

16. Ledson MJ, Wilson GE, Tran J, Walshaw MJ. Tracheal microaspiration in adult cystic fibrosis. *J R Soc Med* 1998; 91: 10–2.
17. Nash M. Swallowing problems in the tracheotomized patient. *Otolaryngol Clin North Am* 1988; 21: 701–9.
18. Elpern EH, Scott MG, Petro L, Ries MH. Pulmonary aspiration in mechanically ventilated patients with tracheostomies. *Chest* 1994; 105: 563–6.
19. Logemann JA. Evaluation and treatment of swallowing disorders. Austin, TX: Pro-Ed, 1983.
20. Dent J, Brun J, Fendrick AM *et al.* An evidence-based appraisal of reflux disease management—the Genval workshop report. *Gut* 1999; 44 (Suppl. 2): S1–16.
21. Bamford J, Sandercock P, Dennis M, Burn J, Warlaw C. Clarification and natural history of clinically identifiable subtypes of cerebral infarction. *Lancet* 1991; 337 (8756): 1521–6.

Received 19 September 2005; accepted in revised form 14 October 2005

Age and Ageing 2006; **35**: 53–60

doi:10.1093/ageing/afi206

Published electronically 20 October 2005

© The Author 2005. Published by Oxford University Press on behalf of the British Geriatrics Society.

All rights reserved. For Permissions, please email: journals.permissions@oxfordjournals.org

Does home treatment affect delirium? A randomised controlled trial of rehabilitation of elderly and care at home or usual treatment (The REACH-OUT trial)

GIDEON A. CAPLAN^{1,2}, JANIS COCONIS¹, NEVILLE BOARD³, ALLYN SAYERS¹, JAN WOODS¹

¹Post Acute Care Services, Prince of Wales Hospital, Randwick, Sydney, New South Wales 2031, Australia

²School of Public Health and Community Medicine, University of New South Wales, Sydney, New South Wales 2052, Australia

³Department of Health, North Sydney, New South Wales 2060, Australia

Address correspondence to: G. A. Caplan. Tel: (+61) 2 9382 2470. Fax: (+61) 2 9382 2477. Email: g.caplan@unsw.edu.au

Abstract

Background: delirium is a frequent adverse consequence of hospitalisation for older patients, but there has been little research into its prevention. A recent study of Hospital in the Home (admission substitution) noted less delirium in the home-treated group.

Setting: a tertiary referral teaching hospital in Sydney, Australia.

Methods: we randomised 104 consecutive patients referred for geriatric rehabilitation to be treated in one of two ways, either in Hospital in the Home (early discharge) or in hospital, in a rehabilitation ward. We compared the occurrence of delirium measured by the confusion assessment method. Secondary outcome measures were length of stay, hospital bed days, cost of acute care and rehabilitation, functional independence measure (FIM), Mini-Mental State Examination (MMSE) and geriatric depression score (GDS) assessed on discharge and at 1- and 6-month follow-up and patient satisfaction.

Results: the home group had lower odds of developing delirium during rehabilitation [odds ratio (OR) = 0.17; 95% confidence interval 0.03–0.65], shorter duration of rehabilitation (15.97 versus 23.09 days; $P = 0.0164$) and used less hospital bed days (20.31 versus 40.09, $P \leq 0.0001$). The cost was lower for the acute plus rehabilitation phases (£7,680 versus £10,598; $P = 0.0109$) and the rehabilitation phase alone (£2,523 versus £6,100; $P \leq 0.0001$). There was no difference in FIM, MMSE or GDS scores. the home group was more satisfied ($P = 0.0057$).

This study was supported by a grant from the National Demonstration Hospitals Program 3, Commonwealth Department of Health and Ageing. The researchers are independent of the granting body. The granting body did not have the right to review nor did it review the manuscript prior to submission. This article has been prepared following the CONSORT guidelines.

Conclusions: home rehabilitation for frail elderly after acute hospitalisation is a viable option for selected patients and is associated with a lower risk of delirium, greater patient satisfaction, lower cost and more efficient hospital bed use.

Keywords: delirium, health services for the aged, home-care services, hospital based, patient satisfaction, rehabilitation, elderly

Introduction

Delirium (acute confusion) is a common presenting symptom of almost any medical and surgical disease in frail older patients as a result of the interaction between disease severity, comorbidity, cerebral susceptibility and environmental hostility [1–3]. Delirium is often unrecognised and results in higher morbidity and mortality [1, 2]. Despite being so common, the pathophysiology is poorly understood, the treatment is guided by little randomised evidence and the outcome is poor [1]. Some attempts to reduce delirium have used multicomponent interventions in hospital to address as many factors as possible that may induce delirium [4–6], and an alternative approach tested was nighttime sedation [7].

