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Disclosures

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• In this activity, no persons associated with this activity have disclosed any relevant financial relationships.
Learning Objectives

- Review guideline-directed medical therapy (GDMT) for patients with chronic heart failure (HF), including the role of newer agents.
- Describe the clinical pharmacy services that improve care and reduce hospital readmissions for patients with HF.
- Using case scenarios, illustrate the pharmacist’s role in addressing barriers to the management of HF.

Abbreviations

- ACEI=angiotensin converting enzyme inhibitor
- ADRs=adverse drug reactions
- ARB=angiotensin receptor blocker
- ARNI=angiotensin receptor-neprilysin inhibitor
- BID/TID=twice daily/three times daily
- BNP=b-type natriuretic peptide
- BP=blood pressure
- CI=confidence interval
- CMR=comprehensive medication reconciliation
- CV=cardiovascular
- ED=emergency department
- eGFR=estimated glomerular filtration rate
- GDMT=guideline-directed medical therapy
- HF=heart failure
- HFrEF=heart failure with reduced ejection fraction
- HMO=health maintenance organization
- HYD=hydralazine
- HR=heart rate
- ISDN=isosorbide dinitrate
- LVEF=left ventricular ejection fraction
- MI=myocardial infarction
- MOA=mechanism of action
- MRA/ARA = mineralocorticoid receptor/aldosterone receptor antagonist
- NRCT=non-randomized clinical trial
- NSR=normal sinus rhythm
- NYHA=New York Heart Association
- NT-proBNP=N-terminal pro b-type natriuretic peptide
- PPO=preferred provider organization
- RAAS=renin-angiotensin-aldosterone system
- RCT=randomized controlled trial

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Case: MD, a 76-year-old African-American Female

- Past medical history
  - HFrEF (3rd hospitalization in 1 year)
  - Dyslipidemia
  - Diabetes mellitus (DM)
  - Hypertension
  - Chronic kidney disease

- Home medications (adherence appears good)
  - Lisinopril 40 mg daily
  - Metoprolol succinate 100 mg daily
  - Bumetanide 1 mg daily
  - Metformin 500 mg twice daily
  - Atorvastatin 80 mg daily
  - Potassium chloride 20 mEq daily

- Being discharged from hospital
- Lives with son (primary caregiver)
- Patient is a poor historian with low health literacy
- Insurance: Medicare HMO/PPO
- Medication changes made prior to discharge
  - Increased bumetanide to 1 mg twice daily
  - Increased metoprolol succinate to 200 mg daily
  - Added spironolactone 12.5 mg daily
  - Discontinued potassium chloride

Guideline-Directed Management of Chronic Heart Failure

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HF in 2018

- #big problem, #long way to go
- Prevalence: 5.7 million (US)
- Annual mortality: 75,251
- Lifetime risk @ age 45 years: 1 in 2-5

Estimated HF Prevalence

<table>
<thead>
<tr>
<th>Year</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.7M</td>
</tr>
<tr>
<td>2030</td>
<td>8M</td>
</tr>
</tbody>
</table>

↑46%


HF: The Other Problem

- #1 Reason for hospital readmission
  ≈1,000,000 admissions annually (US)
- #1 Discharge diagnosis in the elderly
  ≈540,600 age ≥65 years annually (US)
- #1 Principal condition for ED visit in the elderly
  ≈500,000 ED visits annually

HF Mortality After Hospitalization

Guideline-Directed Medical Therapy (GDMT) for HF

### Class of Recommendation (COR) and Level of Evidence

<table>
<thead>
<tr>
<th>COR</th>
<th>Benefit</th>
<th>Risk</th>
<th>Level</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (Strong)</td>
<td>Benefit &gt;&gt;&gt; Risk</td>
<td>Level A</td>
<td>High-quality RCT</td>
<td></td>
</tr>
<tr>
<td>IIa (Moderate)</td>
<td>Benefit &gt;&gt; Risk</td>
<td>Level B-R</td>
<td>Moderate-quality RCT</td>
<td></td>
</tr>
<tr>
<td>IIb (Weak)</td>
<td>Benefit ≥ Risk</td>
<td>Level B-NR</td>
<td>Moderate-quality NRCT</td>
<td></td>
</tr>
<tr>
<td>III: No Benefit (Moderate)</td>
<td>Benefit = Risk</td>
<td>Level C-LD</td>
<td>Limited data</td>
<td></td>
</tr>
<tr>
<td>III: Harm (Strong)</td>
<td>Risk &gt; Benefit</td>
<td>Level C-EO</td>
<td>Expert opinion</td>
<td></td>
</tr>
</tbody>
</table>

### Heart Failure Stages

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk for HF but without structural heart disease or symptoms of HF</td>
<td>Structural heart disease but without signs or symptoms of HF</td>
<td>Structural heart disease with prior or current symptoms of HF</td>
<td>Refractory HF requiring specialized interventions</td>
</tr>
<tr>
<td>ACEI or ARB in appropriate patients for vascular disease/diabetes mellitus Statins as appropriate</td>
<td>ACEI or ARB Beta-blocker</td>
<td>Diuretics ACEI or ARB (or ARNI) Beta-blocker MRA</td>
<td>Advanced measures Heart transplantation Chronic inotropes Mechanical Circulatory Support Palliative care</td>
</tr>
</tbody>
</table>

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Pharmacological Treatment for Stage B HF With Reduced Ejection Fraction


HFrEF Stage B
NYHA FC I

Class I, LOE A
ACEI or ARB

Class I, LOE B/C
Beta-blocker

Class III:
Harm, LOE B
Non-DHP CCB

Non-DHP CCB = non-dihydropyridine calcium channel blocker

ACE Inhibitor or ARB

<table>
<thead>
<tr>
<th>SOLVD-Prevention</th>
<th>SOLVD-Treatment</th>
<th>CONSENSUS</th>
<th>SAVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYHA FC I</td>
<td>NYHA FC II-III</td>
<td>NYHA FC IV</td>
<td>Post-MI+EF&lt;40%</td>
</tr>
<tr>
<td>59 yo</td>
<td>61 yo</td>
<td>70 yo</td>
<td>59 yo</td>
</tr>
<tr>
<td>N = 4228</td>
<td>2569</td>
<td>253</td>
<td>2231</td>
</tr>
<tr>
<td>LVEF 28%</td>
<td>25%</td>
<td>31%</td>
<td>31%</td>
</tr>
<tr>
<td>Enalapril 10 mg BID</td>
<td>Enalapril 10 mg BID</td>
<td>Enalapril 20 mg BID</td>
<td>Captopril 50 mg TID</td>
</tr>
<tr>
<td>37 mo</td>
<td>41 mo</td>
<td>12 mo</td>
<td>42 mo</td>
</tr>
<tr>
<td>Relative Risk Reduction 8% (p=0.3)</td>
<td>16% (p=0.0036)</td>
<td>31% (p=0.001)</td>
<td>19% (p=0.019)</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>All-cause mortality</td>
<td>All-cause mortality</td>
<td>All-cause mortality</td>
</tr>
</tbody>
</table>

