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

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Outline

- 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

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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

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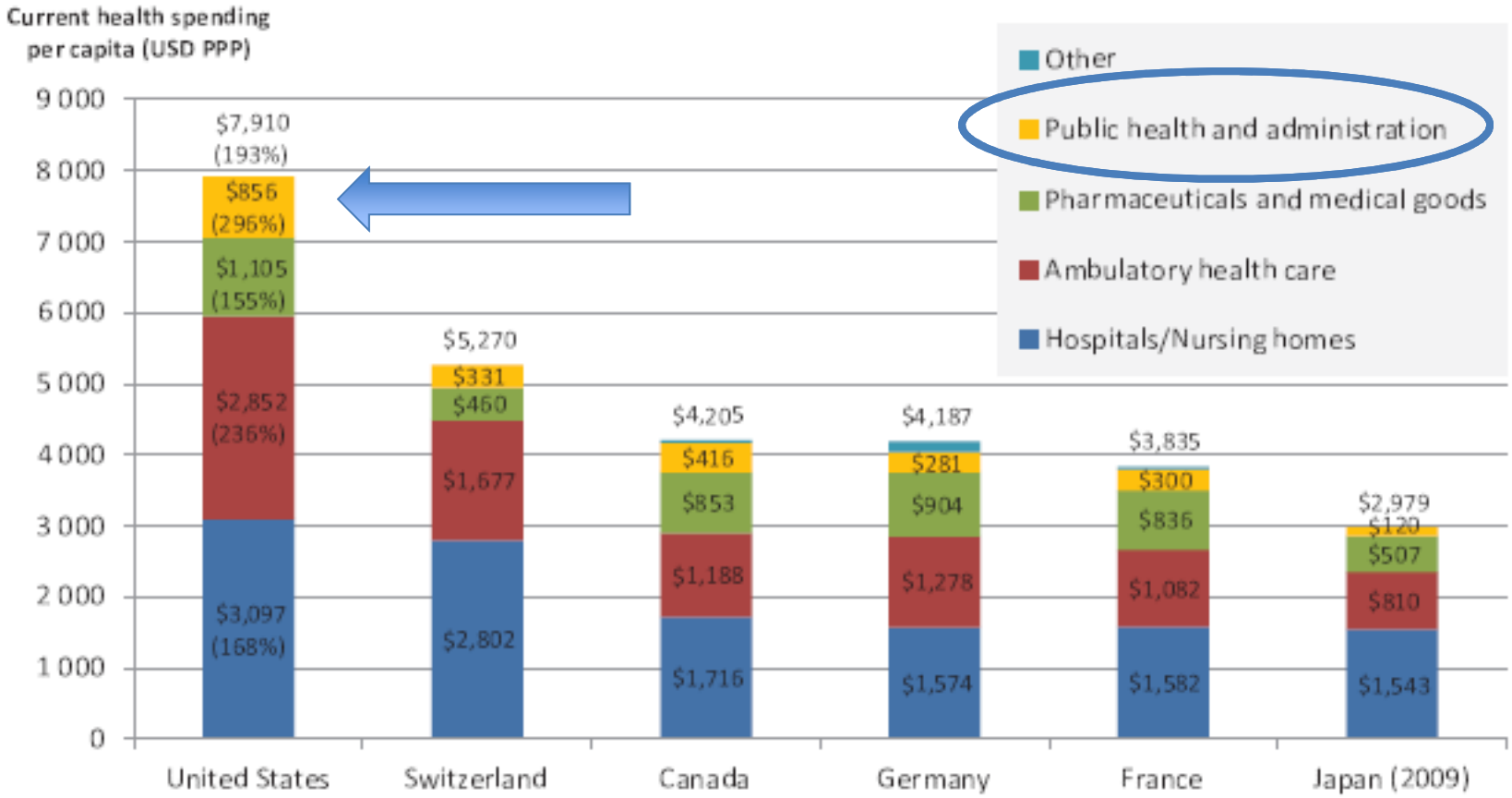
US health spending is much greater for all categories of care, particularly for ambulatory care and administration cost

2010 (or latest year available)



Life expectancy	79	83	82	81	82	84
Rank (WHO 2013)	34	2	8	19	8	1

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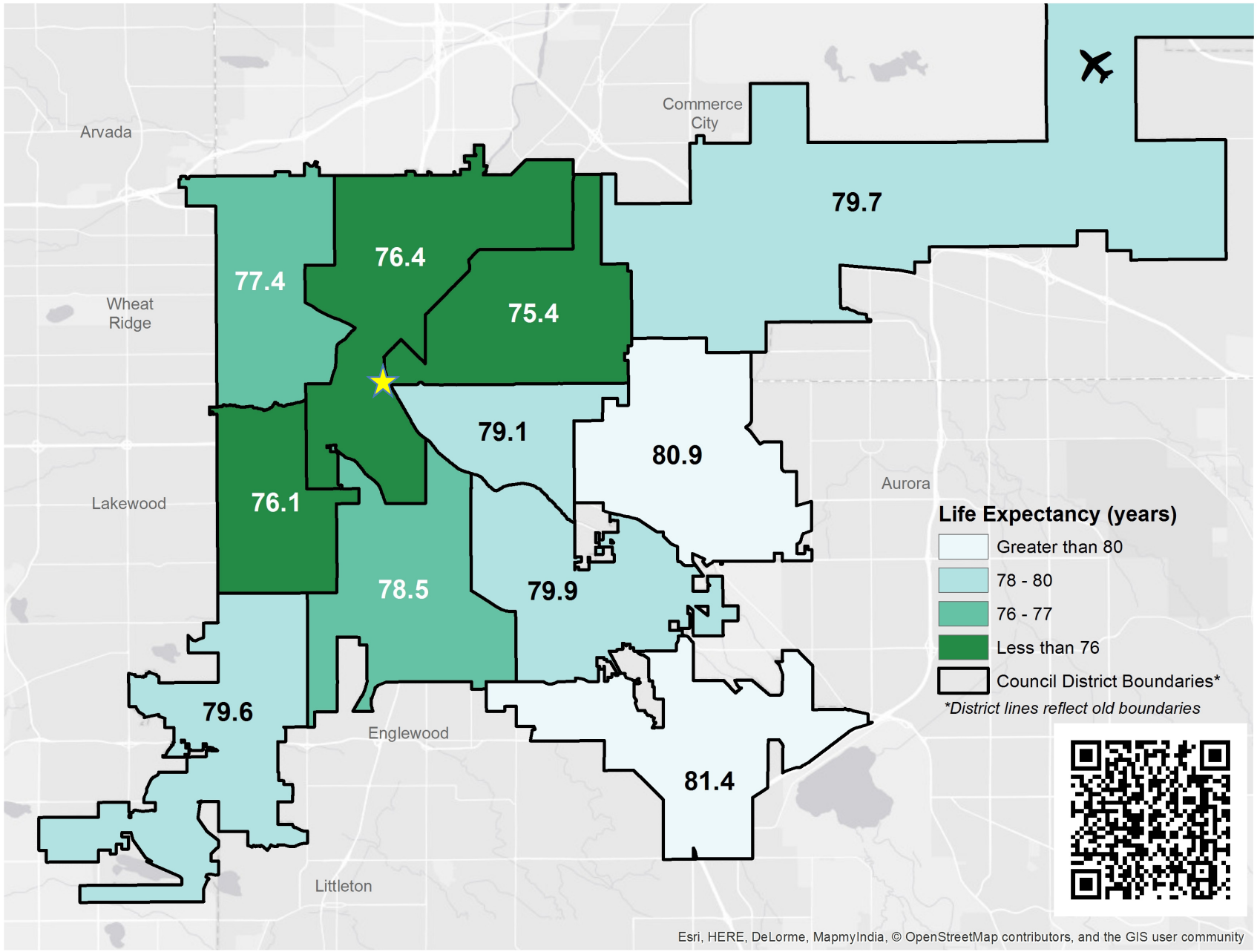
Arvada
Commerce City
Wheat Ridge
Lakewood
Aurora
Englewood
Littleton
77.4
76.4
75.4
79.7
79.1
80.9
76.1
78.5
79.9
79.6
81.4
Life Expectancy (years)
Greater than 80
78 - 80
76 - 77
Less than 76
Council District Boundaries*
*District lines reflect old boundaries
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

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Public Health Informatics

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

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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

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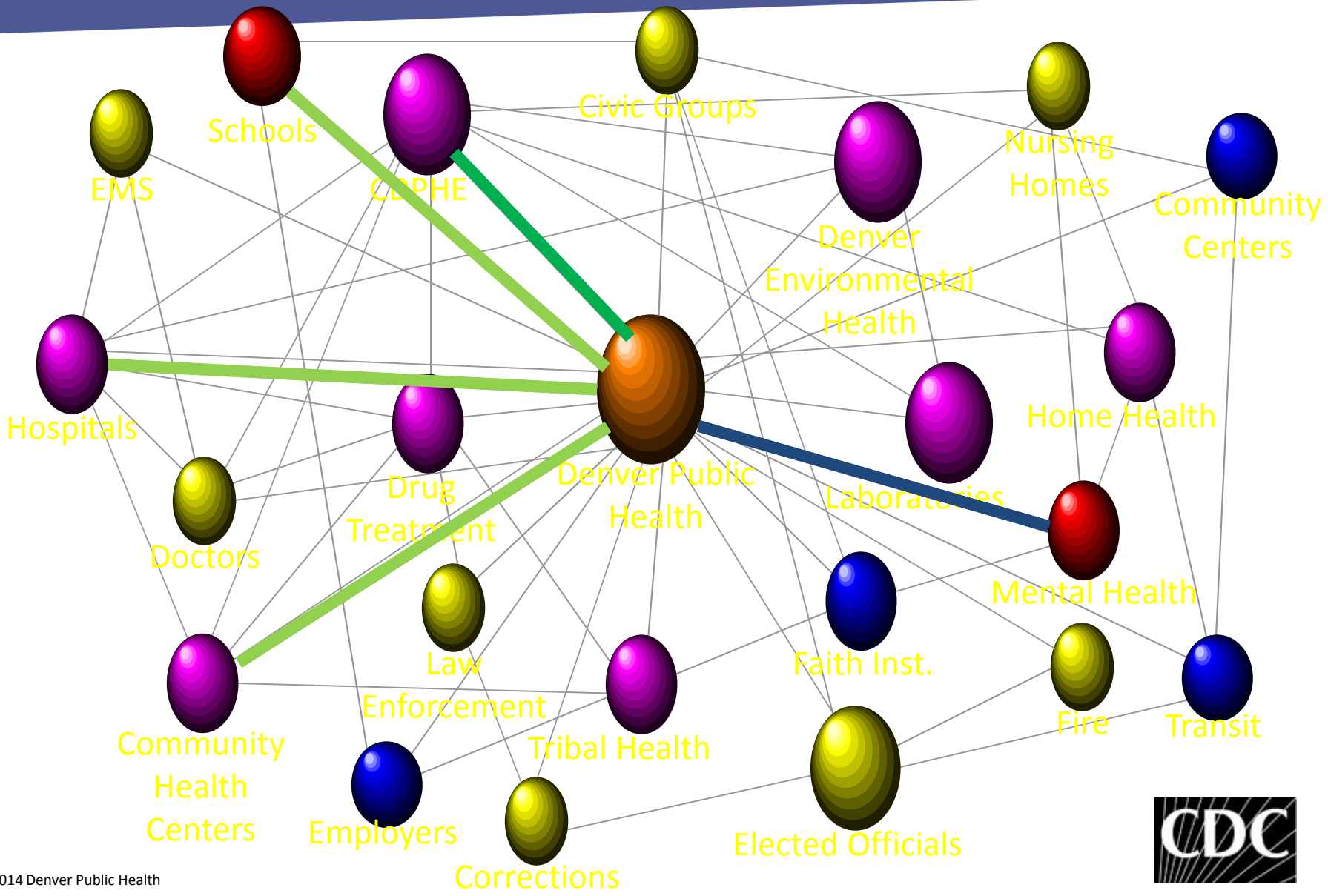
Public Health System



