# Geriatric-Based Versus General Wards for Older Acute Medical Patients: A Randomized Comparison of Outcomes and Use of Resources

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**BACKGROUND:** The effects of residence in an acute geriatrics-based ward (AGW) with emphasis on early rehabilitation and discharge planning for older patients with acute medical illnesses were assessed. Outcome and use of resources were compared with those of patients treated in general medical wards (MWs). A per-protocol rather than intention-to-treat analysis was performed.

**METHODS:** A randomized trial with 3-months follow-up. A total of 190 patients aged 70 years and older were randomized to an acute geriatrics-based ward, and 223 patients were randomized to general medical wards.

**RESULTS:** The two groups were comparable at inclusion. However, after care in the AGW, 71% of patients could be discharged directly home compared with 64% of those treated in MWs (relative risk 1.17; 95% CI, 0.93–1.49). The length of stay was shorter in the AGW (mean 5.9 vs 7.3 days; $P = .002$). The proportion of patients in geriatric or other hospital wards or in nursing homes did not differ, but the proportion of AGW patients in sheltered living tended to be lower ($P = .085$). At the follow-up, case fatality, ADL function, psychological well-being, need for daily personal assistance, drug consumption, need for readmission to hospital, and total health care costs after discharge did not differ between the two groups. Poor global outcome was observed in 37% of AGW and 34% of MW patients.

**CONCLUSIONS:** A geriatric approach with greater emphasis on early rehabilitation and discharge planning in the AGW shortened the length of hospital stay and may have reduced the need for long-term institutional living. This occurred despite patients in an acute geriatric ward not having better medical or functional outcome than older acute patients treated in general medical wards. **J Am Geriatr Soc 48:1381–1388, 2000.**

**Key words: Geriatric rehabilitation; geriatric assessment; general medical wards; randomized trials; hospitalization; healthcare organization**

A growing body of scientific evidence supports the view that older patients with severe illness are particularly vulnerable to systems of care that ignore their specific needs.[1,2] In many countries, acute geriatric units have been established in an attempt to meet the particular needs of older patients. Their effectiveness and costs have, however, seldom been evaluated systematically. Most of the supporting evidence for comprehensive geriatric assessment and rehabilitation comes from studies that have included patients after the acute phase and with long hospital stays.

A meta-analysis of controlled trials performed up to 1992 showed that comprehensive geriatric assessment and rehabilitation programs carried out in hospital settings improved both survival and the ability of frail older people to remain at home.[3] Strict targeting, intensive treatment, and multidisciplinary care and rehabilitation were found to be the major characteristics of successful programs.[3] Few of the trials reviewed in the meta-analysis included acutely ill older patients. However, later trials have included patients admitted acutely to the hospital, often with specific diagnoses such as stroke or hip fracture. The results have been conflicting.[4–9] In some of the trials, the geriatric component has been restricted to a consultation team. Resource consumption in acute geriatric wards has not been compared systematically with that in general medical wards, except in the study by Landefeld et al.[5]

In the present randomized trial, two main hypotheses were tested: (1) when compared with patients admitted to general medical wards, global outcome at 3 months after admission (defined as death and/or severe dependence on others for primary ADL and/or poor psychological well-being) is improved in patients admitted acutely to a dedicated combined geriatric-medical unit without increase in resource consumption, and (2) acute care in a dedicated geriatric-medical unit reduces resource consumption without compromising patient outcome at 3 months.

## PATIENTS AND METHODS

### Patients and Randomization Procedure

All 1201 patients older than age 70 admitted acutely to the University Hospital of Umeå for medical ailments during the study period were considered for inclusion in the study. Patients who required treatment in specialized units, such as the intensive care unit, coronary care unit, or acute stroke unit, or required treatment in one of the designated subspe-

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This study was supported by the Västerbotten County Council and by grants from Vårdalstiftelsen and King Gustaf V's and Queen Victoria's Foundation.
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0002-8614/00/$3.50

cialities, such as in a renal unit, were excluded. Patients fulfilling the above criteria were assigned randomly to one of three wards: one designated as an acute geriatrics-based ward (AGW) or either of two of the previously existing general medical wards (MWs). All patients were admitted directly from the emergency ward by the internist on duty. Each patient could be included only once in the study. Patients who were readmitted within 3 months were admitted to the same ward as on the previous occasion but were not reincluded in the trial.

