



Predictive Analytics in State Government

Turning insights into action

Margot Bean, David Duden, and B.J. Walker

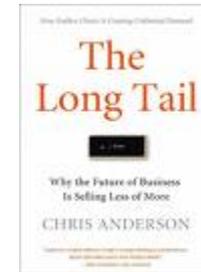
Deloitte Consulting LLP

September 30, 2014

Analytics has gone mainstream

“**Perhaps the most important cultural trend today:** the explosion of data about every aspect of our world and the rise of applied math gurus who know how to use it.”

-- Chris Anderson, editor-in-chief of *Wired*



“In the past, one could get by on intuition and experience. Times have changed. **Today, the name of the game is data.**”

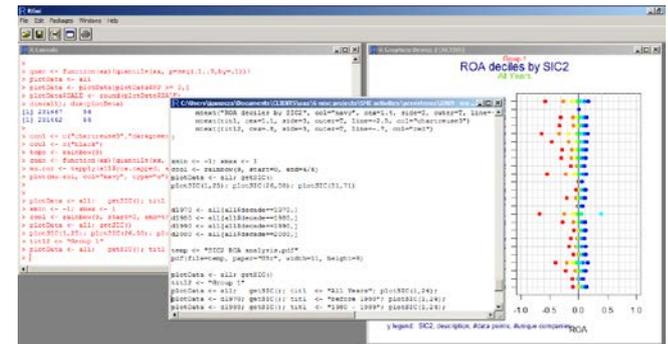
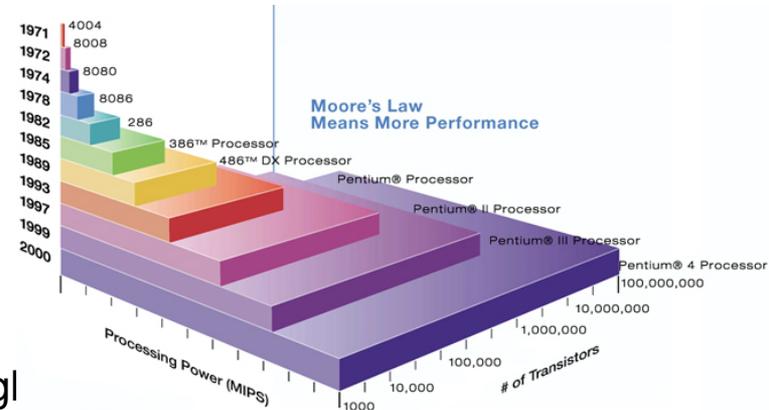
-- Steven Levitt, University of Chicago Economist
and author of *Freakonomics*



Analytics enabling factors

Reasons why analytics is now **possible**:

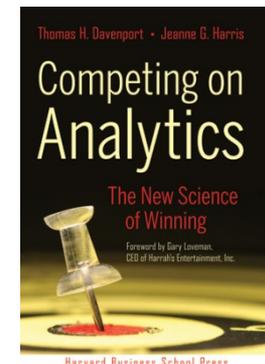
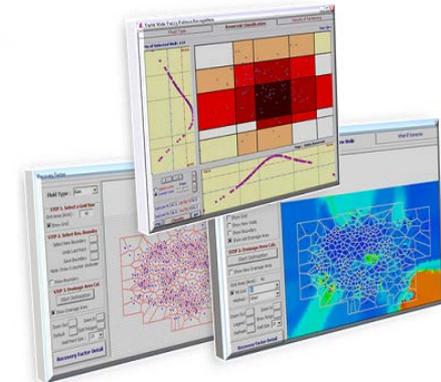
- Technology
 - Moore's Law
 - Cost of storage and computing power has decreased exponentially
- Data
 - Third-party & lifestyle data is becoming increasingly available
 - Companies are learning to do more with their internal data
- Software and Algorithms
 - Innovative analytic ideas continually coming from statistics, economics, machine learning, marketing, etc.
 - Widespread availability of advanced analytic tools



Analytics for the masses

Reasons why analytics is now **mainstream**:

- Need for Fairness
 - Effective implementation of predictive models enables agencies to more effectively deploy reduced resource
- Flexibility, Accuracy, Scalability
 - Analytics replaces “the broad brush” with “the long tail”
 - Mass customization: targeted offers/messages can be crafted for millions of citizens, employees, etc.
- Competing on Analytics
 - Innovative companies in all sizes and in all industries are finding ways of fashioning core competitive strategies around the use of analytics



Increasing applications for analytics

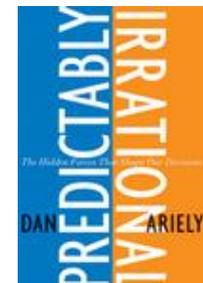
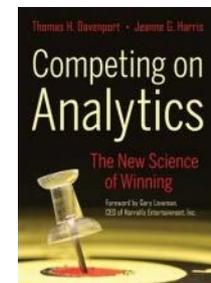
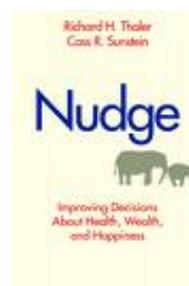
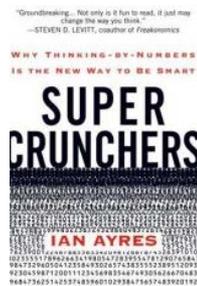
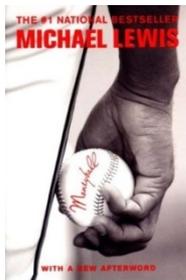
Growing recognition in cognitive psychology & behavioral economics: **Predictive models help human experts make decisions more accurately, objectively, and economically.**

- Academic / psychological research dates back to the 1950's.
- Now a growing consensus in the worlds of business, education, law, government, medicine, entertainment, ... and professional sports.

Predictive modelling is the ultimate “transferable skill” – it applies in domains where experts must make decisions by judgmentally synthesizing information.

“Human judges are not merely worse than optimal regression equations; they are worse than almost any regression equation.”

-- Richard Nesbitt & Lee Ross, *Human Inference: Strategies and Shortcomings of Social Judgment*



Bringing an objective lens to society's issues

Think of it this way:

Probably due to some quirk in evolution, many of us are nearsighted.

So eyeglasses were invented to help us see better.

Behavioral economics teaches us that probably due to some quirk in evolution, our minds are not equipped to weigh evidence in an unbiased way

- **Heuristics and Biases:** the mental “heuristics” (or rules of thumb) that we use to make decisions are biased in surprising ways
- We aren't stupid... it's just that we are Humans, not Vulcans

So predictive models are built to help us think better.



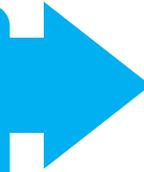
Predictive analytics in the Public Sector

Proven Success in the *Private Sector*

Property & Casualty Insurance
Predicted Loss Ratio Modeling
Soft Fraud Detection Modeling

Financial Services
Credit Scoring
Credit Card Delinquency Modeling

Health Insurance
Insured Segmentation Modeling
Clinical Utilization Modeling
Provider Fraud Detection



Applied to the *Public Sector*

Predicted Loss Ratio Modeling
Claimant Severity/Duration Modeling

Tax Payer Delinquency Modeling
Tax Payer Non-filer Discovery Modeling

Government Sponsored Health
Insurance Member Retention Modeling

Medicaid Fraud Detection
Unemployment Insurance Overpayment

Benefits to the State

Improved Workforce Effectiveness

- Reduce user guesswork and “cherry picking”
- Prioritize workload based on high impact
- Incorporate historical experience to drive future activities
- Eliminate a one size fits all approach
- Efficiency of customer service interactions
- Over time reduce future workload
- Change from a sequential process to a “smart” work queue

Increased Resource Allocation Efficiency

- Shift from reactive enforcement to early intervention
- Learning component for new case management approaches
- Assign high risk cases to case workers sooner
- Different approaches for different regions and different case types
- Automate certain research processes

Improved Outcomes

- Better estimates of delinquencies, child support collections
- Increased revenue, reduced fraud, waste and Abuse
- Fewer child support and cases in arrears
- Model results can be used to quantify historical process inefficiencies
- Significant marketing value – “We Know Our Citizens”
- Create unified view across all regions and business processes



Child Support

Predictive Analytics

Moving from “what I need to do” to “what I need to know”

Current challenges for child support case management

Working the Right Cases



Information Overload



Visible Results



Next Appropriate Action



Case Worker Management



**Lack of a targeted
case management strategy**

Predictive modeling child support strategy

- Child support case management has traditionally been a **reactive** process
- Shift focus to **predicting** which Noncustodial Parents are most likely to fail to pay in the near future through regression analysis
- Anticipated outcomes:
 - Prevent growth of child support arrears
 - Decrease custodial parent complaints
 - Reliable payments each month
 - Increased worker efficiency by taking the right action on a case at the right time
 - Ability to assign the right case workers to the right cases
 - Improve performance on federal child support measures – increased incentives for the state

Use analytics to make smarter decisions, do more with less, and improve people's lives

Using the scores

Prioritize Cases

- Predict which cases likely to fall into delinquency
- Identify the top reasons the case is predicted to fall into delinquency
- Provide child support workers with information needed to proactively reduce likelihood case will fall into delinquency
- Focus on cases most likely to respond to targeted worker actions

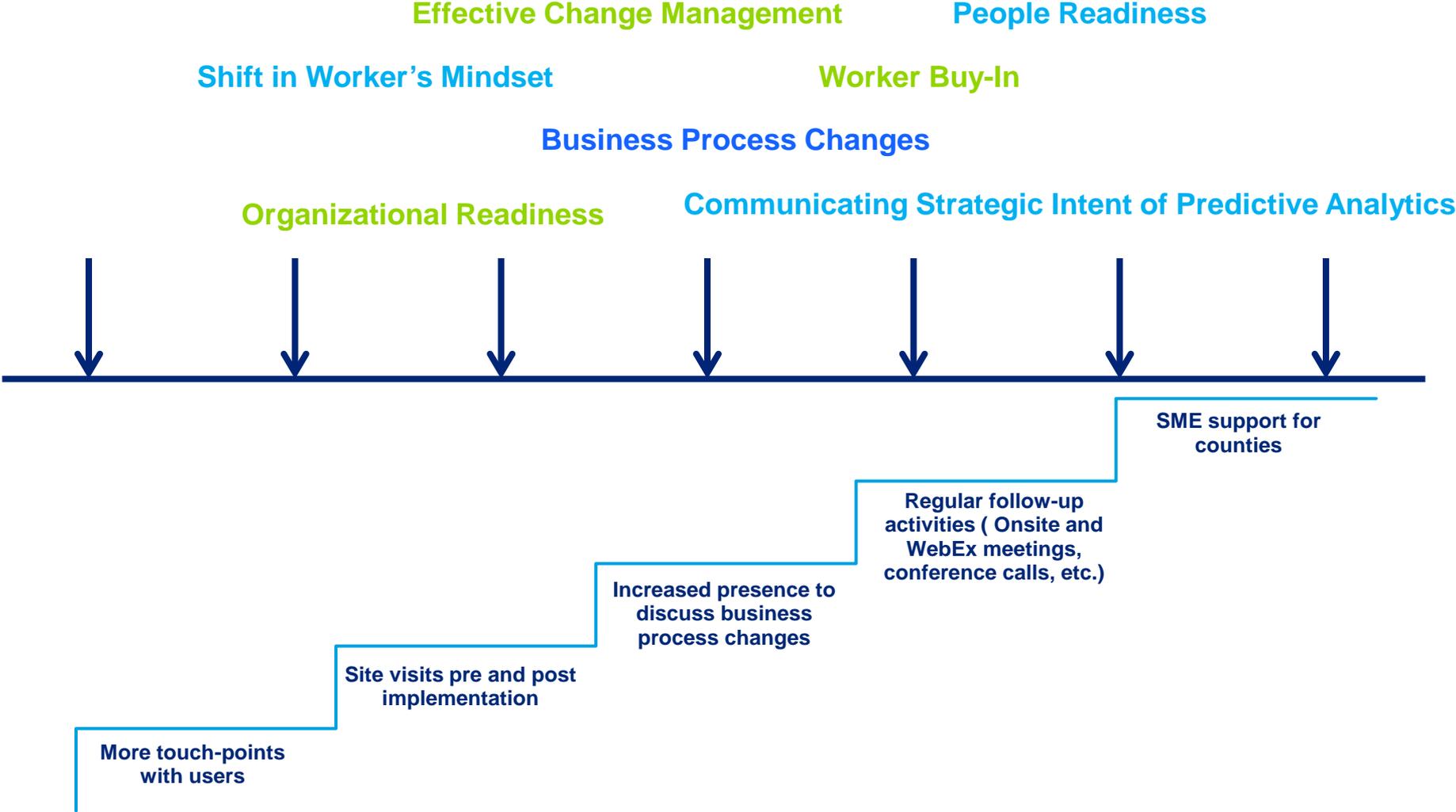
Suggest Actions

- Identify opportunities for proactive enforcement activities
- Tailor customer engagement actions on each case based on top reasons for predicted delinquency
- Provide the right service at the right time to the case to encourage compliance with the order

See Results

- More effective case assignment by matching worker skills with case difficulty
- Increased quantity and frequency of collections in 2 state child support agencies
- More productive meetings with noncustodial parents
- Decreased enforcement costs by focusing action where it will be most productive

Critical adoption success factors





Child Welfare

How predictive analytics can help us make decisions that *really* are in the “best interests of the child”

Some inconvenient truths about the child welfare system

**REACTIVE VS.
PROACTIVE**

Most typical ways to hold child welfare systems accountable – media scrutiny, consent decrees, federal reporting – are too little, too late

**POLICY VS.
PRACTICE**

Policy, procedures and even evidence-based practice models offer false comfort in a harsh and unpredictable business

**ADMINISTRATIVE
VS. OPERATIONAL**

The people and systems who manage the data and reporting in your organization are not the people doing the work

**EFFECT VS.
CAUSE**

Tracking and reporting on metrics is not enough – unless you know why people are making the decisions they do and impact of those decisions real time

**“WHAT” VS.
“WHY”**

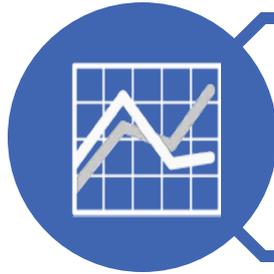
The standard response to tragedy and crisis is to explain what happened, not why it happened

Making the case for predictive analytics in child welfare

You have plenty of data, but time and time again you find yourself not being able to use it to stop bad things from happening or to prevent them from happening again. The information lurking deep under the surface of wrong work and lack of results is a game changer – but you get it too late (and sometimes not at all).



First, it starts with getting the **questions right – ask them early and often**



Second, get the **analysis right**



Third, use what you learn to expect **different behaviors and better decisions**

Asking the right questions helps set the context and put us into an analytics frame of mind

Good business questions are the tail that wags the predictive analytics dog— it is about what you need to know, when you need to know it, what you do about *it*, and *your willingness to keep asking yourself if it is effective.*

In the past, we focused on the Federal measures but:

- Lag measures alone offer few insights into why situations occurred.
- These metrics – without context – do not pay us back in changed systems (ones where people consistently make better decisions and exhibit more effective behaviors)

Current metrics tracked in child welfare:

- initial response time in a hotline call
- amount of time it takes to complete an investigation
- time it takes to file a termination of parental rights (TPR), finalize adoptions, or reunify children with their parents
- rate of recurrence of maltreatment or re-entry into care

In a dangerous business, knowing what just happened is only useful if it helps you predict and shape what will happen next

Performing the right analyses

Realize that algorithms are only as good as your questions. But once you get the questions right -- then you need to make sure that you get the math right.

