Cost-Benefit Analysis of a Case Management Project for the Community-Dwelling Frail Elderly in Hong Kong

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This randomized, controlled trial evaluates the cost-benefit of a case management project for older persons in Hong Kong. Case managers provided integrated care to participants in an intervention group while participants in a control group received conventional care only. Minimum Data Set–Home Care was used to assess health conditions, and hospital admissions were used as the basis to calculate health care costs. After the intervention, hospital admissions were reduced by 36.8% in the intervention group ($p = .01$*) and 20.4% in the control group. The total number of acute hospital bed-days decreased by 53.1% in the intervention group (*$p < .05$*), compared to 4.4% in the control group. Compared with the control group, U.S.$170,448 was saved in acute hospital care and community health services in the intervention group. Well-planned case management interventions reduced hospital admissions and the length of stay in hospitals with corresponding savings in total health care costs.*

Keywords: *case management; cost-benefit analysis; older persons; Hong Kong*

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With decreasing birth rates and increasing life expectancy, many countries are facing the economic impact of the aging population on their health care systems, especially publicly funded health care services (Reinhardt, 2000). This, together with rising expectations for the quality of care, has made health care reform a major task of many central governments. Examples are the recently published National Health Service reform plan in the United Kingdom (National Health Service, 2000) and the health care reform consultancy paper in Hong Kong (Health and Welfare Bureau, 2000).

In the United States, health care spending is expected to grow by two thirds by 2008, and the elderly account for one third of the country's $112 billion prescription drug costs, which are growing by more than 10% a year ("Critical Conditions," 2000). Similarly, Hong Kong is also experiencing a steady growth in its elderly population. It is estimated that the population aged 65 and over will grow to 13% of the total population in the next 15 years, and the elderly dependency ratio will increase from 149 in 2001 to 184 in 2016 (Hospital Authority, 2000). Even though aging is not synonymous with frailty, elderly people are major consumers of health care. In 1998-1999, slightly more than half of the inpatients staying in publicly funded hospitals in Hong Kong were elderly people. The average hospital length of stay among patients of all ages was 15.22 days, compared with 19.97 days for those aged 65 to 74 and 26.17 days for patients aged 75 and older (Hospital Authority, 2000). Furthermore, the utilization of health services by elderly people exceeds the growth in the elderly population; for example, 64% of care recipients cared for by community nursing personnel were frail elderly persons in 1998-1999 (Hospital Authority, 2000).

In a recent health care reform proposal, the Hong Kong special administrative regional government aimed to improve the health outcomes and cost efficiency of the health care system through a series of restructuring and financing initiatives (Health and Welfare Bureau, 2000). There is global concern to look for cost-effective and efficient service delivery models that are responsive to the needs of elderly persons. This article reports the findings from a randomized controlled trial of a case management project for community-dwelling frail elderly patients discharged from hospitals, and discusses the use of case management as a tool in achieving integrated, quality, and cost-effective care for this group of people.

Method

In June 2000 we recruited 260 hospital-discharged patients aged 60 and older from a rehabilitative hospital in Hong Kong, after obtaining their

informed consent. Most of these elderly persons suffered from one or more chronic illnesses such as chronic obstructive pulmonary disease, stroke, diabetes, and/or heart disease. They were assigned randomly to an intervention or a control group. Participants in the control group ($n = 130$) received conventional and often fragmented health and social services, such as home visits by community nurses and home help service, provided by existing care providers. Conventional health and social service systems in Hong Kong are highly compartmentalized, which threatens the organizational sustainability, quality, and efficiency of long-term care for the elderly (Harvard Report, 1999; Leung, Liu, & Chow, 1999). Moreover, communication and collaboration between health and social care providers are inadequate (Ko, Boey, Chi, & Cheng, 1997). This has an adverse effect on the continuum of care.

