Connecting the Dots: Behavioral Economics and a Cluster Randomized Trial

Adrian F. Hernandez, MHS
Disclosures

- Research grant to the Duke Clinical Research Institute from:
  - Novartis (Independent Investigator Award)
The Agenda

- A Story about Minecraft
- Why Heart Failure?
- Can We Change Behavior?
- Simple... Just Study It!
- What’s Next?
Question 1

What does Minecraft have to do with health?
Question 2

▪ Does Stampy Cat have the keys to health?
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5.7 million American Adults Have Heart Failure

Forecasting the Impact of Heart Failure in the United States

Projected Prevalence

Projected Cost Increases

Heidenreich PA et al. Circ Heart Failure. 2013;6(3):606-19
Heart Failure: Hospitalizations Remain Common

$2.7 trillion spent annually on health care
(18% of US GDP)

CV disease costs >$445 billion today, $1 trillion by 2030

HF costs >$31 billion today, $71 billion by 2030
17 years for new knowledge generated by randomized controlled trails to be incorporated into practice, and even then application is highly uneven.
A complete and utter failure to change care...

Cluster-Randomized Trial of Personalized Site Performance Feedback in Get With The Guidelines-Heart Failure Failure

Adam D. DeVore, MD; Margueritte Cox, MS; Paul A. Heidenreich, MD, MS; Gregg C. Fonarow, MD; Clyde W. Yancy, MD; Zubin J. Eapen, MD, MHS; Eric D. Peterson, MD, MPH; Adrian F. Hernandez, MD, MHS

Background—There is significant variation in the delivery of evidence-based care for patients with heart failure (HF), but there is limited evidence defining the best methods to improve the quality of care.

Methods and Results—We performed a cluster-randomized trial of personalized site performance feedback at 147 hospitals participating in the Get With The Guidelines-Heart Failure quality improvement program from October 2009 to March 2011. The intervention provided sites with specific data on their heart failure achievement and quality measures in addition to the usual Get With The Guidelines-Heart Failure tools. The primary outcome for our trial was improvement in site composite quality of care score. Overall, 73 hospitals (n=33 886 patients) received the intervention, whereas 74 hospitals (n=37 943 patients) did not. One year after the intervention, both the intervention and control arms had a similar mean change in percentage points in their composite quality score (absolute change, +0.31 [SE, 1.51] versus +3.18 [SE, 1.68] in control; P=0.21). Similarly, none of the individual achievement measures or quality measures improved more at

Expanding Choices: Will we be any better?

1989
- Digoxin
- Diuretics
- Vasodilators

2017
- ACE inhibitors/ARBs
- Beta-blockers
- Aldosterone antagonists
- ARB/Neprilysin Inhibitor
- Hydralazine/Nitrates
- Ivabradine
- ICD and CRT
- Mechanical circulatory support
- CardioMEMS
- Disease management
- Palliative care
SHIFT was a randomized, placebo-controlled trial of ivabradine

In SHIFT, patients treated with ivabradine were less likely to experience the primary composite endpoint of CV death or HF hospitalization (HR 0.82, 95% CI 0.75, 0.90) compared to placebo.
PARADIGM-HF: Prospective comparison of ARNI with ACEI to Determine Impact on Global Mortality and morbidity in HF trial

Kaplan-Meier Estimate of Cumulative Rates (%)

- **Enalapril** (n=4212)
  - Kaplan-Meier Estimate
  - Patients at Risk
    - Enalapril: 4212
    - LCZ696: 4187
- **LCZ696** (n=4187)
  - Kaplan-Meier Estimate
  - Patients at Risk
    - Enalapril: 4212
    - LCZ696: 4187

Days After Randomization

- **HR = 0.80 (0.73-0.87)**
- **P = 0.0000002**
- **Number needed to treat = 21**
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Perhaps... We don’t always do the “right” thing
# Barriers to behavior change

<table>
<thead>
<tr>
<th>Concept</th>
<th>Barrier</th>
<th>Heart Failure Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present bias</td>
<td>Tendency to heavily discount future effects compared to present benefits</td>
<td>Patient decides to consume an unhealthy but delicious meal now despite knowing that it contributes to poor health outcomes in the future</td>
</tr>
<tr>
<td>Intent-behavior gap</td>
<td>The disconnect between knowledge and action</td>
<td>Patient understands the importance of symptom monitoring but fails to do it.</td>
</tr>
<tr>
<td>Status quo bias (inertia)</td>
<td>Tendency to favor the current state of things over initiating change</td>
<td>Patient continues to manage prescription refills on their own rather than enrolling in the more efficient automatic refill program.</td>
</tr>
<tr>
<td>Bounded rationality</td>
<td>People operate under the limitations of time, cognitive abilities, and inadequate information when making decisions</td>
<td>Patients do not always make the most logical and best decisions in their heart failure care.</td>
</tr>
<tr>
<td>Prospect theory</td>
<td>Extent of risk-seeking and risk-averse behaviors are determined by perceived gains and losses (reference point)</td>
<td>Heart failure patients tend to be more risk-averse in making treatment decisions because they perceive a less acute deterioration of their health.</td>
</tr>
</tbody>
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### Concepts utilized to design interventions

