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SPECIAL ARTICLE

A RANDOMIZED, CONTROLLED TRIAL OF A GERIATRIC ASSESSMENT UNIT IN A COMMUNITY REHABILITATION HOSPITAL

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Abstract We conducted a randomized trial in a community rehabilitation hospital to determine the effect of treatment in a geriatric assessment unit on the physical function, institutionalization rate, and mortality of elderly patients. Functionally impaired elderly patients (mean age, 78.8 years) who were recovering from acute medical or surgical illnesses and were considered at risk for nursing home placement were randomly assigned either to the geriatric assessment unit (n = 78) or to a control group that received usual care (n = 77). The two groups were similar at entry and were stratified according to the perceived risk of an immediate nursing home placement.

After six months, the patients treated in the geriatric assessment unit had significantly more functional improvement in three of eight basic self-care activities ($P<0.05$). Those in the lower-risk stratum had significantly more improvement in seven of eight self-care activities. Both six weeks and six months after randomization, significantly more patients treated in the geriatric assessment unit than controls (79 vs. 61 percent after six months) were residing in the community. During the year of follow-up, the control patients had more nursing home stays of six months or longer (10 vs. 3; $P<0.05$). However, there was no difference between the groups in the mean number of days spent in health care facilities (acute care hospital, nursing home, or rehabilitation hospital). Survival analysis showed a trend toward fewer deaths among the patients treated in the geriatric assessment unit, and mortality was significantly reduced in the patients considered to be at lower risk of immediate nursing home placement ($P<0.05$).

We conclude that the treatment of selected elderly patients in a specialized geriatric rehabilitation unit improves function, decreases the risk of nursing home placement, and may reduce mortality. The beneficial effects on mortality and function appear greatest for patients at a moderate rather than high risk of nursing home placement. (N Engl J Med 1990; 322:1572-8.)

WHEN impaired older persons become ill, they are at high risk of death or functional deterioration that leads to institutionalization.[1,2] Acute care hospitals have financial incentives to discourage the prolonged stays these patients may require to recover functional independence.[2] Unfortunately, older patients who remain functionally impaired after hospitalization may not qualify for skilled nursing care, and home health services may not meet all their medical, rehabilitative, and social needs. A relatively new clinical resource is the inpatient geriatric assessment unit,[3] a multidisciplinary unit that provides comprehensive medical and social assessment as well as treatment, often with an emphasis on rehabilitation.

The initial descriptive studies suggested that geriatric assessment units favorably affected health status, functional activities, and discharge to more independent living arrangements.[1,4,5] However, there have been few randomized trials to evaluate the effectiveness of such units. In 1984 Rubenstein and colleagues reported the results of a randomized clinical trial of treatment in a geriatric assessment unit based in a Veterans Administration (VA) hospital.[6] That study found that treatment in the unit reduced subsequent rates of mortality and institutionalization and lowered health

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care costs per year of life. Questions have remained about whether these results can be extrapolated to non-VA settings and whether the differences ascribed to the geriatric assessment unit may have been a result of specialized follow-up care in an outpatient geriatric clinic.

We conducted a randomized, controlled clinical trial to determine whether care for functionally impaired older patients in a geriatric assessment unit in a community-based rehabilitation hospital would affect their subsequent function, rate of institutionalization, and mortality. The patients in this study received care in the geriatric assessment unit as the only intervention and did not receive specialized follow-up care. To evaluate which types of patients might benefit most from such a unit, randomization to the geriatric assessment unit or a control group was stratified according to whether the patient was judged before randomization to be at a lower or higher risk of immediate nursing home placement.

Methods

Patients

The patients who participated in this study were selected from all patients referred to the geriatric assessment unit of the Baptist Memorial Hospital, Memphis, by physicians or social-work personnel. Referrals came primarily from discharge planners and an array of physicians in primary care and various specialties throughout the Baptist Memorial Hospital (a 1500-bed university-affiliated community hospital) system, although some referrals were received from each hospital in the city. In general, the patients referred were functionally impaired and were deemed to be at risk of a nursing home placement.

