The Phoenix Indian Medical Center has been able to achieve one of the largest electronic health record implementations in the Indian Health Service to date, by focusing its initial efforts on implementation in the ambulatory care setting. The Medical Informatics department has reviewed the decisions made regarding use of the RPMS-EHR at PIMC, the steps taken in planning the implementation, the mechanics of how the implementation was carried out, and what lessons can be taken away, retrospectively. The current status of implementation at the facility will be summarized, and we will draw some conclusions on how the implementation experience relates to future planning.

**RPMS-EHR BACKGROUND**

The Indian Health Service’s Resource and Patient Management System (RPMS) was developed in the 1970s, and along with the primary clinical component known as the Patient Care Component (PCC), developed in the 1980’s, has allowed for collection of data for nearly thirty years. The Resource and Patient Management System—Electronic Health Record (RPMS-EHR) is the graphical user interface (GUI) extension of the RPMS system. RPMS is analogous to the Veterans Health Administration’s
PIMC BACKGROUND

The Phoenix Indian Medical Center (PIMC), built in 1970, is responsible for 350,000 annual ambulatory visits and 1,500 admissions yearly. PIMC has a staff of over 1,100 with approximately 170 providers. In 2003, PIMC implemented the PCC+ form, which allowed data residing in RPMS to be combined with a clinical encounter form real-time at one of numerous points in the clinical workflow. This was thought to ultimately be a stepping stone to an electronic records system, known to be in early development at that time. PCC+ implementation was carried out successfully in several ambulatory clinics.

Several factors led to the decision by administration to begin to put together an EHR implementation plan. All federally operated IHS health centers were mandated to begin implementation of the RPMS-EHR by 2008. The potential benefits of an EHR system across a large campus, with six separate pharmacies and many other decentralized processes, was felt to be great. In particular, the literature at the time suggested EHR implementation could significantly reduce a number of medication errors, including errors of transcription. Also known at the time was the positive experience of the VHAs VistA implementation, including the experience of the Phoenix VA Medical Center, just nine blocks away from PIMC. In addition to the increase in staff satisfaction that was evident when discussing with VHA providers, evidence suggested a significant increase in the quality of health care attributable to use of an EHR.

PIMC RPMS-EHR IMPLEMENTATION TEAM:

In the autumn of 2004, PIMC administration called for the assembly of an implementation team tasked with planning the design and implementation of the RPMS-EHR at PIMC. A physician champion was identified and, along with a clinical applications coordinator and the chief of information technology, traveled to Albuquerque to attend a five-day training sponsored by the IHS Office of Information Technology covering many facets of the RPMS-EHR, including the basics of design, setup and configuration of local parameters, implementation planning, and issues surrounding training and support. After returning, a full team was assembled, including a pharmacy applications coordinator, a lab applications coordinator, a nursing champion, a representative from staff development, the chief of medical records, representatives from coding and billing, a radiology applications coordinator, and the clinical director.

To help determine the best strategy for PIMC, several site visits were planned and carried out. Several key “lessons learned” were brought back from these visits. Most memorable was a site that had essentially experienced a failed EHR implementation. In discussing the reasons with the staff of that institution, several key factors emerged including lack of physician leadership and support, and lack of understanding of numerous issues surrounding integration of technology into the clinical workflow. The providers at the facility essentially stopped using the system during a busy winter. In contrast, a successful implementation was demonstrated at another site, which seemed to coincide with very strong clinical application support, in the form of staff working directly with individual users on the creation of note templates and customized order entry menus. The clinical staff was essentially a full stakeholder in the implementation, and had significant input into how the technology was used in their practices. In addition to the IHS sites visited, the team also spent a day at the Phoenix VA Medical Center. Because of the size and complexity of the VA hospital, the team felt some comparisons could be made with PIMC that could not be made at smaller IHS sites, in particular the organizational structure of a Medical Informatics department working side-by-side with a robust Information Technology department, and a large number of clinical applications coordinators working under the umbrella of Medical Informatics, directly engaged with chiefs, supervisors and super-users of the EHR system.

In order to lead the EHR implementation effort, a Medical Informaticist role was defined, and the physician champion was placed in this role in an acting capacity during the pre-implementation period. The Informaticist divided his time planning and providing oversight over the EHR implementation, and providing clinical care in the ambulatory setting. The Informaticist worked closely with the PCC+ Clinical Application Coordinator, who also became the EHR Clinical Application Coordinator. This nucleus formed the basis of what would ultimately become the Medical Informatics department, essentially providing oversight over all elements of the EHR implementation.