Even when you think a statistical formula is telling you something – you need to put it into context to make any sense out of it.

- ✓ How many times has this situation happened before?
- ✓ Were the contextual factors the same?
- ✓ Has it happened this way before enough times for you to rely on the pattern as being predictable?

Challenges

- We can get lost in statistical jargon (coefficients, cluster analysis, regression to the mean??)
- Those performing the analysis may want to emphasize the math over the meaning

None of this is pure science – that's why the outputs from predictive analytics are called insights instead of answers

Putting results into action = different behaviors and better decisions

The question is not simply “can you predict something?” Sure you can. But “what can you do about it?” Real change requires organizations to generate different behaviors and better decisions based on the analytics outputs



Using data to “profile” a problem you need to fix

Example: Placement Disruptions

CHILD WELFARE/SACWIS DATA SOURCES

- Length of time child has been in care
- Reason child came into care
- Allegations of maltreatment by child while in care
- Length of time child has been with provider
- Proximity of provider to child’s parent/removal home
- Placement with /without siblings
- Number of substantiated or unsubstantiated reports of abuse and neglect by provider
- Number of children served by the provider
- Adult/child ratio at the child’s placement home/facility
- Timeliness and content of case reviews
- Number of moves child has had in foster care
- Age, gender, gender preference, race, ethnicity of child

EXTERNAL SOURCES

- School absence
- School academic and behavioral performance
- School changes and disruptions
- Neighborhood social and economic factors
- Caregiver characteristics (single parent, parent with prior child welfare contact, homelessness, substance abuse, domestic violence, involvement with criminal justice; education level)

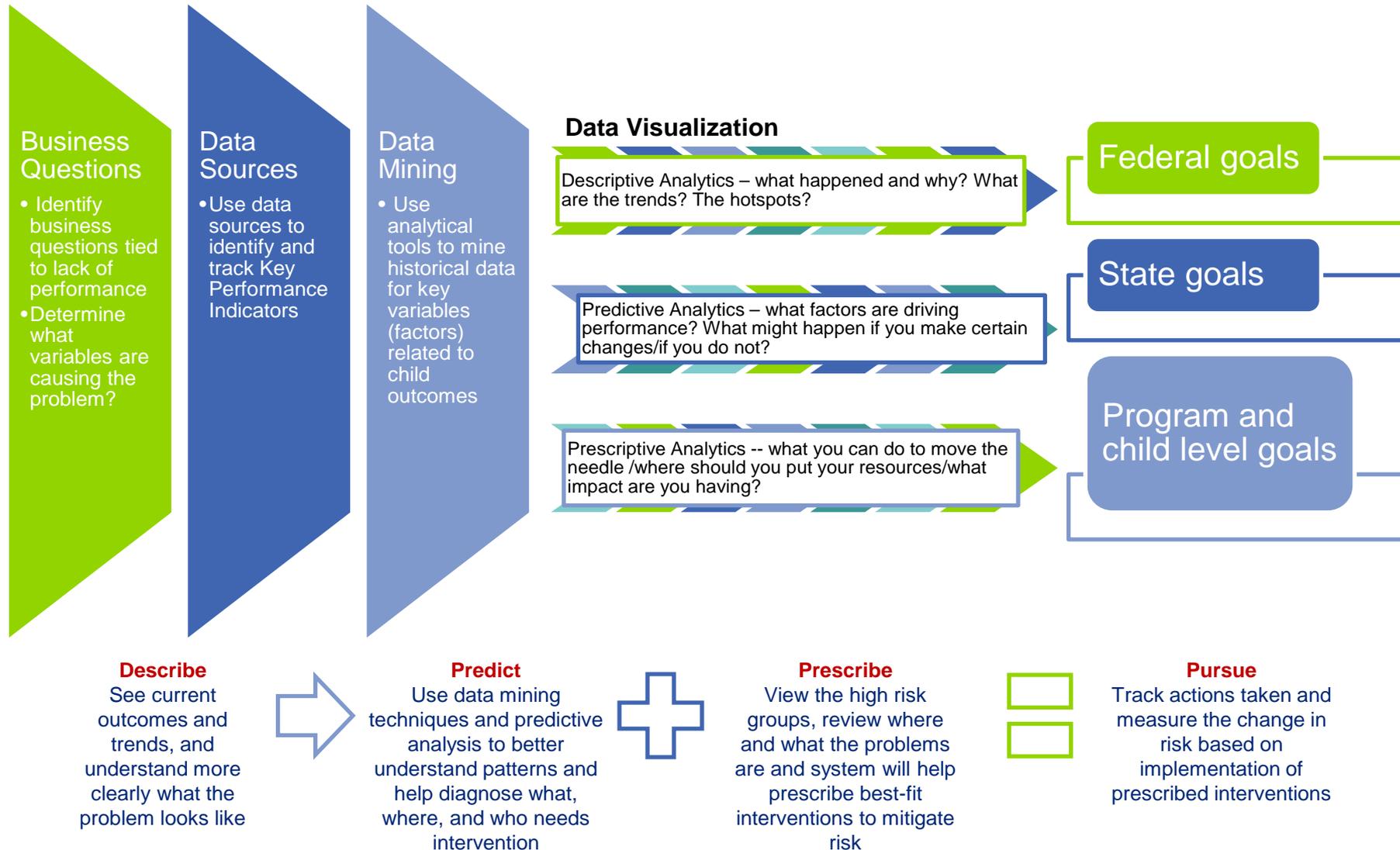
Potential Impacts

- Better, more stable initial placements
- Increase in number of successful reunifications
- Decrease in time children spend in care

...and ultimately an improved ability to provide what is best for the child

Using Analytics and Predictive Modeling to Move From Data to Insight to Action to Impact

We know what a good “end to end” process looks like:



Using Visualization Tools to better communicate with your front line – put insights in front of your people

Example: Children at High Risk for Maltreatment in Care

Drill Down to Every Level:

- Given our history, which children are most likely to be at risk of maltreatment in care?
- Which counties and case workers have children in their caseload who are most likely to be at risk?
- Given our history, which children are most likely to remain in care for long periods of time?
- Who are those children and what factors are likely to keep them in care?



Value Delivered:

- Tracks outcomes at the level of individuals – by caseworker, by child, by family
- Allows for immediate identification of children at high risk for maltreatment and long stays in care and their associated drivers – allowing us to identify points of intervention sooner.

Questions?



Allegheny County
DEPARTMENT OF HUMAN SERVICES



Public School District Partnerships: Improving Educational & Well Being Outcomes
September 2014

Integrated Human Services Model

- Assistance for older persons with/without disabilities
- Child protective services
- Mental health services (including 24-hour crisis counseling)
- Drug and alcohol services
- Services for individuals with a diagnosis of intellectual disability
- Hunger services
- Emergency shelters and housing for the homeless
- Non-emergency medical transportation
- Job training/placement for older adults and adults on TANF/SNAP.
- Family support
- After school and summer programs for children
- At-risk child development and early education



Organizational Viewpoints

- Department of Human Services (DHS) provides an integrated set of services
- Consumers are “Consumers of DHS”
- Staff work for DHS
- Program Offices were created for management purposes
- Providers contract with DHS, not Program Offices
- DHS data
 - Community resource
 - Get data where it needs to be



Integrated Data Systems

Internal Sources

- Aging
- Child Welfare
- Community Service Block Grant
- Drug & Alcohol
- Early Intervention (partial)
- Family Support Centers
- HeadStart (partial)
- Homeless
- Housing
- Mental Health
- Intellectual Disabilities

External Sources

- Allegheny County Housing Authority
- Allegheny County Jail
- Allegheny County Medical Examiner's Office
- Department of Public Welfare
- Housing Authority City of Pittsburgh
- Physical Health Claims (Medicaid)
- Juvenile Probation
- Pittsburgh Public Schools + 11 additional County School Districts
- Pre-trial Services
- Adult/family court

Potential Data Sources

- Vital Statistics Data
- Early Childhood (PELICAN)
- Post Secondary Education
- Employment & Training

Data to Integrate Care

[Help](#) [Logout](#)

[Home/Client Search](#) : Client Information : Service Activity

Home/Client Search
Search Results
Client Information
Demographics
Service Activity
Services Rendered
Placement Activity

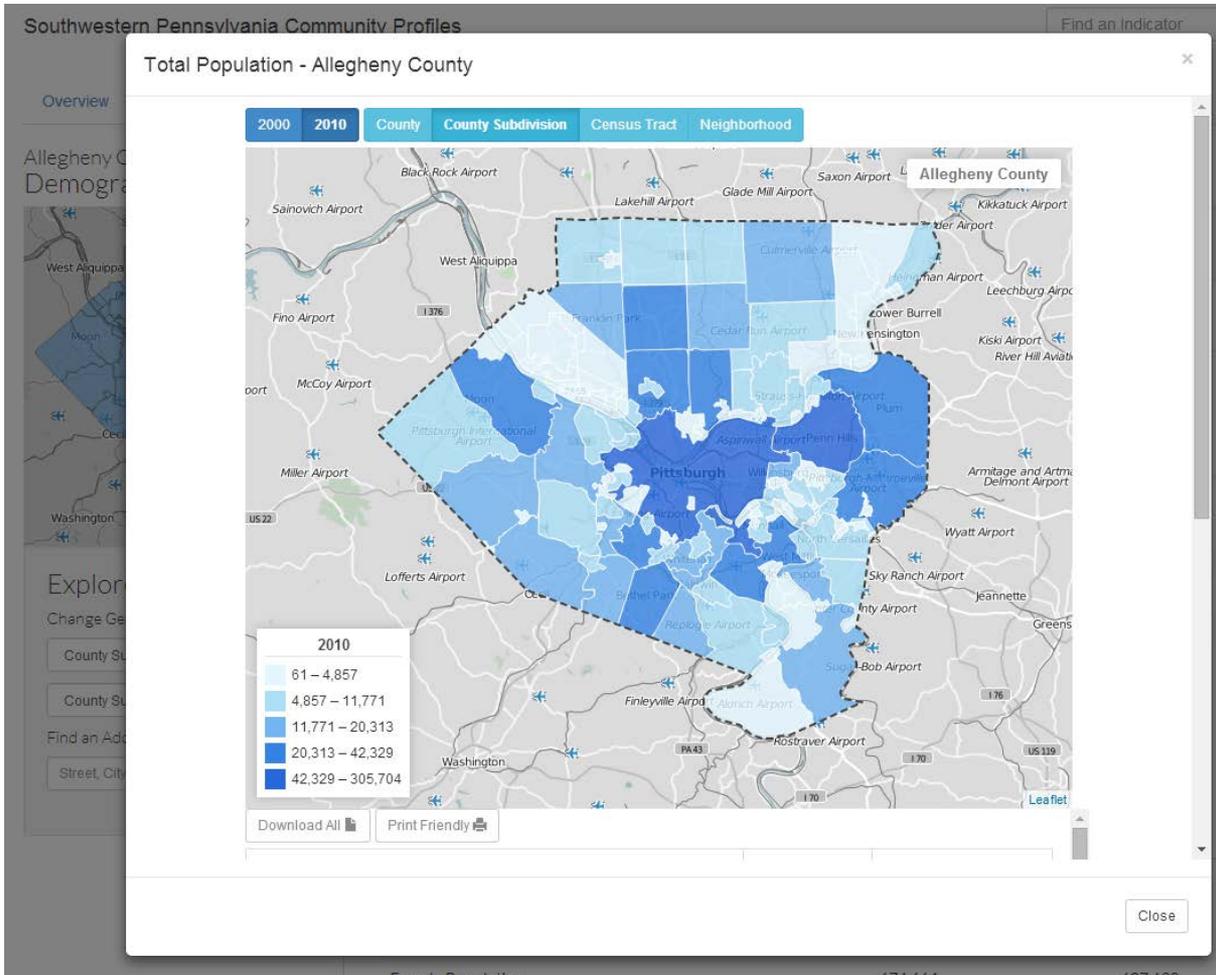
Recent Clients

Service Activity

Program Office	Program Office Breakdown	Activity Status	Month	Week
Office of Children, Youth, and Families	CYF Children	Actively case managed	Details	Details
Office of Behavioral Health (Drug and Alcohol)	DA CCBHO	Inactive	Details	Details
DPW	DPW	Eligible Child	Details	Details
HACP	HACP	Inactive	Details	Details
Juvenile Probation Office	JPO	Active	Details	Details
Key Information and Demographic System	KIDS Children	Active CYF Non Placement	Details	Details
Medical Assistance Transportation Program	MATP	Active, not case managed - Non Assessment	Details	Details
Office of Behavioral Health (Mental Health)	MH CCBHO	Actively case managed	Details	Details
Office of Behavioral Health (Mental Health)	MH County	Actively case managed	Details	Details
Maximizing Participation Project	MPP	Inactive	Details	Details
Pittsburgh Public Schools	PPS	Active	Details	Details

Aggregate Data for Public Use

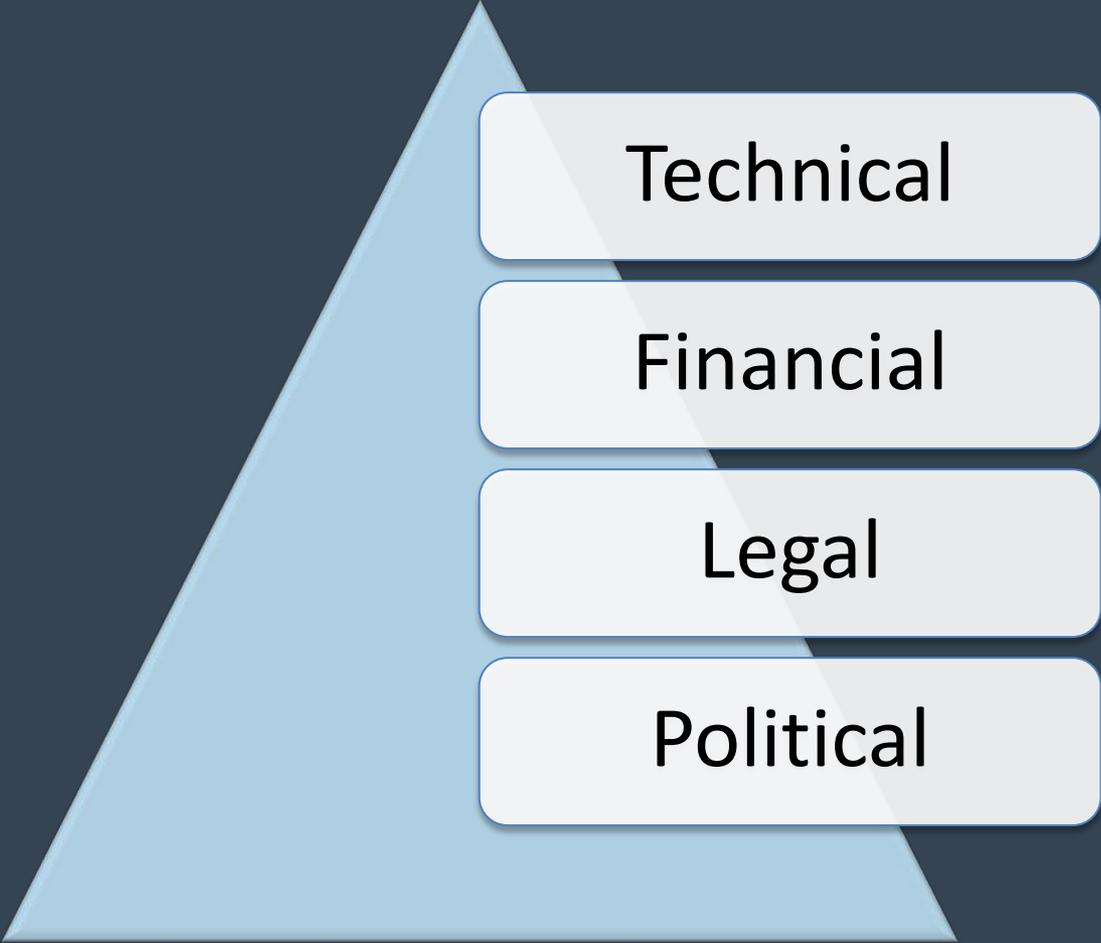
Community Profiles with local NNIP site *Planned Release – Fall 2014*



