

The health and cost effects of substituting home care for inpatient acute care: a review of the evidence

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Abstract

Background: There is much interest in reducing hospital stays by providing some health care services in patients' homes. The authors review the evidence regarding the effects of this acute care at home (acute home care) on the health of patients and caregivers and on the social costs (public and private costs) of managing the patients' health conditions.

Methods: MEDLINE and HEALTHSTAR databases were searched for articles using the key term "home care." Bibliographies of articles read were checked for additional references. Fourteen studies met the selection criteria (publication between 1975 and early 1998, evaluation of an acute home care program for adults, and use of a control group to evaluate the program). Of the 14, only 4 also satisfied 6 internal validity criteria (patients were eligible for home care, comparable patients in home care group and hospital care group, adequate patient sample size, appropriate analytical techniques, appropriate health measures and appropriate costing methods).

Results: The 4 studies with internal validity evaluated home care for 5 specific health conditions (hip fracture, hip replacement, chronic obstructive pulmonary disease [COPD], hysterectomy and knee replacement); 2 of the studies also evaluated home care for various medical and surgical conditions combined. Compared with hospital care, home care had no notable effects on patients' or caregivers' health. Social costs were not reported for hip fracture. They were unaffected for hip and knee replacement, and higher for COPD and hysterectomy; in the 2 studies of various conditions combined, social costs were higher in one and lower in the other. Effects on health system costs were mixed, with overall cost savings for hip fracture and higher costs for hip and knee replacement.

Interpretation: The limited existing evidence indicates that, compared with hospital care, acute home care produces no notable difference in health outcomes. The effects on social and health system costs appear to vary with condition. More well-designed evaluations are needed to determine the appropriate use of acute home care.

Acute care hospital stays in many countries are being shortened by substituting home care for inpatient care. Patients are discharged earlier and are then provided further treatment in their homes by health care professionals, generally for short periods. Health care planners argue that this short-term acute care at home (acute home care) will improve health outcomes and reduce health care costs. We reviewed the existing evidence about the health and cost effects of this type of home care for adults. Our review is more complete than others in the last decade,¹⁻⁵ which omitted some studies and paid insufficient attention to the internal validity of studies cited.

We focused on the extent to which existing evidence for specific health conditions both is internally valid and indicates for acute home care the following 3 effects: it does not adversely affect the health of patients, it does not adversely affect the health of caregivers (family and friends), and it reduces public and private costs of managing those conditions (i.e., costs borne by governments, health care



Evidence

Études

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This article has been peer reviewed.

CMAJ 1999;160:1151-55

providers, patients and caregivers). We focused on evidence about the health and cost effects experienced by all parties involved. We did this because, as economists argue, the effect of a health care service on society as a whole should be considered when making decisions about the use of that service.⁶

If internally valid studies consistently show that acute home care has these 3 effects for a specific health condition, its use for that condition is attractive from the perspective of society as whole. However, even if public and private costs are higher with acute home care, its use could still be justified if the health benefits for patients were sufficiently great and any negative health effects for caregivers sufficiently small. (To determine this, cost-effectiveness or cost-benefit analyses would be necessary.⁷) Similarly, if there are minor negative health effects, the use of acute home care could be justified if there were large cost savings.

The effect of home care on public and private costs is the social cost effect. This effect is the sum of 3 factors: the hospital cost savings from shorter inpatient stays, the added public and private costs of the home care program and other health services used (e.g., outpatient drugs and supplies, additional private home care services, hospital readmissions, outpatient physician services and home equipment), and the change — positive or negative — in other non-health-system costs borne by patients and caregivers (e.g., babysitting, transportation and value of time required to manage the health condition).

We also reviewed evidence regarding 2 other cost effects. The health system cost effect indicates only the change in costs for health services; it omits changes in the non-health-system costs borne by patients and caregivers. The patients' and caregivers' cost effect indicates the change in health-system and non-health-system costs borne by patients and caregivers.

