Comprehensive Discharge Planning and Home Follow-up of Hospitalized Elders
A Randomized Clinical Trial

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THE CONTINUED GROWTH OF DI-agnosis related groups (DRGs) and capitated reimbursement for inpatient care have increased pressures on hospitals to reduce length of stay. Consequently, elders with complex health needs are being discharged from hospitals earlier.[1-3] Home health services and families have served as safety nets for many of these patients. However, the rapid and dramatic growth of home health care has recently resulted in decreased access to services.[4-6] Potential consequences for elders with serious health problems include increased risk for preventable hospital readmissions and nursing home placement.[7-11]

Recent studies have evaluated innovative interventions to facilitate the transition of older adults from hospital to home.[12-17] Most of these efforts focused on elders hospitalized with specific health problems, such as congestive heart failure (CHF).[12-14,17] A randomized trial[17] that we completed in 1992 demonstrated short-term reductions in readmissions and decreased costs of care for hospital-

Context Comprehensive discharge planning by advanced practice nurses has demonstrated short-term reductions in readmissions of elderly patients, but the benefits of more intensive follow-up of hospitalized elders at risk for poor outcomes after discharge has not been studied.

Objective To examine the effectiveness of an advanced practice nurse–centered discharge planning and home follow-up intervention for elders at risk for hospital readmissions.

Design Randomized clinical trial with follow-up at 2, 6, 12, and 24 weeks after index hospital discharge.

Setting Two urban, academically affiliated hospitals in Philadelphia, Pa.

Participants Eligible patients were 65 years or older, hospitalized between August 1992 and March 1996, and had 1 of several medical and surgical reasons for admission.

Intervention Intervention group patients received a comprehensive discharge planning and home follow-up protocol designed specifically for elders at risk for poor outcomes after discharge and implemented by advanced practice nurses.

Main Outcome Measures Readmissions, time to first readmission, acute care visits after discharge, costs, functional status, depression, and patient satisfaction.

Results A total of 363 patients (186 in the control group and 177 in the intervention group) were enrolled in the study; 70% of intervention and 74% of control subjects completed the trial. Mean age of sample was 75 years; 50% were men and 45% were black. By week 24 after the index hospital discharge, control group patients were more likely than intervention group patients to be readmitted at least once (37.1% vs 20.3%; $P<.001$). Fewer intervention group patients had multiple readmissions (6.2% vs 14.5%; $P = .01$) and the intervention group had fewer hospital days per patient (1.53 vs 4.09 days; $P<.001$). Time to first readmission was increased in the intervention group ($P<.001$). At 24 weeks after discharge, total Medicare reimbursements for health services were about $1.2 million in the control group vs about $0.6 million in the intervention group ($P<.001$). There were no significant group differences in postdischarge acute care visits, functional status, depression, or patient satisfaction.

Conclusions An advanced practice nurse–centered discharge planning and home care intervention for at-risk hospitalized elders reduced readmissions, lengthened the time between discharge and readmission, and decreased the costs of providing health care. Thus, the intervention demonstrated great potential in promoting positive outcomes for hospitalized elders at high risk for rehospitalization while reducing costs.

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ized elders with medical cardiac conditions managed according to a comprehensive discharge planning protocol implemented by advanced practice nurses (APNs). Findings suggested that elders at risk for poor outcomes after discharge might benefit from more intensive home follow-up.

The objective of this randomized clinical trial was to examine the effectiveness of an APN-centered comprehensive discharge planning and home follow-up protocol for elders hospitalized with 1 of several common medical and surgical reasons for admission. Based on our earlier research, we hypothesized that this intervention would improve patient health outcomes and reduce service utilization and health care costs compared with usual hospital and home care.

METHODS
Study Sample

The study was conducted at the Hospital of the University of Pennsylvania and the Presbyterian Medical Center of the University of Pennsylvania Health System and was approved by the institutional review boards at both institutions. All subjects screened for study

Figure 1. Patient Flow Diagram

participation were age 65 years or older and were admitted from their homes to either hospital between August 1992 and March 1996 with 1 of the following diagnoses: CHF, angina, myocardial infarction, respiratory tract infection, coronary artery bypass graft, cardiac valve replacement, major small and large bowel procedure, and orthopedic procedures of lower extremities. These diagnoses were among the top 10 reasons for Medicare beneficiary hospitalization in 1992.[18] The DRGs were assigned at hospital admission and validated at discharge.

