Measuring performance indicators in clinical pharmacy services with a personal digital assistant

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Patients in our 285-acute-bed community hospital receive a full range of pharmacy services. There is a well-defined system for the provision of direct patient care that is supported by written policies and procedures. Depending on the severity of the patient's drug-related issues (DRIs), a pharmacist may elect to provide pharmaceutical care or therapeutic monitoring. The primary difference between these two levels of pharmacy services is that the former requires follow-up by the pharmacist to determine patient outcomes. Recognizing that assessment of patient outcomes is necessary for the provision of pharmaceutical care,[1] we ask our pharmacists to do so when addressing DRIs that may be detrimental to a patient's quality of life. Pharmacists are required to record their assessment of the patient's drug therapy outcomes and to distinguish between the observed outcomes (e.g., pain relief) and the anticipated outcomes (e.g., stroke prevention).

As part of the department's commitment to patient care, there is a quality management program in place for pharmacy services. The continuous quality improvement (CQI) process specifies that indicators of quality shall be measured and analyzed. Then, if any deficiencies are identified, corrective measures are taken. These steps are repeated until the variance has been corrected.[2] Performance indicators for clinical pharmacy services should measure steps in the process of providing patient care (process indicators), as well as the outcomes of that care (outcome indicators).[2,3] An example of an outcome indicator at our institution is the percentage of counseled patients who have improved medication knowledge as reported by the pharmacists.

At our institution, data for the performance indicator report are retrieved from a handwritten log of patient care services that pharmacists maintain on preprinted forms. One purpose of the log is to have in the department a summary of pharmacists' care plans so as to help staff track their patients and to facilitate follow-up of the patients' DRIs. The written record is also used to provide data for pharmacy's quality-management program. Key steps in the processes and outcomes of clinical pharmacy services are recorded by pharmacists on the log sheet. The process and outcome performance indicators are measured from the summary of the pharmacist's care plan and then transcribed into a database for analysis.

While the written department log of the pharmacists' care plan, which exists in addition to the pharmacists' notes in the patient's health record, has been a longstanding part of pharmacy practice, we, like others, find it to be too time-consuming.[4] A significant amount of clerical time is required to collate the information and to transcribe the data into the database. Because of these inefficiencies, there are limits to the amount of information that can be collected, and there are delays in the analysis of data. Also, the process of manually updating, sorting, and organizing patient records in a handwritten form is likely to result in incomplete documentation on the paper records.

It has been demonstrated that a computerized record-keeping process may address some of the limitations of the paper forms. Pharmacists have reported that using computer terminals on a network improved their documentation and that there was better communication compared with using a manual system.[5] Since the handheld computer is available for use at the point of care, it may offer an advantage over desk-

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top documentation systems. Studies that have evaluated this device for the purpose of documentation by pharmacists have demonstrated that the personal digital assistant (PDA) is a portable tool well suited to recording pharmacist interventions.[6-8] Upon comparing documentation on the PDA with documentation on paper, it has been shown that the handheld computer produces more complete information and is more efficient for gathering data.[9]

Given the dual nature of the role that paper forms play in our department, an electronic alternative will have to be efficient both as a documentation tool and as a data-gathering and -reporting tool. The advantages that PDAs offer pharmacists for the purpose of documenting clinical pharmacy services have been well described by others.[6-8] However, very little has been published about the PDA's potential role as a data-capture device in support of quality management.

This article describes the development and implementation of an electronic form for use on a PDA that documents the processes and outcomes of the pharmacist's care plans and that transfers the information from the PDA to a personal computer (PC) database for producing performance indicator reports.

Methods. In consultation with the pharmacist users, it was determined that the electronic log must have the following capabilities:

- Document key processes associated with the provision of therapeutic monitoring services.
- Document key processes and outcomes associated with the provision of pharmaceutical care services.
- Import requests for consultations by pharmacists from the pharmacy's computerized distribution system.
- Link the records of therapeutic monitoring issues and the records of pharmaceutical care issues for the same patient.
- Search and sort patient records using a variety of data fields, including patient identification number, room number, and category of DRI.
- Transfer patient records between PDAs.
- Export patient records directly to a database on a PC.