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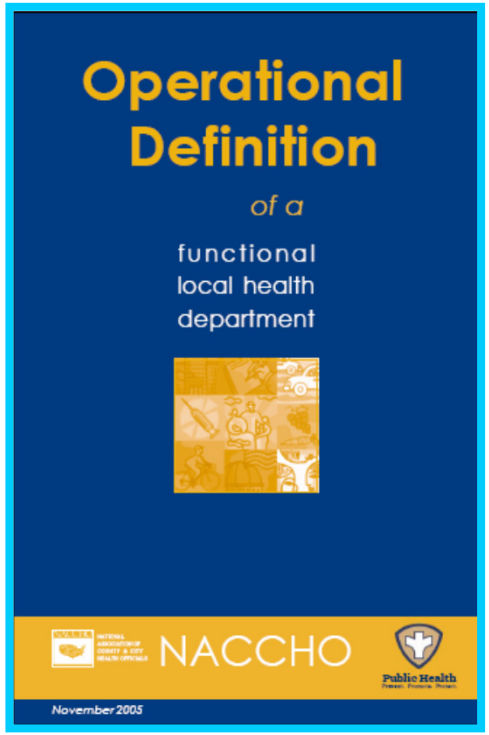
Operational Definition



2005

- 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

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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

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Are we there yet?

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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

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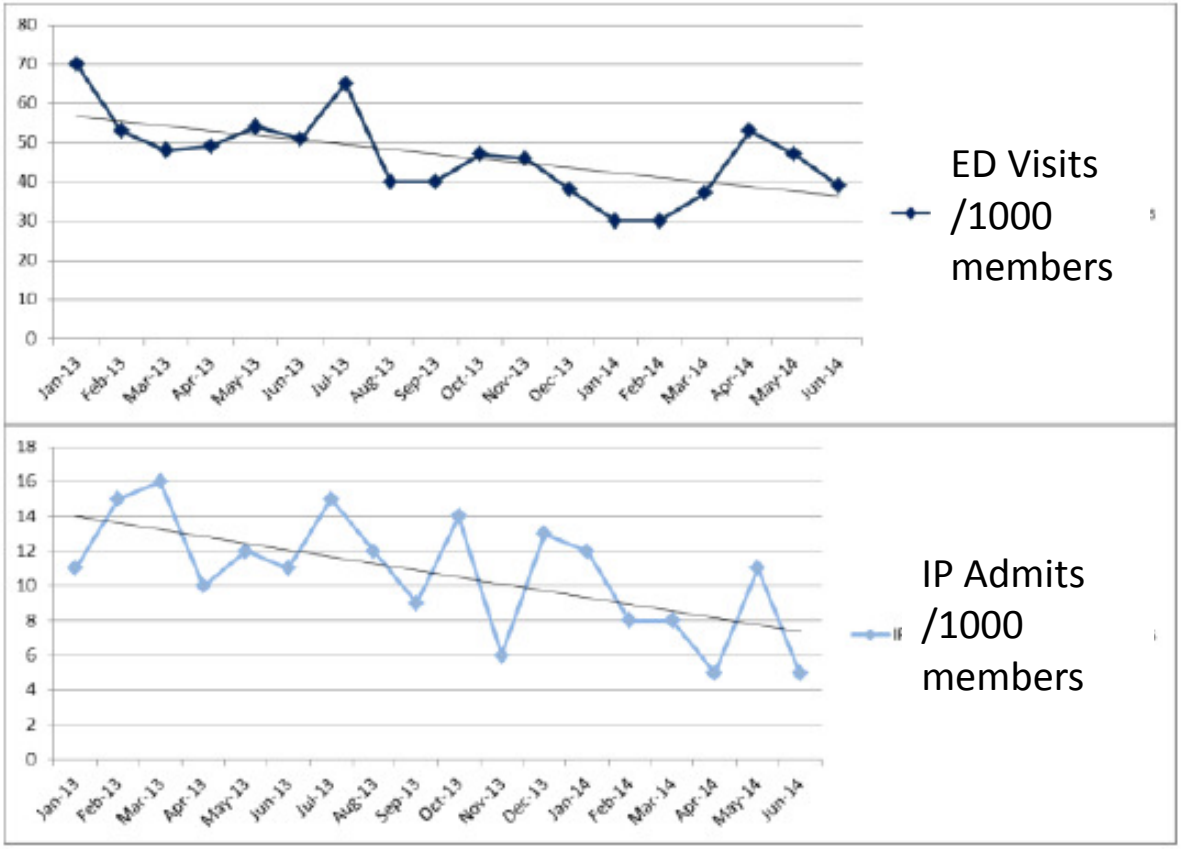
Regional: Hennepin Health
Housing Navigation

Outcomes: Continuously Enrolled Members

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



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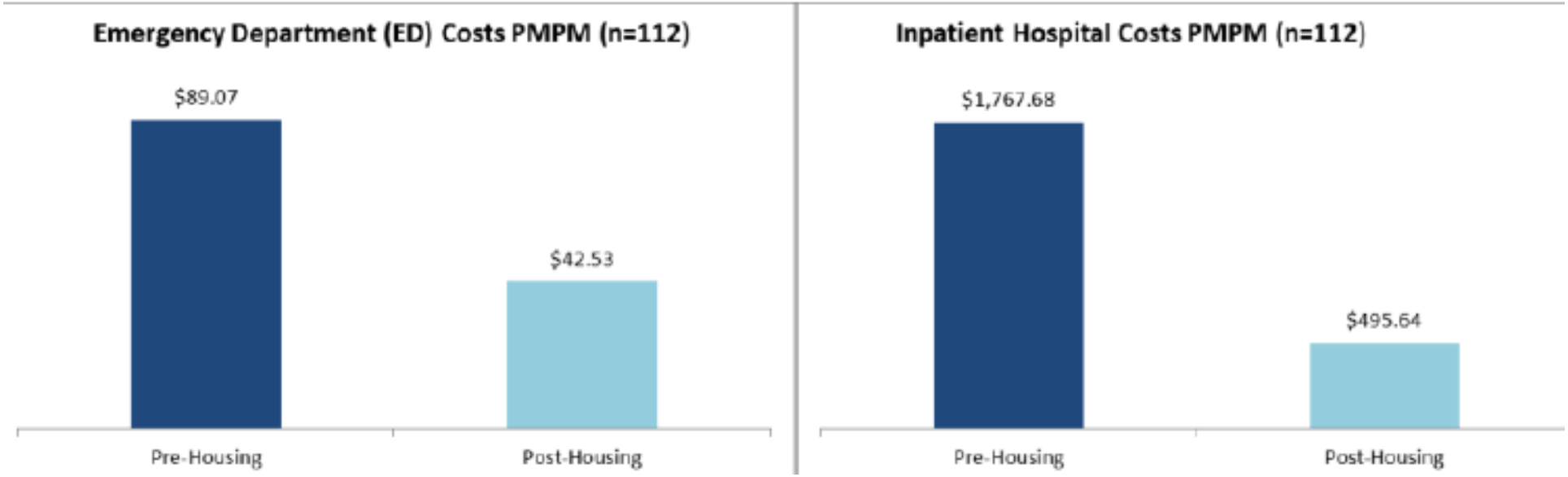
Garrett N. ONC Hearing Advanced Care Models, June 2, 2015

Regional: Hennepin Health
Housing Navigation

- 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



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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

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MU Payments through January 2015

	Amount Paid 2011 Program Year	Amount Paid 2012 Program Year	Amount Paid 2013 Program Year	Amount Paid 2014 Program Year	Amount Paid 2015 Program Year	Amount Paid Program - To - Date
Medicare Eligible Professionals	**$ 979,666,454**	**$ 2,879,790,933**	**$ 2,575,693,027**	**$ 541,054,080**	**$ -**	**$ 6,976,204,495**
Doctors of Medicine or Osteopathy	$ 869,606,164	$ 2,606,127,832	$ 2,317,169,243	$ 489,192,480	$ -	$ 6,282,095,719
Dentists	$ 757,738	$ 2,256,298	$ 2,041,322	$ 419,440	$ -	$ 5,474,799
Optometrists	$ 39,019,045	$ 116,937,152	$ 105,218,728	$ 15,288,000	$ -	$ 276,462,924
Podiatrists	$ 51,783,860	$ 97,193,161	$ 75,523,922	$ 15,217,440	$ -	$ 239,718,383
Chiropractors	$ 18,499,648	$ 57,276,490	$ 75,739,812	$ 20,936,720	$ -	$ 172,452,670
Medicaid Eligible Professionals	**$ 1,048,787,200**	**$ 1,197,669,278**	**$ 1,059,931,697**	**$ 185,092,878**	**$ 63,750**	**$ 3,491,544,804**
Certified Nurse-Midwives	$				-	$ 73,231,750
Dentists	$				42,500	$ 308,937,584
Nurse Practitioners	$				21,250	$ 628,348,605
Optometrists	$				-	$ 2,020,167
Physicians	$				-	$ 2,437,186,698
Physicians Assistants	$ 13,515,000	$ 12,932,750	$ 12,788,250	$ 2,584,000	$ -	$ 41,820,000
Eligible Hospitals & CAHs	**$ 3,178,959,355**	**$ 5,583,260,866**	**$ 6,254,411,386**	**$3,173,901,625**	**$ 1,772,204**	**$ 18,192,305,437**
Medicare Only	$ 113,430,824	$ 231,421,666	$ 229,659,211	$ 128,077,130	$ -	$ 702,588,831
Medicaid Only	$ 129,581,442	$ 107,540,952	$ 116,192,294	$ 25,284,341	$ 1,594,619	$ 380,193,649
Medicare/Medicaid	$ 2,935,947,089	$ 5,244,298,248	$ 5,908,559,881	$3,020,540,154	$ 177,586	$ 17,109,522,958
Medicare Advantage Organizations For Eligible Professionals	**$ 180,106,590**	**$ 134,773,289**	**$ 91,873,828**	**$ -**	**$ -**	**$ 406,753,707**
Total	**$ 5,387,519,599**	**$ 9,795,494,367**	**$ 9,981,909,938**	**$3,900,048,584**	**$ 1,835,954**	**$ 29,066,808,443**

