

Home-Based Advance Care Programme is Effective in Reducing Hospitalisations of Advanced Heart Failure Patients: A Clinical and Healthcare Cost Study

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Abstract

Introduction: In end-stage heart failure (HF) that is not eligible for mechanical assist device or heart transplant, palliative care serves to maximise symptom control and quality of life. We sought to evaluate the impact of home-based advance care programme (ACP) on healthcare utilisation in end-stage HF patients. **Materials and Methods:** Prospectively collected registry data on all end-stage HF recruited into ACP between July 2008 and July 2010 were analysed. Chart reviews were conducted on HF database and hospital electronic records. Phone interview and home visit details by ACP team were extracted to complete data entry. HF and all-cause hospitalisations 1 year before, and any time after ACP inception were defined as events. For the latter analysis, follow-up duration adjustment to event episodes was performed to account for death less than a year. **Results:** Forty-four patients (mean age 79 years, 39% men) were followed up for 15±8 months. Fifty-seven percent had diabetes, 80% ischaemic heart disease, and 60% chronic kidney disease. All reported functional class III/IV at enrolment. Mean serum sodium was 136±6 mmol/L, and creatinine 186±126 mmol/L. Thirty (68%) died within the programme. Mean time to death was 5.5 months. Mean all-cause and HF hospitalisations were 3.6 and 2.0 per patient before enrolment, but improved to 1.0 and 0.6 respectively after ACP. Thirty-six (71%) patients had fewer HF hospitalisations. When only those who survived more than a year were considered (n = 14), 10 (71%) and 9 (64%) experienced reduced HF (mean: 1.4 episodes per patient) and all-cause hospitalisations (mean: 2.2 episodes per patient) respectively. **Conclusion:** Home-based advance care programme is potentially effective in reducing healthcare utilisation of end-stage HF patients, primarily by reducing HF rehospitalisations, and in probably saving costs as well.

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Key words: Palliative care, End-stage heart failure

Introduction

Advanced heart failure (HF) is a debilitating chronic disease that negatively impacts patients' quality of life (QOL)¹ and is associated with high mortality rates.² The economic burden from HF is substantial to both healthcare system and to individuals and their families.^{3,4} It is associated with recurrent hospitalisation for HF exacerbations² and the need for intravenous vasoactive treatment that becomes increasingly frequent.⁵⁻⁷ In our prior publication, we found high mortality mirroring that of western figures among unselect cohort of HF patients.⁸ In end-stage HF not eligible for heart transplantation or destination mechanical assist device, palliative care complementing a chronic disease management programme serves to optimise symptom controls and address multiple domains of patient and

family distress,⁹⁻¹¹ albeit some deficiencies in hard clinical evidence. Treatment models have historically emphasised management of acute exacerbations of cardiovascular disease, during which end-of-life issues figure frequently and prominently.¹² In particular, home-based palliative care management as a component of optimal medical and device treatment allowing care in a familiar comfortable environment may provide the right balance for these patients with limited lifespan where QOL is paramount and may shift the evaluation and care to patients' home, thereby reducing readmissions for HF.¹³ This could potentially lead to the relief of hospital beds and cost savings incurred from hospitalisations and instrumentations. Patients with HF undergoing end-of-life care may be considered for hospice

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services that can be delivered in the home, a hospital setting, or a special hospice unit.¹⁴

We sought to evaluate the impact of a home-based palliative care programme on healthcare utilisation in terms of reducing rehospitalisation and potential cost savings in end-stage HF patients in a tertiary hospital in Singapore, amongst end-stage HF patients, defined as those who are in New York Heart Association (NYHA) class III or IV despite optimal medical therapy, with or without implantation of devices.¹⁵

Materials and Methods

Study Population

We prospectively collected registry data on all end-stage HF patients recruited into the palliative care programme in a single tertiary care hospital between July 2008 and July 2010. We defined end-stage HF as NYHA class III and IV despite optimal medical treatment and/or cardiac resynchronisation therapy, as stated above. All care was taken to ensure full compliance to salt, dietary and fluid compliance, as well as adequate caregiver support. Enrolment depends on independent programme entry criteria (expected 1-year survival, symptoms or end-of-life psychosocial needs likely to benefit from a multidisciplinary approach, with potential for adequate and safe care at home).

