Database Design and Implementation for a PDA-based Decision Support System for Screening and Tailored Care Planning

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Abstract: The database architecture for Mobile Decision Support for Advanced Practice Nursing (MODS-APN), a personal digital assistant (PDA)-based decision support system (DSS) for screening and tailored care planning by APN students, consists of 6 Microsoft Access databases for data storage, synchronization, reporting, and PDA user interfaces.

Introduction
In order to improve APN students’ adherence to clinical practice guideline (CPG) recommendations, a DSS was integrated to an existing Clinical Log-APN that supports the documentation of student clinical encounters in three areas: obesity, tobacco cessation, and depression. A randomized controlled trial is in progress.

System Architecture and Database Design
The user interface of MODS-APN was developed using AppForge, a mobile application development tool for Palm OS 4.0 and 5.0. De-identified clinical data collected by students on PDAs are synchronized to the synchronization database (DB) using OneBridge from extended systems through wired or wireless networks. The databases for the MODS-APN have been designed based on the database structure for the Clinical Log-APN using Microsoft Access. It consists of 6 DBs (Figure 1) whose purposes are as follows:

- **Repository DB:** storing the knowledge base and generating drop-down tables for the PDA user interface
- **Scrubbing DB:** storing and cleaning clinical encounter data transferred from the Synchronization DB through manual procedures using Structured Query Language (SQL) queries
- **Synchronization DB:** collecting data through Extended Systems
- **NPOps DB:** providing an interface for all active SQL queries for transformation and reporting, tables, forms, and reports
- **User DB:** supporting user’s authentication for synchronization
- **Application DB:** storing all database files for the PDA user interface

Screening and Tailored Plans
MODS-APN integrates a set of rules and CPG-based plan templates as mechanisms for decision support. Algorithms based on CPGs drive the screening questions, generation of diagnoses, and provision of tailored care plans based on the results of screening.

Diagnoses are generated from screening results (e.g., Body Mass Index value, use of tobacco). CPG-related plan tables support the display of tailored care plans based upon: 1) obesity - obesity diagnosis and patient goal; 2) tobacco cessation - willingness to quit and pregnancy status; and 3) depression – depression-related diagnosis and preceptor validation of risk of suicide or functional impairment. The CPG-based plan templates consist of five-part care plans (diagnostics, procedures, prescriptions, teaching and counseling, and referrals). Standardized terminologies and customized terminologies were used to represent data elements.

To implement the database for the DSSs, we created 8 new drop-down tables for the PDA user interface related to screening and CPG-based care plan and 4 synchronization and scrubbing tables related to screening. We also revised two existing scrubbing tables (Observation and Encounter) to capture new values related to screening. Each drop-down table (e.g., SCREENDX and SCREENGOAL) has unique screen type IDs for each of the three CPGs. This feature supports display of the relevant application (obesity, tobacco cessation, or depression) according to the group to which the APN student has been randomly assigned.

Conclusions
APN students have used the DSS in approximately 10,000 encounters during the last year and it is expected that the number of encounters will significantly increase in the future. Current database architecture requires manual procedures for data transfer, cleaning, and reporting. Therefore, we are planning to migrate into Microsoft SQL Server to increase the robustness of the database, reduce manual processes, and support a web-based customized reporting system.

Acknowledgments
This research was supported by the National Institute of Nursing Research (1R01 NR008903).