HEALTH CARE REFORM

Impact of a Pharmacist-Facilitated Hospital Discharge Program

A Quasi-Experimental Study

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Background: Medication discrepancies are common at hospital discharge and can result in adverse events, hospital readmissions, and emergency department visits. Our objectives were to characterize medication discrepancies at hospital discharge and test the effects of a pharmacist intervention on health care utilization following discharge.

Methods: We used a prospective, alternating month quasi-experimental design to compare outcomes of patients receiving the intervention (n=358) with controls (n=366). All patients were discharged to home and were at high risk for medication-related problems following discharge because of the number or types of medications they were prescribed, multiple medication changes during hospitalization, or problems managing medications. The intervention consisted of medication therapy assessment, medication reconciliation, screening for adherence concerns, patient counseling and education, and postdischarge telephone follow-up. The primary outcomes were 14-day and 30-day readmission rates and emergency department visits within 72 hours of discharge. Medication discrepancies occurring at discharge were also characterized.

Results: Medication discrepancies at discharge were identified in 33.5% of intervention patients and 59.6% of control patients ($P<.001$). Although all discrepancies were resolved in the intervention group prior to discharge, readmission rates did not differ significantly between groups at 14 days (12.6% vs 11.5%; $P=.65$) and 30 days (22.1% vs 18%; $P=.17$), nor did emergency department visits (2.8% vs 2.2%, respectively; $P=.60$).

Conclusion: While our intervention improved the quality of patient discharge by identifying and reconciling medication discrepancies at discharge, there was no effect on postdischarge health care resource utilization.

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APPROXIMATELY 20% OF PATIENTS discharged from hospital to home experience postdischarge adverse events, nearly two-thirds of which are medication related.[1] Twenty-nine percent of these adverse drug events (ADEs) are serious or life threatening, sometimes resulting in emergency department (ED) visits and hospital admissions. It is estimated that 60% of postdischarge ADEs could be prevented or ameliorated, and studies suggest that redesigning the discharge process to incorporate activities such as medication reconciliation at each point of transition, discharge medication counseling, and postdischarge follow-up and monitoring can help reduce the incidence of these ADEs and their associated costs.[2-8]

See also pages 1945, 1988, and 1996

Pharmacists are well-suited to identify and resolve medication-related problems that occur as patients transition between health care settings, and using pharmacists to facilitate patient discharge by identifying and reconciling medication discrepancies may reduce adverse outcomes.[4,9-11] Studies of the impact of pharmacist interventions at discharge report reduced preventable ADEs after discharge, hospital readmissions, and return visits to the ED.[4-7] However, questions remain regarding the benefit of pharmacist involvement in the discharge process and how best to involve pharmacists in the process. This study was undertaken to characterize medication discrepancies that occur at discharge and to

