A cost-effectiveness study of person-centered integrated heart failure and palliative home care: Based on a randomized controlled trial

Klas-Göran Sahlen[1,2,3], Kurt Boman[2,4] and Margareta Brännström[1,3]

Abstract

Background: Previous economic studies of person-centered palliative home care have been conducted mainly among patients with cancer. Studies on cost-effectiveness of advanced home care for patients with severe heart failure are lacking when a diagnosis of heart failure is the only main disease as the inclusion criterion.

Aim: To assess the cost-effectiveness of a new concept of care called person-centered integrated heart failure and palliative home care.

Design: A randomized controlled trial was conducted from January 2011 to 2013 at a center in Sweden. Data collection included cost estimates for health care and the patients' responses to the EQ-5D quality of life instrument.

Setting/participants: Patients with chronic and severe heart failure were randomly assigned to an intervention ($n = 36$) or control ($n = 36$) group. The intervention group received the Palliative Advanced Home Care and Heart Failure Care intervention over 6 months. The control group received the same care that is usually provided by a primary health care center or heart failure clinic at the hospital.

Results: EQ-5D data indicated that the intervention resulted in a gain of 0.25 quality-adjusted life years, and cost analysis showed a significant cost reduction with the Palliative Advanced Home Care and Heart Failure Care intervention. Even if costs for staffing are higher than usual care, this is more than made up for by the reduced need for hospital-based care. This intervention made it possible for the county council to use €50,000 for other needs.

Conclusion: The Palliative Advanced Home Care and Heart Failure Care working mode saves financial resources and should be regarded as very cost-effective.

Keywords

Cost-effectiveness, heart failure, home care

What is already known in this topic?

- Integrated heart failure care and palliative care at home is recommended by The European Association of Cardiology.
- A Cochrane review shows that cost-effectiveness studies in home palliative care services is lacking.

What this paper adds?

- It shows that the Palliative Advanced Home Care and Heart Failure Care (PREFER) intervention has potential to save costs compared to standard care.

Implication for practice, theory or policy

- Policy makers should take the result into consideration when allocating recourses

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[1]Department of Nursing, Umeå University, Umeå, Sweden
[2]Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden
[3]The Arctic Research Centre, Umeå University, Umeå, Sweden
[4]Research Unit, Department of Medicine, Umeå University, Skellefteå, Sweden

Corresponding author:
Klas-Göran Sahlen, Department of Nursing, Umeå University, Umeå S-901 87, Sweden.
Email: klasse.sahlen@umu.se

Introduction

Chronic heart failure (CHF) is a major public health issue, and its prevalence is increasing owing to the aging population and the improved management of heart disease.[1,2] Approximately 1%–2% of the adult population in developed countries has CHF, with the prevalence rising to ≥10% among persons 70 years of age and older.[1] Worldwide, the prevalence is over 23 million people and over 5.8 million people in the United States. The health care costs of CHF are substantial, and more than 39 billion dollars are spent annually in the United States alone due to high rates of hospitalizations, readmissions, and outpatient visits. CHF is the most common condition for hospital admission in people aged >65 years, and it is the most common cause of readmission with 27% of patients being readmitted within 30 days. Although the mortality of CHF has improved, it still results in a high 5-year mortality that rivals that of many cancer diseases.[2] CHF has an unpredictable disease trajectory, and it can be difficult, therefore, to identify a specific time point to consider palliative care.[3] Patients with CHF have symptoms as severe and distressing as those of cancer patients,[4] but they do not have equal access to palliative care.[5]

Finding new ways to care for patients with CHF that both increase the patients' quality of life and reduce health care costs are necessary and challenging. In a randomized controlled study, we found that Palliative Advanced Home Care and Heart Failure Care (PREFER) increased quality of life in patients with CHF, reduced the number of hospitalizations, and reduced the number of days of hospitalization.[6] Recently, a study also showed that home-based palliative care is effective in reducing hospitalizations of severe CHF patients, but the cost savings for delivering home-based services compared to hospitalizations were not evaluated.[7] In addition, a per-protocol analysis by Ekman et al.[8] found that when person-centered care (PCC) was fully implemented, the length of hospital stay was reduced for patients with CHF. Nevertheless, to our knowledge, the cost-effectiveness of person-centered integrated heart failure and palliative home care has not yet been evaluated. The aim of the study was to assess the cost-effectiveness of the PREFER intervention compared to standard care for patients with CHF.