All patients referred to the geriatric assessment unit were first evaluated by one of two physicians on the staff of the unit, who judged whether or not the patients met the criteria for the study. To be eligible, a patient had to be considered at risk for nursing home placement, to have potentially reversible functional impairment, or both. In addition, the patient had to meet the following criteria for inclusion: age of 65 or older, loss of independence in more than one activity of daily living,[7] willingness to participate in a randomized study and give signed informed consent, and access to a primary physician willing to resume care of the patient at discharge. A few patients under the age of 65 were considered if they met all other criteria. Patients were excluded if they had medical problems that were unstable or required continued short-term monitoring, if their survival was estimated to be less than six months, if they had serious chronic mental impairment, or if a nursing home placement was considered inevitable.

During the enrollment period from July 1985 to June 1987, 278 referrals were received. Of the patients referred, 123 (44 percent) were considered ineligible for the following reasons: medical instability in 18 (6.5 percent of the total number of referrals), low estimate of survival in 12 (4.3 percent), excessively severe cognitive impairment in 34 (12.2 percent), insufficient medical or functional impairment in 12 (4.3 percent), refusal of consent in 21 (7.6 percent), inevitability of a nursing home placement in 8 (2.9 percent), and miscellaneous reasons in 18 (6.5 percent). The remaining 155 patients were randomly assigned, 77 to the control group and 78 to the geriatric assessment unit.

Randomization

Randomization was conducted in a stratified-block design with a computer-generated table of random numbers. Stratification was performed before randomization according to whether the patient, the family, or the consulting physician thought that the patient had a higher or lower risk of immediately going to a nursing home. In the case of patients whose mental status was intact, their opinion of the likelihood of immediate nursing home placement was used in the stratification. If the patient was confused, the family's opinion was used or, if there was no family, the physician's opinion was used. At the initial consultation, the patient (or family) was asked the following question: "If you were discharged from the hospital today, where would you go?" If the answer was "definitely (or possibly) to a nursing home," the patient was placed in the higher-risk stratum. If the patient or the family mentioned another option for placement at discharge, the patient was placed in the lower-risk stratum.

After the initial consulting physician had seen the patient and agreed that the patient was a candidate for the study, a trained interviewer obtained informed consent from the patient or family member and collected base-line data. If no new information was discovered that would serve to exclude the patient from the study, the interviewer obtained the randomization assignment. The time from referral to randomization averaged two days, and the time from randomization to admission to the geriatric assessment unit averaged three days.

The Geriatric Assessment Unit

The geriatric assessment unit studied was a 10-bed unit in a rehabilitation hospital that occupies a separate building within the Baptist Memorial Hospital complex. The unit's organization and functioning and the specific roles of the staff members have been described in detail elsewhere.[1,8] In the unit, emphasis was placed equally on an interdisciplinary assessment of the problems of the patients and on rehabilitation. The primary objective of the unit was to improve health and functional status sufficiently that patients at risk of institutionalization could avoid placement in a nursing home. The secondary purpose was to provide rehabilitation for acutely disabled older patients, regardless of the risk of nursing home placement.

In the geriatric assessment unit, an interdisciplinary assessment of medical, social, and psychological function was completed within 72 hours of admission by a team of physicians (university faculty and fellows), rehabilitation nurses, physical therapists, occupational therapists, psychologists, social workers, nutritionists, and specialists in speech therapy and audiology.[1,8] Particular attention was paid to problems common in frail, hospitalized older persons, such as incontinence, decubitus ulcers, contractures, confusion, sensory disorders, depression, toxic effects of medication, inadequate nutrition, weakness or lack of motivation, inability to perform activities of daily living, gait disorders, and falls. Also, the degree of family and other social support was assessed.

