Demonstrating the Value of a Disease Management Program: Introduction to TEAM-HF Tools for Economic Evaluation

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Disclosure

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The development and content of the TEAM-HF economic tools are solely the responsibility of the authors and do not necessarily represent the official views of the National Institute of Nursing Research or the National Institutes of Health, the American Heart Association, or Circulation: Cardiovascular Quality and Outcomes.
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Overview

- Project Team
- Motivation and Background
- Costing 101
- TEAM-H$ Costing Tool
- Basics of Cost-Effectiveness Analysis (CEA)
- TEAM-H$ CEA Model
## Project Team

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelby Reed, PhD</td>
<td>Principal Investigator, Health economist</td>
<td>Duke University</td>
</tr>
<tr>
<td>Yanhong Li, MS</td>
<td>Statistician</td>
<td>Duke University</td>
</tr>
<tr>
<td>Matt Neilson, PhD</td>
<td>Mathematician</td>
<td>University of Glasgow</td>
</tr>
<tr>
<td>Andrew Briggs, DPhil</td>
<td>Health economist</td>
<td>University of Glasgow</td>
</tr>
<tr>
<td>Wayne Levy, MD</td>
<td>Cardiologist</td>
<td>University of Washington</td>
</tr>
<tr>
<td>David Whellan, MD</td>
<td>Cardiologist</td>
<td>Thomas Jefferson University</td>
</tr>
<tr>
<td>Margaret Bowers, MSN</td>
<td>Nurse practitioner, Director</td>
<td>Duke University</td>
</tr>
<tr>
<td>Kevin Schulman, MD</td>
<td>Health policy expert</td>
<td>Duke University</td>
</tr>
<tr>
<td>Felicia Graham, MBA</td>
<td>Project Manager</td>
<td>Duke University</td>
</tr>
<tr>
<td>Reza Alavi, MD</td>
<td>Advisory Panel Member,</td>
<td>Center for Medical Technology Policy</td>
</tr>
<tr>
<td>Dan Polsky, PhD</td>
<td>Advisory Panel Member, Health economist</td>
<td>University of Pennsylvania</td>
</tr>
<tr>
<td>Sara Paul, DNP</td>
<td>Advisory Panel Member, Nurse practitioner, Director</td>
<td>Heart Function Clinic, Hickory Cardiology Associates</td>
</tr>
<tr>
<td>Barbara J Riegel, DNSc</td>
<td>Advisory Panel Member, Nurse practitioner, Director, Dean</td>
<td>University of Pennsylvania</td>
</tr>
</tbody>
</table>
Projected total cost of Heart Failure in the U.S.

The Hospital Readmissions Reduction Program (HRRP) was initiated on October 1, 2012.

1% payment cut from Medicare for hospitals with higher-than-predicted readmission rates.

Hospital Characteristics with Payment Cuts

What are the effects of disease management on costs and outcomes???
Background

- As health care budgets tighten, new and existing programs must demonstrate their value.
- Economic evaluation provides a tool to discriminate between higher-value and lower-value health care interventions.”
Motivation

Economic evaluations of patient-focused programs

- Majority of are limited to costs.
- Few have examined longer-term cost-effectiveness.
- Methods in the literature are highly variable.
- Lack of methodological detail provided.
Limited ability to make comparisons between programs.
Consistent and valid methodology is key.
General Aim

TEAM-HF provides clinicians and researchers with user-friendly tools to facilitate the conduct of high-quality economic evaluations of patient-focused interventions.
TEAM-HF

Costing Tool
- Excel spreadsheets designed to generate high-quality cost estimates of patient-focused interventions.

CEA Model
- Web-based tool designed to generate estimates of long-term costs and (quality-adjusted) survival.

Cost-Effectiveness
- To demonstrate value of disease management programs.
- To design cost-effective disease management programs.
COSTING 101

Cost- Value of resources required to produce a service or objective.

**Accounting Cost** - The monetary outlay for resources required to produce the service.

**Opportunity cost** - The value of the services that reflects what was given up by employing the resource in one use rather than another.
COSTING 101

Cost = Price * Quantity

Examples
- Salaries and fringe benefits
- Rent and overhead for facilities
- Market prices/acquisition costs for equipment, supplies, etc.

