Redefining and Redesigning Hospital Discharge to Enhance Patient Care: A Randomized Controlled Study

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BACKGROUND: Patients are routinely ill-prepared for the transition from hospital to home. Inadequate communication between Hospitalists and primary care providers can further compromise post-discharge care. Redesigning the discharge process may improve the continuity and the quality of patient care.

OBJECTIVES: To evaluate a low-cost intervention designed to promptly reconnect patients to their “medical home” after hospital discharge.

DESIGN: Randomized controlled study. Intervention patients received a “user-friendly” Patient Discharge Form, and upon arrival at home, a telephone outreach from a nurse at their primary care site.

PARTICIPANTS: A culturally and linguistically diverse group of patients admitted to a small community teaching hospital.

MEASUREMENTS: Four undesirable outcomes were measured after hospital discharge: (1) no outpatient follow-up within 21 days; (2) readmission within 31 days; (3) emergency department visit within 31 days; and (4) failure by the primary care provider to complete an outpatient workup recommended by the hospital doctors. Outcomes of the intervention group were compared to concurrent and historical controls.

RESULTS: Only 25.5% of intervention patients had 1 or more undesirable outcomes compared to 55.1% of the concurrent and 55.0% of the historical controls. Notably, only 14.9% of the intervention patients failed to follow-up within 21 days compared to 40.8% of the concurrent and 35.0% of the historical controls. Only 11.5% of recommended outpatient workups in the intervention group were incomplete versus 31.3% in the concurrent and 31.0% in the historical controls.

CONCLUSIONS: A low-cost discharge-transfer intervention may improve the rates of outpatient follow-up and of completed workups after hospital discharge.

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Poor care coordination at the time of hospital discharge can jeopardize patient safety and result in substandard medical care.^{1–5} Patients and their caretakers are routinely ill-prepared for the transition from hospital to home.^{6,7} With shorter hospitalizations and high patient loads for both physicians and nurses, discharge planning is often hurried and incomplete. A large national survey of hospital care revealed that only 50% of patients with congestive heart failure received written instructions at the time of discharge.⁸ Other studies have demonstrated that most patients do not know their discharge diagnosis,⁹ misunderstand the use of new medications,^{2,10} and receive insufficient post-discharge care.^{3,4,11}

As physicians increasingly specialize in either inpatient or outpatient medicine, collaboration between Hospitalists and primary care providers (PCPs) is imperative to ensure high-quality post-discharge care. Yet communication between Hospitalists and PCPs is frequently lacking. For more than two-thirds of patients, their PCP will not have received a written discharge summary by the time of the first post-discharge visit; for fully one-quarter of patients, their PCP will never receive one.^{6,12,13} Discharge reports are of uneven quality and often fail to provide important information such as updated medication lists, diagnostic test outcomes, and pending test results.^{14,15} And despite the acknowledged benefits of care continuity,^{8,16,17} a follow-up appointment may not be scheduled for weeks after discharge, well after problems are likely to arise.

When patients and their PCPs are not well integrated into the discharge process, patients may be at risk. Necessary home services may not be delivered,¹⁸ and medication errors, incomplete outpatient workups, and readmissions occur with concerning frequency.^{4,5,12,19,20} Studies exploring the use of transition coaches, advanced practice nurses, and pharmacists demonstrated improved outcomes after hospital discharge.^{2,21–23} The present study evaluates a discharge-transfer intervention designed to improve communication between inpatient and outpatient care teams and to promptly reconnect discharged patients with their “medical home.”²⁴ We

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structured our intervention to meet the needs of a culturally and linguistically diverse patient population and studied the effects on continuity and quality of care in the post-discharge period.

METHODS

Study Setting and Participants

The study was conducted at Somerville Hospital, a 100-bed community teaching hospital affiliated with Harvard Medical School. Somerville Hospital is 1 of 3 hospitals within the Cambridge Health Alliance (CHA), a safety net system which serves a diverse community. About 25% of hospitalized patients are non-English speakers, primarily Portuguese and Spanish. In-house interpreter services are readily available for Portuguese, Spanish, and Haitian-Creole speakers. Other languages are supported through the AT&T language line. All patients in the study received care from a Hospitalist-led medical team with approximately one-half of the patients admitted to the teaching and the nonteaching services, respectively. The study was approved by the Institutional Review Board at the Cambridge Health Alliance.

