

## SPECIAL ARTICLE

## DOES INCREASED ACCESS TO PRIMARY CARE REDUCE HOSPITAL READMISSIONS?

MORRIS WEINBERGER, PH.D., EUGENE Z. ODDONE, M.D., M.H.SC., AND WILLIAM G. HENDERSON, PH.D.,  
FOR THE VETERANS AFFAIRS COOPERATIVE STUDY GROUP ON PRIMARY CARE AND HOSPITAL READMISSION\*

**Abstract Background.** For chronically ill patients, re-admission to the hospital can be frequent and costly. We studied the effect of an intervention designed to increase access to primary care after discharge from the hospital, with the goals of reducing readmissions and emergency department visits and increasing patients' quality of life and satisfaction with care.

**Methods.** In a multicenter randomized, controlled trial at nine Veterans Affairs Medical Centers, we randomly assigned 1396 veterans hospitalized with diabetes, chronic obstructive pulmonary disease, or congestive heart failure to receive either usual care or an intensive primary care intervention. The intervention involved close follow-up by a nurse and a primary care physician, beginning before discharge and continuing for the next six months.

**Results.** The patients were severely ill. Half of those with congestive heart failure (504 patients) had disease in New York Heart Association class III or IV; 30 percent of those with diabetes (751 patients) had end-organ dam-

age; and a quarter of those with chronic obstructive pulmonary disease (583 patients) required home oxygen treatment or oral corticosteroids. The patients had extremely poor quality-of-life scores. Although they received more intensive primary care than the controls, the patients in the intervention group had significantly higher rates of readmission (0.19 vs. 0.14 per month,  $P=0.005$ ) and more days of rehospitalization (10.2 vs. 8.8,  $P=0.041$ ). The patients in the intervention group were more satisfied with their care ( $P<0.001$ ), but there was no difference between the study groups in quality-of-life scores, which remained very low ( $P=0.53$ ).

**Conclusions.** For veterans discharged from Veterans Affairs hospitals, the primary care intervention we studied increased rather than decreased the rate of rehospitalization, although patients in the intervention group were more satisfied with their care. (N Engl J Med 1996;334:1441-7.)

©1996, Massachusetts Medical Society.

**D**ESPITE strategies such as prospective payment and required approval for hospitalization before admission, costs of inpatient care in 1993 accounted for \$327 billion, or 42 percent of national spending for medical care.<sup>1</sup> Readmissions account for up to half of all hospitalizations and 60 percent of hospital costs.<sup>2-5</sup> Besides the expense, readmissions may reflect poor-quality care.<sup>6-9</sup>

There is pressure both to reduce inpatient services and to deliver high-quality care. One efficient strategy would be to identify patients who are at increased risk for hospital readmission and to provide them with intensive primary care.<sup>8,10</sup> Because of their multiple coexisting medical illnesses, poor functional status, and low socioeconomic status,<sup>11-14</sup> veterans discharged from the General Medicine Service of Veterans Affairs Medical Centers are one such group.<sup>6,15</sup>

We conducted a multicenter randomized, controlled trial of a program designed to increase access to pri-

mary care for such veterans. Our primary hypothesis was that this program would reduce the patients' rates of readmission and days of hospitalization during the six months after discharge. We also examined the effects of the program on the time to the first readmission, the proportion of patients readmitted, and the number of emergency department visits, and on health-related quality of life and satisfaction with care.

## METHODS

## Study Sites

This multicenter randomized, controlled trial was conducted at nine Veterans Affairs Medical Centers (see Appendix) chosen for diversity of location and academic affiliation; the sites were not selected on the basis of their readmission rates. Before the investigation began, all the study personnel met to review and standardize the study protocol. The study was approved and reviewed annually by the human rights committee of the Hines Veterans Affairs Cooperative Studies Program Coordinating Center. The Research and Human Subjects Committee of each participating Veterans Affairs Medical Center also approved the study.

## Criteria for Eligibility

Patients hospitalized in the General Medicine Service were potentially eligible if they had a diagnosis of diabetes mellitus, chronic obstructive pulmonary disease, or congestive heart failure that was documented in the medical record at or before the time of the index admission (and that was not necessarily the reason for that admission). We selected these three diseases because they are prevalent among veterans, because patients with these diseases are commonly readmitted, and because hospital readmissions to treat these diseases might be reduced if primary care physicians provided intervention to outpatients.

Patients were excluded if they were already receiving continuous care at a primary care clinic (for example, in general medicine or geriatrics); if they were receiving dialysis, chemotherapy, or radiation therapy; if they resided in, or planned to be discharged to, a nursing home; if they were admitted only to undergo a procedure; if they were participating in another active study; if they were hospitalized to rule

From the Richard L. Roudebush Veterans Affairs Medical Center (VAMC), Indianapolis (M.W.); the Center for Health Services Research in Primary Care, Durham VAMC, Durham, N.C. (E.Z.O.); and the Center for Cooperative Studies in Health Services, Hines VAMC, Hines, Ill. (W.G.H.). Address reprint requests to Dr. Weinberger at Health Services Research and Development (11H), Richard L. Roudebush VAMC, 1481 W. Tenth St., Indianapolis, IN 46202.