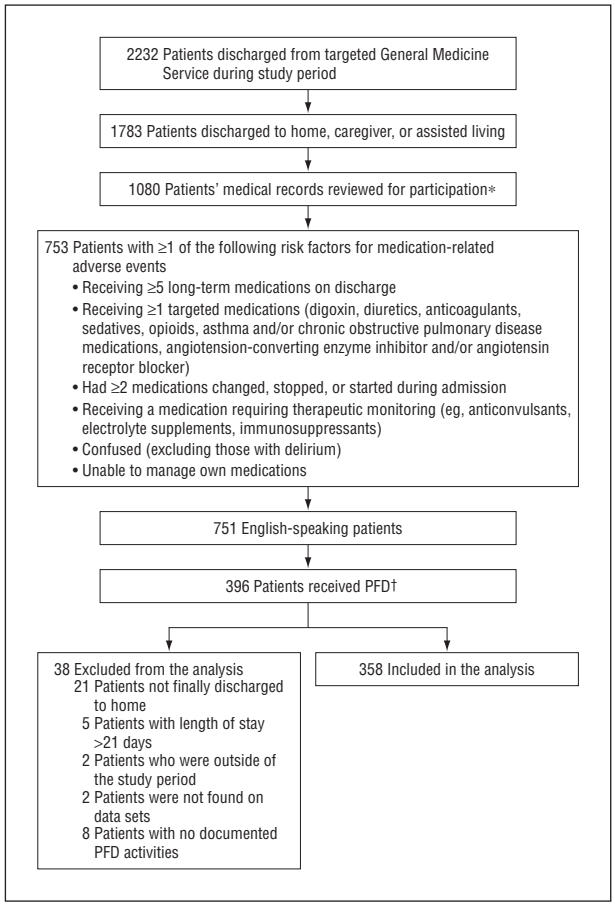

Figure 1. Patient selection. *703 Patients were not screened for eligibility owing to time constraints. †355 Patients did not receive the pharmacist-facilitated discharge (PFD) because they were discharged when the pharmacist was unavailable (eg, weekends or after 4 PM weekdays, or working with other patients), were unavailable when the pharmacist presented to perform the service, declined the service, or were transferred to a nontargeted service prior to discharge.

evaluate the impact of a pharmacist on health care utilization when added to a discharge process that includes a postdischarge call program for Medicare beneficiaries.

METHODS

SETTING

This study was conducted on the general medicine services at the University of Michigan Medical Center, Ann Arbor, a 550-bed tertiary care academic teaching hospital. The general medicine service consists of 6 traditional resident services, each composed of an attending physician, 1 resident, 2 to 3 interns, and several medical students, and 1 faculty hospitalist service composed of 6 teams, each managed by 1 attending physician with limited physician assistant support. The maximum census for the resident services and the faculty hospitalist teams are 16 patients and 12 patients, respectively. The average daily discharge volume is 3 to 5 patients per service or team. An interdisciplinary team consisting of the attending physician, a social worker, and a discharge coordinating nurse meet daily for discharge rounds to discuss clinical and social aspects of each patient's care in preparation for discharge.

STUDY PARTICIPANTS

Eligible subjects were adults (18 years or older) admitted to 2 of the resident services or the hospitalist service between July 1, 2006, and June 30, 2007, who were being discharged to home and who were at high risk for postdischarge medication-related adverse events based on the following literature-reported factors: receiving 5 or more long-term medications at discharge; receiving 1 or more targeted medications (digoxin, diuretics, anticoagulants, sedatives, opioids, asthma and/or chronic obstructive pulmonary disease medications, angiotensin-converting enzyme inhibitor and/or angiotensin receptor blocker); receiving other medications requiring therapeutic monitoring (eg, electrolyte supplements, anticonvulsants, immunosuppressants); having 2 or more medication therapies started, changed, or stopped during the admission; medical record documentation of dementia or confusion; or being unable to manage their own medications (**Figure 1**).[2,12-15] Only patients discharged between 8:00 AM and 4:30 PM Monday through Friday were included because of pharmacist availability. Non–English-speaking patients and patients with a length of stay of 21 days or longer were excluded. If a patient had more than 1 admission during the study period, only the first admission was evaluated. The study was approved by the institutional review board of the University of Michigan, Ann Arbor.

STUDY DESIGN

One pharmacist (J.N.T.J.) was assigned to the project for the entire study. This pharmacist participated in the discharge process for patients meeting inclusion criteria, covering the resident services one month and then the hospitalist service the next month in an alternating fashion throughout the study period. The pharmacist attended interdisciplinary discharge rounds; conducted patient interviews; assessed appropriateness and accuracy of discharge medications; performed medication reconciliation to identify and resolve discrepancies; ensured that a follow-up plan for medication monitoring after discharge was identified and communicated to the patient; provided medication counseling, including written medication information; verified patient comprehension with medication instructions; identified and addressed potential adherence concerns; communicated a reconciled medication list to the patient's follow-up health care provider; and provided postdischarge follow-up by telephone at 72 hours and 30 days to non-Medicare recipients to assist with medication-related problems and identify additional concerns. The pharmacist documented all interventions in the patient's electronic medical record or in Pharmdoc.net, an internal pharmacy workload documentation and patient monitoring database.[16]

Control subjects meeting inclusion criteria were randomly selected from patients discharged during the study period from a service opposite the one(s) to which the pharmacist was assigned for any given month (eg, when assigned to the hospitalist service, controls for the month were selected from the resident services). Control patients received usual care at discharge, when discharge instructions and medication information, including a printed list of medications with instructions, were provided by nursing staff. For Medicare beneficiaries (in both the intervention and control groups), usual care included a telephone call from a nurse-manned call center within 72 hours following discharge to identify, triage, and resolve postdischarge problems. This postdischarge call program was developed as part of our health system's participation in the Center for Medicare and Medicaid Services' (CMS) Physician Group Practice Demonstration Project.[17] Medicare patients were excluded from the call program if they were organ transplant recipients; had human immunodeficiency virus/AIDS; were un-

dergoing dialysis; resided in an extended-care facility or group home; or were discharged to a subacute facility, skilled nursing facility, rehabilitation facility, other acute care facility, or palliative care service or hospice.

