# SPECIAL ARTICLES

## A RANDOMIZED TRIAL OF CARE IN A HOSPITAL MEDICAL UNIT ESPECIALLY DESIGNED TO IMPROVE THE FUNCTIONAL OUTCOMES OF ACUTELY ILL OLDER PATIENTS

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**Abstract** *Background.* Older persons who are hospitalized for acute illnesses often lose their independence and are discharged to institutions for long-term care.

*Methods.* We studied 651 patients 70 years of age or older who were admitted for general medical care at a teaching hospital; these patients were randomly assigned to receive usual care or to be cared for in a special unit designed to help older persons maintain or achieve independence in self-care activities. The key elements of this program were a specially prepared environment (with, for example, uncluttered hallways, large clocks and calendars, and handrails); patient-centered care emphasizing independence, including specific protocols for prevention of disability and for rehabilitation; discharge planning with the goal of returning the patient to his or her home; and intensive review of medical care to minimize the adverse effects of procedures and medications. The main outcome we measured was the change from admission to discharge in the number of five basic activities of daily living (bathing, getting dressed, using the toilet, moving from a bed to a chair, and eating) that the patient could perform independently.

*Results.* Twenty-four patients in each group died in the hospital. At the time of discharge, 65 (21 percent) of the 303 surviving patients in the intervention group were classified as much better in terms of their ability to perform basic activities of daily living, 39 (13 percent) as better, 151 (50 percent) as unchanged, 22 (7 percent) as worse, and 26 (9 percent) as much worse. In the usual-care group, 40 (13 percent) of the 300 surviving patients were classified as much better, 33 (11 percent) as better, 163 (54 percent) as unchanged, 39 (13 percent) as worse, and 25 (8 percent) as much worse ($P = 0.009$). The difference between the groups remained significant ($P = 0.04$) in a multivariable model in which we controlled for potentially confounding base-line characteristics of the patients. Lengths of stay and hospital charges were similar in the two groups.

Fewer patients assigned to the intervention group were discharged to long-term care institutions (43 patients [14 percent], as compared with 67 patients [22 percent] in the usual-care group; $P = 0.01$). Among the 493 patients discharged to private homes, similar proportions (about 10 percent) in the two groups were admitted to long-term care institutions during the three months after discharge.

*Conclusions.* Specific changes in the provision of acute hospital care can improve the ability of a heterogeneous group of acutely ill older patients to perform basic activities of daily living at the time of discharge from the hospital and can reduce the frequency of discharge to institutions for long-term care. (N Engl J Med 1995;332: 1338-44.)

THERE is heightened interest today in improving the outcomes in a variety of groups of patients.[1-3] Most recent efforts to improve patients' outcomes, however, have focused on specific diseases,[4,5] treatments,[6-8] or behavior of physicians.[9,10] We evaluated a clinical system of care designed to improve overall outcomes in a heterogeneous group of older adults who were hospitalized for acute illnesses.

Patients 65 years of age or older account for 31 percent of acute care hospital admissions in the United States and 45 percent of hospital expenditures for adults.[11] These older patients are at high risk for loss of independence and institutionalization.[12-15] Many interventions designed to improve the outcomes of acutely ill elderly patients have had disappointing results.[15-21]

We used complementary principles of quality improvement and comprehensive geriatric assessment to develop a new system of care for acutely ill older patients in our hospital.[3,22] This program, which we call Acute Care for Elders, is designed to help patients maintain or achieve independence in basic activities of daily living through the combined effects of four key elements: a specially designed environment, patient-centered care, planning for discharge, and review of medical care (Table 1).[22] In order to carry out the specific nursing protocols and to facilitate the work of an interdisciplinary team, our teaching hospital instituted this program in a single 14-bed unit.

### Methods

From November 1990 through March 1992, we compared the outcomes of patients treated in this special unit with those of patients who received usual care at the University Hospitals of Cleveland, a private, nonprofit teaching hospital affiliated with Case Western Reserve University that has 874 beds.