A review of the literature and the marketplace failed to yield a commercially available electronic form that met the pharmacists' and department's requirements. Therefore, custom-designed data collection forms were developed utilizing Pendragon Forms (version 3.2, Pendragon Software Corporation, Buffalo Grove, IL). The functions of Pendragon Forms have been described elsewhere.[7]

Data fields were defined for patient identification, health status, key processes for therapeutic monitoring services, and key processes and outcomes (health and economic) for pharmaceutical care services. The definitions of key processes and health outcomes were adapted from the pharmaceutical care model of direct patient care services.[1,10] To facilitate complete record entry, mandatory data fields, look-up lists, and check boxes were utilized. There was an initial evaluation of the electronic forms over a five-month period, during which suggestions for improvement to the design were solicited and implemented.

The electronic patient care (ePCARE) log was installed on four Sony PEG Clie S360 PDAs and introduced into clinical pharmacy practice in December 2002. Each pharmacist received a two-week orientation to the ePCARE log before using it in place of the paper forms. Supporting documentation was provided to each pharmacist. Six pharmacists who provided direct patient care services in the medicine, psychiatry, pediatrics, palliative care, neurology, and surgery subprograms were trained to use the PDAs. Three or four PDAs were in use on any given day, depending on the number of pharmacists who were on clinical rotation.

Pharmacists were required to connect their PDA to a single PC once daily. During the synchronizations, patient information from the distributive service's computer system was uploaded to the PDA, and patient records were downloaded directly from the ePCARE log to a common Access database. Once every 4 weeks for 12 consecutive weeks, data recorded on the PDA by clinical pharmacists were analyzed to measure process and outcome performance indicators. The chosen process indicators were number of patients seen, number of patients counseled, number of DRIs identified, and frequency of patient-counseling sessions as a percentage of the number of DRIs identified. The outcome indicator measured was the frequency of improved patient knowledge as a percentage of counseling sessions.

Several measures were implemented to protect patient confidentiality. The PDAs, which were provided by the department, were not to be used as personal organizers and were not permitted to leave the hospital, a password was required for access to the PDA, and the patient's name did not appear on the record. Patient records were identified by a combination of the following: hospital account number, initials, and bed location. Patient records on the PDA could be downloaded only to a single desktop PC located in the pharmacy department.

Results. With the implementation of the ePCARE forms, an electronic chart was created on the PDA for each patient who received clinical pharmacy services from a participating pharmacist. Demographic data included the patient's identification, the patient's health status, and the pharmacist's reason for attending to the patient. Also recorded were key steps in the therapeutic monitoring and pharmaceutical care processes,

such as identifying the DRI, implementing an action or recommendation, and specifying the resolution of the problem. Pharmacists also documented on the electronic forms the outcomes associated with the pharmaceutical care process.

Using the PDA, each issue investigated by a pharmacist was treated as a separate record linked to a specific patient. The DRI was summarized in a text field and identified as belonging to one of the following eight categories listed in a drop-down table: untreated indication, improper selection, subtherapeutic dose, failure to receive a prescribed medication, supratherapeutic dose, adverse reaction to a drug, drug interaction, and drug without an indication. The actions and recommendations were recorded using free-text entry, assisted by a drop-down list of the most common actions or recommendations made by our pharmacists. Pharmacists were required to specify the outcomes, health related and otherwise, associated with the resolution of a pharmaceutical care issue. The choices for outcomes were cure of disease, relief of signs and symptoms, prevention of deterioration in health status, relief of adverse drug reaction (ADR), prevention of ADR, improved patient satisfaction, improved patient knowledge about drug therapy, medication cost savings, and other cost savings to the institution. Beneficial outcomes were categorized as either being observed (i.e., witnessed) or anticipated (i.e., expected to occur in the future) by the pharmacist. Unintended outcomes were also recorded.

Pharmacists used the ePCARE log at the point of care on a variety of acute care wards throughout the hospital to keep track of the DRIs of the patients in their care. The search and sort features of the forms made it easy for staff to organize their patient records. Following the 12-week introductory phase, the consensus of staff was that the department should proceed with full implementation of electronic forms rather than go back to using paper records. This finding suggested that pharmacists preferred the ePCARE forms over the original handwritten documentation tool.

During the first 12 weeks following implementation, ePCARE records were completed for a total of 398 patients and 1034 DRIs were addressed by the pharmacists. The types of clinical services provided heavily favored pharmaceutical care, which accounted for 93% of the DRIs (n = 960). The remaining issues were addressed by therapeutic monitoring. Desired outcomes were recorded for 783 (82%) of the 960 pharmaceutical care issues. Unintended outcomes were recorded for 5 cases (0.5%). The remaining 172 pharmaceutical care issues had no documented outcomes.

