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# Implementing patient accessible health information site for diabetes management

## **Abstract**

The focus of health care has changed from health care provider paternalistic approach to consumer focused approach. The aim of this study is to implement an online health information site for patient education of Diabetes. To achieve this, design criteria for effective patient education were considered and diabetes patients information site was implemented which includes patient information access, diabetes challenge, administrator module and the scheduler module. Implementing patients access for their health information with providing patients tailored health information according to their needs to enhance patient education is important. This project contributes vastly in consumer health informatics as it develops the system that will enhance consumer involvement in their own health care.

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# IMPLEMENTING PATIENT ACCESSIBLE HEALTH INFORMATION SITE FOR DIABETES MANAGEMENT

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## Abstract

*The focus of health care has changed from health care provider paternalistic approach to consumer focused approach. The aim of this study is to implement an online health information site for patient education of Diabetes. To achieve this, design criteria for effective patient education were considered and diabetes patients information site was implemented which includes patient information access, diabetes challenge, administrator module and the scheduler module. Implementing patients access for their health information with providing patients tailored health information according to their needs to enhance patient education is important. This project contributes vastly in consumer health informatics as it develops the system that will enhance consumer involvement in their own health care.*

*Keywords: patient education, diabetes, online health information, patient empowerment*

## **1. INTRODUCTION**

Chronic diseases are the primary concern of healthcare systems throughout the world (Epping-Jordan et al. 2004). Prevention and management of chronic diseases, such as diabetes is a national priority in healthcare industry. Cause of Diabetes is multifactorial. It has been estimated that type 2 diabetes is expected to reach 350 million cases by 2030 (WHO 2007).

Several health organizations have implemented personal health record systems which provide patients' access to their health record (Win 2006). Patients who are well informed about their health will be more involved in their healthcare and asking insightful questions, therefore having access to their health information would be beneficial to patients in their healthcare management. The focus of healthcare also has been changed from healthcare providers' paternalistic approach to the consumer oriented approach (Eysenbach 2000). Providing appropriate health information to patients will strengthen the patient- provider relationship and will enhance the effective healthcare management. Patients would like to see their health information because they would like to be more involved in their own healthcare, understand the condition better, see if they are getting better or worse, and jog their memory about medical history (Fowles et al. 2004).

The aim of this study is to implement an effective patient education system for Diabetes.

### **1.1. Patient Health Education**

Patient education is an important aspect in healthcare management. Patient education is defined as "systematic experience in which a combination of methods is generally used, such as the provision of information and advice and behaviour modification techniques, which influence the way the patient experiences his illness and/or his knowledge and health behaviours, aimed at improving or maintaining or learning to cope with a condition, usually a chronic one" (van den Borne 1998). However, in many circumstances patients have expressed inadequacy of patient education in face to face communication (Koivunen et al.2008). These could be related to staff workload, communication skills (Koivunen et al. 2008), having a lot of information to patient in a short period of time (Thakurdesai et al. 2004). When patients understand their disease status, complications and their management, they would be more involved in their healthcare and obtain better health outcome as it would create increasing patient knowledge and experience (Mollaoğlu and Beyazit 2009). Computer assisted education will aid patients education as patient would visualise the importance of their disease management. Effective patients' education would assist in reducing diabetes complications, health service utilisation and healthcare costs, improve quality of life and psychological problems (Duke, Colagiuri and Colagiuri 2009). Providing tailored information to patients will assist in patient's education as they would not need to browse through all information on the site. It is well documented that users of websites are swamped in the vast amount of material available on the web. (Tang and Newcomb 2004). Therefore, it is important to individualise information according to patients needs.

### **1.2. Quality of Health information online**

It is noted that reliability, credibility, accessibility and readability of information are main concerns from consumers for health information websites (Mitchell et al. 2004). Several researchers have identified evaluation tools for quality of health information online. It was noted that the Health on the Net Foundation code of principles are widely used from many health information websites to demonstrate the credibility of their site. HON code of principles include following attributes: authoritative, complementarity, privacy, attribution, justifiability, transparency, financial disclosure and advertising policy (HON code). Health Summit Working Group (HSWG) also has established evaluation criteria for health information site, which includes credibility, content, disclosure, links, design, interactivity and caveats (Thakurdesai et al. 2004).