Indicators Include

- Demographic
- Economy
- Education
- Health
- Housing & Properties
- **Human Services**
- Environment
- Public Safety
- Arts & Culture
- Governance & Civic Vitality
- Transportation

Getting to the School District MOU



Technical

Financial

Legal

Political

The Legal Framework

MOU I: One-way data sharing: School district data to DHS

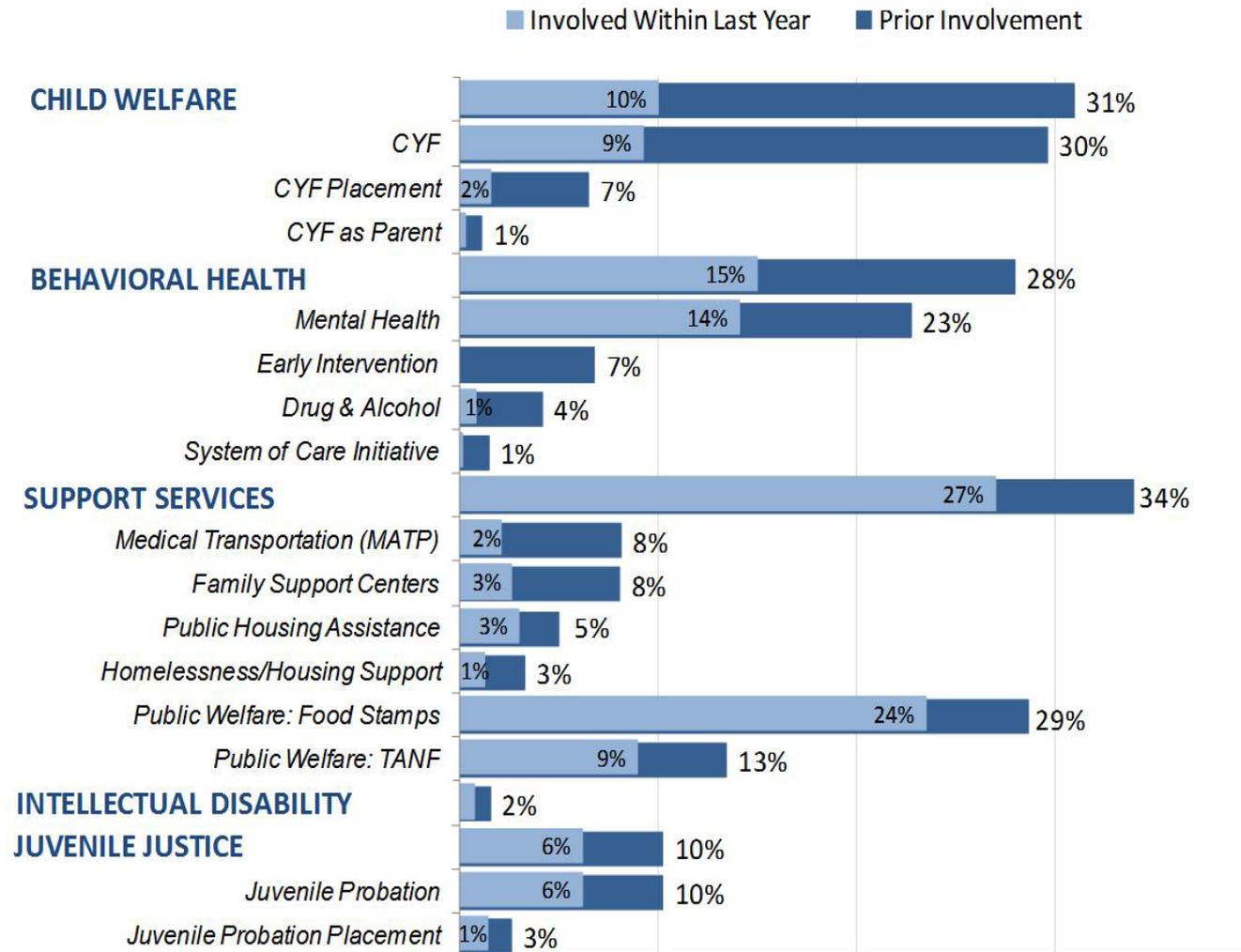
- Directory information
- Educational outcomes for all kids – action research agreement
- Educational outcomes for kids for whom DHS is the legal custodian
- Consent

MOU II: DHS Data to school district

- Child Welfare, students who are adjudicated dependent
- Homelessness services

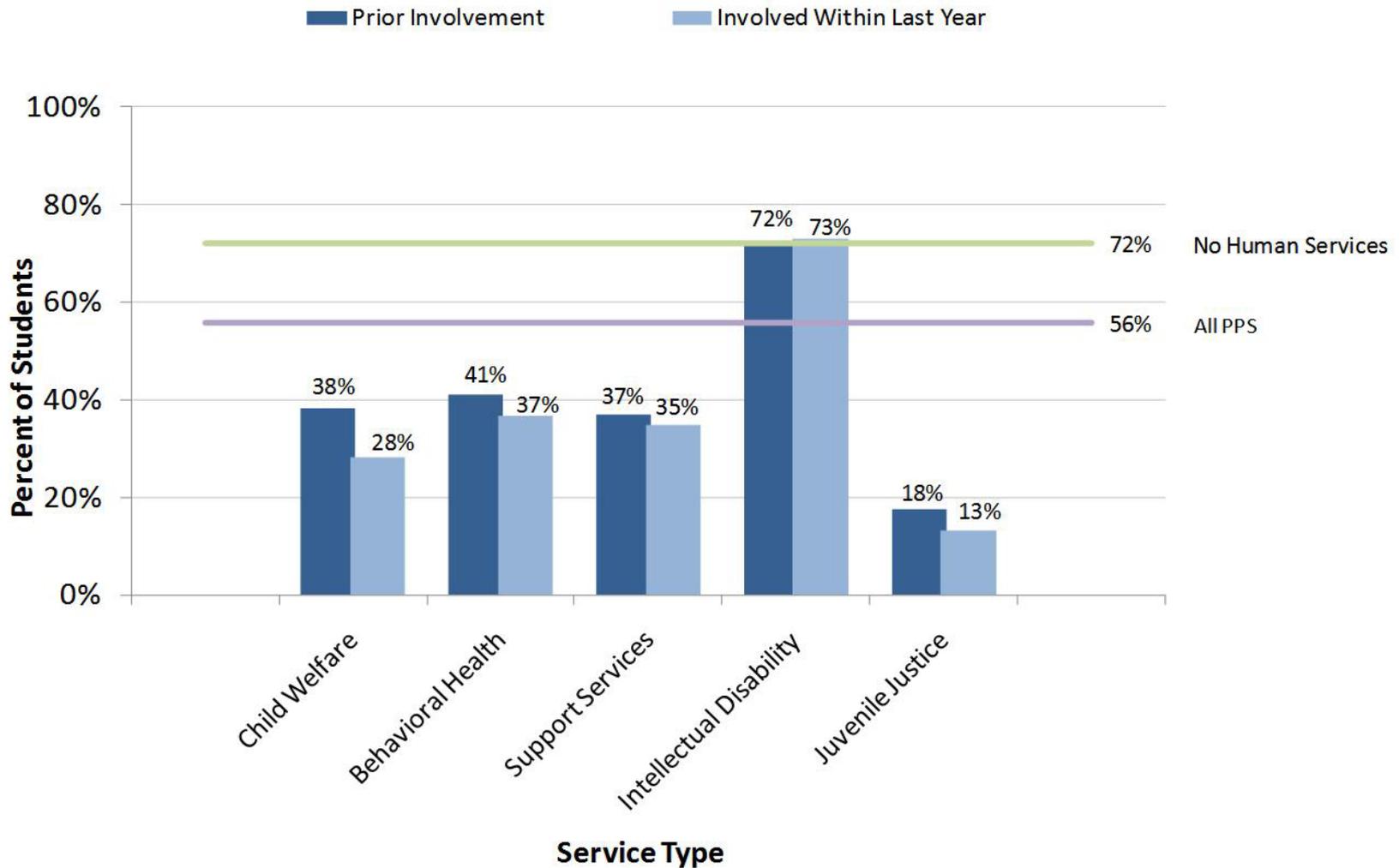
More than Half of Students Involved in Human Services

53 percent (14,450) of PPS Students have prior Human Service involvement
36 percent (9,750) were involved with a Human Service within the last year



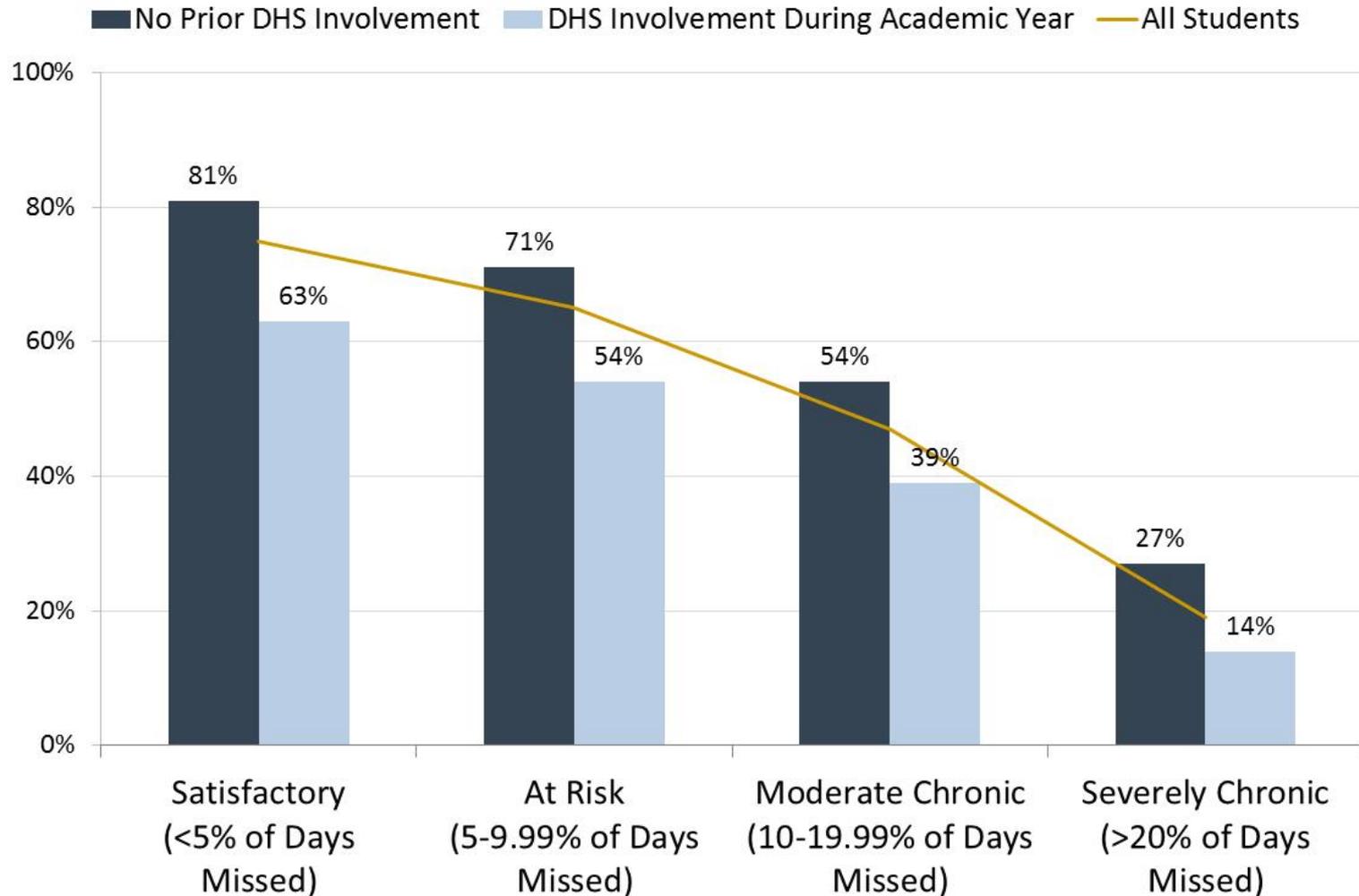
Achievement Gap

Percent of Students with GPA 2.5 or Above by Service Type



Attendance Matters

Percent of Students with a GPA of 2.5 or Above by Attendance Category



Predictive Analytics Methodology

CART Analysis (Classification & Regression Tree)

Dr. Kevin Kim, University of Pittsburgh

Time Period: 2004-05 to 2010-11 academic years (218,522 records)

What we're trying to predict:

Absences (Not Chronic:< 10% days missed, Chronic: >10%)

GPA

Independent variables

Race

Gender

Old for Grade

Within School Year Move

Assisted Housing

Public Benefits (Poverty indicator – DPW TANF, SNAP)

