HEART FAILURE OVERVIEW

Scott L. Hummel, MD MS
Advanced Heart Failure/Transplant Cardiologist
Assistant Professor, University of Michigan
Staff Cardiologist, Ann Arbor VA Health System
March 4, 2013

Outline

• Heart failure terminology, epidemiology
• Evidence-based treatment of systolic heart failure
• Diuretic management in patients who are hard to diurese
• Assessment and management of “diastolic” heart failure
• Risk stratification and advanced heart failure therapies vs. end of life care
• Preventing heart failure readmissions
Heart failure types

“Systolic” heart failure
• Heart muscle is weakened and cannot provide adequate output
• Left ventricular ejection fraction is < 40%
• Also called HFREF, “Heart Failure with Reduced Ejection Fraction”
• Multiple evidence-based drug and device therapies

“Diastolic” heart failure
• Heart muscle (and often large arteries) are stiff
• Left ventricular ejection fraction is ≥ 50% (EF threshold varies)
• Also called HFPEF, “Heart Failure with Preserved Ejection Fraction”
• No specific evidence-based treatments

Heart failure severity assessment

<table>
<thead>
<tr>
<th>Functional assessment</th>
<th>ACC/AHA staging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>ACC/AHA HF Stage</td>
</tr>
<tr>
<td></td>
<td>Health</td>
</tr>
<tr>
<td></td>
<td>Lipids</td>
</tr>
<tr>
<td></td>
<td>Blood Pressure</td>
</tr>
<tr>
<td></td>
<td>Smoking</td>
</tr>
<tr>
<td></td>
<td>Obesity</td>
</tr>
<tr>
<td></td>
<td>Diabetes</td>
</tr>
<tr>
<td>No limitation of physical activity. Ordinary physical activity does not cause undue breathlessness, fatigue, or palpitations.</td>
<td></td>
</tr>
<tr>
<td>Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in undue breathlessness, fatigue, or palpitations.</td>
<td></td>
</tr>
<tr>
<td>Marked limitation of physical activity. Comfortable at rest, but less than ordinary physical activity results in undue breathlessness, fatigue, or palpitations.</td>
<td></td>
</tr>
<tr>
<td>Unable to carry on any physical activity without discomfort. Symptoms at rest can be present. If any physical activity is undertaken, discomfort is increased.</td>
<td></td>
</tr>
<tr>
<td>A CV Disease</td>
<td></td>
</tr>
<tr>
<td>B LV Remodeling and Dysfunction</td>
<td></td>
</tr>
<tr>
<td>C Overt HF</td>
<td></td>
</tr>
<tr>
<td>D Terminal HF and Death</td>
<td></td>
</tr>
</tbody>
</table>
Heart failure epidemiology

Prevalence by age group

Hospitalizations 1979-2007

Nearly 6 million Americans are thought to currently be living with heart failure

Most common reason for hospitalization and most costly diagnosis for Medicare patients

Lloyd-Jones et al. Circulation 2012

Heart failure outcomes

Table 3  Post-Discharge 60- to 90-Day Clinical Outcomes by Ventricular Function

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Patients With LVSD (n = 20,169)</th>
<th>Patients With PEF (EF ≥50%) (n = 23,149)</th>
<th>p Value (95% vs. 50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital mortality: all patients (% 95% CI)</td>
<td>3.0 (2.6-3.4)</td>
<td>2.4 (2.1-2.8)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Follow-up cohort (n = 20,046)</td>
<td>3.0 (2.6-3.4)</td>
<td>2.4 (2.1-2.8)</td>
<td>0.647</td>
</tr>
<tr>
<td>Post-discharge mortality at 60-90 days (% 95% CI)</td>
<td>9.4 (8.9-10.1)</td>
<td>9.4 (7.9-11.0)</td>
<td>0.610</td>
</tr>
<tr>
<td>Readmission at 60-90 days (% 95% CI)</td>
<td>29.0 (26.8-31.3)</td>
<td>29.3 (26.8-32.3)</td>
<td>0.469</td>
</tr>
<tr>
<td>Post-discharge mortality/readmission at 60-90 days (% 95% CI)</td>
<td>36.1 (34.3-37.9)</td>
<td>36.1 (34.3-37.9)</td>
<td>0.473</td>
</tr>
</tbody>
</table>

