Public Health Informatics – Are We There Yet?

Arthur Davidson, MD, MSPH

*Denver Public Health*

Monday, August 3, 2015  |   7:30 – 8:30 am
Sabin Classroom
Denver Health, Denver, CO
• Context
• Review regional informatics efforts
  – Massachusetts
  – New York City
• Review Colorado-specific informatics efforts
  – CHORDS
• Discuss national initiatives
  – Learning health system
  – Public health community platform
Public health is “what we as a society do collectively to assure the conditions in which people can be healthy”

*The Future of Public Health, Institute of Medicine, 1988*
### Life expectancy

<table>
<thead>
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<td>United States</td>
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</tbody>
</table>

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systematic and effective application and use of data, information and knowledge to **improve the health of individuals and the community**.

### Denver Public Health

**Data:**
- build and implement electronic health records and hand-held tools
- retrieve measures, observations and surveys results (e.g., HCKS, American Community Survey, CIIS, and many DH systems)

**Information:**
- build and nurture numerous business intelligence tools
- report on a wide array of topics (highly responsive service)

**Knowledge:**
- design rules and systems for when to inform, act or intervene
- manage projects and curate a spectrum of PH business requirements
Operational Definition

- Monitor health status and understand health issues facing the community
- Protect people from health problems and health hazards
- Give people information they need to make healthy choices
- Engage the community to identify and solve health problems
- Develop public health policies and plans
- Enforce public health laws and regulations
- Help people receive health services
- Maintain a competent public health workforce
- Evaluate and improve programs and interventions
- Contribute to and apply the evidence base of public health

2005

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Public Health Informatics: Rationale

• **Technology** necessary for effective, innovative application to public health practice is **available today at very reasonable costs**.

• **Effective application** of information technology to public health or to any other discipline is **very challenging**.

• Not a question of computer science or information technology *per se*; it is a question of **informatics**—harnessing the available technology to meet the information needs of health practitioners in general, and of public health practitioners in particular.

Source: O’Carroll P. Public Health Informatics and Information Systems, 2003
Are we there yet?
Health Equity

Achieved when:

• every person has the opportunity to **attain his or her full health potential**
• no one is **disadvantaged from achieving this potential because of social position or other socially determined circumstances**
• Health inequities are reflected in differences in:
  – length of life
  – quality of life
  – rates of disease, disability, and death
  – severity of disease
  – access to treatment

*Centers for Disease Control and Prevention*
Outcomes: Continuously Enrolled Members

Jan 2013 – Jun 2014 (n=932); Epic EHR Data

ED Visits /1000 members

IP Admits /1000 members

Garrett N.  ONC Hearing Advanced Care Models, June 2, 2015
Dedicated staff work to place medically complex Hennepin Health members in supportive housing available to them.

Resulted in considerable reductions in ED and hospital use post-housing.
Demographics and Social Determinants of Health (Meaningful Use [MU] Program)

Stage 1-2-3
- Sexual orientation
- Gender identity
- Race/ethnicity
- Preferred language

Stage 3 (proposed)
- Education
- Stress
- Depression
- Physical activity
- Alcohol use
- Social connection and isolation
- Intimate partner Violence
## MU Payments through January 2015

