Which Heart failure Intervention is most Cost-effective & consumer friendly in reducing Hospital care?

Primary endpoints from the multicentre randomised WHICH? Trial

Simon Stewart on behalf of the WHICH? Trial Investigators

National Health and Medical Research Council of Australia (# 418967) Australian New Zealand Clinical Trials Registry (# 12607000069459)
Background

- Multidisciplinary programs now gold-standard in CHF post-discharge care
- Historical divide - specialist CHF clinics (outpatient) & home-based programs
- As a complex syndrome CHF does not occur in isolation
- We postulated that home visits may confer additional benefits beyond optimal CHF management
Dedicated disease management applied in a range of different settings

Key components of management:

- Dietary Advice
- Clinical Monitoring
- Treatment/Adherence
- Exercise Therapy
- Monitoring Weight
- Knowledge/Self-care

WHICH? TRIAL

Home Visits
Specialist Clinics

Telemonitoring
Telephone Care
Study Hypothesis

Compared to an equivalent clinic-based program of management, a nurse-led, post-discharge, multidisciplinary management program for CHF patients (including those with preserved LVEF) involving post-discharge home visits, will be superior in reducing the composite primary end-point of unplanned (all-cause) readmission or death during 12-18 months follow-up by an absolute margin of 15%.

Also that a home-based approach will also (cost-effectively) reduce the rate of unplanned hospital stay (all-cause) by a minimum of 15% relative to clinic-based management during study follow-up.

**Study Design**

- Multicentre RCT
- Standardised care
- Blinded endpoint adjudication
- No “contamination” from home to clinic
- Prospective health economic analyses
- Prospective consumer choice analyses

Patients with chronic heart failure discharged to home from 3 Australian hospitals (SA, NSW & Qld)

Blinded randomisation (1:1) to clinic or home-based per site (stratified preserved LVEF vs. impaired LV function)

- Specialist CHF outpatient clinic
  - Comprehensive clinical and social assessment and management via post-discharge visit to the CHF clinic
  - Gold-standard treatment management
  - Minimise risk factors for recurrent events/clinical deterioration
  - Promote clinical stability/self-care
  - Holistic/individualised care
  - Close links with primary care/GP

- Nurse-led, home-based intervention
  - Comprehensive clinical and social assessment and management via home visit at 7-14 days
  - 6 month review by cardiac nurse to determine clinical status & management

Re-application of home-based review and short-term intervention if readmitted

Blinded end-point determination

**Primary endpoint:** unplanned readmission or all-cause death

Secondary endpoints: recurrent hospital stay; CHF-specific stay; event-free survival; optimal management, quality of life & health care costs
Consort flow-chart

Cardiology in-patients screened for eligibility (n=6123)

Ineligible (n=5400)
- Heart disease not confirmed (n=3291)
- Out of catchment area (n=828)
- Clinical condition not permitted (n=631)
- Nursing home/ cognitively impaired (n=467)
- Other reasons (n=155)
- Participating in another study (n=28)

Eligible patients (n=723)

Excluded (n=425)
- Refused – individual (n=249)
- Refused – doctor (n=26)
- Missed / other (n=150)

Enrolled / stratified randomised (n=298)

Allocated to specialist CHF outpatient clinic (n=144)
- Preserved Systolic HF (n=40)
- Impaired Systolic HF (n=104)

Allocated to nurse-led home-based intervention (n=154)
- Preserved Systolic HF (n=39)
- Impaired Systolic HF (n=115)
## Baseline characteristics

