Is There Cost Justification for Decentralized Clinical Pharmacists?

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Theoretically, moving pharmacists out of the centralized pharmacy and into the patient care setting maximizes their ability to help prevent costly adverse drug events. Here, VA researchers subject the theory to practical economic and clinical scrutiny.

Over the past 25 years, clinical pharmacy has had a tremendously positive impact on patient care. A 1992 study of U.S. hospitals revealed that having more clinical pharmacists per occupied medical center bed is associated with significant reductions in mortality rates, drug costs, and length of stay.[1] In another study, conducted in a tertiary care teaching hospital, participation by a pharmacist in a patient care team resulted in lower pharmacy and hospital costs and shorter average lengths of stay compared with a control team that did not include a pharmacist.[2]

It's well established that a large part of the role clinical pharmacists play in reducing health care costs and improving patient outcomes relates to the prevention of adverse drug events (ADEs)—defined as any type of injury connected to the use of a drug (including both adverse reactions and medication errors). ADEs are estimated to affect roughly one million patients each year in the United States,[3] and medication errors are believed to account for one in 854 inpatient deaths.[4] Aside from the physical harm they cause, medication errors can diminish patients' trust in the health care system and place an enormous financial burden on the medical center. In a 1997 study of 4,108 admissions at two tertiary care hospitals over a six-month period, the average cost of a preventable ADE was estimated at $4,700, which translated to $2.8 million annually.[5] If these costs are extrapolated nationally, the figure rises to $2 billion.[4]

Preventing medication errors requires multiple interventions at all points in the medication use process, including prescribing, dispensing, administering, monitoring, and systems and management control. The idea behind moving the clinical pharmacist from the centralized pharmacy setting to the patient care setting is that it allows the pharmacist to intervene at more points in this process,

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which, theoretically, has a greater impact on ADE prevention.

Administrators at the New Mexico VA Health Care System (NMVAHCS) had attempted decentralized staffing of clinical pharmacists in the past, but for various reasons they had gone back to a centralized inpatient pharmacy. In 2001, however, a new effort in this direction was made when clinical pharmacists were assigned to the psychology, surgery, cardiology, and general medicine units. The expectation was that the cost savings achieved by the participating pharmacists' interventions would exceed the costs of employing the pharmacists—while also improving the effectiveness of the health care team.

This article presents a retrospective pilot study of the economic and clinical impact of the pharmacist assigned to the general medicine unit. Using data collected over a three-month period, we assessed both provider acceptance of the pharmacist's recommended interventions and cost savings generated by these interventions. By attaching a dollar amount to such interventions, we hope to support quantitatively the integration of decentralized pharmacists into routine inpatient care.

THE TIME WAS RIGHT

The reinstitution of a decentralized pharmacy program at our facility was made easier by certain technologic innovations relating to medication ordering, filling, and administration, which hadn't been in place during earlier attempts at such a program. Examples include the recent initiation of bar code medication administration, in which the scanning of bar codes on patient wristbands and medication units tracks each dose administered and issues warnings about errors and potential ADEs,[6] and the installation of an automated cabinet system, which provides further electronic tracking of medication ordering and dispensing as well as secure storage.[7] Computerized prescription order entry also had been established at our facility a few years prior.

Yet despite these advances, the administrators felt that more could be done to prevent medication errors. With medical literature supporting the ability of decentralized clinical pharmacists to help decrease the incidence of preventable ADEs,[8] it seemed that the time had come to try this type of staffing again. It was hoped that by being readily available on the unit floors and directly involved in patient care, pharmacists would be better able to address questions and concerns about individual patients' prescriptions and health status, intervene to prevent medication errors, and provide a vital link to the central pharmacy.

ROLE OF THE DECENTRALIZED PHARMACIST

The primary role of the decentralized pharmacist on a given patient care unit is to provide quality pharmacy care to inpatients. This is accomplished by reviewing each patient's profile and relevant data—including progress notes and laboratory test results—for appropriateness of therapy. Participation in daily rounds gives the pharmacist an opportunity to evaluate patients' treatment and make recommendations to the other members of the patient care team. Throughout the day, the pharmacist checks (and, if necessary, corrects) orders entered on other shifts; inputs and verifies current orders; and, as needed, suggests clarifications and changes to patients' medication regimens. Discharge planning and medication counseling also are part of the pharmacist's responsibilities.

THE PILOT STUDY

Our review involved a three-month retrospective analysis of interventions made by the decentralized pharmacist assigned to the general medicine unit of the NMVAHCS. This unit consists of four medicine teams, each headed by a resident physician who rotates teams on a monthly basis. In addition, two attending physicians are assigned to two of the teams for two weeks at a time. The mean daily census of the unit is 25 patients, the mean length of stay is six days, and the mean number of medications each patient takes per day is 10. The average monthly rate of patient turnover in the general medicine unit is very high (508%)—which translates to about 127 discharges per month.