After the assessments were completed, the team determined at the first of a series of weekly meetings whether the patient was a candidate for a specific treatment, rehabilitation, or both. If medical treatment was required, the patient was either treated in the unit or returned to the care of the referring physician. Any patient with a defect in vision, hearing, or speech was referred to the appropriate therapist. If the patient needed rehabilitative care, a rehabilitation plan with specific goals was developed, and the patient's progress was reevaluated weekly. All patients receiving rehabilitative care were required to have a degree of impairment such that physical, occupational, or recreational therapy was needed in some combination three times a day in order to meet Medicare requirements. When patients reached their rehabilitation goals or attained a stable level of function, they were discharged without any subsequent services from the geriatric-assessment-unit team.

Control Group

Neither the staff members of the geriatric assessment unit nor the investigators in the study were involved in the care of the patients in the control group after randomization. Instead, the controls received the usual care provided by their physicians. There were no differences between groups in the specialties of the primary physicians providing care for their patients; two thirds of the patients in each group received primary care from internists in the community.

The patients in the control group received a wide range of services after discharge from the acute care hospital, including home health care in 36 patients (47 percent) and care in other rehabilitation units in 17 (22 percent).

The care provided to patients in the control group in the Baptist Memorial Hospital system would compare favorably with national norms. The Baptist Memorial Hospital offers a diverse range of services (including the free-standing rehabilitation hospital that houses the geriatric assessment unit). Because the patients were referred by physicians in many specialties and received no special follow-up care, it is unlikely that the control group received care different from that given to the geriatric-assessment-unit group, except for care received in the unit itself.

Measures

All data were collected by trained interviewers who did not participate in the clinical care of the patients. The evaluations of the patients were made before randomization and six weeks, six months, and one year after randomization. The interviews after discharge were conducted at each patient's place of residence. The data collected included demographic characteristics, information on place of residence, self-reported ability to perform physical activities ranging from basic self-care to moving heavy objects,[9] observed performance on timed physical tests (including timed manual-function tests),[10] scores on the Center for Epidemiologic Studies depression (CES-D) scale,[11] and results of the Folstein Mini–Mental State examination.[12]

For the activities-of-daily-living or ADL scale, the data on eight indexes were graded on scales with five points, as follows: (1) unable to perform the activity, (2) requires assistance of another person and equipment, (3) requires assistance of another person, (4) requires assistance of equipment only, and (5) requires no assistance. Independence with respect to each activity was defined as the ability to perform the task without assistance from another person. Minimal ADL impairment was defined as independence on six or more of the indexes, moderate impairment as independence on two to five indexes, and severe impairment as independence on no more than one index. Data on nursing home use and hospital use were obtained from the patient and the family and were verified by the institutions involved.

At the end of the study, the patients' severity of illness during the hospital stay before randomization was assessed retrospectively from the medical records by a physician experienced in such assessments and not previously involved in the study. Severity was measured as an APACHE II score for each patient with the method of Knaus and colleagues.[13] In cases of missing or undocumented clinical data, normal values with no points for severity were assigned. The assignments to intervention groups were in the medical records, but the risk-stratification assignments were not.

Statistical Analysis

For continuous variables, the comparability of the study groups was tested with Student's t-test for differences between the means of two independent samples (pooled estimate of population variance); the chi-square test of statistical independence was used for categorical variables.[14] All analyses related to outcomes used the intention-to-treat approach, with all data for a patient assigned to the group to which the patient had been assigned at randomization. Survival distributions and distributions of the time to a first nursing home admission were analyzed with the log-rank-test statistic.[15,16] Hazard ratios and their 95 percent confidence intervals were estimated with Cox proportional-hazards regression models.[16,17] All statistical tests were nondirectional (two-sided), with $P = 0.05$ used as the criterion of statistical significance.