In our experimental case management program, clients in the intervention group ($n = 130$) received the following services from our case managers—a social worker plus a registered nurse:[1]

(a) regular (usually biweekly) home visits and telephone consultations;
(b) comprehensive geriatric assessment using the Hong Kong version of the Minimum Data Set–Home Care (MDS-HC; Chi, Lam, & Lam, 1997; Gate-Keeping Consultant Team, 2000; Kwan, Chi, Lam, & Chou, 2000) as the assessment tool;
(c) formulation, implementation, and revision of care plans with reference to the results of MDS-HC and discussion with elderly care recipients and their informal caregivers (see Table 1);
(d) linking of elderly care recipients with formal health and social services in an integrated care approach, that is, through formal referral procedures plus routine case conferences;
(e) monthly monitoring of elderly care recipients' health and hospitalization patterns via a computing program—Integrated Patient Administration System (IPAS)—operated by the Hospital Authority of Hong Kong;
(f) on-site and/or over-the-phone health and psychosocial counseling;
(g) health educational programs; and
(h) supportive groups and educational classes for elderly care recipients and their informal caregivers.

Measurement

After randomization, all participants were evaluated by a research nurse using the MDS-HC as the assessment tool. The evaluation was repeated at half-year intervals to assess change in their health conditions over time. The hospitalization record was reviewed through the IPAS, which is a centralized system recording all admissions to public hospitals in the territory.

Table 1. Elderly Care Recipients' Level of Impairment and Care Plans ($n = 130$)

Health Status of Care Recipients	*Informal Support*	*Care Plan*
Severe impairment ($n = 31$, 23.8%)	Adequate ($n = 28$, 21.5%)	Supervision by community nurses, home-based care, and respite hospital care
	Inadequate ($n = 3$, 2.3%)	Supervision by community nurses, home-based care, respite hospital care, PLUS caregiver support programs
Moderate impairment ($n = 25$, 19.3%)	Adequate ($n = 24$, 18.5%)	Day rehabilitative program and community support services
	Inadequate ($n = 1$, 0.8%)	Day rehabilitative program, community support services, PLUS caregiver training programs
Mild impairment ($n = 42$, 32.2%)	Adequate ($n = 13$, 9.9%)	Mutual-aid self-help group, regular health checks, and educational programs
	Inadequate ($n = 3$, 2.3%)	Mutual-aid self-help group, regular health checks, and educational programs, PLUS community support services
Without impairment ($n = 32$, 24.6%)	Adequate ($n = 29$, 22.3%)	Mutual-aid self-help group and health educational programs
	Inadequate ($n = 3$, 2.3%)	Mutual-aid self-help group, health educational programs, PLUS volunteer visits

Cost-benefit analysis "measure[s] all the inputs and outputs of treatment and care in common units, usually money" (St. Leger, Schnieden, & Walsworth-Bell, 1992, p. 15) and is useful for comparing treatments for the same health problems. The hospitalization records of the participants were captured and the cost calculated within a 6-month interval. For the intervention group, the salaries of the case managers were included in the total cost. We also considered the cost of informal caring hours, which was expressed in monetary terms as an indirect cost that was shouldered by the elderly care recipients' informal caregivers. The number of caring hours provided by the elderly care recipients' informal caregivers was translated into dollars based on the average wage rate per hour (excluding managerial and professional employees) in Hong Kong during the assessment period (i.e., U.S.$7.50 per hour in December 2000; Census & Statistics Department, 2001). We

evaluated the benefits (of the intervention) in terms of costs saved by the reduction in hospitalizations.

Results

No major differences were detected in baseline characteristics between the intervention and the control group, except that participants in the intervention group stayed in acute hospitals significantly longer than their counterparts (see Table 2). After 6 months, all participants had improved significantly in their levels of mood symptoms ($p < .001$) and informal support ($p < .001$; see Table 3). However, because of death or moving to old-age homes, 14 elders from the intervention group and 10 elders from the control group dropped out.

Concerning the hours of care provided by the elderly respondents' informal caregivers per week, caregivers in the intervention group offered more caregiving hours to their care recipients than those in the control group, but the difference did not reach statistical significance (*M* caring hours: intervention = 20.7, *SD* = 22.3 vs. control = 18.6, *SD* = 18; *p* = *ns*). If these were translated into monetary terms, the mean financial cost of informal care per week in the intervention was U.S.$155.30 (*SD* = $167), compared to U.S.$139.50 (*SD* = $135) in the control group (*p* = *ns*).

