# Reducing Errors in Discharge Medication Lists by Using Personal Digital Assistants

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This study examined whether the number of errors in discharge medication lists at a psychiatric hospital would decrease when the practice of transcribing the lists by hand from physicians' discharge orders was replaced by the use of personal digital assistants (PDAs) to create and directly print out such lists. In a four-month period before the use of PDAs was introduced, 20 of the 110 hand-transcribed lists (22 percent) contained errors. In the four-month period after the use of PDAs was implemented, seven of the 90 PDA-generated lists (8 percent) contained errors. Use of a PDA may be helpful in providing safer patient care. (*Psychiatric Services* 53:1325–1326, 2002)

It is increasingly recognized that medication errors are a significant cause of harm to patients in general care settings (1). The Harvard Medical Practice Study cited adverse drug

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events as the cause of 19 percent of all injuries to hospitalized patients (1,2). Between 28 percent and 56 percent of adverse drug events that occur in adult general care settings could be prevented (1,3,4). The Institute of Medicine's 1999 report on the safety of health care systems suggested that more deaths occur annually from medication errors than from industrial accidents (5). Medication errors are also costly from a financial perspective. The annual cost of such errors to U.S. hospitals has been estimated to be $2 billion dollars, excluding malpractice costs and costs of injuries (6). However, most of the available data on medication errors come from general care units. Only a few studies have been published about medication errors in psychiatric hospitals (7–9).

At the Augusta Mental Health Institute, a state psychiatric hospital, errors in discharge medication lists are tracked and reported by pharmacy staff as a category of all medication errors. The discharge medication list is used in preparing the aftercare plan and is sent to each patient's outpatient clinician. A copy of the list is also used for patient education at the time of discharge. Pharmacy staff are the last to check each list for errors by comparing it with each patient's medication profile in the pharmacy computer system.

At one time discharge medication lists at the institute were transcribed by hand. The physician referred to the medication administration record or a to hard copy of the pharmacy profile and then wrote discharge orders specifying all current medications. The orders were then transcribed by nursing staff to a handwritten discharge medication list.

Since April 2001, institute physicians have created all discharge medication lists by using a personal digital assistant (PDA) and a printer with an infrared port, thereby eliminating hand transcription of the lists. This retrospective study compared error rates before and after the introduction of PDAs. We hypothesized that use of PDAs would result in a decrease in the error rate.

## Methods

In a previous report, we described how PDAs were introduced at the institute and how they were used to reduce medication errors (10). When that report was published, all patient medication profiles were updated daily by pharmacy staff and were made available to medical staff by means of the PDA's "hot-synching" function, in which the PDA is linked to the central computer system and data are transferred and updated. Also available on the PDA is a psychopharmacology database with information about drug interactions and copies of each patient's previous psychiatric evaluations and discharge summaries.

All medical staff members were initially trained in the use of the PDA, and a weekly multidisciplinary "PDA support group" was scheduled to address ongoing educational needs and technical problems. After the medical staff had used the PDAs for several

months, they were taught how to use them to print a list of a patient's current medications as a discharge medication list, which was done by using a printer with an infrared port. The PDA transmitted the current medication profile directly to the printer, thereby eliminating hand transcription of the discharge medication list.

For the study reported here, the pharmacists retrospectively reviewed discharge medication lists for medication errors. All discharges between June 1 and September 30, 2000, were reviewed for errors in hand transcription, and the error rate was compared with the rate for all discharges between April 1 and July 31, 2001, when only PDAs were used to generate the lists. The same criteria for identifying a medication error were used for each review. No significant changes in admission or discharge criteria or medical and pharmacy nursing staff occurred during the study period.

The criteria used by pharmacy staff to review discharge medication lists were the same criteria used in reviewing the hospital's orders for prescription errors. The criteria included erroneous exclusion of a currently used drug; erroneous addition of a new drug; incorrect or incomplete dosage, quantity to be dispensed, or frequency of administration; illegibility; and inclusion of usages that are prone to misinterpretation. For example, a trailing zero can be misread, such as when 1.0 mg is read as 10 mg. Another example is omission of a leading zero—when .1 mg is misread as 1 mg. The detected errors were not rated for the degree of harm they might have caused the patient.

## Results

A total of 110 discharge medication lists were transcribed by hand during the first period in the study. Twenty contained errors, yielding an error rate of 22 percent. In the second period, seven of the 90 lists generated by PDAs contained errors, for an error rate of 8 percent ($\chi^2$=4.58, df=1, p<.05). The difference is most likely explained by the introduction of PDAs, which supports our hypothesis that their use would reduce errors. All errors detected during the period when PDAs were used involved med-

ications that were erroneously excluded from the discharge list.

The possibility that use of our criteria detected false errors—that is, instances in which no error actually occurred—deserves comment. We attempted to prevent such false errors by counting only errors that were introduced by hand transcription or direct transcription with the PDA. We did not count errors that occurred because of system procedures over which we had no control. For example, no error was recorded when a physician added a medication to the list immediately before discharge. In such a case, there would have been insufficient time for the order to be reflected in the pharmacy database, and therefore the database list would not have matched the hand-transcribed list or the list generated by the PDA.

It could be argued that the errors attributed to the PDA originated elsewhere in the prescribing sequence. PDA errors occurred only in cases in which a medication was ordered late in a patient's stay and was not reflected in the patient's pharmacy profile in time for the last "hot synch" before the PDA was used to print the discharge medication list. Such errors occurred when unit staff were slow to fax the transcribed order to the pharmacy or when pharmacy staff were slow to add the order to the patient's medication profile. If such errors had not been counted, the PDA error rate would have been zero.

## Discussion and conclusions

Our study was simple in design, limited in scope, and modest in terms of the empirical support for the conclusions that can be drawn. Nonetheless, undetected errors in discharge medication lists can have significant clinical implications. Detection and prevention of such errors improves patient safety, and by ensuring that the medications prescribed at discharge are correct, prevention of errors may also increase the likelihood of successful discharge and transition to the community and reduce the likelihood of rehospitalization.

Use of a PDA to create discharge medication lists resulted in a decrease in the percentage of lists with errors—from 22 percent to 8 percent

over the first four months of implementation. The PDA is inexpensive and simple to use. With a PDA, clinicians have immediate access to up-to-date patient-specific medication profiles and to information about medications, including drug interactions, without having to obtain the patient's chart or consult a pharmacology reference text. The medical staff quickly embraced the PDA, in part because of its simplicity and portability. Use of the PDA may be helpful in providing safer patient care. ◆

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