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A Web-Based Database for Nurse Led Outreach Teams (NLOT) in Toronto

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Abstract. A web-based system can provide access to real-time data and information. Healthcare is moving towards digitizing patients' medical information and securely exchanging it through web-based systems. In one of Ontario's health regions, Nurse Led Outreach Teams (NLOT) provide emergency mobile nursing services to help reduce unnecessary transfers from long-term care homes to emergency departments. Currently the NLOT team uses a Microsoft Access database to keep track of the health information on the residents that they serve. The Access database lacks scalability, portability, and interoperability. The objective of this study is the development of a web-based database using Oracle Application Express that is easily accessible from mobile devices. The web-based database will allow NLOT nurses to enter and access resident information anytime and from anywhere.

Keywords. Web-based, mobile, health information, e-Health, emergency mobile nursing

1. Introduction

The increasing use of mobile devices such as smart phones tablets, and laptops in healthcare linked by universal web-based systems can dramatically improve health care communications and remote monitoring of patient health status [1]. Web-based systems are accessible from more than one mobile device, and as they run on a web browser and their use are not limited to access from a single work place [2]. Previous studies since the 1970s have shown that web-based systems in healthcare can create efficiencies in giving medications in a timely manner, scheduling appointments, and medication tracking [3]. The introduction of web-based mobile devices have shown benefits that include real-time communication with patients or between healthcare providers, flexibly sending appointment reminders to the patient and accessing real-time reports when they are at a patient's bedside in the hospital or at a patient's home [4].

In several health regions in Ontario Canada, Nurse Led Outreach Teams (NLOT) provide emergency mobile nursing services to help reduce unnecessary transfers from long-term care homes to emergency departments, see eg. [5]. Currently, the NLOT

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nurses in one region use a Microsoft Access database to keep track of the LTCH visits (new and follow-up), telephone consults, and capacity building activities.

Nine Nurse Practitioners and advanced practice nurses are strategically located in hubs at 6 regional hospitals; the Microsoft Access database is housed in their respective hospital network drives and is not portable, creating redundancy in record keeping which, in turn, makes it harder for nurses to perform their daily activities.

Hence, a web-based database is important for the NLOT nurses as they are always on the go and at residents' bedside in long-term care homes. A web-based database would allow nurses to enter the resident's data directly into the Oracle database, rather than writing it down on a piece of paper and later entering it into the Access database. The database will be easily accessible from any mobile device or desktop and will help NLOT nurses decrease the time spent on data entry.

2. Methods

2.1. Web-Based System Architect and System Features

Oracle HTTP Server with Application Express version 5.0 and Oracle Database 12c are the main components of the web-based system. APEX a database application development tool was used to design the systems Graphical User Interface (GUI) that replicates the NLOT Access tables and data relationships. The Oracle HTTP server communicates with the Oracle database. All requests from the GUI are sent to the database where they are connected over an Oracle Net Services Connection. Many elements are integrated in the NLOT web-based system using dynamic drop down lists. Key elements include type of user, resident descriptors, presenting problems, outcomes, service locations and new user registration.

3. Results

3.1. System Implementation and Functions

Throughout the system design, developers used APEX 5.0 to create a GUI that was user friendly and user-friendly and intuitive as possible. The design especially focused on the needs of the different types of users, which is why there are two different user account types (administrator and normal) designed to meet specific needs and preserve the integrity of the data within the system.

3.2. The Web-Based NLOT Database System: User - Administrator

Following secure login administrative users will be brought to the NLOT database home page (Figure 1) and have access to all the available system functionalities- Resident information, Capacity Building, Presenting Problem, User, Visit History Calendar, and Report Map. The system also has a mechanism to maintain audit logs and to review these logs at any time to check who accessed the system, when they did it, and which page of the system they accessed. The administrator can search and edit

information about the residents, hospitals, create new users, as well as generate reports that are used for strategic planning and review purposes.

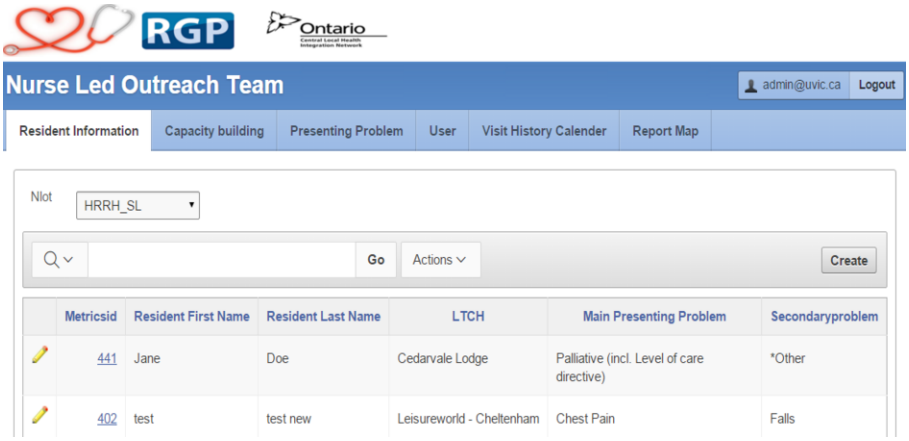

Figure 1. Main Screen of the web-based NLOT database for administrator.

The report section is a useful tool to view the progress of the NLOT teams in order to prepare activity reports and develop strategic planning. The reports are created with a combination of tables, bar graphs, and pie chart that are illustrated in Figure 2.