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**Beta-blockers**

<table>
<thead>
<tr>
<th>MDC</th>
<th>MERIT-HF</th>
<th>US Carvedilol</th>
<th>COPERNICUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYHA FC II, III</td>
<td>II, III, (IV)</td>
<td>II, III</td>
<td>IV</td>
</tr>
<tr>
<td>49 yo</td>
<td>64 yo</td>
<td>58 yo</td>
<td>63 yo</td>
</tr>
<tr>
<td>N = 383</td>
<td>3991</td>
<td>1094</td>
<td>2289</td>
</tr>
<tr>
<td>LVEF 22%</td>
<td>28%</td>
<td>22%</td>
<td>20%</td>
</tr>
<tr>
<td>Metoprolol</td>
<td>Metoprolol XL</td>
<td>Carvedilol 50-100 mg/day</td>
<td>Carvedilol 50 mg/day</td>
</tr>
<tr>
<td>100-150 mg/day</td>
<td>200 mg/day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 mo</td>
<td>12 mo</td>
<td>6.5 mo</td>
<td>10.4 mo</td>
</tr>
<tr>
<td>Odds Ratio</td>
<td>0.66</td>
<td>0.35</td>
<td>0.65</td>
</tr>
<tr>
<td>(p=0.058)</td>
<td>(95% CI 0.53-0.81)</td>
<td>(0.20-0.61)</td>
<td>(0.52-0.81)</td>
</tr>
<tr>
<td>All-cause mortality + transplantation</td>
<td>All-cause mortality</td>
<td>All-cause mortality</td>
<td>All-cause mortality</td>
</tr>
</tbody>
</table>

**Pharmacological Treatment for Stage C HF With Reduced Ejection Fraction**

- **HFrEF Stage C**
  - NYHA FC I-IV
    - ACEi or ARB* + Beta-blocker; diuretic as needed (COR I)
    - NYHA FC II-IV, K<5.0, CrCl >30 (COR I)
    - Switch to ARNI (COR I)
    - HYD/ISDN (COR I)
    - Ivabradine (COR IIa)

*HYD/ISDN for ACEi/ARB intolerant

ACEi or ARB or ARNI

- In patients with chronic symptomatic HFrEF NYHA class II or III who tolerate an ACEI or ARB, replacement by an ARNI is recommended to further reduce morbidity and mortality. (COR I, B-R)
- ARNI should not be administered concomitantly with ACEI or within 36 hours of the last dose of an ACEI. (COR III, B-R)
- ARNI should not be administered to patients with a history of angioedema. (COR III, C-EO)


Angiotensin Receptor and Neprilysin Inhibitor (ARNI)

Valsartan + Sacubitril

- Attenuate negative effects of angiotensin II
- Boost positive effects of the natriuretic peptides (& other vasodilatory peptides)

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### PARADIGM-HF – Study Design

**Single-blind Active Run-in Period**
- **Enalapril 10 mg BID Run-in**
- **LCZ696 100 mg BID Run-in**
- **LCZ696 200 mg BID Run-in**

**Double-blind Treatment Period**
- **LCZ696 200 mg BID**
- **Enalapril 10 mg BID**

- 2 weeks
- 1-2 weeks
- 1-2 weeks

LCZ696 = sacubitril/valsartan


### PARADIGM-HF – Baseline Characteristics

<table>
<thead>
<tr>
<th></th>
<th>LCZ696</th>
<th>Enalapril</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yr</td>
<td>64</td>
<td>64</td>
</tr>
<tr>
<td>Female, %</td>
<td>21.0</td>
<td>22.6</td>
</tr>
<tr>
<td>Black Race, %</td>
<td>5.1</td>
<td>5.1</td>
</tr>
<tr>
<td>SCr, mg/dL</td>
<td>1.13</td>
<td>1.12</td>
</tr>
<tr>
<td>NYHA FC, %</td>
<td>I:4.3  II:71.6 III:23.1 IV:0.8</td>
<td>I:5.0 II:69.3 III:24.9 IV:0.6</td>
</tr>
<tr>
<td>Pretrial Use, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACEI</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>ARB</td>
<td>22</td>
<td>23</td>
</tr>
</tbody>
</table>

## PARADIGM-HF - Results

<table>
<thead>
<tr>
<th>%</th>
<th>LCZ696 (n=4187)</th>
<th>Enalapril (n=4212)</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary endpoint</strong></td>
<td>21.8</td>
<td>26.5</td>
<td>0.80 (0.73-0.87)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Cardiovascular death</strong></td>
<td>13.3</td>
<td>16.5</td>
<td>0.80 (0.71-0.89)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Hospitalization for HF</strong></td>
<td>12.8</td>
<td>15.6</td>
<td>0.79 (0.71-0.89)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>


## PARADIGM-HF - Results

<table>
<thead>
<tr>
<th>%</th>
<th>LCZ696 (n=4187)</th>
<th>Enalapril (n=4212)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypotension (symptomatic)</td>
<td>14.0</td>
<td>9.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Elevated SCr (≥2.5 mg/dL)</td>
<td>3.3</td>
<td>4.5</td>
<td>0.007</td>
</tr>
<tr>
<td>Elevated K+ (&gt;6.0 mmol/L)</td>
<td>4.3</td>
<td>5.6</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>


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Mineralocorticoid/Aldosterone Receptor Antagonists (MRAs/ARAs)

- ARAs (or MRAs) are recommended in patients with NYHA class II–IV HF and who have LVEF ≤35% to reduce morbidity and mortality. (COR I, LOE A)
  - NYHA class II HF should have a history of prior CV hospitalization or elevated plasma natriuretic peptide levels
  - SCr should be ≤2.5 mg/dL in men or ≤2.0 mg/dL in women (or eGFR >30 mL/min/1.73 m2), and potassium should be <5.0 mEq/L.
- ARAs are recommended to reduce morbidity and mortality following an acute MI in patients who have LVEF of 40% or less who develop symptoms of HF or who have a history of diabetes mellitus, unless contraindicated. (COR I, LOE B)


