A prospective, randomised controlled trial of an aged care nurse intervention within the Emergency Department

David Basic and David A Conforti

Abstract

The aim of this randomised controlled trial involving 224 elderly patients was to determine whether early geriatric assessment (in the form of an aged care nurse intervention based in the emergency department) reduced admission to the hospital, length of inpatient stay (LOS), or functional decline during the hospitalisation. Baseline geriatric assessments were recorded in the medical files of intervention patients ($n = 114$). The nurse also liaised with the patients' carers and health care providers, organised referrals for out-of-hospital assessment and support services, and assisted in the care of those admitted as inpatients by documenting suggestions for assessment and referral. Assessment data from control patients ($n = 110$) were withheld, and the nurse had no further involvement in their inpatient or outpatient care. One hundred and seventy-one patients (76%) were admitted to the hospital, for a median LOS of 10 days. The nurse successfully identified those needing admission (odds ratio [OR], 14.0; 95% confidence interval [CI], 2.6–75.1). Thirty-nine of 160 inpatients with available data (24%) had a functional deterioration during the hospitalisation. The intervention had no significant effect on admission to the hospital (OR, 0.7; CI, 0.3–1.7), LOS (hazard ratio, 1.1; CI, 0.7–1.5) or functional decline during the hospitalisation (OR, 1.3; CI, 0.5–3.3).

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What is known about the topic?

Emergency attendance and admission rates are high among older people, who are sometimes admitted in circumstances where better access to health and support services at home or in the community could have prevented the need for admission/attendance.

What does this study add?

Intervention by an aged care nurse, providing early geriatric assessment and referral in the emergency department, had no impact on admission rates, length of stay or functional decline.

What are the implications?

This intervention was probably a case of doing 'too little'; and indicates that interventions which lack the capacity to provide timely access for older people to community health and support services, or to change the course of care in hospital, are unlikely to succeed in preventing admission or reducing length of stay.

ELDERLY PERSONS VISIT the emergency department (ED) more often than younger persons.[1] They often have serious complaints that limit function and restrict their ability to live independently. For many, hospitalisation results in functional decline despite cure or repair of the condition for which they were admitted.[2,3] Functional status is a strong predictor of LOS, mortality, and nursing home placement.[4,5] Early assessment of elderly patients can identify risk factors that contribute to hospital-acquired dependency.[2,6]

The best models of care for older persons visiting emergency departments are not known, and few randomised, controlled trials of interventions in the ED setting have been published. A two-stage intervention, comprising screening and a brief standardised nursing assessment and referral, reduced the rate of functional decline four months after the ED visit.[7] The beneficial outcomes resulted primarily from early provi-

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sion of home care services rather than early contact with the primary physician.[8] Comprehensive geriatric assessment by an advanced practice nurse, with subsequent referral to community-based services, had no effect on overall service use (repeat ED visits, hospitalisations or nursing home admissions) at 30 and 120 days after the ED visit, though nursing home admissions were reduced at 30 days.[9]

In Australia, up to 68% of unselected elderly patients[10] and 57% of those presenting after a fall[11] are admitted to the hospital from the emergency department. Functional deterioration occurs early, with as many as 65% suffering a decline in mobility by day two of the hospitalisation.[3] Although inpatient geriatric programs reduce LOS, mortality, morbidity, nursing home placements, and inappropriate medication use, and improve quality of life and functional status,[12-15] many patients fail to improve. High-risk patients in particular may suffer irreversible decline before commencement of geriatric risk assessment and intervention programs.[2,3] Despite this, and the potential for early intervention in the ED setting, there are no randomised studies of programs in this setting to reduce index admissions to the hospital, functional decline during the hospitalisation, or LOS. Our objective in this study was to evaluate the effect of a nurse experienced in multidimensional assessment and care of the elderly on these outcomes.

Methods

Hospital and ethics approval

The study was undertaken in 1996–97 in the ED of Liverpool Hospital, a busy, tertiary referral hospital in south-western Sydney, NSW, where an aged care nurse worked between the hours of 08:00 and 16:00, Monday to Friday. The institutional review committee of the area health service approved the trial.

