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

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Abstract

Study Objective—To determine if recommendations made by pharmacists and accepted by hospital physicians resulted in fewer post-discharge readmissions and urgent care visits compared to recommendations that were not implemented.

Design—Prospective review of pharmacist recommendations.

Setting—Patients admitted to a tertiary hospital and discharged to private community-based care.

Patients—A total of 192 subjects age 18 years or older who were a subsample of a randomized, prospective study, admitted with one of 10 cardiovascular or pulmonary disease or diabetes and utilized private community physicians and community pharmacies.

Measurements and Main Results—Pharmacy Case Managers (PCMs) performed evaluations for subjects and made recommendations to inpatient physicians. Subjects received medication counseling, a medication list and wallet card at discharge. Data from subjects and private

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physicians for 90 days post-discharge were collected. PCMs made 546 recommendations to inpatient physicians for 187 (97%) subjects. Overall, 48% of the recommendations were accepted. The acceptance rate was lower for those who ended up with an urgent care visit compared to other subjects (33.6% vs. 52.2%, p=0.033). There were high acceptance rates for medication reconciliation (78%, n=36) and when there was an actual allergy (100%, n=2) or medication error (100%, n=2). Physicians were less likely to accept recommendations related to medication indication (p<0.001), efficacy (p=0.041), and therapeutic disease monitoring (p=0.011). Recommendations made for subjects with a greater number of medications were also less likely to be accepted (p=0.003).

Conclusion—Recommendations to reconcile medications or address actual allergies or medication errors were frequently accepted. However, only 48% of all recommendations were accepted by inpatient physicians and there was no impact on healthcare utilization 90 days after discharge. This study suggests that recommendations by PCMs were underutilized and the low acceptance rate may have reduced the potential to avoid readmissions.

Keywords

Hospital readmissions; adverse drug reactions; pharmacy services

BACKGROUND

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 within 90 days, costing Medicare $17.4 billion in 2004.[1] A similar study found almost one in ten non-elderly Medicaid patients were readmitted one month after discharge in 2007.[3] One study found 16% of hospital admissions were due to adverse drug reactions (ADRs).[4] More extensive pharmacy services such as admission histories, drug protocol management and ADR management have been shown to significantly reduce hospital readmissions and mortality.[5–8]

Inpatient staff physicians, now more frequently hospitalists and specialists, are constrained by limited time and are often unable to optimize therapy for every medical issue prior to 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 by the Patient Protection and Affordable Care Act provide incentives for health care practitioners and institutions to create new care models that improve outcomes and minimize costly readmissions.[1]

The Joint Commission, the National Quality Forum, and the Center for Medicare and Medicaid Services (CMS) 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 multi-disciplinary

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 thirty-six 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 only had a direct impact in one. Other studies have demonstrated that specific pharmacist-provided services reduce healthcare utilization 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 medication 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 to determine if specialized pharmacy case managers (PCMs) can reduce ADEs, re-admissions and urgent care visits.[25] Subjects will be enrolled and participate in the trial through June 2012. Because this study requires that medical records are 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 fewer than half of the PCM recommendations were being accepted by inpatient physicians. PCMs had been informing investigators that it was not uncommon for inpatient physicians to express that they did not want to change chronic 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 if acceptance reduced readmissions and urgent care visits. The investigators felt 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 study suggest that more potent strategies are needed during both the hospitalization and post-discharge period. The objective of the present sub-study was to compare readmissions, emergency department use, and urgent care visits for subjects who had recommendations made by the PCM and accepted or declined by inpatient physicians.

METHODS

This study was conducted at the University of Iowa Hospitals and Clinics (UIHC), a large, tertiary care, academic medical center. The background and methods of this study have been published.[25] The present sub-study included subjects in one of the intervention groups in 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 subjects signed informed consent.

The primary purpose of the ICOC study was to improve communication between the tertiary health center inpatient care with community physicians and community pharmacists to reduce readmissions and urgent visits. For that reason, a more population-based approach was used and the PCMs were located centrally outside the hospital services and they covered many key inpatient services. However, a second purpose of the study was to reduce ADRs both during hospitalization and post-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 study; all were Doctor of Pharmacy (Pharm.D.) graduates who had completed at least one year of post-graduate pharmacy residency training accredited by the American Society of Health-System Pharmacists.