Before the start of the study, we estimated the sample sizes needed for an alpha level of 0.05 (two-tailed) and a power equal to 0.80. These calculations showed that if half the frail elderly patients who were hospitalized and had loss of function were placed in nursing homes within one year, a total sample of 180 would be needed for reliable detection of a reduction in the rate of nursing home placement to 30 percent in the intervention group. Although projections indicated that it would be possible to enroll more than 200 subjects in the study, time and fiscal constraints allowed the randomization of only 155 subjects.

Results

Table 1 shows the base-line demographic characteristics and functional status of the 155 patients enrolled. The mean age of the patients was 78.8 years (range, 61 to 100). There were no significant differences between the geriatric-assessment-unit group and the control group with respect to base-line demographic data, scores on the CES-D inventory and the Mini–Mental State examination, activities of daily living, or measures of timed physical performance. There were no significant differences in types of diagnoses or severity-of-illness scores between the two groups. The most common diagnoses at referral were as follows: hip fracture in 28 patients (18 percent), other fractures in 23 (15 percent), other conditions requiring orthopedic surgery in 9 (6 percent), conditions requiring nonorthopedic surgery in 14 (9 percent), circulatory disorders in 21 (14 percent), stroke in 15 (10 percent), musculoskeletal disorders in 9 (6 percent), psychiatric disorders in 7 (5 percent), endocrine disorders in 6 (4 percent), pulmonary disorders in 6 (4 percent), and miscellaneous medical disorders in 17 (11 percent). There was a trend toward longer initial hospital stays in the control group ($P = 0.09$).

The base-line demographic characteristics, severity-of-illness scores, and functional status of the patients after stratification according to higher or lower risk of immediate nursing home placement are shown in Table 2. The patients in the higher-risk stratum had significantly longer initial hospital stays, higher severity-of-illness scores, and higher levels of dependence as measured on the ADL scale at base line. A logistic

Table 1. Characteristics of 155 Patients at Randomization.*

Variable	Geriatric Assessment Unit	Controls
No. of patients →	78	77
Age (yr)	79.4±7.0	78.1±7.6
Sex (% female)	79.5	74.0
Marital status (% married)	23.1	26.0
Race (% white)	84.6	84.3
Living alone (%)	53.8	51.9
Children (no.)		
Alive	1.4±1.7	1.7±1.8
Nearby	0.77±1.3	0.77±1.2
High-school education or more (%)	53.2	59.7
Initial hospital stay (days)	18.6±12.2	22.7±16.0
ADL impairment (%)†		
Minimal	14.1	14.3
Moderate	50.0	45.5
Severe	35.9	40.3
Severity of illness‡	13.1±6.1	11.8±5.9

*Plus–minus values are means ±SD.

†ADL denotes activities of daily living. Minimal impairment was defined as independence in ≥6 activities, moderate impairment as independence in 2 to 5 activities, and severe impairment as independence in ≤1 activity.

‡Age-adjusted APACHE II scores for the course of illness from hospital admission to randomization.

Table 2. Characteristics of the Patients at Randomization According to Risk of Immediate Placement in a Nursing Home.*

VARIABLE	HIGHER RISK	LOWER RISK
No. of patients →	55	100
Age (yr)	79.7±6.5	78.3±7.7
Sex (% female)	71	80
Marital status (% married)	34.5	19.0†
Mini–Mental State score	20.9±5.4	22.4±5.5
Prescription medications (no.)	5.8±10.7	4.2±2.4
Previous nursing home stay (%)	9.1	3.0
Initial hospital stay (days)	24.8±17.6	18.2±11.5‡
ADL impairment (%)§		
Minimal	12.7	15.0
Moderate	36.4	54.0
Severe	50.9	31.0†
Severity of illness¶	14.0±6.7	11.7±5.5‡

*Plus–minus values are means ±SD.

†P<0.05 by the chi-square test.

‡P<0.05 by the t-test for two independent samples.