$29,066,808,443

($60 M to Denver)

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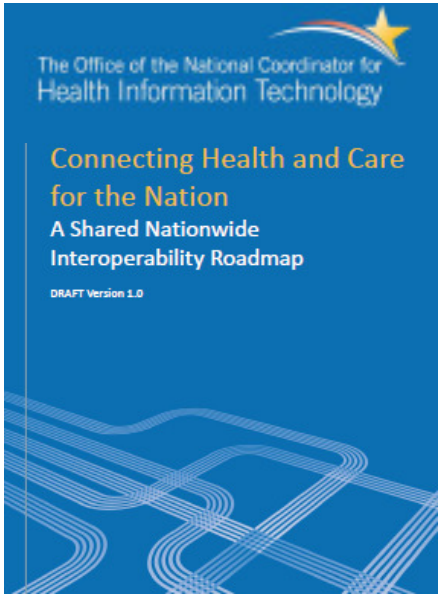
Challenge



- 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"**.

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Primary Care Information Project (PCIP)

Mission

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

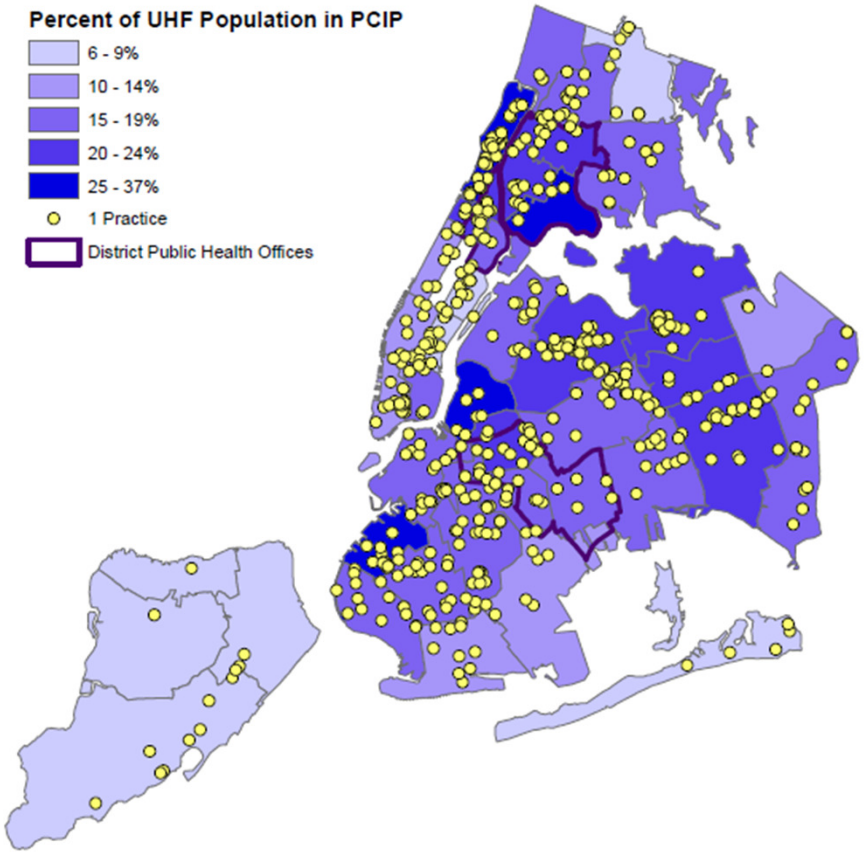
Participation

- **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 then 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

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Comparison of Prevalence Estimates among the Population in Care

http://www.nyc.gov/html/doh/html/data/nycmacroscope.shtml

	2012 NYC Macroscope	2012 CHS (BRFSS)	2004 NYC HANES
Obesity*	29.5	**25.4 (23.8-27.0)**	28.2 (25.1-31.5)
Hypertension Diagnosis	30.7	30.9 (29-4-32.4)	30.9 (28.2-33.8)
Hypertension Treatment	76.4	**70.4 (66.2-74.2)**	**70.2 (64.2-75.6)**
Hypertension Control**	62.2	NA	**73.2 (65.4-79.8)**

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

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

BOLD = significantly different from NYC Macroscope estimate

McVeigh K, CSTE, 2014

New York City Department of Health and Mental Hygiene

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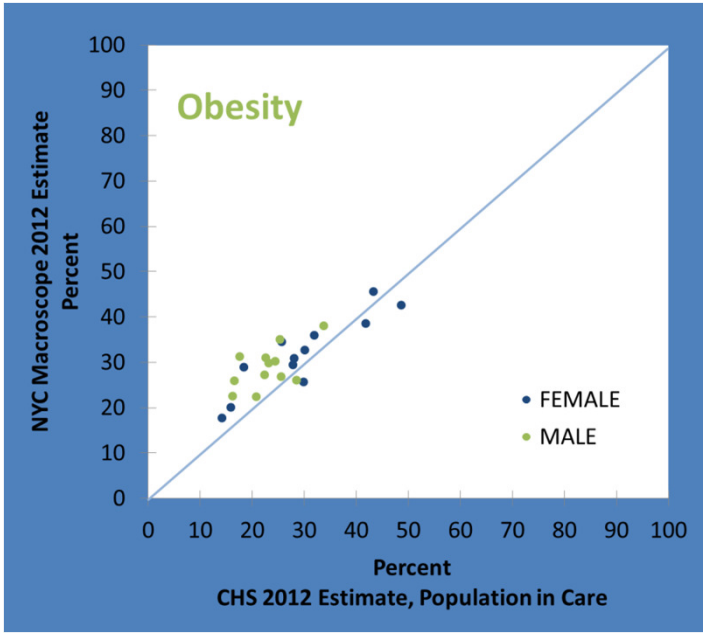
NYC Macroscope 2012 Estimates of Obesity Prevalence vs. Reference Estimates

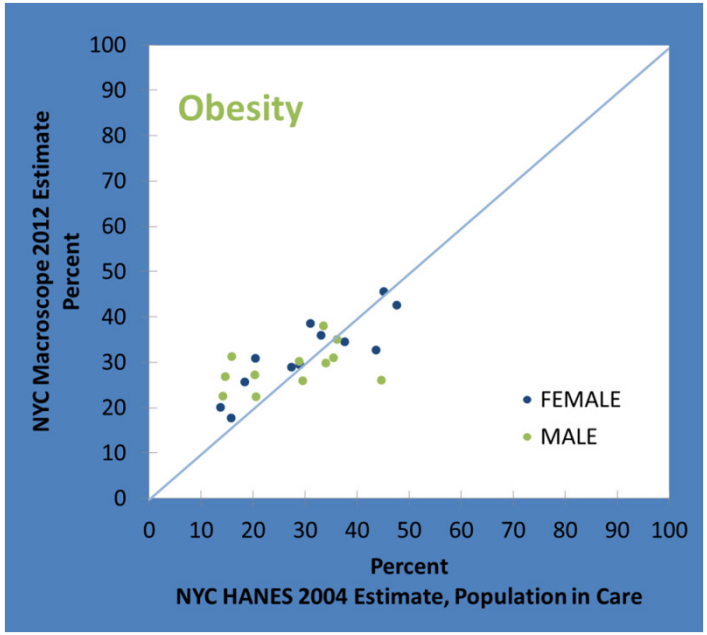
24 Strata Defined by Sex, Age Group and Neighborhood Poverty Rate

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

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New York City Department of Health and Mental Hygiene

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ESPnet: Automated disease detection/ reporting for public health

Electronic Support for Public Health (ESPnet)

Practice EMR's

diagnoses

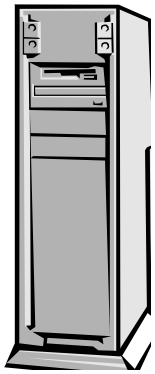
lab results

meds

vital signs

demographics

ESPnet Server



electronic case reports or aggregate summaries

Health Department

Klompas M, et al. JAMIA 2009;16:18-24
MMWR 2008;57:372-375
Am J Pub Health 2012;102:S325–S332

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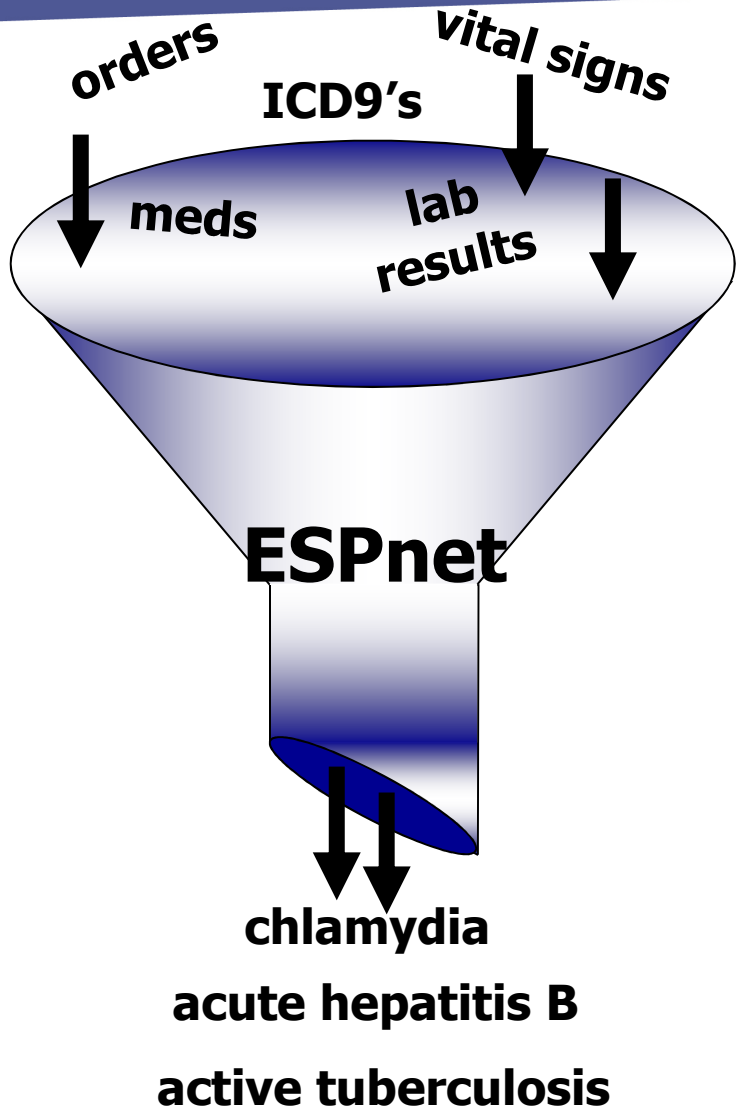
Case Identification



ESPnet Case Reporting

Atrius, CHA, MetroHealth, 2006-2014

Condition	Total Cases
Chlamydia	22,001
Gonorrhea	4,554
Pelvic inflammatory disease	311
Acute hepatitis A	34
Acute hepatitis B	112
Acute hepatitis C	341
Tuberculosis	437
Syphilis	1478

Klompas M, et al. JAMIA 2009;16:18-24
MMWR 2008;57:372-375
Am J Pub Health 2012;102:S325–S332

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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.