<table>
<thead>
<tr>
<th></th>
<th>Amount Paid 2011 Program Year</th>
<th>Amount Paid 2012 Program Year</th>
<th>Amount Paid 2013 Program Year</th>
<th>Amount Paid 2014 Program Year</th>
<th>Amount Paid 2015 Program Year</th>
<th>Amount Paid Program - To - Date</th>
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<tbody>
<tr>
<td>Medicare Eligible Professionals</td>
<td>$979,666,454</td>
<td>$2,879,790,933</td>
<td>$2,575,693,027</td>
<td>$541,054,080</td>
<td>$</td>
<td>$6,976,204,495</td>
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<tr>
<td>Doctors of Medicine or Osteopathy</td>
<td>$869,606,164</td>
<td>$2,606,127,832</td>
<td>$2,317,169,243</td>
<td>$489,192,480</td>
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<td>$6,282,095,719</td>
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<td>Dentists</td>
<td>$757,738</td>
<td>$2,256,298</td>
<td>$2,041,322</td>
<td>$419,440</td>
<td>$</td>
<td>$5,474,799</td>
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<td>Optometrists</td>
<td>$39,019,045</td>
<td>$116,937,152</td>
<td>$105,218,728</td>
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<td>$276,462,924</td>
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<td>Podiatrists</td>
<td>$51,783,860</td>
<td>$97,193,161</td>
<td>$75,523,922</td>
<td>$15,217,440</td>
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<td>$239,718,383</td>
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<td>Chiropractors</td>
<td>$18,499,648</td>
<td>$57,276,490</td>
<td>$75,739,812</td>
<td>$20,936,720</td>
<td>$</td>
<td>$172,452,670</td>
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<tr>
<td>Medicaid Eligible Professionals</td>
<td>$1,048,787,200</td>
<td>$1,197,669,278</td>
<td>$1,059,931,697</td>
<td>$185,092,878</td>
<td>$63,750</td>
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<td>Certified Nurse-Midwives</td>
<td>$</td>
<td>$</td>
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<td>Dentists</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$308,937,584</td>
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<tr>
<td>Nurse Practitioners</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$628,348,605</td>
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<tr>
<td>Optometrists</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$2,020,167</td>
</tr>
<tr>
<td>Physicians</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$2,437,186,698</td>
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<tr>
<td>Physicians Assistants</td>
<td>$13,515,000</td>
<td>$12,932,750</td>
<td>$12,788,250</td>
<td>$2,584,000</td>
<td>$</td>
<td>$41,820,000</td>
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<tr>
<td>Eligible Hospitals &amp; CAHs</td>
<td>$3,178,959,355</td>
<td>$5,583,260,866</td>
<td>$6,254,411,386</td>
<td>$3,173,901,625</td>
<td>$1,772,204</td>
<td>$18,192,305,437</td>
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<tr>
<td>Medicare Only</td>
<td>$113,430,824</td>
<td>$231,421,666</td>
<td>$229,659,211</td>
<td>$128,077,130</td>
<td>$</td>
<td>$702,588,831</td>
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<tr>
<td>Medicaid Only</td>
<td>$129,581,442</td>
<td>$107,540,952</td>
<td>$116,192,294</td>
<td>$25,284,341</td>
<td>$1,594,619</td>
<td>$380,193,649</td>
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<tr>
<td>Medicare/Medicaid</td>
<td>$2,935,947,089</td>
<td>$5,244,298,248</td>
<td>$5,908,559,881</td>
<td>$3,020,540,154</td>
<td>$177,586</td>
<td>$17,109,522,958</td>
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<tr>
<td>Medicare Advantage Organizations For Eligible Professionals</td>
<td>$180,106,590</td>
<td>$134,773,289</td>
<td>$91,873,828</td>
<td>$</td>
<td>$</td>
<td>$406,753,707</td>
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<tr>
<td><strong>Total</strong></td>
<td>$5,387,519,599</td>
<td>$9,795,494,367</td>
<td>$9,981,909,938</td>
<td>$3,900,048,584</td>
<td>$1,835,954</td>
<td>$29,066,808,443</td>
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</table>

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$29,066,808,443
($60 M to Denver)
Federal funders expect a learning health system (LHS) environment that leverages burgeoning and expanding health and healthcare information systems from HITECH and ARRA investments.

LHS is an “environment that links the care delivery system with communities and societal supports in ‘closed loops’ of electronic health information flow, at many different levels, to enable continuous learning and improved health”.

Primary Care Information Project (PCIP)

Mission
- Improve the quality of care in medically underserved areas through health information technology (HIT)

Participation
- **Over 10,000** providers receiving EHR and Meaningful Use assistance
  - 1,064 small practices
  - 31 large practices
  - 63 community health centers
  - 54 hospitals & outpatient clinics

Data Exchange
- More than 700 practices participate in data exchange through the “Hub”

PCIP Hub Coverage of NYC, 2013

McVeigh K, CSTE, 2014
New York City Department of Health and Mental Hygiene
## Comparison of Prevalence Estimates among the Population in Care