§ADL denotes activities of daily living. Minimal impairment was defined as independence in ≥6 activities, moderate impairment as independence in 2 to 5 activities, and severe impairment as independence in ≤1 activity.

¶Age-adjusted APACHE II scores for the course of illness from hospital admission to randomization.

regression analysis of the stratum assignments identified six variables that were related to the opinion expressed by the patient or family at randomization about the likelihood of an immediate nursing home placement if functional status did not improve. These variables were increased length of initial hospital stay ($P\leq0.001$), age ($P<0.01$), inability to bathe independently ($P\leq0.005$), inability to eat independently ($P\leq0.05$), previous nursing home stay ($P<0.05$), and scores indicating depression on the CES-D scale ($P = 0.09$). With this six-factor model the stratum placement was identified correctly for 79 percent of the patients.

The mean (±SD) length of stay in the geriatric assessment unit was 23.6±13.2 days. For the high-risk stratum, the average stay was 28.6±14.4 days, and for the lower-risk stratum it was 21.1±11.9 days. The outcomes with respect to functional status, residence and use of health services, and mortality are described here. Data are presented for each of the study groups as a whole, then for the two risk strata.

Functional Status

As Table 3 shows, the group assigned to the geriatric assessment unit had significantly more improvement ($P\leq0.05$) than the control group in regard to three basic self-care activities (bathing, dressing, and the ability to transfer) during the six months after randomization and tended to have less deterioration in one other activity (the ability to administer medications). However, these differences between groups disappeared after one year. When performance in these basic activities was analyzed within risk strata, the lower-risk patients in the geriatric assessment unit had significantly greater improvement ($P<0.05$) after six months in seven of eight activities than did the control patients at lower risk. In the higher-risk stratum, there were no differences between patients in the geriatric assessment unit and the control patients in terms of change in the ability to perform these activities.

We also collected data on cognition and depressive symptoms. Assignment to the geriatric assessment unit was not found to affect subsequent Mini–Mental State or CES-D scores.

Residence and Use of Health Services

At follow-up, smaller percentages of the patients assigned to the geriatric assessment unit than of the control patients were living in institutions (either a nursing home or a board-and-care home): after six weeks, 6 patients assigned to the geriatric assessment unit (8 percent) were living in institutions, as compared with 17 controls (24 percent; $P<0.01$ by chi-square test); after six months, there were 8 (11 percent) as compared with 14 (23 percent), respectively ($P = 0.08$); and after one year, 7 (11 percent) as compared with 15 (26 percent; $P<0.05$). Residence in an institution was less common in the geriatric-assessment-unit group at each follow-up interval for both risk strata, but the difference was statistically significant only in the higher-risk stratum. Survival analysis with a proportional-hazards regression model was used to compare the groups with regard to the risk of admission to a nursing home during the year after randomization. In the control patients, the risk of nursing home admission was 3.3 times higher (95 percent confidence interval, 2.6 to 3.8; $P<0.001$ by the log-rank test), although this calculation includes some short-term stays in nursing homes by the control patients, who did not go to the geriatric assessment unit.

An examination of the number of days spent in a nursing home revealed a trend for the patients in the geriatric assessment unit to spend fewer mean days than the controls in nursing homes during the study period (28.6 vs. 55.8; $P = 0.07$ by t-test) but more days in rehabilitation settings (24.3 vs. 4.9; $P<0.0001$). There were no differences in the mean number of days per patient spent in acute care hospitals (13 vs. 13) or in the total days per patient spent in

Table 3. Mean Changes after Six Months in Eight Indexes of the ADL Scale, According to Treatment Group.*

ADL INDEX	GERIATRIC ASSESSMENT UNIT	CONTROLS	P VALUE
	mean ±SD		
Walking	1.1±1.9	0.64±2.3	0.18
Bathing	0.57±1.7	0.01±1.6	0.04
Taking medications	−0.09±1.7	−0.58±1.7	0.07
Grooming	0.53±1.9	0.04±2.0	0.13
Dressing	0.90±1.7	0.27±1.9	0.04
Eating	0.17±1.7	0.30±2.1	0.13
Transferring	1.05±1.9	0.42±2.1	0.05
Using the toilet	0.95±1.9	0.66±1.9	0.37

*Differences were assessed with t-tests for independent samples. Data were measured on five-point scales (see Methods). A positive change in the score indicates improved function.

any of these types of health care facilities (geriatric-assessment-unit group, 69 days; control group, 74).