Examples
- Hours of labor by type of employee/provider
- Square footage for office space
- Numbers of IV bags
Potential Uses for Costing Tool

- Budgeting
- Input in cost-effectiveness analysis
- Negotiating reimbursement rates
- Evaluating cost impact of program modifications
Interactive Data Collection Tool (Excel)
Costing Tool Spreadsheets (Excel)
User Manual
Examples and Tips document

Pilot-tested at 3 academic medical centers

Compared cost estimates from Tool with cost estimates from HF-ACTION

Scenarios

- Fixed Duration, Single Cohort
  - Duration of program per patient
  - Number of patients per cohort

- Fixed Duration, Ongoing Accrual
  - Duration of program per patient
  - Number of patients enrolled over 1 year

- Ongoing Duration, Ongoing Accrual
  - Number of patients participating over 1 year
**APOLLO CARE**

*Hypothetical DM program*

- Patients receive an electronic scale upon initiation.

- Once monthly in-person ‘encounters’:
  - LPN records weight, blood pressure, etc.
  - Nurse practitioner discusses proper exercise, diet and medication adherence with patient and family.
  - Nurse practitioner makes medication changes as needed.

- 1 year in duration
# Description and Costing Options

<table>
<thead>
<tr>
<th>Description/Name of the program</th>
<th>APOLLO DM Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target patient population</td>
<td>NYHA Class II-IV outpatients</td>
</tr>
</tbody>
</table>

**Program Type/Scenario (select one)**
- Fixed duration per patient- single cohort

**Duration of the program (in weeks)**
- 52

**Number of patients in cohort**
- 200

**Options for Cost Estimation Methods**

<table>
<thead>
<tr>
<th>Approach to estimating personnel costs (select approach)</th>
<th>Time per encounter for personnel [bottom-up method]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include start-up costs? (select yes or no)</td>
<td>No</td>
</tr>
<tr>
<td>Include personnel time devoted to research activities? (select yes or no)</td>
<td>No</td>
</tr>
<tr>
<td>Include facility costs? (select yes or no)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Approach to estimating facility costs (select approach)**
- 'Cost-per-square-foot' method

If 'cost-per-square foot' method is used to estimate facility costs, add overhead rate as a percentage of facility costs to represent utilities and other overhead costs? (select option)
- Yes- assign overhead rate for utilities and other overhead costs

<table>
<thead>
<tr>
<th>Include equipment costs? (select yes or no)</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include costs for supplies and/or incentives provided at each encounter or for each new patient enrolled? (select yes or no)</td>
<td>Yes</td>
</tr>
<tr>
<td>Total number of patient encounters per week (used to calculate supply costs)</td>
<td>25</td>
</tr>
</tbody>
</table>
### Personnel Costs: Top-Down

<table>
<thead>
<tr>
<th>Type of Personnel</th>
<th>Hours per week spent in contact with patients for each provider/personnel (by phone, face-to-face)</th>
<th>Hours per week spent on other (non-research) activities associated with the program</th>
<th>Hours per week spent on research activities associated with the program</th>
<th>Number of each type of personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse Practitioner</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>11</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Licensed practical/licensed vocational nurse</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Certified Nursing Assistant</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

### Personnel Costs: Bottom-Up

<table>
<thead>
<tr>
<th>Type of Personnel</th>
<th>Number of encounters with patients per week for each provider/personnel</th>
<th>Average duration with patient per encounter (in minutes)</th>
<th>Average duration without patient per encounter (in minutes)</th>
<th>Hours per week spent on research-related activities for each type of personnel</th>
<th>Number of each type of personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse Practitioner</td>
<td>25</td>
<td>25</td>
<td>5</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Registered Nurse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Licensed practical/licensed vocational nurse</td>
<td>25</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Certified Nursing Assistant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Description and Costing Options
Equipment Cost Worksheet

Equipment costs do not vary with small changes in patient volume.

<table>
<thead>
<tr>
<th>Name or description of equipment</th>
<th>Number needed</th>
<th>Percentage used for the intervention</th>
<th>Equipment cost per week (standardized costs)</th>
<th>Equipment cost per week (customized costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer</td>
<td>1</td>
<td>50%</td>
<td>$3.24</td>
<td>$3.17</td>
</tr>
<tr>
<td>Printer</td>
<td>1</td>
<td>15%</td>
<td>$0.25</td>
<td>$0.44</td>
</tr>
<tr>
<td>Copier</td>
<td>1</td>
<td>15%</td>
<td>$0.35</td>
<td>$1.27</td>
</tr>
<tr>
<td>Scanner</td>
<td>0</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Fax</td>
<td>0</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

**Equipment Worksheet (fixed costs)**

**Inputs**

**Results**

Standardized Costs: facilitate apples-apples comparisons across programs.

