The transition to automated practitioner order entry in a teaching hospital:  
The VA Puget Sound experience

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ABSTRACT
We recently installed an automated practitioner order entry system on our busiest inpatient wards and critical care units. The installation followed 20 months preparation in which we created the workstation, network, and host infrastructure, developed requisite policies, recruited personnel to support the system, and installed the software in areas where the pace of order entry was less intense. Since implementing automated order entry, we have experienced problems such as an increase in time required for practitioners to enter orders, workflow changes on inpatient units, difficulties with patient transfers, and others. Our user support system has been heavily used during the transition period. Software tailoring and enhancements designed to address these problems are planned, as is installation of the order entry system in remaining clinical units in our medical centers.

BACKGROUND
On December 1, 1998, we initiated automated practitioner order entry on the medical and surgical wards and critical care units at VA Puget Sound, a teaching hospital in Seattle, Washington. This abruptly changed work patterns, professional roles, and communication between every segment of the hospital. This report describes our experience over the first 3 months of order entry, our preparation, the policies we developed to govern installation, problems we encountered and our solutions. As has been the experience in other hospitals, the transition to practitioner order entry has been difficult.

Setting
VA Puget Sound Health Care System consists of 2 medical centers 40 miles apart with 442,513 outpatient visits and 11,211 discharges annually. The combined medical centers have 347 acute beds and 142 nursing home beds. The Seattle Division is a major teaching hospital of the University of Washington, training 485 residents and 63 medical students each year. Before installing CPRS, VA Puget Sound had only limited experience with direct practitioner order entry and note entry using the predecessor to CPRS in one of our two Nursing Home Care Units, inpatient psychiatry ward, and the Spinal Cord Injury unit.

Software
CPRS is a package developed by the VA to allow clinician order entry, note entry, and to provide results reporting and order checks. Orders entered using CPRS include medications, IV fluids, blood products, admission/discharge/transfer orders, laboratory tests, imaging studies, consults, nursing text orders, and other orders. CPRS is a layer of software on top of the large collection of applications and M databases known as VistA, which are used throughout the VA system [1]. CPRS has 2 front ends: The List Manager version can be used from a terminal or using terminal-emulation software on a PC, and the Graphical User Interface (GUI) version which requires a Windows 95 or Windows NT workstation.

Beginning in September 1997, VA Puget Sound was the third test site nationally for CPRS. As a test site VA Puget Sound end users suggested enhancements and reported software problems to developers, but did not have frequent direct contact with the software development team. CPRS has subsequently been installed in over 80 other medical centers where it is used for a variable percentage of order and note entry and for results reviewed. Some sites are using CPRS in a portion of their patient care settings—-that is, it is not completely installed in every site.

At the time of this report we are beginning the fourth month using CPRS on our busiest inpatient services. Formal evaluation studies are underway, but are not yet complete. The purpose of this report is to describe our early experience, problems we encountered, and how we plan to address those problems.
PREPARATION FOR INSTALLING CPRS

In April, 1997, we began preparing to install CPRS. We installed the workstation and network infrastructure, developed policies governing use of an automated record, recruited personnel to work on the project, and trained users.

Installation of network and workstations

We chose to install desktop Windows NT workstations in nursing stations, in ward hallways, and in patient rooms in critical care units but not on general patient wards. We installed the necessary fiber and Category 5 cabling and other network hardware to service workstations in all locations. We intended to use Metricom (Ricochet) modems to allow wireless network connects using the digital cellular service available in our community, but discovered that the power and transmission frequency of the modems would not permit their use near patient monitoring equipment. We also installed workstations in offices, clinic exam rooms, conference rooms, and in other locations where an automated medical record was likely to be used. In all, we installed over 2,000 Windows NT workstations.

