

Reducing utilisation of hospital services by case management: a randomised controlled trial

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Abstract

A 12-month randomised controlled trial was conducted in Hong Kong to evaluate the effectiveness of case management provided to a group of home-dwelling, frail elderly patients (control group: $n=47$; intervention group: $n=45$) in terms of utilisation of hospital services by these patients.

Significant reductions (significance at $P \leq 0.05$) in mean total number of hospital bed-days ($P < 0.001$), mean total episodes of hospital admissions ($P < 0.001$), and mean total number of attendances at the outpatient department ($P < 0.05$) were observed when the baseline and post-intervention differences between the intervention and control groups were compared.

The study demonstrated that utilisation of hospital services could be significantly reduced when a group of elderly patients and their caregivers received timely interventions and appropriate services through case management services.

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What is known about the topic?

There is mixed evidence on the effectiveness of case management services in achieving health service goals.

What does this paper add?

In Hong Kong, a case management service for community dwelling older adults was associated with a reduction in the use of hospital services.

What are the implications for practitioners?

Community-based case management may assist in reducing demand for hospital services.

LIKE OTHER INDUSTRIALISED COUNTRIES, Hong Kong is facing the challenge of caring for a growing population of increasingly frail elderly people (HKSAR Census & Statistics Department 2000). Statistics of Hong Kong public hospitals showed that more than half of inpatients were aged 60 years and over, and that the average length of stay of elderly patients was longer than their younger counterparts (Hospital Authority 2000). Hong Kong elderly patients also experience the 'revolving door' syndrome (Bound & Gardiner 2002) of frequent and repeated hospitalisations. In Hong Kong, the situation is exacerbated by a lack of knowledge of how to access appropriate and timely services for home-dwelling, frail elderly people — the consequence of which is greater use of the easily accessible hospital services, usually via the emergency department.

In a randomised trial in northern Italy, Bernabei et al. (1998) showed that case management services, providing integrated social and medical care, reduced functional decline and admissions to institutions in 200 subjects. In the study of 115 home-dwelling elderly people in another town in

northern Italy, Landi et al. (1999) found that when participants were provided with 6 months of case management and an integrated service, hospital admissions and length of hospitalisation of the study group were reduced when compared with 6 months earlier. Also noteworthy is the 2-year randomised trial by Burns et al. (2000) on the Geriatric Evaluation and Management project (GEM) in Memphis, USA. GEM interventions included an initial comprehensive assessment followed by the provision of long-term management by an interdisciplinary primary care team. The trial, involving 128 elderly people, yielded positive results in 8 of 11 outcome measures, including improved health perception, use of fewer medications, greater social activity, improved quality of life, life satisfaction, Mini Mental State Examination (MMSE) and Instrumental Activities of Daily Living (IADL) scores, and fewer clinic visits.

On the other hand, the 10-month Canadian randomised controlled study by Gagnon et al. (1999) on nurse case management for community-dwelling elderly people who were repeatedly hospitalised found that there was no significant difference between those people who had received case management services ($n=212$) and those who had received usual care ($n=215$) in terms of functional status, hospitalisation, quality of life, and satisfaction in care. In Hong Kong, published literature on case management studies in frail elderly people is scant.

A group of home-dwelling geriatric patients with multiple health problems and a recent history of repeated hospitalisations participated in a pilot case management project. Launched in April 2001, the aim of the project was to provide continuous support to this group of patients and their caregivers to reduce the utilisation of hospital services. A randomised controlled trial was conducted to evaluate the pilot project. Effectiveness of case management intervention was evaluated by comparing the baseline and post-intervention mean differences for utilisation of hospital services within the intervention and control groups and between the intervention group and the control group.

Methods

Subjects

Subjects of the study were recruited from a cohort of patients discharged from a rehabilitation hospital in Hong Kong. Inclusion criteria of the subjects were: aged 65 and over; a recent history of repeated hospitalisations (ie, two or more episodes in the past 6 months); multiple problems (ie, two or more chronic medical conditions that included hypertension, diabetes, chronic obstructive airway disease, stroke/CVA, heart failure, Parkinson's disease, etc); home-dwelling; and agreement to participate in the project for a period of 12 months.