We included in the study patients who had been admitted to the general medicine unit and had a pharmacist intervention between mid December 2001 and mid March 2002, excluding those under the age of 18. Patient names, social security numbers, and other identifying information were not included during data collection to maintain patient confidentiality.

We used a Palm IIIc (palmOne, Inc., Milpitas, CA) personal digital assistant (PDA) to track the pharmacist's interventions. The PDA tracking software we used, Pendragon Forms 3.1 (Pendragon Software Corporation, Libertyville, IL), had logical, user friendly drop-

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down menus for recording information on each intervention. Once the data were recorded in the PDA, we transferred this information easily to Microsoft Excel 2000 (Microsoft Corporation, Redmond, WA), which made additional analysis straightforward. Overall, this method of data collection simplified analysis and had the additional advantage of allowing us to follow multiple outcomes.

Information obtained included patient sex, age, allergies, and previous ADEs; the type of intervention recommended by the pharmacist and whether the provider accepted the recommendation; and the name, route, and (when possible) strength and dosage of the medications involved. Interventions were assigned to one of the following categories:

- change from intravenous to oral administration,
- change to an alternate dosage form,
- dosage change based on pharmacokinetics,
- identification of expired or expiring medication orders in need of renewal,
- correction of an identified medication duplication,
- identification of a potential or actual drug interaction,
- documentation of a medication allergy reported by the patient or identification of a current allergic reaction to a drug,
- clarification of a medication order,
- identification of a pertinent formulary issue,
- initiation of a therapeutic interchange, or
- identification of the need for a therapeutic consultation.

We further classified these recommended interventions according to whether they were accepted immediately by the provider; accepted by the provider after follow-up; not accepted by the provider; or, in cases in which provider acceptance was unnecessary, performed immediately by the pharmacist. Provider acceptance wasn't required for such administrative interventions as documenting an allergy reported by a patient.

We defined recommended interventions as clinically significant if they potentially could have an impact on patient outcome, and this determination was made both by the decentralized pharmacist and by a separate rating panel. This panel consisted of an administrator, a formulary guidelines specialist, two production pharmacists, and four ambulatory care clinical pharmacists. Other decentralized clinical pharmacists weren't included on the rating panel because of possible bias.

For each intervention, the decentralized pharmacist was asked to check either "yes" or "no" to indicate whether the given intervention was clinically significant. The rating panel was asked to score the probability that an ADE would have occurred in the absence of the intervention according to the following scale: 0—no risk of ADE, 0.01—very low risk, 0.1—low risk, 0.4—moderate risk, or 0.6—high risk. This scale was published by Nesbit and colleagues as part of a study evaluating a clinical staff pharmacist practice model.[9] After a discussion of potential ADEs, each panel member individually assigned a score to the intervention. A collective panel score was determined by taking the mode of the individual scores.

All interventions assigned a rating above 0 were considered clinically significant. We then compared the percentage of clinically significant interventions as determined by the rating panel with the percentage identified as clinically significant by the decentralized pharmacist.

By calculating the percentage of recommended interventions accepted by the providers (excluding those for which provider acceptance was unnecessary), we were able to get a picture of how smoothly the procedures implemented to accommodate the decentralized pharmacist worked and how well the pharmacist fit into the patient care team. Percentages were calculated for each individual intervention categories and for all interventions as a whole.

We assessed economic outcomes by calculating the potential cost savings of the pharmacist, taking into consideration both reductions in medication costs and the costs avoided by preventing potential ADEs. The latter of these was determined by multiplying the overall panel rating assigned to each intervention by $5,006—the average preventable ADE cost ($4,700), according to a 1997 study, adjusted for inflation.[5] The medication cost was calculated using the VA acquisition cost for the medication in question and an average reduction in duration of medication use of a day and a half.[10] The monthly cost to the VA of employing the pharmacist was based on 68% of the salary and benefits, since 32% of the pharmacist's time was spent working as part of the central pharmacy staff. (We didn't include the cost of the PDA and the software in our analysis.) The cost of employing the pharmacist was then compared to the cost savings generated by the pharmacist's interventions.

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ENCOURAGING RESULTS

There were a total of 210 interventions recommended (or performed) by the pharmacist during the three-month study period. Of the patients involved in these interventions, 199 were male and 11 were female. The mean age was 69 years ± 1.1 years (standard deviation). Therapeutic consultation was the most frequent intervention, followed by change from intravenous to oral administration, documentation or identification of a medication allergy, and correction of a medication duplication (Table 1).