Patients were enrolled consecutively upon admission to the medical-surgical floor between June 2006 and January 2007. Eligible patients had their "medical home" at 1 of 2 primary care sites within the CHA system. Both sites utilized an electronic medical record (EMR) linked to the hospital. Admissions from these 2 sites accounted for approximately 20% of all admissions to Somerville Hospital.

Patients were identified as having a medical home if they had an established relationship with their PCP (either a physician or nurse practitioner). An established relationship was defined as having had, within the prior year, 2 or more visits with their PCP or one visit with their PCP and at least 2 RN contacts (one of which was within the previous 6 months.) The 2 primary care sites also met the other key criteria of medical home in terms of provider accessibility and site organization.²⁴

Exclusion criteria included hospital readmission of a previously enrolled patient (a patient could be enrolled only once in the study), elective admission, residence in a long-term care facility, discharge to another institution, or death during hospitalization. Thus, only patients discharged to home were included in the analysis.

Historical controls were identified by a chart review of patients admitted before June 1, 2006. A list of eligible patients was created, using the same inclusion and exclusion criteria as above, by working backward in time until the desired number of 100 patients was achieved.

Patients in both the concurrent and historical control groups were discharged according to existing hospital practices and protocol, which consisted of receiving discharge instructions handwritten in English. Communication between the discharging physician and the primary care provider was done on an as-needed basis, whereas there was no communication between inpatient and outpatient RNs.

The Discharge-Transfer Intervention

The discharge-transfer intervention sought to better equip patients to participate in their post-discharge care, to encourage explicit communication among all involved parties, and to

improve accountability for patient care. The four-step intervention did not require the addition of any new personnel and consisted of the following: (1) a comprehensive, user-friendly Patient Discharge Form provided to patients, in one of 3 languages; (2) the electronic transfer of the Patient Discharge Form to the RNs at the patient's primary care site; (3) telephone contact by a primary care RN to the patient; and (4) PCP review and modification of the discharge-transfer plan. Additional details are provided below.

The Patient Discharge Form was prepared by a discharge planning nurse with input from the discharging physician. The form was computer generated either in English, Portuguese, or Spanish. The floor nurse reviewed the information on the Patient Discharge Form with the patient, using an interpreter as needed. The patient was reminded, in writing, to bring the form to the first post-discharge appointment.

The information included in the Patient Discharge Form sought to address communication problems that occur frequently during care transitions, including patients' inability to state their discharge diagnosis or recall revisions to their medication list;⁹ and PCPs' failure to act on abnormal test results or to complete recommended outpatient workups.^{14,20} Thus, the Patient Discharge Form included the following:

1. Patient demographics
2. Discharge diagnosis
3. Names of hospital physicians (including residents, Hospitalists, and specialists)
4. Vaccinations given
5. New allergies
6. Dietary and activity instructions
7. Home services ordered
8. Scheduled appointments with PCP, specialists, and for diagnostic studies
9. Pending medical test results
10. Recommended outpatient workup(s)
11. Discharge medications list, which consisted of the following:
 - (a) Continued medications (with dose changes highlighted)
 - (b) New medications
 - (c) Discontinued medications
12. Optional nursing comments
13. Reminder to patients to bring the form to their next PCP appointment

The Patient Discharge Form was sent electronically to the RNs at the patient's primary care site and became part of the permanent medical record. Receipt of the form signaled to the primary care RNs that the patient had been discharged from the hospital and that a nurse should telephone the patient by the next business day.

Utilizing a script (available from RB on request), the primary care RN conducted a brief telephone outreach with the patient. The patient's medical status was assessed, the Patient Discharge Form was reviewed, patient questions and concerns were elicited, and scheduled follow-up appointments were confirmed. The nurse arranged immediate interventions as needed, including urgent appointments, medication refills or changes. The Patient Discharge Form and the nurse's telephone notes were then forwarded electronically to the PCP who reviewed the discharge-transfer plan and modified as necessary.

The overarching design of our intervention is based upon the structure-process-outcome framework for quality of care

established by Donabedian.²⁵ The creation of a discharge form and its electronic transfer represent new structures, whereas the nursing outreach and PCP review represent new processes added to the care plan. The third component, outcomes, is addressed in the section below.