Eligible patients had to speak English, be alert and oriented when admitted, be able to be contacted by telephone after discharge, and reside in the geographic service area. Patients also had to meet at least 1 of the following criteria associated with poor postdischarge outcomes in our earlier study[17]: age 80 years or older; inadequate support system; multiple, active, chronic health problems; history of depression; moderate-to-severe functional impairment; multiple hospitalizations during prior 6 months; hospitalization in the past 30 days; fair or poor self-rating of health; or history of nonadherence to the therapeutic regimen.

Of the 1296 patients screened, 28% were enrolled, a percentage consistent with randomized clinical trials involving similar populations.[13,19] The 72% not enrolled comprised those discharged before screening (29%) and refusals (43%) (**FIGURE 1**). Enrollees and refusals were similar in race (P = .99) and sex (P = .25). Mean ages differed by 2 years (75.4 years for enrollees vs 77.3 years for refusals, $P<.001$).

Study Design

Patients were enrolled in the study within 48 hours of hospital admission by research assistants (RAs) blinded to study groups and hypotheses. After screening patients for eligibility and obtaining informed consent, RAs notified the project manager who assigned patients to study groups using a computer-generated algorithm. The project manager contacted APNs if patients were assigned to the intervention group. Baseline data on

both groups (ie, sociodemographic and health status characteristics, functional status, and depression) were collected at enrollment by RAs using standardized instruments (**TABLE 1**).

Control Group. Control group patients received discharge planning that was routine for adult patients at study hospitals. If referred, control group patients received standard home care consistent with Medicare regulations.
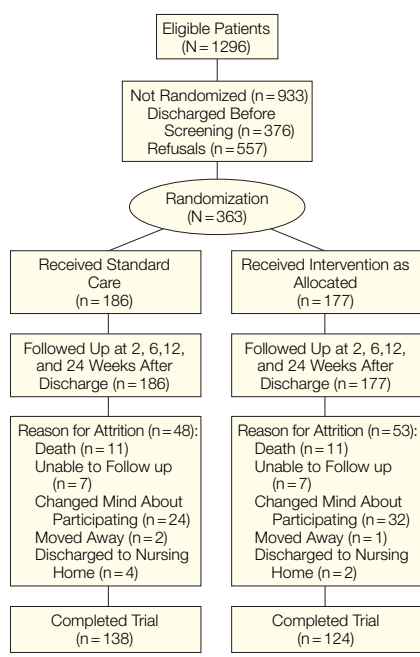
Intervention Group. The intervention extended from hospital admission through 4 weeks after discharge. The APNs assumed responsibility for discharge planning while the patient was hospitalized and substituted for the visiting nurse (VN) during the first 4 weeks after the index hospital discharge. Over the course of the study, the protocol was implemented by 5 part-time, master's-prepared, gerontological APNs with a mean of 6.5 years (range, 2-9 years) postdegree experience in hospital and/or home care of older adults.

Intervention group patients and their caregivers, if available, received a standardized comprehensive discharge planning and home follow-up protocol designed specifically for elders at high risk for poor postdischarge outcomes. The protocol guided patient assessment and management and specified a minimum set of APN visits. However, an important component of the intervention was the ability of the APN, in collaboration with the patient's physician, to individualize patient management within the bounds of the protocol.

The protocol was implemented as follows: initial APN visit within 48 hours of hospital admission; APN visits at least every 48 hours during the index hospitalization; at least 2 home APN visits (1 within 48 hours after discharge, a second 7-10 days after discharge); additional APN visits based on patients' needs with no limit on number; APN telephone availability 7 days per week (8 AM to 10 PM on weekdays and 8 AM to noon on weekends); and at least weekly APN-initiated telephone contact with patients or caregivers.

Hospital Visits. The APNs used data generated from instruments of estab-

lished validity and reliability (Table 1) and their clinical skills to identify patients' and caregivers' discharge needs. Assessment focused on nature and severity of health problems; age-related changes; physical, functional, cognitive, and emotional health status; and discharge goals. Caregiver assessment also included social support,[20] knowledge and skills, strain,[21] and need for formal support. Based on this information, APNs collaborated with the patient, physician, caregiver, and other team members in designing an individualized discharge plan. The APN implemented the plan through direct clinical care, patient and caregiver education, validation of learning, and coordination of needed home services. The APNs attempted to schedule hospital meetings with caregivers present. Within 24 hours of discharge, physicians wrote discharge orders and APNs scheduled the initial home visit.

