CRISP-ENABLED RESEARCH SYMPOSIUM

Thursday, March 14th, 2019, 3:30pm to 5:30pm

Johns Hopkins University Tilghman Auditorium

7160 Columbia Gateway Drive, Suite. 100
Columbia, MD 21046
877.952.7477 | info@crisphealth.org
www.crisphealth.org

INTRODUCTION AND WELCOME

Christopher Chute, MD, DrPH

Bloomberg Distinguished Professor of Health Informatics
Professor of Medicine, Public Health, and Nursing at Johns Hopkins University
Chair of the CRISP Research Subcommittee

CRISP-Enabled Research Symposium – AGENDA

INTRODUCTION AND WELCOME

- Christopher Chute, MD, DrPH, Bloomberg Distinguished Professor of Health Informatics, Professor of Medicine, Public Health, and Nursing at Johns Hopkins University, and Chair of the CRISP Research Subcommittee

OVERVIEW OF CRISP AND THE CRISP RESEARCH INITIATIVE

- Ross D. Martin, MD, MHA, Program Director, CRISP Research Initiative

EXAMPLES OF CURRENTLY SUPPORTED RESEARCH

- UMMS-Friends NavSTAR: Jan Gryczynski, PhD, Senior Research Scientist, Friends Research
- JHU Readmissions, B'FRIEND, Suicide Project: Hadi H.K. Kharrazi, MD, MS, PhD, Assistant Director, Center for Population Health IT (CPHIT), Johns Hopkins Bloomberg School of Public Health
- JHU MESA: Wendy Post, MD, MS – Professor of Medicine and Epidemiology, Division of Cardiology, Johns Hopkins University School of Medicine
- JHU Walgreens: Jodi Segal, MD, MPH – Professor of Medicine, Epidemiology, Health Policy and Management, Johns Hopkins University

CRISP TECHNICAL FRAMEWORK UPDATE

- Michael Berger, CRISP CIO
- Ryan Bramble, CRISP Senior Director of Development and Executive Director, CRISP DC

CURRENT CAPABILITIES AND FUTURE OPPORTUNITIES

- Ross D. Martin, MD, MHA, Program Director, CRISP Research Initiative

CLOSING THOUGHTS

- David Horrocks, MBA, CRISP President and CEO

RECEPTION

OVERVIEW OF CRISP AND THE CRISP RESEARCH INITIATIVE

Ross D. Martin, MD, MHA
Program Director, CRISP Research Initiative

Vision – Mission – Guiding Principles

CRISP is a non-profit health information exchange (HIE) serving Maryland, the District of Columbia, West Virginia and the region.

Our Vision

To advance health and wellness by deploying health information technology solutions adopted through cooperation and collaboration.

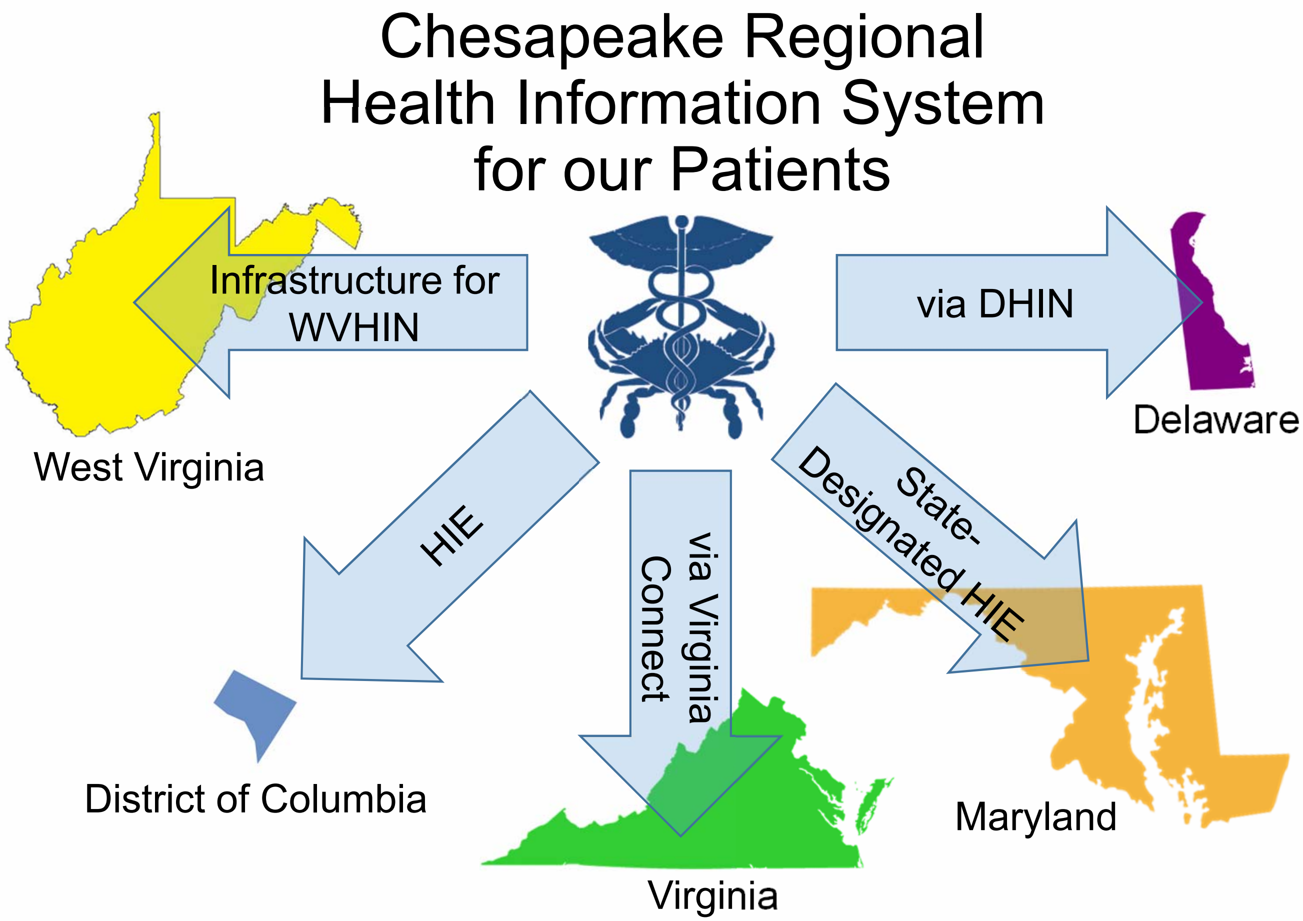
Our Mission

We will enable and support the healthcare community of Maryland and our region to appropriately and securely share data in order to facilitate care, reduce costs, and improve health outcomes.

Our Guiding Principles

1. *Begin with a manageable scope and remain incremental.*
2. *Create opportunities to cooperate even while participating healthcare organizations still compete in other ways.*
3. *Affirm that competition and market-mechanisms spur innovation and improvement.*
4. *Promote and enable consumers' control over their own health information.*
5. *Use best practices and standards.*
6. *Serve our region's entire healthcare community.*

CRISP's Service Area



CRISP Research Initiative – Guiding Principles

1. The support of research is a valuable but secondary component of CRISP's mission to share data to facilitate care, reduce costs, and improve health outcomes. CRISP will support research efforts so long as they do not detract from its primary mission.
2. CRISP will contribute to the learning health system by making CRISP-mediated data available to researchers who are participants in CRISP through a well-governed request submission, review, approval, and audit process.
3. CRISP will not replicate services which are available through participating organizations or agencies or serve as a method for bypassing institutional processes for addressing data needs of researchers.
4. CRISP will assess fees to research data requestors in a cost recovery manner in order to cover its actual direct and indirect costs.

CRISP Research Initiative – Guiding Principles (CONT)

5. CRISP will inform patients and their caregivers of the use cases under which their data may be made available for research purposes.
6. CRISP will maintain a public record of its data disclosures for research through regular publication on its website.
7. CRISP will partner with participating researchers to receive feedback on data and service quality and incorporate research results into CRISP offerings.
8. CRISP will periodically evaluate the value of expanding its ability to deliver data in support of research and will seek input from the research community on optimal methods for delivering data in a manner that can support research related to improving care delivery, reducing costs, and improving health outcomes.