<table>
<thead>
<tr>
<th>Health Condition</th>
<th>2012 NYC Macroscope</th>
<th>2012 CHS (BRFSS)</th>
<th>2004 NYC HANES</th>
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</thead>
<tbody>
<tr>
<td>Obesity*</td>
<td>29.5</td>
<td>25.4 (23.8-27.0)</td>
<td>28.2 (25.1-31.5)</td>
</tr>
<tr>
<td>Hypertension Diagnosis</td>
<td>30.7</td>
<td>30.9 (29-4-32.4)</td>
<td>30.9 (28.2-33.8)</td>
</tr>
<tr>
<td>Hypertension Treatment</td>
<td>76.4</td>
<td>70.4 (66.2-74.2)</td>
<td>70.2 (64.2-75.6)</td>
</tr>
<tr>
<td>Hypertension Control**</td>
<td>62.2</td>
<td>NA</td>
<td>73.2 (65.4-79.8)</td>
</tr>
</tbody>
</table>

* CHS obesity is based on self-reported height and weight. NYC Macroscopic and NYC HANES obesity is based on measured height and weight.

** NYC Macroscopic blood pressure reading for control may be the same one that triggered the diagnosis and medication prescription.

BOLD = significantly different from NYC Macroscopic estimate

---

McVeigh K, CSTE, 2014

*New York City Department of Health and Mental Hygiene*
NYC Macroscope 2012 Estimates of Obesity Prevalence vs. Reference Estimates

24 Strata Defined by Sex, Age Group and Neighborhood Poverty Rate

**CHS (BRFSS) 2012**

- Correlation (Rho): 0.84
- Mean Standardized Deviation: 1.37
- Mean Prevalence Ratio: 1.21

**NYC HANES 2004**

- Correlation (Rho): 0.72
- Mean Standardized Deviation: 0.84
- Mean Prevalence Ratio: 1.15

McVeigh K, CSTE, 2014

New York City Department of Health and Mental Hygiene
ESPnet: Automated disease detection/reporting for public health

Electronic Support for Public Health (ESPnet)

Practice EMR’s

- diagnoses
- lab results
- meds
- vital signs
- demographics

ESPnet Server

electronic case reports or aggregate summaries

Health Department


MMWR 2008;57:372-375

Am J Pub Health 2012;102:S325–S332

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Case Identification

ESPnet Case Reporting
Atrius, CHA, MetroHealth, 2006-2014

<table>
<thead>
<tr>
<th>Condition</th>
<th>Total Cases</th>
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</thead>
<tbody>
<tr>
<td>Chlamydia</td>
<td>22,001</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>4,554</td>
</tr>
<tr>
<td>Pelvic inflammatory disease</td>
<td>311</td>
</tr>
<tr>
<td>Acute hepatitis A</td>
<td>34</td>
</tr>
<tr>
<td>Acute hepatitis B</td>
<td>112</td>
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<tr>
<td>Acute hepatitis C</td>
<td>341</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>437</td>
</tr>
<tr>
<td>Syphilis</td>
<td>1,478</td>
</tr>
</tbody>
</table>