Clinical Data and Demographics

Chart reviews were conducted on HF database and hospital electronic records for demographics, comorbid conditions (hypertension, diabetes, atrial fibrillation, and strokes), laboratory results (serum sodium levels, haemoglobin, renal function as expressed by serum creatinine and estimated glomerular filtration rate or eGFR), medications (beta blockers, angiotensin converting enzyme or angiotensin-converting enzyme (ACE)-inhibitors (ACE-I), angiotensin receptor blockers (ARB), aldosterone blockers, anticoagulation) and clinical events. These are expressed in Table 1.

Follow-Up And Clinical Outcome

The home palliative care programme consisted of a multidisciplinary team consisting of a doctor, a nurse, and/or a counsellor. Patient contacts ranged from weekly to monthly home visitations by the Advance Care Programme (ACP) members depending on patient's acuity of conditions. During visits, patients' parameters and weights were measured, and relevant symptoms and clinical signs were elicited after physical examinations. Oral medications could be modified or initiated to maximally palliate patients' HF and/or general symptoms. Telephonic consults were made available 24/7

to facilitate updates of clinical conditions and delivery of advice/educations. These programme events were detailed and documented in dedicated files, which were used to complete data entry. These patients were also followed in hospital-based chronic disease management programme (CDMP) for HF at regular intervals, between weekly and 3-monthly, depending on clinical indications. HF and all-cause hospitalisations 1 year before and 3 months, 6 months and 12 months after ACP inception were defined as events.

Statistics

Standard statistical analysis including survival study was employed. Studies parameters were displayed as mean $\pm$ standard deviation (SD) for continuous variables or percentage (%) for categorical variables. Comparisons within each patient for events before and after ACP inception were performed using a Spearman χ^2 or Fisher Exact test for categorical variables, and non-parametric Wilcoxon rank sum test for continuous variables. For all analysis a *P* value <0.05 was considered significant. Survival analyses were calculated using the Kaplan Meier method with log rank

Table 1. Baseline Comorbid Conditions, Laboratory Variables and Medications of Patients Recruited in ACP

Comorbid Conditions	Values (%)
Diabetes	57
Hypertension,	66
Ischaemic heart disease*	80
Myocardial infarction	43
Atrial fibrillation	36
Chronic kidney disease	60
Stroke	32
Laboratory Variables	Values
Sodium, mmol/L	136 $\pm$ 6
Creatinine, mmol/L	186 $\pm$ 126
eGFR (by MDRD)	47 $\pm$ 46
Haemoglobin, g/dL	11 $\pm$ 2
Medications	Values (%)
Beta blockers	59
ACE-I/ARB	30
Aldosterone blocker	23
Loop diuretics	91
Home oxygen	36
Oral morphine	23

ACE-I: angiotensin-converting enzyme inhibitor; ARB: angiotensin receptor blocker; eGFR: estimated glomerular filtration rate; MDRD: modification of diet in renal disease

*defined as having prior history of myocardial infarction, percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG)

test to assess the statistical significance. A 2-side P value of <0.05 was considered statistically significant. Given that deaths occurred in 30/44 (68%) of patients during follow-up, we applied follow-up duration-adjustment by using the equation: Raw event episodes $\times$ 365/follow-up duration in days to derive at time-indexed event episodes.

Results

Forty-four patients, mean age 79 ± 9 years, 39% men, were followed up for 15 ± 8 months from that time of inclusion in the ACP programme. Seventy percent were in NYHA class III, while the rest were in class IV. More than half (57%) had diabetes, 66% hypertension, 80% ischaemic heart disease, 60% chronic kidney disease, whilst 36% were in atrial fibrillation and 32% had stroke (Table 1). At least 60% of the patients were on beta blocker, but the use of ACE-inhibitors or ARBs were low at 30%, mostly limited by hypotension and significant renal impairment. In excess of 90% of patients were on loop diuretics, more than 30% on home oxygen supplementation, and approximately 60% of the patients were on oral morphine for symptom control.

Important laboratory values are illustrated in Table 1. At baseline, majority of the patients had renal impairment, as evidenced by elevated serum creatinine level and decreased eGFR values. The mean serum sodium was 136 mmol/L, and haemoglobin was 11 g/dL.