Customized Costs: allow user to enter locally-relevant costs.
### 3 Options for Estimating Facility Costs

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed percentage based on personnel cost</strong></td>
<td>Costs are estimated as a fixed percentage of the total personnel costs.</td>
</tr>
<tr>
<td><strong>‘Cost-per-square-foot’ method</strong></td>
<td>Costs based on estimates of square feet used by the program and the percentage of time the space is used by the program.</td>
</tr>
<tr>
<td><strong>‘Off-the-shelf’ method</strong></td>
<td>Standardized estimates of square footage for each type of space are applied.</td>
</tr>
</tbody>
</table>
Supply/incentive costs increase with each additional encounter or new patient.

"Other" allows users to customize tool for their program.

**Supplies / Incentives Worksheet**

<table>
<thead>
<tr>
<th>Name or description of supplies</th>
<th>Quantity per encounter</th>
<th>Cost per encounter (standardized costs)</th>
<th>Cost per encounter (customized costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Incentive</td>
<td>1</td>
<td>$10.00</td>
<td>$15.00</td>
</tr>
<tr>
<td>Reimbursement for Parking Fees</td>
<td>1</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>Refreshments</td>
<td>0</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Educational Materials</td>
<td>0</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Other (enter description) 1</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Other (enter description) 2</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Other (enter description) 3</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td><strong>Total variable cost per encounter</strong></td>
<td></td>
<td><strong>$15.00</strong></td>
<td><strong>$20.00</strong></td>
</tr>
</tbody>
</table>

**Supplies/incentives provided/required at each encounter***

<table>
<thead>
<tr>
<th>Name or description of supplies</th>
<th>Quantity per patient</th>
<th>Cost per patient (standardized costs)</th>
<th>Cost per patient (customized costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Materials</td>
<td>1</td>
<td>$5.00</td>
<td>$15.00</td>
</tr>
<tr>
<td>Binder</td>
<td>1</td>
<td>$6.99</td>
<td>$8.00</td>
</tr>
<tr>
<td>Blood pressure monitor</td>
<td>0</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Scale</td>
<td>1</td>
<td>$19.00</td>
<td>$150.00</td>
</tr>
<tr>
<td>Other (enter description) 1</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Other (enter description) 2</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Other (enter description) 3</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Other (enter description) 4</td>
<td></td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td><strong>Total variable cost per patient</strong></td>
<td></td>
<td><strong>$30.99</strong></td>
<td><strong>$173.00</strong></td>
</tr>
</tbody>
</table>
Use of **standardized costs** facilitate ‘apples-to-apples’ cost comparisons across programs and centers.

Use of **customized costs** allow the user to apply their costs to inform local decisions-making.

### Total Costs Worksheet

<table>
<thead>
<tr>
<th>Resource Category</th>
<th>Standardized Costs</th>
<th>Customized Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per intervention cohort</td>
<td>Per patient per week in the program</td>
</tr>
<tr>
<td>Start-up</td>
<td>$51,028.56</td>
<td>$4.91</td>
</tr>
<tr>
<td>Personnel</td>
<td>$1,712.77</td>
<td>$0.16</td>
</tr>
<tr>
<td>Facilities</td>
<td>$199.90</td>
<td>$0.02</td>
</tr>
<tr>
<td>Equipment</td>
<td>$25,698.00</td>
<td>$2.47</td>
</tr>
<tr>
<td>Supplies</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$78,639.23</strong></td>
<td><strong>$7.56</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Per intervention cohort</th>
<th>Per patient per week in the program</th>
<th>Per patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up</td>
<td>$44,535.50</td>
<td>$4.28</td>
<td>$222.68</td>
</tr>
<tr>
<td>Personnel</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Facilities</td>
<td>$254.07</td>
<td>$0.02</td>
<td>$1.27</td>
</tr>
<tr>
<td>Equipment</td>
<td>$60,600.00</td>
<td>$5.83</td>
<td>$303.00</td>
</tr>
<tr>
<td>Supplies</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$105,389.57</strong></td>
<td><strong>$10.13</strong></td>
<td><strong>$526.95</strong></td>
</tr>
</tbody>
</table>
Over time...