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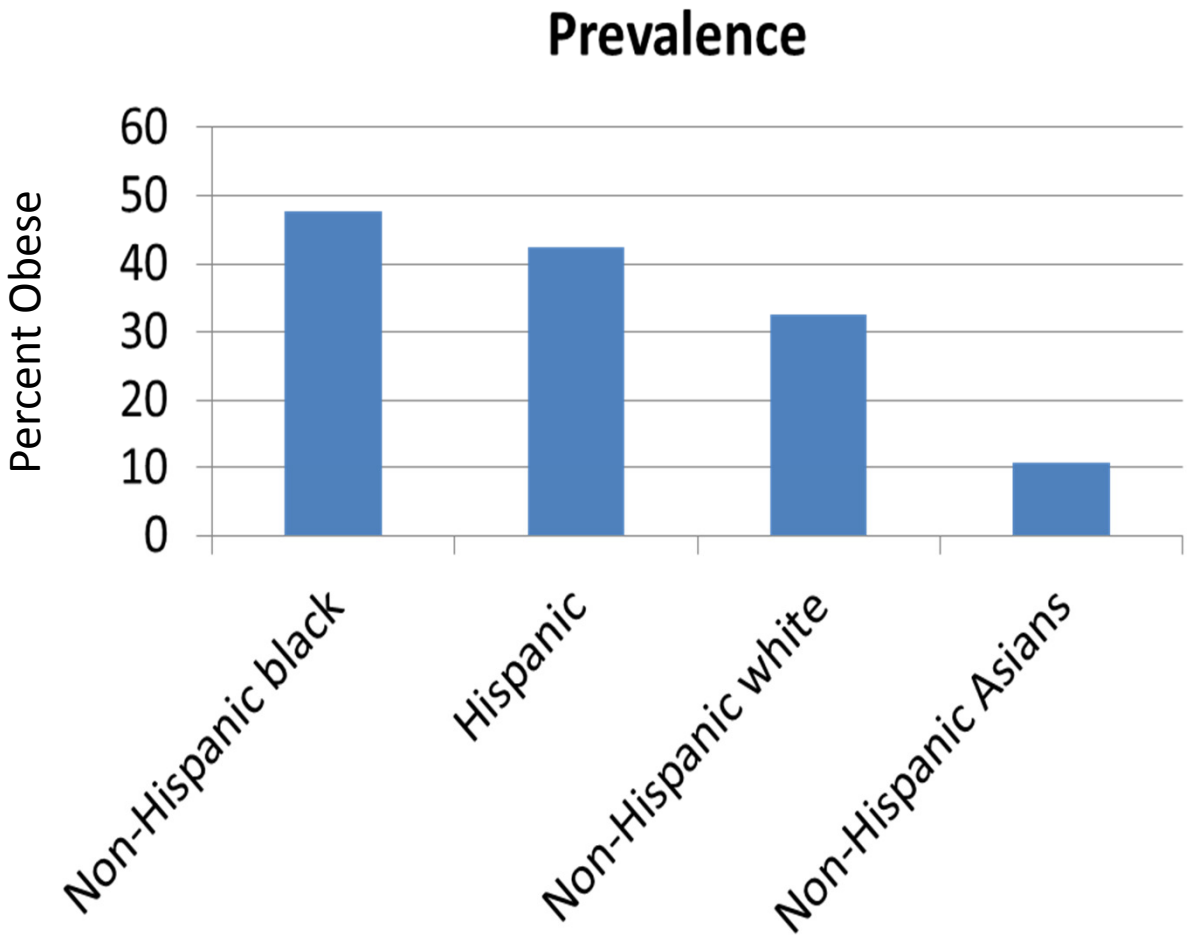
US: Obesity Prevalence Rates by Race/Ethnicity (BRFSS)



34.9% (78.6 million) of U.S. adults are obese. *(CDC)*

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Colorado: Self-Reported, Adult Obesity Prevalence Estimates, (BRFSS)

Group	Source Year	Estimate	CI
Adults – all	2013	21.3	20.4-22.2
White	2011-13	18.8	18.2-19.4
Black (NH)	2011-13	30.5	26.6-34.7
Hispanic	2011-13	28.0	26.2-29.8

http://www.cdc.gov/obesity/data/adult.html

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Denver: 2011 – 2012, What is your age? (BRFSS)

Race	Age group	N	% Pop	StdErr	Lower 95% CL	Upper 95% CL
Black	18-24 years	5	6.1	2.8	0.6	11.6
	25-34 years	12	5.4	1.6	2.2	8.5
	35-44 years	25	12.1	2.5	7.2	17.0
	45-54 years	34	13.7	2.5	8.8	18.5
	55-64 years	45	14.3	2.5	9.5	19.1
	65+ years	47	15.4	2.3	10.9	19.9
Hispanic	18-24 years	50	50.1	2.9	40.3	.8
	25-34 years	81	32.3	3.3	25,8	9
	35-44 years	95	37.4	3.3	30.9	
	45-54 years	66	29.2	3.6		36.2
	55-64 years	68	24.5	3.0		30.3
	65+ years	46	13.0			17.5
Other	18-24 years				1.5	7.7
	25-34 years			1.7	3.5	10.2
	35-44		4.9	1.4	2.1	7.7
		20	4.3	1.1	2.1	6.5
		17	4.3	1.7	1.0	7.7
	65+ years	12	2.5	0.9	0.7	4.3
White	18-24 years	66	39.3	4.6	30.3	48.2
	25-34 years	181	55.5	3.4	48.8	62.1
	35-44 years	177	45.6	3.2	39.3	51.9

CAUTION:BRFSS PROTOCOL STATES THAT ESTIMATES BASED ON FEWER THAN 50 OBSERVATIONS ARE STATISTICALLY UNRELIABLE.

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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***

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Methods

<u>Denominator</u>: Number of individuals using health care facilities

- normalized data - virtual data warehouse (VDW)
- geo-locate home residence for all patients

<u>Numerator</u>: Number of adults with overweight/obese BMI

- leverage height and weight measures from meaningful use (MU) incentive payments
- remove biologically implausible values

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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

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CHORDS Opportunity

Colorado Health Observation Regional Data Service

- 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

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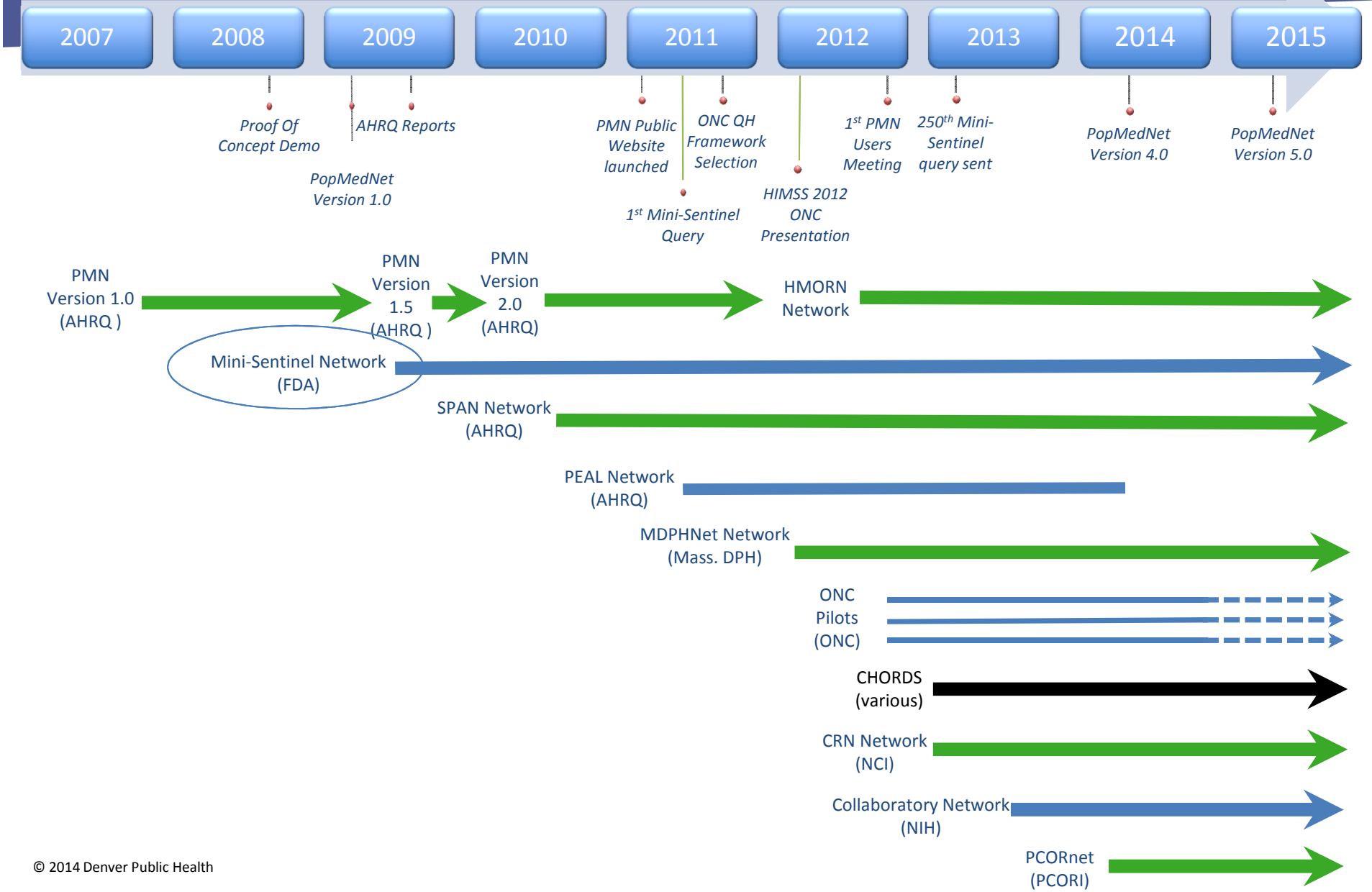
PopMedNet Timeline