Study participants

Study participants were older people presenting to the ED who were not severely ill. Emergency staff were asked to refer patients for assessment by the nurse if they fulfilled any of the following inclusion criteria: functional impairment (inability to transfer to or from a bed or chair, inability to mobilise, bladder or bowel incontinence, or need for assistance with at least two other activities of daily living); psychological disability (dementia, delirium or depression); social disability (poor coping skills, absent or stressed carer, inadequate community supports or inappropriate accommodation); active multi-system disease (two or more systems); or discharge from the hospital within the last 14 days. Patients excluded were those who were medically unstable, living in a nursing home or unable to speak English.

Baseline data

In all eligible and consenting patients, the nurse collected data on the ED visit, demographics, living arrangements, care needs, self-rated health, health care usage in the preceding year, time to complete the assessment, referrals made in the ED, and medical diagnosis. She administered a battery of instruments targeting functional status, pressure ulcer risk, cognition, depression, and range and perceived quality of support services. The following instruments were administered: Folstein Mini-Mental State Examination (MMSE, range 0–30; scores 24 and below indicate impaired cognition),[16] Geriatric Depression Scale (GDS — range 0–15; scores above 5 indicate depression),[17] Social Support Instrument (SSI — range 1–4; higher scores indicate better social supports as perceived by patient),[18] Waterlow Pressure Risk Assessment Scale (Waterlow — scores 15 and above indicate high risk of developing pressure areas),[19] Lawton Instrumental Activities of Daily Living Scale (IADL — range 0–8; higher scores indicate better function),[20] and the Modified Barthel Index (MBI — range 0–20; higher scores indicate better function).[21] The medical diagnosis was the diagnosis primarily responsible for presentation to the ED. Each patient was allocated one of six diagnostic categories (neurological, cardiovascular, respiratory, musculoskeletal, infectious and other). The MBI and the IADL were administered in the ED to

measure functional status at the time of the visit, and retrospectively to measure functional status one month before the visit (premorbid scores). Difference scores between the two measures (MBI-change and IADL-change) were used as the measures of recent functional decline.

Randomisation and interventions

After the detailed baseline assessment, patients were randomised to intervention or control groups via telephone contact with the registration office. The randomisation code was developed using a computer random number generator to select random permuted blocks of varied length (not disclosed to the aged care nurse). Both the nurse and the patient (and/or the carer) were aware of the group allocation. Baseline assessments of intervention patients were recorded in the medical file, with an emphasis on active geriatric problems. The nurse also liaised with the patients' carers and health care providers, including general practitioners and community-based agencies. However, the nurse had little capacity to influence the availability of alternative services. Patients discharged home from the ED with unmet medical, functional, psychological or social needs were referred to a community or social agency and/or the general practitioner. The nurse assisted in the care of those admitted to the hospital by documenting suggestions in the medical file, including recommendations for formal geriatric assessment. Baseline assessment data from control group patients were withheld, and the nurse had no further involvement in their care (including out-of-hospital care). We measured inpatient referral rates to geriatricians, physiotherapists, occupational therapists and social workers in both the control and intervention groups.

Outcome data

The outcome measures were admission to the hospital, LOS, and functional decline during the hospitalisation. Functional decline was defined a priori as a decrease in the total MBI score of three or more points between the score in the ED and that on discharge from the hospital, or new dependency in bathing, dressing, or toileting during the hospitalisation. The aged care nurse collected all outcome data.

Data analysis

We used multivariate logistic regression to model the probability of hospitalisation and functional decline during the hospitalisation, and multivariate Cox proportional hazards regression to model LOS. We measured agreement between two observers (DB and DC) for the principal medical diagnosis with the kappa coefficient. Differences between patients were tested using chi-square tests for dichotomous variables and Wilcoxon rank sum tests for ordinal variables. Linear associations between variables were measured using Spearman rank-order correlation coefficients. With 80% power and a 0.05 level of significance, the study was able to detect a 25% reduction in admissions to the hospital and a 30% reduction in LOS. However, due to the low number of patients with functional decline during the hospitalisation, we were only able to detect a 65% reduction in functional decline. SAS software (version 8.02, SAS Institute Inc; Cary, NC) was used for all analyses.