Methods

We located potential articles by searching MEDLINE and HEALTHSTAR databases using the key word "home care" and by checking references in articles read. Three selection criteria were used: publication between 1975 and early 1998, evaluation of an acute home care program for people at least 18 years old with a nonpsychiatric health condition who were not receiving terminal care, and use of a control group to evaluate the health and cost effects. One of us (L.S.) read the published abstracts of all articles identified and then read the articles that appeared to meet our selection criteria. When he was uncertain whether a study met the criteria, the article was read by the rest of us.

We assessed the internal validity of each selected study using 6 criteria:⁶⁻⁹ (a) all patients in the study were eligible for home care; (b) patients who received home care were compared with similar patients who received traditional inpatient care; (c) the patient sample was large enough that important health and cost effects could be identified with a reasonable probability; (d) the statistical significance of the health and cost effects was assessed using appropriate statistical tests, and the robustness of the cost effect estimates was assessed using sensitivity analysis; (e) the ef-

fects of home care on pertinent aspects of patients' and caregivers' health were measured using validated instruments; and (f) the effect of home care on social costs was estimated using appropriate costing methods. All 3 of us agreed on whether each selected study satisfied these 6 criteria and on the health and cost effects reported in it.

Results

We located 1970 articles on home care published between 1975 and early 1998 and read 148 in their entirety. Many articles related to other types of home care (e.g., Hughes and colleagues¹⁰), to psychiatric conditions (e.g., Fenton and associates¹¹) or to terminal care (e.g., Ferris and collaborators¹²). In some studies of acute home care no control group was used (e.g., Jacobs and coworkers²). A few articles reported on acute home care for children (e.g., Dougherty and colleagues¹³).

Only 22 articles satisfied our selection criteria; 2 articles^{14,15} were excluded because they were early evaluations of home care for conditions for which later research showed day surgery to be more appropriate.¹⁶ The remaining 20 articles reported on evaluations of 14 different programs. Eight articles reported on 4 programs, 2 per program,¹⁷⁻²⁴ 3 articles reported on the same program,²⁵⁻²⁷ and 9 articles reported on 1 program each.²⁸⁻³⁶

The 14 studies provided evaluations for 8 health conditions: hip fracture (3 programs), hip replacement (2 programs), antibiotic therapy (2 programs) and, in 1 case each, chronic obstructive pulmonary disease (COPD), hysterectomy, knee replacement, pressure sores and stroke (Table 1). There were also 6 evaluations of programs that admitted patients with various medical and surgical conditions (Table 1). All programs evaluated provided nursing services, and most included some rehabilitation services. Most patients were over 60 years old.

None of the 14 studies fully satisfied our 6 internal validity criteria (details available from us on request). We focused on studies of 4 British programs: those by PP&H (Pryor and Williams,²⁵ Parker and associates²⁶ and Hollingworth and collaborators²⁷), O' Cathain,²⁹ Shepperd and coworkers^{19,20} and Richards and colleagues.^{23,24} We called these class 1 studies. The main results they presented seemed valid, despite their specific problems: the PP&H studies included patients ineligible for home care; the study by Shepperd and coworkers may have had a similar problem, because some home care patients were not discharged early; and the home care patients in O' Cathain's study may have been healthier than the patients who received traditional inpatient care. The hospital cost savings in all 4 studies may be overstated.

The problems of the 10 remaining studies, which we called class 2 studies, were more serious. None satisfied more than 2 of the 6 internal validity criteria. All had significant problems with their costing methods. Most involved small samples, and most did not assess the statistical significance of the results. Little sensitivity analysis was provided. Most studies did not include comparable patients



in the home care and control groups. For example, the Saskatchewan Health Services Utilization and Research Commission (SHSURC)³⁶ used a heterogeneous sample of patients, some of whom were not eligible for home care. Moreover, patients were not randomly assigned to home care. We doubt whether the empirical methods used to estimate the effects of home care provided adequate control for these problems.

