AMA Innovations in Medical Education Webinar Series: Using Big Data to Teach Population Health

Richard Hawkins, MD
Marc Triola, MD, FACP
August 21, 2017

Your MISSION is Our MISSION
Today’s Host

• Richard Hawkins, MD, Vice-President, Medical Education Outcomes, American Medical Association
Objectives

• Learn about the development of a new curriculum to teach Health Systems Science in which students answer health system-level questions using publicly available patient databases

• Learn how these databases have been used by students to focus on disparities in care and explain variations in quality and cost across hospitals

• Understand how improving population health by leveraging big data can result in changes health care delivery

• Learn how to implement experiential activities like these at your own institution to teach important skills for the future of health care
Marc Triola, MD, FACP
Associate Dean for Educational Informatics at NYU School of Medicine
Founding director of the NYU Langone Medical Center Institute for Innovations in Medical Education
Associate Professor of Medicine.
AMA Innovations in Medical Education Webinar Series

Using Big Data to Teach Population Health
Using Big Data to Teach Population Health

Marc M. Triola, MD
Institute for Innovations in Medical Education
The need for Health Systems Science (HSS) education

- Changes in our health care delivery system are driving new competencies for physicians
- HSS: Person-Centered Care; Population-Centered Care; High-Value Care; Team-Based Care; Health Policy, Economics and Technology; Leadership
- Driven by large digital datasets from electronic medical record systems, claims systems, large clinical and research registries
- Learning to navigate these datasets will be a key emerging competency of 21st century physician-leaders
Health Systems Science (HSS)

- Student participation in HSS educational initiatives have been shown to improve their skills of quality and safety, and benefited their health care delivery organizations.
- HSS education is most successful when students are engaged, motivated, and participate in an “authentic role” within the health care system.
- Most commonly this is a hands-on experiential exercise
Health Care by the Numbers (HCBN)

- With funding from the American Medical Association’s Accelerating Change in Medical Education grant program, we developed an HSS curriculum at NYU School of Medicine focused on Population-Centered Care.
- Our goal was to utilize real patient-level clinical data that reflected the ‘system’ at our medical school’s university, and affiliate hospitals; the diverse and complex New York City; and New York state as a whole.
- By using real clinical data on a large scale, we sought to craft a curriculum that included an authentic experiential learning opportunity at its core. We called the curriculum Health Care by the Numbers (HCBN).
Health Care by the Numbers (HCBN)

- Central component: A student-driven project in which pairs of students identify a system-level clinical question they will answer using a large clinical database.

- Students practice skills core to Population-Centered Care:
  - developing a testable hypothesis across large numbers of patients
  - outlining a methodological approach
  - synthesizing / communicating their findings.
Health Care by the Numbers (HCBN)

HCBN is implemented in the latter half of our Practice of Medicine course, just prior to our students beginning their clinical clerkships. The HCBN curriculum, and the clinical data project, are required of all NYU School of Medicine students.
HCBN Didactics

Four didactic one-hour lectures:

- Orientation to the project, the timeline of the curriculum and the core concepts of a panel approach to patients.
- The ongoing transformation of healthcare and the tools used by faculty across our medical center for population health and panel management.
- Measuring value in healthcare and the approaches to using administrative and clinical data to improve value.
- Incentives in healthcare, including payment models, and how incentives affect behavior of providers, patients, and delivery systems.
HCBN Student Project

● Students are divided into teams of two to define a clinical question they will evaluate for their experiential learning project.
● Their questions could cover any topic or aspect of care, as long as it was answerable by the data contained in the clinical database.
● Each proposed student question required approval by faculty
HCBN Student Project

● Students have five weeks to work with their teammate to perform their analyses and prepare a presentation on their findings and any implications for the health care system.