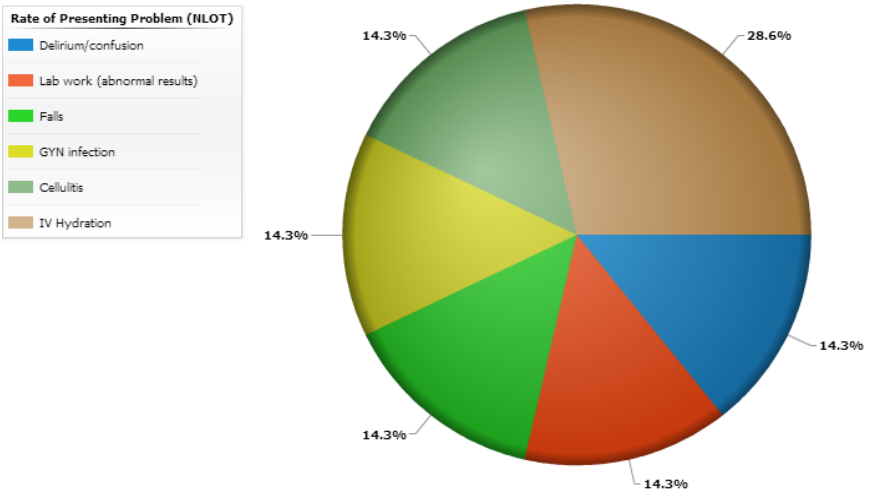

Figure 2. Rate of presenting problem seen by NLOT.

3.3. The Web-Based NLOT Database System: User - Normal

'Normal' users are the NLOT nurses themselves. They, however, will not be able to see the tabs that are meant for admin users. Instead each user is assigned to one team and the user will be limited to viewing his or her team's information only. For example, in Figure 3, the user is from the one NLOT hub hospital. The residents' information listed in Figure 3 only belongs to those residents seen by the nurses of that hub hospital. To

create a new record, the user can click on a 'Create' button and fill the form with necessary details. If the clinician is recording a follow-up visit, he or she can search for previously entered resident information by typing the name in the search box and unique resident identifiers are presented. By clicking on a residents' unique 'Metricsid', resident information window will be opened with information on all visits. To add a follow-up visit, the user has to click on the 'New Follow Up Entry' button and a form will be displayed. Once created, the information will be added and displayed under 'Resident Information'.

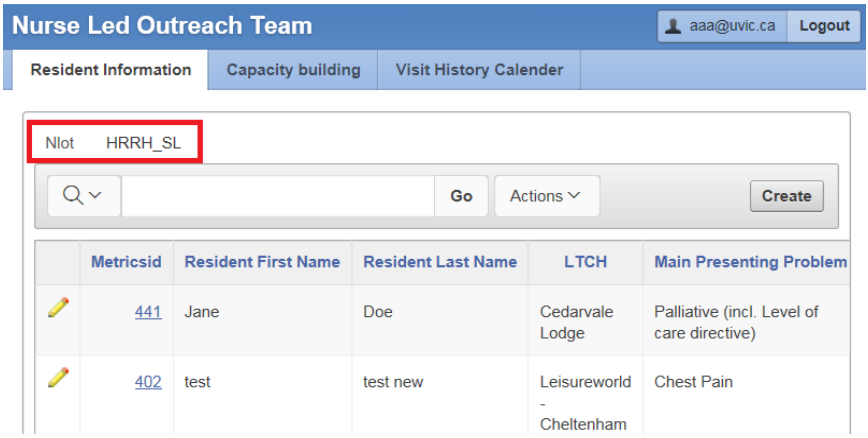

Figure 3. The User logged in as HRRH_SL team.

3.4. Usability Evaluation

Eight potential system end users were recruited to contribute to test system usability. The participants were given a generic guest login name and password to log into the system. The participants were then asked to navigate through the system, perform any tasks of their choice, answer a 10-item system usability scale (SUS) [6] and provide improvement suggestions following the usability test. There were no additional instructions provided to the participants.

Results show a mean SUS score was 90.3 (range = 75-97.5) with a median of 93.7 and a mode of 95.0. The evaluation results revealed that seven of the eight participants (87.5%) found the system to be user-friendly and easy to use. One participant found the system to be complex and reported needing more instruction. Qualitative feedback included recommendations for a 'landing page' with instructions, identification of mandatory fields in the form, re-labeling a 'Save' button instead of 'Create', and inclusion of a caution message when users click 'Cancel' on the filled form. Overall, the high SUS scores indicated that the participants found the system to be useful and simple to use.

4. Discussion

The web-based NLOT database system has demonstrated the possibility of collecting data in real-time and using it to record and report on the NLOT emergency mobile

nursing service. This web-based system was developed to replace an existing Microsoft Access database. The web-based NLOT database system is portable, user-friendly, easy to use, and the site can be accessed from any browser and at any time.

The results indicate that for nurses this web-based system will increase the efficiency of their service reporting and enhance the quality of care. For administrators the web-based system provides equal flexibility in the generation of service reports and information to inform service planning.

The second phase of this project will be to test the application using different mobile devices and to conduct real-time usage processes. When fully functional the system will be fully implemented by the current NLOT team across their 6 hospital sites. As well, the systems generalized as a standard reporting utility to similar nursing services elsewhere across the province of Ontario where it can easily customized to meet local needs. We hope that this web-based NLOT database system will contribute to the information technology revolution that holds such great promise in health care.

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