2016 Conference Presentations

Fall Research Meeting
September 12-14, 2016
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The impacts of institutional arrangements on unwarranted variations in health care

DIFFERENT SYSTEMS, PAYMENT SYSTEMS & POLICY INSTRUMENTS

GWYN BEVAN
PROFESSOR OF POLICY ANALYSIS
LSE
### Systems & policy instruments

#### Institutional arrangements
- Insurance: Multiple / Single
- Universal Coverage?
- Access to specialists by gatekeeper?
- Funding & payment systems?

#### Models of governance
- Trust & Altruism (T&A)
- Choice & Competition (C&C)
- Public Ranking (PR)
- Sanctions & Rewards (S&R)
Social divides ➔ access to specialists: USA & England

**USA**

- Family doctors middle class
- Satisfy high standards ➔ admitting rights
direct access to specialists
- Hospitals for poor

**England**

- General Practice: provincial low status & quality
- Referral system
  - physician & surgeon retain hospitals
  - GP retains patients
- Hospital physicians: London social elite

NHS ➔ $s ➔ £s ➔ NHS
Risk distribution & insurer competition?

Risk distribution

% Total Expenditure

Unregulated ➔ incomplete coverage

Complete coverage ➔ no competition?

Complete coverage & regulated competition ➔ risk equalisation

‘inverse care law’: availability of good medical care tends to vary inversely with need
Variations in access by patients & payments to physicians & providers

**Single payer**
- Free at point of access
- GP as gatekeeper

**Multiple**
- User charges
- Direct access to specialists

**Fixed budget**

**Risk-adjusted funding by capitation?**
- GPs: capitation
- Hospitals: fixed payment
- Hospital physicians: salary

**Finance by activity**
- Hospital charges
- Physician fees
Insurance arrangements
## Systems & policy instruments

### Institutional arrangements
- Insurance: Multiple / Single
- Universal Coverage?
- Access to specialists by gatekeeper?
- Funding & payment systems?

### Models of governance
- Trust & Altruism (T&A)
- Choice & Competition (C&C)
- Public Ranking (PR)
- Sanctions & Rewards (S&R)
Political maxim, every man supposed a knave (but) false in fact

**Organisation: Choice & competition**
- Beveridge: providers
- Bismarck: insurers & providers

**Trust & Altruism**
- Reward failure?

**Individual**
- P4P
- Targets & terror

**Econs**

**Humans**

**Reputation**
- Naming & shaming
- Benchmark competition
Knights & knaves & Models of governance?

- Choice & competition
- P4P
- Targets & terror
- Trust & Altruism
- Naming & shaming
- Benchmark competition
Single payer & provider competition?

**Tried & rejected**

- Scotland
- Wales
- New Zealand

**Still trying**

- Lombardy

LSE
Bismarck: insurer & provider competition?

No:
- Belgium
- France

Yes:
- Switzerland
- Netherlands
- Czech
- Germany
- Slovakia
- Israel
Choice & Competition ➔ equity & efficiency?
↓ Unwarranted variation? ✗

Choice: provider ➔ therapy
Shared decision making?

- National budget
  - Risk-adjusted funding by capitation?
    - Local monopoly insurers
      - Selective contracting ✗
      - Patient choice: principle ➔ policy instrument? ✗
        - Competing providers
    - National competing insurers
      - Selective contracting vs principle of patient choice? ✗
        - Competing providers
            - Choice of insurer ✓
              - Risk equalisation?
                - Premium?
                - Coverage?
                - Quality?

- Single payer (Beveridge)
  - Multiple payers (Bismarck)

- National budget
  - Risk-adjusted funding by capitation?
    - Local monopoly insurers
      - Selective contracting ✗
      - Patient choice: principle ➔ policy instrument? ✗
        - Competing providers
    - National competing insurers
      - Selective contracting vs principle of patient choice? ✗
        - Competing providers
            - Choice of insurer ✓
              - Risk equalisation?
                - Premium?
                - Coverage?
                - Quality?
Public Ranking + Sanctions / Rewards

Public Ranking

1. Ranking
2. Published & widely disseminated
3. Easily understood: performance good / poor?
4. Regular reporting: performance improved?

Types of ranking & Sanctions / Rewards

**England star rating**
- Single score for whole organisations
- Sack zero-rated CEOs

**Tuscany dartboard**
- Variations within & between organisations
- P4P for CEOs
England: star ratings 2000 to 2005

Waiting time targets: England & Wales (T&A)

Limitations: gaming & short term

High-powered incentives

Imperfect measures

Unintended consequences

- Awful ➔ adequate ✔
- Adequate ➔ high performing ✗
Natural experiment: Italy

Marche: T&A

Tuscany: PR & P4P
### Points for discussion

#### Impacts on unwarranted variations

- Differences in coverage?
- User charges?
- Gatekeepers?
- Funding systems
  - Equity?
  - Activity?
- Payment systems
  - Hospital physicians?
  - Primary care physicians?
  - Hospital CEOs?

#### Models of governance for unwarranted variations?

- T&A
- C&C: insurers & providers
- C&C: providers
- shared decision making
- PR
  - ‘targets & terror’ & ‘naming & shaming’ (short term)
  - Pisa dartboard & benchmark competition
Comparative analyses

- Germany & France
  - Dominic von Stillfried
  - Zeynep Or

- USA & England
  - Jon Skinner
  - Matthew Skellern

- Italy & New Zealand
  - Sabina Nuti
  - Catherine Gerard

Universal Health Care

- Single-payer universal health care
- Some form of universal health care
- Universal health care in transition
- No universal health care or no data
References

- Barber (2007) *Instruction to deliver*. Politico’s
- Bevan & Hamblin (2009) Hitting & missing targets by ambulance services for emergency calls. *JRSS (A)*
- Bevan & Van De Ven (2010) Choice of providers & mutual healthcare purchasers: can the English National Health Service learn from the Dutch reforms? *HEPL*
- Bevan & Skellern (2011) Does competition between hospitals improve clinical quality? *BMJ*
References

- Hume (1742) *Essays: Moral, Political & Literary*
Avoidable variation in the different phases of myocardial infarction clinical pathway in Italy

Mirko Di Martino, Luigi Pinnarelli, Adele Lallo, Riccardo Di Domenicantonio, Paola Colais, Danilo Fusco, Marina Davoli

Department of Epidemiology, Lazio Regional Health Service

The acute myocardial infarction (MI) clinical pathway defines the ideal care process, sequencing and timing of interventions.

An optimal clinical pathway improves the quality of MI patient care, by reducing prehospital mortality, intermediate and late mortality from hospital admission.

In Italy a relevant variation was observed in intermediate and late mortality from admission, suggesting avoidable heterogeneity among healthcare providers.
Variation in intermediate and late mortality from hospital admission in MI patients

30-day mortality from admission

12-month mortality from admission in patients alive at 30 days post MI

Objective

To measure unwarranted geographic variation in health outcomes of MI patients, during prehospital, hospital and post-discharge phases.
At national level, data on prehospital mortality are not available. In order to overcome this limitation, we used health information systems of the Lazio Region (about 5 million residents).

Patients with incident MI in the period **2013-2014** were included in the study.

We analyzed prehospital mortality, 30-day mortality from hospital admission, and the incidence of major adverse cardiac and cerebrovascular events (MACCE) in the 12 months after discharge.

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**Data sources and outcomes**

**Phases of the MI clinical pathway**

<table>
<thead>
<tr>
<th>Phases of the pathway</th>
<th>Prehospital phase</th>
<th>Hospital phase</th>
<th>Post-discharge phase</th>
<th>Overall synthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients</strong></td>
<td>All incident patients</td>
<td>Hospitalized patients</td>
<td>Discharged patients</td>
<td>All incident patients</td>
</tr>
<tr>
<td><strong>Outcome measures</strong></td>
<td>Prehospital mortality risk</td>
<td>30-day mortality* risk from admission</td>
<td>MACCE: risk in the 12 months after discharge</td>
<td>Proportion of “event-free” patients at the end of follow-up</td>
</tr>
</tbody>
</table>

* Mortality from all causes.
Measuring variation

Multilevel models were performed in order to measure geographic variation for each phase of the clinical pathway.

Variance components were expressed in terms of median odds ratios (MORs).

This measure is always greater than or equal to 1.00. If the MOR equals 1.00, there is no variation between clusters. If there is considerable between-cluster variation, the MOR will be large.

Why do we need multilevel models?

Multilevel analysis considers the health system like a hydraulic system with some leaks.

This method is useful to identify exactly where the leaks are, and to quantify the extent of the loss.

If variation exists between some geographic areas, policies should shrink upwards the variation, in order to reduce inequalities and improve clinical outcomes.
It was considered appropriate to select 12 areas of residence within the Lazio region as the geographic areas because they correspond directly to the policy level of the local health authorities.

Results: baseline characteristics of the study cohort

We enrolled 24,677 incident MI patients.

About 60% of patients were male. The mean age was 70 ± 14 years for men and 79 ± 13 years for women.

Almost 40% of patients had at least one concomitant disease.

Hypertension (15%), other forms of ischemic heart disease (12%), arrhythmia (11%), heart failure (10%), previous cerebrovascular disease (8%), chronic kidney disease (7%), and COPD (6%) were the most common comorbidities.
Results: patient's risk factors and probability of being event-free

When analyzing the whole MI pathway, we detected patient's risk factors associated with a lower probability of being event-free at the end of follow-up.

<table>
<thead>
<tr>
<th>Patient's risk factors</th>
<th>Risk Ratio</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 65 years</td>
<td>1.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>[65-75]</td>
<td>0.58</td>
<td>0.53 - 0.63</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>[75-85]</td>
<td>0.31</td>
<td>0.29 - 0.34</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>≥ 85</td>
<td>0.11</td>
<td>0.10 - 0.12</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Obesity</td>
<td>0.67</td>
<td>0.49 - 0.94</td>
<td>0.020</td>
</tr>
<tr>
<td>Anemia</td>
<td>0.80</td>
<td>0.68 - 0.95</td>
<td>0.009</td>
</tr>
<tr>
<td>Other forms of ischemic heart disease</td>
<td>0.44</td>
<td>0.39 - 0.50</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Heart failure</td>
<td>0.49</td>
<td>0.43 - 0.57</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Cardiomyopathies</td>
<td>0.93</td>
<td>0.39 - 0.74</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>0.67</td>
<td>0.59 - 0.75</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Cerebrovascular diseases</td>
<td>0.63</td>
<td>0.55 - 0.72</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>0.66</td>
<td>0.56 - 0.77</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Results: outcome measures by phase of pathway

<table>
<thead>
<tr>
<th>Phases of the pathway</th>
<th>Prehospital phase</th>
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<td>Discharged patients</td>
<td>All incident patients</td>
</tr>
<tr>
<td>Outcome measures</td>
<td>Prehospital mortality risk</td>
<td>30-day mortality risk from admission</td>
<td>MACCE: risk in the 12 months after discharge *</td>
<td>Proportion of &quot;event-free&quot; patients at the end of follow-up</td>
</tr>
<tr>
<td>Patients at risk (N.)</td>
<td>24,677</td>
<td>15,987</td>
<td>14,212</td>
<td>24,677</td>
</tr>
<tr>
<td>Outcome Range **</td>
<td>35% (25% - 51%)</td>
<td>10% (7% - 12%)</td>
<td>17% (14% - 20%)</td>
<td>49% (37% - 56%)</td>
</tr>
</tbody>
</table>

* Analyses were limited to patients alive at 30 days post MI.
** Among areas of residence in the Lazio region.
Results: median odds ratios by phase of pathway

<table>
<thead>
<tr>
<th>Phase of pathway</th>
<th>MOR *</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prehospital</td>
<td>1.30</td>
<td>1.19 - 1.49</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Hospital</td>
<td>1.18</td>
<td>1.10 - 1.33</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Post-discharge</td>
<td>1.07</td>
<td>1.03 - 1.18</td>
<td>0.061</td>
</tr>
<tr>
<td>Overall synthesis</td>
<td>1.17</td>
<td>1.11 - 1.27</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

* MORs adjusted for patient sociodemographic and clinical characteristics.

Key issues

- A relevant variation among areas of residence of the Lazio region was observed in each phase of the MI clinical pathway: prehospital, hospital, and post-discharge phase.
- Variation was higher when analyzing prehospital mortality. This finding underlines that early identification of symptoms as well as timely and appropriate interventions are key elements to improve disease management.
- The application of multilevel models to real practice data is the innovative aspect of our study. We believe that this methodology can guide health policies, reduce inequalities, and improve health outcomes.
Perspectives for improvement

- To set up information campaigns: e.g. patients should be transported to the hospital by ambulance rather than by friends or relatives;
- to perform scientific studies for optimizing the location of ambulances in the area.

- To make efforts to reduce the door to balloon time in ST elevation MI patients.

- To improve the organizational processes within the hospital, in order to discharge MI patients from specialist wards and plan the subsequent visits for patient monitoring;
- to stimulate association for primary care physicians, in order to improve the continuity of care (e.g. the adherence to pharmacological treatment).

The interventions at regional level

- As regards acute conditions, such as MI and stroke, in 2014, the emergency networks were revised, by defining a new hub and spoke organization.

- As regards the hospital phase, the door to balloon time was reduced by means of the (1) Regional Outcome Evaluation Program, (2) public disclosure and (3) audit procedures.

- As regards the post-discharge phase, in 2015, training sessions for general practitioners were performed, focusing on the most recent pharmacological clinical guidelines.
The interventions at *national* level

In 2015, the Health Ministry developed new indicators and new statistical methodologies in order to *monitor* health care quality in the Italian Regions, taking into account the *intra-regional variation*.

---

*Be careful about reading health books. You may die of a misprint.*

*Mark Twain*
Preferences In End Of Life Care Substantially Differ Between The Netherlands And Japan

Stef Groenewoud\(^1\), Noriko Sasaki\(^2\), Gert Westert\(^1\), Yuichi Imanaka\(^2\)

\(^1\)Scientific Institute For Quality Of Healthcare, Radboud University Medical Center, 114 IQ Healthcare, Po Box 9101, 6500 Hb, Nijmegen, The Netherlands
\(^2\)Department of Healthcare Economics and Quality Management, Kyoto University Graduate School of Medicine, Kyoto, Japan
**International variation EOL care**

<table>
<thead>
<tr>
<th>Place of death</th>
<th>Lung Cancer (N=306)</th>
<th>Colon Cancer (N=172)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>18 (61.3%) [55.8%-66.8%]</td>
<td>94 (55.0%) [47.5%-62.5%]</td>
</tr>
<tr>
<td>Hospital</td>
<td>69 (22.3%) [17.6%-27.0%]</td>
<td>31 (18.1%) [12.3%-23.9%]</td>
</tr>
<tr>
<td>Hospice / pall care unit</td>
<td>37 (12.1%) [8.4%-15.8%]</td>
<td>22 (12.9%) [7.9%-17.9%]</td>
</tr>
<tr>
<td>Home for the elderly</td>
<td>8 (2.6%) [0.8%-4.4%]</td>
<td>19 (11.1%) [6.4%-15.8%]</td>
</tr>
<tr>
<td>Nursing home</td>
<td>4 (1.3%) [0%-2.6%]</td>
<td>5 (2.9%) [0.4%-5.4%]</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.3%) [0%-0.9%]</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Was this place of preferred death?</th>
<th>Yes</th>
<th>No</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston</td>
<td>196 (70.0%) [64.6%-75.4%]</td>
<td>35 (12.5%) [8.6%-16.4%]</td>
<td>49 (17.5%) [13.1%-22.0%]</td>
</tr>
<tr>
<td>Other</td>
<td>123 (78.8%) [72.4%-85.2%]</td>
<td>17 (10.9%) [6.0%-15.8%]</td>
<td>16 (10.3%) [5.5%-15.1%]</td>
</tr>
</tbody>
</table>

---

Dutch data are from Sentimelc Database, owned by EMGO/Vumc Amsterdam.

