The presentation will begin shortly.
INTRODUCTION: ENHANCING STATEWIDE HOSPITAL DISCHARGE DATABASES

Roxanne Andrews, Ph.D.

*HSR* Special Issue, Guest co-Editor

(Recent retiree from Healthcare Cost and Utilization Project, AHRQ)

October 2, 2015
OUTLINE

- Statewide hospital discharge data
- Healthcare Cost and Utilization Project
- AHRQ-funded Enhanced State Data Grants
- *Health Services Research* special issue on grant findings
STATEWIDE HOSPITAL DISCHARGE DATA

- Almost all states have all-payer statewide collection
- Billing data involve little extra data collection burden
- Fairly standardized across hospitals
- Core data set useful for a wide-range of purposes
- Research methods & software readily available
- AHRQ’s HCUP aggregates at national level; creates uniform research files
THE HCUP PARTNERSHIP

Multi-Year, starting 1988
All-Payer
Inpatient
Emergency Department
Ambulatory Surgery
Databases

Based on Hospital Billing Data

State
Federal
Industry
DATA USES SPANNING 40 YEARS

- Health Services Researchers
  - Health policy
  - Access and quality
  - Clinical practice and clinical aspects of care
  - Race-ethnicity and insurance impacts
  - Economics and financing

- States, Communities, Hospitals
  - Public health and safety
  - Disease and injury surveillance and registries
  - Community health assessments and health planning
  - Quality assessment and performance improvement
  - Public reporting for purchasing and comparative reports
NEED FOR IMPROVED RACE & ETHNICITY DATA

- Racial/ethnic minorities receive lower access & quality care
  
  (Unequal Treatment; Nat’l Healthcare Disparities Report; Numerous studies)

- Need good data to identify areas for improvement; track progress

- Challenges identified by HCUP Partners
  
  - Convincing stakeholders about the value of collecting race/ethnicity data
  
  - Concerns about accuracy (e.g. clerks collecting by observing)
  
  - Sensitivity about asking for the information
  
  - Coding schemes (national standards vs local needs)
NEED FOR IMPROVED CLINICAL DATA

- Limited to ICD-9-CM diagnosis codes
- Missing physiological data (lab values and vital signs) for hospitalization
- Lacks relevant pre- and post-hospitalization clinical information
- With advances in IT and EHRs, there is a growing availability of clinical data in electronic form
AHRQ GRANTS TO ENHANCE STATE ADMINISTRATIVE DATA

- Recovery Act (ARRA) funds to improve data infrastructure for comparative effectiveness research
  - Three-year grants awarded in Fall 2010

- Enhance the data infrastructure of statewide data organizations to improve local uses and HCUP data
## RACE-ETHNICITY DATA GRANTS

<table>
<thead>
<tr>
<th>State</th>
<th>PI</th>
<th>Data Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>David Zingmond, UCLA</td>
<td>Improve accuracy of race-ethnicity and language data through improved auditing methods, training and indirect (statistical) methods.</td>
</tr>
<tr>
<td>NM</td>
<td>Michael Landen, NM Dept of Health</td>
<td>Improve the quality of race and ethnicity data, including use of OMB categories. Collect tribal identifier data.</td>
</tr>
<tr>
<td>ID, OR, WA</td>
<td>Victoria Warren-Mears, Northwest Portland Area Indian Health Board</td>
<td>Using the roster of AI/AN in the Northwest, correct inaccurate AI/AN data in hospital discharge, vital statistics, STD/HIV, cancer &amp; trauma registries.</td>
</tr>
<tr>
<td>State</td>
<td>PI</td>
<td>Hospital Data Enhancement</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------</td>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>HI</td>
<td>Todd Seto, Queen’s Medical Center</td>
<td>Add <strong>laboratory data</strong></td>
</tr>
<tr>
<td>MN</td>
<td>Mark Sonneborn, MN Hospital Association</td>
<td>Increase <strong>lab data</strong> submission, add inpatient <strong>pharmacy</strong>, link patients across hospitals &amp; with <strong>death certificates</strong></td>
</tr>
<tr>
<td>NY</td>
<td>Barbara Dennison, NY State DOH</td>
<td>Add <strong>laboratory data</strong></td>
</tr>
<tr>
<td>State</td>
<td>PI</td>
<td>Hospital Data Enhancement</td>
</tr>
<tr>
<td>-------</td>
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<td>---------------------------</td>
</tr>
</tbody>
</table>
| FL    | Hamisu Salihu  
Univ of South Florida | Link IP with **vital stats**, ED & AS data to create statewide maternal child dataset |
| NJ    | Derek DeLia  
Rutgers University | Link to **prehospital EMS data & death certificates** |
Race and Ethnicity Data Improvement Toolkit