<table>
<thead>
<tr>
<th>Demographic Profile</th>
<th>All n = 280</th>
<th>Home-based n = 143</th>
<th>CHF Clinic n = 137</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>203 (73%)</td>
<td>86 (60%)</td>
<td>14 (51%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>71 ± 14</td>
<td>69 ± 15</td>
<td>71 ± 14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinic Profile</th>
<th>All n = 280</th>
<th>Home-based n = 143</th>
<th>CHF Clinic n = 137</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>177 (63%)</td>
<td>69 (64%)</td>
<td>24 (69%)</td>
</tr>
<tr>
<td>Type 2 diabetes mellitus</td>
<td>109 (39%)</td>
<td>36 (33%)</td>
<td>15 (43%)</td>
</tr>
<tr>
<td>Months since CHF diagnosis</td>
<td>39.4 ± 5.3</td>
<td>39.2 ± 4.9</td>
<td>29.0 ± 3.6</td>
</tr>
<tr>
<td>LVEF (if ≤ 45%)</td>
<td>-</td>
<td>30.2 ± 9.8</td>
<td>-</td>
</tr>
<tr>
<td>NYHA Class II/III</td>
<td>212 (76%)</td>
<td>79 (73%)</td>
<td>29 (83%)</td>
</tr>
<tr>
<td>Acute pulmonary oedema</td>
<td>125 (45%)</td>
<td>42 (39%)</td>
<td>20 (57%)</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>155 (55%)</td>
<td>60 (56%)</td>
<td>16 (46%)</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>148 (53%)</td>
<td>56 (51%)</td>
<td>15 (43%)</td>
</tr>
<tr>
<td>Charlson Index</td>
<td>6.1 ± 2.4</td>
<td>5.7 ± 2.4</td>
<td>6.0 ± 2.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pharmacotherapy</th>
<th>All n = 280</th>
<th>Home-based n = 143</th>
<th>CHF Clinic n = 137</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE inhibitor or ARB</td>
<td>213 (76%)</td>
<td>87 (81%)</td>
<td>23 (66%)</td>
</tr>
<tr>
<td>Beta blocker</td>
<td>200 (71%)</td>
<td>84 (78%)</td>
<td>20 (57%)</td>
</tr>
<tr>
<td>Spirononlactone</td>
<td>109 (39%)</td>
<td>43 (40%)</td>
<td>12 (34%)</td>
</tr>
<tr>
<td>Loop diuretic</td>
<td>232 (83%)</td>
<td>87 (81%)</td>
<td>29 (83%)</td>
</tr>
<tr>
<td>Digoxin</td>
<td>90 (32%)</td>
<td>38 (35%)</td>
<td>6 (17%)</td>
</tr>
</tbody>
</table>
All-cause mortality

Adjusted HR – 0.75 (95% CI 0.45 to 1.23), p = 0.252
(Age, sex, cardiac function, clinical profile & site)
Unplanned readmissions

<table>
<thead>
<tr>
<th>Number of Unplanned Readmissions</th>
<th>Clinic-based Intervention (n = 137)</th>
<th>Home-based Intervention (n = 143)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>31%</td>
<td>33%</td>
</tr>
<tr>
<td>1</td>
<td>31%</td>
<td>24%</td>
</tr>
<tr>
<td>2</td>
<td>12%</td>
<td>16%</td>
</tr>
<tr>
<td>3</td>
<td>10%</td>
<td>15%</td>
</tr>
<tr>
<td>4</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>5+</td>
<td>8%</td>
<td>8%</td>
</tr>
</tbody>
</table>

- Clinic-based Intervention (n = 137)
- Home-based Intervention (n = 143)
Event-free survival

Adjusted HR – 0.97 (95% CI 0.73 to 1.30), p = 0.861
(Age, sex, cardiac function, clinical profile & site)
Total all-cause readmissions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Total readmissions within 18 months</th>
<th>Unplanned admissions</th>
<th>All admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic-based intervention</td>
<td>0.84 ± 0.99 admissions/100 days/patient</td>
<td>0.84 ± 0.99 admissions/100 days/patient</td>
<td>p = 0.570</td>
</tr>
<tr>
<td>Home-based intervention</td>
<td>0.85 ± 1.08 admissions/100 days/patient</td>
<td>0.89 ± 1.16 admissions/100 days/patient</td>
<td>p = 0.384</td>
</tr>
</tbody>
</table>