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82% of cancer patients die in hospitals.
Regional variation in EOL care

Death outside hospital

Data source: Vital statistics for 2014
Regional variation EOL care

### Table: Average Practice Variation Score (pvs) of Top and Lowest Three Regions

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Avg factorscore</th>
<th>Factorscore 2013</th>
<th>Factorscore 2014</th>
<th>Factorscore 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio therapy</td>
<td>10,9</td>
<td>10,1</td>
<td>5,9</td>
<td>16,6</td>
</tr>
<tr>
<td>ICU days</td>
<td>10,2</td>
<td>12,2</td>
<td>9,0</td>
<td>9,5</td>
</tr>
<tr>
<td>Radiotherapy</td>
<td>9,9</td>
<td>9,8</td>
<td>6,3</td>
<td>13,6</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>5,6</td>
<td>6,3</td>
<td>5,1</td>
<td>5,5</td>
</tr>
<tr>
<td>LOS</td>
<td>4,2</td>
<td>2,8</td>
<td>2,4</td>
<td>7,1</td>
</tr>
<tr>
<td>Surgical procedures</td>
<td>3,9</td>
<td>3,6</td>
<td>2,4</td>
<td>5,7</td>
</tr>
<tr>
<td>GP visits</td>
<td>3,7</td>
<td>n.v.t</td>
<td>n.v.t</td>
<td>n.v.t</td>
</tr>
<tr>
<td>Home care</td>
<td>3,5</td>
<td>n.v.t</td>
<td>n.v.t</td>
<td>n.v.t</td>
</tr>
<tr>
<td>GP consultation</td>
<td>3,1</td>
<td>n.v.t</td>
<td>n.v.t</td>
<td>n.v.t</td>
</tr>
<tr>
<td>Emergency Dpt</td>
<td>3,0</td>
<td>2,2</td>
<td>2,3</td>
<td>4,6</td>
</tr>
<tr>
<td>CT-scans</td>
<td>2,6</td>
<td>2,5</td>
<td>2,4</td>
<td>2,8</td>
</tr>
<tr>
<td>Laboratory</td>
<td>2,4</td>
<td>1,9</td>
<td>1,9</td>
<td>3,5</td>
</tr>
<tr>
<td>Trauma (Ambulance, chopper)</td>
<td>2,2</td>
<td>n.v.t</td>
<td>n.v.t</td>
<td>n.v.t</td>
</tr>
<tr>
<td>Intensive home care</td>
<td>2,2</td>
<td>n.v.t</td>
<td>n.v.t</td>
<td>n.v.t</td>
</tr>
</tbody>
</table>

**Factor score** average practice variation score (pvs) of top three regions

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Unpublished data from current study based on DIS database.
Unwarranted variation is either

- Underuse of effective care,
- Misuse of preference sensitive care or
- Overuse of supply sensitive care

Before strategies can be chosen to reduce unwarranted variation, we need to know more about people’s preferences.

Dartmouth Institute, 2007.  
Question

• (How) do people’s preferences regarding EOL care differ within and between Japan and The Netherlands?
Methods (1)

• Using 2 nationwide panel from March to April 2016
• From survey companies (Macromill, Inc., Tokyo, Japan and its Dutch partner company),
• Citizens were randomly recruited in an online opt-in survey,
• Citizens who had Japanese respectively Dutch nationalities and lived in JPN respectively in the NL.
Methods (2)

- To ascertain the citizens’ preferences toward EOL care we asked the following topics:
  - Most important caregiver in case of dependency (eg. dementia)
  - Expected living situation in case of dependency (eg. dementia); move?
  - How they would experience an ACP approach by their doctor in EOL situations
  - Preferred treatment strategy in last phase of life
  - Preferred place of death
  - Preferred medical decision regarding the end of life in terminal phase
  - Feel burden in case of dependency of others?
Methods (3)

**JPN panel**

1.2 million registrants

10,000 samples

‘opt-in’ using sampling survey

**Dutch panel**

220,000 registrants

50,000 samples

‘opt-in’ using sampling survey

Respondents were recruited by randomly sending emails step-by-step until the intended number of participants in each stratum had been fulfilled

<table>
<thead>
<tr>
<th>JPN (Urban area)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–30 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>40 years</td>
<td>52</td>
<td>52</td>
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<tr>
<td>50 years</td>
<td>52</td>
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<tr>
<td>60 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>≥ 70 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>260</td>
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</table>

<table>
<thead>
<tr>
<th>JPN (Other area)</th>
<th>Male</th>
<th>Female</th>
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</thead>
<tbody>
<tr>
<td>20–30 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>40 years</td>
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<tr>
<td>≥ 70 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>260</td>
<td>260</td>
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</table>

<table>
<thead>
<tr>
<th>NL (Urban area)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–30 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>40 years</td>
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<td>52</td>
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<tr>
<td>50 years</td>
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<tr>
<td>60 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>≥ 70 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>260</td>
<td>260</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NL (Other area)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–30 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>40 years</td>
<td>52</td>
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<td>50 years</td>
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<tr>
<td>60 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td>≥ 70 years</td>
<td>52</td>
<td>52</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>260</td>
<td>260</td>
</tr>
</tbody>
</table>

n=1,040

n=1,038

n=1,040

*‘Urban area’ / ‘other area’ were defined as follows: JPN: Tokyo, Kanagawa, Chiba, Saitama, Kyoto, Osaka, and Hyogo Prefectures/the rest of the prefectures NL: Province of North Holland and South Holland/ the rest of the provinces*
Methods (4)

• We performed descriptive statistical analyses, followed by Chi-squared correlation analysis to better understand how individual characteristics were associated with the preferences and attitudes.

Independent variables:
• Nationality
• Subjective area of residence (Urban/Suburban/Rural)
• Gender
• Age group
• Final academic background
• Annual income
• Marital status
• Occupation

All statistical analyses were conducted using SPSS software version 20.01 (SPSS Inc., Chicago, IL, USA). P values (two-tailed) < 0.05 were considered statistically significant.
### Results – baseline characteristics

<table>
<thead>
<tr>
<th></th>
<th>Japan (n=1,038)</th>
<th>The Netherlands (n=1,040)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>519 (50.0)</td>
<td>520 (50.0)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–39 years</td>
<td>207 (19.9)</td>
<td>208 (20.0)</td>
</tr>
<tr>
<td>40–49 years</td>
<td>208 (20.0)</td>
<td>208 (20.0)</td>
</tr>
<tr>
<td>50–59 years</td>
<td>207 (19.9)</td>
<td>208 (20.0)</td>
</tr>
<tr>
<td>60–69 years</td>
<td>208 (20.0)</td>
<td>208 (20.0)</td>
</tr>
<tr>
<td>≥ 70 years</td>
<td>208 (20.0)</td>
<td>208 (20.0)</td>
</tr>
<tr>
<td><strong>Area of residence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>342 (32.9)</td>
<td>444 (42.7)</td>
</tr>
<tr>
<td>Suburban</td>
<td>584 (56.3)</td>
<td>293 (28.2)</td>
</tr>
<tr>
<td>Rural</td>
<td>112 (10.8)</td>
<td>303 (29.1)</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>678 (65.3)</td>
<td>570 (54.8)</td>
</tr>
<tr>
<td>Unmarried</td>
<td>327 (31.5)</td>
<td>342 (32.9)</td>
</tr>
<tr>
<td>Officially registered living together</td>
<td>19 (1.8)</td>
<td>37 (3.6)</td>
</tr>
<tr>
<td>Living together without official registration</td>
<td>14 (1.4)</td>
<td>91 (8.8)</td>
</tr>
<tr>
<td><strong>Family composition &amp; Living arrangements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single living alone</td>
<td>174 (16.7)</td>
<td>252 (24.2)</td>
</tr>
</tbody>
</table>
Results – baseline characteristics

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Japan</th>
<th>The Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company employee</td>
<td>264 (27.3)</td>
<td>314 (30.2)</td>
</tr>
<tr>
<td>Medical/nursing professional</td>
<td>21 (2.0)</td>
<td>20 (1.9)</td>
</tr>
<tr>
<td>Civil servant</td>
<td>24 (2.3)</td>
<td>37 (3.6)</td>
</tr>
<tr>
<td>Self-employed (own firm with personnel)</td>
<td>56 (5.4)</td>
<td>17 (1.6)</td>
</tr>
<tr>
<td>Self-employed (own firm without personnel)</td>
<td>17 (1.6)</td>
<td>41 (3.9)</td>
</tr>
<tr>
<td>Freelance worker</td>
<td>163 (15.7)</td>
<td>7 (0.7)</td>
</tr>
<tr>
<td>Teacher</td>
<td>8 (0.8)</td>
<td>25 (2.4)</td>
</tr>
<tr>
<td>Research &amp; Development</td>
<td>2 (0.2)</td>
<td>11 (1.1)</td>
</tr>
<tr>
<td>Housewife/house-husband</td>
<td>250 (22.2)</td>
<td>85 (8.2)</td>
</tr>
<tr>
<td>Pensioner</td>
<td>66 (6.4)</td>
<td>310 (28.8)</td>
</tr>
<tr>
<td>Student</td>
<td>10 (1.0)</td>
<td>27 (2.6)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>142 (13.7)</td>
<td>71 (6.8)</td>
</tr>
<tr>
<td>Other</td>
<td>14 (1.3)</td>
<td>75 (7.2)</td>
</tr>
<tr>
<td><strong>Final academic background</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>428 (41.3)</td>
<td>459 (44.1)</td>
</tr>
<tr>
<td>Moderate</td>
<td>258 (24.4)</td>
<td>374 (36.0)</td>
</tr>
<tr>
<td>Low</td>
<td>350 (33.7)</td>
<td>201 (18.9)</td>
</tr>
<tr>
<td>None of the above</td>
<td>6 (0.6)</td>
<td>6 (0.6)</td>
</tr>
<tr>
<td><strong>Annual income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under €7,000</td>
<td>57 (9.3)</td>
<td>32 (3.1)</td>
</tr>
<tr>
<td>€7,000–€21,000</td>
<td>221 (21.3)</td>
<td>141 (13.6)</td>
</tr>
<tr>
<td>€21,000–€35,000</td>
<td>281 (25.1)</td>
<td>211 (20.3)</td>
</tr>
<tr>
<td>€35,000–€75,000</td>
<td>237 (22.8)</td>
<td>347 (32.4)</td>
</tr>
<tr>
<td>€75,000 and over</td>
<td>69 (6.6)</td>
<td>63 (5.1)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>153 (14.7)</td>
<td>246 (23.7)</td>
</tr>
</tbody>
</table>
Regional variation

• **No statistically significant regional differences** for people’s preferences *within the two countries*.

• Preferences did not differ between provinces (The Netherlands) or prefectures (Japan), rural or more urbanized areas.

• One exception: in The Netherlands, people from suburban areas more often report that it is likely that they will move from one area to another in case they would become dependent of health care because of illness during last stage of life (26%).
International variation (1/5)

• If asked who they expect to be their *most important care giver in case they would suffer from dementia and become dependent*, Japanese people more often refer to their children (9%) than the Dutch (5%).

• Also, Japanese people more often admit they have not thought about that yet (26% vs. 9%).

• Dutch citizens more often expect nursing professionals to be their primary care givers in that case (51% vs. 33%).

• The Dutch seem to avoid nursing homes (3% vs. 16% of the Japanese) and to favor home care (20% vs. 13%).
International variation (2/5)

• If asked how they would feel if their doctor would pro-actively confront them with their future death and talk with them about goals in life (Advance Care Planning),

• Dutch people more often say they would be happy with such an approach (78% vs. 65%).

• More Japanese people than Dutch people say that ACP is too confronting and that they would expect their doctor to give them more hope (18% vs. 11%).
International variation (3/5)

• Finally, when asked if they would experience themselves to be a burden for those surrounding them if they would become dependent in their last phase of life,
• Far more Japanese admit they would do so (79% vs. 48%)
• Far more Dutch than Japanese people explicitly say this would not be the case (41% vs. 7%).
International variation (4/5)

• Asked for their *preferred place of death*,

• Japanese people more often choose the hospital (20% vs. 4%) whereas

• the Dutch prefer home care combined with outpatient care (66%) more than the Japanese (49%).
International variation (5/5)

• Asked for their preferred medical decision at the end of life if they would become terminally ill,
• the Dutch more often prefer the actively ending of life (43%) than the Japanese (18%),
• Japanese people prefer a more passive approach (forgo active treatment or stop eating and drinking) more often (21%) than the Dutch (7%).
Conclusion

• Japanese and Dutch people’s preferences for EoLC substantially differ.
• These insights are important when interpreting variation in EoLC.
• Interventions for reducing unwarranted variation at the end of life, such as Advance Care Planning cannot be globally applied in a standardized way.
• Knowledge about differences in people’s preferences for EoLC may help making these interventions more tailor made and thus more successful.
Association among hospital bed supply, utilization, and mortality by the case-mix of inpatients in Korea

Sept. 13th 2016

Yoon Kim, MD, PhD, MS
Professor, Dept. of Health Policy and Management, Seoul National University College of Medicine
Reducing avoidable variation in Healthcare
A goal for regional strategies and actions

Unwarranted variation in healthcare utilization reflects important differences in population access, quality and outcomes that cannot be explained by population differences. Therefore, the question is: what can be done to reduce it?

Geographic variation in healthcare among both large (countries and regions) and small areas (hospital service areas) has been found to occur across all dimensions of performance, including quality, access and utilization. Increasingly research is shifting from assessing variation to using the findings to improve care. It is crucial to develop policies, management tools and governance models that can be effective and efficient in reducing unwarranted variation within a healthcare system.

This WIC international conference calls for moving from the detection to the management of unwarranted variation within regional healthcare systems. In particular, this conference is expected to address the following questions: Which tools are proven to support managers and policy-makers in reducing variation? Which are the outcomes of efforts to reduce unwarranted variation at the regional level? What can we learn from these initiatives? How can performance evaluation be leveraged to increase awareness among policy-makers about geographic variations?

This conference will discuss the approaches to answering the above questions. The conference will be organized around four themes:

- Avoidable variation: the clinical perspective
- Avoidable variation: the patient perspective
- Avoidable variation: the organizational and institutional perspective
- Avoidable variation in primary care setting

If you like to join in addressing these issue, then submit a paper or register as a participant!
Motivation:
Oversupply of hospital beds in Korea

Number of hospital beds per 1,000 people

Korea - - OECD Average

Number of beds per 1,000 person

Clinic
Hospital
General Hospital

2.04
4.56
5.53
3.38

'90 '91 '92 '93 '94 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04 '05 '06 '07 '08 '09 '10

1.0
2.0
3.0
4.0
5.0
6.0

0 50,000 100,000 150,000 200,000 250,000 300,000 350,000 400,000
Motivation: Oversupply of small hospitals in Korea

- **U.S.**
  - Number of hospitals (~100): 24.4%
  - Number of hospitals (100~300): 36.1%
  - Number of hospitals (300~500): 25.3%
  - Number of hospitals (500~): 18.0%

- **Japan**
  - Number of hospitals (~100): 19.0%
  - Number of hospitals (100~300): 39.5%
  - Number of hospitals (300~500): 23.5%
  - Number of hospitals (500~): 18.0%

- **Korea**
  - Number of hospitals (~100): 60.3%
  - Number of hospitals (100~300): 10.8%
  - Number of hospitals (300~500): 7.7%
  - Number of hospitals (500~): 21.2%
Research questions

Q1. Hospital bed supply and inpatient utilization
Are people living in areas with higher more hospital beds more likely to be admitted?

Q2. Hospital bed supply and mortality
Q2-1. [Volume] Are people living in areas with more hospital beds less likely to die?

Q2-2. [Structure] Are people living in areas with more large hospitals less likely to die?