TEAM-HF Costing Tool

Systematic Reporting of cost estimates

“Library” of cost estimates across different types of patient-focused interventions
Cost-Effectiveness Analysis

Choice

Intervention A
- Costs_A
- Consequences_A

Intervention B
- Costs_B
- Consequences_B
The comparator
Standard of Care, Active comparator(s)

Time horizon
Long enough to capture:
- Downstream costs
- Downstream health consequences

Perspective
Productivity Costs
Direct non-medical Costs
Judicial System Costs
Social Security/ Disability Costs
Direct Medical Costs
Cost-Effectiveness Analysis

\[
ICER = \frac{C_{\text{ExpTrx}}}{E_{\text{ExpTrx}}} - \frac{C_{\text{StdCare}}}{E_{\text{StdCare}}}
\]

- Case detected
- Event avoided
- LYS
- QALYs gained

To implement decision rules for therapies for different conditions,...

outcomes must be measured using the same units.

Life-Years Saved (LYS)

DM program

Death

Standard care

Death

QALYs gained

• LYS
• QALYs gained

Full health (utility= 1)

Standard care

DM program

utility=0

Quality-Adjusted Life-Years (QALYs)

Death_1

Death_2

time

time
TEAM-HF

- Costing Tool
- CEA Model
- Cost-Effectiveness
Schematic Overview

- **Observation period**
  - Std Care
  - DM program

- **Simulations**

**Observed data on medical resource use/costs and survival**

+ **Simulated estimates of medical resource use/costs and survival**

+ **Cost of DM program from Costing Tool**

= **Long-term estimates of:**
  - Resource use
  - Costs
  - Survival
  - QALYs
  - Cost-effectiveness

*Cost of DM program from Costing Tool (if program is ongoing)*
Inputs for Observation Period

- Length of observation period

Per group
- Number of patients per group
- Number of CV procedure-related, HF, non-HF hospitalizations
- Number of ED visits
- Number of outpatient visits
- Number of patients who died
Simulations

AT END of OBSERVATION PERIOD used for projecting estimates of:

- Medical resource use and costs
- Mode of death
- Survival
- Quality-adjusted survival

Seattle Heart Failure Model* AT END of OBSERVATION PERIOD used for projecting estimates of:

Parallel Groups (clinical trial)

Hypothetical Scenario (planning)

Single cohort (pre-post design)
Advantages of using SHFM:

Prognostic accuracy externally validated in several data sets.

Incorporates:
- patient
- clinical
- treatment characteristics that are important when modeling the impact of DM programs.

Established acceptance among providers.
The Gompertz survival function

- The Gompertz distribution addresses the overestimation that is associated with an exponential distribution.
## SHFM and Survival

### SHFM Scores and Predicted Survival

<table>
<thead>
<tr>
<th>SHFM Score</th>
<th>Predicted Survival Time</th>
<th>1-yr Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>~12 years</td>
<td>2%</td>
</tr>
<tr>
<td>0</td>
<td>~8 years</td>
<td>5%</td>
</tr>
<tr>
<td>1</td>
<td>~5 years</td>
<td>10%</td>
</tr>
<tr>
<td>2</td>
<td>~3 years</td>
<td>24%</td>
</tr>
<tr>
<td>3</td>
<td>~1.5 years</td>
<td>51%</td>
</tr>
</tbody>
</table>

(a) Expected survival time

![Graph showing expected survival time vs. SHFM score]
SHFM and Medical Resource Use/Costs

**Graph 1:**
- Inpatient days, mean: 11.3, 7.4, 3.6, 2.1, 0.4
- Hospitalizations, mean: 1.5, 1.1, 0.6, 0.1

**Graph 2:**
- Total Costs, Mean: $7,570, $12,226, $23,278, $27,885

**SHFM 1-year Mortality (%)**

**SHFM 1-year Mortality (%)**
SHFM and Mode of Death

(a) $\zeta = -1$

(b) $\zeta = 1$

(c) $\zeta = 3$
Utility (QOL) Weights

2012 HFSA Poster: Li Y, Neilson M, Whellan DJ, Schulman KA, Levy WC, Reed SD. Seattle Heart Failure Model Scores are Significantly Predictive of Health Utilities and Their Change over Time.
The model assigns resource use, costs, and utilities as a function of increasing SHFM scores as death approaches.
APOLLO Care

- Specify *expected* values for SHFM variables (clinical, laboratory, medications, devices) **AFTER** 12 months of APOLLO Care and Standard Care.
Scenario: Apollo Care [Modify General Information]

Scenario Name: Apollo Care

Scenario Comment: This is the hypothetical program used to demo the TEAM-HF models.