Patients were informed of the study orally and in writing upon admission. Consent was oral, and in noncompetent patients it was obtained from a family member. The study was approved by the research ethics committee at Umeå University Hospital.

Randomization was performed by the staff in the emergency department, using sealed envelopes. Based on prestudy estimates, the original trial design was that patients would be randomized in blocks of 14 to the AGW and the two MWs in a ratio of 3:2:2. A shorter duration of hospital stay and a smaller number of patients fulfilling the entry criteria than had been expected caused this to be modified to randomization in blocks of 12 patients in a 2:1:1 ratio. When admission to one of the two MWs was temporarily stopped because the ward was full, the patients were randomized to the remaining ward. When the AGW or both MWs stopped admitting patients, randomization was temporarily suspended. Thus, during the trial period all three wards, including the AGW, admitted patients who were not included in the study. However, all analyses of outcome were based only on randomized patients.

Of 444 randomized patients, 25 were excluded because of protocol violations (8 were aged less than 70 years, 12 had an acute myocardial infarction or stroke, and 5 had previously been randomized into the study), four refused to participate after having first consented, and two were transferred to another hospital department within the first few hours. Since the great majority of ineligible patients were those randomized inappropriately ("protocol violators"), it was decided to perform the analyses on a per-protocol rather than an intention-to treat basis.

Thus, 413 patients remained for analysis (34.4% of the hospitalized subjects more than 70 years of age). Of these, 190 were randomized to AGW and 223 to MWs. At 3-months follow-up, 38 patients had died, 12 patients refused to be investigated, and two were lost to follow-up. The remaining 361 were interviewed and investigated.

### Acute Geriatric-Based Ward and Medical Wards

Umeå University Hospital is the only acute-care hospital for a local population of 136,000 people. It also serves as a tertiary referral hospital for four counties in northern Sweden.

The trial randomized patients from March 18 to December 8, 1996 with a temporary 9-week stop because of summer vacations (total inclusion time 29 weeks).

The acute geriatrics-based ward was organized solely for the purpose of this study. Table 1 summarizes the main characteristics of the AGW compared with the medical wards. The geriatric approach followed the principles outlined by the Nordic Working Group on Geriatric Assessment and Rehabilitation.[10] Staffing of the ward was designed to optimize the conditions for treatment, nursing, early rehabilitation, and planning of care for older, acutely ill patients. The staff was recruited from geriatric, medical, and surgical departments. Consultants from both the geriatric and medical departments had joint responsibility for medical care on the ward, with the internist having the main responsibility for acute diagnosis and medical treatment and the geriatrician taking over as soon as the medical condition had stabilized. To reduce the possible influence of differences in competence of individual physicians on patient outcome, consultants and junior physicians (who were recruited from the geriatric department) were replaced at least once during the study period.

Table 1. Major Components of Management Strategies of the Acute Geriatric-Based Ward (AGW) and the General Medical Wards (MW)

| | AGW | MW |
|---|---|---|
| Admission directly from the emergency department | yes | yes |
| Daily medical rounds | yes | yes |
| Staff on ward | | |
| Internist | yes | yes |
| Geriatrician | yes | no |
| Nurses | yes | yes |
| Nurses aids | yes | yes |
| Physiotherapist | yes | not routinely available |
| Occupational therapist | yes | not routinely available |
| Social worker | no | part time |
| Dietician | yes | not routinely available |
| Assessment by physiotherapist and occupational therapist | majority of patients | occasionally |
| Early start of rehabilitation | yes | occasionally |
| Interdisciplinary team work | yes | no |
| Planning of discharge | intense* | moderate† |

*Including conferences and repeated other interactions with the family and contacts with social services very early after admission; nurses directly responsible for these activities after special training.

†Start of planning usually shortly before discharge, mostly by nurses; social workers involved only in selected patients.

The AGW had 11 beds and shared facilities with a surgical ward. There was a 1-week education period for the staff with emphasis on the principles of interdisciplinary and geriatric working forms and on ethical issues. This was followed by a 3-week run-in period of the AGW before the beginning of randomization.

The two internal medical wards each had 30 beds. Both were mixed wards in which acutely ill patients from the local hospital catchment area constituted the majority of patients. Small stroke units, each caring for, on average, 6 to 8 patients, were in operation on both wards. In addition, one of the wards provided tertiary in-hospital care for patients with endocrine disorders and the other for patients with gastroenterological disorders.

