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## Cost-effectiveness of a nurse-led education and psychosocial programme for patients with chronic heart failure and their partners

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### Abstract

**Aims and objectives**—This randomised controlled trial was conducted to estimate the cost-effectiveness of a nurse-led education and psychosocial support programme for patients with heart failure (HF) and their partners.

**Background**—There are few studies evaluating cost-effectiveness of interventions among HF patient–partner dyads.

**Methods**—Dyads randomised to the experimental group received nurse-led counselling, computer-based education and written materials aimed at developing problem-solving skills at two, six and 12 weeks after hospitalisation with HF exacerbation. The dyads in the control group received usual care. A cost-effectiveness analysis that included costs associated with staff time to deliver the intervention and travel costs was conducted at 12 months. Quality-adjusted life-year (QALY) weights for patients and partners were estimated by SF-6D.

**Results**—A total of 155 dyads were included. The intervention cost was €23 per patient. Participants in both groups showed improvements in QALY weights after 12 months. However,

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Contributions

Study design: SA, AS, TD; data collection and analysis: SA, TD and manuscript preparation: SA, AS, LE, TD.

Conflict of interest

None declared.

no significant difference in QALY weights was found between the patients in the two groups, nor among their partners.

**Conclusion**—The intervention was not proven cost-effective, neither for patients nor for partners. The intervention, however, had trends (but not significant) effects on the patient–partner dyads, and by analysing the QALY gained from the dyad, a reasonable mean cost-effectiveness ratio was achieved.

**Relevance to clinical practice**—The study shows trends of a cost-effective education and psychosocial care of HF patient–partner dyads.

### Keywords

dyads; health-related quality of life; heart failure; nursing; QALY

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## Introduction

Healthcare administrators and policymakers are increasingly turning to nurse-led disease management programmes to lessen the economic and health burden of chronic diseases, such as heart failure (HF). Metaanalysis of randomised, controlled trials suggest that nurse management can effectively reduce rehospitalisation and mortality (McAllister McAlister *et al.* 2004). Nurse-led disease management programmes for patients with HF are associated with increased direct costs and potential improvements in health and hospital admissions. The cost-effectiveness of nurse-led disease management programmes involving face-to-face and regular telephone follow-up has been supported in prior research involving patients with HF (Stewart 2005, Hebert *et al.* 2008). However, research examining cost-effectiveness of interventions that focus on patient–partner dyads is limited. Our hypothesis was that a nurse-led education and psychosocial support programme should save healthcare costs.

## Background

The prevalence of HF is increasing. The condition affects between 2% and 3% of the populations in the Western world and rise sharply at about 75 years of age to between 10% and 20% (Dickstein *et al.* 2008, Lloyd-Jones *et al.* 2010). Improvements in pharmacological treatment and more structured follow-up of HF have decreased mortality and morbidity (Stewart *et al.* 2010). Despite advances in management of patients with HF, the mortality rate remains high. Quality of life (QoL) among patients with HF is described as the lowest compared to patients with other chronic disorders (Juenger *et al.* 2002, Lesman-Leege *et al.* 2009).

Not only the patients, but also the families are burdened by HF. We have previously shown that in comparison with their partners, patients with chronic HF experience lower levels in all dimensions of health-related QoL except in mental health measured by SF-36, lower quality-adjusted life-year (QALY) weights and higher levels of depressive symptoms. Partners displayed lower scores in mental health, but were equivalent in the remaining dimensions of QoL and in the QALY weights, compared with their age- and gender-matched reference group (Ågren *et al.* 2010). Quality of life among partners is influenced by the perceived physical health of both patients with HF and partners, as well as by the

partner's own mental health (Luttik *et al.* 2007). Therefore, interventions to improve QoL in patients and their partners are warranted.

As the prevalence of HF increases, so does the cost on a societal level. Heart failure accounts for 2% of the total direct costs of care, mainly related to hospital admissions as HF has been shown to cause 5% of acute hospital admissions and is present in 10% of patients in hospital beds (Dickstein *et al.* 2008). With increasing costs comes an increasing need for health economic evaluations in order to help decision-makers prioritise between various interventions. The most commonly used type of health economic analysis is the cost-effectiveness analysis and the most widely used outcome measure in those analyses is the QALY which combines the value of the health-related QoL associated with a health state, with the duration of that health state (Mortimer *et al.* 2009). QALYs are used increasingly as endpoints in health economic evaluations (Drummond & Mcguire 2001) and provides important information about the impact of HF on valuation of life as perceived by the patients (Alehagen *et al.* 2008). To our knowledge, there is no cost-effective analysis performed on interventions for the HF patient-partner dyads. The purpose of this study was to estimate the cost-effectiveness of a nurse-led education and psychosocial support programme for patients with HF and their partners.