Class 1 studies

The PP&H studies²⁵⁻²⁷ and O’Cathain’s study²⁹ presented similar results for hip fracture (Table 1). Both groups found higher readmission rates with home care, although the difference was statistically significant only in

the program studied by PP&H. However, O’Cathain found that patients who received home care had better emotional adjustment in the short term, and PP&H found that they recovered faster. Other health outcomes were unaffected. Neither group evaluated the effect on caregivers’ health or on the social costs. Both found lower health system costs with home care, although O’Cathain provided little information about the cost data used.

For 4 other conditions Shepperd and coworkers^{19,20} assessed the effects on patients’ health using at least 10 outcome measures for each condition. For hip fracture, there was a statistically significant positive effect only for “quality of life.” For COPD, hysterectomy and knee replacement, no notable effects were found. There was no significant effect on caregivers’ strain.

Table 1: Reported health and cost effects of acute care at home

Condition; study	Internal validity class*	Effect on patients’ health	Effect on caregivers’ health	Effect on social costs	Effect on health system costs	Effect on caregivers’ and patients’ costs
Hip fracture						
PP&H ²⁵⁻²⁷	1	Mixed†	NR	NR	Lower‡	NR
Farnworth et al ²⁸	2	No effect	NR	NR	Lower	NR
O’Cathain ²⁹	1	Mixed†	NR	NR	Lower	NR
Hip replacement						
Hensher et al ³¹	2	NR	NR	NR	Higher	NR
Shepperd et al ^{19,20}	1	Better	No effect	Higher§	Higher§	No effect§
Antibiotic therapy						
Stiver et al ^{17,18}	2	No effect	NR	NR	Lower	NR
Talcott et al ³⁰	2	No effect	NR	NR	Higher§	NR
Chronic obstructive pulmonary disease						
Shepperd et al ^{19,20}	1	No effect	No effect	Higher‡	Higher‡	No effect§
Hysterectomy						
Shepperd et al ^{19,20}	1	No effect	No effect	Higher‡	Higher‡	No effect§
Knee replacement						
Shepperd et al ^{19,20}	1	No effect	No effect	Higher§	Higher§	No effect§
Pressure sores						
Strauss et al ³²	2	No effect	NR	NR	Lower§	NR
Stroke						
Wade et al ³³	2	No effect	No effect	NR	NR	NR
Various conditions combined						
<i>Medical</i>						
Shepperd et al ^{19,20}	1	No effect	No effect	Higher§	Higher§	No effect§
<i>Surgical</i>						
Knowelden et al ³⁴	2	No effect	NR	NR	Lower	NR
<i>Medical and surgical</i>						
Donald et al ³⁵	2	Mixed†	No effect	NR	Higher	NR
Gerson et al ^{21,22}	2	No effect	NR	NR	No effect¶	No effect
SHSURC ³⁶	2	No effect¶	No effect¶	Lower¶	Lower¶	No effect¶
Richards et al ^{23,24}	1	No effect	NR	Lower	Lower	Lower

Note: NR = no evidence reported, SHSURC = Saskatchewan Health Services Utilization and Research Commission.

*Reflects the extent to which the study satisfies the 6 internal validity criteria used in this review. The results presented here for class 1 studies seem valid. See text for details.

†Authors report both positive and negative effects. See text for details.

‡Effect statistically significant ($\alpha \leq 5\%$).

§Effect not statistically significant ($\alpha \leq 5\%$).

¶See text for comments.

For each condition social costs were higher with home care, although the cost effects were insignificant for hip and knee replacement. There were substantial reductions in length of stay for each condition, but the hospital cost savings were still less than the added costs of home care. There were no significant effects on costs borne by patients and caregivers.

For elderly patients with various medical conditions Shepperd and coworkers found no notable effects on patients' or caregivers' health. For elderly patients with various medical and surgical conditions Richards and colleagues^{23,24} also found no notable effects on patient mortality, quality of life or physical functioning.

Although Shepperd and coworkers reported higher social costs associated with home care, Richards and colleagues reported lower costs. Shepperd and coworkers found that home care reduced length of stay by only 0.36 days, so that the hospital cost savings were too small to offset the added costs of home care. There was no significant effect on patients' and caregivers' costs. Richards and colleagues found that length of stay was reduced by 10.4 days, and the hospital cost savings exceeded home care costs. Moreover, patients' and caregivers' costs were also lower with home care.