Case #1

- 67 year-old woman with longstanding hypertension, first heart failure hospitalization (HF) 1 year ago (none since)
- otherwise has GERD, no surgical history

Exam: BP 136/78, HR 78; appears comfortable at rest. JVP 8 cm, lungs clear, RRR, s1s2 normal, 1/6 systolic murmur near laterally displaced PMI, trace-1+ edema to mid-tibial area

Labs: Na 139, K 4.2, BUN 27, Cr 1.1

Cardiomyopathy workup

- Ischemic or not?
  - EKG, echo, stress testing (coronary CT, cardiac MRI)
- Valvular or congenital heart disease? (echo)
- Arrhythmia as cause?
- Family history
- Substance abuse?
- Evidence of systemic illness?
  - Neuromuscular
  - Rheumatologic
  - Infiltrative (sarcoidosis, amyloidosis, hemochromatosis)
  - Endocrinologic (pheochromocytoma, thyroid disease)
  - Infectious (HIV, viral myocarditis, Lyme, Chagas)
Case #1: further details

- Family history: noncontributory

- Social history: African-American, retired bank teller, lives with husband, no smoking/EtOH or illicit drugs

- Symptoms: short of breath and fatigued, stops halfway up if tries to climb a flight of stairs

Case #1: additional data

- Echo: left ventricular EF 30%, global hypokinesis, mild mitral regurgitation

- Cath: no epicardial coronary disease, EF 32%
Case #1 (continued)

• Current medications:
  – Metoprolol tartrate 50 mg bid
  – lisinopril 10 mg qD
  – furosemide 20 mg qAM
  – Omeprazole 20 mg qD
  – Potassium chloride 10 meQ daily

Maximal evidence-based therapy?

• A) The patient is already on maximal evidence-based HF therapy
• B) One medication could be changed or added
• C) More than one medication could be changed or added
• D) A device should be considered
• E) More than one of the above is correct
RALES study: aldosterone blockade

- Pitt et al. NEJM 341:709, NEJM 348:1309; Zannad et al. NEJM 364:11; Jurrlink et al. NEJM 351:343

- NYHA class III-IV (±II)
- EF < 35% (< 40% post-MI)
- Benefits of eplerenone = spironolactone

- Regular lab monitoring important!
- Watch out for things that can increase K, e.g. diet, NSAIDs, ACE inhibitors, Bactrim

A-HeFT study: hydralazine/nitrates

- Self-described African-American, EF 35% or less, NYHA III-IV
- Three times daily dosing can be problematic
- No PDE-5 inhibitors (e.g. Viagra)
- Headaches are frequent but usually get better with time
- Mean systolic BP ↓ 1.9 mmHg

Taylor et al. NEJM 351:2049
Implantable cardiac defibrillators: SCD-HF study and registry data

Bardy et al. NEJM 352:225; Al-Khatib et al. JAMA 309:55

ICD implantation guidelines

- Cardiac arrest survivors if arrest not from reversible cause (e.g., acute MI)
- EF ≤ 35% and NYHA class II-III heart failure on optimized medications x 3-6 months
- EF ≤ 35% and ischemic cardiomyopathy even if NYHA I

Assess goals of care and life expectancy

NICM
EF ≤ 35%
NYHA II-III

Prior MI
EF ≤ 30%
NYHA I-III

CARE-HF study: biventricular pacing

Cleland et al. NEJM 35:1539

Biventricular pacing guidelines

- NYHA class III-IV heart failure (more recently, also NYHA II)
- EF ≤ 35%
- QRS duration on EKG ≥ 120 ms
- Left bundle branch block pattern

QRS duration ≤ 150 ms responded best (2/3 improved)
Can be done without an ICD
Evidence-based systolic HF treatment: does it work?