To determine whether time spent in the geriatric assessment unit could prevent long-term nursing home placement as compared with short-term (convalescent) placement, we divided the nursing home stays into two groups: those of six months or more and those of less than six months. After one year, significantly fewer patients assigned to the geriatric assessment unit had nursing home stays of six months or more (3 vs. 10; $P<0.05$ by the chi-square test).

One of the most important goals of rehabilitation is that of returning patients to independent living in the community. As shown in Table 4, both six weeks and six months after randomization, significantly more patients in the geriatric-assessment-unit group than in the control group were living in the community as opposed to residing in an institution or having died. A similar trend was observed after one year ($P = 0.058$).

Mortality

Figure 1 shows mortality curves for the two groups. A survival analysis of these data showed a trend toward earlier death in the control group throughout the year after randomization. The differences were greatest after six months ($P = 0.08$ by the log-rank test), but they diminished thereafter. By six months, 8 patients in the geriatric-assessment-unit group (10 percent) and 16 patients in the control group (21 percent) had died.

The results comparing mortality among the geriatric-assessment-unit patients and the controls are presented according to risk strata in Figure 2. In the lower-risk stratum, the patients in the control group had a risk of death 4.3 times that of the patients in the geriatric-assessment-unit group six months after randomization (95 percent confidence interval, 1.2 to 15.2; $P<0.05$ by the log-rank test). In contrast, there was no survival advantage attributable to care in the geriatric assessment unit in the higher-risk stratum.

Discussion

Our randomized trial of a geriatric assessment unit in a community-based rehabilitation hospital found

Table 4. Frequency with Which Patients Returned to Residence in the Community.

Time after Randomization	Geriatric Assessment Unit	Controls	P Value*
	no. (percent)		
No. of patients →	78	77	
Six weeks	69 (88.5)	55 (71.4)	0.008
Six months	62 (79.5)	47 (61.0)	0.012
One year	55 (70.5)	43 (55.8)	0.058

*Determined by chi-square tests (1 degree of freedom) of the statistical independence of treatment group and residence status at each time point.

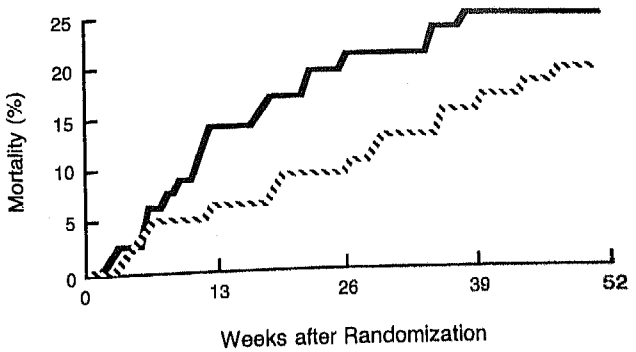

Figure 1. Cumulative Mortality of 78 Patients Randomly Assigned to the Geriatric Assessment Unit (Dashed Line) and 77 Controls (Solid Line).

$P = 0.08$ for the difference in survival risk between the two groups of patients after six months (log-rank test).

that the patients in the unit improved in physical function significantly more than the control patients and were less likely to be residing in nursing homes or board-and-care homes at each follow-up. The patients who went to the geriatric assessment unit spent more days in a rehabilitation setting but were less likely to be admitted to a nursing home and spent fewer days in nursing homes. When the total number of days spent in any health care facility during the year after randomization was analyzed, there were no significant differences between the patients in the geriatric assessment unit and the controls. However, significantly fewer patients assigned to the unit stayed in a nursing home longer than six months, and more such patients were living in the community after each follow-up interval. Care in the geriatric assessment unit did not result in fewer deaths over the one-year study period, although there was a trend toward increased survival in this group overall, particularly in the six months after randomization.

