



Using Data for Evidence & Evaluation

Kristina Crane, Chief Operating Officer, Chief Strategy Officer
Sawyer Koops, Director of Data Science

It Takes a Village = A Coalition



Engagement Through Collaboration, Communication, and Data

SAVE THE DATE

Big Shots for Arizona Awards Ceremony
Honoring the Dr. Daniel T. Cloud Outstanding Practices & Arizona Big Shots

DoubleTree by Hilton Phoenix Mesa
April 23, 2024
5:00pm-8:00pm

Nominations open soon for Cloud & Big Shots awards

- Cloud** - Honors practices that have improved immunization coverage levels. Verified by ASIS assessments. [Open 1/25](#)
- Big Shots** - These awards recognize exceptional efforts of individuals & organizations. [Open 2/6](#)

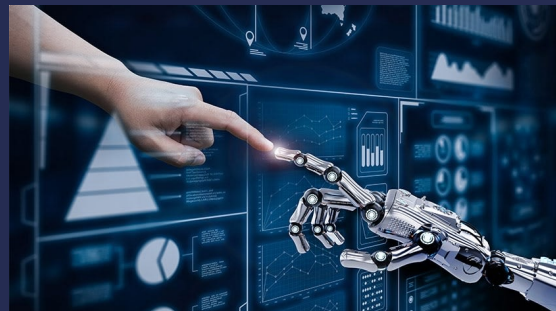
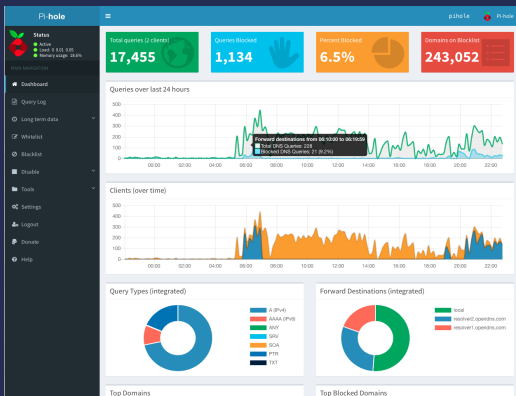
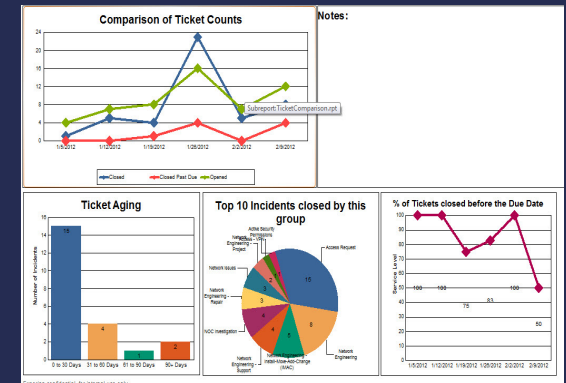
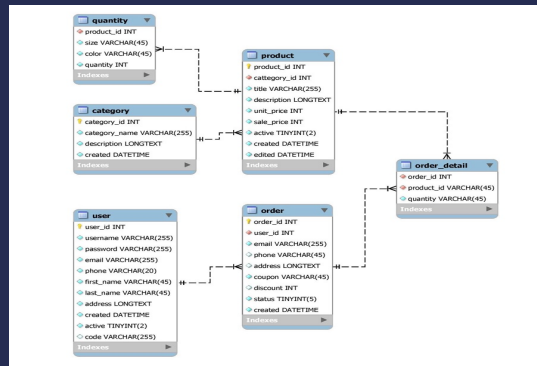