Ivabradine

- Ivabradine can be beneficial to reduce HF hospitalization for patients with (COR IIa, LOE B-R):
  - symptomatic (NYHA class II-III) stable chronic HFrEF (LVEF ≤35%)
  - receiving guideline-directed evaluation and management (GDEM), including a beta blocker at maximum tolerated dose
  - sinus rhythm with a heart rate of 70 bpm or greater at rest

**Ivabradine**

Ivabradine is an antagonist of the $I_f$ current (aka “funny” current) [hyperpolarization-activated cyclic nucleotide-gated (HCN) channel blocker]

Reduces SA node automaticity

Reduction in Heart Rate

No appreciable effect on Contractility or BP

---

**Systolic Heart failure treatment with the $I_f$ inhibitor ivabradine Trial (SHIFT)**

- N=6558
- 23 month follow-up (HR 8-9 bpm lower with ivabradine vs. placebo)

<table>
<thead>
<tr>
<th></th>
<th>Ivabradine</th>
<th>Placebo</th>
<th>HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV death or HF hospitalization</td>
<td>24</td>
<td>29</td>
<td>0.82 (0.75-0.90)</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>16</td>
<td>17</td>
<td>0.90 (0.80-1.02)</td>
</tr>
<tr>
<td>CV death</td>
<td>14</td>
<td>15</td>
<td>0.91 (0.80-1.03)</td>
</tr>
<tr>
<td>HF hospitalization</td>
<td>16</td>
<td>21</td>
<td>0.74 (0.66-0.83)</td>
</tr>
</tbody>
</table>

Ivabradine

- **Contraindications:**
  - Atrial fibrillation (AF)
  - Advanced AV block, sick sinus syndrome (unless pacemaker)
  - Pacemaker dependent
  - Severe hepatic impairment
  - Acute decompensated HF
  - BP < 90/50 mm Hg

- **ADRs:**
  - Bradycardia, phosphenes, atrial fibrillation, hypertension

- **Drug-drug interaction:**
  - CYP 3A4 substrate (avoid with concomitant strong 3A4 inhibitors/inducers)

- **Monitoring:**
  - HR, development of AF

Digoxin

- **Digoxin can be beneficial in patients with HFrEF, unless contraindicated, to decrease hospitalizations for HF.** (COR IIa, LOE B)

### Digitalis Investigation Group (DIG) trial

#### Serum Digoxin Concentrations and Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Digoxin</th>
<th>Placebo</th>
<th>RR (relative risk) (95% CI) p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality (%)</td>
<td>34.8</td>
<td>35.1</td>
<td>0.99 (0.91-1.07)</td>
</tr>
<tr>
<td>Death due to worsening HF (%)</td>
<td>11.6</td>
<td>13.2</td>
<td>0.88 (0.77-1.01)</td>
</tr>
<tr>
<td>Hospitalizations (%)</td>
<td>64.3</td>
<td>67.1</td>
<td>0.92 (0.87-0.98)</td>
</tr>
</tbody>
</table>


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The Challenge of Optimizing GDMT for HF

Initiating GDMT

• Initiation of RAAS inhibitor or beta-blocker first?

WET  OR  DRY

RAAS Inhibitor  Beta-blocker

**CIBIS III**

- N=1010 patients, mild to moderate chronic HF (LVEF ≤35%)
- Not receiving ACEi, beta-blocker, or ARB therapy

![Diagram showing treatment options]

**Bisoprolol-first treatment was noninferior to enalapril-first treatment**


**Initiating GDMT**

- When to switch from ACEi/ARB to ARNI?

  - Tolerating ACEi or ARB
  - NYHA FC II-III
  - (COR 1, LOE B-R)

  - **Ensure 36 hr washout of ACEi**
  - **Adequate BP**
  - **eGFR ≥30 mL/min/m²**

  - ≤20 mg/day or ≤160 mg/day valsartan: ARNI 24/26 mg twice daily
  - >20 mg/day enalapril or >160 mg/day valsartan: ARNI 49/51 mg twice daily

### Titrating GDMT

- Generally, consider titrating doses of GDMT every 2 weeks

<table>
<thead>
<tr>
<th></th>
<th>Starting Dose</th>
<th>Target Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisoprolol</td>
<td>1.25 mg daily</td>
<td>10 mg daily</td>
</tr>
<tr>
<td>Carvedilol</td>
<td>3.125 mg twice daily</td>
<td>25-50 mg twice daily</td>
</tr>
<tr>
<td>Metoprolol succinate</td>
<td>12.5-25 mg daily</td>
<td>200 mg daily</td>
</tr>
<tr>
<td>Sacubitril/valsartan</td>
<td>24/26-49/51 mg twice daily</td>
<td>97/103 mg twice daily</td>
</tr>
<tr>
<td>Captopril</td>
<td>6.25 mg three times daily</td>
<td>50 mg three times daily</td>
</tr>
<tr>
<td>Enalapril</td>
<td>2.5 mg three times daily</td>
<td>10-20 mg three times daily</td>
</tr>
<tr>
<td>Lisinopril</td>
<td>2.5-5 mg daily</td>
<td>20-40 mg daily</td>
</tr>
<tr>
<td>Candesartan</td>
<td>4-8 mg daily</td>
<td>32 mg daily</td>
</tr>
<tr>
<td>Losartan</td>
<td>25-50 mg daily</td>
<td>150 mg daily</td>
</tr>
<tr>
<td>Losartan</td>
<td>12.5-25 mg daily</td>
<td>25-50 mg daily</td>
</tr>
<tr>
<td>Spironolactone</td>
<td>25 mg daily</td>
<td>50 mg daily</td>
</tr>
<tr>
<td>Eplerenone</td>
<td>25-50 mg daily</td>
<td></td>
</tr>
<tr>
<td>Hydralazine/isosorbide dinitrate</td>
<td>25/20 mg three times daily</td>
<td>75/40 mg three times daily</td>
</tr>
</tbody>
</table>


### Titrating GDMT

#### Ivabradine

- Reassess HR in 2-4 weeks

<table>
<thead>
<tr>
<th>HR &lt;50 bpm or symptoms of bradycardia:</th>
<th>↓ by 2.5 mg twice daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR 50-60 bpm:</td>
<td>Maintain dose</td>
</tr>
<tr>
<td>HR &gt;60 bpm:</td>
<td>↑ by 2.5 mg twice daily</td>
</tr>
</tbody>
</table>


#### ARNI

- Consider increasing dose in 2-4 weeks
The Pharmacist’s Role in Heart Failure Care: Getting Back to the Basics

Robert J. DiDomenico, Pharm.D., FACC, FCCP, FHFS
Associate Professor
University of Illinois at Chicago College of Pharmacy
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Consider

What barriers do you encounter when working to optimize drug therapy for patients with chronic HF, especially during transitions of care?
Clinical Predictors of HF Readmission

Opportunities for Improvement?

