Do Hospital-Owned Skilled Nursing Facilities Provide Better Post-Acute Care Quality?

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University of Michigan and NBER

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Harvard University
Background

NH market has two distinct patient populations

• Chronically ill, long-stay residents, financed by Medicaid and private payments
  – Asset and income tests to qualify for Medicaid
  – Private is largely out-of-pocket; little LTC insurance

• Post-acute, short-stay residents financed by Medicare
  – Medicare requires prequalifying 3-day hospital stay
  – 100-day benefit (avg SNF payment = $411/day), patient cost sharing ($157.50/day) begins at day 20
Medicare & SNF

• In 1981, Medicare accounted for 1.6% of NH expenditures, by 2013, this had increased to 22.2%

• How did we get here? Four eras
  1. Era 1: Pre Hospital PPS
  2. Era 2: Hospital PPS
  3. Era 3: SNF PPS
  4. Era 4: ACA payment reforms…
Era 1: Pre Hospital PPS

- In the 1970s and early 1980s, Medicare SNF was an underused benefit (Scanlon and Feder 1982)
- SNFs paid based on routine, ancillary, and capital cost centers
- Medicare hospital PPS adopted in 1983, which led to patients being discharged “sicker and quicker”
- CMS’ stringent interpretation of coverage/eligibility criteria held SNF market growth in check
- Late 1980s, these guidelines were relaxed
Medicare SNF Expenditures, 1981-97

Dollars in Millions

- Hospital PPS
- Issuance of Revised Guidelines
- MCCA

Year:
- 1981
- 1982
- 1983
- 1984
- 1985
- 1986
- 1987
- 1988
- 1989
- 1990
- 1991
- 1992
- 1993
- 1994
- 1995
- 1996
- 1997
Era 2: SNF Growth in 1990s

- Freestanding SNF sector expanded, hospital-based SNF sector exploded
- By 1998, ~2,200 (14%) HB-SNFs nationwide
- Cost-based payment and higher capital costs led to costs being twice as high in HB-SNFs (Wiener et al., 1986)
- Hospitals could also siphon off best patients for rehabilitation
Era 3: Medicare SNF PPS

Medicare adopted a per diem prospective payment system (PPS) on July 1, 1998

- Resource Utilization Groups (RUGS-III) places residents into 44 payment categories
- Adjusted for geographic (area wages, non-labor) factors
- Unfavorable for hospital-based SNFs, it leveled payments across all SNFs, leading to closures. Today, there are ~800 (5%) HB-SNFs in operation.
Medicare SNF Expenditures, 1981-2006

Dollars in Millions

- 1981
- 1983
- 1985
- 1987
- 1989
- 1991
- 1993
- 1995
- 1997
- 1999
- 2001
- 2003
- 2005

Issuance of Revised Guidelines
Hospital PPS
MCCA
PPS
BBRA BIPA

- Dollars in Millions
- $0
- $5,000
- $10,000
- $15,000
- $20,000
- $25,000
SNF PPS constrained HB-SNFs but other issues persist...

- Hospital readmissions
- High mortality
- Frequent transfers to long-stay NH status
- Spending variation across areas (IOM)
- Spending growth…
Era 4: ACA Payment Reforms

ACA holds hospitals more accountable for post-acute case

- Accountable Care Organizations (ACOs)
- Hospital readmission penalties
- Hospital value-based purchasing
  - Rewards hospitals that have low mortality and low spending through 30 days post-discharge
Hospital-SNF Linkages?

In new global payment era, hospitals looking to partner with SNFs

Informal SNF networks  Formal SNF contracts  Joint ownership
Theory

Two pathways by which HB-SNFs may increase efficiency:

– **Economies of scope**: If complementarities exist in production, hospitals and SNFs can produce better outcomes at a given cost through joint ownership.