CRISP Research Initiative Progress To Date

- 4/20/2016
  Research approved as a new permitted purpose under CRISP Participation Agreement
- 6/20/2016
  State regulatory framework supporting the use of HIE data for research goes into effect
- 8/10/2016
  CRISP Research Subcommittee meets for the first time
- 11/8/2016
  First use case approved – Patient-Consented, IRB-Approved Research
- 11/28/2016
  First research study approved: JHU ALIVE
- 3/8/2017
  2nd use case approved - Combining CRISP Data with HSCRC Case Mix Data for Research
- 8/31/17
  Four research projects live and using CRISP data

CRISP Research Subcommittee

- Dr. Christopher Chute (Chair) – Bloomberg Distinguished Professor of Health Informatics at Johns Hopkins University
- Dr. Daniel Durand – Executive Director of Research, LifeBridge Health
- Shannah Koss, BA, MPP – Koss on Care, LLC, Consumer Advocate
- Dr. Michael Horberg – Executive Director of Research and Community Benefit, Mid-Atlantic Permanente Medical Group
- Dr. Kate Tracy – Associate Professor and Director of Clinical Translational Research and Informatics Center at the University of Maryland School of Medicine
- Dr. Neil Weissman – President of the MedStar Health Research Institute

CRISP Core Services

1. **POINT OF CARE: Clinical Query Portal & In-context Information**
   - Search for your patients' prior hospital records (e.g., labs, radiology reports, etc.)
   - Monitor the prescribing and dispensing of PDMP drugs
   - Determine other members of your patient's care team
   - Be alerted to important conditions or treatment information
2. **CARE COORDINATION: Encounter Notification Service (ENS)**
   - Be notified when your patient is hospitalized in any regional hospital
   - Receive special notification about ED visits that are potential readmissions
   - Know when your MCO member is in the ED
3. **POPULATION HEALTH: CRISP Reporting Services (CRS)**
   - Use Case Mix data and Medicare claims data to:
     - Identify patients who could benefit from services
     - Measure performance of initiatives for QI and program reporting
     - Coordinate with peers on behalf of patients who see multiple providers
4. **PUBLIC HEALTH SUPPORT:**
   - Deploying services in partnership with Maryland Department of Health
   - Pursuing projects with the District of Columbia Department of Health Care Finance
   - Supporting West Virginia priorities through the WVHIN
5. **PROGRAM ADMINISTRATION:**
   - Making policy discussions more transparent and informed
   - Supporting Care Redesign Programs

Key Data Elements

1. Real-time visit notifications (ADTs)
   - Show events for patients as they progress through the continuum of care
2. Master Patient Index (MPI)
   - Link patients in disparate systems together based on probabilistic matching
3. Provider Panels
   - Track health care relationships to send ENS alerts, create more transparency across programs, and audit CRISP search activity
4. HIE Registries
   - Provide critical information in fast, scalable, and flexible ways
5. Clinical Documents
   - Display patient health information from multiple sources
6. Administrative Data Sets
   - Enable CRISP Reporting Services and Total Cost of Care Model support

CRISP by the numbers

Service	Typical Week
Admit, Discharges from Hospitals and Ambulatory	4,159,212
Laboratory Reports Received	964,712
Received Transcriptions/Reports	236,335
Received Radiology Reports	163,407
Encounter Notifications Sent	852,411
InContext Requests for HIE Registry data	470,060
Delivery of Registry into EMRs	311,040
InContext Requests for PDMP Data	369,580
Delivery of PDMP Data into EMRs	95,540
Patients Searched	61,489
Patients searched in ULP Portal	41,403
Patients searched from an EMR	13,606
Images Viewed	176
New data sent to MPI	1,833,000

EXAMPLES OF CURRENTLY SUPPORTED RESEARCH

UMMS-FRIENDS NavSTAR

Jan Gryczynski, PhD
Senior Research Scientist, Friends Research Institute

Experiences with using CRISP in the
Navigation Services to Avoid Rehospitalization (NavSTAR)
study at the University of Maryland Medical Center

Jan Gryczynski, PhD
Friends Research Institute

Christopher Welsh, MD
University of Maryland

This project was supported by the National Institute of Health, National Institute on Drug Abuse (grant R01DA037942)

Research Team

- **Friends Research Institute**
  - Jan Gryczynski, PhD
  - Courtney Nordeck, BA
  - Robert Schwartz, MD
  - Shannon Gwin Mitchell, PhD
  - Kevin E. O'Grady, PhD
- **University of MD Medical Center**
  - Christopher Welsh, MD
  - Art Cohen
  - Mike Papa, LCSW-C

Acknowledgements: This project would not have been possible without funding from NIDA, the substance abuse consultation team at UMMC, and the steadfast support of Ross Martin and CRISP.

NavSTAR study

- Builds upon the substance abuse consultation service at the University of Maryland Medical Center.

- **Randomized Clinical Trial** comparing Patient Navigation services vs. Treatment as Usual (TAU) among medical/surgical patients with comorbid substance use disorder (*N*= 400).

- The ultimate goal of the Patient Navigation intervention is to reduce hospitalizations and ED visits.

Application of CRISP to the NavSTAR trial

- NavSTAR was one of the first studies approved to use CRISP for research under the newly-adopted patient-consented research use case.
- Language was included in study consent forms in anticipation of CRISP availability.
- Continued to collect data on hospital events the old fashioned way.
  - Participant self-report at follow-up (using TLFB interview techniques)
  - Discharge summary requests to individual hospitals
  - EHR review at the UMMS institution (initially UMMC, then added UM Midtown)

Participant Characteristics

- First 200 participants to complete 12 months in the study
  - 47 % female
  - 57% African American
  - Mean (SD) age= 45 (12) years

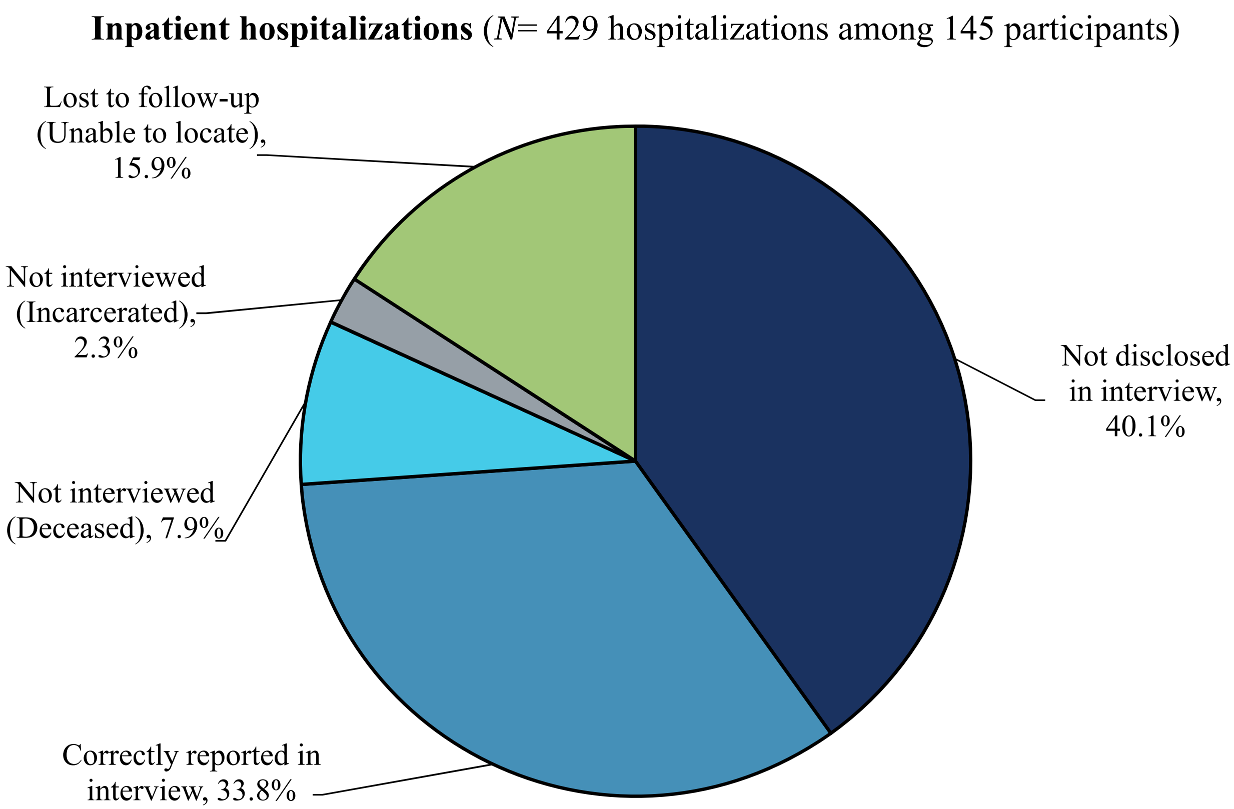
  - 78% met criteria for opioid use disorder (almost all high severity)
  - 42% were homeless based on notes in the EHR
  - By self-report, the sample had mean (SD) of 9.1 (15.3) lifetime medical hospitalizations

Measuring Hospital Service Utilization: CRISP vs. Conventional Methods

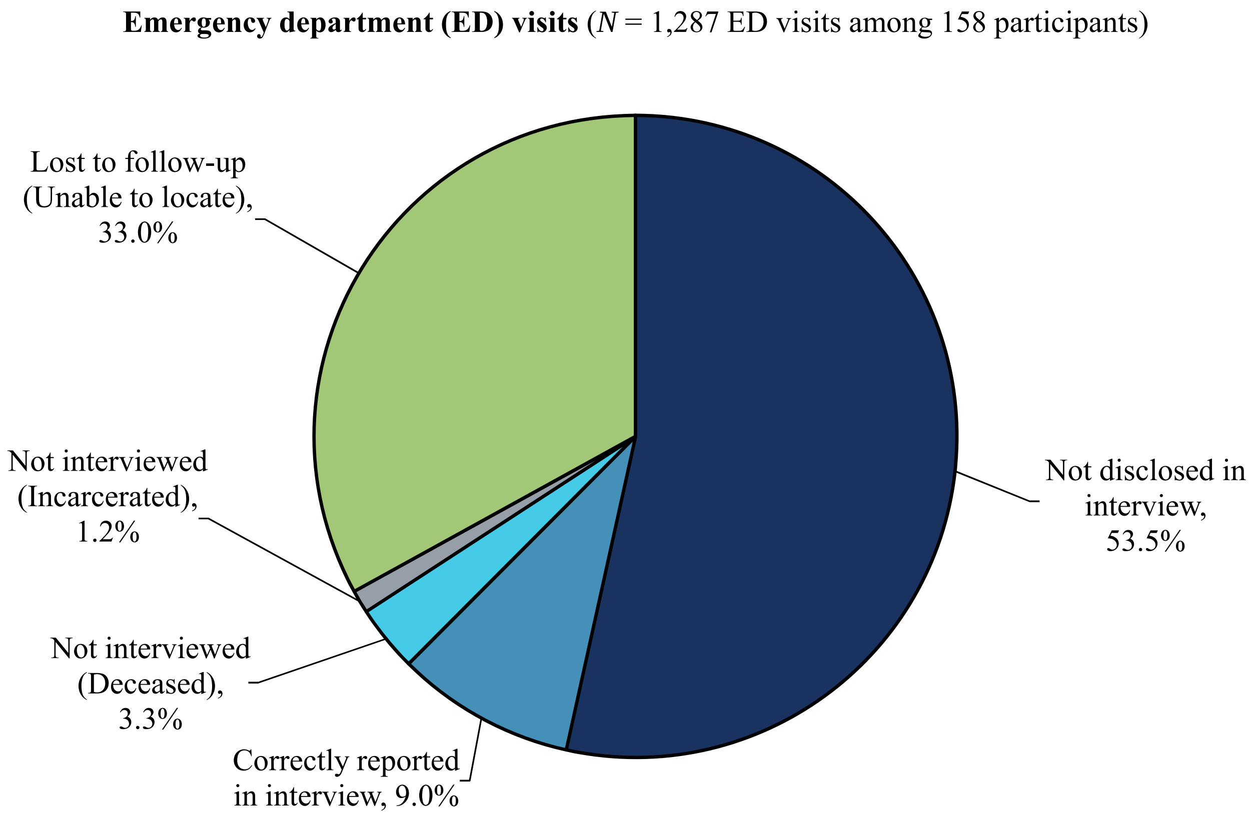
Table 1. Hospital events over a 12-month period as ascertained by different methods
(*N*= 200 medical patients with comorbid SUD enrolled in the NavSTAR trial).