Home Visits, Telephone Availability, and Outreach. The APNs completed physical and environmental assessments and targeted efforts at increasing patients' and caregivers' ability to manage unresolved health problems. Based on individual needs, APN interventions focused on medications, symptom management, diet, activity, sleep, medical follow-up, and the emotional status of patients and caregivers. A variety of strategies reinforced teaching including written instructions and medication schedules. Through home visits and telephone follow-up, APNs addressed questions or concerns from patients, caregivers, or health team members; monitored patients' progress; and collaborated with physicians to make adjustments in therapies and obtain referrals for needed services.

Discharge Summaries. At completion of the intervention, APNs sent written summaries to patients, caregivers, physicians, and other providers to whom APNs had referred patients, detailing the plans, goal progression, and ongoing concerns.

Outcome Measures

Outcome measures included hospital readmissions related to any cause, recur-

Table 1. Sociodemographic and Health Characteristics of Elderly Patients (N = 363)*

Characteristic	Intervention (n = 177)	Control (n = 186)	P Value
Age, y	75.5 ± 6.3	75.3 ± 6.0	.75
Sex			
Men	54	46	.14
Race			
Black	44	46	.76
White	56	54	
Education			
<High school	51	44	.15
≥High school	49	56	
Not employed	85	86	.75
Social support			
Spouse	44	43	
Other relative and/or friend	27	26	.93
None	29	31	
Income, $			
<10 000	42	42	
10 000-19 000	32	28	.56
≥20 000	26	30	
Medicaid	11	9	.61
Diagnosis related group†			
Angina/myocardial infarction	16	15	
Congestive heart failure	30	30	
Respiratory	8	9	
Valve replacement	11	9	.97
Coronary artery bypass graft	22	25	
Bowel	4	5	
Orthopedic	8	8	
Type of admission			
Elective	42	40	
Emergency	46	44	.75
Transfer	13	16	
Index length of stay, total (range), d	1587 (2-54) [9.2 ± 6.7]	1670 (1-60) [9.1 ± 6.7]	.80
Subjective health rating[24] by patient on admission			
Excellent or good	42	45	.63
Fair or poor	58	55	
Short Portable Mental Status Questionnaire[25]‡	9.4 ± 0.9	9.3 ± 1.0	.42
Center for Epidemiologic Studies Depression Scale[23]§	12.1 ± 10.0	10.7 ± 9.8	.26
Physician visits within the past 6 mo	5.5 ± 4.1	6.3 ± 5.6	.79
Hospital admissions within the past 6 mo	0.9 ± 1.1	1.0 ± 1.1	.25
Hospital discharges within the past 30 d	0.36 ± 0.6	0.44 ± 0.7	.17
No. of health conditions‖	5.3 ± 1.8	5.3 ± 1.8	.92
No. of daily medications¶	5.3 ± 2.7	5.2 ± 2.7	.82
Functional status based on the Enforced Social Dependency Scale[22]#			
Personal	14.5 ± 6.1	14.6 ± 6.0	.90
Social	7.9 ± 2.6	8.0 ± 2.8	.78
Total	22.4 ± 8.1	22.6 ± 8.4	.86

*Values are expressed as percentage or mean ± SD unless otherwise indicated.
†Diagnosis related group numbers are: angina/myocardial infarction, 121, 122, 124, and 140; congestive heart failure, 127; respiratory, 79, 88, 89, and 96; valve replacement, 104 and 105; coronary artery bypass graft, 106 and 107; bowel, 148; and orthopedic, 209 and 210.
‡Values below 6 on a zero to 10 scale equal cognitive impairment.
§Values below 16 on a zero to 60 scale equal not depressed.
‖Active health problems requiring therapy as reported by patients and documented in the medical record.
¶Applies to prescription drugs only.
#Higher scores on a 10 to 51 scale equal disability.

rence or exacerbation of the index hospitalization DRG, comorbid conditions, or new health problems. The primary intervention efficacy test was defined on the basis of time to first readmission for any reason. Secondary outcomes were cumulative days of rehospitalization, mean readmission length of stay, number of unscheduled acute care visits after discharge, estimated cost of postindex hospitalization health services, functional status, depression, and patient satisfaction. Outcome data were collected by RAs blinded to study groups and hypotheses.

