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ORIGINAL RESEARCH

Post-Discharge Intervention in Vulnerable, Chronically Ill Patients

Devan Kansagara, MD, MCR[1]*, Rebecca S. Ramsay, BSN, MPH[2], David Labby, MD, PhD[2], Somnath Saha, MD, MPH[1]

[1]Oregon Health and Sciences University, Portland VA Medical Center, Portland, Oregon; [2]CareOregon, Portland, Oregon.

BACKGROUND: Studies suggest that the inpatient to outpatient transition of care is a vulnerable period for patients, and socioeconomically disadvantaged populations may be particularly susceptible.

OBJECTIVE: In this prospective cohort study, clustered by hospital, we sought to determine the feasibility and utility of a simple, post-discharge intervention in reducing hospital readmissions.

METHODS: Chronically ill Medicaid managed care members were consecutively identified from the discharge records of 10 area hospitals. For patients from the 7 intervention hospitals, trained medical assistants performed a brief telephone needs assessment, within 1 week of discharge, in which issues requiring near-term resolution were identified and addressed. Patients with more complicated care needs were identified according to a 4-domain care needs framework and enrolled in more intensive care management. Patients discharged from the 3 control hospitals received usual care. We used a generalized estimating equation model, which adjusts for clustering by hospital, to evaluate the primary outcome of hospital readmission within 60 days.

RESULTS: There were 97 intervention and 130 control patients. Intervention patients were slightly younger and had higher adjusted clinical group (ACG) scores. In unadjusted analysis, the intervention group had lower, but statistically similar, 60-day rehospitalization rates (23.7% vs 29.2%, $P = 0.35$). This difference became significant after controlling for ACG score, prior inpatient utilization, and age: adjusted odds ratio (OR) [95% confidence interval (CI)] 0.49 [0.24-1.00].

CONCLUSIONS: A simple post-discharge intervention and needs assessment may be associated with reduced recurrent hospitalization rates in a cohort of chronically ill Medicaid managed care patients with diverse care needs. *Journal of Hospital Medicine* 2012;7:124–130. © 2011 Society of Hospital Medicine

The inpatient to outpatient transition marks an abrupt paradigm shift from intensive, provider-initiated care to self-managed care, in which patients are primarily responsible for maintaining day-to-day health behaviors, following through with outpatient appointments, and negotiating medications, transport, and equipment needs. Studies indicate that medication nonadherence and medication-related adverse events are common during the post-discharge period, and may be related to the discontinuities associated with transitions of care.[1–10]

Given the complexity and uncertainty inherent in care transitions for patients with chronic illness, it is not surprising that poorly executed care transitions have been associated with increased risk of rehospitalizations and emergency department (ED) use.[11] Patients with chronic illness are at particularly high risk for recurrent hospitalization.[11–14] System-wide improvements in chronic illness care have been successful in triaging longitudinally followed, high-risk outpatients to appropriate higher-intensity care management interventions.[15–19] But the post-discharge setting presents unique challenges for patients with chronic illness, especially those that are socioeconomically disadvantaged. External barriers, such as lack of transportation, lack of monitoring equipment, confusion about arranging follow-up care, uncertainty about medication regimen changes, and financial constraints, represent important targets for improving care in the transition from inpatient to outpatient settings.

Transitional care has been defined as "a set of actions designed to ensure the coordination and continuity of healthcare as members transfer between different locations or different levels of care."[20] Most successful transitional care interventions have focused on geriatric populations or patients with congestive heart failure enrolled in health maintenance organizations, and have involved intensive nurse case management from the hospital setting through the post-discharge period.[21–25] In these studies, trained nurse case managers provided critical support and patient education to improve patients' ability to self-manage chronic illness.[26–29]

***Address for correspondence and reprint requests:** Devan Kansagara, MD, MCR, P3 Med, Portland VA Medical Center, 3710 SW US Veterans Hospital Rd, Portland, OR 97239; Fax: 503-721-7807; E-mail: kansagar@ohsu.edu

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In a resource-poor Medicaid payment structure, the implementation of intensive care management across a broad population of patients may not be practical; alternative options for intervention dosing and implementation may be needed. Few studies have examined care needs and the impact of transitional care interventions in socioeconomically disadvantaged patients with chronic illness, though a recent study including such a population did find benefit from a pharmacist-based intervention.[30] The purpose of our study was to examine the impact of a low-cost, post-discharge needs assessment, as an adjunct to an existing care management program, on the risk of recurrent hospitalization in a clinically diverse cohort of chronically ill Medicaid managed care enrollees.

