Healthcare exceptionalism in a non-market system: hospitals performance, labor supply, and allocation in Denmark

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PRELIMINARY, PLEASE DO NOT CITE WITHOUT AUTHORS’ PERMISSION
Do better care mitigate the impact of negative health condition on labor?
This paper

1. **Measure** quality of treatment by exploiting labor market response to hospital admission
   - higher quality of care $\Rightarrow$ less harmful labor market consequences
   - we link Danish hospital records to labor market data
   - observe how individuals’ earnings and hours worked change before and after hospital admission

2. Evaluate the degree of “Dynamic Allocation” in non-market system
   - Chandra et al (AER 2016) show that better hospitals grow more over time in US and argue it is due to “market forces”
Outline

Background and data

Evidence on labor supply effects of hospital admission

Quality measure of hospitals and hospital departments

Application: Dynamic allocation in a non-market system
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Health Care in Denmark

- Population of 5.7 Million
- Free health care, public hospitals
- Few big hospitals - many merges during last 20 years
Data

1. *Universe* of Danish hospital records from 1994-2013
   - > 48 million observations
   - hospital ID, department ID, department specialty
   - patient type (ER, in- or out-patient)
   - Start-date, end-date, # of bed days
   - 4-digit ICD-10 diagnoses
   - Conducted treatments, operations, examinations and tests

2. Labor market outcomes of Danish population from 1994-2013
   - Everybody - not just patients (> 57 million observations)
   - Yearly earnings, transfers and hours worked (for some workers)
   - Occupation (4 digit ISCO class)
   - Address (Municipality)
   - Highest obtained education, gender, age, marital status

For each Dane, we know his-her work history *and* all interactions with the hospital system

- Use 15% random subsample of individuals
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Application: Dynamic allocation in a non-market system
Mean earnings in population $\approx 320,000$ DKK

Full-time job $\approx 1660$ hours/year

Little pre-trend before admission, persistent negative effect after admission; slight recovery of hours worked
Event Study: Musculoskeletal

- Slight downward trend before admission, persistent negative effect after admission
Event Study: Injury

- Little pre-trend before admission, recovery of earnings and hours worked after admission
What did we learn?

1. large effect of hospital admission on labor market outcomes

2. patients are not randomly selected (e.g. lower earnings)
   - use data richness to control for (observable) heterogeneity
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A measure of quality

post-admission labor market outcomes $\rightarrow$ quality of care

1. compute counterfactual labor income

2. $\Delta\text{Income} = f(\text{hospital/hospital department } | \text{ diagnosis, medical history, ...})$
Earnings Dynamic

Estimate shock to income $\epsilon_{i,t}$, from the AR(1) process

$$y_{i,t} = \rho(educ_{i,t}, age_{i,t}) \cdot y_{i,t-1} + \beta X_{i,t} + \epsilon_{i,t}$$

(1)

where

- $y_{i,t}$ is log earnings of individual $i$ in year $t$
- the autocorrelation coefficients $\rho$ is allowed to vary with age and education
  - $\approx .7$ when held constant
- controls $X_{i,t}$ include
  - age×education FE (heterogeneous age-income profile)
  - occupation×year FE (sector shocks)
  - municipality×year FE (geographical shocks)
Hospital admissions and negative earnings shocks

For each individual $i$ and year $t$ we estimate

$$\hat{\epsilon}_{i,t} = \sum_{n=1}^{10} \beta_n \cdot 1[NAdm_{i,t} = n] + \eta_{i,t}$$

where $NAdm_{i,t} = \#$ of hospitalizations of individual $i$ in year $t$

- Size of earnings shocks log linear in $\#$ of admissions
Health shocks have persistent effect on earnings

For each individual $i$, year $t$ and lag $\tau$ we estimate

$$\hat{\epsilon}_{i,t} = \sum_{\tau=t-5}^{t+5} \beta_{\tau} \cdot NA_{Adm_{i,\tau}} + \eta_{i,t}$$