Q3. Association across case-mix - subgroup analysis
Are those associations more prominent in medical (or surgical) conditions and severe (or mild) diseases?
Objectives

To identify association among hospital bed supply, utilization and mortality by case-mix in Korea

✔ Hospital bed supply
  ▪ Volume - Number of per capita hospital beds
  ▪ Structure - Proportion of large hospital beds

✔ Case-mix
  ▪ Medical vs. surgical
  ▪ Disease severity - DRG Category
Methods
Methods

Study population

✓ Entire population of Korea (2014)

✓ National Health Insurance (NHI) Enrollee
  ▪ 97% of entire population in Korea – 48.5 million

✓ National Medical Aid Enrollee
  ▪ 3% of population – 1.5 million
Methods – Hospital service areas (HSAs)

- Patient-origin method
- Parameters and minimum requirements
  - Population size $\geq$ 15 thousand
  - Localization index $\geq$ 40%
  - Travel time to hospitals $\leq$ 60 min
- 57 HSAs
Methods – dependent variables

- Number of hospital admissions (per capita)
  - NHI claims data during 2014 (1 year)

- Risk-adjusted inpatient mortality ratio
  - SHMI (summary hospital mortality index) methodology
    - Area level aggregation
    - Within 30 day mortality after discharge
  - Mortality ratio
    - Overall mortality
    - Within-HSA utilization mortality
Methods – independent variables

Individual level

✓ Age, gender, premium (proxy of income), place of residence
  ▪ From NHI and Medical Aid Enrollment File
✓ Principal diagnosis and comorbidity code – ICD 10
  ▪ From claims date - NHI and Medical Aid

Area level

✓ Socioeconomic variables
  ▪ Rural population (%)
  ▪ Average premium level (proxy of deprivation index)
✓ Health status and behaviors
  ▪ Subjective health status (fair, %)
  ▪ Regular smoker (%)
  ▪ Average BMI(kg/m2) >=25 (%)
  ▪ Heavy drinking (%)
Methods: measures – hospital bed supply

- **Volume**
  - ✔ Number of hospital beds per capita

- **Structure**
  - ✔ % of large hospital beds (≥ 500 beds)
Methods: case-mix

- Surgical and medical conditions
  - Using DRG classification
    - Surgical DRGs and Medical DRGs

- Disease Severity Group – using DRG classification
  - Group A (9%): severe conditions require tertiary care
    - E.g. Cancer, CVA, AMI, muscular dystrophy
  - Group B (61%): moderate conditions
  - Group C (30%): mild conditions require secondary care
    - E.g. Normal delivery, pneumonia, peripheral neuropathy

- Severity group – the most important criteria for tertiary hospital designation in Korea
Methods: Analysis

- Descriptive analysis, simple regressions
Results – Variation
### Characteristics of patients – 8.5 mil. admissions, 1.2% mortality

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Deaths (%)</th>
<th>All-cause admissions (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>59,120 ( 1.5)</td>
<td>3,826,543 (45.0)</td>
</tr>
<tr>
<td>Female</td>
<td>42,773 ( 0.9)</td>
<td>4,625,913 (55.0)</td>
</tr>
<tr>
<td><strong>Type of admission</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency admission</td>
<td>66,017 ( 4.1)</td>
<td>1,607,807 (19.0)</td>
</tr>
<tr>
<td>Elective admission</td>
<td>35,876 ( 0.5)</td>
<td>6,844,649 (81.0)</td>
</tr>
<tr>
<td><strong>Type of admission</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical admission</td>
<td>14,473 ( 0.5)</td>
<td>3,153,410 (37.3)</td>
</tr>
<tr>
<td>Medical admission</td>
<td>87,420 ( 1.7)</td>
<td>5,299,046 (62.7)</td>
</tr>
<tr>
<td><strong>Income level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (medical aid recipients)</td>
<td>13,729 ( 2.7)</td>
<td>513,580 ( 6.1)</td>
</tr>
<tr>
<td>2 (lowest)</td>
<td>12,178 ( 1.1)</td>
<td>1,121,844 (13.3)</td>
</tr>
<tr>
<td>3</td>
<td>10,349 ( 0.9)</td>
<td>1,128,126 (13.4)</td>
</tr>
<tr>
<td>4</td>
<td>13,262 ( 0.9)</td>
<td>1,436,962 (17.0)</td>
</tr>
<tr>
<td>5</td>
<td>17,314 ( 1.0)</td>
<td>1,778,848 (21.1)</td>
</tr>
<tr>
<td>6 (highest)</td>
<td>29,050 ( 1.4)</td>
<td>2,064,735 (24.4)</td>
</tr>
<tr>
<td>Missing</td>
<td>6,011 ( 1.5)</td>
<td>408,361 ( 4.8)</td>
</tr>
<tr>
<td><strong>Charlson Comorbidity Index</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>35,357 ( 0.6)</td>
<td>6,361,460 (75.3)</td>
</tr>
<tr>
<td>1-5</td>
<td>17,807 ( 1.8)</td>
<td>1,012,066 (12.0)</td>
</tr>
<tr>
<td>&gt;5</td>
<td>48,729 ( 4.5)</td>
<td>1,078,930 (12.8)</td>
</tr>
</tbody>
</table>
Bed supply – Volume

Average 6.3 (3.7~9.9)

OECD Avg. 3.3

(CV: 0.25, EQ: 2.67)
Bed supply - Structure

Average 12.6% (0~52.6%) (CV : 1.18, EQ : - )

% of large hospital bed (≥ 500 beds)

Hospital service areas

27 HSAs (47.4%)
Inpatient utilization

No. of Admissions (per 1000 persons)

Hospital service areas

 Avg. 180 admission (123-288)

OECD Avg. 155

(CV : 0.21, EQ : 2.34)
Risk-adjusted Inpatient Mortality Ratio

57 Hospital Service Areas

0.83

1.71
Results – Association: volume, utilization and mortality
Number of hospital beds and admissions - simple regression

Adj $R^2=0.655$
Number of hospital beds and admissions - Medical vs. Surgical (simple regression)

- Medical: $Y = -16.21 + 14.91X (R^2 = 0.6024, p < 0.0001)$
- Surgical: $Y = 6.12 + 5.10X (R^2 = 0.3644, p < 0.0001)$
Number of hospital beds and admissions: by disease severity - simple regression

- Group A: $Y = -1.59 + 0.100X$ (R²=0.1459, p<0.005)
- Group B: $Y = 5.29 + 10.00X$ (R²=0.5996, p<0.0001)
- Group C: $Y = -13.82 + 8.99X$ (R²=0.6103, p<0.0001)
Number of hospital beds and inpatient mortality - simple regression

\[ y = -0.0398x + 1.4115 \]

\[ R^2 = 0.13687 \]
Number of hospital beds and mortality: medical vs. surgical (simple regression)

- medical: $Y = 1.36 - 0.04X$ ($R^2 = 0.1077$, $p < 0.05$)
- surgical: $Y = 2.02 - 0.10X$ ($R^2 = 0.1707$, $p < 0.005$)
Number of hospital beds and mortality by disease severity (simple regression)

- Group A: $Y=1.87-0.12X$ ($R^2=0.1042$, $p<.05$)
- Group B: $Y=1.46-0.03X$ ($R^2=0.1208$, $p<.01$)
- Group C: $Y=0.84-0.02X$ ($R^2=0.0249$, $p>.05$)
Results – Association: hospital bed structure and mortality
Association between structure of hospital bed supply and inpatient mortality - simple regression

\[ y = -0.6876x + 1.2472 \]

\[ R^2 = 0.34865 \]
Structure of hospital beds and mortality: risk-adjusted mortality ratio using SHMI

Absence or presence of general hospital with larger than 500 beds

- **Absence**
  - Medical: 1.21
  - Surgical: 1.52
  - Group A: 1.12
  - Group B: 1.29
  - Group C: 0.73
  - Total: 1.23

- **Presence**
  - Medical: 1.02
  - Surgical: 1.7 times
  - Group A: 0.67
  - Group B: 1.16
  - Group C: 0.63
  - Total: 1.05

Severity:
- Case-mix

30
Summary

Q1. Number of hospital beds and admissions
   → Medical conditions and mild diseases were more supply-sensitive.

Q3. Hospital bed supply and mortality
Q3-1. *Per capita hospital beds* and mortality
   → No association across all clinical subgroups
Q3-2. *% of large hospital beds and mortality*
   → Strong (+) association in surgical conditions and severe diseases
Next steps

Analytics – multilevel analysis
✓ Using 5-year admission data to ensure sufficient number of observations for multilevel analysis

“Decompose” large hospital effect
✓ Identify characteristics of large hospitals affecting on inpatient mortality
  ▪ Large hospitals – proxy variable of high quality care
Thank you for your attention

yoonkim@snu.ac.kr
KARDIO-Study
Coronary angiography and percutaneous intervention for patients with chest pain and coronary heart disease: Analysis of regional variations and clinical pathways to improve the quality of the indication indication

Research proposal

David Klemperer
Leonie Sundmacher
Norbert Donner-Banzhoff
Wennberg International Collaborative, Oxford
Sept 14, 2016
Healthcare Fact Check
The Development of Regional Variations in German Health Care

OECD Health Policy Studies
Geographic Variations in Health Care
WHAT DO WE KNOW AND WHAT CAN BE DONE TO IMPROVE HEALTH SYSTEM PERFORMANCE?

The Wennberg International Collaborative
Table of Contents
September 18 – 19, 2014 | Royal College Surgeons of England
### Snapshot of key hospital services in Germany compared with other OECD countries

<table>
<thead>
<tr>
<th>Hospital discharges for major diseases</th>
<th>Germany</th>
<th>Rank compared with OECD countries</th>
<th>OECD average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases of the circulatory system, per 1 000 population</td>
<td>35.7</td>
<td>1</td>
<td>19.6</td>
</tr>
<tr>
<td>Cancer, per 1 000 population</td>
<td>24.5</td>
<td>2</td>
<td>13.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedures carried out as inpatient cases (involving an overnight stay in hospital)</th>
<th>Germany</th>
<th>Rank compared with OECD countries</th>
<th>OECD average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cataract surgery per 100 000 population</td>
<td>178</td>
<td>7</td>
<td>118</td>
</tr>
<tr>
<td>Tonsillectomy per 100 000 population</td>
<td>157</td>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>Percutaneous coronary interventions (PTCA) per 100 000 population</td>
<td>624</td>
<td>1</td>
<td>177</td>
</tr>
<tr>
<td>Coronary bypass per 100 000 population</td>
<td>116</td>
<td>2</td>
<td>47</td>
</tr>
<tr>
<td>Appendectomy per 100 000 population</td>
<td>151</td>
<td>7</td>
<td>126</td>
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<tr>
<td>Cholecystectomy per 100 000 population</td>
<td>236</td>
<td>2</td>
<td>154</td>
</tr>
<tr>
<td>Inguinal and femoral hernia per 100 000 population</td>
<td>223</td>
<td>1</td>
<td>110</td>
</tr>
<tr>
<td>Prostatectomy (transurethral) per 100 000 males</td>
<td>197</td>
<td>4</td>
<td>117</td>
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<tr>
<td>Prostatectomy (excluding transurethral) per 100 000 males</td>
<td>85</td>
<td>5</td>
<td>54</td>
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<tr>
<td>Hysterectomy (vaginal only) per 100 000 females</td>
<td>178</td>
<td>6</td>
<td>113</td>
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<tr>
<td>Caesarean section per 1000 live births</td>
<td>314</td>
<td>9</td>
<td>261</td>
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<tr>
<td>Hip replacement per 100 000 population</td>
<td>295</td>
<td>1</td>
<td>154</td>
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<tr>
<td>Knee replacement per 100 000 population</td>
<td>213</td>
<td>2</td>
<td>122</td>
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<tr>
<td>Breast-conserving surgery per 100 000 females</td>
<td>232</td>
<td>1</td>
<td>108</td>
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<tr>
<td>Mastectomy per 100 000 females</td>
<td>69</td>
<td>8</td>
<td>56</td>
</tr>
</tbody>
</table>

*Source: OECD Health Data 2012* 

OECD.2013. Managing Hospital Volumes: Germany and Experiences from OECD Countries.
Hospital beds per 1000 population, 2010 (or latest year available)
Hospital discharges per 1000 population, 2010 (or latest year available)
Coronary revascularisation procedures 2013 (or nearest year)

OECD. Health at a Glance 2015, p.111
CABG

<table>
<thead>
<tr>
<th>Country</th>
<th>Belgium</th>
<th>Germany1</th>
<th>Germany2</th>
<th>Canada</th>
<th>Switzerland</th>
<th>Israel</th>
<th>France</th>
<th>Italy</th>
<th>Finland</th>
<th>Portugal</th>
<th>Spain</th>
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</thead>
<tbody>
<tr>
<td>Crude rate</td>
<td>90</td>
<td>66</td>
<td>73</td>
<td>66</td>
<td>75</td>
<td>49</td>
<td>49</td>
<td>29</td>
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<td>30</td>
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<tr>
<td>Std rate</td>
<td>84</td>
<td>68</td>
<td>72</td>
<td>69</td>
<td>75</td>
<td>52</td>
<td>59</td>
<td>28</td>
<td>41</td>
<td>59</td>
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<tr>
<td>Coeff. of variation</td>
<td>0.17</td>
<td>0.17</td>
<td>0.21</td>
<td>0.24</td>
<td>0.25</td>
<td>0.26</td>
<td>0.27</td>
<td>0.29</td>
<td>0.30</td>
<td>0.34</td>
<td>0.41</td>
</tr>
</tbody>
</table>

PTCA

<table>
<thead>
<tr>
<th>Country</th>
<th>Israel</th>
<th>Switzerland</th>
<th>Belgium</th>
<th>Germany1</th>
<th>Germany2</th>
<th>Canada</th>
<th>Italy</th>
<th>France</th>
<th>Australia</th>
<th>Portugal</th>
<th>Finland</th>
<th>Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude rate</td>
<td>301</td>
<td>235</td>
<td>275</td>
<td>358</td>
<td>358</td>
<td>207</td>
<td>225</td>
<td>272</td>
<td>226</td>
<td>120</td>
<td>179</td>
<td>145</td>
</tr>
<tr>
<td>Std rate</td>
<td>340</td>
<td>242</td>
<td>261</td>
<td>371</td>
<td>370</td>
<td>212</td>
<td>187</td>
<td>247</td>
<td>208</td>
<td>111</td>
<td>189</td>
<td>135</td>
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<tr>
<td>Coeff. of variation</td>
<td>0.12</td>
<td>0.17</td>
<td>0.18</td>
<td>0.18</td>
<td>0.22</td>
<td>0.22</td>
<td>0.23</td>
<td>0.23</td>
<td>0.24</td>
<td>0.27</td>
<td>0.30</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Procedure rates across and within selected OECD countries, 2011 or latest year

OECD. Geographic Variations in Health Care, 2014. p 40-41
Morrisville

- **awareness** feedback of data
- **agreement** on indication
- **responsibility** willingness to change:
  review of candidates
1 hospital / 2 physicians
Lewis Blowers, Robert Parker

Patient Outcomes Research Team – 1987
advancement of the Morrisville approach
BPH

![Graph showing Tonsillectomy rate](image)

**Procedure per 10,000 children (14 years or younger)**

- **Morrisville, VT, USA**

Year
- 1969
- 1970
- 1971
- 1972
- 1973
- 1974
- 1975
- 1976
- 1977

Wennberg et al. Pediatrics 1977
Wennberg 2010, p. 35
The Kardio Study Group

**Academic Departments:** Primary Care, Health Services Research, Health Economics

Department of General Practice / Family Medicine University of Marburg
Norbert Donner-Banzhoff (study leader)
Health Economics & Health Care Research UKE Hamburg Hans-Helmut König
Health Economics & Health Care Research UKE Hamburg Dirk Heider
Health Services Management, LMU München Leonie Sundmacher
Faculty of Social and Health Sciences OTH Regensburg David Klemperer

**Scientific Societies**

German Cardiac Society Karl Werdan
Stiftung Institut für Herzinfarktforschung Uwe Zeymer, Steffen Schneider
AWMF-Institute for Medical Knowledge Management Ina Kopp

**Statutory Health Insurance**

AOK Bundesverband Julian Bleek, Gerhard Schillinger
Scientific Institute of Techniker Krankenkasse Udo Schneider, Dirk Horenkamp-Sonntag
Barmer GEK Ursula Marschall
Research questions and working hypotheses

**Primary working hypothesis**
Regional variations of cardiac procedures represent a quality deficit, not variations of morbidity

**Research question**
Which factors are associated with high / low local rates of procedures?

**Secondary working hypothesis**
Unwarranted variations can be lowered by adhering consequently to transsectoral pathways

**Research question**
Which are the barriers for guideline adherence and how can they be overcome?
Kardio Study Component A
Regional variations and care need

**Aggregated level**

district level place of patients’ residence

**Regional variations of procedure rates**

Variables

data source: administrative data provided by health insurers

**sociodemographic factors** age, sex, social indicators

**morbidity** cardiovascular risk factors, prevalence of arteriosclerotic disease

**treatment capacities** left heart catheter laboratories, operating hours, number of cardiologists; hospital beds
Kardio Study Component A

*individual level*

analysis of treatment sequences of individual patients / cooperation of care providers
reasons for seeking treatment
patient characteristics,
contacted care providers
non-invasive ischemia diagnostics,
characteristics of the regional health system

→ developing a model for regional health care need such as coronary angiography/PCI needed per population
Kardio Study Component B

Qualitative analysis of contextual factors in high-rate vs. low-rate regions

1. How do high-rate regions and low-rate regions differ?
   - local structure, cooperation, attitudes towards guideline recommendation
   - focus group interviews

2. How do primary care physicians and cardiologists justify their practice (beliefs)?
   - Which local norms influence their behaviour?
   - How do they communicate with patients?
   - one-on-one interviews, stimulated recall

3. How do patients experience the decision process?
   - one-on-one interviews
Kardio Study Component C
Development and implementation of cross-sectoral treatment pathways

4 high-use regions

clinical pathway evidence-based consented guidelines

interdisciplinary group discussions primary care physicians, cardiologists, emergency rooms, hospital outpatient consulting rooms

proof-of concept prospective before-and-after intervention trial

before and after implementation of the clinical pathway

200 consecutive patients per region with incident/newly manifested thoracic pain – Primary care physicians 100, cardiologists in ambulatory practice 50, hospitals 50

primary outcome: rate of patients with left heart catheter, secondary outcome: non-invasive diagnostics, cost, patient satisfaction, decision quality, use of decision aid, quality of life, mortality
Unique features of the Kardio Study

Integration of

1. analysis of regional variations of a procedure
2. identification of influencing factors: qualitative and quantitative
3. development of models to estimate health care need
4. development, implementation and evaluation of intersectoral clinical pathways

Aim

A generic model to tackle unwarranted variations of medical procedures.
Thank you very much for your attention!