Medication cost savings generated by the pharmacist's interventions totaled $1,380 for the three-month review period. The total avoided costs from preventing potential ADEs during that same period were estimated at $171,686. Overall, interventions relating to drug interactions were linked to the greatest cost avoidance (an average of $2,065 per intervention), whereas those raising formulary issues and those initiating therapeutic interchange were associated with the lowest cost avoidance (a per-intervention average of $132 and $60, respectively) (Table 2). These results appear to support the validity of the rating scale used, since the two intervention categories at the bottom of the list have more to do with saving on drug prices than preventing ADEs.

When average avoided ADE costs were separated out by rating group, the highest costs consistently were assigned by the medical center administrator—followed by the formulary guidelines specialist and the production pharmacists (Table 3). The ambulatory care clinical pharmacists assigned the lowest average avoided ADE costs. As a group, the panel was more likely to rate an intervention as clinically significant than the decentralized pharmacist recording the intervention: The panel rated 76% of the interventions as clinically significant, compared to 59% identified as such by the decentralized pharmacist.

Of the original 210 interventions recommended by the clinical pharmacist during the three-month study period, 169 required provider approval. Providers accepted 154 (91%) of these recommendations—140 (83%) immediately and 14 (8%) after follow-up (Figure). Only 12 interventions (7%) weren't accepted.

Table 1. Frequency of interventions recommended by the decentralized clinical pharmacist in the general medicine unit of the New Mexico VA Health Care System, Albuquerque between mid December 2001 and mid March 2002

Type of intervention	No. (%) of interventions (n = 210)
Therapeutic consultation	98 (46.7)
Intravenous to oral administration	17 (8.1)
Medication duplication	16 (7.6)
Medication allergy	16 (7.6)
Medication expiration	15 (7.1)
Order clarification	13 (6.2)
Formulary issue	12 (5.7)
Therapeutic interchange	11 (5.2)
Pharmacokinetics	6 (2.9)
Alternate dosage form	4 (1.9)
Interaction	2 (1.0)

THE MERITS OF DECENTRALIZATION

The results presented here show that there is indeed cost justification—in terms of avoided costs from potential ADEs—for using a decentralized clinical pharmacist on the general medicine unit of our facility. Furthermore, deterring ADEs may decrease the potential for litigation. Aside from the economic benefits, the 91% rate of provider acceptance of the pharmacist's recommended interventions suggests that the pharmacist has a positive impact on the quality of the health care team.

Table 2. Average costs avoided through prevention of potential adverse drug events, by intervention category

Intervention category	Average cost avoided per intervention
Interaction	$2,065
Medication expiration	$1,850
Pharmacokinetics	$1,587
Order clarification	$962
Therapeutic consultation	$874
Medication duplication	$797
Medication allergy	$659
Alternate dosage form	$355
Intravenous to oral administration	$304
Formulary issue	$132
Therapeutic interchange	$60

Table 3. Average costs avoided through prevention of potential adverse drug events, by rating group

Rating group	Average cost avoided per intervention*
Administrator	$1,686 ± $79
Formulary guidelines specialist	$866 ± $78
Production pharmacists	$835 ± $43
Ambulatory care clinical pharmacists	$580 ± $61

*Mean ± standard deviation.

Although the actual savings from reduced drug costs alone didn't balance out the costs of employing the pharmacist, several areas of cost savings weren't evaluated in this study. For example, we didn't quantify savings generated by reductions in personnel time, such as the extra time it takes a nurse to flush an intravenous line versus administer an oral medication. In addition, some of the pharmacist's activities—such as patient counseling and discharge planning—weren't assigned a monetary value. The tracking of interventions using the PDA was slightly more time consuming than it would have been with a paper-based system, but it led to a vast time savings during data analysis. With continued use of and increased proficiency with the device, we expect that the electronic tracking process would become more efficient.

STUDY LIMITATIONS

The greatest limitation of this project was the subjectivity involved in rating the interventions. This is evident when comparing ratings between individual panel members and when comparing group ratings to those generated in the study by Nesbit and colleagues (Table 4).[9] While the number of interventions is similar between our study and the Nesbit study, our average medication cost savings per intervention is slightly lower.[9] This may be due to the fact that the Nesbit study took place at a private facility, and the VA acquires medications and supplies at a much lower cost than the private sector.[9]

