Improving Health Care & Reducing Costs with Innovative, Local Data Systems

Aaron Truchil
October 22nd, 2017
Key Lessons For Today

1. No matter what your job/role is, we are all data people
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2. Data is about relationships between people and systems
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1. No matter what your job/role is, we are all data people
2. Data is about relationships between people and systems
3. Our job, as data people, is to capture those relationships through effective analysis and storytelling
4. Effective analysis is more about building trust and less about complex, fancy math
About the Camden Coalition
We are a citywide coalition of hospitals, primary care providers, and community representatives that collaborate to deliver better healthcare to our most vulnerable citizens. We innovate and test health care delivery models to improve patient outcomes and reduce the cost of their care using data driven, human-centered practices.
Camden City

Camden County

Population
City: 77,344
County: 510,923

Median Household Income
City: $25,042
County: $62,185

Adult Asthma Prevalence
City: 14%
County: 9%

Local Data is Key!
Building a Citywide, All-Payer, Hospital Claims Database to Improve Health Care Delivery in a Low-Income, Urban Community

Kenneth Gross, PhD, MPH; Jeffrey C. Brenner, MD; Aaron Truchill, MS; Ernest M. Post, MD; and Amy Henderson Riley, MA, CHES.
Camden Hospital Utilization
2014 Snapshot

total hospital revenue: $132,000,000

total patients with a hospital visit: 42,708

patients visiting 2+ hospitals (same year): 23%

patients visiting 2+ hospitals (over 5 years): 41%
patient overlap across systems

all patients

patient volume

shared
unique

relationship strength
weak
strong

patients w/ primary behavioral health dx

Kennedy
Virtua
Lourdes
Cooper
Inspira
the Camden “Cost” Curve

- 10% of patients = 74% of charges
- 1% of patients = 30% of charges
Where do Camden’s Most Expensive Residents Reside?

Several buildings (e.g.) annually generate $1-$3 million in hospital costs.

6% of city blocks account for 18% of patients and 37% of receipts.

§ 4 of 5: How does the Camden Coalition hotspot?
top diagnoses
Respiratory Abnormality
Chest Pain
Abdominal Pain
Septicemia
Acute Renal Failure
Urinary Tract Infection
Pneumonia
Chronic Systolic Heart Failure

What do Camden’s Most Expensive Residents Look Like?

$≈1\%$ of population
$>5$ chronic conditions

averages:

- 57 years old
- 4.5 ED visits
- 5.3 inpatient hospitalized
- 54 days
- $673,000$ charges
- $73,143$ receipts
Intervention Paradigms

Traditional Medical

Diabetes
Heart Failure
COPD
ESRD

Hotspotting

Complex People... in complex systems
High Cost

- 4 ED
- 0 INP
- $33k
- 1 chronic
- age 40

High Utilization

- 13 ED
- 1 INP
- $58k
- 1 chronic
- age 40

Focus on Segmentation!
§2 What is Hotspotting?
Healthcare hotspotting is the strategic use of data to target evidence-based services to complex patients with high utilization.

These patients are experiencing a mismatch between their needs and the services available.
Three Core Data Systems for Hotspotting

HIE
- real-time, vendor-managed.
- home-grown PostgreSQL database.
- research and quality improvement.
- Integrated Longitudinal Outcomes Database

Internal performance & care tracking
- user-customizable, vendor-hosted.

Camden ARISE
- vendor-hosted.
- vendor-managed.

HIE
- care evolution

Internal performance & care tracking
- TRACKVIA
Admitted Past Month (High Use)

- Population
  - Admitted Past Month (High Use)
  - ED or Inpatient Part 2 Monthly
  - CAMCare
  - Cooper UH
  - NGU
- United
  - Cooper Ambulatory
  - Cooper Family Med
  - Cooper Physicians
  - Lourdes
- Teams
  - Awesome
  - Dynamic
  - INC
  - Unassigned
- Historical Load
  - Cooper Historical
  - Lourdes Historical
  - Virtua Historical

Report Preferences
Add To Favorites
Hide

Facility: Any
Unit: Any
Provider: Any

Displaying 170 results

Generated:

