Comparative Effectiveness Research on Systems and Facilities

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FSU Grand Rounds
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Design of talk

- Low prevalence of ancient Greek letters
- High prevalence of ancient Greek learning styles (read: discussion)
- Focus on facilities & systems from hospital standpoint
  - Contrast with other facilities (e.g. dialysis, nursing facilities)
Overview

- Definitions

- Discussion points
  - Measuring “system”
  - Unit of analysis
  - Sorting of patients
  - Change in study population
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Comparative Effectiveness Research

US HHS defines CER as those efforts that

1. Conduct, support, or synthesize research that compares the clinical outcomes, effectiveness, and appropriateness of items, services, and procedures that are used to prevent, diagnose, or treat diseases, disorders, and other health conditions.

2. Encourage the development and use of clinical registries, clinical data networks, and other forms of electronic health data that can be used to generate or obtain outcomes data.

http://www.hhs.gov/recovery/programs/cer/
CER: Beyond Drug A vs Drug B

Some Comparative Effectiveness Research may need to consider health care systems and practice:

• Differences in systems/practice in effectiveness of a clinical intervention (more a “nuisance parameter”)
• Context of the system/practice
• System/practice level interventions or outcomes

Determining, defining, and measuring system/practice may be crucial for such questions
What is a “system”? 

“System” – a contractual arrangement between different facilities – is best viewed as a continuum, rather than dichotomously.

Possible arrangements:
- Referral arrangements
- Networks
- Leased
- Management contracts
- Fully owned

“System” is usually defined as the last two or three.

Complication: Could be phased (manage for 3 yrs, then own)
What does “system-ness” measure?

Almost always a proxy for “connectedness” on a specific dimension, or “access to external resources”

- Integrated care
- HIT
- Quality improvement resources
- Access to capital
- Referral patterns
- Local community-mindedness

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### Table 2: Summary of Significant Differences Between Health Networks and Systems in Clusters with Similar Labels: 1994 Health Networks and Systems

<table>
<thead>
<tr>
<th>Organizational Cluster Label</th>
<th>Hospital Services</th>
<th>Physician Arrangements</th>
<th>Insurance Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centralized health network/system</td>
<td>Networks are more differentiated than systems in long-term/chronic care services and more decentralized in all hospital services.</td>
<td>Networks are more differentiated and more decentralized than systems in contractual arrangements.</td>
<td>None</td>
</tr>
<tr>
<td>Decentralized health network/system</td>
<td>Networks are more differentiated in high-tech services than systems.</td>
<td>Networks are more differentiated and more decentralized than systems in all arrangements.</td>
<td>Networks are more decentralized than systems in HMO products.</td>
</tr>
<tr>
<td>Moderately centralized health network/system</td>
<td>Networks are more differentiated and more decentralized.</td>
<td>Networks are more differentiated and more decentralized than systems in all arrangements.</td>
<td>Networks are more decentralized and more decentralized in all products.</td>
</tr>
<tr>
<td>Independent hospital network/system</td>
<td>Networks are more differentiated than systems in all services.</td>
<td>Networks are more differentiated and more decentralized in contractual arrangements.</td>
<td>None</td>
</tr>
</tbody>
</table>

*Note: Based on t-tests across similarly labeled health systems and networks. To achieve a joint α = .05 given multiple comparisons, threshold for significance was p ≤ .003.*
How should we evaluate “systems”? 

- Sometimes we want to evaluate *individual hospitals* but **control** for the effect of being a system
  - Need to know if hospital is part of a system
- Sometimes we want to evaluate a *system* – this will often entail aggregating data from individual units
  - Need to know what hospitals comprise a system (harder)
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Defining organizations can be tricky

Consider a “practice”

- What is this? Same building? Interchangeable patient panel? Common medical staff? Or a common billing number?

Common approach: aggregate physicians into practices
How we like to think practices work
How they *really* work

28% of North Carolina PCPs (N=7402) list at least two practice locations (including 7% with >2)
Measuring system-ness

Healthcare Cost Reporting Information System (HCRIS, “Medicare cost reports”)

“Home office expense”: does the “mother ship” charge the hospital for administrative expense?