After the subjects had signed informed consent, data were collected by a research assistant. PCMs were then informed if the subject was randomized into an intervention group. PCMs performed comprehensive medication reconciliations and identified drug-related problems within 24 hours of admission by collecting information from subjects, caregivers, the electronic medical record, and community pharmacy records. The PCMs met with subjects every 2 or 3 days (Monday through Friday) throughout the course of the admission to provide education on medication indications, goals of therapy, adverse drug effects, 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. PCM recommendations were documented in the electronic medical record and were communicated to inpatient physicians via 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 medications, recommendations to physicians and care plans within the ICOC 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 list more than one recommendation “type” and\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 and 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 medication list and wallet card detailing medication 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 occurred over the weekend, the pharmacist provided the discharge education by telephone and mailed the paperwork to the patient. The PCM workspace was located offsite, therefore they did not participate in medical rounding. 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 who covered three cardiology teams. Decentralized pharmacists did not round with the orthopedics service.

Eligible subjects were required to be English or Spanish speaking, 18 years of age or older and with a prior diagnosis of hypertension, hyperlipidemia, heart failure, coronary artery disease, myocardial infarction, stroke, transient ischemic attack, asthma, chronic obstructive pulmonary disease, or diabetes or those who received oral anticoagulation therapy. Eligible subjects were admitted to one of four hospital services: general internal medicine, family medicine, cardiology, or orthopedics. Eligible subjects also had to receive primary care from a private physician in the community and fill their prescriptions at a local pharmacy. Subjects were excluded if they received primary care at a medical office that shares electronic information in 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 six months (as documented in the medical record or plans for hospice), admitted to psychiatric, surgery, or hematology/oncology services, or the presence of dementia, cognitive impairment, 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 post-discharge telephone calls to subjects 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 subjects 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 subjects with accepted or declined PCM recommendations.

Recommendation acceptance rates were stratified by subject outcomes, recommendation type, and pharmacotherapy problem category. Fisher’s exact test was used to test whether recommendation acceptance rates varied by subject outcomes, recommendation type, and pharmacotherapy problem. Associations between recommendation acceptance rates and numeric variables (number of medications at admission and number of diagnosed condition) were assessed using logistic regression. All hypothesis tests were performed with two-sided tests and statistical significance was accepted with a p value of <0.05.

RESULTS

Of 192 subjects enrolled, 187 (97%) had 546 recommendations made to the inpatient physicians. The number of recommendations ranged from 1 to 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 at least seven recommendations. The number of recommendations and percent accepted were: orthopedics (188, 42.6%), internal medicine

(174, 52.3%), cardiology (164, 48.2%), and family medicine (20, 50.0%). While the percent of recommendations accepted for orthopedics was somewhat lower than other services, there were no significant differences between services (p=0.315, Fisher's exact test). Recommendations were made to 61 physicians and 53 (86.9%) were either specialists or hospitalists. These physicians included: 18 hospitalists and 12 other specialists on the four internal medicine services, 20 cardiologists on three cardiology services, 3 orthopedists (one service) and 8 family physicians (one service). Thus, all of the physicians except the family physicians were hospitalists or specialists.

From these 546 recommendations, the most common types were to add a medication, change medication intensity, discontinue a medication, monitor a disease state, or schedule physician follow-up (Table 1). Physicians accepted 260/546 (47.6%) 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 disease monitoring (33.3%, p=0.011). "Other" recommendations included were typically more procedural such as taper medication before discontinuing, clarify duration, dietician consult or restart medication when at home.

Within 90 days of discharge, 83 subjects (44.4%) utilized healthcare 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. Since there could be multiple recommendations per subject, we calculated a recommendation acceptance rate for each subject. The acceptance rate was lower for those who ended up with an urgent care visit compared to all other subjects (33.6% vs. 52.2%, p=0.033). There was no significant association between recommendation acceptance rates and readmission, emergency department visits, or death.

The most common recommendations by pharmacotherapy problem category included medication/indication issues (n=237), risk to the subject (n=219), or pharmaceutical issues (n=102) (Table 3). Physicians were more likely to accept recommendations for a record update (p<0.001). Physicians were less likely to accept recommendations regarding indication (p<0.001) and efficacy (p=0.041). Recommendations were further classified into distinct pharmacotherapy problem sub-categories. Table 4 displays selected subcategories where the most frequent recommendations were made by the PCMs. Physicians accepted less than 50% of the recommendations for potential ADE/ADRs, 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 subjects as the number of admission medications increased. Specifically, the odds ratio of recommendation acceptance due to higher admission medications was estimated by logistic regression to be 0.96 (CI= 0.93–0.99, p=0.003), meaning that for each additional admission medication, the odds of recommendation acceptance decreased by 4%.

DISCUSSION

This study found a high rate of acceptance of recommendations when the subject had an allergy to an ordered drug (100%, n=2) or when there was a medication error (100%, n=2). Acceptance rates were also high for updating the record following 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. While there are some differences in acceptance rates between medical services, these differences were not significant. Because the odds for acceptance decreased by 4% for each additional admission medication, 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 was prepared for the Data and Safety Monitoring Board. The findings caused us to evaluate more effective strategies to improve care following discharge since inpatient physicians were reluctant to make changes. In a competitive renewal application for the ICOC study, we are proposing more proactive and assertive strategies aimed at the community physician for an extended period of time after discharge.