When comparing the mean difference before and after the study, respondents in the intervention group obtained greater improvement in the level of continence than those older persons in the control group ($p = .022$; see Table 4). There was a 36.8% decrease in the total number of unplanned hospital admissions in the intervention group ($p = .011$; see Table 3) compared to a 20.4% decrease in the control group (see Table 4). The total number of acute hospital bed days was decreased by 53.1% in the intervention group (a total of 551 days; $p = .03$; see Table 3), compared to 4.4% (a total of 28 days; see Table 4) in the control group. The cost of 1 acute hospital bed day in Hong Kong is U.S.$378. This translated into a saving of U.S.$208,278 for the intervention group compared to U.S.$10,584 in the control group. After deducting the salary of the case managers, the overall cost saved in acute hospital stays in 6 months was U.S.$170,448 in the intervention group compared with the control group.

There was a trend toward utilizing more community-based health services, especially the geriatric day hospital, among participants over the 6-month interval (see Tables 3, 4, and 5). Participants in the intervention group, especially those persons who were severely impaired, had a decreased health status over time, which caused our case managers to modify their care plans.

Table 2. Results Before the Study

	Intervention			*Control*		
	M		SD	M		SD
General characteristics						
Age at baseline	74.4		7.1	75.3		7.2
Distribution of males at baseline	56.9%			52.3%		
No. of chronic illnesses at baseline	2.7		1.4	2.9		1.5
Minimum Data Set–Home Care (MDS-HC) results						
No. of health problems (0-10)	2.0		1.9	1.9		1.4
Mood symptoms (0-4)	1.7		1.9	1.8		1.9
Mental functioning (0-5)	1.3		1.1	1.5		1.1
Activity of daily living (ADL) and instrumental ADL (0-5)	0.8		1.3	0.8		1.3
Continence (0-3)	0.12		0.5	0.08		0.3
Behavioral symptoms (0-4)	0.05		0.3	0.02		0.2
Informal support (0-4)	0.3		0.7	0.4		0.7
	N	M	SD	N	M	SD
Total hospitalization rate						
Total no. of bed-days in acute hospitals in 6 months	1,038**	8.1	15.3	635	4.9	8.4
Total no. of unplanned admissions to hospitals	144	1.1	1.6	113	0.9	1.2
Total no. of attending emergency rooms	43	0.3	0.8	38	0.3	0.6
Total attendance of community-based health services						
Community nursing service	150	1.2	3.9	111	0.7	2.5
Geriatric day hospital	325	2.5	6.3	95*	0.7	3.1

NOTE: Higher scores in MDS-HC represent greater impairment, except at the level of informal support.
All differences are not statistically significant, except *$p < .05$, **$p < .006$.

Accordingly, they used slightly more community nursing services (costing about U.S.$66 per visit) and geriatric day hospital (costing about U.S.$185 per day) services over the follow-up period. This increased the total cost of community-based health care by U.S.$1,942. Taking this into account, the total savings over time in overall health care costs for the intervention group was still 93% more than that in the control group (U.S.$179,090 vs. U.S.$12,526).

Six months post study, elders in the intervention group showed more improvement in their health status, especially in continence control and

Table 3. Comparison of Health Assessment Results and Health Care Utilization (Intervention Group)

	Before			*After*		
	M		SD	M		SD
Minimum Data Set–Home Care (MDS-HC) results						
No. of health problems (0-10)	2.0		1.9	1.8		1.8
Mood symptoms (0-4)	1.7		1.9	0.8		1.0**
Mental functioning (0-5)	1.3		1.1	1.1		1.0
Activity of daily living (ADL) and instrumental ADL (0-5)	0.8		1.3	1.1		1.9
Continence (0-3)	0.12		0.5	0.11		0.4
Behavioral symptoms (0-4)	0.05		0.3	0.07		0.3
Informal support (0-4)	0.3		0.7	1.1		0.8**
	N	M	SD	N	M	SD
Total hospitalization rate						
Total no. of bed-days in acute hospitals in 6 months	1,038	8.1	15.3	487**	3.8	6.5
Total no. of unplanned admissions to hospitals	144	1.1	1.6	91*	0.7	1.1
Total no. of attending emergency rooms	43	0.3	0.8	55	0.4	1.0
Total attendance of community-based health services						
Community nursing service	150	1.2	3.9	157	1.2	4.7
Geriatric day hospital	325	2.5	6.3	333	2.6	7.6