*MMWR* 2008;57:372-375

*Am J Pub Health* 2012;102:S325–S332
Colorado Use Case: BMI Surveillance

- Obesity is associated with major morbidity, mortality and healthcare costs and contributes to substantial health disparities.
- Obesity-related conditions include heart disease, stroke, type 2 diabetes and certain cancers, many causes of preventable death.
- Interventions should include clinical- and community-based efforts (e.g., policies, systems and environmental changes).
- Interventions should be tailored to individuals or communities based on local obesity prevalence estimates.
- A PH monitoring system should efficiently track obesity trends, and outcomes of various interventions.
34.9\% (78.6 million) of U.S. adults are obese. (CDC)
<table>
<thead>
<tr>
<th>Group</th>
<th>Source Year</th>
<th>Estimate</th>
<th>CI</th>
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</thead>
<tbody>
<tr>
<td>Adults – all</td>
<td>2013</td>
<td>21.3</td>
<td>20.4-22.2</td>
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<tr>
<td>White</td>
<td>2011-13</td>
<td>18.8</td>
<td>18.2-19.4</td>
</tr>
<tr>
<td>Black (NH)</td>
<td>2011-13</td>
<td>30.5</td>
<td>26.6-34.7</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2011-13</td>
<td>28.0</td>
<td>26.2-29.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th>Age group</th>
<th>N</th>
<th>% Pop</th>
<th>StdErr</th>
<th>Lower 95% CL</th>
<th>Upper 95% CL</th>
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</thead>
<tbody>
<tr>
<td>Black</td>
<td>18-24 years</td>
<td>5</td>
<td>6.1</td>
<td>2.8</td>
<td>0.6</td>
<td>11.6</td>
</tr>
<tr>
<td></td>
<td>25-34 years</td>
<td>12</td>
<td>5.4</td>
<td>1.6</td>
<td>2.2</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td>35-44 years</td>
<td>25</td>
<td>12.1</td>
<td>2.5</td>
<td>7.2</td>
<td>17.0</td>
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<tr>
<td></td>
<td>45-54 years</td>
<td>34</td>
<td>13.7</td>
<td>2.5</td>
<td>8.8</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>55-64 years</td>
<td>45</td>
<td>14.3</td>
<td>2.5</td>
<td>9.5</td>
<td>19.1</td>
</tr>
<tr>
<td></td>
<td>65+ years</td>
<td>47</td>
<td>15.4</td>
<td>2.3</td>
<td>10.9</td>
<td>19.9</td>
</tr>
<tr>
<td>Hispanic</td>
<td>18-24 years</td>
<td>50</td>
<td>50.1</td>
<td>2.9</td>
<td>40.3</td>
<td>59.8</td>
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<tr>
<td></td>
<td>25-34 years</td>
<td>81</td>
<td>32.3</td>
<td>3.3</td>
<td>25.8</td>
<td>38.9</td>
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<tr>
<td></td>
<td>35-44 years</td>
<td>95</td>
<td>37.4</td>
<td>3.3</td>
<td>30.8</td>
<td>43.8</td>
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<tr>
<td></td>
<td>45-54 years</td>
<td>66</td>
<td>29.2</td>
<td>3.6</td>
<td>21.0</td>
<td>36.2</td>
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<tr>
<td></td>
<td>55-64 years</td>
<td>68</td>
<td>24.5</td>
<td>3.0</td>
<td>17.3</td>
<td>30.3</td>
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<td></td>
<td>65+ years</td>
<td>46</td>
<td>13.0</td>
<td>2.3</td>
<td>9.3</td>
<td>17.5</td>
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<tr>
<td>Other</td>
<td>18-24 years</td>
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<td>4.6</td>
<td>1.6</td>
<td>1.5</td>
<td>7.7</td>
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<tr>
<td></td>
<td>25-34 years</td>
<td>23</td>
<td>6.8</td>
<td>1.7</td>
<td>3.5</td>
<td>10.2</td>
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<td>35-44 years</td>
<td>17</td>
<td>4.3</td>
<td>1.1</td>
<td>2.1</td>
<td>6.5</td>
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<tr>
<td></td>
<td>45-54 years</td>
<td>12</td>
<td>2.5</td>
<td>0.9</td>
<td>0.7</td>
<td>4.3</td>
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<td></td>
<td>55-64 years</td>
<td>17</td>
<td>4.3</td>
<td>1.7</td>
<td>1.0</td>
<td>7.7</td>
</tr>
<tr>
<td>White</td>
<td>18-24 years</td>
<td>66</td>
<td>39.3</td>
<td>4.6</td>
<td>30.3</td>
<td>48.2</td>
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<tr>
<td></td>
<td>25-34 years</td>
<td>181</td>
<td>55.5</td>
<td>3.4</td>
<td>48.8</td>
<td>62.1</td>
</tr>
<tr>
<td></td>
<td>35-44 years</td>
<td>177</td>
<td>45.6</td>
<td>3.2</td>
<td>39.3</td>
<td>51.9</td>
</tr>
</tbody>
</table>
BMI Monitoring System

• Outputs:
  – measure overweight/obesity rates across groups
  – represent those rates geographically
  – combine geographic analysis with social economic measures

• System qualities:
  – ease of access to longitudinal data
  – completeness
  – timeliness
  – representativeness
  – extensibility
**Methods**

**Denominator:** Number of individuals using health care facilities
- normalized data - virtual data warehouse (VDW)
- geo-locate home residence for all patients