METHODS

Setting

CareOregon is an Oregon-based, not-for-profit, Medicaid managed care organization that administers outpatient and inpatient health benefits for nearly 110,000 members, 5% of whom are dually eligible for Medicaid and Medicare benefits. The CareOregon network includes 950 primary-care providers, 3000 specialists, 33 hospitals contracted statewide, and 14 public health departments. Approximately 85% of CareOregon's membership lives in the Portland metropolitan area. The remaining 15% are dispersed across mostly rural Oregon counties. CareOregon's membership is both culturally and medically diverse: 55% are female, 21% below age 5 (63% below age 20), and 43% self-identify as persons of color. Hospitalized patients are generally cared for by inpatient-based physicians, and an array of primary care and specialty providers based in safety-net clinics, private practices, and university-based clinics cares for patients out of the hospital setting. In 2004, CareOregon began CareSupport, a care management program designed to incorporate the principles of the Chronic Care Model[31] in which a team-structured approach is used to improve patient self-management and coordination of care.

Patients

As part of the authorization and concurrent review activity of CareOregon's Utilization Management unit, hospitalized CareOregon members are identified and a discharge date is entered in the system. CareOregon programmers develop a daily hospital discharge report, which is reviewed each day by medical assistants. Between January and July 2007, this process was used to prospectively identify all CareOregon members over age 35 discharged from 1 of 10 area hospitals. Seven hospitals served as intervention sites, the other 3 as control sites. Patients discharged from intervention hospitals were called at home after discharge and screened for eligibility. Those with one or more chronic illnesses (congestive heart failure, ischemic heart disease, diabetes mellitus, arthritis, depression, chronic obstructive pulmonary disease, and asthma), who consented to participate, were included in the study. The presence of a chronic illness was determined by patient self-report, and subsequently corroborated by inpatient and outpatient International Classification of Diseases, Ninth Revision (ICD-9) codes in CareOregon's claims dataset. Patients with one or more of the following were excluded: 1) language other than English; 2) no telephone access; 3) direct, elective hospital admission; 4) admission for <24 hours; 5) primary residence in an extended care facility.

Patients discharged from control hospitals during the study period were included in the control group if they were over age 35, were hospitalized for more than 24 hours, and had one or more chronic illnesses (listed above) as determined by ICD-9 codes. These patients were identified exclusively through the CareOregon claims database, which includes both inpatient and outpatient diagnostic coding and basic sociodemographic information.

Six of the 10 hospitals from which patients were discharged are large (>300 beds), located in an urban district, and have a robust hospital medicine service. Three of these large, urban hospitals were intervention sites (hospitals 1, 3, and 6), and 3 were control sites (hospitals 2, 4, and 5). All except one of these hospitals (hospital 1) has its own internal medicine residency program. Of the 4 remaining hospitals, all of which were intervention sites, 2 are small (<300 beds) and in an urban district (hospitals 7 and 9), and 2 are small and in rural districts (hospitals 8 and 10).

Intervention

Trained medical assistants conducted a scripted post-discharge telephone-based needs assessment and attended to simple interventions. Training included lectures on basic chronic condition management and several months in a peer-to-peer learning environment with more experienced medical assistants. Medical assistants were also paired with nurse care managers who provided ongoing training and clinical mentorship. The trained medical assistants called intervention patients within 2-7 days of hospital discharge. If a patient was not available, a contact number was given and up to 2 additional attempts were made to reach the patient. Medical assistants administered a 35-item needs assessment survey, which typically took 10-15 minutes to complete (see Supporting Appendix A in the online version of this article). The survey is based on an existing theoretical framework of healthcare utilization which considers predisposing sociodemographic and healthcare belief variables, enabling resources, and illness level variables.[32] Our survey (see Supporting Appendix A in the online version of this article) includes 4 related subdomains: 1) enabling resources (medical home, transportation, housing);

2) psychosocial comorbidities; 3) patient activation[33]; and 4) past utilization.

The needs assessment was designed to identify issues requiring near-term resolution, such as the need for follow-up care, pharmacy access, transportation needs, and medical equipment needs. These identified needs prompted appropriate, immediate, ''brief-touch'' interventions by the medical assistants (eg, arrange transportation, schedule a follow-up appointment, or provide access telephone numbers).

The needs assessment was also designed to identify members for referral to intensive care management (CareSupport), based on responses to questions about their medical home relationship, prior utilization, self-management ability, and presence of competing needs. Medical assistants referred patients for intensive care management if they had high-intensity needs in any one of these domains, or any need in two or more domains. For example, a patient with a history of frequent emergency room visits would be referred for more intensive care management. The CareSupport team—a registered nurse specially trained in case management, a behavioral health specialist, and a medical assistant—reviewed each referred case. For patients qualifying based on an anticipated ongoing need identified in one or more of the above domains, the CareSupport team constructed an individualized, multifaceted care plan based on disease-specific guidelines and results of the needs assessment.