Results (recall that average $\rho \approx .7$):
Hospital heterogeneity

We measure hospital quality $q_h$ as a FE from regression

$$
\hat{\epsilon}_{i,t} = q_h + \gamma_d + \beta X_{i,t} + \xi_{age} + \kappa_{gender} + \eta_{i,d,h,t}
$$

- one obs is a hospital admission of individual $i$ in year $t$ with main diagnosis $d$ in hospital $h$ (or hospital-specialty pair $s$)
- controls ($X_{i,t}$) for severity of other conditions in the same and previous year
- estimate the model for 4 4-years periods from 1995 to 2012 (we exclude 2007 and 2008)
Hospital- And Specialty Quality Measures

1995-1998

1999-2002

2003-2006

2009-2012
Hetereogenity across hospitals and within specialties

Magnitude (example)

- internal medicine: "good" (top 25%) vs. "bad" (bottom 25%) department ⇒ earnings loss ≈ 20% of \( std(\epsilon_{it}) \)
Are better hospitals better at everything?

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Dynamic Allocation: Motivation

- Declining number of hospitals despite stable (and slightly increasing) number of admissions
- Do better hospital grow faster even in the non-market system?
“Healthcare Exceptionalism?” by Chandra et al (2016) investigate correlations between some measures of quality and hospital growth. We perform similar exercise:

1. for each hospital $h$ (or hospital-specialty $hs$) and period $t$ we compute growth rate as

$$\Delta_{h,t} = 2 \frac{N_{h,t} - N_{h,t-1}}{(N_{h,t} + N_{h,t-1})}$$

where $N_{h,t}$ is the number of total admissions.

2. we estimate

$$\Delta_{h,t+1} = \beta \cdot \hat{q}_{h,t} + \gamma_t + \eta_{i,t}$$

and

$$\Delta_{hs,t+1} = \beta \cdot \hat{q}_{hs,t} + \gamma_t + \lambda_s + \eta_{i,t}$$
Results

Higher quality hospitals grow more, but not at specialty level

➤ “dynamic allocation” without markets

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$\hat{q}_{h,t}$

7.424***

[1.732]

$\hat{q}_{hs,t}$

0.374

0.167

[0.292]  [0.321]

Year FEs  ×  ×  ×

Specialty FEs  ×

Obs  297  2251  2248

$R^2$  0.376  0.412  0.461
Conclusion

- Labor market effect of hospital admissions $\rightarrow$ substantial variation in treatment quality
- Higher quality hospitals grow faster despite the absence of market forces
Appendix: Admissions and Labor Supply

Let \( e_{i,t} = 1 \) if individual \( i \) is admitted for the first time (in the most recent 5 years) to any hospital for a specific condition in year \( t \)

- We run the event-study regression:

\[
Y_{i,t} = \sum_{\tau=t-5}^{t+5} \beta_\tau \cdot e_{i,\tau} + FE_{age,gender,t} + \eta_{i,t}
\]

Notice:

- \( Y_{i,t} \) is yearly earnings or hours worked
- Mean labor earnings in 2010 = 300k DKK (\( \approx \$47k \))
- Full-time annual work hours = 1924 hours
Appendix: Controls

1. consider patient-years with only one hospitalization and run

\[ \hat{\epsilon}_{i,t} = \gamma_{d'} + \eta_{i,t} \]

2. take estimated FEs \( \hat{\gamma}_{d'} \) as proxy for disease \( d' \) severity

3. then, given all diagnoses \( d'' \) experienced by patient \( i \) in year \( t \)
build the vector

\[ X_{i,t} = [\min(\hat{\gamma}_{d''_{t}}), \sum(\hat{\gamma}_{d''_{t}}), 0.7 \times \sum(\hat{\gamma}_{d''_{t-1}}), P_{i,t}] \]

where \( P_{i,t} \) is a polynomial in the number of admissions