The Race and Ethnicity Data Improvement Toolkit provides practical tools and guidance to organizations interested in improving their collection of hospital patient race, ethnicity, and primary language data. It presents the combined experience of several Enhanced State Data grantees that embarked on data quality improvement projects in their states.

Race and Ethnicity Data Improvement Toolkit

This toolkit provides practical tools and guidance to those interested in improving the quality of their hospital patient race, ethnicity, and primary language (R/E/L) data collection efforts. The toolkit is designed for statewide data organizations that collect hospital administrative data, such as those participating in AHRQ’s Healthcare Cost and Utilization Project. However, the toolkit may also be useful for a variety of others with a role in improving the collection of R/E/L in hospital data, such as hospital leadership, quality improvement personnel, clinicians, patients and consumers, registration and admitting departments, and hospital IT departments.

The toolkit is based on the materials developed by, and the experiences of, three AHRQ Enhanced State Data grantees from California, New Mexico, and the Northwest region (Idaho, Oregon, and Washington) that embarked on R/E/L data quality improvement projects. Enhancements included making substantial, sustainable improvements to the reporting of R/E/L data among patients in California’s hospitals; improving the quality of race and ethnicity data in hospital discharge databases by revising the New Mexico administrative code to mandate race, ethnicity, and tribal identifier data reporting; and conducting record linkage with an array of health-related data systems in a three-state region in the Pacific Northwest to identify and, in some cases, augment racial misclassification and improve disease/mortality estimates.

- The Case for Improving Race, Ethnicity, and Language Data
- Data Improvement through Education and Training of Hospital Staff
- Data Improvement through Data Linkages and Data Validation
- About the Grants (includes tools developed by each grantee)

http://www.hcup-us.ahrq.gov/datainnovations/raceethnicitytoolkit/home_race.jsp
Clinical Content Enhancement Toolkit

The Clinical Content Enhancement Toolkit provides practical tools and guidance to organizations interested in supplementing their existing statewide hospital encounter data with additional clinical data. It presents the combined experience of several Enhanced State Data grantees that embarked on clinical content enhancement projects in their states.

Clinical Content Enhancement Toolkit

This toolkit provides practical tools and guidance to those interested in broadening and supplementing their existing administrative health data by adding clinical data elements. The toolkit is designed for statewide data organizations that collect hospital administrative data, such as those participating in AHRQ’s Healthcare Cost and Utilization Project. However, the toolkit may also be useful for a variety of others with a role in enhancing administrative databases with clinical data elements, such as hospital leadership, quality improvement personnel, clinicians, and hospital IT departments.

The toolkit is based on the materials developed by, and the experiences of, five AHRQ Enhanced State Data grantees from Florida, Hawaii, Minnesota, New Jersey, and New York who collaborated with state and health care provider organizations to enhance existing hospital claims databases with clinical data, and use them to demonstrate how the enhancements improved their value in comparative effectiveness research. Enhancements included linking hospital claims data to hospital numerical laboratory data, to hospital ambulatory and emergency room claims data, to birth and death certificate data, to inpatient pharmacy order data, and to pre-admission emergency medical services data.

- The Case for Improving Clinical Data
- Project Initiation and Planning
- Training
- Data Collection, Linkage, and Management
- About the Grants (includes tools developed by each grantee)

http://www.hcup-us.ahrq.gov/datainnovations/clinicalcontentenhancementtoolkit/home_toolkits.jsp
AHRQ-SPONSORED HSR SPECIAL ISSUE

- Background on Statewide Discharge Data & Grants
- Grantee Challenges & Lessons Learned (collaborative paper)
- Case study - Sustainability of grant achievements
- Demonstration of the value of adding laboratory data
- An innovative approach for linking patient data
- Two different approaches to assessing and improving race-ethnicity data quality
PARTING COMMENTS TO RESEARCHERS

- Develop new methods to broaden the usefulness and improve statewide discharge data

