

Moving Toward Population Health & Wellness

APPLYING THE ANALYTICS CAPABILITY CURVE

**Uma Ahluwalia, Director
Department of Health and Human Services
Montgomery County, Maryland**

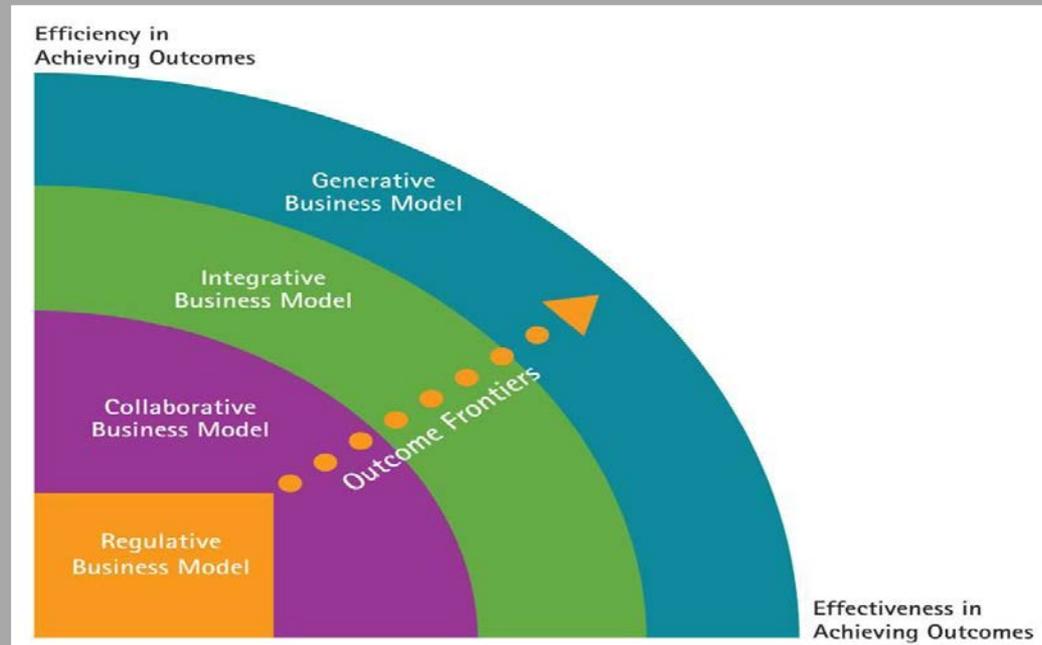
**Megan Lape, Program Manager
National Workgroup on Integration, APHSA**



September 30,
2014

Where Are We Now & Where Are We Going?

HUMAN SERVICES VALUE CURVE



Antonio M. Oftelie. *The Pursuit of Outcomes: Leadership Lessons and Insights on Transforming Human Services: A Report from the 2011 Human Services Summit on the Campus of Harvard University*. Leadership for a Networked World. 2011

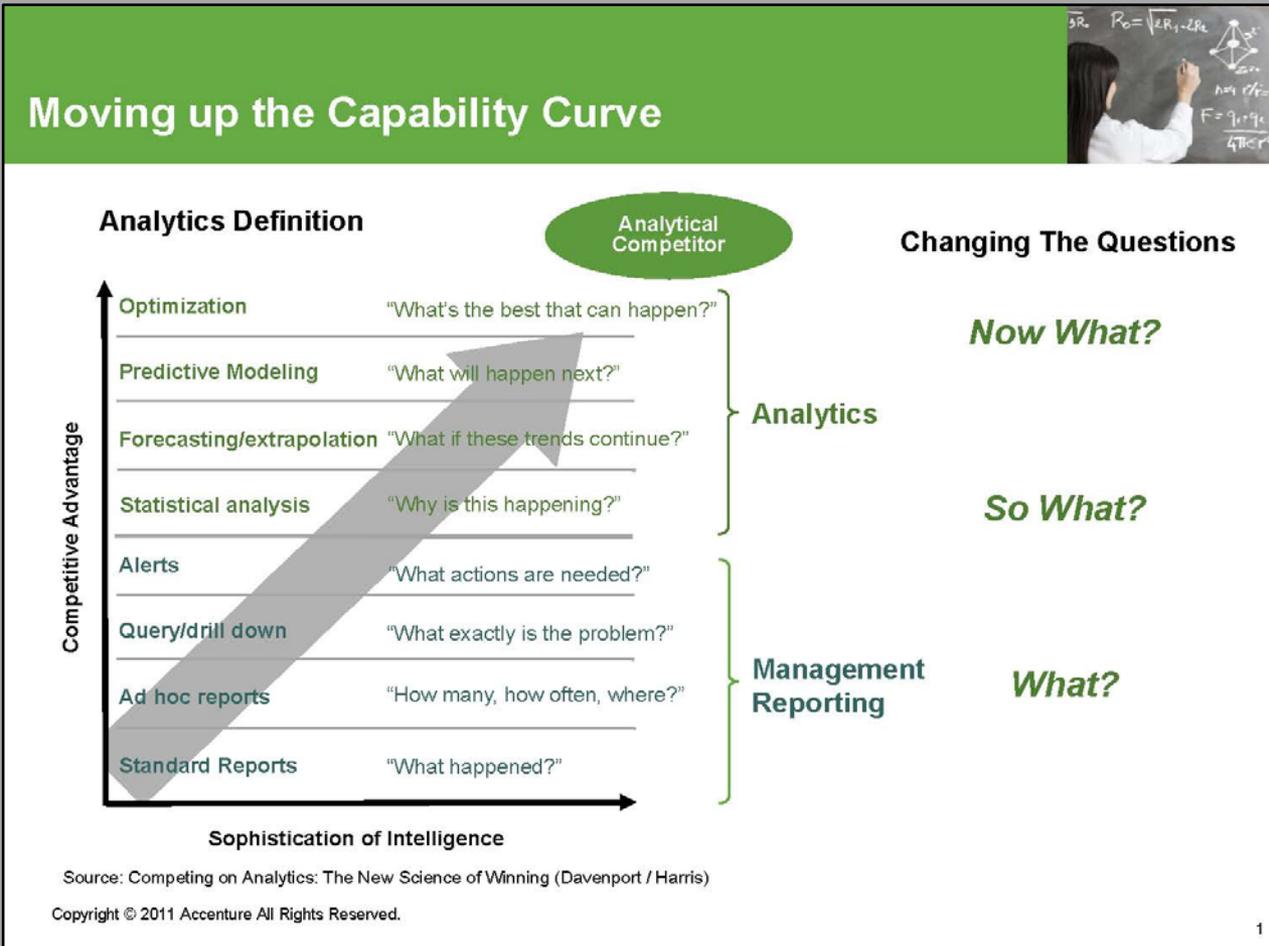
Using Analytics to Get There

Analytic Capability Roadmap 1.0 for Human Service Agencies

Key Features:

- *Types of Analytics*
- *Human Services Capability
Assessment Model*
- *Strategies for Analytic Preparation
& Capacity Building*

THE ANALYTICS CAPABILITY CURVE



Operationalizing the Curve

- **Capability Assessment Model is a Maturity Model**
- **Consists of:**
 - **3 Levels of Maturity: *Basic, Advanced & Leading***
 - **8 Domains: Descriptive Analytics (*Standard Reporting, Random Reporting, Focused Reporting, Automated Alerts*) and Advanced Analytics (*Statistical Analytics, Forecasting & Extrapolation, Predictive Modeling, Optimization*)**

What is the Human Services Capability Assessment Model (CAM)?

Human Services Capability Assessment Model

| Domain | Basic | Advanced | Leading |
|---------------------------|---|---|--|
| Standard Reporting | -Formats suitable for federal reporting -Delivered quarterly | -Formats for federal reporting AND Key Program Indicators (KPI) - Delivered via the web at least monthly | -Formats for federal reporting, KPI AND geographic segmentation -Delivered via the web at least weekly. |
| Random Reporting | -Basic query | -Complex query -Use multiple sources of data | -Joined, multiple complex queries -Use multiple sources of data |
| Focused Reporting | -Specific users are licensed to conduct analysis | -Key supervisory decision makers are licensed to conduct analysis | Staff administering program are licensed to conduct analysis |
| Automated Alerts | -Batch runs -Manual review and application | -Batch runs or real time -Automated review and application | -Multiple, real time alerts -Automated review and application |

CAM Continued...

| Domain | Basic | Advanced | Leading |
|--------------------------------------|---|--|---|
| Statistical Analysis | <ul style="list-style-type: none"> -Structured data -Comparative analysis -Clearly defined sources | <ul style="list-style-type: none"> -Structured data -Comparative and trend analysis -Clearly defined sources -Results reviewed by statistician | <ul style="list-style-type: none"> -Structured and unstructured data -Comparative and trend analysis -Results reviewed/verified by statistician or data scientist |
| Forecasting and Extrapolation | <ul style="list-style-type: none"> -Linear extrapolation -Based on recent available historic data | <ul style="list-style-type: none"> -Linear and possibly multi-variant models -Based on recent, available historic data | <ul style="list-style-type: none"> -Multi-variant models -Based on recent, available historic & current data -Extrapolated forecast |
| Predictive Modeling | <ul style="list-style-type: none"> -Not used | <ul style="list-style-type: none"> -Uni-variant or multi-variant model -Linear extrapolation (e.g., predicting behavior for one question) | <ul style="list-style-type: none"> -Uni-variant or multi-variant models -Iterative regression analysis used to develop statistical probabilities (aka predictive analytic models) |
| Optimization | <ul style="list-style-type: none"> -Not used | <ul style="list-style-type: none"> -Using predictive models (see above) to achieve specified outcomes -Single or multiple variables applied to the predictive models | <ul style="list-style-type: none"> -Using predictive models to answer “what if” questions relative to the outcome -Multiple variables applied to predictive models |

Considerations for Using Analytics



➤ *Governance & Management Structure*



➤ *Cleanliness of Data*



➤ *Data Transparency*



➤ *Inaccuracies in Data Collection*

What's Next?

- **Analytics Roadmap 2.0**
- **Confidentiality & privacy barriers**

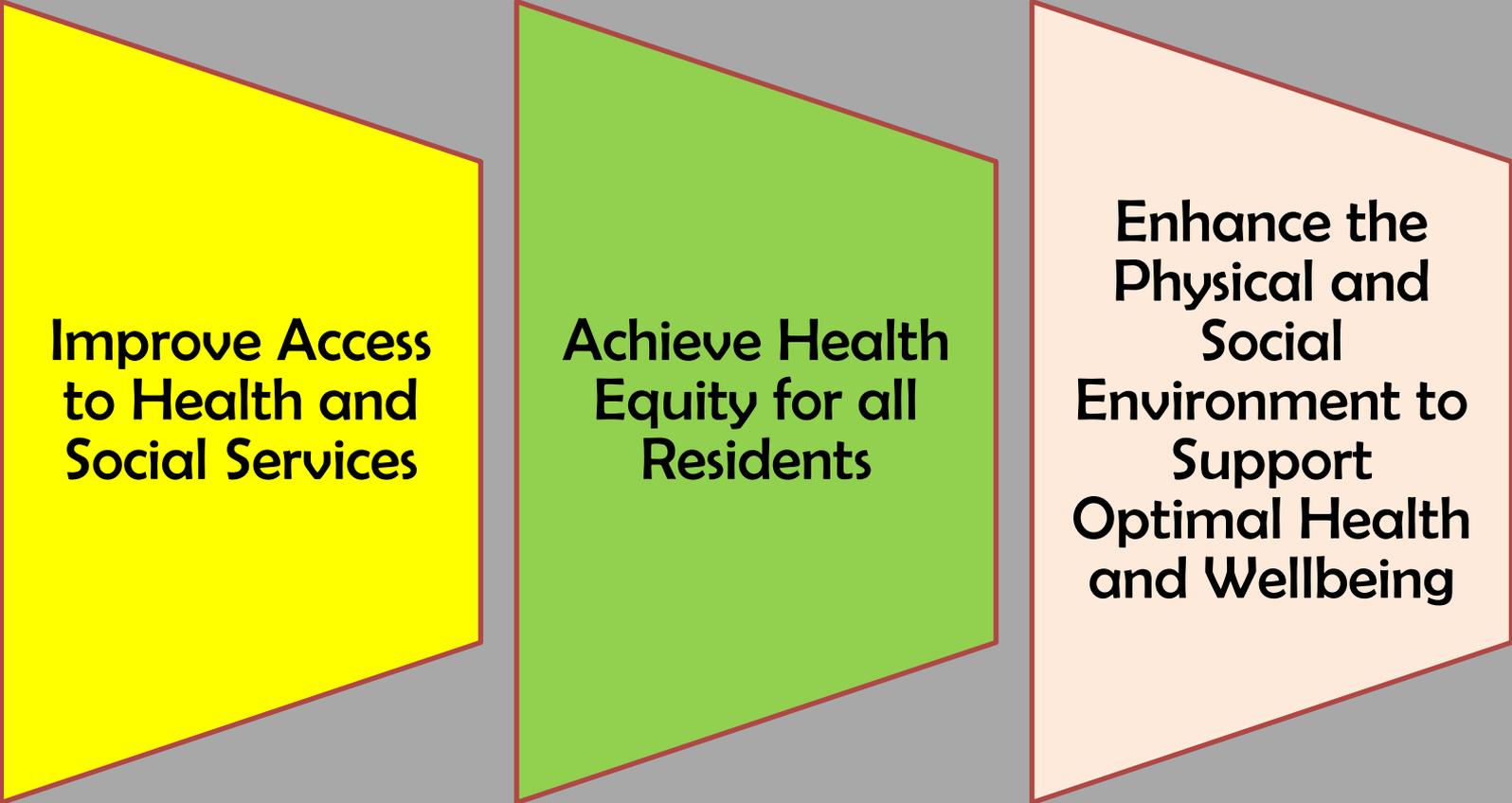
Thank you!

Megan Lape, Program Manager
National Workgroup on Integration
APHSA

mlape@aphsa.org

THE ANALYTICS VALUE CURVE AND THE MCDHHS

**COMMUNITY HEALTH AND HUMAN SERVICES
NEEDS ASSESSMENT JOURNEY – MOVING FROM
STANDARD REPORTS TO OPTIMIZATION**

The image features three chevron-shaped boxes arranged horizontally. The first box on the left is yellow and contains the text 'Improve Access to Health and Social Services'. The middle box is green and contains 'Achieve Health Equity for all Residents'. The third box on the right is light orange and contains 'Enhance the Physical and Social Environment to Support Optimal Health and Wellbeing'. All boxes have a thin red border.

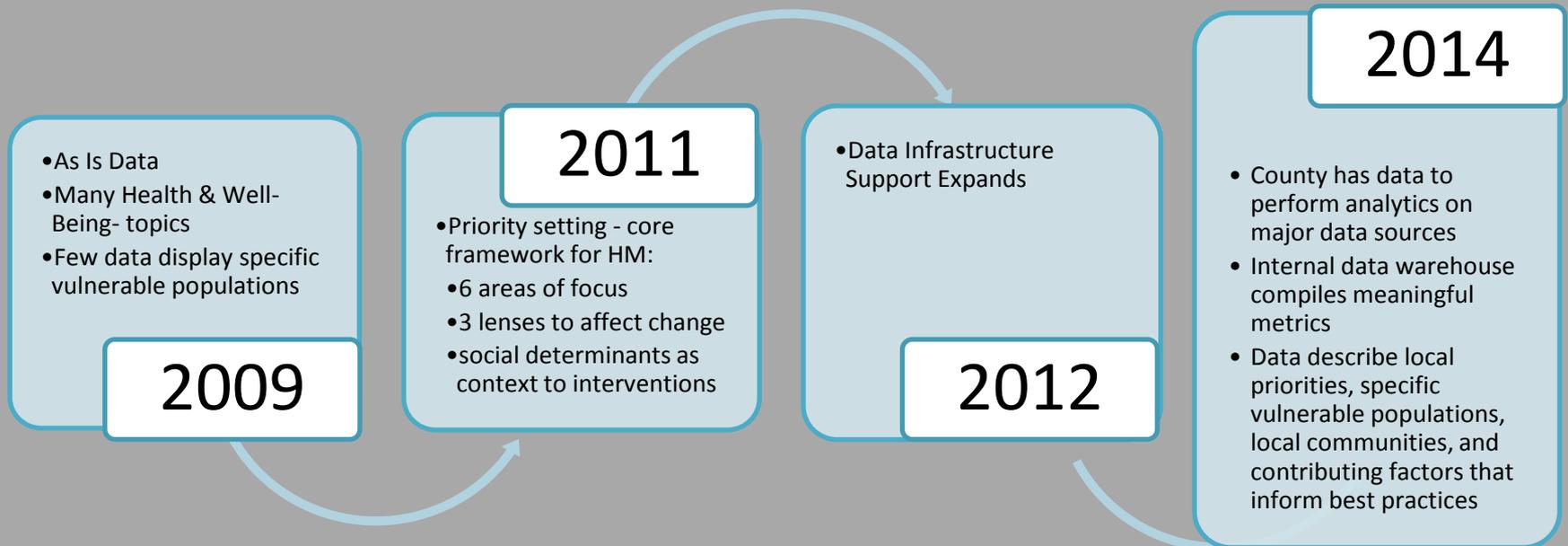
**Improve Access
to Health and
Social Services**

**Achieve Health
Equity for all
Residents**

**Enhance the
Physical and
Social
Environment to
Support
Optimal Health
and Wellbeing**

Three Key Goals of Healthy Montgomery

Healthy Montgomery Data Matured Over Time



2009 Identified 100 Indicator Topics

Social Determinants Of Health: 39 Indicators

- Economy (15)
- Education/Social Environment (11)
- Environment (7)
- Transportation (6)

Health & Well-Being: 61 Indicators

- Access to Quality Health Services (6)
- Chronic Diseases (20)
- Communicable Diseases/ Immunizations (7)
- Family Planning (1)
- Injury & Violence Prevention (5)
- Maternal, Infant & Child Health (8)
- Mental Health (3)
- Nutrition, Phys. Activity, & Weight (4)
- Oral Health (0)
- Substance Abuse & Tobacco Use (7)

- As Is Data
- Many Health & Well-Being-topics,
- Few data display specific vulnerable populations

2009

Healthy Montgomery Establishes Focus

Priority Areas

- Behavioral Health
- Cancers
- Cardiovascular Disease
- Diabetes
- Maternal and Infant Health
- Obesity

Lenses to Frame Action

- Health Inequities
- Lack of Access
- Unhealthy Behaviors

2011

- Priority setting - core framework for HM:
- 6 areas of focus
- 3 lenses to affect change
- social determinants as context to interventions

HM Priorities and Considerations

Cancers

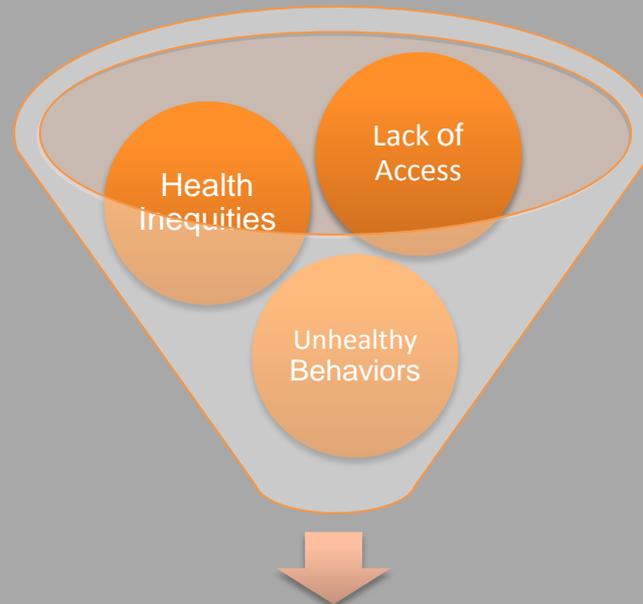
Cardiovascular
Disease

Diabetes

Obesity

Behavioral
Health

Maternal &
Infant Health



Healthy Montgomery Data Infrastructure Expands

Primary data feeds now at MCDHHS to build/adapt metrics:

- Mortality
- Natality
- Inpatient visits
- Emergency room visits
- US Census Population
- American Community Survey
- Youth Risk Behavior Survey

Analytic Capacity

- Hardware
 - secure storage for data feeds
- Software
 - SAS and SPSS
- Technical Expertise
 - ICD-9-CM
 - ICD-10
 - Clinical Classification
 - Demography
 - GIS
- Technical Assistance
 - IT
 - State Data Owners
 - Hospitals

2012

Infrastructure Improvements

Preparing for Next Needs Assessment

- First HM Needs Assessment - September 2011
- Community Health Needs Assessment (CHNA) requirements (HSCRC/IRS) for hospitals- update hospital CHNAs every 3 years
- HM Data Project Team - researching /compiling new data sources that have come online since 2011 to consider for inclusion (ACS, YTRBS, WIC, others)

Preparing for Next Needs Assessment - Continued

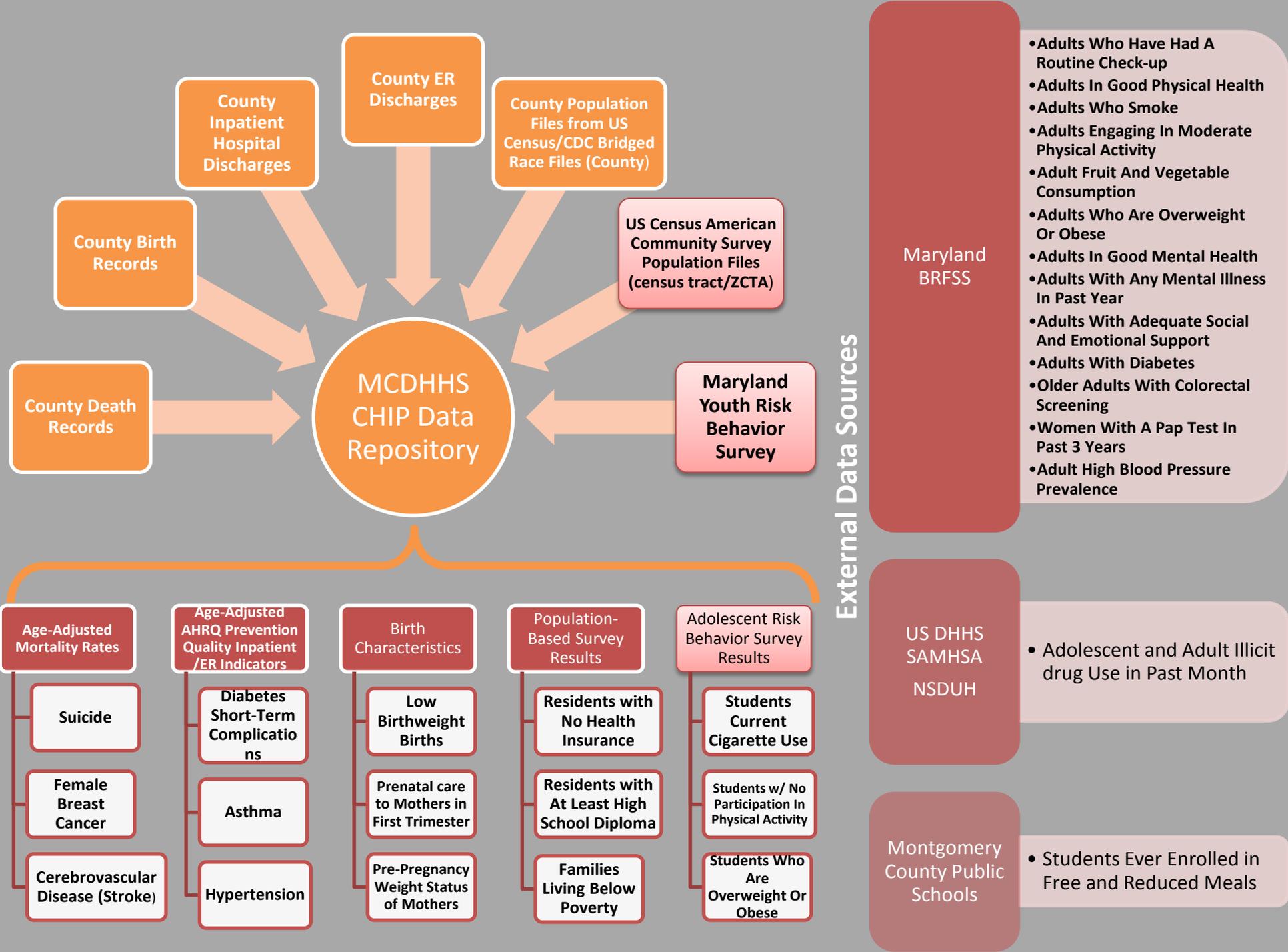
- HM Core Measures Set under development installs a hierarchy of core required (1st tier dashboard) indicators; decisions on remaining (2nd tier) indicators will be made after core measures are finalized
- HM website (Community Dashboard) offers ~100 indicators supported under HHS contract- additional indicators need additional support locally to maintain contents (accuracy, timeliness of data updates, etc.)

| Data Source Name | Acronym | Periodicity | Population Subgroups | | | | | | Sub-geography Subgroups | | | | | |
|--|--------------------------|--|----------------------|------|-----------|-----|--------|-----------|-------------------------|-------|--------|----------|----------------|----------------|
| | | | Gender | Race | Ethnicity | Age | Income | Education | National | State | County | Zip Code | Census Tract | Other |
| Maryland Behavioral Risk Factor Surveillance System | MD BRFSS | Annual- Core module Biannual-Optional modules | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| Maryland Births | MD VSA Births | Annual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ ¹ |
| Maryland Deaths | MD VSA Deaths | Annual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ ¹ |
| Maryland Youth Tobacco and Risk Behavior Survey | MD YTRBS | Biannual | ✓ | ✓ | ✓ | ✓ | ✗ | n/a | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| Maryland Healthcare Services Cost Review Commission Inpatient Discharges | MD HSCRC Inpatient | Annual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ |
| Maryland Healthcare Services Cost Review Commission ER Discharges | MD HSCRC ER | Annual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ |
| National Cancer Institute SEER | NCI SEER | Annual | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| National Survey on Drug Use and Health | SAMHSA NSDUH | Annual | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| U.S. Census American Communities Survey | ACS | Annual | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ ² | ✗ |
| Montgomery County Public Schools – School at a Glance | MCPS Schools at a Glance | Annual | ✓ | ✓ | ✓ | ✓ | ✗ | n/a | ✗ | ✗ | ✓ | ✗ | ✗ | ✓ ³ |

1. With street address can assign other geographies based on street address (planning area, transportation zone, school enrollment boundaries, etc.)