### **1.3. Accessible online patient information systems**

Several online patient information systems have been developed in the world to enhance patients involvement in their own healthcare, such as a web based self monitoring system for people living with HIV/AIDS (Gómez et al. 2002), STEPPS (Structured Evaluated Personalised Support) for Burn care (Doupi & Lei 2005), POEM System (Lee et al. 2007), Dias Net (Plougmann et al. 2001) for Diabetes. It has been noted that these systems enhance patient provider communication, better healthcare outcome and patient empowerment and effective patient education. It is also recommended that these sites should ensure patient empowerment (Plougmann et al 2001) include easily locatable information (Rei et al. 2008), links to related information (Rezailaskajani 2008), integrate with patient record (Doupi & Lei 2005), having reminders (Lee et al. 2007), glossary (Rezailaskajani 2008).

## **2. PATIENT ACCESSIBLE DIABETES INFORMATION SYSTEMS**

The development process involved understanding stakeholders requirement of the system. It is important that healthcare providers are involved in the decision making process of the system implemented as the information provided will be patients' health information. Therefore, various stakeholders such as the Local division of General Practice (LDGP), Diabetes Physician, General Practitioners, Exercise Physician, Diabetes Educator and the technical staffs from the LDGP were consulted to gather requirements of the system. Development team and the various stakeholders met fortnightly to implement the system proposed. Moreover, patient's opinions related to willingness to use of online health information material was surveyed to the local community and 82.3% of respondents believed that it would be beneficial for them to have their health information accessible. The design consideration was considered through understanding the requirements of online health information, criteria for effective patient education, stake holders interviews and user surveys Iterative development process was followed and evolutionary prototypes were developed and demonstrated to stakeholders and users regularly during the development process.

The application developed is web-based, add-on module for the Diabetes Patients currently residing in the local community. However, online patient education material will be available for anyone else as well.

### **2.1. DESIGN CONSIDERATION**

It is essential that the diabetes health information site for patient follows the established criteria to ensure maximum effectiveness for users. Published literatures were reviewed and identified design consideration for the website (Table 1).

After analysing previous patient education website, the following were considered for this project.

#### *2.1.1. Content*

To ensure the credibility of information, the information provided on the web follows the Diabetes Management Guidelines from the Royal Australian College of General Practitioner. Diabetes Management guidelines are a consolidated source of healthcare knowledge from best clinical practices and integrating guidelines into health records that would improve patients' health outcome. Using the standard management guideline will ensure the accuracy and completeness of information provided to users which could ensure the information quality.

#### *2.1.2. User Friendly Design*

As patients with Diabetes could include elderly or patients with a poor eyesight, the users are allowed to adjust the font sizes on the screen. Link to site map is included and all the lab results, blood pressure and BMI (Body Mass Index) are displayed both in text form and graphical displays. That will enhance the readability and understandability as users can visualise their results compared against the normal range or the targeted results.

| Disease/<br>condition         | Study  | Design Consideration  |
|-------------------------------|--|---|
| Diabetes                      | Plougmann, Hejlesen and Cavan 2001,<br>Dias Net online patient diary                         | Reminder, better patient education, learning<br>mode, prediction mode   |
|                               | Thakurdesai, Cole and Pareek 2004,<br>Evaluation of health information website               | Follow HSWG Criteria  |
| Inflammatory<br>bowel disease | Rezailashkajani et al. 2008, Persian Web-<br>based Patient education system                  | Weblink, glossary, forum, communicate,<br>exchange material   |
| Breast cancer                 | Clayman et al. 2008, Interview providers<br>and patients for developing patient<br>education | Addressing patient information need, easy to<br>understand patient information                                    |
| Cardiovascu-<br>lar           | Goessens et al. 2008, Internet based<br>coaching   | A tailored treatment plan   |
| Psychiatry                    | Koivunen et al. 2008, evaluates effect of<br>IT use in psychiatirc ward, N=89                | Patient centered tailored information, peered<br>support for patient and counseling                               |
| Burn care                     | Doupi & Lei 2005, Design STEPPS  | Integrate with electronic patient record, user<br>friendliness, online material,                                  |
| HIV                           | DeGuzman and Ross 1999, interview<br>results of HIV related health professionals,<br>N=16    | Confidentiality, privacy, interactive counselling,<br>multimedia, individualised, support group,<br>interactivity |