After randomisation, subjects in the control group ($n=47$) received the usual service of regular medical follow-up through the hospital service system of Hong Kong. Subjects ($n=45$) in the intervention group received case management services, with the case manager coordinating all services received.

Intervention

Subjects in the intervention group received case management services through assigned case managers. The four case managers in the trial were nurses trained in nursing elderly patients in the community. Case managers were paired with case geriatricians for medical support. Case managers were instructed in the scope of the case management services to be provided to their assigned subjects. The scope of services included: regular monitoring of subjects' health status so that preventive and corrective interventions could be delivered proactively; availability for phone assistance to subjects daily from 8am to 9pm; home visits, if needed; prescribing of community-based supportive services, including community nursing services; and access to the case geriatrician by the case manager for medical support which included telephone consultation, assessment of subjects in the outpatient department, and admission of subjects to the hospital for further investigation and treatment.

Measurement parameters

The expected outcome of the case management intervention was a reduction in the utilisation of

hospital services, defined as those services provided through the public hospital system of Hong Kong. The measurement parameters of hospital services in the study were hospital bed-days, episodes of hospital admissions, attendances at the emergency room, outpatient department and geriatric day hospital, and home visits by community nurses (Box 1). Among the measurement parameters, hospital bed-days, being the unit of measure for hospitalisation, were most costly, with acute hospital bed-days more expensive than rehabilitation hospital bed-days. Treatments and care delivered to patients at home by the nurses of the community nursing service, which is part of hospital services in Hong Kong, were the least expensive service on the list. The functional status of the subjects at baseline and at the end of the intervention period was also noted.

Data collection

Data related to utilisation of hospital services were captured by a computerised network of databases of public hospitals in Hong Kong. Reliability and validity of the databases can be considered to be very high, as each use of a

public hospital service in any part of Hong Kong must be accounted for through the patient's personal identification card number for registration and fee-charging purposes. A period of 12 months before the commencement of the intervention was taken as the baseline period. Data related to hospital services utilised within this period were treated as baseline data. Utilisation of hospital services and deaths of subjects in the intervention and control groups were monitored by a research assistant.

Minimal Data Set–Home Care Version (MDS-HC) (Chinese version) was used to collect demographic, health, and functional data for the subjects (Chi, Lam TP & Lam KF 1997). Data for MDS-HC were collected by trained interviewers just before the commencement and at the end of the intervention.

Data analysis

Before conducting statistical analysis, data verification of utilisation of hospital services, mortality and institutionalisation rates was performed by the project coordinator. Data were analysed by SPSS 10.1 for Windows. Simple descriptive statistics and comparative analysis were applied. The

I Comparison of the baseline and post-intervention differences on the utilisation of hospital services between the subject groups

Hospital services	Target group mean (SD)		Control group mean (SD)		U	P
Total no. of acute hospital bed-days	-3.3	(16.2)	3.9	(14.8)	695.5	<0.01
Total no. of rehabilitation hospital bed-days	-4.6	(23.4)	13.4	(46.6)	814.0	0.05
Total no. of hospital bed-days	-7.9	(32.0)	17.2	(54.4)	635.0	0.001
Total episodes of unplanned hospital admission	-0.2	(0.9)	0.3	(1.3)	842.0	<0.05
Total episodes of hospital admission	-0.7	(2.8)	1.3	(2.9)	626.5	0.001
Total no. of attendances at emergency department.	-0.2	(1.0)	0.4	(1.4)	855.5	ns
Total no. of attendances at outpatient department	-0.8	(9.9)	0.2	(7.3)	809.5	0.05
Total no. of attendances at geriatric day hospital	-0.8	(11.0)	-0.9	(6.1)	1020.0	ns
Total no. of home visits by community nurse	6.7	(41.0)	-1.2	(15.4)	676.0	<0.05

ns = not significant

Kolmogorov–Smirnov test for normality testing was performed before the choice of a comparative procedure. The chi-square test, Mann–Whitney *U* test, and the Wilcoxon signed rank test were applied for hypothesis testing. Significance level was set at $P \leq 0.05$.

