Nurse-led heart failure clinics improve survival and self-care behaviour in patients with heart failure

Results from a prospective, randomised trial

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Aim The aim of this trial was to prospectively evaluate the effect of follow-up at a nurse-led heart failure clinic on mortality, morbidity and self-care behaviour for patients hospitalised due to heart failure for 12 months after discharge.

Methods A total of 106 patients were randomly assigned to either follow-up at a nurse-led heart failure clinic or to usual care. The nurse-led heart failure clinic was staffed by specially educated and experienced cardiac nurses, delegated the responsibility for making protocol-led changes in medications. The first follow-up visit was 2–3 weeks after discharge. During the visit the nurse evaluated the heart failure status and the treatment, gave education about heart failure and social support to the patient and his family.

Results There were fewer patients with events (death or admission) after 12 months in the intervention group compared to the control group (29 vs 40, p=0.03) and fewer deaths after 12 months (7 vs 20, p=0.005). The intervention group had fewer admissions (33 vs 56, p=0.047) and days in hospital (350 vs 592, p=0.045) during the first 3 months. After 12 months the intervention was associated with a 55% decrease in admissions/patient/month (0.18 vs 0.40, p=0.06) and fewer days in hospital/patient/month (1.4 vs 3.9, p=0.02). The intervention group had significantly higher self-care scores at 3 and 12 months compared to the control group (p=0.02 and p=0.01).

Conclusions Follow up after hospitalisation at a nurse-led heart failure clinic can improve survival and self-care behaviour in patients with heart failure as well as reduce the number of events, readmissions and days in hospital.

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Introduction

Heart failure is affecting an increasing number of individuals in the industrialised countries and is associated with a poor prognosis.1 The one-year survival rate has been estimated at 80–90% in mild to moderate heart failure2 and 50–60% in severe heart failure,3 which is more malignant than breast, bowel, bladder, prostate and ovarian cancer.4 Heart failure is also associated with high morbidity and is the most common discharge diagnosis for patients over 65 years of age, in many industrialised countries.5,6 In Sweden, hospital costs account for 50 to 75% of the total costs for heart failure, while drug costs only account for 2–8%.7

There are several issues in the management of patients with heart failure that need to be taken into account in order to improve outcomes. Many patients do not have optimal treatment.8 The education given to patients with heart failure in order to teach self-care is often insufficient.9 Studies from different settings have shown that non-compliance with medication, diet or symptom monitoring caused 15–64% of the hospital readmissions.10–12 One model of care and follow-up that addresses management problems, such as insufficient drug treatment and patient education is the nurse-led heart failure clinic. Previous studies have shown that nurse-led or nurse-coordinated disease management programmes for patients with heart failure, including early follow-up after hospitalisation and intensified patient education, have the potential to prolong event-free survival,13,14 decrease the number of hospital admissions,13,15–17 as well as improve compliance,18 self-care behaviour,19 and quality of life.15 Nurses with special education and training, work independently in these clinics. The first nurse-led heart failure clinic in Sweden started in Linköping in 199020,21 and since then the concept has spread to more than two-thirds of all Swedish hospitals.22 The aim of this trial was to prospectively evaluate the effect of follow-up at a nurse-led heart failure clinic on mortality, morbidity and self-care behaviour for patients hospitalised due to heart failure 12 months after discharge.

Methods

Design and setting

A prospective, randomised study with a 12-months follow-up was conducted. Permission was obtained from the Regional Ethics Committee for Human Research at the University of Linköping, Sweden. The setting was one university hospital and two county hospitals.

Sample and randomisation

Patients hospitalised due to heart failure in New York Heart Association classification (NYHA class) II–IV were asked to participate in the study during the predetermined recruitment period of 2.5 years, from June 1997 to December 1999. Inclusion criteria were diagnosed heart failure, either by echocardiography, radiographic evidence of pulmonary congestion or typical symptoms and signs of heart failure. Exclusion criteria were severe chronic pulmonary disease, dementia or other psychiatric illness, short anticipated survival, discharge to a geriatric clinic or home care or already receiving follow-up at the nurse-led heart failure clinic. The patients received both written and verbal information about the study before they agreed to participate. The included patients were randomised to either the intervention group with follow-up at a hospital-based, nurse-led heart failure clinic or to the control group who received usual care. The randomisation was blinded with the use of a computer-generated list of random numbers and sealed envelopes.