Data Collection and Outcome Measures

All patient demographic and outcome data was abstracted from the EMR and hospital progress notes by one author (RB); outcome data was verified by a second author (PS). Data was collected on 4 undesirable outcomes:

1. No outpatient appointment within 21 days with either an MD or NP at the patient's primary care site or with a relevant specialist (related to the hospitalization).
2. Readmission, for any reason, within 31 days to any of the 3 CHA hospitals.
3. Emergency department visits within 31 days for a problem related to the original admission in any of the 3 CHA hospitals. For example, a patient with a discharge diagnosis of CHF, a related problem might be chest pain, whereas an unrelated problem might be knee strain.
4. Failure to complete an outpatient workup recommended by a hospital doctor. For the intervention group, recommended outpatient workups were abstracted from the Patient Discharge Form and the discharge summary. For the control groups, this data was abstracted from the discharge summary and the final hospital progress note. All outpatient results and office notes were available through the EMR. If the PCP documented that the workup was unnecessary, the workup was considered "complete" in our analysis.

Statistical Analysis

Differences in the proportion of patients who experienced undesirable outcomes were compared between the intervention and the historical controls and between the intervention group and the concurrent controls using chi-squared tests. *T* tests were used to analyze continuous variables. A summary variable was

created by counting one or more of the undesirable outcomes, and analyses proceeded as above. An exploratory analysis was performed on subgroups defined by day of discharge (weekend versus weekday), language, length of stay, and age.

RESULTS

During the study period, there were 140 admissions of eligible patients. From the 140, we excluded 9 readmissions of previously enrolled patients, 4 elective admissions, and 5 admissions of patients residing in nursing homes. The remaining 122 patients were randomized to the intervention and control groups. We subsequently excluded 24 patients who were discharged to another institution (i.e., not discharged home) and 2 who died in the hospital, leaving 96 patients for study; 47 in the intervention group and 49 as concurrent controls. Outcomes were also compared to historical controls.

Baseline patient characteristics are shown in Table 1. The 3 groups were similar with respect to sex, age, length of hospital stay, insurance status, and chronic medical conditions. Despite randomization, there were more non-English speakers and more weekend discharges in the intervention group.

Table 2 compares the outcomes among the 3 groups. The intervention group had a significantly lower summary outcome rate than the 2 control groups; 25.5% of the patients in the intervention group had 1 or more undesirable outcomes compared to 55.1% of the concurrent controls and 55.0% of the historical controls.

The intervention group's improved outcome rate was attributable primarily to a higher outpatient follow-up rate within 21 days. In the intervention group, only 14.9% of the patients failed to follow-up within 21 days compared to 40.8% of the concurrent and 35.0% of the historical controls.

Members of the intervention group were also more likely to complete outpatient workups recommended by the Hospitalist. Only 11.5% of recommended workups in the intervention group were incomplete versus 31.3% of the concurrent controls and 31.0% of the historical controls.

Of note, as a result of the telephone outreach by the primary care RN, 4 patients were scheduled for urgent appointments

Table 1. Patient Characteristics

	Historical control (n=100)	Concurrent control (n=49)	Intervention (n=47)	P value: Intervention versus historical control	P value: Intervention versus concurrent control
Demographics					
Female, n (%)	60 (60.0)	30 (61.2)	27 (57.4)	.77	.70
Average age (years)	61.1	54.1	58.0	.72	.70
Non-English speaking, n (%)	31 (31.0)	9 (18.4)	19 (40.4)	.26	.18
Average length of stay (days)	3.1	3.1	3.3	.95	.96
Weekend discharges, n (%)	20 (20.0)	7 (14.3)	13 (27.7)	.30	.11
Insurance status					
Free Care/Medicaid, n (%)	47 (47.0)	30 (61.2)	26 (55.3)	.35	.56
Medicare, n (%)	42 (42.0)	12 (24.5)	15 (31.9)	.24	.42
Private insurance, n (%)	11 (11.0)	7 (14.3)	6 (12.8)	.75	.83
Chronic conditions					
Diabetes, n (%)	37 (37.0)	18 (36.7)	12 (25.5)	.17	.24
CHF, n (%)	17 (17.0)	5 (10.2)	5 (10.6)	.31	.95
CAD, n (%)	13 (13.0)	9 (18.4)	8 (17.0)	.52	.86
COPD, n (%)	12 (12.0)	6 (12.2)	6 (12.8)	.89	.93
Depression, n (%)	30 (30.0)	19 (38.8)	23 (48.9)	.30	.32