- Acute coronary syndrome (ACS), ischemia
- Increasing age
- Anemia
- Arrhythmia
- Depression
- Hyponatremia
- Low LVEF

- NYHA class IV symptoms
- Pneumonia/respiratory process
- Suboptimal HF medication regimen
- Uncontrolled hypertension (HTN)
- Worsening renal function

Nonclinical Predictors of HF Readmission Opportunities for Improvement?

- **Socioeconomic**
  - Medicaid recipient
  - Income inadequacy

- **Psychosocial**
  - Poor social support
  - Low health literacy
  - Low prescription label reading score/ability
  - Medication/dietary nonadherence

- **Patient-centered & health system**
  - Distressing symptoms
  - Poor self-care
  - Low readiness for discharge
  - Inconvenient or lack of early follow-up scheduled


Causes of HF Readmission in Older Adults

- Nonadherence: meds (~33%)
- Nonadherence: diet (~35%)
- Inadequate discharge planning
- Inadequate follow-up
- Failed support system
- Failure to seek care

Medication-Related Readmissions

- Systematic review of 19 studies
- Prevalence (n=12 studies)
  - Median 21% (IQR 14 - 23%)
  - Range 3 – 64%
- Preventability (n=4 studies)
  - Median 69% (IQR 19 – 84%)
    - Range 5 – 87%
  - Drug-related problems: 76%

- Most common drugs causing preventable readmissions
  - Vitamin K antagonists
  - Diuretics
  - Heparin derivatives
  - Antihypertensives
  - Digitalis glycosides
  - Antiplatelets


How Can We Help?

Basic Pharmacist Interventions That Improve Care
Patient Education & Discharge Counseling
Heart Failure and Post-Myocardial Infarction

- Address barriers
- Perform thorough review of medications
- Use inpatient and outpatient settings
- Assess readiness to learn
- Vary teaching methods
- Engage caregivers
- Engage other team members
- Optimize written materials
- Emphasize self-care
- Employ teach-back method
- Assess patient resources
- Refer to disease management programs
- Focus on smooth care transitions


Inpatient Medication Histories
Clinical & Economic Outcomes

- ↓ ADRs
  - 1 of 8 clinical pharmacy services
- ↓ Drug costs
  - 1 of 4 clinical pharmacy services
- ↓ Total costs
  - 1 of 6 clinical pharmacy services
- ↓ Inpatient mortality
  - 1 of 7 clinical pharmacy services
- Services with ≥2 favorable associations with outcomes
  - Drug information
    - Admission medication histories
  - ADR program/management
  - Collaborative drug management
  - Participation on medical rounds


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Pharmacy Medication Reconciliation
Clinical Outcomes

Outcomes
• ↓ Medication discrepancies
  – 10 of 10 studies
• ↓ Potential adverse drug events (ADEs)
  – 2 of 3 studies
• ↓ Preventable ADEs
  – 1 study
• ↓ Health care resource use
  – 2 of 7 studies

Themes from Successful Programs
• Limit to older adult patients
  – ≥70 or 80 years
• Intensive staff involvement
  – Med history/reconciliation on admission, during hospitalization, and at discharge
• Communication with primary care provider
• Phone follow up after discharge


Medication History, Reconciliation, Education
Time to Get Back to the Basics

• Separate survey of 950 U.S. hospitals
  – RPh performs admission medication histories in <5% hospitals
  – RPh provides medication counseling/patient education in <50% hospitals

Barriers to Effective Transitions of Care (TOC)
Opportunities for Pharmacists to Improve Care

- Poor readiness for discharge
- Poor health literacy
- Paperwork/third-party payer
- Poor communication
  - Teaching methods often reliant on written materials
  - No engagement of caregiver(s)
  - System challenges
  - Patient factors
- Poor postdischarge follow-up
- Medications
  - Inaccurate, incomplete medication histories
  - Complexity
  - Need for prior authorization(s)
  - Neglecting to stop previous meds
  - High cost/copay
  - Insufficient refills
  - Inability to read labels

Patient & Caregiver Perspectives on Care Transitions

<table>
<thead>
<tr>
<th>Themes</th>
<th>Examples of Barriers &amp; Concerns Expressed by Patients &amp; Caregivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital discharge process</td>
<td>Limited health at discharge; interest in shared decision-making; <strong>discharge instructions of limited utility</strong></td>
</tr>
<tr>
<td>Socioeconomic resources</td>
<td><strong>Health insurance/affordability</strong>; inadequate housing; difficulty arranging transportation to follow-up appointments</td>
</tr>
<tr>
<td>Access to care after discharge</td>
<td>Difficulty arranging transportation to follow-up appointments; lack of primary care provider; <strong>limited access to ambulatory services after hours</strong></td>
</tr>
<tr>
<td>Healthcare-seeking behaviors</td>
<td>Delays in seeking care; ignore caregiver advice about seeking care; reliance on emergency department</td>
</tr>
<tr>
<td>Patient anxiety</td>
<td>Anxiety about post-discharge events</td>
</tr>
<tr>
<td>Self-management skills for patients &amp; caregivers</td>
<td><strong>More education desired on lifestyle, disease, appropriate use of medications, &amp; medication reconciliation; lack of understanding led to mistrust of health care system; involvement of caregivers in health-related education desired</strong></td>
</tr>
<tr>
<td>Social support for patients &amp; caregivers</td>
<td>Peer support groups for patients &amp; caregivers desired; request assistances with various social support needs: emotional, informational, instrumental, &amp; peer coaching; caregiver burden</td>
</tr>
<tr>
<td>Navigators</td>
<td>Patient &amp; caregiver perceptions on allowing patient care navigators in their homes</td>
</tr>
</tbody>
</table>


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Improving Transitions of Care
ACCP White Paper on Pharmacist Roles

1. Perform medication reconciliation during care transitions
2. Round with patient care team
3. Educate patient & caregiver
4. Participate in discharge
   - Conduct discharge patient interviews
   - Follow up on drug-related problems
   - Assess and address adherence issues
   - Assure post-discharge follow up within 2-4 days
5. Engage consultant pharmacists
   - Perform medication reconciliation in LTCFs & assisted living
6. Engage community pharmacists
   - Clarify discrepancies & review auto refills post-discharge
7. Engage ambulatory care pharmacists
8. Collaborate with home health care (HHC) pharmacists & HHC agencies
9. Medically underserved and homeless
   - Provide services to address adherence, access, & health literacy issues

ACCP=American College of Clinical Pharmacy
LTCF=long-term care facility


Pharmacist Engagement in Transitions of Care Progress But More To Do...