<table>
<thead>
<tr>
<th>Name</th>
<th>DOB</th>
<th>Age</th>
<th>Gender</th>
<th>Admit Date</th>
<th>Discharge Date (Day)</th>
<th>Facility</th>
<th>Total Days</th>
<th>IP (60mo)</th>
<th>ED (60mo)</th>
<th>Provider</th>
<th>Practice</th>
<th>Insurance</th>
<th>Adm Diagnoses</th>
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<td>F</td>
<td></td>
<td></td>
<td>(Day 1)</td>
<td>CUH</td>
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<td>3</td>
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<tr>
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Show Query Definition

• $2,800,000 (6%) in ED payment

- ED & Inpatient Utilization Matrix
Daily Triage

Bedside Engagement

Person-Centered Care Planning
Home Visits & Community Support

Support PCP

Care Management Meetings
§3 Measuring & Evaluating Hotspotting
<table>
<thead>
<tr>
<th>Feature</th>
<th>Any thirty Day Readmission (Odds ratio)</th>
<th>Any sixty Day Readmission (Odds ratio)</th>
</tr>
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<tbody>
<tr>
<td>Age 56-65 (compared to age 20-55)</td>
<td>1.563</td>
<td>1.405</td>
</tr>
<tr>
<td>Over age 65 (compared to age 20-55)</td>
<td>2.313**</td>
<td>1.561</td>
</tr>
<tr>
<td>2-4 ED visits 6 months prior (compared to 0-1)</td>
<td>1.580</td>
<td>1.029</td>
</tr>
<tr>
<td>5+ ED visits 6 months prior (compared to 0-1)</td>
<td>2.504**</td>
<td>1.522</td>
</tr>
<tr>
<td>3 admissions 6 months prior (compared to 2)</td>
<td>2.131**</td>
<td>1.942**</td>
</tr>
<tr>
<td>4+ admissions 6 months prior (compared to 2)</td>
<td>3.780***</td>
<td>3.624***</td>
</tr>
<tr>
<td>3-5 chronic medical conditions at triage (compared to 2)</td>
<td>.705</td>
<td>1.075</td>
</tr>
<tr>
<td>6+ chronic medical conditions at triage (compared to 2)</td>
<td>.774</td>
<td>1.567</td>
</tr>
<tr>
<td>1 diagnosed behavioral health condition at triage (compared to 0)</td>
<td>1.357</td>
<td>2.035**</td>
</tr>
<tr>
<td>2+ diagnosed behavioral health conditions at triage (compared to 0)</td>
<td>.957</td>
<td>1.409</td>
</tr>
<tr>
<td>Home visit &lt;= 5 days PCP &gt; 7 days (compared to home visit &gt; 5 days)</td>
<td>.841</td>
<td>.786</td>
</tr>
<tr>
<td>Home visit &lt;= 5 days PCP &lt;= 7 days (compared to home visit &gt; 5 days)</td>
<td>.534*</td>
<td>.452**</td>
</tr>
<tr>
<td>Graduated or currently enrolled (compared to incomplete)</td>
<td>.576~</td>
<td>.822</td>
</tr>
<tr>
<td>Enrolled as part of RCT (compared to HCIA clients)</td>
<td>.700</td>
<td>.923</td>
</tr>
<tr>
<td>Drop in -2 Log Likelihood full model – null model (Null model -2 Log likelihood for 30-day readmissions =494.271; for 60-day readmissions =569.539)</td>
<td>47.038***</td>
<td>47.085***</td>
</tr>
<tr>
<td>Percentage of cases that the full model classifies correctly (30-day null model =73.2%; 60-day null model =60.7%)</td>
<td>75.1%</td>
<td>67.3%</td>
</tr>
</tbody>
</table>
Hospital billing data allowed us to identify, in retrospectively. We filter real time Admissions-Discharge-Transfer (ADT) records to identify outliers, we were able to identify and activate our community operations team and trigger our intervention.

**Miguel**
the Patient Experience

**System Failures**
- misspelling on SS card
- slowed paperwork
- follow-up paperwork mis-filed
- common name compounded simple mistakes

**Driving Diagnoses**
- Hepatitis C
- Hypertension
- Congestive Heart Failure

**Social Indicators**
- unemployed
- no income
- uninsured
- homeless
- no social support
- active drug use

**Hospital Utilization**
in the 9 months prior to enrollment:
- 3 Emergency Department visits
- 7 Inpatient stays
- 61 days hospitalized

**Total Receipts**
$112,583

**Enrollment**

**1st Engagement Attempt**

**VOA/Drug Rehab**

**Cardiology**

**Rutgers Behavioral Health Program**

**IHOC transitional Housing**

**Living Recovery Center**

**Hospital Utilization**
in the 9 months post enrollment:
- 0 Emergency Department visits
- 1 Inpatient stays
- 3 days hospitalized

**Total Receipts**
$3,955

"They showed me how to bring myself back."