PIMC RPMS-EHR STRATEGY

The implementation team discussed various strategies, and in March of 2005 presented their recommended plan to administration. This involved implementing one component of the EHR at a time broadly (termed the “step-wise” approach), instead of trying to get entire clinics up and running with the full EHR functionality (termed the “big bang” approach). The reasons for this included a disparity in workstations among the various clinics on campus, the varying use of RPMS, PCC and PCC+ among clinics, the need to promote standardization and consistency, and the thought that a step-wise deployment would lessen the potential trauma of EHR implementation. This step-wise approach was also thought to allow the Information Technology and Medical Informatics personnel the ability to focus their support efforts on one aspect of the EHR at a time.

PRE-IMPLEMENTATION PLANNING

A detailed hardware assessment of all ambulatory clinics was performed. Several clinics had what was deemed to be a requisite amount of equipment needed to implement, but most clinics needed additional workstations brought in, especially in areas where direct patient care was being performed. Most exam rooms had a terminal client that allowed the user access to the RPMS system in a ‘roll and scroll’ format (see picture 1). This meant networking existed in these areas, and these terminals were able to be swapped for personal computers. Those clinics that were already fairly well equipped (pediatrics, primary care, and podiatry) had previously had their RPMS terminals replaced with thin client (terminal server) workstations running Windows 2000 Server Edition as a
replacement for their RPMS terminal clients. Approximately 75 PCs were deployed prior to the ‘view only’ phase, and another 75 PCs were installed prior to the laboratory and radiology computerized provider order entry (CPOE) phase.

As the team proceeded with its hardware assessment, we looked to engage staff on the issue of EHR implementation with a specific goal of identifying super-users who would be willing to serve as ambassadors of EHR in their clinics, and assist in providing real-time support to colleagues and staff. These people were instrumental in helping the implementation team understand the particular workflow in each area, and to anticipate what changes EHR implementation would bring along with it. We also worked with these users to create laboratory and radiology quick orders. The goal was to have upwards of 90% of the most commonly ordered items available on a single page for ease of use. This same strategy was followed successfully during the medication CPOE phase.

After additional computers were purchased and installed, users were asked to logon to EHR and as use the system to view data elements previously accessed in RPMS via the terminal clients, such as lab results, medication lists, and demographic information. It became clear that the basic logon process was a significant barrier for many providers. Working with the IHS Office of Information Technology, a waiver for workstations in exam rooms, hallways and other ‘multi-user’ areas allowed the bypassing of the network logon, so users were taken right to the EHR icon. The only other icons allowed on this desktop were to applications that required a logon, which maintained the security of these ‘generic’ desktops.

The PIMC implementation team customized the layout of the EHR, specifically to meet our wide range of ambulatory clinical services. The GUI design created by users at the Cherokee Indian Hospital was adopted, which allowed for grouping of basic nursing functionality and data entry, thereby limiting the number of tabs users had to click on to perform data entry.

A system change that had to be completed across all clinics prior to implementation was standardization of the check-in process. Clinics had to use the RPMS scheduling system known as the Patient Information Management System (PIMS) and had to set the system to create a visit at check-in. Otherwise providers would not be able to place orders or write notes.

Space for a training room was generously donated by the chief of ophthalmology. Twelve PCs were set up in the room, allowing for 11 students and an instructor. The Medical Informatics department acquired an overhead projector. The first phases involved the entire department attending a training session to orient them to the specific phase. As able, department-specific workflow was discussed at the same time. No longer than one week was planned between the training and the go-live, and ideally it occurred on the same day. It was recommended that clinics allow some additional time during the first day of implementing a new EHR function.

**INITIATION OF IMPLEMENTATION PLAN**

The following functions were essentially implemented one at a time, one clinic at a time:

- **Phase A**: view only.
- **Phase B/C**: laboratory and radiology CPOE, consults.
- **Phase D**: nursing documentation (chief complaint, vitals, pre-visit screening).
- **Phase E**: notes and visit coding.
- **Phase F**: medication CPOE.

The order of clinics was determined taking into account the hardware readiness of each clinic area, the engagement of the clinical leadership, and the input of super-users within the department and their assistance with creation of note templates and quick orders. Two clinics in particular were very open to the change from a paper system to the electronic health record: the Pediatric Clinic and the Salt River Clinic. From the start they realized the advantages for moving to an electronic system, including better access to records and streamlining many workflow processes.