- Collaborate with statewide data organizations and hospitals on data improvement
  - The Enhanced State Data grant projects are examples

- Let statewide data organizations (and HCUP) know about your data needs and ideas for improvement
RESOURCES

- HCUP Website
  http://www.hcup-us.ahrq.gov/

- HCUP Partners (Statewide Data Organizations)
  http://www.hcup-us.ahrq.gov/partners.jsp

- Clinical Content Enhancement Toolkit
  http://www.hcup-us.ahrq.gov/datainnovations/
  clinicalcontentenhancementtoolkit/home_toolkits.jsp

- Race and Ethnicity Data Toolkit
  http://www.hcup-us.ahrq.gov/datainnovations/
  raceethnicitytoolkit/home_race.jsp
Improving the Reporting of Race, Ethnicity, and Language in California Hospitals

David Zingmond, MD, PhD
The David Geffen School of Medicine at UCLA
Objectives and Approach

**Overall Objective:** To improve the reliability, validity, and completeness of self-reported Race, Ethnicity, and Language in data for patients seen in California hospitals (inpatient, ED, and ambulatory surgery)

1. Pre- and Post- needs assessments through structured surveys to hospital registrars (and others) in California hospitals.

2. Adaptation/development/implementation of training materials

3. Development of revised data auditing rules for evaluating data quality throughout the project and feeding back to hospitals

4. Post-collection data improvement (supplementation and imputation)
Study Approach

• Compared R/E reporting in 2008-2009 discharge data vs. existing self-report R/E information overall and by hospital
• Created new audit measures based upon hospital population mean estimates from zip code of residence
• Assessed new audit measure vs self-report
• Compared new audit measure vs existing measures
Gold Standard Assessment

- Linked the California Patient Discharge Data to two external gold-standards
  - California State Vital Statistics – birth records
  - California State Cancer Registry
    - Subset of cases with self-reported race/ethnicity (SF Bay Area and LA County)
    - Full state cancer registry – chart abstraction with name-based algorithm
- Calculated agreement for race/ethnicity for each cohort
Table 1: Demographics and Overall Agreement: Inpatient Data versus Maternal Cohort* and versus Cancer Cohort†

<table>
<thead>
<tr>
<th></th>
<th>Maternal Cohort 1</th>
<th>Cancer Cohort 2,3</th>
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</thead>
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<tr>
<td></td>
<td>% Gold Standard Agreement</td>
<td>% Gold Standard Agreement</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Total discharges</td>
<td>1,052,238</td>
<td>14,918</td>
</tr>
<tr>
<td>Overall combined race/ethnicity</td>
<td>85.8</td>
<td>90.1</td>
</tr>
<tr>
<td>Overall race only</td>
<td>70.7</td>
<td>90.7</td>
</tr>
<tr>
<td>Discharges by race/ethnicity</td>
<td></td>
<td></td>
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<tr>
<td>Hispanic</td>
<td>551,643</td>
<td>1,264</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>500,595</td>
<td>13,654</td>
</tr>
<tr>
<td>Whites (all)</td>
<td>792,975</td>
<td>11,000</td>
</tr>
<tr>
<td>Non-whites</td>
<td>259,263</td>
<td>3,918</td>
</tr>
<tr>
<td>Mean age of patients at discharge (years)</td>
<td>28.1</td>
<td>62.8</td>
</tr>
<tr>
<td>Number of hospitals involved</td>
<td>261</td>
<td>227</td>
</tr>
<tr>
<td>Number of observations</td>
<td>4,001</td>
<td>66</td>
</tr>
<tr>
<td>per hospital (mean, range)</td>
<td>&lt;1, 15,263&gt;</td>
<td>&lt;1, 715&gt;</td>
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</tbody>
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### Demographics and Overall Agreement: Inpatient Data versus Cohort* and versus Cancer Cohort†

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<tr>
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<td>Combined race/ethnicity only</td>
<td>551,643</td>
<td>89.1</td>
<td>1,264</td>
<td>66.4</td>
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<tr>
<td>Specialty</td>
<td>500,595</td>
<td>82.1</td>
<td>13,654</td>
<td>92.3</td>
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<tr>
<td>Race</td>
<td>792,975</td>
<td>72.3</td>
<td>11,000</td>
<td>93.7</td>
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<tr>
<td>Ethnic</td>
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<td>3,918</td>
<td>82.5</td>
</tr>
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<td>227</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>4,001</td>
<td>&lt;1,15,263&gt;</td>
<td>66</td>
<td>&lt;1,715&gt;</td>
</tr>
<tr>
<td>(mean, range)</td>
<td></td>
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</tr>
</tbody>
</table>