The study was approved by the institutional review board of the Oregon Health and Sciences University.

Comparator

Patients in the control cohort received usual care as recommended by discharging and outpatient providers. Patients in the control cohort were not given ''brief-touch'' interventions or referred to CareSupport by study personnel. They could be referred to CareSupport by their outpatient providers.

Analysis

The primary outcome variable was recurrent hospitalization within 60 days to any hospital after index hospitalization discharge. The CareOregon dataset includes inpatient and outpatient claims at any site. Because there may be up to a 3-month delay in posting claims, we examined the claims dataset 6 months from index hospital discharge for all patients. Sociodemographic, chronic illness comorbidity, and prior utilization data were collected from the CareOregon claims dataset. We used the adjusted clinical group (ACG) score for case-mix adjustment. The ACG predictive model is an automated risk assessment tool that uses ambulatory diagnoses to identify patients at risk for high inpatient and outpatient utilization in the following year.[34,35] ACG scores range from 0 to 1, with a score of 0.5 corresponding to a 50% chance of high utilization (ie, of being in the top 3% of utilizers) over the following year.

Data for all patients enrolled in the CareSupport care management program are entered and tracked through a separate database, which we accessed to determine whether patients were enrolled in this program during the study period. Information about specific ''brief-touch'' interventions performed was entered narratively by medical assistants.

Baseline characteristics of the 2 groups were compared using t tests or χ^2 tests, as appropriate. All patients were analyzed according to the group to which they were originally assigned, regardless of subsequent enrollment in CareSupport. We used bivariate analyses to identify covariates associated with the primary outcome. These and other clinically important variables were used to develop a generalized estimated equation model of the impact of the transitional care intervention on risk of rehospitalization within 60 days of discharge, accounting for clustering of patients within hospitals. We included age, hospitalization within the past year, and ACG score as covariates in the final model.

In secondary analyses, we sought to determine whether any association between our transitional care intervention and rehospitalization was mediated by greater use of primary care or care management services. To do this, we used the CareOregon claims dataset to determine primary care utilization for the year following hospital discharge, and we used the CareSupport database to determine whether patients were enrolled in care management. We then repeated our original multivariate model, adding primary care utilization as a covariate, and considered mediation to be present if the addition of primary care utilization substantively attenuated the association between intervention and rehospitalization. We then conducted the same mediation analysis using CareSupport enrollment as a covariate. All analyses were conducted using Stata/SE 9.0 (College Station, TX).

RESULTS

We enrolled 97 intervention and 130 control patients. Follow-up utilization data were available for all patients. Table 1 compares sociodemographic, utilization, and comorbidity characteristics of the 2 groups, and Table 2 summarizes patient distribution and characteristics of the hospitals from which they were discharged. The control group was significantly older and more racially diverse than the intervention group. On the other hand, the intervention group had a higher burden of illness as suggested by higher ACG scores and a higher rate of hospitalization within the previous year. Most patients had been hospitalized at large, urban hospitals.

Patients in the intervention group had a slightly lower 60-day rehospitalization rate compared to the control group, but this difference was not statistically

TABLE 1. Baseline Characteristics

Variable	Intervention (n = 97)	Control (n = 130)
Mean age (SE)	56.3 (1.1)	60.1 (1.2)*
Caucasian race, n (%)	81 (83.5)	70 (53.8)*
Female, n (%)	56 (57.7)	83 (63.8)
Mean ACG score (SE)	0.49 (0.03)	0.39 (0.03)*
Mean hospitalizations in prior year (SE)	1.97 (0.26)	1.18 (0.13)*
No primary care visit in prior year, n (%)	8 (8.2)	19 (14.6)
Medicare + Medicaid, n (%)	40 (41.2)	47 (36.2)
Chronic illness, n (%)		
Diabetes mellitus	48 (49.5)	67 (51.5)
Depression	17 (17.7)	23 (17.9)
Congestive heart failure	29 (29.5)	45 (34.6)
Chronic obstructive pulmonary disease or asthma	51 (52.6)	57 (43.8)

Abbreviations: ACG, adjusted clinical group; SE, standard error. * $P < 0.05$ for comparison with intervention group.