Hospital in the Home has also been reported to result in a lower incidence of confusion. In one trial, older patients attending the emergency department who required acute hospital care were randomised to receive appropriate treatment either at home or in the hospital; confusion was less common in those treated at home, but the finding was based on retrospective chart review [8]. It is unclear whether this difference in delirium incidence would also pertain during post-acute treatment that is of increasing importance with the ageing of the population [9]. Previous studies comparing hospital and home post-acute care have found no difference in health outcomes, though the general health status instruments they used were not designed to detect delirium and were mostly applied long after the patients finished their post-acute episode of care [10–14].

Therefore, we conducted a randomised controlled trial (RCT) comparing in-hospital rehabilitation with early discharge rehabilitation at home for frail older patients and prospectively tested for delirium using the confusion assessment method (CAM).

Methods

Setting

The setting for this trial was the Prince of Wales Hospital, a tertiary referral hospital attached to the University of New South Wales in Sydney, Australia.

Participants

Between April 2000 and October 2002, all inpatients with a length of stay (LOS) exceeding 6 days, who were referred for geriatric rehabilitation, were eligible for inclusion in our trial on condition that they required and were suitable for rehabilitation; that is they were expected to return home and live reasonably independently after rehabilitation and lived in the local area of the hospital, but not in a nursing home. Patients and their carers were required to give informed consent.

Assessment

The initial assessment was performed by study staff, nurses or allied health before randomisation.

Overall health status was assessed by the functional independence measure (FIM) [15], cognitive function via the Mini-Mental State Examination (MMSE) [16], mood via the geriatric depression scale [17] on enrolment, at the start and completion of rehabilitation and at 1- and 6-month follow-up. The CAM [18] was performed on enrolment and then every second day during the acute and rehabilitation phases to detect delirium. No patients had delirium at enrolment, though this was not an exclusion criterion. Study staff were trained in the use of these instruments, and their scores were compared on sample patients to ensure interrater reliability.

Detailed costing analysis was made with standard casemix costing for admitted phases using data generated by the Prince of Wales Hospital Casemix Unit based on detailed costing methodologies developed and refined for inpatient admissions across Australia. This methodology is based on diagnosis-related groups and has been tested on large patient populations. Clinical cost modelling for the home-based care which summed all fixed and variable costs for non-admitted episodes of care, including overheads such as leave, locum cover and secretarial costs, and then divided costs across patient groups according to duration of patient contact with therapeutic staff, has been previously detailed [19, 20].

The project was approved by the hospital ethics committee and overseen by a committee including consumer and other stakeholder representation.

Within 1 week of discharge from rehabilitation, satisfaction surveys were mailed to the patients, carers and their general practitioners asking them to rate the quality of rehabilitation on a five-point scale.

Intervention

Patients randomised to the home rehabilitation service were kept in hospital until they could transfer independently and mobilise sufficiently to toilet themselves. All time in hospital was counted as 'acute LOS'. Home rehabilitation was provided by a hospital-based multidisciplinary outreach service which also provides home rehabilitation for orthogeriatrics and an acute admission substitution Hospital in the Home service. This meant that if patients deteriorated once transferred home, certain conditions could be treated at home, such as infections requiring intravenous antibiotics, provided the patient was not hypotensive or hypoxic. The multidisciplinary team has been in operation since 1989, and hence is experienced in the nuances of hospital outreach services [21]. The team includes nurses, physiotherapists, occupational therapists and doctors. Patients were visited a mean of 20 times during the home rehabilitation episode by rehabilitation staff. Any equipment required was supplied free for up to 3 months.

Patients randomised to hospital rehabilitation were transferred to the geriatric rehabilitation ward when a bed was available and their acute illness was settling. We enrolled 104 patients in the study, but seven did not make it to rehabilitation, either in hospital or at home, because of a deterioration in their condition preventing rehabilitation or because of withdrawal of consent. Three required placement in an aged care facility (nursing home or hostel providing permanent care for frail older people), three died on the ward and one person had their consent revoked by a relative who transferred their parent's care to their home in a rural community.

Objectives

The objective of the study was to evaluate whether home-based rehabilitation for frail older patients was associated with a lower incidence of delirium, lower cost and greater satisfaction. In addition, the impact on hospital bed usage was evaluated.

Outcomes

Primary: Incidence of delirium measured by the CAM

The CAM diagnostic algorithm requires the presence of acute onset with fluctuating course and inattention plus either of disorganised thinking or altered level of consciousness.

It has high sensitivity (94–100%) and specificity (90–100%) for delirium [18]. We extended the range of the CAM by also examining probable or possible delirium, defined as scoring two or one items positive on the CAM, instead of the necessary three to declare delirium, as has been done before [22].

Secondary: LOS, hospital bed days and cost of acute care and rehabilitation

Health status measured by the FIM, MMSE and geriatric depression score (GDS) assessed on discharge from rehabilitation and at 1- and 6-month follow-up and satisfaction scores.