**Beta blockers:**
- Carvedilol (Coreg)
- Metoprolol Succinate (Toprol XL)
- Bisoprolol (Zebeta)

**ACE:** probably interchangeable; Lisinopril, captopril, enalapril

**ARB:**
- Valsartan (Diovan) – bid
- Candesartan (Atacand) ± Losartan (?less effective)

**Case #2**

- 72 yo M with nonischemic cardiomyopathy (?viral myocarditis) for five years
  - hospitalized for HF last month
  - Baseline NYHA class III symptoms, ICD in place

- Called your office this AM,
  - “I’m feeling more short of breath.”
  - “My water pills don’t seem to be working.”
  - “I’ve gained 7 pounds in the last 10 days.”
Case #2 (continued)

- Vitals: BP 114/79, HR 80
- JVP near mandible, decreased fremitus and dullness to percussion at R lung base, s1s2, no gallop; 3/6 TR and 2/6 MR murmurs
- Abdomen firm with flanks dull to percussion, 1+ edema to knees bilaterally
- Extremities warm with intact pulses
- Labs: Na 137, K 4.2, BUN 31, Cr 1.5

Case #2 (continued)

- Medications (cardiac): Toprol XL 100 mg daily, lisinopril 10 mg daily, spironolactone 25 mg daily, furosemide 40 mg daily
- Uses pillbox, reports good adherence
- “I take all my pills in a handful with breakfast.”
What should be done next?

- A) Increase the frequency of furosemide dosing
- B) Change to a different loop diuretic
- C) Change the timing of furosemide dose
- D) Increase the dose of furosemide
- E) Add metolazone

Diuretic threshold

At threshold = response in < 1 hour, lasts 4-6 hours afterwards

Sica and Gehr, Clin Pharmacol 30:229
Diuretics – what to know?

- **Loop diuretics:**
  - furosemide 40 mg = Torsemide 20 mg = Bumetanide 1 mg
  - Bumetanide/torsemide more consistently bioavailable, especially if high central venous pressure
  - Food decreases blood levels and time to maximum level of diuretics – take on empty stomach!
  - If still not at diuretic threshold, increase the dose or change agent!

- **Thiazide diuretics:**
  - Use these as primary diuretic if patient doesn’t need loop diuretics
  - Use these if patient’s not responding well to appropriate loop diuretic at appropriate dose timed appropriately
  - “Prime the pump” – use 30 minutes prior to AM loop diuretic dose
  - Use intermittently if you can
  - Expect electrolyte derangement, check labs frequently after instituting

Diuretics – suggested strategy

- Still volume overloaded?
  - Yes: Dietary indiscretion?
    - Yes (educate): Multiple daily loop diuretic doses needed?
    - No: Above diuretic threshold?
      - Yes: Maintain/reduce dose based on clinical status
      - No: Still volume overloaded?
        - Yes: Double furosemide until 120-160 mg/dose
        - No: Taking appropriately?
          - Yes: Add thiazide primer (e.g. metolazone 2.5-5 mg) 30 minutes prior to loop diuretic
          - No: Maintain/reduce loop diuretic frequency based on labs/clinical status

- Still volume overloaded?
  - No: Above diuretic threshold?
    - Yes: Maintain/reduce dose based on clinical status
    - No: Double furosemide until 120-160 mg/dose
Rising creatinine = over-diuresed? Low cardiac output? Physical exam is helpful!

**Higher, not lower, central venous pressure predicts poor renal function in HF, and predicts better than cardiac output!**


---

**Systolic vs ‘Diastolic’ HF**

Ventricular remodeling in diastolic and systolic heart failure

Normal heart  Hypertrrophied heart (diastolic heart failure)  Dilated heart (systolic heart failure)
Current concept of “diastolic” heart failure

May not be the same disease in all patients!