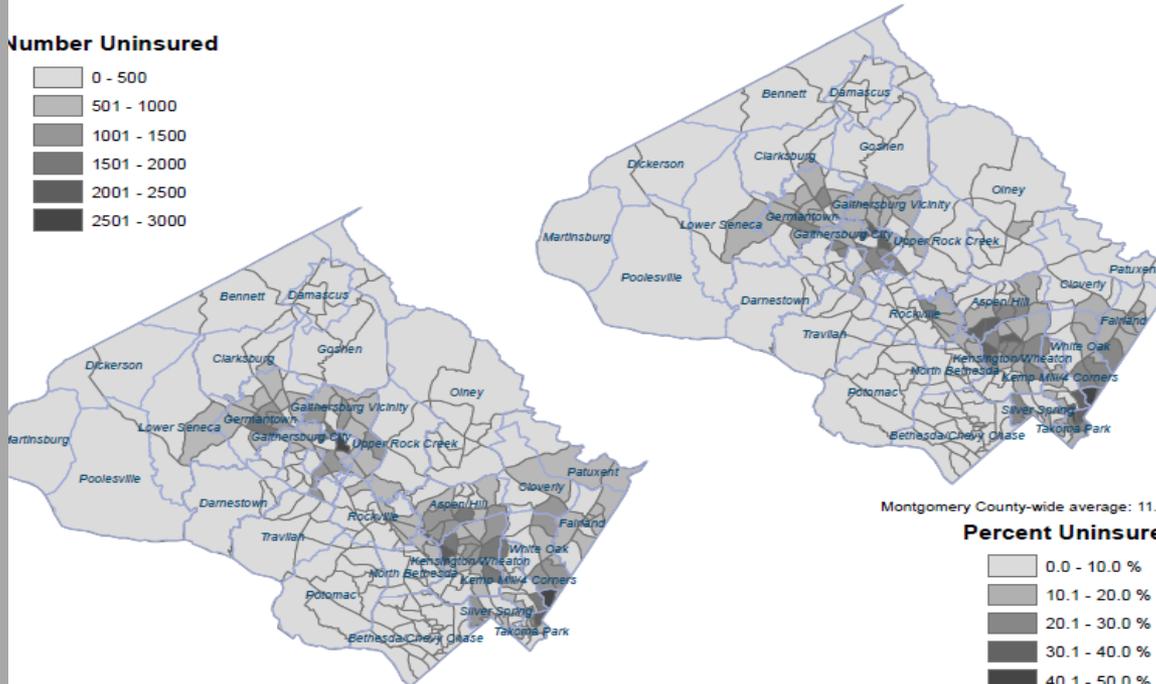
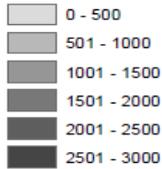
2. Zip code tabulation area (ZCTA) – not always equivalent to zip code.

3. School enrollment area; elementary, middle, and senior high schools.



Montgomery County Residents that Lack Health Insurance By Census Tract, American Community Survey 2008-2012

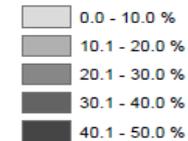
Number Uninsured



Montgomery County-wide annual estimate: 113,918

Montgomery County-wide average: 11.3%

Percent Uninsured



Uninsured Residents in Montgomery County

2008-2012 American Community Survey 5-Year Estimates.
Montgomery County, Table No. S2701.

Preparation for 2015 Healthy Montgomery Needs Assessment

2014

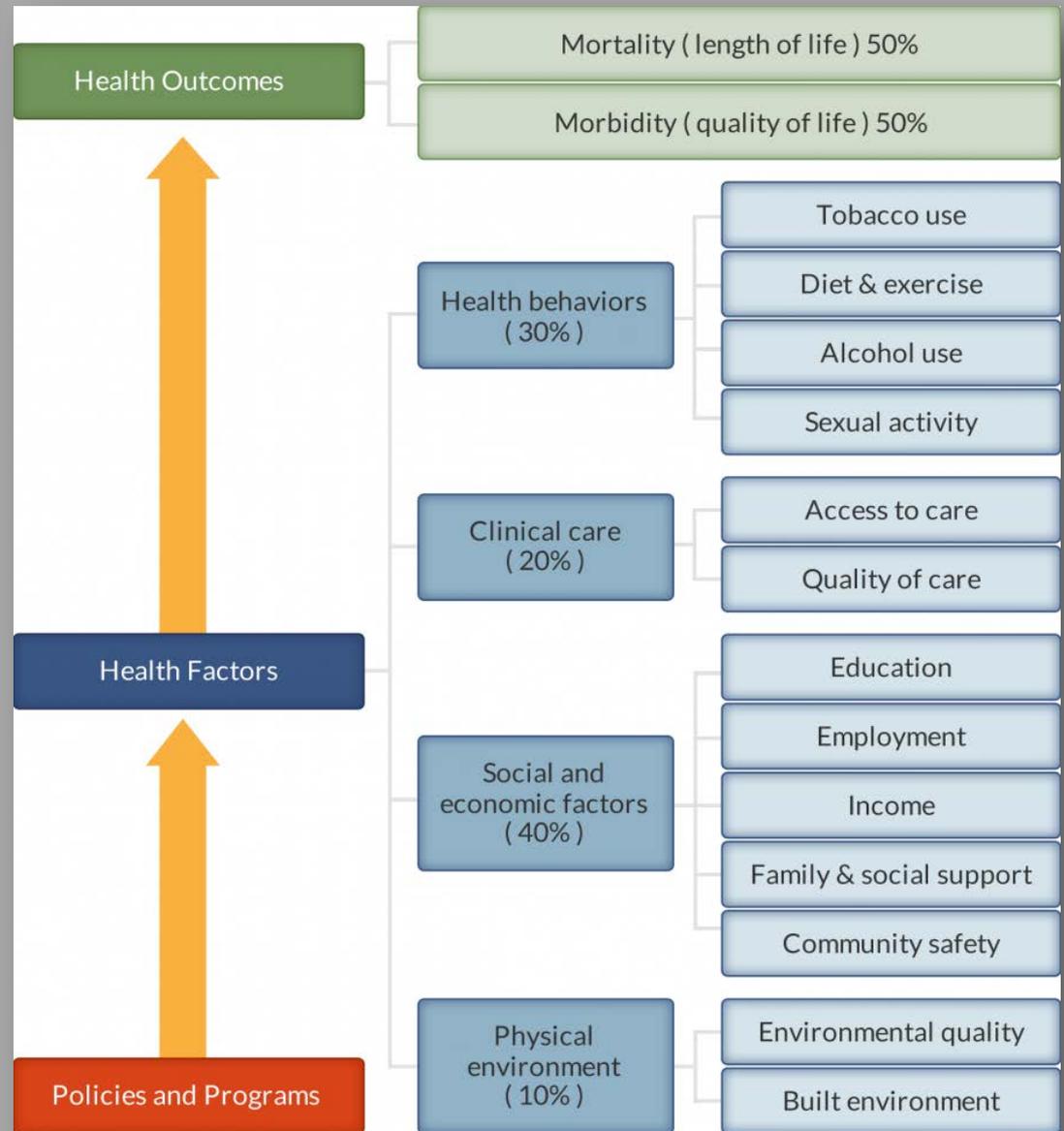
- Data feeds to MCDHHS
- Internal data warehouse
- MCDHHS measures local priorities, specific vulnerable populations, local communities, and contributing factors to inform and evaluate best practices

- Revisited how data and metrics are applied to decision-making
- New criteria to select metrics:
 - ❖ Comply with the County Health Rankings Construct
 - ❖ Demonstrate County needs improvement
 - ❖ Captures issue that County has ability to address
 - ❖ Captures disparities or inequities among comparison groups
 - ❖ Useful to hospital community benefit reporting
 - ❖ Supports 6 areas of focus., 3 lenses to affect change, and/or the context of the community

County Health Rankings Construct

Healthy Montgomery Measures align with CHR types of community indicators:

- Health behaviors,
- Clinical care (access to care),
- Social and economic factors (context/social determinants of health),
- Physical environment, or
- health outcomes



Core Measures Selection Process

Team of local data experts (from cross-section of public and private organizations) developed and applied criteria to 150+ measures (existing and new) to create the Healthy Montgomery dashboard.

37 measures were selected and adopted by the Healthy Montgomery Steering Committee to inform next Needs Assessment to be completed in 2015.



Core Measures Set

Behavioral Health

- Adolescent and Adult Illicit drug Use in Past Month
- Adults with Any Mental Illness in Past year
- ER Visits for Behavioral Health Conditions
- Suicide

Cancers

- Colorectal screening
- Pap in past 3 years
- Prostate cancer incidence
- Breast cancer mortality

Cardiovascular Health

- Heart disease mortality
- Stroke mortality
- High blood pressure prevalence

Cross-Cutting Measures

- Adults who have had a routine check-up
- Persons without health insurance
- Adults in Good Physical Health
- Adults in Good Mental Health
- Students in Good General Health
- Students ever feeling sad or hopeless in past year
- Adults who smoke
- Students current cigarette use
- Adults engaging in moderate physical activity
- Adult fruit and vegetable consumption
- Adults who are overweight or obese
- Students with no participation in physical activity
- Students who drank no soda or pop in the past week
- Students who are overweight or obese

Diabetes

- Adults with diabetes
- ER visits for diabetes

Maternal & Infant Health

- Mothers who received early prenatal care
- Infant mortality
- Babies with low birthweight

Obesity

See Highlighted Cross-Cutting Measures

Context Measures (SDOH)

- Families Living Below Poverty Level
- Residents 5+ years old that report speaking English "not very well"
- Students ever receiving Free And Reduced-price Meals (FARMS)
- Adults with Adequate Social and Emotional Support
- Students who could talk to adult besides a parent
- Student participation in extracurricular activities
- High School Completion Rate

WHERE ARE WE ON THE CAPABILITY CURVE – We are doing this right now:

STATISTICAL ANALYSIS

- Structured data are analyzed
- Sources of all data are clearly identified, defined and explained
- Multi-period structured data are used to describe trends
- Advanced statistical methods are used and conclusions are reviewed and verified by a data scientist

FORECASTING AND EXTRAPOLATION

- Utilization forecasting is based on most recent historical data available
- Dynamic forecasting is used between two more interrelated variables and
- Multi-variant models are developed, monitored and modified as necessary and the most current data is used.

PREDICTIVE MODELING

- Currently using skills around forecasting and predictive modeling algorithms to strengthen our health care delivery system – towards achieving community based Triple Aim outcomes of –
 - Improved Patient Experience
 - Reduced Costs
 - Improving the Health of the Population

Maryland
Hospital
Waiver

Hospital
Payment
Reform

Affordable
Care Act

Triple Aim

Patient
Centered
Medical Home

Behavioral
Health
Integration

Aging in Place

Advancing a
Prevention
Agenda

Community
Benefit Efforts

Key Drivers

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Thank You!

The Digital Transformation of Medicine

“The role of informatics, electronic medical records, data warehouses, genomics, predictive modeling and health information exchange in that transformation.”

**Marshall Ruffin, MD, EVP & CTO, Inova and
Chairman, HITSAC of Virginia**

September 30,
2014

Key Questions

- What is the digital transformation of medicine?
- How can we use the digital transformation of medicine to improve our lives?
- What role does analysis of data play?
- What sources of data can we use?
- What pilots of analysis can we do?
- What does Government need to do?

The Creative Destruction of Medicine: **How the Digital Revolution Will Create Better Health Care**

- **Eric Topol, MD, published by Basic, 2011**
– **Scripps Research Foundation**
- **Digital medicine and genetic medicine**
- **EMRs, genetics, big data**
- **Move from population medicine to personalized, individualized medicine**
- **Patients more active in their care**
- **Physicians as advisers & interpreters**

The Second Machine Age: *Work, Progress and Prosperity in a Time of Brilliant Technologies*

- **Erik Brynjolfsson and Andrew McAfee**
 - MIT Professors, published by Norton, 2014
- **The first machine age**
 - Steam and internal combustion engines
- **The digital information revolution**
 - Digitization, exponential, combinatorial
- **The second machine age**
 - Computers, big data, predictive models, robots, intelligent and autonomous devices

Analog to Digital Comparison

Analog

Digital

| | |
|---|---|
| Information in atoms | Information in bytes |
| Information has weight | Information weightless |
| Moves at courier speed | Moves at light speed |
| In one location at a time | In multiple locations simultaneously |
| Storage, sorting and retrieval expensive and slow | Storage, sorting and retrieval cheap and fast |
| Data collection idiosyncratic | Data collection standardized |
| Retrospective analysis for knowledge creation is expensive, unreliable and infrequent | Retrospective analysis for knowledge creation is inexpensive, reliable, frequent and indispensable. |

What's Coming Tomorrow

- “Computers doubled in speed every three years at the beginning of the twentieth century, every two years in the 1950s and 1960s, and are now doubling in speed every twelve months. This trend will continue, with computers achieving the memory capacity and computing speed of the human brain by around the year 2020.”
 - Ray Kurzweil, The Age of Spiritual Machines, 1999

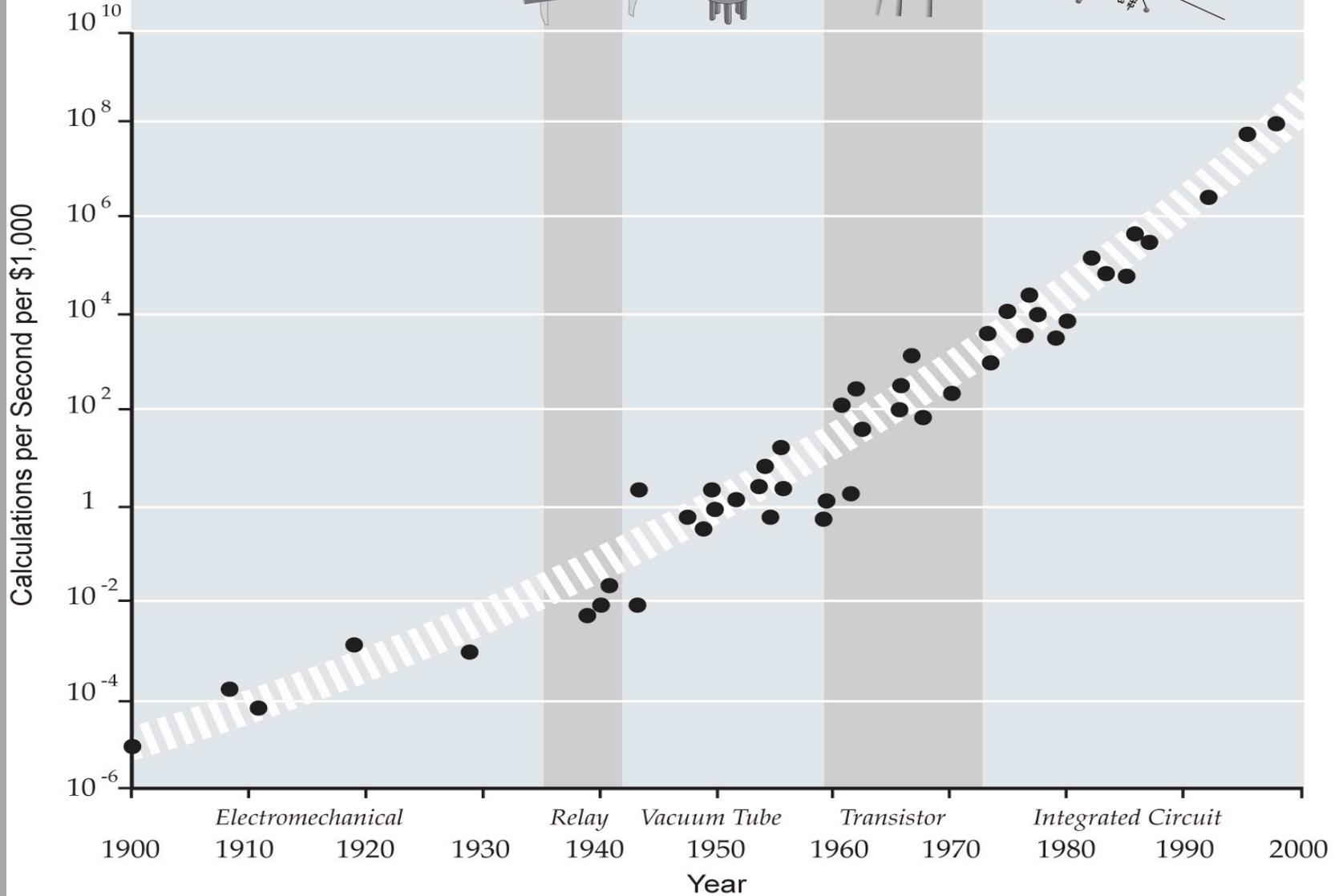
The Law of Accelerating Returns

- “An analysis of the history of technology shows that technological change is exponential, contrary to the common-sense "intuitive linear" view. So we won't experience 100 years of progress in the 21st century - - it will be more like 20,000 years of progress (at today's rate). The "returns," such as chip speed and cost-effectiveness, also increase exponentially. There's even exponential growth in the rate of exponential growth. Within a few decades, machine intelligence will surpass human intelligence, leading to The Singularity -- technological change so rapid and profound it represents a rupture in the fabric of human history.”
 - Ray Kurzweil, PhD, The Singularity Is Near, 2006

Moore's Law

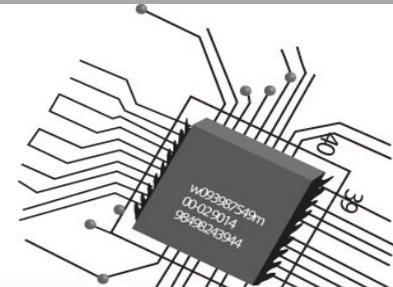
The Fifth Paradigm

Logarithmic Plot

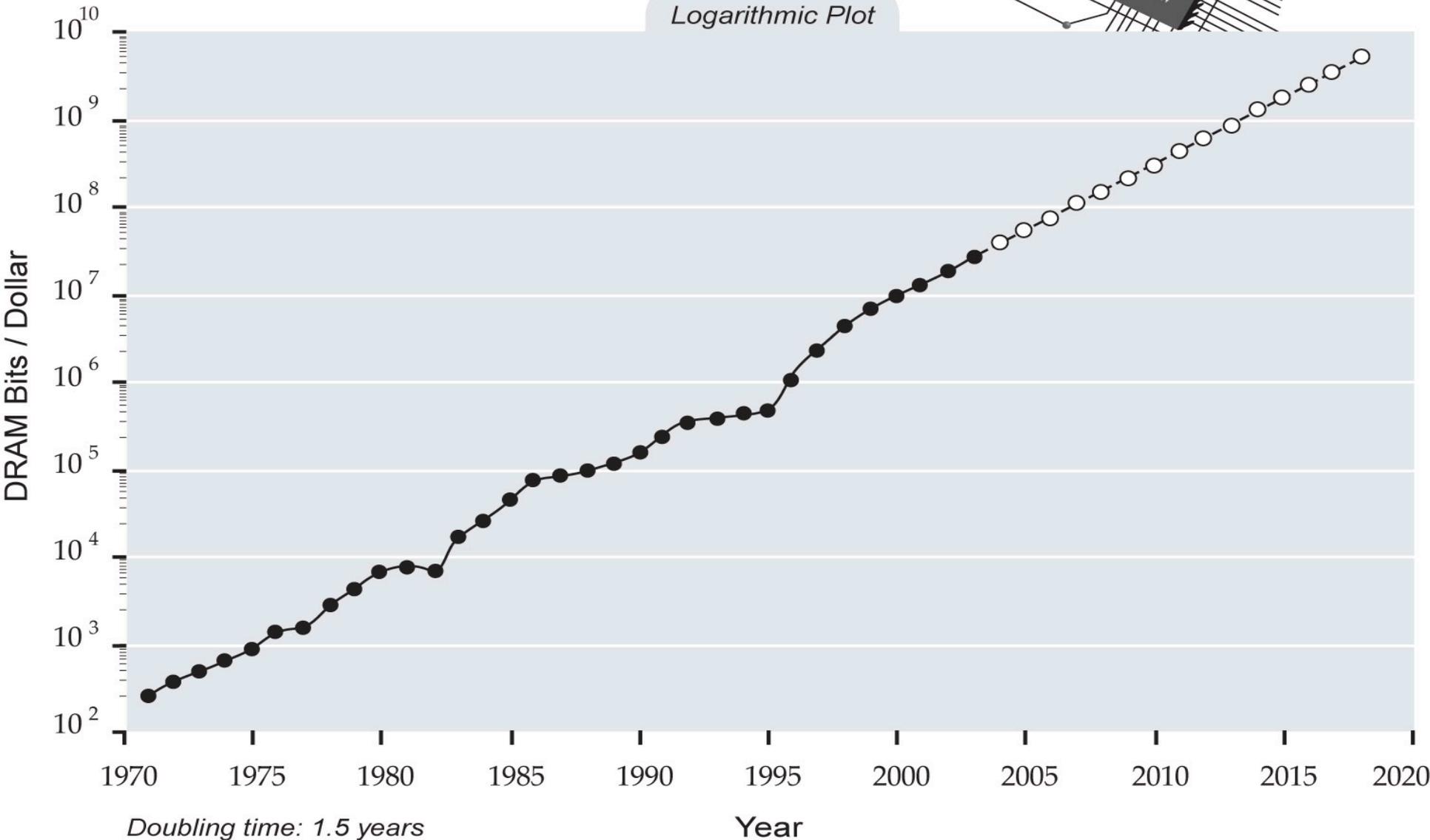


Dynamic RAM Price

Bits per Dollar at Production
(Packaged Dollars)



Logarithmic Plot



Doubling time: 1.5 years

Note that DRAM speeds have increased during this period.