Study Design: Hypothetical scenario

Group Details

Comparator Group Name: Standard Care
Size: 200 patients

Intervention Group Name: Apollo Care
Size: 200 patients
## Populate SHFM Characteristics

**Scenario: Apollo Care [Modify Patient Clinical]**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Standard Care</th>
<th>Apollo Care</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>Mean 63.032 SD 11.279</td>
<td>Mean 63.032 SD 11.279</td>
</tr>
<tr>
<td><strong>Gender (proportion male)</strong></td>
<td>0.788</td>
<td>0.788</td>
</tr>
<tr>
<td><strong>Weight (kg)</strong></td>
<td>Mean 79.695 SD 16.065</td>
<td>Mean 76.926 SD 16.065</td>
</tr>
<tr>
<td><strong>NYHA (proportion)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>0.000</td>
<td>Class 1 0.000</td>
</tr>
<tr>
<td>Class 2</td>
<td>0.55</td>
<td>Class 2 0.70</td>
</tr>
<tr>
<td>Class 3</td>
<td>0.25</td>
<td>Class 3 0.16</td>
</tr>
<tr>
<td>Class 4</td>
<td>0.20</td>
<td>Class 4 0.15</td>
</tr>
<tr>
<td><strong>Systolic blood pressure (mmHg)</strong></td>
<td>Mean 123.017 SD 19.189</td>
<td>Mean 121 SD 19.189</td>
</tr>
<tr>
<td><strong>Ejection fraction (%)</strong></td>
<td>Mean 26.777 SD 8.469</td>
<td>Mean 26.777 SD 8.469</td>
</tr>
<tr>
<td><strong>Ischemic Etiology (proportion)</strong></td>
<td>0.556</td>
<td>0.556</td>
</tr>
</tbody>
</table>

**Status: Draft [Pending Submission]**

[Save]  [Cancel]
# Medications and Devices

## Scenario: Apollo Care [Patient Medications/Patient Devices]

### Medications

<table>
<thead>
<tr>
<th></th>
<th>Standard Care</th>
<th>Apollo Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta-blocker (proportion)</td>
<td>0.300</td>
<td>0.400</td>
</tr>
<tr>
<td>Aldosterone blocker (proportion)</td>
<td>0.344</td>
<td>0.200</td>
</tr>
<tr>
<td>ARB (proportion)</td>
<td>0.365</td>
<td>0.380</td>
</tr>
<tr>
<td>ACE inhibitor (proportion)</td>
<td>0.750</td>
<td>0.850</td>
</tr>
<tr>
<td>Statin (proportion)</td>
<td>0.250</td>
<td>0.250</td>
</tr>
</tbody>
</table>

### Devices

<table>
<thead>
<tr>
<th></th>
<th>Standard Care</th>
<th>Apollo Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bi-ventricular pacemaker (proportion)</td>
<td>0.100</td>
<td>0.100</td>
</tr>
<tr>
<td>ICD (proportion)</td>
<td>0.250</td>
<td>0.250</td>
</tr>
<tr>
<td>Bi-ventricular ICD (proportion)</td>
<td>0.200</td>
<td>0.200</td>
</tr>
</tbody>
</table>
**Unit Costs**

Inpatient cost estimates derived from hospital billing data collected in HF-ACTION.
Cost for DM program

Scenario: Apollo Care [Modify Disease Management Program]

Time periods representing disease management program

<table>
<thead>
<tr>
<th>Intense period (months)</th>
<th>12.00 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongoing period duration</td>
<td>Fixed</td>
</tr>
<tr>
<td>Ongoing period (months)</td>
<td>0 months</td>
</tr>
</tbody>
</table>

Time periods representing disease management program

<table>
<thead>
<tr>
<th>One-time initiation cost (per patient)</th>
<th>$ 150.00 per patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of intense period (per patient/month)</td>
<td>$ 33.00 per patient/month</td>
</tr>
<tr>
<td>Cost of ongoing period (per patient/month)</td>
<td>$ 0.00 per patient/month</td>
</tr>
</tbody>
</table>

*Removed cost of scale from monthly DM costs.*

![Graph](image-url)
Simulation Options

Scenario: Apollo Care [Modify Simulation Options]

Status: Draft [Pending Submission]

Time Horizon

- Time Horizon: Specified
- Time Horizon (years): 5 years

Discount Rates

- Discount Rate for Costs (% per year): Costs: 3.0 % per year
- Discount Rate for Survival (% per year): Survival: 3.0 % per year

Resource Use Counts

- CVHF procedure-related hospitalizations
- HF hospitalizations
- Non-HF hospitalizations
- ED visits
- Outpatient visits