– **Specialization**: HB-SNFs generally specialize in production of Medicare services, prevent readmission to hospital.
Selection

• Favorable selection
  – Hospitals choose to keep the least expensive patients to make money

• Adverse selection (after ACA)
  – Hospitals choose patients most at risk for readmission, try to prevent readmission

• Either way, choice of SNF is not random
Prior Literature

• In unadjusted analysis, Liu and Black (2003) found HB-SNFs had lower LOS (13 days vs 27 days), mortality (4% vs 7%), and hospital readmission (23% vs 28%)

• Using propensity matching, Stearns et al (2006) found HB-SNFs had 16.7% shorter stays, a 7.7% greater likelihood of home discharge within 30 days, and 2.3% fewer preventable 30-day hospital readmissions

“One limitation of our analysis is that unobserved selection still may explain the remaining differences in outcomes for patients of hospital-based SNFs. A natural approach to investigate this issue is to use instrumental variables (IV) models.” (p 620)
Research Objective

To estimate the causal effect of hospital-based SNF status on post-acute discharge outcomes using IV.
Data and Cohort

- Medicare claims within **180 days** of hospital discharge
- Minimum Data Set (MDS) to identify first-time admissions in 2009
- Facility data from CMS Online Survey Certification and Reporting (OSCAR) system.
- Zip code level data from Census 2000 aggregates
- 827,153 beneficiaries discharged from 3,173 acute care hospitals to 14,374 SNFs
General Empirical Approach

\[ Y_{in} = HB_{n}\beta + X_i\delta + \nu_{HRR} + \varepsilon_{in} \]

Where:
- \( Y_{in} \) is the outcome for person \( i \) in SNF \( n \)
- \( HB_{n} \) is hospital-based status at SNF \( j \)
- \( X_i \) is a vector of person and zip-code residential covariates
- \( \nu_{HRR} = \) hospital referral region fixed effects
- \( \varepsilon_{in} \) is a randomly distributed error term
### Table 2: Summary of (N=827,513)

<table>
<thead>
<tr>
<th>Days in different setting in the 180 days following hospital discharge</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death (# of days)</td>
<td>25.19</td>
<td>52.79</td>
</tr>
<tr>
<td>Hospital (# of days)</td>
<td>8.29</td>
<td>18.02</td>
</tr>
<tr>
<td>Skilled nursing facility (# of days)</td>
<td>51.01</td>
<td>52.00</td>
</tr>
<tr>
<td>Community with home health care (# of days)</td>
<td>28.44</td>
<td>38.47</td>
</tr>
<tr>
<td>Community (# of days)</td>
<td>67.06</td>
<td>63.85</td>
</tr>
</tbody>
</table>

### Accumulated outcomes in first 30 days following discharge

| Reimbursement for Inpatient hospital care ($)                       | 2,256 | 6,327    |
| Reimbursement for SNF care ($)                                      | 9,160 | 4,438    |
| Reimbursement for Home health care ($)                              | 415   | 781      |
| Total reimbursement ($)                                             | 11,903| 6,815    |
| Death                                                               | 0.071 | 0.257    |
| Any hospital readmission                                            | 0.201 | 0.401    |

### Accumulated outcomes in first 180 days following discharge

| Reimbursement for Inpatient hospital care ($)                       | 8,214 | 16,978   |
| Reimbursement for SNF care ($)                                      | 14,413| 10,673   |
| Reimbursement for Home health care ($)                              | 2,545 | 3,299    |
| Total reimbursement ($)                                             | 25,790| 22,151   |
| Death                                                               | 0.220 | 0.414    |
| Any hospital readmission                                            | 0.446 | 0.497    |
Control Measures

Person-lvl (baseline) vars
- Age; Gender; Race
- Marital status; Dual elig.
- Length of index hosp.
- HH use in prior 30 days
- Deyo>2; Elixhauser>2
- # of ICU days
- Diabetes; CHF
- COPD; Stroke; Cancer
- Hip fracture
- Schizophrenia; Bipolar
- # of meds past 7 days
- ADL score; CHESS score
- Cognitive performance
- RUGS score

Zip Code residential vars
- % Medicare Advantage
- % Black
- % under poverty line
- Population density
Assume hospital-based status has reduced form:

\[ HB_n = DD_{in} \lambda + X_i \gamma + \nu_{HRR} + u_{in} \]