Discharge prescription services
- 2012: 11.8%
- 2014: 21.5% p<0.0001
- 2016: 34.6%

392 hospitals surveyed

Pharmacist TOC Programs Improve Care!

**OPTIMIST Study**

- Basic intervention
  - Structured, patient-centered medication review
- Extended intervention
  - Medication review
  - Medication reconciliation
  - Discharge patient education
  - Provider & caregiver handoffs
  - Follow-up phone calls


---

Pharmacist TOC Programs Improve Care!

**Meta-Analysis**

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Event Rate</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pharmacist (%)</td>
<td>Control (%)</td>
<td>Odds Ratio (OR) (95% CI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medication errors (n=2,764)</td>
<td>28.8</td>
<td>40.5</td>
<td>0.45 (0.32-0.63)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital readmissions (n=2,146)</td>
<td>37.1</td>
<td>39.2</td>
<td>0.73 (0.48-1.13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency department visits (n=1,274)</td>
<td>16.1</td>
<td>27.4</td>
<td>0.42 (0.23-0.79)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13 studies; 3,503 patients

### Key Components of Successful HF TOC Programs

<table>
<thead>
<tr>
<th>Study</th>
<th>Collaborative with Other Providers</th>
<th>Med History (Med Rec)</th>
<th>GDMT Intervention with Physician</th>
<th>Patient Education</th>
<th>Med Adherence</th>
<th>Phone Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varma</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Gattis</td>
<td>X X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Rainville</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Gwadry-Sridhar</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>(multidisciplinary)</td>
<td>X</td>
</tr>
<tr>
<td>Lopez Cabezas</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Gunadi</td>
<td>X X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Walker</td>
<td>X X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>


### TOC Programs & Outcomes in Heart Failure

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Duration of Follow-up</th>
<th>Relative Risk of Readmission</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home visits</td>
<td>30 days</td>
<td>0.54</td>
<td>0.21 – 1.37</td>
</tr>
<tr>
<td></td>
<td>3-6 months</td>
<td>0.75</td>
<td>0.66 – 0.86</td>
</tr>
<tr>
<td>Structured telephone support</td>
<td>30 days</td>
<td>0.80</td>
<td>0.38 – 1.65</td>
</tr>
<tr>
<td></td>
<td>3-6 months</td>
<td>0.92</td>
<td>0.77 – 1.10</td>
</tr>
<tr>
<td>Telemonitoring</td>
<td>30 days</td>
<td>1.02</td>
<td>0.64 – 1.63</td>
</tr>
<tr>
<td></td>
<td>3-6 months</td>
<td>1.11</td>
<td>0.87 – 1.42</td>
</tr>
<tr>
<td>Nurse-led clinic-based</td>
<td>3-6 months</td>
<td>0.88</td>
<td>0.57 – 1.37</td>
</tr>
<tr>
<td>Multidisciplinary HF clinic</td>
<td>6 months</td>
<td>0.70</td>
<td>0.55 – 0.89</td>
</tr>
<tr>
<td>Primary care clinic-based</td>
<td>6 months</td>
<td>1.27</td>
<td>1.05 – 1.54</td>
</tr>
</tbody>
</table>


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Pharmacist Care of Patients with HF

• Systematic review
  – 11 randomized controlled trials
  – 2060 patients

• Patient care settings
  – Outpatient clinic: 5
  – Hospital: 3
    • With phone follow-up: 1
  – Home visit: 3
  – Community pharmacy: 1

• Pharmacist Roles
  – Patient education: 12
  – Medication recommendations: 6
  – Adherence aids/assessment: 4
  – Self-care monitoring: 3
  – Liaison with PCP: 2
  – Referral to community pharmacist: 1


Outcomes Associated With HF Pharmacy Services

<table>
<thead>
<tr>
<th>Intervention Type</th>
<th>Mortality Odds Ratio (95% CI)</th>
<th>Hospitalization Odds Ratio (95% CI)</th>
<th>Heart Failure Hospitalization Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacist-directed care</td>
<td>0.92 (0.62–1.38)</td>
<td>0.77 (0.54–1.09)</td>
<td>0.89 (0.68–1.17)</td>
</tr>
<tr>
<td>Pharmacist collaborative care</td>
<td>0.69 (0.41–1.17)</td>
<td>0.60 (0.38–0.95)</td>
<td>0.42 (0.24–0.74)</td>
</tr>
<tr>
<td>Overall effect</td>
<td>0.84 (0.61–1.15)</td>
<td>0.71 (0.54–0.94)</td>
<td>0.69 (0.51–0.94)</td>
</tr>
</tbody>
</table>

Case Study:
Patient-Related Barriers to Medical Optimization of HF Therapy

Tien M.H. Ng, Pharm.D., BCPS AQ Cardiology, FACC, FCCP, FHISA
Associate Professor of Clinical Pharmacy and Medicine
Director, PGY2 Residency in Cardiology
Vice Chair, Titus Family Department of Clinical Pharmacy
School of Pharmacy and Keck School of Medicine
University of Southern California, Los Angeles, California

Case: GS

Chief Complaint: GS 64yo WM seen in clinic 2 weeks after being discharged from the hospital for worsening heart failure. GS is Polish-speaking only and struggles reading English.

History of Present Illness: Three weeks ago, he presented to the ED with complaints of increasing lower extremity and abdominal edema, decreasing exercise tolerance and weight gain for a month. He was diuresed for a couple of days and discharged. During these past 2 weeks, he still gets short of breath walking a couple blocks or grocery shopping, and wakes up once or twice a night with difficulty breathing. However, he only sleeps using one pillow.