Goal of Big Data: Predict the Future

- **Measure**
 - Standardized measurements
- **Data**
 - Descriptive Statistics (mean, median, etc.)
- **Information**
 - Comparative Statistics (significance testing, etc.)
- **Knowledge**
 - Relational Statistics (correlation, regression)
- **Wisdom**
 - Predictive models – machine learning (neural nets, genetic algorithms)

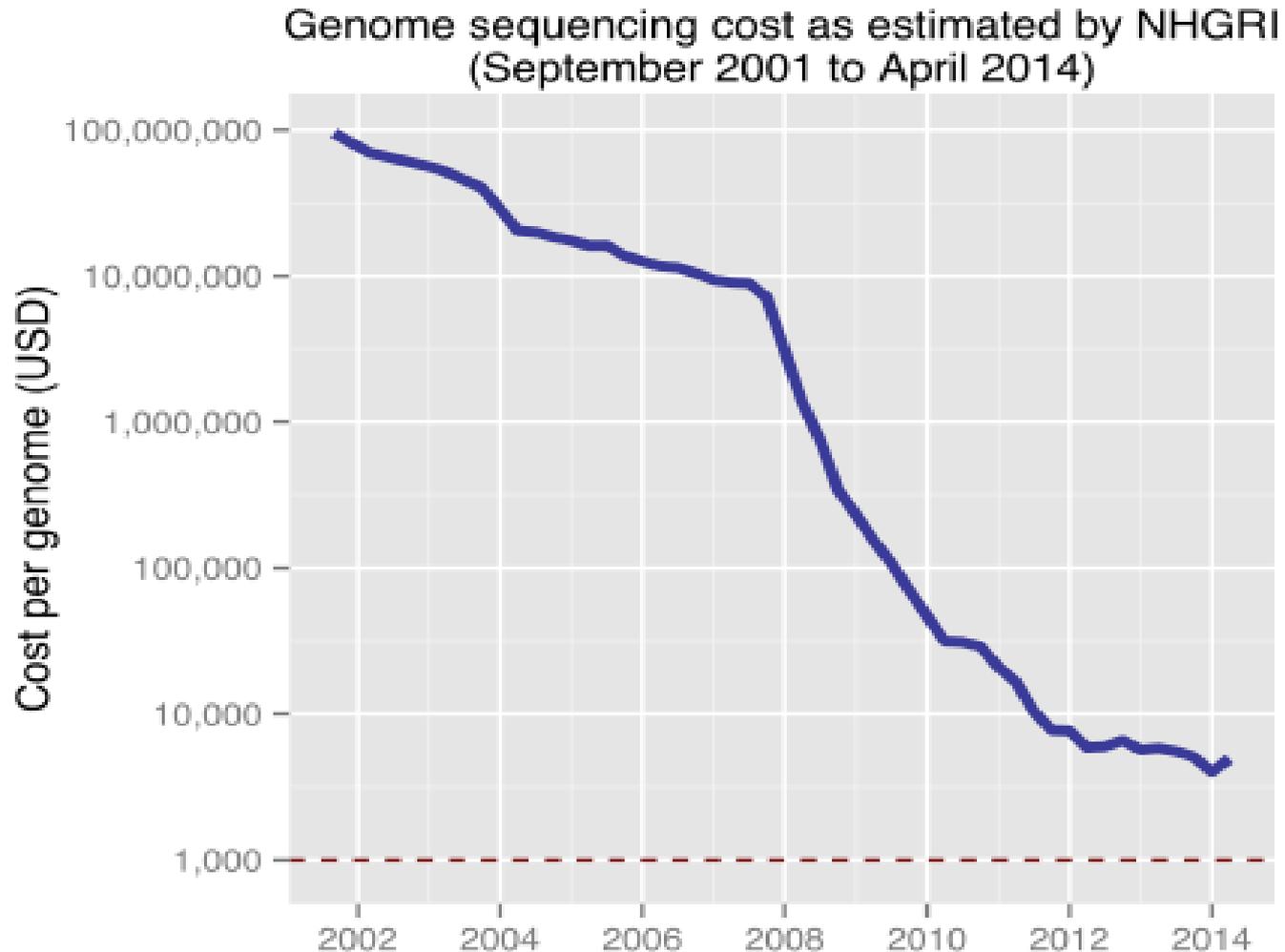
Predicting the Future Creates Wealth for Society

- We can prevent predictable bad outcomes and we can promote predictable good outcomes
- Predicting and preparing for weather
- Predicting and preventing injuries and chronic diseases
- Predicting and producing salutary treatments and beneficial effects

Life Is Digital

- **“It is simply not worth arguing with anyone so obtuse as not to realize that this complex of discoveries (molecular genetics) is the greatest achievement of science in the twentieth century.”**
 - Peter Medawar, 1960 Nobel Prize in Physiology or Medicine
- **Referring to the discovery of the double helix and the digital nature of inheritance.**
 - **Electronic digital:**
 - 8 bits (two states each - on or off) = one character (256 choices)
 - **Genetic digital:**
 - 3 bases (4 states each – A, C, G or T = one amino acid (64 choices)
 - Adenine, Cytosine, Guanine, Thymine (or Uracil)

Whole Genome Sequencing Costs by Year



Moore's Law and Genetics

- **Cost of sequencing DNA (\$/base pair) plummeting FASTER than anything in history**
 - There are 3 billion base pairs in a human genome
 - Year \$/base pair
 - 1965 \$2,000
 - 1975 \$20
 - 1985 \$5
 - 1995 \$1
 - 2000 \$0.20
 - 2010 \$0.000001
 - In 2010, sequencing one human genome costs \$3,000
 - 2020 \$0.0000001
 - In 2020, sequencing one human genome will cost \$300

Societal Effect

- "A complete DNA read-out for every newborn will be technically feasible and affordable in less than five years, promising a revolution in healthcare" and that "by 2019 it will have become routine to map infants' genes when they are born".
– Jay Flatley, CEO of Illumina, 2009

Examples

- Epic
- Capsule Tech
- Medical Predictive Science Corporation
- Explorys
- Predilytics
- Illumina
- Inova Translational Medicine Institute
- HITSAC
- ConnectVirginia

Example: Epic

- **Founded in 1979**
- **Judy Faulkner created Chronicles database**
- **All applications use single database**
- **Growing rapidly**
 - **50% of Americans have active Epic EMR**
 - **In 8 countries**
- **Will never acquire another company, never be sold, never go public**

Example: Epic

- **Uses a single database – Chronicles**
 - Built on Cache from InterSystems
- **Forms for structured data**
- **Enterprise data warehouse – Cogito**
 - Star schema and de-normalized
- **Integration with Business Objects**
 - Registries, Universes, Dashboards
- **Benchmarking and Profiling Services**

Example: Capsule

- Device that takes signals from physiological monitors and sends them to the EMR as structured data
- Collect vital signs, heart rhythm, ventilator settings, dialysis data, infusion pumps, etc.
- Inova installed > 3,000 Capsule devices

Predict Sepsis by Heart Rate

- **University of Virginia research**
 - Randall Moorman, MD, et al.
- **Medical Predictive Science Corporation**
- **Decline in heart rate variability predicts sepsis in neonates**
 - HeRO score
- **Significant (>20%) reduction in neonatal mortality when HeRO score was monitored in the NICU**
 - finding of a large randomized trial

Example: Explorys

- Born in the Cleveland Clinic
- “Big data analytics” for population health management
- Provide enterprise data warehousing primarily for provider organizations.
- Incorporate data from providers and payers across continuum of care.
- Predictive analytics

Example: Predilytics

- Population Health Management for health plans and defined populations
- Predictive models of clinical outcomes
- Genetic algorithms for predictions
- Integrate “consumer data” from financial services and credit cards
- Works with health plans and providers of care with health plans

Example: Illumina

- Early developer of genetic sequencing machines
- Next generation sequencing platforms dramatically more efficient
- Rapidly sequence whole genomes at “high coverage” (30x)
- Germ line, somatic, microbiologic and cancer cell genomic sequencing
 - Sequencing from 1 gigabase to 1 terabase per run
 - Number of reads from millions to billions

Example: Inova Translational Medicine Institute (ITMI)

- \$150M grant from Inova Health System
- Led by John Niederhuber, MD, former Director of the National Cancer Institute, and Joseph Vockley, PhD, also of the NCI.
- Obtaining complete gene sequences on thousands of people; In one study of premature birth:
 - Preterm infants admitted to Inova Fairfax Hospital NICU
 - Mothers, fathers and grandparents of the preterm infants
 - Infants born full term are controls matched by age, gender, race, etc.
 - Mothers, fathers and grandparents of controls
 - Very diverse population of patients
- Merging those data with laboratory results, medications, demographics for those patients found in Inova's enterprise data warehouse (Epic Cogito) to create predictive models of acute and chronic diseases.

Example: HITSAC

- **HITSAC is an advisory committee appointed by the Information Technology Advisory Council (ITAC). HITSAC is tasked with assisting the ITAC in providing advice to the Commonwealth Chief Information Officer on the utilization of nationally recognized technical and data standards for health information technology (IT) systems or software, pursuant to subdivision A 5 of § 2.2-2699.6 of the Code of Virginia.**

Example: Genomics Working Group of HITSAC

- The HITSAC Genomics Working Group has been established by HITSAC to investigate requirements within the Commonwealth of Virginia for health information technology (IT) standards to support interoperability for the exchange of information in personalized medicine, clinical genomics, genetic research and related bioinformatics.

Example: ConnectVirginia

- The health information exchange of the Commonwealth of Virginia
- Services:
 - Public Health Reporting to Virginia Department of Health
 - Encounter Alerts
 - Assist participating organizations to connect directly to eHealth Exchange.
 - Provider portal for exchange of CCD
 - Prescription Monitoring Program

What Can the Secretaries of HHR and Technology Do?

- **Standardization – break down silos of information between state agencies**
 - Portal and government gateway for all citizens
- **Complete the vision of State Government Gateway and Enterprise Data Governance and the Enterprise Information Architecture (EIA) Strategy for VITA**
- **Expand the vision of eHHR to all agencies**
- **Promote electronic information exchange for patient care using ConnectVirginia**

Support Standardization

- **Support eHHR**
- **Support Commonwealth Data Governance**
- **Support EIA Strategy**
- **Support ConnectVirginia**
- **Support semantic interoperability of all information systems of state government**

Everyone on the Data Bus?

Providing VITA tools to enable data analytics – EDM, SOA, Analytic Rules Engine, Data Stewards

Rich Barnes, Shared Services Manager
Nicole Helmantoler, Enterprise Architect

Virginia Information Technologies Agency

**September 30,
2014**

Virginia's Services Oriented Architecture

**ENTERPRISE DATA MANAGEMENT AND
ENTERPRISE SERVICE BUS**

Enterprise Data Management in Virginia

Is this the same person?

| Name | NPI | DOB | Address 1 | Zip Code | Phone | IRS TIN# |
|-------------------|------------|----------|---------------------------|----------|--------------|-------------|
| Deborah Becker | | 06021964 | 43776 Maison Blanc Square | | 312-334-1012 | |
| Dr. Debbie Becker | 1821125661 | 02-06-64 | 19456 Madison, Suite 207 | 60606 | 312-334-1012 | 454-76-1211 |

Enterprise Data Management in Virginia

Is this the same person?

| Name | NPI | DOB | Address 1 | Zip Code | Phone | IRS TIN# |
|----------------|-----|----------|---------------------------|----------|--------------|----------|
| Deborah Becker | | 06021964 | 43776 Maison Blanc Square | | 312-334-1012 | |

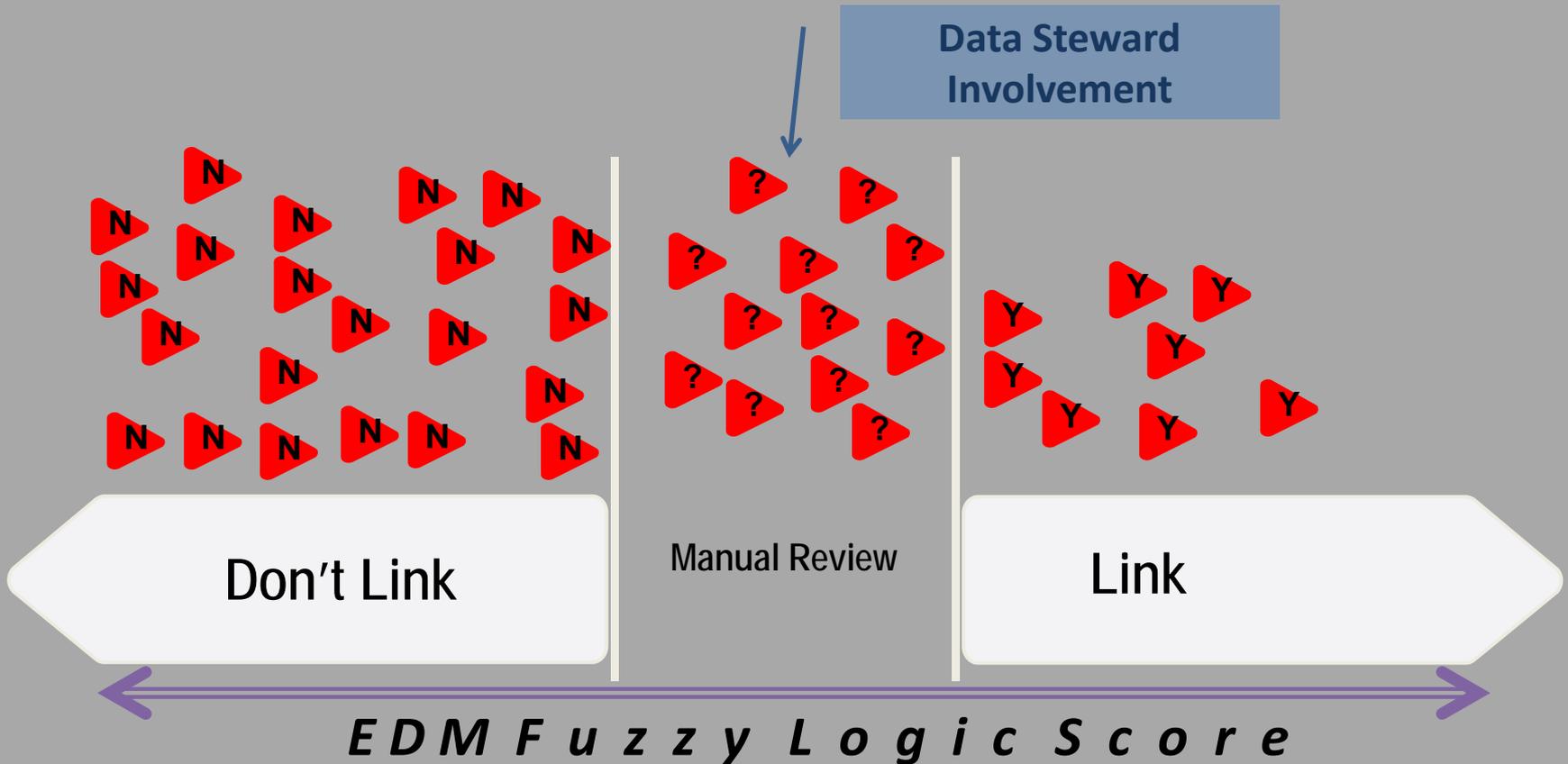


| | | | | | | |
|----------------|------------|------------|---------------------------|-------|--------------|-------------|
| Deborah Becker | 1821125661 | 06-02-1964 | 43776 Maison Blanc Square | 60054 | 312-334-1012 | 454-76-1211 |
|----------------|------------|------------|---------------------------|-------|--------------|-------------|

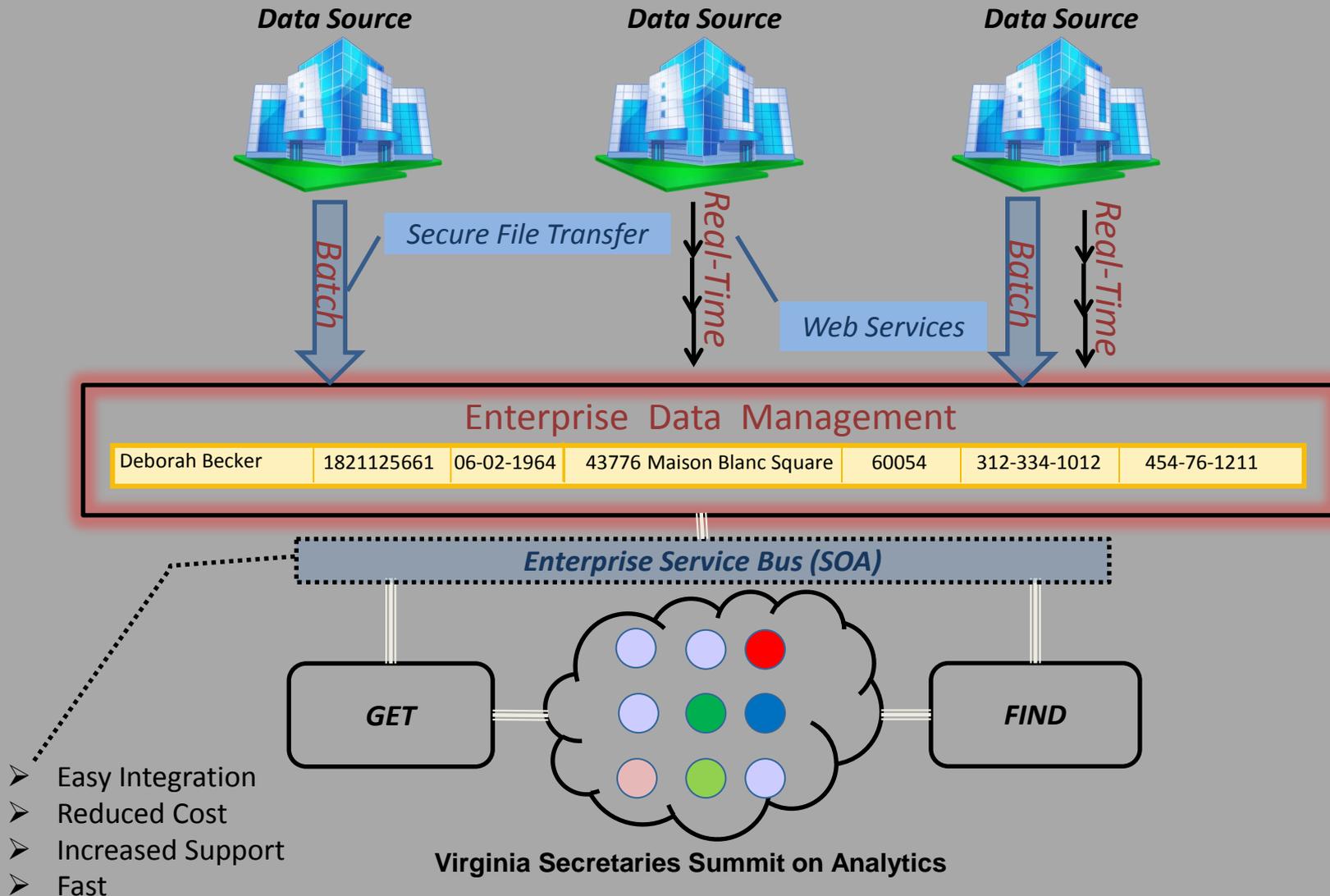


| Dr. Debbie Becker | 1821125661 | 02-06-64 | 19456 Madison, Suite 207 | 60606 | 312-334-1012 | 454-76-1211 |
|-------------------|------------|----------|--------------------------|----------|--------------|-------------|
| Name | NPI | DOB | Address 1 | Zip Code | Phone | IRS TIN# |

Enterprise Data Management in Virginia



Enterprise Data Management in Virginia

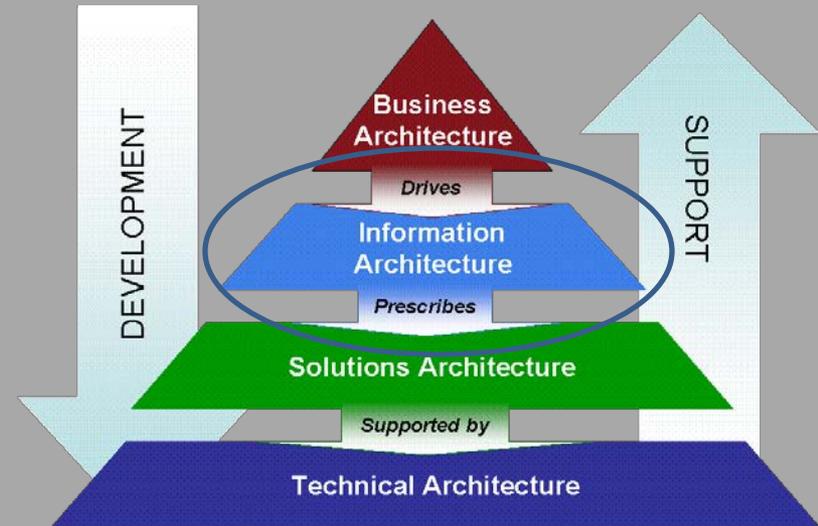


Virginia's Enterprise Information Architecture

A BROADER PERSPECTIVE

Enterprise Information Architecture

- Enterprise Information Architecture (EIA) provides the framework to enhance the Commonwealth's ability to quickly discover, access, and understand data in order to support decision making



Dr. Peter Aiken *"You can accomplish advanced data practices without basic data practices but it will: take longer, cost more, deliver less and present greater risk"*

Virginia's EIA Strategy

- Adopted by Secretary of Technology on August 14, 2013
<http://www.vita.virginia.gov/oversight/dm/default.aspx?id=10340>
- A strategic plan to support interoperability and enterprise information sharing across Commonwealth agencies and their partners
- Developed over an 8 month period by 120+ data stewards, business leads and technical staff representing 30+ Commonwealth agencies

Virginia's EIA Goals

Data Governance

- *Forge a disciplined approach to data governance across the Commonwealth with formal roles for data stewards and other stakeholders*

Data Standards

- *Promote the use of standardized data and shared data definitions as a means of supporting business-driven information exchange across agency systems, government domains, and levels of governance*

Data Asset Management

- *Manage information as an enterprise asset, with an emphasis on quality, security, efficiency, accessibility, reduced redundancy, and a higher return on investment*