Table 2. Undesirable Outcomes in Intervention and Control Groups

	Historical control (n=100)	Concurrent control (n=49)	Intervention (n=47)	P value: Intervention versus historical control	P value: Intervention versus concurrent control
4 Types of undesirable outcomes					
No follow-up within 21 days, n (%)	35 (35.0)	20 (40.8)	7 (14.9)	.01	.005
Readmission within 31 days, n (%)	14 (14.0)	4 (8.2)	4 (8.5)	.34	.96
ED visit within 31 days, n (%)	8 (8.0)	1 (2.0)	1 (2.1)	.16	.97
Incomplete outpatient workup, x/y (%)	13/42 (31.0)	5/16 (31.3)	3/26 (11.5)	.07	.11
Patients with one or more of the above outcomes, n (%)	55 (55.0)	27 (55.1)	12 (25.5)	.0008	.003

Recommended outpatient workups were for either laboratory work, diagnostic studies, or subspecialists.

x: patients with incomplete outpatient workups

y: patients for whom outpatient workups were recommended by hospital physician

with their PCP and 3 patients had new prescriptions called into their pharmacy. Thus, at least 7 of the 47 intervention patients (14.9%) had their care altered by the RN telephone outreach.

Table 3 provides results among several subgroups: non-English versus English speakers, weekend versus weekday discharges, shorter versus longer stay patients, and younger versus older patients. It should be considered exploratory because of the small number of subjects and reduced statistical power. Notably, non-English speakers had a significantly lower outcome rate in the intervention group (21.1%) compared to both the concurrent (55.6%) and historical (51.6%) controls. The intervention was especially effective among weekend discharges, demonstrating a significantly lower outcome rate in the intervention group (8.3%) compared to both the concurrent (85.7%) and historical (60.0%) controls. Finally, the intervention appeared to have had a greater effect on patients with the shortest hospital stays of 1–2 days and patients 60 years and older.

DISCUSSION

Our discharge–transfer intervention proposes a new paradigm; that the systematic transfer of patient care to the PCP becomes an integral part of the discharge process. The goal is to provide seamless medical care during the transition from hospital to

home and to formalize communication to ensure that all parties are well-informed about the post-discharge plan.

As the results show, among a culturally and linguistically diverse population, the intervention significantly increased the rates of timely outpatient follow-up and the completion rates of recommended outpatient workups. Subgroup analysis suggested that the intervention may be effective with non-English speakers, weekend discharges, shorter stay and older patients.

What may have contributed to the success of our discharge–transfer intervention? First, the intervention formalized the roles of the transferring and accepting parties. The hospital-based care team had a standardized means of communicating information to patients and their PCPs. Upon receipt of this information, the PCP and a primary care RN explicitly assumed patient care responsibility.

Second, the discharge–transfer intervention utilized medical personnel who often knew the patient well; the clinical nurses at the primary care site. Their outreach may have been particularly effective with patients who could benefit from such individualized care. Given that 15% of their calls resulted in a modification of the medical plan, this outreach might represent a real way to reduce medical errors and improve quality in the post-discharge period.

Third, the Patient Discharge Form provided written discharge information for the patient. This minimized the need to

Table 3. Outcome Rate of Subgroups (Any of 4 Undesirable Outcomes)

	Historical Control		Concurrent Control		Intervention		P value: Intervention versus historical control	P value: Intervention versus concurrent control
	n	Any undesirable outcome (%)	n	Any undesirable outcome (%)	n	Any undesirable outcome (%)		
Language								
Non-English speaking	31	16 (51.6)	9	5 (55.6)	19	4 (21.1)	.03	.07
English speaking	69	39 (56.5)	40	22 (55.0)	28	8 (28.6)	.01	.03
Discharge day								
Weekend discharge	20	12 (60.0)	7	6 (85.7)	12	1 (8.3)	.004	.0007
Weekday discharge	80	43 (53.8)	42	21 (50.0)	35	11 (31.4)	.03	.10
Length of stay								
1–2 days	61	34 (55.7)	28	14 (50.0)	23	3 (13.0)	.0004	.005
3–4 days	20	9 (45.0)	10	6 (60.0)	14	5 (35.7)	.59	.24
>4 days	19	12 (63.2)	11	7 (63.6)	10	4 (40.0)	.23	.28
Age								
<60 years	45	26 (57.7)	34	18 (52.9)	27	9 (33.3)	.04	.13
>60 years	55	29 (52.7)	15	9 (60.0)	20	3 (15.0)	.004	.006

remember verbal instructions, which are often rapidly forgotten.²⁶ These informed patients may have been empowered to participate more actively in their outpatient care.