Heart failure with preserved ejection fraction (HFPEF) – why haven’t trials ‘worked?’

1) 88 year-old woman with obesity, DM, longstanding HTN; BP 190/90, Cr 1.8
   Poor HTN control? Undiagnosed CAD? Renal artery stenosis?

2) 65 year-old man with coronary artery disease s/p CABG 5 months ago
   Recurrent CAD? Pericardial constriction? Atrial arrhythmias?
   Post-operative deconditioning?

3) 84 year-old man with BP 89/46, osteoarthritis and history prostate cancer s/p resection
   CAD? Hypertrophic cardiomyopathy? Restrictive cardiomyopathy?
   Sarcoidosis? Amyloidosis? (remember TTR)
Heart Failure With Preserved Ejection Fraction
Treat Now by Treating Comorbidities

Sanjit J. Shah, MD
Vikram Ghosh, MD

Heart failure (HF) is a major public health problem, with a prevalence of more than 3 million cases and an incidence of 660,000 new cases per year in the United States alone. Among patients older than 65 years, HF has become the most common discharge diagnosis and the primary cause of readmission within 60 days of discharge, resulting in estimated costs of $34.8 billion per year. Nearly half of all patients with HF have a preserved ejection fraction (HFrEF). Patients with HFrEF have a high all-cause mortality after hospitalization for HF: 2.9% in hospital mortality; 9.3% by 90-day mortality. Proposed causes of increased mortality in HFrEF include atrial fibrillation (32%-41%), diabetes mellitus (32%-43%), chronic kidney disease (23%-26%), cerebrovascular disease (15%) as well as obesity and anemia. In the Acute Decompensated Heart Failure National Registry (ADHERE) study, 91% of patients with HFrEF had a diagnosis of hypertension, CAD, or diabetes. Secular trends demonstrate that the prevalence of comorbidities in patients with HFrEF is continuing to increase. CAD may be especially important in patients with HFrEF. Although CAD appears to be less common in patients with HFrEF than in patients with HF and reduced ejection fraction, the prevalence and severity of angiographically documented CAD in patients with HFrEF has not been well studied. In the Coronary Artery Surgery Study (CASS), in which CAD was documented by coronary angiography, the presence

Case #3

- 79 yo F with longstanding difficult-to-control HTN (systolic BP often 160-200), DM2 with neuropathy, CAD s/p remote stenting, anemia, hypothyroidism, stage III chronic kidney disease (baseline Cr 1.3-1.7), history of hyperkalemia on Bactrim, old LUE AV fistula (never used), polymyalgia rheumatica, osteoarthritis

- Echo: EF 70%, bi-atrial enlargement, grade 2 diastolic dysfunction, pulmonary hypertension (RV systolic estimated at 65 mmHg)

- 3 hospitalizations for HF in prior 1 year, course often complicated by worsening renal function
Case #3 (continued)

• 5 hours after Thanksgiving dinner:
  – Orthopnea, severe dyspnea walking around room
  – Pulse oximeter 70% on 2 liters nasal cannula

• In emergency department -> hospital
  – Diffuse pulmonary edema
  – Markedly elevated blood pressure requiring nitroprusside drip
  – Troponins normal, EF normal
  – Intubated x 5-6 days

One month later in my clinic, we meet for the first time…

• Vitals: 126/62, HR 64, O2sat 92% (RA)
• No evidence of volume overload
• RRR, normal s1, pronounced aortic component of second heart sound, +s4 gallop; PMI non-displaced, no murmurs

• Labs: Na 141, K 4.8, BUN 79, Cr 1.7, BNP 388
• EKG: NSR @ 61, lateral T wave inversions (old)

• Heart failure self-care: remembers eating pizza and very salty Italian soup during the couple of days prior to Thanksgiving dinner, which was also quite salty. Takes diuretics with breakfast, > 2 hours for response
Case #3 (continued)