Can we identify a variable \( DD \) that is correlated with hospital-based status, but not \( \varepsilon \), the error term in the main equation?
DD Instrument: Rationale

• Distance matters in the choice of hospitals (e.g. McClellan et al., 1994)

• Individuals choose their place of residence without regard to whether surrounding hospitals have a HB-SNF
\( DD = \ln(\text{km to nearest hospital with a SNF}) \) minus \( \ln(\text{km to nearest hospital without a SNF}) \)

Mean = 0.951

- \( DD = \ln(3\text{km}) - \ln(1\text{km}) \)
  \( DD = 1.1 \)

- \( DD = \ln(6\text{km}) - \ln(2\text{km}) \)
  \( DD = 1.1 \)

- \( DD = \ln(1\text{km}) - \ln(6\text{km}) \)
  \( DD = -1.79 \)
Literature Using DD as IV

Has been used going back to McClellan et al. (JAMA 1994)
Specifically has been used for nursing homes
  – Grabowski et al. (2013) and Hirth et al. (2014) used a DD instrument to examine FP-NFP nursing home outcomes

• **Marginal person** is someone who choses HB-SNF because they happen to live close to hospital with HB-SNF
Exposure to HB-SNFs Varies Based on Residence

Figure 1: Fraction of skilled nursing facility (SNF) patients in state who were treated in a hospital that owned a SNF.
IV Assumptions

Assumption 1: IV correlated with HB-SNF
  • Expected negative sign and strongly significant in first stage

Assumption 2: IV is uncorrelated with the error
  • Balance test
  • Falsification test
## Comparison of Observables by Value of Instrument (Table 3)

<table>
<thead>
<tr>
<th></th>
<th>DD&gt;median</th>
<th>DD&lt;median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital-based</td>
<td>7%</td>
<td>17%</td>
</tr>
<tr>
<td>Age</td>
<td>81.5</td>
<td>81.2</td>
</tr>
<tr>
<td>Female</td>
<td>66%</td>
<td>65%</td>
</tr>
<tr>
<td>White</td>
<td>90%</td>
<td>89%</td>
</tr>
<tr>
<td>Medicaid</td>
<td>19%</td>
<td>19%</td>
</tr>
<tr>
<td>CHF</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td># meds last 7 days</td>
<td>12.1</td>
<td>12.3</td>
</tr>
<tr>
<td>ADL score</td>
<td>16.6</td>
<td>16.5</td>
</tr>
</tbody>
</table>
Falsfication Test

• Doyle (2011) examines effect of health spending on outcomes for individuals on vacation

• DD Instrument should only work for individuals entering hospital near their residence
  – For individuals on vacation or entering hospital near an adult child, instrument will only work if DD correlated with unobservables
Table 4: First-stage results, regression of a hospital with a skilled nursing facility (SNF) on differential distance

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>All</th>
<th>Entered hospital 100km+</th>
<th>Entered hospital 200km+</th>
<th>Entered hospital 500km+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Distance</td>
<td></td>
<td>-0.0579***</td>
<td>-0.0135***</td>
<td>-0.0044***</td>
<td>-0.00184</td>
</tr>
<tr>
<td>(natural log of nearest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hospital w/ SNF – natural</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log of nearest w/out)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differential Distance</td>
<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– nearest w/out)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t-statistics</td>
<td>8.78</td>
<td>20.06</td>
<td>6.77</td>
<td>3.31</td>
<td>1.21</td>
</tr>
<tr>
<td>F-statistics</td>
<td>77.01</td>
<td>402.40</td>
<td>45.87</td>
<td>10.98</td>
<td>1.47</td>
</tr>
<tr>
<td>Partial R-squared</td>
<td>0.031</td>
<td>0.057</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>826,485</td>
<td>826,485</td>
<td>48,287</td>
<td>27,449</td>
<td>17,996</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.0927</td>
<td>0.104</td>
<td>0.041</td>
<td>0.037</td>
<td>0.035</td>
</tr>
</tbody>
</table>