tapi
The Arizona Partnership
for Immunization
WhyImmunize.org

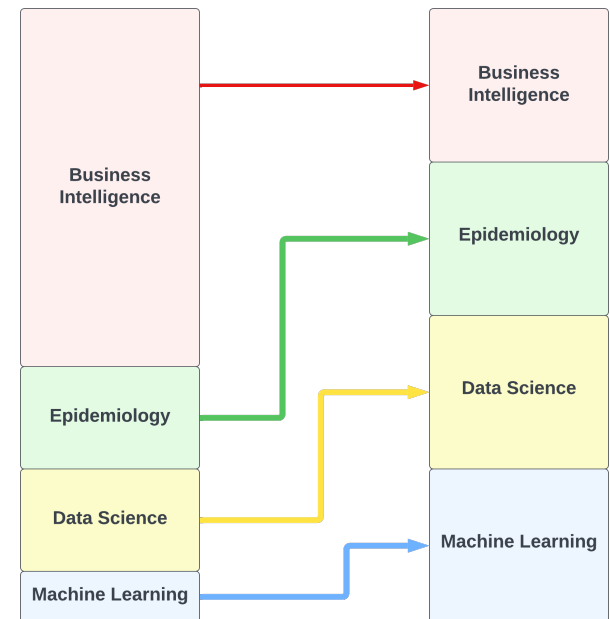
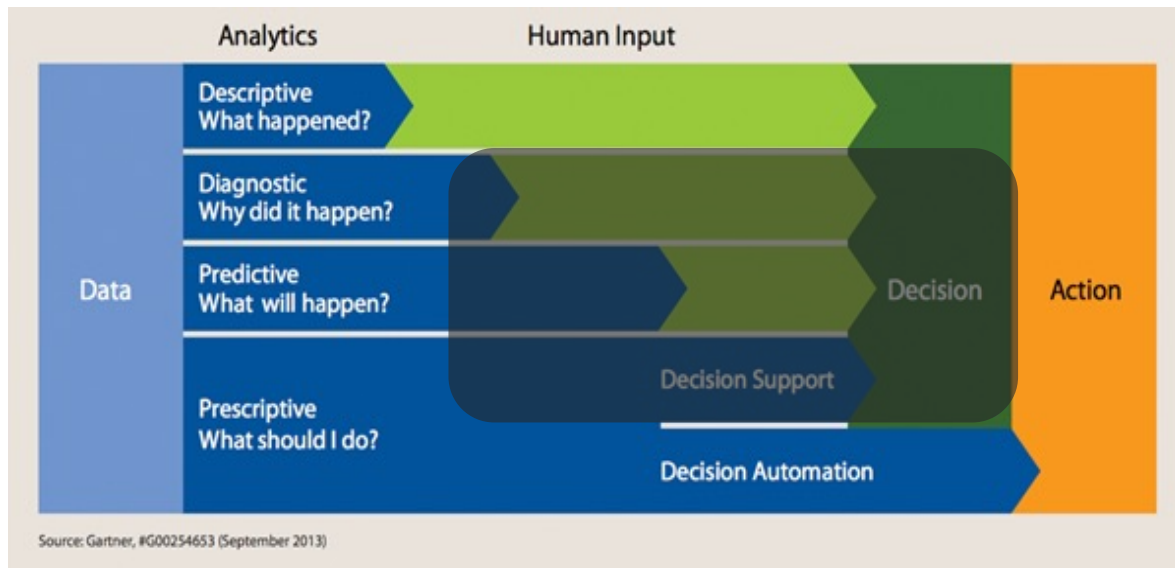


A look back

Fixed_Width_File.txt				
1	John	Doe	69265	04/27/78
2	Steve	Johnson	81083	12/11/69
3	Jane	Austin	98334	06/14/78
4	Susan	Hepburn	56723	08/02/70



Where are we now?



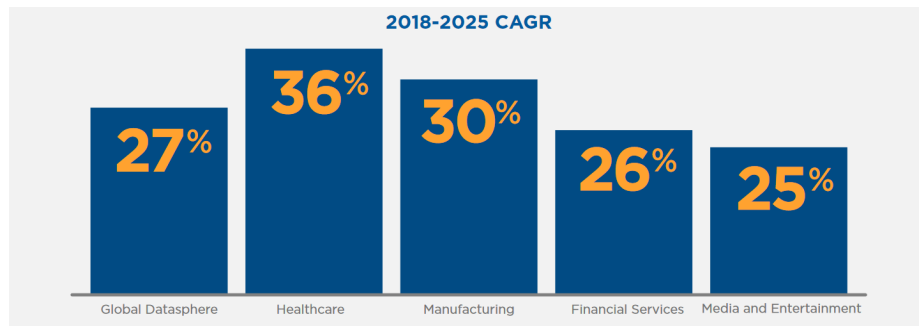
Opportunity

Healthcare data

- Data tailwinds: medical record keeping + compliance & regulatory requirements
- Lots of data: “Hospitals produce an average of 50 petabytes of data each year with as much as 97% of that data going unused.”
- ...And growing

Immunization data

- Unique qualities:
 - Touchpoint for healthy people
 - Longitudinal
 - (Potentially) indicative of behavior/sentiment



Source: Data Age 2025, sponsored by Seagate, Nov 2018

With great power...