Supported by the Health Services Research and Development Service, Department of Veterans Affairs, through Veterans Affairs Cooperative Study in Health Services No. 8 and the Career Development Program.

\*Other contributing authors were Anita Giobbie-Hurder (Hines VAMC, Hines, Ill.), Maria Horner (Durham VAMC, Durham, N.C.), Francis Goldstein (William Jennings Bryan Dorn VAMC, Columbia, S.C.), Paulette Ginier (Fresno VAMC, Fresno, Calif.), Charles Mengel (Dwight D. Eisenhower VAMC, Leavenworth, Kans.), James Huey (Cincinnati VAMC, Cincinnati), David A. Asch (Philadelphia VAMC, Philadelphia), Neil Farber (Philadelphia VAMC), Lawrence Loo (Jerry Pettis Memorial VAMC, Loma Linda, Calif.), Edward Mack (Brooklyn VAMC, Brooklyn, N.Y.), David M. Smith (Richard L. Roudebush VAMC, Indianapolis), Denise M. Hynes (Hines VAMC), and John R. Feussner (Durham VAMC). Additional participating institutions and investigators are listed in the Appendix.

out cancer or to receive terminal care; if they did not speak English; if they had a score of 5 or less on the Mental Status Questionnaire<sup>16</sup> and had no care giver; if they refused to give informed consent; or if they had no access to a telephone.

### Study Design

Research assistants at each site screened all patients admitted to the General Medicine Service. Potentially eligible patients were referred to the study nurse, who determined their eligibility, obtained informed consent, and collected base-line data. The patients were then randomly assigned to receive either customary post-discharge care or the primary care intervention. They were stratified within each study site according to entitlement status (a variable derived from the patient's service-connection status, which can affect access to outpatient care) and index disease (diabetes, congestive heart failure, chronic obstructive pulmonary disease, or more than one of these). The patients' group assignments were made by telephoning the statistical coordinating center.

All the patients were followed for six months. The research assistant, who was unaware of the patients' group assignments, telephoned the patients 30 and 180 days after randomization to assess their quality of life, satisfaction with care, and use of health care services outside the Veterans Affairs Medical Centers.

### Intervention Group

At each site, the intervention was delivered by a team consisting of one licensed registered nurse and one primary care physician. The study nurses were experienced in patient care (mean length of experience, 5.8 years; range, 2 to 10); four had prior clinical experience with the Department of Veterans Affairs. There were 96 attending physicians, 6 fellows in general medicine, and 12 house staff. The attending physicians were predominantly board-certified in internal medicine (70 physicians) or family practice (3 physicians); they had completed medical school a mean of 12.7 years earlier and had a mean of 4.8 years of Veterans Affairs experience.

The intervention (the details of which are specified in Table 1) had both an inpatient component, which began immediately after randomization, and an outpatient component, which began at discharge. When patients assigned to the intervention group were readmitted to the hospital, the inpatient protocol was repeated.

### Control Group

We neither required nor prohibited any post-discharge care for the patients in the control group. Their care after discharge could be provided by community physicians or at Veterans Affairs clinics, as arranged by the physicians treating them as inpatients. The control patients did not have access to the primary care nurse and received no supplemental education or assessment of needs beyond what was customarily offered at each site.

### Primary and Secondary Outcomes

For outcomes involving the use of Veterans Affairs health services, data were abstracted from the Patient Treatment File (a national administrative data base containing information on all Veterans Affairs hospitalizations) and computer systems at local hospitals (to obtain data on outpatient visits) for 180 days after randomization. The use of non-Veterans Affairs health services was estimated on the basis of reports by the patients. With the patients' permission, we asked non-Veterans Affairs providers identified by the patients to send records of the use of their services during the study period. Only use of services that could be verified by the provider was counted. We computed the total number of days of rehospitalization and rates of readmission per patient, the time to the first readmission, the proportion of patients who were readmitted, the number of emergency department visits, and the number of outpatient visits during the 180-day study period.

Quality of life was measured on the "short form" of a questionnaire (the SF-36) that contains 36 items and has been well validated<sup>17-21</sup> and widely used among veterans.<sup>12-14</sup> Eight scores (physical functioning, physical role functioning, emotional role functioning, social functioning, bodily pain, mental health, vitality, and general perceptions of

Table 1. Components of the Primary Care Intervention and Mean Ratings of Compliance.