New Audit Measure: Mean-Population Comparison

Estimate disagreement between:

Reported = Distribution of race categories as reported by the hospital

Predicted = Population mean predicted distribution using zip-code level distribution for each patient in the hospital

Root mean squared difference (normalized vector difference between the reported and predicted)
<table>
<thead>
<tr>
<th>Facility</th>
<th>%Hisp</th>
<th>% NH White</th>
<th>% NH Black</th>
<th>% NH Native American</th>
<th>% NH Asian/PaciSl</th>
<th>% NH Other</th>
<th>% NH</th>
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</thead>
<tbody>
<tr>
<td>ID</td>
<td>fac</td>
<td>SF2</td>
<td>fac</td>
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<td>fac</td>
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<td>fac</td>
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<tr>
<td>010739</td>
<td>34.53</td>
<td>30.36</td>
<td>24.60</td>
<td>25.02</td>
<td>19.85</td>
<td>19.26</td>
<td>.26</td>
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<tr>
<td>010805</td>
<td>48.89</td>
<td>33.96</td>
<td>21.97</td>
<td>23.75</td>
<td>8.50</td>
<td>12.71</td>
<td>.35</td>
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<tr>
<td>010846</td>
<td>51.90</td>
<td>35.90</td>
<td>8.10</td>
<td>17.05</td>
<td>24.21</td>
<td>21.69</td>
<td>.50</td>
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<tr>
<td>010856</td>
<td>20.64</td>
<td>27.01</td>
<td>22.78</td>
<td>27.00</td>
<td>19.23</td>
<td>20.97</td>
<td>.19</td>
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<tr>
<td>010858</td>
<td>32.37</td>
<td>29.82</td>
<td>16.11</td>
<td>21.49</td>
<td>8.63</td>
<td>9.86</td>
<td>.00</td>
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<tr>
<td>010967</td>
<td>55.95</td>
<td>32.96</td>
<td>12.75</td>
<td>20.37</td>
<td>7.87</td>
<td>10.19</td>
<td>.00</td>
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<tr>
<td>010987</td>
<td>16.32</td>
<td>15.88</td>
<td>15.88</td>
<td>23.91</td>
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<td>014050</td>
<td>26.52</td>
<td>18.80</td>
<td>32.43</td>
<td>53.47</td>
<td>1.87</td>
<td>3.93</td>
<td>.16</td>
</tr>
<tr>
<td>Unk</td>
<td>fac</td>
<td>SF2</td>
<td>fac</td>
<td>SF2</td>
<td>fac</td>
<td>SF2</td>
<td>fac</td>
</tr>
<tr>
<td>Cent</td>
<td>fac</td>
<td>SF2</td>
<td>fac</td>
<td>SF2</td>
<td>fac</td>
<td>SF2</td>
<td>fac</td>
</tr>
</tbody>
</table>
Audit measure vs Gold Standard

- Overall kappa: 0.44
- Kappa (highest 20% versus lowest 80% by RMSD): 0.47
- Kappa of audit rank disagreement versus gold standard measure: 0.1
Audit Measures by States and Years

• Examined race and ethnicity reporting in CA and six comparison states—AZ, CO, FL, NJ, OR, & WA

• Compared the existing measure and the new audit measure
Rates of High ‘Other/Unknown’ RE Reporting by State

[Graph showing rates of high 'Other/Unknown' RE reporting by state from 2008 to 2012. The states include AZ, CA, CO, FL, NJ, OR, and WA. The y-axis represents the rate, ranging from 0 to 1.2, and the x-axis represents the years from 2008 to 2012.]
Average Estimated Disagreement in RE across Hospitals by State
Rates of High* Disagreement of RE Reporting by State

* > 0.20 error
Discussion

• Created audit measures that can assist hospitals and states with tracking overall reporting performance for R/E

• Development of alternative validated metrics for assessing the accuracy of data is difficult
  – For R/E, self-report is the gold standard
  – Few routinely collected sources of information are available for data auditing or comparison
Discussion