The following is the order in which implementation occurred through the campus:

- Pediatrics
- Salt River Clinic
- Primary Care
- Women's Clinic
- Behavior Health
- Podiatry Clinic
- Specialty Clinic
- Primary Care Annex (additional specialty clinics)

On Jan. 11, 2006, an official “kick-off” of EHR was done with a presentation to the medical staff during their morning conference, and live demonstration of the EHR during the lunch hour. The staff was introduced to the implementation team, the historical background of the EHR was shared, and users were instructed on the timeline for campus-wide implementation. The EHR was loaded on every computer on campus, and “view-only” use was considered to be the first phase. The idea was for users to get comfortable with logon, display of data, and basic navigation of the EHR system prior to having to use the system for data entry and documentation. We found that users that took advantage of this phase became our early adopters, and in several instances drove implementation in their areas. Other users essentially ignored this phase entirely, stating years later that they “still had no access to the EHR.” Use of the consult system was also included early on, beginning with nutrition, diabetes education, orthopedics and gastroenterology consultations. For some users this mandated use of the EHR to perform this element, which was generally regarded to be helpful.

With the rollout of the electronic health record, the team understood that we would be moving away from a paper system, and in the interim before the majority of clinics were on EHR, the system would essentially be a hybrid of paper and electronic data. For this reason, the team recommended to the Health Records department that a notice be placed on each chart, informing providers that if the full view of the patient’s record was needed that they would need to access both the paper record and the electronic record. This hybrid environment was also brought to the attention of Risk Management so they could utilize Root Cause Analysis methodology to lessen the potential of harm to patients.

**OBSERVATIONS REGARDING IMPLEMENTATION**

At the end of August 2006, after the first three clinics went live with laboratory and radiology CPOE, it was noticed that some providers
were still not using the system. Their progress was assessed using a performance monitoring report function of RPMS which identifies how many orders are placed electronically directly by the provider, and what percentage of total orders this encompasses. In reviewing the data we inferred that there were two broad categories of provider engagement with the EHR: those providers who embraced the system and quickly incorporated it into their workflow, and those who used it begrudgingly and ultimately reverted back to paper methodology. Medical Informatics staff discussed this issue with the department chief and several users in both categories, and it became evident that the impact of workflow was the biggest impedence on adoption. We looked to identify additional super-users who were supportive of the technology and had already adapted their workflow to incorporate use of the system. The workflow of these individuals was studied and ultimately most of the non-adopters were retrained, with an emphasis on incorporating these workflow changes into their practices. This understanding helped us with proceeding implementation events in other clinics as well, and the team worked towards having discussions regarding workflow change brought into the initial training sessions proactively.

Demonstration and use of the RPMS-EHR notifications system proved a helpful tool in furthering adoption. For some users, the ability to send themselves notifications replaced the need to keep paper notes or some other types of tickler systems. It also allowed for secure communications containing personally identifiable information (PII) about patients from one care provider to another, something that was not possible with the IHS e-mail system.

Specialty clinic proved to be one of the more challenging arenas in which to implement the EHR, largely due to the presence of a wide range of services being provided, often by single specialists. The super-user concept was not as helpful here; instead the informatics staff worked closely with users individually, and over time each specialist was able to get through the requisite phases of implementation.

Two additional clinical application coordinators were hired to assist with training, note template creation, order creation, and a variety of other tasks needed to facilitate implementation of additional providers and departments, as well as to maintain and support those providers and areas that had already achieved partial or full EHR implementation. They were and continue to be instrumental in the ability to work with staff one-on-one. The Medical Informaticist position became a full time position (10 percent clinical) with a formal hire into the position, and a Medical Informatics Department was created with the Medical Informaticist providing oversight of the work of four clinical application coordinators.

The Medical Informatics department established regular training sessions, to train new employees who would be working in EHR areas, and also to educate staff who had yet to use the EHR (in areas where it had not yet been implemented) and in some cases, to get staff back into the training room that needed additional training or support.

**CURRENT STATUS**

Figure 1 shows the steady increase in percentage of orders placed electronically in the ambulatory setting. Of interest is that in the time we have been collecting data, the number of ambulatory orders placed overall has doubled, from 28,000 in December of 2005 to over 59,000 this year. As of this writing, 63 percent of ambulatory orders are placed electronically, accounting for 80 percent of ambulatory staff, or 126 providers.