COMPONENT	MEAN COMPLIANCE (%)*
<b>Before discharge</b>	
Within three days before discharge, primary care nurse assessed the patient's post-discharge needs, developed a list of medical problems, provided educational materials, assigned the patient to a primary care physician, and gave the patient a card with the names and beeper numbers of the primary care nurse and primary care physician.	99.7
Primary care physician visited the patient personally within two days before discharge to review the hospital course, discharge plans, lists of problems, and medication regimens, discussing discharge plans with hospital physicians as necessary.	74.5
Primary care nurse made an appointment for the patient to visit the primary care clinic within one week of discharge.	62.5
<b>After discharge</b>	
Primary care nurse telephoned the patient within two working days after discharge to assess potential difficulties with medications or medical regimens, identify health problems arising since discharge, make sure that patient knew how to contact providers, and remind patient of the follow-up appointment.	87.3
Patient kept first post-discharge appointment.	82.0
Primary care physician and primary care nurse reviewed and updated the treatment plans at the first post-discharge appointment.	94.1
Appointment reminder sent, if necessary.	50.0
Missed-visit protocol implemented, if necessary.	43.1
<b>Overall score</b>	<b>89.0</b>

\*Scores are means for all patients in the intervention group.

health) are calculated from the responses, ranging from 0 (for poorest) to 100 (for best); differences of 3 to 5 points are considered important.<sup>18,21</sup> To measure patients' satisfaction with their care, we used the following 11 scales from the Patient Satisfaction Questionnaire<sup>22</sup> that are relevant to veterans: satisfaction with emergency care, convenience of care, access to care, continuity of care, competence, risks (i.e., those at which doctors place their patients), quality of doctor's facilities, expenses, explanations of care, degree of consideration shown, and overall satisfaction. Each scale is scored from 1 (for least satisfied) to 5 (for most satisfied).

### Other Variables

Because prior hospitalization is a predictor of future use, we used the Patient Treatment File to extract data on hospital use for all study patients during the 180 days before randomization. According to a validated measure of coexisting conditions,<sup>23</sup> we classified the patients as being at low, medium, or high risk for readmission at base line. The severity of each of the three diseases being studied was estimated by a review of the patient's chart at base line.

Each readmission to a Veterans Affairs Medical Center during the 180-day study period was classified in two ways by a panel of physicians comprising all the principal investigators at each site. First, preventability was assessed on the basis of patient-related, clinical, or systemwide factors that could have averted the readmission<sup>24</sup> (rating forms are available on request). Each readmission was also classified as elective or nonelective. Elective readmissions were those occurring for nonurgent, scheduled procedures (for example, cataract surgery, cardiac catheterization, bronchoscopy, hernia repair, and colonoscopic examination). All other readmissions were considered nonelective.<sup>25</sup>

### Intensity of Primary Care

For each patient in the intervention group, each component of the intervention (Table 1) was rated according to whether it had been carried out according to the protocol. Scores for compliance were aggregated for all components to calculate both overall and site-specific scores. Other indicators of the intensity of primary care delivery in-

cluded the number of days from the patient's discharge after the index hospitalization to the first visit to the primary care clinic, the number of visits to that clinic, and the number and duration of telephone calls between patients and primary care nurses during the study period.

### Statistical Analysis

Assuming a two-sided significance level of 0.05 and 85 percent power, we calculated that 700 patients would be needed in each group in order to detect 28 percent reductions in both primary outcomes (re-admission rates and days of rehospitalization).

The success of randomization was determined by comparing the base-line characteristics of the intervention group with those of the control group by the chi-square test (for categorical variables), Student's t-test (for continuous variables), and the Wilcoxon rank-sum test (for non-normally distributed variables).

Patients continued in the study for 180 days unless they died or withdrew. For those who did not remain in the study for the entire 180 days, the data collected between randomization and the date of censoring were used in all the analyses (that is, we conducted an intention-to-treat analysis). Our main analyses used Wilcoxon rank-sum tests (of readmission rates, days of rehospitalization, emergency department visits, and outpatient visits), chi-square tests (of the proportion of patients readmitted), and Kaplan-Meier estimates of survival and log-rank tests (of the time to readmission). Because the measures of quality of life and patients' satisfaction were multidimensional, we studied them by multivariate analysis of variance. Finally, we performed an analysis of covariance for our primary and secondary outcomes. The covariates included the stratification variables and the number of hospital days during the 180 days before randomization.

## RESULTS

### Study Patients

From November 1992 through July 1994, 10,129 patients were screened; 3209 met all eligibility criteria, and 1396 of them (43.5 percent) were randomized (range per site, 116 to 202 patients). The most common reasons for the nonenrollment of eligible patients were the patient's decision not to participate (971 patients) and discharge from the hospital before randomization (446 patients). Patients who declined to participate typically did so because they had an established relationship with a specialist or a non-Veterans Affairs physician and did not wish to risk random assignment to the care of a new physician.

The demographic and clinical characteristics of the patients are shown in Table 2. The patients had a substantial burden of illness at base line: half of those with congestive heart failure had disease in New York Heart Association class III or IV; one third of the diabetic patients had objective evidence of end-organ damage; and one quarter of the patients with chronic obstructive pulmonary disease required oxygen treatment at home, oral corticosteroids, or both. Moreover, two thirds of the study patients had risk scores that placed them at medium or high risk for readmission. There were no statistically significant differences between the study groups, although there was a trend toward more hospital days during the 180 days before randomization in the intervention group (4.6 days, vs. 3.9 days in the control group;  $P=0.09$ ).