Standardized telephone interviews with patients at 2, 6, 12, and 24 weeks after index hospital discharge identified patients' readmissions to any hospital and unscheduled acute care visits to physicians, clinics, and emergency departments. Data on functional status (measured by the Enforced Social Dependency Scale),[22] depression (assessed using the Center for Epidemiologic Studies Depression Scale),[23] and patient satisfaction (measured by an investigator-developed instrument) were also collected during these interviews.

Data on the number, timing, reasons, and charges for readmissions, unscheduled acute care visits, and home visits by VNs or APNs (intervention group only), allied health professionals, and assistive personnel were abstracted from patients' records (inpatient, outpatient, and home care) and bills and recorded on standardized data collection forms. Reasons for readmissions were validated in writing by patients' physicians. The RAs categorized the reasons using discharge diagnoses as index-related (discharge diagnosis same as index hospitalization); comorbid (discharge diagnosis 1 of comorbid conditions identified at index hospitalization); or new health problem (not related to index diagnosis or comorbid condition during index admission). Estimated resource costs were generated using standardized Medicare reimbursements. Costs of pharmaceuticals, over-the-counter drugs, assistive devices, other supplies, and indirect costs (eg, productivity losses by patients and caregivers) were not included.

Statistical Analysis

For patients who did not complete the entire 24-week postindex hospitalization study period (death or withdrawal), data collected between randomization and withdrawal were used in the analyses, performed according to the intention-to-treat principle, and censored at time of death or withdrawal.

Baseline data for intervention and control groups were compared using χ^2 tests for categorical variables, t tests for normally distributed continuous variables, and the Wilcoxon rank sum test for abnormally distributed variables. Based on a prior clinical trial,[17] we estimated that in each of the 2 study groups, 125 patients had to complete the study to detect a 50% reduction in hospital admission rates (2-sided α, .05 and power, 0.80, based on a control group readmission rate of 0.30).[26]

Descriptive comparisons between groups used χ^2 tests for the proportions of patients readmitted, t tests or Wilcoxon rank sum tests for number of readmissions, total days of hospitalization, mean readmission length of stay, number of acute care visits, and reimbursements for postdischarge health services. Multivariate analysis of variance tested for measures of functional status, depression, and patient satisfaction.

Kaplan-Meier survival curves[27] were used to compare control and intervention groups to account for unequal follow-up times for the primary end point of time to first readmission for any reason and the secondary outcomes of time to first index-related readmission and time to first readmission or death. Crude testing of the primary hypothesis that the 2 cumulative readmission-free rate curves were identical was performed using a log-rank statistic.[28] Potentially confounding variables were adjusted using proportional hazards regression,[29] providing an adjusted hospital readmission rate ratio (incidence density ratios) along with 95% confidence intervals (CIs). A final multivariate model included covariates retaining their bivariate significance (P<.05) along with intervention group to obtain adjusted significance levels and adjusted risk estimates with 95% CIs.

Variables were removed in a stepwise manner. Intervention group interactions with significant index diagnoses were assessed by adding appropriate terms to the model.

Group differences in both charges and actual Medicare reimbursements for postindex hospitalization health services were examined. The more conservative reimbursement results are reported. Although reimbursements are not the same as costs, they are a reasonable proxy and provide reasonably unbiased estimates of relative differences in cost between intervention and control groups. The index hospital reimbursement included the costs of discharge planning services provided by registered nurses, social workers, and discharge planners. Since the APN hospital visits in this intervention substituted for standard discharge planning, no additional costs were assigned to this phase of the intervention. The cost of APN services after discharge was estimated by assessing APN intervention–related effort (from detailed logs) and applying Medicare reimbursement rates. In the primary analysis, postdischarge APN and VN services were assigned the same rate since this reflected Medicare's reimbursement during the study period. Sensitivity analyses were conducted using higher estimates for APN services (actual APN reimbursement plus 20%), reflecting their increased skill and training relative to VNs, and representative annual salary for APNs plus benefits was weighted by percentage of effort attributable to the intervention.