Costs

- Total costs
- Inpatient costs for CVHF procedure-related hospitalizations
- Inpatient costs for HF hospitalizations
- Inpatient costs for Non-HF hospitalizations
- Costs for ED visits
### Time Horizon

<table>
<thead>
<tr>
<th>Time Horizon</th>
<th>Specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Horizon (years)</td>
<td>5.0</td>
</tr>
</tbody>
</table>

### Discount Rates

<table>
<thead>
<tr>
<th>Discount Rate for Costs (% per year)</th>
<th>3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate for Survival (% per year)</td>
<td>3.0</td>
</tr>
</tbody>
</table>

### Resource Use Counts

- CVRHF procedure-related hospitalizations
- HF hospitalizations
- Non-HF hospitalizations
- ED visits
- Outpatient visits

### Costs

- Total costs
- Inpatient costs for CVRHF procedure-related hospitalizations
- Inpatient costs for HF hospitalizations
- Inpatient costs for Non-HF hospitalizations
- Costs for ED visits
- Costs for Outpatient visits

### Survival

- Life-years (remaining survival)
- QALYs (quality-adjusted life-years)

### Incremental Cost-Effectiveness Ratios

- Cost/LYS (life-years saved)
Discounted estimates at 5 Years

<table>
<thead>
<tr>
<th></th>
<th>APOLLO Care</th>
<th>Standard Care</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Costs</td>
<td>$100,045</td>
<td>$105,293</td>
<td>$-5,247</td>
</tr>
<tr>
<td>Life-years</td>
<td>3.80</td>
<td>3.69</td>
<td>0.12</td>
</tr>
<tr>
<td>QALYs</td>
<td>3.05</td>
<td>2.94</td>
<td>0.11</td>
</tr>
<tr>
<td>5-year survival</td>
<td>0.61</td>
<td>0.57</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Incremental cost-effectiveness ratio (ICER) ‘Dominant’- Cost-saving and QALY increasing
Cost-effectiveness Plane

(p) cost-effective at $50,000/QALY threshold = 81%

(p) cost-effective at $100,000/QALY threshold = 84%

(p) Dominant (cost-savings and QALY increasing) = 53%
Vary Cost for DM program

Scenario: Apollo Care [Modify Disease Management Program]

Time periods representing disease management program

Intense period (months) 12.00 months

Ongoing period duration Indefinite

Time periods representing disease management program

One-time initiation cost (per patient) $1500.00 per patient

Cost of intense period (per patient/month) $200.00 per patient/month

Cost of ongoing period (per patient/month) $100.00 per patient/month

Include additional advanced options? 

Save Cancel
# Discounted estimates at 5 Years

<table>
<thead>
<tr>
<th></th>
<th>APOLLO Care</th>
<th>Standard Care</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Costs</td>
<td>$105,379</td>
<td>$105,293</td>
<td>$86</td>
</tr>
<tr>
<td>Life-years</td>
<td>3.80</td>
<td>3.69</td>
<td>0.12</td>
</tr>
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<td>QALYs</td>
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<td>0.57</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Incremental cost-effectiveness ratio (ICER): $778 per QALY, $809 per LYS
(p) cost-effective at $50,000/QALY threshold = 67%

(p) cost-effective at $100,000/QALY threshold = 75%

(p) Dominant (cost-savings and QALY increasing) = 38%
Other Model Output

**Resource Use Counts:**
- CV/HF procedure-related hospitalizations
- HF hospitalizations
- Non-HF hospitalizations
- ED visits
- Outpatient Visits

**Survival**
- Life-years
- QALYs (quality-adjusted life-years)
- Survival (proportion still alive)

**Costs**
- Total Costs
- Inpatient costs for CV/HF procedure-related hospitalizations
- Inpatient costs for HF hospitalizations
- Inpatient costs for Non-HF hospitalizations
- Costs for ED visits
- Costs for outpatient Visits

**Incremental Cost-Effectiveness Ratios**
- Cost/LYS (life-years saved)
- Cost/QALY

Plus 95% CIs for each estimate
Questions?

shelby.reed@duke.edu
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Please visit www.heart.org/certification or email us at accreditation@heart.org.

Joint Effort

American Heart Association
The Joint Commission

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For more information and to register for Target: Heart Failure, go to [www.heart.org/targethf](http://www.heart.org/targethf).

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This is also a great site that the American Heart Association provides where you can *Learn at Heart with the latest Cardiovascular and Stroke CME/CE activities.*