Sample size

The study was powered to demonstrate a difference in the occurrence of episodes of delirium of 20% between the two groups, assuming an $\alpha=0.05$ and a $\beta=0.80$, allowing for a 10% dropout rate with a 2 : 1 randomisation.

Randomisation

Randomisation was via computer-generated random numbers coded into opaque envelopes by a secretary using a 2 : 1 distribution to allow efficient functioning of the home rehabilitation service without affecting the power of the study. A study nurse enrolled patients and then returned to the study office to retrieve an envelope only after completing the enrolment assessment.

Blinding

Assessors were blinded to the patients' group allocation during the initial assessment because it was conducted prior to randomisation. Subsequent assessments were unblinded due to the patients' locations.

Statistical methods

We compared the patients in the two groups on a modified intention-to-treat basis, namely including all subjects who

started rehabilitation, using the *t*-test, Mann–Whitney U test and the Chi-square test for normally distributed data, non-normally distributed and ordinal data and categorical data, respectively.

Results

Between April 2000 and October 2002, we assessed 812 patients who were referred for geriatric rehabilitation, of which 568 did not meet the inclusion criteria and 140 subjects declined to participate (Figure 1). We randomised 104 subjects.

Baseline characteristics demonstrated no significant differences between the two groups (Table 1). At the start of the rehabilitation phase, the FIM score was higher in the intervention group (intervention versus control; 100.31 versus 78.94; $P<0.0001$), indicating that intervention patients needed to be more independent before they could go home than the control patients had to be before transfer to the rehabilitation ward. This was at the expense of nearly an extra 2 days in the acute ward (18.73 versus 17.03; $P = 0.4530$).

The CAM was assessed on every patient every second day from enrolment to discharge from rehabilitation. From enrolment until commencement of rehabilitation, there was no difference in the rate of delirium between the two groups measured by positive CAM scores over all CAM scores in the acute phase (1.4 versus 2.5%; $P = 0.6156$). However, during the rehabilitation phase, there was a significantly lower incidence of delirium in the home rehabilitation group, as measured by positive CAM scores divided by all CAM scores during the rehabilitation phase [3/530 (0.6%) versus 12/376 (3.2%); absolute risk reduction = 2.6%; $P = 0.0029$], so that the odds ratio for developing delirium during rehabilitation was 0.17 (95% confidence interval 0.04–0.65) for the home group compared to the hospital rehabilitation group. There was a trend towards reduction in probable delirium [15/530 (2.9%) versus 21/376 (5.6%); $P = 0.0564$], but no difference in possible delirium [54/530 (10.2%) versus 41/376 (10.9%); $P = 0.7422$] between the two groups, defined as scoring two (probable) or one (possible) items positive on the CAM, instead of the necessary three. The number (per cent) of patients scoring positive at each level on the CAM during the rehabilitation phase was positive: 2 (3.1%) versus 2 (6.1%); probable: 7 (10.9%) versus 5 (15.2%); and possible: 16 (25.0%) versus 11 (33.3%).

The positive CAM scores at home in the intervention group occurred in two patients. One patient's positive CAM score occurred after 2 weeks at home and was associated with the patient being readmitted to hospital with severe pneumonia. However, the delirium settled rapidly in hospital with oxygen therapy. The second patient was taken home for rehabilitation with a positive CAM score which remained positive 2 days later but then reverted to normal for the three subsequent CAM scores, and the patient successfully completed rehabilitation at home. All of the positive CAM scores in the control group occurred a minimum of 2 weeks after transfer to rehabilitation, and hence were not because of earlier transfer to rehabilitation in the control group.