MEASUREMENTS

The primary outcome was utilization of health care resources as defined by 14- and 30-day readmission rates and ED visits within 72 hours after discharge. Data, collected from patients' medical records and clinical and administrative databases, included demographic information, acuity scores (All Patient Refined–Diagnosis Related Group [APR-DRG] case-mix index),[18] discharge diagnoses, medications at discharge, length of hospital stay, 14- and 30-day hospital readmissions, and ED visits to the University of Michigan Medical Center within 72 hours of discharge. We used data from the CMS Physician Group Practice Demonstration Project to assess the impact of readmissions and ED visits to other hospitals and health centers for those patients with Medicare insurance assigned to the University of Michigan.

Medication discrepancies were defined as any unintended difference between medication use history or admission medication orders and medications prescribed at discharge and included (but were not limited to) omission of a medication; prescribing of a discontinued medication; unnecessary duplication of a therapeutic agent; substitution of an agent within the same pharmacologic class or from a different class; and changes in or missing dose, route, or frequency of administration. Medication discrepancy data for the intervention group were collected from the pharmacist's concurrent documentation; for the control group, medical record audits were conducted by physician investigators (J.P. and H.-W.K.) to quantify the number and type of medication discrepancies that occurred at discharge.

STATISTICAL ANALYSIS

Bivariate analyses (χ^2 analysis and Wilcoxon rank sum and *t* tests) were carried out to compare characteristics of the intervention and control groups. χ^2 Analyses and *t* tests were used to assess unadjusted bivariate comparisons between groups with respect to medication discrepancies and other clinical outcomes. Logistic regression was used to assess the relationship between independent variables and 14- and 30-day readmission, with α level set at .05, 2-tailed. Effect modification was assessed by entry of first-order interaction terms. Covariates were considered potential confounders (and remained in the model) if they resulted in a 10% or greater change in the β coefficient for the intervention. The following variables were included in the multivariable model: marital status, admitting source, length of stay, APR-DRG score, the presence of a medication discrepancy, the number of hospitalizations in the 12 months before the index admission, and the interaction term (intervention × postdischarge call). Postestimation diagnostics included the Hosmer and Lemeshow goodness of fit test and calculation of the area under the receiver operating characteristic curve. The study had an 80% power to detect a 10.0% difference in rates of medication discrepancies, a 5.8% difference in the rates of 14-day readmissions, and a 7.3% difference in the rate of 30-day readmissions. All analyses were conducted using Stata/SE 9.0 statistical software (StataCorp, College Station, Texas).

RESULTS

STUDY COHORT

During the study period, 5017 patients were discharged from the 3 general medicine services included in this study. Of these, 2232 were managed by the hospitalist or resident service during the months the pharmacist was on-service (Figure 1). Eighty percent of these patients (n=1783) were discharged to home, caregiver, or assisted living. We reviewed the records of 1080 of these patients and identified 751 as potentially eligible for the study. Although 396 of these patients received the pharmacist-facilitated discharge (PFD), only 358 are included in the analyses. Thirty-eight patients were excluded because they were ultimately discharged to an ineligible facility (eg, a nursing home or another hospital), stayed longer than 21 days, were enrolled outside the study period, were not present in all data sets, or had no documented PFD activities. The control group (n=366) was randomly selected from the 3 general medical services included in the study when the pharmacist was not on-service, resulting in a total of 724 subjects for the study.

The intervention and control groups were similar for most demographic and clinical characteristics (**Table 1**). Ages ranged from 19 to 97 years, with cases and controls having similar mean ages of 57.8 years and 57.4 years, respectively. Intervention patients were more likely to be married than those in the control group (57.3% vs 49.7%, respectively; $P=.04$) and also had a greater severity of illness (median APR-DRG score, 0.91 vs 0.86, respectively; $P=.02$). Almost half of the intervention patients received postdischarge telephone calls, while less than one-third of control patients received such a call ($P<.001$). As given in **Table 2**, the majority of first postdischarge telephone calls were made within 72 hours of discharge among both intervention patients (133 vs 22; $P<.001$) and control patients (87 vs 21; $P<.001$).

