Acceptance of Recommendations by Inpatient Pharmacy Case Managers: Unintended Consequences of Hospitalist and Specialist Care

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Study Objective. To determine whether recommendations made by pharmacists and accepted by hospital physicians resulted in fewer postdischarge readmissions and urgent care visits compared with recommendations that were not implemented.

Design. Prospective substudy of pharmacist recommendations.

Setting. Tertiary care academic medical center and private community-based physician practices and community pharmacies.

Patients. A total of 192 patients aged 18 years or older who were a subsample of a randomized, prospective study, who were admitted with a previous diagnosis of one of nine cardiovascular or pulmonary diseases or diabetes mellitus or had received oral anticoagulation therapy and who were discharged to community-based care provided by private physicians and community pharmacists.

Measurements and Main Results. Pharmacy case managers performed evaluations for patients and made recommendations to inpatient physicians. Patients received drug therapy counseling, a drug therapy list, and a wallet card at discharge. Data were collected from patients and private physicians for 90 days after discharge. Pharmacy case managers made 546 recommendations to inpatient physicians for 187 patients (97%). Overall, 260 (48%) of the 546 recommendations were accepted. The acceptance rate was lower for patients who had an urgent care visit compared with the other patients (33.6% vs 52.2%, $p=0.033$). High acceptance rates were noted for updating the record after medication reconciliation (36 patients [78%]) and when there was an actual allergy (2 [100%] of 2 patients) or medication error (2 [100%] of 2 patients). Physicians were less likely to accept recommendations related to drug indications ($p<0.001$), drug efficacy ($p=0.041$), and therapeutic drug and disease state monitoring ($p=0.011$). Recommendations made for patients with a relatively greater number of drugs were also less likely to be accepted ($p=0.003$).

Conclusion. Recommendations to reconcile medications or address actual drug allergies or medication errors were frequently accepted. However, only 48% of all recommendations were accepted by inpatient physicians, and there was no impact on health care use 90 days after discharge. This study suggests that recommendations by pharmacy case managers were

underused, and the low acceptance rate may have reduced the potential to avoid readmissions.

Key Words: hospital readmissions, adverse drug reactions, pharmacy services.

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Hospital readmissions are a major clinical and economic problem in the United States.[1, 2] One in five elderly patients are readmitted within 30 days of discharge, and one in three are readmitted within 90 days, costing Medicare $17.4 billion in 2004.[1] A similar study found that almost 1 in 10 nonelderly patients with Medicaid were readmitted within 1 month after discharge in 2007.[3] Another study found that 16% of hospital admissions were due to adverse drug reactions (ADRs).[4] The provision of more extensive pharmacy services, such as admission histories, drug protocol management, and ADR management, has been shown to significantly reduce hospital readmissions and mortality.[5–8]

Inpatient staff physicians, now more frequently known as hospitalists and specialists, are constrained by limited time and are often unable to optimize therapy for every medical issue before patient discharge. Acute medical problems take priority, and once the issue is resolved, the patient is discharged back to the community. The prospective payment model, focused primarily on the admission issue, may leave some chronic medical problems unaddressed by hospitalists. As a result, some patients may be transitioned to outpatient care without full consideration of all chronic conditions.[9] Hospital payment models and insufficient care coordination are recognized as contributors to high readmission rates.[1, 9–11] New policies outlined in the Patient Protection and Affordable Care Act provide incentives for health care practitioners to create new care models in their institutions that improve outcomes and minimize costly readmissions.[1]