“Related organizations” – are there organizations with “common ownership or control”? 
## Among Critical Access Hospitals (2009)

<table>
<thead>
<tr>
<th>(A-8-1)</th>
<th>Not Owned</th>
<th>No HO expense</th>
<th>HO expense</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>607</td>
<td>369</td>
<td>976</td>
<td></td>
</tr>
<tr>
<td>Owned</td>
<td>0</td>
<td>240</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>607</td>
<td>609</td>
<td>1216</td>
<td></td>
</tr>
</tbody>
</table>
Measuring system-ness, con.

AHA:
- System member
- Is the hospital contract-managed?

We have attempted to validate these measures (by phoning hospitals) and the results have been disappointing
- But not many alternatives
Analysis of Facilities within System

- Take the economist view: trust no one (what’s their angle?)

- Facilities in systems may have incentives (financial, quality, etc.) to behave differently
  - Example (Stearns et al 2006): Evaluate free-standing SNFs vs hospital-based SNFs
  - Guess what?
    - Very few hospitals that did NOT have a HB SNF discharged patients to a HB SNF
    - Patients discharged to HB SNF very different from those to FS SNF (can you guess?)

- Can we ever really “match” these guys?
Driving Force for Referral Decision

- Single strongest predictor of HB referral is coming from a hospital that operates its own SNF.
- Referral decision appears to be very different when coming from a hospital that does not operate its own SNF.

<table>
<thead>
<tr>
<th></th>
<th>By Qualifying Hospital Stay</th>
<th>By SNF setting:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospital has SNF</td>
<td>No SNF</td>
</tr>
<tr>
<td>Number of cases</td>
<td>652,483</td>
<td>312,239</td>
</tr>
<tr>
<td>Percent referred from a hospital with its own SNF unit</td>
<td>47.7</td>
<td>100</td>
</tr>
<tr>
<td>Percent in a hospital-based SNF</td>
<td>28.8</td>
<td>51.1</td>
</tr>
</tbody>
</table>
The probability distribution for a HB referral is different in a hospital that has its own unit versus one that doesn’t. The other coefficients are also different, so it appears to be a different choice process.

![Graph showing predicted probability of HB referral](image)

- **Predicted Probability of HB Referral**
  - **x-axis**: Probability of HB (p(HB))
  - **y-axis**: Density Function
  - Line with squares: Hospital has HB unit
  - Dashed line: Does not have HB unit
Understanding the dynamics of the care patterns / transition

- Can be especially important to understand the pathways to the “outcome of interest”
  - In facilities/ system analyses, patient outcomes likely to be more associated with events with longer “upstream” influences
  - E.g. trauma— why this particular facility? (how does EMS decide?)
Unit of analysis

- Trends in facility-level adjusted rates vs. “direct” changes
  - Facility-level precision?
  - Functional form assumptions?
- “Match” facilities? Or match patients?
  - Especially if comparing facility types:

*To determine whether CAHs had outcomes different from those of other small, rural hospitals without the CAH designation, 2 sets of analyses were conducted. In the first, each CAH was matched to at least 1 non-CAH based on size, rurality, teaching status, and region.*

(Joynt et al 2013)
Quarterly (risk-adjusted) mortality rates for CAH and non-CAH; linear trends shown.

Joynt et al (2013)

Facility type as the “treatment” variable?
Comparing facilities

Purpose of comparison

Evaluation vs. public reporting vs. payment

- Adjusted rates?
- Bayesian / shrinkage?
- Comparing facilities vs. comparing facility types
“Adjusted” differences

To a large extent, whether facility differences can be “adjusted away” is uninteresting

“Sorry to inform you, but your loved one did not survive the procedure. The good news is that he had a high mortality risk and he lasted longer than we expected.”