NOTE: Higher scores in MDS-HC represent greater impairment, except at the level of informal support.
All differences are not statistically significant, except *$p < .05$, **$p < .006$.

mood symptoms (see Table 6). There was also a trend toward more improvement in mental functioning, behavioral support, and informal support. In the intervention group, the number of acute hospital bed days dropped significantly, there were fewer geriatric day hospital attendances, and emergency room use was lower, except among frail care recipients who visited emergency rooms because of decreased health conditions, compared to the control group.

Case managers conducted 361 home visits, 1,171 telephone consultations, 145 face-to-face counseling sessions at the hospital, 424 case discussion meetings, and 157 referrals to community health and social services.

Table 4. Comparison of Health Assessment Results and Health Care Utilization (Control Group)

	Before			*After*		
	M		SD	M		SD
Minimum Data Set–Home Care (MDS-HC) results						
No. of health problems (0-10)	1.9		1.4	1.9		1.8
Mood symptoms (0-4)	1.8		1.9	0.9		1.1
Mental functioning (0-5)	1.5		1.1	1.4		1.1
Activity of daily living (ADL) and instrumental ADL (0-5)	0.8		1.3	1.2		1.9
Continence (0-3)	0.08		0.3	0.3		0.7**
Behavioral symptoms (0-4)	0.02		0.2	0.08		0.5
Informal support (0-4)	0.4		0.7	1.2		1.9**
	N	M	SD	N	M	SD
Total hospitalization rate						
Total no. of bed-days in acute hospitals in 6 months	635	4.9	8.4	607	4.7	7.8
Total no. of unplanned admissions to hospitals	113	0.9	1.2	90	0.7	1.1
Total no. of attending emergency rooms	38	0.3	0.6	25	0.2	0.5
Total attendance of community-based health services						
Community nursing service	111	0.7	2.5	61	0.5	2.2
Geriatric day hospital	95	0.7	3.1	169	1.3	5.1

NOTE: Higher scores in MDS-HC represent greater impairment, except at the level of informal support.
All differences are not statistically significant, except $^{**}p < .006$.

Discussion

Our findings showed that timely and appropriate intervention using a case management approach is effective and reduces health care costs. Furthermore, participants in the intervention group showed less decline in mental functioning and continence than those in the control group. These satisfactory results may be explained by the following factors:

A stable interdisciplinary case management team. Case management has a long history in human services, and the different backgrounds of case managers may generate diverse foci; for example, nursing case managers tend to

Table 5. Comparison of the Results After 6 Months of Case Management Between Intervention and Control Group

	Intervention			*Control*		
	M		SD	M		SD
Minimum Data Set–Home Care (MDS-HC) results						
No. of health problems (0-10)	1.8		1.8	1.9		1.8
Mood symptoms (0-4)	0.9		1.0	0.9		1.1
Mental functioning (0-5)	1.1		1.0	1.4		1.1
Activity of daily living (ADL) and instrumental ADL (0-5)	1.1		1.9	1.2		1.9
Continence (0-3)	0.11		0.4	0.3		0.7*
Behavioral symptoms (0-4)	0.07		0.3	0.08		0.5
Informal support (0-4)	1.1		0.8	1.2		1.9
	N	M	SD	N	M	SD
Total hospitalization rate						
Total no. of bed-days in acute hospitals in 6 months	487	3.8	6.5	607	4.7	7.8
Total no. of unplanned admissions to hospitals	91	0.7	1.1	90	0.7	1.1
Total no. of attending emergency rooms	55	0.4	1.0	25*	0.2	0.5
Total attendance of community-based health services						
Community nursing service	157	1.2	4.7	61	0.5	2.2
Geriatric day hospital	333	2.6	7.6	169	1.3	5.1

NOTE: Higher scores in MDS-HC represent greater impairment, except at the level of informal support.
All differences are not statistically significant, except *$p < .05$.