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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

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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)

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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

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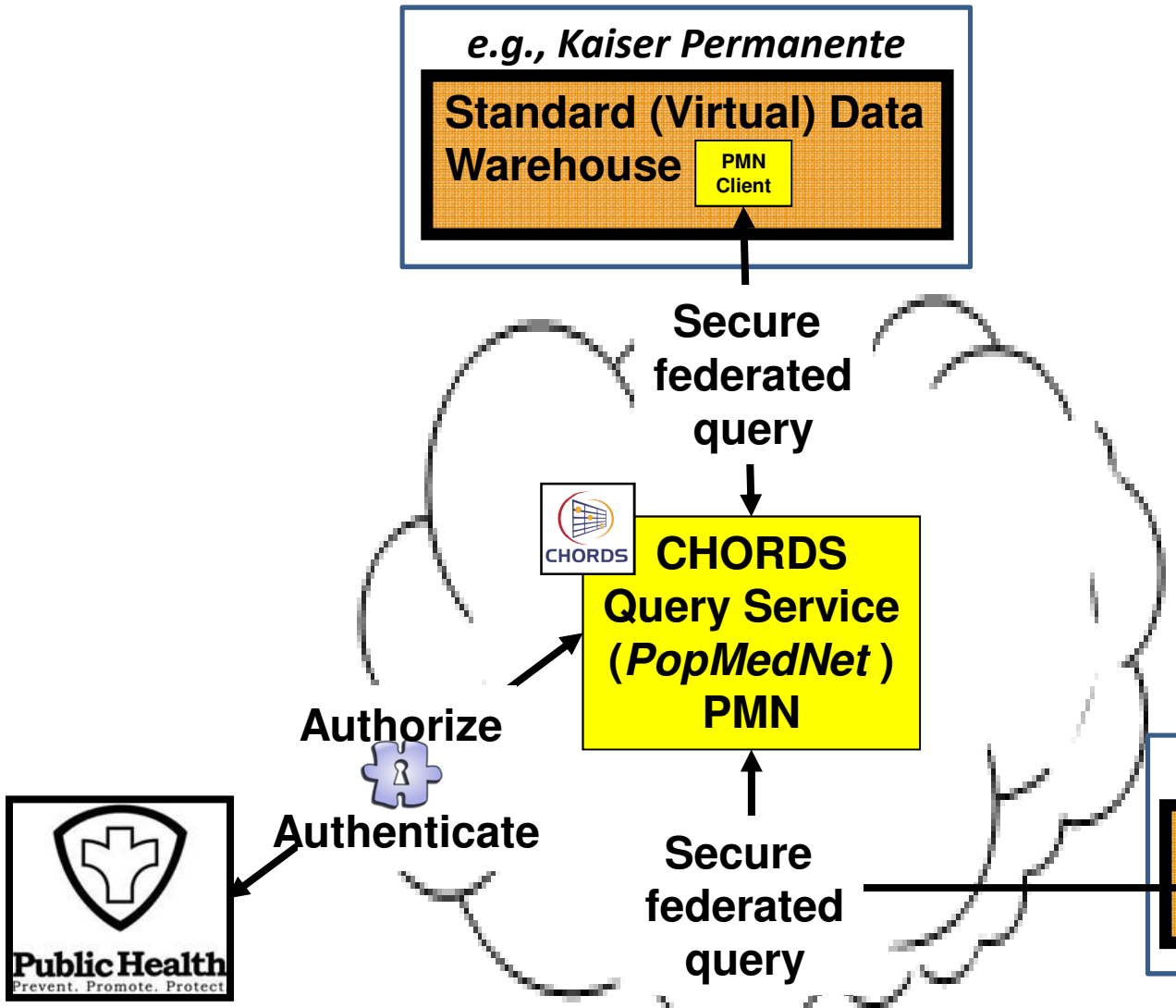
CHORDS Registries

Colorado Health Observation Regional Data Service



Current registry efforts:

- **BMI**
- **CVD risk**
- **Tobacco use and 2nd hand smoke exposure**
- **Mental health**
- **HIV**
- **Hepatitis C**

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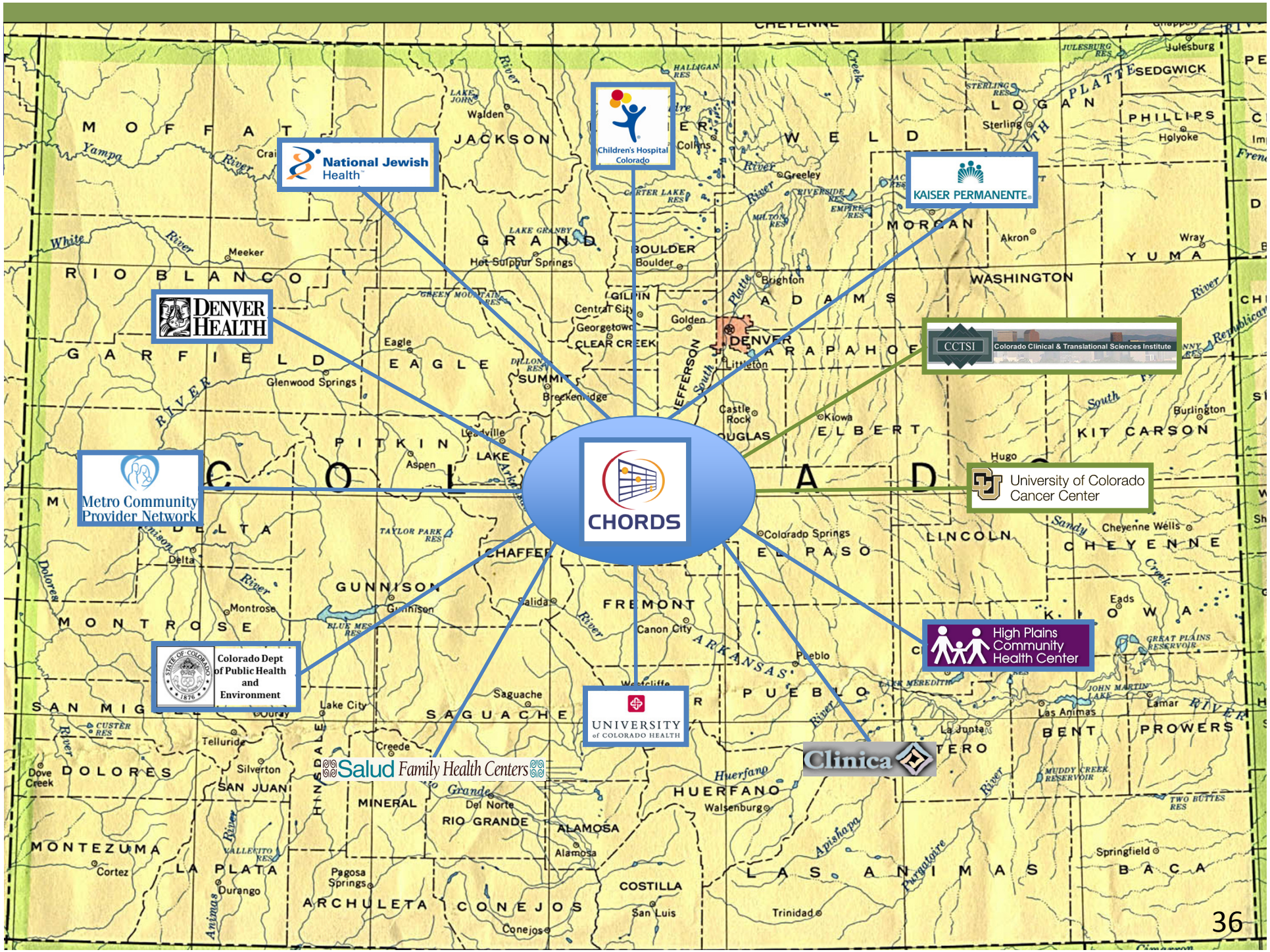
National Jewish Health
Children's Hospital Colorado
KAISER PERMANENTE
DENVER HEALTH
CCTSI
Colorado Clinical & Translational Sciences Institute
Metro Community Provider Network
CHORDS
University of Colorado Cancer Center
Colorado Dept of Public Health and Environment
High Plains Community Health Center
UNIVERSITY of COLORADO HEALTH
Salud Family Health Centers
Clinica

CHORDS Use Cases

Registry Focus	Example Indicators	Funder
Healthy Weight	% of children and adults obese	TCHF KP Comm Ben.
Tobacco Use and Exposure	% of adults using tobacco % of children exposed to second hand smoke	CDPHE
Cardiovascular Disease Risk	% of adults with hypertension - % controlled -% on lipid Rx	CDC CDPHE
Mental Health	% of Denver adolescents diagnosed with depression	AHRQ

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Results: Adult BMI Registry Summary by County

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

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Results: Comparison BMI Registry to BRFSS

	Valid EHR BMI, 2009-2013				BRFSS, 2011/2012		
Denver	N	%	Percent Obese	Percent Overweight	N	Percent Obese	SE
Overall	161,580				1977	20.1	1.2
Male	68,664	95.1	28.0	37.7	887	20.0	1.7
Female	92,916	95.9	32.2	27.6	1090	20.1	1.6
Race/Ethnicity							
White	97,732	96.8	29.4	31.8	1324	13.5	1.1
Black	21,080	95.5	37.8	29.8	160	33.9	4.7
Asian/Pacific Isl.	4,495	94.9	11.6	27.1	-	-	-
American Indian	1,218	96.2	41.8	29.8	-	-	-
Other /multiple	7,433	92.3	33.2	33.2	90	17.2	4.4
Unknown	29,624	92.4	30.0	34.3	-	-	-
Hispanic	15,459	94.1	38.1	34.1	370	27.6	2.8
Non-Hispanic	59,508	96.8	24.4	31.5	-	-	-
Unknown Hispanic origin	86,615	95	33.2	31.8	-	-	-
Age							
18-24 yrs	21,805	90.9	20.5	22.6	118	11.6	3.3
25-34 yrs	32,186	94.4	23.8	29.6	277	13.1	2.5
35-44 yrs	27,391	95.5	33.7	35.0	300	24.7	3.1
45-54 yrs	26,624	96.8	38.9	34.1	324	28.5	3.2
55-64 yrs	25,912	97.5	37.2	34.1	443	25.1	2.6
65+ yrs	27,664	97.9	28.1	34.8	515	18.5	2.2

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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