"She talked to me as a person, not a patient."

"They took the time to listen, they took the time to explain."

"Just to have them come around and sit and talk... is what I enjoyed."

"They showed me how to bring myself back."

"She talked to me as a person, not a patient."

"They took the time to listen, they took the time to explain."

"They showed me how to bring myself back."

"She talked to me as a person, not a patient."

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"She talked to me as a person, not a patient."

"They took the time to listen, they took the time to explain."
Hope for New Jersey's City Hospitals: The Camden Initiative

Steven R Green, PhD, a research scientist, Veena Singh, MA, MCRP, a research scientist, and William O'Byrne, The state coordinator

Average Monthly Charges

$1,500,000
$1,218,010
$1,000,000
$500,000
$0

Average Monthly Hospital Visits

61.6
37.2
Primary Outcomes: reduced re-hospitalizations and ED visits in 12 month period following discharge
Inpatient & Emergency Visits per Patient-Day for the 1st 47 Housing First Clients Reduced by 63%
§4 leveraging hotspotting for state policy
"When I call transportation for a doctor's appointment... and they send the wrong van, that's the worst," said Irene Carrasquillo, who obviously would not be able to step up into a van.

Patient Jackie Fitzgerald of Trenton recalled a 9 a.m. ride that showed up after 2 p.m. one day. In repeated calls, Fitzgerald said she was told the ride was "around the corner."

45% of respondents missed 1 or more appointments due to transportation
Camden County rides in 2013

11,720 people
400,066 rides

Patient Data

Trip To:
- Dentist
- Doctor
- Other
- Hospital
- Methadone
- Oncology

Trip From:
- Methadone
- Home
- Other
- Doctor

Jan 1  Feb 1  Mar 1  Apr 1  May 1  Jun 1  Jul 1  Aug 1  Sep 1  Oct 1  Nov 1  Dec 1
Current:
all trips planned separately

... vs. Shared trips, coordinated at either end:
- reduce trips and total distance
- familiarity reduces location errors & use of slow routes
- creates potential for riders to help each other
- keep appointments, facilities to improve scheduling
Address Variation for Cooper Locations in Camden

Camden Cooper Locations Geocoded outside of Camden

Philadelphia

Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, IPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013.
Messy Data!

Scheduled Pick-up Time

Actual Pick-up Time

12 am                 11:59pm

1.9% 92.7% 5.5%

Drop off Times?
Bad Data!

5 to 18 minutes early 3 late

0 to 57
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Included</th>
<th>Content &amp; Specifics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Require tracking and data capture system that leverages accurate, timely data for improved service reliability and system oversight</td>
<td>Yes</td>
<td>Contractor must provide 90% of their network providers with live electronic system for purposes of tracking rides and creating monthly reports for the state documenting performances.</td>
</tr>
<tr>
<td>Complaints must be logged by Contractor and reported to the State on a monthly basis. State must also be able to audit total number of complaints.</td>
<td>Yes</td>
<td>Section 3.10 outlines the Contractor’s obligations around having a separate phone line with dedicated staff for handling complaints. Section 3.10.5 includes new content around reporting and resolving lateness. Section 3.13.5 outlines monthly reporting requirements to state.</td>
</tr>
<tr>
<td>In terms of logging and resolving complaints, the Contractor must train all customer service representatives in a standard model.</td>
<td>Yes</td>
<td>Section 3.10 outlines how the Contractor must develop written policies and procedures for processing and resolving complaints.</td>
</tr>
</tbody>
</table>

Finding a Solution: RFP
expanding sector data sharing to cross-sector expanding
Health Data

Claims

the observed world
Social Service Data
- Housing
- School
- Justice
- Child Services