Note: All the regressions include patients and residential zip-code level explanatory variables listed in table 3 and hospital referral region (HRR) fixed effects. Test statistics are based on robust standard error.
Estimation

• Least squares to replicate previous literature with endogenous hospital-based status

• Two-stage least squares (2SLS)
# Results – Marginal Effects

<table>
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<tr>
<th>Outcome (days)</th>
<th>OLS</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>0.55***</td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>0.47***</td>
<td></td>
</tr>
<tr>
<td>SNF</td>
<td>-16.91***</td>
<td></td>
</tr>
<tr>
<td>Home w/ home health</td>
<td>5.04***</td>
<td></td>
</tr>
<tr>
<td>Home w/out home health</td>
<td>10.85***</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>827,513</td>
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*** p<.001, ** p<.01, * p<.05
### 180-Day Results – Marginal Effects

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<tr>
<td>Hospital</td>
<td>0.47***</td>
<td>-0.61**</td>
</tr>
<tr>
<td>SNF</td>
<td>-16.91***</td>
<td>-5.71***</td>
</tr>
<tr>
<td>Home w/ home health</td>
<td>5.04***</td>
<td>0.70</td>
</tr>
<tr>
<td>Home w/out home health</td>
<td>10.85***</td>
<td>4.76***</td>
</tr>
<tr>
<td>N</td>
<td>827,513</td>
<td>827,513</td>
</tr>
</tbody>
</table>

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Magnitude of IV Estimates

Relative to dependent variable means, hospital-based SNFs:

– Decrease hospital days by 7%
– Decrease SNF days by 11%
– Increase home days (w/out HHA) by 7%
– (No stat significant impact on HHA days or mortality)
Instrumented Difference in HB versus FS Patients

A: Death
B: Hospital
C: Nursing Home
D: Home Health
E: Community

95% CI  Effect of being discharged to HB SNF
## 180-Day Spending Outcomes

<table>
<thead>
<tr>
<th>Outcomes (spending)</th>
<th>OLS</th>
<th>IV</th>
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<tbody>
<tr>
<td>Hospital</td>
<td>-$327***</td>
<td>$43</td>
</tr>
<tr>
<td>SNF</td>
<td>-$4,677***</td>
<td>-$3,858***</td>
</tr>
<tr>
<td>Home Health</td>
<td>$414***</td>
<td>-$57</td>
</tr>
<tr>
<td>Total</td>
<td>-$4,550***</td>
<td>-$4,196***</td>
</tr>
</tbody>
</table>

N 827,513  827,513

*** p<.001, ** p<.01, * p<.05
## 180-Day Spending Outcomes

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<td>827,513</td>
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16% Decline in Medicare spending

*** p<.001, ** p<.01, * p<.05
## 180-Day Outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>OLS</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehospitalization (0/1)</td>
<td>-0.027***</td>
<td>-0.040***</td>
</tr>
<tr>
<td>Death (0/1)</td>
<td>0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>N</td>
<td>827,513</td>
<td>827,513</td>
</tr>
</tbody>
</table>