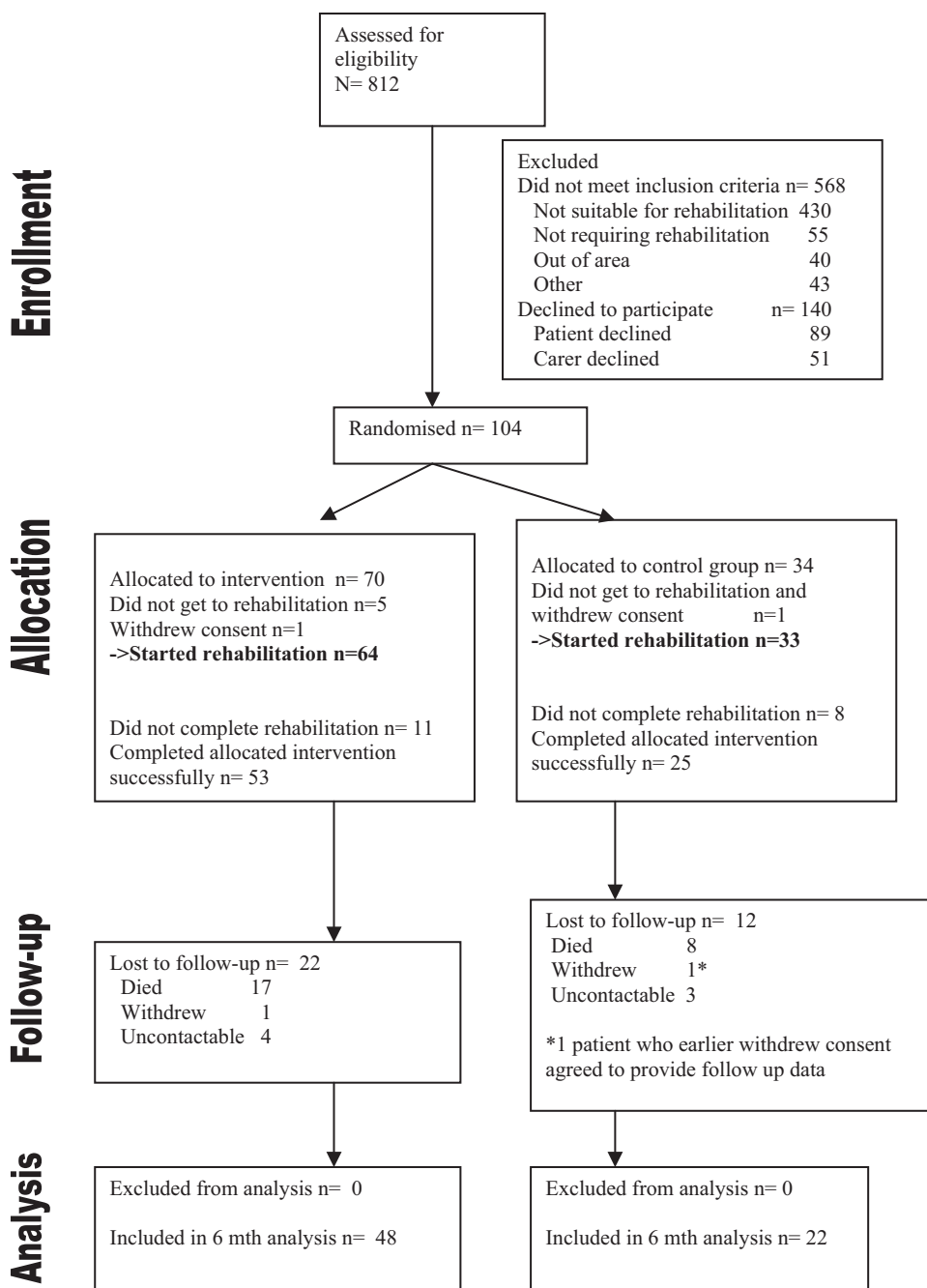


Figure 1. Flow diagram.

The overall length of the episode of care from hospital admission to end of rehabilitation was not significantly different between the two groups (34.91 versus 40.12 days; $P = 0.1889$), although 5 days appears clinically significant. However, the duration of the rehabilitation phase (time from transfer to rehabilitation at home—i.e. discharge from hospital—to end of rehabilitation at home for the home group and time from transfer to the rehabilitation ward to discharge from hospital for the control group) was significantly shorter for the home rehabilitation group (15.97 versus 23.09 days; $P = 0.0164$). Moreover, the home rehabilitation

group used 18 less hospital bed days per episode of care (20.31 versus 40.09 days; $P \leq 0.0001$).

Fifteen of the home rehabilitation group were transferred to the rehabilitation ward for a mean of 13.53 days for the 15 patients, which equated to a mean of 2.63 days over the whole home rehabilitation group, until they met the criteria for home rehabilitation, namely being able to independently transfer and mobilise to the toilet. These days were counted in their acute LOS (Table 2).

The overall cost in Australian dollars (£ at conversion rate 42.32 pence/A\$) was significantly lower for:

Table 1. Baseline characteristics

	Home rehabilitation group	Hospital rehabilitation group	P-value
Number	70	34	
Age [mean (SD)]	83.86 (7.80)	84.00 (7.02)	0.9284
Sex (female : male)	43 : 20	22 : 11	>0.9999
Ischaemic heart disease [<i>n</i> (%)]	30 (42.86)	20 (58.82)	0.1467
Diabetes [<i>n</i> (%)]	7 (11.11)	4 (12.12)	>0.9999
Dementia [<i>n</i> (%)]	19 (27.14)	7 (21.21)	0.6300
Number of medications [mean (SD)]	5.64 (3.29)	5.71 (2.99)	0.9250
Number of medical problems [mean (SD)]	6.70 (3.14)	7.06 (3.44)	0.5970
FIM at enrolment [mean (SD)]	75.46 (22.10)	78.47 (19.13)	0.4977
MMSE at enrolment [mean (SD)]	22.33 (6.70)	24.85 (10.41)	0.1387
GDS at enrolment [mean (SD)]	10.33 (5.94)	10.24 (6.34)	0.9438
FIM at start of rehabilitation [mean (SD)]	100.31 (16.94)	78.94 (16.01)	<0.0001
MMSE at start of rehabilitation [mean (SD)]	22.67 (7.25)	23.81 (4.97)	0.3689
GDS at start of rehabilitation [mean (SD)]	9.66 (6.01)	10.06 (6.43)	0.7665

FIM, functional independence measure; GDS, geriatric depression scale; MMSE, Mini-Mental State Examination.