The Joint Commission, the National Quality Forum, and the Centers for Medicare and Medicaid Services have launched quality improvement initiatives promoting the development of multidisciplinary care models focused on reducing readmissions.[5] The proposed model of inpatient care, supported by numerous studies, is a multidisciplinary team working together to optimize patient outcomes.[2, 5, 12–15] This team includes physicians, pharmacists, social workers, nurses, physical therapists, and others to optimize the inpatient stay and facilitate transitions of care. A 2006 systematic review summarizing the outcomes of 36 studies involving pharmacist-provided care to hospital inpatients showed a positive impact on a number of process and outcome measures.[2] However, of the six studies that included hospital readmission, pharmacists had a direct impact in only one. Other studies have demonstrated that specific pharmacist-provided services reduce health care use after discharge.[16–18] When pharmacists work with the inpatient team, studies have found that pharmacists' recommendations resulted in positive clinical and economic outcomes, with acceptance rates of drug therapy recommendations as high as 95%.[12, 19–22]

Although including pharmacists on inpatient teams is now common, their role in reducing readmissions remains unclear.[23, 24] The Iowa Continuity of Care (ICOC) study is a randomized trial designed to determine whether specialized

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pharmacy case managers (PCMs) can reduce adverse drug events (ADEs), readmissions, and urgent care visits.[25] Patients were enrolled and participated in the trial through June 2012. Because the study requires that medical records be obtained from private physicians, followed by an extensive evaluation of case abstracts and adjudication of events, overall results will not be available until late 2013. During the process of providing data to the external Data and Safety Monitoring Board, it was revealed that there was no apparent effect of the pharmacy intervention at the first planned interim analysis. It was also found that less than half of the PCM recommendations were being accepted by inpatient physicians. The PCMs had been informing investigators that it was not uncommon for inpatient physicians to express that they did not want to change long-term therapy because patients were being cared for by primary care physicians elsewhere. These findings led us to explore the types of recommendations that were accepted and whether acceptance reduced readmissions and urgent care visits. The investigators thought that these findings deserved more rapid dissemination, rather than waiting until the entire study results are known.

Hospital readmissions, in part, are due to behaviors by patients and private physicians that cannot be controlled by inpatient physicians. Because hospitals will increasingly be at risk for costs of readmissions, the preliminary findings of the ICOC trial suggest that more potent strategies are needed during both the hospitalization and postdischarge periods. Thus, the objective of this substudy of the ICOC trial was to compare readmission rates, emergency department use, and urgent care visits for patients who had recommendations made by the PCMs that were accepted or declined by inpatient physicians.

Methods

This study was conducted at the University of Iowa Hospitals and Clinics (Iowa City, IA), a large, tertiary care, academic medical center. The background and methods of the parent study, the ICOC trial, have been published previously.[25] Our substudy included patients in one of the intervention groups of the parent study who received recommendations by the PCMs. The study was approved by the University of Iowa Institutional Review Board for Human Subjects, and all patients provided signed informed consent.

The primary purpose of the ICOC study was to improve communication between the tertiary health center inpatient care (inpatient physicians and PCMs) and community-based care (community physicians and pharmacists), with a goal of reducing readmissions and urgent care visits. For that reason, a more population-based approach was used; the PCMs were located centrally outside the hospital services, and they covered many key inpatient services. However, a second purpose of the ICOC study was to reduce ADRs both during hospitalization and after discharge. Therefore, the PCM identified drug-related problems during the inpatient stay and communicated recommendations to the inpatient physicians. Only one or two PCMs participated in the study at any given time. Four PCMs participated over the course of the present substudy; all were Doctor of Pharmacy (Pharm.D.) graduates who had completed at least 1 year of postgraduate pharmacy residency training accredited by the American Society of Health-System Pharmacists.