specialize in disease management or in elderly care recipients' rehabilitation needs, foster close partnerships between individuals and hospital or other health service staff, and provide clinical management of high-risk clients across the health care continuum (Waszynski, Murakami, & Lewis, 2000). Social work case managers emphasize the development of community resources and linkage to service providers, coordination of care, advocacy, and teaching (Huber, 2000). Because the needs and problems of elderly persons are multidimensional, we used an integrated approach with both our social worker and registered nurse acting as case managers, with the backup of an interdisciplinary team. In their division of labor, the nurse case manager usually followed up more frail cases that needed more intensive health

Table 6. Effect of Changes Over Time

	Intervention (%)	*Control (%)*	p *Value*
Minimum Data Set–Home Care (MDS-HC) results			
No. of health problems	–10	0	*ns*
Mood symptoms	–52.9	–50	.004
Mental functioning	–15.4	–6.7	*ns*
Activity of daily living (ADL) and instrumental ADL	+37.5	+50	*ns*
Continence	–8.3	+275	.023
Behavioral symptoms	+40	+300	*ns*
Informal support	+266.7	+200	*ns*
Total hospitalization rate			
Total no. of bed days in acute hospitals in 6 months	–53.1	–4.4	.029
Total no. of unplanned admissions to hospitals	–36.8	–20.4	*ns*
Total no. of attending emergency rooms	–27.9	–34.2	*ns*
Total attendance of community-based health services			
Community nursing service	+4.7	–45.0	*ns*
Geriatric day hospital	+2.5	+77.9	*ns*

NOTE: Higher scores in MDS-HC represent greater impairment, except at the level of informal support.

counseling and comprehensive geriatric assessment. The social work case manager provided psychosocial counseling and service coordination. The case managers designed individualized care plans in consultation with care recipients and their informal caregivers. They could adjust care plans without going through third-party providers. Support and advice were also available from an interdisciplinary consultant team comprising geriatricians, senior social workers, a geriatric nursing specialist, a clinical psychologist, and rehabilitation therapists. Through monthly case conferences, all team members could contribute to enhance the care plans and services. Although it is argued that the cost and the clinical effectiveness of interdisciplinary teams have not been assessed adequately (Schofield & Amodeo, 1999), our findings indicate that good coordination and appropriate division of labor in an interdisciplinary case management team can effectively serve clients with diverse needs and problems.

The use of integrated computing databases. Our case management team made effective use of two computing databases, the MDS-HC and the IPAS,

to closely monitor our elderly care recipients' changes in health conditions over time. Participants in the intervention group were classified into four groups—no impairment, mild impairment, moderate impairment, and severe impairment—according to MDS-HC results. Individual care plans were developed for all clients through accurate assessment of their clinical condition and regularly updated or revised according to their changing health status. This ensured the quality of care provided (Kwan et al., 2000). The development of a computerized health care database is an important tool in effective case management intervention, and good management of clients' health information can contribute to the success of health care services (Slaughter, 2000).

Facilitation of the interface of health care and social intervention. To match different interventions (as shown in Table 1) to elderly care recipients with different levels of impairment and needs, our case management team worked closely with other health and social care providers. Collaborative efforts can facilitate innovation and enhance user satisfaction and choices (Brachman, 1999). Our case managers endeavored to establish formal and informal linkages with other health and social services providers in the community such as community nurses and home help providers. After making the referral, our case managers made follow-up contact with service providers to discuss the health and social conditions of the clients. To interface among different service providers, quarterly service coordinating meetings, including health and social service providers in the local community, were held to discuss operational issues and formulate strategies for better cooperation. In our experience, close collaboration and trust between health and social service organizations can facilitate a "win-win" situation, enhance service quality and client-centered care, and improve cost-effectiveness.

Support for and from informal caregivers. Elderly persons prefer to receive care in their homes, and most community-dwelling elderly persons in Hong Kong use formal and informal care simultaneously when they become frail (Liu, Cheng, & McGhee, 2001). Our case managers, therefore, made a special effort to support informal caregivers, including on-site and/or over-the-phone psychosocial and health counseling, health education training programs, mutual support groups, and assistance in care planning and coordination to encourage them to continue their care. Our findings indicate that elders in the intervention group received more informal caring hours than those in the control group (20.7 hours vs. 18.6 hours).