**Numerator:** Number of adults with overweight/obese BMI
- leverage height and weight measures from meaningful use (MU) incentive payments
- remove biologically implausible values
Public Health Surveillance (Colorado): BMI

- **Transparency** (distributed data network)
  - Modeled on successful federal models (FDA/PCORI)
- **Governance**
  - Voluntary participation; unlike mandated reporting, data use agreements established/required
- **Privacy**
  - Minimal data necessary to achieve stated goal (de-identified to start)
- **Technical** (local instance – University of Colorado)
  - Infrastructure: 1) common data model, 2) emphasize data quality assessment, and 3) federated query tool
• provide a "laboratory" to develop and evaluate **scientific methods** to support public health surveillance and research

• affords an opportunity to **use existing EHR data systems** for public health surveillance

• learn about **barriers and challenges** to building an accurate system to monitor public health events (e.g., conditions, behaviors and outcomes)

• build an **event agnostic infrastructure** for public health surveillance, quality assessment, and research
Mini-Sentinel Pilot Project

Sponsored by FDA in response to the Congressional mandate in the FDA Amendments Act of 2007

— perform active surveillance for **safety of approved drugs/devices**

• Uses **pre-existing healthcare data** from multiple sources (i.e., Data Partners) with **distributed data approach** in which Data Partners retain control over data in their possession collected through normal clinical activities

• Distributed dataset relies on use of a **Common Data Model** at each partner site (i.e., 17 organized tables)

• Data Partners execute **standardized computer programs or queries** within their own institutions and share aggregated results with the Mini-Sentinel Operations Center
A Local Distributed Data Network

Leverages local:

- decades of HMO Research Network’s (HMORN) research experience
- common desired infrastructure for UCD researchers
- UCD informatics resources and skills

and national investments:

- 7 years, Food and Drug Administration (FDA) ~130M post-marketing drug/device surveillance, ($75 M)
- 2 years, Patient Centered Outcomes Research Institute ~100M patient-centered outcomes research, ($100 M)
- 3 years, National Institute of Health (NIH): Health Care Systems Research Collaboratory, 11 sites, ($10-20M)
Colorado Health Observation Regional Data Service (CHORDS)

- distributed data network (PopMedNet)
- retrieves data from each healthcare system’s EHR
- creates a common information image (Virtual Data Warehouse)
- allows questions to be asked
- permits population-based monitoring and evaluation
- measures change in priority health outcomes
- integrates clinical, demographic, and/or place-based data
CHORDS Registries
Colorado Health Observation Regional Data Service

Current registry efforts:
- BMI
- CVD risk
- Tobacco use and 2nd hand smoke exposure
- Mental health
- HIV
- Hepatitis C
# CHORDS Use Cases

<table>
<thead>
<tr>
<th>Registry Focus</th>
<th>Example Indicators</th>
<th>Funder</th>
</tr>
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<tbody>
<tr>
<td>Healthy Weight</td>
<td>% of children and adults obese</td>
<td>TCHF KP Comm Ben.</td>
</tr>
<tr>
<td>Tobacco Use and Exposure</td>
<td>% of adults using tobacco % of children exposed to second hand smoke</td>
<td>CDPHE</td>
</tr>
<tr>
<td>Cardiovascular Disease Risk</td>
<td>% of adults with hypertension - % controlled -% on lipid Rx</td>
<td>CDC CDPHE</td>
</tr>
<tr>
<td>Mental Health</td>
<td>% of Denver adolescents diagnosed with depression</td>
<td>AHRQ</td>
</tr>
</tbody>
</table>
# Results: Adult BMI Registry Summary by County

