, www.thrf.org.tw), up to 75% large teaching affiliate hospitals didn't provide adequate drug information or consultation service for their outpatients[1,2]. Although hospitals or healthcare providers are required to print the information of a patient's prescribed drugs on the drug bags, and to set up drug consultation windows for helping patients understand the use of their drugs, the survey result indicated that it is important to develop pharmaceutical education information systems in which people can easily inquire the knowledge of their diseases, medication and drug guidelines to compensate the inadequacy of patient education.

In fact, patients always concern about their own health conditions, especially to their diseases and the drugs they are taking. There are two reasons for lack of providing such information. One is insufficient space on the drug bags on which the drug information must be printed. The other is shortage of patient education professionals. Providing such information without the help from medical professionals, patients may make misinterpretations, and lead to unwilling to take their physicians' orders.

Appropriate pharmaceutical education could help patients realize the advantages and risks of medication, and would cooperate with their caregivers easily. Therefore, in

order to empower patient by giving them more drug knowledge on one hand, and not to increase the cost of the service on the other hand, how to improve patient pharmaceutical education is an important research issue.

In this paper the authors developed a computer based pharmaceutical education information system (PEIS) based on an individual profile of his/her prescriptions. The profile can automatically be built up by retrieving the related information from hospital information systems. They also designed a multimedia drug database containing the appearance of a drug, drug guidelines, summaries of drug use, and links to relevant materials. Thus, a patient can access his/her drug information easily.

Materials and Methods

System Architecture

The computer based pharmaceutical education information system (PEIS) consists of a PEIS server and clients (as shown in Figure 1). The client is an Internet based browser, which interacts the server to retrieve and display the information for users. The PEIS server consists of the following major components: an integration gateway, a document manger, a drug database, a patient profile, and system administration and management.

The integration gateway is used to connect the PEIS server to a hospital information system (HIS). Through the gateway the PEIS server can retrieve a patient's clinical data from the HIS, such as medication orders, prescriptions, and medical records. The patient's clinical data combined with his/her demographic data comprise the patient profile. Currently the PEIS is used to help outpatients acquire their pharmaceutical education materials. Hence, the patient profile is organized by four dimensions: patient identity, visit time, diagnoses, and prescribed drugs. Each outpatient has his/her own folder containing these four dimensions data items for each visit. Thus, when the patient logs in the PEIS, he/she can easily access the needed pharmaceutical education materials based on the links between his/her patient profile and the document manager.

The document manager organizes pharmaceutical education materials. There are three types of the materials with the formats of MSWORD, PDF, and JPG. The appearance of a drug is usually represented by a JPG file. Directions for use of a drug, published by pharmacy vendors, are usually represented by PDF files. And the drug guidelines made by

clinicians and druggists, are represented by MSWORD files. For each drug item, the needed education materials are associated with it. Thus, a hierarchy of pharmaceutical education materials can be formed from general to specific by the patient profile, drug guidelines, and directions of use, as shown in Figure 2. As such organization of patient data and their education documents can make patients easily to access their medication histories and the needed pharmaceutical education materials. More importantly, the system provides just the information what the patients need.

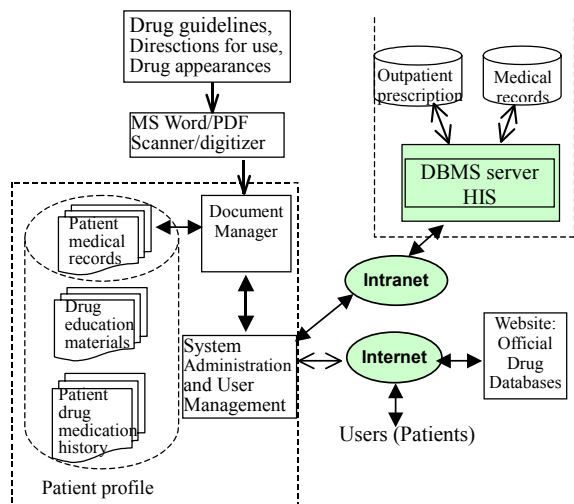


Figure 1: A computer based pharmaceutical education information system

System Evaluation method

The PEIS has been developed and installed at Taipei Medical University Wanfang Hospital (TMUWFH) since July 2002. A patient who wants to utilize the system must apply a user account and a password. The system maintains users accounts, passwords, and their dates of birth in order to prevent unauthorized people who accidentally enter the system. Since the PEIS operates in the hospital currently, no encryption is enforced.

We conducted a questionnaire survey to outpatients of the TMUWFH starting from October to December, 2002. The patients were randomly selected, one for every 20 from the list of waiting for drug dispensing. For each selected patient there were pre and post-tests with respect to before and after the use of the PEIS. The patients answered the questions. However, assistants were available at any time if needed. There were 154 selected patients, and all of them returned their survey questionnaires.

The survey questions include demographic data such as gender, age and education, and the knowledge of drugs before and after the use of the PEIS. Besides the demographic data, there were four questions for the pre-test, and five for the post-test. Four questions were exactly same between pre and post-tests. Only one more question in the post-test, which was used to evaluate whether the PEIS can provide more exact and appropriate drug information, and improve their knowledge in use of drugs. Each answer is represented by 5 scales(ranking from 1 to 5): completely agree (5), agree(4), OK(3), disagree(2), strongly disagree(1).

The results were collected and input to a computer, and analyzed by using SPSS 8.0.

Results

The analysis of the demographical data is shown in Table 1. The selected female and male patients is evenly distributed. Their age is also in normal distribution. However, more than 60% of the patients have college or above degree. This is because the communities in the neighborhood of the TMUWFH are famous for high education areas in Taipei city.