A clear advantage of the ePCARE log over a paper record was the ease with which process and outcome indicators were measured and analyzed to produce a performance indicator report. Table 1 provides a sample of the content that was reported to the pharmacists approximately once every four weeks. The percentage of patients counseled improved over the implementation phase from 16% at 4 weeks to 38% at 8 weeks, and at 12 weeks the percentage was 37%. Pharmacists also reported improved patient knowledge with increasing frequency over time. For the DRIs that required patient counseling, the outcome "improved knowledge" was documented for 60% of issues at 4 weeks, compared with 78% and 72% of issues at 8 and 12 weeks, respectively.

All of the above analyses were achieved using process and outcome data elements imported directly into an Access database from the PDAs. Since data download occurred on a daily basis, the information was current, and since minimal data manipulation was required, the period-end quality-management reports were readily generated in a timely manner once every four weeks.

Discussion. Many publications are available in an electronic format for installation on PDAs. The role that handheld computers play as drug and disease information references has been well described. Compared with books, these devices offer the advantages of portability, ease of filtering information, and timely updates.[11-13] These are the attributes that also make the PDA a convenient

Table 1.
Sample of Performance Indicators Measured by Electronic Patient Care Form[a]

Performance Indicator and Data Element	Time following Implementation of PDA (wk) 0–4	4–8	8–12
Processes			
No. patients	141	137	120
No. patients counseled (%)	23 (16)	52 (38)	44 (37)
No. DRIs identified	299	379	356
No. patient-counseling sessions (%)[b]	40 (13)	100 (26)	65 (18)
Outcome			
No. sessions yielding improved patient knowledge	24 (60)	78 (78)	47 (72)

[a]PDA = personal digital assistant, DRI = drug-related issue.
[b]Patient-counseling session = encounter in which a pharmacist counseled a patient regarding a DRI.

documentation tool in clinical pharmacy practice. The successful application of PDAs for the purpose of tracking interventions[7] and documenting clinical pharmacy services[6-9] has been previously described. We have described here the use of handheld computers not only to document the pharmacist's care plan but also to measure process and outcome indicators so as to provide regular, timely feedback to the staff (once every four weeks) about the quality of clinical pharmacy services.

By using the ePCARE log to regularly measure data elements related to processes and outcomes, trends in clinical pharmacy practice have been measured. These patterns of practice could not be readily identified using the paper records of the pharmacist care plan. For example, the number of patients seen by the pharmacists, the number of DRIs addressed by the pharmacists, and the frequency of patient counseling can be used to establish standards against which future practice can be measured. With ongoing measurement of the performance indicators, variances from the standard can be detected and investigated in a timely manner. There were two notable improvements in performance indicators during the implementation phase. First, with regard to processes, the number of patients counseled increased by about twofold over the course of 12 weeks. Second, over the same time frame, improved knowledge among patients who were counseled by a pharmacist was being reported with greater frequency. The reasons for these observations are uncertain but may reflect a change in practice by the pharmacists in response to feedback about performance. Further study is needed to test this hypothesis.

As part of the pharmacy department's quality-management program, we had specified that one measure of the quality of pharmacy services was that all patients counseled by pharmacists should be assessed for improved medication knowledge. On the basis of data collected during the implementation phase, the frequency with which improved knowledge was reported was less than 100%. The variance in this performance indicator points to a potential quality issue and suggests the need for further investigation. Therefore, our department has identified patient counseling as a focus for quality improvement. The patient-counseling process will be reviewed, and, using the process and outcome performance indicators, pharmacists will be given regular, timely feedback about their practice. The influence, if any, of this CQI initiative on the quality of pharmacy services will be investigated.

The ePCARE log provides for a virtually continuous stream of information about the processes and outcomes of clinical pharmacy services. Compared with the paper system, the time commitment for data collection is no longer an issue, and much less time is required to analyze the data. Therefore, the pharmacy department will be proceeding with full implementation of the ePCARE log. The frequency of performance indicator reports is now limited only by the amount of time needed to acquire a representative sample of the data and to complete the analysis.

Conclusion. An electronic form installed on a handheld computer was successfully implemented in place of a preprinted paper form to be used as a tool to record, measure, and analyze the processes and outcomes of clinical pharmacy services.

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