Methods

Trial design/setting

Complete details of the design of the study, its methods, and its main findings have been reported previously.[5,9] Briefly, the PREFER study was a randomized controlled study in which 72 patients were randomly assigned to the PREFER intervention ($n=36$) or control ($n=36$) group. The intervention group (IG) received the person-centered and integrated PREFER intervention over the course of 6 months. The control group (CG) received standard care that is usually provided by a primary health care center or the nurse-led heart failure clinic at the hospital. Both groups had full access to hospital-based emergency care. The randomized controlled trial (RCT) followed the Consolidated Standards of Reporting Trials (CONSORT) guidelines. The data were collected over a total of 6 months between 2011 and 2013. The research setting was an advanced home care unit providing services Monday–Friday during the day and based in a county hospital located in northern Sweden.

Participants

Patients with a confirmed diagnosis of CHF according to the criteria of the European Society of Cardiology (ESC)[10] were asked to participate in the study. Inclusion criteria were CHF with New York Heart Association (NYHA) functional class III−IV symptoms and at least one of the following: a hospitalized episode of worsening heart failure that resolved with the injection/infusion of diuretics or the addition of other heart failure treatment in the preceding 6 months and being regarded as "optimally treated" according to the responsible physician; the need for frequent or continual i.v. support; chronically poor quality of life based on a visual analogue scale score < 50; signs of cardiac cachexia defined as an involuntary non-oedematous weight loss ≥ 6% of total body weight within the preceding 6–12 months; and life expectancy of < 1 year. Exclusion criteria were previously described in the design paper.[9]

Intervention

The patients were offered structured PCC at home with easy access to care, and the team was responsible for the total care, including co-morbidities. PCC is described as a partnership between patients/careers and professional caregivers, and includes initiating, working on, and documenting the partnership. The starting point is the patient's narrative, which is recorded in a structured manner and from which a mutual care plan is created that incorporates goals and strategies for implementation and follow-up.[11]

A model for person-centered palliative care was used. The model is called the six S and consist of the six S key words: self-image, self-determination, social relationships, symptom control, synthesis, and surrender.[12] The PREFER intervention was developed from the goals and steps in the process of providing palliative care for patients with CHF as recommended by the ESC.[3] These were patient features, confirm diagnosis, patient education, establishment of an advanced care plan, required organization of services, symptom management, identifying end-stage heart failure, breaking bad news to the patient and family, and establishing new goals for care. The PREFER model also includes goals to support relatives/bereavement and support to the

Table 1. Assumptions used for allocated time per care situation in minutes/event.

		Category	Time
1	Visit at primary care center and hospital clinics	Physician	30 min/0.5 h
2	Visits at hospitals	RN	30 min/0.5 h
3	Visits at primary care center	RN	20 min/0.33 h
4	Telephone contact, prescriptions, etc.	Physician and nurse	10 min/0.17 h
5	Telephone contact, prescriptions, etc.	Physiotherapist and occupational therapist	15 min/0.25 h

RN: registered nurse.

Table 2. Assumptions on health care providers direct costs for different care-related items.

	Activity	Unit/item	Euro (€)
1	Ambulance transport	Per transport	320
2	Salary/month[a]	Physician	5990
3	Salary/month[b]	RN, physiotherapist, and occupational therapist	3060
4	Hospital care[c]	Per day	570
5	Travel expenses[d]		0.2/km

RN: registered nurse; PREFER: Palliative Advanced Home Care and Heart Failure Care.
[a]According to Statistics Sweden + 50% value added tax (VAT) and employers' charges and overhead (2012).
[b]Monthly salaries are converted to salary per hour by division with 160 which is standard working hours per month in Sweden.
[c]Average costs for a hospital stay In Västerbotten County (2012).
[d]Travel expenses for ordinary care are not included because data are lacking for both groups. For the PREFER project, data for travel expenses are included. With the stated pricing, this increases the costs for the intervention by SEK200,000 (€20,400).