Results

Subject characteristics

Mean age of the subjects was 75.5 (± 6.6) years. Fifty-three point three per cent of the subjects were female. Comparisons of the demographic

2 Comparison of the baseline demographic characteristics, health status, and utilisation of hospital services between the subject groups

Gender and problem areas identified by MDS-HC	Intervention group (n=45)	Control group (n=47)	χ^2 (df=1)	P
Gender (female)	44.4 %	57.4 %	1.56	ns
Marital status (without a spouse)	48.9 %	48.9 %	0.00	ns
Living alone	22.2 %	17.0 %	0.40	ns
No. of environmental risk factors (>1)	2.2 %	6.4 %	0.96	ns
Self-rated health (poor)	31.1 %	10.6 %	5.88	<0.05
No. of health problems (>2)	28.9 %	29.8 %	0.01	ns
No. of medical diagnoses (>3)	51.1 %	61.7 %	1.05	ns
Stroke/CVA	42.2 %	38.3 %	0.16	ns
Heart failure	11.1 %	12.8 %	0.06	ns
Hypertension	48.9 %	63.8 %	2.09	ns
Parkinson's disease	8.9 %	12.8 %	0.36	ns
Diabetes	33.3 %	31.9 %	0.02	ns
Chronic obstructive airway disease	28.9 %	27.7 %	0.02	ns
Functional Performance by MDS-HC	Mean (SD)	Mean (SD)	U	P
Level of Activities of Daily Living	2.3 (2.3)	1.6 (2.2)	872.5	ns
Level of transfer	2.0 (2.3)	1.4 (2.1)	902.0	ns
Level of continence	0.6 (1.1)	0.3 (0.8)	922.0	ns
Level of mental status	1.1 (0.9)	1.0 (0.9)	964.5	ns
Level of mood symptoms	1.2 (1.1)	0.4 (0.8)	616.5	<0.001
Level of impairment	2.9 (1.7)	2.0 (2.0)	758.5	<0.05
Utilisation of Hospital Services	Mean (SD)	Mean (SD)	U	P
Total no. of acute hospital bed-days	12.9 (16.6)	6.8 (12.7)	657.5	0.001
Total no. of rehabilitation hospital bed-days	12.9 (25.5)	5.1 (17.8)	796.0	0.01
Total no. of hospital bed-days	25.8 (37.4)	11.9 (25.9)	638.0	0.001
Total episodes of unplanned hospital admission	0.5 (0.9)	0.1 (0.4)	811.5	<0.01
Total episodes of hospital admission	3.0 (3.1)	1.4 (2.6)	620.5	<0.001
Total no. of attendances at emergency room	0.5 (1.0)	0.4 (0.7)	1047.0	ns
Total no. of attendances at outpatient department	9.0 (5.4)	6.7 (4.7)	813.5	ns
Total no. of attendances at geriatric day hospital	5.7 (10.1)	2.4 (5.5)	905.5	ns
Total no. of home visits by community nurse	18.1 (39.0)	8.6 (18.5)	666.0	0.001

ns = not significant. MDS-HC = Minimal Data Set–Home Care Version (Chinese version)

characteristics, health and functional status of the control group ($n = 47$) and the intervention group ($n = 45$) showed that there were no significant differences between the mean age, gender and disease-type composition of the two groups (Box 2). Other health and functional variables of the two groups were also comparable at baseline, except for the intervention group being worse-off than the control group in terms of

their self-perceived health status ($P < 0.05$), level of mood symptoms ($P < 0.001$), and level of impairment ($P < 0.05$). Two subjects from the intervention group and four from the control group died during the trial period, while one subject from the intervention group and two from the control group were admitted to residential facilities for long-term placement during the trial period.