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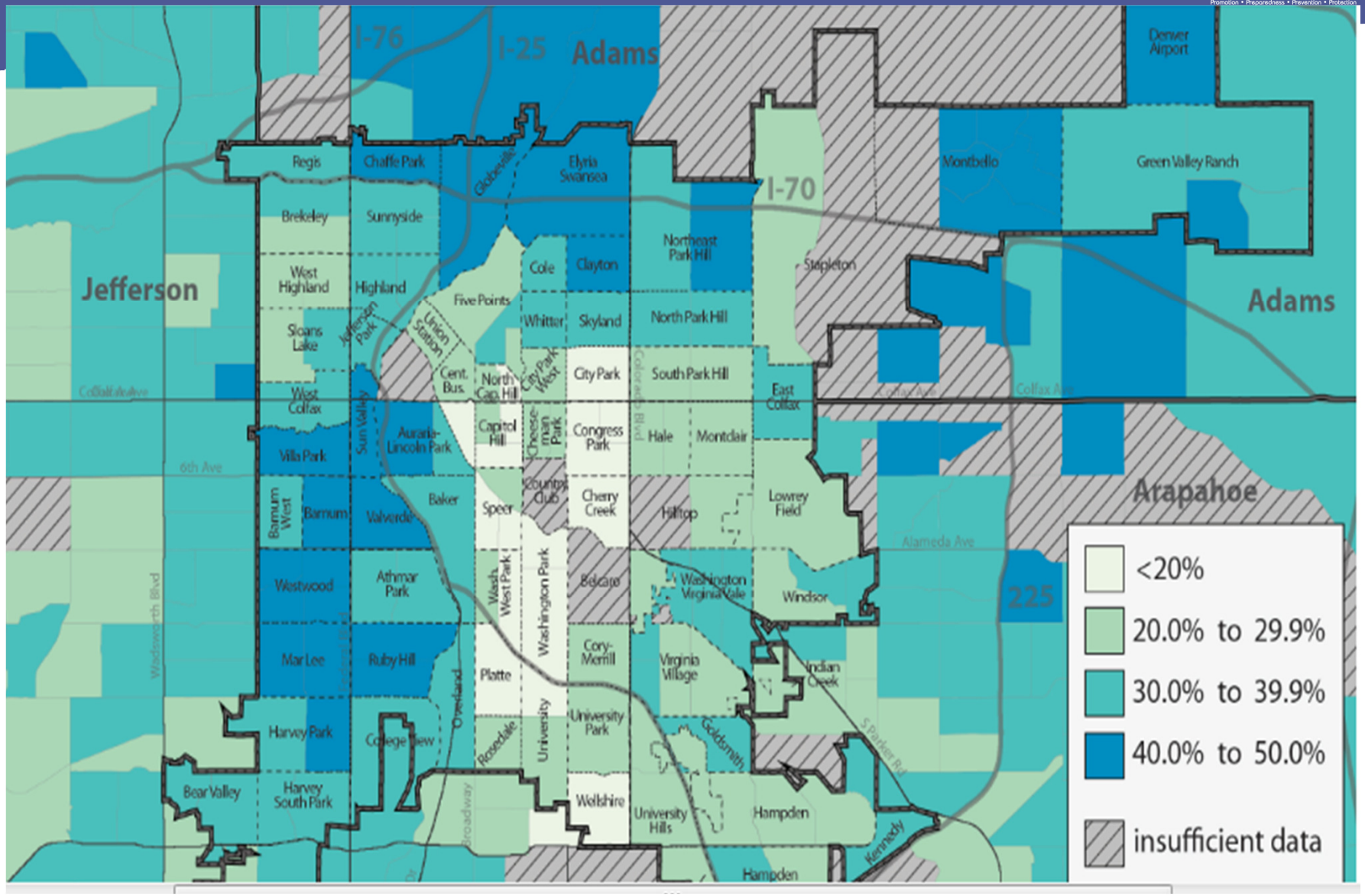
Denver: Adult Obesity Prevalence – Registry



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

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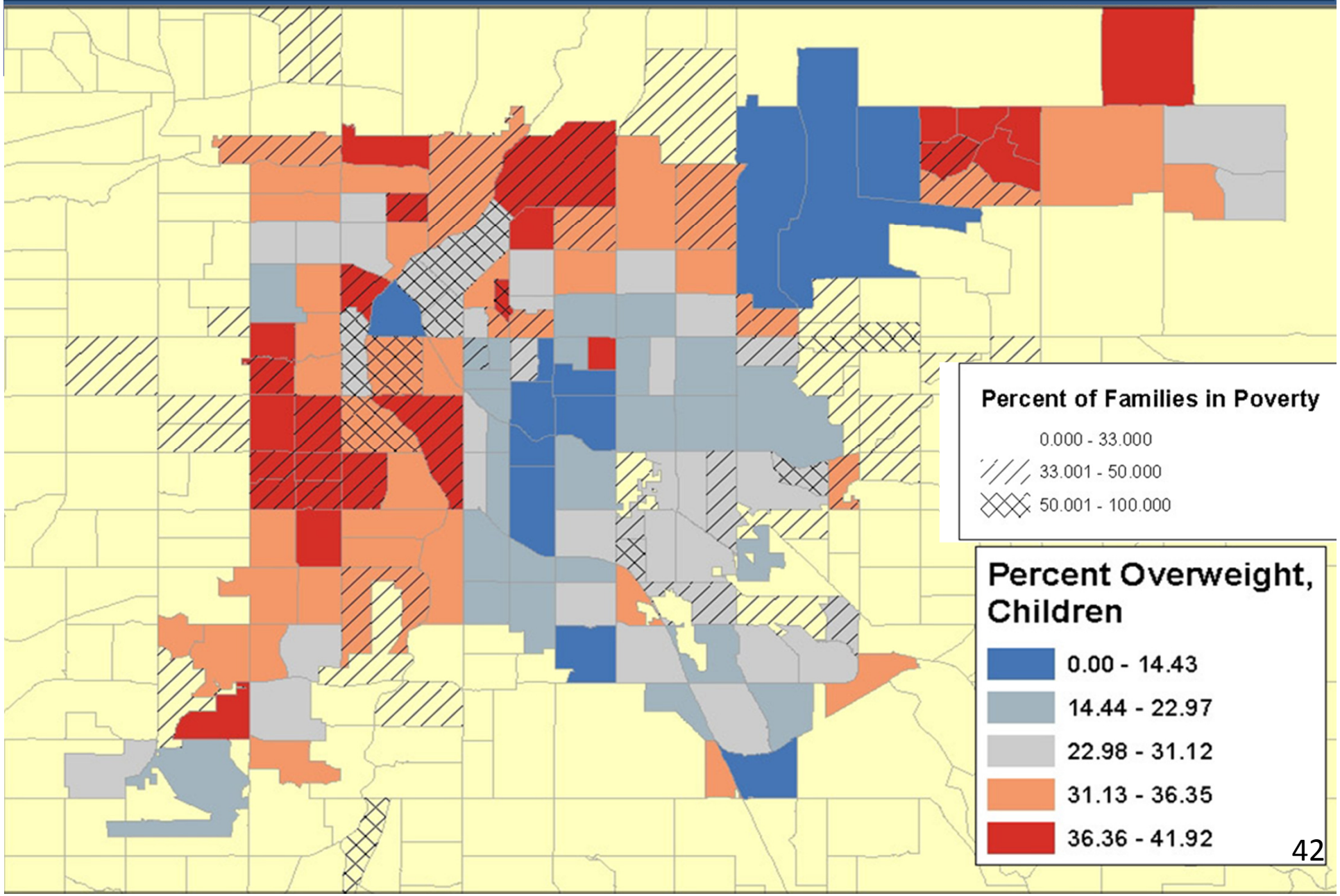
Denver: % Children Overweight + % Families in Poverty



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***

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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.

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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

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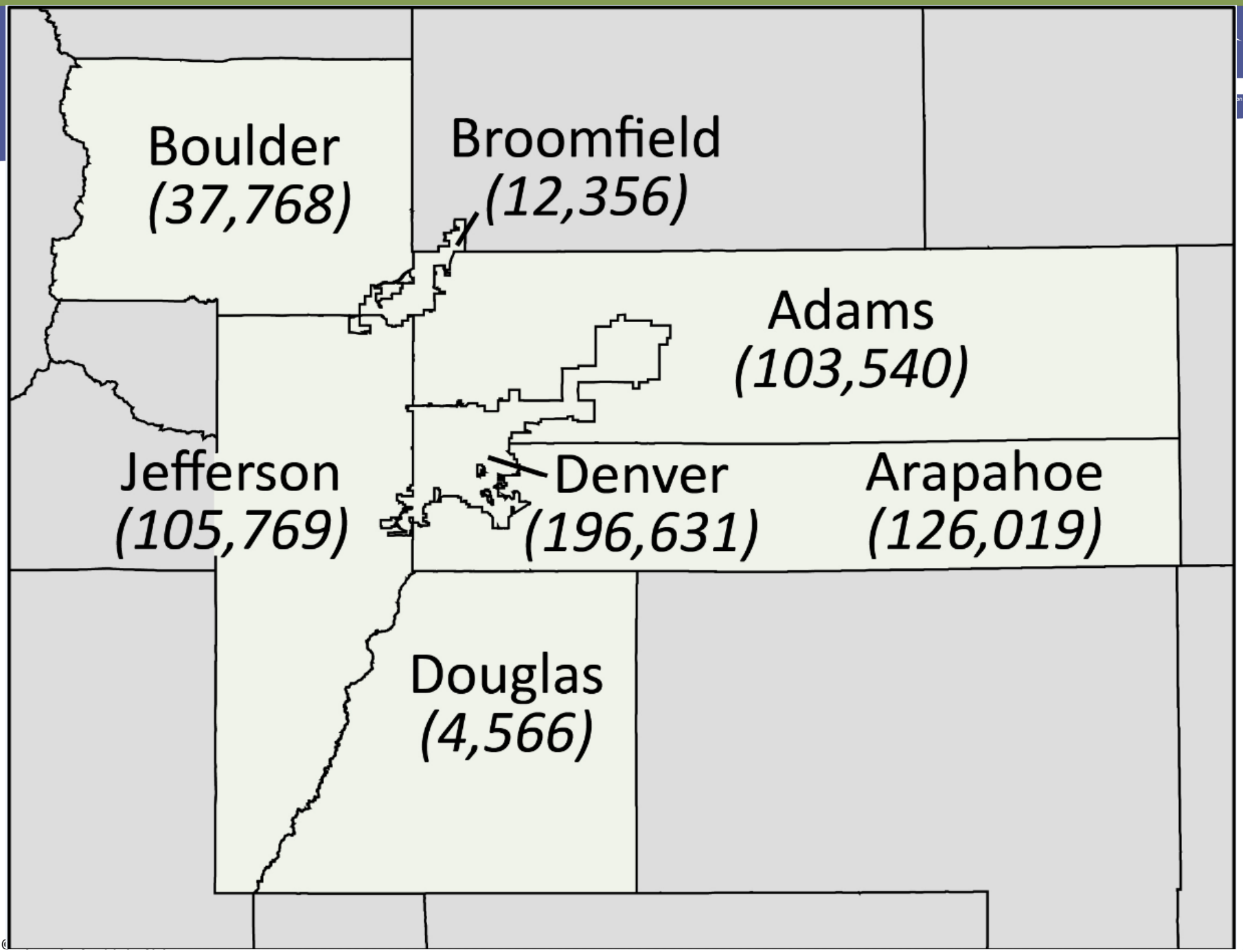
Boulder
(37,768)
Broomfield
(12,356)
Adams
(103,540)
Jefferson
(105,769)
Denver
(196,631)
Arapahoe
(126,019)
Douglas
(4,566)