Intervention group

The patients in the intervention group were followed up at a nurse-led heart failure clinic staffed by specially educated and experienced cardiac nurses, delegated the responsibility for making protocol-led changes in medications. The first visit was scheduled 2–3 weeks after discharge. All visits lasted for 1 h and the nurse evaluated the status and if the heart failure treatment was optimised, gave education about heart failure and social support to the patient and his family. The status taken during the visit included anamnesis, auscultation of heart and lungs and inspection of oedema. If treatment needed to be optimised, the cardiologist with medical responsibility for the heart failure clinic was consulted and treatment changed in accordance with current clinical guidelines. For example the dose of the ACE-inhibitor and/or beta-blocker could be increased if reaching the target-dose or highest tolerable dose was not done during hospitalisation.

The education was individualised, included both written and verbal information and was based on guidelines.23,24 The patients and their families were educated on heart failure and the content
included definition and symptoms/signs of heart failure, aetiology, rationale for treatment and drug counselling. It also included non-pharmacological treatment with dietary changes such as restricted fluid, sodium and alcohol intake, individually adjusted energy intake in order to reduce over-weight or prevent malnutrition, smoking cessation, exercise in stable heart failure and infection prophylaxis with vaccinations. The nurses adjusted the education to previous knowledge, educational level and cognitive function of the patient. The education specially aimed at assisting patients to improve their self-care regimen e.g. maintain a flexible regimen with loop-diuretics, restrict the intake of fluids and sodium and monitor symptoms such as weight gain, increased breathlessness and oedema daily.

Another important component of the nursing intervention was to provide psychosocial support by creating a supporting relationship between the nurse and the patient. The patients could contact the nurses at the heart failure clinics during daily telephone hours (8 a.m.–5 p.m. during weekdays) and the heart failure nurses called patients in order to provide psychosocial support, evaluate drug changes or other actions taken due to deterioration and side effects.

If the patient was unstable with symptoms of worsening heart failure at the time of the follow-up visit or if further education was needed, the patient was scheduled for another visit to the heart failure clinic. When the patients were stable and well informed, they were referred back to their general practitioner in primary health care.

**Control group**

All patients in the control group were managed in accordance with current clinical practice and received conventional follow-up in primary health care. The responsible physicians in the primary health care were free to evaluate and treat the patient according to their own judgement. Some patients got a scheduled visit after discharge, but most patients were encouraged to phone primary health care if they had problems due to heart failure. There were no specialised heart failure nurses, no standardised education or structured follow-up for patients with heart failure at any of primary health care centres.

**Data collection**

Clinical and demographic data were collected from the medical chart of the patient and if needed complemented by information from the patient. Clinical evaluation of the NYHA class and documentation of drug therapy were done on the day of inclusion. Medical charts and/or death certificates verified deaths. Data on the number of readmissions, hospital days and time to readmission were prospectively collected from the medical charts. Day care and outpatient clinic visits were not recorded as readmissions.

Self-care behaviour was measured through a questionnaire called the *Heart Failure Self-Care Behaviour Scale*. The patients were asked to respond yes or no to 19 items regarding self-care behaviour related to heart failure e.g. I restrict my fluid intake to 1500 ml/day. Performing the self-care behaviour scored 1 and not performing scored 0, with a theoretical frame from 0–19 when the total score of all answers was calculated. Higher scores indicate a better self-care behaviour. The questionnaire has been tested by face validity and reliability by Cronbach’s alpha with sufficient result. A Swedish version of the scale has been developed with translation from both a linguistic and semantic point of view and Cronbach’s alpha for the scale was 0.69 at baseline.

Data were collected at baseline, after 3 and 12 months. All baseline data were collected before randomisation. The assessment and outcome measures were blinded. The nurse doing the assessment and collecting of data was blinded to the intervention and not involved in the care of the patients. The questionnaire on self-care behaviour was administered to both the intervention and control group at the heart failure clinic. The same method was used when the instrument was developed.

**Study end-points and statistical analysis**

The primary endpoint was all-cause mortality or all-cause hospital admission after 12 months. Secondary endpoints were mortality, number of readmissions for any reason, number of days in hospital and self-care behaviour.

The study was powered to detect a 50% difference in total rate of readmission or death between the groups, with a 25% event-free survival in the control group (two-sided alpha=0.05, beta 0.80). With approximately 69 patients in each group the study would be able to detect this difference in the primary end-point. This reduction is comparable with earlier studies of nurse intervention.