It is well established that inter-professional team work requires interdependence, commitment and trust.[27] One of us has extensively evaluated physician\pharmacist collaborative relationships and validated instruments to measure attitudes towards collaboration.[28–30] We have described the transition through five stages of development including: 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] While we did not measure collaborative relationships in the present trial, we would estimate they were at Stage 1 or perhaps Stage 2 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. 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*."[31] If the inpatient medical team does not optimize chronic 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 medications. This potential miscommunication could lead to care gaps that lead to future readmissions.

The rate of hospital readmissions, emergency department use, and urgent care visits within 90 days after discharge in the present study did not differ significantly between subjects

whose recommendations were accepted versus 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 to recommendations to intensify therapy or 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 over 90%.[12, 32, 33] Our findings are similar to another study in which clinical pharmacists performed medication reviews for intervention patients on an internal medicine ward at a regional hospital in Denmark. Physicians approved 39% of the 187 pharmacist recommendations to modify drug therapy with no significant difference between intervention and control patients regarding readmissions, emergency department use and visits for outpatient care 3 months after discharge.[24] In the present study, recommendations were less likely to be accepted by physicians if they related to medication 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 potential to reduce healthcare utilization. It is estimated that 12% to 17% of general medicine patients experience an ADE after discharge, with 6% to 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 odds ratio of acceptance by number of medications was 0.96 (CI= 0.93–0.99, $p=0.003$), meaning that the odds of recommendation acceptance decreased by 4% with each additional medication. Patients with polypharmacy are known to be at a higher risk of ADEs.[34]

Studies have shown 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 adding a pharmacist to the care team.[12] In that study, physicians accepted 362/366 (99%) recommendations made by the pharmacist, much higher than observed in the present study. It is possible that the majority of recommendations in that study in the intensive care unit did not focus on chronic medications but, rather, focused on acute 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. Patients in the clinical pharmacist arm experienced fewer hospital readmissions at 3 months post-discharge than usual care (OR=0.63, 95% CI=0.42, 0.94).[18]

A recent study by Curry et al examined Medicare data from eleven US 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 admitted to the hospital, there is an opportunity to evaluate and optimize treatment of chronic conditions. Once 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 subjects for outpatient follow-up. Over one-third of the 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, ultimately resulting in a serious acute 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 United States health system.[19] Pharmacists have the ability to impact patient outcomes in both the inpatient and outpatient environment, as well as facilitate transitions of care. Health systems that utilize 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. The present 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 subjects by specialized clinical pharmacists located more centrally in a cardiovascular risk service. Because of the broad coverage, 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 subject’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 subjects usually every two to three 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 subject failed to report it during follow up phone calls. However, this study is one of the most

comprehensive evaluations of re-admissions and ADRs since 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 would propose specific structural features of any similar interventions. Because of the challenges and limitations on physicians in tertiary care, recommendations for chronic 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 comes 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 subjects with actual medication allergies or errors. However, overall acceptance rate was 48% despite the fact that recommendations were based on clinical guidelines and published evidence. Subjects with accepted pharmacist recommendations did not show reduced readmissions, emergency department, or urgent-care visits within 90 days after discharge. Future studies should identify efficient strategies to improve the chronic 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. Type of Recommendation