Immunization Information systems are the gold standard of immunization data ...but have limitations (deduplication, jurisdictional requirements, etc.)

Impacts can include:

1. Accurate coverage assessments
2. Identification of disparities
3. Allocation of resources
4. Policymaking

Case Study 1



The case of the missing data

Jurisdiction: Missing 19% race & 39% ethnicity data

Options evaluated:

1. Omission
2. Imputation
 - Estimation of missing values using non-missing across a series of synthetic datasets
 - Can reduce bias
 - Increase statistical power
3. Machine Learning
 - Supervised vs. semi-supervised
4. Current method
 - Manual review?

Results - MICE

1. 10 person-hours
2. 4 computer-hours
3. Effectiveness
 1. Model fit: ideal
 2. Extensibility: good
 3. Scalability: good

Race/Ethnicity	Pre-MICE (%)	Post-MICE (%)
<i>White</i>	88.86	88.76
<i>Black/African American</i>	3.47	3.48
<i>Asian</i>	0.87	0.86
<i>American Indian or Alaskan Native</i>	0.40	0.404
<i>Native Hawaiian or PI</i>	0.10	0.102
<i>Multiracial</i>	0.17	0.18
<i>Other</i>	6.12	6.21
<i>Hispanic/Latino</i>	1.95	3.2
<i>Not Hispanic/Latino</i>	98.05	96.8
Age	Pre-MICE	Post-MICE
<i>Mean</i>	45.14336	45.14408
<i>Standard Deviation</i>	25.4999	25.51
<i>Median (Interquartile Range)</i>	46	46

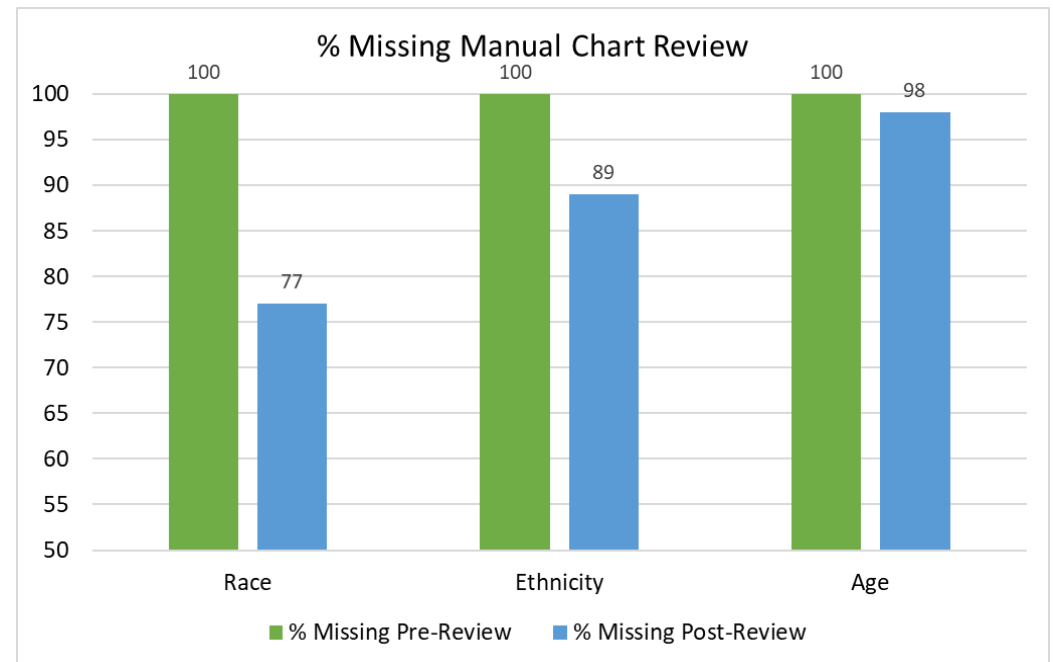
Results - Ethnicity

1. 8 person-hours
2. 0.1 computer-hours
3. Effectiveness
 1. Model fit: poor
 2. Extensibility: good
 3. Scalability: moderate