MEDICATION DISCREPANCIES

Medication discrepancies were common in both groups with omitted medications occurring in one-fifth of the patients (**Table 3**). Patients in the intervention group were less likely to have a "discrepant or missing dose or frequency" compared with those in the control group (13.4% vs 38.8%, respectively; $P<.001$). Intervention patients were also noted to have a higher rate of discontinued medication prescribed at discharge ($P<.001$) but a lower rate of having a "discrepant dosage form or medication from another class prescribed" ($P=.002$) than those in the control group. Overall, patients in the intervention group were less likely than those in the control group to have 1 or more medication discrepancies noted prior to discharge (33.5% vs 59.6%, respectively; $P<.001$).

CLINICAL OUTCOMES

While approximately 12% of patients were readmitted to the University of Michigan hospital within 14 days of discharge and 20% within 30 days of discharge, there were no significant differences between the control and intervention groups in unadjusted analyses (**Table 4**). Similarly, there were no differences between the 2 groups in the proportion of patients who returned to the ED within 72 hours, 14 days, and 30 days of discharge. To assess the extent of admissions and ED visits to other health facilities, we analyzed data for the 248 Medicare recipi-

Table 1. Patient Characteristics by Intervention or Control Group

Characteristic	Patients, No. (%)		*P* Value
	Intervention (n = 358)	Control (n = 366)	
Age, mean (range), y	57.8 (19-95)	57.4 (19-97)	.70
Male	165 (46.1)	176 (48.1)	.59
Race			
White	283 (79.0)	305 (83.3)	
Black	59 (16.5)	54 (14.8)	.11
Other/unknown	16 (4.5)	7 (1.9)	
Married	205 (57.3)	182 (49.7)	.04
Admitting source			
Emergency department or clinic	325 (93.9)	347 (94.8)	.61
Hospital transfer	21 (6.1)	19 (5.2)	
Insurance			
Public	202 (57.4)	218 (60.1)	.47
Private	150 (42.6)	145 (39.9)	
Length of stay, median (range), d	4.0 (1-19)	3.0 (1-18)	.06
Length of stay group, d			
1-6	279 (77.9)	300 (82.0)	
7-13	64 (17.9)	58 (15.8)	.21
14-20	15 (4.2)	8 (2.2)	
Principal diagnosis			
Infection	51 (14.2)	43 (11.7)	
Gastrointestinal	48 (13.4)	59 (16.1)	
Pulmonary	43 (12.0)	46 (12.6)	
Endocrine/diabetes/electrolytes/fluid	40 (11.2)	42 (11.5)	
Cardiovascular	39 (10.9)	46 (12.6)	.38
Renal/urological	36 (10.1)	42 (11.5)	
Neurological/psychological	18 (5.0)	11 (3.0)	
Dermatologic	15 (4.2)	6 (1.6)	
Other[a]	68 (19.0)	71 (19.4)	
APR-DRG, median (range)	0.91 (0.40-7.41)	0.86 (0.29-4.89)	.02
No. of previous hospitalizations in the previous 12 mo			
1	74 (20.7)	85 (23.2)	
2	40 (11.2)	42 (11.5)	
3	28 (7.8)	29 (7.9)	.09
≥4	57 (15.9)	33 (9.0)	
Unknown	159 (44.4)	177 (48.4)	
Type of postdischarge telephone call			
Pharmacist call	82 (22.9)	0	
Medicare call	73 (20.4)	108 (29.5)	<.001
No call	203 (56.7)	258 (70.5)	

Abbreviation: APR-DRG, All Patient Refined–Diagnosis Related Group.[14]
[a] "Other" includes cancer, deep venous thrombosis or pulmonary embolus, hematologic, rheumatologic, and injuries.

Table 2. Type of First Postdischarge Follow-up Telephone Call by Time[a]

Call Type	Within 72 h		Greater Than 72 h	
	Intervention (n = 358)	Control (n = 366)	Intervention (n = 358)	Control (n = 366)
Pharmacist call	78 (21.8)		4 (1.2)	
Medicare call only	55 (15.4)	87 (23.8)	18 (5.0)	21 (5.7)

[a]Data are given as number (percentage) of patients.

ents included in the CMS Physician Group Practice Demonstration project. Fewer than 10% of readmissions and ED visits occurred at other hospitals (data not shown).