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

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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. gonorrheae ***ICD-10*** *O98.23*
- **Pragmatic** (usage)
  - organize results for aggregation / visualization
  - use results for decision support (e.g., case reporting)

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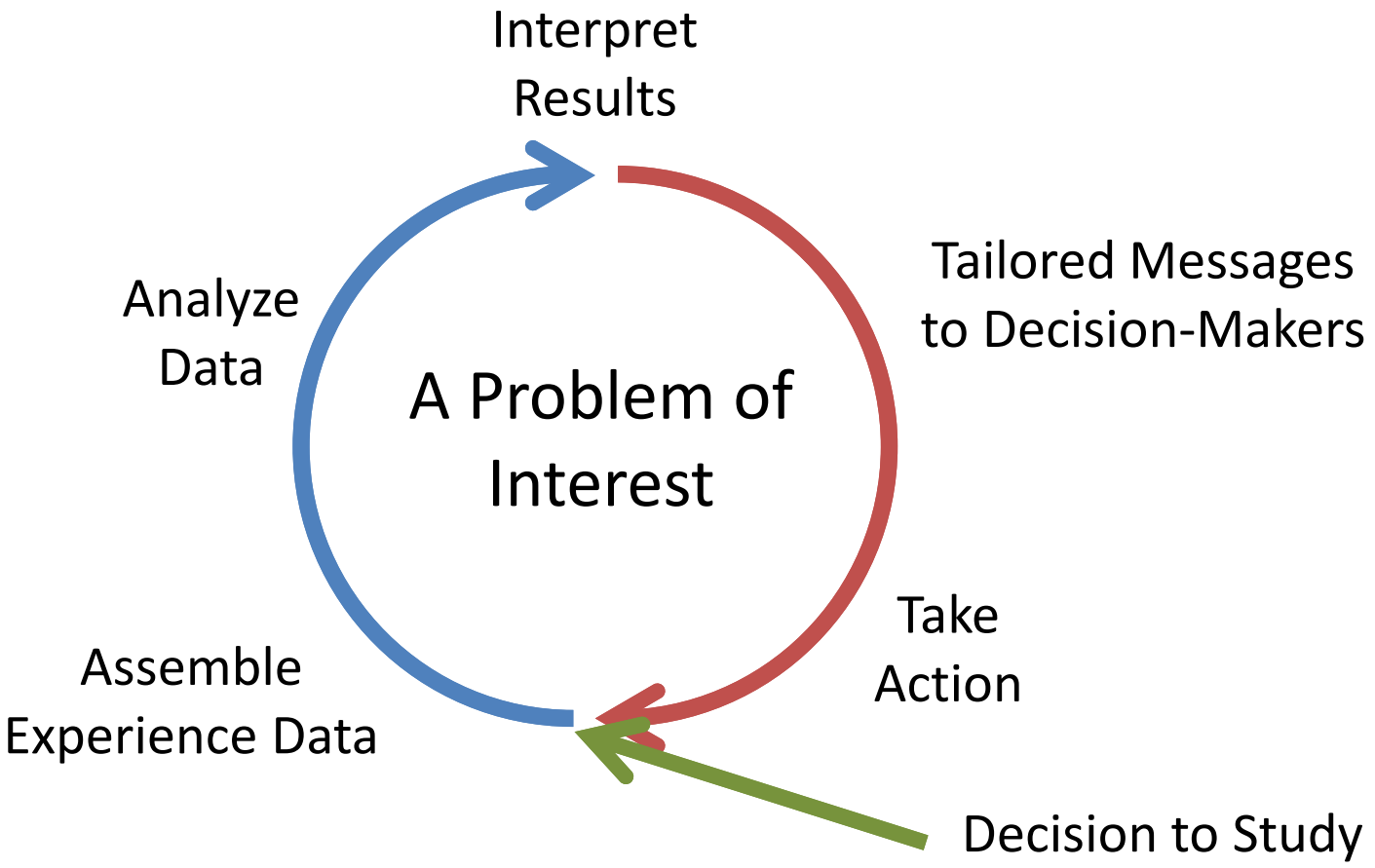
Learning Health System:
Virtuous Cycles of Study and Change

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



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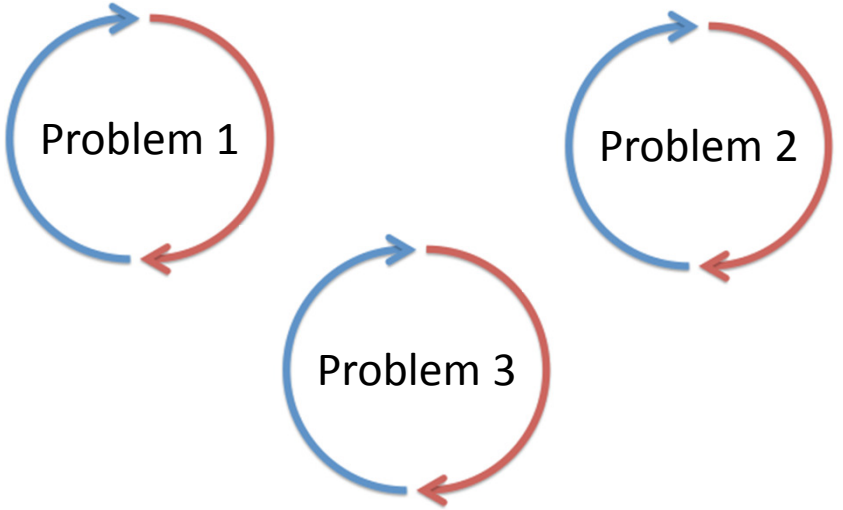
(C Friedman)

How Do We Convert?

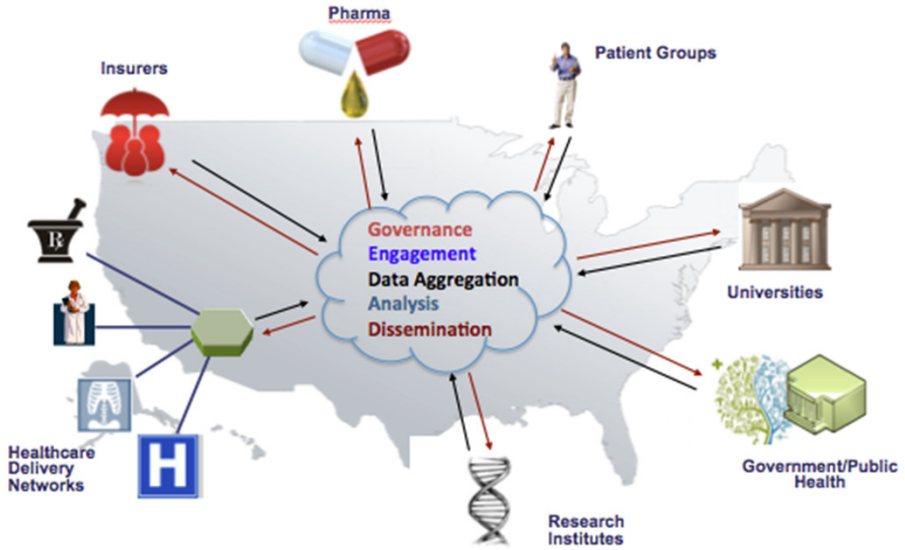
From:

- 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:



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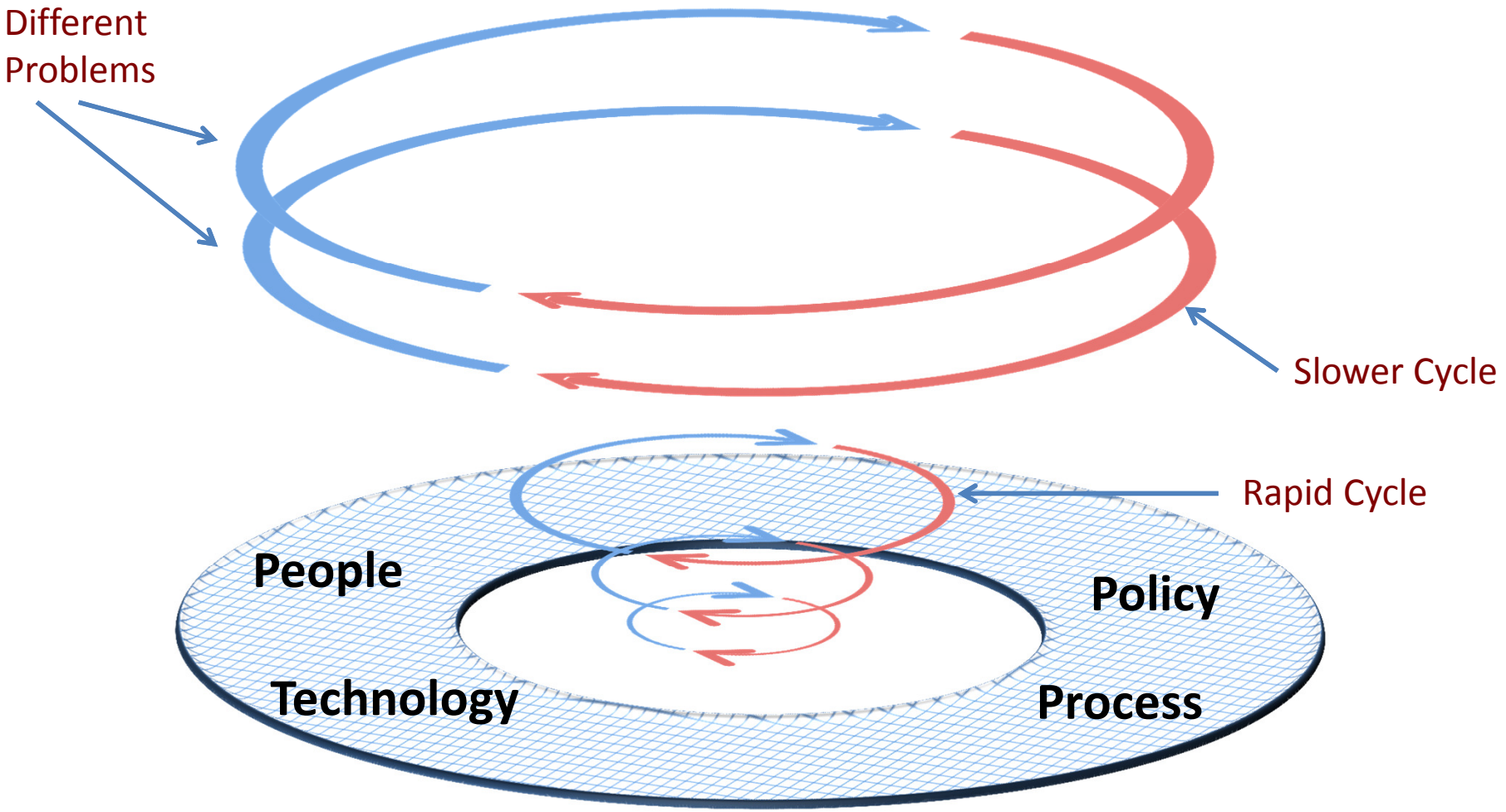
Single Platform Supports Multiple Simultaneous Learning Cycles