	Self-report alone	EHR review alone	Self-report + EHR review	CRISP alone	CRISP+EHR combined
Any Hospital Utilization (Inpatient or ED)					
Number of Events	261	953	1052	1666	1716
Unique Participants	105	158	167	181	183
% of events accurately identified	**15.2%**	**55.5%**	**61.3%**	**97.1%**	**100%**
Inpatient Hospitalizations					
Number of Events	145	233	283	421	429
Unique Participants	83	113	128	143	145
% of events accurately identified	**33.8%**	**54.3%**	**66.0%**	**98.1%**	**100%**
ED visits					
Number of Events	116	720	769	1245	1287
Unique Participants	58	126	133	157	158
% of events accurately identified	**9.0%**	**55.9%**	**59.8%**	**96.7%**	**100%**

Self-report methods failed to identify a large number of inpatient hospitalizations.



Self-report methods failed to identify a large number of emergency department visits.



Utility of CRISP for clinical trials and health services research

- Comprehensive tracking of health service utilization as study outcomes
  - Accuracy and efficiency advantages over conventional methods

- Health economic research

- Monitoring serious adverse events (SAEs) in high-risk studies

- CRISP will be especially useful in studies with populations that have high levels of service utilization and care fragmentation

JHU B'FRIEND
JHU SUICIDE PROJECT

Hadi H.K. Kharrazi, MD, MS, PhD

Assistant Director, Center for Population Health IT (CPHIT)
Johns Hopkins Bloomberg School of Public Health

ICTR CRISP Symposium
Mar 2019

Using CRISP data for population health research: The geriatric falls and suicide prevention projects

Center for Population Health IT (CPHIT)

Hadi Kharrazi *(kharrazi@jhu.edu)*

Johns Hopkins University
Bloomberg School of Public Health
Department of Health Policy and Management

Overview

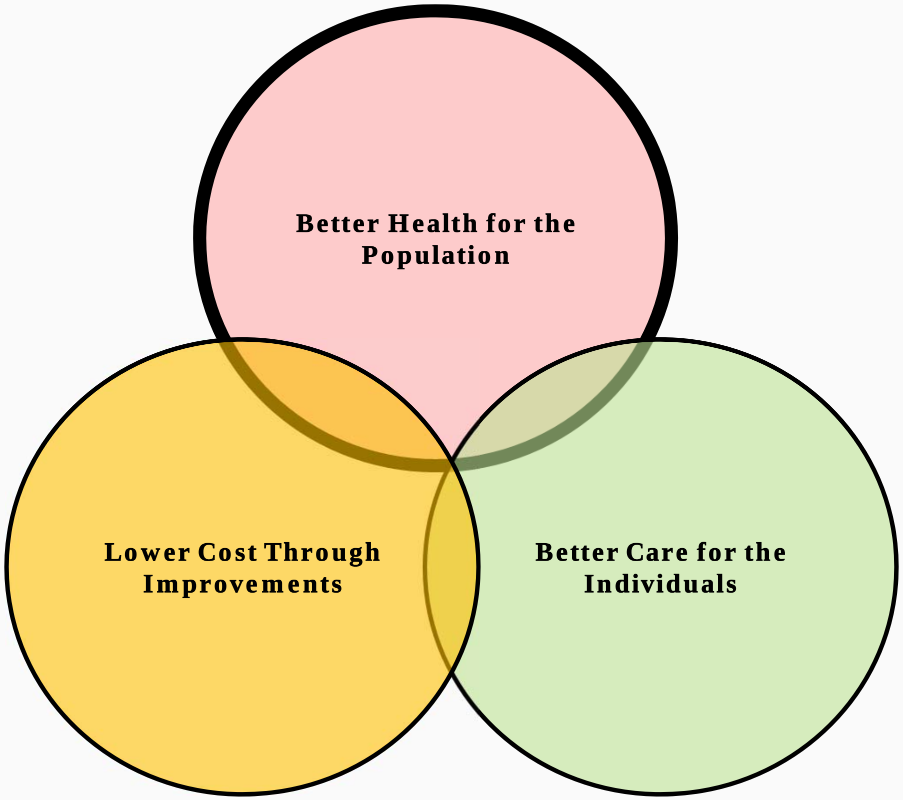
- Population Health Informatics
  - Center for Population Health IT (CPHIT)
  - Risk Stratification
  - New Data Sources

- Use of CRISP data for Population Health Analysis
  - Geriatric Falls (B'FRIEND)
  - Suicide Prevention

- Discussion
  - Challenges & Opportunities

Population Health Informatics

Population Health Informatics → Emerging Field



Triple Aims developed by the Institute for Healthcare Improvement (IHI)

Population Health Informatics → JHU CPHIT

JHU Center for Population Health Information Technology

(CPHIT)

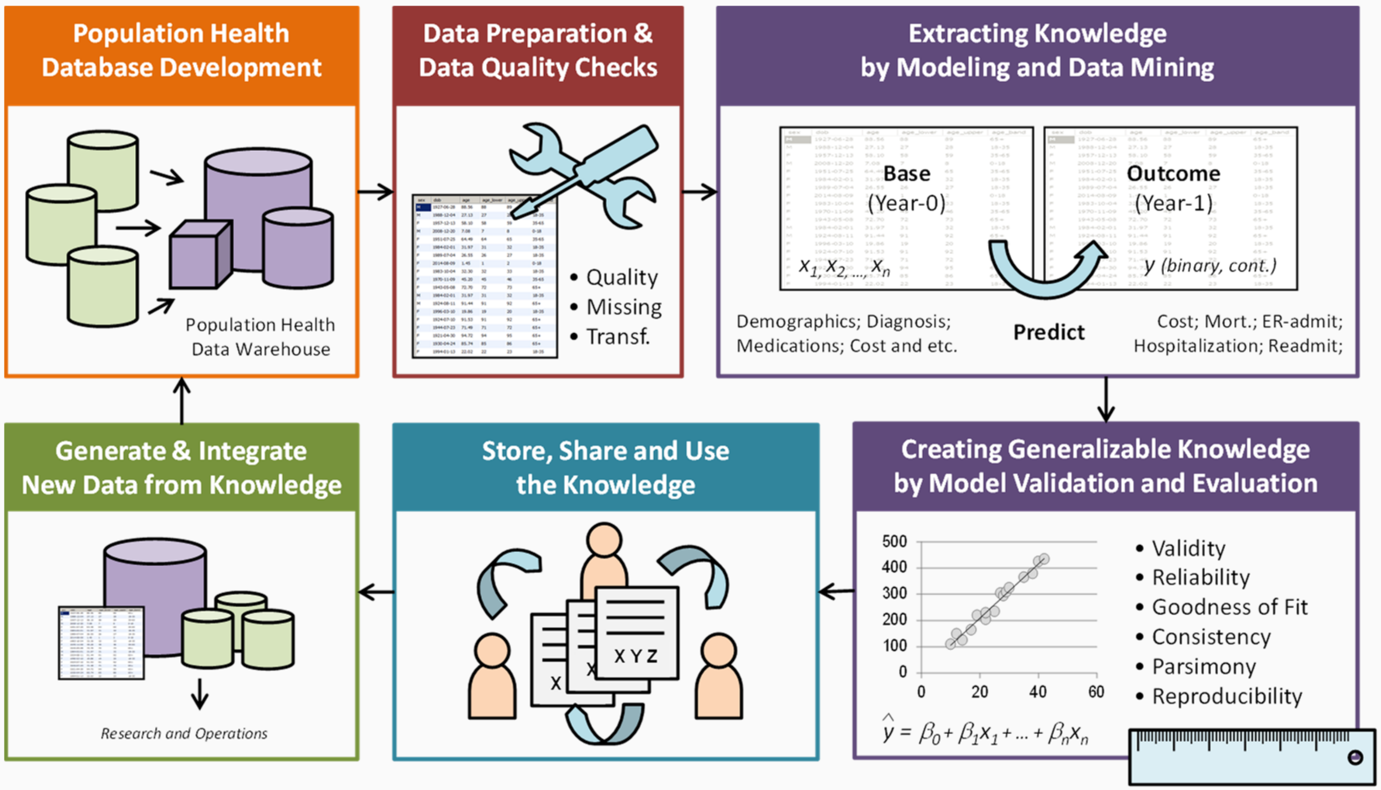
- *CPHIT improves the health of populations by advancing cutting edge health IT across all sectors*