During the study period, 1794 patients who were 70 or older were admitted for general medical care. Patients who were admitted to a specialty unit (e.g., intensive care, cardiology–telemetry, or oncology) were ineligible for the study ($n = 2067$). We randomly assigned 651 of the 1794 eligible patients either to the Acute Care for Elders pro-

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Table 1. Key Elements and Illustrative Features of the Intervention Program.

| KEY ELEMENT | ILLUSTRATIVE FEATURES |
|---|---|
| Prepared environment | Carpeting, handrails, uncluttered hallways |
| | Large clocks and calendars |
| | Elevated toilet seats and door levers |
| Patient-centered care | Daily assessment by nurses of physical, cognitive, and psychosocial function |
| | Protocols to improve self-care, continence, nutrition, mobility, sleep, skin care, mood, cognition (implemented by the primary nurse and based on the daily assessment) |
| | Daily rounds by the multidisciplinary team, led by the medical and nursing directors with the primary nurse, social worker, nutritionist, physical therapist, and visiting-nurse liaison |
| Planning for discharge | Early, ongoing emphasis on the goal of returning home |
| | Assessment of plans and needs for discharge by a nurse at the time of admission |
| | Early involvement of a social worker and home health care nurse, if indicated |
| Medical care review | Daily review by the medical director of medicines and planned procedures |
| | Protocols to minimize the adverse effects of selected procedures (e.g., urinary catheterization) and medications (e.g., sedative–hypnotic agents) |

gram (n = 327) or to usual care (n = 324) in another general medical unit; the remaining 1143 eligible patients were not enrolled in the study because beds were not available in both the intervention and usual-care units at the time of their admission. Assignment according to computer-generated random numbers was performed at the time of admission by the admitting clerk. Informed consent was obtained orally from patients or their proxies (usually family members), according to procedures approved by the hospital's institutional review board.

### Patient Care

In both the intervention and usual-care units, each patient was assigned a primary nurse, two resident physicians, and an attending physician. The intervention and usual-care units had the same hospital-supported staff-to-patient ratios (roughly one budgeted position for a registered nurse for each two beds) and used the same hospital-wide support services (for example, social work, physical therapy, and nutrition). Extramural grant support provided funds for increases in hours worked in the intervention unit by the medical and nursing directors, social worker, physical therapist, occupational therapist, and dietitian; these fractional increases totaled less than one additional full-time person per year. Under the leadership of the medical and nursing directors, the primary nurse assigned to each patient in the intervention group was responsible for assessing the patient's specific needs daily and implementing protocols for the prevention of disability and for rehabilitation.

Usual care consisted of services provided by physicians and nurses in other acute care medical units. The staff of the intervention unit was not involved in the care of patients receiving usual care, and none of the four elements of the program were implemented in usual-care units. However, attending physicians and resident physicians provided care to patients in both the intervention and usual-care groups.

### Sources of Data

Data were obtained by means of interviews and from medical records. On admission, interviews were attempted with each patient, the patient's primary nurse, and a family member or other care giver. The patient and nurse were also interviewed at the time of discharge, and the patient and a family member or care giver were contacted three months after discharge. The interview covered sociodemographic characteristics, the ability to function in performing activities of daily living,[23,24] the ability to walk, overall health status, the items on a geriatric depression scale,[25] and the first 21 items of the Mini–Mental State Examination.[26] The five basic activities of daily living that were included in the study were bathing, dressing, using the toilet, moving from a bed to a chair, and eating[23]; continence was not included because it is not reported as reliably as the other self-care activities.[27] The seven instrumental activities of daily living were shopping, cooking, performing household chores, using transportation, managing money, managing medication, and using the telephone.[24] On admission, patients and family members were asked about the patients' functional status and overall health two weeks before admission and at the time of admission. Three months after discharge, information was obtained about any stays in long-term care facilities, readmissions to a hospital, and health care services by paid providers at home.

All interviews were conducted by research assistants who were not involved in patient care. These interviewers received standardized training consisting of a written protocol, scripted scenarios, role playing, and observed interviews. Standardization of interviews was maintained during the study by weekly reviews of interview procedures. Interviewers were not blinded to the patients' group assignments. Interrater reliability for data obtained by the interviewers was assessed for 10 hospitalized patients (1.5 percent). The mean kappa statistics were 0.98 for the basic activities of daily living, 0.94 for the instrumental activities of daily living, 0.96 for the mental-status items, and 0.99 for items related to depression.

Clinical data were obtained from medical records. These included the reason for hospitalization,[28] the Charlson comorbidity score,[29] and the Acute Physiology and Chronic Health Evaluation (APACHE) II score[30] on the day of admission.