After the patients had provided signed informed consent, data were collected by a research assistant. The PCMs were then informed of whether the patient was randomized into an intervention group. The PCMs performed comprehensive medication reconciliations and identified drug-related problems within 24 hours of admission by collecting information from patients, caregivers, the electronic medical record, and community pharmacy records. The PCMs met with patients every 2 or 3 days (Monday through Friday) throughout the admission to provide education on drug indications, goals of therapy, ADEs, drug adherence mechanisms, and self-monitoring measures. These patient education meetings occurred regardless of whether the PCM recommendations were accepted by the physician. A comprehensive assessment of the current pharmacotherapy regimen was prepared, and recommendations were made to inpatient physicians to promote compliance with current clinical practice guidelines and best practices. The PCM recommendations were documented in the electronic medical record and were communicated to inpatient physicians by telephone. Recommendations were also communicated typically within 24 hours of admission or the identification of a new drug-related problem. We did not capture the number of cases that required more time to reach the physician. These cases, however, were

not common, and the PCMs usually spoke with the physician within 24 hours. The PCMs recorded all drug therapy, recommendations to physicians, and care plans within the study electronic database. The PCMs also classified each recommendation by type (Appendix 1) and problem category (Appendix 2) using a modification of a validated taxonomy.[26] The PCMs could categorize each recommendation into more than one type or problem category, so the number of these classifications exceeded the overall number of individual recommendations. Research assistants verified whether recommendations were accepted or rejected using documentation in the electronic medical record; they then assigned each recommendation to the most appropriate subcategory (Appendix 2). Recommendations that physicians agreed with, but failed to implement, were considered to be rejected.

The PCM provided discharge education, a drug therapy list, and a wallet card detailing each drug's name, indication, dosage, and directions at discharge. If a patient was discharged on a weekend and it was planned, the pharmacist provided discharge education and counseling on Friday. If the discharge plans were not clear on Friday, and the discharge occurred over the weekend, the pharmacist provided the discharge education by telephone and mailed the paperwork to the patient. The PCM work space was located offsite; therefore, they did not participate in medical rounds. They did, however, communicate with the decentralized pharmacists on the various services for serious events, which were rare. At the time these data were collected, there were two decentralized pharmacists who covered the nine medical services involved in this study. There was one decentralized pharmacist who rounded with four internal medicine teams and one family medicine team and one pharmacist who covered three cardiology teams. Decentralized pharmacists did not round with the orthopedics service.

Eligible patients were required to speak English or Spanish, to be 18 years of age or older, and to have a previous diagnosis of hypertension, hyperlipidemia, heart failure, coronary artery disease, myocardial infarction, stroke, transient ischemic attack, asthma, chronic obstructive pulmonary disease, or diabetes mellitus or had received oral anticoagulation therapy. Eligible patients were admitted to one of four hospital services: general internal medicine, family medicine, cardiology, or orthopedics. Eligible patients also had to receive primary care from a private physician in the community and fill their prescriptions at a local pharmacy. Patients were excluded if they received primary care at a medical office that shares electronic information within the hospital network; had prescriptions consistently filled at the hospital-affiliated outpatient pharmacies; could not be reached by telephone; had a life expectancy of less than 6 months (as documented in the medical record or plans for hospice); were admitted to psychiatric, surgery, or hematology-oncology services; or had dementia, cognitive impairment, or severe psychiatric or psychosocial conditions (including substance abuse). The surgery and hematology-oncology services were excluded because these conditions are often complicated and take precedent over chronic medical conditions.

A research nurse made postdischarge telephone calls to patients at 30 and 90 days to collect self-reported data on ADRs, readmissions, emergency department use, and urgent care visits. All events were validated with the respective facilities by requesting medical records from other hospitals and community physicians for all patients after the 90-day period, including primary care visits, hospitalizations, consultant visits, laboratory values, and procedures. The primary end point was combined readmissions, emergency department use, urgent care visits, or death within 90 days of discharge. This outcome was compared between patients with accepted and those with declined PCM recommendations.

Recommendation acceptance rates were stratified by patient outcomes, recommendation type, and pharmacotherapy problem category. The Fisher exact test was used to test whether recommendation acceptance rates varied by patient outcomes, recommendation type, and pharmacotherapy problem. Associations between recommendation acceptance rates and numeric variables (number of drugs at admission and number of diagnosed conditions) were assessed using logistic regression. All hypothesis tests were performed with 2-sided tests, and statistical significance was accepted with a p value of less than 0.05.