3 Comparison of the baseline and post-intervention differences on hospital services utilisation by the subject group

Hospital services	Intervention group			Control group		
	Baseline mean (SD)	Post-intervention mean (SD)	<i>P</i>	Baseline mean (SD)	Post-intervention mean (SD)	<i>P</i>
Total no. of acute hospital bed-days	12.9 (16.6)	9.6 (12.2)	ns	6.8 (12.7)	10.7 (14.8)	<0.05
Total no. of rehabilitation hospital bed-days	12.9 (25.5)	8.3 (15.1)	ns	5.1 (17.8)	18.5 (51.1)	<0.05
Total no. of hospital bed-days	25.8 (37.4)	18.0 (22.6)	ns	11.9 (25.9)	29.1 (60.0)	<0.01
Total episodes of unplanned hospital admission	0.5 (0.9)	0.3 (0.6)	ns	0.1 (0.4)	0.4 (1.4)	ns
Total episodes of hospital admission	3.0 (3.1)	2.3 (2.5)	0.05	1.4 (2.6)	2.7 (4.0)	<0.01
Total no. of attendances at emergency room	0.5 (1.0)	0.3 (0.5)	ns	0.4 (0.7)	0.8 (1.5)	ns
Total no. of attendances at outpatient department	9.0 (5.4)	8.3 (10.1)	<0.01	6.7 (4.7)	6.9 (8.1)	ns
Total no. of attendances at geriatric day hospital	5.7 (10.1)	5.0 (9.3)	ns	2.4 (5.5)	1.5 (4.8)	ns
Total no. of home visits by community nurse	18.1 (39.0)	24.8 (53.3)	<0.05	8.6 (18.5)	7.5 (21.3)	ns

ns = not significant

4 Comparison of the baseline and post-intervention differences on the functional characteristics between the subject groups ($n = 83$)

Functional Performance by MDS-HC	Target group mean (SD)		Control group mean (SD)		<i>z</i>	<i>P</i>
Level of ADL	+0.3	(1.0)	+0.2	(1.1)	758.5	ns
Level of transfer	+0.4	(1.2)	+0.2	(1.0)	857.5	ns
Level of continence	+0.3	(0.8)	0	(0.2)	717.0	<0.05
Level of mental status	-0.1	(1.4)	-0.2	(0.8)	852.5	ns
Level of mood symptoms	-0.5	(1.2)	-0.2	(0.7)	768.5	ns
Level of impairment	+0.1	(1.1)	-0.1	(1.2)	717.0	ns

ns = not significant

Baseline utilisation of hospital services

Significant differences were observed between the two groups on most of the parameters for hospital services at baseline (Box 2). The intervention group's utilisation of hospital services was significantly higher than the control group at baseline, except for attendance at the outpatient department, geriatric day hospital, and the emergency room, where the differences, though higher, were not significant.

Comparison of the baseline and post-intervention differences within the intervention group for utilisation of hospital services

There were reductions in utilisation of hospital services for the intervention group in all of the outcome parameters except utilisation of community nursing services, where an increase was significant ($P < 0.05$) (Box 3). Significant reductions were found on the mean total episodes of hospital admission ($P = 0.05$) and the mean total attendances at the outpatient department ($P < 0.01$).

Comparison of the baseline and post-intervention differences within the control group for utilisation of hospital services

There were increases in utilisation of hospital services by the control group in all of the outcome parameters, except in the mean total number of attendances at the geriatric day hospital and in the utilisation of community nursing services, where there were decreases (Box 3). Increases in hospital services were significant for the mean total number of acute hospital bed-days ($P < 0.05$), rehabilitation hospital bed-days ($P < 0.05$), and mean total episodes of hospital admission ($P < 0.01$).

Comparison of the baseline and post-intervention differences between the intervention group and the control group for utilisation of hospital services

The baseline and post-intervention mean differences were compared between the intervention

and control groups to elicit effectiveness of the case management intervention. The comparison showed a significant reduction in utilisation of hospital services in the intervention group on most of the outcome parameters, including mean total number of acute hospital bed-days ($P < 0.01$), mean total number of rehabilitation bed-days ($P < 0.05$), mean total episodes of unplanned hospital admission ($P < 0.05$), mean total episodes of hospital admission ($P < 0.001$), and mean total number of attendances at the outpatient department ($P < 0.05$). However, while the control group showed a reduced utilisation of community nursing services, the intervention group increased their utilisation of community nursing services, and the difference between the two groups was statistically significant ($P < 0.01$) (Box 1).

Comparison of the baseline and post-intervention mean differences for the functional characteristics between the two subject groups

Comparison between the two subject groups for the baseline and post-intervention mean differences in the MDS-HC health and functional assessment showed no significant difference on all the items, including levels of IADL, transfer, mental status, mood symptoms, and impairment, except for the item of continence ($P < 0.05$) where the intervention group was worse off (Box 4).