### Evaluations

The primary measure of effects was poor global outcome at 3-months follow-up, defined as death and/or severe dependence on others for primary ADL and/or poor psychological

well-being. The main items in estimates of resource consumption were number of readmissions to hospital, consumption of outpatient medical care after discharge, and total healthcare costs during the first 3 months after inclusion into the study.

Following admission, each patient was assessed by one of two study nurses. Since the assessments were performed on the ward, the observers were aware of the group to which the patients had been assigned. They also were also aware of the main hypotheses of the study. Before the study began they trained together to assure uniformity in applying the evaluation instruments. No formal testing of interobserver variability was performed.

Information was gathered from the patient, from the ward nurse responsible for the patient, and from previous and present hospital records. When the patient was unable to provide information, the spouse and/or other family members were interviewed. Information regarding marital status, the existence of close relatives, their location, living conditions of the patient, amount of help with daily activities needed from relatives and from social services was obtained. Data collection based on informants other than the patient was acquired in a similar proportion from those treated in the GMW (16%) and those in MWs (18%). All such patients had a Mini-Mental State Examination (MMSE) score of less than 15.

Ability to carry out activities of daily living was estimated using the Barthel Index.[11] Cognitive function was assessed by the MMSE.[12] Delirium was assessed by the criteria developed by Inouye et al.[13] Previous diagnoses and symptoms leading to the present hospitalization were registered, as was medication before admission.

At discharge from the hospital, length of hospital stay, survival, and whether the patient was discharged home or to institutional care were recorded along with diagnoses and medication. Diagnosis-related group (DRG) weights were coded centrally by the hospital administration office.

Mean costs per day in hospital were calculated separately for AGW and MWs. Total costs per day included all costs of staff, including physicians, nurses, and rehabilitation professionals. Although the AGW used more rehabilitation staff than the MWs, this was counterbalanced by less use of other staff, making the total costs per day only marginally different. Costs of physician time were calculated without adjustment for time spent on-call and in out-patient clinics. Thus, the mean costs per day were 1834 SEK (232 USD) in the AGW and 1763 SEK (223 USD) in MWs. Use of laboratory tests and other diagnostic procedures, e.g., X-ray examinations, were recorded separately. In a more detailed analysis of the number of blood and urine laboratory tests performed, consecutive records from 50 AGW and 50 MW patients were abstracted.

Follow-up was performed in 361 patients who survived for 3 months after inclusion in the study. In 244 patients, this was done by a visit to the home, hospital, or other institution by one of the two study nurses, who were not blinded to the ward in which the patient had been treated during the acute phase. One hundred two patients who lived close to the hospital and were able to use public transportation were interviewed and investigated at an out-patient hospital visit. Fifteen patients who were unable to communicate or who lived far from the hospital were interviewed by telephone (with institutional staff when needed). Acute worsening of a patient's health state resulting in readmission to the hospital or contact with a physician were recorded. Current accommodation, current medication. ADL proficiency, amount of help needed, and cognitive function were assessed in the same way as on admission. In addition, their psychological well-being was assessed using the Philadelphia Geriatric Center Morale (PGCM) scale.[14, 15] When needed, complimentary information was obtained from relatives and from personnel caring for the patient. Poor global outcome at 3 months was defined as death or a Barthel ADL score below 15 (indicating a high risk of long-term institutional care[16]) or a PGCM

Table 2. Basic Characteristics of Patients Randomized to Treatment in an Acute Geriatric-Based Ward (AGW) or General Medical Wards (MW)

| | AGW ($n$ = 190) | MW ($n$ = 223) | Odds Ratio (95% CI) |
|---|---|---|---|
| Age, mean (95% CI) | 80.9 (80.1–81.9) | 81.0 (80.3–81.8) | |
| Sex | | | |
| Men | 42% (79) | 37% (83) | 1.20 (0.81–1.78) |
| Women | 58% (111) | 63% (140) | |
| Residence | | | |
| Cohabitant | 38% (73) | 33% (74) | 1.26 (0.84–1.88) |
| Living alone | 46% (87) | 51% (113) | 0.82 (0.56–1.21) |
| In institution | 16% (30) | 16% (36) | 0.97 (0.57–1.65) |
| Barthel's ADL Index* | | | |
| 0–14 points | 16% (30) | 15% (32) | 1.10 (0.64–1.89) |
| 15–19 points | 32% (60) | 41% (89) | 0.67 (0.45–1.02) |
| 20 points (independent) | 52% (96) | 44% (94) | 1.46 (0.99–2.17) |
| Impaired cognitive function, at entry† | 47% (86) | 53% (113) | 0.80 (0.54–1.19) |
| Consumption of healthcare resources during preceding year, SEK × 1000, mean (95% CI) | 32.7 (26.1–39.5) | 39.7 (31.7–47.7) | |