Figure 2 displays the effect by study group of receipt of a postdischarge call on 14-day unadjusted readmission rates. Among those who received a call, intervention patients had lower rates of 14-day readmission (12.3%) compared with controls (21.3%). However, among those who did not receive a call, intervention patients had higher rates of 14-day readmission (12.8%) compared with controls (7.4%). Due to this interaction, multivariable analyses incorporating receipt of a postdischarge call were required to determine the impact of the intervention on readmission rates.

Table 3. Medication Discrepancies by Intervention or Control Group

Discrepancy Type	Patients, No. (%)		*P* Value
	Intervention (n = 358)	Control (n = 366)	
Omitted medication	69 (19.3)	80 (21.9)	.39
Discrepant or missing dose or frequency	48 (13.4)	142 (38.8)	<.001
Different medication within class prescribed	23 (6.4)	23 (6.3)	.94
Discontinued medication prescribed at discharge	35 (9.8)	6 (1.6)	<.001
Unnecessary duplication	21 (5.9)	22 (6.0)	.93
Discrepant dosage form or medication from another class prescribed	4 (1.1)	19 (5.2)	.002
Any discrepancy	120 (33.5)	218 (59.6)	<.001
Discrepancies per patient for all patients, mean, No.	0.86	1.28	<.001

Table 4. Readmission to the Hospital and Return to the Emergency Department (ED) by Intervention and Control Groups

	Patients, No. (%)		*P* Value
	Intervention (n = 358)	Control (n = 366)	
Readmission within 14 d of discharge	45 (12.6)	42 (11.5)	.65
Readmission within 30 d of discharge	79 (22.1)	66 (18.0)	.17
Return to ED within 72 h of discharge	10 (2.8)	8 (2.2)	.60
Return to ED within 14 d of discharge	22 (6.2)	27 (7.4)	.51
Return to ED within 30 d of discharge	34 (9.5)	45 (12.3)	.23
Return to the hospital within 30 d of discharge[a]	98 (27.4)	94 (25.7)	.61

[a]Composite end point comprised all readmissions and ED visits.

In the multivariable model, the relationship between study group and a 14-day readmission differs depending on the receipt of a postdischarge telephone call (**Table 5**). Among the subjects who received a postdischarge telephone call, intervention patients had an adjusted odds ratio of 0.46 of being readmitted to the hospital within 14 days compared with controls (*P*=.03). There was no difference in the rates of readmission for subjects who did not receive a postdischarge telephone call. The relative odds of readmission within 14 days increased by approximately 8% for each day a patient was in the hospital (ie, length of stay). We performed a regression analysis with age, sex, and race included in the model and found no significant differences in the outcome; thus, these variables were not included in the final model (data not shown). In a multivariable model we tested whether the study group and the type of postdischarge call (ie, made by the study pharmacist or the University of Michigan Health System's postdischarge Medicare call program) had an effect on readmission rates. We found no significant differences between call type (data not shown).

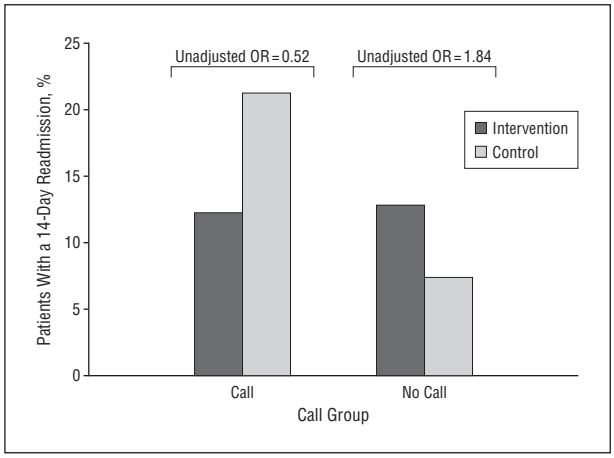

Figure 2. Frequency of a 14-day readmission by receipt of a postdischarge call. OR indicates odds ratio.