● During that time:
  – Required to meet with a Medical Librarian for a structured search to find existing literature on their topic
  – Optional office hours with faculty in Health Systems Science, Informatics, and Biostatistics

● Students presented their findings using a standardized template to their Practice of Medicine course groups (3 teams per group)
HCBN Creating the Database

- Established by New York Public Health law in 1979, New York State Department of Health Statewide Planning and Research Cooperative System (SPARCS) collects patient-level demographics, provider details, diagnoses, procedures, costs, and charges for all inpatient admissions to all 227 New York hospitals.
- Free for public use and includes detailed patient-level records for each of the 2.2 million inpatient admissions yearly in New York.
HCBN - SPARCS Clinical Database

• Demo and tour
  – http://ace.iime.cloud/sparcs/
NYU School of Medicine - Health Care By The Numbers Curriculum

This site lets you explore real clinical data from the New York State Department of Health Statewide Planning and Research Cooperative System (SPARCS). Data from years 2013, and 2014 are included - over 4.6 million patient-level records. View and download the full SPARCS data sets. View the 'Data Dictionary' for SPARCS (PDF). This NYU School of Medicine Curriculum is funded by the AMA Accelerating Change in Medical Education Program.

Search for a diagnosis/procedure: This system uses APR-DRG terms to search the SPARCS database.

20 Most Common Admissions by APR-DRG Code for 2014

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
<th>Avg. LOS</th>
<th>Avg. Charges</th>
<th>Avg. Cost</th>
<th>Sum of all 2014 Charges</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEONATE BIRTHWT &gt;2490G, NORMAL NEWBORN OR NEONATE W OTHER PROBLEM</td>
<td>202,834</td>
<td>2.4</td>
<td>$7,291.02</td>
<td>$2,617.63</td>
<td>$1,478,865,743</td>
</tr>
<tr>
<td>VAGINAL DELIVERY</td>
<td>149,626</td>
<td>2.4</td>
<td>$14,597.30</td>
<td>$6,609.20</td>
<td>$2,184,134,500</td>
</tr>
<tr>
<td>SEPTICEMIA &amp; DISSEMINATED INFECTIONS</td>
<td>84,721</td>
<td>8.2</td>
<td>$57,544.10</td>
<td>$22,095.20</td>
<td>$4,875,191,739</td>
</tr>
<tr>
<td>CESAREAN DELIVERY</td>
<td>76,962</td>
<td>3.8</td>
<td>$24,822.10</td>
<td>$10,871.80</td>
<td>$1,910,359,919</td>
</tr>
<tr>
<td>HEART FAILURE</td>
<td>54,218</td>
<td>5.8</td>
<td>$36,847.40</td>
<td>$14,163.10</td>
<td>$1,997,791,842</td>
</tr>
<tr>
<td>OTHER PNEUMONIA</td>
<td>42,164</td>
<td>5.0</td>
<td>$29,996.30</td>
<td>$11,670.00</td>
<td>$1,264,764,931</td>
</tr>
</tbody>
</table>
# 10 Highest Average Charge APR-DRG Codes for 2014

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
<th>Avg Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEONATE BWT &lt;1600G W MAJOR PROCEDURE</td>
<td>249</td>
<td>$1,130,350</td>
</tr>
<tr>
<td>HEART &amp;/OR LUNG TRANSPLANT</td>
<td>203</td>
<td>$979,083</td>
</tr>
<tr>
<td>NEONATE W ECMO</td>
<td>42</td>
<td>$686,863</td>
</tr>
<tr>
<td>EXTENSIVE 3RD DEGREE BURNS W SKIN GRAFT</td>
<td>32</td>
<td>$633,158</td>
</tr>
<tr>
<td>NEONATE BIRTHWT 500-749G W/O MAJOR PROCEDURE</td>
<td>327</td>
<td>$625,633</td>
</tr>
<tr>
<td>TRACHEOSTOMY W MV 96+ HOURS W EXTENSIVE PROCEDURE OR ECMO</td>
<td>2,901</td>
<td>$600,566</td>
</tr>
<tr>
<td>NEONATE BIRTHWT 750-999G W/O MAJOR PROCEDURE</td>
<td>510</td>
<td>$549,702</td>
</tr>
<tr>
<td>LIVER TRANSPLANT &amp;/OR INTESTINAL TRANSPLANT</td>
<td>360</td>
<td>$506,076</td>
</tr>
<tr>
<td>NEONATE BWT 1500-2499G W MAJOR PROCEDURE</td>
<td>184</td>
<td>$504,764</td>
</tr>
<tr>
<td>NEONATE BWT 1000-1249G W RESP DIS SYND/OTH MAJ RESP OR MAJ ANOM</td>
<td>588</td>
<td>$468,955</td>
</tr>
</tbody>
</table>
# 10 Highest Sum Total Charges APR-DRG Codes for 2014