Baseline medications:

- **bumetanide 4 mg qD**, darbepoetin, Colace, iron sulfate, gabapentin 300 mg qHS, Imodium prn, Synthroid 100 micrograms daily, Lidoderm patch p.r.n., **metoprolol tartrate 200 mg bid**, minoxidil 10 mg bid, mirtazapine 30 mg qHS, omeprazole, NCO2 at nighttime, potassium chloride 40 meQ daily, **prednisone 10 mg qD**, simvastatin 40 mg qHS, **tramadol 50 mg bid prn**, Tylenol Arthritis 650 mg bid, Viactiv

- Previous intolerance to ACE due to renal insufficiency; renal ultrasound did not suggest renal artery stenosis

Dietary sodium restriction advice at hospital discharge

*Figure 2. Comparison of ACC/AHA discharge recommendation documentation by heart failure type*
Predictors of 30-day death and readmission in Michigan HFPEF

<table>
<thead>
<tr>
<th>Variable</th>
<th>Univariate 30-day mortality or readmission (OR 95% CI)</th>
<th>Adjusted 30-day mortality or readmission (OR 95% CI)</th>
<th>Adjusted 30-day readmission only (OR 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HFPEF severe (Casualties)</td>
<td>1.15 (1.04-1.26)</td>
<td>1.01 (0.89-1.13)</td>
<td>0.98 (0.88-1.09)</td>
</tr>
</tbody>
</table>

Hummel et al. 2009 AJM

Case #3 (follow-up)

- Extensive dietary education, reinforced by dietitian visits and at clinic
- Close follow-up through nurse telemanagement
- Gradual change of antihypertensives
  - Amlodipine for minoxidil
  - Carvedilol for metoprolol
  - Chlorthalidone added
  - Bumetanide dose increased, but intermittent use on empty stomach with improved response

- No hospitalizations x 3+ years
Case #4

- 66 yo M admitted for decompensated HF
- 4\textsuperscript{th} HF admission in last 12 months
- Ischemic cardiomyopathy s/p CABG

- Obesity, DM2, sleep apnea, baseline Cr 1.4 with microalbuminuria
- ICD in place
- Previously taken off of ACE inhibitor due to low blood pressure and worsening renal insufficiency, had prior hyperkalemia on spironolactone

- Current symptoms: dyspnea while bathing/dressing, 4-5 pillow orthopnea, paroxysmal nocturnal dyspnea, nausea, early satiety
Case #4 (continued)

• Vitals: BP 91/57, HR 86, O2 sat 98% on 2l NCO2
• Chronically ill, NAD lying at 45 degrees
• JVP 2/3 up neck
• Decreased lung sounds bilateral bases, no rales
• Tachy/regular s1, pulmonary s2 > aortic s2, +s3; PMI lateral, + parasternal lift
• Abdomen slightly firm, liver edge 3 cm below costal margin and mildly tender
• 2+ edema to knees, feet slightly cool to touch with faintly palpable pulses

Case #4 (continued)

• Cath on last admission: no targets for revascularization
• Echo: EF 15%, moderate RV systolic dysfunction, moderate MR, moderate TR
• EKG: NSR, Q waves v1-2 (old), QRS 110 ms
• Labs: Na 128, K 4.5, BUN 54, Cr 2.3, BNP 685
• Medications (cardiac): carvedilol 3.125 mg bid, bumetanide 4 mg qD, metolazone 5 mg qD, aspirin, atorvastatin 20 mg qHS
What is this patient’s one-year mortality?

• A) 10%
• B) 25%
• C) 40%
• D) 60%
• E) 90%

Survival post-HF hospitalization

Figure. In the Worcester Heart Failure Study, the total death rates were high throughout the 5-year follow-up period among patients discharged after hospitalization for decompensated heart failure.