Class 2 studies

Even if we were to ignore the serious problems with the class 2 studies, their results are very similar to those reported in the class 1 studies. In 8 class 2 studies home care had no effect on patients' health. Donald and associates³⁵ reported better functional gait and urinary continence, but possibly higher death rates, with home care. Thus, most class 1 and 2 studies suggest that home care had no notable effects on patients' health (Table 1).

Three class 2 studies assessed the effect on caregivers' health, and all found no effect.^{33,35,36}

The social cost effect was assessed in only one class 2 study. The SHSURC³⁶ concluded that home care could reduce social costs. However, this conclusion was not well supported by the evidence provided. The statistical analysis indicates that patients receiving home care had 30% higher social costs. The SHSURC conjectured, however, that costs would be lower with home care if more intensive use were made of it. But this was not apparent from the evidence presented. For example, the SHSURC reported that costs were \$486 higher for patients who received home care. It asserts this occurred because those patients were not switched to home care early enough. The data presented suggest that if those patients had been switched to home care sooner, the additional home care might have cost less than the additional hospital days averted. However, the SHSURC does not show that the savings, if any, would be sufficient to offset the initial \$486 in higher costs.

Most of the class 2 studies assessed only effects on health system costs. For hip fracture Farnworth and collaborators²⁸ reported lower costs with home care. For hip replace-

ment Hensher and coworkers,³¹ like Shepperd and coworkers,^{19,20} found higher costs. For antibiotic therapy, there is conflicting evidence. For pressure sores Strauss and colleagues³² found lower costs with home care, although the difference was not statistically significant. For combined surgical conditions Knowelden and associates³⁴ found lower costs, Donald and associates³⁵ higher costs. Gerson and collaborators^{21,22} reported finding no cost effect, but their numbers indicated higher costs. The SHSURC³⁶ concluded costs should be lower, but, again, this conclusion was not well supported by the evidence provided.

Interpretation

Fourteen studies satisfied our selection criteria, of which only 4 studies^{19,20,23-27,29} also satisfied our internal validity criteria. These 4 studies provided evidence regarding the health and cost effects of acute home care for 5 specific health conditions and for various medical and surgical conditions combined. This evidence indicates that, in general, home care had no notable effects on patients' or caregivers' health. Hip fracture was perhaps an exception, although the effects on patients' health for this condition did not seem great.

The cost effects were mixed. For hip fracture 2 studies indicated lower health system costs with home care. There was no evidence of lower social or health system costs for the 4 other conditions, however. For hip and knee replacement, home care had no significant effect on social costs, and for COPD and hysterectomy, social costs were significantly higher. For various conditions combined, one study showed no significant social cost effect, and one study showed lower costs.

Thus, hip fracture was the only condition for which internally valid evidence provided some support for acute home care. However, there was no evidence regarding the effects on caregivers' health or on patients' and caregivers' costs.

The 4 studies with internal validity did not consistently show that home care reduced social costs. The same conclusion holds if we consider all social cost effects reported in the 14 studies. Moreover, there is no consistent evidence of lower costs even if we consider only the effects on health system costs reported in all studies. Eight studies reported lower health system costs, but the difference was statistically significant in only 2 and was not significant in 1. No statistical analysis was reported in 4 other studies. The study by the SHSURC³⁶ provided little evidence to support its conclusion of lower costs (if better data analysis methods had been used, there may have been better support for this conclusion).

We doubt that these mixed cost results from the class 1 studies stem from flawed research methods. The evidence available suggests 2 other explanations. First, the cost effects may, in fact, vary among health conditions. Home care that does not adversely affect patients' or caregivers' health is less costly for some conditions (e.g., hip fracture)



and more costly for others (e.g., hysterectomy). This possibility limits the usefulness of studies that evaluate programs for patients with various health conditions. More research is needed to identify conditions for which home care is appropriate.