## Methods

### Design and setting

A randomised controlled trial comparing an intervention with education and psychosocial support to usual care was applied. The setting was one university hospital and one county hospital in south-eastern Sweden. Follow-up after 12 months was used to estimate QALY weights.

### Sample

The inclusion criteria were being a partner living in the same household as a patient diagnosed with HF based on the European Society of Cardiology guidelines (Dickstein *et al.* 2008), in NYHA class II-IV, and having been recently discharged from the hospital (i.e. 2–3 weeks) following a HF acute exacerbation. Exclusion criteria for the dyads were dementia, or other severe psychiatric illnesses, drug abuse, difficulties understanding or reading the Swedish language, undergoing cardiac surgery including cardiac transplant or participating in other studies. A sample size was not calculated because of the exploratory nature of the study. Further, because there are few studies looking at the cost-effectiveness of type of intervention for both patients and partner, it was difficult to assess an effect size.

### Procedures

The study was conducted from January 2005–December 2008 and included all consecutive patients with HF presenting to the Emergency Department and the Department of Cardiology at a university hospital and all hospitalised patients visiting a nurse-led HF clinic at a county hospital. Information about the study was provided verbally to potential participants through a telephone call or during a visit to the HF clinic. To be included in the study, interested dyads provided written informed consent and were then given additional

information related to the study and questionnaires were sent by mail to their home 2–3 weeks after hospital discharge. Dyads that returned the questionnaires by mail were then randomised to either the intervention or control group. The randomisation code was developed using a random-number table.

## Intervention

**Intervention group**—The dyads in the experimental group participated in an integrated intervention at home or in the HF visit clinic. The intervention was delivered in three face-to-face sessions and included nurse-led counselling, with educational, supportive and behavioural components two, six and 12 weeks after discharge. The dyads were assisted by the nurse when working with the computer-based program if needed. Each session included education on HF and development of problem-solving skills to assist the dyads in recognising and modifying factors that contribute to psychological and emotional distress. The intervention focused on changing thoughts and behaviours and implementing strategies for self-care. The integrated care programme covered a 3-month intervention period.

**Control group**—The dyads in the control group received standard care including usual care in hospital and outpatient education and support. The partner was not systematically involved in the follow-up focusing on education and psychosocial support.

## Data collection

Demographic data and health history with comorbidities (patients and their partners): A self-administered questionnaire to collect data on age, gender, education, smoking, physical activity and comorbidities was used at baseline.

## QALY weights

The SF-6D, which is a shorter version of the SF-36, was used to elicit QALY weights for the patients and their partners. A QALY weight is a commonly used outcome measurement in health economics, representing individuals' utility from health states. QALYs are created by multiplying the value of a health state (the QALY weight) with the length of that health state. The QALY weights are distributed on a scale between 0, representing death, and 1, representing full health. A previously developed algorithm based on the standard gamble method has estimated QALY weights to all available health states defined by SF-6D (Brazier *et al.* 1998, 2002). These earlier estimated QALY weights represent a general population in the United Kingdom, but are nevertheless often used for other populations and countries. To calculate patient–partner dyad QALYs, the two different QALY weights (patient and partner) were summarised.

**Costs**—Costs were calculated in Swedish kronor (SEK) and presented in Euros (€), using an exchange rate of €1 = SEK9. A restricted healthcare perspective was used for the cost calculations, which included the costs for the health care but not for the patients and their partners. Costs included in the analysis were related to the time used by nurses and travel costs. The monthly salary of a nurse at the cardiology department was €5033 including labour fees and taxes. This equals €7 per hour. The intervention consisted of three meetings between a nurse and the patient–partner dyad. Every meeting took on average about 2 hours.

For some meetings, another 1 hour was needed in travel time. The cost of transportation was recorded in files during the intervention process.

### Statistical analysis

For the comparison of QALY weights between baseline and 12 months, paired sample t-tests were performed. For comparing the two groups, intervention and controls, both patients and partners separately and the dyads together, independent sample t-tests were performed. The level for statistical significance was set to overall  $p < 0.05$ . Statistical analyses were performed using *SPSS*, version 19 (SPSS Inc, Chicago, IL, USA).

### Ethical approval

Throughout the study, the principles outlined in the Declaration of Helsinki were followed. Permission to carry out the study was granted from the Regional Ethical Review Board in Linköping (Dnr 03-568, Dnr M178-04). All patients and partners signed an informed consent prior to study participation.