Race/Ethnicity	Pre-Ethnicity(%)	Post-Ethnicity(%)
White	80	88
Black/African American	3.4	5.8
Asian	0.75	2.1
American Indian or Alaskan Native	0.46	N/A
Native Hawaiian or PI	0.10	N/A
Multiracial	0.32	N/A
Other	15	4.3
Hispanic/Latino	2.1	4.3
Not Hispanic/Latino	98	96

Results - Chart Review

1. 12 person-hours
2. 1 computer-hour
3. Effectiveness
 1. Model fit: ideal
 2. Extensibility: moderate
 3. Scalability: poor



Benefits

1. Reduce bias, increased statistical power
2. Greater confidence in decision making
3. Targeted allocation of resources & standardized measurement
4. Harness full immunization ecosystem to inform outreach
5. Foster collaboration

Conclusions

1. Not all methods of addressing missing data are created equally
2. Multiple imputation in immunization data could have utility in improving demographic data quality post-hoc
 - a. Needs to be used carefully. Test assumptions, strict model diagnostic procedures.
3. Strong coalitions & partnerships between providers and Public Health will maximize leverage of these techniques
4. No substitute for improving data quality at entry

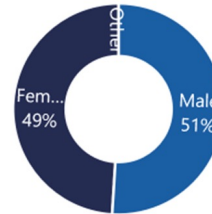
Case Study 2

Initiating HPV vaccination at age 9-10: A pilot example using Immunization Information Systems

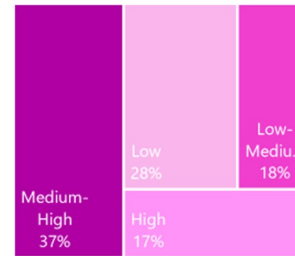
Methods:

- Retrospective cohort ages 9-18 years (n=388,531)
- “Follow up” through October 1, 2023
- **Primary Exposure:** Age at HPV series initiation
- **Outcome:** HPV vaccine series completion. Series completion defined as 2 recorded doses for those whose first dose was administered before their 15th birthday and 3 recorded doses for those whose first dose was administered on or after their 15th birthday.
- **Statistical Analyses:** Complete case analysis. Multivariable logistic regression using general linear models. Results presented as unadjusted and adjusted odds ratios with 95% confidence intervals, all to two significant digits.
- **Covariates:** age, race, ethnicity, gender, urbanicity, VFC eligibility

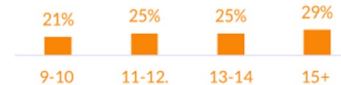
49% Female



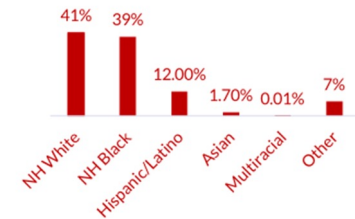
Half lived in a high-medium to high SVI county



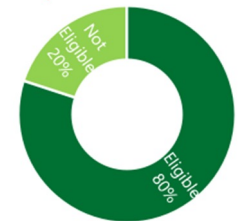
A quarter were ages 11-12



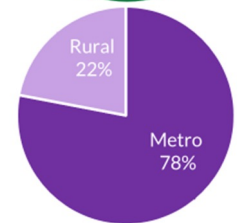
One third is Non-Hispanic Black



80% VFC Eligible



Over three-quarters live in an urban county



Association between individual characteristic and odds of series completion

Characteristic	Reference Group	Unadjusted Odds Ratio [95% CI]	Adjusted* Odds Ratio [95% CI]
Initiated at age 9-10 years	Initiated at 11-12 years	1.38 (1.28, 1.48)	1.39 (1.30, 1.50)

*n=388,531. Adjusted odds ratios control for age, sex, race, ethnicity, urbanicity, SVI, and VFC eligibility.