Data Sharing

- *Leverage the sharing of information based on business need and in compliance with governing laws, statutes, and regulations to increase government performance, improve service to citizens and more effectively achieve business outcomes*

Data Governance



- Commonwealth Data Stewards Group
 - Executive, Functional and Technical Working Groups
- Data Standards Adoption/Compliance Process
- Embedded within IT Strategic Planning and Project Management Oversight

Data Asset Management

- Open Data – Published to [Data.Virginia.Gov](https://data.virginia.gov)
- “Enterprise” Data – EDM Person Hub is an example
- Exploring “de-identification” (also known as anonymization) technologies for sensitive data
- Investigating Data Asset and Metadata Repository

Data Interoperability/Exchange

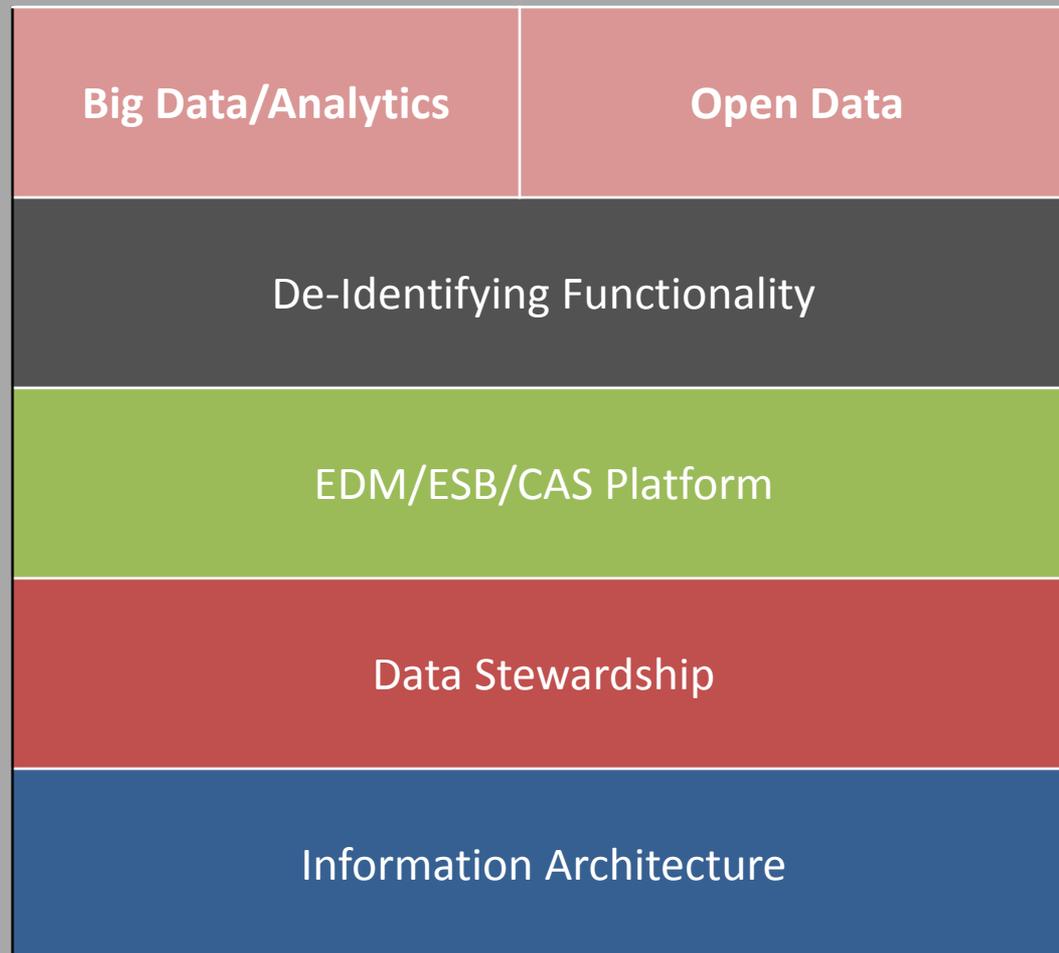
- Standards Repository - adopting national standards when possible (XML, HL7)
 - <http://www.vita.virginia.gov/oversight/dm/default.aspx?id=10344>
- Adopted NIEM (National Information Exchange Model) Standard for Person data exchanges
- Enterprise Service Bus, Transformation Tools to facilitate data exchange
- All data sharing must comply with state/federal statutes

How Can Virginia's Data Be Leveraged?

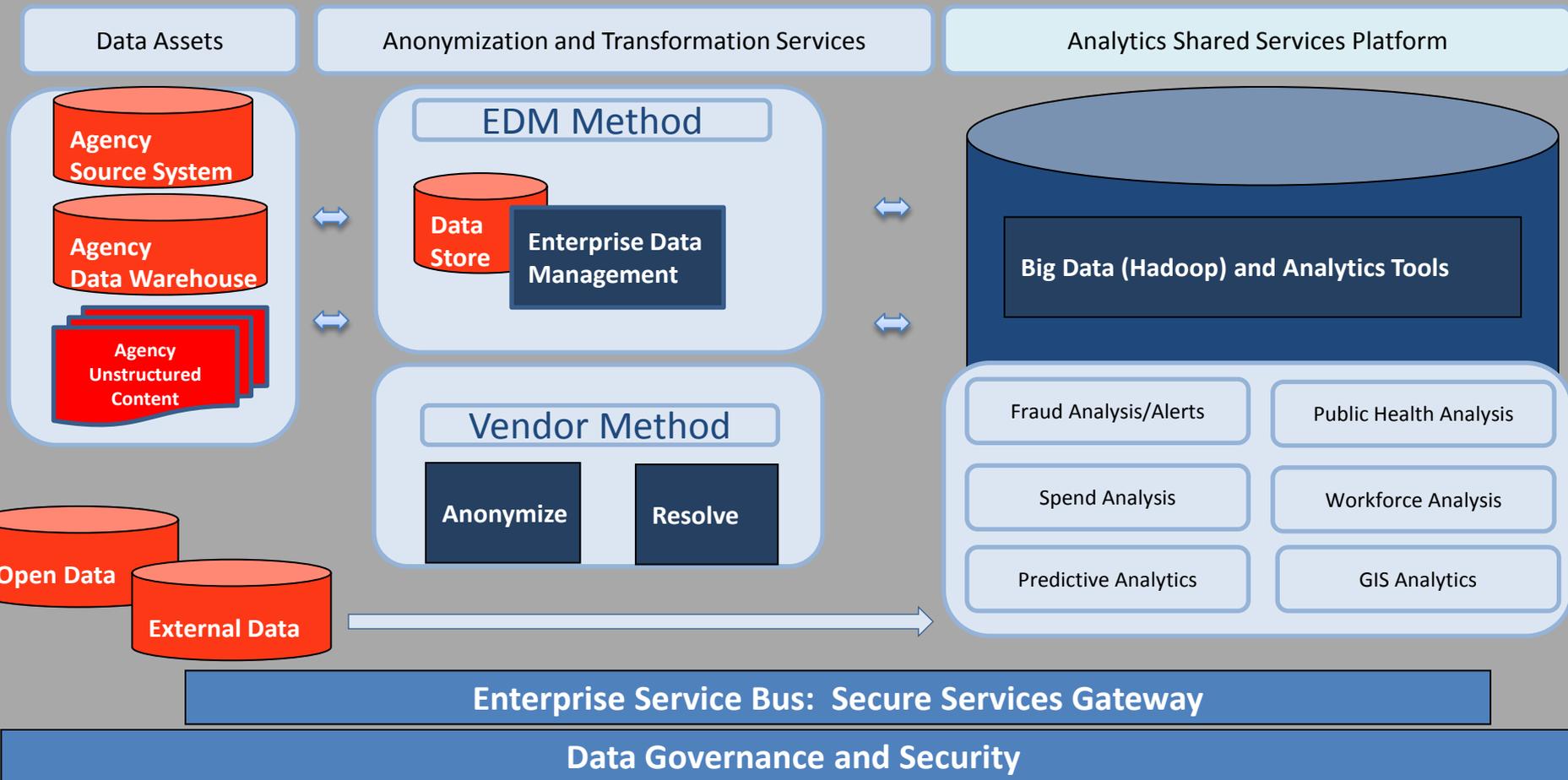
- Being informed by data on what programs are effective vs. which ones are not
- Ability to coordinate programs or create new programs for targeted populations based on data
- Detecting fraud, waste, abuse
- Alerts/Notifications – from one agency to another
- Multi-factor authentication, reduce identity fraud
- Predictive analytics – data forecasting what services are needed 1,3,5 years into the future



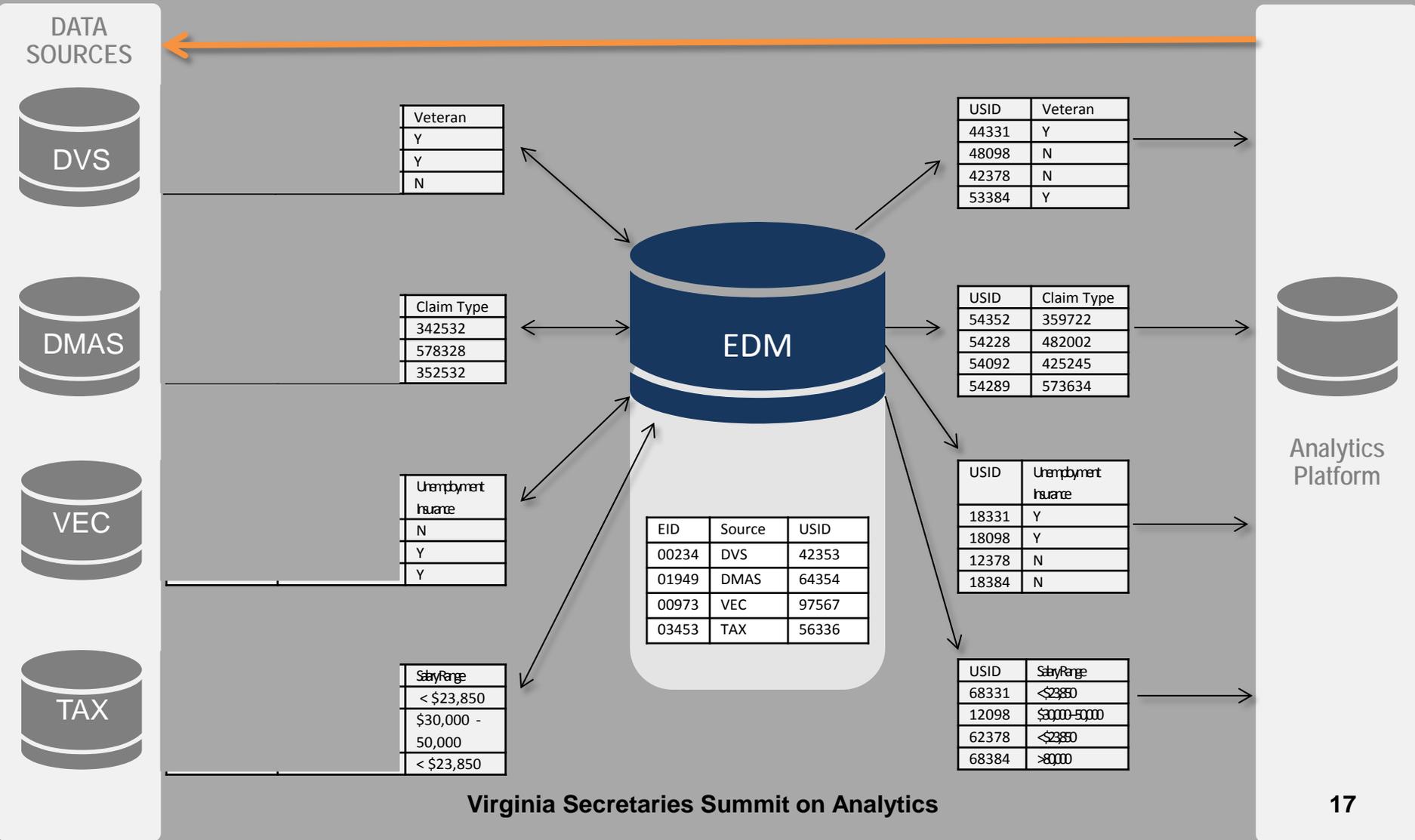
A Convergence of Efforts



A Notional Analytics Platform



Anonymization with EDM



Summary

- **Law before technology - All data sharing must comply with state/federal statutes**
- **VITA facilitates data stewardship – education, knowledge sharing**
- **VITA provides standards and tools to facilitate data interoperability/exchange**
- **VITA committed to safeguarding data – exploring anonymization technologies**
- **VITA assisting agencies with identification of use cases for analytics**

Visual Analytics

Applying the Science of Visualization in Your Agency

Dave Kopniske
Tableau Software



September 30,
2014

What is Visual Analytics?

“Visual analytics is the representation and presentation of data that exploits our visual perception abilities in order to amplify cognition.”

- Andy Kirk, author of “Data Visualization: a successful design process”

What is Visual Analytics?

Visual analytics.... lets you see and understand your data!

- Tableau Software

Principles of Visual Perception

Try to determine as quickly as you can the number of times the number 5 appears in the list.

0394869328476538476293729876697934769834785034734768
3486709236083091023546890398639468976938964767830389
2293867209493903498643583769304968398867094626892344
8823748672304726347164987304858876769276118346735663

Principles of Visual Perception

Now, try it again...

0394869328476**5**3847629372987669793476983478**5**034734768
3486709236083091023**5**46890398639468976938964767830389
2293867209493903498643**5**83769304968398867094626892344
88237486723047263471649873048**5**887676927611834673**5**663

Mental Math is Slow

Try this math problem in your head...

$$\begin{array}{r} 34 \\ \times 72 \\ \hline \end{array}$$

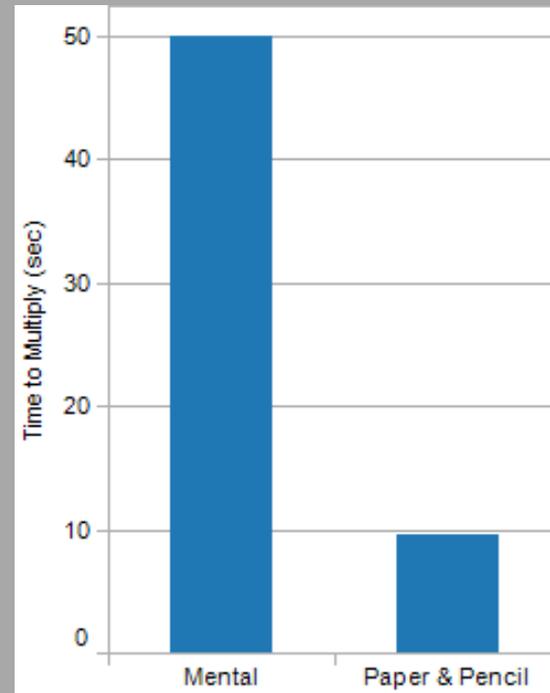
We're Faster When We Use the Right Tools

But if you have pencil and paper, it becomes easier...

$$\begin{array}{r} 34 \\ \times 72 \\ \hline 68 \\ 23^280 \\ \hline 2448 \end{array}$$

Much Faster!

$$\begin{array}{r} 34 \\ \times 72 \\ \hline 68 \\ 23^280 \\ \hline 2448 \end{array}$$



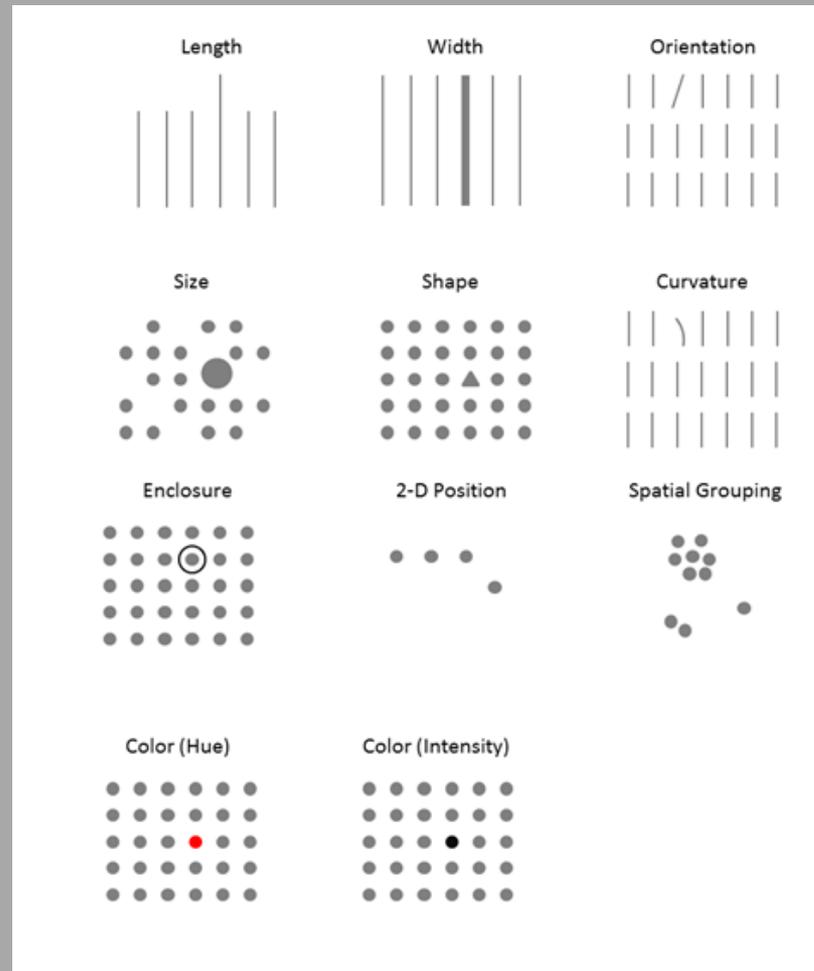
We're Faster When We Can "See" Data

| Region | CDBG | Energy | Public Safety | Program Schools | Streets/Roads | Transit | Water |
|-----------------|-------------|--------------|---------------|-----------------|---------------|-------------|-------------|
| MidAtlantic | \$3,209,423 | \$1,780,642 | \$1,184,462 | \$2,004,708 | \$2,885,460 | \$290,950 | \$1,908,709 |
| MidWest | \$4,411,448 | \$1,818,891 | \$726,072 | \$1,638,077 | \$6,251,008 | \$2,374,536 | \$5,278,999 |
| Mountain | \$2,205,018 | \$1,938,698 | \$381,470 | \$71,430 | \$4,217,854 | \$1,705,426 | \$2,676,357 |
| New England | \$375,282 | \$170,970 | \$68,838 | \$382,350 | \$418,162 | \$122,515 | \$420,659 |
| Non-Continental | \$2,063,967 | \$18,697,260 | \$491,053 | \$36,784 | \$1,288,740 | \$1,412,794 | \$964,965 |
| South | \$9,941,773 | \$2,169,556 | \$1,548,194 | \$1,861,811 | \$14,368,592 | \$3,043,883 | \$7,909,152 |
| West | \$4,361,790 | \$4,069,949 | \$1,278,877 | \$1,097,485 | \$6,618,561 | \$2,487,829 | \$4,396,247 |

We're Faster When We Can "See" Data



Preattentive Attributes



Say What?

Visualizations make advanced analytics concepts easy to understand:

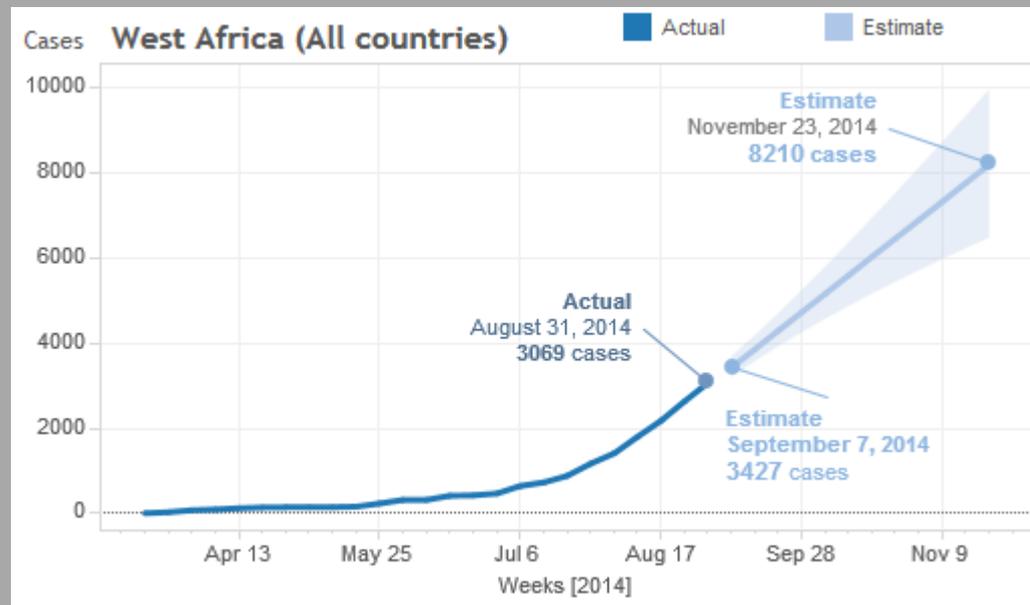
Ebola Outbreak in West Africa:

A total of **3,069** clinical cases (confirmed, probable and suspected) of Ebola virus has been reported by WHO up to August 26th, 2014.

Based on the prediction model, the total number of cases next week (Sept 7) could reach **3,427** cases with a 95% Confidence Interval (95% CI) from **3,184** to **3,669** cases and **8,210** cases with a 95% CI (**6,466-9,954**) on November 23rd (12 weeks later).

Say What?

Visualizations make advanced analytics concepts easy to understand:



Why Does Visualization Matter?