Child Welfare Involvement

Mental Health Services Involvement

Juvenile Justice involvement

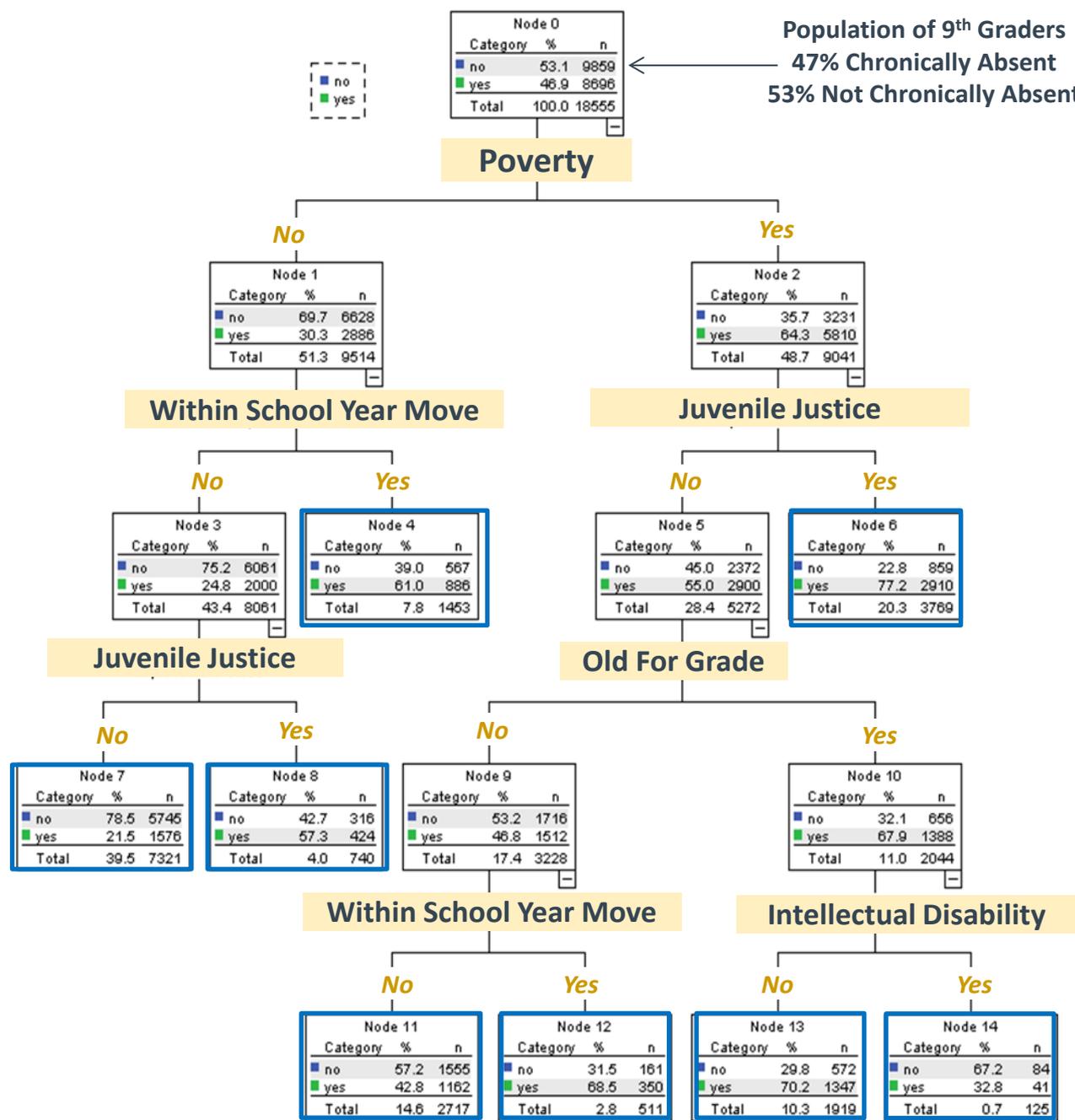
Intellectual Disability

Predictive Factors for 9th Graders

Independent Variable (By order of Predictive Importance)	
Dependent Variable : Chronic Absence	Dependent Variable : GPA
Juvenile Justice	Within school year move
Within school year move	Juvenile Justice
Poverty indicator	Old for grade
Old for grade	Child Welfare
Child Welfare	Poverty Indicator
Mental Health services	Drug and Alcohol services
Drug and Alcohol services	Race
Race	Mental Health services
Public Housing	Public Housing
Homeless and Housing Supports	Homeless and Housing Supports

9th Grade Absence Predictors

Population of 9th Graders
 47% Chronically Absent
 53% Not Chronically Absent

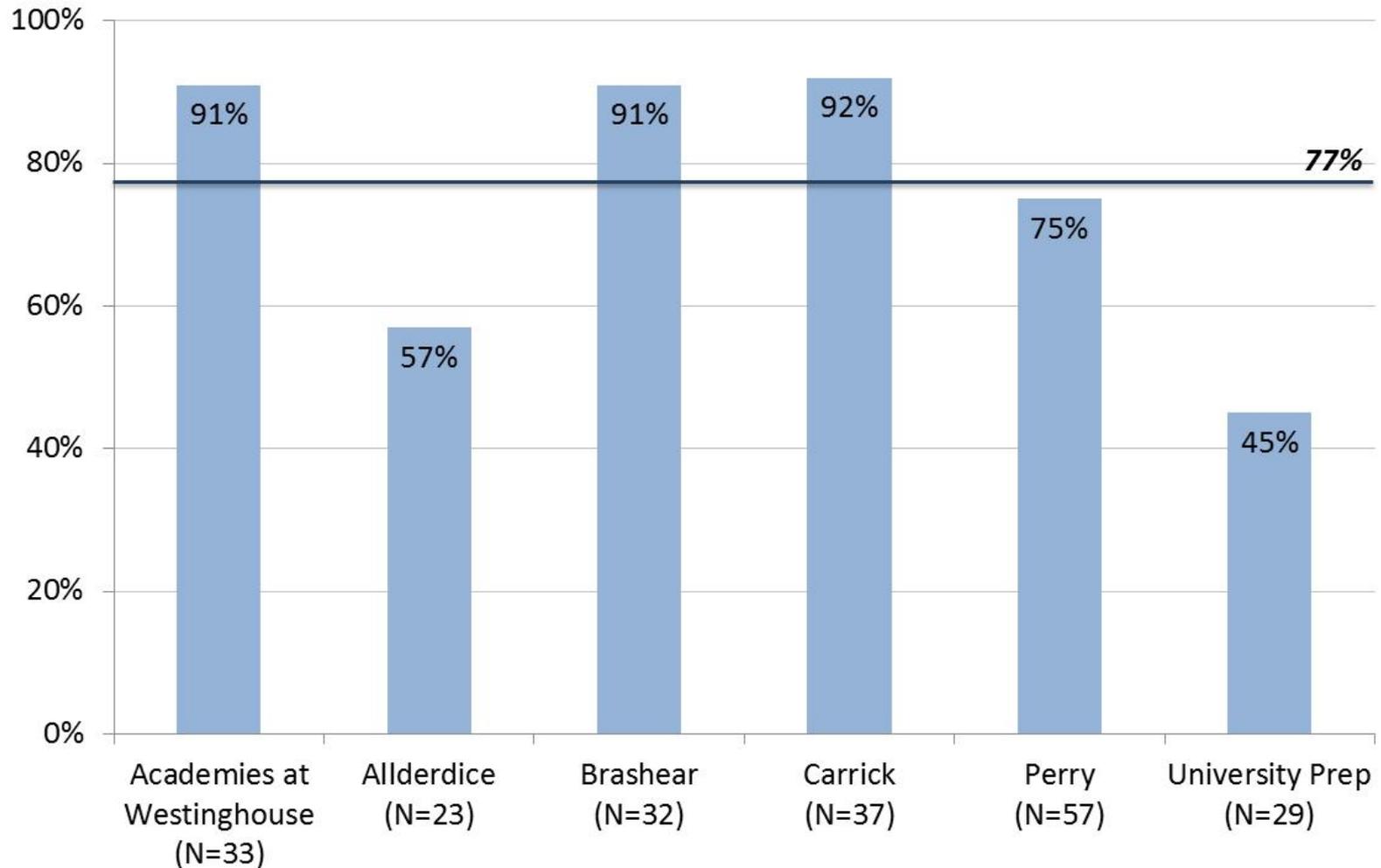


9th Grade Absence – Summary of Nodes

% of Pop.	Node	Chronic Absence
20%	Poverty and Juvenile Justice (Node 6)	77%
10%	Poverty and Old for Grade (Node 13)	70%
3%	Poverty and Within School Year Move (Node 12)	69%
8%	Within School Year Move (Node 4)	61%
4%	Juvenile Justice Involvement (Node 8)	57%
15%	Poverty (Node 11)	43%
1%	Poverty, Old for Grade & Intellectual Disability (Node 14)	33%
40%	Not Poor, Stable School, No Juvenile Justice (Node 7)	22%

School Building Effects

Percent of Students Involved in Juvenile Probation and Receiving Public Benefits Who are Chronically Absent, by School Building



Next Steps for Chronic Absenteeism

Adding neighborhood indicators to predictive analytics

How important are neighborhood factors in predicting chronic absenteeism? Add place-based data to the current people-based data.

- asthma
- poor property conditions
- financial instability
- high crime rates

Share with “Be there” stakeholders to inform upcoming strategies & interventions



Human Services/Public Schools Analysis

ACTION RESEARCH APPROACH

Analysis

Perform integrated analysis to assess specific nature and dynamics of targeted issue.

Critical Reflection

Carefully examine analyses to develop effective strategies to improve both organizations' way of working with children and families.

Action

Create, implement and assess strategies and interventions

Detailed attendance analysis

Identifying school aged children active in human services who are not currently enrolled in school

Improving school stability – Best Interest Placement Tool, decision support tool used when caseworkers make placement decisions

McKinney-Vento vs. HUD definitions of homelessness. Exploring housing crisis prevention services for schools where families are often first identified.

Data Where It's Needed

Direct Service Staff Access to Child-Level Data

Up-to-date education information (where legal)

Data Vue - Enrollment

Home/Client Search : Client Information : School Activity

Name MCI ID

School Activity

School Involvement

Current School Information

School Name: NORTHVIEW K-5
Current Grade: Seventh Grade
School Contact #: 412-323-3130
Enrollment Dates: 04/10/2012

KIDS – Education Records

School/Early Learning/College/University | Strength/Needs | Financial Aid

School District Data

Enrollment Date Withdrawal Date Student ID Number PA State ID Number

School Name School Contact Grade

IEP Date of Last IEP Type of IEP SAP Referral Lunch Eligibility

Days of Enrollment Days of Suspension Days of excused absence Days of unexcused absence Days of excused tardy Days of unexcused tardy

GPA Weighted GPA GPA Q1 GPA Q2 GPA Q3 GPA Q4

PSSA Reading Category PSSA Math Category PSSA Science Category PSSA Writing Category

Absences/Tardies/Suspensions

Date	Type	Excused/Unexcused
<input type="text"/>	<input type="text"/>	<input type="text"/>

Caseworker Alerts - Weekly

SUMMARY OF EDUCATION CONCERNS

Case ID	Client ID	Client Name	School Attended	School Contact	IEP	Attendance	Suspension	Withdrawal
12345	51235	Shawn Glover	Pittsburgh Public - Schiller	412-529-4190	Y	X		
23456	54485	Jerome Wyley	Clairton - Middle School	412-233-9200	N	X		
34567	51006	Erika Briggs	Pittsburgh Public - Carrick	412-529-7700	N	X	X	
45678	52322	Sam O'Conner	Pittsburgh Public - King	412-529-4160	N			X

DETAILS

ATTENDANCE					
Client Name	Days Absent			Tardies	
	Days Missed in Prior Week	Days Missed This Academic Year	Attendance Category	Days Tardy in Prior Week	Days Tardy This Academic Year
Shawn Glover	1	27	Chronic	5	22
Jerome Wyley	5	9	At-Risk	7	11
Erika Briggs	4	45	Severly Chronic	5	12

SUSPENSIONS		
Client Name	Days Suspended in Prior Week	Days Suspended This Academic Year
Erika Briggs	4	16

WITHDRAWALS				
Client Name	Date of Withdrawal	Reason for Withdrawal	Date of Enrollment	New School
Sam O'Conner	12/20/2013	Left District		

Expanding Predictive Analytics Across DHS

Issued an RFP for Decision Support Tools and Predictive Analytics in Human Services RFP (Closed April 2014)

<http://www.alleghenycounty.us/dhs/rfp041814.aspx>

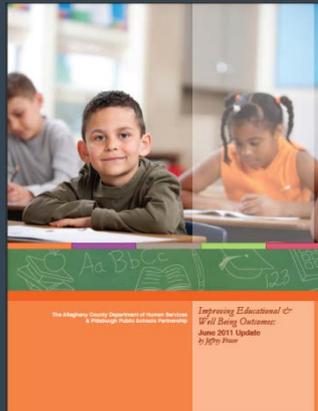
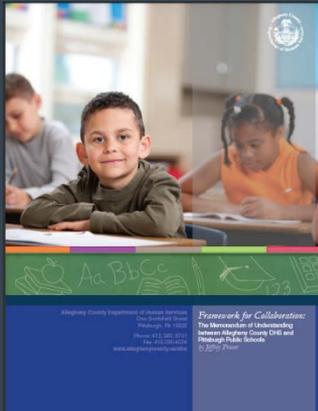
- What's the best way to prioritize child welfare intake cases for response?
- Which seniors receiving services in their homes are at risk of requiring nursing home care or hospitalization?
- How do we organize our prescription drug payment data to alert workers when a client (child or adult) may be on counter-indicating medications (for example, when children are receiving multiple psychotropic medications and no therapy)?
- Which clients receiving behavioral services may not be receiving services at the appropriate level of care?

16 agencies responded, 1 will be selected

Questions?

Additional Information:

<http://www.alleghenycounty.us/dhs/research-education.aspx>



emily.kulick@alleghenycounty.us

USING DATA, ANALYTICS TO SERVE CITIZENS BETTER

or...