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Geographical variation in acute readmission among hip fracture patients in Denmark

Pia Kjær Kristensen, Søren Paaske Johnsen
Introduction

Unwanted variation in survival and readmission at the hospital level after hip fracture in Denmark.

Denmark: 5.6 million inhabitants with free access to medical care, divided into 98 municipalities (local administrative bodies)

Municipality will determine which hospital the patient is admitted to and which rehabilitation and nursing care the patient can receive after discharge.

Hypothesis: The readmission rate in relation to the municipality level will reveal even more unwanted variation than the already known at hospital level, even after taking into account any differences in patient characteristics and hospital characteristics.
Aim

We examined whether the municipality level is associated with acute readmission rate to any Danish hospital within 30 days after discharge.

Secondly we examined whether patient characteristics and hospital characteristics were associated with variation at municipality level.
Design

First time hospitalisations for hip fracture patients registered in the DMHFR. These data were linked with other registry.

The Danish Multidisciplinary Hip Fracture Registry (DMHFR)
- National clinical registry documenting quality of care reflected by receiving seven process performance measures.
- Mandatory quality improvement project.
- A multidisciplinary expert panel consisting of experienced clinicians based on a systematic search of the scientific literature have developed the process performance measures.

The Danish Civil Registration System
- Vital status

Statistic Denmark
- Population registry
- Education registry
- Income registry

Danish National Patient Registry
- Dates and times of any hospital contact
- Procedures performed
- Diagnosis.
Readmission:
Defined as an acute all-cause readmission to any Danish hospital within 30 days after discharge for patients discharged alive after hip fracture.

Patient characteristic included:
• Sex
• Age (65-75 years, 75-85 years and >85)
• Fracture type (medial, pertrochanteric, subtrochanteric)
• Comorbidity (charlson comorbidity index; low, medium high)
• Type of surgery (osteosynthesis, hemiarthroplasty, total hip replacement)
• Family mean income (four quartiles of increasing income)
Definitions

Hospital characteristics included

- Quality of care reflected by seven process performance measures:
  1. Systematic pain assessment
  2. Being mobilized within 24 hours postoperatively
  3. Basic mobility assessment at admission
  4. Basic mobility assessment at discharge
  5. Post discharge rehabilitation program
  6. Treatment to prevent future osteoporotic fracture
  7. Initiation of treatment to prevent future fall accidents.

Receiving quality of care categorized as (0-50 % 50-75 % and 75-100 %)

- Hip fracture unit volume (<151, 152-350 and >350) hip fracture patients per year

- Time to surgery (<24 hours, 24-48 hours, >48 hours)

- Orthogeriatric specialization (orthopaedic unit or orthogeriatric unit)
The cumulative risk of acute readmission

23,641 hip fracture patients 2010-2013 discharged alived.

The 30-day readmission rate varied between 11.9 % to 27.2 % for the 98 municipalities
• 26 municipalities had still higher readmission rate compared to the municipality with the lowest readmission rate.

• The OR varied between 1.55 (1.04-2.30) to 2.49 (1.55-4.01)

• Further adjustment for hospital characteristics did not reduce the variation between the municipalities.

• The OR varied between 1.64 (1.04-2.58) to 2.61 (1.56-4.37).
Possible explanations

- Unmeasured and residual confounding
- Lack of information on preoperative functional level and overall hospital capacity.
- Differences in waiting time for rehabilitation in the municipalities.
- Differences in the quality of care provided in the municipalities.
- Differences in access to general practitioners.
Take home messages

• Substantial geographical variation in acute readmission rates after hip fracture at municipality level in Denmark.

• Differences in patient characteristics and hospitals characteristics did not explain the variation in readmission rates at the municipality level.

• Further research should aim to identify characteristics at the municipality level which may explain the variation in acute readmission rates.

Thank you for your attention
Establishing The Optimal Hospital Access Time For Pregnant Women Living In Obstetric Care Underserved Area In Korea: Using Change Point Analysis

Mi Young Kwak¹), Sang Jun Eun²), Yoon Kim³), Hyun Joo Kim⁴), Jin Yong Lee⁵)

¹) Center For Public Health, National Medical Center, Seoul; ²) Department Of Preventive Medicine, Chungnam National University School Of Medicine, Daejeon; ³) Department Of Health Policy And Management, Seoul National University College Of Medicine, Seoul; ⁴) Department Of Nursing Science, Shinsung University, Dangjin; And ⁵) Public Health Medical Service, Boramae Medical Center, Seoul National University College Of Medicine, Seoul, Korea.
The Korean government designated 37 regions among 250 administrative districts as "Obstetric Care Underserved Areas (OCUA)".

The Korean government recognizes OCUA could be a serious public health concern.

In particular, long travel time from home to hospital could affect the health of mothers and babies.

However, little is known regarding the association between geographic accessibility and maternal outcomes in south Korea.
Fig 1. Map of 38 OCUA in Korea

Fig 2. Map of 38 OCUA according to abortion rate
Objectives

- The Korean government would like to establish the Optimal Hospital Access Time (OHAT, Travel Time From Home To Hospital) for OCUA regions.
- If the OHAT is appropriately established, the significant maternal outcomes should be different according to before and after the OHAT.
- The purpose of this study were to establish and validate OHAT for OCUA.
Geographical Location of OCUA

The distribution of administrative district (250) in Korea

Locations of 37 OCUAs
How to select OCUA?

Locations of Delivery Room (543)

Their Catchment Areas in 60 min
How to select OCUA?

Calculating population proportion can not reach to OBGY in 60 min by each district

If over 30%, designated to OCUA
Methods

Data source

National Health Insurance Database in Korea

Whole dataset of women who terminated pregnancy including delivery and abortion from January 1, 2013 to December 31, 2013.

Total subjects were 371,341 women

Divided the mothers into mother group living in OCUAs (4,239) and others (367,102)

Evaluated the adequacy of prenatal care (using Kessner index) and calculated 14 incidence rates as PRIs

- PRIs: including abortion, Cesarean section, vaginal delivery, acute pyelonephritis, preeclampsia, eclampsia, gestational hypertension, gestational diabetes, placenta previa, placental abruption, obstructed labor, preterm delivery, still birth, and obstetric hemorrhage.
- Define the severity of obstetric hemorrhage: we calculated incidences of transfusion, intensive care unit admission, uterine artery embolization, and hysterectomy
Methods

- **Change Point Analysis (CPA), Developed By Taylor WA**
  
  We used two different analysis to get The Optimal Hospital Access Time (OHAT, Travel Time From Home To Hospital) for OCUA region

  ① **Change Point Analysis** (Commercial Program by Taylor)

  ② **Validated the result (screened change point)** (Multiple logistic regression)

  ![Change Point Analysis Diagram]

  ![Multiple Logistic Regression Table]
Change point analyzer 2.3 program

1. Enter the Data and Labels
2. Select the Label Column
3. Perform the Analysis
4. Interpret the Results

Change-Point Analyzer automatically checks for significant changes
## Table 1. The definition of abortion, delivery, and maternal (obstetrical) complications

<table>
<thead>
<tr>
<th>Variables</th>
<th>ICD-10 code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abortion</td>
<td>O00-O08 (O00-O089)</td>
</tr>
<tr>
<td>Delivery</td>
<td></td>
</tr>
<tr>
<td>Cesarean section</td>
<td>O82 (O820-O829), O842</td>
</tr>
<tr>
<td>Vaginal delivery</td>
<td>O80 (O800-O809), O81 (O810-O815), O83 (O830-O839), O840, O841</td>
</tr>
<tr>
<td>Maternal (Obstetrical) complications</td>
<td></td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>O14 (O140-O149)</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>O15 (O150-O159)</td>
</tr>
<tr>
<td>Gestational hypertension</td>
<td>O13</td>
</tr>
<tr>
<td>Gestational diabetes mellitus</td>
<td>O244</td>
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<tr>
<td>Placenta previa</td>
<td>O44 (O440-O441)</td>
</tr>
<tr>
<td>Abruptio placentae</td>
<td>O45 (O450-O459)</td>
</tr>
<tr>
<td>Obstructed labor</td>
<td>O64-O66 (O640-O669)</td>
</tr>
<tr>
<td>Preterm delivery</td>
<td>O601</td>
</tr>
<tr>
<td>Still birth</td>
<td>O364</td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>O23 (O230-O239), N10, N12, N159</td>
</tr>
<tr>
<td>Perineal laceration</td>
<td>O702, O703</td>
</tr>
<tr>
<td>Obstetric hemorrhage</td>
<td>O67 (O670-O679), O72 (O720-O723)</td>
</tr>
<tr>
<td>Fetal stress</td>
<td>O68 (O680-O689)</td>
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<tr>
<td>Transfusion</td>
<td>X1001, X1002, X2011, X2012, X2021, X2022, X2031, X2032, X2131, X2132, X2091, X2092, X2515, X2512</td>
</tr>
<tr>
<td>Uterine artery embolization</td>
<td>M6644</td>
</tr>
<tr>
<td>Cesarean hysterectomy</td>
<td>R4507, R4508, R4509, R4510, R5001, R5002</td>
</tr>
</tbody>
</table>

ICD: International Classification of Diseases, ICU: Intensive Care Unit
## Results

Table 2. Screening detected significant multiple changeable variability by change point analysis (CPA) tool

<table>
<thead>
<tr>
<th>Change Point (Travel time, min)</th>
<th>First CP (Change Point)</th>
<th>Outcome variability (CL)</th>
<th>Second CP</th>
<th>Outcome variability (CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate prenatal care</td>
<td>30-40 min</td>
<td>8.05-8.37 (97%)</td>
<td>60-70 min</td>
<td>8.46-8.48 (100%)</td>
</tr>
<tr>
<td>Abortion</td>
<td>20-40 min</td>
<td>2.93-3.25 (99%)</td>
<td>60-70 min</td>
<td>3.25-3.41 (94%)</td>
</tr>
<tr>
<td>APN during pregnancy</td>
<td>20-30 min</td>
<td>4.68-4.76 (96%)</td>
<td>30-40 min</td>
<td>4.76-4.81 (100%)</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>30-40 min</td>
<td>0.18-0.21 (99%)</td>
<td>70-80 min</td>
<td>0.21-0.24 (100%)</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>30-60 min</td>
<td>0.009-0.010 (99%)</td>
<td>80-110 min</td>
<td>0.0105-0.011 (98%)</td>
</tr>
<tr>
<td>Gestational hypertension</td>
<td>20-30 min</td>
<td>0.280-0.291 (95%)</td>
<td>60-70 min</td>
<td>0.297-0.300 (99%)</td>
</tr>
<tr>
<td>Gestational diabetes mellitus</td>
<td>20-30 min</td>
<td>6.81-6.94 (97%)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

CL: Confidence Level by change point analysis (implemented by Taylor WA)
CP: Change point
### Results

Table 2. Screening detected significant multiple changeable variability by change point analysis (CPA) tool (continue)

<table>
<thead>
<tr>
<th>Change Point (Travel time, min)</th>
<th>First CP (Change Point)</th>
<th>Outcome variability (CL)</th>
<th>Second CP</th>
<th>Outcome variability (CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placenta previa</td>
<td>20-40 min</td>
<td>0.34-0.37 (99%)</td>
<td>70-80 min</td>
<td>0.39-0.40 (100%)</td>
</tr>
<tr>
<td>Placental abruption</td>
<td>20-30 min</td>
<td>0.022-0.023 (98%)</td>
<td>50-70 min</td>
<td>0.024-0.025 (98%)</td>
</tr>
<tr>
<td>Obstructed labor</td>
<td>50-70 min</td>
<td>0.119-0.122 (97%)</td>
<td>100-120 min</td>
<td>0.122-0.123 (98%)</td>
</tr>
<tr>
<td>Preterm delivery</td>
<td>20-40 min</td>
<td>1.16-1.27 (92%)</td>
<td>50-70 min</td>
<td>1.30-1.33 (97%)</td>
</tr>
<tr>
<td>Obstetric hemorrhage</td>
<td>20-30 min</td>
<td>1.180-1.181 (98%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Transfusion</td>
<td>30-40 min</td>
<td>2.02-2.12 (92%)</td>
<td>60-70 min</td>
<td>2.17-2.21 (99%)</td>
</tr>
<tr>
<td>Cesarean hysterectomy</td>
<td>20-40 min</td>
<td>0.026-0.029 (94%)</td>
<td>50-70 min</td>
<td>0.030-0.032 (98%)</td>
</tr>
<tr>
<td>Uterine artery embolization</td>
<td>20-40 min</td>
<td>0.136-0.145 (92%)</td>
<td>50-70 min</td>
<td>0.146-0.149 (99%)</td>
</tr>
<tr>
<td>Admission to ICU</td>
<td>20-40 min</td>
<td>0.142-0.153 (91%)</td>
<td>60-70 min</td>
<td>0.158-0.162 (98%)</td>
</tr>
</tbody>
</table>

CL : Confidence Level by change point analysis (implemented by Taylor WA)
CP: Change point
Figure 1. Plot of cumulative maternal utilization and outcome data by time (continue)

Outcome: 8.05~8.37
CP: 30~40min

Outcome: 8.46~8.48
CP: 60~70min

< Inadequate prenatal care >
Results

Figure 1. Plot of cumulative maternal utilization and outcome data by time (continue)

Outcome: 3.38 ~ 3.41 (CP) 60~70min
Outcome: 3.05 ~ 3.10 (CP) 20~40min

<Abortion>
Figure 1. Plot of cumulative maternal utilization and outcome data by time (continue)

<Preterm delivery>
Figure 1. Plot of cumulative maternal utilization and outcome data by time (continue)

Outcome: 1.180 ~ 1.181 (CP) 20~30min

< Obstetric hemorrhage >
Results

Figure 1. Plot of cumulative maternal utilization and outcome data by time (continue)

<Cesarean hysterectomy>
### Table 3. Odds ratio for maternal utilization and outcome by travel time on multiple logistic regression analysis (To validate result by CPA) (continue)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Travel time</th>
<th>Odds ratio(95% CI)</th>
<th>Odds ratio(96% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate prenatal care (ref : ≤10min=1)</td>
<td>60-70 min</td>
<td>1.18(1.06-1.28)</td>
<td></td>
<td>0.0003</td>
</tr>
<tr>
<td>Abortion (ref : ≤10min=1)</td>
<td>30-40 min</td>
<td>1.22(1.12-1.33)</td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>60-70 min</td>
<td>1.53(1.34-1.75)</td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>APN during pregnancy (ref : ≤10min=1)</td>
<td>20-30 min</td>
<td>1.09(1.05-1.16)</td>
<td></td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>30-40 min</td>
<td>1.10(1.04-1.17)</td>
<td></td>
<td>0.0018</td>
</tr>
<tr>
<td>Preeclampsia (ref : ≤10min=1)</td>
<td>30-40 min</td>
<td>2.34(1.74-3.15)</td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>60-70 min</td>
<td>2.03(1.32-3.10)</td>
<td></td>
<td>0.0011</td>
</tr>
<tr>
<td>Eclampsia(ref : ≤10min=1)</td>
<td></td>
<td></td>
<td>No significant</td>
<td></td>
</tr>
<tr>
<td>Gestational hypertension (ref : ≤10min=1)</td>
<td>30-40 min</td>
<td>1.31(1.03-1.66)</td>
<td></td>
<td>0.0295</td>
</tr>
<tr>
<td></td>
<td>60-70 min</td>
<td>1.51(1.04-2.20)</td>
<td></td>
<td>0.0285</td>
</tr>
<tr>
<td>Gestational diabetes mellitus (ref : ≤10min=1)</td>
<td>20-30 min</td>
<td>1.16(1.12-1.21)</td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Placenta previa (ref : ≤10min=1)</td>
<td>30-40 min</td>
<td>2.12(2.12-2.13)</td>
<td></td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>60-70 min</td>
<td>2.53(2.52-2.55)</td>
<td></td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Multiple logistic regression analysis and adjusted for age, socio-economic status, Carlson comorbidity index, urbanization, and volume of the hospital (Reference 0-10min)
Table 3. Odds ratio for maternal utilization and outcome by travel time on multiple logistic regression analysis (To validate result by CPA) (continue)