The patients' extensive burden of illness was also evident from their extremely poor base-line scores for quality of life (Table 3). The patients were moderately

Table 2. Base-Line Characteristics of the Patients According to Study Group.\*

CHARACTERISTIC	INTERVENTION GROUP (N = 695)	CONTROL GROUP (N = 701)
Age (yr)	63.0±11.1	62.6±10.9
Education (yr)	11.2±3.2	11.0±3.2
Marital status (% married)	52.4	54.6
Race (%)		
White, non-Hispanic	64.2	65.9
Black, non-Hispanic	28.5	26.4
Other	7.3	7.7
Male sex (%)	99.0	98.0
Any employment, full- or part-time (%)	17.7	16.4
Length of index admission (days)	10.1±14.3	10.4±13.1
Time from randomization to discharge (days)	6.6±13.0	6.8±11.6
Eligibility status (% service-connected)	28.6	29.7
Hospital days during the 180 days before randomization	4.6±10.6	3.9±10.4
Index diagnosis (% of patients)		
Diabetes mellitus	35.7	35.0
Congestive heart failure	13.2	13.4
Chronic obstructive pulmonary disease	23.2	23.4
>1 diagnosis	27.9	28.2
Disease status†		
Diabetes (no. of patients)	376	375
Not using insulin, no end-organ disease (%)	45.0	42.9
Using insulin, no end-organ disease (%)	26.9	24.5
End-organ disease (%)	28.2	32.5
Congestive heart failure (no. of patients)‡	249	255
NYHA class I (%)	12.9	11.8
NYHA class II (%)	38.1	36.1
NYHA class III (%)	32.9	32.9
NYHA class IV (%)	16.1	19.2
Chronic obstructive pulmonary disease (no. of patients)	295	288
No home oxygen or corticosteroid use (%)	74.9	75.7
Home oxygen, corticosteroid use, or both (%)	25.1	24.3
Risk of readmission (% of patients)		
Low	35.7	34.4
Medium	38.1	42.6
High	26.2	23.0

\*Plus-minus values are means ±SD. There were no significant base-line differences between groups.

†The total number of patients shown in the three disease categories exceeds the total number of patients in the study (1396) because some patients had more than one disease.

‡NYHA denotes New York Heart Association.

satisfied with most aspects of their care, giving it an average score of approximately 3 on the 5-point scales for satisfaction (Table 3). There were no base-line differences between the study groups in quality of life or satisfaction with care. During the study period, 106 patients died (59 in the intervention group and 47 in the control group), and 16 withdrew their consent to be studied (11 and 5, respectively). There were no significant differences between the study groups in the follow-up status of the patients ( $P=0.13$ ).

### Intensity of Primary Care

Table 1 shows data on the patients' compliance with the intervention protocol. The mean composite score for compliance was 89 percent (range among sites, 83 to 93 percent). The median time from discharge after the index hospitalization to the first visit to a general medicine clinic was significantly shorter in the intervention group (7 vs. 13 days,  $P<0.001$ ). The patients in the intervention group were more likely than the controls

to visit at least one general medicine clinic during the study period (93 percent vs. 77 percent,  $P<0.001$ ). Over the six-month study period, the patients in the intervention group also made 68 percent more visits to general medicine clinics (mean, 3.7 vs. 2.2;  $P<0.001$ ) and 5 percent fewer visits to subspecialty clinics (2.1 vs. 2.2,  $P=0.010$ ) than did the control patients. Otherwise, use of outpatient services, including visits to the emergency department (1.9 vs. 1.7,  $P=0.12$ ), was similar in the two groups. In addition to providing care during visits, primary care nurses talked with the patients in the intervention group by telephone a mean of 7.5 times during the study period (range, 4.0 to 13.4 calls), for an average of 5.7 minutes per call. Use of outpatient services outside Veterans Affairs Medical Centers was infrequent in both groups (intervention group, 7 percent; controls, 9 percent;  $P=0.55$ ).