Goldberg et al. ArchIntMed 167:490
ADHERE Registry: In-Patient Mortality

Evaluated > 39 predictors of HF death 2001-03. Mean age 73, >40% with EF >40%.

Seattle Heart Failure Model

http://depts.washington.edu/shfm/
What is the appropriate next step?

- A) Upgrade ICD to biventricular pacing device
- B) Discontinue beta-blocker, increase diuretics
- C) Refer to transplant/LVAD capable center
- D) Begin intravenous inotropic support
- E) Refer to hospice program

Intravenous inotropes

- The good:
  - Improve NYHA class
  - Improve self-reported QOL
  - Can improve end-organ function
  - Effective bridge to transplantation

- The bad:
  - Can increase arrhythmias and ICD shocks
  - Neutral effect or increase in overall mortality
  - No clear reduction in hospitalizations
  - Require PICC line or indwelling central port
  - Complex to manage for some patients
  - Many insurance plans (including Medicare) require multiple right heart caths to prove benefit

The ugly: Too expensive for most hospice programs
Back to our patient: “optimal” medical management?

Stevenson et al. Circ 110: 975

ADULT HEART TRANSPLANTATION
Kaplan-Meier Survival by Era

All comparisons are significant at p < 0.0001

ISHLT
J Heart Lung Transplant. 2010 Oct; 29 (10): 1083-1141
Left ventricular assist devices

Thoratec Heart Mate II  HeartWare HVAD

LVAD as destination therapy

Dick Cheney is a robot! When he goes to the hospital, it’s to get his circuits rewired.
What can you expect if you have an LVAD and survive the initial implantation?

- Improved length/quality of life
- Unless other contraindications, excellent survival to transplant
- 2-3 hospitalizations per year
- Change batteries 2-3 times/day, plug device in at night
- Daily sterile dressing changes, inspection of driveline site
- Need to know how to respond (quickly and correctly) to various alarms
- Warfarin-based anticoagulation
- 24-hour supervision, no showering, no driving

Contraindications to LVAD/transplant

- Cardiovascular
  - Severe pulmonary hypertension*
  - Right ventricular failure†
  - Severe aortic insufficiency †
  - ‘Porcelain aorta’

- Noncardiovascular
  - Age > 70?*, > 75-80? †
  - BMI > 35*, > 40? †
  - Excessive surgical risk

- Noncardiovascular (con’t)
  - Severe renal dysfunction
  - Hepatic dysfunction
  - Non-HF life-limiting illness
  - Bleeding/clotting diathesis
  - Active cancer
  - Cognitive limitations
  - Poor support network
  - Active tobacco*/drug abuse
  - Nonadherence to therapy
  - Inability to rehabilitate

* transplant, † LVAD
What? Other outcomes are important in HF besides death and readmission?

Patient preferences in advanced HF

Allen et al. Circ 125:1928

Stevenson et al. JACC 52:1702
Hospitals Face Pressure to Avert Readmissions


What predicts readmissions?

LACE model: Length of stay, Acuity of admission, Charlson comorbidity score, Emergency room visits in last 6 months

CMS model: calculator available at: http://readmissionscore.org

Neither has very high predictive accuracy

Hummel (unpublished data)
Hospitalization in older HF patients

Vinson et al. (1990, U.S.)
- 53% of readmissions likely preventable
- Nonadherence to meds 15%/diet 18%
- Poor discharge planning 15%/follow-up 20%
- Poor social support 21%
- Did not seek attention for symptoms 20%

Michalsen (1998, Germany)
- 179 pts admitted for HF, mean age 75
- Nonadherence to drugs/diet in 42%

Rodriguez-Artalejo et al. (2006, Spain)
- Poor social support = prior admissions
- 4 simple questions:
  - Married, live alone, daily contact, alone <2 hrs