Use Visualization in Analytics to:

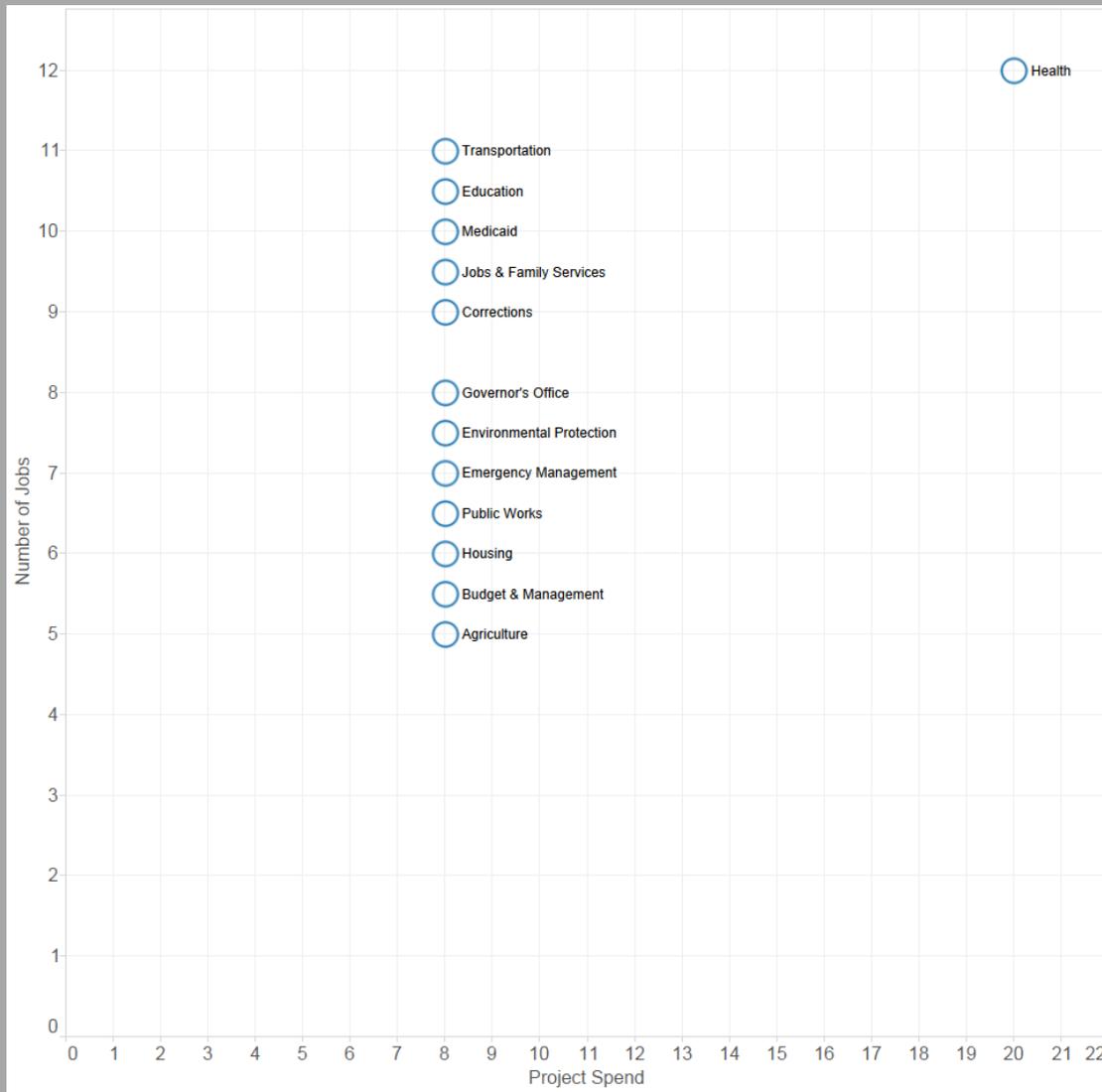
- Communicate successes
- Identify client needs proactively
- Forecast how to better serve clients more efficiently
- Understand how the citizen's community might be changing
- Consolidate messaging across agencies and public domain

How to Communicate the Right Message

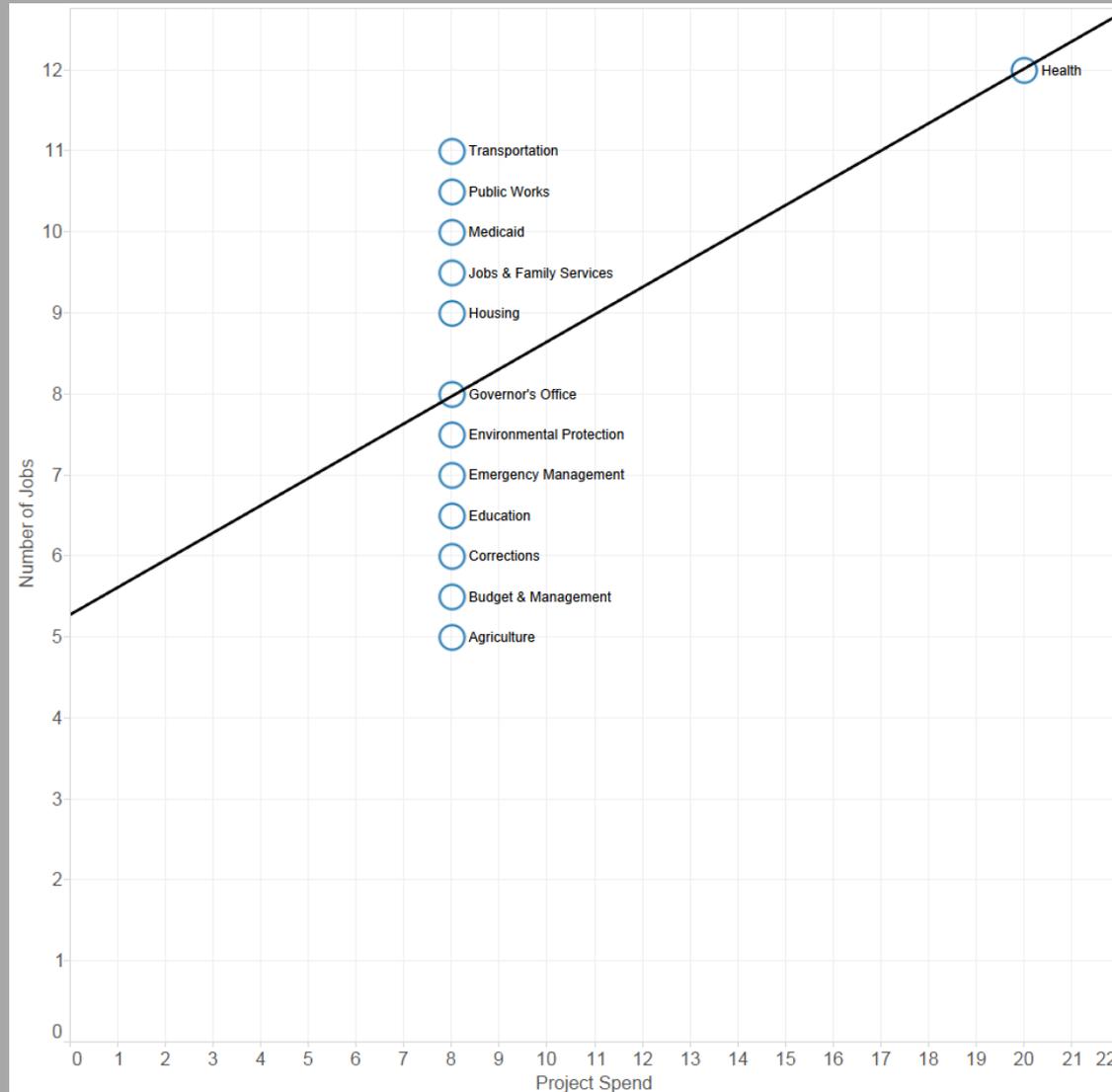
What's Going On With... ?

| Agency | Project Spend | Number of Jobs |
|--------------------------|---------------|----------------|
| Agriculture | 8.00 | 5.00 |
| Budget & Management | 8.00 | 5.50 |
| Corrections | 8.00 | 9.00 |
| Education | 8.00 | 10.50 |
| Emergency Management | 8.00 | 7.00 |
| Environmental Protection | 8.00 | 7.50 |
| Governor's Office | 8.00 | 8.00 |
| Health | 20.00 | 12.00 |
| Housing | 8.00 | 6.00 |
| Jobs & Family Services | 8.00 | 9.50 |
| Medicaid | 8.00 | 10.00 |
| Public Works | 8.00 | 6.50 |
| Transportation | 8.00 | 11.00 |

How to Communicate the Right Message



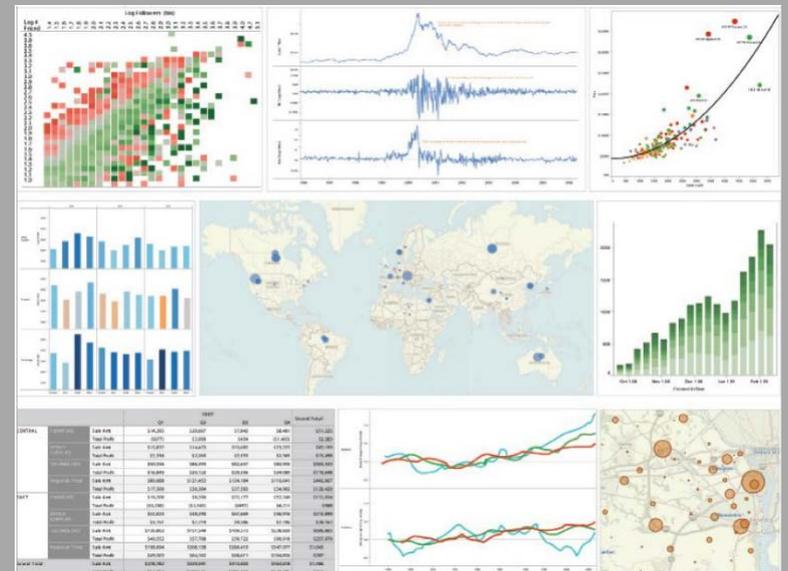
How to Communicate the Right Message



What is Visual Analytics?

“Visual analytics is the representation and presentation of data that exploits our visual perception abilities in order to amplify cognition.”

- Andy Kirk, author of “Data Visualization: a successful design process”



Accountability and Management

Government Transparency

Business

Science & Technology

Climate Change

Education

Transportation

Defense & Security

Infrastructure

Water Resources

Oceans

Urbanization & Development

Nature Conservation

Energy

Utilities

Human Health

Agriculture

Environment

Location

Smart Growth

Government

Most Valuable Data

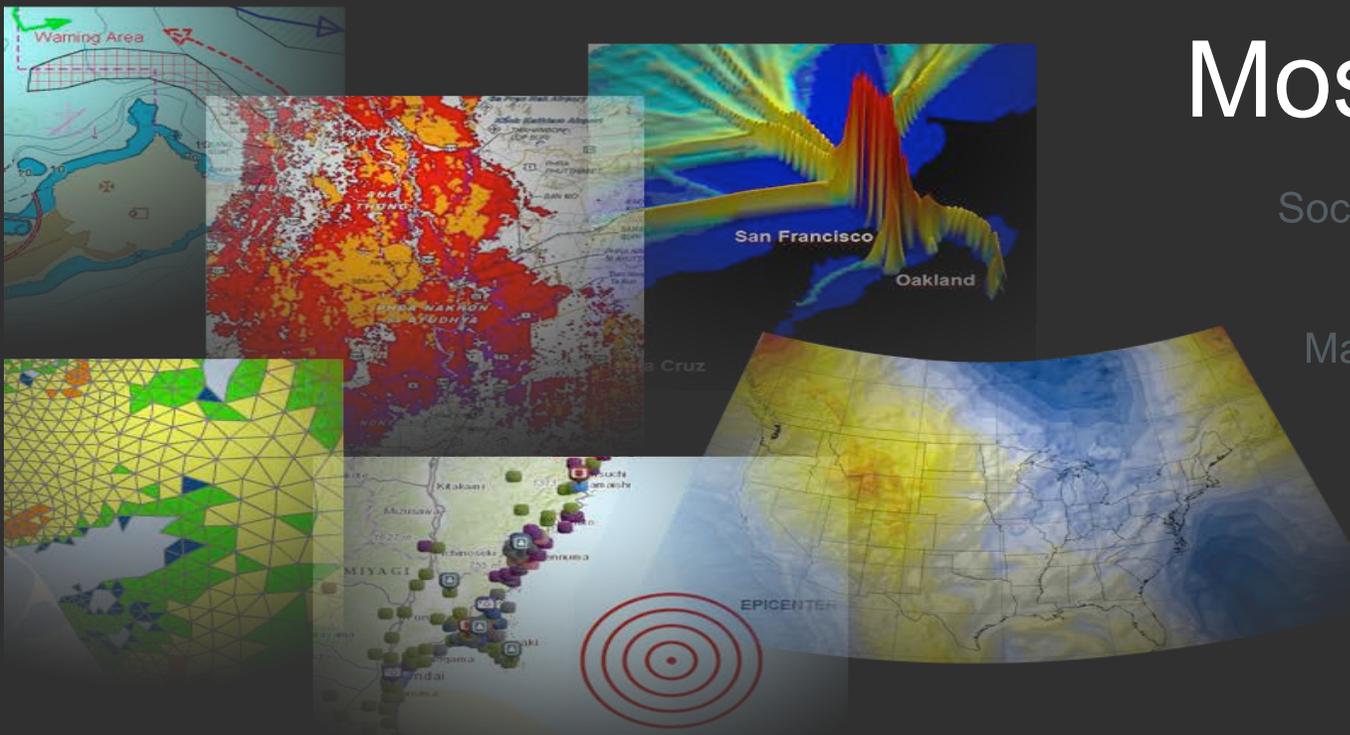
Social Conflicts

Natural Disasters

Economic Recovery

Mapping

Research



Across Many Organizations, Missions, and Projects

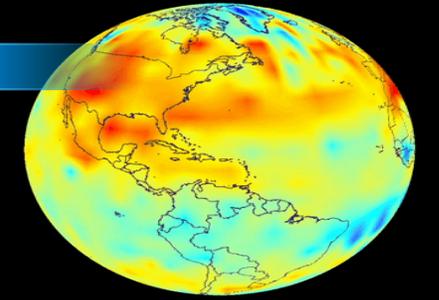


Maps

Most common and powerful product of a GIS

- Timely
- Communicate Importance
- Support Decision Making
- Interoperable and Sharable
- Show Status and Performance