RESULTS
Study Patients

A total of 363 patients were enrolled in the study (Table 1). The 2 study groups were similar in all sociodemographic and baseline health characteristics, including index hospitalization DRG, type of admission, and length of stay. Mean age of the entire sample was 75 years, 50% were men, and 45% were black.

The attrition rate from the intervention group (including deaths) was 30% (53/177) compared with 26% (48/186) for the control group (P = .26). Of the 363

enrolled patients, 22 (6%) died by 24 weeks after discharge, with 11 deaths in each of the 2 study groups (Figure 1). Most of the deaths occurred during the index hospitalization or in the first 6 weeks after discharge (4% control, 5% intervention). An additional 4% in each of the study groups withdrew because of inability to complete follow-up interviews (changes in health status such as stroke or cognitive decline). The remaining withdrawals (16% control, 20% intervention; $P = .64$) occurred because patients changed their minds about participating (13% control, 18% intervention; $P = .28$); moved away (1% control, 1% intervention); or were discharged to a nursing home (2% control, 1% intervention). Intervention group withdrawals were slightly higher because a few patients in this group decided, after enrolling, to maintain existing VN relationships and services.

Study follow-up did not differ significantly between control and intervention groups (18.1 weeks vs 19.1 weeks; $P = .41$). The 28% attrition rate was consistent with rates reported in other randomized clinical trials with a similar patient population.[17,19,30] The 262 patients who completed the study and the 101 persons in the attrition group did not significantly differ in sociodemographic variables and severity of illness measures (eg, number of comorbid conditions).

Readmissions

Control group patients were more likely than intervention group patients to be readmitted at least once (**TABLE 2**; 37.1% vs 20.3%; $P<.001$; relative risk, 1.8; 95% CI, 1.3-2.6). The 16.8% absolute reduction in hospital readmissions at 24 weeks represented a 45% relative reduction in control group readmission rate. More control group patients had multiple readmissions during the 24-week period than intervention group patients (14.5% vs 6.2%; $P = .01$; relative risk, 2.3; 95% CI, 1.2-4.6).

The intervention resulted in fewer total hospital readmissions at 24 weeks after index hospitalization discharge (107 control vs 49 intervention; rank sum test, $P<.001$). The reduction in readmissions was significant during both the first

6 weeks after discharge ($P<.001$) and the 6-week to 24-week period ($P = .02$).

Of the 156 readmissions, 60.3% were related to the index hospitalization, 22.4% to comorbid conditions, and 17.3% to new health problems. There were fewer readmissions related to the index hospitalization in the intervention group compared with the control group (30 vs 64; $P = .005$). There were trends toward reduced intervention group readmissions due to comorbid conditions (10 vs 25; $P = .06$) and new health problems (9 vs 18; $P = .10$).

At 24 weeks, control group patients experienced 760 days of hospitalization, compared with 270 days in the intervention group ($P<.001$). Hospital days per patient were higher in the control group compared with the intervention group (4.09 vs 1.53; rank sum test, $P<.001$ [with or without adjustment for follow-up time]). The mean length of stay for readmitted patients in the control group (n = 69) was higher than the in-

tervention group (n = 36), (11.0 ± 10.6 days vs 7.5 ± 4.8 days; $P<.001$).

Time to first readmission for any reason was increased in the intervention group (log-rank $\chi^2_1 = 11.1$, $P<.001$) (**FIGURE 2**). Twenty-five percent of control patients were readmitted within 48 days after index hospital discharge (95% CI, 34-63 days), whereas 25% of intervention patients were readmitted within 133 days (lower 95% confidence limit, 78 days; upper 95% confidence limit, not estimable). The effect of the intervention on time to first readmission for any reason remained significant ($P<.001$, **TABLE 3**) after adjusting for simultaneously significant variables including self-reported health status, number of hospitalizations in the previous 6 months, living arrangements, and diagnosis of CHF. The time to index diagnosis-related readmissions similarly was increased in the intervention group (log-rank $\chi^2_1 = 4.97$, $P = .03$).