Results

Of 192 patients enrolled, 187 (97%) had 546 recommendations made to the inpatient physicians. The number of recommendations/patient ranged from 1–13, with a mean ± SD of 2.9 ± 2.3. Specifically, 33.2% had one, 24.6% had two, 15.5% had three, 8.0% had four, 3.7% had five, 4.8% had six, and 10.2% had 7–13 recommendations. The number of recommendations and

the percent accepted (in parentheses) for the four hospital services were as follows: 188 (42.6%) for orthopedics, 174 (52.3%) for internal medicine, 164 (48.2%) for cardiology, and 20 (50.0%) for family medicine. Although the percentage of recommendations accepted for orthopedics was somewhat lower than that for the other services, no significant differences were noted between services (p=0.315, Fisher exact test). Recommendations were made to 61 physicians, and 53 (86.9%) were either specialists or hospitalists. These physicians consisted of 18 hospitalists and 12 other specialists on the four internal medicine services, 20 cardiologists on three cardiology services, three orthopedists (one service), and eight family physicians (one service). Thus, all of the physicians except the family physicians were hospitalists or specialists.

Of the 546 recommendations, the most common types were to add a drug, change drug intensity, discontinue a drug, monitor a drug or disease state, or schedule physician follow-up (Table 1). Physicians accepted 260 (47.6%) of 546 recommendations. Physicians were more likely to accept recommendations in the "other" category (78.8%, p<0.001) but less likely to accept recommendations related to therapeutic drug or disease state monitoring (33.3%, p=0.011). The recommendations in the "other" category were typically more procedural such as to taper a drug before discontinuation, clarify duration, provide dietician consultation, or restart a drug when at home.

Within 90 days of discharge, 83 patients (44.4%) used health care resources or died (Table 2). Specifically, 43 (23.0%) were readmitted to a hospital, 46 (24.6%) were evaluated in an emergency department, and 28 (15%) visited urgent care. Because there could be multiple recommendations/patient, we calculated a recommendation acceptance rate for each patient. The acceptance rate was lower for those who had an urgent care visit compared with all other patients (33.6% vs 52.2%, p=0.033). No significant association was noted between recommendation acceptance rates and readmission, emergency department visit, or death.

Table 2. Events Occurring within 90 Days of Discharge in the 187 Patients

Event Type	No. of Events	No. (%) of Patients with One or More Event
Readmission	47	43 (23.0)
Emergency department visit	54	46 (24.6)
Urgent care visit	30	28 (15.0)
Death	5	5 (2.7)
Total	136	83 (44.4)

The most common recommendations by pharmacotherapy problem category included drug or indication issues (n = 237 recommendations), risk to the patient (n = 219 recommendations), or pharmaceutical issues (n = 102 recommendations) (Table 3). Physicians were more likely to accept recommendations for a record update (p<0.001). Physicians were less likely to accept recommendations regarding drug indication (p<0.001) and efficacy (p=0.041). Recommendations were further classified into distinct pharmacotherapy problem subcategories. Table 4 displays selected subcategories with the most frequent recommendations made by the PCMs. Physicians accepted less than 50% of the recommendations for potential ADEs and ADRs,

Table 1. Types of Recommendations and Acceptance Rates for the 187 Patients

Category	Recommendations Accepted	Recommendations Declined	p Value
Refer to social services	3/3 (100)	0 (0)	0.107
Other[a]	41/52 (78.8)	11/52 (21.2)	<0.001
Encourage adherence	4/6 (66.7)	2/6 (33.3)	0.431
Discontinue drug	49/104 (47.1)	55/104 (52.9)	0.914
Change drug intensity	55/124 (44.4)	69/124 (55.6)	0.415
Provide physician follow-up with patient	19/45 (42.2)	26/45 (57.8)	0.534
Add drug	82/195 (42.1)	113/195 (57.9)	0.060
Perform therapeutic drug or disease state monitoring	24/72 (33.3)	48/72 (66.7)	0.011
Provide patient education	3/9 (33.3)	6/9 (66.7)	0.509
Total[b]	260/546 (47.6)	286/546 (52.4)	NA

Data are no. (%) of recommendations for each category.
[a]Other included recommendations to withhold drug therapy, taper drug before discontinuation, restart home dosage, clarify duration, restart drug therapy at home, provide dietician consultation, or not specified by pharmacist
[b]Because recommendations could be included in multiple categories, the numbers in each category total 610 (for the 546 individual recommendations).