*Table 1: Examples of online patient education design consideration*

### *2.1.3. Interpretability*

Medical terms in the site will be explained in the Glossary so that health care consumers will understand information related to diabetes.

### *2.1.4. Patient tailored information*

The information provided in the site will be according to patients needs. According to patients' information, they will lead to the relevant pages. Recommendations are tailored according to the daibetes guidelines.

### *2.1.5. Interactivity*

Users can input data in diabetes challenge, weight management module, eye and feet examination recommendations, in patients forum. Decision support systems related to weight loss management and examination are in place to deliver patient tailored information. The system will send email reminders if users are involved in the diabetes challenge for regular activities.

### *2.1.6. Accessibility*

To ensure the site can be easily searched from crawlers, web searches, metadata were included in every page. Site map is provided for users to navigate easily within the site. The site also allows information search for users.

### *2.1.7. Privacy*

Every usage of system will be logged with the activity log. That will enhance security of the system as well as patients' interest in their healthcare and usefulness of the system can be monitored. Local diabetes patient will be able to see their health information securely. The privacy policy will be displayed on the homepage.

The site follows the HON code of principles and fulfills the HSWG evaluation criteria for health information website.

### **3. SYSTEM DESCRIPTION**

#### **3.1. Project Scope**

The system will allow diabetic patients whose records are in the system to have secured access to all their data. Other patients and public users will be able to participate in the diabetes challenge, which is a guided weight-loss system. Participants enter their height and weight over a user defined period of time and the system.

#### **3.2. Environment Scope**

The application has been written using Java and its dynamic web pages technology, servlets and Java Server Pages (JSP). The servlet container used is Apache's Tomcat 5.5. The database used is Microsoft SQL Server 2000. Because Microsoft SQL Server 2000 was used. The client side pages are HTML with JavaScripts and Cascading Style Sheets (CSS). It is recommended that the site be viewed using Microsoft Internet Explorer 6 or higher.

#### **3.3. Application Scope**

##### *3.3.1. Patient Module*

This module allows only to those diabetic patients who have an account in the system to view their diabetes-related test results. Patient can access their results of HbA1c (Haemoglobin A1c), total Cholesterol, triglycerides, HDL (High Density Lipoprotein), LDL (Low Density Lipoprotein), Microalbuminuria and blood pressure. These results are presented to patients both in text format and in the graphical presentation. Presenting the lab results in the graphical format allows patients to visualise their data more and allowed them to compare against the normal range, historical data and recommended range for them. It also provides information regarding eyes and feet examination. Diabetes patients should attend regular check according to the diabetes guidelines. The system will inform them when they will need to have the next follow-up visit. Apart from telling the user how often they should go for their checkups, these sections include small JavaScript-based calculators so that users can enter related data and let the system calculate their check-up frequency for them.

##### *3.3.2. Sign Up Module*

This module takes care of all new users sign up and the information is stored separately from the patient health information database. The information includes email (primary key), password, password challenge question, first name, last name, date of birth, gender.

### 3.3.3. *Diabetes Challenge Module*

The Lifestyle modifications play a significant role in the diabetes management. Patient will need to target their BMI (Body Mass Index) to be in the healthy range. Lifestyle modifications such as exercise and diet modification will assist in reaching the target BMI. Therefore, motivating patients to be actively participating in the life style modification is important. Moreover, if patients could see their pathology results, they would be more involved in their health care management as they could see the outcome of the life style changes and the diabetic control.

Patients often felt that they are not the principal decision makers for their healthcare and healthcare providers arranged and decided their health plan (Lorence and Monatesti 2005 p.354). As the site will allow the patient to target their weight loss, it is empowering patients in their healthcare decision making and patients will be more active in participating.