BUT if we can understand the source of the unadjusted difference, we may be able to develop policy/practice solutions

“explained” ≠ “clinically indicated”
Do facility factors explain racial/ethnic disparities in post acute rehab?

- Consider post-acute rehab care (Home, Home w/ HH, SNF, IRF) for stroke, hip fracture, joint replacement
  - Generally, racial/ethnic minorities receive less intensive care
- Can these disparities be explained by hospital characteristics?
- Big Idea: Extension to Blinder-Oaxaca

Holmes, Freburger and Ku 2012
Model

Multilevel logistic model

\[ \Pr(\text{Institution}) = f(X_{ihcs} \beta + \mu_h) \]

for individual, hospital, county, state variables and a hospital-specific random intercept

Disposition patterns may exist for hospital-specific reasons unobservable to the analyst
Lots of Hispanics who are dx’d to an institution are admitted to an acute hospital with tendency to dx to IRF (not SNF) for reasons unobserved to the analyst.
Contextual data

- We often want to adjust for the population served by the system/facility
  - Easy: county / MSA
    - Official term: "clunky"
  - Better(?): Build your own
    - Use fine geography (e.g. ZIP) and market share (HMSA – Medicare inpatient)
    - Actual versus potential market share
Example: Concord, NC
Using 5% Hospital Share Threshold

A Doughnut
A “point ZIP”
A Doughnut Hole or Island

Ricketts (2012)
...but...

- Assumes that equal likelihood of using hospital within each ZIP.
- What do we know about “sorting” based on something other than distance?
- Consider Medicare patients and distance to a “high quality” hospital – what percent instead attend a “low quality” hospital?
- Does this vary by race?
Holding constant distance to “average or high” quality hospital, black patients more likely to attend low quality than white patients.

Contextual data may not be capture “population” well
More on “bypass” behavior

- In rural settings, patients who bypass tend to be
  - Commercially insured (vs. Medicare/uninsured)
  - Have more complex procedures
- Thus, those that get care at local hospital may be different from those that do not
- ➔ (Factors that are typically) unobserved selection may be important

Radcliff et al (2008)
Dartmouth’s Hospital Referral Regions for Central North Carolina

Based on actual utilization patterns
People on this side go to Hospital A

People on this side go to Hospital B
Ambulatory Care Sensitive Condition Hospital Admissions (2008) All Conditions
by County for All Persons

Admission Rate per 10,000 Population
(# of Counties)
243.48 to 363.62 (13)
202.04 to 243.47 (15)
174.65 to 202.03 (14)
157.95 to 174.64 (14)
140.10 to 157.94 (14)
118.07 to 140.09 (14)
73.09 to 118.06 (16)

Note: Only admissions to North Carolina Hospitals are included.
Sources: Thomson Inpatient Discharge Database, October 1, 2007 to September 30, 2008; NC Office of State Budget and Management, 2008.
Produced by: North Carolina Rural Health Research and Policy Analysis Center, Cecil G. Sheps Center for Health Services Research, University of North Carolina at Chapel Hill.
Temporal stability

Although not as large a problem as it is in practices (with physicians migrating in and out of the practice over time), systems and facilities also suffer from turnover (e.g. personnel (provider and management), clinics, services, other facilities...)

Case Study: The Stephensons

For pre-post / longitudinal studies, how stable is “stable enough”?
Subject instability can change outcomes

- Consolidation (e.g. due to more centralized system) should channel procedures into “centers of excellence”: increased volume => better outcomes (eg. Gaynor 2006)

- But Hayford (2012) found increases in market share (due to merger) led to more intensive treatment and higher mortality

- Anecdotally, acquisition often associated with consolidation at the “mother ship hospital” (or at least the profitable care)
Back to Joynt et al

CAHs in 2002 looked a lot different from CAHs in 2010

Does the straight line assume homogeneity?
Concern: CAHs are cutting L&D

Evidence: From 2001-2006, the CAHs were more likely to offer L&D....

....but that’s primarily because bigger hospitals were becoming CAH; by 2007 conversions stopped and the tipping point was reached
Discussion

Subtitle