- Outcomes: Healthcare Utilization (e.g., cost, hospitalization, ER admission)
- Predictors: Demographics, Diagnoses, Medications, Social Determinants + “new variables”
- Data Source: Insurance Claims, EHRs, HIEs, Hospital Discharges
- Scale: Populations (n = mil+)
- Temporal: Multi-year (t = 3 yrs+)

- Director: Dr. Weiner
- Research Director: Dr. Kharrazi

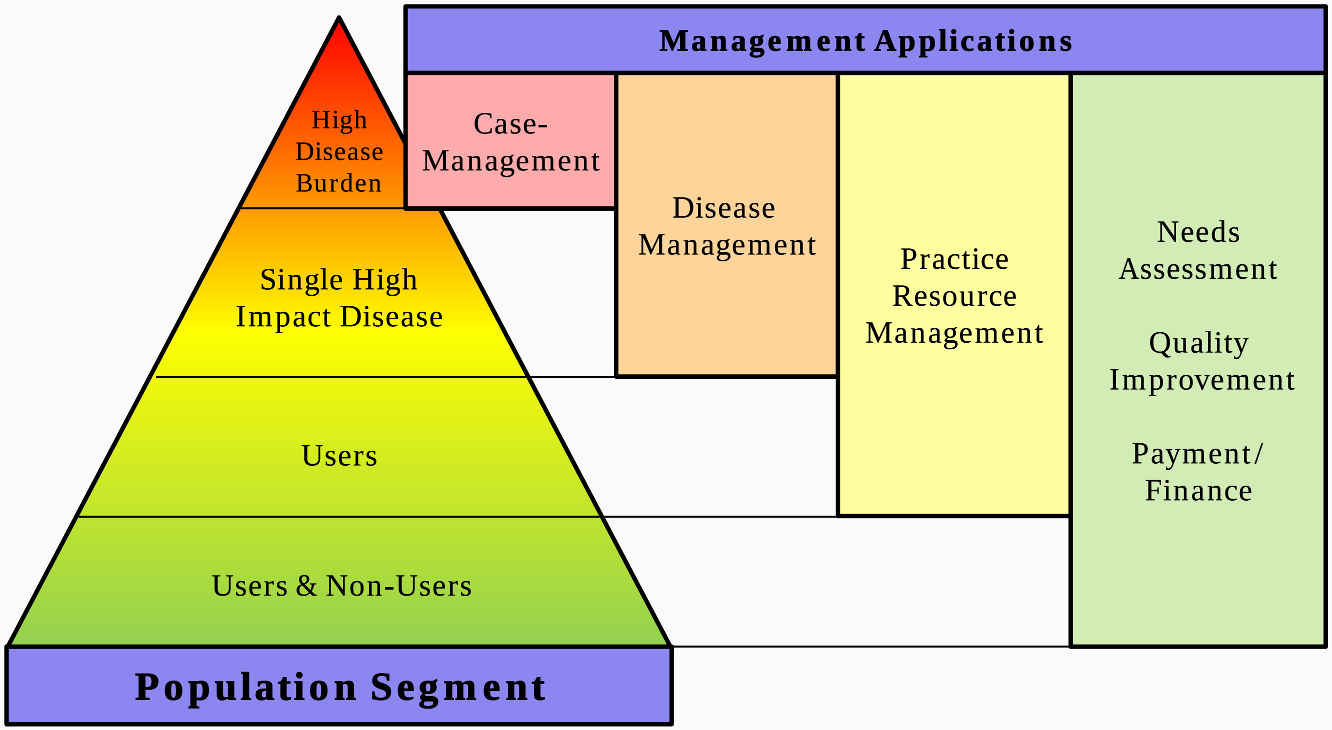
www.jhsph.edu/cphit

Population Health Informatics → Data Analytic Cycle

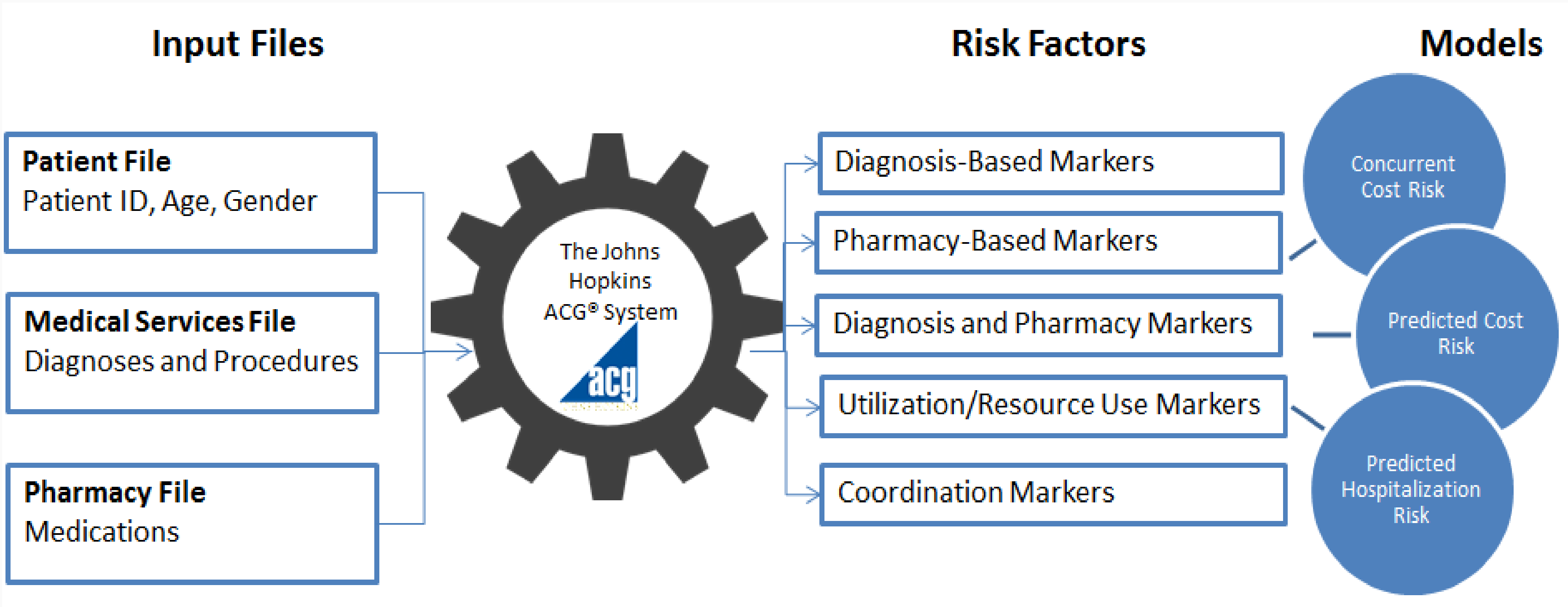


Overall Population Health Knowledge Management Process

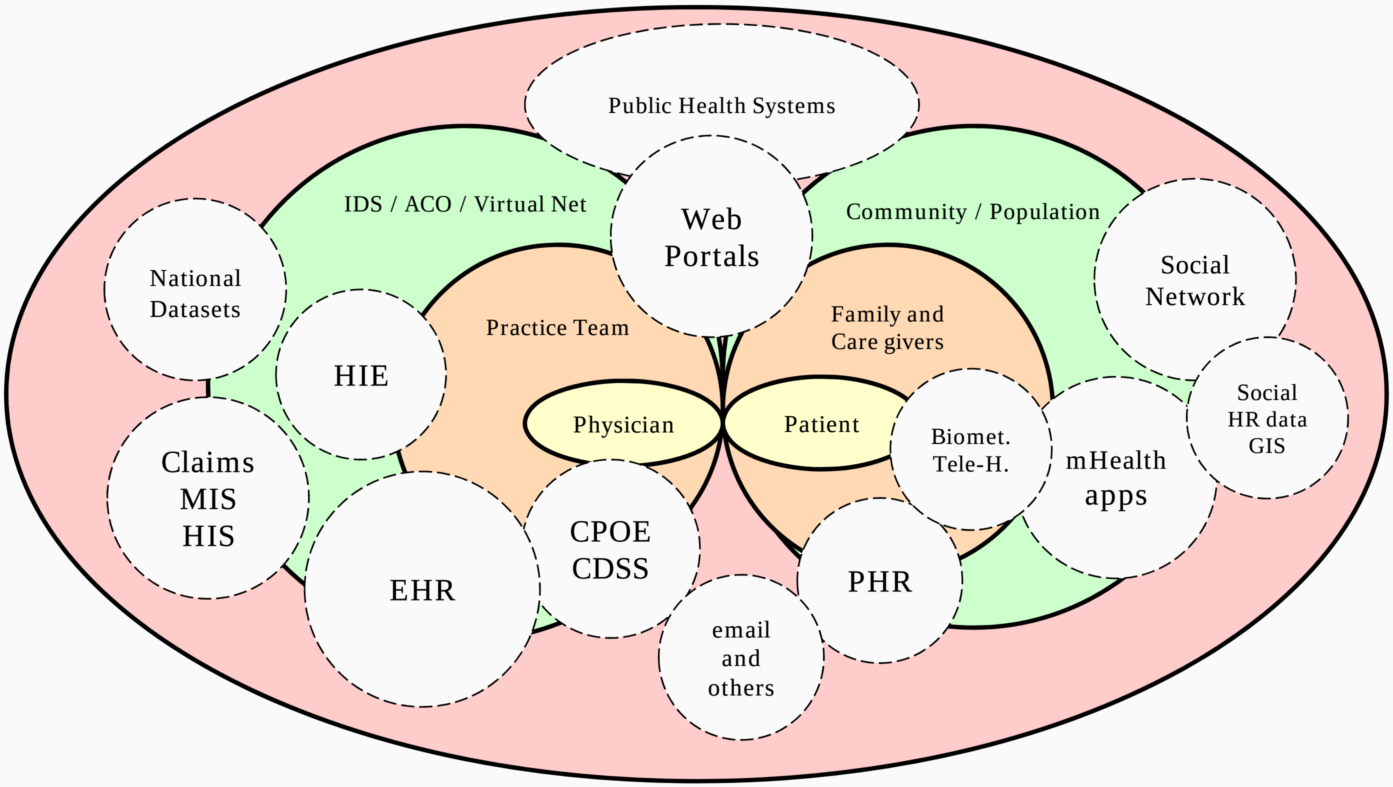
Population Health Informatics → Claims-based Risk Stratification (ACG) acg.jhsph.edu