Network passwords and security

To access CPRS, users must use a workstation that is logged on to our network, requiring Novell network authentication. Because the network login process requires roughly 25 seconds, we developed a 'shared login' identity to be used in nursing stations and wards where many users would share use of a workstation. This shared login allows access to a minimal set of network servers and applications such as CPRS, a World Wide Web browser, and a terminal emulation package. The shared identity allows users on shared workstations to access CPRS more rapidly because they need only log in to CPRS itself--a much more rapid process. Users are encouraged to login using their individual username and password to gain access to password protected network disk space and other files when using a workstation for a longer period.

Policy development

We developed policies governing the transition from paper ordering to electronic ordering; for note entry; for security and confidentiality, and for other topics. Briefly, our policy for use of CPRS is that users in clinics have the choice to enter pharmacy and laboratory orders using paper or CPRS, but are required to use CPRS to enter imaging orders and consults. All orders for hospitalized patients on units in which CPRS is in use must be entered in CPRS. At the time of this writing, the exceptions to this policy are that orders written in highly complex care settings (e.g. bone marrow transplant, post-operative cardiac surgery) are still written on paper, as are orders for chemotherapeutic agents. We required use of CPRS on inpatient services because of concern that if orders were written both on paper and electronically, it would be difficult for nurses to be aware of all new orders.

We have decided that within 3 months of full implementation of CPRS that 95% of notes will be available for viewing within CPRS. Users can directly enter notes, use a variety of templates to create notes, or dictate. Some services use third party packages to create notes that are then transferred into CPRS.

Transition to the electronic record

Because we wished to provide intensive support to users when CPRS was first installed, we introduced CPRS to different care settings in successive 'waves.' The first wave was inpatient psychiatry, our nursing home, and most ambulatory care areas. This report covers the fifth wave areas, which included the major medical and surgical units and critical care units.

Team recruitment

To support users during the transition to CPRS, we recruited 10 full time Clinical Application Coordinators (CACs). In addition to these the Nursing Service assigned 4 additional full time CACs. CACs train users, configure software, and provide telephone and in-person support for CPRS users. We also recruited a Project Manager and a Program Assistant for installation. Each of these individuals became familiar with the software, and provides support to other VA facilities in the Northwest during their installation of CPRS.

The Information Resources Management (computing systems and programming team) dedicated one full time programmer to CPRS with backup, and recruited individuals for hardware installation, Help Desk (for hardware problems), network and systems support. Changes to core CPRS software were made by the VA CPRS development team based in Salt Lake City and other locations.
IMPLEMENTING ORDER ENTRY ON WARDS AND CRITICAL CARE UNITS

Transition
We began using CPRS on inpatient Medicine and Surgery wards at 5 am on December 1, 1998. The majority of inpatient orders are written by housestaff, so this date allowed us make the transition with a new group of housestaff, who begin their rotations on the first of the month.

The week before beginning use of CPRS on inpatient services we back entered all medications to create automated Medication Administration Records (MARs), and trained all nursing staff in receiving orders and using the automated MAR.

Since the transition to automated order entry our methods for training and user support are as described below.

User training
Training for physicians occurs during the first morning of their rotation at our facility. Medicine residents are required to attend a 1 hour session in which they are instructed in use of CPRS. Surgical housestaff receive 1-on-1 and small group training. One to 3 days later, Medicine housestaff receive additional training during a Morning Report session devoted to CPRS. Nurses from all 3 shifts receive training in small groups in their work area.

A web tutorial describing CPRS use is available on all workstations*, and printed pocket guides are distributed to all users.

User support
We provide 24 hour a day, 7 day a week in house support by CACs who carry pagers that respond to CPRS Help pages. On some shifts there are 2 or more CACs in the hospital to answer pages, assist users in person, conduct impromptu training, and to troubleshoot problems.

The use of the pager support system is shown in Table 1, which shows categories of problems for which CPRS support pages were received during a 23 day period in February and March, 1999. We receive between 20 and 69 pages per day. As is clear from this table, the in-house CAC pager support system is heavily used. Nurses are the most frequent group of professionals to request pager support; they are also the largest group of professionals in VA Puget Sound.