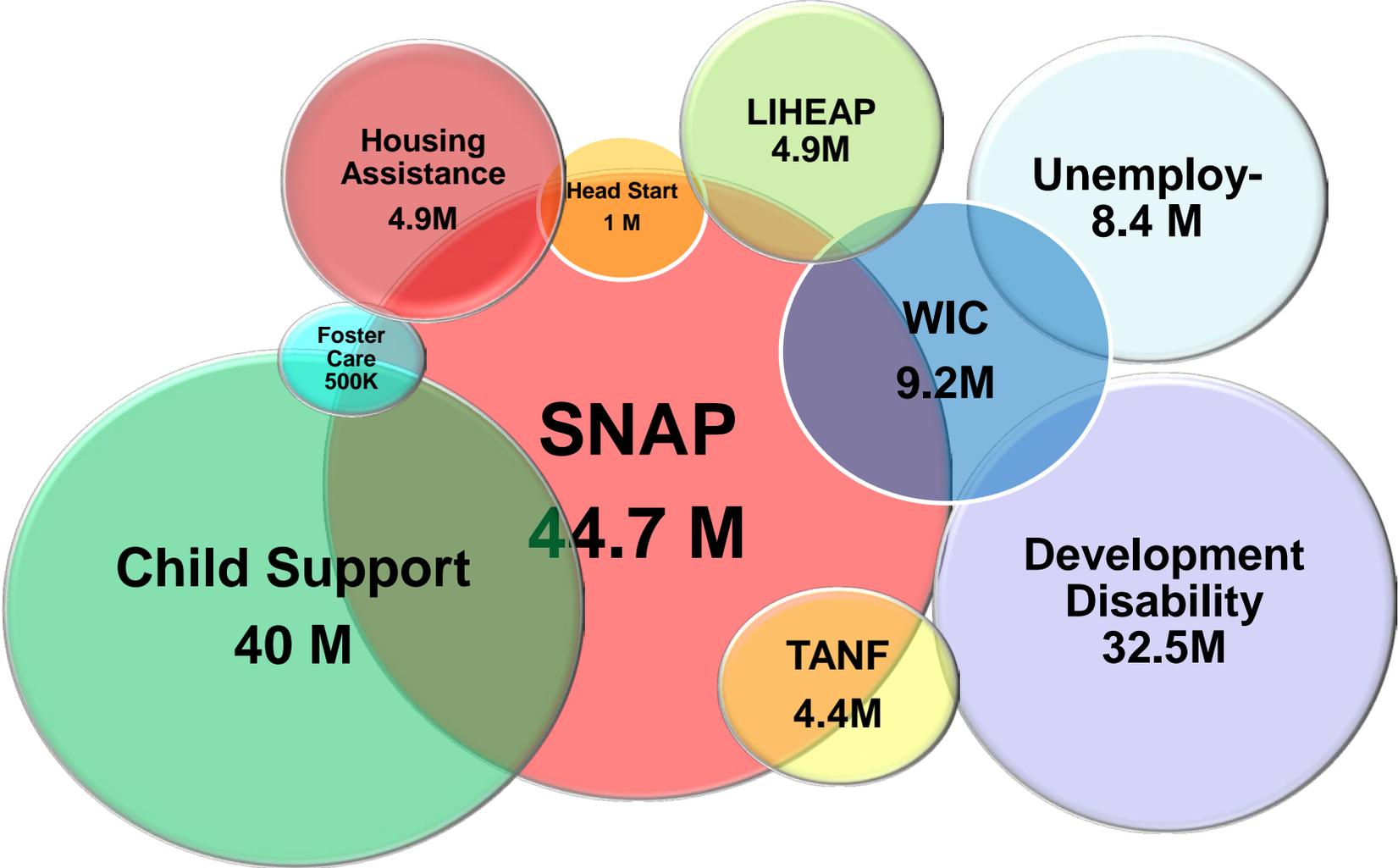
The Art of the Possible

Presented by:
Stewards of Change Institute
Daniel Stein, President

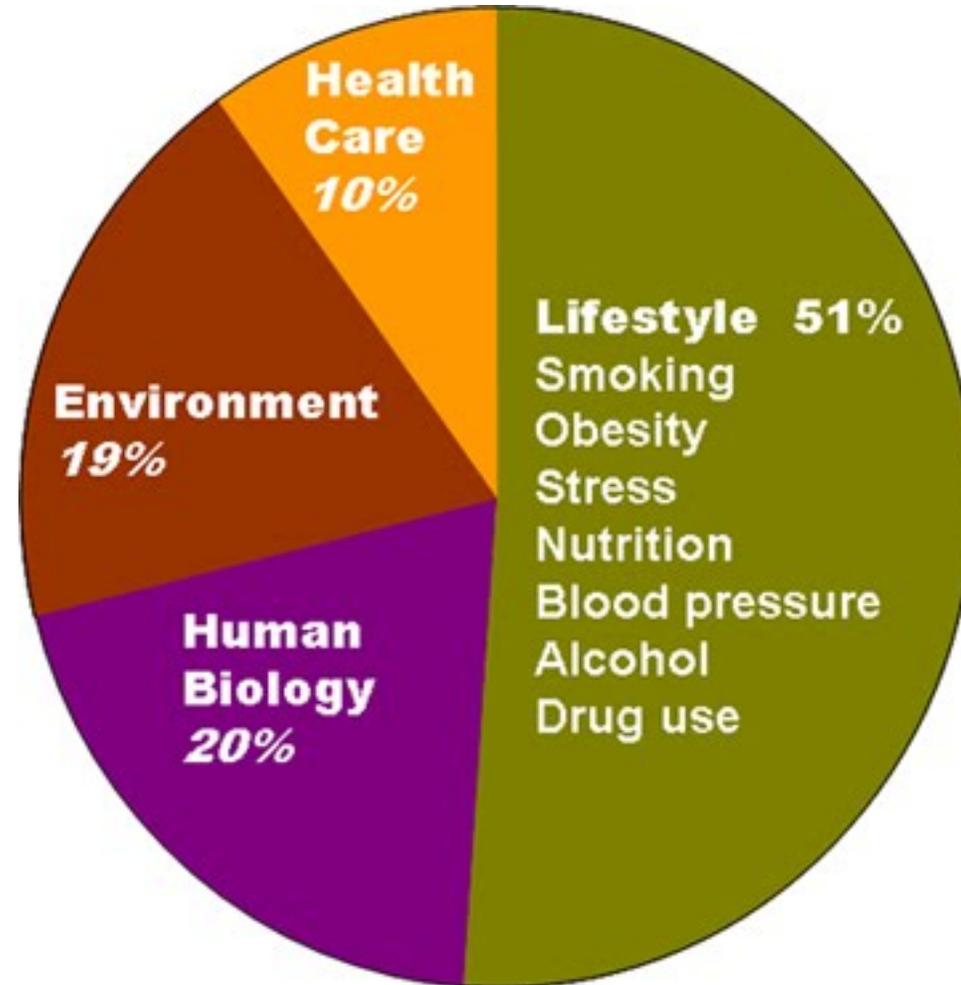
Agenda

- **Introduction and Purpose**
 - Session Strategy
- **Why we should care about the data and analytics:**
 - Overview of Social Determinants of Health and Wellness
- **Personas**
 - Scenario Exercise & Debrief
- **Human Services 2.0 - InterOptimability**
 - A new way to access and use data

Medicaid Serves 70.2 Million People... Human Services 100+ Million



“Social Determinants” are Key Factors Contributing to the Population Health and Wellness of A Community





Client Centric



- Foster Care
- Persons with Physical & Intellectual Disabilities
- Behavioral Health
- Family
- Isolated Senior
- Veteran



The Garcia Family





Mrs. Garcia, 40, Widowed

Situation

- Grandmother/mother
- Lives in a rural community
- Fixed income on disability due to an accident

Services Need:

- Child Protective Services
- Health Care needs:
Primary/Specialty Care
- Depression & counseling
- Transportation
- Child care
- Adult Services





Marisol Garcia -- 20 Years Old

Situation:

- Teen Mother and Pregnant with 2nd child
- Known to the Child Welfare
- Transient living situation,
- Drug addiction and exploitation

Service Needs:

- Health Insurance
- Prenatal Care
- Housing
- Transportation
- Medical referral for substance abuse





Angelina Garcia -- 2 Years Old

Situation

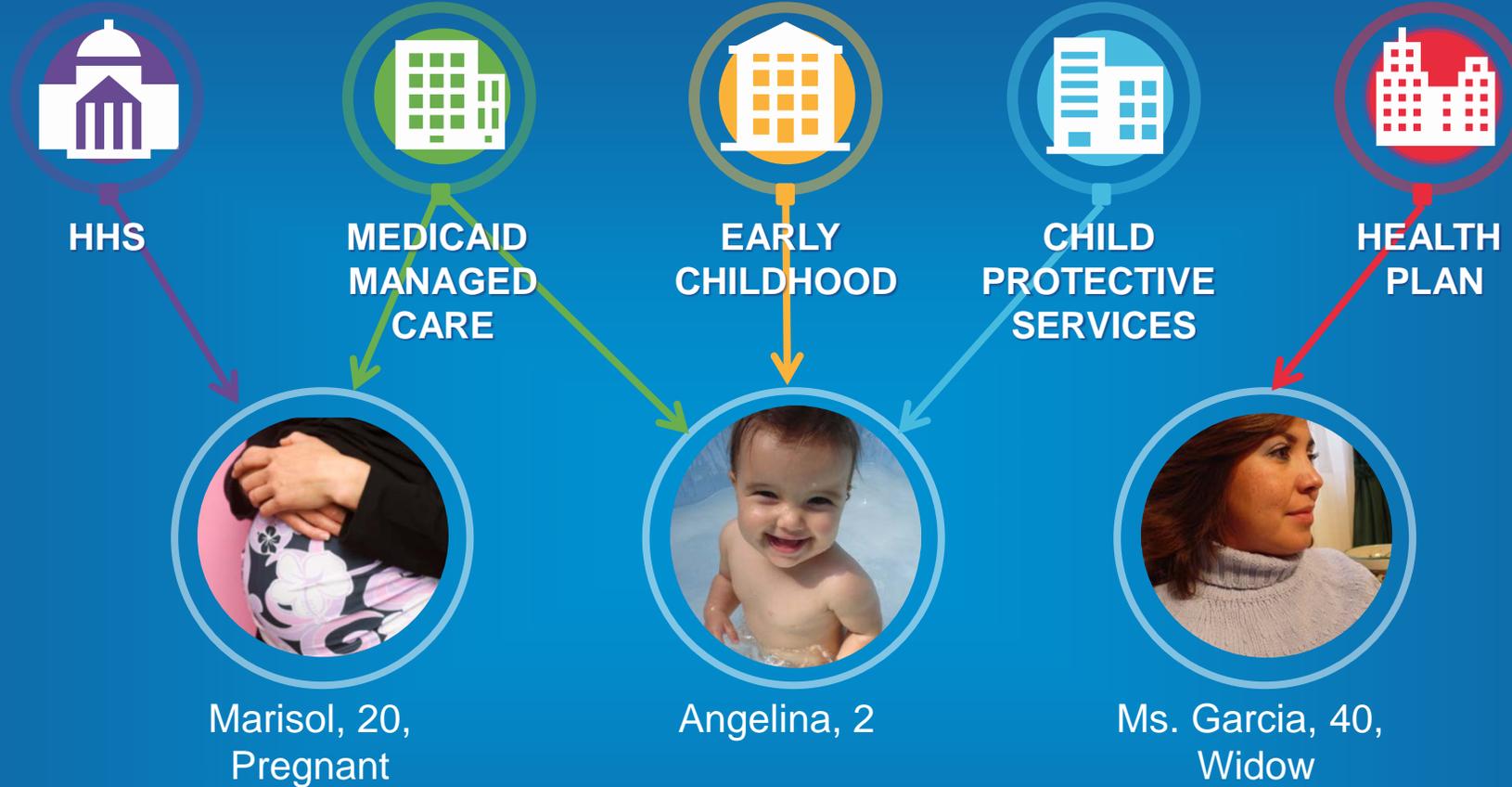
- Separated from mother
- At risk of removal
- Potential developmental issues due to chemical exposure at birth

Service Needs:

- Permanent Mom
- Immunization Screening
- Lead Screening
- Developmental Screening
- Parenting education
- Well child visits



Current System



Needs:

- Health Insurance
- Prenatal Care
- Medical Home
- Medical Referral for substance abuse
- Transportation

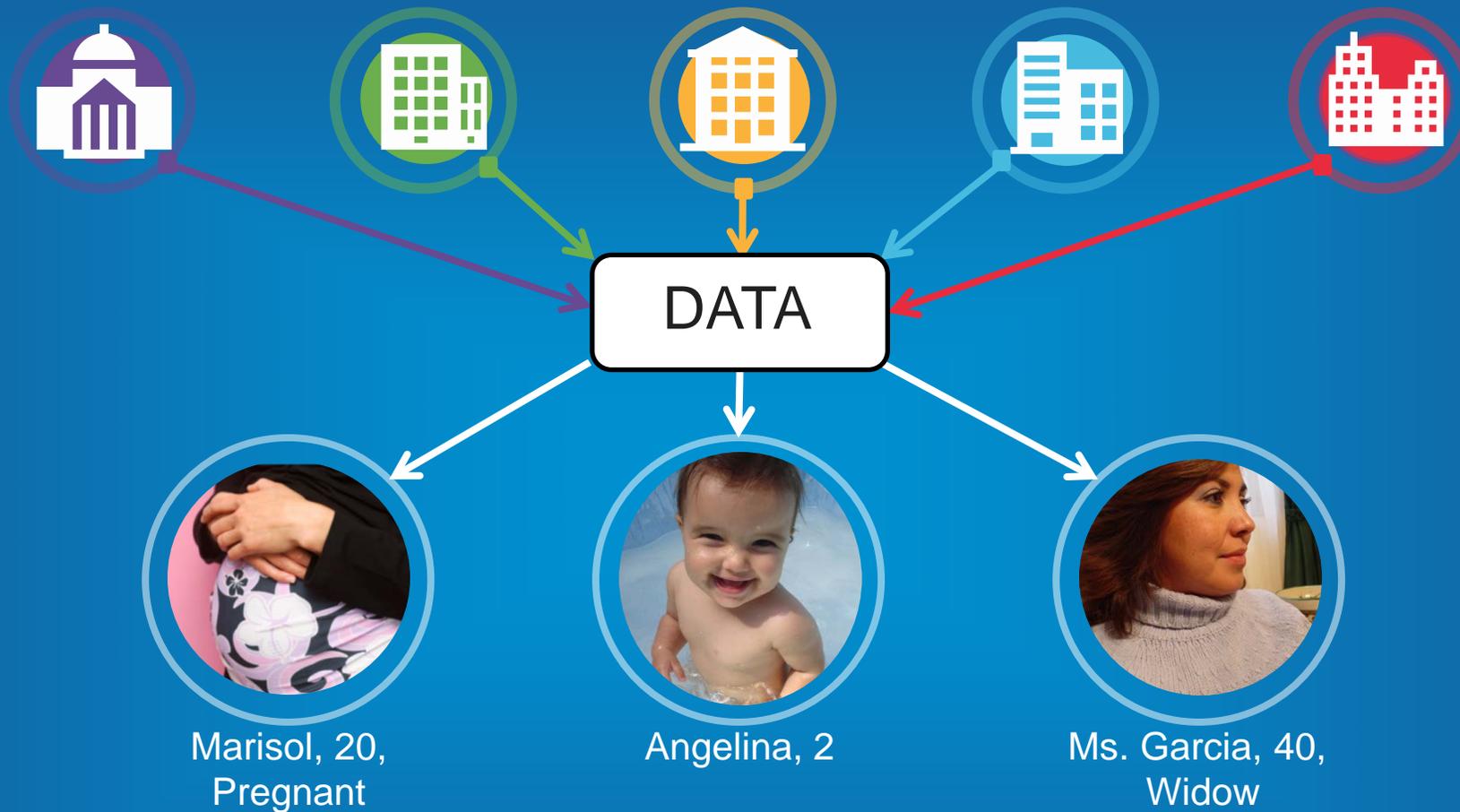
Needs:

- Immunization Screening
- Lead Screening
- Developmental Screening
- Parenting education
- Well child visits

Needs:

- Medical referral – Primary care
- Medical referral – Specialty care
- Medical referral – depression and counseling
- Transportation

Care Coordination Through Better Data and Analytics



Marisol, 20,
Pregnant

- Health Insurance PW
- Pregnancy PW
- Medical Home PW
- Medical Referral PW - substance abuse
- Social Service PW- transportation

Angelina, 2

- Medical Referral PW
- Immunization PW
- Lead Screening PW
- Developmental PW
- Educational PW