LHS Infrastructure



Socio-Technical Supporting Platform

(C Friedman)

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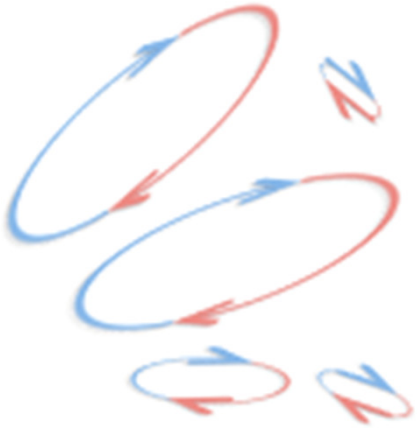
Why a Platform?

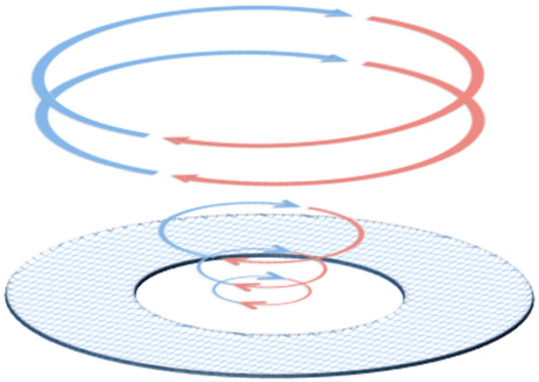
- **Without a platform:**
  - Every cycle requires its own agreements technology, staffing, analytics, dissemination mechanisms
  - No economy of scale

  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)



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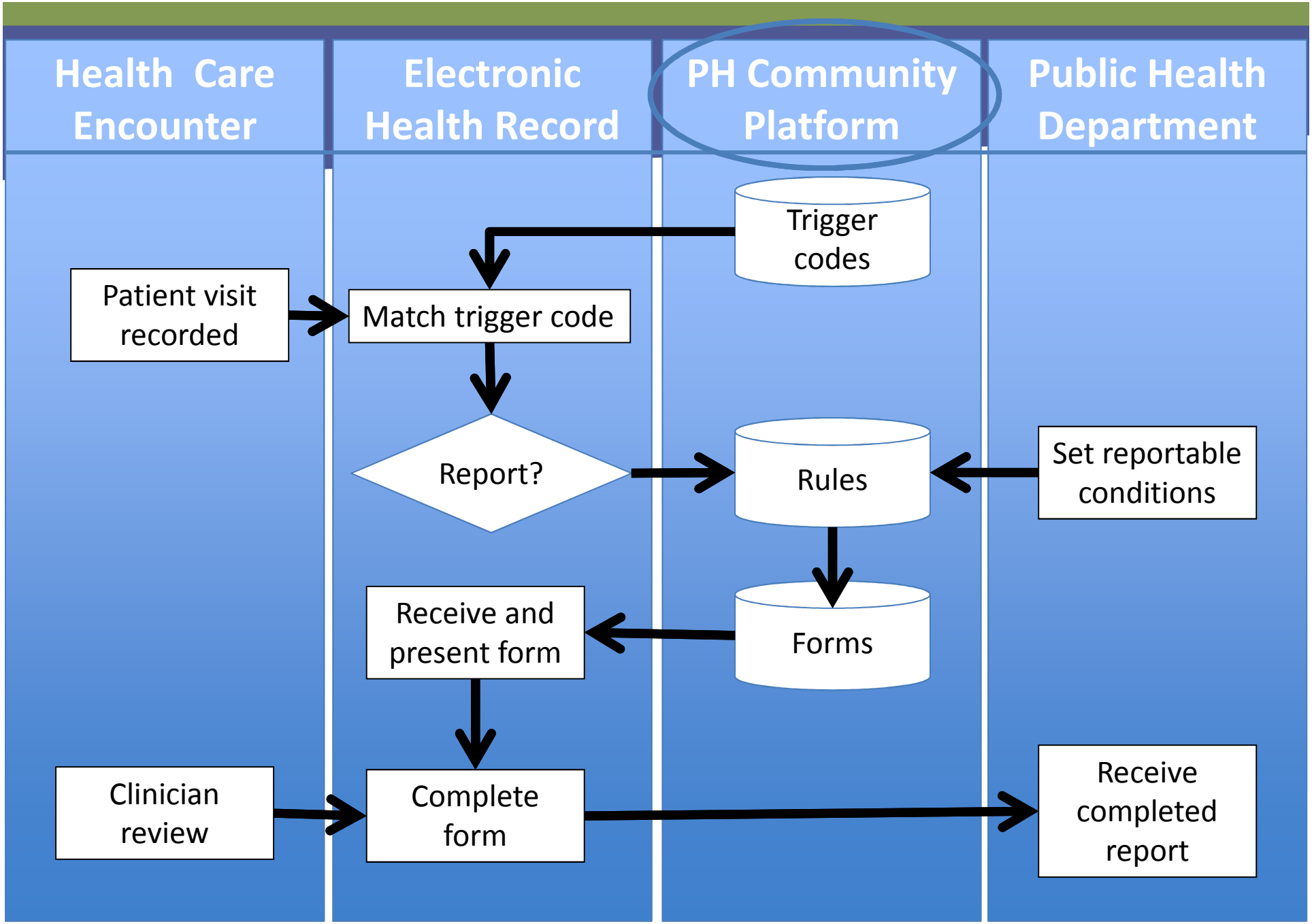

https://drive.google.com/file/d/0BzEl7x_8ybJ5YVJWX0xjdi1xWDg/view?usp=drive_web&pli=1

Summary

- 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 1st President – it's complicated and not always what we envision

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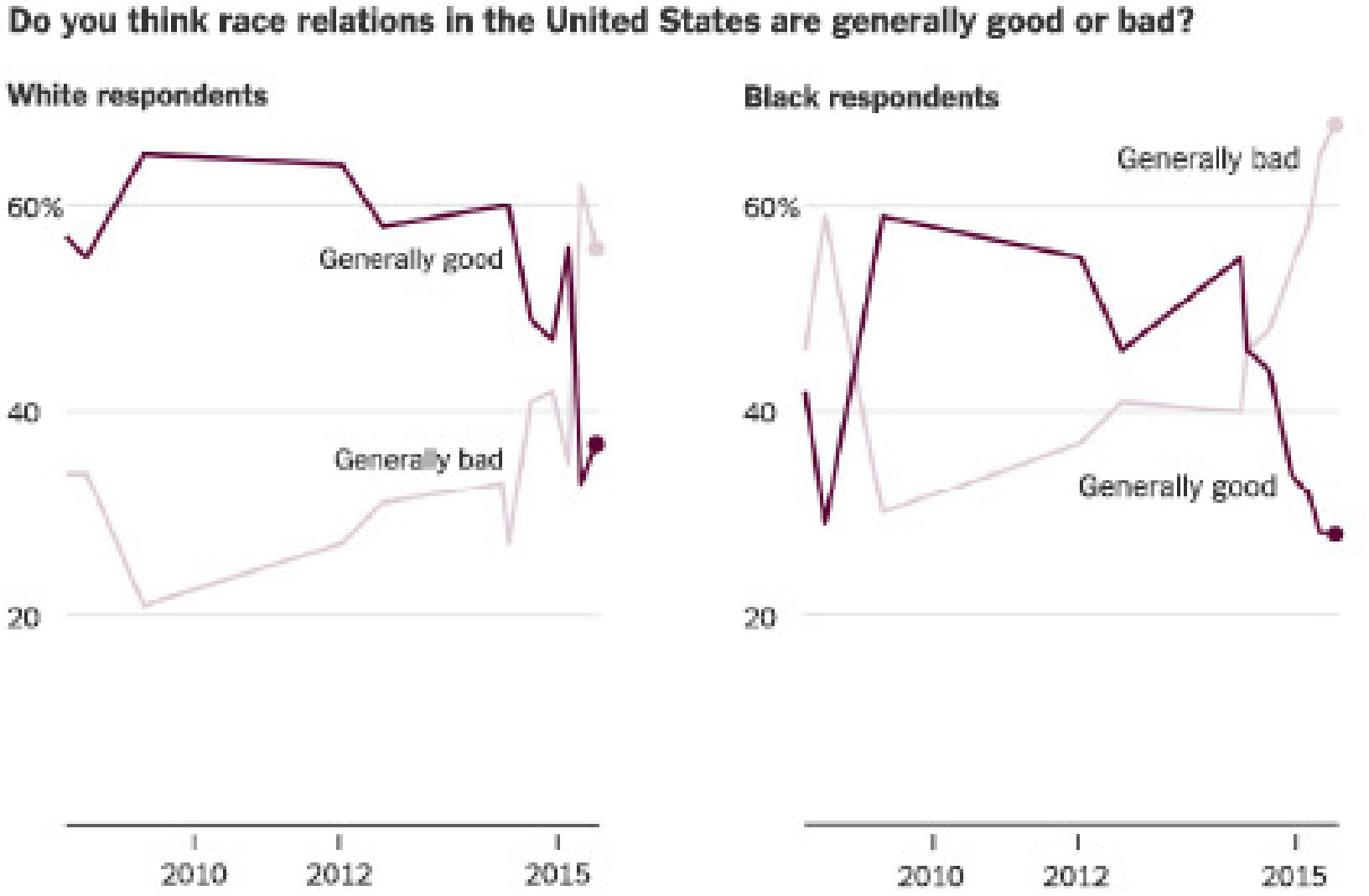
Are we there yet?



New York Times/CBS Poll , July 2015

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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)

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