Climate Change



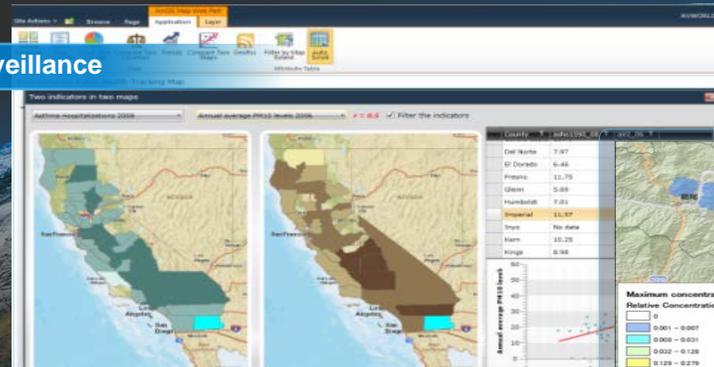
Hotspot Mapping



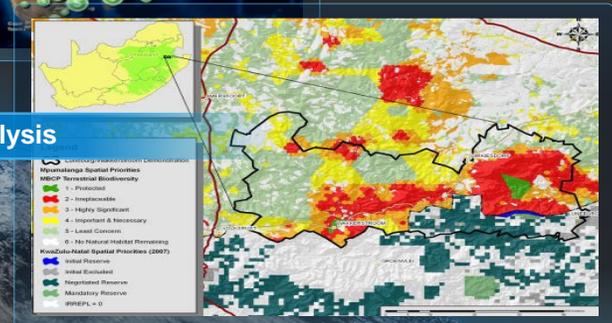
Financial Tracking



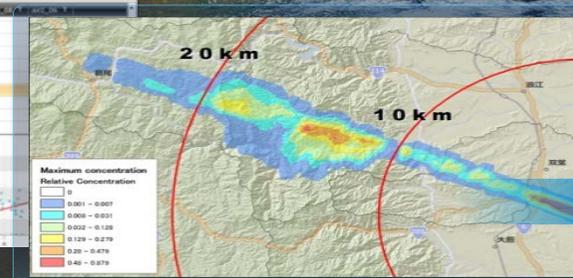
Disease Surveillance

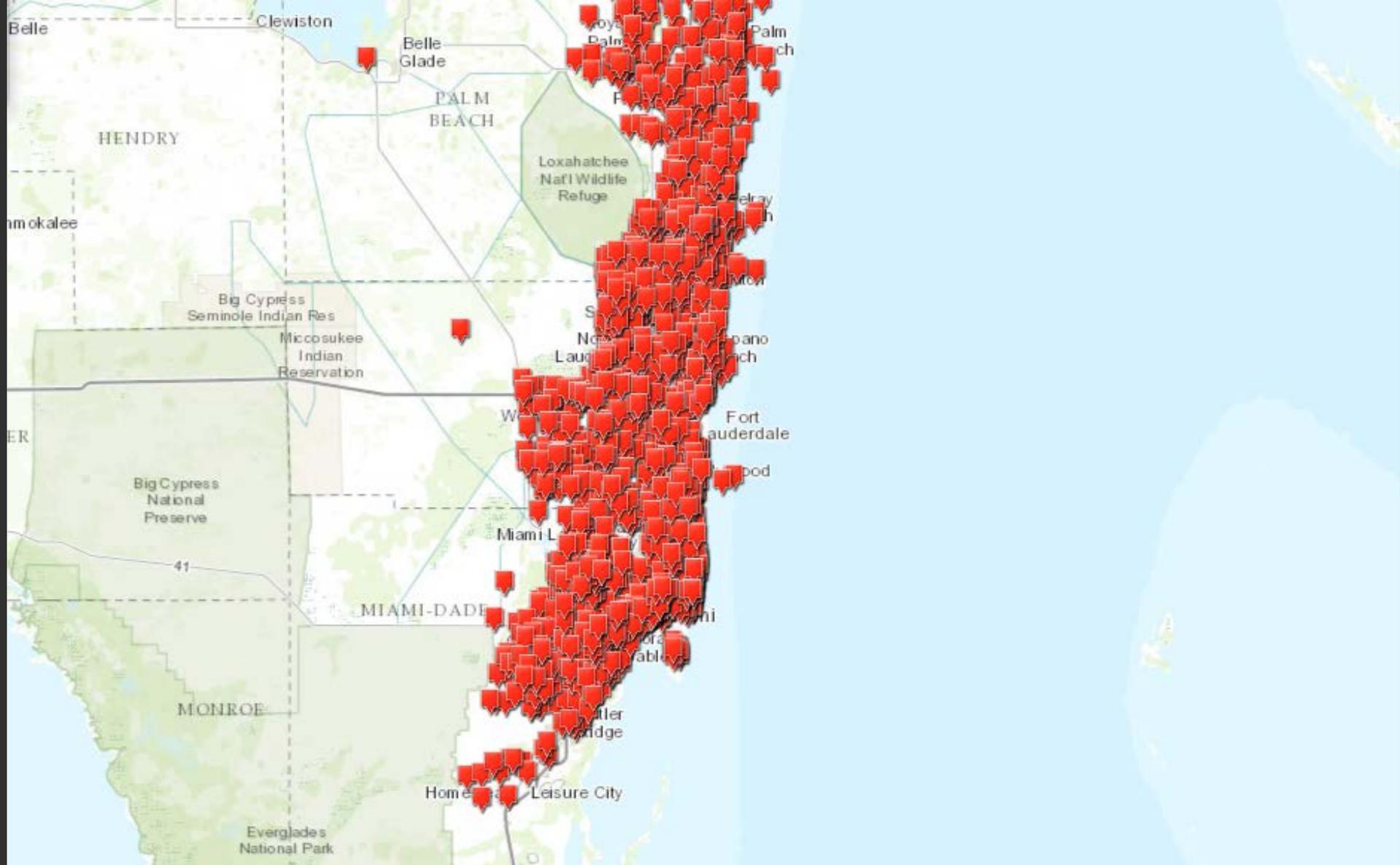


Suitability Analysis



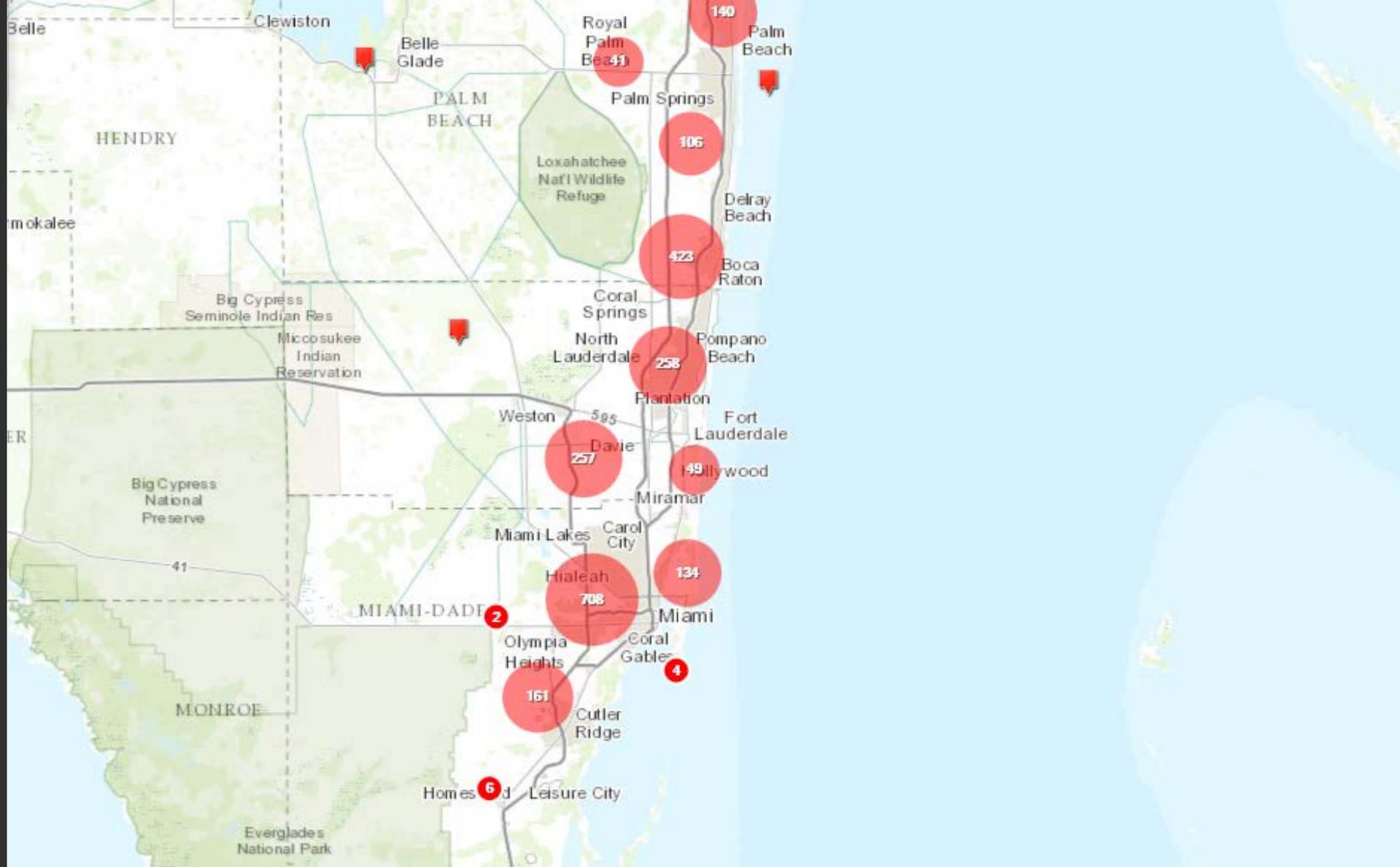
Plume Modeling





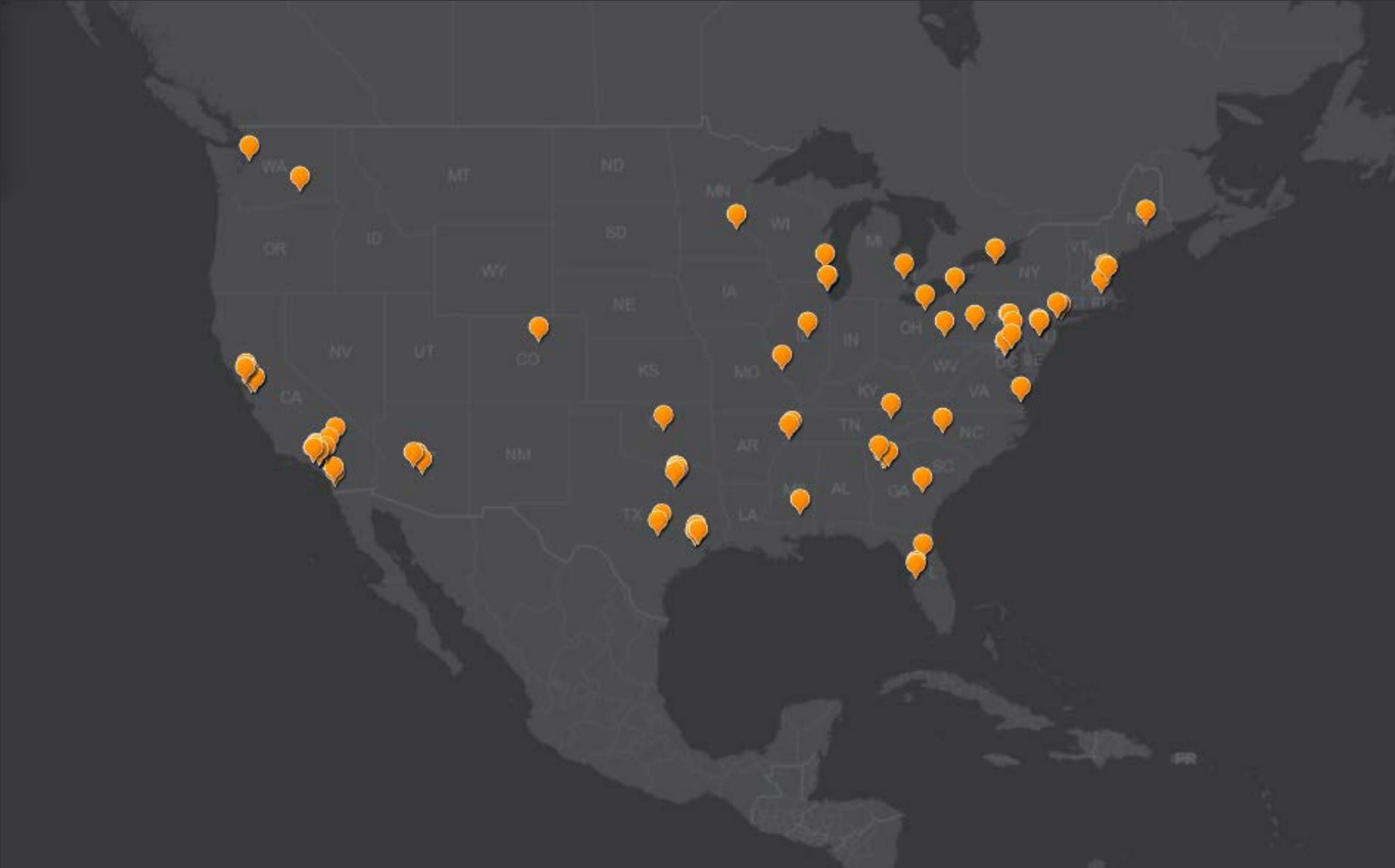
Mapping Data

Take advantage of your location data



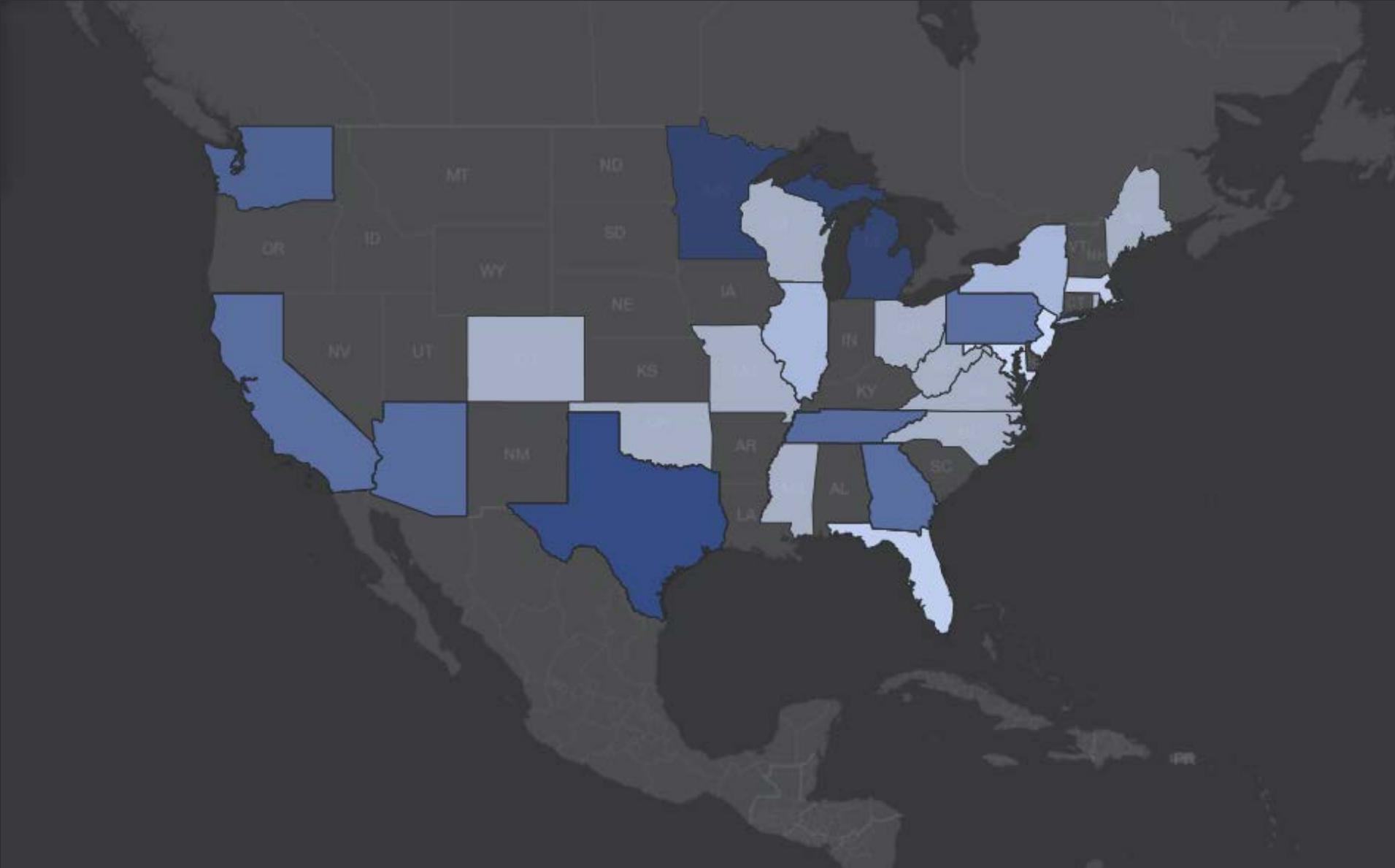
Making Sense of the Map

Easily see patterns



Make your own Map

Integrated into everyday
tools



Use your own Data

Common or Custom areas

| 1 | NAME | COUNTY | STREET_ADDR | CITY | STATE | ZIP | PHONE | ANNL_SALES_EST | EMPS_EST | SIZE_EST |
|---|----------------|------------|------------------------|---------------|-------|-------|--------------|----------------|----------|--------------------|
| 2 | HONEYBAKED HAM | BURLINGTON | 898 ROUTE 73 N | MARLTON | NJ | 08053 | 856-985-4777 | 376000 | 2 | 1 - 2,499 sqft |
| 3 | HONEYBAKED HAM | MERCER | 3371 US HIGHWAY 1 #159 | LAWRENCEVILLE | NJ | 08648 | 609-452-1011 | 1504000 | 8 | 2,500 - 9,999 sqft |
| 4 | HONEYBAKED HAM | SOMERSET | 1549 US HIGHWAY 22 | WATCHUNG | NJ | 07069 | 908-755-2200 | 940000 | 5 | 1 - 2,499 sqft |
| 5 | HONEYBAKED HAM | MIDDLESEX | 1197 AMBOY AVE #1 | EDISON | NJ | 08837 | 732-452-0039 | 1128000 | 6 | 1 - 2,499 sqft |
| 6 | HONEYBAKED HAM | MONMOUTH | 500 STATE ROUTE 35 | RED BANK | NJ | 07701 | 732-842-1115 | 564000 | 3 | 1 - 2,499 sqft |

Custom boundary added to map and data are grouped (classified) by total annual sales in the color-coded map

Style Configuration

Do you want to group your data: Yes No

Choose the column to group: Sum of ANNL_SALES_EST

Group column values by: Number Ranges

Classification Method: Natural Breaks

Number of Groups: 2 3 4 5 6 7

Color Ramp: [Color Ramp]

Reverse Colors

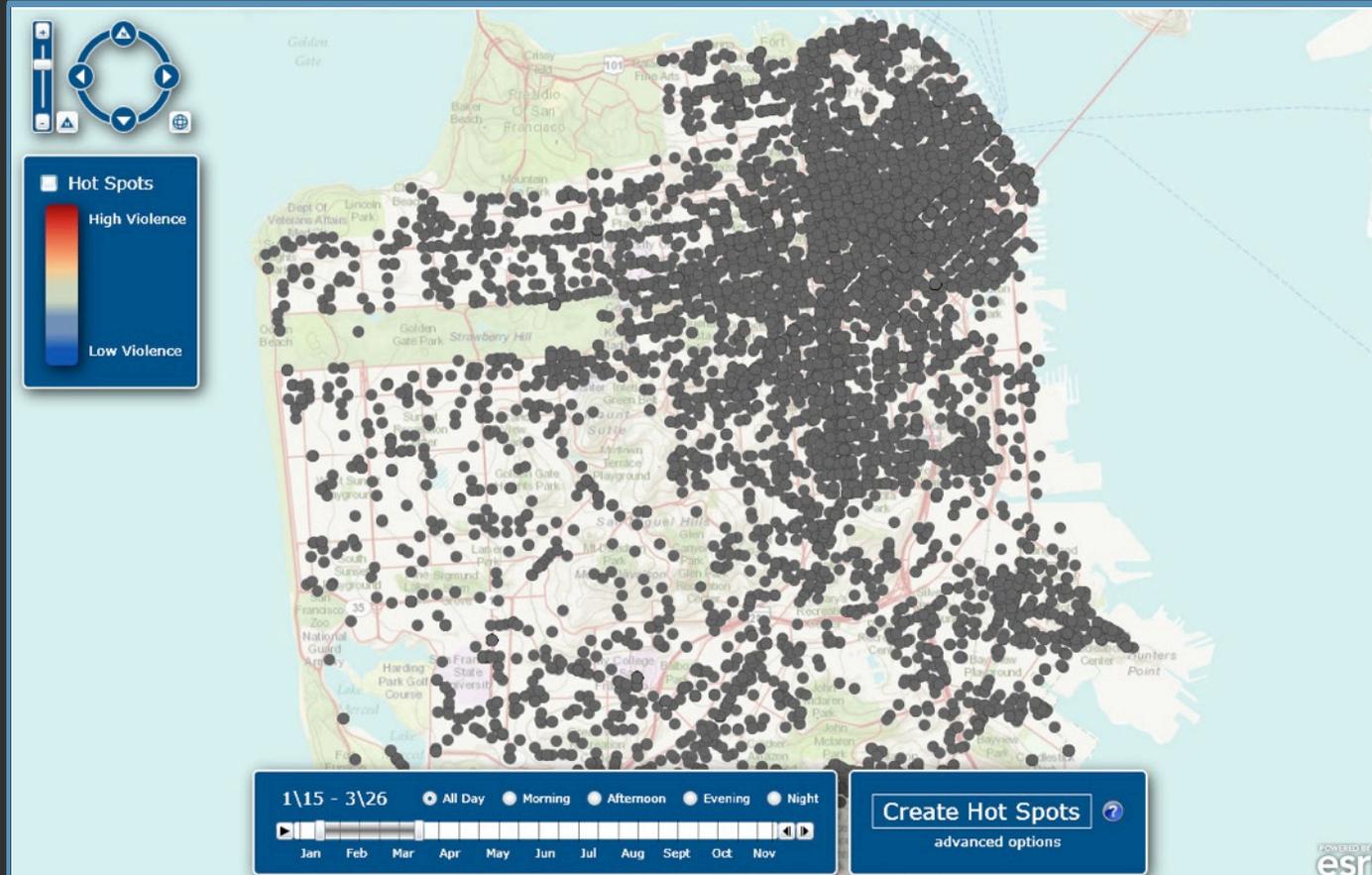
Map Contents

Table1

- Not Grouped
- 376000 - 376000
- 376001 - 564000
- 564001 - 940000
- 940001 - 1128000

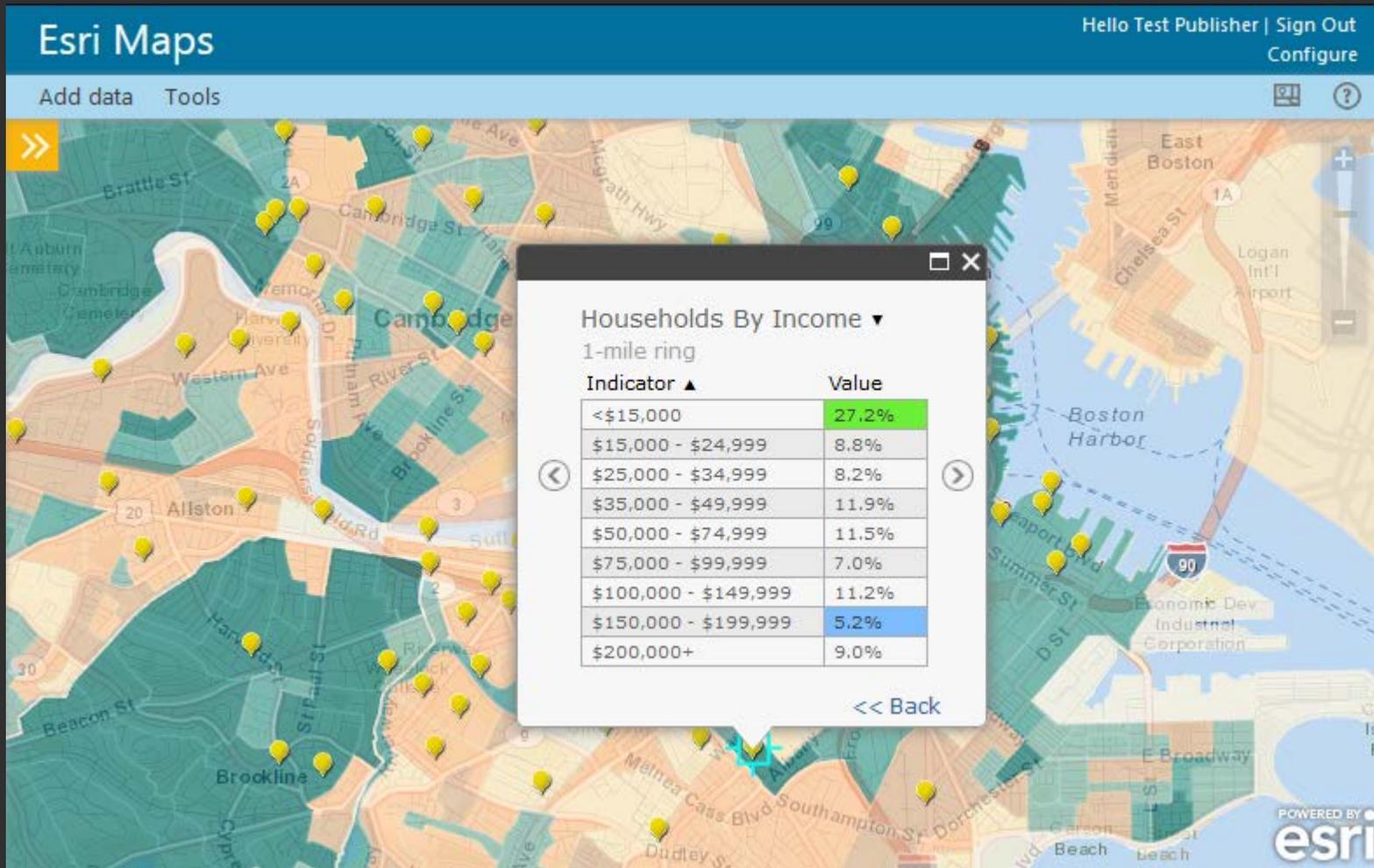
Map to **Your** Regions

Not just administrative areas



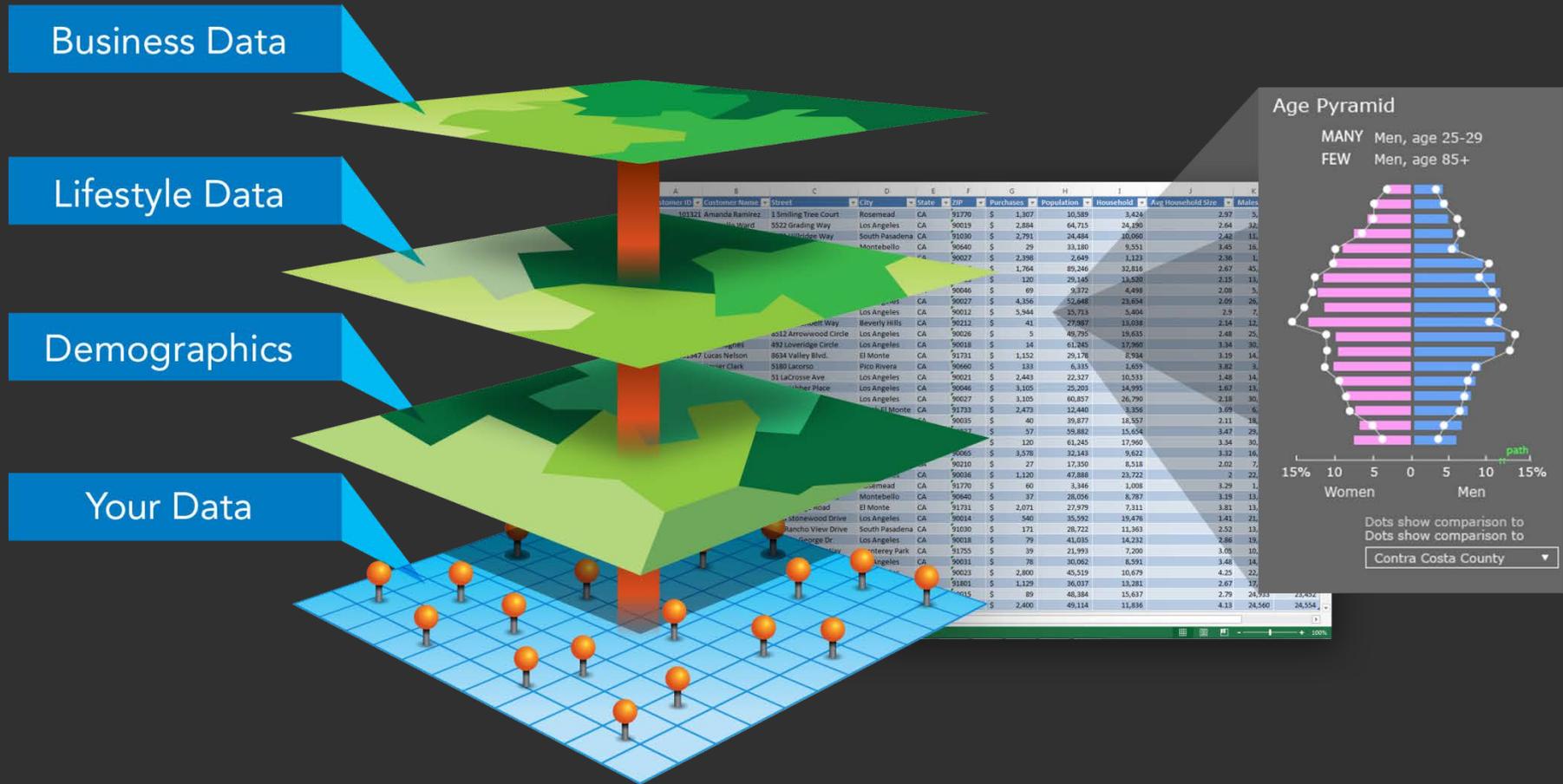
Heat Maps & Hot Spots

See What's
Statistically Significant



**Instant Insight to
What's Going On Where**

In the geographic areas that are
important to you



- Information about people, places and businesses

Enrich Your Maps

Esri's authoritative data and public data in conjunction with your business data

Helping you answer...

“Where” Questions?



and Understand...

“Why” Questions?