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
<th>Sum Total for all 2014 Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia &amp; Disseminated Infections</td>
<td>84,721</td>
<td>$4,875,191,739</td>
</tr>
<tr>
<td>Vaginal Delivery</td>
<td>149,626</td>
<td>$2,184,134,500</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>54,218</td>
<td>$1,997,791,842</td>
</tr>
<tr>
<td>Cesarean Delivery</td>
<td>75,962</td>
<td>$1,910,359,919</td>
</tr>
<tr>
<td>Rehabilitation</td>
<td>30,533</td>
<td>$1,894,147,117</td>
</tr>
<tr>
<td>Knee Joint Replacement</td>
<td>36,503</td>
<td>$1,875,415,449</td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>35,899</td>
<td>$1,828,894,718</td>
</tr>
<tr>
<td>Percutaneous Cardiovascular Procedures w/o AMI</td>
<td>20,879</td>
<td>$1,824,640,931</td>
</tr>
<tr>
<td>Hip Joint Replacement</td>
<td>31,304</td>
<td>$1,799,676,666</td>
</tr>
<tr>
<td>Tracheostomy w MV 96+ Hours w Extensive Procedure or ECMO</td>
<td>2,901</td>
<td>$1,742,240,969</td>
</tr>
</tbody>
</table>
HEART FAILURE
54,218 admissions to New York hospitals in 2014.
Data derived from the 2014 New York State Department of Health SPARCS. These data reflect in-patient discharge data only.

Demographics
- 60.8%
- 22.6%
- 22.6%
- 50%
- 50%

Payors and Charges
- 2014 Average Charges per Admission: $36,847
- Medicare: $36,832
- Medicaid: $38,949
- Private Health Insurance: $35,508
- Blue Cross/Blue Shield: $37,642
- Self-Pay: $24,773
- Managed Care, Unspecified: $33,680
- Federal/State/Local/VA: $30,393
- Miscellaneous/Other: $23,135
- Unknown: $24,305
- Department of Corrections: $39,177

Clinical Outcomes
- 5.82 Days
- 2.52 / 4
### 2014 results

Click on a column header to sort ascending or descending.