To date, in the ambulatory care arena, we have completed implementation in Primary Care (Family Practice and Internal Medicine), Pediatrics, Podiatry, Women’s Clinic, Behavioral Health, Express Care (urgent care), Pre-operative, Pulmonology, Rheumatology, Employee Health, Allergy Clinic, Endocrinology, Orthopedics, Dermatology, Nephrology, Hematology/Oncology, Optometry, Surgery, Breast Clinic, Wound Care Clinic, Acupuncture Clinic, Cardiology, Nutrition, Physical Therapy, Respiratory Therapy, Diabetes Education, Case Management, Public Health Nursing, HIV Clinic, Anticoagulation Clinic, Latent Tuberculosis Clinic, Pain Management Clinic (both medical and surgical), and Tobacco Cessation Clinic. In addition, all of the clinics at the other IHS sites that share our RPMS database are now using the RPMS-EHR: Salt River Clinic, Yavapai-Apache Health Center, and Wassaja Memorial Health Center. To support these providers, the Medical Informatics staff has created 190 note templates, 437 laboratory quick orders, 73 radiology quick orders, 1,590 pharmacy quick orders, 47 consult referral templates, and seven unique GUI interfaces now individualized for various departments and specialties.

Remaining clinics in the ambulatory arena include Ophthalmology, Otolaryngology, Audiology, and Emergency Care. We are planning implementation in the Ophthalmology Clinic after implementation of VistA Imaging (discussed below) to allow input of eye drawings and photographs into the electronic record. Otolaryngology will be piloting use of voice recognition technology as a means for clinical documentation in the RPMS-EHR. We are in the early stages of planning for Emergency Department EHR implementation. The Emergency Department currently resides in a temporary space, which is a limiting factor in designing the ideal EHR experience. We are looking at the possibility of utilizing a number of computers on wheels (COWS) to allow bedside charting. Study of the implementation of VistA in a similar sized Emergency Care area at the Phoenix VA will allow for some comparisons to be made and for optimal workflow planning.

Recent surveys by CMS and JCAHO have helped highlight both the tangible and intangible benefits of the EHR in terms of legibility, use of abbreviations, dating/timing of notes, and general availability of medical information. These findings are helping to spur work in both the Emergency Department and Inpatient Units.

**FUTURE PLANS**

In addition to fully completing ambulatory care implementation, the Medical Informatics department, in conjunction with Information Technology department, the Health Records department, and PIMC administration, has begun the early stages of inpatient EHR implementation planning. A site visit is planned to Whiteriver Indian Hospital in Whiteriver, Arizona, approximately five hours to the northeast of Phoenix, where a successful inpatient implementation of the RPMS-EHR has taken place in an inpatient unit roughly equal in size to PIMC. The PIMC team, drawing on past experiences, feels site visits are vitally important, particularly early in the planning stages. Site visits will help to pull the right person-
nel together to form the team, and will highlight deficiencies in the team, providing an opportunity to add additional members in key roles prior to advanced implementation planning. There are many lessons learned to take away from sites, and while it is helpful to review successful sites, it can be just as informative to visit sites that have struggled with implementation, as we experienced during our ambulatory EHR implementation planning.

In order to pull off EHR implementation in our Emergency Department and Inpatient Units, it has become clear that the facility needs to complete a technology refresh of workstations, servers, switches, and many of our networking components. It is not uncommon to find providers working on seven+ year-old workstations. Budget planning will be more of a factor with this next phase of implementation, as in retrospect we were able to implement the EHR in our ambulatory arena without spending a considerable amount of money. In addition, the Information Technology department will need to increase its capacity to continue implementation, particularly in areas where no networking currently exists, in addition to maintaining the work that has been done on a day-to-day basis. The addition of wireless networking, and the added volume of work that the Emergency Department and Inpatient Units will create, are not issues PIMC is taking lightly.

The implementation of VistA Imaging will bring a multimedia experience to the EHR by adding functionality that will allow scanned outside documents, images, drawings, and other work that cannot currently be captured in the constraints of our EHR to be brought into the medical record. This DICOM gateway will also provide the capability of a full picture archiving and communication system (PACS). This functionality is largely dependent on our Health Records department to lead and coordinate, with support coming from the Information Technology and Medical Informatics departments. Site visits will be taking place to make sure the right personnel are involved to make this project a success.

Finally, we are anticipating a number of services to be provided via telemedicine. The RPMS-EHR will complement this work. We are planning use of the Alaska Federal Healthcare Access Network (AFHCAN) software and technology as a means to share information between sites, including consult referrals, images, and clinical documentation.

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Jeffrey Walling is the Pharmacy Applications Coordinator at PIMC, and a practicing clinical pharmacist. He has trained providers at the facility on computerized medication order entry.

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