Assistance with handling orders during patient transfer is the most common category of problems for which users page us. We expect this number to be substantially reduced when planned enhancements to simplify the transfer process are available.

Table 1. Categories of problems for which support pager called

<table>
<thead>
<tr>
<th></th>
<th>MD</th>
<th>RN</th>
<th>Clk</th>
<th>Othr</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfers</td>
<td>59</td>
<td>31</td>
<td>65</td>
<td>4</td>
<td>159</td>
</tr>
<tr>
<td>Order entry</td>
<td>49</td>
<td>62</td>
<td>5</td>
<td>1</td>
<td>117</td>
</tr>
<tr>
<td>Note entry</td>
<td>13</td>
<td>23</td>
<td>3</td>
<td>6</td>
<td>45</td>
</tr>
<tr>
<td>Access probs.</td>
<td>15</td>
<td>11</td>
<td>7</td>
<td>4</td>
<td>37</td>
</tr>
<tr>
<td>Printer probs.</td>
<td>1</td>
<td>24</td>
<td>8</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>RN chart check</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>All others</td>
<td>28</td>
<td>97</td>
<td>16</td>
<td>26</td>
<td>167</td>
</tr>
</tbody>
</table>

Clk=clerk

Attending conferences and making rounds
Members of our team regularly attend Medicine Morning Report, Surgical M&M conference, and attend monthly service meetings as needed. The usual format is to spend 5 minutes announcing CPRS updates, and 5 minutes listening to suggestions and comments.

PROBLEMS ENCOUNTERED

During the first three months of inpatient use of CPRS, the main problems described by users are summarized in Table 2. Some of the problems listed in this table affect specific user groups more than others, while some (system availability) affect all users.

Physicians
The most common problems described by physicians are the length of time required to enter orders, difficulties entering outpatient medications for inpatients, difficulty in handling orders when patients are transferred, and interruption of workflow required by use of workstations to enter orders while on rounds.

Nurses
The main concerns of nurses during the first three months of CPRS use are the time required to verify orders and perform chart checks, clarity of orders


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entered by physicians but edited by pharmacists, difficulty becoming aware that new orders have been entered, time spent entering notes electronically, and acquiring basic computer skills necessary to operate the software. Nurses also noted that because physicians could enter orders without being physically present on the ward, there were fewer opportunities to discuss the care of patients with housestaff.

Pharmacists
Pharmacists' main concerns are the length of time required to process medication orders entered by physicians, assuring that edits to practitioner-entered medication orders are clearly understood by nurses, and their inability to use macros and time-saving shortcuts that were previously available to them.

Table 2. Summary of problems reported by users

<table>
<thead>
<tr>
<th>Problem</th>
<th>Item</th>
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</thead>
<tbody>
<tr>
<td>Time required to enter orders</td>
<td></td>
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<tr>
<td>Handling of orders during patient transfers</td>
<td></td>
</tr>
<tr>
<td>Transferring of outpatient medications to inpatient</td>
<td></td>
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<tr>
<td>Preparing patient medications for discharge home and to nursing homes</td>
<td></td>
</tr>
<tr>
<td>Redefining roles of physicians, nurses, and clerks</td>
<td></td>
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<tr>
<td>Nursing awareness of new orders, esp. ASAP orders</td>
<td></td>
</tr>
<tr>
<td>Usefulness of alerts and order checks</td>
<td></td>
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<tr>
<td>Clarity of medication orders after pharmacy edits</td>
<td></td>
</tr>
<tr>
<td>Clutter of order and note screens</td>
<td></td>
</tr>
<tr>
<td>Locking of patient ordering during pharmacy order processing</td>
<td></td>
</tr>
<tr>
<td>Location and accessibility of workstations</td>
<td></td>
</tr>
<tr>
<td>System availability—unscheduled downtime</td>
<td></td>
</tr>
</tbody>
</table>

PERCEIVED ADVANTAGES
Clinicians found the ability to enter orders and to review orders, notes, and results from any location to be a clear advantage. Since many users had not used CPRS before order entry was installed, the time-saving potential of enhanced results review capabilities helped balance the extra time required for order entry.