<table>
<thead>
<tr>
<th>Hospital</th>
<th># Discharges</th>
<th>Avg. Charges</th>
<th>Avg. Costs</th>
<th>Avg. Severity Score</th>
<th>Avg. LOS</th>
<th># Expired</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adirondack Medical Center-Saranac Lake Site</td>
<td>55</td>
<td>$17,932.09</td>
<td>$13,480.07</td>
<td>2.45</td>
<td>3.89</td>
<td>6</td>
</tr>
<tr>
<td>Albany Medical Center Hospital</td>
<td>396</td>
<td>$44,988.03</td>
<td>$14,022.38</td>
<td>2.56</td>
<td>6.87</td>
<td>13</td>
</tr>
<tr>
<td>Albany Memorial Hospital</td>
<td>128</td>
<td>$15,589.63</td>
<td>$5,701.19</td>
<td>2.80</td>
<td>4.18</td>
<td>8</td>
</tr>
<tr>
<td>Alice Hyde Medical Center</td>
<td>71</td>
<td>$8,955.92</td>
<td>$3,684.70</td>
<td>2.39</td>
<td>4.10</td>
<td>2</td>
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<tr>
<td>Arnot Ogden Medical Center</td>
<td>309</td>
<td>$19,576.26</td>
<td>$7,718.84</td>
<td>2.46</td>
<td>5.56</td>
<td>9</td>
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<tr>
<td>Auburn Memorial Hospital</td>
<td>267</td>
<td>$16,374.26</td>
<td>$5,689.16</td>
<td>2.61</td>
<td>5.03</td>
<td>18</td>
</tr>
<tr>
<td>Aurelia Osborn Fox Memorial Hospital</td>
<td>120</td>
<td>$10,177.78</td>
<td>$5,030.04</td>
<td>2.28</td>
<td>5.93</td>
<td>10</td>
</tr>
<tr>
<td>Bellevue Hospital Center</td>
<td>362</td>
<td>$41,950.71</td>
<td>$31,952.46</td>
<td>2.21</td>
<td>7.01</td>
<td>6</td>
</tr>
<tr>
<td>Bertrand Chaffee Hospital</td>
<td>45</td>
<td>$10,073.62</td>
<td>$3,852.33</td>
<td>2.36</td>
<td>3.78</td>
<td>0</td>
</tr>
<tr>
<td>Bon Secours Community Hospital</td>
<td>140</td>
<td>$29,269.91</td>
<td>$8,793.91</td>
<td>2.82</td>
<td>4.66</td>
<td>7</td>
</tr>
<tr>
<td>Bronx-Lebanon Hospital Center - Concourse Division</td>
<td>666</td>
<td>$16,965.43</td>
<td>$15,905.72</td>
<td>2.41</td>
<td>5.36</td>
<td>11</td>
</tr>
<tr>
<td>Brookdale Hospital Medical Center</td>
<td>550</td>
<td>$33,556.20</td>
<td>$17,430.52</td>
<td>2.55</td>
<td>6.49</td>
<td>18</td>
</tr>
<tr>
<td>Brookhaven Memorial Hospital Medical Center Inc</td>
<td>476</td>
<td>$60,407.39</td>
<td>$10,509.67</td>
<td>2.66</td>
<td>7.29</td>
<td>26</td>
</tr>
<tr>
<td>Brooklyn Hospital Center - Downtown Campus</td>
<td>444</td>
<td>$31,715.31</td>
<td>$10,608.81</td>
<td>2.29</td>
<td>6.65</td>
<td>20</td>
</tr>
<tr>
<td>Brooks Memorial Hospital</td>
<td>128</td>
<td>$12,131.66</td>
<td>$10,947.73</td>
<td>2.52</td>
<td>4.33</td>
<td>8</td>
</tr>
<tr>
<td>Buffalo General Hospital</td>
<td>709</td>
<td>$20,257.87</td>
<td>$9,272.51</td>
<td>2.66</td>
<td>5.60</td>
<td>30</td>
</tr>
<tr>
<td>Calvary Hospital Inc</td>
<td>144</td>
<td>$47,140.05</td>
<td>$28,069.38</td>
<td>2.37</td>
<td>21.18</td>
<td>127</td>
</tr>
</tbody>
</table>
## Download raw APR-DRG data as CSV (Excel) files

Download data for all NY State hospitals that treated this condition:

- Download all hospitals - 2014
- Download all hospitals - 2013

Download a smaller 2014 dataset for a selected group of 8 hospitals:

- Download 8 Hospitals Only

### 2014 data for this DRG from NYU Hospitals and Affiliates:

- NYU Hospitals Center
- NYU Hospital for Joint Diseases
- NYU Lutheran Medical Center
- Bellevue Hospital Center
VAGINAL DELIVERY
149,626 admissions to New York hospitals in 2014.