Table 2. Results

	Home rehabilitation group	Hospital rehabilitation group	P-value
Acute LOS [mean (SD)]	18.73 (11.39)	17.03 (8.68)	0.4530
Rehabilitation LOS [mean (SD)]	15.97 (9.37)	23.09 (19.41)	0.0164
Total length of episode of care from admission to end of rehabilitation [mean (SD)]	34.91 (15.37)	40.09 (23.22)	0.1889
Hospital bed days [mean (SD)]	20.31 (12.45)	40.09 (23.22)	<0.0001
FIM at end of rehabilitation [mean (SD)]	105.47 (17.06)	103.69 (20.30)	0.6569
MMSE at end of rehabilitation [mean (SD)]	23.79 (6.53)	23.71 (6.28)	0.9538
GDS at end of rehabilitation [mean (SD)]	8.38 (5.94)	9.42 (6.61)	0.4524
Days of delirium (positive CAM) during acute phase [<i>n</i> (%)]	3 (1.4)	2 (2.5)	0.6156
Days of delirium during rehabilitation [<i>n</i> (%)]	3 (0.6)	12 (3.2)	0.0029
Odds ratio for delirium in home rehabilitation group during rehabilitation phase (95% CI)	0.17 (0.03–0.65)		
Days of probable CAM during rehabilitation [<i>n</i> (%)]	15 (2.9)	21 (5.6)	0.0564
Days of possible CAM during rehabilitation [<i>n</i> (%)]	54 (10.2)	41 (10.9)	0.7422
Costs			
Acute phase	A\$12,185 (A\$8,946) £5,157 (£3,786)	A\$10,629 (A\$6,659) £4,498 (£2,818)	0.5103
Rehabilitation phase	A\$5,961 (A\$3,210) £2,523 (£1,347)	A\$14,413 (A\$12,631) £6,100 (£5,345)	<0.0001
Total	A\$18,147 (A\$9,816) £7,680 (£4,154)	A\$25,042 (A\$15,041) £10,598 (£6,365)	0.0109
Follow-up			
FIM at 1 month [mean (SD)]	100.93 (22.68)	105.47 (17.06)	0.3602
FIM at 6 months [mean (SD)]	102.96 (23.80)	106.35 (14.43)	0.5324
MMSE at 1 month [mean (SD)]	23.89 (6.42)	24.52 (5.97)	0.6648
MMSE at 6 months [mean (SD)]	23.22 (6.90)	25.18 (5.01)	0.2377
GDS at 1 month [mean (SD)]	8.84 (6.07)	8.17 (5.73)	0.6282
GDS at 6 months [mean (SD)]	7.80 (5.60)	7.14 (3.96)	0.6235
Patients readmitted within 28 days after end of rehabilitation [<i>n</i> (%)]	13 (21)	8 (24.2)	1.0000
Mortality to 6 months [<i>n</i> (%)]	15 (23.4)	7 (21.2)	1.0000

CAM, confusion assessment method; CI, confidence interval; FIM, functional independence measure; GDS, geriatric depression scale; LOS, length of stay; MMSE, Mini-Mental State Examination

- (i) the acute plus rehabilitation phases [A\$18,147 versus A\$25,042 (£7,680 versus £10,598); *P* = 0.0109]; and
- (ii) the rehabilitation phase alone [A\$5,961 versus A\$14,413 (£2,523 versus £6,100); *P* ≤ 0.0001].
- (iii) There were no differences in functional outcomes as measured by the FIM or in the MMSE or GDS.

Satisfaction surveys

On a five-point scale from 1 (unsatisfactory) to 5 (excellent), home rehabilitation patients gave a higher rating to the quality of their rehabilitation compared to controls [mean score (SD) 4.66 (0.64) versus 4.06 (0.94); *P* = 0.0057], whereas carers [4.47 (0.86) versus 4.08 (1.04); *P* =

0.1894] and general practitioners [4.06 (0.96) versus 3.78 (0.97); $P = 0.4091$] ratings were not significantly different.