### Results

Demographics and clinical characteristics of the patients and partners are presented in Tables 1 and 2. No significant difference could be found between the patients, and partners only differed in the rate of lung disease.

Patients in both the intervention group and the control group had a significantly improved QALY weight after 12 months compared with baseline. There was no significant difference between the two groups' mean improvements. For the partners, no significant changes in the QALY weights were found in the study. These data are presented in Table 3.

The cost of the intervention was €63 per patient without transportation costs. For some visits to the dyads, the nurses had to use more time for transportation. Transportation costs for all patients were estimated to €737, which equals €10.4 per patient. Total cost of the intervention including transportation was €15,825, which equals €223 per patient.

Cost-effectiveness was calculated as the incremental costs associated with the intervention divided by the incremental effects gained from the intervention. Even though the intervention did not lead to a significant QALY weight increase, the mean values can be used to explore the estimated mean cost per QALY gained (Table 4). In this analysis, we assume that the increase in QALY weights lasts for 1 year. When only considering the patient, the cost per QALY gained becomes very high and the intervention cannot be considered cost-effective. The intervention, however, had positive effects on both the patient and the partner, and by analysing the QALY gained from the dyad, the cost gained per QALY was €16,159.

### Discussion

This study estimated the cost-effectiveness of a nurse-led education and psychosocial support programme in patients with HF and their partners in Sweden. At 12 months follow-

up, QALY weights significantly increased in both the patients undergoing this intervention and those who did not. However, no significant difference in QALY weights was found between the patients nor the partners in the two groups. The intervention (including transportation costs) was found to cost €223 per patient. As no effect could be found, the intervention was not proven cost-effective. When using the small (insignificant) QALY increase from both the patient and their partner to estimate the incremental cost-effectiveness ratio, a cost gained per QALY of €16,159 was found, a value that is often considered cost-effective in Sweden, even though no exact threshold value exist. (<http://www.TLV.se>). If the change in QALY weights would last for more than 1 year, the effects maybe become larger than those found in this study.

One study has partly shown different results. The use of nurse-led disease management programmes led to health improvements, but increased costs for the clinics caring for patients with coronary heart disease. The researchers conclude that these disease management programmes can be regarded as cost-effective, as the cost per QALY gained even in the short term is at an acceptable level. (Turner *et al.* 2008).

In a small randomised study by Patel *et al.* (2008), patients seeking medical attention at the Emergency Department for worsening HF were randomised to home-based HF care or hospital-based HF care. After 12 months, patients in the home-care group were monitored by a specialised HF nurse. The total cost related to HF was significantly lower in the home-care group (Patel *et al.* 2008).

In a 12-month nurse-based programme with telephone follow-up, costs were reduced and QoL improved compared with the group receiving traditional care. At 12 months, the intervention was reasonably cost-effective (Hebert *et al.* 2008). A previous large trial did not find an effect on event-free survival of intensive education and follow-up. The intervention was effective in a subgroup analysis when excluding patients with symptoms of depression, but the cost-effectiveness could not be estimated because of the small sample size (Jaarsma *et al.* 2008, Jaarsma *et al.* 2010).

There are few studies evaluating this type of intervention in dyads. The two studies published have only included smaller sample sizes (Dunbar *et al.* 2005, Schwarz *et al.* 2008). Dunbar *et al.* (2005) only had salt-restriction as the intervention and Schwarz *et al.* (2008) used telemonitoring to reduce hospital admission. However, none of the previous studies has evaluated the cost-effectiveness of their interventions.

The current study has some limitations that need to be addressed. The reason for the neutral effects of the intervention in the partners may be that our sample, even though classified as a risk group because of their NYHA functional status and recent hospitalisation for HF, was more stable than other populations. For patients in NYHA class II and III in Sweden, an earlier study has estimated the QALY weights to be 0.71 and 0.56, respectively (Alehagen *et al.* 2008). A slight majority of our patients were in NYHA III-IV, but their QALY weights were similar to the patients in NYHA II in the study by Alehagen *et al.* This might underline that our patients may have been more stable in their HF.

Another limitation was that patients in the control group might have received education and psychosocial support that to some extent was based on the same principles as the intervention group because they received care at a HF clinic and some partners may have been included in that care. However, the main difference was that partners in the intervention group were always actively involved as equal to the patient because they were treated as a dyad.