COMMENT

Medication discrepancies at discharge were common, occurring in 33.5% and 59.6% of the patients in the intervention and control groups, respectively. In approximately 20% of cases, irrespective of group, a needed medication was not prescribed at discharge. While there was no significant impact of our intervention on health care utilization as measured by 14-day and 30-day readmissions and ED visits within 72 hours following discharge, we found that telephone calls following discharge, regardless of the call type, reduced the risk for readmission within 14 days among patients who received the discharge intervention.

Our findings are consistent with other reports describing medication discrepancies in 41.3% to 53.6% of patients at discharge.[10-12,19] Although a variety of factors contribute to the occurrence of a medication discrepancy, prescribers often fail to routinely compare a patient's inpatient medication list with his or her preadmission list at the time of prescribing and may not communicate medication information effectively at the time of prescribing.

Table 5. Multivariable Analysis of Readmission Within 14 and 30 Days of Discharge

	Readmission Within 14 Days of Discharge		Readmission Within 30 Days of Discharge	
	Adjusted OR (95% CI)	*P* Value	Adjusted OR (95% CI)	*P* Value
Intervention[a]				
With a postdischarge call	0.46 (0.22-0.92)	.03	0.67 (0.37-1.20)	.18
Without a postdischarge call	1.62 (0.83-3.14)	.16	1.52 (0.90-2.56)	.12
Married[b]	0.75 (0.47-1.21)	.24	0.83 (0.56-1.21)	.33
Admitting source[c]	0.36 (0.08-1.56)	.17	0.73 (0.29-1.82)	.50
Length of stay	1.08 (1.01-1.15)	.02	1.06 (1.00-1.12)	.06
APR-DRG	1.13 (0.87-1.48)	.35	1.07 (0.85-1.35)	.57
Presence of a medication discrepancy[d]	0.84 (0.51-1.38)	.49	0.82 (0.55-1.22)	.33
Previous number of hospitalizations[e]				
1	1.48 (0.80-2.72)	.21	1.48 (0.90-2.44)	.12
2	1.67 (0.80-3.50)	.18	2.25 (1.25-4.03)	.01
3	1.09 (0.42-2.82)	.87	1.35 (0.64-2.85)	.42
≥4	2.23 (1.13-4.40)	.02	2.44 (1.38-4.32)	.002

Abbreviations: APR-DRG, All Patient Refined–Diagnosis Related Group; CI, confidence interval; OR, odds ratio.

[a] The interaction term between the intervention and receipt of a postdischarge call was significant for 14-day readmission ($P = .01$), which indicates that the OR for the intervention with a postdischarge call (0.46) was significantly different from the OR for the intervention without a call (1.62). Similarly, the interaction term was significant for 30-day readmission ($P = .04$).

[b] Married (reference, not married).

[c] Admitting source (reference, emergency department or clinic).

[d] Presence of a medication discrepancy (reference, no discrepancy).

[e] Previous number of hospitalizations (reference, unknown).

We found significantly more discrepancies in the control group. This may, in part, be explained by our method in which discrepancies in this group were identified retrospectively by physician investigators. Despite attempts to minimize variability in the assessments between the groups by having the pharmacist train the physicians to use a similar method to identify and classify discrepancies, some differences in classification of discrepancies may have occurred. Nevertheless, discrepancies at hospital discharge were very common in our cohort.

While most unintended discrepancies do not pose risk for serious harm, some may have significant clinical consequences that prompt rehospitalization or ED visits in the first few weeks following discharge. Coleman et al[12] found that 14.3% of patients with medication discrepancies were rehospitalized at 30 days compared with only 6% of patients who did not have medication discrepancies ($P = .04$). Thus, utilization of health care resources might be reduced if discrepancies are resolved prior to or shortly after discharge. Our pharmacist effectively identified and reconciled all the discrepancies prior to discharge; however, no effort was made to address discrepancies in the control group prior to discharge. Because we did not assess whether ADEs occurred following discharge, it is not known if patients experienced any morbidity from discrepancy-associated ADEs. Since we did not look for reduction in ADEs after discharge, there may be benefits that we did not find; however, there was not reduction in use of hospital resources.

Results of studies evaluating the impact of pharmacist interventions at discharge on health care utilization have been mixed. Consistent with our results, some studies have not found any significant effect on readmissions or ED visits.[20,21] Others have found that a PFD process decreases the number of preventable adverse medication events after discharge, as well as ED visits and hospital readmissions related to preventable medication-related events.[4,6] Program components (eg, medication reconciliation, discharge counseling) and time frame for readmission varied between studies, which may account for differences in results.