Second, home care may have been underused in some programs. It may have replaced only the least expensive last day or 2 days of the hospital stay, so that the hospital cost savings may have been too small to offset the added cost of home care. However, as the SHSURC argued, it may be clinically feasible to shorten inpatient stays still further by replacing more hospital days with home care.³⁶ The hospital costs saved on those days may be much greater than the added home care costs. Research is necessary to determine whether any such savings would be sufficient to make social costs lower with home care.

Thus, more well-designed evaluations of acute home care are needed. Given the current interest in this type of home care, federal and provincial governments should give high priority to such research. It should not be limited to evaluating health system cost effects. To determine whether society would be better served with increased use of home care, the effects on patients' and caregivers' health as well as the effects on their costs should also be evaluated. Although evidence about these effects is now available for 5 conditions, the consequences may be different with other conditions and with more intensive use of home care.

Competing interests: None declared.

References

1. Federal-Provincial-Territorial Working Group on Home Care, Director General of Health Services and Promotion, Health Canada. *Report on home care*. Ottawa: Ministry of Supply and Services; 1990. Cat no H39-186/1990.
2. Jacobs P, Henderson I, Nichols D. *Episodic acute care costs: linking inpatient and home care*. Ottawa: University of Ottawa; 1994. Cost-effectiveness of the Canadian Health Care System, Queen's-University of Ottawa Economic Projects (discussion paper 94-07).
3. Saskatchewan Health Services Utilization and Research Commission. *The cost-effectiveness of home care: a rigorous review of the literature* [background paper 2]. Saskatoon: The Commission; 1996.
4. Shepperd S, Iliffe S. Effectiveness of hospital at home compared to in-patient hospital care [Cochrane review]. In: The Cochrane Library; issue 1, 1999. Oxford: Update Software.
5. Marks L. *Home and hospital care: redrawing the boundaries*. London: King's Fund Institute; 1991.
6. Gold MR, Siegel JE, Russell LB, Weinstein MC. *Cost-effectiveness in health and medicine*. Oxford: Oxford University Press; 1996. p. 3-7.
7. Drummond MF, O'Brien B, Stoddart GL, Torrance GW. *Methods for the economic evaluation of health care programmes*. 2nd ed. London: Oxford Medical Publications; 1996. chap. 2. p. 53.
8. Sackett DL, Haynes RB, Tugwell P. *Clinical epidemiology: a basic science for clinical medicine*. Toronto: Little, Brown & Co; 1985. p. 285-321.
9. Soderstrom L. The estimation of the cost effect of a health service: a note on methodology. Paper presented at Fifth Canadian Conference on Health Economics; 1993 Aug 27; Regina.
10. Hughes SL, Cummings J, Weaver F, Manheim LM, Conrad KJ, Nash K. A randomized trial of Veterans Administration home care for severely disabled veterans. *Med Care* 1990;28(2):135-45.
11. Fenton FR, Tessier L, Contandriopoulos AP, Nguyen H, Struening EL. A comparative trial of home and hospital psychiatric treatment: financial costs. *Can J Psychiatry* 1982;27(3):177-87.
12. Ferris FD, Wodinsky HB, Kerr IG, Sone M, Hume S, Coons C. A cost-minimization study of cancer patients requiring a narcotic infusion in hospital and at home. *J Clin Epidemiol* 1991;44(3):313-27.
13. Dougherty GE, Soderstrom L, Schiffrin A. An economic evaluation of home care for children with newly diagnosed diabetes: results from a randomized controlled trial. *Med Care* 1998;36(4):586-98.
14. Adler MW, Waller JJ, Creese A, Thorne SC. Randomised controlled trial of early discharge for inguinal hernia and varicose veins. *J Epidemiol Community Health* 1978;32:136-42.