Discussion

This is the first RCT to examine incidence of delirium in different care settings to confirm that home treatment results in a lower incidence of delirium. This study compared rehabilitation at home with rehabilitation in hospital for frail elderly patients. Home rehabilitation patients attained the same level of functional independence at home as hospital rehabilitation patients, but the home rehabilitation group achieved better health outcomes as measured by rate of delirium as well as a shorter rehabilitation LOS, less use of hospital bed days and greater patient satisfaction.

Delirium is a multifactorial marker for poor outcomes occurring in 15–50% of elderly medical patients and leading to a 26% 6-month mortality rate [1, 2]. Although the incidence decreases greatly after hospital day 9, it continues to be a problem among post-acute patients [3, 22]. A number of studies have looked at reduction of delirium during hospitalisation, and using different interventions all have successfully reduced two of the following: the incidence and duration and severity of delirium [4–6], though never the same two.

The ageing of the population results in an irresistible, increasing number of frail elderly being admitted to acute hospitals for medical and surgical treatment, but shorter LOS means that they more frequently require post-acute care for rehabilitation or restoration of function [9]. It is recognised that many of these frail older patients do not do well in hospital [23], which has led to many studies comparing at home with in-hospital post-acute care [10–14, 24]. However, the literature in this area is complicated by the variety of terminology including Hospital at Home, community rehabilitation, intermediate care and post-acute care all aiming to ‘facilitate the transition from hospital to home, and from medical dependence to functional independence’. [25] Most studies of such post-hospital home treatment focus on administrative outcomes such as LOS and hospital bed days saved. Where health outcomes have been measured, tools which are designed to measure general or disease-specific health status have been used rather than focus on hospital-associated adverse events such as delirium. General health status tools may not be sensitive to the specific effects of hospitalisation in this group of patients.

Previous studies that have compared early discharge services for elderly medical and surgical patients against control inpatient care have found no significant differences in hospital LOS or functional outcomes, such as indices of cognitive and physical function. The functional outcomes were generally tested after discharge from care, in some cases months later [10, 11, 26]. This study suggests that the health outcomes advantage pertains most clearly during the admission or is most easily detected in a small study during admission, while on discharge we found no difference in general status, cognitive or physical function or affect.

It has been known for 40 years that the hospital environment may have a role in causing delirium [27]. Part of the success of in-hospital programs that decrease the incidence

of delirium in older patients is by making the ward environment more home-like and less intrusive onto patients’ daily routines [4–6]. Studies of adverse events arising from hospitalisation demonstrate other noxious effects of hospitalisation [28]. These two strands of evidence led us to wonder whether home treatment should not offer some health outcomes advantage. An RCT of Hospital in the Home (admission substitution) which targeted older patients and completely substituted home treatment for acute treatment in hospital, by randomising patients presenting to the emergency department, found a decrease in confusion and other geriatric complications with home treatment [8]. In that study, confusion was assessed using review of patient notes, most of which would have met DSM IV criteria. In this study, using more rigorous criteria, prospective testing and a slightly different patient group, the outcome has been replicated. This finding is important because delirium is a marker of acute deterioration in frail elderly patients with long-term health consequences, and therefore a useful, but non-specific, acute-on-chronic health outcome. Our finding of reduced delirium suggests the possibility that a much larger study, with greater power, in similar frail elderly patients may find significant differences in the consequences of delirium, namely morbidity and mortality.

This study found significantly lower costs associated with home treatment, as have others [20, 24, 29], whereas some studies have suggested no savings at all [30, 31]. This is partly because of the difference in LOS that we found which demonstrates, we believe, that effective discharge timing into post-acute care requires criteria for discharge that allow patients to be confident in accepting discharge advice [21]. Sometimes, the service studied does not substitute for in-hospital care but merely adds an additional service on after hospitalisation [30]. Timing of discharge to post-acute care may vary in different health systems depending on a variety of factors including cost pressures. In the US, a patient would not be retained in acute care until they could transfer independently and mobilise to the toilet, because of a desire to save money by managed care funds. This study suggests that overall costs are lower with slightly more time in acute care and home-based post-acute care.

Another problem that bedevils economic analyses of new services is slow recruitment when the service is first set up, and especially if conducting a trial, mentioned above. A newly created team delivering a new service will run at less-than-efficient rates. However, we have grafted this new service onto an existing multiskilled hospital outreach team, thereby ensuring it was always working at high efficiency.

To patients, and many clinicians, the most important difference between the two groups is the higher satisfaction rating. Controlled studies have found that patients are more satisfied with treatment at home compared to in hospital [8, 29]. In some cases, carers were also more satisfied with home care [8]. Consumers’ views are an important aspect of assessing quality of care that should not be ignored in policy decisions. That is, if the more expensive treatment option (hospital rehabilitation) offers no benefit over and above the less-expensive option and is less

attractive to patients and carers, the argument switches from defending the home rehabilitation to questioning the control model's intensive institutional bed and resource usage. In some countries, such rehabilitation might not take part in hospital but rather in a skilled nursing facility or other post-acute facility. Institutional care is still associated with risks and costs [22].