• Alternative metrics must depend upon routinely available, self-report data
  – Census data uniformly available, but problematic
  – Granularity of data likely to improve estimates
  – Certain comparisons of this type may cause false positives (& negatives) due to selection effects

• Revised audit measures show promise, but cannot account for specific, underlying biases
  – e.g. the general population (Census) does not resemble patients seen in the hospital
Reasonable Approaches to Improve Data

• Collecting institutions could change data reporting by adding:
  – Patient name
  – More granular geographic information

• Improving dissemination of developed education intervention
Reasonable Approaches to Improve Data

• Hospitals could change data collection by:
  – Increasing avenues for data collection and data improvement, e.g. allow patients to modify their profiles electronically
Incentivizing Hospitals to Make Change

- Fairness
- Quality $\Leftrightarrow$ assure appropriate decision making
- Marketing $\Leftrightarrow$ appeals to competitiveness / attractiveness to community members
  - Directed marketing
  - Improved patient satisfaction
- Publicly reporting estimated accuracy
- Regulatory fiat (with penalties)
Conclusions

• Mean population predictions appear to be a reasonable contextually relevant improvement for audit purposes
• Data improvement will come with improved data collection and collateral information for auditing and indirect improvement (imputation) of data
• Changes in hospital culture are necessary to improve collection of patient demographic data
Incorporation of Laboratory Results into Statewide Hospital Data

Todd Seto, M.D. Principal Investigator
Jill Miyamura, Ph.D. Co-Principal Investigator
Christine Reuschel, Project Manager
HAWAII HEALTH INFORMATION CORPORATION

and

Hawaii Hospitals
Large Administrative Databases
Administrative, or Billing Data

UB-92 (UB-04) Billing Form

- Demographics (age, sex)
- Diagnoses & procedures (ICD-9-CM, DRG)
- Expected payer
- Length of stay
- Patient disposition
- Admission source & type
- Admission month
- Charges
Predictive Accuracy
Adding Laboratory

Aim 1: Build infrastructure for CER
- Add laboratory data
- Extend MPI to all new records

Aim 2: Use enhanced database for CER
# ADMISSION LABS

<table>
<thead>
<tr>
<th>Category</th>
<th>Lab Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemistry</strong></td>
<td></td>
</tr>
<tr>
<td>Albumin</td>
<td>Creatinine</td>
</tr>
<tr>
<td>Sodium</td>
<td></td>
</tr>
<tr>
<td>Alkaline phosphatase</td>
<td>Glucose</td>
</tr>
<tr>
<td>Troponin I</td>
<td></td>
</tr>
<tr>
<td>Blood urea nitrogen (BUN)</td>
<td>Gamma glutamyl transferase</td>
</tr>
<tr>
<td>SGOT</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>Potassium</td>
</tr>
<tr>
<td>SGPT</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>Phosphate</td>
</tr>
<tr>
<td>Creatine kinase-MB</td>
<td>BNP</td>
</tr>
<tr>
<td><strong>Blood Gas</strong></td>
<td></td>
</tr>
<tr>
<td>pO2</td>
<td>pH</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td></td>
</tr>
<tr>
<td>pCO2</td>
<td>Base Excess</td>
</tr>
<tr>
<td><strong>Hematology</strong></td>
<td></td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>Partial thromboplastin time (PTT)</td>
</tr>
<tr>
<td>Platelet Count</td>
<td></td>
</tr>
<tr>
<td>Hematocrit</td>
<td>INR</td>
</tr>
<tr>
<td>White blood count (WBC)</td>
<td></td>
</tr>
<tr>
<td><strong>Microbiology</strong></td>
<td></td>
</tr>
<tr>
<td>Blood Culture</td>
<td>Urine Culture</td>
</tr>
<tr>
<td>Sputum Culture</td>
<td></td>
</tr>
</tbody>
</table>
DATA TRANSFORMATION

HHIC Lab Data Flow

1. Hospital/Lab Engagement
   - CLH (17)
   - DLS (2)
   - HPH (4)
   - Kaiser
   - Castle
   - HMC (2)
   - Maui Memorial
   - Kuakini

2. Quality Review/Standardization
   - Security Validation
   - SFTP
   - *HL7
   - Inpatient Database
   - ROM (POA Model)