### Hospital Use

Although the patients in the intervention group had contact with the primary care team, the effect of the intervention on hospital use was contrary to that predicted by our hypothesis (Table 4). The intervention group had a higher monthly readmission rate than the control group (0.19 vs. 0.14 readmission,  $P=0.005$ ) and more days of rehospitalization (10.2 vs. 8.8,  $P=0.041$ ). Approximately 5 percent of the use of inpatient services by both study groups occurred in non-Veterans Affairs hospitals. We also found trends suggesting that a higher proportion of the patients in the intervention group

Table 4. Effect of the Intervention on the Use of Inpatient Services, According to Diagnosis and Study Group.\*

VARIABLE	INTERVENTION GROUP (N = 695)	CONTROL GROUP (N = 701)	P VALUE
<b>No. of readmissions/mo</b>			
All patients	0.19±0.4	0.14±0.2	0.005
Diabetes	0.13±0.2	0.11±0.2	
CHF	0.27±0.7	0.15±0.3	
COPD	0.19±0.3	0.14±0.2	
>1 diagnosis	0.23±0.3	0.17±0.2	
<b>Days of rehospitalization</b>			
All patients	10.2±19.8	8.8±19.7	0.041
Diabetes	7.8±18.1	8.0±21.4	
CHF	11.7±26.6	6.8±14.8	
COPD	11.7±20.2	8.3±15.5	
>1 diagnosis	11.4±17.5	11.1±22.4	
<b>Proportion readmitted (%)</b>			
All patients	49.4	44.2	0.06
Diabetes	37.1	38.0	
CHF	52.2	41.5	
COPD	53.4	48.2	
>1 diagnosis	60.3	50.0	

\*Plus-minus values are means ±SD. Because the distributions of monthly readmission rates and days of rehospitalization were non-normal, Wilcoxon rank-sum tests were used to calculate P values. CHF denotes congestive heart failure, and COPD chronic obstructive pulmonary disease.

were readmitted (49 percent vs. 44 percent,  $P=0.06$ ), and were readmitted sooner ( $P=0.07$ ), than was the case in the control group. Finally, more patients in the intervention group ( $P=0.052$ ) had multiple readmissions during the study period (Fig. 1).

Although the study lacked adequate power to permit us to conduct subgroup analyses according to disease category, greater hospital use was observed in the intervention group in all three disease strata. There were no significant differences between groups with regard to either nonelective (80 percent vs. 77 percent,  $P=0.22$ ) or preventable (35 percent vs. 37 percent,  $P=0.57$ ) readmissions. After we adjusted for the stratification variables and the number of days spent in the hospital during the six months before randomization, the difference between the groups in monthly readmission rates remained significant (0.21 vs. 0.15,  $P<0.001$ ), although the difference in the number of days of rehospitalization did not (10.5 vs. 9.2,  $P=0.23$ ).

### Quality of Life and Satisfaction with Care

Follow-up interviews were completed with 87 percent and 83 percent of the patients available for interview at one and six months, respectively. In both groups, patients' scores on the SF-36 questionnaire were low at base line and remained so throughout the study period, with no significant differences between groups at one month ( $P=0.99$ ) or six months ( $P=0.53$ ).

The patients in the intervention group were significantly more satisfied ( $P<0.001$ ) with their care than the controls at one month (data not shown), and this difference persisted at six months (Fig. 2). Although the group differences were consistent on most of the 11 scales of the Patient Satisfaction Questionnaire that we used, the differences were greatest with regard to the

Table 3. Base-Line Scores on Questionnaires Measuring Quality of Life and Satisfaction with Care, According to Study Group.\*

MEASURE	INTERVENTION GROUP (N = 695)	CONTROL GROUP (N = 701)
	mean ±SD	
<b>Quality of life (SF-36)</b>		
Physical functioning	44.4±29.9	43.6±30.2
Physical role functioning	23.0±37.1	20.8±34.5
Emotional role functioning	55.6±45.8	56.1±45.4
Social functioning	55.9±32.0	54.5±32.6
Bodily pain	50.5±33.0	48.5±31.9
Mental health	65.5±24.0	64.1±23.4
Vitality	33.7±25.5	31.1±24.4
General perceptions of health	42.2±21.9	39.4±21.3
<b>Patient Satisfaction Questionnaire</b>		
Nonfinancial access to care		
Emergency care	3.3±0.7	3.4±0.7
Convenience	3.5±0.8	3.4±0.9
Access to care	3.2±0.9	3.1±0.9
Continuity of care	2.7±1.0	2.7±1.0
Technical quality of care		
Quality — competence	3.4±0.5	3.4±0.5
Prudence — risks	3.0±0.5	3.1±0.5
Doctor's facilities	3.6±0.7	3.6±0.7
Prudence — expenses	3.1±0.7	3.1±0.7
Interpersonal manner		
Explanations	3.1±0.9	3.1±0.8
Consideration	3.6±0.5	3.6±0.6
Overall satisfaction	3.2±0.7	3.2±0.7

\*Scores on the SF-36 questionnaire for the patients' quality of life range from 0 (lowest) to 100 (highest). On the Patient Satisfaction Questionnaire, scores range from 1 (least satisfied) to 5 (most satisfied). There were no statistically significant differences between groups.