Medical History: HFrEF, myocardial infarction 2010, hypertension, DM

Physical Exam: BP 109/71 mmHg, HR 95 bpm, respiratory rate (RR) 20
Jugular Venous Pulsation 15 cm, + rales, regular rate and rhythm, +S3, right ventricular heave, abdominal distention, 2+ lower extremity edema

Labs: Pending  ECHO: LVEF 30%, anteroapical akinesis, normal valve function
Case: GS

Home Medications (all taken orally):

• Aspirin 81 mg once daily
• Furosemide 20 mg once daily
• Lisinopril 10 mg once daily
• Metoprolol tartrate 25 mg twice daily
• Amlodipine 2.5 mg once daily
• Atorvastatin 40 mg once daily
• Metformin 500 mg twice daily

Please refer to your own chronic HF protocols as you consider this case.
The addition of which of the following medications should be considered to prolong survival?

a. Hydralazine/ isosorbide dinitrate
b. Spironolactone
c. Digoxin
d. Ivabradine

Case: GS

Labs:

- eGFR: 56 mL/min/m²
- PT/INR: 11.7 sec/0.98
- BNP: 328 pg/mL
- sST2: 30 ng/mL

Audience Polling
What is the most prudent approach to management of this patient’s ACEI considering his renal function?

a. Increase dose to 20 mg once daily
b. Keep the dose at 10 mg once daily
c. Reduce the dose to 5 mg once daily
d. Discontinue lisinopril

Optimizing RAAS Inhibition

- Renal considerations

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Interpretation of Increasing SCr

- Not all ↑ in SCr are created equal
- SOLVD post-hoc analysis (N=6,377)
  - Early worsening renal function (WRF) defined as ↓20% in eGFR within 14 days of randomization

<table>
<thead>
<tr>
<th></th>
<th>Enalapril</th>
<th>Placebo</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>eGFR change</td>
<td>-0.7 ± 14.2</td>
<td>0.4 ± 15.4</td>
<td>0.002</td>
</tr>
<tr>
<td>Adjusted HR (95% CI) for early WRF</td>
<td>1.0 (0.78-1.3)</td>
<td>1.4 (1.1-1.8)</td>
<td></td>
</tr>
</tbody>
</table>


Interpretation needs to include congestion status

Survival

- No Cong and no WRF (N=265)
- WRF but no Cong (N=253)
- Cong but no WRF (N=31)
- WRF and Cong (N=45)


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Optimizing RAAS Inhibition

• Minimizing risk or managing hyperkalemia
  – Use of salt substitutes
  – Close monitoring renal function and serum potassium
    • After 3 days, 1 week, q1 month x 3 months
  – Use of potassium binders


Potassium Binders

<table>
<thead>
<tr>
<th>MOA</th>
<th>Sodium Polystyrene Sulfonate</th>
<th>Patiromer</th>
<th>Sodium Zirconium Cyclosilicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na cation exchange resin</td>
<td>Ca-K cation exchange resin</td>
<td>K cation trapping agent</td>
<td></td>
</tr>
<tr>
<td>Formulation</td>
<td>Oral, Rectal</td>
<td>Oral</td>
<td>Oral</td>
</tr>
<tr>
<td>Onset</td>
<td>1-2 hr</td>
<td>7 hr</td>
<td>1 hr</td>
</tr>
<tr>
<td>Dosing</td>
<td>One to four times daily</td>
<td>Once daily</td>
<td>One to three times daily</td>
</tr>
<tr>
<td>Indications</td>
<td>Treatment of hyperkalemia; should not be used as an emergency treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Acute</td>
<td>Chronic</td>
<td>Chronic</td>
</tr>
<tr>
<td>Notes</td>
<td>Sodium load; intestinal necrosis; hypoMg/Ca; space meds 3 hr pre/post</td>
<td>HypoMg; space meds 3 hr pre/post</td>
<td>Edema (sodium load), can change gastric pH; space meds 2 hr pre/post</td>
</tr>
</tbody>
</table>

Case Continues: GS

GS returns to clinic 4 weeks later. He feels better and is able to do his daily chores, and walk the few blocks to the grocery store as long as he takes it slowly. His sleeping is improved as he only wakes up once a week with difficulty breathing.

**PE:** BP 114/80 mmHg, HR 78 bpm, RR 16
JVP 7cm, - rales, regular rate and rhythm, +S3, PMI displaced, trace LE edema

**Labs:** Na 136, K 4.7, SCr 1.28 (eGFR=60), BUN 15
BNP 215

**TTE:** LVEF 30%

Case Continues: GS

**Updated Home Medications (all taken orally):**
- Aspirin 81 mg once daily
- Furosemide 20 mg twice daily
- Lisinopril 20 mg once daily
- Metoprolol succinate 200 mg once daily
- Amlodipine 2.5 mg once daily
- Atorvastatin 40 mg once daily
- Metformin 500 mg twice daily
The patient is doing well symptomatically. However, what would provide further evidence that medication optimization should continue? (Select all that apply)

a. LVEF
b. BNP
c. HR
d. Na

Biomarkers to Guide Treatment

- Measurement of BNP or NT-proBNP is useful for establishing prognosis or disease severity in chronic HF. (COR I, LOE: A)
- Measurement of baseline levels of natriuretic peptide biomarkers and/or cardiac troponin on admission to the hospital is useful to establish a prognosis in acutely decompensated HF. (COR I, LOE: A)
- During a HF hospitalization, a predischarge natriuretic peptide level can be useful to establish a postdischarge prognosis. (COR IIa, LOE: B-NR)
- In patients with chronic HF, measurement of other clinically available tests, such as biomarkers of myocardial injury or fibrosis, may be considered for additive risk stratification. (COR IIb, LOE: B-NR)

BNP/NT-proBNP Application to Chronic HF

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>Description</th>
<th>Diagnosis</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNP/NT-proBNP</td>
<td>Natriuretic peptides</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>NT-proBNP</td>
<td>&lt;50 yr</td>
<td>&lt;50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50-75 yr</td>
<td>&lt;75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;75 yr</td>
<td>&lt;250</td>
<td></td>
</tr>
</tbody>
</table>

To exclude/identify acute decompensated HF:

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>Description</th>
<th>Diagnosis</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNP</td>
<td></td>
<td></td>
<td>&lt;100</td>
</tr>
<tr>
<td>NT-proBNP</td>
<td></td>
<td></td>
<td>&lt;900</td>
</tr>
</tbody>
</table>

Select Biomarkers in HF

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>Description</th>
<th>Diagnosis</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNP/NT-proBNP</td>
<td>Natriuretic peptides</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>sST2</td>
<td>Fibrosis/Hypertrophy</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Gal-3</td>
<td>Fibrosis</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Troponin</td>
<td>Myocardial injury</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>MR-proANP</td>
<td>Natriuretic peptide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPO (myeloperoxidase)</td>
<td>Oxidative stress</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adrenomedullin</td>
<td>Vasodilatory peptide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MMPs/TIMPs</td>
<td>Extracellular matrix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDF (growth differentiation factor-15)</td>
<td>Apoptosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IL-6</td>
<td>Inflammation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cystatin C</td>
<td>eGFR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NGAL, KIM-1, NAG</td>
<td>Renal injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin</td>
<td>Liver, congestion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adiponectin</td>
<td>Adipokine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Key Takeaways

• Elevations in SCr should not automatically lead to discontinuation or lack of further titration of life-saving RAAS inhibitor therapy.
• Potassium binders are now FDA approved for the chronic management of hyperkalemia and should be utilized to keep patients on RAAS inhibitor therapy.
• Persistent elevation of BNP or NT-proBNP should identify patients at higher risk of poor outcomes, and further optimization of therapy should be considered.