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<td>Mental accounting</td>
<td>Tendency to have separate mental accounts of one resource, especially as it pertains to money</td>
<td>Patients react differently to financial rewards given as a deduction on insurance premiums versus a check of the same amount.</td>
</tr>
<tr>
<td>Loss aversion</td>
<td>Tendency to react more strongly to avoiding losses than acquiring gains</td>
<td>Patient is more motivated to engage in physical activity by a financial incentive framed as a loss (money taken from patient) rather than a gain (money given to patient).</td>
</tr>
<tr>
<td>Anticipated regret (regret aversion)</td>
<td>In the face of uncertainty, people tend to take into account the possibility of feeling regret when making a decision</td>
<td>Patient adheres to medication regimen to avoid feeling of regret in a lottery incentive.</td>
</tr>
<tr>
<td>Libertarian paternalism</td>
<td>The behavior of individuals can be influenced while not restricting their freedom of choice</td>
<td>Employers implement financial incentives to modify patient behavior.</td>
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<tr>
<td>Tool</td>
<td>Description</td>
<td>Heart Failure Example</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Automated hovering</td>
<td>Monitoring patient behavior in their daily lives and continuously encouraging behavior change</td>
<td>Electronically monitoring medication adherence via pillbox or trending changes in weight via electronic scale.</td>
</tr>
<tr>
<td>Commitment contract</td>
<td>Patients pre-commit to behavior change by depositing a certain sum of money that is only accessible after a goal is achieved</td>
<td>Patient decides to exercise 150 minutes a week and deposits $100. The money is lost if patient fails to meet the goal in a previously determined timeframe.</td>
</tr>
<tr>
<td>Social networks</td>
<td>Behavioral change is influenced by behavior of individuals in patient’s social networks</td>
<td>Patient joins with other heart failure patients in his social circle. They decide collectively to commit to monitoring weights daily.</td>
</tr>
</tbody>
</table>
A ton of questions....

- What are the long-term impacts and sustainability of behavioral change of the interventions?
- What is the role of mobile technology, wearables, and telemonitoring for outpatient management of heart failure patients?
- How can we increase utilization of these devices, especially in patients whom it would benefit?
- What is the optimal design and framework of financial incentives?
- How can we utilize social networks of heart failure patients to encourage behavior change?
- What are the incremental effects of each of the factors (loss aversion, anticipated regret, etc.) on patient engagement?
- What combination of incentives and monitoring is ideal for heart failure patients?
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Heart Failure QI Interventions Today
## Two Quality Improvement Interventions

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<th>Direct Engagement (Patient and Site Level)</th>
<th>Digital Engagement (Patient Level only)</th>
</tr>
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<td>• Opinion leaders in HF and QI working with local cardiology and/or HF specialists and support staff to help healthcare systems and hospitals design or revise quality improvement plans</td>
<td>• Mobile applications featuring behavioral tools</td>
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<tr>
<td>• Duke Pillbox (medication management tool)</td>
<td>• Self-monitoring and self-management of heart failure</td>
</tr>
<tr>
<td></td>
<td>• Facilitate continued use of evidence-based care</td>
</tr>
</tbody>
</table>
CONNECT-HF
2x2 Design with 160 US Sites and 8000 patients

Digital Engagement
patient engagement to improve self-management/medication adherence

Direct Engagement
health system engagement to improve local QI programs

CONNECT-HF Registry

Direct & Digital
n=40 sites

Direct & Registry
n=40 sites

Registry Alone
n=40 sites

12 Month Follow-up

Engagement:
Designed with
The CardioYaks!

Care Optimization through Patient and hospital Engagement
Clinical Trial for HF

2 Co-primary Endpoints:
1. Time to 1st readmission or death
2. Change in HF quality metrics
Intervention
Digital Strategy

Optimizing chronic disease management and secondary prevention efforts requires sustainable and durable change in patient behavior.
Fabulous

- Utilizes the principle of habitualization for “nudges” on self-management and adherence
- Mobile app features:
  - Reminders, notifications
  - User progress
  - Activity tracker
Utilizes the principle of loss aversion on:

- Medication adherence
- Activity
- Diet
- Weight measurements
Direct Engagement

A health-system engagement strategy (direct) that will involve site visits and ongoing mentoring from teams of healthcare professionals with specialized training and field experience to help health systems and individual hospitals to design local quality improvement plans.
Direct Intervention Tools

- Hospital management protocols
- Duke PillBox
- Supplemental Discharge Patient Materials
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What’s next?

- Clinical engagement
- Patient engagement
- Intervention refinement
- Launch!
- And….  
  - Deployment in health systems
  - Fidelity
  - Follow-up
  - Sweat it out
Conclusions

- Addiction is a powerful tool
- Heart failure is a paradigm case for challenges in US Healthcare
  - Chronic
  - Poor outcomes
  - Costly
  - Growing
- If we can employ the evolving behavioral economic tools integrated with new technologies, perhaps we can improve health
- Or will it take dedicated health system interventions!
- Regardless, trials integrated into practice will be needed to get the answers
Thanks

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- Duke HSR
  - Linda Davidson-Ray
  - Mayme Roettig

The CardioYaks!