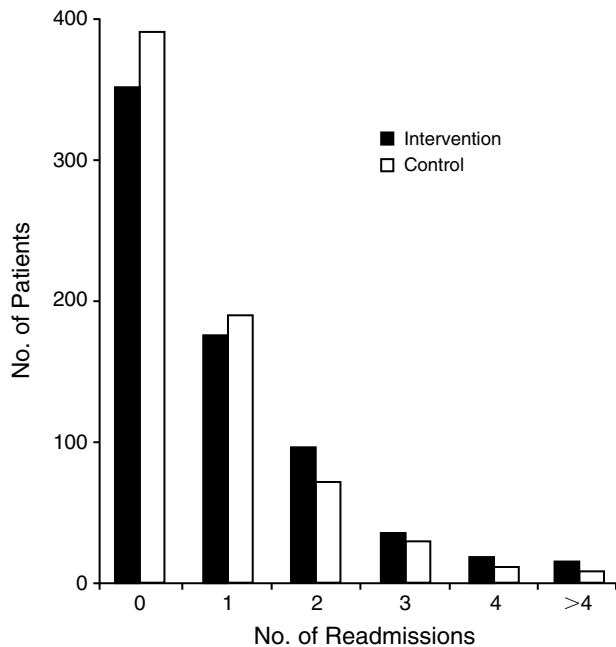


Figure 1. Effect of Intervention on the Number of Readmissions.

P=0.052 for the comparison between the study groups, by the chi-square test.

patients' perceptions of the continuity of their care (33 percent) and "nonfinancial access to medical care" (i.e., barriers other than financial ones) (16 percent).

**DISCUSSION**

We examined the effect of an intervention designed to enhance primary care for medically vulnerable patients who were discharged from the General Medicine Service at nine Veterans Affairs Medical Centers. The intervention was designed to improve their access to primary care providers, the coordination of outpatient services, and the provision of comprehensive and continuous care.<sup>26</sup> Although the intensity of primary care was successfully increased, patients receiving this intervention used the hospital significantly more during the six-month study period. At only one of the nine sites were readmissions reduced, and that site was at or below the median level of compliance with the intervention protocol, the frequency of primary care visits per patient, and the extent of telephone contact between patients and nurses. The primary care intervention did not affect the quality of life of the patients who received it, but they were substantially more satisfied than the controls with their care.

What may account for these findings? First, the premise that comprehensive primary care may reduce the use of inpatient services by vulnerable patients may be wrong, at least in the short term. The patients in this study had major complications of their chronic diseases and poor quality of life. They were also at higher risk for readmission than vulnerable patients discharged from a municipal teaching hospital.<sup>27,28</sup> The primary care offered to these seriously ill patients may have led to the detection and treatment of previously undetected medical problems. Second, greater access to primary care providers could have improved communication and, in turn, increased readmissions. Having a channel to voice their complaints can lead to more readmissions among severely ill patients. With a longer period of follow-up, the patients and primary care teams may become more accustomed to each other, and perhaps readmissions would be diminished over time. Finally, the patients in the intervention group may have been sicker than the controls at base line. There was a trend toward more use of inpatient services in this group than among the controls during the six months before enrollment, but even when we adjusted for this prior use there was still a significant difference in readmission rates, although the difference in the number of days of rehospitalization was no longer significant.

Did the intervention harm patients? The patients receiving it were readmitted more frequently and spent more time in the hospital than those receiving usual care, but there is no evidence that the patients receiving the intervention experienced decreased quality of life. Furthermore, at one and six months they were substantially more satisfied with their care.

How do our findings compare with those of earlier randomized trials of interventions designed to reduce hospital readmissions? Facilitating linkages between in-

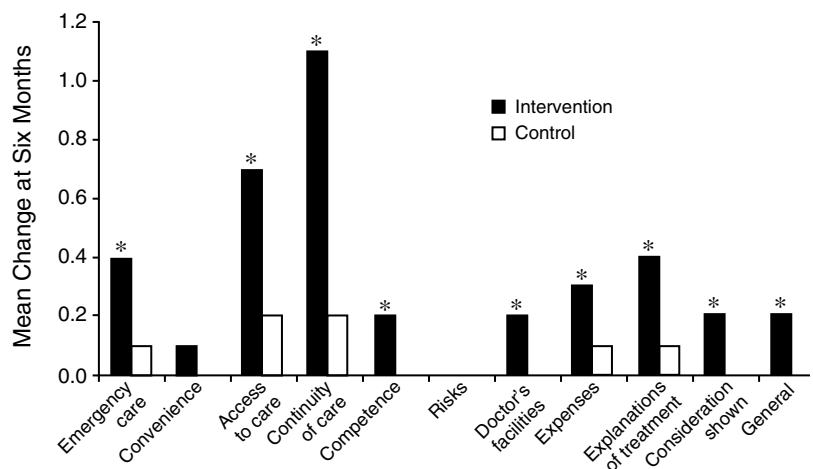


Figure 2. Effect of Intervention on Patients' Satisfaction with Their Care.