<table>
<thead>
<tr>
<th>Outcome Description</th>
<th>Travel Time</th>
<th>Odds Ratio (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placental abruption (ref: ≤10min=1)</td>
<td>50-60 min</td>
<td>3.23 (1.82-8.65)</td>
<td>0.0014</td>
</tr>
<tr>
<td>Obstructed labor (ref: 0~10min=1)</td>
<td>50-60 min</td>
<td>1.71 (1.11-2.65)</td>
<td>0.0155</td>
</tr>
<tr>
<td>Preterm delivery (ref: ≤10min=1)</td>
<td>20-30 min</td>
<td>1.73 (1.57-1.91)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>60-70 min</td>
<td>3.11 (2.67-3.63)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Obstetric hemorrhage (ref: ≤10min=1)</td>
<td>No significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfusion (ref: ≤10min=1)</td>
<td>20-30 min</td>
<td>1.23 (1.14-1.33)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>50-60 min</td>
<td>1.66 (1.47-1.86)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Uterine artery embolization (ref: ≤10min=1)</td>
<td>30-40 min</td>
<td>1.54 (1.05-1.83)</td>
<td>0.0093</td>
</tr>
<tr>
<td></td>
<td>50-60 min</td>
<td>1.63 (1.05-2.54)</td>
<td>0.0312</td>
</tr>
<tr>
<td>Cesarean hysterectomy (ref: ≤10min=1)</td>
<td>20-30 min</td>
<td>2.19 (1.21-3.99)</td>
<td>0.0098</td>
</tr>
<tr>
<td></td>
<td>50-60 min</td>
<td>2.69 (1.09-6.65)</td>
<td>0.0316</td>
</tr>
<tr>
<td>Admission to ICU (ref: ≤10min=1)</td>
<td>30-40 min</td>
<td>1.42 (1.02-1.98)</td>
<td>0.0383</td>
</tr>
<tr>
<td></td>
<td>60-70 min</td>
<td>1.99 (1.24-3.12)</td>
<td>0.0042</td>
</tr>
</tbody>
</table>

Multiple logistic regression analysis and adjusted for age, socio-economic status, Carlson comorbidity index, urbanization, and volume of the hospital (Reference 0-10min)
Conclusion

➢ Our results showed that the OHAT for OCUA could be established within 60 minutes.

➢ The Korean government should take initiatives for protecting the health of pregnant women in OCUA in two ways;

  ✓ *First, they should provide special intervention for pregnant women who have travel time over 60 minutes till hospitals;*

  ✓ *Second, in case of considering new hospital for childbirth, the location should be where maximum pregnant women could be included in its catchment area.*
THANK YOU!
**Methods**

- **Procedure for performing a Change Point Analysis**
  Performing a change-point analysis iteratively uses a combination of cumulative sum charts (CUSUM) and bootstrapping to detect the changes.

The CUSUM chart appears 1~multiple changes

CUSUM charts are constructed by calculating and plotting a cumulative sum based on the data.

1. First calculate the average $\bar{X} = \frac{X_1 + X_2 + \ldots + X_{24}}{24}$
2. Start the cumulative sum at zero by setting $S_0 = 0$.
3. Calculate the other cumulative sums by adding the difference between current value and the average to the previous sum, i.e., $S_i = S_{i-1} + (X_i - \bar{X})$ for $i = 1, 2, \ldots, 24$.

For the Trade Deficit data:

- $\bar{X} = 11.39583$
- $S_0 = 0$
- $S_1 = S_0 + (X_1 - \bar{X}) = 0 + 10.7 - 11.39583 = -0.69583$
- $S_2 = S_1 + (X_2 - \bar{X}) = -0.69583 + 13.0 - 11.39583 = 0.90833$
- $\vdots$
- $S_{24} = S_{23} + (X_{24} - \bar{X}) = 0.89583 + 10.5 - 11.39583 = 0.0$

CUSUM charts are constructed by calculating and plotting a cumulative sum based on the data.

- **Bootstrap (1000)**
  A single bootstrap is performed by:
  1. Generate a bootstrap sample of 24 units, denoted $X_{01}, X_{02}, \ldots, X_{024}$, by randomly reordering the original 24 values.
  2. Based on the bootstrap sample, calculate the bootstrap CUSUM, denoted $S_{01}^*, S_{02}^*, \ldots, S_{024}^*$.
  3. Calculate the maximum, minimum and difference of the bootstrap CUSUM, denoted $S_{0}^{max}$, $S_{0}^{min}$ and $S_{0}^{diff}$.
  4. Determine whether the bootstrap difference $S_{0}^{diff}$ is less than the original difference $S_{diff}$.

Let $N$ be the number of bootstrap samples performed and let $X$ be the number of bootstraps for which $S_{0}^{diff} < S_{diff}$.

Then the confidence level that a change occurred as a percentage is calculated as follows: (%) Out of 1,000 bootstraps, 995 had $S_{0}^{diff} < S_{diff}$:

- Confidence level = 95%

![CUSUM charts are constructed by calculating and plotting a cumulative sum based on the data.](image)

![Bootstrap (1000) Validate properly interpret (using bootstrapping method).](image)

![Confidence Level indicating the likelihood that a change occurred](image)
Interpret the result, Change Point Analysis

Step 1: Plot

- **Plot of the data (wavy black line)**: This indicates that the change-point analysis detected two changes in outcome data.

- **Two red lines**: Represent the maximum range.

- **Shows a cumulative sum chart (CUSUM) of the data**.

Step 2: Table Changes

<table>
<thead>
<tr>
<th>TRV_min2_CAT</th>
<th>Confidence Interval</th>
<th>Conf. Level</th>
<th>From</th>
<th>To</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>(60, 60)</td>
<td>99%</td>
<td>0.11858</td>
<td>0.12172</td>
<td>1</td>
</tr>
<tr>
<td>100</td>
<td>(100, 100)</td>
<td>94%</td>
<td>0.12172</td>
<td>0.12323</td>
<td>2</td>
</tr>
</tbody>
</table>

After 1000 bootstrap, first change is around 50~60min (99% confidence) and second change is 90~100min (94% confidence). Each change is a confidence level (how confident the analysis is that the change actually occurred). The program shows much more confidence about the first change.
Are Potentially Avoidable Hospitalizations A Good Measure Of Primary Care in France?

Grégoire Mercier & Vera Georgescu
Montpellier Teaching Hospital & University
Montpellier, France
Potentially avoidable hospitalizations (PAH) are low-value and high-cost episodes.

Understanding the drivers of PAH might help to design and to monitor policy interventions.
Potentially avoidable hospitalizations (PAH) are partly explained by primary care

Demographics  Epidemiology  Deprivation

Primary Care:
- Supply
- Access
- Use
- Continuity
- Quality

Critical points include:

- Choice of the PC measure (supply vs. use)
- Adjustment (needs and socio-economic status)
- Health system traits (e.g. gatekeeping)
Main findings:

- Supply (number of GPs): 2 inverse, 2 positive, 1 not significant
- Use (number of GP visits): 1 inverse, 3 positive

Adjustment on needs:

- Facility level vs. individual level
- Heterogeneity: age, general comorbidities, diabetes-specific factors
Primary care and PAH: methodological issues

<table>
<thead>
<tr>
<th>Key point</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Target population</td>
<td>General vs. disease specific</td>
</tr>
<tr>
<td>Study design</td>
<td>Ecologic vs. analytic</td>
</tr>
<tr>
<td>Primary care measure</td>
<td>Supply, access, use</td>
</tr>
<tr>
<td>Adjustment</td>
<td>Focus on needs and socio-economic status</td>
</tr>
<tr>
<td>Analysis</td>
<td>Simple, multilevel, spatial</td>
</tr>
</tbody>
</table>
The evidence in France

- Mercier 2015:
  - Inverse association with the density of nurses
    - G. Mercier et al., Health Affairs 34, no.5 (2015):836-843

- Weeks 2016 (1):
  - Inverse association with the density of GPs
  - Disappeared after adjustment on GP use in neighboring departments
    - WB Weeks et al., Eur Jour Health Econ (2016)

- Weeks 2016 (2):
  - Inverse association with the density of GPs
    - WB Weeks et al., submitted (2016)
Our 3 Studies on PAH in France

<table>
<thead>
<tr>
<th></th>
<th>French national study</th>
<th>Project #1: Occitanie (France) study</th>
<th>Project #2: Diabetics study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>French ZIP code level</td>
<td>French ZIP code level</td>
<td>Individual level</td>
</tr>
<tr>
<td>Variable</td>
<td>Age and sex standardized PAH rate</td>
<td>Age and sex standardized PAH rate</td>
<td>Risk of PAH</td>
</tr>
<tr>
<td>Model</td>
<td>Multi-level regression model</td>
<td>Spatial regression model</td>
<td>Logistic model (multi-level)</td>
</tr>
<tr>
<td>Expl. Variables (primary care)</td>
<td>Primary care supply</td>
<td>Primary care supply, access and use</td>
<td>Primary care access, use and continuity</td>
</tr>
<tr>
<td>Other info</td>
<td>Mercier et al (2015)</td>
<td>Collaboration with regional health agency</td>
<td>Collaboration with Denmark (Anders Green) and future comparison btw France and Denmark</td>
</tr>
</tbody>
</table>
Project #1: Geographic variation of PAH in the Occitanie region

### Population 2014

<table>
<thead>
<tr>
<th>Region</th>
<th># PAH</th>
<th># patients with PAH</th>
<th>PAH per 1000 inhab.</th>
<th>PAH patients per 1000 inhab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>289 635</td>
<td>239 849</td>
<td>4.53</td>
<td>3.75</td>
</tr>
<tr>
<td>Occitanie region</td>
<td>26 512</td>
<td>22 287</td>
<td>4.62</td>
<td>3.88</td>
</tr>
</tbody>
</table>

### Occitanie Region

<table>
<thead>
<tr>
<th>Condition</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive Heart Failure (≥ 40)</td>
<td>12 504</td>
<td>47.16%</td>
</tr>
<tr>
<td>COPD (≥ 18)</td>
<td>6 652</td>
<td>25.09%</td>
</tr>
<tr>
<td>Angina without procedure (≥ 40, urgent admission)</td>
<td>3 781</td>
<td>14.26%</td>
</tr>
<tr>
<td>Dehydration in elderly people (≥ 65)</td>
<td>2 119</td>
<td>7.99%</td>
</tr>
<tr>
<td>Asthma in Adults (≥ 18)</td>
<td>1 050</td>
<td>3.96%</td>
</tr>
<tr>
<td>Diabetes short-term complication (≥ 40)</td>
<td>406</td>
<td>1.53%</td>
</tr>
</tbody>
</table>

### Age

<table>
<thead>
<tr>
<th>Age (mean, SD, min, Q25, median, Q75, Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>76.44, 13.78, 18, 68, 80, 87, 109</td>
</tr>
</tbody>
</table>

### Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>13800</td>
<td>52.05%</td>
</tr>
<tr>
<td>Female</td>
<td>12712</td>
<td>47.95%</td>
</tr>
</tbody>
</table>

13 Sept. 2016
Project #1: Geographic variation of PAH in the Occitanie region

- Inverse association with access to specialists (cardiologist)
Project #1: Geographic variation of PAH in the Occitanie region

- Inverse association with unemployment rate (but PAH patients mainly retired)
Project #2: Patient-level analysis of PAH in France

- 32 900 diabetics in EGB database (1% sample of French pop)
- 517 PAH within diabetics population
- 435 diabetics with at least 1 PAH in 2013 (1.33% of adult diabetics)

<table>
<thead>
<tr>
<th>PAH category</th>
<th>Diabetics from EGB</th>
<th>EGB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nb of stays</td>
<td>%</td>
</tr>
<tr>
<td>Congestive Heart Failure (≥ 40)</td>
<td>279</td>
<td>53,97</td>
</tr>
<tr>
<td>COPD (≥ 18)</td>
<td>79</td>
<td>15,28</td>
</tr>
<tr>
<td>Angina without procedure (≥ 40, urgent admission)</td>
<td>68</td>
<td>13,15</td>
</tr>
<tr>
<td>Diabetes short-term complication (≥ 40)</td>
<td>38</td>
<td>7,35</td>
</tr>
<tr>
<td>Dehydration elderly people (≥ 65)</td>
<td>35</td>
<td>6,77</td>
</tr>
<tr>
<td>Asthma in Adults (≥ 18)</td>
<td>18</td>
<td>3,48</td>
</tr>
</tbody>
</table>
## Preliminary results of the French PAH studies

<table>
<thead>
<tr>
<th>Determinants</th>
<th>French national study</th>
<th>Project #1: Occitanie (France) study</th>
<th>Project #2: Diabetics study</th>
</tr>
</thead>
</table>
| Primary/secondary care var. | - Nurses density*  
- Density of acute care beds* (*département level) | + Frequency of visits to specialist  
- Access to specialist (cardiologist)  
+ Access to GP  
+ Access to nurses  
⇒ *Add supply variables* | + Number of specialist visits/patient  
- Continuity of care index |
| Health status var. | + Standard mortality ratio* (*département level) | + Standard premature mortality ratio (before 65) | ⇒ *Not yet available, to be added at patient level:*  
- Comorbidity index (e.g. Charlson)  
- Diabetes severity index  
- Time since diabetes onset |
| Socio-economic var. | - Income  
- Education | - Unemployment rate (15 - 64) | ⇒ *Not yet available, to be added at ZIP code level* |

Determinants in the multivariate model of standardized PAH rate:  
+ positive association with PAH rate  
⇒ inverse association with PAH rate  
⇒ not yet available, to be added
Future directions
« The rejection of complexity by ‘classical science’ led to extremely positive developments of scientific knowledge up to the point where the limits of intelligibility which they constituted became more important than their elucidations. »

E Morin + image
Thank you for your attention!

Acknowledgments:
- Annick Lepape, Agence Régionale de Santé d’Occitanie
- Valérie Clément, LAMETA, Université de Montpellier
- Jean Bousquet, MacVia-LR

Funding by the French Ministry of Health (PREPS 2015)
Swedish quality registers in healthcare – a Goldmine or just GIGO

Presentation at
WIC 2016 Fall Research meeting –
Lady Margaret Hall, Oxford, UK

Mats Nilsson, Statistician/Epidemiologist PhD
Futurum – the Academy of Health and Care
Region Jönköping County, Jönköping, Sweden

GIGO = Garbage in, Garbage Out

- A computer acronym that means “Sloppy programmed” inputs lead to incorrect output
- First mentioned in The Hammond Times, November 10, 1957 (according to Wikipedia)
- Is attributed to Army Specialist William D. Mellin, explaining that computers cannot think by themselves.
A pioneer in Swedish register research and development


Professor Barbro Westerholm
Associate Professor at Karolinska Institute 1965,
Director-general for The National Board of Health and Welfare 1979 - 1985
Professor at Karolinska Institute 1986-1989
Member of the parliament for the Liberal party, 1988-1999, 2006 -

Mats Nilsson, Statistician/Epidemiologist PhD Futurum – the Academy of Health and Care
Region Jönköping County, Jönköping, Sweden

A background to quality registers in Sweden

- The thalidomide (Neurosedyn) catastrophe 1961
  - Led to:
    - Establishment of the Swedish malformation register 1964
    - Establishment of the Swedish adverse drug reaction register 1965
A prerequisite for registers in Swedish healthcare

- Every Swedish citizen has a unique 12 digit personal identity number
- Introduced 1st January 1947
- Has the form YYYYMMDD-XXGC where XXG is serial number and C is a checksum number, G defines gender, Female even, Male odd
- Patient registers makes it relatively easy to trace medical records and patients over time and geography

Type of register in the Swedish health care

- National public authorities (e.g. Statistics Sweden, The National Board of Health and Welfare)
- National Quality registers (today 105, e.g. SWESPINE, SWEDHEART, PIDcare)
- Researcher generated registers (e.g. MONICA, LIFEGENE, VIP)
- Banks/register that deals with biological specimens (some with more than 250 000 blood-samples, NSHDS - Northern Sweden Health and Disease Study)
- Linkage of records possible between different registers
  - Need ethical approval and approval from authorities
National Quality registers

- Individual data about:
  - Health problems
  - Diagnosis
  - Treatment
  - Results of healthcare and medical treatment
  - Patient reported outcome and experience measures
    - PROM and PREM

Demands on a Swedish quality register

- The register must be quality inspected
- Be certified by the Steering committee for quality registers (four levels)
- Be affiliated to a Register Center
- Seven Register-centers in Sweden
www.pidcare.com

A National Quality Register to supporting individual care of patients with primary immune deficiency and/or increased susceptibility to infections

PIDcare – primary immune deficiency

- Data might be used for the following purposes:
  - National (prevalence, cost of treatment)
  - County (Number of treating clinics, number of patients)
  - Clinic (Treatment results, type of treatment)
  - Patient (Self reported health related quality of life, infections from infections diary, treatment and reactions to treatment)
  - Patient interest groups (annual reports)
Prevalence of patients with IgG subclass deficiency, D80.3

Prevalence of patients with variable immunodeficiency, CVID D83.0

Cost for Human Immunoglobulin (extra vascular) per 1000 inhabitants 2010 and 2015 in US $.