Statistical evidence was weak that the relative efficacy differed between pa-

Table 2. Readmissions and Hospital Days Within 24 Weeks of Discharge From Index Hospitalization

	Intervention (n = 177)	Control (n = 186)	Arithmetic Difference	P Value*
No. (%) of patients readmitted				
≤1 Time	36 (20.3)	69 (37.1)	−16.80%	<.01
≥2 Times	11 (6.2)	27 (14.5)	−8.30%	.01
No. of readmissions				
Index-related	30	64	−34	.005
Comorbidity-related	10	25	−15	.06
New health problem	9	18	−9	.10
Total	**49**	**107**	**−58**	<.001
Time of readmissions, No.				
Discharge to 6 wk	17	47	−30	<.001
6 to 24 wk	32	60	−28	.02
Time spent in hospital, d				
All	270	760	−490	
Per patient, mean ± SD	1.53 ± 3.69	4.09 ± 8.35	−2.56	<.001
Median	0	0		
25th Percentile	0	0		
50th Percentile	0	0		
75th Percentile	0	4		
Per readmitted patient, mean ± SD†	7.50 ± 4.7 (n = 36)	10.1 ± 10.6 (n = 69)	−3.51	<.001
Median	6.5	7		
25th Percentile	4	4		
50th Percentile	6.5	7		
75th Percentile	10.75	14.5		

*Wilcoxon rank sum tests used to compare the distribution of per patient rates for number of readmissions and hospital days; χ^2 for proportion of patients readmitted.
†The intervention group had 36 subjects and the control group had 69 subjects.

tients with and without CHF ($\chi^2_1 = 2.47$, $P = .11$). The crude rates for any readmission per year among control and intervention patients without a CHF diagnosis were 1.17 (41 events/35.2 years) and 0.42 (16 events/38 years), respectively, for a crude relative rate of 2.8. Among CHF patients, the crude control and intervention group admission rates per year were 1.93 (25 events/13 years) and 1.48 (19 events/12.8 years), respectively, for a crude relative ratio of 1.30. In clinical terms, however, the intervention's relative efficacy was significantly larger for patients without CHF compared with patients with CHF (rate ratio, 1.6 vs 2.7).

Relative efficacy did not depend on study site for time to any first admission ($P = .82$). When a secondary end point defining deaths as an event rather than being censored was examined, time until first readmission for any reason remained increased in the intervention group (rate ratio, 1.6; 95% CI, 1.1-2.3; $P = .01$).

Other Patient and Health Services Outcomes

Intervention and control groups were similar in mean functional status ($P = .33$), depression scores ($P = .20$), and patient satisfaction ($P = .92$). At 24 weeks, mean functional status scores in both groups were slightly improved over baseline (21.5 to 19.2) as were mean depression scores (10.7 to 6.6). Mean patient satisfaction scores showed little change over time; both groups remained highly satisfied with care.
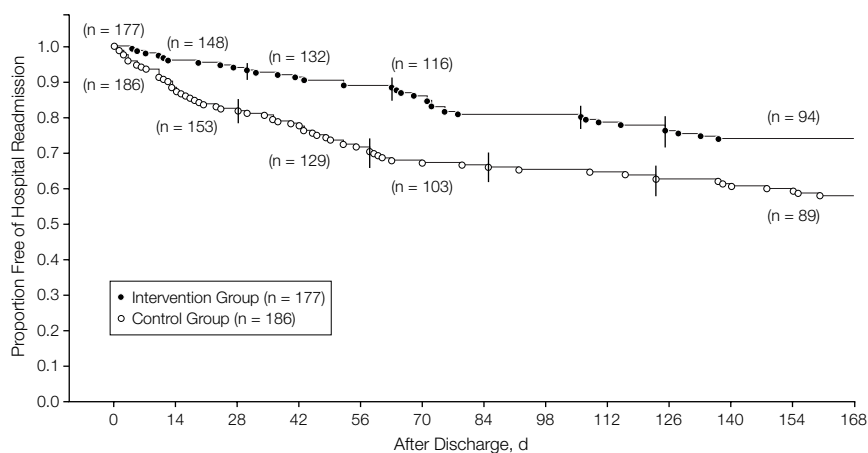
At 24 weeks after discharge, the control and intervention groups did not significantly differ in the mean number of unscheduled acute care visits to physicians or emergency departments, or home visits by VNs or APNs, allied health professionals, or home health aides (**TABLE 4**). The pattern of home visits by nurses immediately after index hospital discharge differed between study groups. Only 44% of the control group received at least 1 home visit by VNs during the first 2 weeks after discharge. Consistent with the study protocol, all of the intervention group received at least 1 APN visit. Of the 69 control patients rehospitalized at least once, 51% received VN visits during the immediate postdischarge period.