Case Study: Addressing Barriers to Optimizing Heart Failure Care

Robert J. DiDomenico, Pharm.D., FACC, FCCP, FHFSA
Associate Professor
University of Illinois at Chicago College of Pharmacy
Chicago, Illinois
4 months later, GS is hospitalized for unstable angina & acute decompensated heart failure. He recently started a new job as a janitor and is now caring for his 13 year-old grandson. These events have made follow-up challenging and increased his stress level. His new insurance has a restrictive formulary, $10 copay for generic medications, 20% copay for brand name medications. His daughter translates for him but is only present after 5 p.m. She voices concern about his ability to afford any more medications & his stubbornness in seeking care

PE: BP 164/80 mmHg, HR 98 bpm, RR 24
JVP 10 cm, bilateral rales at bases, RRR, +S3, PMI displaced, 2+ LE edema
Labs:  Na 134, K 4.9, SCr 1.56 (eGFR=47), BUN 28
       BNP 915

Case Continues: GS
Questions to Consider

• What predictors for HF readmission does GS possess?
• What pharmacy services would you consider at this time?
• Do pharmacists at your institution provide patient education, transitions of care services, and/or utilize HF protocols to care for HF patients?
Clinical Predictors of HF Readmission Opportunities for Improvement?

- Acute coronary syndrome (ACS), ischemia
- Increasing age
- Anemia
- Arrhythmia
- Depression
- Hyponatremia
- Low LVEF
- NYHA class IV symptoms
- Pneumonia/respiratory process
- Suboptimal HF medication regimen
- Uncontrolled hypertension (HTN)
- Worsening renal function


Nonclinical Predictors of HF Readmission Opportunities for Improvement?

- Socioeconomic
  - Medicaid recipient
  - Income inadequacy
- Psychosocial
  - Poor social support
  - Low health literacy
  - Low prescription label reading score/ability
  - Medication/dietary nonadherence
- Patient-centered & health system
  - Distressing symptoms
  - Poor self-care
  - Low readiness for discharge
  - Inconvenient or lack of early follow-up scheduled


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Inpatient Medication Histories
Clinical & Economic Outcomes

- ↓ ADRs
  - 1 of 8 clinical pharmacy services
- ↓ Drug costs
  - 1 of 4 clinical pharmacy services
- ↓ Total costs
  - 1 of 6 clinical pharmacy services
- ↓ Inpatient mortality
  - 1 of 7 clinical pharmacy services
- Services with ≥ 2 favorable associations with outcomes
  - Drug information
  - Admission medication histories
  - ADR program/management
  - Collaborative drug management
  - Participation on medical rounds


Pharmacy Medication Reconciliation
Clinical Outcomes

Outcomes
- ↓ Medication discrepancies
  - 10 of 10 studies
- ↓ Potential adverse drug events (ADEs)
  - 2 of 3 studies
- ↓ Preventable ADEs
  - 1 study
- ↓ Health care resource use
  - 2 of 7 studies

Themes from Successful Programs
- Limit to older adult patients
  - ≥70 or 80 years
- Intensive staff involvement
  - Med history/reconciliation on admission, during hospitalization, and at discharge
- Communication with primary care provider
- Phone follow up after discharge

Case Continues: GS to be Discharged

4 days later, GS is being discharged home

PE: BP 104/80 mmHg, HR 78 bpm, RR 16
Labs: Na 137, K 5.0, SCr 1.30 (eGFR=60), BUN 20

Previous Home medications
- Aspirin 81 mg PO once daily
- Furosemide 20 mg PO twice daily
- Lisinopril 20 mg PO once daily
- Metoprolol succinate 200 mg PO once daily
- Amlodipine 2.5 mg PO once daily
- Atorvastatin 40 mg PO once daily
- Metformin 500 mg PO twice daily

Medication changes
- Increased dose of furosemide 40 mg PO twice daily
- Added ivabradine 5 mg PO twice daily
- Changed metoprolol succinate to carvedilol 25 mg PO twice daily
- ePrescribed to his community pharmacy
- Patient education pamphlets printed in English

Case Continued: GS
Questions to Consider

- What barriers to optimal care are present?
- What pharmacy services would you consider at this time?
Barriers to Effective Transitions of Care (TOC)
Opportunities for Pharmacists to Improve Care

- Poor readiness for discharge
- Poor health literacy
- Paperwork/third-party payer
- Poor communication
  - Teaching methods often reliant on written materials
  - No engagement of caregiver(s)
  - System challenges
  - Patient factors
- Poor postdischarge follow-up
- Medications
  - Inaccurate, incomplete medication histories
  - Complexity
  - Need for prior authorization(s)
  - Neglecting to stop previous meds
  - High cost/copay
  - Insufficient refills
  - Inability to read labels

Improving Transitions of Care
ACCP White Paper on Pharmacist Roles

1. Perform medication reconciliation during care transitions
2. Round with patient care team
3. Educate patient & caregiver
4. Participate in discharge
   - Conduct discharge patient interviews
   - Follow up on drug-related problems
     - Assess and address adherence issues
     - Assure post-discharge follow up within 2-4 days
5. Engage consultant pharmacists
   - Perform medication reconciliation in LTCF & assisted living
6. Engage community pharmacists
   - Clarify discrepancies & review auto refills post-discharge
7. Engage ambulatory care pharmacists
8. Collaborate with home health care (HHC) pharmacists & HHC agencies
9. Medically underserved and homeless
   - Provide services to address adherence, access, & health literacy issues


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Prescribing Does Not Guarantee Medication Possession


Effects of Removing Medication Cost as a Barrier


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Case Continued: GS
Questions to Consider

- What post-discharge services should be considered?