### Payors and Charges

2014 Average Charges per Admission
Lowest: $496 ~ Highest: $738,154

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Payer</th>
<th>Avg. Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olean General</td>
<td>Blue Cross</td>
<td>$4,442.95</td>
</tr>
<tr>
<td>New York Presbyterian</td>
<td>Blue Cross</td>
<td>$21,421.53</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Payor</th>
<th>Avg. Charges</th>
<th>Avg. Costs</th>
<th># Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid</td>
<td>$14,679</td>
<td>$7,058</td>
<td>75,230</td>
</tr>
<tr>
<td>Private Health Insurance</td>
<td>$15,595</td>
<td>$6,207</td>
<td>38,355</td>
</tr>
<tr>
<td>Blue Cross/Blue Shield</td>
<td>$13,789</td>
<td>$5,995</td>
<td>29,427</td>
</tr>
<tr>
<td>Managed Care, Unspecified</td>
<td>$12,595</td>
<td>$5,770</td>
<td>2,023</td>
</tr>
<tr>
<td>Self-Pay</td>
<td>$11,768</td>
<td>$6,673</td>
<td>1,866</td>
</tr>
<tr>
<td>Federal/State/Local/VA</td>
<td>$8,560</td>
<td>$7,513</td>
<td>1,652</td>
</tr>
<tr>
<td>Medicare</td>
<td>$13,301</td>
<td>$6,722</td>
<td>726</td>
</tr>
<tr>
<td>Miscellaneous/Other</td>
<td>$9,475</td>
<td>$5,157</td>
<td>231</td>
</tr>
<tr>
<td>Unknown</td>
<td>$17,048</td>
<td>$5,963</td>
<td>74</td>
</tr>
<tr>
<td>Department of Corrections</td>
<td>$24,461</td>
<td>$8,187</td>
<td>42</td>
</tr>
</tbody>
</table>
HCBN - Results

- Introduced to the entire first-year medical student class in 2014 and has been run yearly since.
- To date, 225 student pairs have answered questions using the clinical database we created.
- 74 student pairs in the 2014 HCBN cohort:
  - 8 project questions required significant revision upon review by faculty.
  - 15 teams participated in at least one of the optional office hours covering informatics, biostatistics, and health systems.
HCBN - Results

- Students most interested in factors contributing to disparities in care and geographic variations in quality/availability.
- The most common factors chosen by students:
  - patient’s source of payment (23%)
  - the race of the patient (18%)
  - the location of the hospital (15%)
- Most common clinical conditions chosen:
  - Cardiovascular (23%)
  - Mental-health (18%)
HCBN - Selected Student Questions

• Does hospital caseload relate to the length of stay for patients with heart failure?
• How does day-of-week of admission for acute MI relates to patient outcomes in terms of mortality and/or length of stay?
• How does the gender and racial composition of patients admitted with a diagnosis of major depressive disorder change between various age ranges?
• Is Cesarean delivery being performed equally conservatively among various racial/ethnic groups?
• Is the availability of residency positions an indicator of a hospital’s billed amount to the privately insured?
HCBN - Selected Student Questions

• Is there a difference in sepsis mortality rates between teaching hospitals (University-affiliated) and non-teaching hospitals in New York?
• We plan to use SPARCS data to compare outcomes of patients with sepsis in 2012 to patients with sepsis from 2013 to the present. The reason we chose to look at the clinical outcomes in these two time periods is the implementation of new laws in New York that require hospitals to take certain steps in identifying and treating septic patients.
HCBN - Lessons Learned

- Faculty development is key
- Faculty and students can use the same datasets both in the classroom and for original research
- Can access data from affiliate hospitals
- Data sets are too big and unwieldy for learners to access directly
More resources

• Overall website:
  – http://ace.iime.cloud

• SPARCS database:
  – http://ace.iime.cloud/sparcs/

• Other clinical data sets for education:
  – http://ace.iime.cloud/clinicaldata/
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Questions

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## Future Events

### Continue the discussion

Please join us to ask questions of our panelists at:


- Role of big data in managing population health
- Challenges in using big data in healthcare

### Future webinars

- **Health Systems Science**
  - October 23 at 3 p.m. Central

- **Interprofessional Education**
  - January 2018

### ChangeMedEd 2017

Mark your calendars:

- September 14-16 in Chicago