Users also find the improved legibility of orders and notes to be an advantage. Use of order checks and reminders is growing, but not yet fully implemented. We are conducting user satisfaction surveys to more formally describe problems and advantages perceived by users.

Creation of quick orders and order sets
Quick orders are orders that are pre-entered, and need only be selected with a mouse click to be prepared for signature. Order sets are a linked collection of orders that if selected, allow multiple orders to be prepared for signature. Because quick orders and order sets reduce the amount of time required to enter orders, they were viewed as an advantage by all users who were aware of them. At present, we have over 70 screens of quick orders and order sets created, and hundreds of quick orders.

LESSONS LEARNED
We have three months experience with use of automated practitioner order entry on our busiest inpatient services—far less experience than many other organizations. However, since we have recently made the transition from paper to automated systems, a transition that many other health care organizations may soon experience, we will review what we believe the most important lessons of the last few months.

Value of user support system
The number of individuals engaged in user support is higher in our organization than in others in our community. However, our user support system is heavily used at all hours. We believe that on-site support has been extremely valuable to us during this difficult transition from paper to electronic ordering. Our opportunities for classroom training of users is limited because of clinical demands of physician, nurse, clerical, pharmacy, and other users. Our CACs are able to teach small groups of users, and individual users, when the need arises. It has been particularly valuable to have clinically-experienced users in the role of CACs, because they understand the environment in which CPRS is installed.

Need for regular software enhancements
Installing order entry software in a tertiary care hospital requires that needs of users in intensive care units, wards, emergency rooms, cardiac catheterization laboratories, and all other patient care locations be anticipated and addressed. In a teaching hospital, there is the additional requirement that new users be able to learn to use the software rapidly. We have served as a CPRS test site, and part of our role is to report to developers needs for new functionality and correction of problems identified during intense use. In addition, we must be able to recognize where
local configuration by programmers and by CAC staff (order sets, quick orders, menu creation) can solve problems without involving developers. Software of this complexity should constantly evolve as new needs are identified. Regular communication with developers is critical.

Value of intense Information Systems support

Since CPRS is now used 24 hours a day in busy clinical units, the availability of Information Systems Services (ISS) support at all times is essential. We regularly call upon our ISS group to attend to problems with the host servers on which CPRS is dependent, to unlock patient records when ordering sessions are accidentally interrupted, and to attend to network problems affecting clinical users. Our in-house CACs serve to triage many of the problems reported by users, and make decisions to call on ISS support for problems requiring their assistance.

PLANS

We plan to continue practitioner order entry using CPRS in all clinical areas currently using it, and to begin using CPRS in other areas of our 2 campuses where CPRS is not yet in use. We receive new releases of CPRS at intervals of 6-8 weeks which add needed functionality and correct problems. We will add additional templating software to simplify note entry, and plan to install the VistA Imaging System to display graphical portions of the patient record. Specific enhancements that will address the most frequently-expressed concerns of users are 1) the use of a display screen that notifies ward nurses when new orders have been entered that the nurse has not yet verified (known as a 'bingo board'); 2) simplification of the entry of orders that are to be delayed until a patient movement (e.g. transfer, admission) has occurred; 3) simplification of the process of transferring outpatient medications to inpatient status, and visa versa.

SUMMARY

We have described our early experience installing practitioner order entry in our tertiary care teaching hospital. Our transition to automated direct practitioner order entry has been difficult, as it has been in many other organizations. [2,3]. The increase in time required for practitioners to directly enter orders has been noted elsewhere [4]. However, the advantages to direct order entry when these problems have been overcome are also clear [5-7], and for this reason we plan continued work to improve and more broadly use CPRS in our organization.

ACKNOWLEDGEMENTS

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REFERENCES