Fourth, the intervention incorporated a level of redundancy, a key element of good system design,²⁶ which helped to ensure implementation of the discharge plan. Examples of redundancy included: the patient reviewed the Patient Discharge Form twice, once with the floor nurse and once with the primary care RN; the Patient Discharge Form was transferred to the primary care site by two means—electronically and hand-carried by the patient; and both the primary care RN and the PCP reviewed the discharge plan to ensure that patients' needs were being met.

Fifth, the intervention deepened the role of both the inpatient and primary care RNs. With increasing demands on physician time, it becomes essential to meaningfully involve RNs in patient care. Via the Patient Discharge Form, the inpatient RNs communicated to the primary care team concerns regarding home safety, patterns of medication compliance, and subtle memory problems. Such vital information may have helped the primary care team to work with patients to identify and address post-discharge problems.

Finally, the costs associated with the discharge-transfer intervention were low. Unlike other interventions reported in the literature,^{2,21–23} no additional personnel were required and the roles of existing personnel were only incrementally expanded. The inpatient RN expended approximately 15 minutes per patient to create the Patient Discharge Form. In the future, much of this work could be automated. Medication reconciliation was performed by the discharging physician, and while time consuming, is becoming a standard discharge task. Finally, the primary care RNs made a targeted patient outreach, typically lasting 5–10 minutes. Thus, a simple restructuring of discharge responsibilities served to improve communication and care continuity.

There were a number of limitations to this study that could affect its generalizability. First, an underlying clinical assumption is that timely outpatient follow-up after every hospitalization is desirable. There are, however, no published guidelines as to when or whether a patient should have outpatient follow-up after hospitalization. We selected a 21-day follow-up to accommodate both the seriously ill patients who need rapid follow-up and those patients who can reasonably wait longer. Beyond 21 days, we believe the immediacy and relevancy of the hospitalization diminish. Future studies may wish to examine other time periods.

Second, the study was conducted within a single safety net hospital system. As all patients had their PCP within this system and most lacked private insurance, it was likely that patients received the majority of their care within this system. Whereas it is possible that patients could have had an ED visit, a readmission, or specialty care at an outside institution, it is unlikely that this would have altered our results given the randomization of the groups.

Third, our system serves primarily a lower socioeconomic group of patients. Whether similar benefits would be realized with more affluent patients remains uncertain. However, studies of various populations have reported quality problems during care transitions, indicating that not only low-income patients are at risk in the post discharge period.^{1,3–6,8–14,20,27–29}

Fourth, our intervention requires that a patient has a PCP and that the PCP's office conducts a telephone outreach after hospital discharge. Whereas an integrated medical and information system such as CHA's is ideal, the intervention could

readily be implemented with associated independent practices, if these practices were willing and able to carry out the post discharge outreach. Still, some patients do not have a PCP or their PCP's office may not be prepared to perform such outreach. As evidence accumulates regarding the benefits of coordinated inpatient and outpatient care, medical standards will ideally advance so that more patients have a medical home to actively manage their post-discharge care.

Fifth, the study was small in size and was not powered to examine important outcomes such as cost savings, health improvements, or decreased resource utilization. Larger studies could answer these questions.

In conclusion, there is a well-documented imperative to improve care transitions,^{8,30–32} and the present study is one of only a few randomized controlled trials to address this issue.^{2,21–23,33} The low-cost discharge-transfer intervention used in this study improved the rates of outpatient follow-up and of completed outpatient workups. Gaps in care were reduced by improving patient preparation for discharge, formalizing inpatient-to-outpatient communication, and promptly reconnecting patients with their medical home. As EMRs advance and become more widespread, comprehensive inpatient-to-outpatient communication could become a precondition for discharge, whereas electronic prompts could facilitate telephone contact with patients immediately upon discharge. Such innovations could help to further the goal, advocated by the Institute of Medicine,²⁶ that high-quality medical care be uniformly delivered by failsafe medical systems.

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