Data on each patient's hospital charges as reported to the Health Care Financing Administration on the Universal Bill-1982, a standard billing form, were obtained from the hospital. Actual hospital costs, as estimated by the hospital's cost-accounting system, were available for 601 patients and correlated highly with charges ($r = 0.96$). The results of analyses of hospital costs and charges were similar and are not reported separately. We estimated the cost of the additional staff time paid for by the grant and the capital costs of special features of the intervention unit, which were not included in hospital reports of charges or costs.

### Missing Data

Interview data were obtained primarily from the patients; 461 (71 percent) were interviewed on admission, 403 of the 603 surviving patients (67 percent) at discharge, and 328 of the survivors (63 percent) three months after discharge. When information about function was not available from the patients, data from proxy respondents were used; the primary nurse was the source of proxy data obtained at admission and discharge, and a family member or care giver was the source of preadmission and post-discharge data. Only patients' reports were used for the assessment of mental status and mood.

### Statistical Analysis

The main outcome variable was the change from admission to discharge in the number of basic activities of daily living that the patients could perform independently. The patient's functional status at discharge was classified as better if the number of activities he or she could perform independently increased from admission to discharge, and worse if this number decreased. Changes from two weeks before admission to discharge were calculated similarly.

We examined differences between the intervention and usual-care groups in base-line characteristics, main end points and other outcomes at discharge, hospital charges and length of stay, and outcomes after discharge. Differences between the groups in the change in the ability to perform activities of daily living independently were evaluated with the chi-square test for linear trend.[31] The results of ridit analyses[32] confirmed those of the chi-square tests for linear trend and are not reported separately. We used the Wilcoxon rank-sum test to assess differences in continuous variables and the chi-square test for categorical variables, with the modification for linear trend when appropriate.[31] The consistency of differences between the intervention and usual-care groups was examined in subgroups defined by several clinical characteristics: age, ability to perform basic and instrumental activities of daily living two weeks before admis-

Table 2. Characteristics of the 651 Patients on Admission to the Hospital.*

| VARIABLE† | INTERVENTION GROUP (N = 327) | USUAL-CARE GROUP (N = 324) |
|---|---|---|
| Age — yr | 80.2±6.9 | 80.1±6.6 |
| Sex — no. (%) | | |
| Male | 104 (32) | 112 (35) |
| Female | 223 (68) | 212 (65) |
| Race — no. (%) | | |
| White‡ | 193 (59) | 193 (60) |
| Black | 134 (41) | 131 (40) |
| Living situation before admission — no. (%) | | |
| Living alone in a private home | 108 (33) | 110 (34) |
| Living with spouse in a private home | 106 (33) | 111 (34) |
| Living with another adult in a private home | 87 (27) | 73 (23) |
| Living in a long-term care institution§ | 24 (7) | 29 (9) |
| Overall health status two weeks before admission — no. (%) | | |
| Excellent | 15 (5) | 15 (5) |
| Good | 100 (33) | 67 (23) |
| Fair | 110 (36) | 124 (43) |
| Poor | 82 (27) | 82 (28) |
| Overall health status on admission — no. (%) | | |
| Excellent | 10 (4) | 4 (1) |
| Good | 63 (22) | 55 (20) |
| Fair | 109 (38) | 95 (34) |
| Poor | 103 (36) | 122 (44) |
| No. of basic activities performed two weeks before admission — no. of patients (%)¶ | | |
| 5 | 196 (62) | 190 (62) |
| <5 | 122 (38) | 117 (38) |
| Mean no. of basic activities performed two weeks before admission | 4.0±1.6 | 3.9±1.7 |
| No. of basic activities performed on admission — no. of patients (%)¶ | | |
| 5 | 125 (38) | 133 (41) |
| <5 | 202 (62) | 191 (59) |
| Mean no. of basic activities performed on admission | 3.0±2.0 | 3.0±2.1 |
| Instrumental activities of daily living‖ | | |
| Two weeks before admission | 4.2±2.4 | 4.1±2.5 |
| On admission | 2.8±2.1 | 2.8±2.3 |
| Chief reason for admission — no. (%) | | |
| Change in mental status or other neurologic abnormality | 36 (11) | 40 (13) |
| Congestive heart failure, chest pain, or other cardiac problem | 58 (18) | 49 (15) |
| Fever, pneumonia, or other infection | 59 (18) | 63 (20) |
| Acute dyspnea or other pulmonary problem | 60 (19) | 46 (14) |
| Gastrointestinal bleeding or other gastrointestinal problem | 61 (19) | 63 (20) |
| Diabetes mellitus, failure to thrive, or other problem | 46 (14) | 57 (18) |
| Coexisting conditions — no. (%) | | |
| Congestive heart failure | 83 (26) | 74 (23) |
| Cancer | 74 (23) | 67 (21) |
| Chronic lung disease | 70 (22) | 64 (20) |
| History of myocardial infarction | 53 (17) | 66 (21) |
| Cerebrovascular disease | 39 (12) | 56 (18) |
| Dementia | 31 (10) | 41 (13) |
| Charlson comorbidity score** | 2.3±2.3 | 2.3±2.2 |
| APACHE II score†† | 13.4±4.8 | 13.4±4.9 |
| Mental-status score‡‡ | 16.8±3.9 | 16.9±4.1 |
| Depression score§§ | 4.3±3.0 | 4.9±3.4 |