If home treatment as a substitution for hospital treatment can deliver better health outcomes and greater patient satisfaction at a lower cost, it should be more widely utilised. It does not mean that we can close all our rehabilitation beds nor can we reduce the cost of rehabilitation to nothing. Successful home treatment, replacing in-hospital care, depends on careful selection of patients and their homes and adequate resources for the home treatment team.

Limitations

The study does have some limitations. The number of patients we recruited was low as a percentage of those assessed for the trial, although this is not because the service is only suitable for a small number of patients. It is difficult to convince patients and their carers that the decision about staying in hospital or going home should be left up to a computer-generated random number. For our Hospital in the Home service, delivering acute treatment at home, during the trial phase, we initially recruited only one patient per fortnight. Now we treat over 20 patients in an average fortnight. But the study was only conducted at one centre; therefore, the generalisability may be questioned. The assessors were not blinded to the patients' group allocation after the initial assessment, which may have allowed unconscious biases to alter the scores. However, such blinding is technically very difficult, where subjects are in two such different settings.

The study patients going home for rehabilitation had to improve to a greater level before they could go home, and this was demonstrated by the significantly higher FIM score at the start of rehabilitation in the home rehabilitation group. It is also reflected in the acute LOS which is longer, though not significantly so, for the home group. There was also more time for clinical deterioration in hospital for the home group, if it was going to happen. So, amongst the patients who did not successfully complete rehabilitation, more failed before they went to rehabilitation in the home group (7 versus 1), but overall the proportion was similar (24.3 versus 26.5%) (Figure 1).

Acknowledgements

We thank the staff of Post Acute Care Services and the Geriatric Rehabilitation Ward at Prince of Wales Hospital, without whose help this study would not have been possible.

Conflicts of interest statement

There are no conflicts of interest.

The corresponding author had full access and control of the data in the study and final responsibility for the decision to submit for publication.

Funding source

This study was supported by a grant from the National Demonstration Hospitals Program 3, Commonwealth Department of Health and Ageing.

The study sponsor had no role in study conception, design, analysis or interpretation of data, writing of the report, reviewing of this report nor in the decision to submit this report for publication.

Key points

- Hospital in the Home (early discharge) for older rehabilitation patients is associated with a lower incidence of delirium than in-hospital treatment.
- Home treatment, which substitutes for hospital treatment, is cheaper.
- Home treatment is associated with higher satisfaction levels than in-hospital treatment.
- Identical rehabilitation outcomes can be achieved at home for frail older patients.

References

1. Lindsay J, MacDonald A, Starke I. Delirium in the elderly. Oxford: Oxford University Press, 1990.
2. Lawlor PG, Fainsinger RL, Bruera ED. Delirium at the end of life: critical issues in clinical practice and research. *JAMA* 2000; 284: 2427–9.
3. Inouye SK, Charpentier PA. Precipitating factors for delirium in hospitalized elderly persons: predictive model and interrelationship with baseline vulnerability. *JAMA* 1996; 275: 852–8.
4. Inouye SK, Bogardus ST, Charpentier P *et al*. A multicomponent intervention to prevent delirium in hospitalized older patients. *N Engl J Med* 1999; 340: 669–76.
5. Marcantonio ER, Flacker JM, Wright RJ, Resnick NM. Reducing delirium after hip fracture: a randomized controlled trial. *J Am Geriatr Soc* 2001; 49: 516–22.
6. Milisen K, Foreman MD, Abraham IL *et al*. A nurse-led interdisciplinary intervention program for delirium in elderly hip-fracture patients. *J Am Geriatr Soc* 2001; 49: 523–32.
7. Aizawa K-I, Kanai T, Saikawa Y *et al*. A novel approach to the prevention of postoperative delirium in the elderly after gastrointestinal surgery. *Surg Today* 2002; 32: 310–4.
8. Caplan GA, Ward JA, Brennan N, Board N, Coconis J, Brown A. Hospital in the Home: a randomised controlled trial. *Med J Aust* 1999; 170: 156–60.
9. Cotterill PG, Gage BJ. Overview: Medicare post-acute care since the Balanced Budget Act of 1997. *Health Care Financ Rev* 2002; 24: 1–6.
10. Shepperd S, Harwood D, Jenkinson C, Gray A, Vessey M, Morgan P. Randomised controlled trial comparing hospital at home care with inpatient care. I: three month follow up of health outcomes. *Br Med J* 1998; 316: 1786–91.
11. Richards SH, Coast J, Gunnell DJ, Peters TJ, Pounsford J, Darlow M-A. Randomised controlled trial comparing effectiveness of an early discharge, hospital at home scheme with acute hospital care. *Br Med J* 1998; 316: 1796–801.
12. Wilson A, Parker H, Wynn A *et al*. Randomised controlled trial of effectiveness of Leicester hospital at home scheme compared with hospital care. *Br Med J* 1999; 319: 1542–6.