*Information is missing for 4 AGW patients and 8 MW patients.
†MMSE score ≤23; information missing for 8 AGW patients and 9 MW patients.
n = number of patients.

Table 3. Previous Medical History and Presenting Symptoms on Admission in Patients Randomized to Treatment in an Acute Geriatric-Based Ward (AGW) or General Medical Wards (MW)

| | AGW ($n$ = 190) | MW ($n$ = 223) | Statistical Significance* |
|---|---|---|---|
| Medical history: | | | |
| Myocardial infarction | 24% (46) | 17% (37) | .06 |
| Angina pectoris | 25% (48) | 27% (60) | .74 |
| Cardiac failure | 13% (25) | 15% (34) | .58 |
| Stroke | 16% (31) | 22% (48) | .21 |
| Diabetes | 17% (33) | 23% (51) | .18 |
| Dementia | 6% (12) | 5% (12) | .83 |
| Main presenting symptom† | | | |
| Chest pain | 21% (39) | 25% (55) | .35 |
| Other pain | 8% (16) | 13% (30) | .12 |
| Dyspnea | 18% (35) | 18% (41) | 1.00 |
| Nausea/vomiting | 11% (21) | 11% (25) | 1.00 |
| Vertigo | 11% (20) | 11% (25) | .88 |

*By Fisher's exact test; NS denotes $P > .05$.
†Only symptoms occurring in ≥10% of all patients are listed.
n = number of patients.

psychological well-being score below 9 ("low" in the original description of the instrument[14] and in a later validation study.[15])

Data on consumption of healthcare resources 1 year before inclusion into the study and during the first 3 months after inclusion were obtained by an economic accounting system developed at Umeå University Hospital covering all expenses by the healthcare system in the local catchment area. By use of unique person identification numbers and record linkage, the costs are specified at an individual level. By this system, it is possible to monitor all consumption of in-hospital resources as well as those incurred by out-patient visits, e.g., to physicians, nurses, physiotherapists, and occupational therapists in the hospital catchment area. Costs for institutional care at 3 months were based on the following mean daily costs derived from the hospital and local community administrations: geriatric or other hospital ward 1760 SEK (223 USD), nursing home 925 SEK (117 USD), and sheltered living 520 SEK (66 USD).

### Statistics

In sample size calculations, the possibility of reaching statistical significant differences in a number of end-points was considered. Thus, including 420 patients permitted the detection (at $P < .05$, $\beta > 0.80$) of a 15% absolute difference in the proportion of patients who had reduced ADL function or were dead at 3-months follow-up and a 3% absolute difference in poor global outcome at 3 months (death and/or severe dependence on others for primary ADL and/or poor psychological well-being). The study was not designed to detect moderate differences in survival. A sample size of 420 was also calculated to be sufficient to detect a 20% difference in length of hospital stay, a 20% difference in days spent in institutional care during the first 3 months, and a 2500 SEK (313 USD) difference in mean total costs for medical care during the first 3 months.

Proportions, means, medians, and relative risks are presented with their 95% confidence intervals (CI). Test scores and measures of resource consumption usually had skewed distributions. Therefore, nonparametric statistical tests (Kruskal-Wallis test and Wilcoxon rank sum W test) were used throughout when comparing the two experimental groups. Differences in proportions were tested by Fisher's exact test. The SPSS program, version 6.1, was used for statistical calculations.