*Plus–minus values are means ±SD. Differences between the groups were not statistically significant, with the exceptions that patients assigned to the intervention group reported better overall health status at admission (P = 0.04) and were less likely to have a clinical diagnosis of cerebrovascular disease (P = 0.05). Because of rounding, percentages do not always total 100.

†Data were missing for some patients, as follows: living situation before admission, 3 patients; overall health status two weeks before admission, 56 patients; overall health status on admission, 90 patients; ability to perform basic and instrumental activities of daily living two weeks before admission, 26 patients; ability to perform instrumental activities of daily living on admission, 28 patients; chief reason for admission, 13 patients; Charlson comorbidity score and coexisting conditions, 12 patients; Acute Physiology and Chronic Health Evaluation (APACHE) II score, 8 patients; mental-status score, 215 patients; and depression score, 224 patients.

‡Includes one Asian woman.

§Long-term care institutions included skilled nursing facilities, rehabilitation hospitals, and other institutions providing assistance with daily activities.

¶The five basic activities of daily living were bathing, dressing, using the toilet, moving from a bed to a chair, and eating. The numbers shown indicate how many of these activities the patient could perform independently.

‖The seven instrumental activities of daily living were shopping, cooking, performing household chores, using transportation, managing money, managing medications, and using the telephone. The numbers shown indicate how many of these activities the patient could perform independently.

**Higher scores on the Charlson comorbidity index indicate more coexisting illnesses.

††Higher APACHE II scores indicate greater severity of illness.

‡‡Higher scores on the Mini–Mental State scale (0 to 21) indicate better cognitive function.

§§Higher scores on the depression scale (0 to 15) indicate more depressive symptoms.

sion, comorbidity score, and APACHE II score at admission. Stratified and multivariable ordinal logistic-regression analyses were used to control for potentially confounding factors.[31,33] All statistical tests were two-sided, with P = 0.05 as the criterion to indicate statistical significance.

## RESULTS

On admission, the patients randomly assigned to the intervention group were similar to those assigned to receive usual care in most sociodemographic characteristics, health-status measures, chief reasons for admission, and coexisting illnesses (Table 2). Forty-eight of the 651 patients (7 percent) died in the hospital — 24 patients each in the intervention and usual-care groups.

### Outcomes at Discharge

At the time of hospital discharge, 65 (21 percent) of the 303 surviving patients in the intervention group were classified as much better in terms of their ability to perform basic activities of daily living, 39 (13 percent) as better, 151 (50 percent) as unchanged, 22 (7 percent) as worse, and 26 (9 percent) as much worse. In the usual-care group, 40 (13 percent) of the 300 surviving patients were classified as much better, 33 (11 percent) as better, 163 (54 percent) as unchanged, 39 (13 percent) as worse, and 25 (8 percent) as much worse (P = 0.009) (Fig. 1). The findings were similar (P = 0.009) in an analysis limited to the 382 patients who provided complete information about their functional status at both admission and discharge.