Although others have observed a growing number of nonfamily members, including friends and neighbors, assuming the role of caregivers (Himes &

Reidy, 2000), all of the informal caregivers in our study were family members—mainly the spouse, children, or children-in-law—and they deemed caregiving as part of their normative duties. This reflects that in the Chinese society of Hong Kong, the culture and virtue of filial piety is still being practiced and respected (Chow, 1992, 1999). In many cases, the daughters and/or the daughters-in-law take up the role of informal caregiver for their frail parents and/or parents-in-law (Plowfield, Raymond, & Blevins, 2000). The care they provide usually includes practical care, such as personal hygiene and assistance in daily household chores, and emotional support such as being with the elderly care recipients.

Case Illustration

The following example illustrates how our case management intervention worked.

An older woman suffering from congestive heart failure and severe functional impairment was discharged recently from the hospital. She lived with her husband, who was her informal caregiver responsible for all the caregiving tasks. She also received home-based care, including domiciliary physiotherapy, from a support team. Our nursing case manager provided close supervision by means of regular home visits and telephone contacts. In a regular home visit, our nursing case manager discovered that the client's husband was diagnosed recently with chronic renal failure. The case manager immediately assessed the husband's physical health, functioning level, and psychosocial status and offered timely health counseling and education to the couple. After the home visit, the case manager reported changes in the health of the couple in the regular case conference, and care plans were revised accordingly. The client was transferred to a day care center for center-based rehabilitation so that the husband would not be overloaded by intensive caregiving. A community nurse was invited to provide direct supervision and health education to the husband. At the same time, our social work case manager reassessed the clients' financial condition and their mechanisms of coping with the husband's ill health. Financial assistance was arranged, and a series of psychosocial counseling sessions and a support program were made available to the couple. Case managers monitored the couple and addressed new problems with the support of the interdisciplinary team. With our intervention, the couple could be maintained in the community without further deterioration in their health status and unnecessary readmissions to hospitals.

This illustration shows that the uniqueness of our interdisciplinary case management service lies in the comprehensive holistic assessment of elderly

care recipients' needs and timely response to changes in health and/or social conditions. An effort was also made to coordinate and consolidate the health and social services after referral and to ensure effective communication among providers in different care settings, including the home, clinic, day health center, and hospital.

Impact of the Demonstration Project

Although case management has been applied to linking clients and service providers in Western countries since the 19th century (McNeese-Smith, 1999), this approach has not been applied widely in Hong Kong except in pilot studies (e.g., Mackenzie, Lee, Dudley-Brown, & Chin, 1998). It is argued that there is no scientific evaluation of outcome and cost-effectiveness of the case management approach in the literature (Rubin, 1992). This comment is particularly true in Hong Kong, where trials conducted to assess the cost-effectiveness of case management intervention for frail elderly people lack adequate controls. Data to judge the effectiveness of inpatient case management are lacking (Cook, 1998). The effectiveness of case management should be evaluated scientifically. The findings and methods employed in the present trial may contribute to better evaluation of the case management approach to caring for frail elderly people.

Conclusion

The quality and financial implications of care for frail elderly persons is a pressing issue in most countries. In the next 20 years, the proportion of people in Hong Kong who are elderly will increase to 15%, and an effective way to finance and deliver health and long-term care will be a major challenge. This calls for an integrated acute- and long-term care system (Branch, 1999) and more innovative alternatives to conventional fragmented care. However, from our experience, structure and system integration is only the hardware for better service delivery. Collaborative and coordinated care (Cassel, 2001) includes interdisciplinary case management and care planning, the leadership of both health care and social service professionals, assessment tools such as the MDS (Rantz, Popejoy, Zwygart-Stauffacher, Wipke-Tevis, & Grando, 1999), adequate access to resources (Bull & Kane, 1996), timely referral (Kiel, 2000), monitoring patterns of care utilization (Marshall, Long, Voss, Demma, & Skerl, 1999), and ongoing care plan reassessment and adjustment (Noetscher, 1999). This is the "software" essential for quality long-term care for community-dwelling frail elderly people.

Note

1. The social work case manager served mildly impaired elders (n = 65), whereas the nurse case manager served moderately impaired elders (n = 65).

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