WHAT PUTS HEART FAILURE PATIENTS AT RISK FOR POOR MEDICATION ADHERENCE?

Barbara Riegel, DNSc, RN, FAAN, FAHA
Edith Clemmer Steinbright Professor of Gerontology
Director, Biobehavioral Research Center
University of Pennsylvania
briegel@nursing.upenn.edu
Background

- Heart failure (HF) affects more than 5 million adults (12% of older adults) in the US.
- 1 in 4 HF patients is readmitted to a hospital within 30 days of discharge.
  - Almost half are readmitted within 6 months.
- Hospitalizations are the primary contributor to the staggering medical cost of HF:
  - Total costs for HF are estimated to increase from $31 billion in 2012 to $70 billion in 2030.

AHA, 2014; Heidenreich, 2013
Background

- We previously demonstrated that poor medication adherence was the best predictor of hospitalization in a sample of adults with chronic HF.
- 7 interactions predicting hospitalization ($C$-index = 0.83):
  - 1) pattern of poor adherence type and poor short-term memory;
  - 2) more comorbid conditions and more daily medications;
  - 3) higher BUN and lower percentage of prescribed doses taken;
  - 4) low Hgb and poor perceived health;
  - 5) older age and poorer cognition;
  - 6) higher BMI and lower Hgb; and
  - 7) lower ejection fraction and higher fatigue

Riegel & Knafl, 2013
Purpose

• The purpose of this work is to identify risk factors associated with poor medication adherence in HF patients

• **Ultimate goal**: to identify and implement interventions that address important barriers to adherence, and so reduce the chance of hospitalization

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Methods

• Prospective cohort comparison study
• Data collected between 2007-2009
• Subjects enrolled from 3 sites in the northeastern US
• Institutional review board approval obtained at all sites
• Research assistants collected data from the medical record and directly from participants
• Objective and subjective data obtained in the home during face-to-face visits at enrollment, 3- and 6-months
Sample Selection Criteria

Inclusion criteria:
• Adults with a confirmed diagnosis of stage C (i.e. symptomatic) chronic HF were enrolled

Exclusion criteria:
• Frank dementia
• Major depression
• Drug or alcohol abuse within past year
• Night shift workers
Measurement

- Medication adherence
  - Medication Event Monitoring System (MEMS)
  - 0-3 months, 3-6 months
  - 1 medication monitored (56.7% beta-blocker, 15.2% ACE-I, 3.2% diuretic, 24.9% other and varied)
Measurement

- **Demographic** (self-report)
- **Social support** (marital status, living situation, support quality)
- **Clinical** (months with HF, ejection fraction, comorbidities, BP, pulse, BMI, exercise, BUN, creatinine, Hgb, serum sodium)
- **Self-care** (knowledge about HF, self-care maintenance, management, confidence, all medications, weight logs, urine for dietary sodium)
- **Symptoms** (perceived health, trouble breathing, fatigue, sleepiness, depression, NYHA class)
- **Cognition** (global screen + formal neuropsychological battery measuring processing speed, simple and complex attention, working memory, verbal memory, crystallized cognitive ability)
Analysis

1. Characterized individual adherence patterns (mean adherence and adherence variability) over time for 6 months (using adaptive methods with a K-fold likelihood cross-validation [LCV] approach)
   • Adherence patterns were normalized by the prescribed number of doses of the drug in the MEMS to be comparable
2. Classified these patterns into 7 adherence types
   • Mean adherence and adherence variability were estimated at 20 proportionally spaced times within each patient’s study participation period (5%, 10%, . . . 100%)
3. Adherence types were categorized into poor vs better adherence because this predicted hospitalization in 6 mo.
Plots of average mean adherence and of average adherence variability, used in interpreting clusters to form adherence types.
Sample Adherence Patterns

Better adherence

Poor adherence

Riegel & Knafl 2013
Results

• 280 subjects were enrolled
  • 242 completed the 6-month follow-up
  • 218 of the 242 (90.1%) had usable MEMS data
    • Hospitalization rates no different for patients with no MEMS data (9.9%) vs the 90.1% with MEMS data ($P=0.722$)

• 28.9% of the patients had poor medication adherence
Sample Description (N=218)

<table>
<thead>
<tr>
<th>Demographic Characteristic</th>
<th>Mean or Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>62.8 (SD 11.6) years</td>
</tr>
<tr>
<td>Male</td>
<td>64.2%</td>
</tr>
<tr>
<td>White race</td>
<td>68.3%</td>
</tr>
<tr>
<td>Formal education in years</td>
<td>14 (SD 2.9) (8-29 years range)</td>
</tr>
<tr>
<td>Income</td>
<td></td>
</tr>
<tr>
<td>- Enough or more than enough</td>
<td>83.9%</td>
</tr>
<tr>
<td>- Not enough to meet needs</td>
<td>16.1%</td>
</tr>
<tr>
<td>HF ejection fraction</td>
<td>35.8 (SD 17.4) (range 5-80)</td>
</tr>
<tr>
<td>NYHA functional status</td>
<td></td>
</tr>
<tr>
<td>- Class I/III</td>
<td>82.1%</td>
</tr>
<tr>
<td>- Class IV</td>
<td>17.9%</td>
</tr>
<tr>
<td>Total number of medications taken daily</td>
<td>9.9 (SD 4.0)</td>
</tr>
<tr>
<td>Prescribed rate of medication in MEMS</td>
<td></td>
</tr>
<tr>
<td>- 1x daily</td>
<td>39.0</td>
</tr>
<tr>
<td>- 2-3x daily</td>
<td>61.0</td>
</tr>
</tbody>
</table>
## Multiple Risk Factor Interactions Model for Poor versus Better Adherence (N=218)

<table>
<thead>
<tr>
<th>Interaction</th>
<th>at risk group</th>
<th>P value</th>
<th>Odds Ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>More comorbidities (≥4), taking more medications (≥ 9)</td>
<td>67 (30.7)</td>
<td>0.002</td>
<td>2.89</td>
<td>1.18-7.06</td>
</tr>
<tr>
<td>older age (≥ 61) with poorer global sleep quality (≥ 3)</td>
<td>117 (53.7)</td>
<td>0.004</td>
<td>3.20</td>
<td>1.45-7.07</td>
</tr>
<tr>
<td>Less experience with heart failure (≤ 21 months) with poorer global sleep quality (≥ 3)</td>
<td>44 (20.2)</td>
<td>0.006</td>
<td>2.82</td>
<td>1.35-5.85</td>
</tr>
</tbody>
</table>
The C-index for the risk index model was acceptable, at 0.71, and the estimated OR for a unit increase in the risk index variable was 2.62 (95% CI, 1.78–3.86; \( P<0.001 \))

Knafl & Riegel, 2014
Limitations and Strengths

Limitations

- Possible selection bias (patients selected for variability in daytime sleepiness and cognitive function to fill cohorts)
- Sample younger and better educated than some community samples of HF patients
- One medicine monitored; adherence for medications not controlled by the MEMS has not been accounted for

Strengths

- Medication adherence measured objectively
- Statistical approach accounted for both mean adherence and adherence variability
Conclusion

- Medication nonadherence is a continuing problem
- Clinicians caring for patients who are older age, with multiple comorbid conditions, taking numerous medications, and are newly diagnosed should anticipate problems with medication adherence
- Asking patients about their sleep quality should be a routine element of all clinical encounters
  - Even “minor” sleep problems pose a risk
- Future research is needed to identify interventions that adequately address these predictors of nonadherence