*** p<.001, ** p<.01, * p<.05
**Table 8: Specification checks (N=827,513 unless otherwise noted)**

<table>
<thead>
<tr>
<th>Model</th>
<th>Death</th>
<th>Hospital</th>
<th>SNF</th>
<th>HHA</th>
<th>Home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline model</td>
<td>0.853</td>
<td>-0.607**</td>
<td>-5.711***</td>
<td>0.704</td>
<td>4.761***</td>
</tr>
<tr>
<td>Linear differential distance</td>
<td>-2.445**</td>
<td>-1.371***</td>
<td>-6.207***</td>
<td>2.535***</td>
<td>7.488***</td>
</tr>
<tr>
<td>Binary DD measure (above/below) median</td>
<td>-0.174</td>
<td>-0.708*</td>
<td>-7.111***</td>
<td>1.255</td>
<td>6.738***</td>
</tr>
<tr>
<td>Urban SNFs only (N= 690,991)</td>
<td>2.166*</td>
<td>-1.122**</td>
<td>-2.900**</td>
<td>0.231</td>
<td>1.625</td>
</tr>
<tr>
<td>Rural SNFs only (N= 136,010)</td>
<td>-1.02</td>
<td>0.246</td>
<td>-10.15***</td>
<td>3.750***</td>
<td>7.170***</td>
</tr>
<tr>
<td>High competition markets (N= 768,508)</td>
<td>0.737</td>
<td>-0.570*</td>
<td>-5.134***</td>
<td>0.57</td>
<td>4.396***</td>
</tr>
<tr>
<td>Low competition markets (N= 58,493)</td>
<td>0.303</td>
<td>-0.701</td>
<td>-5.731**</td>
<td>2.906</td>
<td>3.223</td>
</tr>
<tr>
<td>Hip fracture patients (N=69,352)</td>
<td>-1.375</td>
<td>-2.523***</td>
<td>-7.158***</td>
<td>4.399**</td>
<td>6.656**</td>
</tr>
<tr>
<td>Acute myocardial infarction patients (N=19,068)</td>
<td>3.346</td>
<td>-1.755</td>
<td>-2.803</td>
<td>-2.966</td>
<td>4.178</td>
</tr>
<tr>
<td>Stroke patients (N=27,397)</td>
<td>2.418</td>
<td>1.473</td>
<td>-10.49**</td>
<td>-0.286</td>
<td>6.881*</td>
</tr>
</tbody>
</table>

Note: All the regressions include patients and residential zip-code level explanatory variables listed in table 3 and hospital referral region (HRR) fixed effects. Standard errors are based on robust standard error.

*** p<.001, ** p<.01, * p<.05
Summary

• In 180 days following discharge, hospital-based SNF patients have:
  – Fewer days in institution, more in community
  – Lower Medicare spending
  – Fewer hospital readmissions
  – No difference in mortality

• 30-day outcomes largely consistent with these 180-day findings

• IV results differ from the OLS, confirming importance of instrumenting for hospital-based status
Implications

• Payment policies
  – In “make or buy” decision under ACA reforms, our results suggest hospital systems may wish to “make” these services rather than “buy” these services from freestanding SNFs
  – In era of site-neutral payments, should CMS look to increase payments to HB-SNFs?

• Care-planning
  – Could aid patients/families in choosing SNFs
  – Hospital-based status is reported on NH Compare report card
Step 2: Choose Nursing Home to Compare

Your Search Results
Your search resulted in 1 nursing home available in Massachusetts matching your search criteria.
Selected up to 3 Nursing Homes from the results table below and select the "Compare" button to compare your selections in more detail.
These results are sorted by Nursing Home Name.

Five Star Quality Rating
Nursing homes are rated overall and on health inspections, nursing home staffing and quality measures. More stars are better.

- Much Above Avg. ★★★★★
- Above Avg. ★★★★
- Average ★★★
- Below Avg. ★★
- Much Below Avg. ★

Your Search Criteria
You have selected the following criteria for your search:
Name: Hebrew
State: Massachusetts
+ New Search
+ Modify Search

Refine Your Results:
- Nursing Home within a Continuing Care Retirement Community
- Nursing Home within a hospital
- Nursing Homes with Resident and Family Council

View Nursing Home Locations on a Map

Choose up to 3 nursing homes to Compare

Nursing Home Name and General Information

REHABILITATIVE SERVICES UNIT-HEBRREW REHAB CENTER
1200 CENTRE STREET
BOSTON, MA 02131
(617) 362-0695
Located in a Hospital
Mapping & Directions

Overall Rating
- ★★★★★
- ★★★★
- ★★★
- ★★
- ★

Health Inspections
- ★★★★★
- ★★★★
- ★★★
- ★★
- ★

Nursing Home Staffing
- ★★★★★
- ★★★★
- ★★★
- ★★
- ★

Quality Measures
- ★★★★★
- ★★★★
- ★★★
- ★★
- ★

Program Participation
- Medicare

Number of Certified Beds
- 60

Type of Ownership
- Non-profit Corporation