Results

Characteristics of study participants

Numbers of patients at each stage of the trial are shown in the study flow chart (Box 1). Two hundred and twenty-four patients (134 women and 90 men) with a mean age of 78.7 ± 6.4 years agreed to participate and were randomised. Self-referral was the most common source of referral to the ED, accounting for 39% of participants. The family and general practitioner referred 27% and 19%, respectively. The source of referral was unknown in 3%. Of referrals to the aged care nurse, emergency nurses and doctors made 47% and 18%, respectively. The aged care nurse selected 24% of intervention patients and 28% of controls. The source of referral was not collected in 1%. The remaining 9% were referred by a wide range of health care workers, both emergency department and community-based.

Box 2 shows the characteristics of patients according to group allocation. Overall, 81% of patients were able to complete a detailed baseline assessment (85% of intervention patients, 76% controls). Although there were more females in the intervention group, patients in the control group were more likely to be living alone, with a higher proportion receiving community help. Fewer patients in the control group had a respiratory disease as the primary medical diagnosis, and they reported better overall health. Otherwise, the two groups were similar. Although not severely ill, the level of disability among the patients was high. Overall, 64% had MBI scores (at the time of the ED visit) below 15, 47% had MMSE scores below 25, 42% had Waterlow scores above 15, and 26% had GDS scores above 5.

Interobserver agreement for the diagnostic category was excellent, with a kappa coefficient of 0.89 (95% CI, 0.85–0.94).

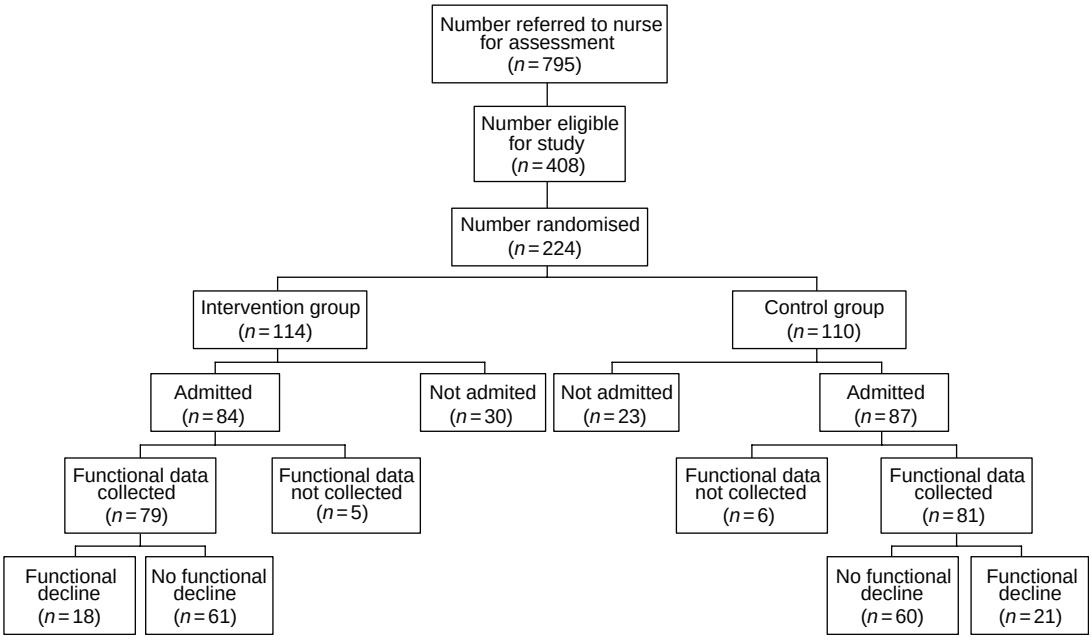
Hospitalisation and functional decline

One hundred and seventy-one patients (76%) were admitted to the hospital, six (4%) of whom were censored due to death, for an overall median LOS of 10 days (interquartile range 7–15 days). Of the 171 admitted patients, functional data were available for 160 (94%), 39 of whom deteriorated during the hospitalisation (18 intervention patients and 21 controls).