Mats Nilsson, Statistician/Epidemiologist PhD Futurum – the Academy of Health and Care
Region Jönköping County, Jönköping, Sweden
2016-09-26
Cost for Human Immunoglobulin (intra vascular) per 1000 inhabitants 2010 and 2015 in US $.

Number of patients in the register divided on diagnosis

Mats Nilsson, Statistician/Epidemiologist PhD Futurum – the Academy of Health and Care
Region Jönköping County, Jönköping, Sweden
2016-09-26
Age distribution among patients with immune deficiency

<table>
<thead>
<tr>
<th>Agegroup</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9</td>
<td>0</td>
</tr>
<tr>
<td>10-17</td>
<td>50</td>
</tr>
<tr>
<td>18-29</td>
<td>100</td>
</tr>
<tr>
<td>30-39</td>
<td>150</td>
</tr>
<tr>
<td>40-49</td>
<td>200</td>
</tr>
<tr>
<td>50-59</td>
<td>250</td>
</tr>
<tr>
<td>60-69</td>
<td>300</td>
</tr>
<tr>
<td>70-79</td>
<td></td>
</tr>
<tr>
<td>80-89</td>
<td></td>
</tr>
<tr>
<td>90-99</td>
<td></td>
</tr>
</tbody>
</table>

Mats Nilsson, Statistician/Epidemiologist PhD Futurum – the Academy of Health and Care
Region Jönköping County, Jönköping, Sweden

Treatment with Immunoglobulin

- Intra venous: 81.7%
- Subcutan: 10.0%
- Intra muscular: 8.3%
Result of treatment CVID and IgG sub-class def.

Patient’s health diary
Patient specific overview with data from the register and the self-reported infection diary

Patient interest group
May quality registers be a goldmine in healthcare?

- **Well – it depends**
  - It depends on quality of input
  - It depends on professional knowledge in analyzing and interpreting data
  - It depends on the ability to use the information and knowledge to change the clinical practice

*Then it might be a Gold mine, and even a couple of diamonds might be found.*

---

Thank you for your attention!
Supplier-induced Demand in Newborn Treatment: Evidence from Japan

Hitoshi Shigeoka
Simon Fraser University and NBER
(Joint with Kiyohide Fushimi, MD)
Objective

- Physicians may “induce” the demand of health service by exploiting their informational advantage over patients (SID). However, the magnitude of SID in the previous literature is often insignificant/small.

- We focus on at-risk newborns and look at less risky medical procedures such as Neonatal Intensive Care Unit (NICU) utilization to measure the size of the SID
  - No selection: birth weight and severity of newborn conditions are difficult to predict in advance
  - Arguably little harm with excessive treatment unlike C-sections (Gruber and Owing 1996) and CABG surgeries (Yip 1998)
  - Very costly

- We exploit two features of Japan’s health care system for empirical strategy
Feature 1: *partial* PPS

Since 2003, Japan has implemented its unique prospective payment system (PPS) by *partially* replacing the conventional fee for service system (FFS).

- **Government divides medical procedures into two types:**
  - Hospital-fee procedures
    - paid under a per-diem PPS
    - relatively standardized ones such as diagnostic imaging, injections
  - Doctor-fee procedures
    - *still* paid under the conventional FFS
    - reflect the technical work by physicians, such as surgeries and anesthesia + **NICU for newborn treatment**

- This policy makes the doctor-fee procedures *relatively more profitable* than the other procedures included in the fixed payment.
**Differential Timing of PPS Adoption**

- PPS started in 2003 with 82 hospitals as an experiment (mandatory)

- Since hospitals are guaranteed the last year’s revenue for the time-being, hospitals wanted to join

- We exploit the timing of adoption by hospitals in **Dif-in-Dif framework**
  - There are five hospital groups that adopted the PPS at different times: 2003, 2004, 2006, 2008, and 2009

- **Concern: Endogenity of adoption**
  - For example, anecdotal evidence suggests that government hospitals tended to adopt later since they often needed approvals from municipalities  
    [Hazard analysis]
Feature 2: Rule for NICU reimbursement

- NICU: one of the main contributors to the decline in death rate among at-risk newborns (Phibbs et al., 2007)

- However, very costly
  - JPY85,000 (USD944)/day or USD40K for average reimbursement for VLBW (birth weight<=1500 gram)

- Government acknowledges the concern about overuse

- Thus, the maximum # of the days that hospital can be reimbursed for NICU use is set by birth weight range
  - 21 days : >=1500 gram
  - 60 days : 1000<=birth weight<1500 gram
  - 90 days : <1000 gram

- Note: these thresholds existed even before PPS
Data

- Insurance claim data for in-hospital births between April and December 2004-2008

Sample selection
- 187 hospitals that claim with NICU beds
- Birth weight < 2000 gram
- Out of the total 15725 births less than 2000 gram in the data, 12406 (79 %) are born in these 187 hospitals

Outcomes
- NICU utilization dummy, number of days in NICU
- Price: One great advantage of Japanese claim data is that it includes price information for each procedure, since the national fee schedule sets uniform prices for each procedure.
Estimation

\[ Y_{iht} = \theta_t + \alpha_h + X'_{iht}\beta + Z'_{ht}\gamma + \phi Post_{ht} + \epsilon_{iht} \]  - (1)

- \( Y_{iht} \): Outcomes of newborn \( i \) in hospital \( h \) born at year \( t \)
- \( \theta_t \): Year fixed effects
- \( \alpha_h \): Hospital fixed effects
- \( X_{ijt} \): A vector of the newborn characteristics such as birth weight, gestational length and gender
- \( Z_{ht} \): All the interactions of hospital predetermined characteristics in 2002 with the linear time trend
- \( Post_{ht} \): 1 if the hospital \( h \) is under PPS at year \( t \), and 0 otherwise

- Since the data spans 2004-2008, the variation comes from hospitals that adopted PPS in 2006 or 2008
- Standard errors are clustered at hospital-year level
## Summary statistics

### Variables

<table>
<thead>
<tr>
<th>Years when PPS is adopted</th>
<th>2003/2004</th>
<th>2006/2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Post only</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>A. Birth characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight (grams)</td>
<td>1,468.2</td>
<td>1,502.3</td>
<td>1,474.2</td>
</tr>
<tr>
<td>Gestational length (weeks)</td>
<td>31.9</td>
<td>31.9</td>
<td>31.6</td>
</tr>
<tr>
<td>Male</td>
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<td>0.49</td>
<td>0.51</td>
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<td>B. NICU</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Utilization</td>
<td>0.79</td>
<td>0.78</td>
<td>0.82</td>
</tr>
<tr>
<td>Length of stay in NICU (days)</td>
<td>30.9</td>
<td>30.0</td>
<td>32.2</td>
</tr>
<tr>
<td>Fraction of maximum stay in NICU</td>
<td>0.18</td>
<td>0.20</td>
<td>0.19</td>
</tr>
<tr>
<td>C. Treatment Intensity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total length of stay (days)</td>
<td>52.9</td>
<td>52.9</td>
<td>53.7</td>
</tr>
<tr>
<td>Total number of surgeries (times)</td>
<td>0.43</td>
<td>0.36</td>
<td>0.47</td>
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<tr>
<td>D. Reimbursement (thousand Yen)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total payment per patient ((1)+(2))</td>
<td>3,275</td>
<td>3,017</td>
<td>3,289</td>
</tr>
<tr>
<td>(1) Doctor-fee procedures</td>
<td>2,224</td>
<td>2,354</td>
<td></td>
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<tr>
<td>(of NICU)</td>
<td>2,094</td>
<td>2,009</td>
<td>2,254</td>
</tr>
<tr>
<td>(2) Hospital-fee procedures</td>
<td>1,051</td>
<td>935</td>
<td></td>
</tr>
</tbody>
</table>

| Number of hospitals | 74 | 72 | 72 | 41 |
| Number of observations | 5,850 | 1,695 | 2,684 | 2,177 |
Birth distribution (pre and post PPS)

- Bad sorting or good sorting? Probably the former
- No sorting observed in hospitals without NICU beds
- Confirmed similar pattern in national birth certificate
McCrary’s density test

<table>
<thead>
<tr>
<th>Binsize (g)</th>
<th>10</th>
<th>10</th>
<th>20</th>
<th>20</th>
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<tr>
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<td>200</td>
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<td><strong>Panel A: post PPS</strong></td>
<td></td>
<td></td>
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<td></td>
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<td>Cutoff (g)</td>
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</tr>
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<td>800</td>
<td>0.26</td>
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<td>0.39</td>
<td>0.17</td>
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<td>(0.42)</td>
<td>(0.31)</td>
<td>(0.31)</td>
<td>(0.23)</td>
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<td>900</td>
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<td>-0.16</td>
<td>-0.11</td>
<td>-0.06</td>
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<td></td>
<td>(0.37)</td>
<td>(0.28)</td>
<td>(0.27)</td>
<td>(0.21)</td>
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<tr>
<td><strong>1000</strong></td>
<td>0.98***</td>
<td>0.84***</td>
<td>0.61***</td>
<td>0.35*</td>
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<tr>
<td></td>
<td>(0.42)</td>
<td>(0.31)</td>
<td>(0.30)</td>
<td>(0.21)</td>
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<tr>
<td>1100</td>
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<td>0.09</td>
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<td>(0.44)</td>
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<td>(0.29)</td>
<td>(0.20)</td>
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<tr>
<td>1200</td>
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<td>0.36</td>
<td>0.27</td>
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<td>(0.24)</td>
<td>(0.18)</td>
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<td>1300</td>
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<td>0.07</td>
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<td>(0.25)</td>
<td>(0.24)</td>
<td>(0.17)</td>
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<td>1400</td>
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<td>0.32</td>
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<tr>
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<td>(0.33)</td>
<td>(0.22)</td>
<td>(0.22)</td>
<td>(0.15)</td>
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<tr>
<td><strong>1500</strong></td>
<td>0.72***</td>
<td>0.45***</td>
<td>0.42***</td>
<td>0.27*</td>
</tr>
<tr>
<td></td>
<td>(0.28)</td>
<td>(0.20)</td>
<td>(0.20)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>1600</td>
<td>0.11</td>
<td>-0.06</td>
<td>-0.06</td>
<td>-0.09</td>
</tr>
<tr>
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<td>(0.29)</td>
<td>(0.20)</td>
<td>(0.20)</td>
<td>(0.14)</td>
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<tr>
<td>1700</td>
<td>0.29</td>
<td>0.11</td>
<td>0.11</td>
<td>0.12</td>
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<tr>
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<td>(0.25)</td>
<td>(0.18)</td>
<td>(0.17)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>1800</td>
<td>-0.16</td>
<td>-0.25</td>
<td>-0.23</td>
<td>-0.18</td>
</tr>
<tr>
<td></td>
<td>(0.23)</td>
<td>(0.16)</td>
<td>(0.16)</td>
<td>(0.12)</td>
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<tr>
<td>1900</td>
<td>0.30</td>
<td>0.04</td>
<td>0.01</td>
<td>0.05</td>
</tr>
<tr>
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<td>(0.20)</td>
<td>(0.15)</td>
<td>(0.15)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>2000</td>
<td>0.36</td>
<td>0.22</td>
<td>0.21</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>(0.21)</td>
<td>(0.15)</td>
<td>(0.16)</td>
<td>(0.11)</td>
</tr>
</tbody>
</table>

Note that the *positive* estimates here indicate an excessive mass just *below* the cut-off values.
Length of stay in NICU (pre vs post PPS)
## Basis results

<table>
<thead>
<tr>
<th></th>
<th>NICU use dummy</th>
<th></th>
<th>Length of stay in NICU</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>all</td>
<td>&gt;=1500</td>
<td>&lt;1500</td>
</tr>
<tr>
<td>NICU use dummy</td>
<td></td>
<td>Probit</td>
<td>Probit</td>
<td>Probit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Post</td>
<td>-0.010</td>
<td>-0.018</td>
<td>-0.001</td>
<td>2.75***</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.050)</td>
<td>(0.031)</td>
<td>(0.93)</td>
</tr>
<tr>
<td>R2/Persudo R2</td>
<td>0.31</td>
<td>0.31</td>
<td>0.19</td>
<td>0.59</td>
</tr>
<tr>
<td>Sample size</td>
<td>12,406</td>
<td>6,981</td>
<td>5,425</td>
<td>9,915</td>
</tr>
<tr>
<td>Mean</td>
<td>0.80</td>
<td>0.70</td>
<td>0.93</td>
<td>30.3</td>
</tr>
</tbody>
</table>

[R robustness checks]
Event-study

- We replace the policy dummy $Post_{ht}$ in equation (1) with the series of dummies for each year since PPS adoption.

Note: Year zero is the year when PPS is adopted. The dashed line corresponds to the 95% confidence interval. The sample focuses on newborns with birth weights lower than 1,500 g.
### Treatment intensity, and size of SID

#### Hospital-fee procedures

<table>
<thead>
<tr>
<th></th>
<th>Inspection</th>
<th>Diagnostic imaging</th>
<th>Medicine</th>
<th>Injection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>7.7</td>
<td>5.3*</td>
<td>7.9*</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td>(6.3)</td>
<td>(2.9)</td>
<td>(4.8)</td>
<td>(15.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Surgery</th>
<th>Anesthesia</th>
<th>NICU related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>41.6</td>
<td>2.8</td>
<td>440.2***</td>
</tr>
<tr>
<td></td>
<td>(28.6)</td>
<td>(6.2)</td>
<td>(156.9)</td>
</tr>
</tbody>
</table>

| R-squared | 0.41   | 0.28       | 0.38         | 0.26       |
| Sample size | 5,018 | 5,018      | 5,018        | 5,018      |
| Mean      | 81.4   | 47.7       | 32.8         | 185.2      |

|          | 277.6  | 192.7      | 4318.1       |

#### Doctor-fee procedures

<table>
<thead>
<tr>
<th></th>
<th>Surgery</th>
<th>Anesthesia</th>
<th>NICU related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post</td>
<td>41.6</td>
<td>2.8</td>
<td>440.2***</td>
</tr>
<tr>
<td></td>
<td>(28.6)</td>
<td>(6.2)</td>
<td>(156.9)</td>
</tr>
</tbody>
</table>

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| Sample size | 5,018 | 5,018      | 5,018        | 5,018      |
| Mean      | 81.4   | 47.7       | 32.8         | 185.2      |

|          | 277.6  | 192.7      | 4318.1       |

---

- Additional reimbursement of JPY440 thousands (USD4,900) per VLBW newborns
- In 2008, # of VLBW in Japan is 21,667.
- Thus, SID can increase health spending by JPY9.5 billion (USD106 million) per year
Conclusion

- This research may indicate that we may observe much larger SID in *less risky* medical procedures.
- This paper also suggests the caution against the use of birth weight for reimbursement.
- Limitation: This study focuses only on at-risk newborns, thus our results do not capture the overall response of hospitals to the introduction of the PPS.
Hazard analysis

See whether predetermined hospital characteristics in 2002 can predict the timing of the participation in PPS