## RESULTS

### Comparability at Randomization and Early After Admission

As shown in Table 2, patients randomized to the AGW were similar to those randomized to MWs in most prognostic variables. Thus, age and sex distribution and living conditions before the hospitalization did not differ. A slightly higher proportion of MW patients were living alone, had some degree of reduced primary ADL proficiency, and had impaired cognitive function at entry, but the differences between the groups were not statistically significant. The mean number of drugs prescribed before admission was 4.8 (95% CI 4.3–5.3) in patients randomized to the AGW and 5.2 (95% CI 4.8–5.7) in patients randomized to MWs. The use of healthcare resources, including all costs for hospitalization, outpatient visits, rehabilitation, and major laboratory investigations, during the year preceding the index event was only marginally greater in the MW group (Table 2).

A somewhat higher proportion of patients in the AGW group had a history of myocardial infarction, whereas a history of stroke or diabetes was slightly more common among MW patients; otherwise, previous medical histories were similar in the two groups (Table 3). Presenting symptoms did not differ between AGW and MW patients (Table 3).

When first seen by the study observers early after admission, the proportion of patients fulfilling the standardized criteria for delirium[13] was 4.3% in the AGW patients and 5.0% in the MW patients. The proportions of patients who, by the same criteria, developed confusion later during the hospital stay were 3.3% and 1.9%, respectively.

### Status at Discharge

The diagnoses at discharge were similar in the two groups. The most frequent primary diagnosis was heart fail-

Table 4. Discharge Status in Patients in an Acute Geriatric-Based Ward (AGW) or in General Medical Wards (MW). Number of patients are given in parentheses. Information missing in 5 AGW and 8 MW patients.

| | All patients | | | Not institutionalized before the event* | | |
|---|---|---|---|---|---|---|
| Discharged to | AGW (*n* = 190) | MW (*n* = 223) | Relative Risk (95% CI) | AGW (*n* = 160) | MW (*n* = 187) | Relative Risk (95% CI) |
| Home | 71% (134) | 64% (143) | 1.17 (0.93–1.49) | 83% (132) | 75% (140) | 1.30 (0.95–1.79) |
| Geriatric rehabilitation ward | 4% (8) | 9% (19) | 0.63 (0.35–1.13) | 4% (7) | 9% (17) | 0.61 (0.33–1.16) |
| Other hospital ward | 3% (6) | 5% (12) | 0.72 (0.37–1.39) | 4% (6) | 6% (12) | 0.71 (0.37–1.38) |
| Nursing home | 5% (9) | 2% (5) | 1.42 (0.95–2.12) | 3% (4) | 1% (2) | 1.46 (0.82–1.59) |
| Sheltered living | 13% (25) | 17% (38) | 0.90 (0.65–1.25) | 3% (5) | 6% (12) | 0.57 (0.24–1.33) |
| Death | 4% (8) | 3% (6) | 1.25 (0.79–2.00) | 4% (6) | 2% (4) | 1.31 (0.78–2.20) |
| Returning to previous living | 80% (152) | 74% (166) | 1.20 (0.91–1.57) | | | |

*Not living in institution (including sheltered living) before the index event.
n = number of patients.

Table 5. Outcome After Discharge from an Acute Geriatric-Based Ward (AGW) or General Medical Wards (MW) and up to Three Months after the Index Event (number of patients are given in parentheses unless stated otherwise)

| | AGW (*n* = 190) | MW (*n* = 223) | Relative Risk (95% CI) |
|---|---|---|---|
| Events after discharge to 3 months* | | | |
| Proportion with acute worsening needing attention by physician | 37% (67) | 36% (79) | 1.01 (0.81–1.26) |
| Proportion readmitted to acute-care hospital | 34% (61) | 28% (61) | 1.14 (0.92–1.43) |
| Place of stay at 3 months† | | | |
| At home | 63% (117) | 58% (124) | 1.11 (0.89–1.38) |
| Geriatric or other hospital ward | 8% (15) | 8% (16) | 1.04 (0.71–1.52) |
| Nursing home | 6% (11) | 8% (16) | 0.87 (0.54–1.38) |
| Sheltered living | 12% (22) | 19% (40) | 0.73 (0.51–1.04) |
| Dead | 11% (21) | 8% (17) | 1.27 (0.95–1.69) |
| Barthel's ADL Index at 3 months‡ | | | |
| 0–14 points | 28% (47) | 25% (50) | 1.08 (0.85–1.38) |
| 15–19 points | 28% (46) | 32% (63) | 0.89 (0.69–1.15) |
| 20 points (independent) | 44% (74) | 43% (85) | 1.03 (0.82–1.29) |
| Cognitive function by MMSE at 3 months, median score (interquartile range)§ | 26 (21–28) | 24 (17–27) | |
| Psychological well-being by PGCM at 3 months, median score (interquartile range)¶ | 12 (9–14) | 13 (9–14) | |