<table>
<thead>
<tr>
<th>Geography (County)</th>
<th>Census Population</th>
<th>2009-2013 BMI Registry Valid BMI</th>
<th>% Coverage</th>
<th>% Obese</th>
<th>2011-12 BRFSS % Obese</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams</td>
<td>316,908</td>
<td>76,889</td>
<td>24.3</td>
<td>36.3</td>
<td>24.8</td>
<td>11.5%</td>
</tr>
<tr>
<td>Arapahoe</td>
<td>427,719</td>
<td>98,522</td>
<td>23.0</td>
<td>30.3</td>
<td>21.4</td>
<td>8.9%</td>
</tr>
<tr>
<td>Boulder</td>
<td>234,700</td>
<td>37,201</td>
<td>15.9</td>
<td>20.8</td>
<td>15.8</td>
<td>5.0%</td>
</tr>
<tr>
<td>Broomfield</td>
<td>41,579</td>
<td>10,313</td>
<td>24.8</td>
<td>27.7</td>
<td>17.9</td>
<td>9.8%</td>
</tr>
<tr>
<td>Denver</td>
<td>474,106</td>
<td>158,036</td>
<td>33.3</td>
<td>30.7</td>
<td>20.1</td>
<td>10.6%</td>
</tr>
<tr>
<td>Douglas</td>
<td>200,373</td>
<td>35,883</td>
<td>17.9</td>
<td>25.2</td>
<td>16.1</td>
<td>9.1%</td>
</tr>
<tr>
<td>Jefferson</td>
<td>417,448</td>
<td>108,492</td>
<td>26.0</td>
<td>29.1</td>
<td>19.7</td>
<td>9.4%</td>
</tr>
<tr>
<td>Prowers</td>
<td>9,147</td>
<td>6,169</td>
<td>67.4</td>
<td>38.6</td>
<td>32.4</td>
<td>6.2%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2,112,833</td>
<td>525,336</td>
<td>24.9</td>
<td>29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Results: Comparison BMI Registry to BRFSS

<table>
<thead>
<tr>
<th></th>
<th>Valid EHR BMI, 2009-2013</th>
<th>BRFSS, 2011/2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td><strong>Denver</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>161,580</td>
<td>19.77</td>
</tr>
<tr>
<td>Male</td>
<td>68,664</td>
<td>95.1</td>
</tr>
<tr>
<td>Female</td>
<td>92,916</td>
<td>95.9</td>
</tr>
<tr>
<td><strong>Race/Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>97,732</td>
<td>96.8</td>
</tr>
<tr>
<td>Black</td>
<td>21,080</td>
<td>95.5</td>
</tr>
<tr>
<td>Asian/Pacific Isl.</td>
<td>4,495</td>
<td>94.9</td>
</tr>
<tr>
<td>American Indian</td>
<td>1,218</td>
<td>96.2</td>
</tr>
<tr>
<td>Other/multiple</td>
<td>7,433</td>
<td>92.3</td>
</tr>
<tr>
<td>Unknown</td>
<td>29,624</td>
<td>92.4</td>
</tr>
<tr>
<td>Hispanic</td>
<td>15,459</td>
<td>94.1</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>59,508</td>
<td>96.8</td>
</tr>
<tr>
<td>Unknown Hispanic origin</td>
<td>86,615</td>
<td>95</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24 yrs</td>
<td>21,805</td>
<td>90.9</td>
</tr>
<tr>
<td>25-34 yrs</td>
<td>32,186</td>
<td>94.4</td>
</tr>
<tr>
<td>35-44 yrs</td>
<td>27,391</td>
<td>95.5</td>
</tr>
<tr>
<td>45-54 yrs</td>
<td>26,624</td>
<td>96.8</td>
</tr>
<tr>
<td>55-64 yrs</td>
<td>25,912</td>
<td>97.5</td>
</tr>
<tr>
<td>65+ yrs</td>
<td>27,664</td>
<td>97.9</td>
</tr>
</tbody>
</table>
Results: Coverage

Assessment of registry coverage

- geo-location processes established
- quality assurance routine for all data
- compared with 2010 US Census data and recent American Community Survey

- EHR representation of Denver County:
  - 30% for adults
  - 50% for children
  - 95% of patient records accurately matched for geocoding
Denver: Adult Obesity Prevalence – Registry

**Insufficient data:** <50 adults with valid BMI or <10% of >21 year old census population represented

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Limitations

- Selection biases
  - obese people have more co-morbid conditions and visit healthcare providers more frequently
  - omission of persons not seeking care
  - omission of persons with access to care barriers

- Misclassification
  - patients may be represented more than once

  skew EHR results to higher obesity prevalence
BMI Use Case Discussion

- EHR BMI data were more comprehensive than BRFSS
- Compared with BRFSS, EHR data showed higher obesity rates in general, by gender, and by race
- Objective BMI measures are presumably more accurate than self-assessment
- BRFSS may underestimate obesity prevalence
- BRFSS has limited small area analyses capacity
- Rate discrepancies among complementary data sources need to be better understood for a consistent message.
BMI Use Case: Next Steps