Main results

In multivariate analyses (Box 3, Box 4 and Box 5), the intervention had no significant effects on admission to the hospital (OR, 0.7; 95% CI, 0.3–1.7), LOS (hazard ratio [HR], 1.1; 95% CI, 0.7–1.5) or functional decline during the hospitalisation (OR, 1.3; 95% CI 0.5–3.3). Sixty patients were admitted under the care of one of three geriatricians (intervention 29, control 31). Only 17 of the 111 others (15%) were referred for geriatric medical review during the hospitalisation (intervention 6, control 11). Seventy-four patients (67%) were referred to a physiotherapist (intervention 36, control 38), 63 (57%) to a social worker (intervention 32, control 31), 52 (47%) to an occupational therapist (intervention 27, control

1 Study flow chart



25), and 20 (18%) were not referred (intervention 9, control 11).

Boxes 3, 4 and 5 show the significant predictors for each of the three outcome measures. Those selected by the aged care nurse as needing assessment were more likely to be admitted. One or more variables in Boxes 3, 4 and 5 were missing in 18%, 25% and 16%, respectively. For each of the three models, a similar proportion of intervention and control

2 Comparison of groups at enrolment

Variable	*n* *	Intervention (*n*=114)	*n* †	Control (*n*=110)
Demographic data				
Number of women (%)	114	80 (70)	110	54 (49)
Mean age ± SD (years)	114	78.4 ± 5.8	110	79.1 ± 6.9
Number born in NESB country (%)	114	22 (19)	109	24 (22)
Number currently married (%)	112	45 (40)	108	40 (37)
Number living alone (%)	114	38 (33)	110	47 (43)
Functional data				
Median MMSE (range)	108	25 (22-28)	98	24 (20-27)
Median GDS (range)	98	4 (2.0-7.0)	84	4 (2.5-6.0)
Median Waterlow (range)	112	14.5 (11.5-19.5)	108	14 (10.0-18.0)
Median SSI (range)	106	3.2 (2.8-3.6)	98	3.5 (3.0-4.0)
Median MBI-change (range)	112	6 (2-8)	110	5 (2-8)
Median IADL-change (range)	112	2 (1-4)	108	2 (0-4)
Number self-caring (%)	114	77 (68)	110	77 (70)
Number with community help (%)	113	37 (33)	109	47 (43)
Self-rated health	104		96	
Number excellent health (%)		5 (5)		4 (4)
Number good health (%)		28 (27)		33 (34)
Number average health (%)		31 (30)		36 (38)
Number poor health (%)		25 (24)		15 (16)
Number very poor health (%)		15 (14)		8 (8)
Diagnostic category data	107		107	
Number neurological category (%)		15 (14)		19 (18)
Number cardiovascular category (%)		21 (20)		14 (13)
Number respiratory category (%)		13 (12)		5 (5)
Number musculoskeletal category (%)		29 (27)		27 (25)
Number infectious category (%)		14 (13)		21 (20)
Number other category (%)		15 (14)		21 (20)

* Number of intervention patients with available data for each variable. † Number of control patients with available data for each variable. NESB = Non-English speaking background. MMSE = Folstein Mini-Mental State Examination; range 0–30; scores 24 and below indicate impaired cognition.[16] GDS = Geriatric Depression Scale; range 0–15; scores above 5 indicate depression.[17] Waterlow = Waterlow Pressure Risk Assessment Scale; scores 15 and above indicate high risk of developing pressure areas.[19] SSI = Social Support Instrument; range 1–4; higher scores indicate better social supports as perceived by patient.[18] MBI = Modified Barthel Index; range 0–20; higher scores indicate better function.[21] MBI-change defined in text. IADL = Lawton Instrumental Activities of Daily Living Scale; range 0–8; higher scores indicate better function.[20] IADL-change defined in text.

group patients had missing data ($P = 0.52$ for admission; $P = 0.52$ for LOS; $P = 0.27$ for functional decline). Those with missing data were less likely to be admitted than those without missing data (63% v 79%; $P = 0.03$). However, they had similar LOS (median of 10 days in both groups; $P = 0.87$) and rates of functional decline (31% v 23%; $P = 0.41$).

Discussion

Our aged care nurse intervention, based in the emergency department and comprising detailed assessment, monitoring and referral, failed to reduce admission of elderly patients to the hospital, LOS, or functional decline during the hospitalisation.