Impact areas for Health and Human Services



Healthy Communities

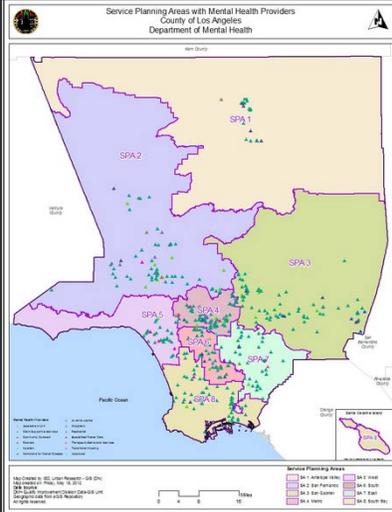
Context

Components

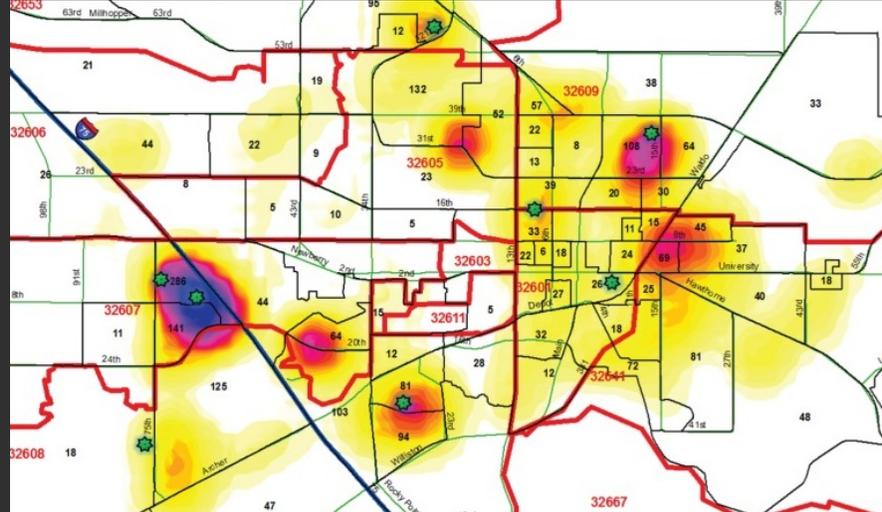
- Healthy environments
- Equal access to care
- Reduction of negative health outcomes
- Stakeholder engagement
- Community partnerships



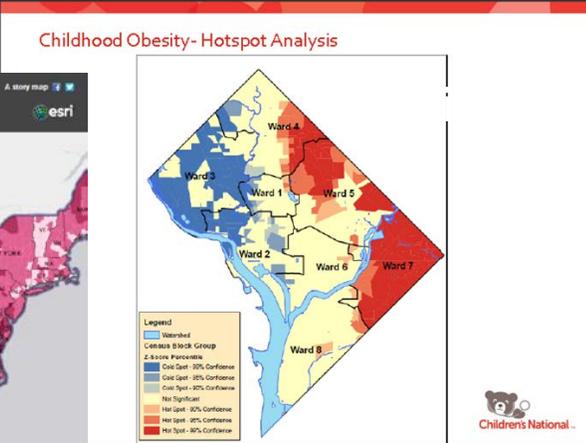
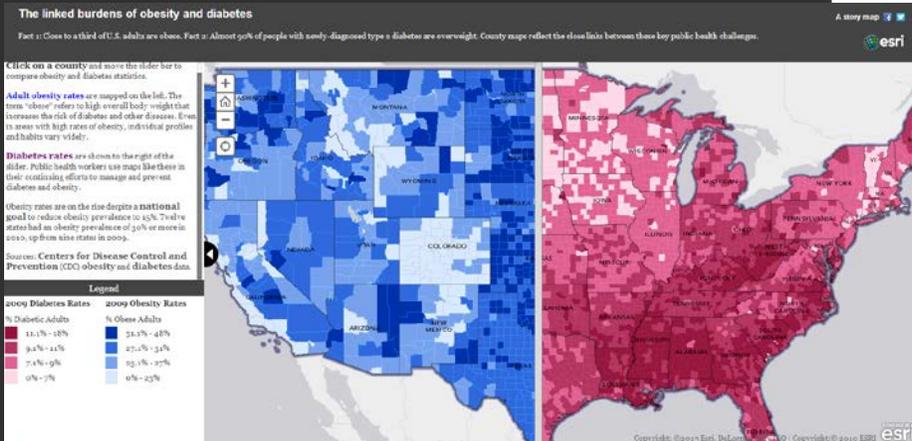
Mental Health Providers



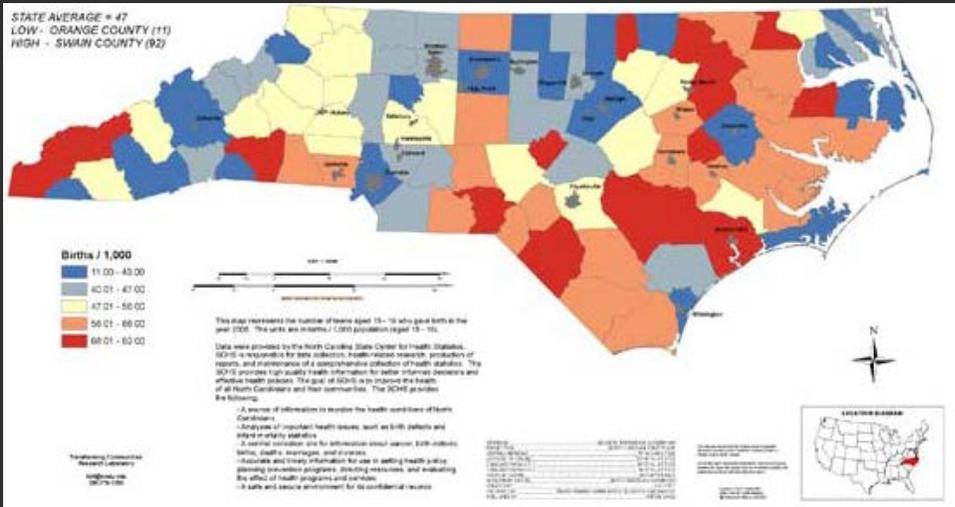
Diabetic Hotspots



Obesity Rates

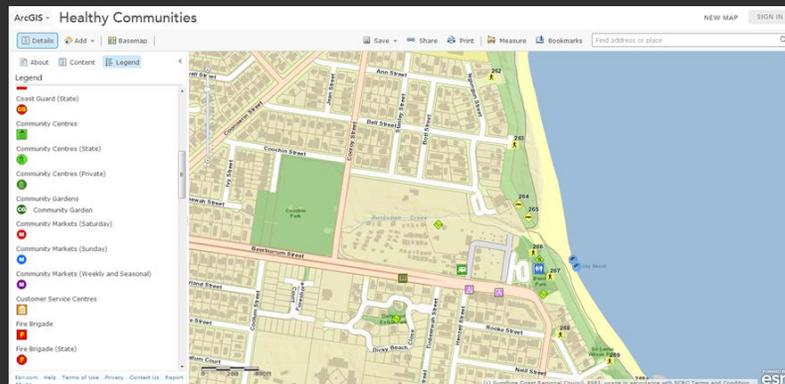


Teen Birth Rates



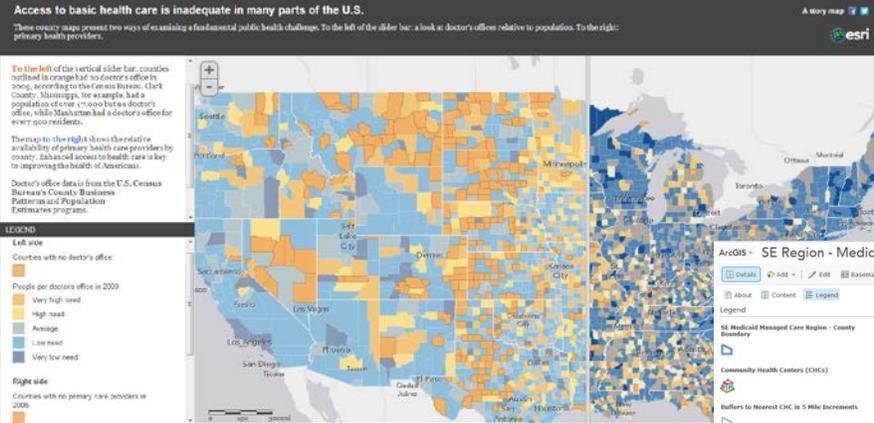
- Binge drinking rates
- Drug Abuse
- Tobacco use

Access to Healthy Food

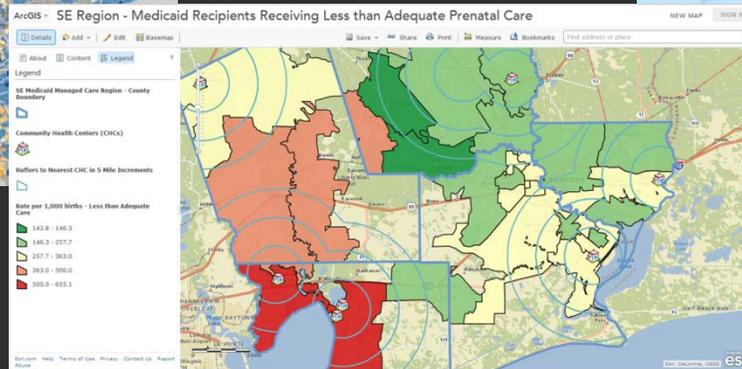


Hospital Access

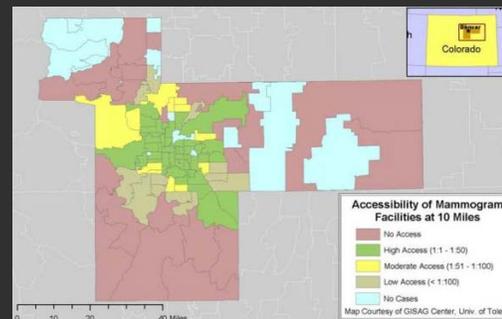
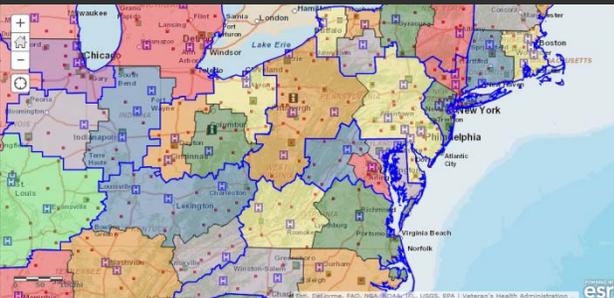
Access to Primary Care



Prenatal Care



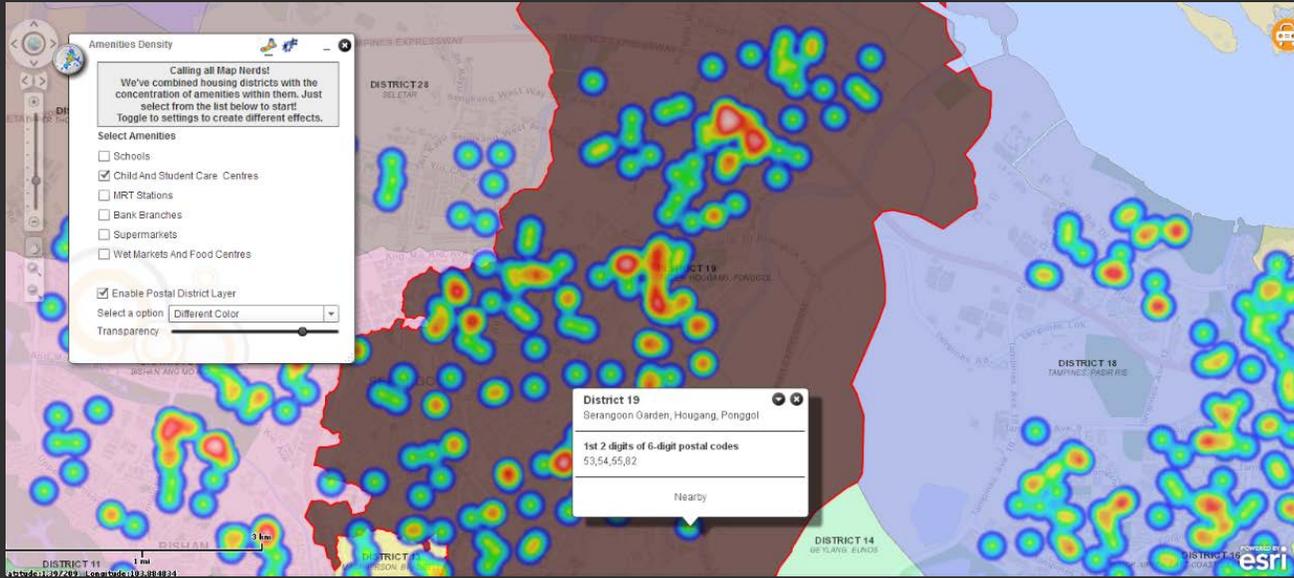
Access to Mammography Care



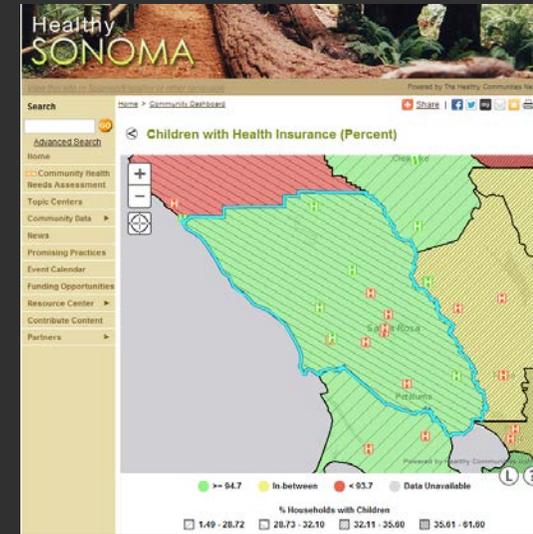
Hospital Regions



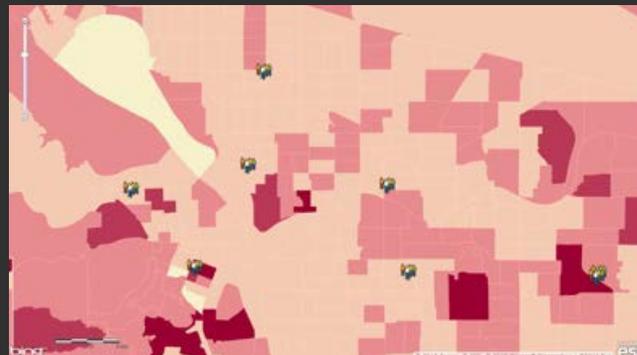
Community Resources – Availability & Access



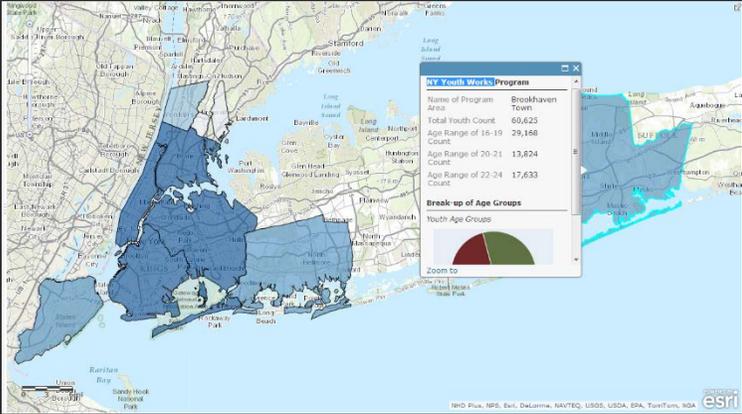
Vulnerable Populations



Senior Services



Employment



Youth Job Training Programs

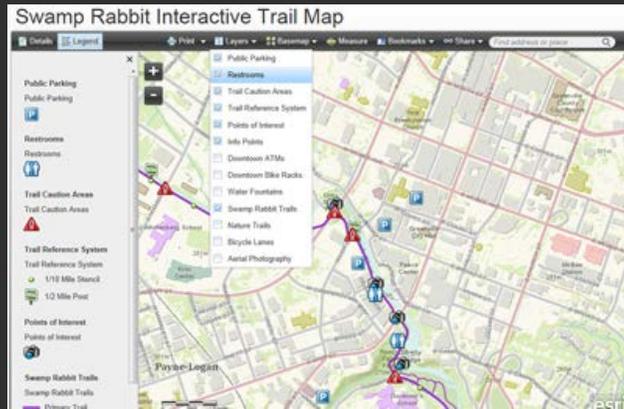


Housing

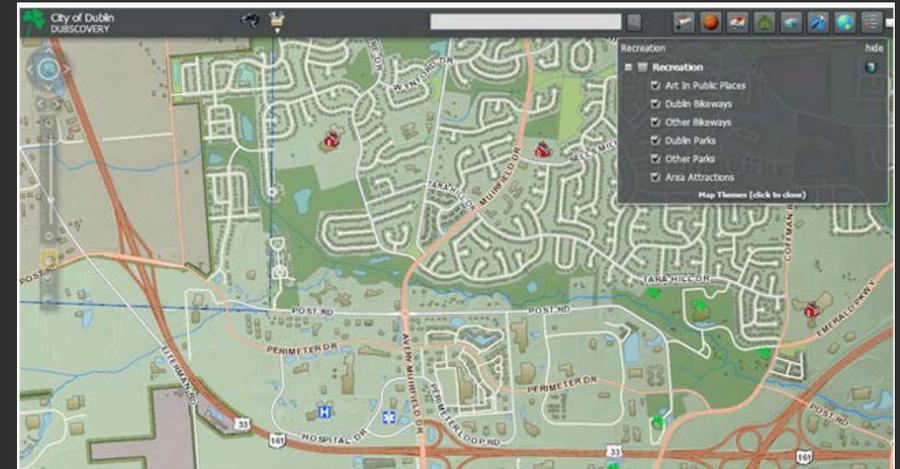
Homelessness



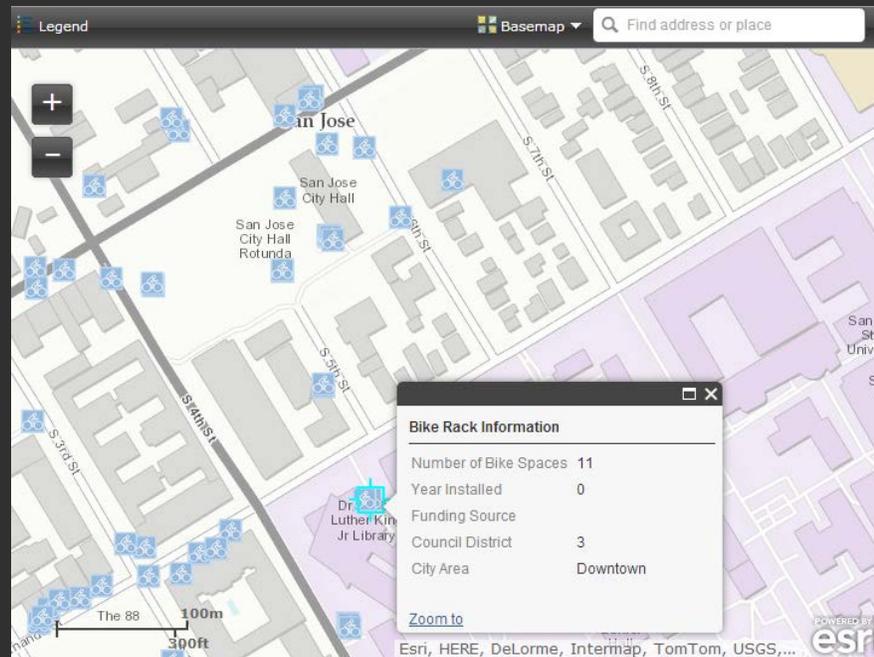
Walking Trails



Parks and Open Space



Bike Rack Locations



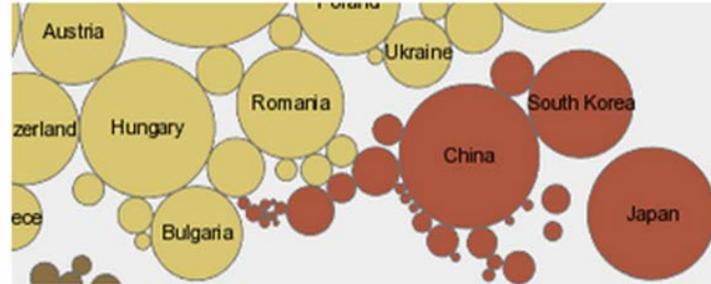
Spatial Analytics

Driving location-based results





Understand and compare places



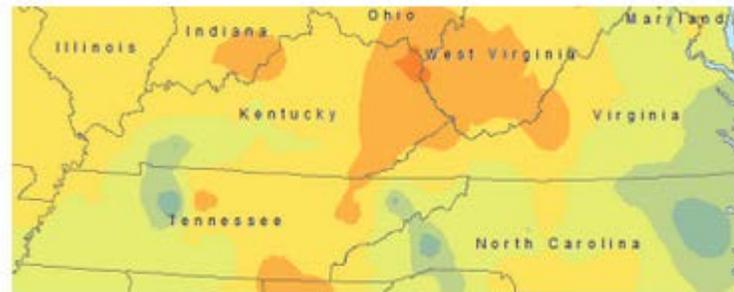
Determine how places are related



Detect and quantify patterns



Find the best locations and paths



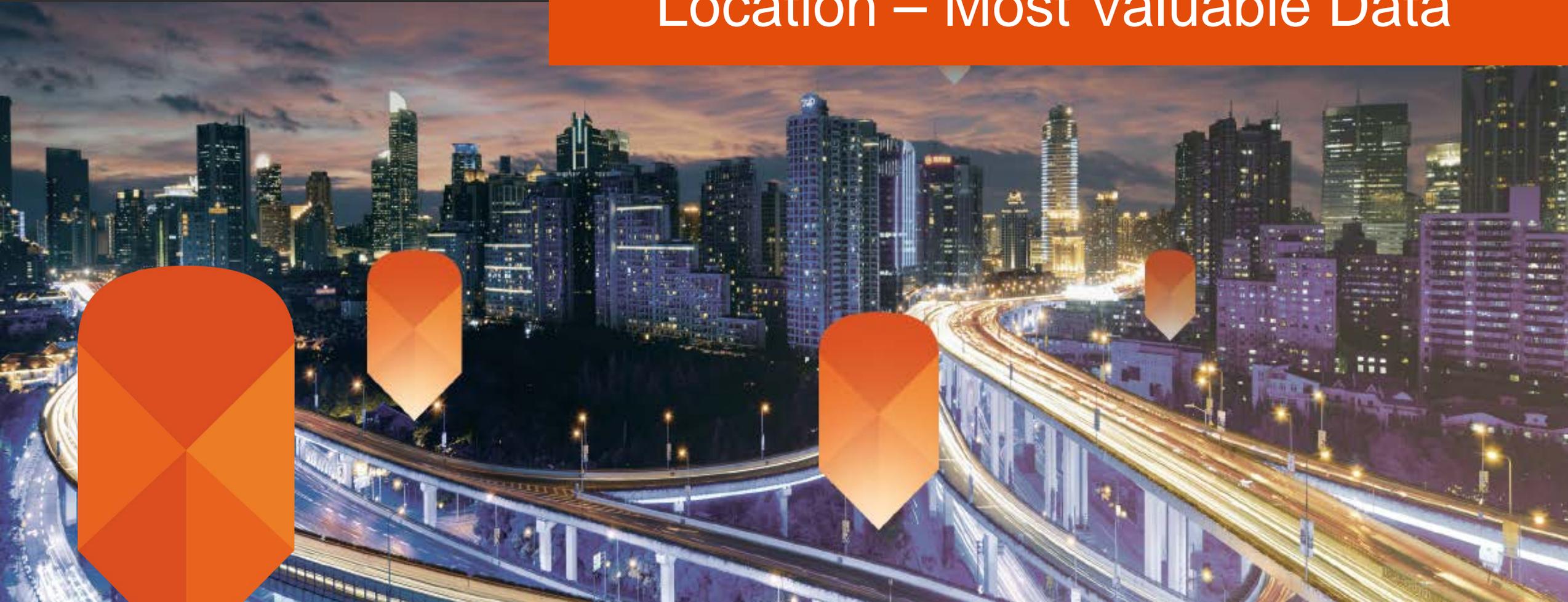
Make predictions



Automation and processing



Location – Most Valuable Data





Virginia GIS Clearinghouse

Virginia Geographic Information Network

Featured Content



Virginia GARDEN Sites



Virginia Administrative Boundaries



Virginia Basemap Updates



Virginia Clearinghouse Nodes

Virginia's Statewide GIS Clearinghouse hosted by the Virginia Geographic Information Network (VGIN) and the Virginia Information Technologies Agency (VITA). The GIS Clearinghouse is a repository of geospatial data produced and used by state agencies in Virginia, localities in Virginia, our Federal partners, non-profits, and colleges and universities in Virginia. Questions? email VBMP@VITA.VIRGINIA.GOV



Thank you!

Anthony Puzzo

apuzzo@esri.com

202-714-2411

@anthonypuzzo





Office of Analytics

Medicaid – The Road Ahead



Dr. Hans Rosling

“...having the data is not enough...”