3. Linking
   - Lab Staging
   - Inpatient Discharge
   - Link Lab Data to Discharge
   - LAB

4. Risk Enhancement
   - ROM (Lab Model)
Hospital Participation – As Conceived
STRATEGIES THAT WORKED
Not Necessarily in Order of Importance

• Expect “surprises”; have back-up plan(s)
• Invest in technology
• Others important to our success
  – CEO buy-in (signed Agreements)
    • Clear description of roles
  – Communicate often; be adaptable; be nice
  – Reimburse for time
  – Have a great Project Manager!
  – Remove obstacles
    • Centralized labs
    • HL7 interface (Rhapsody)
2. **DATA STANDARDS**

Established Data Specifications

<table>
<thead>
<tr>
<th>Lab Data Transmission – Data Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Sending Facility</em></td>
</tr>
<tr>
<td><em>Account Number</em></td>
</tr>
<tr>
<td><em>Medical Record Number</em></td>
</tr>
<tr>
<td><em>DOB</em></td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td><em>SSN</em></td>
</tr>
<tr>
<td><em>Patient First Name</em></td>
</tr>
<tr>
<td><em>Patient Last Name</em></td>
</tr>
<tr>
<td><em>Patient Middle Initial</em></td>
</tr>
<tr>
<td><em>Admission Date/Time</em></td>
</tr>
<tr>
<td><em>Discharge Date/Time</em></td>
</tr>
<tr>
<td>Order Physician First Name</td>
</tr>
<tr>
<td>Order Physician Last Name</td>
</tr>
<tr>
<td>Order Physician Middle Initial</td>
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<tr>
<td>Physician Identifier</td>
</tr>
</tbody>
</table>

* Variables used for linking Lab data to HHIC Inpatient discharge data
2. Data Quality/Standardization

Too much, too little, what is this???

– Too Much
  • ALL lab data received vs. 32 requested labs

– Too Little
  • Limited or Missing Key Demographic Linking Variables
  • Missing Laboratory Data

– What is this?
  • Logical Observation Identifiers Names and Codes (LOINC)
  • Facility ID Standardization
# 3. Data Linking

<table>
<thead>
<tr>
<th>Data Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sending Facility</td>
</tr>
<tr>
<td>Account Number</td>
</tr>
<tr>
<td>Medical Record Number</td>
</tr>
<tr>
<td>Date of Birth</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Patient First Name (up to first space if multiple names were present)</td>
</tr>
<tr>
<td>Patient Last Name</td>
</tr>
<tr>
<td>Date of Admission/Lab Observation Date</td>
</tr>
<tr>
<td>SSN</td>
</tr>
</tbody>
</table>
Data Transformation

HHIC Lab Data Flow

Secured HITECH Compliant Environment

Security Validation

SFTP

*HL7

Lab Staging

Inpatient Discharge

Link Lab Data to Discharge

Inpatient Database

ROM (POA Model)

ROM (Lab Model)

CLH (17)

DLS (2)

HPH (4)

Kaiser

Castle

HMC (2)

Maui Memorial

Kuakini
Impact of Risk-Adjusted In-Hospital Mortality Models*

• 3 Models
  – Model 1: 3M ROM (POA) + Age + Gender
  – Model 2 : Model 1 + Lab severity
  – Model 3 : Model 2 + Race/Ethnicity

• Lab severity: based on number of abnormal lab tests

<table>
<thead>
<tr>
<th>Reason for Hospitalization</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHF</td>
<td>0-5</td>
<td>6-8</td>
<td>9-20</td>
</tr>
<tr>
<td>AMI</td>
<td>0-3</td>
<td>4-6</td>
<td>10-24</td>
</tr>
</tbody>
</table>

*Lim, E, Cheng, Y, Reuschel, C, Mbowe, O, Ahn, H, Juarez, D, Miyamura, J, Seto, T, Chen, J: Risk-Adjusted In-Hospital Mortality Models for Congestive Heart Failure and Acute Myocardial Infarction: Value of Clinical Laboratory Data and Race/Ethnicity. Health Services Research, 50:S1, Part II (August 2015), pp1351-1371. (Based on Figure 1)
Impact of Risk-Adjusted In-Hospital Mortality Models*

(A) Congestive Heart Failure

(B) Acute Myocardial Infarction

Notes: Model 1 = 3M Risk of Mortality (ROM) + Gender + Age; Model 2 = 3M ROM + Gender + Age + Lab Severity; Model 3 = 3M ROM + Gender + Age + Lab Severity + Race/Ethnicity.