Bars show the difference between the six-month scores and the base-line scores. P<0.001 for the comparison between groups by multivariate analysis of variance at both one and six months. Asterisks indicate dimensions for which the difference in the mean change (on a five-point scale) between the study groups was statistically significant (P<0.001). Subscales for which no bar is shown (e.g., Risks) had a mean change of zero.

patient and outpatient care at an urban teaching hospital reduced both the use of services after discharge<sup>27</sup> and the costs of health care<sup>28</sup> among the patients at highest risk for readmission. However, providing access to a case manager at discharge from a Veterans Affairs Medical Center and thereafter had no effect on readmissions.<sup>29</sup> Intensive discharge planning may reduce hospital readmissions in the short term, but not in the long term.<sup>7,30</sup> A single-site study of a multidisciplinary intervention directed by an experienced cardiovascular nurse reduced the use of inpatient services by high-risk elderly patients with congestive heart failure during the 90 days after discharge.<sup>31</sup> This success may be attributed to the use of an intensive, disease-specific protocol that included individualized dietary assessment and instruction, analysis of medications by a geriatric cardiologist, and home visits after discharge.

This study has several limitations. First, it was conducted largely among disadvantaged men receiving care at Veterans Affairs Medical Centers. The generalizability of our findings may also be affected by the presence of systematic differences between the study patients and the eligible patients who did not enroll. However, the 971 eligible patients who declined to participate in the study did not differ from the study patients during the six months after screening with regard to rates of readmission to Veterans Affairs Medical Centers, the number of days of rehospitalization, or the proportion of patients readmitted (data not shown). Second, all the patients were screened while they were hospitalized. Intensive primary care interventions designed for outpatients who were not identified in the hospital might have produced different results. Third, we cannot assess the incremental value of specialty care among patients receiving primary care. For such patients, the mix of generalist and specialist care may be as important as the coordination of care by a primary care team. Finally, the intervention may have improved the quality of care despite the increased rate of readmission.

Our findings show that tremendous resources were needed to sustain the health of this vulnerable group of veterans. If these findings also apply to other groups of medically and socioeconomically disadvantaged patients (for example, the Medicaid population), health care administrators may be reluctant to provide care unless a high capitation rate is established. In addition, the patients in the intervention group were significantly more satisfied with their care than the controls. This difference in satisfaction exceeds that previously shown to result in patients' changing their health care providers.<sup>32-34</sup> Such information is critical for the design of health care systems, given that patients base their decisions about where they will obtain their care largely on subjective ratings of their own experiences. Finally, and perhaps most important, this study highlights the need to evaluate assumptions about changes in health care systems rigorously, across the entire spectrum of patients and diseases. We need a better understanding of how to optimize the care of vulnera-

ble patients, so that the use of services is reduced and the quality of care enhanced.

## APPENDIX

The following additional persons and institutions participated in this investigation: *Chairperson's Office* — P. Landsman and M. Monger (Durham, N.C.); *Hines Center for Cooperative Studies in Health Services* — D. Cavello and R. Lott (Hines, Ill.); *Participating Veterans Affairs Medical Centers* — E. Anteola and R. Varano (Brooklyn, N.Y.); V. Hedger and J. Schultz (Cincinnati); G. Allen and J. Calkins (Columbia, S.C.); A. Ward and M. Foy (Durham, N.C.); P. Hensley and K. Cox (Fresno, Calif.); G. Redmon (Indianapolis); L. Carrel and M. Cook (Leavenworth, Kans.); E. Wise and N. Gordon (Loma Linda, Calif.); and A. Cooney and J. Havey (Philadelphia). *Executive Committee* — C. Ashton, T. Adams, J. Demakis, and J. Gibbs. *Data Monitoring Board* — T. Meyer (chairperson), M. Foulkes, M. Hlatky, and K. Nichol. *Human Rights Committee (Hines, Ill.)* — T. Bering, T. Burris, A. Cole, E. Collins, M. D'Arcy, M. Emanuele, Z. Flournoy-Gill, S. Sanders, T. Schmid, A. Henrick, S. Braithwaite, W. Knopp, W. Juneau, and R. Hahn. *Veterans Affairs Central Office* — D. Deykin and J. Gold (Boston); and J. Gough, S. Meehan, C. Smith, and C. Welch (Washington, D.C.).