team members, for example, ethical rounds.[13] Patients in the IG were offered a multidisciplinary approach involving collaboration between specialists in palliative and heart failure care, that is, specialized nurses, palliative care nurses, cardiologist, palliative care physician, physiotherapist, and occupational therapist. Rounds were scheduled every 2 weeks with all the team members (*n*=7). Information between the scheduled rounds was shared within the unit in meetings and through email and phone calls. The assessment of need, the length of the home visits, and the number of telephone calls were adapted to each patient. Advanced care such as the administration of injections/infusions of diuretics and transmission of the electrocardiogram (ECG) to the hospital was performed in the patient's home.[5] The model has been described earlier in published papers.[5,9]

Assessment of health-related quality of life

A common concept in health economic analyses is "quality-adjusted life years" (QALYs), and these can be described as a measurement that combines the number of lived years with the quality of those lived years. The idea is to have an outcome measure that is sensitive to both longevity and morbidity.[14]

The EQ-5D instrument is a commonly used instrument to calculate QALYs with five questions. The person's state of health is given a numerical number (QALY weight) derived from the EQ-5D instrument. If a person feels free from disease and in good health (Best imaginable health status), a QALY weight of 1 is given, but if the person experiences the opposite (Worst imaginable health status), a QALY weight of 0 is given. The QALY weight is a result of the five questions and calculated according to common practice.[15]

We investigated the participants' health-related quality of life at inclusion in the study and at the end of the project after 6 months (±2 weeks). To get the gained number of QALYs, the difference between the two endpoints was multiplied with the length of time period in years.

Assessment of costs for health care

Both groups had access to primary health care and hospital-based care and thus generated costs. In addition, the IG had significant costs for staffing, including general practitioners, registered nurses, physiotherapists, and so on. Below, we will present how we calculated the costs for health care. It is based on the time spent for each patient. When services are given as part of our intervention, minutes are documented and used to calculate costs for each staff category. Health care services offered as part of the standard care (both primary health care and hospital care) are calculated similarly but based on assumptions made on timing. These assumptions are based on recommendations from the county council and according to practice in the area. These assumptions are listed in Table 1.

Costs were calculated by multiplying the allocated time for given services by the average salaries listed in Table 2. The average costs for emergency care and in-hospital care

Table 3. Excerpts from the Standard Cost Model (2011).

	Activity	Unit	Euro (€)
1	Physician, specialist	Visit at hospital	360
2	Registered nurse	Visit at hospital	38
3	General practitioner	Visit at care center	110
4	General practitioner	Visit in patients home	100
5	Telephone contacts, prescriptions, general practitioner	Number	10
6	Registered nurse	Visit at primary health care center	46
7	Registered nurse	Visit in patient's home	57
8	Telephone contacts, prescriptions, district nurse	Number	6
9	Occupational therapist/primary health care center	Visit in patient's home	100
10	Physiotherapist	Visit in patient's home	160
11	Telephone contacts, prescriptions, physiotherapist	Number	10
12	Hospital care	Per day	570

Table 4. Interpretations used in the sensitivity analysis based on the Standard Cost Model.

	Activity	Unit	Euro (€)
1	Palliative advanced home care	Home visits	57
2	PREFER nurse	Home visits	57
3	PREFER occupational therapist/ physiotherapist	Home visits	100
4	Ambulance transport	Per trip	360

PREFER: Palliative Advanced Home Care and Heart Failure Care.

came from the 2012 accounting records of Västerbotten County.

A sensitivity analysis was performed using the standard cost model for Sweden (Table 3) that was developed by the HCM Healthcare Management in October 2011 (http://www.hcmconsulting.se/english.php). The development of this cost model was made on behalf of the Swedish Association of Local Authorities and Regions, and the intention was to use it when monitoring elderly people with multiple morbidities. When using this model, significantly higher costs are derived because this model includes the overhead costs, travel expenses, and so on for each item.

Some items of importance in our project are not included specifically in the standard cost model. We had to assume, for example, that the PREFER nurse is as expensive as other nurses in primary health care, and ambulance transports had the same price as in the first model. All assumptions are listed in Table 4.