13. Anderson C, Rubenach S, Mhurchu CN, Clark M, Spencer C, Winsor A. Home or hospital for stroke rehabilitation? Results of a randomized controlled trial. I: Health outcomes at 6 months. *Stroke* 2000; 31: 1024–31.
14. Ricauda NA, Bo M, Molaschi M *et al.* Home hospitalization service for acute uncomplicated stroke in elderly patients: a randomized trial. *J Am Geriatr Soc* 2004; 52: 278–83.
15. Keith RA, Granger CV, Hamilton BB, Sherwin FS. The functional independence measure: a new tool for rehabilitation. *Adv Clin Rehabil* 1987; 1: 6–18.
16. Folstein MF, Folstein SE, McHugh PR. Mini-Mental State: a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975; 12: 189–98.
17. Yesavage JA, Brink TL, Rose TL *et al.* Development and validation of a geriatric depression scale: a preliminary report. *J Psychiatr Res* 1983; 17: 37–49.
18. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegel AP, Horwitz RI. Clarifying confusion: the confusion assessment method: a new method for detecting delirium. *Ann Intern Med* 1990; 113: 941–8.
19. Board N, Caplan G. Implications of decreasing surgical length of stay. *Aust Health Rev* 2000; 23(2): 71–85.
20. Board N, Brennan N, Caplan GA. A randomised controlled trial of the costs of hospital as compared with hospital in the home for acute medical patients. *Aust N Z J Public Health* 2000; 24(3): 305–11.
21. Caplan GA, Brown A. Post acute care: can hospitals do better with less? *Aust Health Rev* 1997; 20: 43–54.
22. Kiely DK, Bergman MA, Murphy KM, Jones RN, Orav EJ, Marcantonio ER. Delirium among newly admitted postacute facility patients: prevalence, symptoms and severity. *J Gerontol Med Sci* 2003; 58A: 441–5.
23. Creditor MC. Hazards of hospitalization of the elderly. *Ann Intern Med* 1993; 118: 219–23.
24. Anderson C, Mhurchu CN, Rubenach S, Clark M, Spencer C, Winsor A. Home or hospital for stroke rehabilitation? Results of a randomized controlled trial: II cost minimization analysis at 6 months. *Stroke* 2000; 31: 1032–7.
25. Vaughan B, Lathlean J. Intermediate care: models in practice. London: King's Fund, 1999.
26. Donald IP, Baldwin RN, Bannerjee M. Gloucester hospital-at-home: a randomized controlled trial. *Age Ageing* 1995; 24: 434–9.
27. Egerton N, Kay JH. Psychological disturbances associated with open heart surgery. *Br J Psychiatry* 1964; 110: 433–8.
28. Leape LL, Brennan TA, Laird N *et al.* The nature of adverse events in hospitalised patients: results of the Harvard Medical Practice Study II. *N Engl J Med* 1991; 324: 377–84.
29. Caplan GA, Brown A, Crowe PJ, Yap S-J, Noble S. Reengineering the elective surgical service of a tertiary hospital: a historical controlled trial. *Med J Aust* 1998; 169: 247–51.
30. Shepperd S, Harwood D, Gray A, Vessey M, Morgan P. Randomised controlled trial comparing hospital at home care with inpatient care. II: cost minimisation analysis. *Br Med J* 1998; 316: 1791–6.
31. Coast J, Richards SH, Peters TJ, Gunnell DJ, Darlow M-A, Pounsford J. Hospital at home or acute hospital care? A cost minimisation analysis. *Br Med J* 1998; 316: 1802–6.

Received 30 January 2005; accepted in revised form 3 August 2005

Impaired cognitive performance in asymptomatic peripheral arterial disease: relation to C-reactive protein and D-dimer levels

ROBERTO ANTONIO MANGIAFICO, FABRIZIO SARNATARO, MARCO MANGIAFICO, CARMELO ERIO FIORE

Department of Internal Medicine, University of Catania School of Medicine, Clinica Medica 'L. Condorelli', Ospedale Vittorio Emanuele, Via Plebiscito 628, 95124 Catania, Italy

Address correspondence to: R. A. Mangiafico. Tel: (+39) 0957 435 387. Fax: (+39) 0957 435 363. Email: rmangiafico@tiscali.it

Abstract

Background and purpose: asymptomatic peripheral arterial disease (APAD), a highly prevalent condition in the general older population, is associated with an increased risk of cerebrovascular events because of co-existing clinical or subclinical cerebral atherosclerosis. The purpose of this study was to investigate whether cognitive function is impaired in stroke- and