Before the start of the study, it was known that the patients referred to the geriatric assessment unit were prognostically heterogeneous. Thus, randomization was stratified according to the perceived risk of an immediate nursing home placement. Although the analyses of subgroups should be viewed with caution, prognostic stratification at randomization is recommended in situations in which the study cohort may be extremely diverse in terms of the base-line risk of an ultimate outcome.[18] Also, the a priori nature of a stratified randomization increases the credibility of the inferences drawn. Some important differences in outcome between the patients assigned to the geriatric assessment unit and the controls were observed between the risk strata. For the stratum at higher risk of a nursing home placement, care in the unit appeared to decrease the likelihood of residence in an institution but did not influence mortality or physical function. For the lower-risk group, care in the unit appeared to improve survival significantly during the first six months, with a trend still favoring the

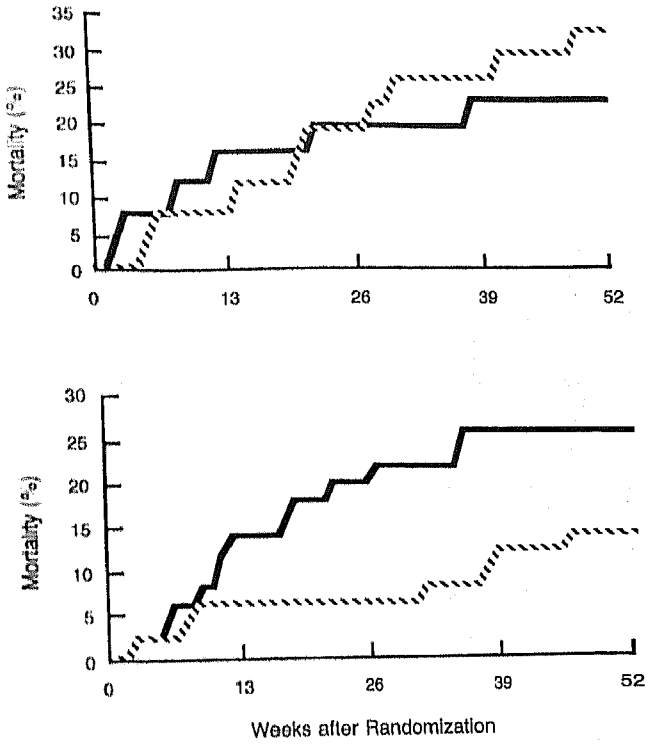

Figure 2. Mortality Curves within the Higher-Risk Stratum (Upper Panel) and the Lower-Risk Stratum (Lower Panel) of Patients Randomly Assigned to the Geriatric Assessment Unit (28 Patients at Higher Risk and 50 at Lower Risk) (Dashed Line) and the Control Group (27 at Higher Risk and 50 at Lower Risk) (Solid Line).

P = 0.92 for the difference in survival risk after six months between groups in the higher-risk stratum, and P = 0.025 for the difference in survival risk after six months between groups in the lower-risk stratum (log-rank test).

unit after one year. In addition, care in the geriatric assessment unit appeared to improve physical function more in this lower-risk stratum than in the higher-risk stratum.

The differences between strata in the effect of the geriatric assessment unit on outcomes are consistent with the clinical profile of the patients at base line. The patients in the higher-risk stratum had higher severity-of-illness scores, longer initial hospital stays, and more functional impairment. These patients may have been too ill and impaired to benefit fully from the intervention in terms of improved mortality and function. The finding that the group assigned to the geriatric assessment unit in the lower-risk stratum (which was somewhat less functionally dependent and less severely ill) had significant improvements in function and survival suggests that these units may have their maximal effect on the health of patients who are moderately but not severely impaired.