Telephone follow-up can be used to provide early identification and management of symptoms, complications, and medication-related problems after discharge. However, the real benefit of telephone follow-up, particularly of pharmacist-initiated calls, is not well defined. Some trials suggest that telephone calls from a pharmacist 2 to 4 days following discharge help to significantly reduce hospital utilization.[6,22,23] A recent review of 33 studies exploring the effect of follow-up telephone calls from hospital-based health care professionals (primarily nurses) to recently discharged patients failed to identify a significant benefit across a variety of primary and secondary outcomes, including the physical and psychosocial health of the patients, patient adherence, patient knowledge, adverse events, and health care resource utilization.[24] Other data suggest that telephone call follow-up may actually increase utilization of health care resources, perhaps because they lead to early identification of clinical findings that warrant follow-up, which might otherwise go undetected.[25] Our study was not designed to isolate the impact of telephone calls, thus the meaning of our findings with specific regard to calls is unclear. We could not reach all study participants after discharge. Only 43.3% and 29.5% of calls were completed in the intervention and control groups, respectively; we did not evaluate whether differences existed between those patients we were able to contact and those we could not. Furthermore, calls to control subjects as

part of the CMS Physician Group Practice Demonstration Project were limited geographically to patients living in 8 local counties, and it is unclear how many controls may have been outside of the call radius of the call center. Pharmacist-initiated calls to the intervention group were not limited by where patients lived.

Our inability to demonstrate a significant effect of the PFD program on health care utilization may be due to limitations of our study. While we could not identify readmissions or ED visits that may have occurred outside of our health system for all the study patients, we know that for the one-third of patients for whom we had complete data from Medicare, fewer than 10% of readmissions or ED visits occurred at other facilities. Furthermore, patients in the intervention group tended to have a higher severity of illness (by APR-DRG), and although it did not reach statistical significance, the median length of stay was 1 day longer in the intervention group. These patients may have been more likely to be readmitted owing to reasons for which we were unable to control. We did not assess whether the causes for ED visits or readmissions were different between the 2 study groups. No one was blinded to the pharmacist intervention, which could have biased physicians to do a better job with prescribing at discharge when the pharmacist was on service. Finally, it is unclear what bias may have been introduced by the inability of the pharmacist to see all eligible patients because of logistical problems (eg, time constraints, weekend or after-hours discharges); complex and challenging cases likely to benefit from the intervention may have been missed.

We believe that these limitations are offset by the strengths of our study, which include an alternate-month design allowing for the use of concurrent controls, rigorous inclusion criteria, adequate power to detect meaningful differences in resource utilization, and comprehensive patient follow-up.

Our results have important implications for health care systems struggling to implement strategies to address mandates regarding medication issues at hospital discharge. In spite of dedicating 1 full-time pharmacist to this effort, we were unable to have an impact on large numbers of patients. Facilitating discharge was very time consuming, and although we did not measure the time required, a recent report estimates that it takes 87.5 minutes per patient to reconcile medications and perform other discharge-related activities.[19] Our pharmacist was able to screen only 60% of patients discharged to home for participation and could facilitate discharge in only 52.7% of the eligible patients. Thus, despite the mandate to reconcile medications at discharge, the effects of using a pharmacist may be much smaller than anticipated in real-world settings. It may be that we could not isolate the true effect of our PFD program due to multiple concurrent institutional interventions (such as the CMS demonstration project); however, our work reflects the "real-life" context in which quality improvement research is often conducted. As recently noted by Davidoff et al,[26(p672)] "trying to control context out of improvement interventions is both inappropriate and counterproductive because improvement interventions are inherently and strongly context-dependent."

In conclusion, the intervention improved the quality of patient discharge by identifying and reconciling medication discrepancies at discharge, but the lack of effect on health care resource utilization suggests that this may not be a cost-effective use of the pharmacist. Additional studies are needed to test strategies designed to mitigate the impact of postdischarge adverse drug events and determine which elements of the discharge process are best targeted to improve clinical outcomes and reduce resource utilization. These might include a trial comparing a PFD process with a postdischarge call program or evaluation of other models, such as using ambulatory care pharmacists to provide transitional care shortly after discharge.

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