Population Health Informatics → Claims-based Risk Stratification (ACG) *(cont.)*



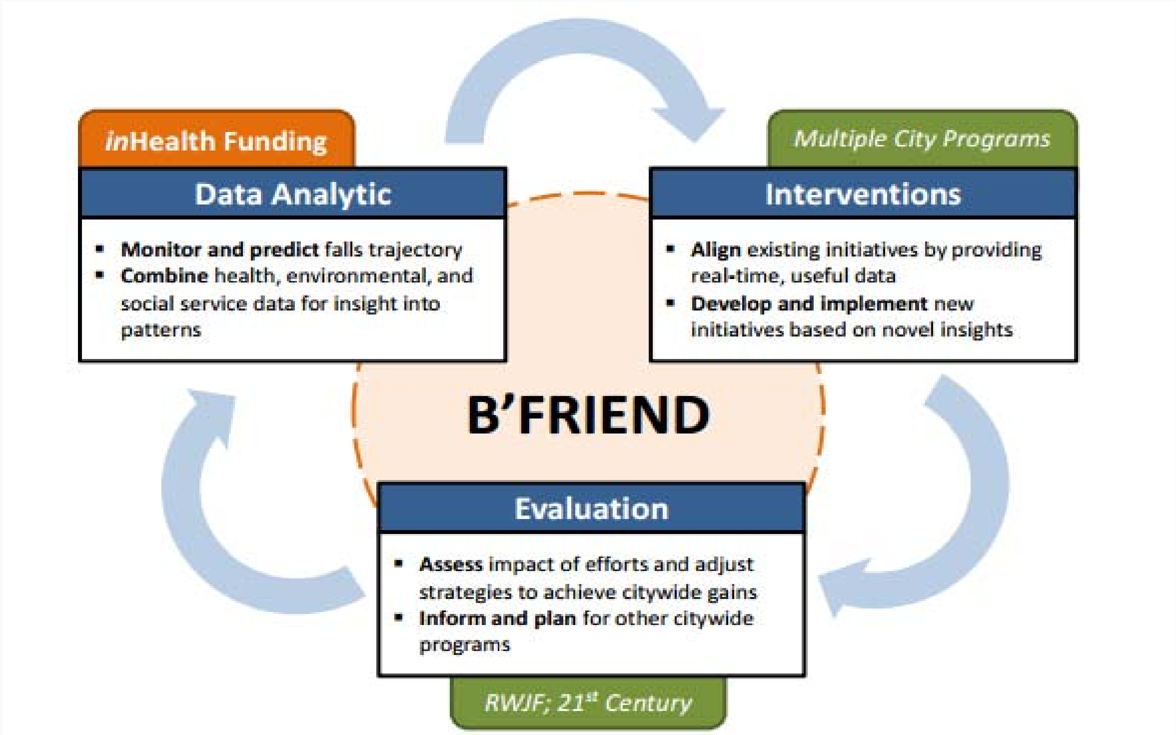
Population Health Informatics → Data Sources



Weiner, 2012 http://www.ijhpr.org/content/1/1/33

Use of CRISP data for Population Health Analysis

Baltimore Falls Reduction Initiative Engaging Neighborhoods and Data (B'FRIEND)



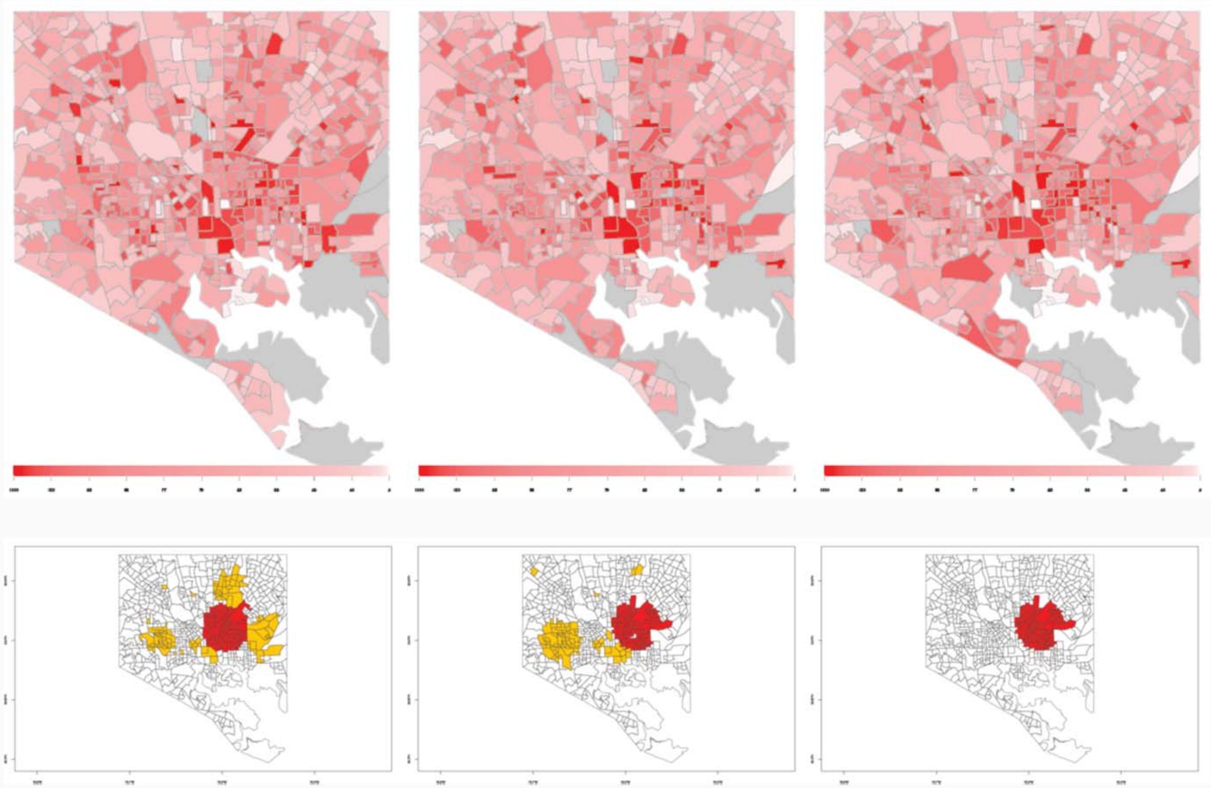
Unprecedented public-private partnership in Baltimore City committed to
reducing falls in the elderly by 1/3 in three years

B'FRIEND → Data Sources

- **HSCRC** (Maryland's Health Services Cost Review Commission) – provided us discharge summary data (both inpatient and outpatient) on Baltimore City residents in 2014

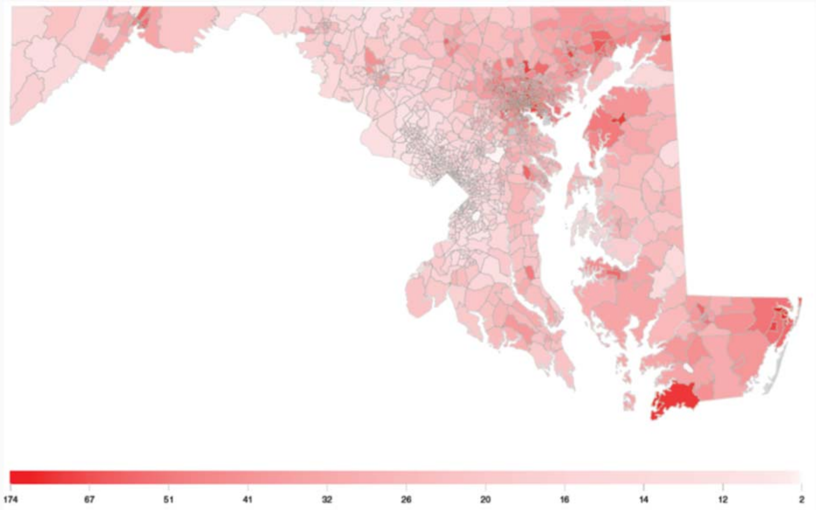
- **CRISP** (Chesapeake Regional Information System for our Patients) – Maryland's health information exchange that aggregates data from all hospitals in Chesapeake region