In comparison between the intervention and control groups the chi-square test was used for discrete variables. Student’s t-test was used for
normally distributed continuous variables, and if the distributions were not approximately normal or ordinal the Mann–Whitney U test was used. Kaplan–Meier survival curves were constructed to assess differences between the control and intervention groups in the percentage of surviving patients during 12 months follow-up and log-rank test was used to calculate the difference in survival and all-cause death or readmission. A Cox proportional-hazards model assessed survival, with data on patients who died, censored at the time of death with an additional analysis adjusting for diabetes. All analysis was made on an intention-to-treat basis and a p-value of less than 0.05 was considered significant.

Results

Study patients

During the period of recruitment 1964 patients were screened with heart failure. Just before and during the recruitment period, the care and follow-up of heart failure patients underwent several changes at the hospitals participating in the study. Many patients already received follow-up at the nurse-led heart failure clinic or were discharged to follow-up at the geriatric clinic or through home care. Since the majority of patients hospitalised with heart failure were over 75 years of age, other limitations of recruitment were that patients were in an end-stage of heart failure or other severe disease or had cognitive dysfunction. A total of 161 patients met the inclusion criteria, 55 patients declined to participate mainly due to fatigue. A total of 106 patients consented to participate and were enrolled in the study. They were randomised to either the intervention group (n=52) or to the control group (n=54). Flow chart of the trial profile is shown in Fig. 1. Demographic and clinical characteristics of the patients are shown in Table 1. There were significantly more patients with hypertension in the intervention group, 26 vs 16 (p<0.05). There were more patients with diabetes in the control group, 17 vs eight (p=0.05). When comparing patients with diabetes in the intervention and control group, there were no differences between the groups regarding gender, age, number of co-morbidities, marital status, treatment for heart failure and diabetes or NYHA-class.

Follow up at a nurse-led heart failure clinic

The majority of patients in the intervention group paid one visit to the nurse-led heart failure clinic (n=28), 12 patients paid two visits and the rest of the patients three to eight visits. In total 84 visits. There were four patients in the intervention group that did not visit the nurse-led heart failure clinic because they declined or were not well enough to visit the clinic, but all these patients received telephone contact and counselling from the heart failure nurses. In the analysis these patients were kept in the intervention group, firstly because they had received parts of the intervention and secondly since it had been predetermined to do all analysis on an intention-to-treat basis.

At baseline and after 12 months there was no difference in the prescription of ACE-inhibitors and beta-blockers between the groups. After 3 months the patients in the intervention group had 81% of target dose compared to 61% in the control group (p=0.005), but there were no difference in the use of beta-blockers.

Morbidity

Table 2 summarises the clinical events. After 12 months there were significantly fewer patients in the intervention group with events (29 vs 40, p=0.03), Kaplan–Meier curve shown in Fig. 2. The number of admissions to hospital during the first 3 months after hospitalisation was significantly lower in the intervention group, 33 vs 56, a reduction of 42% (p=0.047). However after 12 months there was no significant difference. The number of days in hospital was significantly lower in the intervention group after 3 months (350 vs 592, p=0.045), a reduction of 41%. After 12 months, the intervention group had consumed a total of 688 hospital days and the control group 976 days (p=0.13).

Since mortality was almost three times higher in the control group after 12 months, morbidity data were also adjusted for time of survival. The numbers of readmissions and days in hospital were divided by the number of months of follow-up. After the adjustment for time of survival, the intervention group had significantly fewer days in hospital compared to the control group (1.4 vs 3.9, p=0.02) and there was a trend toward fewer readmissions in the intervention group (0.18 vs 0.4, p=0.06) compared to the control group during 12 months of follow-up. Hospital days were reduced by 45% and the rate of readmission by 31%.

Mortality

Three months after inclusion, a total of three patients in the intervention group had died compared to 13 patients in the control group (p=0.009) and after 12 months the differences in mortality
remained, seven in the intervention group and 20 patients in the control group had died ($p=0.005$). According to the Kaplan–Meier analysis, the cumulative risk of death after 12 months was 13% in the intervention group and 37% in the control group (Fig. 3). Most patients died due to cardiovascular causes, five patients in the intervention group and 18 in the control group. After 12 months, six out of 17 patients with diabetes had died in the control group compared to none out of eight diabetics in the intervention group, however this difference was not statistically significant ($p=0.16$). In multivariate Cox proportional hazard model, after adjusting for diabetes, the intervention group still had significantly lower risk for death.