Interpretation

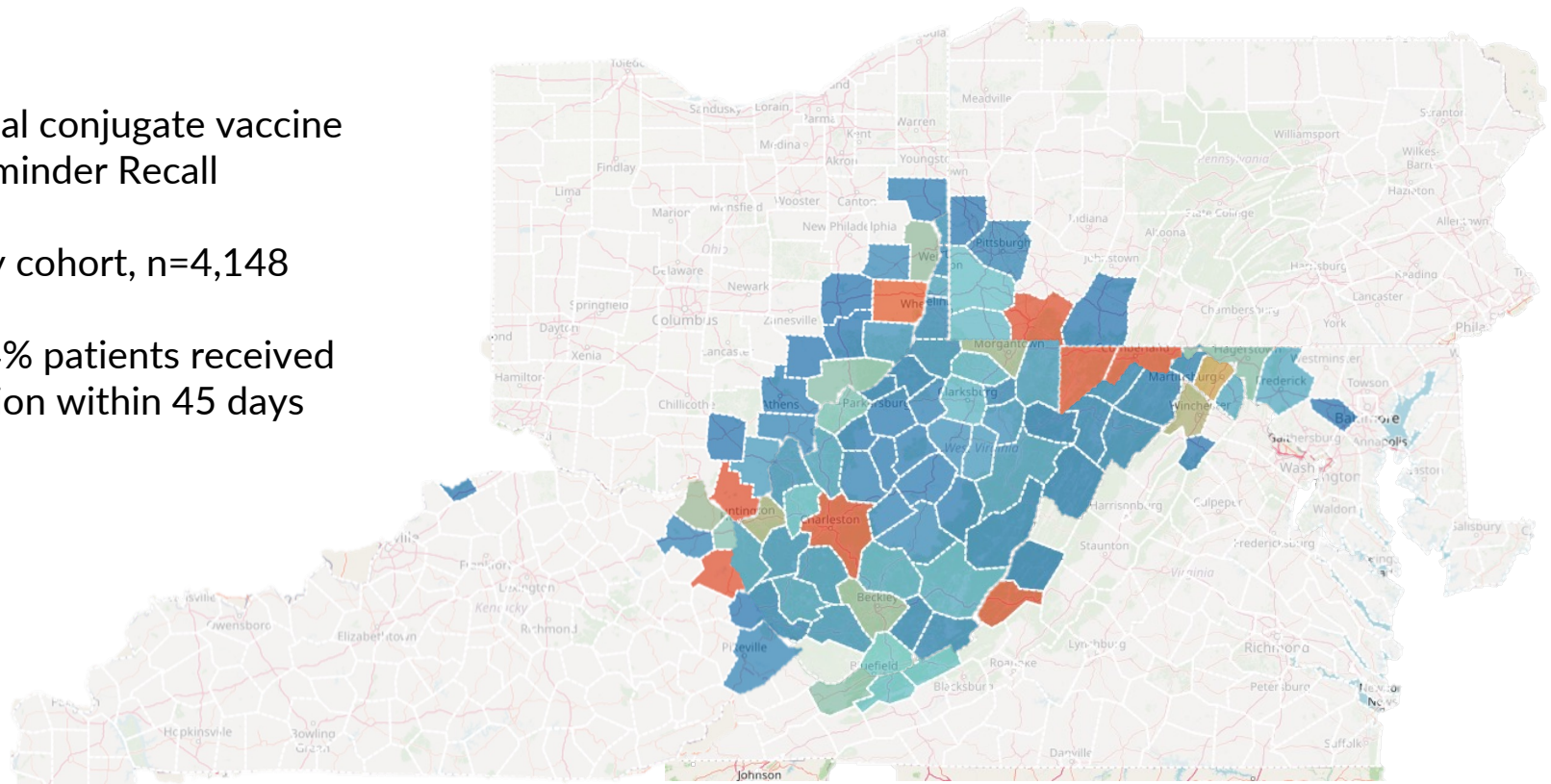
- Non-Hispanic Black individuals, VFC eligible, and high SVI counties were 7-13% less likely to complete the series compared with their counterparts.
- Females were slightly more likely to complete the series
- No differences by urbanicity
- Those who initiated the HPV series at 9-10 years of age were 40% more likely to complete the series compared with those who initiated at 11-12 years (1.39 (1.3, 1.5))

Case Study 3

Pneumococcal conjugate vaccine (PCV 13) Reminder Recall

One monthly cohort, n=4,148

Results: 35.4% patients received any vaccination within 45 days of recall



The future