Rational for the cost analysis

Our aim of the study was to assess the cost-effectiveness of the PREFER intervention compared to standard care for patients with CHF in order to advice policy makers in health care organizations. Our purpose is to advise decision-makers responsible for health care organizations. With this background, we chose to include only direct medical costs from a provider perspective. Patients' costs, indirect costs either as a result of loss of productivity or premature mortality, and expenses incurred by state authorities are thus not included. This way we also avoid double counting

Statistics

The costs for the two groups were compared with a non-parametric approach using the Mann–Whitney U-test; *p*-values below 0.05 are regarded as significant.

Ethics

The regional Ethics Committee for Human research at Umeå University gave permission for the study (Ref number 2010-294-31M). Written informed consent was obtained from all participants.

Results

Health-related quality of life

At baseline, the QALY weight was 0.569 and 0.538 for the IG and CG, respectively. At the end of the intervention period, the IG had a slight improvement in QALYs (+0.006) and the CG had a decline (−0.024). The changes were small but significant ($p = 0.026$) and were in accordance with our hypothesis. If we assume that the changes between baseline and the end of the intervention period (an average of 5.4 months or 0.45 years) are linear, it is possible to calculate the gained QALYs as a result of the intervention. This assumption is reasonable because it would be to overestimate the impact if we assume that it occurs in full at the first day of the intervention, (Gained QALY weight) × (linear effect) × (intervention period) × (number of participants) = QALYs. Using the numbers above, this becomes $0.03 \times 0.5 \times 0.45 \times 36 = 0.25$ QALYs.

Costs of health care

As described in Tables 5 and 6, the costs for staffing are significantly higher in the IG compared to the CG. Costs for nurses, physiotherapists, and occupational therapists are 10 times higher. However, this is balanced by significantly lower costs for hospital care and emergency transport.

The total cost for the IG was SEK1.4 million SEK (€140,000). The CG generated costs for health care of SEK2.0m (€205,000). The result of the intervention was a reduced cost of SEK600,000 (€61,000) over the 6-month intervention period. The result reflects actual used time. With the Swedish standard cost model, the result was similar as described in the sensitivity analysis in Table 7 with a reduced cost of €49,000 (Table 8).

The cost utility analysis becomes a pure cost analysis because savings from the intervention are larger than the cost for the intervention.

Discussion

The main finding was that the PREFER intervention saves financial resources while improving quality of life, and this suggests that person-centered and staff-intensive home care for this patient group is cost-effective. The intervention is done in Sweden, but we have reason to believe that the results can be transformed to other Western care systems. Earlier economic studies have looked at including PCC,[16] heart failure management programmes,[17] or palliative home care[18,19] as a part of the intervention. A cost-effectiveness study of a PCC integrated-care pathway intervention for patients with hip fracture showed that the intervention was less expensive and more effective than

usual care. The cost reduction originated mostly from the decrease in hotel costs owing to the reduced length of hospital stay.[16] A Cochrane study about cost-effectiveness of home palliative care services for adults with advanced illness and their caregivers reported inconclusive evidence. Two randomized clinical trials, one from the United Kingdom and one from the United States, suggested that home palliative care is cost-effective, but the remaining four studies did not provide a consistent result regarding cost-effectiveness.[18,19] The studies included in the Cochrane review[18] comprised mainly studies on patients with cancer or with mixed cancer diagnosis. Only two articles included patients with CHF, and none included CHF alone. Therefore, the cost-effectiveness of strategies for CHF cannot be evaluated from the Cochrane review. Our article adds to the current knowledge by being the only study, according to our knowledge, with patients suffering from severe CHF as the main disorder. In other published studies, CHF has been studied as one of other severe diseases.[20] It is, therefore, difficult to assess the economic outcome for CHF itself. Other studies have mainly focused on heart failure clinics, which is not equal to the concept of the PREFER strategy.[17] With the PREFER strategy, our calculations revealed cost savings of around SEK500,000 (€50,000). This pattern of cost saving has to our knowledge not been reported before in a limited number of patients over only 6 months of intervention. The cost saving is mainly driven by the substantial reductions in hospital admissions and the number of days spent in the hospital. In addition, there was a marked reduction in the need for ambulance transportation.