Cognitive impairment in HF

<table>
<thead>
<tr>
<th>Study</th>
<th>Heart Failure n/N</th>
<th>Control n/N</th>
<th>OR (95% CI)</th>
<th>Weight %</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alemi et al.</td>
<td>97/66</td>
<td>16/70</td>
<td>0.82 (0.59-1.19)</td>
<td>17%</td>
<td>0.82 (0.59-1.19)</td>
</tr>
<tr>
<td>Cacciatore et al.</td>
<td>20/68</td>
<td>33/176</td>
<td>2.40 (0.94-6.05)</td>
<td>25%</td>
<td>2.40 (0.94-6.05)</td>
</tr>
<tr>
<td>Conde-Verde et al.</td>
<td>20/63</td>
<td>38/93</td>
<td>0.40 (0.17-0.97)</td>
<td>15%</td>
<td>0.40 (0.17-0.97)</td>
</tr>
<tr>
<td>Grubesic et al.</td>
<td>12/14</td>
<td>6/16</td>
<td>0.68 (0.06-6.62)</td>
<td>10%</td>
<td>0.68 (0.06-6.62)</td>
</tr>
<tr>
<td>Hoven et al.</td>
<td>12/49</td>
<td>72/297</td>
<td>1.00 (0.79-1.24)</td>
<td>10%</td>
<td>1.00 (0.79-1.24)</td>
</tr>
<tr>
<td>Melo et al.</td>
<td>144/509</td>
<td>121/1207</td>
<td>0.50 (0.36-0.69)</td>
<td>10%</td>
<td>0.50 (0.36-0.69)</td>
</tr>
<tr>
<td>Zucali et al.</td>
<td>412/1560</td>
<td>2296/1202</td>
<td>0.70 (0.52-0.93)</td>
<td>15%</td>
<td>0.70 (0.52-0.93)</td>
</tr>
</tbody>
</table>

Total (65% CI) | 239/7 | 149/40 |


- Inpatients
  - Prolonged length of stay
  - Functional decline and need for long-term care
  - Increased long-term mortality

- Outpatients
  - Poor functional capacity
  - Worse quality of life
  - Increased risk for hospitalization
  - Poor self-care

Comorbidity, Disability Burden, and Polypharmacy in HF patients

Table 3  Trends in Disability and Impairment among Patients with Heart Failure

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility disabled*</td>
<td>52.6 (3.2)</td>
<td>57.6 (4.2)</td>
<td>56.8 (2.8)</td>
<td>4.3 (-4.1 to 12.7)</td>
<td>.11</td>
</tr>
<tr>
<td>Activities of daily living disabled*</td>
<td>12.5 (1.0)</td>
<td>13.8 (2.1)</td>
<td>11.1 (1.5)</td>
<td>-1.4 (-6.2 to 3.4)</td>
<td>.57</td>
</tr>
<tr>
<td>Vision impaired*</td>
<td>11.8 (1.7)</td>
<td>11.1 (2.8)</td>
<td>11.3 (1.8)</td>
<td>-0.1 (-4.9 to 4.7)</td>
<td>.97</td>
</tr>
</tbody>
</table>

Table 4  Trends in Prescription Medication Use among Patients with Heart Failure

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of prescription medications</td>
<td>4.1 (0.2)</td>
<td>5.1 (0.3)</td>
<td>6.4 (0.2)</td>
<td>2.4 (1.8-2.9)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>


What works for HF readmissions?

1 hour of discharge education

Early post-discharge follow-up in clinic

Nurse-directed multidisciplinary care
Intensive HF and dietary education
Medication reconciliation
Transitional care planning
Home care services follow-up

Figure 1. Kaplan–Meier Curves for the Probability of Not Being Readmitted to the Hospital during the 90-Day Period of Risk.
Take-home messages

• Systolic heart failure has extensive evidence-based treatment that reduces mortality
• Ask about diuretic threshold, educate on self-care and appropriate dosing, then adjust dosing
• Don’t give up on ‘diastolic’ heart failure – think about underlying causes and manage comorbidities