Ms. Garcia, 40,
Widow

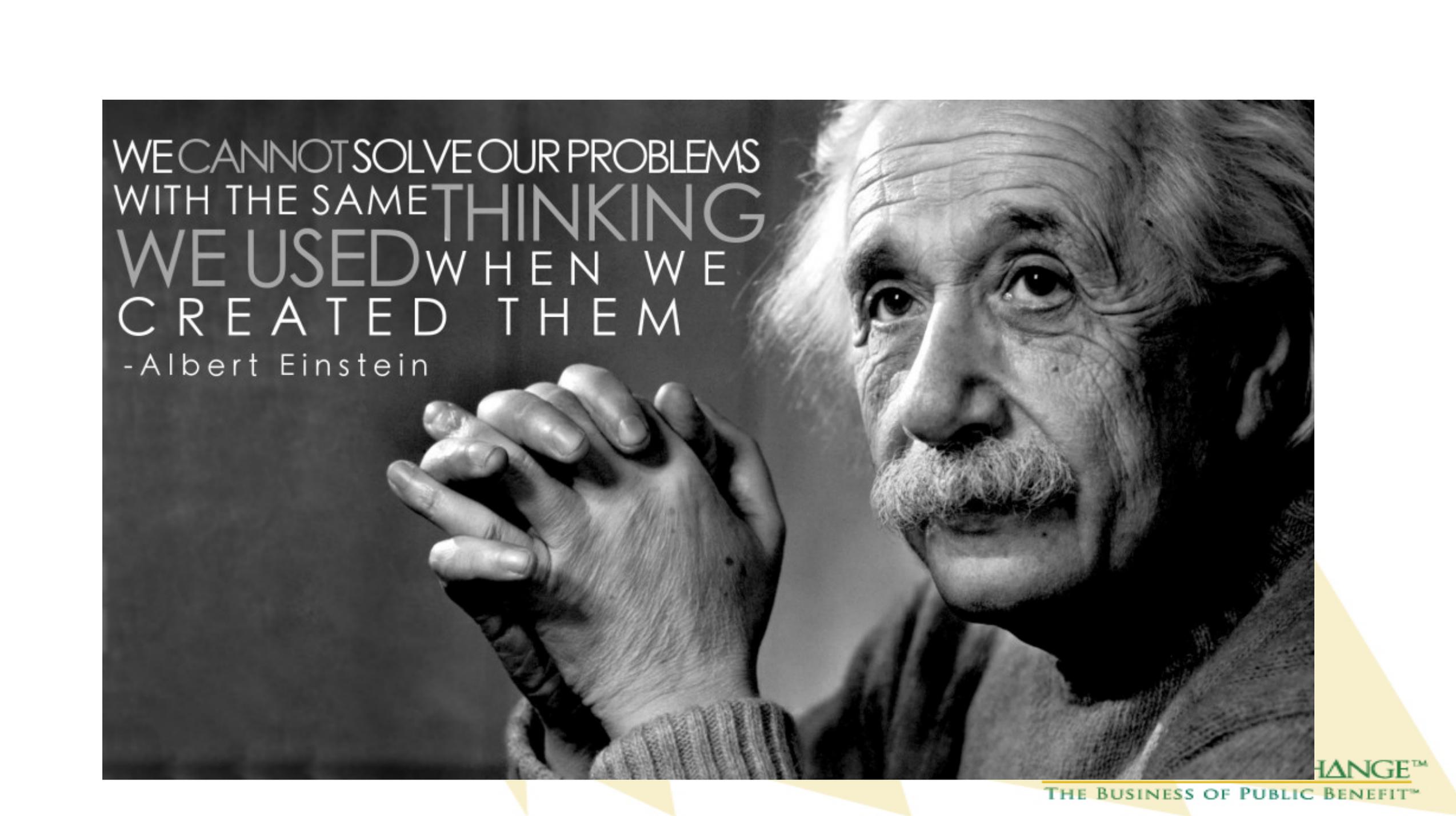
- Medical Referral PW
Primary Care
- Medical Referral PW
Specialist
- Medical Referral PW
Counseling
- Social Service Ref. PW
transportation

Get Acquainted And Discuss Your Persona (20 minutes)

HARRIET COOPER



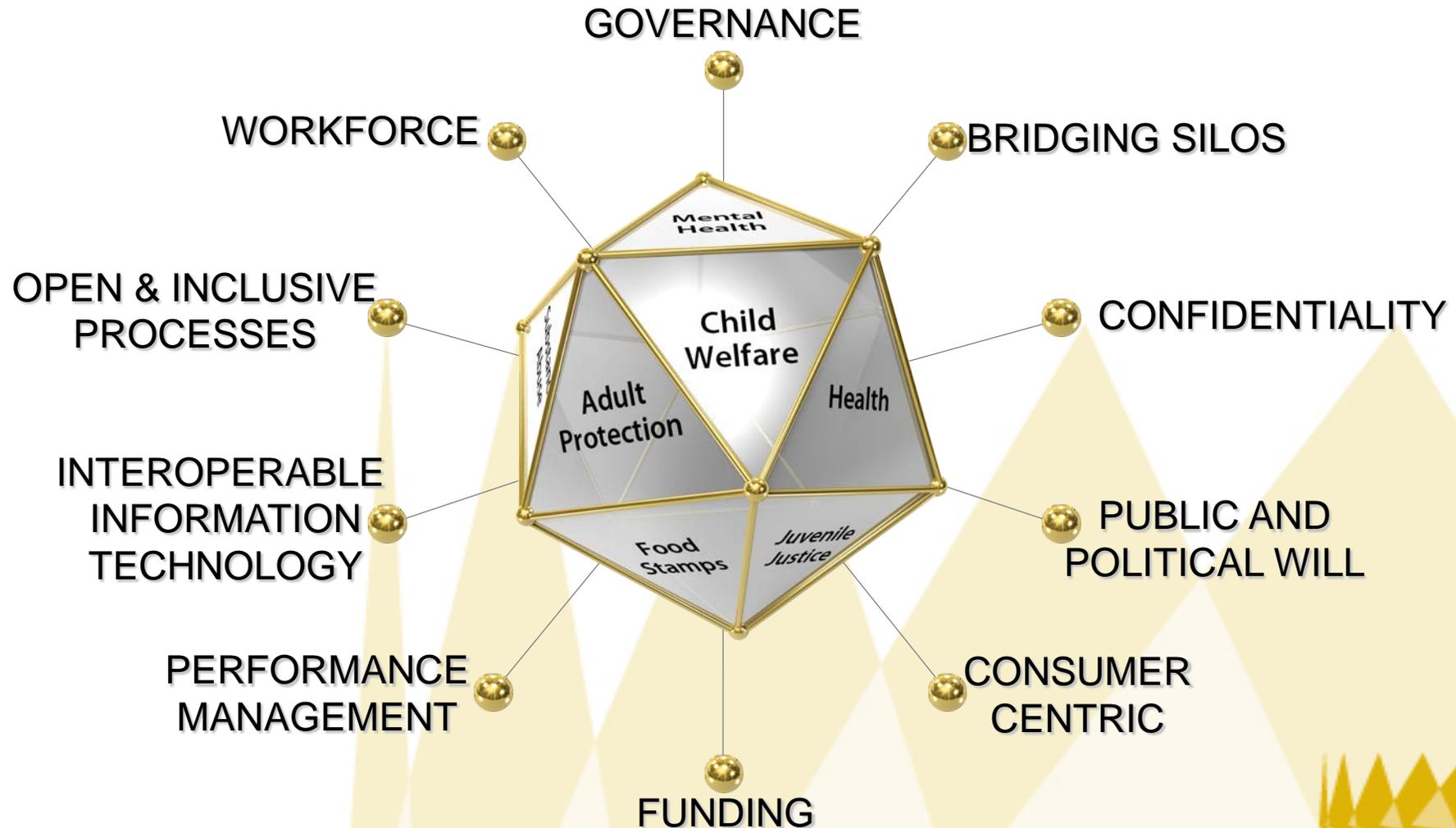
- Select a partner and after reading your Persona discuss these questions:
 - What is the Persona's life situation? What are the main issues she is facing?
 - Think about the "systems" that your Persona encounter as she is trying to get help:
 - How many systems does the Persona interact with?
 - What changes are needed to provide a more client-centered, coordinated, and comprehensive service environment?
 - How can better data and analytics assist or inhibit providing services to this Persona?
 - How will your recommended system changes impact your "internal customers" e.g. case workers, supervisors, software designers, project managers, business owners, vendor partners, fiscal, legal, etc.



WE CANNOT SOLVE OUR PROBLEMS
WITH THE SAME THINKING
WE USED WHEN WE
CREATED THEM
-Albert Einstein

Human Services 2.0: InterOptimability

Key Change Drivers



***The Art of the Possible:
Where We Are Headed***

INSIGHTS TO  ACTION
Powered by 


STEWARDS OF CHANGE™
THE BUSINESS OF PUBLIC BENEFIT™

Search, Analytics, Mapping & Visualization

- **Search (Appliance and Cloud)**
- **Data Analytics/Predictive Analysis**
 - Data Cleansing; Fusion Tables (filter/sort/group); Prediction API's; Visualization
- **Mapping and Data Visualization**
- **Mobility**
- **Coordination and Collaboration**

It's as easy as using a search box on your browser....

Open Data: *The Next Frontier*

<https://www.youtube.com/watch?v=LkGxWmsYcTw>

Using Data Analytics in the 21st Century Healthcare Delivery Eco-System—

What providers need
to know

Nancy E. Dunlap, MD, PhD, MBA
Dean, School of Medicine
University of Virginia



September 30,
2014

Meet Clara

- 45 year old with multiple medical problems:
 - Obesity
 - Diabetes
 - Hypertension
 - Bipolar Disorder
 - Substance Abuse
- Recently admitted to the hospital after car accident
 - Broken leg and multiple contusions
- Medical Records at hospital incomplete
- Follow-up fragmented





CONNECTing to the Nationwide Health Information Network (NHIN): The Road Ahead;
Office of the National Coordinator for Health IT

Do we have enough data?



NIH Clinical Center 1960s



Intensive Care Unit 2014

What is Big Data? What is NOT?

- **Big Data: The 3 Vs**
 - Volume
 - Velocity
 - Variety

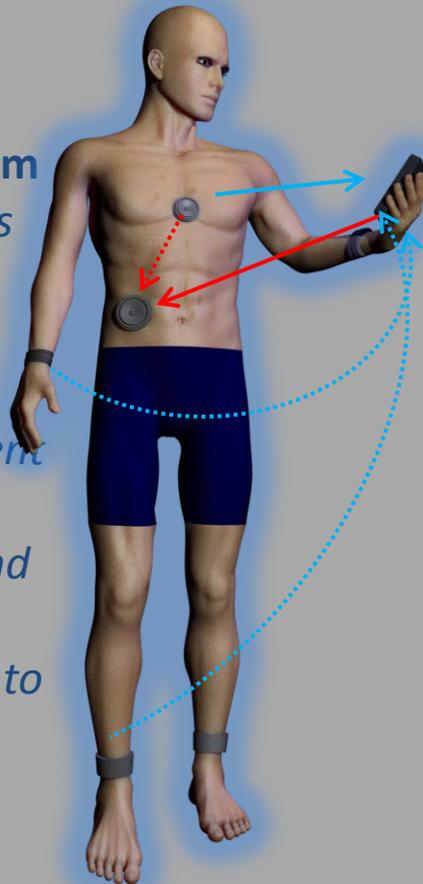
- **Strategic Use of Operational Data**
 - Focused
 - Driven by specific need

Cancer Treatment– Personalized to Genome



Diabetes Treatment-- Artificial Pancreas

Local Services Run by a System Hub (e.g. UVA's DiAs smart phone running closed-loop control & patient safety supervision, and transmitting real-time data to the Cloud)



Global Services Run in the Cloud
(e.g. remote monitoring, diagnostics, and, in the future, big data analytics combining medical records and real-time data for thousands of patients)



Wireless Data Transmission



Monitoring at Home



Epic

Patient Demographics

Curaspan
HEALTH GROUP

Service Order Info

SIEMENS

Financial Information



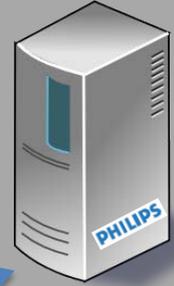
Data Hub



Data Analytic & Reporting



Care Coordinator Center



Patient Stats to EMR

Patient Stats

Equipment Serial #'s

Care Coordinator Consultation

Daily Stats Upload

Dispatch C3 Medical Technician



Care Transition, Home Installation & Training

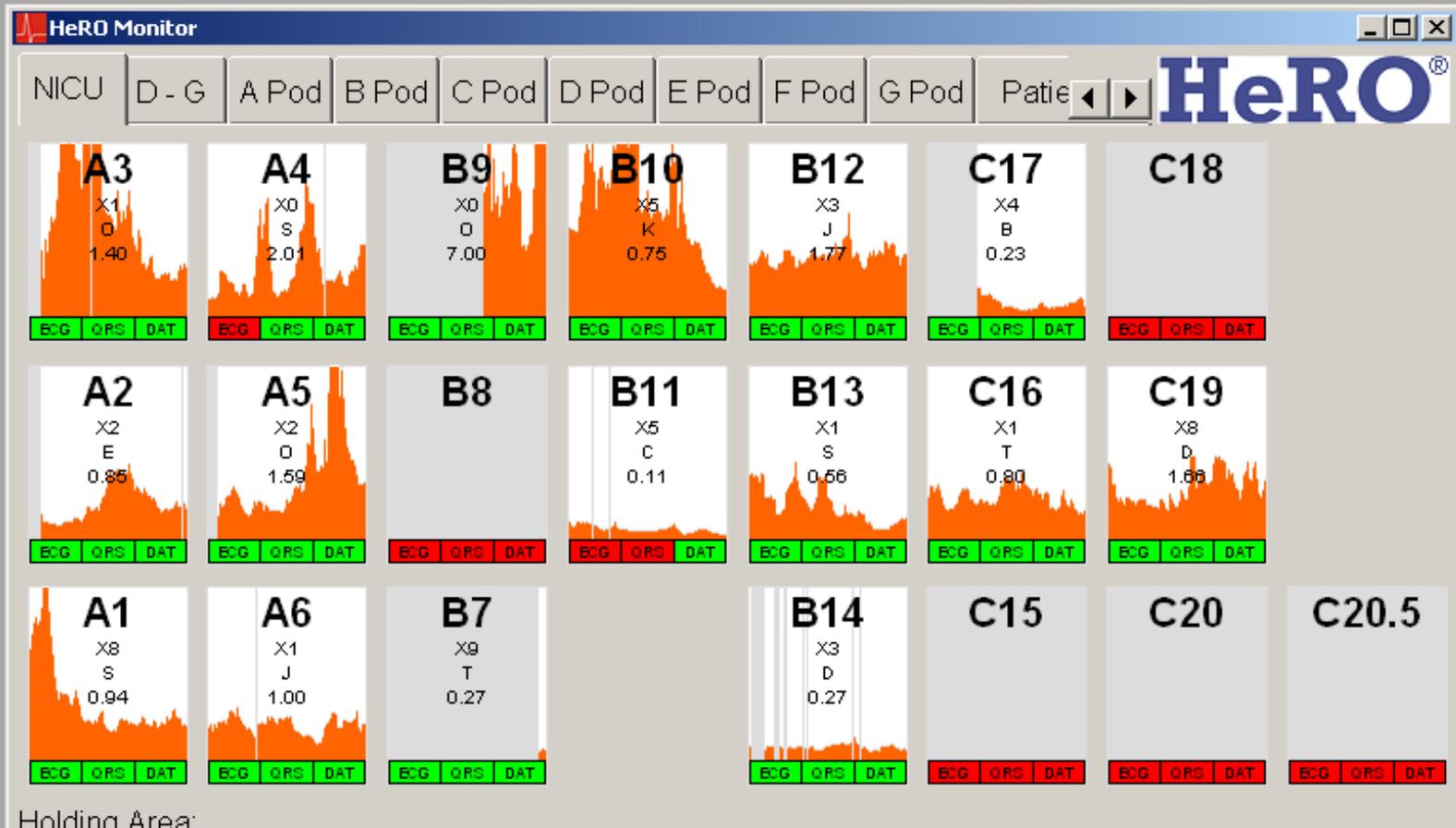


PHILIPS Philips Remote Patient Monitoring

8



Aggregate Monitoring



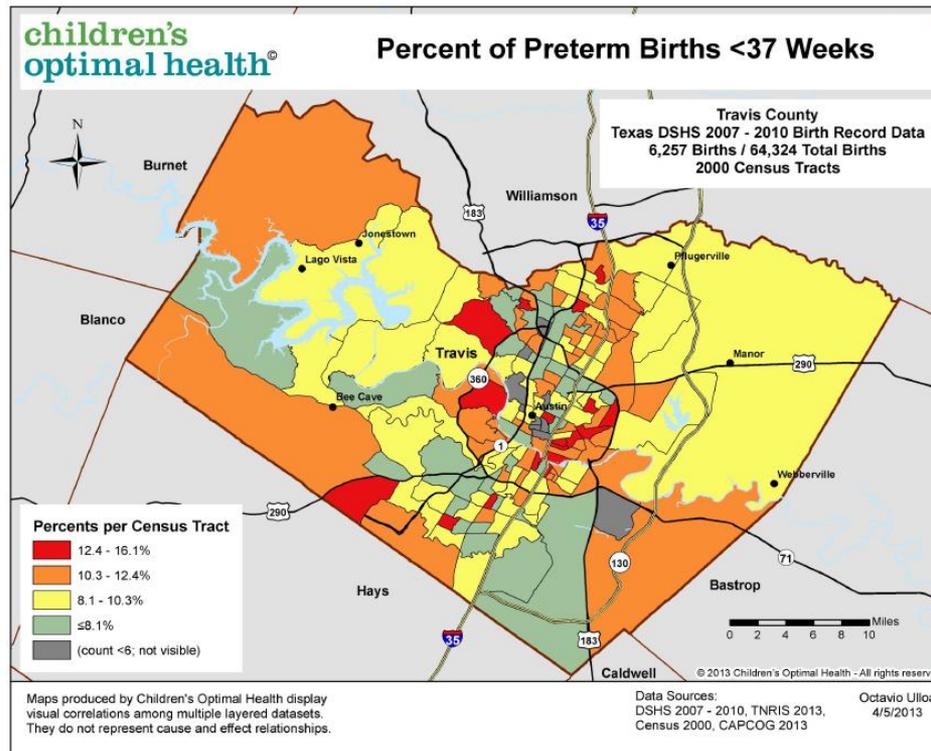
Leveraging Expertise



Tele-ICU



Geographic Hotspotting



- This map reflects the percent of births per census tract that were preterm births (< 37 weeks).
- In Travis County 10% of births were preterm.
- In red areas above, over 12% of births were born preterm in those census tracts.
- Both higher and lower income census tracts are represented in preterm and very preterm proportions.