Table 3. Pharmacotherapy Problem Categories and Acceptance Rates for the 187 Patients

Category	Recommendations Accepted	Recommendations Declined	p Value
Record update	28/36 (77.8)	8/36 (22.2)	<0.001
Other[a]	8/12 (66.7)	4/12 (33.3)	0.245
Pharmaceutical issue	52/102 (51.0)	50/102 (49.0)	0.510
Risk to patient	108/219 (49.3)	111/219 (50.7)	0.541
Cost	9/22 (40.9)	13/22 (59.1)	0.664
Drug or indication issue	91/237 (38.4)	146/237 (61.6)	<0.001
Efficacy issue	21/60 (35.0)	39/60 (65.0)	0.041
Total[b]	260 (47.6)	286 (52.4)	NA

Data are no (%) of recommendations for each category.
[a]Other included clarify dose, verify drug, withhold drug, postpone drug, or not specified by pharmacist.
[b]Because recommendations could be included in multiple categories, the numbers in each category total 688 (for the 546 individual recommendations).

Table 4. Selected Pharmacotherapy Problem Subcategories and Acceptance Rates for the 187 Patients

Category and Subcategory	Recommendations Accepted	Recommendations Declined
Risk to patient		
Allergy	2/2 (100)	0 (0)
Medication error	2/2 (100)	0 (0)
Monitoring for toxicity	7/10 (70.0)	3/10 (30.0)
Actual adverse drug event	8/16 (50.0)	8/16 (50.0)
Potential adverse drug event	61/136 (44.9)	75/136 (55.1)
Drug indication issue		
No/unclear indication	6/10 (60.0)	4/10 (40.0)
Undertreated condition	24/56 (42.9)	32/56 (57.1)
Untreated condition	43/103 (41.7)	60/103 (58.3)
Alternative therapy	4/25 (16.0)	21/25 (84.0)
Efficacy issue		
Drug adherence or administration issue	7/10 (70.0)	3/10 (30.0)
Therapeutic monitoring for effectiveness	13/42 (31.0)	29/42 (69.0)
Minimal effectiveness	2/7 (28.6)	5/7 (71.4)
Pharmaceutical issue		
Inappropriate route	1/1 (100)	0 (0)
Therapeutic duplication	8/10 (80.0)	2/10 (20.0)
Inappropriate or suboptimal dose	24/44 (54.5)	20/44 (45.5)
Inappropriate or suboptimal schedule	1/3 (33.3)	2/3 (66.7)

Data are no. (%) of recommendations for each category.

untreated conditions, undertreated conditions, and monitoring for efficacy and just over half for inappropriate or suboptimal doses.

Recommendations were significantly less likely to be accepted for patients as the number of admission drugs increased. Specifically, the odds ratio (OR) of recommendation acceptance due to higher number of admission drugs was estimated by logistic regression to be 0.96 (95% confidence interval [CI] 0.93–0.99, p=0.003), meaning that for each additional admission drug, the odds of recommendation acceptance decreased by 4%.

Discussion

This study found a high rate of acceptance of recommendations when the patient had an allergy to an ordered drug (2 [100%] of 2 patients) or when there was a medication error (2 [100%] of 2 patients). Acceptance rates were also high for updating the record after medication reconciliation (78%) or when there was a therapeutic duplication (80%). However, the overall physician acceptance rate was low (47.5%) for all the recommendations made by PCMs. Although there are some differences in acceptance rates between medical services, these differences were not significant. Because the odds of recommendation acceptance decreased by 4% for each additional admission drug, our findings may be related to the high degree of complexity exhibited by many of these patients.

