Effect of Discharge Summary Availability During Post-discharge Visits on Hospital Readmission

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OBJECTIVE: **To determine if the delivery of hospital discharge summaries to follow-up physicians decreases the risk of hospital readmission.**

SUBJECTS: **Eight hundred eighty-eight patients discharged from a single hospital following treatment for an acute medical illness.**

SETTING: **Teaching hospital in a universal health-care system.**

DESIGN: **We determined the date that each patient's discharge summary was printed and the physicians to whom it was sent. Summary receipt was confirmed by survey and phoning each physician's office. Each patient's hospital chart was reviewed to determine their acute and chronic medical conditions as well as their course in hospital. Using population-based administrative databases, all post-hospitalization visits were identified. For each of these visits, we determined whether the summary was available.**

MAIN OUTCOME MEASURES: **Time to nonelective hospital readmission during 3 months following discharge.**

RESULTS: **The discharge summary was available for only 568 of 4,639 outpatient visits (12.2%). Overall, 240 (27.0%) of patients were urgently readmitted to hospital. After adjusting for significant patient and hospitalization factors, we found a trend toward a decreased risk of readmission for patients who were seen in follow-up by a physician who had received a summary (relative risk 0.74, 95% confidence interval 0.50 to 1.11).**

CONCLUSIONS: **The risk of rehospitalization may decrease when patients are assessed following discharge by physicians who have received the discharge summary. Further research is required to determine if better continuity of patient information improves patient outcomes.**

KEY WORDS: **discharge summary; hospital readmission; continuity of patient information.**
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Communication is central to the practice of medicine. Physicians must regularly communicate effectively with both patients and other health professionals for optimal care. Increased patient-physician communication is associated with improved outcomes[1] but interphysician communication has been less studied. Individual accounts have documented poor communication in health care,[2,3] medico-legal case reports have associated poor interphysician communication with serious adverse outcomes,[4] and communication among health professionals has been labeled "a mess."[2] The effect of interphysician communication upon patient outcomes requires further analysis.[2,5,6]

Despite its importance, the effect of interphysician communication on patient outcomes has been infrequently studied. Direct contact between radiologists and family physicians may increase the likelihood of further testing for patients with mammographic abnormalities.[7] Improved communication between diabetologists and family physicians was associated with a marginal improvement in glycemic control.[8] Tierney and colleagues[9] found that providing physicians with previous laboratory results decreased the number of tests that physicians ordered. Communication between family physicians and emergentologists decreased laboratory utilization.[10] However, increased interphysician communication does not always improve patient care.[11,12]

Patients who are discharged from the care of a hospitalist represent an ideal setting for studying the effect of interphysician communication upon health outcomes. Hospitalists are physicians who spend much of their time caring for inpatients who are commonly unknown to them prior to the admission. These patients are often returned to the care of their regular physician following discharge from hospital. Hospitalists are common in both Canada and Europe, and their prevalence is increasing in the United States.[13] However, concern has been raised over the effect that such "discontinuity of care," combined with poor communication, might have upon the quality of care.[13–16] Several authorities have called for research into the effects that such discontinuity has upon health care.[17,18] However, to our knowledge, no such research has ever been conducted.

This study determines if communication between hospitalists and patients' regular physicians by the discharge summary affects patient outcomes. The discharge summary is one of the most common methods used by hospital physicians to communicate with family doctors.[19] Although many studies have assessed discharge summary content,[20–22] accuracy,[23] and timeliness,[21,22,24] no study has measured their effects upon health outcomes. In this study, we anonymously linked information about patients who participated in a previous trial[25] with administrative

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databases to determine if delivery of the discharge summary to posthospitalization physicians changed the risk of rehospitalization.

METHODS

Study Setting and Population

Patients participated in a previous clinical trial[25] that took place between September 1996 and June 1997 in the general internal medicine service at the Ottawa Civic Hospital. This is a 700-bed tertiary-care teaching center in which all medical patients admitted to the service were eligible for inclusion in the study and were treated by physicians-in-training supervised by hospitalists. Patients were excluded if they were transferred to or from another service, died during the hospitalization, or remained in hospital after the study was completed.[25] Patients were also excluded from the present study if they did not have a valid Ontario Health Insurance Plan (OHIP) number, because this was necessary to link with the administrative databases. The OHIP number is a health insurance identifier that is unique to each Ontarian. Patients would not have a valid OHIP number if they were from another province or country, or had recently immigrated to Canada.

Finally, some patients entered the previous clinical trial more than once, since the unit of analysis of that trial was the hospitalization rather than the patient. For the present study, only the final admission was considered if patients were entered into the previous clinical trial more than once. This ensures that each observation in the present study is independent.