Although the study participants were not severely ill, the level of disability was high. Despite this, only six of 55 intervention patients (11%) not admitted under the care of a geriatrician were referred for geriatric medical review during the hospitalisation. Although 11 of 56 controls (19.6%) were referred to a geriatrician, the difference in referral rates was not significant ($P = 0.20$). Referrals to physiotherapy, occupational therapy and social work were also less than anticipated, and were no more frequent in intervention patients than in controls. We did not fully measure compliance with the nurse's recommendations by inpatient

3 Multivariate logistic regression: admission to the hospital ($n = 183$)

Variable	Parameter estimate	SE	*P*	OR (95% CI)
Group allocation	–0.43	0.49	0.38	0.65 (0.25–1.70)
MBI-change	0.36	0.09	< 0.0001	1.43 (1.20–1.71)
Musculoskeletal disorder	–1.75	0.56	0.002	0.17 (0.06–0.52)
Selected by nurse	2.64	0.86	0.002	13.98 (2.60–75.09)
ED visits last 12 months	–0.37	0.15	0.01	0.69 (0.52–0.92)
Waterlow	0.12	0.05	0.02	1.13 (1.02–1.25)
MMSE	–0.13	0.06	0.04	0.87 (0.77–0.99)
Self-rated health	–0.53	0.26	0.04	0.59 (0.36–0.97)

R-square = 0.34; maximum-rescaled R-square = 0.53. SE = standard error. OR = odds ratio. MBI-change defined in text. Waterlow = Waterlow Pressure Risk Assessment Scale; scores 15 and above indicate high risk of developing pressure areas.[19] MMSE = Folstein Mini-Mental State Examination; range 0–30; scores 24 and below indicate impaired cognition.[16]

4 Multivariate survival analysis*: LOS in the hospital ($n = 128$)

Variable	Parameter estimate	SE	*P*	HR (95% CI)
Group allocation	0.06	0.19	0.76	1.06 (0.74–1.52)
Waterlow	–0.06	0.02	0.0003	0.94 (0.91–0.97)
Time for nurse assessment	–0.008	0.004	0.03	0.99 (0.9–1.0)
Use of ambulance	–0.54	0.25	0.03	0.59 (0.36–0.96)
Infectious disorder	–0.45	0.26	0.08	0.64 (0.38–1.06)
Self-rated health	–0.12	0.09	0.19	0.89 (0.74–1.06)
GDS	0.01	0.04	0.73	1.01 (0.94–1.10)

* Cox proportional hazards regression. SE = standard error. HR = hazard ratio. Waterlow = Waterlow Pressure Risk Assessment Scale; scores 15 and above indicate high risk of developing pressure areas.[19] GDS = Geriatric Depression Scale; range 0–15; scores above 5 indicate depression.[17]

teams. However, referral rates were similar in both patient groups, suggesting poor overall compliance with the nurse's recommendations. In a randomised controlled trial confirming the effectiveness of a geriatric consultation team, Allen reported overall compliance of 72%, with higher rates for recommendations addressing instability and falls (95%) and discharge planning (94%). In the control group, only 27% of the actions that would have been recommended by the team were implemented independently.[22] While strategies to improve compliance may be an effective addition to our intervention, inpatient geriatric consultation has not been consistently shown to improve outcomes.[23] High-risk patients may suffer irreversible decline before the consultation begins.

Multidisciplinary geriatric assessment and management beginning in the ED is an alternative strategy that has been described,[24] but not tested in a randomised study. Care of the elderly in the emergency department is a government priority, and many NSW hospitals recently launched Aged Care Services Emergency Teams (ASETs). By employing a mix of health professionals, these innovative teams may be better able to address the needs of elderly patients, many of whom have multiple problems that span several health disciplines.

The aged care nurse selected a substantial number of patients for inclusion in the study (24% of intervention patients, 28% of controls). In multivariate analyses, those selected by the nurse were more likely to be admitted (Box 3), and the longer the nurse took to assess the patient the longer the predicted LOS (Box 4). There were no important correlations between these and other variables, including measures of function, cognition or depression, with the possible exception of SSI, where the correlations were weak (0.27 for self-selection, 0.38 for time to assess patient). Higher SSI scores indicate more extensive and better self-perceived support structures. The need for extensive supports may be a marker of frailty, and it is noteworthy that patients with higher SSI scores were more likely to decline functionally during the hospitalisation (Box 5). During regular rounds in the ED, the nurse may have selected patients who looked frail.