*Among patients discharged alive from AGW (*n* = 182) and MW (*n* = 217).
†Information missing in 4 AGW and 10 MW patients.
‡Information missing in 2 AGW and 8 MW surviving patients.
§Data available in 163 AGW and 194 MW patients.
¶Data available for 139 AGM and 161 MW patients.

ure, which occurred in 15% of AGW and 13% of MW patients. Other common diagnoses were unspecified vertigo (8% and 7%), angina pectoris (7% and 5%), and chest pain without specific cause (7% and 6%), respectively. Mean DRG weight was slightly higher in the MW (1.22; 95% CI 1.11–1.33) than in the AGW (1.13; 95% CI 1.04–1.23) group.

As shown in Table 4, case fatality during acute hospital stay was low in both groups. A higher proportion of AGW patients was discharged home and a lower proportion to continued hospital care; these differences did not, however, reach statistical significance. The proportion discharged to further hospital care was also lower (although not statistically significantly so) in AGW patients when only patients who had lived independently before the index event were considered (Table 4, right panel). Of the patients who had not been institutionalized before their admission to hospital, 17.5% (28/160) of those cared for in AGW were discharged to any form of institutional care or died compared with 25.1% (47/187) of those cared for on MWs ($P = .09$ by Fisher's exact test).

### Outcome at Three Months

From the time of discharge to follow-up at 3 months after inclusion into the study, the proportion of patients in need of medical attention by a physician because of acute

Table 6. Resource Consumption in Patients Treated in an Acute Geriatric-Based Ward (AGW) or General Medical Wards (MW) up to Three Months After the Index Event (95% confidence intervals are given in parentheses unless otherwise stated)

| | AGW | MW |
|---|---|---|
| Length of hospital stay, index event, mean days | 5.9 (5.1–6.7) | 7.3 (6.5–8.0) |
| Costs of hospital stay, mean SEK × 1000* | 10.8 (9.3–12.3) | 12.8 (11.5–14.1) |
| Mean number of out-patient visits after discharge and up to 3 months | | |
| Physician | 2.1 (1.8–2.4) | 2.0 (1.7–2.2) |
| Nurse | 2.6 (1.9–3.6) | 3.4 (1.8–5.0) |
| Physio and/or occupational therapist | 0.9 (0.3–1.5) | 0.2 (0.1–0.3) |
| Proportion with personal assistance at 3 months | | |
| by family member† | 15% (10–21%) | 18% (13–25%) |
| by community social services‡ | 37% (29–45%) | 38% (30–46%) |
| Mean number of drugs per patient at 3 months | 4.8 (4.5–5.1) | 5.0 (4.8–5.3) |
| Total health care costs from discharge to 3 months, median SEK × 1000 (interquartile range) | 3.6 (1.2–15.2) | 3.6 (1.2–14.6) |

*Index event only, not including diagnostic tests.
†Among 161 AGW and 135 MW patients without assistance by family member before the index event.
‡Among 102 AGW and 100 MW patients without assistance by community social services before the index event.

deterioration and the proportion needing readmission to an acute-care hospital were not grossly different between the two groups (Table 5). The total number of readmissions was also similar (mean 0.49 per patient discharged alive after the index event in the AGW group vs 0.57 in the MW group).

At 3 months, case fatality was similar, but a somewhat smaller proportion of AGW patients were in sheltered living; the difference did not reach statistical significance. However, among those who had lived independently before the index event, the difference was greater (4% vs 11% of survivors; $P = .085$ by chi-square test).

At the 3 month assessment, the proportion of patients who had any degree of impaired ADL function was 56% in AGW and 57% in MW patients. Among patients with a maximum Barthel score before the index event, a slightly higher proportion of AGW patients had impaired primary ADL function at 3 months' follow-up (25% vs 18%, NS). On the other hand, fewer AGW patients had impaired cognitive function as assessed by the MMSE ($P = .03$ by the Kruskal-Wallis test). This difference lost its statistical significance after adjustment for differences in cognitive function at entry into the trial (cf. Table 2). Scores for psychological well-being were similar in the two groups at 3 months (Table 5).