Exposure Variable or Determining Whether Summaries Were Available for Physician Visits

The discharge summary of each patient was collected. The date that the summary was printed and the physicians to whom the summary was sent were abstracted from the summary.

We confirmed whether physicians actually received the summaries prior to the outpatient visit using 2 methods. First, a survey that was to be completed by the receiving physician was sent with each summary.[25] Second, we telephoned each physician's office 1 to 2 months after their summaries had been sent to them and asked office staff to review the patient chart. Summaries were classified as received if the survey was returned or if the summary was in the patient's office chart.

In Ontario, each person has a unique Ontario Health Insurance Plan (OHIP) number, and each physician has a unique claim identifier. Unique identifiers for patients and physicians in the study were encrypted to permit anonymous linkage with population-based administrative databases. For each patient, all physician assessments in the 3 months following discharge from hospital were identified in the OHIP database. This database identifies the patient, physician, and date of all patient assessments by more than 95% of Ontario family practitioners and almost all specialists.

For each physician visit, we were able to determine whether the discharge summary had been delivered to that physician in time for the assessment. To be available for the visit, the summary had to be received (see above) prior to the visit. To determine when the physician received the summary, we used local observations that summary delivery to most physician offices usually takes 3 days. This delay is similar to that in other studies.[26] Therefore, summaries that had been received by physicians had to be mailed 3 days before the visit in order to be classified as available for that visit. Our results did not change significantly when we varied this delay between 1 and 7 days.

Outcome Variable

The outcome of interest was the first nonelective readmission to hospital within 3 months of discharge. All readmissions were identified in the Discharge Abstract Database (DAD) which records the date of every admission to Ontario acute-care hospitals. Elective admissions, as indicated by an 'acuity' variable in the DAD, were not considered. Observation ended when patients died, were urgently readmitted to hospital, or at 3 months after discharge. We reviewed the provincial Registered Persons Database, which records the death date of all Ontarians, to determine whether patients died prior to hospital readmission.

Controlling Factors

Many factors influence readmission to hospital. We, therefore, collected an extensive amount of information for each patient to control for these potential confounders.

Each patient's medical record was reviewed by one of the investigators (CvW, RS) in a standardized fashion. Admission and discharge dates along with patient age and gender were recorded. We determined whether patients lived in a nursing home by reviewing their address and the physician admission note. Medical conditions abstracted directly from the record by the physician reviewers included active medical problems, admission diagnoses, procedures, and complications. Patients were classified as having a procedure if the skin was broached at any time (with the exception of noncentral vein venipuncture) or an instrument entered any body orifice (with the exception of nasogastric or rectal tubes, or Foley catheters). Complications were defined as any condition that started after the patient was admitted to hospital. If the chart contained notes from other hospital services, the patient was classified as having had a consultation. Physician notes were reviewed to identify all family physician visits that were documented in the chart.

Further information regarding each patient was anonymously determined from the administrative databases. To

measure each patient's propensity toward the utilization of health services, we used the OHIP database to measure the number of outpatient physician assessments and emergency room assessments in the 6 months prior to admission. The number of times that patients were urgently or emergently admitted to hospital during the same time period was determined using the DAD. Visits to the emergency department was identified by special codes in the OHIP database. Finally, the socioeconomic status of each patient was measured using the average household income of the patients' neighborhood from the 1996 Canadian Census. This was determined from the first 3 α-numerics of each patient's postal code.

Analysis

The dichotomous exposure variable (whether or not the patient was seen by a physician who had received the summary) changes in value during each patient's observation period. We therefore used a Cox proportional-hazards model that represented this variable as a time-dependent covariate.[27] This analysis controls for the time from patient discharge to the follow-up visit. To determine which of the controlling factors were most important, we first calculated univariate Cox regression models for each of the controlling factors using time to readmission in the first 3 months after discharge as the outcome variable. Tied data were handled using the exact method.[27] All covariates whose association with readmission to hospital had a *P* value less than .2 were entered into a mulitvariate Cox regression model that used forward variable selection with a *P* value cutoff of .05. The covariates that were significant in this model were forced into the final model along with a time-dependent variable representing whether or not a physician who had received the summary saw the patient. Patients who died before readmission censored in all Cox regression models. SAS (version 8.0; SAS Institute, Cary, NC) was used for all analyses. The Ottawa Hospital Research Ethics Board approved the study.

RESULTS

Patient Description

During the original randomized trial,[25] there were 1,402 admissions to the internal medicine service. Of these, 1,274 patients (90.9%) entered the trial, of whom 386 were excluded from the present study because they died in hospital (149 patients), were enrolled in the randomized trial twice (123), did not have a valid OHIP number (75), or were transferred to another service (39). This left 888 (69.7%) patients.