Economic Impact

At 24 weeks, total and per-patient imputed reimbursements for postindex acute health services in the control group were approximately twice as much as that of the intervention group ($1 238 928 vs $642 595 [$P < .001$] and $6661 vs $3630 [$P < .001$]; **TABLE 5**). Intervention group cost savings were driven by the control group's substantially greater total DRG reimbursements for all hospital readmissions at 24 weeks after discharge ($1 024 218 vs $427 217; $P < .001$). Substitution of charges, adjusted charges, and weighted APN average annual salary and benefits for reimbursements as measures of resource use further increased the estimated differences between groups. Total reimbursements for other postdischarge acute care visits were not significantly different between study groups (Table 4; $P = .72$).

COMMENT

This study demonstrated that a comprehensive discharge planning and home follow-up intervention designed specifically for elders at high risk for poor posthospital discharge outcomes and implemented by gerontological APNs reduced hospital readmissions, lengthened the time to first readmission, and decreased cost of care. Improved patient outcomes and health care savings have also been demonstrated when a similar approach to care was tested with women with high-risk pregnancies and low-birth-weight infants.[31-33]

By 24 weeks after the index hospital discharge, 37% of the control group had been rehospitalized compared with 20%

Figure 2. Time to First Hospital Readmission for Any Reason

The relative readmission rates comparing the control group with the intervention group are 1.96 (95% confidence interval [CI], 1.31-2.92) for the crude rate and 2.03 (95% CI, 1.34-3.08) for the adjusted rate. The survival curve distance is $P < .001$ (calculated with the log-rank test).

Table 3. Time to First Hospital Readmission by Patient Characteristics (Multivariate Cox Proportional Hazards Model)

Variable	Incidence Density Ratio	95% Confidence Interval	P Value
Control group vs intervention group	2.03	1.33-3.08	<.001
Fair or poor self-rating vs good or excellent self-rating	2.18	1.38-3.45	<.001
No. of prior hospitalizations within the past 6 mo	1.29	1.09-1.52	<.002
Living with relative or friend vs spouse	0.59	0.37-0.94	.03
Living with relative or friend vs alone	0.50	0.29-0.84	.009
Congestive heart failure vs other diagnosis related groups	1.64	1.07-2.50	.02

of the intervention group. Although non-randomized studies[12,34,35] have demonstrated greater reductions in rehospitalization rates for adult cardiac patients, only 1 randomized clinical trial, limited to patients with congestive heart failure, demonstrated a similar absolute readmission rate reduction.[13] In contrast to this study that included rehospitalizations to any hospital, other studies have examined only readmissions to study hospitals[34] or did not specify if readmissions to hospitals other than study hospitals were included.[13,35]

Study findings are especially important given the current attention to new models of patient care management. In contrast to the typical disease management model that focuses on all patients hospitalized with a specific primary condition, such as heart failure, this intervention targeted elders hospitalized with common medical and surgical conditions. We believe that the focus of the clinical intervention on the combined effects of primary health problems, comorbid conditions, and other health and social issues common in this patient population, rather than on the management of a single disease, was a major factor in its success.

Other factors may have contributed to these observed outcomes. The target study population, elders at high risk for poor outcomes after hospital discharge, was not limited to those who met current Medicare home-care eligibility requirements. Approximately one third of control patients who did not receive a visit from a VN immediately after the index discharge were rehospitalized. The factors that influence health professionals' decision making regarding which patients are referred for home care is an important area for further study. Home visits alone, however, do not explain the differences in group outcomes demonstrated in this study. One in 2 control patients visited by VNs immediately after the index hospital discharge were rehospitalized compared with 1 in 5 intervention patients visited by APNs.

While the protocol tested in this study was derived from current research, the framework that guided APNs' decision making was individualized care. In contrast to most VNs who are bachelor's-prepared generalists, the APNs who implemented this protocol were master's-prepared specialists in gerontological nursing. This intervention benefited from APNs' clinical acumen as well as their expertise in communicating, collaborating, and coordinating care with physicians and other health care professionals. For example, a preliminary analysis of APNs' case studies suggests that joint clinical decision making with physicians resulted in timelier interventions in the home and prevented negative outcomes.