The biggest difference between the two studies, however, is in the average cost avoidance for preventing potential ADEs. For example, in the Nesbit study, a change in antimicrobial agents due to identification of a resistant organism was assigned a $0 cost impact.[9] By contrast, a similar intervention in our study (change of levofloxacin to ampicillin/sulbactam for improved anaerobic coverage) was assigned a potential cost savings of $2,002. Furthermore, in our study, there were only two pharmacist interventions relating to drug interactions (sulfamethoxazole/trimethoprim was changed to ciprofloxacin in a patient taking warfarin and sumatriptan was discontinued in a patient who was receiving fluoxetine and ergotamine), yet these two had the largest dollar amounts of all in-

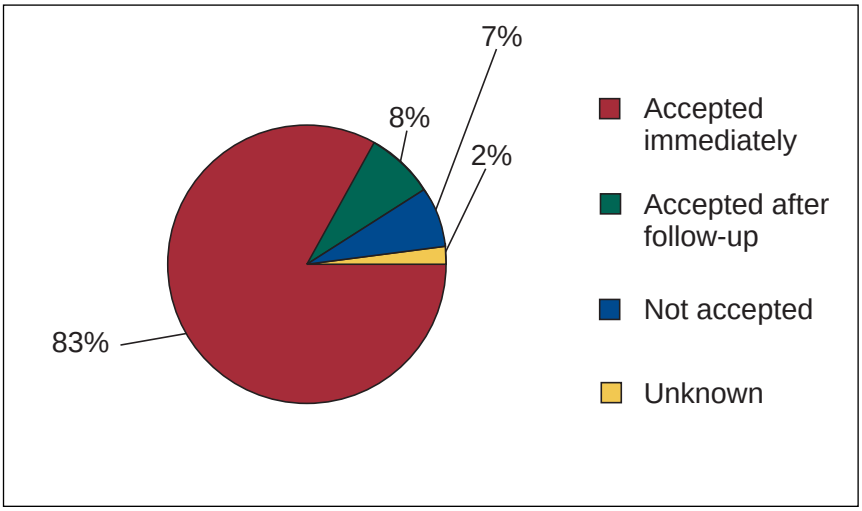

Figure. Provider acceptance of interventions recommended by the decentralized clinical pharmacist on the general medicine unit of the New Mexico VA Health Care System, Albuquerque (n = 169 interventions requiring provider approval).

Table 4. Comparison of current study with 2001 study by Nesbit and colleagues[9]

Comparison criteria	Current study	Nesbit et al
No. of pharmacist interventions	210	286
Average medication cost saved per intervention	$6.47	$9.33
Average potential adverse drug event cost avoided per intervention	$818.00	$114.00

terventions. In the Nesbit study, the discontinuation of cisapride upon the prescription of fluconazole—which also was classified as an interaction—was associated with a mere $50 cost impact.[9]

These cost differences originate from the much lower ratings of ADE probability assigned in the Nesbit study compared to our study, which might be explained by the fact that the rating panel in the Nesbit study was comprised entirely of clinical pharmacists.[9] In our study, clinical pharmacists assigned the lowest ADE probability ratings of all types of providers on the rating panel.

The results of our study also may be limited in terms of external validity. The NMVAHCS is a 217-bed teaching institution, and similar to most VA medical centers, it has a predominantly male patient population. Even within the hospital, there is some variability among units and among pharmacists. The NMVAHCS is a teaching hospital with new medical residents each year, and this staff turnover could create variability in the rate of provider acceptance of pharmacist recommended interventions. In addition, documentation and categorization of interventions is subject to different determination by each pharmacist. Nevertheless, we believe the results to be internally valid and therefore applicable within the institution and perhaps to other similar VA institutions.

The assumption that other health care providers or the centralized pharmacist wouldn't have made the changes the decentralized pharmacist recommended also is a limitation. The study design wasn't randomized or controlled due to multiple confounding factors, especially patient variability. It isn't known if a three-month period was sufficient to yield valid results. Other studies looking at cost savings have used a data collection period of one year. Due to time constraints, only three months of data collection were possible. Finally, this study did not assess patient outcomes.

BEYOND COST SAVINGS

ADEs can have a significant financial effect on the health care institution and be devastating for the affected patient and family members. It's not an easy task to assign a monetary value to the avoidance of ADEs, but using a previously published probability scale, this study has shown that a decentralized clinical pharmacist can decrease potential ADE costs as well as medication costs. There are many other tasks this type of clinical pharmacist performs that weren't assessed in terms of cost savings, but it's evident that the decentralized clinical pharmacist serves as a valuable member of an integrated health care team and has substantial influence on medication choices.

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The opinions expressed herein are those of the authors and do not necessarily reflect those of Federal Practitioner, *Quadrant HealthCom Inc., the U.S. government, or any of its agencies. Please review complete prescribing information for specific drugs or drug combinations—including indications, contraindications, warnings, and adverse effects—before administering pharmacologic therapy to patients.*

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