This information was elucidated when our preliminary data were prepared for the Data and Safety Monitoring Board. The findings caused us

to evaluate more effective strategies to improve care after discharge because inpatient physicians were reluctant to make changes.

It is well established that interprofessional teamwork requires interdependence, commitment, and trust.[27] One of us has extensively evaluated physician-pharmacist collaborative relationships and validated instruments to measure attitudes toward collaboration.[28–30] We have described the transition through five stages of development: professional awareness (stage 0), professional recognition (stage 1), exploration and trial (stage 2), professional relationship expansion (stage 3), and commitment to a collaborative working relationship (stage 4).[27, 29] Although we did not measure collaborative relationships in the present trial, we would estimate they were at stage 1 or perhaps stage 2, both of which are low levels of collaboration.

The PCM recommendations included both the acute medical problem responsible for the admission and chronic conditions. For instance, many patients enrolled from the orthopedics service were often admitted for elective surgeries but were eligible for this study because of their chronic conditions. The fact that PCM recommendations included medical conditions outside the scope of the primary reason for the hospital admission may have contributed to the low acceptance rate, which several inpatient physicians mentioned anecdotally. This observation is supported by a recent study that found hospitalists did not want to interfere with the prescribing of the patient's primary physician.[31] These authors evaluated hospitalists, and quotes such as the following were documented: "I don't cut across somebody else's prescribing unless I'm taking over the patient." If the inpatient medical team does not optimize long-term medical therapy, the primary care physician may interpret that therapeutic plan as appropriate as determined by the tertiary care team when, in fact, the inpatient team did not deal with those drugs. This potential miscommunication could lead to care gaps that then result in future readmissions.

The rate of hospital readmissions, emergency department use, and urgent care visits within 90 days after discharge in this study did not differ significantly between patients whose recommendations were accepted and those whose recommendations were declined. One possible explanation for this finding may be the low acceptance rate of PCM recommendations. Another explanation is that many of the recommendations that were accepted may not have had as much influence on readmissions compared with recommendations to intensify therapy or to change a drug when there is a potential ADE. A possible explanation for the lower than expected acceptance rate is that the PCMs did not round with the teams and were not as well known to the physicians.

Other studies investigating inpatient pharmacist recommendations have reported positive clinical and economical outcomes associated with acceptance rates of greater than 90%.[12, 32, 33] Our findings are similar to those of another study in which clinical pharmacists performed drug therapy reviews for patients on an internal medicine ward at a regional hospital in Denmark (intervention group).[24] Physicians approved 39% of the 187 pharmacist recommendations to modify drug therapy with no significant difference between patients in the intervention and control groups regarding readmissions, emergency department use, and visits for outpatient care 3 months after discharge. In the present study, recommendations were less likely to be accepted by physicians if they related to drug indication ($p<0.001$) or efficacy ($p<0.041$). Physicians accepted less than half of the recommendations to address untreated and undertreated conditions by adding or intensifying therapy. Based on these findings, it may be that physicians in typical inpatient settings are less likely to accept many of the recommendations made, especially ones that may be perceived to be of lower importance (e.g., costs, untreated indication, therapeutic monitoring).