<http://www.youtube.com/watch?v=jbkSRLYSojo>



We Are Not Alone

- 300+ C-level exec. respondents
- 2012 Oracle survey
- Over **60%** gave their **organization a C or worse** regarding their organizations' preparedness to manage data

38% Unable to gather right information

36% Unable to provide management with efficient access

29% Did not have the appropriate systems in place to collect and analyze data

*Surveyed executives estimated that they were losing **\$71.2M**, because they couldn't fully leverage the information they collected*

<http://www.oracle.com/us/industries/oracle-industries-scorecard-1692968.pdf>



Agenda

- Empowering the organization
- Building data capability
- Leveraging data management
- Data management objectives
- Data strategy
- Medicaid - the road ahead
- Absolute essentials for success



Empowering the Organization

Measuring Impacts

- Correlate outcomes to the implemented programs
- Measurements are holistic and multi-dimensional

Business Intelligence

- Accessible, accurate and reliable insights
- Consistently available to the right people at the right time

Evidence Based Approach

- Data systematically leveraged throughout decision making
- Evidence-based decision making permeates the culture



Empowering the Organization Cont'd



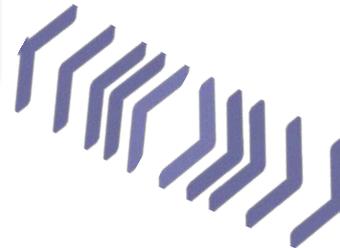
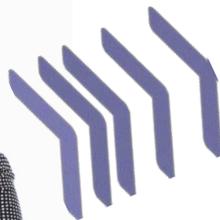
Analysts



Executive management



Business users



Business managers



Empowering the Organization Cont'd

- Reporting can be user driven with customization options
- Analysis does not have to be limited to a specialized skill set

The screenshot displays the United States Census Bureau website interface. At the top, there is a search bar and a navigation menu with categories: Topics (Population, Economy), Geography (Maps, Geographic Data), Library (Infographics, Publications), Data (Tools, Developers), About the Bureau (Research, Surveys), and Newsroom (News, Events, Blogs). A featured article titled "Resources for Emergency Preparedness and Recovery" is highlighted, describing a real-time, map-based data tool for emergency planning. Below this, three main content blocks are visible: "Population Clock" showing U.S. and World population figures; "QuickFacts" with a state selection dropdown and a map of the U.S.; and "U.S. Census Bureau Economic Indicators" listing reports such as "New Residential Construction" (956,000 housing starts, -14.4% change) and "Quarterly Profits - Retailers" (\$20.9 B after-tax profits, \$7.0 B change).



Agenda

- Empowering the organization
- Building data capability
- Leveraging data management
- Data management objectives
- Data strategy
- Medicaid - the road ahead
- Absolute essentials for success



Building Data Capability

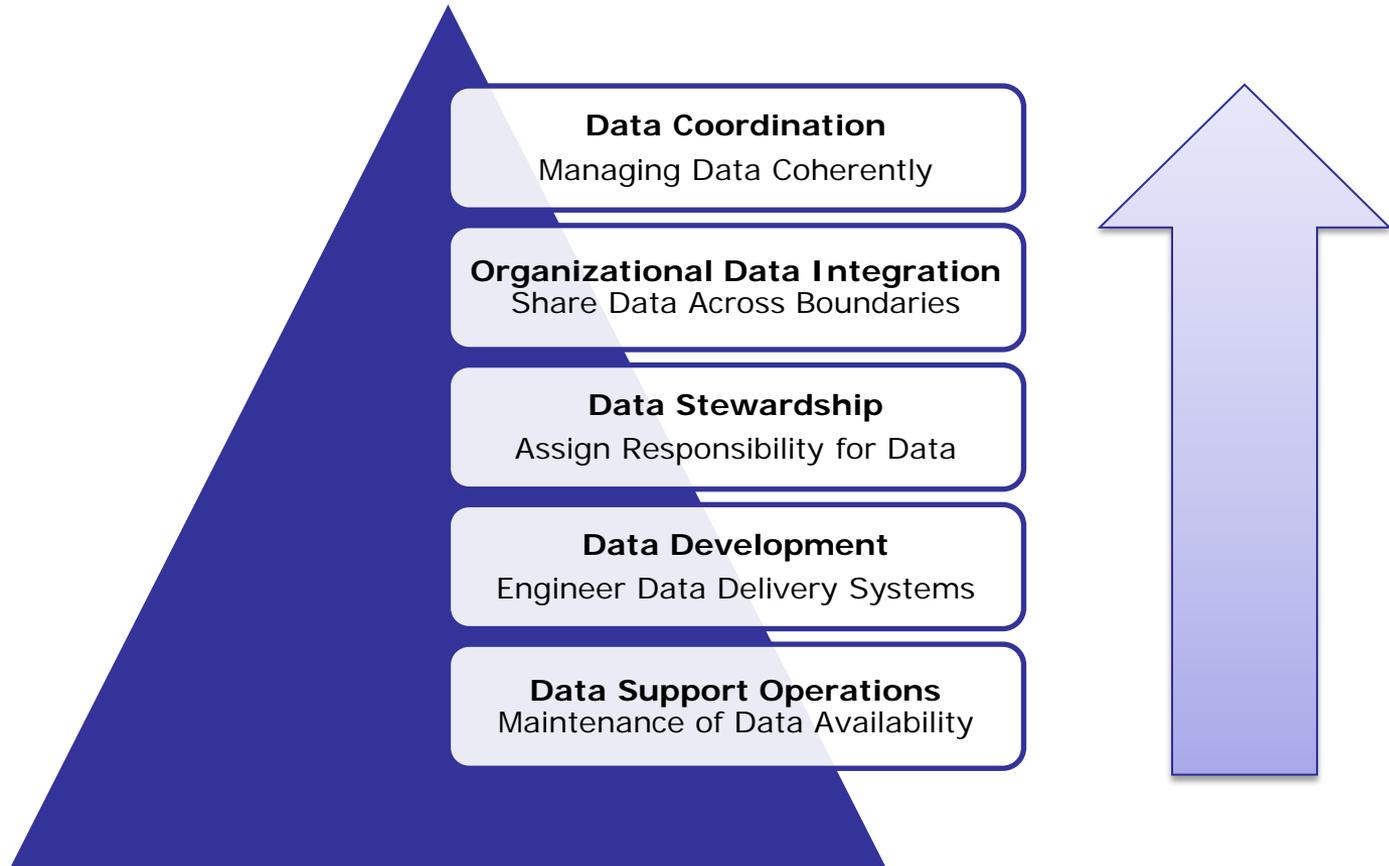
| | Type of Reporting Query and Analytics | Focus | Decision Making and Action Perspective |
|---------------------|---------------------------------------|--|--|
| Analytics | Optimization | <i>What's the best that can happen?</i> | Overall management and orchestration of analysis/query/reporting |
| | Predictive Modeling | <i>What will happen next?</i> | Embed predictive analytics in processes |
| | Forecasting/ Extrapolation | <i>What if these trends continue?</i> | Create "what if" capacity |
| | Statistical Analysis | <i>Why is this happening?</i> | Understand "why" |
| Query and Reporting | Alerts (Real Time) | <i>What actions/ interventions are needed?</i> | Intervene |
| | Query/Drill Down (Real Time) | <i>Where exactly is the problem?</i> | Target problem groups, individuals or processes |
| | Ad Hoc Reports (Real Time) | <i>How many, how often, where?</i> | Conduct special analyses to gain fresh perspective |
| | Standard Reports (Real Time) | <i>What happened?</i> | Continuous review, standard metrics |

Data Governance and Stewardship Perspective: **Improve quality and availability of data**

Source: Adapted from Davenport and Harris 2007



Building Data Capability





Agenda

- Empowering the organization
- Building data capability
- Leveraging data management
- Data management objectives
- Data strategy
- Medicaid - the road ahead
- Absolute essentials for success



Leveraging Data Management



Technical Solutions

- Data integration
- Data platforms
- Business intelligence
- Data architecture

- 
- Data strategy
 - Data governance
 - Data education
 - Data quality



Foundational Practices



Leveraging Data Management Cont'd

- Implementing technical solutions without the foundational practices takes longer, costs more, and delivers less
- Data quality errors can incur costs, introduce error into analyses, and may embarrass the organization



Power grid : North-East USA blackout

Failures of complex systems can be difficult to correct because it is so difficult to work out what is actually going on. Some things are vitally important and some are not, but which is which? It is easy to suffer from 'IT blindness' when you live in hope of everything being OK.

Bank mailshot : Addressing direct mail

There are many stories about mistakes in addressing mail. Most relate to 'dirty' data where the address fields are full of keying errors. This one highlights a problem to look out for when using data from another system - the fields may not contain the data you think.

http://dataquality.origma.co.uk/modules/pico/index.php?content_id=16

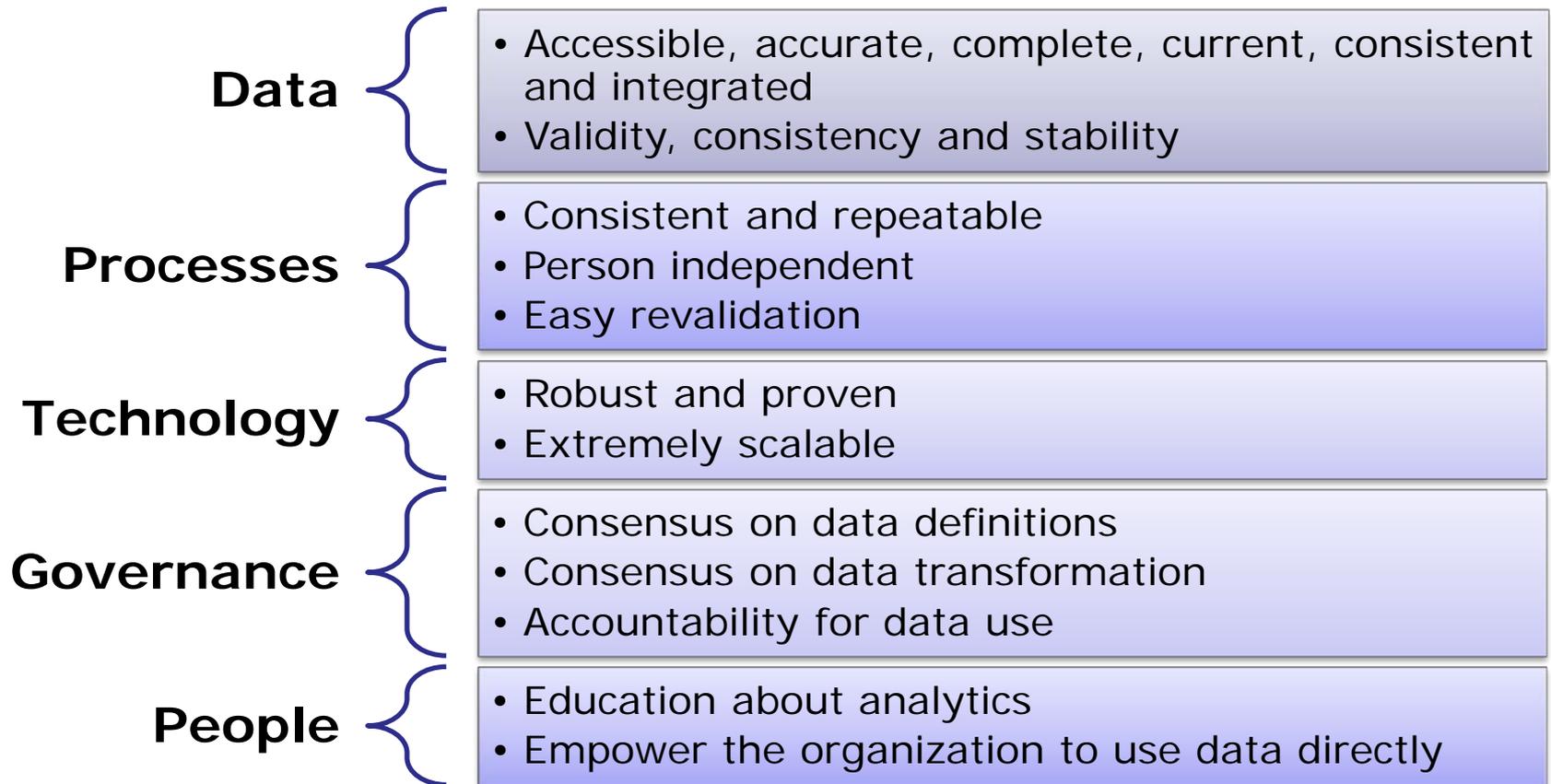


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Data Management Objectives





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Data Strategy

Data Integrity

- Single source and organization of data
- Automation of extraction, loading, and transformation of data
- Data quality concerns addressed in transformation processes
- Back-up, archival and disaster recovery protocols included

Metadata Management

- Standardization of data architecture
- Documentation of data classification, control and delivery
- Documentation of business rules and processes
- Documentation of analytics and forecasting models

Enterprise Analytics Environment

- Version control of programs
- Introduction of review and testing process
- Automation of processes
- Introduction of visualization tool(s)
- Introduction of multi-layer access analytics tools

Publishing Platform

- Intranet based reporting platform
- Controlled access
- Collaboration platform
- Dashboard platform
- Content management
- Retrieval and retention policy

Data Governance

- Standardization of data architecture
- Documentation of data classification, control and delivery
- Documentation of business rules and processes
- Documentation of analytics and forecasting models



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Medicaid – The Road Ahead

Implement foundational data management practices

Build technical capability, engage stakeholders, and foster a data driven culture

Empower organization to consistently rely upon data during decision making

Set the stage for leveraging data across the Commonwealth

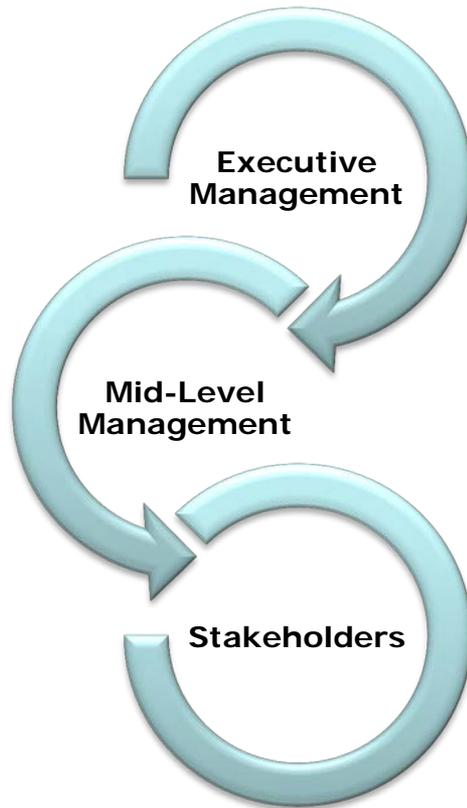


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Absolute essentials of success



- Agrees to invest resources and time to achieve the goal
- Agrees to a roadmap to integrate and consolidate the analytics assets across the organization
- Understands and embraces need for analytics
- Supports staff participation and contributions
- Aligns with the objectives of the data analytics vision
- Agrees to have open, unbiased dialogue regarding potentially controversial insights
- Agrees to continuous improvement and review



Department of Medical Assistance Services



Questions

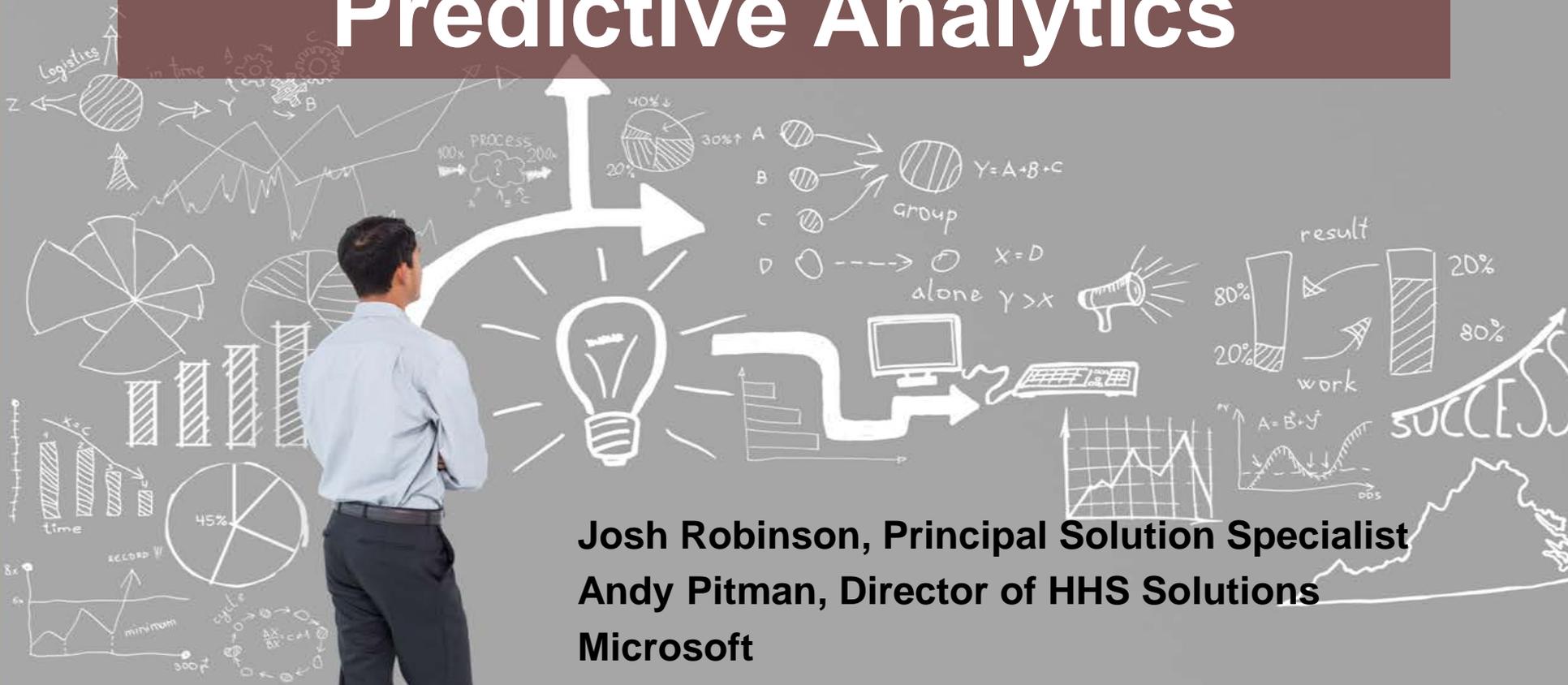
Bhaskar Mukherjee

Director, Office of Analytics

Bhaskar.Mukherjee@dmas.virginia.gov

<http://www.dmas.virginia.gov/>

BI in the era of Big Data and Predictive Analytics



Josh Robinson, Principal Solution Specialist
Andy Pitman, Director of HHS Solutions
Microsoft



Microsoft

September 30,
2014

Big Data

- 1880 U.S. Census
 - 8 Years to process
- 1890 U.S. Census
 - 1 Year – Hollerith Keypunch

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| 2 | | " William N. Jr. | w | m | 25 | | |
| 3 | | " Mary E. | w | f | 28 | | |
| 4 | | Hartley J. Jane | w | f | 19 | | |
| 5 | 331 356 | Hood Gabriel L. | w | m | 47 | | |
| 6 | | " Sarah J. | w | f | 44 | | |
| 7 | | " Annamatha | w | f | 25 | | |
| 8 | | " Augusta E. | w | f | 23 | | |
| 9 | | " Alice | w | f | 20 | | |
| 10 | | " Charles | w | m | 16 | | |
| 11 | | " Irving | w | m | 5 | | |
| 12 | 332 357 | Edison Thomas A. S. | w | m | 32 | | |



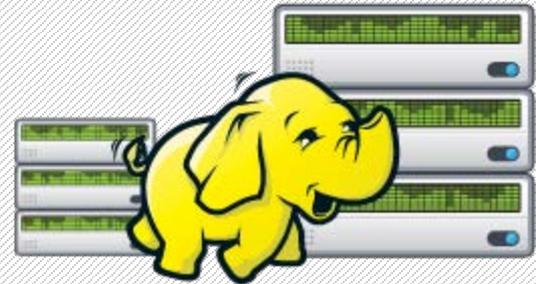
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| D | 4 | 4 | 4 | 4 | 1 | 4 | D | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
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| G | 7 | 7 | 7 | 7 | B | E | G | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| H | 8 | 8 | 8 | 8 | a | F | H | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| I | 9 | 9 | 9 | 9 | b | c | I | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |

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Big Data

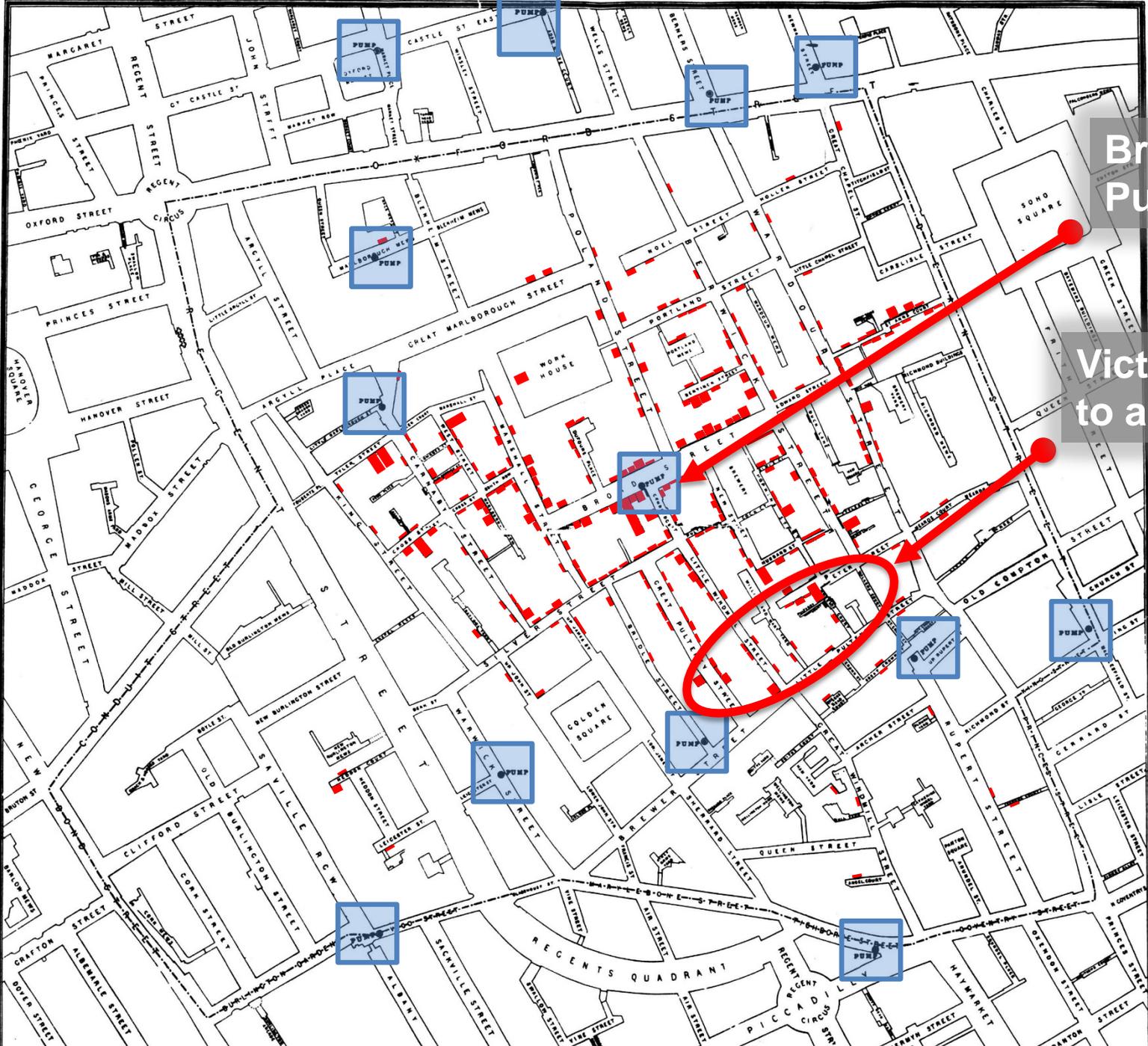
Demo:

Big Data in the Cloud



Broad Street Pump

Victims Closer to another pump



Analytics

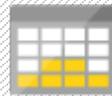
Demo:

Impact of Hurricane Sandy on
Elderly Population

Predictive Analytics

Demo:

Microsoft Cybercrimes Fraud
Detection



QUESTIONS AND DISCUSSION