*Lim, E, Cheng, Y, Reuschel, C, Mbowe, O, Ahn, H, Juarez, D, Miyamura, J, Seto, T, Chen, J: Risk-Adjusted In-Hospital Mortality Models for Congestive Heart Failure and Acute Myocardial Infarction: Value of Clinical Laboratory Data and Race/Ethnicity. Health Services Research, 50:S1, Part II (August 2015), pp1351-1371. (Based on Figure 1)
AMI MORTALITY RATES*

The Impact of Different Risk Models on Hospital Ranking

<table>
<thead>
<tr>
<th>Hospital ID</th>
<th>Unadjusted</th>
<th>Model 1 (3M ROM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>H</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>F</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>I</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>J</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>G</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Model 1: 3M Risk of Mortality+ POA +Age + Gender

*Lim, E, Cheng, Y, Reuschel, C, Mbowe, O, Ahn, H, Juarez, D, Miyamura, J, Seto, T, Chen, J: Risk-Adjusted In-Hospital Mortality Models for Congestive Heart Failure and Acute Myocardial Infarction: Value of Clinical Laboratory Data and Race/Ethnicity. Health Services Research, 50:S1, Part II (August 2015), pp1351-1371. (Based on Table 4)
### AMI MORTALTY RATES*

The Impact of Different Risk Models on Hospital Ranking

<table>
<thead>
<tr>
<th>Hospital ID</th>
<th>Unadjusted</th>
<th>Model 1</th>
<th>Model 2 (w Labs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>5</td>
<td>5</td>
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<tr>
<td>H</td>
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<td>4</td>
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<tr>
<td>I</td>
<td>8</td>
<td>7</td>
<td>6</td>
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<tr>
<td>J</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>G</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Model 1: 3M Risk of Mortality + POA + Age + Gender
Model 2: Model 1 + Add Lab

*Lim, E, Cheng, Y, Reuschel, C, Mbowe, O, Ahn, H, Juarez, D, Miyamura, J, Seto, T, Chen, J: Risk-Adjusted In-Hospital Mortality Models for Congestive Heart Failure and Acute Myocardial Infarction: Value of Clinical Laboratory Data and Race/Ethnicity. Health Services Research, 50:S1, Part II (August 2015), pp1351-1371. (Based on Table 4)
## AMI MORTALITY RATES*

The Impact of Different Risk Models on Hospital Ranking

<table>
<thead>
<tr>
<th>Hospital ID</th>
<th>Unadjusted</th>
<th>Model 1</th>
<th>Model 2 (w Labs)</th>
<th>Model 3 (+Race)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
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<td>D</td>
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<td>C</td>
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<tr>
<td>J</td>
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<tr>
<td>G</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Model 1: 3M Risk of Mortality + POA + Age + Gender  
Model 2: Model 1 + Add Lab  
Model 3: Model 2 + Add Ethnicity/Race

*Lim, E, Cheng, Y, Reuschel, C, Mbowe, O, Ahn, H, Juarez, D, Miyamura, J, Seto, T, Chen, J: Risk-Adjusted In-Hospital Mortality Models for Congestive Heart Failure and Acute Myocardial Infarction: Value of Clinical Laboratory Data and Race/Ethnicity. Health Services Research, 50:S1, Part II (August 2015), pp1351-1371. (Based on Table 4)
Beyond Risk Stratification...
New Opportunities
Using Clinically Enhanced Claims Data

• Public health
  – Injury Prevention (toxicology labs)
  – MRSA

• Research topics
  – Diabetes (HbA1c)
  – Others...
MAHALO!

• AHRQ (Grant # 1R01HS019990-01)
• Hospitals
• Clinical Labs Hawaii
• Diagnostic Lab Services
• HHIC Team
  – Christine Reuschel, Project Manager
  – Mike Murata, Data Warehouse Manager
  – Lana Kadooka, Senior Developer
  – Billy Lin, DBA/Business Analyst
  – Jean Kailiawa, Data Manager
• Office of Biostatistics & Quantitative Health Sciences – University of Hawaii John A Burns School of Medicine
  – NIMHD (Grant 2U54MD007584-04 AND G12MD007601); NIGMS of the NIH (P20GM103466)
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