**Self-care behaviour**

Apart from the patients that died before 3 and 12 months follow-up (16 and 27 patients respectively), all patients completed the self-care behaviour questionnaire. The number of missing data for items within the questionnaire was low, between 4–7 in total at each measurement. These data were estimated with the average score for the valid items in the questionnaire.

At baseline, the patients in both groups complied, on average, with 10 of the 19 self-care behaviour items. The patients in the intervention group had improved their self-care on with average 3.0 scores compared to the control group that
improved by 1.4 scores (p=0.02). The intervention group retained the improved self-care behaviour after 12 months, but the patients in the control group did not. The intervention group had significantly higher self-care scores also after 12 months with 2.3 scores higher than baseline compared to the control group that only had 0.5 scores higher than baseline (p=0.01), see Fig. 4.

There were no differences in self-care behaviour in single items at baseline between the groups. The single items with the largest difference between the intervention and control group after 3 and 12 months were self-care behaviour such as daily weighing, alerting health care at weight gain and restricting fluid intake. At baseline 35% of the patients in the intervention group and 42% in the control group weighed themselves, after 3 months weighing had increased by 79% in the intervention group and 61% in the control group. After 12 months there was a significant difference between the groups, with 79% weighing themselves in the intervention group and 41% in the control group (p=0.002). There was a significant difference between the intervention and control groups in alerting the health care at weight gain, after 3 months 74% vs 46% (p=0.009) and after 12 months 74% vs 38% (p=0.004). At baseline, 33% in the intervention group restricted their fluid intake and 38% in the control group, after 3 months 67% vs 43% restricted the fluids (p=0.03) and after 12 months, 50% in the intervention group and 28% in the control group (p=0.07).

### Table 1  Demographic and clinical characteristics at baseline of the patients with heart failure in the intervention and control group (n=106)

<table>
<thead>
<tr>
<th></th>
<th>Intervention (n=52)</th>
<th>Control (n=54)</th>
<th>p-value</th>
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</tr>
<tr>
<td>Men</td>
<td>33</td>
<td>32</td>
<td>ns</td>
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<tr>
<td>Women</td>
<td>19</td>
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</tr>
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<td>30</td>
<td>32</td>
<td>ns</td>
</tr>
<tr>
<td>Not married</td>
<td>22</td>
<td>22</td>
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<tr>
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<tr>
<td>II</td>
<td>7</td>
<td>12</td>
<td>ns</td>
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<td>III</td>
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<tr>
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<tr>
<td>Mean±SD</td>
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<td>131±24</td>
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<td><strong>LOS</strong></td>
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<td>Mean±SD</td>
<td>8±7</td>
<td>8±5</td>
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</table>

*NYHA=New York Heart Association classification; BP=blood pressure; LOS=Length of Stay.*
Discussion

Mortality and morbidity

Our study found that there were fewer patients with events (all cause death or all cause hospital admission) in the intervention group compared to the control group after 12 months.

Other studies evaluating nurse-led interventions have also shown large beneficial effects on event-free survival. The largest benefit of the nurse-led intervention in our trial was on mortality. Stewart et al. have also reported effects on improved survival and event-free survival as an effect of a single home-visit by a nurse after hospitalisation, but the major effect in other studies have been on the reduction of hospital days by 25–43% and admissions by 25–44%. In our study admissions to hospital were significantly reduced by 42% and days in hospital by 41%, 3 months after follow-up at a nurse-led heart failure clinic. After 12 months the number of hospital admissions and days were also lower in the intervention group. There were significantly more patients that died in the control group and therefore fewer patients that consumed care. When morbidity data after 12 months follow-up had been adjusted for time of survival, the intervention group had significantly lower days in hospital and there was a trend toward fewer readmissions in the intervention group.

Self-care behaviour

Most heart failure management programmes emphasize that improved self-care behaviour is the
The key to success in reducing morbidity and healthcare costs. The nurse-led intervention in our study was successful in improving self-care behaviour in three of the most important areas; daily weighing, alerting healthcare at weight gain and restricting fluid intake. This can be one important factor for the positive effect of the intervention, that the patients were active in their self-care in order to prevent, and at an early stage detect fluid retention.