The website allows visitors who have diabetes but are not registered there to attempt losing their weight. They can create an account from which a weight loss challenge can be managed by themselves to monitor their own progress, with options to update their weight at specific intervals. Users can then see for themselves how they are doing for the progress of their weight loss. Information is also provided to suggest ways for the user to continue improving their health by weight loss. If the consumers set the unrealistic goals the site will inform them and suggest on targeting the appropriate weight loss range. Self management support is integral to improving care, outcomes, collaborative care and patient educations (Bodenheimer et al. 2002) and the site assist these by having diabetes challenge module.

Information related to dietary advice and nutrition are displayed on the website in “Did you know” section and the Diabetes challenge module. They are displayed together with motivational messages randomly.

### 3.3.4. *Administrator Module*

The module allows management of the Challenger accounts, allows updating of Medical Guidelines, The Medical Guidelines are presented as a static set of values (which are stored by the system in an XML file) and the administrator can change the values and implement the changes system-wide, allows management of the Patient forum, “Did you know” entries, and site glossary section. The site glossary is an informative implementation. The administrator can add terms into the site glossary, where medical terms are provided with definitions to enhance consumer understandability. These terms are underlined with dotted lines on the site and definition of the term are presented when the user pass the mouse on the word.

It allows management of “Weight loss tips”, Weight loss tips are randomly shown to the user in the Diabetes challenge module, this section will allow adding and maintaining of tips. Healthcare providers will need to monitor and control efficiently and conveniently. Hence the control panel allows them to manage users, and update the health guidelines for diabetes in general.

Links to other diabetes related information such as Diabetes Australia, consumer health information website such as Better Health websites links will be provided and the administrator will be able to manipulate links easily.

### 3.3.5. *Scheduler Module*

The scheduler module is responsible for sending out reminder emails to the account holders and system maintenance, sending reminders to Challenge users to update their BMI, also check through the database and terminate challenges that are due for termination, the scheduler runs on Tomcat and is started up when the application starts up. It is programmed to run daily.



There will be a patient forum where they can login and post messages which will be moderated by the administrator. This will enhance interactivity among patients and support. Secure email reminders will be sent to anyone participating in the Diabetes challenge.

#### **4. DISCUSSION**

The system developed attempts to reach the patients and consumers through the internet and assist in patient education and enhanced patients to be involved in their own healthcare. The system provides the users (Diabetes patients from the local community), a secured access to their personal health information. This promotes patients to review their health and lab results. Implementing patients access for their health information and providing patients tailored health information according to their needs to enhance patient education is innovative. Although many health information systems are currently available in Australia, patient access to health record could not be seen in most places as online personal health record systems are not widely available in Australia.

Using diabetes management guideline as the source of information satisfies using the information according to the principle of evidence based medicine. The diabetes challenge modules targeted the life style modifications through weight loss challenges and dietary information which assist also in reducing the alarming increase of obesity in the world which has not been decreased by new treatment regimens (Noël and Pugh 2005). Having discussion forum in the site assist patients by having internet based support interventions and helping them in managing diabetes.

This project contributes towards effective diabetes health care management as it has assisted in patients involvement in their healthcare. Diabetes challenge module motivates patient to be involved in active life style management. Patients can decide their target and set goals according to their preferences and involved them in decision making processes in health care. The system promotes consumer involvement in healthcare, and empowered patients in their health care. The system will not replace the health care providers in patient care, but it will assist to have a better patient provider relationship as patients will become active partners in their healthcare for diabetes management. The system will complement health education for patients as discussed in Section 1.1. This will strengthen the patient provider relationship as patients will be more informed and have a proactive role in their health care.

#### **5. CONCLUSION**

This project contributes vastly in consumer health informatics as it develops the system that will enhance consumer involvement in their own health care. It considers the information quality of health web sites, health education and successful implementation of health information website through stakeholders involvement. Future work will be to analyse improvement in health outcome for those involved in patient accessible diabetes information system.

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