Seton Healthcare Family News
11/12/13

***So what is needed to capitalize
on this data revolution?***

IT Governance Matters!



Impossible architecture by Phillip Dujardin

IT Governance

- **Goal:**
 - Ensure the results accomplish what you set out to do!
- **R**esponsibility
- **A**ccountability
- **C**ommunication
- **E**mpowerment

IT Governance - Structure and Processes.

Posted by Douglas Shuptar in SAP Services on May 25, 2012 7:31:19 PM

***Data quality is everyone's
responsibility!***

GIGO

Garbage in = Garbage out



Incomplete Data



Les Voyageurs by Bruno Catalano

Timeliness of Data

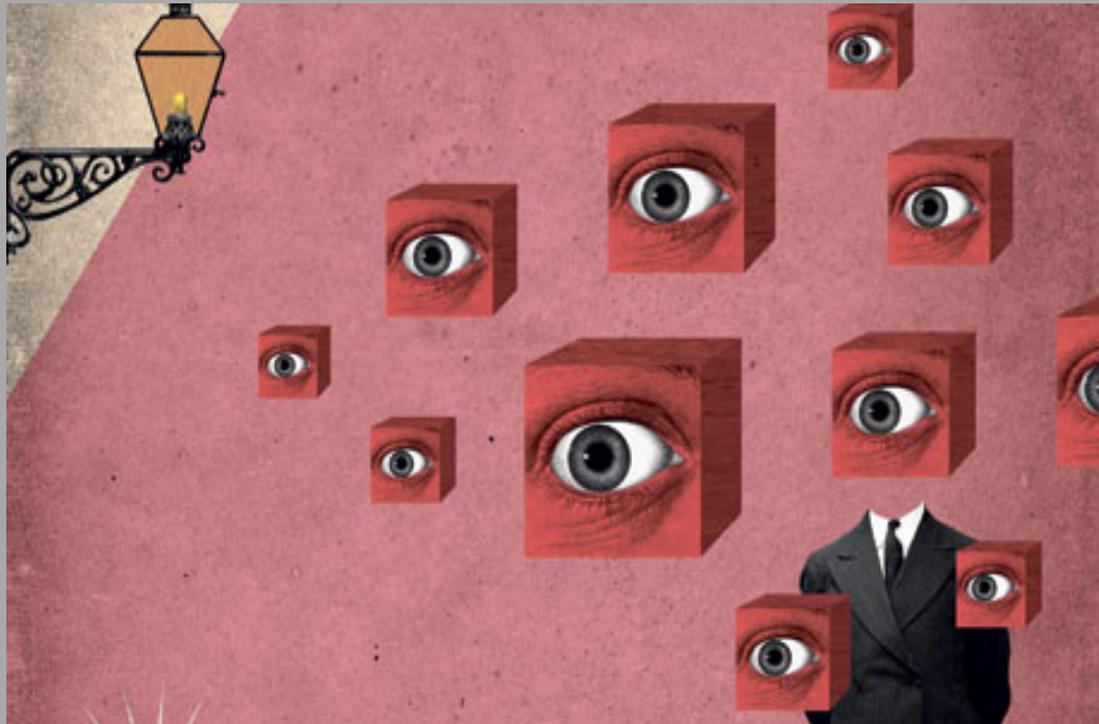


So what do providers need to do differently?

Break Down the Silos



Learn to Observe Patterns



Photograph: Randy Mora/YCN (The Guardian, 2013)

Develop Analytic Skills



Data Scientist: The Sexiest Job of the 21st Century
by Thomas H. Davenport and D.J. Patil



Clara's Case Re-imagined

- Coordinated care between all providers
- Complete medical records available
- Continuum of care that reaches into the home

Can you re-imagine how data can change your work in a way that will benefit your patients?



Juvenile Justice Case Study in Analytics

Identifying Potential Re-Offenders

Nick Intintolo, National Industry Specialist (IBM)
David Schwartz, President (Analytic Solutions)

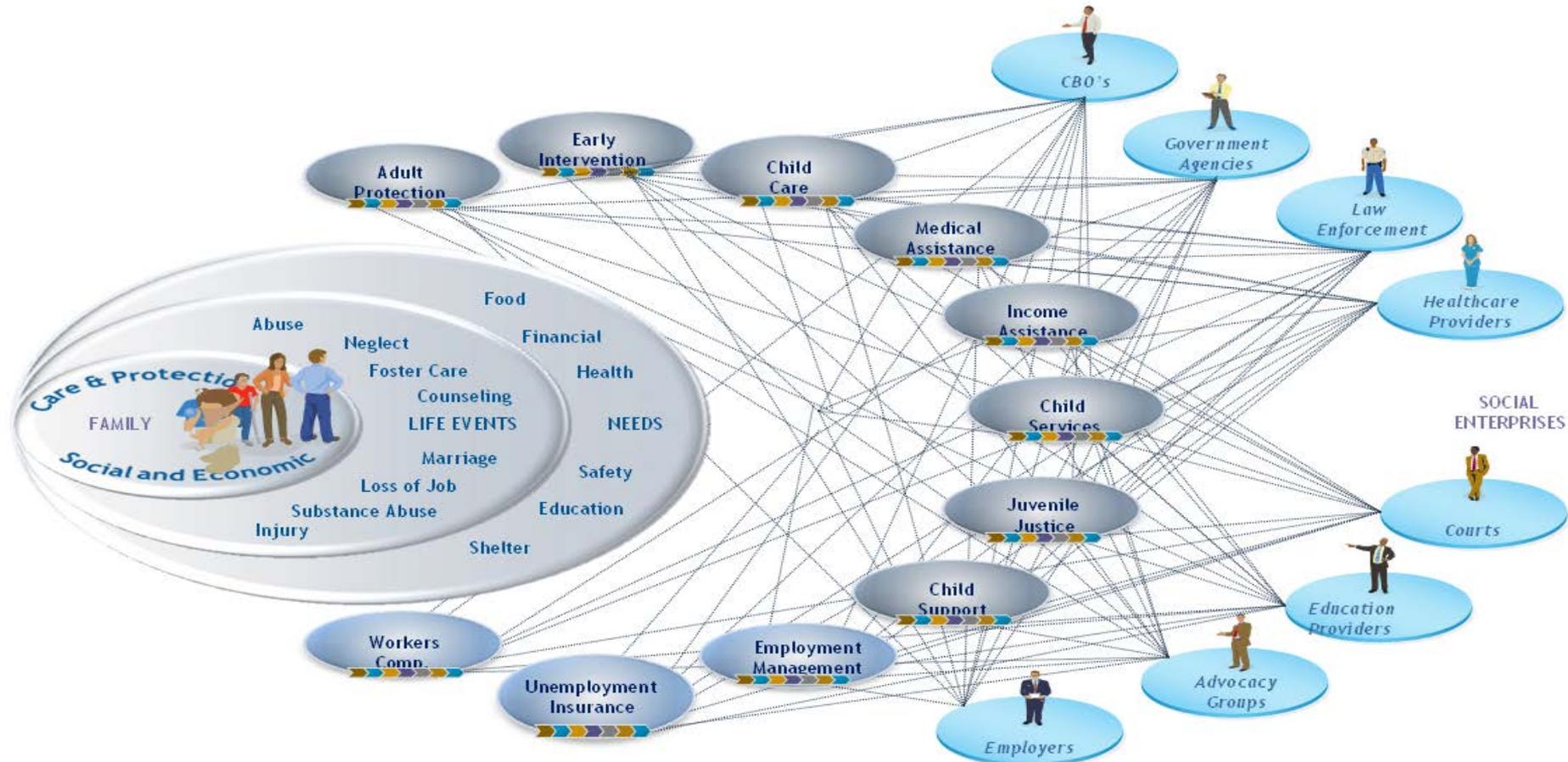


ANALYTIC SOLUTIONS LLC

September 30,
2014

Today's Human Services Eco-system

Vast array of programs, touch points, & variables



An Evidence-Informed Approach

Carefully leverages data to support improvements in individual outcomes and operational efficiencies

Information from
Different Extant Data Sources

&

Diverse Stakeholders, e.g.

- *Government Agencies*
- *Community-based Providers*
- *Hospitals*
- *CJIS*
- *School District*

Interdisciplinary research across the human service eco-system provides **outcome-driven** decision support



Improved:

Insight

Outcomes

Efficiencies

Smart Tools & Seasoned Experts

Leverage data to create measurable social and economic impact

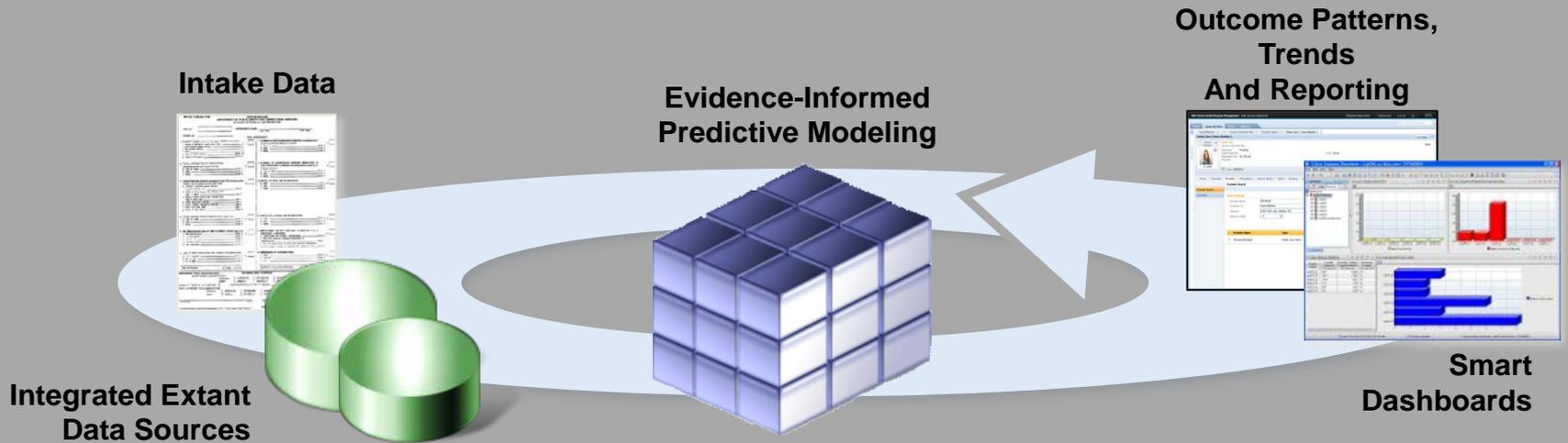


Bridging the utilization gap between IBM's market-leading solutions and world-class expertise and thought leadership



Developing rigorous Predictive Analytics grounded in the best available research that can learn over time

Intelligent Outcome Management Analytics



Smart Interventions • Outcome Prediction • Forecasting • Programmatic Insights

Characteristics of Success

- **Deep Practice Knowledge**
 - **Successful predictive analytic modeling requires deep knowledge of clients array of services**
 - **Models must be translated to inform practice, “black box” models and modeling not acceptable**
 - **Integrated data requires an integrated understanding of the agencies and their functions**
- **Experience with Large Human Services Data**
 - **Data must be structured carefully to increase accuracy and understandability**
- **Interdisciplinary Collaboration**
 - **Important to be comfortable working across several disciplines (social work, psychology, psychiatry, criminal justice, health professionals, machine learning, etc.)**
- **Rigorous Methods**
 - **Model developers must have experience defending their models in peer reviewed scholarly publications**

What Outcome Do We Seek?

Predicting Re-Offenders in Philadelphia With Integrated Data & Increased Accuracy

Data Source

- All dispositions from Philadelphia Family Court where more than regular probation (program or state)
- 8,239 cases in the sample, database of 40,000+ cases, 1994-2004
- Data drawn from Integrated Data System

Results show significant variation by method

From individual rights perspective...

- SDM classifies 1215 low risk.. **correct 75%**
- Predictive analytic model classifies 5424 low risk.. **correct 97%**

From public safety perspective...

- SDM classifies 1752 high risk.. **correct 30%**
- Predictive analytic model classifies 2815 high risk.. **correct 81%**

What Outcome Do We Seek?

Maximize Outcomes; Minimize Delay/Cost

Data Source

- Juvenile historical records, combined with intake data captured through current risk instruments at Florida Department of Juvenile Justice.

Agency reforms showing significant impact

- 26% decrease in the number of juveniles referred to secure facilities
- 15% lowered detention referral rate
- Developed new scoring algorithm utilized to predict high-risk children

“With powerful predictive analytics technology, we can gain the deep insight we need to increase the chance of a successful outcome for each and every child.”