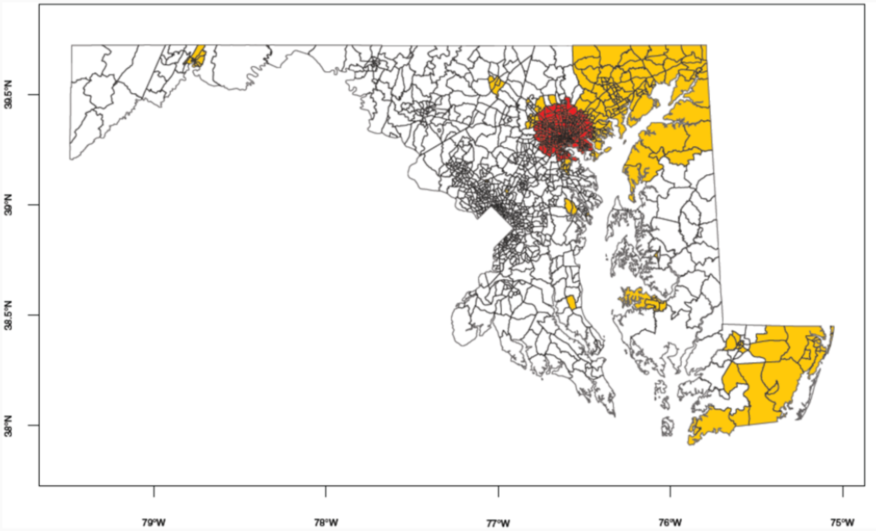
B'FRIEND → Geographic Factors (Elderly Falls)



Prevalence of falls among elderly in Baltimore City (Census Block Group)

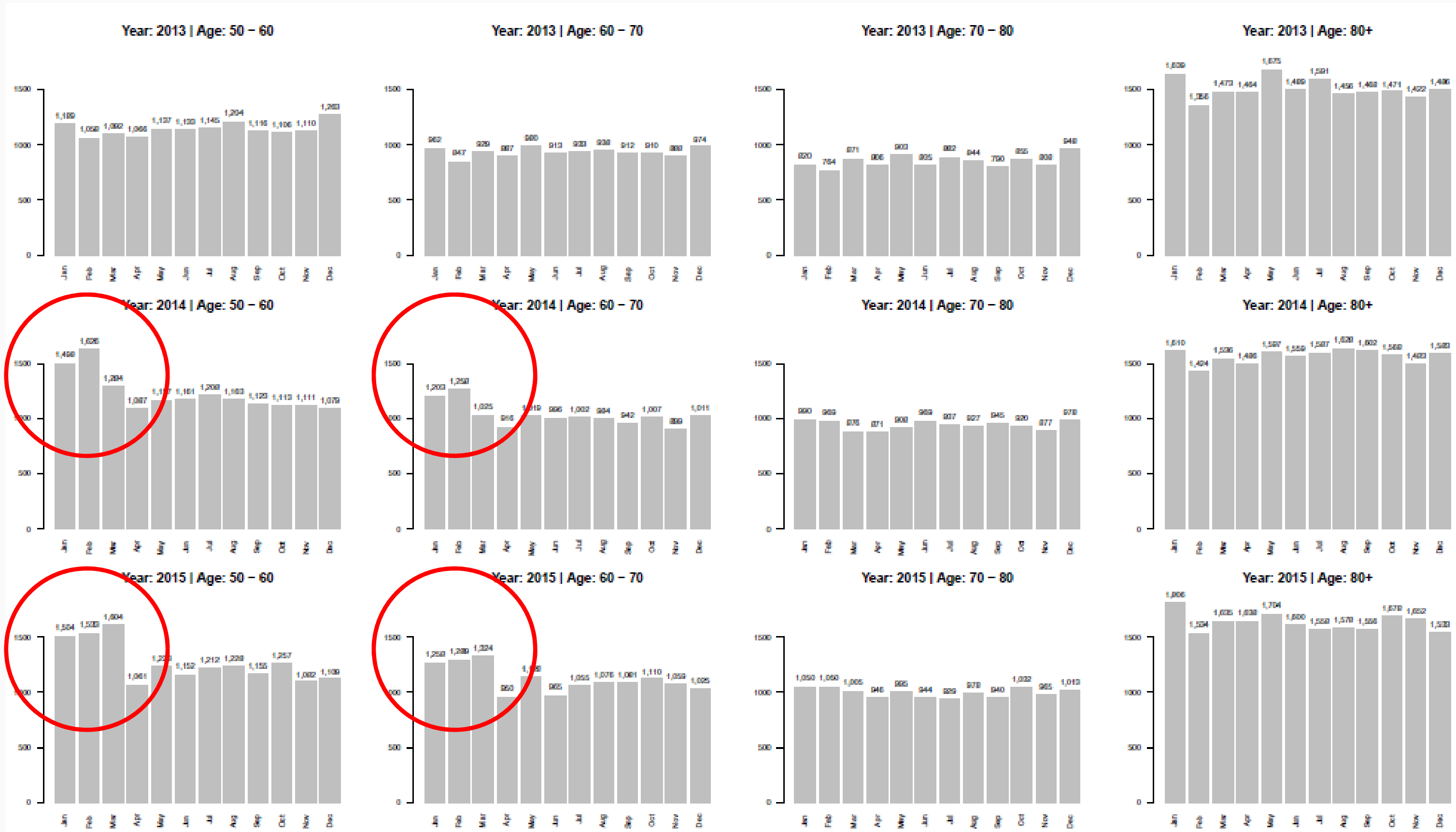
B'FRIEND → Geographic Factors (Elderly Falls) *(cont.)*



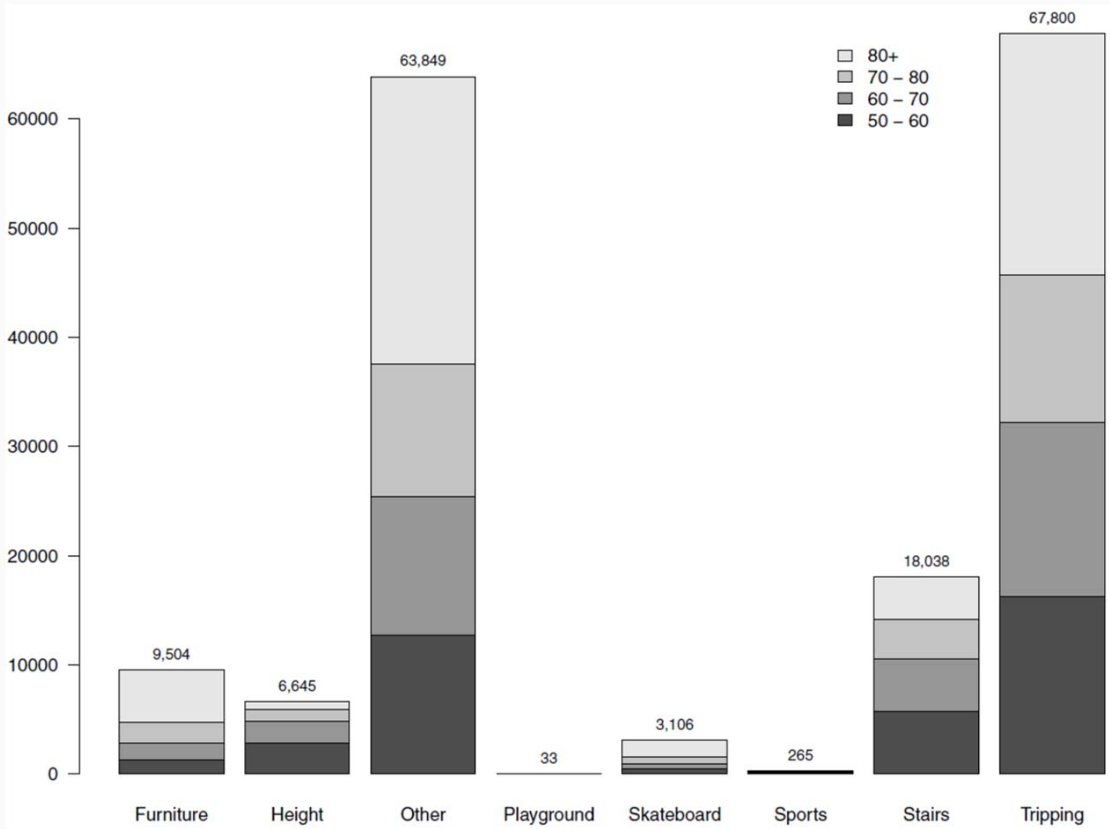


Prevalence of falls among elderly in Maryland (Census Block Group)