Interventions to prevent ADEs have the potential to reduce health care use. It is estimated that 12–17% of patients on a general medicine service experience an ADE after discharge, with 6–12% resulting in emergency department visits and 5% in hospital readmissions.[23] In our study, physicians did accept a high percentage of recommendations when there was a medication allergy, actual ADE, or medication error. These more serious events, however, were rare. In contrast, the OR of acceptance by number of drugs was 0.96 (95% CI 0.93–0.99, $p=0.003$), meaning that the odds of recommendation acceptance decreased by 4% with each additional drug. Patients with polypharmacy are known to be at a higher risk of ADEs.[34]

Studies have shown that physicians and pharmacists can work collaboratively to reduce ADEs

in intensive care units. Preventable ADEs decreased in one study by 66% ($p<0.001$) when a pharmacist was added to the care team.[12] In that study, physicians accepted 362 (99%) of 366 recommendations made by the pharmacist, which is a much higher rate than that observed in the present study. It is possible that the majority of recommendations in the intensive care unit study did not focus on long-term drugs but, rather, focused on short-term problems. In that case, this process would increase the likelihood that recommendations would be accepted in that trial.

Improved outcomes have also been demonstrated when adding pharmacists to medicine teams. A 2009 Canadian study evaluated all-cause readmission rates of 452 inpatients randomized to usual care or enhanced care from the addition of a clinical pharmacist to the team.[18] Patients in the clinical pharmacist arm experienced fewer hospital readmissions at 3 months after discharge than patients in the usual care arm (OR 0.63, 95% CI 0.42–0.94).

A recent study examined Medicare data from 11 U.S. hospitals ranking in the top or bottom 5% for mortality rates after acute myocardial infarction.[35] The role of pharmacists in high-performing hospitals was described as being closely integrated into care processes and having influenced clinical decisions. In low-performing hospitals, pharmacist roles were described as being narrowly circumscribed and having limited participation in clinical decisions. Other studies have shown that with high acceptance rates, pharmacist interventions can decrease costs and improve clinical outcomes.[32, 33, 36]

When a patient is admitted to the hospital, there is an opportunity to evaluate and optimize the treatment of chronic conditions. Once the patient is discharged, it should not be assumed that these disease states will be appropriately addressed. A retrospective study completed in 2007 found inpatient physicians at a large, academic teaching hospital recommended only 27.6% of discharged patients for outpatient follow-up. More than one third of these recommended follow-ups were not completed. Our concern is that if adjustments are not made during the inpatient stay, the primary care physician could interpret this as approval of his or her patient care plan by specialists at the hospital. This could lead to many patients "falling through the cracks," not having the treatment of their chronic condition optimized, and ultimately resulting in a serious short-term event. It is our opinion that these issues should be addressed during hospitalization because they represent missed opportunities to intervene to improve chronic disease management.

A recent systematic review demonstrated the positive effect pharmacists have on therapeutic, safety, and economic outcomes in the U.S. health system.[19] Pharmacists have the ability to impact patient outcomes in both the inpatient and outpatient environment, as well as to facilitate transitions of care. Health systems that use hospitalists or other specialists should examine policies and procedures to improve gaps in therapy when patients are discharged to the care of primary care physicians in the community. These gaps will be particularly important as hospitals are at risk for costs associated with early readmissions.

This study is not without limitations. This study was purposefully designed to add PCMs to usual pharmacy services in this hospital, in part, because there were only two decentralized pharmacists on all nine medical services. In addition, at any given time, there was only one or two PCMs involved with this study so it was not possible to cover all the critical services by PCMs. The goal of the intervention was to provide more in-depth surveillance of high-risk patients by specialized clinical pharmacists located more centrally in a cardiovascular risk service. Because of the broad coverage, the PCMs did not function as part of the inpatient medical team because this study deployed them on the nine inpatient services. Instead, they centrally covered these services and made therapy recommendations based on a comprehensive review of each patient's medical case. The physicians may have been reluctant to accept recommendations from a pharmacist working outside of the medical team without previously established trust and rapport. However, the PCMs were frequently in the hospital as they visited study patients, usually every 2–3 days. Second, data were collected by reviewing medical records and self-reporting. Events may have been missed if they were not documented in the records that were reviewed or the patient failed to report it during follow-up telephone calls. However, this study is one of the most comprehensive evaluations of readmissions and ADRs because medical records from the hospital, community physicians, and community hospitals were obtained to minimize any missed events.