The mean numbers of basic activities of daily living that could be performed independently at hospital discharge were 3.6 for the intervention group and 3.3 for the usual-care group (P = 0.05). At discharge, the intervention group also had a higher level of function in the basic activities of daily living than they did two weeks before discharge (P = 0.05) (Fig. 1). Thirty-six (12 percent) of 297 patients in the intervention group were better or much better, 171 (58 percent) had no change, and 90 (30 percent) were worse or much worse, as compared with 16 (6 percent) of 285 patients in the usual-care group who were

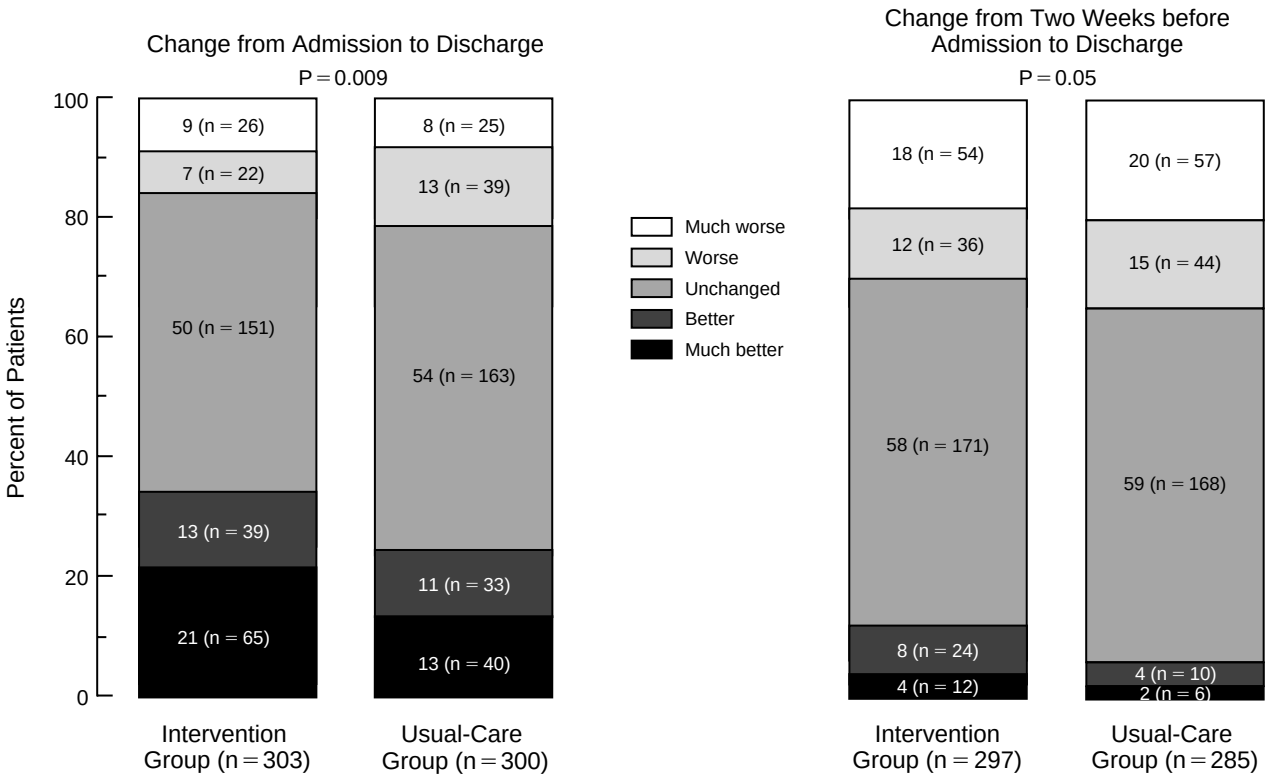


Figure 1. Change in Patients' Ability to Perform Basic Activities of Daily Living from Admission to Discharge and from Two Weeks before Admission to Discharge, According to Treatment Group.

The five basic activities of daily living we studied were bathing, dressing, using the toilet, moving from a bed to a chair, and eating. "Much better" indicates an increase of two or more in the number of basic activities a patient could perform independently, "better" indicates an increase of one, "worse" indicates a decrease of one, and "much worse" indicates a decrease of two or more. The left-hand panels show the changes from admission to discharge for the 603 patients who survived to discharge. For 382 patients, the data were obtained from interviews with the patient at both admission and discharge; for 221 patients, data missing from the interviews were obtained from the patient's primary nurse at admission or discharge. The right-hand panels show the changes from two weeks before admission to discharge for the 582 patients who survived to discharge for whom data on function two weeks before admission were available. Differences between the treatment groups were tested with the chi-square test for linear trend.

better or much better, 168 (59 percent) who had no change, and 101 (35 percent) who were worse or much worse.