B'FRIEND → Year/Month & Age Range



B'FRIEND → Mechanism of Fall

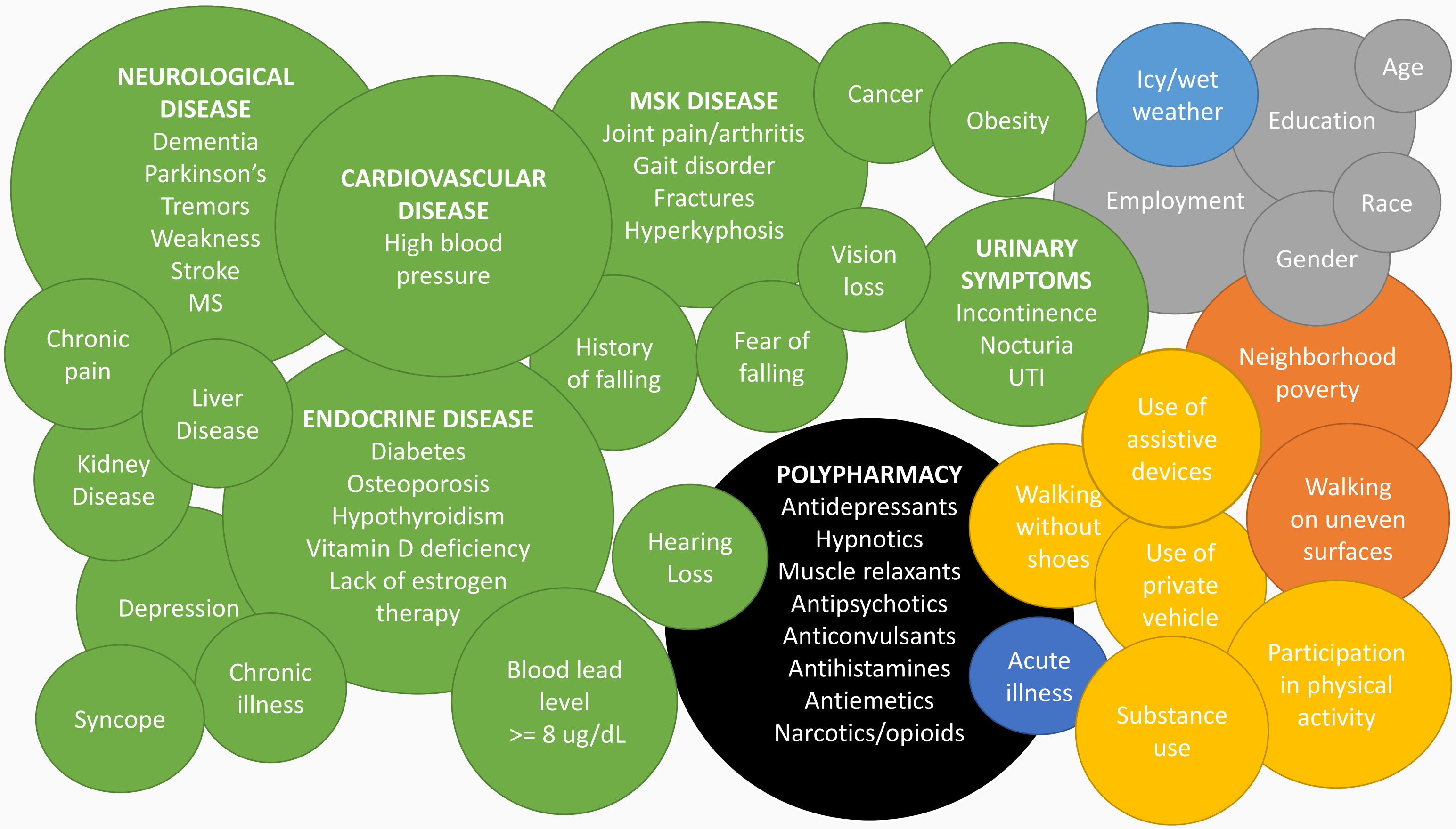


B'FRIEND → Predictive Analytics

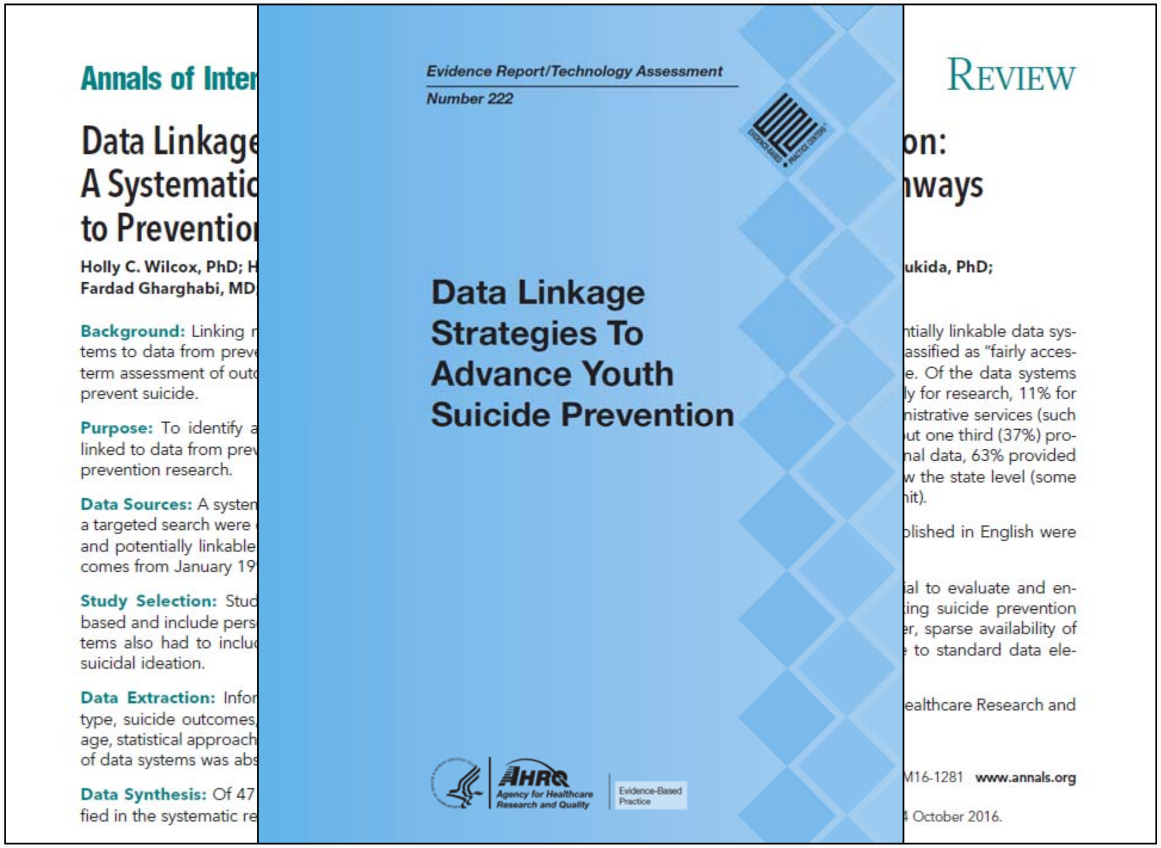
Predictors	Estimate	Std. error	z value	Pr(>|z|)	Significance	OR	2.50%	97.50%
History of fall	1.795	0.074	24.113	<2e-16	***	6.02	5.20	6.97
Fracture	0.604	0.104	5.821	5.85E-09	***	1.83	1.49	2.24
Substance Abuse	0.520	0.082	6.364	1.96E-10	***	1.68	1.43	1.97
Parkinson	0.337	0.178	1.895	0.058056	.	1.40	0.98	1.97
Kyphoscoliosis	0.322	0.153	2.102	0.035519	*	1.38	1.01	1.85
Sex (female)	0.173	0.046	3.736	0.000187	***	1.19	1.09	1.30
Depression	0.146	0.068	2.141	0.032238	*	1.16	1.01	1.32
Mental Illness	0.128	0.065	1.980	0.047652	*	1.14	1.00	1.29
Age	0.038	0.003	14.895	<2e-16	***	1.04	1.03	1.04
Charlson Index	-0.053	0.009	-5.711	1.12E-08	***	0.95	0.93	0.97
Vision	-0.211	0.057	-3.689	0.000225	***	0.81	0.72	0.91
Obesity	-0.251	0.076	-3.311	0.000931	***	0.78	0.67	0.90
Cardiovascular Disease	-0.313	0.050	-6.301	2.95E-10	***	0.73	0.66	0.81
Lower Urinary Tract Symptoms	-0.345	0.074	-4.656	3.23E-06	***	0.71	0.61	0.82
Hypertension	-0.357	0.050	-7.080	1.44E-12	***	0.70	0.63	0.77
Cancer	-0.441	0.081	-5.418	6.02E-08	***	0.64	0.55	0.75
Lower Back Pain	-0.495	0.067	-7.368	1.73E-13	***	0.61	0.53	0.69
Joint Trauma	-0.526	0.197	-2.674	0.007487	**	0.59	0.39	0.85
Lower Extremity Joint Surgery	-1.069	0.182	-5.870	4.36E-09	***	0.34	0.24	0.48
(Intercept)	-4.372	0.197	-22.249	<2e-16	***	0.01	0.01	0.02
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1								