Because our study was based on referrals, it is impossible to estimate accurately the proportion of hospitalized patients over the age of 65 who might be eligible for care in a geriatric assessment unit. A previous study found that 4 percent of all persons over 65 who were admitted to a VA hospital (and 8.5 percent of those who stayed in the hospital longer than one week) would be eligible for such care.[6] It seems likely that similar percentages should apply in this community-hospital setting. As Table 2 shows, approximately 65 percent of the patients admitted to the geriatric assessment unit were in the lower-risk group. Although we do not report financial data, some estimates can be made. There were no differences between the patients assigned to the geriatric assessment unit and the controls with respect to subsequent hospital stays. The mean total charges for inpatient rehabilitation during the study period were approximately $400 per patient per day,[8] whereas the mean total nursing home charges in this community range from $40 to $90 per patient per day. Therefore, the charges during the one-year study for the mean excess of 19 days the patients in the geriatric assessment unit spent in rehabilitation settings as compared with the controls (24 vs. 5 days, respectively) would probably not have been offset by the savings from the mean reduction of 27 days (29 vs. 56 days) spent in nursing homes. Whether a longer study would have found more savings as a result of fewer nursing home days is unknown.

The limitations of our study include the fact that we did not enroll a sample of the size estimated to be necessary, thus increasing the probability of a Type II error for some of the comparisons. Because the study involved a single intervention site, the generalizability of the results to other sites cannot be guaranteed. In addition, the subjective nature of the stratifications, although highly predictive of patient outcome, does not allow definitive statements about the appropriate targeting of services.

The effect of our geriatric assessment unit on patients' subsequent mortality and function was less striking than that reported previously by Rubenstein et al.[6] In their study, the intervention group had a 50 percent reduction in mortality and a 48 percent improvement in overall function. However, the effect of the geriatric assessment units on nursing home residence was comparable in their study and ours. There are several crucial differences between the studies that may help explain the differences in the findings. First, the intervention group of Rubenstein et al. received both care in a geriatric assessment unit and specialized follow-up care in a geriatric clinic. Second, our sample was drawn from a community hospital instead of a VA hospital. Third, our sample consisted predominantly of women, whereas theirs was almost all men. On the other hand, both studies demonstrated reductions in nursing home residence and improvements in physical function in the intervention groups; both studies involved at-risk populations and combined assessment with intensive treatment. That the patients in our study, unlike those in the study of Rubenstein et al., received no special intervention

after the geriatric assessment unit argues strongly that treatment in the geriatric assessment unit alone has a significant effect on clinical outcome.

Our findings are also supported by earlier descriptive studies[1,5] and one cohort study[4] involving geriatric assessment units. However, other studies combining geriatric assessment with treatment in different settings, including inpatient consultation services[19-24] and outpatient assessment services,[25-28] have had conflicting results, and the effectiveness of these services is still questioned. Recent reviews of the effect of geriatric assessment in various settings have been published.[22,29] According to the summary statement of a recent National Institute on Aging Consensus Conference, data from studies of the various types of geriatric assessment indicate that the forms of assessment that have shown the most impressive results to date are those that target at-risk patients, are based on studies of inpatients, and combine assessment with intensive treatment or rehabilitation.[30] Our study supports this conclusion, because our inpatient geriatric assessment unit identified patients with functional disabilities, and the outcome data indicated that the unit improved function and increased the probability of continued residence in the community. Furthermore, our analysis of the differences in outcome between risk strata indicated that there may be a threshold effect with regard to the degree of benefit patients will receive from the services of a geriatric assessment unit. Our data suggest that the beneficial effect of such a unit on mortality and physical function may be greatest for elderly hospitalized patients with moderate illness and moderate functional impairment.

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