• Capture community feedback about the maps
• Develop method to un-duplicate individuals using health information exchange resources
• Expand data contributing partners
• Expand PH jurisdictions able to access the data
• Expand use cases: tobacco use/2nd hand smoke exposure, cardiovascular disease risk, mental health, hepatitis C, and HIV
Building interoperability

2012: 5.8 billion ATM withdrawals totaling $687 billion in value

- **Structural** (physical nature)
  - (>1,000,000) ATM card/machines
    - same card/reader size, same place for magnetic stripe

- **Semantic** (meaning)
  - ATM message: works anywhere in the world (160 countries)
    - Dollars <-> Euros

- **Pragmatic** (usage)
  - Banking system is aware of the methods and procedures that the ATM is employing
    - Bank statement deducts dollars from account
Building interoperability: public health

2012: 2 million communicable disease reports (e.g., >330K Gonorrhea)

- **Structural**: (physical nature)
  - need to define a standard envelope / message
  - HL7 (various flavors need alignment)
  - segments need absolute definition
    - (e.g., pregnancy, treatment)

- **Semantic** (meaning)
  - need a common health concept language
  - proprietary / idiosyncratic names need mapping
  - value is capacity to reuse, reorganize based on common meaning / concept
    - e.g., Gonorrhea <-> N. gonorrhoeae  *ICD-10 O98.23*

- **Pragmatic** (usage)
  - organize results for aggregation / visualization
  - use results for decision support (e.g., case reporting)
Learning Health System: Virtuous Cycles of Study and Change

Any health system, at any level of scale, becomes a learning system when they can continuously study and improve themselves (IOM 2007).

A Problem of Interest

- Decision to Study
- Take Action
- Tailored Messages to Decision-Makers
- Interpret Results
- Analyze Data
- Assemble Experience Data
- Tailored Messages to Decision-Makers
- Take Action
- Interpret Results
- Analyze Data
- Assemble Experience Data
- Decision to Study

(C Friedman) 49
How Do We Convert?

From:
• A set of learning loops, each addressing a different problem (or same problem in different jurisdiction):

To:
• Into an efficient large scale or enterprise system:

(C Friedman)
Single Platform Supports Multiple Simultaneous Learning Cycles

LHS Infrastructure

Different Problems

Slower Cycle

Rapid Cycle

People

Policy

Technology

Process

Socio-Technical Supporting Platform

(C Friedman)
Why a Platform?

- **Without a platform:**
  - Every cycle requires its own agreements, technology, staffing, analytics, dissemination mechanisms
  - No economy of scale
  Cost of 10 cycles = 10 x (Cost of one)

- **With a platform:**
  - All cycles are supported by the infrastructure
  - Big economy of scale
  Cost of 10 cycles << 10 x (Cost of one)

(C Friedman)
Patient visit recorded

Match trigger code

Report?

Receive and present form

Complete form

Trigger codes

Rules

Forms

Set reportable conditions

Receive completed report

https://drive.google.com/file/d/0BzEl7x_8ybJ5YJWX0xjdi1xWDg/view?usp=drive_web&pli=1
• Opportunity exists to leverage ever expanding technologies

• EHR data hold promise for monitoring health and automation of PH business processes

• Still far from a platform like the banking industry ATM model, yet there are emerging use cases and investments

• Like issues of race and my youthful journey to the home of our 1\textsuperscript{st} President – it’s complicated and not always what we envision
Are we there yet?

Do you think race relations in the United States are generally good or bad?

White respondents

<table>
<thead>
<tr>
<th>Year</th>
<th>Generally good</th>
<th>Generally bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Black respondents

<table>
<thead>
<tr>
<th>Year</th>
<th>Generally good</th>
<th>Generally bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Are we there yet?

The greatest thing in this world is not so much where we stand as in what direction we are moving.

*Johann Wolfgang von Goethe (1749-1832)*

You can't connect the dots looking forward; you can only connect them looking backwards. So you have to trust that the dots will somehow connect in your future.

*Steve Jobs (1955-2011)*