Table 3 shows the changes from hospital admission to discharge in the number of activities of daily living that could be performed independently by different groups of patients. In the intervention group, benefits were seen for patients less than 80 years old ($P = 0.03$), those who were able to perform independently fewer than five basic activities of daily living two weeks before admission ($P = 0.04$), and those with APACHE II scores of 0 through 14 ($P = 0.02$). Trends toward a benefit were seen in other groups.

In a multivariable ordinal logistic-regression model controlling for age, sex, race, the number of basic and instrumental activities of daily living the patient was able to perform independently two weeks before admission, and each of five characteristics measured on admission (overall health status and APACHE II score, Charlson comorbidity score, mental-status score, and depression score), we found that an increase in the number of activities of daily living performed independently from admission to discharge was independently associated ($P = 0.04$) with assignment to the intervention program. A parallel analysis limited to the 382 patients who provided complete data on their functional status both at admission and at discharge had similar results (data not shown).

With regard to changes from admission to discharge in the ability to perform individual activities of daily living, more patients assigned to the intervention group improved, and fewer became worse, in their ability to bathe and dress themselves ($P = 0.006$ and $P = 0.02$, respectively). More patients in the intervention group than in the usual-care group showed improvement in their ability to move from a bed to a chair and to use the toilet, but these differences were not significant ($P = 0.2$ and $P = 0.3$, respectively).

Fewer patients assigned to the intervention group were discharged to a long-term care institution (43 patients [14 percent], as compared with 67 patients [22 percent] in the usual-care group; $P = 0.01$) (Table 4). Among the 555 patients admitted to the hospital from private homes who survived to discharge, fewer patients assigned to the intervention group than to the usual-care group were discharged to long-term care institutions for the first time (9 percent vs. 16 percent, $P = 0.02$). Among the 493 patients discharged to private

homes, similar proportions of the intervention and usual-care groups were discharged with plans for new paid health care at home, such as the services of a nurse, homemaker, or health aide (43 percent vs. 41 percent, P = 0.6).

Overall health status at discharge was better (P<0.001) for patients assigned to the intervention group (Table 4); this difference remained significant after we controlled for overall health status at admission in a stratified analysis (P = 0.01). In the intervention group, there was a trend toward greater improvement during hospitalization in the patients' ability to perform instrumental activities of daily living (P = 0.06) and in their ability to walk (P = 0.10) (Table 4). The patients in the intervention group had a lower mean depression score at discharge than those in the usual-care group (Table 4). The two groups did not differ significantly, however, after we controlled for depression scores on admission in a multivariable linear regression analysis (P = 0.3). Mental status at discharge was similar in the two groups (Table 4).

### Resources Used in the Hospital

The mean length of the hospital stay was 1 day shorter for patients assigned to the intervention group (7.3, as compared with 8.3 days for the usual-care group), but the median length of stay was the same (6 days) for each group (P = 0.4). Mean total hospital charges were $10,289 for patients in the intervention group, as compared with $12,412 for patients who received usual care; the median hospital charges were $7,057 and $7,839, respectively (P = 0.3; 95 percent confidence interval for the difference between groups, −$1,212 to $392). The cost of additional hours worked by clinical personnel for the 17-month intervention period totaled $65,000. Capital costs allocated to the intervention group for the special features of the unit totaled $10,500. The total costs not reflected in hospital charges were thus approximately $75,500, or $231 for each of the 327 patients assigned to the intervention program.

Table 3. Change from Hospital Admission to Discharge in the Ability to Perform Basic Activities of Daily Living among the 603 Patients Who Survived to Hospital Discharge.*