**Nurse-led follow-up**

Sweden has been a leading country in Europe in the area of nurse-led patient education and follow-up. Between 1990–1998, nurse-led heart failure clinics opened in two-thirds of all Swedish hospitals. Previous to our study, two Swedish studies have evaluated nurse-led follow-up after hospitalisation. Cline et al. found prolonged time to readmission in patients followed up at the nurse-led outpatient clinic and a trend towards reduced number of admissions and days in hospital and healthcare costs. Ekman et al. found no difference in admission or days in hospital, mortality or event-free survival between usual care and nurse-led follow-up, but in this study the drop out rate was high and 29% of the patients in the intervention group were not able to come to the nurse-monitored clinic at any visit mainly due to fatigue. Ekman and co-workers therefore concluded that home-care intervention would have been more appropriate in their study population.

The different parts of the intervention in our study were optimised treatment, easy access to the heart failure nurses by telephone and facilitated self-care through education and psychosocial support from the nurses. The majority of our patients only visited the nurse-led clinic once. Obviously one visit can make a difference and our results confirm results reported by Stewart and co-workers. Since we did not have a clear long-term effect on reduced hospital admissions, there might be a need for a standardised visit to the heart failure clinic 3–6 months after the initial visit for all patients. However, it is not certain this would have an effect. Stewart and co-workers showed that the effect of the single visit was retained over a period of 18 months without repeated visits. Cline and co-workers had a visit at 8 months, but only showed a trend toward fewer readmissions and days in hospital. All studies performed in this field have included quite a small number of patients. It would be valuable to conduct a larger, randomised, multicentre trial. Today it is difficult to conduct this type of trial in Sweden, since the concept with nurse-led heart failure clinics is an established model for follow-up after hospitalisation in the majority of the county and university hospitals in Sweden.

The principal limitation of the present study is the small sample size. In order not to exceed the predetermined recruitment period of 2.5 years, the study was terminated despite the fact that only 106 patients had been enrolled. Despite randomisation there were significantly more patients with diabetes in the control group. In the additional analysis of all clinical and demographic data there were no differences between the patients with diabetes in the control and intervention group. In the multivariate Cox proportional hazard model we adjusted for diabetes, but the intervention group still had significantly lower risk for death. The reduced number of patients at 12 months follow-up may have had an impact on the results of morbidity and self-care behaviour. The number of readmissions was significantly lower in the intervention group after 3, but not after 12 months. The almost three times higher mortality in the control group may have influenced this and we therefore recalculated morbidity data to admissions during time of survival. In self-care behaviour we could not adjust or substitute data, but we did not have any missing data other than from patients that died.

According to age, sex and co-morbidities the patients included in our study are representative for the heart failure population. However, there were almost 2000 patients screened and only 161 found eligible for the study. Ekman et al. found similar results in another Swedish study. Patients that are immobile, demented or in end-stage heart...
failure are not suitable for the type of intervention given at a nurse-led heart failure clinic, they need other models of care. Another reason was that several of the screened patients had already been referred to the heart failure clinic after earlier hospitalisation.

The strength of our study was that it was conducted at three centres of which only one was a university hospital. This ensures that the evaluation of the intervention was not only an evaluation of the organisation and staff from one large academic hospital, as in most of the earlier studies that have been conducted.14–17,19,25,28

Follow-up after hospitalisation in order to improve quality of life, prevent readmission and decrease costs has now been included in the guidelines for diagnosis and treatment of chronic heart failure.8,26 The guidelines point out that the organisation of the follow-up should be adapted to the different needs for patients within the heart failure population and to the health care system of each country. The model with nurse-led heart failure clinics has already been implemented in several European countries and the number of clinics is increasing.

Our study showed that nurse-led follow-up at an outpatient heart failure clinic after hospitalisation improved survival and self-care behaviour in patients with heart failure and reduced the number of events (death/readmission) and the need for hospital care. Therefore this type of follow-up should be considered for patients hospitalised due to heart failure.

It is also likely that this type of follow-up after hospitalisation is cost effective. Data from Stewart et al.29 suggest that when the reduction of hospital readmissions is above 40%, the savings exceed the costs for nurse-led heart failure clinics. Further health economical analyses including all type of costs (medications, primary health care utilisation etc) will be performed in order to evaluate the total cost effectiveness of this intervention.

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