Discussion

Baseline and post-intervention comparisons within the control group showed that there were increases for most of the parameters for hospital services. In particular, increases in the most costly services of hospitalisation were significant. Without the case management intervention, the control subjects turned to the easily accessible hospital services through the common portal of entry of the hospital emergency room. At the time of the study, access to emergency room services in Hong Kong was free.

On the other hand, baseline and post-intervention comparisons within the intervention group

indicated that there were reductions on all of the parameters for hospital services except for the utilisation of community nursing services (Box 3). The effectiveness of the case management intervention was further indicated by the significant differences on the major outcome parameters detected by the between-group analysis (Box 1). Baseline data showed that the average total number of episodes of hospital admissions for the intervention group was twice as high as that of the control group. Moreover, the average total number of home visits by community nurses and the average total number of hospital bed-days utilised by the intervention group were more than twice that of the control group, indicating that the intervention group was more at risk of being hospitalised at the start of the trial. However, by providing the intervention group clients with timely, appropriate and individualized services through case management, their problems were either prevented or corrected by regular monitoring, advice and education, or by offering a more appropriate and efficient alternative.

A similar randomised controlled trial by Naylor et al. (1999) ($n=363$), where care coordination and home follow-up by five experienced geriatric nurses, pairing with the patients' physicians, achieved significant reduction in hospital readmissions by Week 24 after discharge in the intervention group compared with the control (37.1% v 20.3%; $P<0.001$). The scope of intervention was similar to the present study, except that Naylor et al's study included comprehensive discharge planning. Early discharge planning has proven to decrease the chance of unplanned readmission in the 9-month randomised clinical trial ($n=835$) by Evans and Hendricks (1993). In the present study, subjects were already at home. Nonetheless, even without discharge planning, this present study was able to demonstrate the effectiveness of case management in the frail elderly people under study. Lim, Lambert and Gray (2003) ($n=598$) have also demonstrated recently that case management through post-acute care coordinators who were empowered to purchase/organise both therapeutic and supportive services for patients in the post discharge

period was cost-effective and beneficial for both older patients and their caregivers.

The reason for the significant increase in utilisation of community nursing services by subjects in the intervention group is that case managers in the study were empowered to prescribe community nursing services as deemed appropriate. Normally, access to community nursing services is restricted, as only doctors can prescribe it for patients who require further nursing care at home after discharge from hospital. With this empowerment, case managers in the trial prescribed community nursing services with the aim to avoid inappropriate and unnecessary hospital admission. The increased use of community services, and, consequently, closer monitoring of the clients in the intervention group by the case managers, may have contributed to the decrease in the use of other hospital services.

It is noted that generally no significant difference was found in the functional status between the intervention and control groups when pre and post mean differences were compared. The result appears to show that the effect of the case management service on the intervention group and the increased utilisation of hospital services by the control group did not produce sufficient magnitude of change for observable significant differences. The probable reason for the observed significant difference with regard to the item of continence is that the continence level of the target group was poorer than, though not significantly worse than, the control group at baseline.

The study yielded encouraging results for case management services to be provided for frail elderly people who are frequently hospitalised in Hong Kong. The results appear to contradict those obtained in the Canadian study by Gagnon et al (1999). The scope of case management services was somewhat similar, and nurses were employed as case managers, but no significant difference in hospitalisation was found between the control and intervention groups in the Canadian study. However, Gagnon et al. (2000) explained the results as probably due to the insufficient credibility and authority of the case managers in organising services for their clients. The nurse case managers were

hired for the study only and were probably not accepted as part of the team. On the other hand, the nurse case managers of this study were well accepted by the team.

Another likely reason could be the difference in the target clients. It has been reported that targeting high-risk elderly patients is more effective than case managing a larger and more general group of elderly patients (Boult C et al. 1998; Reuben et al. 1999). In our study, only frail elderly people with a recent history of repeated hospitalisations were included, and their frailty may have differed from the study population of Gagnon et al. Nonetheless, the Canadian study was of a much larger scale, involving over 400 subjects and 11 case managers. Hence, the results in this trial should be interpreted within the limitations of the scale of the study. Similar studies of a larger scale are recommended to confirm the findings of this research project.

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