Poor global outcome at 3 months, defined as death and/or severe dependence on others for primary ADL (Barthel score below 15) and/or poor psychological well-being (PGCM score below 9), was observed in 57 of 156 patients (37%) with complete data randomized to the AGW and in 57 of 168 patients (34%) with complete data randomized to MWs (relative risk 1.06; 95% CI 0.84–1.34).

### Use of Healthcare Resources

As shown in Table 6, the mean length of stay in the acute ward was, on average, 1.4 days shorter in the AGW than in the MWs ($P = .002$ by the Kruskal-Wallis test). It remained statistically significant ($P = .03$) after adjustment for differences in DRG weights between AGW and MW patients. The difference was also present among patients discharged directly home but was no longer statistically significant (5.1 vs 6.3 days; $P = .06$). There was a tendency ($P = .08$ by Kruskal-Wallis) toward lower mean costs of hospital stay in the AGW (Table 6).

The number of outpatient visits to various healthcare professionals after discharge and up to 3 months are also shown in Table 6. There were no major differences in visits to physicians or nurses, whereas the patients who had been treated in the AGW were significantly more likely to be treated by a physiotherapist and/or occupational therapist after discharge ($P = .02$). At 3 months after the initial admission to hospital, similar proportions of AGW and MW patients had daily personal assistance by family members or professional assistance by community services (Table 6).

The number of drugs prescribed at discharge did not differ between the two groups at discharge (data not shown) or at 3 months' follow-up (Table 6).

Calculations of total healthcare costs after discharge from the acute ward were based on: (i) costs for all in-hospital care after transfer to long-term facilities or because of readmission(s) to the acute-care hospital, (ii) out-patient care by physicians and other healthcare professionals, and (iii) major laboratory examinations. It did not include costs for social services, sheltered living, or nursing home care provided by the local community. The median total costs after discharge were identical in AGW and MW patients and were similarly distributed in the two groups (Table 6). At 3 months, the mean daily costs for institutional care (in geriatric rehabilitation, other hospital wards, nursing homes, and various forms of sheltered living) was 8% lower in AGW patients (284 vs 309 SEK) when the costs were distributed among all survivors. Because there was a slight imbalance in the proportion of patients who died, sensitivity analyses were performed. It was assumed that all patients who were dead at 3 months follow-up would have been in institutional care had they survived. When they were assigned daily institutional costs ranging from the lowest (520 SEK per day) to the highest (1760 SEK per day), the difference in daily costs for institutional care varied from 6% lower to 6% higher in AGW compared with MW patients.

## DISCUSSION

It has been advocated that acutely ill older people in need of nonsurgical hospital care should be admitted directly to

geriatric care rather than to medical care. The rationale for this is that greater emphasis on social and rehabilitative aspects, better collaboration with social services provided by the community, and more knowledge about specific needs of older patients come together to serve to improve long-term outcome and reduce costs. Our present results provide partial support for this hypothesis. Although no differences in medical outcome, ADL function, or psychological well-being were noted between patients treated in the AGW and MWs, the mean length of hospital stay was significantly shorter and, among patients admitted from home, there were fewer patients who were in sheltered living 3 months after the initial hospital stay. The gains were achieved without an increase in the consumption of specific health care resources in the acute phase.

In this trial, the study cohorts were, in many aspects, representative of older patients admitted to the hospital. Less than a third were cohabitant, and a large proportion had a history of serious medical disorders and were receiving medication with a substantial number of drugs. There was a wide variety of discharge diagnoses, the majority of which related to the circulatory system, but many were also nonspecific. It should be emphasised that older patients for whom specialized treatment was considered appropriate were not included. Thus, older patients with suspected myocardial infarction were admitted to a coronary care unit, stroke patients to a dedicated stroke unit, patients with renal failure to a renal ward, etc.

The randomization procedure was reasonably effective in that it produced closely similar cohorts of older patients admitted to the acute geriatrics-based ward and the general medical wards, respectively. However, patients admitted to the MWs seem to have had a slightly less favorable prognostic profile in that more of them were living alone and had impaired ADL performance and impaired cognitive function before the index event. The consumption of healthcare resources during the year preceding inclusion into the study was also slightly greater in MW patients, as were the mean DRG weights.