TABLE 3. Rehospitalization Within 60 Days in Intervention and Control Patients

	Intervention (n = 97)	Control (n = 130)	Adjusted OR (95% CI)
Unadjusted	23 (23.7%)	38 (29.2%)	0.75 (0.41-1.37)
Adjusted, model 1*			0.49 (0.24-1.00)
Model 1 + primary care utilization			0.49 (0.24-1.00)
Model 1 + care management			0.41 (0.19-0.88)

Abbreviations: CI, confidence interval; OR, odds ratio. *Adjusted for age, adjusted clinical group (ACG) score, and hospitalization within the prior year.

TABLE 2. Patient Distribution and Hospital Characteristics

Hospital No., Intervention or Control	No. of Patients	Hospital Characteristics
1, I	13	Large, urban
2, C	89	Large, urban
3, I	26	Large, urban
4, C	35	Large, urban
5, C	6	Large, urban
6, I	30	Large, urban
7, I	4	Small, urban
8, I	5	Small, rural
9, I	7	Small, urban
10, I	12	Small, rural

Abbreviations: C, control; I, intervention.

TABLE 4. Brief-Touch Intervention Examples

Type of Assistance*	n (%)
Access information	13 (13.4)
Clinic visit/PCP change	13 (13.4)
Simple self-management advice	10 (10.3)
Health promotions packet	6 (6.2)
Transportation	4 (4.1)
Tobacco cessation guidance	4 (4.1)
Prescription/pharmacy	4 (4.1)
Flu vaccine promotion	2 (2.1)
Housing/home support	1 (1.0)
Any type of assistance	47 (48.5)

Abbreviations: PCP, primary care physician. *Some patients received more than 1 type of assistance.

significant in unadjusted analyses (Table 3; 23.7% vs 29.2%, $P = 0.35$). This difference became significant after controlling for ACG score, prior inpatient utilization, and age: adjusted odds ratio (OR) [95% confidence interval (CI)] 0.49 [0.24-1.00].

Nearly half the intervention patients received one or more ''brief-touch'' interventions (48.5%), and the majority of patients (61.7%) receiving a ''brief-touch'' intervention did not require referral to care management. Table 4 lists examples of ''brief-touch'' interventions received by patients. More patients in the intervention group than in the control group were enrolled in the CareSupport care management program (40.2% vs 14.6%, $P < 0.001$), and about half (53.8%) of the intervention patients referred for care management did not receive a ''brief-touch'' intervention. Patients enrolled in care management were slightly younger (mean age 56.7 vs 59.1 years, $P = 0.16$), but had a higher burden of illness (mean ACG score 0.53 vs 0.40, $P = 0.006$) than those not enrolled in care management.

More patients in the intervention group compared to control patients had one or more primary care visits within the year after hospital discharge (86.6% vs 72.3%, $P = 0.01$), and within 60 days after hospital discharge (68.0% vs 58.5%, $P = 0.14$), though the latter difference did not reach statistical significance. Interestingly, in an exploratory analysis, we found that hospitalization was more likely to introduce discontinuities in longitudinal primary care in control patients than in intervention patients: among patients who had had 3 or more primary care visits in the year prior to hospitalization, control patients were more likely than intervention patients to have 2 or fewer primary care visits during the year following hospitalization (33.8% vs 20.6%, $P = 0.03$).

Our mediation analyses suggested that neither post-hospitalization primary care utilization within 60 days nor care management services accounted for the lower rate of recurrent hospitalization in the intervention group (Table 3). The addition of post-hospitalization primary care utilization to the original model did not change the primary effect estimate, while controlling for care management enrollment actually increased the effect size. Finally, there was no difference in readmission rates between those receiving and not receiving brief-touch interventions (31.8 vs 25.7%, $P = 0.92$).

DISCUSSION

We found that a simple, telephone-based, transitional care intervention may be associated with lower 60-day rehospitalization rates in a cohort of Medicaid managed care patients. We observed a reduced rate of readmissions in the intervention, a difference that became significant after adjustment for important

confounders. Implicit in the design of the intervention was a recognition that patients' transitional care needs may vary, from help negotiating the post-discharge follow-up care process to more substantial and complex care management support needs. Our study adds to the current body of literature by examining an understudied, socioeconomically disadvantaged population in a resource-poor health system. Importantly, our study targeted the most intensive intervention to those with the highest anticipated needs based on a simple triage scheme. Such targeted approaches may be especially important in resource-poor settings.

Although our study was too small to characterize in detail the relative importance of specific elements of our intervention responsible for lower short-term rehospitalization rates, the study does highlight the diversity of transitional care needs. Patients received logistic support negotiating the health system, preventive health promotion, and patient empowerment through self-management and information access training. Nearly half the patients received a documented simple telephone-based intervention, and many of these patients did not require referral for intensive nurse care management. On the other hand, our needs assessment did identify over one-third of recently discharged patients as having more complex chronic disease management needs requiring assessment for ongoing nurse care management.