Patients and their hospitalizations are described in Tables 1 and 2, respectively. Patients were elderly (mean

Table 1. Baseline Description of 888 Patients in the Study and Univariate Association of These Factors with Nonelective Readmission Within 3 Months

Factor	Descriptor	Relative Hazard of Readmission (95% CI)*
Demographics		
Mean age, y (SD)	65.7 (18.5)	1.01 (1.00 to 1.01)
Female gender, *n* (%)	446 (50.2)	1.10 (0.86 to 1.43)
Patient had a family physician, *n* (%)	816 (91.9)	2.29 (1.22 to 4.32)
Patient from a nursing home, *n* (%)	49 (5.6)	1.24 (0.72 to 2.12)
Median average household income (IQR)	$ 60,228 ($54,043 to $73,574)	0.87 (0.78 to 0.98)‡
Health service utilization in 6 mo prior to admission (IQR)		
Median physician visits	9 (4 to 15)	1.01 (1.00 to 1.02)†
Median emergency visits	2 (0 to 4)	1.04 (1.01 to 1.06)†
Median hospitalizations	0 (0 to 1)	1.40 (1.27 to 1.55)†
Chronic medical condition prior to admission, *n* (%)		
Hypertension	237 (26.7)	1.03 (0.77 to 1.36)
Diabetes	176 (19.8)	1.33 (0.98 to 1.80)
Coronary artery disease	171 (19.3)	1.55 (1.16 to 2.07)
Congestive heart failure	112 (12.6)	1.20 (0.84 to 1.73)
Chronic obstructive pulmonary disease	105 (11.8)	1.27 (0.88 to 1.81)
Cancer	77 (8.7)	1.72 (1.17 to 2.53)
Chronic renal failure	77 (8.7)	2.07 (1.44 to 3.00)
Cerebrovascular disease	89 (10.0)	1.21 (0.80 to 1.82)
Hypothyroidism	70 (7.8)	1.38 (0.91 to 2.11)
Epilepsy	27 (3.0)	1.67 (0.91 to 3.06)
Patient had 1 or more chronic conditions	805 (90.6)	2.43 (1.33 to 4.46)

* *A relative risk above 1 indicates that the factor was associated with an increased risk of readmission within 3 months. A relative risk below 1 indicates that the factor was associated with a decreased risk of readmission. If the 95% confidence interval excludes 1, the association is statistically significant at the* P = .05 *level.*

† *Relative risk expresses change in risk of readmission when increased factor increased by one unit.*

‡ *Relative risk expresses change in risk readmission when regional household income increased by one quartile.*

CI, confidence interval; IQR, interquartile ratio.

Table 2. Description of Hospital Factors for Study Patients and Univariate Association of These Factors with Nonelective Readmission Within 3 Months

	Descriptor	Relative Hazard of Readmission (95% CI)
Reason for admission to hospital, *n* (%)		
Pneumonia	127 (14.3)	0.86 (0.60 to 1.28)
Congestive heart failure exacerbation	86 (9.7)	1.18 (0.78 to 1.77)
Asthma/COPD exacerbation	75 (8.4)	0.87 (0.54 to 1.40)
Gastrointestinal bleed	73 (8.2)	0.57 (0.33 to 1.00)
Deep vein thrombosis/pulmonary embolism	35 (3.9)	0.36 (0.14 to 0.98)
Stroke	32 (3.6)	0.43 (0.16 to 1.15)
Hospitalization factors		
Patient was consulted by other service, *n* (%)	418 (47.1)	1.32 (1.02 to 1.69)
Patient had 1 or more complications, *n* (%)	172 (19.4)	1.46 (1.09 to 1.96)
Patient had 1 or more procedures, *n* (%)	289 (32.5)	1.41 (1.09 to 1.83)
Mean length stay in days (SD)	6.6 (9.1)	1.02 (1.01 to 1.02)*

* *Relative risk expresses change in risk of readmission when increased factor increased by 1 unit.*

age 65.7, SD 18.5) and 50.2% were female. Overall, the patients were ill with a median of 2 chronic medical illnesses (interquartile range [IQR], 1 to 4) Patients interacted frequently with the health care system (Table 1). In the 6 months prior to admission, physician visits were common (median of 7 visits per patient), 448 patients (50.4%) had 1 or more emergency room assessments, and 261 patients (29.4%) had been admitted to hospital at least once.