Pharmacist Post-Discharge Phone Calls
Project Re-Engineered Discharge (Project RED)

*Excluding hospitalizations related to substance use
### TOC Programs & Outcomes in Heart Failure

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Duration of Follow-up</th>
<th>Relative Risk of Readmission</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home visits</td>
<td>30 days 3-6 months</td>
<td>0.54</td>
<td>0.21 – 1.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.75</td>
<td>0.66 – 0.86</td>
</tr>
<tr>
<td>Structured telephone support</td>
<td>30 days 3-6 months</td>
<td>0.80</td>
<td>0.38 – 1.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.92</td>
<td>0.77 – 1.10</td>
</tr>
<tr>
<td>Telemonitoring</td>
<td>30 days 3-6 months</td>
<td>1.02</td>
<td>0.64 – 1.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.11</td>
<td>0.87 – 1.42</td>
</tr>
<tr>
<td>Nurse-led clinic-based</td>
<td>3-6 months</td>
<td>0.88</td>
<td>0.57 – 1.37</td>
</tr>
<tr>
<td>Multidisciplinary HF clinic</td>
<td>6 months</td>
<td>0.70</td>
<td>0.55 – 0.89</td>
</tr>
<tr>
<td>Primary care clinic-based</td>
<td>6 months</td>
<td>1.27</td>
<td>1.05 – 1.54</td>
</tr>
</tbody>
</table>


### Multidisciplinary Heart Failure Post-Discharge Clinic

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Control (n=133)</th>
<th>Clinic (n=144)</th>
<th>Adj Hazard ratio (95% CI) P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF Readmission, n (%)</td>
<td>31 (23.3%)</td>
<td>11 (7.6%)</td>
<td>0.17 (0.07-0.41) p &lt; 0.001</td>
</tr>
<tr>
<td>Death (all cause), n (%)</td>
<td>7 (5.3%)</td>
<td>2 (1.4%)</td>
<td>0.12 (0.02-0.93) p = 0.043</td>
</tr>
<tr>
<td>HF Readmission &amp; Death, n (%)</td>
<td>38 (28.6%)</td>
<td>13 (9%)</td>
<td>0.14 (0.06-0.31) p &lt; 0.001</td>
</tr>
</tbody>
</table>

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Medication Adherence In Multidisciplinary HF Post-Discharge Clinic

BB=beta-blocker, AA=aldosterone antagonist, PDC-90=ratio of days’ supply of medication to days prescribed

Care Transitions, Inpatient Medication Therapy Management (MTM), & Reimbursement?

An Inside Job: Hospital Adds $1.6 Million in Billables Via MTM

## Care Transitions, Inpatient MTM, & Reimbursement?

<table>
<thead>
<tr>
<th>MTM Description Level</th>
<th>Example</th>
<th>Reimbursement Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>High complexity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presenting problem: high</td>
<td>99214</td>
</tr>
<tr>
<td></td>
<td>- New start warfarin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- High complexity pharmacotherapy (drug induced neutropenia, elevated liver enzymes, drug rash)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Very complex</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple high-severity problems</td>
<td>99215</td>
</tr>
<tr>
<td></td>
<td>- Not billable due to need for head-to-toe assessment</td>
<td></td>
</tr>
</tbody>
</table>


## Case: MD, a 76-year-old African-American Female

- Past medical history
  - HFrEF (3rd hospitalization in 1 year)
  - Dyslipidemia
  - Diabetes mellitus (DM)
  - Hypertension
  - Chronic kidney disease
- Home medications (adherence appears good)
  - Lisinopril 40 mg daily
  - Metoprolol succinate 100 mg daily
  - Bumetanide 1 mg daily
  - Metformin 500 mg twice daily
  - Atorvastatin 80 mg daily
  - Potassium chloride 20 mEq daily
- Being discharged from hospital
- Lives with son (primary caregiver)
- Patient is a poor historian with low health literacy
- Insurance: Medicare HMO/PPO
- Medication changes made prior to discharge
  - Increased bumetanide to 1 mg twice daily
  - Increased metoprolol succinate to 200 mg daily
  - Added spironolactone 12.5 mg daily
  - Discontinued potassium chloride

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Key Takeaways

• With the exception of loop diuretics, GDMT for HFrEF is associated with reduced cardiovascular events and should be individualized based on LVEF & symptomatology
• Appropriate monitoring and assessment of SCr and serum potassium are critical to assure optimal titration of life-saving RAAS inhibitor therapy.
• Basic pharmacy services, including TOC programs, can improve outcomes in patients with HF
• A patient-centered approach to care transitions can effectively remove barriers to optimal HF care

Additional Care Innovations for Patients with HF?

• Does your institution utilize novel approaches to optimize GDMT?
• Does your institution utilize novel approaches for identifying & addressing barriers to optimal HF care?
• Does your institution provide novel pharmacy services, including care transitions?
Selected Resources


Selected Resources

Standardized discharge processes
- Project BOOST
  [www.hospitalmedicine.org/boost](http://www.hospitalmedicine.org/boost)
- Project RED
  [www.bu.edu/fammed/projectred](http://www.bu.edu/fammed/projectred)
- The Care Transitions Program
  [www.caretransitions.org](http://www.caretransitions.org)
- Guided Care Model
Consider these practice changes.
Which will you make?

• Read the 2017 ACC Expert Consensus Pathway.
• Compare my organization’s protocols with the most up to date heart failure treatment guidelines.
• Evaluate my organization’s utilization & escalation of GDMT for HFrEF prior to discharge.
• Assess my pharmacy department’s participation in care transitions (e.g., frequency of medication histories upon admission & medication reconciliation upon discharge, participation in patient education).
• Engage both patients & caregivers in educational encounters.
• Determine the feasibility of post-discharge pharmacist involvement (e.g., post-discharge telephone contact, multidisciplinary clinic).
ABOUT THE FACULTY

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Dr. Ng completed his Bachelor of Science degree in pharmacy from Dalhousie University in Halifax, Canada and his Doctor of Pharmacy degree from Wayne State University in Detroit, Michigan. He completed a Cardiovascular Pharmacotherapy Fellowship from the University of Utah in Salt Lake City, Utah. He is a board certified pharmacotherapy specialist (BCPS) with added qualifications in cardiology (AQ Cardiology).

Dr. Ng’s primary research interests focus on heart failure pathophysiology and pharmacotherapy. He has published numerous peer-reviewed manuscripts, abstracts and book chapters related to heart failure pharmacotherapy. Dr. Ng has also been an invited speaker at national pharmacy and cardiology scientific meetings.

Dr. Ng has been conferred Fellow of the American College of Cardiology (ACC), the American College of Clinical Pharmacy (ACCP), and the Heart Failure Society of America (HFSA), and has been an active member of ACC, ACCP, HFSA, the American Society of Health-System Pharmacists (ASHP), and the American Heart Association (AHA). He is a past recipient of the HFSA Clinical/Integrative Physiology new investigator award. Dr. Ng was also selected to and currently sits on the inaugural Board of Pharmaceutical Specialties (BPS) Cardiology Specialty Council.

Additional Activities on Chronic Heart Failure

- Ask the Experts CE activity coming spring 2019

www.ashpadvantagemedia.com/chf

ACCREDITATION

The American Society of Health-System Pharmacists (ASHP) is accredited by the Accreditation Council for Pharmacy Education as a provider of continuing pharmacy education.

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