*—Mark Greenwald, Research and Planning Director,
Florida Department of Juvenile Justice*

Integrated Data Systems Fuel Cross-Agency Analytic Insights

Government



Provider(s)



Mental Health

- High-Risk Populations (dual diagnoses) and Risk Management/Harm Reduction
- Institutional Prevention/Diversion
- Relapse Prevention/Lapse Mitigation
- Collaboration and Integration of Primary Care
- Medication Safety/Adherence
- Provider Performance Measurement
- ACO Integration

Education

- Drop-out Prevention
- School Violence Prevention
- School-level Performance Assessment

Long-Term Care

- CMS HCBS Quality Measurement
- CMS HCBS Cross-Cutting Quality Efforts
- Provider Performance Measurement
- System Rebalancing

Child Welfare

- Placement Assessments
- Child Protective Services
- Cross-Over Youth
- Transitioning Youth and Homelessness Avoidance
- Provider Performance Measurement

Juvenile Justice

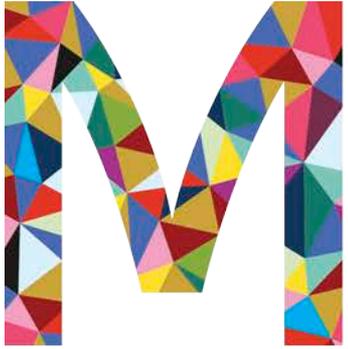
- Detention Prevention and Diversion
- Disproportionate Minority Contact
- Juvenile Probation
- Recidivism

Criminal Justice

- Recidivism
- Programming Effectiveness Measurement
- Provider Performance Measurement
- Drug Court Treatment
- Offender Risk Management
- Gang Identification and Monitoring

Q&A

Thank You

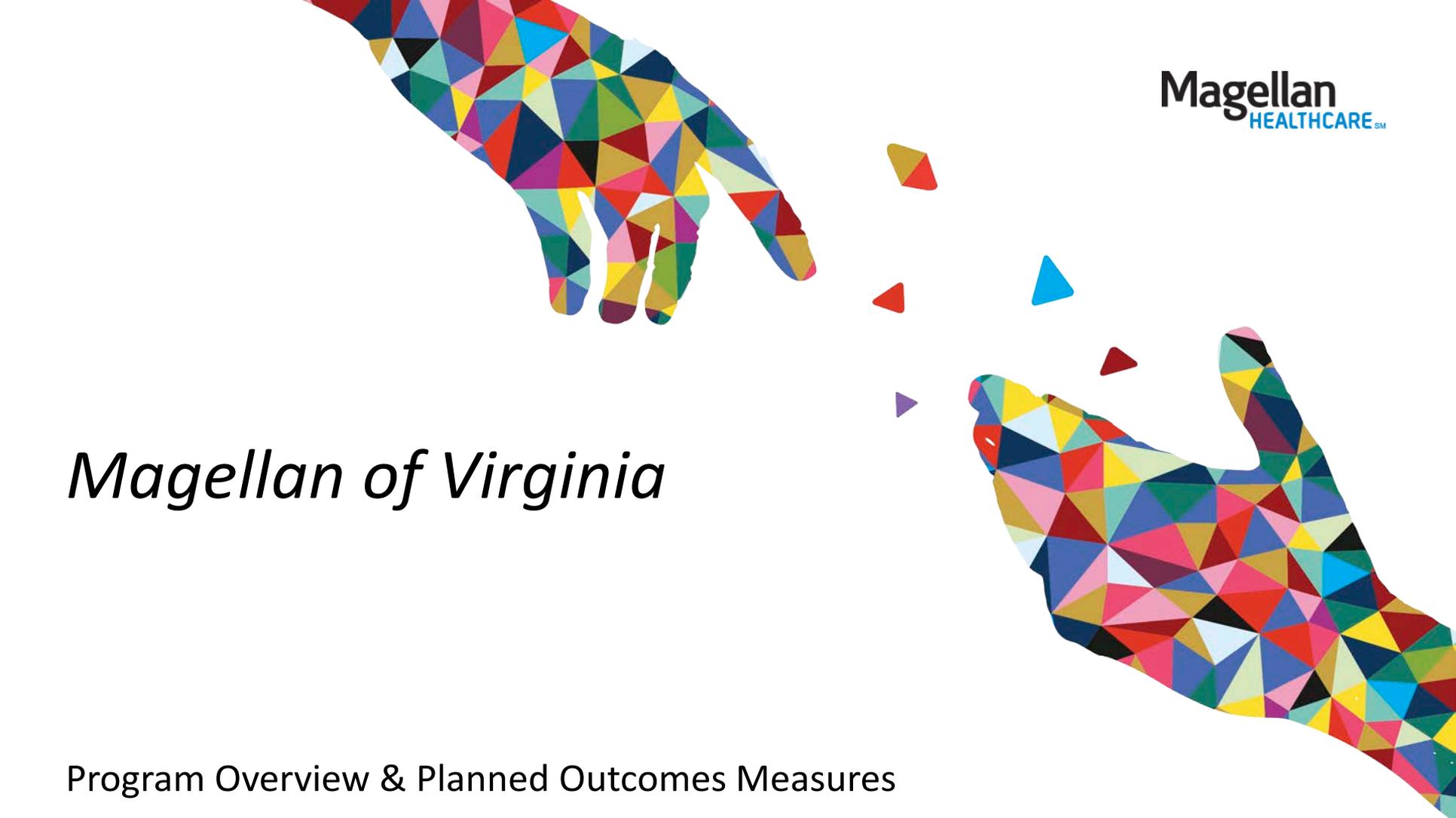


MARICOPA COUNTY CASE STUDY

*Improving behavioral health outcomes
through predictive modeling and risk
stratification*

Shareh Ghani, MD
Bill Phipps, LCSW





Magellan of Virginia

Program Overview & Planned Outcomes Measures

Magellan of Virginia: An Overview

- Magellan serves as the Behavioral Health Services Administrator for the Commonwealth, effective 12/1/13
- Provide care coordination, utilization management, credentialing/contracting & network management, customer service and claims payment
- Manage non-traditional behavioral health/community based rehabilitation services for members enrolled in managed care plans
- Manage the entire spectrum of covered behavioral health services for members enrolled in Fee-For-Service Medicaid plans

Magellan of Virginia: Planned Outcome Measures

- Data collection began 12/1/13 with the launch of the BHSA
- Some historical data will be shared by DMAS with Magellan to create a more comprehensive dataset for analysis
- Primary data sources include:
 - Authorizations
 - Claims

Magellan of Virginia: Planned Outcome Measures

- Initial outcomes measures planned for the BHSA program include:
 - Access to care
 - Member & provider satisfaction
 - Network geo-access availability
 - Member employment/school participation
 - Availability of housing
 - Coordination with medical care

Maricopa Case Study



Predictive Modeling in measuring health outcomes

In most populations, 20% of the highest cost patients consume a large portion of healthcare resources in a year

Predictive modeling can:

- Identify those patients who will continue to be of higher risk
- Identify patients of emerging risk *before they become higher cost* –when intervention can have a real impact
- Characterize patients and their clinical attributes, supporting appropriate interventions

Risk Stratification

- Risk stratification assists in identifying outcomes for specific patient populations. Once a population has been identified, clinicians can intervene appropriately to promote a positive result.
- The ability to risk stratify saves healthcare systems a great deal of time, energy, and money.
- Risk stratification takes the guesswork out of helping our patients and helps us preserve fixed resources.
- Most importantly it provides members with a level of care appropriate to meet their healthcare needs.

Predictive Modeling and Risk Stratification at Magellan

- Magellan is using a robust suite of tools ensure that a member's unique condition and needs as well as the score on his or her comprehensive risk profile drive specific services and intensity of the care management services offered.
- Monthly analysis of current and historical data yields:
 - Risk stratification
 - Identification of emerging trends in utilization in this specific population, along Medical, BH, Rx, Inpatient, Outpatient, etc. categories
 - Identification of major drivers of utilization/cost of care on a rolling 12 month window and during the historical period for individual members and for relevant cohorts
 - Prediction of near- and intermediate- term risk (utilization/cost of care/probability of hospitalization, etc.) for individual members and for relevant cohorts
- Case identification of patients who meet specific inclusion criteria for specific intervention. Disease Management.
- Ongoing identification of gaps in care or patients who trigger for specific high risk events or attributes (e.g., high risk combinations of Rx, etc.) using a range of evidence-based metrics
- Generation of summary patient profiles for export to care teams

Characteristics of MCCAZ's Care Management Program

Robust analytics

High risk/high cost identification through population specific tools

Chronic health care condition support and services

Innovative reach and engagement strategies targeted to the SMI population

Proactive health promotion

Complex case management/transition in care support for acute encounters and hospitalizations

Incorporation of the member's voice in all treatment planning activities (this is key..)

Individual and programmatic based outcomes

Magellan Analytics Suite

Predictive Modeling

Risk Stratification

Predictive Engine - IPRO

- Claims – Encounters, Rx and lab
- Demographics
- Utilization
- Clinical Categorization
- EBM standards

HRA – Health Risk Assessment

- Health Status
- Social Connectedness
- Disease Burden
- Preventive Screenings

LCG – Level of Care Guide

- Admissions
- Days in level of care (Level I)
- Urgent Psychiatry Care utilization
- Incarcerations in past year
- Medications prescribed

9 BLOCK

Unique algorithm to identify high risk/high cost individuals using both physical health and behavioral health data analytics

Individual Care Plan

- Comprehensive care management
- Care Coordination
- Health Promotion
- Individual & Family Support
- Referral to Community/Social Services
- Comprehensive Transitional Care

TMR

- Care management system
- Complete member information
- Provider information
- NCQA and CMS requirements are built in

Member Specific Repository

- Risk Stratification
- Co-morbid conditions
- Care History
- Gaps in care
- Medication adherence
- Treatment Adherence
- Social Connectedness
- Functionality

NINE BLOCK RISK SCORE

HB	HB	HB
LP	MP	HP
MB	MB	MB
LP	MP	HP
LB	LB	LB
LP	MP	HP

L = Low, M = Medium, H = High
B = Behavioral Health and P = Physical Health

Monitoring of Care Plan

- Treatment adherence
- Medication adherence
- Better managed chronic conditions

Enterprise Data Warehouse

- Advanced Analytics
- Data Reporting

Ongoing Risk Stratification

- Initial and ongoing assessments
- Data refreshed every 30 days or when there is an incident – ED/Hospitalization

Magellan's 9 block

9 Block		Physical Health			
		Low	Moderate	High	Total
Behavioral Health	High	11.0%	6.4%	2.5%	20.0%
	Moderate	18.5%	11.3%	3.6%	33.4%
	Low	26.8%	16.0%	3.9%	46.7%
	Total	56.3%	33.7%	10.0%	100.0%

The 9 block (HRA x LCG)

- Based on an algorithm derived from self-reported HRA responses and inpatient and emergency department utilization and social factors such as homelessness, recipients are assigned to one of the nine blocks. Each block describes the types of services/interventions specific to an individual's physical and behavioral health risk level. MCCAZ's model promotes recovery and resilience, health lifestyles and living well with chronic conditions

3 STAGES DRIVEN BY ANALYTICS

(PRE, DURING AND FOLLOW UP)

- Identification: Using predictive modeling and risk stratification to identify most vulnerable population
- Care Management – ensure no gaps in care, treatment adherence (including meds)
- Follow up – outcomes measure such as ED/hospitalization; lower morbidity due to better management etc.
- Scalability

Case Study (contd.)

- Based on the risk stratification process the health guide receives a list of individuals who would benefit from outreach and coordination efforts.
- Juan, a 48 year old Latino male who receives treatment for Schizophrenia, Hypertension, Hyperlipidemia and is also obese.
- The annual Health Risk Assessment (HRA) shows that Juan had a long history of obesity and had not been to see a primary care provider in years.
- His utilization pattern shows 3 ED (two related to elevated BP) visits in the past 12 months and 02 psychiatric hospitalizations.
- He is assigned a health guide and it is also suggested that the Care Management Program connect Juan to a nurse care coordinator if he would like additional information and support re: healthy eating, active living and weight management.
- The NCC could help Juan focus on achievable, personal goals for weight loss and design specific interventions that member could successfully incorporate into his lifestyle. .

Case Study (contd.)

- Juan agreed to meet with the onsite Primary Care Provider and she completed a series of blood work.
- His cholesterol was high at 275 and his Blood Pressure was dangerously elevated at 180/150.
- She immediately places him on medications for both conditions.
- Juan, his PCP and inter-disciplinary care team including the Health Guide and nurse care coordinator met to develop a coordinated care plan to support Juan with his recovery plan: medication adherence, weight loss and blood pressure control.
- The PCP agreed to talk to Juan's Behavioral Health Medical Provider to see if he could be changed from his atypical anti-psychotic medication which was contributing to his obesity.
- The MCCAZ nurse care coordinator met with Juan and he agreed to see a dietician to learn about healthy food choices and a low salt diet.
- He also agreed to have his MCCAZ Health Guide accompany him to that appointment.

Case Study (cont.)

- Juan told the Health Guide that it was hard to add in the new blood pressure medications as they made him feel dizzy.
- Although he had been taking medications for his mental health condition off and on for 20 years, the new medications took time and the team agreed to work with him as he changed his daily routine. The nurse from the BH clinic team visited Juan at the Assisted Living Facility where he has an efficiency and provided education on how and when to take his medications. She also met with the staff at the ALF at Juan's request to help them understand the need for Juan to eat a low salt diet and healthier food choices.
- The ALF usually had a dinner once a week for all the residents. Juan had stopped attending as the food they offered tended to have a high fat content. He really missed the dinners as they were a nice social event. After the meeting, they added salad as an option and, occasionally, fish. This allowed Juan to continue to attend these dinners without concern for attaining his weight loss and low salt diet goal,
- As he lost weight and his BP stabilized, Juan continued to meet with the Health Guide and with encouragement started walking short distances and then longer distances two to three times per week. He agreed that his goal would be to walk 30 minutes every day. He continued to lose weight gradually and his blood pressure stabilized.
- The Health Guide reported to the nurse care coordinator the progress, and she was available as needed to talk with the team by phone. Juan was very pleased with his progress, and when the Health Guide and team asked him to talk with other individuals in the network about his successes and how he achieved better health, he readily accepted the offer.

Case Study: Juan, 48 year old Hispanic male

Predictive modeling , ongoing risk stratification and 9 Block refreshes identifies :

Utilization Data
3 ED visits and 2 hospital stays in 12 months

Behavioral Health Conditions
Schizophrenia

Chronic Medical Conditions
High BP, Cholesterol, Obesity

Risk & Resiliency Factors
Social Connectedness

Impactable Behaviors
Diet & Exercise

Juan is a 48 year old man with schizophrenia, and is obese. His weight has contributed to his HBP and cholesterol levels

Juan has not followed through with repeated referrals to a local FQHC

Juan 's treatment team provide education about the importance of PH care. He agrees to see the co-located ARNP

Juan needed support to incorporate his new medications into his already established medication regimen

Juan, his IHH team and his ARNP worked together to create a treatment plan that addresses all his health needs

Juan's cholesterol level is 275 and his BP is 180/150. Along with medication, Juan is referred to a dietitian

Juan 's IHH team continue to provide support and education to help Juan make the adjustment to a new health approach

Juan and his care coordinator meet with his ALF staff to stress the importance of Juan's diet. He is encouraged to add salads and fish to his diet

Juan slowly begins to loose weight. He adds walking to his daily routine and begins to see results that encourage him to stick with the new health approach

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Juan's progress over time as tracked through the 9 block

9 Block		Physical Health			Total
		Low	Moderate	High	
Behavioral Health	High	11.0%	6.4%	2.5%	20.0%
	Moderate	18.5%	11.3%	3.6%	33.4%
	Low	26.8%	16.0%	3.9%	46.7%
	Total	56.3%	33.7%	10.0%	100.0%

Juan was here before the complex care management

Juan moves to a lower risk strata after the interventions