Hospitalizations lasted a median of 4 days (IQR, 2 to 7) (Table 2). During the hospitalizations, 172 patients (19.4%) experienced at least 1 complication, 289 (32.5%) underwent at least 1 procedure, and 418 (47.1%) were assessed by other specialists. Family physicians were noted on the chart to have visited patients for only 15 hospitalizations.

Health Resource Utilization in the Follow-up Period

Six hundred eight patients (68.5%) were observed for the entire 3 months after discharge from hospital. The other patients were either readmitted to hospital (239 patients, 26.9%) or died (41 patients, 4.5%). During the observation period, patients had a median of 4 physician visits (IQR, 1 to 6) by a median of 2 physicians (IQR, 1 to 3). One hundred sixty-four patients (18.5%) had at least 1 emergency room visit.

Discharge summaries were generated for 628 (70.7%) of patients during the study period within a median of 6 days from patient discharge (IQR, 3 to 17 days). The summaries were sent to a median of 2 physicians (IQR, 2 to 3). Sixty-five summaries (10.4%) were not sent to any physician other than the admitting physician. In total, there were 4,639 physician visits during the observation period. The discharge summary was available for only 568 (12.2%) of these visits. When this proportion was calculated for each patient separately, we found that summaries were available for at least 1 of the follow-up visits for only 218 patients (24.5%).

Hospital Readmission

Overall, 240 (27.0%) of patients were urgently readmitted to hospital within the first 3 months after discharge. Several baseline (Table 1) and hospital (Table 2) factors were significantly associated with time to hospital readmission. The demographic factors in Table 1 that had the strongest association with readmission included whether or not the patient had a regular family physician and the socioeconomic status of the patient's neighborhood. Each measure of prehospitalization health service utilization was significantly and positively associated with readmission. Baseline medical conditions significantly associated with an increased risk of readmission included coronary artery disease, cancer, and chronic renal failure. Admission to hospital for either acute gastrointestinal bleeding or thromboembolic disease was associated with a decreased risk of readmission (Table 2). Finally, each hospitalization factor listed in Table 2 was significantly associated with an increased risk of readmission.

Table 3 lists the patient factors that were independently associated with nonelective readmission to hospital within 3 months of discharge. Readmission risk increased if patients had a regular family physician, had a higher baseline health service utilization rate, had cancer, or had a procedure during the hospitalization. Readmission risk decreased if patients lived in a neighborhood with a higher average household income or were admitted with acute gastrointestinal bleeding. When discharge summary dissemination was added to this model, we found a trend toward a decreased risk of readmission within 3 months if patients were seen in follow-up by a physician who had received the discharge summary (relative risk, 0.74; 95% CI, 0.05 to1.10).

DISCUSSION

Continuity of care can improve patient outcomes.[28,29] To our knowledge, this is the only study to explore

Table 3. Multivariate Analysis Determining the Association of Various Patient and System Factors Associated with Hospital Readmission Within 3 Months

Factor	Relative Hazard of Readmission (95% CI)*
Patient has a regular family physician	2.26 (1.20 to 4.29)
Regional average household income increased by 1 quartile	0.87 (0.77 to 0.98)
Number of physician assessments before admission increased by 1	1.01 (1.00 to 1.02)
Number of hospital days before admission increased by 1	1.31 (1.18 to 1.47)
Patient has cancer	1.55 (1.04 to 2.29)
Number of chronic medical conditions increased by 1	1.08 (1.01 to 1.16)
Patient was admitted for a GI bleed	0.48 (0.27 to 0.86)
Patient had a procedure during the hospitalization	1.55 (1.17 to 2.06)
Length of stay increased by 1 day	1.01 (1.00 to 1.02)
Discharge summary received by 1 or more follow-up physicians	0.74 (0.50 to 1.11)

** A relative hazard above 1 indicates that the factor was associated with an increased risk readmission within 3 months. A relative risk below 1 indicates that the factor was associated with a decreased risk of readmission. If the 95% confidence interval excludes 1, the association is statistically at the* P = *.05 level.*

whether the dissemination of patient-specific information alters the risk of hospital readmission. After controlling for important factors, we found a trend toward a lower likelihood of readmission for patients who were seen in follow-up by a physician who had received the discharge summary. Our data suggest that discharge summary dissemination could be more successful at decreasing hospital readmission than case managers.[30,31] Further study is required to determine whether 'continuity of information,' in addition to continuity of care, can improve patient outcomes.

We were surprised by two of our findings. First, only a small number of follow-up physicians had received the discharge summary at the time of the patient visit. Although this may have occurred because patients consulted new physicians after discharge from hospital, we believe that it more likely results from hospital physicians failing to systematically identify all physicians involved in a patient's care and ensuring that summaries were sent to each. Since discharge summaries can only help patient care if they are received by their physicians, we must pursue methods to improve the timely dissemination of discharge summaries.