## REFERENCES

1. Medicare and Medicaid statistical supplement, 1995. *Health Care Financ Rev* 1995;16(Stat Suppl/Fall):159.
2. Zook CJ, Savickis SF, Moore FD. Repeated hospitalization for the same disease: a multiplier of national health costs. *Milbank Q* 1980;58:454-71.
3. Zook CJ, Moore FD. High-cost users of medical care. *N Engl J Med* 1980;302:996-1002.
4. Anderson GF, Steinberg EP. Hospital readmissions in the Medicare population. *N Engl J Med* 1984;311:1349-53.
5. *Idem*. Predicting hospital readmissions in the Medicare population. *Inquiry* 1985;22:251-8.
6. Holloway JJ, Medendorp SV, Browning J. Risk factors for early readmission among veterans. *Health Serv Res* 1990;25:213-37.
7. Evans RL, Hendricks RD. Evaluating hospital discharge planning: a randomized clinical trial. *Med Care* 1993;31:358-70.
8. Weinberger M, Oddone E. Strategies to reduce hospital readmissions: a review. *Q Rev Bull* 1989;15:255-60.
9. Ashton CM, Kuykendall DH, Johnson ML, Wray NP, Wu L. The association between the quality of inpatient care and early readmission. *Ann Intern Med* 1995;122:415-21.
10. Safran C, Phillips RS. Interventions to prevent readmission: the constraints of cost and efficacy. *Med Care* 1989;27:204-11.
11. Waite K, Oddone E, Weinberger M, Samsa G, Foy M, Henderson W. Lack of association between patients' measured burden of disease and risk for hospital readmission. *J Clin Epidemiol* 1994;47:1229-36.
12. Weinberger M, Kirkman MS, Samsa GP, et al. A nurse-coordinated intervention for primary care patients with non-insulin-dependent diabetes mellitus: impact on glycemic control and health-related quality of life. *J Gen Intern Med* 1995;10:59-66.
13. Weinberger M, Oddone EZ, Samsa GP, Landsman PB. Are health-related quality of life measures affected by the mode of administration? *J Clin Epidemiol* 1996;49:135-40.
14. Kazis LE, Clark JA, Miller D, et al. Quality of life in veterans: preliminary results from the Veterans Health Study. In: Submitted abstracts for the 11th Annual HSR&D Service Meeting, Washington, D.C., April 19-21, 1993. Washington, D.C.: Department of Veterans Affairs, 1993:57. abstract.
15. Ludke RL, MacDowell NM, Booth BM, Hunter SA. Appropriateness of admissions and discharges among readmitted patients. *Health Serv Res* 1990;25:501-25.
16. Kahn RL, Goldfarb AI, Pollack M, Peck A. Brief objective measures for the determination of mental status in the aged. *Am J Psychiatry* 1960;117:326-8.
17. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care* 1992;30:473-83.
18. Stewart AL, Greenfield S, Hays RD, et al. Functional status and well-being of patients with chronic conditions: results from the Medical Outcomes Study. *JAMA* 1989;262:907-13. [Erratum. *JAMA* 1989;262:2542.]
19. McHorney CA, Ware JE Jr, Raczek AE. The MOS 36-item short-form health survey (SF-36). II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care* 1993;31:247-63.
20. McHorney CA, Ware JE Jr, Rogers W, Raczek AE, Lu JF. The validity and relative precision of MOS short- and long-form health status scales and Dartmouth COOP charts: results from the Medical Outcomes Study. *Med Care* 1992;30:Suppl:MS253-MS265.

21. Ware JE Jr. SF-36 health survey: manual and interpretation guide. Boston: Health Institute, New England Medical Center, 1993.
22. Ware JE Jr, Snyder MK, Wright WR, Davies AR. Defining and measuring patient satisfaction with medical care. *Eval Program Plann* 1983;6:247-63.
23. Smith DM, Norton JA, McDonald CJ. Nonelective readmissions of medical patients. *J Chronic Dis* 1985;38:213-24.
24. Oddone EZ, Weinberger M, Hurder A, Henderson WG, Feussner JR. Classifying general medicine admissions: are they preventable? *Clin Res* 1993; 41:819A. abstract.
25. Smith DM, Weinberger M, Katz BP. Predicting nonelective hospitalization: a model based on risk factors associated with diabetes mellitus. *J Gen Intern Med* 1987;2:168-73.
26. Starfield B. Primary care: concept, evaluation, and policy. New York: Oxford University Press, 1992.
27. Smith DM, Weinberger M, Katz BP, Moore PS. Postdischarge care and readmissions. *Med Care* 1988;26:699-708.
28. Weinberger M, Smith DM, Katz BP, Moore PS. The cost-effectiveness of intensive postdischarge care: a randomized trial. *Med Care* 1988;26:1092-102.
29. Fitzgerald JF, Smith DM, Martin DK, Freedman JA, Katz BP. A case manager intervention to reduce readmissions. *Arch Intern Med* 1994;154:1721-9.
30. Naylor M, Brooten D, Jones R, Lavizzo-Mourey R, Mezey M, Pauly M. Comprehensive discharge planning for the hospitalized elderly: a randomized clinical trial. *Ann Intern Med* 1994;120:999-1006.
31. Rich MW, Beckham V, Wittenberg C, Leven CL, Freedland KE, Carney RM. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. *N Engl J Med* 1995;333:1190-5.
32. Marquis MS, Davies AR, Ware JE Jr. Patient satisfaction and change in medical care provider: a longitudinal study. *Med Care* 1983;21:821-9.
33. Davies AR, Ware JE Jr. Involving consumers in quality care assessment. *Health Aff (Millwood)* 1988;7(1):33-48.
34. Ware JE Jr, Davies AR. Behavioral consequences of consumer dissatisfaction with medical care. *Eval Program Plann* 1983;6:291-7.