Table 1: demographical data N=154

Variable	counts	Percentage %
Gender		
male	72	46.75%
female	82	53.25%
Age (year)		
Under (or equal to) 19	16	10.39%
20~39	62	40.26%
40~59	36	23.38%
Over or equal to 60	40	25.97%
Education		
illiterate	9	5.84%
High school(or under)	52	33.76%
College or above	93	60.40%

In order to investigate the dependant sample of patients between before and after use of the PEIS, we adopted Wilcoxon signed ranks test with 99% (*i.e.* $\alpha = 0.01$) confidence interval to calculate the statistical significant difference of two results. The *p*-value for the test is 0.00, which is far smaller than 0.01, $p = 0.00 < 0.01$. Thus, we can conclude that the sampled patients can improve and increase their drug knowledge after use of the PEIS.

Discussion

With the increasing popularity of Internet use, people are beginning to get accustomed to gaining medical information, finding medical support or medical consultation from the Web. Matarrese and Helwig indicated that patients increase their satisfaction with their healthcare providers, and improve their ability to take care of themselves when their healthcare providers provide adequate health education via the Internet [3]. The PEIS takes the advantages of Internet popularity, and provides pharmaceutical education based on patient's medication profile. Thus, it can help patients access their complete medication records, and can provide them the drug information including not only the appearance of drugs they are in use, but also a hierarchical structure of directions of use for the drugs, and the drug guidelines provided by their doctors. Therefore, the PEIS can be a useful supporting system for healthcare providers in improvement of patient

pharmaceutical education.

Table 2: the results before and after the use of the PEIS

Question	pre/post test	strongly agree %	agree %	OK %	slightly disagree %	disagree %	N=154	
							Wilcoxon Signed Ranks Test (Z)	
You understood the use of prescribed drugs by your doctor	pre	14.94	35.71	33.77	12.99	2.60		-5.849 *
	post	31.82	48.70	16.23	2.60	0.65		
You can avoid adverse drug reactions when understanding the drugs you are taken	pre	30.52	40.26	20.78	7.79	0.65		-6.158 *
	post	48.70	48.70	1.95	0.65	0		
You know the contra-indications or side effects of the drug you are taken	pre	10.39	25.32	37.66	20.78	5.84		-7.391 *
	post	36.36	42.86	14.29	4.55	1.95		
You can easily acquire drug information when needed	pre	6.49	28.57	35.71	20.78	8.44		-9.520 *
	post	48.70	47.40	3.90	0	0		
The PEIS can provide you more exact and appropriate drug information	pre							
	post	55	31	14	0	0		

* p < 0.001

Although many web sites such as WebMD (<http://www.webmd.com/>), ImpactHealth (<http://www.impacthealth.com/>), etc. provide health information for general public, there are two problems with these web sites. One is that the provided information is mostly a generalized overview such as the cause of the disease, its symptoms, and treatment. But most patients might not know the disease they've contracted, the name of the drug they're applying, and the contraindications of a specific drug to themselves. It is very difficult for the patients to acquire complete information from these websites for their need. The other problem is that the credibility and reliability of provided the information by these web sites are also under question because there is lack of a policy for management of information quality. In contrast with these problems, the medication and pharmaceutical information the PEIS provides is centered on the patient. It automatically acquires the patient's prescriptions from hospital databases and creates the patient's profile. Through the profile, the patient can easily access his/her complete medication records, and the pharmaceutical education materials pertaining to the drug the patient is applying. The education materials provided by the PEIS are crafted to each patients needs, and also approved by physicians and pharmacists, and therefore they are more credible and reliable.

Reeder, Leo G. et al observed that since the consumer movement began in the 1960's[4,5], patients have become the major consumers of the medical service industry, and medical professionals have played the role of healthcare

providers. This mode of customers and providers in the patient-doctor relationship emphasizes shares of equal responsibility between the patients and medical professionals concerning the decisions and actions on medical treatment. Therefore, after patients have acquired adequate drug knowledge, they are encouraged to involve in decision making for medical treatment. It can be seen that the patients may induce the questions or asks to doctors who might consider them as annoyance. As a matter of fact, patients will be empowered by the Internet, and can access more medical knowledge. Thus, medical professionals should adopt this changes, and catch up the most advanced knowledge to improve doctor-patient relationships.

This study indicates that patients desire more drug information[6]. After the PEIS supports pharmaceutical education, most patients have a much better understanding of the medication they are applying, the adverse drug reactions, and side-effects. The patients agreed that the PEIS can help them acquire necessary drug information easily. Hence they are more confident with medical professionals, and willing to obey their doctor orders, which could lead to better treatment outcomes. As a result, the PEIS help patients pay more attention to the drug they are applying, avoid adverse drug reactions, and improve patient safety.

Conclusion

Medication could cure diseases, but might harm to one's health. The adverse drug reactions often cause severe result to human life. As the Internet popularity, it is a trend for patients to acquire the information about their own health and the drug they applying.

In this paper we described a computer based pharmaceutical education information system (PEIS) based on an individual profile of his/her prescriptions. The profile can automatically be built up by accessing the related hospital information systems. We also designed a multimedia drug database containing the appearance of drugs, directions of drug and drug guidelines. Thus, a patient can access his/her drug information by keying his account name, date of birth and password.

The evaluation result showed that with the support of the PEIS, most patients can acquire necessary drug information easily, and have a much better understanding of the medication they are applying, the adverse drug reactions, and side-effects. As a result, the PEIS help patients pay more attention to the drug they are applying, avoid adverse drug reactions, and improve patient safety. Hence the patients are more confident with medical professionals, and willing to obey their doctor orders, which could lead to better treatment outcomes.

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