We also found that patients who had a regular family physician had a significantly higher risk of readmission. This is probably because patients with a family physician were sicker. Such patients were significantly older (66.6 vs 55.5 years; $P < .001$) and were more likely to have coronary artery disease (20.2% vs 8.3%; $P = .01$), chronic renal failure (9.3% vs 1.4%; $P = .02$), diabetes (20.7% vs 9.7%; $P = .03$), or any significant chronic medical condition (91.8% vs 77.8%; $P < .001$). Therefore, we believe that having a regular family physician is a marker of underlying chronic illness and comorbidity that increases the risk of readmission and was not controlled for in our model.

If the association between the receipt of discharge summaries and decreased readmission is true, this would be one of the most dramatic effects of interphysician communication yet documented. Previous studies have found that improved interphysician communication decreased waiting time in the emergency room,[10] repetition of laboratory tests,[10] and glycosylated hemoglobin levels,[8] and increased cancer screening rates.[7,32] One other study, by Williams and Fitton,[33] found that communication between the hospital and the primary care physician was significantly less likely to occur in elderly patients who were readmitted to hospital. However, this study was susceptible to recall bias, given its case-control design, and did not use a multivariate analysis to determine the independent association of communication with readmission.

This study has a number of strengths including a large and well-defined sample of patients. We combined primary data with population-based administrative databases to collect enough information on each patient that we could adjust for factors that have been associated with readmission to hospital. These include demographic factors (such as age,[34–38] gender,[34–36,39–41] nursing home status,[37,42] and socioeconomic status[43,44]), prehospitalization health service utilization (including emergency department use,[45] hospitalizations,[34,35,37,44,46–50] and physician visits[35]), baseline medical conditions (such as diabetes,[35,51] coronary artery disease,[35] congestive heart failure,[47,52,53] and chronic renal failure[41,52]) and hospital factors (including length of stay[34,37]). Follow-up was sufficiently long and was, given the population-based status of the administrative databases used to follow patients, complete. Our outcome, emergent readmission to hospital, was objective and was measured without some of the common pitfalls often encountered when measuring hospital readmissions.[54] This is because we were able to document readmissions to all Ontario hospitals (not just the original hospital, as is sometimes used in studies) and we censored people who died during the observation period. We also completely determined whether follow-up physicians received the discharge summary, using both mail and phone surveys.

However, this study had some weaknesses that need to be addressed in future research to truly determine the effect that continuity of information has upon patient outcomes. While the discharge summary is the most common media of communication following discharge from hospital,[19] we did not document information flow using other methods such as interim discharge reports, faxes, phone calls, and patient knowledge about their hospitalization. We could not determine whether the summary was actually read by the receiving physician. Although hospital readmission is a very important outcome, many readmissions are due to progression of disease rather than medical errors. Therefore, future studies should explore the effect of postdischarge communication on outcomes such as avoidable adverse events and avoidable readmissions. We did not control for whether physicians seeing patients after discharge had also seen them prior to the hospitalization. Physician continuity could importantly influence patient outcomes. Although we studied 888 patients, they were all from 1 service in a single teaching hospital. Furthermore, we had notably poor dissemination of our discharge summaries to follow-up physicians. More studies are needed to determine if our observations are reproduced in a variety of hospital care systems.

The final 3 weaknesses of this study could be addressed simultaneously by a trial in which patients are randomized to routine care versus exemplary dissemination of patient information to follow-up physicians. Although we controlled for many important factors, our observational study could not control for all potential confounders. For example, patients whose follow-up physicians received a discharge summary may be systematically different from other patients. Also, readmission to hospital might be associated with poor care during the initial hospitalization,[55–58] which itself could be associated with poor dissemination of discharge summaries. These and other unmeasured confounding factors, such as quality of care by the primary care physician, would be controlled in a properly conducted randomized clinical trial. Finally, our study was unable to determine how the dissemination of discharge summaries to follow-up physicians might avoid readmission to hospital. Ideally, one would want to document how information in the summary affected the decision making that influenced outcomes.

Our finding that dissemination of patient-specific hospital information to follow-up physicians may influence important outcomes is important for both physicians and health policy makers. Recent advances have resulted in a rapid proliferation of information and communication technologies that could extensively integrate health information as never before. However, the costs of adopting these technologies into exisiting health systems will be considerable. We believe that further research to determine the effects that continuity of patient information have upon important health outcomes is essential for appropriate decision making regarding these technologies.

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