| Patient Category and Change in Function | Intervention Group (N = 303) | Usual-Care Group (N = 300) | P Value |
|---|---|---|---|
| | *no. (%)* | | |
| Age <80 yr | | | 0.03 |
| Better | 58 (35) | 43 (27) | |
| Unchanged | 87 (53) | 88 (54) | |
| Worse | 20 (12) | 31 (19) | |
| Age ≥80 yr | | | 0.07 |
| Better | 46 (33) | 30 (22) | |
| Unchanged | 64 (46) | 75 (54) | |
| Worse | 28 (20) | 33 (24) | |
| Performed 5 basic activities two weeks before admission | | | 0.06 |
| Better | 55 (30) | 44 (24) | |
| Unchanged | 109 (59) | 108 (58) | |
| Worse | 22 (12) | 34 (18) | |
| Performed <5 basic activities two weeks before admission | | | 0.04 |
| Better | 46 (41) | 24 (24) | |
| Unchanged | 40 (36) | 48 (48) | |
| Worse | 25 (23) | 27 (27) | |
| APACHE II score 0–14 | | | 0.02 |
| Better | 70 (34) | 44 (22) | |
| Unchanged | 98 (48) | 117 (57) | |
| Worse | 36 (18) | 43 (21) | |
| APACHE II score ≥15 | | | 0.12 |
| Better | 33 (35) | 26 (29) | |
| Unchanged | 49 (52) | 44 (49) | |
| Worse | 12 (13) | 20 (22) | |

*Patients whose function was classified as better were able to perform independently more of the five basic activities of daily living at the time of discharge than at the time of admission, those with unchanged function could perform the same number at both times, and those whose function was classified as worse could perform fewer at discharge than on admission. Because of rounding, percentages do not always total 100. Results are not shown but were similar for patients with Charlson comorbidity scores of 0–2, those with Charlson comorbidity scores ≥3, those who could perform 0, 1, or 2 instrumental activities of daily living independently two weeks before admission, and those who could perform ≥3 instrumental activities two weeks before admission. Information was available on basic and instrumental activities of daily living performed two weeks before admission for 582 patients and on Charlson comorbidity scores and APACHE II scores for 592 patients.

Table 4. Other Outcomes for the 603 Patients Who Survived to Hospital Discharge.

| Variable* | Intervention Group (N = 303) | Usual-Care Group (N = 300) | P Value |
|---|---|---|---|
| | *no. (%)* | | |
| Discharge destination | | | 0.01 |
| Private home | 260 (86) | 233 (78) | |
| Long-term care institution† | 43 (14) | 67 (22) | |
| Residence in a long-term care facility during the three months after discharge | | | 0.03 |
| No | 236 (78) | 210 (70) | |
| Yes | 67 (22) | 90 (30) | |
| Overall health status at discharge | | | <0.001 |
| Excellent | 18 (7) | 10 (4) | |
| Good | 115 (44) | 80 (32) | |
| Fair | 105 (40) | 123 (49) | |
| Poor | 23 (9) | 39 (15) | |
| Change from admission to discharge in instrumental activities performed‡ | | | 0.06 |
| Better | 133 (45) | 95 (33) | |
| Unchanged | 87 (29) | 115 (40) | |
| Worse | 76 (26) | 76 (27) | |
| Change from admission to discharge in ability to walk§ | | | 0.10 |
| Better | 58 (19) | 40 (14) | |
| Unchanged | 223 (74) | 233 (79) | |
| Worse | 21 (7) | 23 (8) | |
| Depression score at discharge¶ | 3.7 | 4.6 | 0.02 |
| Mental-status score at discharge‖ | 17.3 | 17.7 | 0.3 |

*Data were missing for some patients, as follows: overall health status, 90 patients; instrumental activities of daily living, 21 patients; ability to walk independently, 5 patients; depression score, 259 patients; and mental-status score, 273 patients. Because of rounding, percentages do not always total 100.

†Long-term care institutions included skilled nursing facilities, rehabilitation hospitals, and other institutions providing assistance with daily activities.

‡Patients who could perform more of the seven instrumental activities of daily living at discharge than at admission were classified as having better function, those who could perform the same number as unchanged, and those who could perform fewer as worse. The instrumental activities of daily living are listed in a footnote to Table 2.

§Patients who could not walk independently on admission but could do so at discharge were classified as better, and those who could walk independently on admission but not at discharge were classified as worse. Other patients' status was unchanged.

¶Higher depression scores indicate more depressive symptoms.

‖Higher mental-status scores indicate better cognitive function.

### Outcomes and Use of Resources during the Three Months after Discharge

During the three months after discharge, 82 patients died — 42 (14 percent) assigned to the intervention group and 40 (13 percent) assigned to the usual-care group; 6 patients (1 percent) were lost to follow-up. Three months after discharge, the intervention and usual-care groups did not differ significantly in the mean number of basic activities of daily living the patients could perform independently (4.0 and 3.8, re-

spectively; P = 0.3), the mean number of instrumental activities of daily living they could perform independently (3.9 and 3.8, respectively; P = 0.5), or overall health status as reported by the patients or proxy respondents (P = 0.5).