It could also be discussed whether other outcome measures could have been more relevant when evaluating cost-effectiveness. QALY is the most commonly used measure but QALY weights can be elicited by different methods. Various instruments have been shown to give different weights, but the most important aspect is that the same instruments were used for both the control and intervention group. In this study, we elicited population-based QALY weights from the SF-6D instrument, based on standard gamble technique. Weights elicited from the EQ-5D instrument are commonly used and they are generally based on time trade-off technique (Dolan 1997). The EQ-5D has been shown to provide larger improvements in QALY weights compared with SF-6D for several diseases (Andersson *et al.* 2010). Furthermore, direct methods such as standard gamble, time trade-off or a rating scale, could have been used instead of population-based weights, and this may also have affected the result. However, the reason why SF-6D was used was that the dyads completed the SF-36 and we did not want to add additional instruments to burden these old and sick patients and their partners. Examining re-admissions and mortality could have been another way to ascertain QoL among patients and partners. Finally, it is important to note that there are concerns whether QALYs by patients and their partners can be combined without causing double counting (van den Berg *et al.* 2004). It is, however, argued that this is not a major problem as long as only QALYs are combined and not the partners' cost for informal care (Davidson & Levin 2010).

## Conclusions

Patients had significantly improved QALY weights at 12 months, but it did not matter which group they belonged to (intervention or control). As there were no significant effects on QALY weights between the intervention group and the controls, the intervention was not found to be cost-effective for the patient alone. However, the intervention had trends (but not significant) on the patient-partner effect, and by analysing the QALY gained from the dyad, the cost per QALY gained was €16,159.

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**Relevance to clinical practice**

The study shows trends of a cost-effective education and psychosocial care of HF patient–partner dyads. Today with increasing numbers of individuals suffering from different types of chronic illness that affect the QoL of both themselves and their families and there are limited resources in the healthcare systems we need new types of innovative interventions aiming to both improve patient and partner outcomes and at the same time be cost-effective. Systematic evaluations of new intervention should be carried out before deciding on introducing them in clinical practice or not.

**Table 1**

Clinical and demographic characteristics of the patients

	Control ( <i>n</i> = 84)	Intervention ( <i>n</i> = 71)	<i>p</i> -value
Age			
Mean ± SD	73 ± 10	69 ± 13	ns
Gender			
Male	68 (80.9%)	49 (69.1%)	ns
Female	16 (19.1%)	22 (30.9%)	ns
NYHA class			
II	25 (30%)	25 (35%)	ns
III	43 (51%)	39 (55%)	ns
IV	16 (19%)	7 (10%)	ns
Type of comorbidity			
Myocardial infarction	38 (45%)	24 (34%)	ns
Hypertension	26 (31%)	27 (38%)	ns
Diabetes	10 (12%)	8 (11%)	ns
Stroke	8 (10%)	9 (13%)	ns
Lung disease	7 (8%)	3 (4%)	ns
Medication			
ACEI	76 (90%)	65 (92%)	ns
β-Blockers	74 (88%)	62 (87%)	ns
Diuretics	63 (75%)	56 (79%)	ns

**Table 2**

Clinical and demographic characteristics of the partners

	Control ( <i>n</i> = 84)	Intervention ( <i>n</i> = 71)	<i>p</i> -value
Age			
Mean ± SD	70 ± 10	67 ± 12	ns
Gender			
Male	16 (19.1%)	22 (30.9%)	ns
Female	68 (80.9%)	49 (69.1%)	ns
Type of comorbidity			
Myocardial infarction	13 (15%)	8 (11%)	ns
Hypertension	25 (30%)	25 (35%)	ns
Diabetes	4 (5%)	7 (10%)	ns
Stroke	4 (5%)	3 (4%)	ns
Lung disease	10 (12%)	1 (1%)	<0.05

**Table 3**

Estimated quality-adjusted life-year (QALY) weights for patient and partner at baseline and after 12 months

	<i>n</i>	Baseline QALY weight	12 months QALY weight	Mean change	SE (Mean)	<i>p</i> -value
Patient						
Intervention	55	0.6234	0.6595	0.0361	0.11	0.003
Control	59	0.6329	0.6686	0.0357	0.13	0.009
Difference	-	-	-	0.0004	0.02	0.980
Partner						
Intervention	55	0.7112	0.7172	0.0061	0.14	0.677
Control	54	0.7096	0.7023	-0.0073	0.12	0.556
Difference	-	-	-	0.0134	0.02	0.484

**Table 4**

Cost-effectiveness analysis of the nurse-led intervention

	Costs €	QALY	Cost (€ per QALY gained)
Patient	223	0.0004	557,500
Patient-partner dyad	223	0.0138	16,159

QALY, quality-adjusted life-year.

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