We were not able to identify the specific aspects of the intervention responsible for the observed reduction in recurrent hospitalization. Our mediation analysis suggests that triaging patients to a nurse care management program was not responsible for the observed reduction in recurrent hospitalizations. In fact, the analysis suggests these patients may have been more likely to require hospitalization, though our study was too small to allow strong conclusions to be drawn from a subgroup analysis. Past studies have similarly suggested that patients enrolled in care management may simply have a higher burden of disease or may have the need for hospitalization recognized more frequently.[36] Readmission rates were also similar between patients who did and did not receive a ''brief-touch'' intervention, possibly suggesting that patients with a higher level of need were appropriately selected to receive assistance.

Although our intervention appeared to increase post-discharge follow-up in primary care, this also did not explain the observed reduction in 60-day rehospitalization rates. Despite differences in post-discharge outpatient utilization patterns, there were relatively few patients in either group that had no follow-up, and the lack of effect may simply reflect inadequate power given our small sample size. On the other hand, the lack of association between outpatient utilization and 60-day rehospitalization rates may reflect a true lack of association between primary care follow-up and rehospitalization as seen in some studies, though a larger Medicare study did find an association.[36–38]

Improvements in outpatient utilization patterns, as we saw in this study, may be a laudable intermediate outcome benefit despite the lack of association with 60-day rehospitalization rates in our study. Short-term rehospitalization rates represent only one outcome and do not capture the expected slow, iterative benefits from chronic illness risk reduction, which may accrue over time, with stable longitudinal primary care and associated outpatient chronic illness care systems' innovations.[15,31,39,40]

Recent studies of transitional care interventions in publicly insured adults have produced mixed results. An evaluation of Medicare demonstration projects found largely negative results, but did find 2 successful programs in which the highest-risk patients seemed to benefit most, a finding that supports the importance of assessing risk and appropriately dosing interventions.[41] Another recent study in a socioeconomically disadvantaged population suggests the utility of an alternate transitional care approach centered on a pharmacy-based intervention.[30]

Ours is essentially a test-of-concept study, with several important limitations, which should temper widespread application of these results and suggest the need for further study. The sample size of our study was limited, and this, coupled with a slightly lower-than-expected event rate, limits our ability to detect potentially important effects. Our study was not a randomized trial, and we cannot discount the possibility that our results reflect the effect of residual or unmeasured confounders, especially those factors such as patient volume and care quality related to the discharging hospitals themselves. We attempted to minimize the effects of such confounders by balancing the types of hospitals included in each group, and by accounting for clustering by hospital in our statistical analysis. Important differences in baseline characteristics between the 2 groups also raise the possibility of residual confounding despite multivariate adjustment. However, the intervention group generally carried a higher burden of illness which would, if anything, have biased results towards the null. The pragmatic study design necessitated an intervention that was defined broadly and left much to the discretion of the staff delivering the intervention, rather than adherence to a strictly defined protocol. We believe this approach allows evaluation of systems innovations within limited-resource settings, but we acknowledge the challenges this presents in applying study results to other settings. Finally, only approximately 1 in 4 intervention patients were successfully contacted and completed the post-discharge survey within 1 week. The relatively low rate of successful telephone contact underscores the difficulty of implementing transitional care interventions dependent on post-discharge contact in a socioeconomically disadvantaged population

with unstable telephone access. Because only successfully contacted patients were included in the intervention group, selection bias is a potential issue, though again, most baseline discrepancies between the 2 groups suggest that intervention patients were more complex.

Transitions of care in uninsured and publicly insured nonelderly adults should be studied in greater depth. Outpatient access to care deficiencies may be compounded in these groups, especially as states face widespread budget crises. Future studies should examine the effects of inpatient to outpatient linkages for such patients. Also, studies should assess the impact of transitional care interventions on self-management, quality of care, and intermediate health outcomes in the outpatient setting after hospital discharge. Future research should taxonomize the range of transitional care needs by qualitatively evaluating subgroups of patients and delineating challenges faced by each group. For example, the post-discharge needs of marginally housed patients may be unique and could inform the development of interventions specifically targeted to this group.

In summary, we found that a simple, brief-touch intervention and needs assessment in the post-discharge period may be associated with reduced recurrent hospitalization rates in a cohort of chronically ill Medicaid managed care patients with diverse post-discharge care needs, though the exact mechanisms responsible for the observed improvements are unclear. Future studies should evaluate transitional care interventions targeted to needs in a larger group of chronically ill patients.

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