During follow-up, 30 patients (68%) died within programme, of which 24 (55%) died within 12 months of recruitment; mean time to death was 5.5 months and 50th percentile to death was 171 days, reflecting the advanced stage of the disease (Fig. 1). Fourteen (32%) patients survived till time of analysis. The likelihood for death before and after 12 months of programme inclusion remained the same, adjudged by the steep slopes of the survival curve.

Mean all-cause and HF hospitalisations were 3.6 and 2.0 episodes per patient before enrolment, but improved to 1.0 and 0.6 per patient after recruitment to palliative home care ($P < 0.0001$), representing a relative reduction of 72% and 70% respectively for the entire cohort, without sanctioning for death as events. After adjustment for follow-up duration, the corresponding reduction in hospitalisations remained highly significant at 1.2 and 0.5 episodes per patient respectively ($P < 0.0001$, Figs. 2 and 3).

With regards to trends of hospitalisation, 36 (71%) patients experienced reduced number of HF hospitalisation, 2 (5%) had more frequent admissions; while the remainder experienced similar readmission rates (Fig. 4). Hence, 95% of the recruited cohort had no worsening of incidence of hospitalisations. After adjustment for follow-up duration, the corresponding numbers were 70% and 7% respectively (Fig. 5).

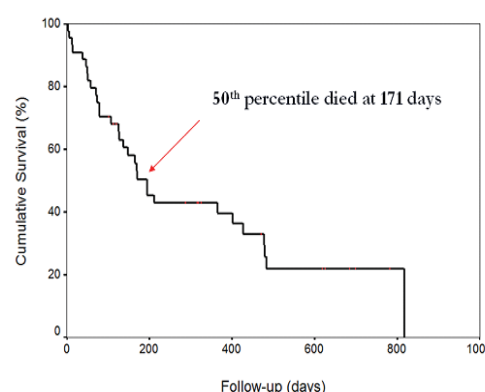


Fig. 1. Kaplan Meier survival curve showing high mortality rates of the study population ($n = 44$).

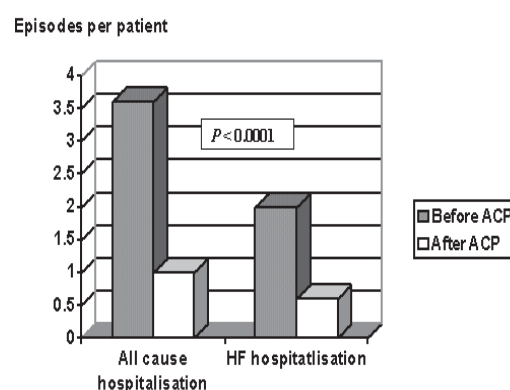


Fig. 2. Bar chart illustrating the unadjusted trends in hospitalisations ($n = 44$) expressed in episodes per patient before and after ACP recruitment.

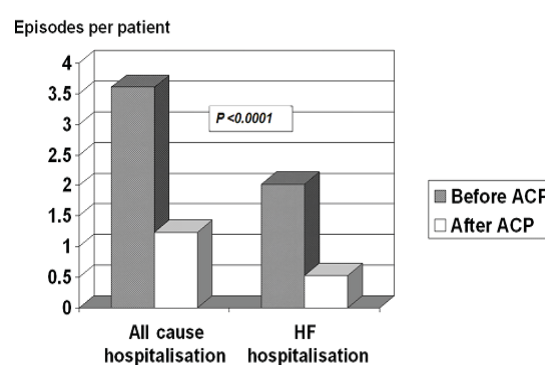


Fig. 3. Bar chart illustrating the follow-up duration-adjusted trends in hospitalisations ($n = 44$) expressed in episodes per patient before and after ACP recruitment.

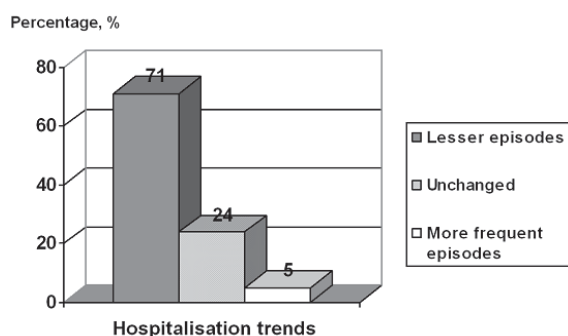


Fig. 4. Bar chart illustrating the unadjusted trend in hospitalisation ($n = 44$), categorically expressed as lesser episodes per patient, unchanged, and more frequent episodes after the initiation of ACP.