<table>
<thead>
<tr>
<th>Dependent variable: Year to adoption</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of beds</td>
<td>1.000</td>
<td>1.001**</td>
</tr>
<tr>
<td></td>
<td>[0.587]</td>
<td>[0.049]</td>
</tr>
<tr>
<td>Ownership: semi-public</td>
<td>0.971</td>
<td>0.681</td>
</tr>
<tr>
<td></td>
<td>[0.934]</td>
<td>[0.180]</td>
</tr>
<tr>
<td>Ownership: government</td>
<td>0.947</td>
<td>0.449***</td>
</tr>
<tr>
<td></td>
<td>[0.874]</td>
<td>[0.003]</td>
</tr>
<tr>
<td>Teaching hospital</td>
<td>2.008</td>
<td>1.290</td>
</tr>
<tr>
<td></td>
<td>[0.384]</td>
<td>[0.698]</td>
</tr>
<tr>
<td>Care level: secondary care</td>
<td>2.174</td>
<td>1.770</td>
</tr>
<tr>
<td></td>
<td>[0.570]</td>
<td>[0.389]</td>
</tr>
<tr>
<td>Care level: tertiary care</td>
<td>2.301</td>
<td>1.349</td>
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<tr>
<td></td>
<td>[0.550]</td>
<td>[0.659]</td>
</tr>
<tr>
<td>Have ER section</td>
<td>0.821</td>
<td>0.710</td>
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<tr>
<td></td>
<td>[0.799]</td>
<td>[0.537]</td>
</tr>
<tr>
<td>Have mandatory hosp within same HSA</td>
<td>1.346</td>
<td>1.031</td>
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<tr>
<td></td>
<td>[0.272]</td>
<td>[0.875]</td>
</tr>
<tr>
<td>Doctor-patient ratio</td>
<td>0.973</td>
<td>0.982</td>
</tr>
<tr>
<td></td>
<td>[0.161]</td>
<td>[0.140]</td>
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<tr>
<td>Nurse-patient ratio</td>
<td>1.013</td>
<td>1.022</td>
</tr>
<tr>
<td></td>
<td>[0.754]</td>
<td>[0.499]</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-279.43</td>
<td>-519.10</td>
</tr>
<tr>
<td>Sample size</td>
<td>72</td>
<td>124</td>
</tr>
</tbody>
</table>

Note: The hazard ratio is reported, and the p-value is reported in bracket.
Birth Distribution for Hospitals without NICU beds
McCrary’s density test (at 1500 gram, post PPS)

Log dif in distribution is -0.720 (t = -2.55)

In contrast to Almond et al (2010) in US
Birth distribution from birth certificate

**before PPS**
Years 1995-2002

**After PPS**
Years 2003-2008

Graphs by period
Alternative explanations (robustness check 1)

1. Endogeneity of participation
   - For example, if the hospitals exploit the revenue-neutral nature of the PPS, hospital would have increased its treatment intensity just a year prior to the adoption of PPS
   - Approaches taken: event-study approach, inclusion of lead dummy and hospital specific time trend

2. Sicker newborns
   - PPS may induce the hospitals to focus on the treatment of diseases that hospitals have highest cost efficiency (Dranove 1987)
   - Approaches taken: inclusion of diagnosis fixed effects, control for complications

3. Increase in Supply of beds
   - Approaches taken: Excluding 15 hospitals that has opened or closed the NICU beds
“Bite” analysis (robustness check 2)

\[ Y_{iht} = \theta_t + \alpha_h + X'_{iht}\beta + Z'_{ht}\gamma + \delta(B_h \times \text{Post}_{ht}) + \epsilon_{iht} \] - (2)

- where \( B_h \) is a “bite” variable for each hospital \( h \)

- Equation (2) exploits the variation to allow the volume response to vary with the financial pressure exerted by the PPS on each hospital unlike Equation (1) which assumes an equal response

- \( B_h \) is defined as the ratio of fees for hospital-fee procedures to total fees, measured as per prices in the national fee schedule in the year prior to PPS adoption (ranging from 0.003 % to 85.4 %)
## Results: robustness checks 1

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>No Controls</th>
<th>Only Year FE</th>
<th>Lead dummy</th>
<th>Time varying hospital controls</th>
<th>Hospital linear time trend</th>
<th>With DPC groups fixed effects</th>
<th>With DPC groups fixed effects and complications</th>
<th>Availability effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Post Dummy</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Post</td>
<td>4.72***</td>
<td>4.49**</td>
<td>4.13**</td>
<td>5.27**</td>
<td>4.49***</td>
<td>7.00**</td>
<td>4.64***</td>
<td>4.16**</td>
<td>4.04**</td>
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<tr>
<td></td>
<td>(1.69)</td>
<td>(1.80)</td>
<td>(1.97)</td>
<td>(2.30)</td>
<td>(1.59)</td>
<td>(2.73)</td>
<td>(1.65)</td>
<td>(1.70)</td>
<td>(1.75)</td>
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<td>Lead</td>
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<td>(1.96)</td>
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<td><strong>Panel B: Bite variable</strong></td>
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<tr>
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<td>17.64***</td>
<td>16.97**</td>
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<td>23.27**</td>
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<td></td>
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<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Year FE</td>
<td>×</td>
<td>–</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Controls</td>
<td>×</td>
<td>–</td>
<td>–</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>2002 HC*linear time</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Sample size</td>
<td>5,018</td>
<td>5,018</td>
<td>5,018</td>
<td>5,018</td>
<td>5,018</td>
<td>5,018</td>
<td>5,018</td>
<td>5,018</td>
<td>4,795</td>
</tr>
</tbody>
</table>
The estimate suggests that for the average hospital, the introduction of the PPS is associated with an increase in NICU use of about 4.41 days ( = 18.16 × 0.243)
Future relative utilization of SHI-physicians – a small-area projection by specialty for the 2020 to 2035 period

Mandy Schulz, DrPH, MSPH
Background

- Demographic change – characterized by shift of populous birth cohorts into the second half of life, increasing life expectancy, low fertility levels and internal migration – poses major challenges for the future of medical care in Germany.

- Significant changes in future utilization of physicians expected.

- No consideration of prospective change in physician capacity planning

Share of age groups in Germany's population (in %)

Source: Berlin-Institute for Population and Development
Aim

- To show changes in utilization of SHI-physician services resulting from change in age-structure and net balance of migration.
- To propose the computation of a relative utilization index (rBIX) at county-level for 2020 to 2035.
Methods – I. Data sets

1. **Claims data 2011/2012 (20% sample)**
   - Age- and gender-specific (AGG) volumes of utilized health services (LB) by specialty (FG)
   - Average volume of health services by specialty
   - Number of insurees

2. **Zi-Practice Panel (ZiPP)**
   - Average working time of doctors per case in minutes by specialty

3. **Regional planning forecast of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)**
   - Predicted age- and gender-specific population up to the period of 2035
   - Spatial forecast (county-level)

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Working time per case [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ophthalmology</td>
<td>15.86</td>
</tr>
<tr>
<td>Surgery</td>
<td>29.17</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>33.36</td>
</tr>
<tr>
<td>Gynecology</td>
<td>22.74</td>
</tr>
<tr>
<td>GP</td>
<td>30.57</td>
</tr>
<tr>
<td>ENT</td>
<td>21.93</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>26.94</td>
</tr>
<tr>
<td>Neurology</td>
<td>37.78</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>22.53</td>
</tr>
<tr>
<td>Urology</td>
<td>25.93</td>
</tr>
</tbody>
</table>

*Source: Zi-Practice-Panel 2012*
Methods – II. Model calculation to compute the relative utilization index (rBIX)

- Volume of services (AGG)
  \[ LB_{\text{Fall}}_{AGG,FG} = \frac{LB_{AGG,FG}}{FZ_{AGG,FG}} \]

- Avg. volume of services
  \[ \phi \ LB_{Fall_{FG}} = \frac{\sum LB_{AGG,FG}}{\sum FZ_{AGG,FG}} \]

- Working time modifier
  \[ \text{Zeit}_\text{modi} = \frac{LB_{Fall_{AGG,FG}}}{\phi \ LB_{Fall_{FG}}} \]

- Working time per case (AGG)
  \[ AAZ_{AGG,FG} = \phi AAZ_{FG} \times \text{Zeit}_\text{modi} \]

- Working time per insuree
  \[ AAZ_{\text{Vers}_{AGG,FG}} = AAZ_{AGG,FG} \times \frac{FZ_{AGG,FG}}{n\text{Vers}_{AGG}} \]

- Relative utilization index
  \[ rBIX_{FG,2020} = \frac{\sum \text{Bev}_{AGG,2020} \times AAZ_{\text{Vers}_{AGG,FG}}}{\sum \text{Bev}_{AGG,2012} \times AAZ_{\text{Vers}_{AGG,FG}}} \]
Methods – II. Model calculation to compute the relative utilization index (rBIX)

- Average working time of physician
- Volume of health services of patient (age-specific)
- Physician’s working time according to age of treated patients
- Population at baseline
- Population at projection period
- Relative utilization index (rBIX)
Methods – III. Component analysis of the relative utilization index according to population size and structure

- 1st component = population size: what is expected due to changes in population numbers? → Quantative aspect of demographic change

- 2nd component = population structure: what is expected due to changes in age-structure? → Qualitative aspect of demographic change

\[ 1^{\text{st}} \text{ component} + 2^{\text{nd}} \text{ component} = rBIX \]

Ex.: rBIX 2020 for GP
Results – I. Small-area projection

Expected change (%) in utilization due to population size (1st component), 2020 and 2035
Results – II. Small-area projection

Expected change (%) in utilization due to population structure (2nd component), 2020

GP

Gyn.
Results – III. Small-area projection

Expected change (%) in utilization due to population size and structure (rBIX), 2020
### Results – IV. Relative utilization index 2020 and 2035 by specialty

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Relative utilization index (rBIX)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2020</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>1.07</td>
</tr>
<tr>
<td>Surgery</td>
<td>1.02</td>
</tr>
<tr>
<td>Internal medicine</td>
<td>1.07</td>
</tr>
<tr>
<td>Gynecology</td>
<td>0.99</td>
</tr>
<tr>
<td>GP</td>
<td>1.05</td>
</tr>
<tr>
<td>ENT</td>
<td>1.02</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>0.97</td>
</tr>
<tr>
<td>Neurology</td>
<td>1.04</td>
</tr>
<tr>
<td>Orthopedicts</td>
<td>1.03</td>
</tr>
<tr>
<td>Urology</td>
<td>1.09</td>
</tr>
</tbody>
</table>
Summary

• Main feature of the model calculation is the translation of age- and gender-specific volumes of utilized services into age- and gender-specific working time of SHI-physicians and the extrapolation on a spatial basis by means of forecasted population figures.

• According to the projection, we may expect increased utilization of specialties primarily involved in the treatment of older people (general practitioners, specialists in internal medicine, ophthalmologists, urologists) and decreased utilization of pediatricians and gynecologists.

• From a spatial perspective, most metropolitan regions, but also a multitude of districts in Baden-Württemberg and Lower Saxony, will face increases in utilization of SHI-physicians, while most of the districts in the new federal states, as well as in the Saarland and the Ruhr area, typically show decreases in projected utilization.

• The decomposition of rBIX into expected changes in utilization based on population size and structure illustrates that greater future utilization will be moderated only by the trend in population size, especially in the new federal states.
Limitations

- Ceteris paribus projection, i.e. no changes in
  - Billing practice
  - Morbidity
  - Utilization
  - ...

- Validity of population forecast

- Dynamics in health care system
Conclusions

- Demographic change is likely to lead to increased utilization of ambulatory care provided by most specialties.

- Spatially, this will affect areas which are, to date, legally over-supplied. In order to guarantee provision of health services in the near future this calls for concerted actions on the federal and regional level and for policy changes.

- By applying mean nationwide figures of utilization, we compensated for regional differences in health care structure, thus diminishing the projection of possible supplier induced demand. However, we were unable to consider present differences in quality and future dynamics in ambulatory health care system, such as an increasing reliance on ambulatory care or progress in medical technology.

- The region-specific consideration and interpretation of the projection should take account of further regional features relating to health care.
Zukünftige relative Beanspruchung von Vertragsärzten – Eine Projektion nach Fachgruppen für den Zeitraum 2020 bis 2035

Versorgungsatlas-Bericht Nr. 16/02


Um die hieraus resultierenden Veränderungen der Beanspruchung greifbar zu machen wird in Ermangelung einer konsistenten Maßeinheit, welche die regionale Veränderung der Beanspruchung von Vertragsärzten abbildet, ein neu entwickelter „relativer Beanspruchungsindex (rBIX)“ vorgestellt.


Bericht (Langfassung)

Anhang: Kartenmaterial

Infoblatt

Abstract (englisch)

Pressemitteilung

Schlagwörter (Keywords): Beanspruchungsindex, Bevölkerungsprognose, Modellrechnung, demografischer Wandel, Inanspruchnahme, Projektion, ambulante Versorgung, Vertragsärzte, Hausärzte, Fachärzte

Zitierweise des Berichts vom 02.06.2016
Schulz M, Czihal T, Bätzing-Feigenbaum J, von Stillfried D.
DOI: 10.20364/VA-16.02
Link: http://www.versorgungsatlas.de/themen/alle-analysen-nach-datum-sortiert/?tab=6&uid=67
Thanks to my co-authors.

Thomas Czihal
Jörg Bätzing-Feigenbaum
Dominik von Stillfried
Thanks for your attention.

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Healthcare variation research and the PHRN

Dr Merran Smith, Chief Executive, PHRN
Wennberg International Collaborative
Oxford, 14 September 2015
Overview

- Data linkage in Australia
- Healthcare variation research
- Challenges and opportunities
A federation, with population of 24 m

One federal, six state and two territory governments

A mixed health system (Bismarckian)

- Federal government subsidises general practice, pharmaceuticals, hospitals and health insurance
- States/territories provide hospital, community and public health services
- A significant private health sector
Population Health Research Network (PHRN) is a national data linkage network

Links statutory and administrative data held by Australian governments eg hospitalisations, ED attendances, cancer, births and deaths data

Supports secure access to high quality, linked data for approved research

Enables research into complex problems within and between jurisdictions
PHRN currently supports:

- Five state data linkage units
- A federal/national data linkage unit
- A secure remote access data laboratory
- A secure file transfer system
- An online application system
All states/territories now have enduring linkage keys.

PHRN is supporting development of enduring cross-jurisdiction linkage keys.
Healthcare variation research via PHRN
Is PHRN infrastructure used to study health care variation? If so, what topics are covered?

Method:

- Assessed peer-reviewed publications related to use of PHRN infrastructure
- Five year period, 2010-11 to 2014-15
- Analysed publications by theme
Results

- PHRN infrastructure is being used to study healthcare variation
- Of the 221 publications reviewed, 51 (23%) were on healthcare variation
- 234 researchers were involved in the healthcare variation research
Results

- Majority of the healthcare variation publications used single-jurisdiction linked data (66%), compared to cross-jurisdiction linked data (34%).

Healthcare variation publications by jurisdiction:

- Single-jurisdiction: 66%
- Cross-jurisdiction: 34%
## Project topics

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer (NHPA)</td>
<td>17</td>
</tr>
<tr>
<td>Hospital utilization</td>
<td>11</td>
</tr>
<tr>
<td>Cardiovascular (NHPA)</td>
<td>7</td>
</tr>
<tr>
<td>Diabetes mellitus (NHPA)</td>
<td>3</td>
</tr>
<tr>
<td>Maternal health</td>
<td>3</td>
</tr>
<tr>
<td>Other NHPA (Arthritis and musculoskeletal; Injury; Mental health)</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>51</strong></td>
</tr>
</tbody>
</table>

* NHPA = National Health Priority Area. 63% of projects were on NHPA topic
Colorectal cancer

- **Aim:** Assess patterns of care and concordance with guidelines for patient management
- **Method:** Linkage of state cancer registry, hospital separations, radiotherapy and hospital based cancer registries (SA)
- **Results:** 4,641 patients over 5 years. 83% of colon and 56% of rectal cancer patients received recommended stage-specific treatment. Treatment for older patients and those in rural areas was less in-line with guidelines.

*Beckmann et al, J Evaluation Clin Practice, 2014*
Aim: Determine the extent of geographic variation in arthroscopies for people with Osteo Arthritis (OA)

Method: Linkage of state public and private hospital data (Vic)

Results: 9,450 patients over 1 year period. Considerable geographic variation in knee arthroscopy rates for patients with OA. Highest incidence rate ratio (IRR) reported in Barwon-South Western (1.266); lowest IRR in Gippsland region (0.89).