Based on our experience with this trial to date, we propose specific structural features of any similar interventions. Because of the challenges and limitations for physicians in tertiary care, recommendations for long-term therapy should probably be made to the community physician. This intervention will need to be structured so that more intense recommendations and follow-through can be achieved. It would also be helpful if the care plans come from a PCM who is easily identified as a member of the team of providers caring for the patient during the inpatient stay.

Conclusion

Physicians accepted the majority of PCM recommendations to reconcile medications on admission and for patients with actual drug allergies or medication errors. However, the overall acceptance rate was 48% despite the fact that recommendations were based on clinical guidelines and published evidence. Patients with accepted pharmacist recommendations did not show reduced readmissions or emergency department or urgent care visits within 90 days after discharge. Future studies should identify efficient strategies to improve the long-term care of hospitalized patients both during and after discharge. These studies should help to clarify the proper care structure and role of pharmacists in hospital settings and how their involvement can improve continuity of care with community providers.

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Appendix 1. Types of Recommendations

Discontinue drug
Add drug
Change drug intensity
Perform therapeutic drug or disease state monitoring
Provide physician follow-up with patient
Provide community pharmacist follow-up with physician
Provide insurance follow-up
Refer to social services
Refer to home health care
Provide patient education
Encourage adherence
Other[a]

[a]Other included recommendations to withhold drug therapy, taper drug before discontinuation, restart home dosage, clarify duration, restart drug therapy at home, provide dietician consultation, or not specified by pharmacist.

Appendix 2. Pharmacotherapy Problem Categories[26]

Categories and Subcategories	Definitions
Risks to patient	
Allergy	Patient had known allergy to drug or drug class, or actual ADE or ADR. Patient had a previous undesirable experience with the drug and therefore either discontinued the drug or wants to discontinue the drug due to previous experience
Potential ADE or ADR	Patient is at increased risk for an ADE or ADR, including drug interaction or absolute or relative contraindication to a drug
Medication error	Errors that occur in the process of ordering or delivering a drug, regardless of whether an injury occurred or the potential for injury was present (i.e., not a therapeutic decision)
Therapeutic monitoring	Includes drug and disease state monitoring (e.g., laboratory results, vital signs, symptoms) for toxicity purposes
Drug or indication issues	
No or unclear indication	No clear indication for the drug that the patient is taking or has been prescribed
Untreated condition	Drug should be started
Undertreated condition	Dose should be increased or new drug should be added
Alternative therapy	Not receiving the best or most appropriate therapy (therapeutic decision) for the indication; requires a change to a potentially more effective therapy
Efficacy issues	
No evidence of effectiveness	Based on clinical assessment or patient has self-discontinued a drug based on belief of ineffectiveness
Monitor for effectiveness	Includes drug and disease state monitoring (e.g., laboratory results, vital signs, symptoms)
Drug adherence or administration issue	Patient not taking drug or not taking drug as prescribed; need for adherence aids and/or education about appropriate use of drug

(continued)

Appendix 2. (continued)

Categories and Subcategories	Definitions
Pharmaceutical issues	
Inappropriate or suboptimal dose	Dose is too high or too low; inappropriately high dose unlikely to lead to ADR or ADE
Inappropriate or suboptimal schedule	Schedule problem without changing total daily dose
Inappropriate or suboptimal route	Includes inappropriate or suboptimal drug administration instructions and convenience issues for drug administration
Therapeutic duplication	Inappropriate duplication of drugs
Cost issues	
Formulary adherence	Replacement of nonformulary drug with formulary alternative
Less expensive alternative	Switch to a generic drug or other lower cost alternative
Record update	
Admission drug therapy is different from community records	Update drug therapy profile
Label instructions do not match how patient was actually instructed to take the drug	Update drug therapy profile
Prescription not on profile	Add drug to the profile

ADR = adverse drug reaction; ADE = adverse drug event.