Unlike home care nurses, whose visit

Table 4. Acute Care Visits, Home Visits, and Reimbursements (Costs) for Health Services After Discharge for 24 Weeks

Health Service	Intervention (n = 177)*		Control (n = 186)*		P Values	
	Visits†	Costs, $	Visits†	Costs, $	Visits	Costs
Acute care visits						
Physician's office	1.5 ± 2.2	24 937	1.6 ± 2.2	27 121	.59	.82
Emergency department‡	0.1 ± 0.5	9138	0.2 ± 0.4	10 600	.21	.78
Home visits						
Nurses						
Visiting	3.1 ± 7.2	40 097	7.1 ± 12.0	101 049	.05	.05
Advanced practice	4.5 ± 4.3§	61 600	0	0	<.001	<.001
Advanced practice and visiting	7.6 ± 9.4	101 697	7.1 ± 12.0	101 049	.65	.73
Physical therapists	3.5 ± 8.8	44 819	3.1 ± 8.3	40 803	.32	.62
Occupational therapists	0.1 ± 0.9	912	0.2 ± 1.4	2722	.95	.33
Speech therapists	0.03 ± 0.5	474	0	0	.31	.32
Social workers	0.03 ± 0.3	676	0.07 ± 0.4	1252	.23	.40
Home health aides	3.7 ± 11.8	32 725	3.6 ± 12.5	31 163	.46	.78
Total Visits and Costs	16.6 ± 22.9	**215 378**	15.9 ± 25.9	**214 710**	.77	.72
Median	8		4			
25th Percentile	3		0			
50th Percentile	8		4			
75th Percentile	24.5		23.3			

*Visits and costs are aggregate values. Costs were standardized for unequal follow-up by converting to costs per week in the study before significance testing.
†Values are measured as mean ± SD.
‡Includes only those that did not result in hospital admissions.
§Mean (SD) number of advance practice nurses in-hospital visits, 4.0 (3.2).

Table 5. Reimbursements (Costs) for Readmissions, Acute Care Visits, and Home Visits for 24 Weeks After Discharge

Health Service	Aggregate Costs, $*		P Value
	Intervention (n = 177)	Control (n = 186)	
Readmissions			
Index-related	249 436	596 741	<.004
Comorbidities	110 198	250 720	.10
New problems	67 583	176 757	.09
Total Readmissions	**427 217**	**1 024 218**	<.001
Acute care visits (physician's office, emergency department)	34 075	37 721	.74
Home visits			
Nurses	101 697	101 049	.72
Other visits	79 606	75 940	.70
Totals	**642 595**	**1 238 928**	<.001
Per patient	3630	6661	<.001

*Cost values were standardized for unequal follow-up by converting to costs per week in the study before significance testing.

pattern is constrained by reimbursement and other barriers, APNs used their judgment to define the frequency, intensity, and focus of contacts needed to meet patient and caregiver needs. Consequently, the time and focus of services provided by the APNs varied.

Functional status was not improved with this intervention, a finding consistent with published data from other discharge planning and home care studies in recent years.[30,36] Reductions in rehospitalizations and cost in the absence of differences in functional status may indicate that the APN-based intervention achieved its benefit by enhancing the capacity of high-risk elders to better cope with their multiple medical problems and disabilities.[37] Mean scores at all data collection points revealed little evidence of depressive symptoms in this study sample.[24] The skewed distribution of patient satisfaction scores suggests the need for more sensitive items.

At 6 months, the intervention generated estimated savings in Medicare reimbursements for all postindex hospital discharge services of almost $600 000 for the 177 intervention group beneficiaries, a mean per-patient savings of approximately $3000. Thus, the intervention was dominant from an economic perspective—improved outcomes were achieved at reduced cost. Virtually all of the savings resulted from reductions in rehospitalizations, with use of nonhospital postdischarge health services similar in intervention and control groups. When extrapolated to the number of older adults hospitalized each year with similar conditions, the potential patient benefits and savings to the Medicare system resulting from this intervention are substantial.

In conclusion, an APN-centered discharge planning and home care intervention for at-risk, hospitalized elders reduced readmissions, lengthened the time between discharge and readmission, and decreased the costs of providing health care. This intervention has great potential in promoting positive outcomes for this challenging group of elders while reducing costs.

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