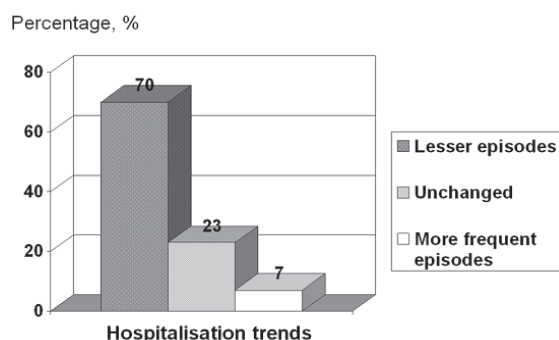


Fig. 5. Bar chart illustrating the follow-up duration-adjusted trend in hospitalisation ($n = 44$), categorically expressed as lesser episodes per patient, unchanged, and more frequent episodes after the initiation of ACP.

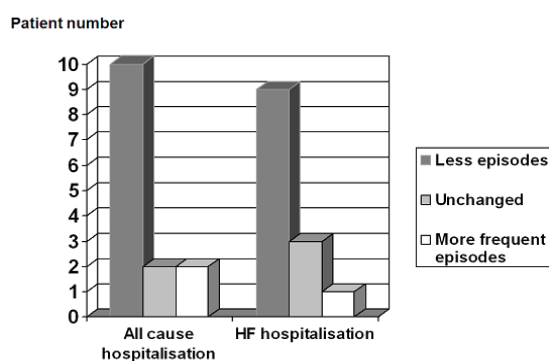


Fig. 6. Bar chart illustrating the unadjusted trend in hospitalisation among survivors at least 1 year ($n = 14$), categorically expressed as lesser episodes per patient, unchanged, and more frequent episodes after the initiation of ACP.

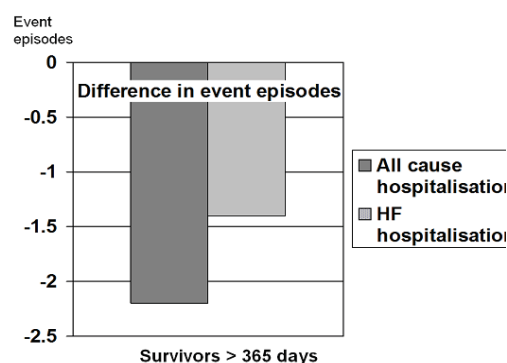


Fig. 7. Bar chart illustrating the unadjusted trend in hospitalisation among survivors at least 1 year ($n = 14$), after the initiation of ACP. Negative numbers represent a reduction in rates of hospitalisation.

When only patients who survived at least 365 days were considered ($n = 14$), i.e. to eliminate the contribution of death less than a year in the rehospitalisation statistics, 10 (71%) and 9 (64%) experienced reduced HF (mean: 1.48 per patient) and all-cause hospitalisations (mean: 2.2 per patient) respectively, in mean follow-up duration of 15 months ($P < 0.05$) (Figs. 6 and 7).

The hospital bills of the readmission cases in the first quarter of 2012 were analysed. There were a total of 16 readmissions in that period. Eight patients were admitted in Ward C, 3 in Ward B1 and 5 in Ward B2. The average round up bill size of a HF admission in Ward B1 for this period was S\$2800 with average length of stay (ALOS) of 2.3 days while in Ward B2 with ALOS of 4.6 days, showed S\$4300. The average bill size of HF admissions in Ward C, with average length of stay (ALOS) of 4.2 days, showed S\$4000. We admittedly did not have the figures reflecting the total spending by the ACP in the community, either administratively or incurred from home visitations, as counterbalances against the cost saved from hospitalisation.

Discussion

Our study validates the effectiveness of a palliative home care programme on reducing rehospitalisation of advanced HF patients, translating to cost savings and improved QOL for them and caregivers. Notably, despite the longer duration of follow-up up before being recruited in the home care programme, the episodes of patients hospitalised continued to show a reduction compared to a year before enrolment especially amongst the survivors beyond one year.