☐ Discontinue medication

☐ Add medication

☐ Change medication intensity

☐ Therapeutic disease state monitoring

☐ Physician follow-up with patient

☐ Community pharmacist follow-up with physician

☐ Insurance follow-up

☐ Social services referral

☐ Home health referral

☐ Patient education

☐ Encourage adherence

☐ Other

Appendix 2. Pharmacotherapy Problem Categories26

Categories and Subcategories	Definitions
Risk to Patient	
Allergy	Patient had known allergy to drug or drug class, actual ADE/ADR. Patient has had a prior undesirable experience with the medication, therefore either discontinued medication or wants to discontinue due to prior experience.
Potential ADE/ADR	Patient is at increased risk for an ADE/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 medication, regardless of whether an injury occurred or the potential for injury was present (Not a therapeutic decision).
Therapeutic Monitoring	Includes drug and disease state monitoring (laboratory, vital signs, symptoms) for toxicity purposes.
Medication/Indication Issue	
No/Unclear Indication	No clear indication for medication patient is taking or has been prescribed.
Untreated Condition	Medication should be started.
Undertreated Condition	New medication should be added or dose increased.
Alternative Therapy	Not on the best or most appropriate therapy (therapeutic decision) for indication; requires a change to a potentially more effective therapy.
Efficacy Issue	
No Evidence of Effectiveness	Based on clinical assessment or patient has self-discontinued a medication based on belief of ineffectiveness.
Monitor for Effectiveness	Includes drug and disease state monitoring (laboratory, vitals, symptoms).
Adherence or Administration	Patient not taking medication or not taking as prescribed, need for adherence aids and/or education about appropriate use of medication.
Pharmaceutical Issue	
Inappropriate/Suboptimal Dose	Dose is too high or too low. Inappropriately high dose unlikely to lead to ADR/ADE.
Inappropriate/Suboptimal Schedule	Schedule problem without changing total daily dose.
Inappropriate/Suboptimal Route	Includes inappropriate/suboptimal administration instructions and convenience issues for drug administration.
Therapeutic Duplication	Inappropriate duplication of medications.
Cost Issue	
Formulary Adherence	Replacement of nonformulary medication with formulary alternative
Less expensive alternative	Switch to a generic medication or other lower cost alternative
Record Update	
Admission medication different from community records	Update medication profile
Label instructions do not match how patient actually instructed to take medication.	Update medication profile
Prescription not on profile	Add medication to the profile

ADR – adverse drug reaction, ADE- adverse drug event

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Table 1

Types of recommendations and acceptance rates (n=187 subjects)

Category	Accepted (%)	Declined (%)	P Value
Social services referral	3 (100)	0	0.107
Other[a]	41 (78.8)	11 (21.2)	<0.001
Encourage adherence	4 (66.7)	2 (33.3)	0.431
Discontinue medication	49 (47.1)	55 (52.9)	0.914
Change medication intensity	55 (44.4)	69 (55.6)	0.415
Physician follow-up with patient	19 (42.2)	26 (57.8)	0.534
Add medication	82 (42.1)	113 (57.9)	0.060
Therapeutic monitoring	24 (33.3)	48 (66.7)	0.011
Patient education	3 (33.3)	6 (66.7)	0.509
Total[b]	260 (47.6)	286 (52.4)	NA

[a] The Other category included: Hold medication, taper medication before discontinuing, restart home dose, clarify duration, restart medication at home, dietician consult, or pharmacist did not specify.

[b] Since recommendations could be of multiple types, the individual counts do not sum to the total of 546, but to 610.

Table 2

Events within 90 days of discharge (n=187 patients).

Event Type	Number of Events	Number (%) Patients w/ One or More Event
Readmissions	47	43 (23.0)
Emergency Department Use	54	46 (24.6)
Urgent Care Visit	30	28 (15.0)
Death	5	5 (2.7)
Total	136	83 (44.4)

Table 3

Pharmacotherapy problem categories and acceptance rates (n=187 subjects).

Category	Accepted (%)	Declined (%)	P Value
Record Update	28 (77.8)	8 (22.2)	<0.001
Other[a]	8 (66.7)	4 (33.3)	0.245
Pharmaceutical Issue	52 (51.0)	50 (49.0)	0.510
Risk to Patient	108 (49.3)	111 (50.7)	0.541
Cost	9 (40.9)	13 (59.1)	0.664
Medication/Indication Issue	91 (38.4)	146 (61.6)	<0.001
Efficacy Issue	21 (35.0)	39 (65.0)	0.041
Total[b]	260 (47.6)	286 (52.4)	NA

[a] The “Other” category includes clarify dose, verification, hold medication, postpone medication or pharmacist did not specify.

[b] Since recommendations could be of multiple problem categories, the individual counts do not sum to the total of 546, but to 688.

Table 4

Selected Pharmacotherapy problem sub-categories and acceptance rates (n=187 subjects).

Category	Accepted (%)	Denied (%)
Risk to Patient		
Allergy	2 (100)	0 (0)
Medication error	2 (100)	0 (0)
Monitoring for toxicity	7 (70.0)	3 (30.0)
Actual ADE	8 (50.0)	8 (50.0)
Potential ADE	61 (44.9)	75 (55.1)
Medication Indication		
No/Unclear indication	6 (60.0)	4 (40.0)
Undertreated condition	24 (42.9)	32 (57.1)
Untreated condition	43 (41.7)	60 (58.3)
Alternative therapy	4 (16.0)	21 (84.0)
Efficacy		
Adherence or administration issue	7 (70.0)	3 (30.0)
Therapeutic monitoring for effectiveness	13 (31.0)	29 (69.0)
Minimal effectiveness	2 (28.6)	5 (71.4)
Pharmaceutical		
Inappropriate route	1 (100)	0 (0)
Therapeutic duplication	8 (80.0)	2 (20.0)
Inappropriate dose	24 (54.5)	20 (45.5)
Inappropriate schedule	1 (33.3)	2 (66.7)