Bohensky et al, Internal Medicine Journal, 2014
Aim: Explore the variation in CS rates for women having their first baby in NSW

Method: Linkage of state hospital and birth data for 2009-10 (NSW)

Results: 67,239 singleton live births at term. Differences in clinical practice contributed to variation in intrapartum CS rates. CS rates in some hospitals could be lowered without adversely affecting pregnancy outcomes.

Nippita et al, BJOG, 2015
Challenges in responding to healthcare variation include:

- Distinguishing between variation that is warranted and unwarranted
- Routinely collecting information on patient outcomes
- Routinely collecting information on patient preferences (ACSQHC 2014, Page 5)

Opportunities

- Conduct research on healthcare variation between jurisdictions
- Follow patient outcomes over time and across locations and settings (including new settings)
- Progress international collaborations
Conclusion

- Linked data is being used to support research on healthcare variation in Australia.
- The majority of recent research used data from within a single jurisdiction.
- There are opportunities for healthcare variation research on a wider scale.
For more information about the PHRN

www.phrn.org.au
Funding and other support
- Australian Government Department of Education and Training
- The University of Western Australia

PHRN
- Dr F Flack and Dr N Wray (Program Office)
- Professor B Kearney (Board Chairman)

Researchers
Ontario Health Links: An organizational policy initiative that targets high need, high cost patients

Therese Stukel, Ruth Croxford
Institute for Clinical Evaluative Sciences
Toronto
Multispecialty Physician Networks

Chronic disease care is uncoordinated, costly; poor care leads to more readmissions, ED visits & higher longitudinal costs

Readmission is the single most expensive component of health care spending

Multispecialty physician networks shown to improve performance (fewer readmissions and ED visits) for chronic disease patients through*:

- Strong primary care (PC) systems
- Coordinated and integrated care among PC physicians, specialists, hospitals
- Engagement of interdisciplinary health professionals
- Focus on longitudinal efficiency (total spending over 1 year)

* Crosson, Commonwealth Fund, 2009
High Need/ High Cost Patients

On average, health care spending is highly concentrated with the top 5% of the population (ranked by cost) accounting for 66% of expenditure.
The largest costs are incurred in acute care (including physician services in acute care), physician and long-term care (LTC) institutional costs with the latter costs contributing relatively more in the highest 1% of the population.
High need vs high cost users

Targeting high-cost groups for intervention is problematic:
• it misses the opportunity to manage patients before their conditions have exacerbated
• only 40% are persistently high cost in the following year
• it does not incentivize integrated care systems.

High need patients
• **Complex chronic conditions** (diabetes, congestive heart failure (CHF), asthma, epilepsy, chronic obstructive pulmonary disease (COPD), stroke, coronary artery disease (CAD), cancer)
• **Children with complex medical conditions** (neurological impairment and with technology dependence)
• **Mental health disorders** (schizophrenia, bipolar disorder, depression, anxiety states, substance abuse, personality disorders, dual diagnosis)
• **Frail elderly** (dementia, Alzheimer’s, chronic dialysis, those in long-term care, rehabilitation, chronic care facilities)
• **Multiple chronic conditions** (≥3 chronic conditions or severe mental illness with ≥1 chronic condition)
Healthcare: The Current State

- Too many people relying on Emergency Departments instead of receiving the right care in the community
- Too many people are having trouble navigating the system
- Too many ALC patients
- Too many people being readmitted to hospital within days of leaving hospital

Ministry of Health and Long Term Care, June 25, 2013
Ontario Ministry of Health implements the Excellent Care for All Act (ECFA)

- **Goal**: provide coordinated, efficient, effective care for patients with complex needs
- ECFA focused on primary care (PC) but…
- Looking to create networks of physicians for quality improvement and inter-sectoral (hospital-community) challenges like hospital readmissions.
- The networks form a unit of measurement, accountability and local action for quality improvement.
- Creation of Health Links: December 2012
Zones of Concentration of Comprehensive Primary Health Care Within Multispecialty Physician Networks - Greater Toronto Area View -
Transfoming Ontario's Health Care System

Community Health Links provide coordinated, efficient and effective care to patients with complex needs

Five per cent of patients account for two-thirds of health care costs. These are most often patients with multiple, complex conditions. When the hospital, the family doctor, the long-term care home, community organizations and others work as a team, the patient receives better, more coordinated care. Providers will design a care plan for each patient and work together with patients and their families to ensure they receive the care they need. For the patient it means they will:

- Have an individualized, coordinated plan
- Have care providers who ensure the plan is being followed
- Have support to ensure they are taking the right medications
- Have a care provider they can call who knows them, is familiar with their situation and can help.

Read about evidence informed best practices in Transitions of Care, Optimizing Chronic Disease Management and Supporting Health Independence at bestPATH, a Health Links resource designed by Health Quality Ontario.

For an example of how a community Health Link can make a difference in a patient’s life, read Bernice’s story.

The concept of a community Health Link is very similar to a project The Change Foundation is leading, supporting a project in Northumberland. Read more about this extraordinary community initiative.

Health Links: Partnering Around Patients

- New model of care at the clinical level where providers are charged with coordinating plans at the patient level.
- Initial focus on improving patient care and outcomes for people with complex health conditions, while delivering better value for investment.

Ministry of Health and Long Term Care, June 25, 2013
Indicators of success

Results Based Metrics
(Moving the needle)
1. Reduce the time from primary care referral to specialist
2. Reduce the number of 30 day readmissions to hospital
3. Reduce the number of avoidable ED visits for patients with conditions best managed elsewhere
4. Reduce time from referral to home care visit
5. Reduce unnecessary admissions to hospitals
6. Ensure primary care follow-up within 7 days of discharge from an acute care setting

Operational Metrics
(Settling the stage for coordinated care straight away)
1. All complex patients will have a coordinated care plan
2. Complex patients and seniors will have regular and timely access to a primary care provider

Evaluation Based Metrics
(How you’ll know you’ve arrived)
1. Enhance the health system experience for patients with the greatest health care needs
2. Achieve an ALC rate of nine per cent or less
3. Reduce the average cost of delivering health services to patients without compromising the quality of care

Health Links: Work-planning & the Path Forward July 2013 Ministry of Health & Long-Term Care
Do Health Links Work?

Cohort Study

- Created separate cohorts pre- and post-HLs: 2010 and 2014, alive April 1st
- Separated into top 10% (high cost) and bottom 90% (low cost) of spending in previous 1 year
- Followed for 2 years
Do Health Links Work?

Quality Domains

- Hospital-community transitions
- Evidence-based (EB) Medications
- Screening and prevention
- Readmissions within 30 days
- Hospitalizations for Ambulatory Care Sensitive (ACS) Conditions
- Cancer end-of-life (EOL) care
- Spending
## Table 1: Comparison of high (top 10%) vs. low cost (bottom 90%) patients

<table>
<thead>
<tr>
<th></th>
<th>High vs. low cost users in 2009/10, alive 1 April 2010 (N = 12,744,589)</th>
<th>High vs. low cost users FY13, alive 1 April 2014 (N = 12,997,325)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>high cost users (top 10%) (9.5%)</td>
<td>low cost users (bottom 90%) (90.5%)</td>
</tr>
<tr>
<td>Female: (%)</td>
<td>59.1</td>
<td>50.9</td>
</tr>
<tr>
<td></td>
<td>58.1</td>
<td>51.1</td>
</tr>
<tr>
<td>Age group: %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>6.0</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td>5.8</td>
<td>24.6</td>
</tr>
<tr>
<td>20 – 44</td>
<td>22.0</td>
<td>34.4</td>
</tr>
<tr>
<td></td>
<td>21.3</td>
<td>33.9</td>
</tr>
<tr>
<td>45 – 64</td>
<td>23.9</td>
<td>28.2</td>
</tr>
<tr>
<td></td>
<td>24.9</td>
<td>28.9</td>
</tr>
<tr>
<td>65 – 74</td>
<td>18.3</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>18.7</td>
<td>7.8</td>
</tr>
<tr>
<td>75 – 84</td>
<td>19.2</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>17.6</td>
<td>3.7</td>
</tr>
<tr>
<td>85+</td>
<td>10.6</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>11.7</td>
<td>1.1</td>
</tr>
<tr>
<td>died during year, %</td>
<td>5.2</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>5.7</td>
<td>0.2</td>
</tr>
</tbody>
</table>
## Table 2. Unadjusted rates for high and low cost users, 2010 and 2014

<table>
<thead>
<tr>
<th>Quality Indicator</th>
<th>2010</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% high cost users</td>
<td>Low Cost Users</td>
</tr>
<tr>
<td>Office visit within 7 days after AMI hospitalization</td>
<td>30.3%</td>
<td>46.6%</td>
</tr>
<tr>
<td>Office visit within 7 days after CHF hospitalization</td>
<td>65.4%</td>
<td>46.4%</td>
</tr>
<tr>
<td>Office visit within 7 days after COPD, diabetes, asthma, pneumonia or angina hospitalization</td>
<td>58.5%</td>
<td>37.7%</td>
</tr>
<tr>
<td>Readmissions after AMI hospitalization</td>
<td>30.3%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Readmissions after CHF hospitalization</td>
<td>65.4%</td>
<td>16.8%</td>
</tr>
<tr>
<td>ACSC hospitalizations per 1000, annualized</td>
<td>16.3%</td>
<td>2.71</td>
</tr>
<tr>
<td>Asthma</td>
<td>29.2%</td>
<td>2.71</td>
</tr>
<tr>
<td>Diabetes</td>
<td>61.3%</td>
<td>25.16</td>
</tr>
<tr>
<td>CHF</td>
<td>49.0%</td>
<td>29.22</td>
</tr>
<tr>
<td>COPD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescriptions following CHF hospitalization, age 65+</td>
<td>67.5%</td>
<td>71.0%</td>
</tr>
<tr>
<td>ACE/ARB</td>
<td>70.2%</td>
<td>68.8%</td>
</tr>
<tr>
<td>Beta blocker</td>
<td>56.2%</td>
<td>65.9%</td>
</tr>
<tr>
<td>Statin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescriptions to people with diabetes</td>
<td>43.2%</td>
<td>69.3%</td>
</tr>
<tr>
<td>ACE/ARB</td>
<td>80.9%</td>
<td>89.0%</td>
</tr>
<tr>
<td>Antihypertensive</td>
<td>66.2%</td>
<td>72.6%</td>
</tr>
<tr>
<td>Statin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal screening for diabetes</td>
<td>26.1%</td>
<td>30.9%</td>
</tr>
</tbody>
</table>
AMI: % with 7-day Follow-Up Visit Post-discharge

### Percent of AMI discharges followed by an office visit within 7 days

<table>
<thead>
<tr>
<th>P1</th>
<th>Percent with follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Any follow-up within 7 days</td>
<td>35.4</td>
</tr>
<tr>
<td>Shared care within 30 days</td>
<td>13.9</td>
</tr>
</tbody>
</table>
Office visit within 7 days after AMI hospitalization
CHF: % with 7-day Follow-Up Visit Post-Discharge

Percent of CHF discharges followed by an office visit within 7 days

<table>
<thead>
<tr>
<th>P4</th>
<th>Percent with office visit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
</tr>
<tr>
<td>Any follow-up within 7 days</td>
<td>33.3</td>
</tr>
<tr>
<td>Shared care within 30 days</td>
<td>12.9</td>
</tr>
</tbody>
</table>
Office visit within 7 days after CHF hospitalization
Chronic Conditions: % with 7-day Follow-Up Visit Post-Discharge

Percentage of adult COPD, diabetes, asthma, pneumonia and angina discharges followed by an office visit within 7 days

<table>
<thead>
<tr>
<th>P23</th>
<th>Percent with office visit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>adults: follow-up within 7 days</td>
<td>26.9</td>
</tr>
<tr>
<td>Children (pneumonia and asthma only): follow-up within 7 days</td>
<td>28.6</td>
</tr>
</tbody>
</table>
Office visit within 7 days after COPD, diabetes, asthma, pneumonia or angina hospitalization
CHF: % with Prescriptions Post-Discharge

P5 Percent who filled a prescription

<table>
<thead>
<tr>
<th></th>
<th>Percent who filled a prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
</tr>
<tr>
<td>ACE/ARB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>61.9</td>
</tr>
<tr>
<td>B-blocker</td>
<td></td>
</tr>
<tr>
<td></td>
<td>61.5</td>
</tr>
<tr>
<td>Statin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>55.9</td>
</tr>
</tbody>
</table>
ACE/ARB prescription after CHF hospitalization
B-blocker prescription after CHF hospitalization
Statin prescription after CHF hospitalization
Diabetes: % with EB Medications

<table>
<thead>
<tr>
<th>P17</th>
<th>Percent who filled a prescription</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th 25th 50th 75th 90th</td>
</tr>
<tr>
<td>ACE/ARB</td>
<td>69.9 70.6 72.0 73.4 75.3</td>
</tr>
<tr>
<td>Antihypertensive</td>
<td>82.4 83.5 84.5 86.0 86.8</td>
</tr>
<tr>
<td>Statin</td>
<td>65.9 67.5 69.6 70.7 72.4</td>
</tr>
</tbody>
</table>

Percent of people with diabetes filling a prescription for an ACE/ARB

Percent of people with diabetes filling a prescription for an antihypertensive

Percent of people with diabetes filling a prescription for a statin
ACE/ARB prescription to people with diabetes
Antihypertensive prescription to people with diabetes
Statin prescription to people with diabetes
Diabetes: % receiving optimal screening

<table>
<thead>
<tr>
<th>P9</th>
<th>Percent tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Eye exam</td>
<td>66.1</td>
</tr>
<tr>
<td>Cholesterol testing</td>
<td>84.2</td>
</tr>
<tr>
<td>HbA1C testing</td>
<td>36.1</td>
</tr>
<tr>
<td>Optimal care</td>
<td>30.0</td>
</tr>
</tbody>
</table>
Optimal screening rates for diabetes
AMI: 30-day All-Cause Readmission Rates

Percentage of AMI discharges followed by readmission (all-cause) within 30 days

<table>
<thead>
<tr>
<th>PA7</th>
<th>Percent of AMI hospitalizations with a readmission</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th  25th  50th  75th  90th</td>
</tr>
<tr>
<td>All-cause readmissions</td>
<td>9.1    10.6  12.1   13.1  14.1</td>
</tr>
<tr>
<td>All-cause ED visits after discharge</td>
<td>20.1   21.4  23.3   25.1  29.9</td>
</tr>
</tbody>
</table>
30-Day readmission after AMI hospitalization
CHF: 30-day All-Cause Readmission Rates

Percentage of CHF discharges followed by readmission (all-cause) within 30 days

<table>
<thead>
<tr>
<th>PA8</th>
<th>Percent of CHF hospitalizations with a readmission or ED visit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
</tr>
<tr>
<td>All-cause readmissions</td>
<td>16.2</td>
</tr>
<tr>
<td>All-cause ED visits after discharge</td>
<td>24.8</td>
</tr>
</tbody>
</table>
30-day readmission after CHF hospitalization
Diabetes: Admission Rates for Chronic Complications of Diabetes, per 1000

<table>
<thead>
<tr>
<th>PA4</th>
<th>Number of hospitalizations per 1,000 people with diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
</tr>
<tr>
<td>For an acute condition</td>
<td>3.7</td>
</tr>
<tr>
<td>For a chronic condition</td>
<td>15.9</td>
</tr>
<tr>
<td>For any condition</td>
<td>19.7</td>
</tr>
</tbody>
</table>
Diabetes hospitalizations for chronic complications, per 1000
ACSC: Admission Rates, by Condition

<table>
<thead>
<tr>
<th>PA5</th>
<th>Annualized non-elective hospitalizations for the specific condition / 1,000 people</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10th</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.87</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.9</td>
</tr>
<tr>
<td>CHF</td>
<td>39.3</td>
</tr>
<tr>
<td>COPD</td>
<td>53.0</td>
</tr>
</tbody>
</table>
Asthma hospitalizations per 1000, annualized
CHF hospitalizations per 1000, annualized
COPD hospitalizations per 1000, annualized
Advanced Health Links

- Enhanced Governance Structure
- Integrated Performance Management Framework
- Quality/Best Practices Framework
Health Links?

• It may be too early to tell if Health Links (HL) are successful
• Discussion about coordinated care planning and transitions may be premature since insufficient time to have systems up and running and identify high-need patients
• Health Links becoming more comfortable with the process of data review and practice discussions
• Effective coordination across the care continuum is a challenging goal
• Individual care plans with each HL implementing in its own way may not work ➔ we need system-wide approaches
• System change is difficult!