Among the 493 patients discharged to private homes, similar proportions of the intervention and usual-care groups were admitted to long-term care institutions during the three months after discharge (24 of 260 patients [9 percent] vs. 23 of 233 patients [10 percent], respectively). Fewer patients assigned to the intervention group lived in long-term care institutions at any time during the three months after discharge (67 patients, vs. 90 patients in the usual-care group; P = 0.03) (Table 4). Among the 603 patients who survived to discharge, similar numbers in the intervention and usual-care groups were readmitted to acute care hospitals during the three months after discharge (104 of 303 patients [34 percent] vs. 109 of 300 patients [36 percent], respectively; P = 0.6), and similar numbers received paid health care services from nurses, health aides, or homemakers (158 of 303 patients [52 percent] vs. 143 of 300 patients [48 percent]; P = 0.3).

## Discussion

This randomized trial provides evidence that specific changes in the provision of acute hospital care can improve the ability of a heterogeneous group of older patients hospitalized with acute illnesses to perform basic activities of daily living at the time of discharge. More patients assigned to the intervention group — as opposed to those who received usual care — improved from admission to discharge in their ability to perform basic activities of daily living, and fewer became worse, despite their somewhat shorter hospital stays and shorter time for recovery before discharge. Other differences observed at discharge were consistent with this main finding, and the differences between the groups remained significant in multivariable and stratified analyses in which we controlled for potentially confounding base-line characteristics of the patients. Fewer patients assigned to the intervention group were discharged to long-term care institutions or lived in them during the three months after discharge. For every 15 patients treated in the intervention unit, 1 more patient was returned home than from the usual-care units, and 1 less patient was admitted to a long-term care institution. The beneficial effects we observed were apparently achieved without increasing in-hospital or post-discharge costs. Nevertheless, it is important to emphasize that the functional status of the majority of patients in both groups was unchanged or worse at the time of discharge. Three months after discharge, the groups did not differ significantly in terms of their ability to perform basic or instrumental activities of daily living.

### Comparison with Past Studies

Despite the dramatic benefits of geriatric evaluation and management at the end of acute care hospital stays for at least some patients,[34,35] consultative and unit-based interventions to improve the functional outcomes of acutely ill hospitalized older persons have had little benefit.[15,17-21,36-43] The intervention we studied differed from most earlier interventions in several ways, notably by incorporating the physical redesign of the hospital unit, the key role assigned to nurses in initiating assessment and case management, and the scheduling of daily rounds by a multidisciplinary team. Two earlier studies[44,45] also involved nurse-initiated interventions; both of these studies found evidence of beneficial effects.

### Methodologic Considerations

We recognize potential limits to the validity of our findings. The impracticality of blinding patients and interviewers to the treatment assignments may have biased the reports of outcomes. To obtain reports about health status for all patients, proxy reports were required in many cases, and reports from patients and proxies may differ.[27,46] Nonetheless, several factors support the validity of our findings. Different outcome measures consistently indicated that the intervention had a beneficial effect. The better function in the intervention group than in the usual-care group at the time of discharge was consistent in subgroup and multivariable analyses. Finally, bias in the design and conduct of the study was reduced by the random assignment of patients, the use of measures with established validity and reliability, and the complete follow-up data for the main outcome variable.

Our study was designed to test the efficacy of the Acute Care for Elders program as a whole, rather than to determine the relative efficacy of its different components, its cost effectiveness, or its long-term effects. Further evaluation will be necessary to address these issues and to test the effectiveness of this approach in other settings.

### Implications

The loss of functional independence is not an inevitable consequence of acute illness and hospitalization among older patients. The intervention we studied can serve as a model for improving aspects of overall function — indicated by the ability to care for oneself — that are not specifically related to a particular disease or treatment. Although functional outcomes are rarely the focus of conventional medical care, they may be critical determinants of the quality of life, independence, cost of care, and prognosis among older patients.[46-48] Functional outcomes are especially important in acutely ill, hospitalized older patients, who are often frail, chronically ill, and at high risk for functional decline and institutionalization for long-term care.[12,14,48] Furthermore, an intervention program such as ours does not preclude, and may complement, disease-specific or treatment-specific efforts to improve patients' outcomes.[4-8,49]

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