15. Ruckley CV, Cuthbertson C, Fenwick N, Prescott RJ, Garraway WM. Day care after operations for hernia or varicose veins: a controlled trial. *Br J Surg* 1978;65:456-9.
16. Pineault R, Contandriopoulos AP, Valois M, Bastian ML, Lance JM. Randomized clinical trial of one-day surgery: patient satisfaction, clinical outcomes and costs. *Med Care* 1985;23(2):171-82.
17. Stiver HG, Telford GO, Mossey JM, Cote DD, Van Middlesworth EJ, Trosky SK, et al. Intravenous antibiotic therapy at home. *Ann Intern Med* 1978;89(pt 1):690-3.
18. Stiver HG, Trosky SK, Cote DD, Oruck JL. Self-administration of intravenous antibiotics: an efficient, cost-effective home care program. *CMAJ* 1982;127:207-11.
19. Shepperd S, Harwood D, Jenkinson C, Gray A, Vessey M, Morgan P. Randomised controlled trial comparing hospital at home care with in-patient hospital care: 1. Three month follow up of health outcomes. *BMJ* 1998;316:1786-91.
20. Shepperd S, Harwood D, Gray A, Vessey M, Morgan P. Randomised controlled trial comparing hospital at home care with in-patient hospital care: 2. Cost minimisation analysis. *BMJ* 1998;316:1791-6.
21. Gerson LW, Collins JF. A randomized controlled trial of home care: clinical outcome for five surgical procedures. *Can J Surg* 1976;19:519-23.
22. Gerson LW, Hughes OP. A comparative study of the economics of home care. *Int J Health Services* 1976;6(4):543-5.
23. Richards SH, Coast J, Gunnell DJ, Peters TJ, Pounsford J, Darlow MA. Randomised controlled trial comparing effectiveness and acceptability of an early discharge, hospital at home scheme with acute hospital care. *BMJ* 1998;316:1796-801.
24. Coast J, Richards SH, Peters TJ, Gunnell DJ, Darlow MA. Hospital at home or acute hospital care? A cost minimisation analysis. *BMJ* 1998;316:1802-6.
25. Pryor GA, Williams DRR. Rehabilitation after hip fractures: home and hospital management compared. *J Bone Joint Surg [Br]* 1989;71B(3):471-4.
26. Parker MJ, Pryor GA, Miles JW. Early discharge after hip fracture. *Acta Orthop Scand* 1991;62(6):563-6.
27. Hollingworth W, Todd C, Parker M, Roberts JA, Williams R. Cost analysis of early discharge after hip fracture. *BMJ* 1993;307:903-6.
28. Farnworth MG, Kenny P, Shiell A. The costs and effects of early discharge in the management of fractured hip. *Age Ageing* 1994;23:190-4.
29. O' Cathain A. Evaluation of a hospital at home scheme for the early discharge of patients with fractured neck of femur. *J Public Health Med* 1994;16(2):205-10.
30. Talcott JA, Whalen A, Clark J, Rieker PP, Finberg R. Home antibiotic therapy for low-risk cancer patients with fever and neutropenia: a pilot study of 30 patients based on a validated prediction model. *J Clin Oncol* 1994;12(1):107-14.
31. Hensher M, Fulop N, Hood S, Ujah S. Does hospital-at-home make economic sense? Early discharge versus standard care for orthopaedic patients. *J R Soc Med* 1996;89(10):548-51.
32. Strauss MJ, Gong J, Gary BD, Kalsbeck WD, Spear S. The cost of home air-fluidized therapy for pressure sores: a randomized controlled trial. *J Fam Pract* 1991;33(1):52-9.
33. Wade DT, Langton-Hewer R, Skilbeck C, Bainton D, Burns-Cox C. Controlled trial of a home-care service for acute stroke patients. *Lancet* 1985;1:323-6.
34. Knowelden J, Westlake L, Wright KG, Clarke SJ. Peterborough hospital at home: an evaluation. *J Public Health Med* 1991;13(3):182-8.
35. Donald IP, Baldwin RN, Bannerjee M. Gloucester hospital-at-home: a randomized controlled trial. *Age Ageing* 1995;24:434-9.
36. Saskatchewan Health Services Utilization and Research Commission. *Hospital and home care study* [summary report 10]. Saskatoon: The Commission; 1998.

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