Importance of Palliative Care Management in Advance Stage HF Patients

In a systematic literature review, it was found that advanced HF patients had little discussion with health professionals about their clinical status and sense a lack of timely support to accommodate their evolving needs; furthermore, health professionals reported poor multidisciplinary communication and lack confidence both in diagnosing advanced HF and in communicating a poor prognosis to those affected, impacting the provision of good quality coordinated care.¹⁶ This was despite the evidence that end-stage HF has one of the largest effects on QOL of any advanced disease,¹⁷ and that palliative/hospice care referral was recommended for end-stage HF (level of evidence 1A) in the American College of Cardiology/American Heart Association HF guidelines.¹⁵

Mode of Delivery of Palliative Care, Institution Versus Home-Based

The setting up of a palliative home care programme was based on the principle that the care of advanced illness should be sited appropriately, i.e. their own home. We showed in our model of care that a significant proportion of advanced HF patients survived beyond a year. Even amongst those who survived beyond 12 months, they continued to enjoy the benefit of lesser hospitalisation as compared to before the inclusion into ACP. A large number of debilitating symptoms, involving psychological, physical and mental capacity,¹⁸ may be better managed at home with improved satisfaction and overall symptom management.^{19,20} This is particularly true when the physical dependence on activity of daily living was considered. Patients who receive home-based palliative care are more likely to die at home, in line with the expressed wishes of most patients.²¹ We admittedly did not compute the percentage of eligible patients for ACP that were actually included in the programme; as stated above, the final decision to join the home-based palliative care programme depended on multiple factors.

Why Home-Based ACP can Reduce Readmissions: Importance of Prognostication

An important caveat for our healthcare model to work was that prognostication of patients' conditions had to be fairly practical and accurate. Patients that needed institution care for palliation of the advanced HF symptoms would be actively offered places in the inpatient hospices. We included socio-demographic factors vis-à-vis patients' preference for home care, caregivers' willingness to participate in end-of-life nursing issues, and fitting of home

appliances such as oxygen concentrator. It is uncertain if widely accepted HF risk stratification models stand well in accurately predicting patients in the last year of life. In an observational cohort study that tested Gold Standards Framework Prognostic Indicator Guide (GSF) criteria for end-of-life care and the Seattle Heart Failure Model (SHF), it was found that sensitivity and specificity for GSF and SHF in predicting death were 83% and 22%, and 12% and 99%, respectively. Overall, only one third of patients had died by 12-month follow-up.²² Given the complexity of HF prognostication and the urgency of appropriate care for this group of patients, a non-hospice model of care instead of a hospice model of care where needs rather than prognosis determines enrolment may be more appropriate.

Impact on Cost of Healthcare and QOL

The authors are convinced that the creation of resources in support of the home palliative care team more than balances the cost of hospitalisation as shown in the literature.²³ We believe that avoidance of hospital admissions also translates to improved QOL as the patients and family can spend more time at home while being treated.²⁴ Admittedly in the present study, we did not analyse the change in QOL scores within the programme. In the present study, we showed the actual cost saving for these patients per episode of hospitalisation. Admitted patients in the ward may be subject to varied laboratory and radiological tests, in addition to repeated instrumentations such as urine catheterisation or intravenous cannula placements, leading not only to increased cost but also to secondary complications such as inadvertent infections or inflammation. Based on these arguments, it can be concluded that an averted readmission translated to cost savings to the patient as well as the institution.

Limitations

The observed findings in the present study may not be widely applicable due to the small sample size; latter may also lead to inherent type II statistical error and data analysis. The determinants within the home palliative programme, such as placebo effects, resulting in its effectiveness have not been analysed in this study. The actualised economic impact, when cost of delivering home-based services against cost of hospitalisations saved, has not been evaluated in this study. We admittedly did not detail the counterbalance effect of expenses directly incurred from home visitation and administration charges in the entire duration of ACP delivery. Finally, the perceived benefit of this mode of healthcare delivery cannot be generalised to other institutions or disease entities because of the lack of a control group.

Conclusion

Home-based palliative care programme is potentially effective in reducing healthcare utilisation of end-stage HF patients, primarily by reducing HF rehospitalisations. Home-based palliative care can be maximally developed to enhance QOL for advanced HF patients and their caregivers. In addition, healthcare related costs can potentially be reduced for patients and families, as well as the entire healthcare system.

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