Previous studies consistently report impaired function to be a strong predictor of outcomes, including admission status,[25] LOS[4] and functional decline.[26] In concordance, the Waterlow scale was a significant predictor of all three outcomes in our multivariate analyses. While devised to screen for pressure ulcer risk, several of the 11 categories evaluate function or condi-

5 Multivariate logistic regression: functional decline (*n* = 134)

Variable	Parameter estimate	SE	*P*	OR (95% CI)
Group allocation	0.23	0.49	0.63	1.26 (0.48–3.30)
Waterlow	0.13	0.05	0.007	1.14 (1.04–1.24)
Infectious disorder	1.55	0.61	0.01	4.71 (1.42–15.66)
Self-rated health	0.60	0.26	0.02	1.83 (1.10–3.04)
SSI	–0.77	0.37	0.04	0.46 (0.22–0.96)
MBI-change	0.12	0.07	0.08	1.13 (0.99–1.28)
Admissions last 12 months	–0.29	0.23	0.20	0.75 (0.48–1.16)
MMSE	–0.06	0.05	0.22	0.94 (0.86–1.04)
Referred to ED by doctor	0.04	0.58	0.94	1.05 (0.34–3.26)

R-square = 0.19. Maximum-rescaled R-square = 0.29. SE = standard error. OR = odds ratio. Waterlow = Waterlow Pressure Risk Assessment Scale; scores 15 and above indicate high risk of developing pressure areas.[19] SSI = Social Support Instrument; range 1-4; higher scores indicate better social supports as perceived by patient.[18] MBI-change defined in text. MMSE = Folstein Mini-Mental State Examination; range 0–30; scores 24 and below indicate impaired cognition.[16]

tions impairing function, including recent orthopaedic surgery or fracture below the waist, neurological deficit, mobility and continence.

All patients were randomised via telephone contact with the registration office, and we used a computer random number generator to develop a randomisation code with permuted blocks of varied length. The purpose was to maximise the efficiency of the study by having equal numbers of patients in the intervention and control groups. The block lengths were varied and hidden from the aged care nurse to prevent any speculation on the likely code to be allocated to any particular patient. Despite these precautions, and a sample size of 224, considerably more females were allocated to the intervention group ($n = 80$) than to the control group ($n = 54$), almost certainly due to chance. We therefore evaluated the effect of gender, and found it to be neither a univariate predictor nor a multivariate predictor for any of the outcomes.

Our study has several limitations. First, although assessment data from control patients were withheld, the activities of the aged care nurse could not be concealed. Emergency and inpatient staff may have observed and replicated some of these activities in control patients. We did not measure these and cannot exclude the possibility that both groups of patients benefited from our intervention. Second, due to the low number of patients with functional decline during the hospitalisation, we were only able to detect a 65% reduction in functional decline. An effect of this magnitude is highly unlikely with the type of intervention studied, particularly as the median LOS of 10 days was relatively short, and it is noteworthy that both McCusker[7] and Mion[9] reported delayed benefits from their nursing interventions. Third, we were unable to measure functional decline in a blinded manner. However, we defined this outcome a priori and measured it using a standardised instrument (MBI) with good interobserver reproducibility. Finally, the population of elderly patients who deteriorate in the hospital (and have prolonged lengths of stay) is much larger than our study population suggests, particularly as we excluded those who were medically unstable or living in a nursing home. Consequently, the results of our study do not address these high-risk patient groups, nor can they be extrapolated to all elderly patients visiting the ED.

In summary, our aged care nurse intervention had no significant effect on admission to the hospital, LOS, or functional decline during the hospitalisation, indicating that early geriatric assessment and referral alone, without clear mechanisms to implement recommended care, is ineffective within existing models of care and funding. Additional strategies to improve compliance with the nurse's recommendations may help. Multidisciplinary assessment beginning in the ED may be more effective, particularly as many patients have problems that span several health disciplines.

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Competing interests

None identified.

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