0.89 ± 0.99 admissions/100 days/patient

0.89 ± 1.16 admissions/100 days/patient
Rate of all-cause stay

- Clinic-based intervention:
  - All-cause stay: 8.65 ± 11.6 days of stay/100 days/patient
  - Unplanned stay: 7.56 ± 11.6 days of stay/100 days/patient
  - Total recurrent stay within 18 months: p = 0.003

- Home-based intervention:
  - All-cause stay: 5.78 ± 10.2 days of stay/100 days/patient
  - Unplanned stay: 5.30 ± 10.1 days of stay/100 days/patient
  - Total recurrent stay within 18 months: p = 0.059
Total CV-related readmissions

Clinic-based intervention

0.52 ± 0.76 admissions/100 days/patient

p = 0.434

Home-based intervention

0.53 ± 1.02 admissions/100 days/patient

p = 0.826

All-CV admissions

0.69 ± 0.76 admissions/100 days/patient

p = 0.826

CHF admissions

0.76 ± 1.04 admissions/100 days/patient

p = 0.434
Rate of CV-related stay

- Clinic-based intervention: 4.96 ± 8.57 days/100 days/patient
- Home-based intervention: 3.62 ± 6.36 days/100 days/patient

Total CV recurrent stay in 18 months:
- All-CV stay: 6.55 ± 9.26 days/100 days/patient (p = 0.025)
- CHF-related stay: 4.96 ± 8.96 days/100 days/patient (p = 0.218)
All-cause length of stay

Median (IQR) event-free days alive

501 (348 to 542) vs. 537 (422 to 546) days
\( p = 0.009 \)

Adjusted predictors of > 25 days stay

HBI: 0.37 (95% CI 0.19 to 0.71) \( p = 0.003 \)

Age: 1.05 (95% CI 1.02 to 1.09) \( p = 0.002 \)
Summary

Compared to clinic-based management of CHF, home-based intervention:

• Modestly improved survival profile (non-significant 25% adjusted hazard reduction)
• No impact on risk of readmission (unplanned vs. elective & CV vs. non-CV)
• No impact on event-free survival
• Potentially important reductions in hospital stay:
  • 934 less days of all-cause stay (-35%): $p = 0.003$
  • 668 less days of all-cause unplanned stay (-30%): $p = 0.059$
  • 259 less days of CHF-related unplanned stay (-25%): $p = 0.218$
  • 590 less days of CV-related stay (-37%): $p = 0.025$
• Economic and consumer preference analyses ....
WHICH? Trial Collaboration

Baker IDI Heart and Diabetes Institute
- Professor Simon Stewart
- Dr Melinda Carrington
- Dr Yih Kai Chan
- Alicia Calderone

Princess Alexandra Hospital/University of Queensland
- Professor Thomas Marwick
- Julie Holliday
- Robyn Peters
- Mary Boyde

The Queen Elizabeth Hospital/University of Adelaide
- Professor John Horowitz
- Libby Birchmore
- Terina Selkow
- Jenny Poulton

St Vincent’s Hospital/Curtin University of Technology
- Professor Peter Macdonald
- Professor Patricia Davidson
- Dr Phillip Newton

Griffith University
- Professor Paul Scuffham
- Dr Jenny Whitty

Monash University, VIC
- Professor Henry Krum
- Assoc Professor Christopher Reid
CV-related length of stay

+ 17 patients

+ 15 patients
HF-related length of stay

Number of related hospital events

- Clinic-based intervention
- Home-based intervention

+ 15 patients

- 1 to 5 days
- 6 to 10 days
- 11 to 15 days
- 16 to 20 days
- 21 to 25 days
- 26 to 30 days
- 31 to 35 days
- 36 to 40 days
- 41 to 45 days
- 46 to 50 days
- 50+ days