Since the great majority of ineligible patients were those randomized inappropriately ("protocol violators"), it was decided to perform the analysis on a per-protocol than an intention-to-treat basis. After randomization, 31 of 444 patients were excluded, the great majority (25) because they had been randomized inadvertently in the emergency room despite not meeting the inclusion criteria. Cross-over between AGW and MW occurred only in two patients with acute myocardial infarction who were transferred to the coronary care unit.

Previous randomized trials of acute geriatric care, often for patients with specific diagnoses, have provided contradictory results. Comprehensive assessment, early rehabilitation, and interdisciplinary team care in acute stroke units have been shown to improve functional outcome after stroke.[17] However, the beneficial effects seem to be present whether the stroke unit is established in a medical, neurologic, or geriatric setting.[17] In patients admitted acutely with hip fracture, geriatric intervention has been shown to reduce complications and the length of hospital stay.[4] A hospital medical unit designed specially to improve the functional outcome of acutely ill older patients was shown to improve ADL function and decreased the need for long-term institutional care.[5] In a small randomized trial, early case fatality was reduced and there was a tendency toward improved functional status with fewer readmissions in acutely ill older patients who had received multidisciplinary geriatric rehabilitation.[6] These findings should be contrasted with the results of several other randomized trials,[7–9] one of which included as many as 2300 patients,[9] in which geriatric intervention by consulting teams had little effect on outcomes in older hospitalized patients.

In the present randomized trial, neither medical (survival) outcome at 3 months, need for readmissions to the hospital, ADL performance, psychological well-being, nor global outcome was improved. However, despite the lack of any substantial beneficial effects of AGW care on medical and functional outcome, there was an important reduction in the length of hospital stay (a predefined secondary end-point in this study) and, possibly, a reduction also in the need for institutional living after the hospital stay. In the AGW there was more emphasis on early rehabilitation with more physiotherapy and occupational therapy provided. Although this had no apparent effect on functional outcome or psychological well-being at 3 months after admission, it seems probable that the more intense early rehabilitation and the greater effort in planning discharge from the AGW contributed to the reduction in length of stay in the acute ward. It should be noted that total staff costs were only marginally greater in the AGW than in the MWs.

Fewer patients were transferred to geriatric rehabilitation from the AGW than from the MWs. At the same time, there was a greater use of outpatient resources in AGW patients, indicating a shift from inpatient to outpatient rehabilitation.

Polypharmacy is a well recognized problem among older patients.[18] During the planning phase of the present study, acute geriatric care was expected to reduce drug prescription. However, the number of drugs prescribed at discharge from the acute unit was only marginally smaller for the AGW patients. This minor difference was already present at entry, and it persisted at 3 months follow-up.

A concern raised by the internists before onset of the study was that geriatric-based acute care could compromise the quality of acute medical management. A part-time consultant in internal medicine was, therefore, added to the geriatric team. There were no indications in terms of case fatality or otherwise that patients treated in the AGW fared any worse than MW patients. Another hypothesis was that the AGW strategy would reduce the need for early readmissions to an acute-care hospital; the results did support this.

Despite slightly higher costs per day in the AGW, the shorter hospital stay resulted in a (nonsignificant) reduction of total resource consumption during acute hospitalization. Healthcare costs later during the 3-month follow-up period were similar in the two groups. The exact resource consumption of older patients in the MWs was not readily assessable. These wards accommodated two small stroke units and admitted patients with severe gastrointestinal and endocrine disorders. In our estimates, the ward staff, including physicians, was assumed to devote about the same average time per patient to those included in the trial as to other patients on the ward. Results of individualized measurements of the burden of care showed this to be true for the nursing staff (unpublished). For physicians, our approach probably overestimated the resource utilization in the GMWs. On the other hand, the limited size of the AGW unit (11 beds) in the present study was less than optimal from a cost-effectiveness point of view.

More than one-third of all patients aged 70 and older admitted during the study period fulfilled the inclusion criteria for the trial. It is highly unlikely that a broader range of inclusion criteria would have caused a larger difference in outcome in favor of the AGW than that seen in this study. It should be noted that the multidisciplinary team in the AGW was brought together specifically for this study. Although most of the staff had extensive experience of working with acutely ill medical patients, it is possible that a longer period of working together would have been needed to fully take advantage of the multidisciplinary approach.

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