Public Data
- Census
- Property

Other Data
- Survey Data
- EMR
- Claims

Health Data

ARISE Camden

the observed world
**ARISE Data To Date**

**Existing Data Sharing:**

1) hospital claims from 5 regional health systems
2) Camden County Police Department (arrest, call-for-service, & overdose)
3) Camden County Corrections (jail data) and State Prison
4) Camden City School District (enrollment, truancy, absenteeism, & suspension data)
5) Property Data (citywide vacancy survey)
6) Perinatal Risk Assessment data
7) Medicaid Claims (All-Provider) data

**In Discussion:**

1) Homelessness Management Information Systems
2) Mortality Data
Case Study: Dual System High Utilizers
278 Overdose Victims Intercepted by the Camden County Police Department
Overdose Victims Intercepted by the Camden County Police Department

The diagram illustrates the types of overdose-related incidents intercepted by the police.

- Police Overdose
- Hospital Overdose
- Drug Charge
- Alcohol/Substance Abuse Hospital Visit
- Other Hospital or Police Encounters
Overdose Victims Intercepted by the Camden County Police Department
18,755 people with an arrest

93,344 people visiting the hospital

12,541 people overlap

226 people with dual sector high utilization

5 years, ever having a Camden address
7+ arrests
16+ emergency department visits
16+ emergency department visits

7+ police encounters
Segmenting dual-system high utilizers

- % Arrested for:
  - disorderly conduct
  - drug possession
  - violent crime
  - property crime
  - drug manu / distrib

- % Diagnosed with:
  - substance abuse
  - severe substance abuse
  - severe mental illness

- % In the demographics:
  - female
  - ever homeless
  - age 18-29
  - age 60+

- % Diagnosed with:
  - HIV
  - chronic hepatitis
  - chronic heart failure

**Median #**
- inpatient stays (if > 0)
- emergency visits
% Arrested for:
- disorderly conduct
- drug possession
- violent crime
- property crime
- drug manu / distrib

% Diagnosed with:
- substance abuse
- severe substance abuse
- severe mental illness

% In the demographic:
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Median #:
- inpatient stays (if > 0)
- emergency visits

Non-violent, medically very complex drug offenders \( (N = 37) \)
Non-violent, with mental health complexity, arrested mostly for petty crimes \( (N = 65) \)
Assault victims with mental health complexity & addictions, committing crimes against others \( (N = 59) \)
Male drug offenders, some with violence arrests, with few hospitalizations and less prevalent serious mental illness \( (N = 65) \)
Non-violent, medically very complex drug offenders \( (N = 37) \)

Non-violent, with mental health complexity, arrested mostly for petty crimes \( (N = 65) \)

Assault victims with mental health complexity & addictions, committing crimes against others \( (N = 59) \)

Male drug offenders, some with violence arrests, with few hospitalizations and less prevalent serious mental illness \( (N = 65) \)
§5 expanding hotspotting with cross-sector data
% of Overall Population and Camden Coalition Care Management Patients with Criminal Justice Involvement

Statute Violations for Camden Coalition Population (n=612)
- Disorderly Conduct: 53%
- Criminal Justice Admin: 30%
- Drug Possession: 14%
- Property: 9%
- Violent: 4%
- Drug Distribution / Manu: 1%
Potential client criteria and yearly cohort sizes:

3+ jail stays with either 6+ ED stays OR 2+ Inpatient stays
- 102 individuals (54 Camden) w/ 153 jail admissions

2+ jail stays with either 6+ ED stays OR 2+ Inpatient stays
- 164 (85 Camden) individuals w/ 231 jail admissions

3+ jail stays with either 4+ ED stays OR 2+ Inpatient stays
- 159 (84 Camden) individuals w/ 228 jail admissions

Daily number of RESET-eligible clients housed in jail
June 2016 - May 2017
Emergency Department, Inpatient, and Jail visits
For 80 clients meeting RESET triage criteria upon jail admission from June 2016 - May 2017

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Jail LOS</th>
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<tbody>
<tr>
<td>1</td>
<td>4 days</td>
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<tr>
<td>2</td>
<td>13 Days</td>
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<tr>
<td>3</td>
<td>20 Days</td>
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<tr>
<td>4</td>
<td>46 Days</td>
</tr>
<tr>
<td>5</td>
<td>277 Days</td>
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</tbody>
</table>
Other projects in the pipeline...
Thank You!

camdenhealth.org
healthcarehotspotting.com
aaron@camdenhealth.org