For decision-makers at the county council, an important question arises. Can an intervention such as PREFER provide financial benefits if implemented? We can say that the health-related quality of life is better and that the number of hospital admissions and days spent in hospital are reduced with the PREFER method. Regarding costs and savings, all modes of care, all programmes, and all treatments must be judged with existing knowledge, and the existing knowledge provided in this study indicates that considerable resources can be spent for other needs at the hospital.

Limitations

The number of patients was limited, and this was a single-center study at a county council hospital. However, we included all patients in the target group in the geographical

Table 5. Average cost over a 6-month period per participant in the intervention group and the control group and the mean differences in costs for the items, Euro (€).

	Intervention	Controls	Difference	p-value
General practitioner	457	224	233	0.000
Other medical professionals	1890	189	1702	0.000
Emergency transport	98	418	−320	0.004
Hospital care	1632	4896	−3264	0.009
Total	4078	5727	−1649	NS

Table 6. A list of services including total costs over a 6-month period for intervention group and control group, Euro (€).

	Intervention	Controls
General practitioner	16,468 for 295 h	8,075 for 144 h
Other medical professionals	68,103 for 2381 h	6,807 for 238 h
Emergency transport	3,525 for 11 transports	15,061 for 47 transports
Hospital care	58,793 for 103 days	176,357 for 309 days

Table 7. Sensitivity analysis using the Standard Cost Model to calculate average cost over a 6-month period per participant in the intervention group and the control group, Euro (€).

	Intervention	Controls	Difference	p-value
General practitioner	788	1,591	−803	0.000
PH nurses	2,146	476	1,669	0.000
PHC, other professional	1,683	142	1,541	0.000
Emergency transport	98	418	−320	0.004
Hospital care	1,632	4,896	−3,264	0.009
Total	6,459	7,862	−1,404	NS

PH: primary health; PHC: primary health care.

Table 8. Total cost and average cost per patient and month for the intervention group and the control group, Euro (€), according to (a) primary analysis and (b) sensitivity analysis.

	Total cost	Average cost per patient/month	Maximum cost per patient per month	Minimum cost per patient per month
(a) Primary analysis				
Intervention group	146,889	756	5,643	141
Control group	206,301	1,061	5,069	15
Difference	−59,412			
(b) Sensitivity analysis				
Intervention group	232,656	1,197	6,608	187
Control group	283,224	1,457	5,619	137
Difference	−50,568			

area and believe that those included are representative of patients with severe CHF and advanced need for home care. Although CHF was the main underlying disease, other co-morbidities such as renal dysfunction, pulmonary disorders, anemia, diabetes, and stroke were prevalent,[6] and care was provided for these as well. However, we do not have any reason to believe that the distribution of co-morbidities differed between the groups in a way that would systematically affect the results.

It can be discussed if it is appropriate to use the QALYs as an outcome measure in palliative care given the short time that patients can benefit from a higher quality.[21] The result of our study shows that the PREFER concept is not dependent upon measurable quality of life improvements since the intervention saves financial resources.

We have in this article not had the possibility to include informal care and other indirect costs. This is a limitation to give the full picture of this home-based, staff-intensive working mode. If we have had those data, the PREFER project would have been even better.

Travel expenses for ordinary care were not included for either IG or CG. In the sensitivity analysis, average travel costs are included. The used cost model includes overhead costs and travel expenses. This is a limitation but will not change the cost pattern presented.

The results of this study are noteworthy, but they are probably context bound and the method must be studied in

other settings before generalizations can be made. Extrapolating the findings of the PREFER study is difficult and is a good topic for future studies. This is also the case for other disorders that might be treated according to the PREFER concept such as chronic obstructive pulmonary disorders and cancer.

Clinical implications

The main reason to use the PREFER concept was to improve health-related quality of life and to reduce morbidity. When new strategies of patient management are introduced, they are usually accompanied with increased costs. When health-related quality of life, morbidity, or mortality can be improved, the strategies will be regarded as cost-effective if QALYs or life years gained per cost unit are within certain limits. The PREFER intervention goes beyond this by not only improving health-related quality of life and morbidity but also by providing cost savings.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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