Predictors and coefficients of the elderly-fall model

B'FRIEND → Other Data Sources



Suicide Prevention Review / Study

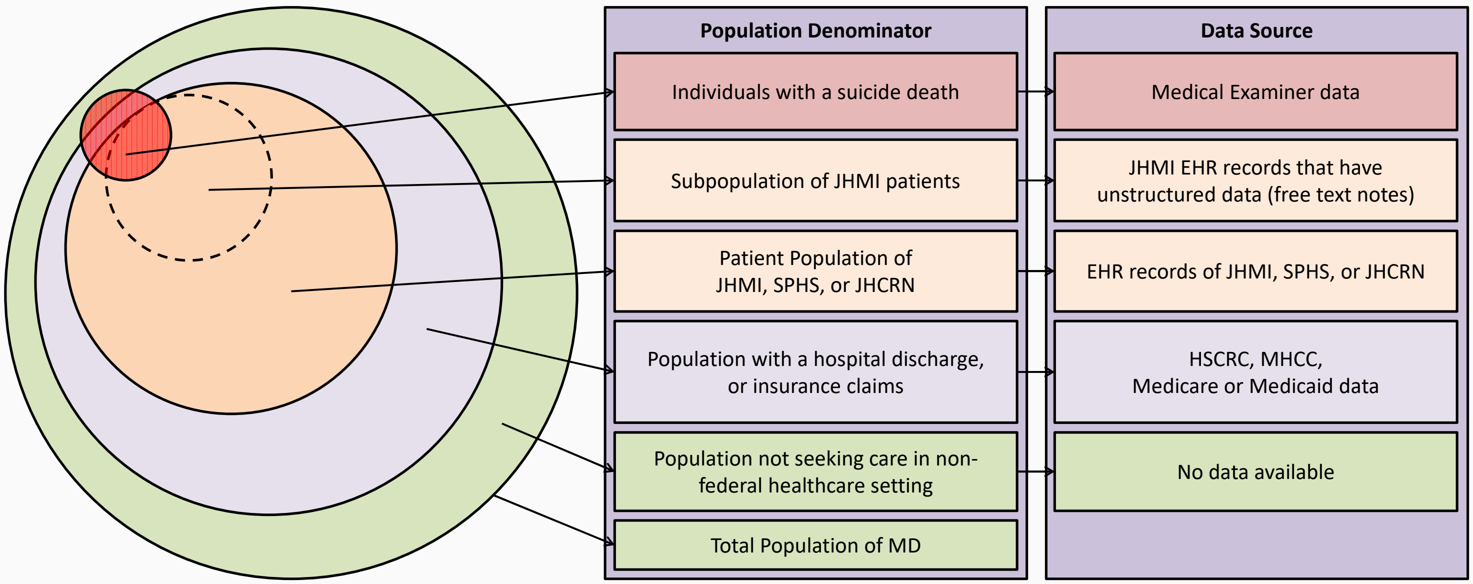


Reviewing data linkage strategies and methods to advance youth suicide prevention (funded by NIH P2P)

Addressing Suicide Research Gaps

- OCME (Medical Examiner) → [outcome]
- HIE data (admission, discharge, transfers)
- Hospital discharges (i.e., HSCRC)
- Claims (Commercial – MHCC, Medicare, and Medicaid)
- EHR data (Johns Hopkins, Sheppard Pratt, AAMC, PRMC, VHA)
- Child Protection Services & Corrections Data
- Geo-derived Social Determinants of Health (Census, ESRI)
- State-wide VDRS
- … and other novel data sources

Addressing Suicide Research Gaps *(cont.)*

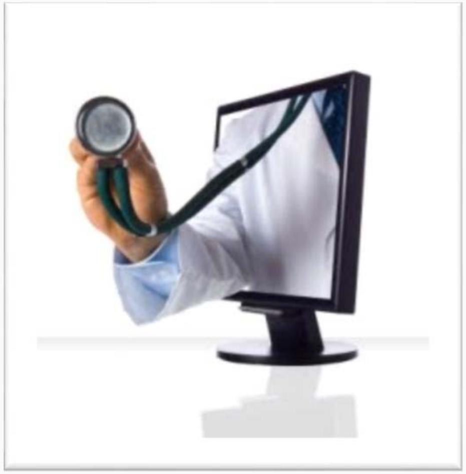


Schematic representation of population coverage of various identified data sources in Maryland

Discussion

Discussion → Challenges and Opportunities

- **Data sources/types:**
  - How to compare data types and their added value?
  - What are the limits of each data type? What are we missing?
  - What can be used from unstructured data?
- **Data quality:**
  - How much juice is left in this data type (e.g., claims)?
  - Do objective measures have data quality issues (e.g., BMI)?
  - How can we measure the quality of subjective data?
- **Denominator:**
  - Are we excluding noise or signal?
  - Is this a too big of a cut or too narrow – sample size issues?
  - Patient attribution issues...



Thank you!

Q & A

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CRISP

JHU MESA

Wendy Post, MD, MS

Professor of Medicine and Epidemiology, Division of Cardiology
Johns Hopkins University School of Medicine

JHU WALGREENS

Jodi Segal, MD, MPH

Professor of Medicine, Epidemiology, Health Policy and Management
Johns Hopkins University

Walgreens Meds to Beds

Jodi Segal, MD, MPH
Professor of Medicine, Epidemiology, Health Policy and Management
Division of General Internal Medicine

Evaluation

Walgreens aimed to promote medication adherence and reduce unplanned readmissions by expanding the role of the outpatient pharmacy.

Intervention: **Bedside delivery** of medications prior to discharge in 2017

- Medications were delivered directly to the patient's room by a technician from the Walgreens pharmacy on the hospital campus
- If patient had questions, pharmacist connected via telephone or came to the room.
- Pharmacy staff processed insurance verifications and approvals and collected copayments, just as they would if the patient was at the community pharmacy.

This program was implemented at 14 acute care hospitals in Maryland and we were asked **to evaluate the impact on 30-day readmissions in the 11 hospitals** from which data was expected to be available from CRISP

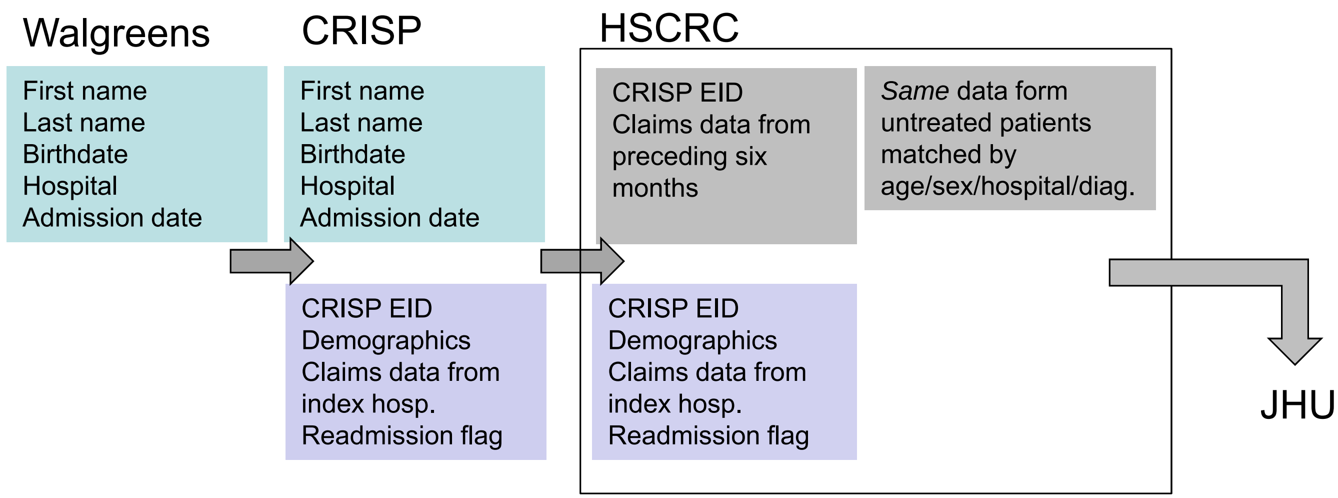
Study Question

Does bedside delivery of medication reduce 30-day readmissions relative to usual prescription management in acute care hospitals in Maryland?

[We hypothesized that it does based on results from Walgreens' evaluation of the program in 2 hospitals in North Carolina.]

Design

- Retrospective cohort study
- Data: CRISP and HSCRC Casemix data



Data

Hospital Source Code	Hospital Name	Number of Patients in Source File	Patients Matched in IP	Patients Matched in OBS	Patients Matched in OP	Patients Not Matched
ADVSGAH	Shady Grove Adventist	35	21	*	*	*
ADVWAH	Washington Adventist	1024	661	88	141	134
CVMH	CalvertHealth Medical Center, Inc.	1599	482	90	927	100
DCH	Doctors' Community Hospital	290	158	26	84	*
FMH	Frederick Memorial	768	343	*	300	104
GBMC	Greater Baltimore Medical Center	913	704	47	139	23
MHS	Mercy Medical Center	3824	2304	580	698	242
MMC	Meritus Medical Center	1353	1123	91	102	37
SAH	Saint Agnes Hospital	843	617	109	62	55
UMMS_B WMC	UM Baltimore Washington Medical Center	232	177	37	*	*
All Hospitals	All Hospitals	10,881 (100%)	6,590 (60.6%)	1,092 (10.0%)	2,473 (22.7%)	726 (6.7%)

Needed to allow flexibility in the date of service (+/- 3 days of intervention)

Flexibility with Date

Difference in Days from Intervention Date	Percent of Patients Matched in IP	Percent of Patients Matched in OBS	Percent of Patients Matched in OP
-3	0.7%	1.2%	1.0%
-2	1.0%	*	1.1%
-1	3.0%	3.7%	2.6%
0 (Intervention Date)	84.8%	90.1%	90.1%
1	8.0%	3.6%	3.9%
2	1.9%	*	0.6%
3	0.7%	*	0.6%
Total Number of Patients	6,590	1,092	2,473

Non-intervention Group

Comparison Group Matching Strategy

- Age group
- Gender
- Hospital
- Clinical characteristics of the admission/visit:
  – IP or OBS-matched patients: APR DRG for hospital admission
  – OP surgical matched patients: CPT code of procedure based on CPT code on the claim with the highest relative weight
  – ER-matched patients: CCS (diagnosis category) for the primary diagnosis

- Sought up to **5 matches** for each intervention patient
- Delivered de-identified data – from 6 months before admission and 30 days after intervention (or index visit)

Patient Data

- Received 10,155 intervention patients and 50,714 non-intervention patients
- Inclusion criteria for study: inpatient admission, eligible for readmission reduced sample to:

6,167 intervention and 28,546 non-intervention

Lightly Matched (As delivered)

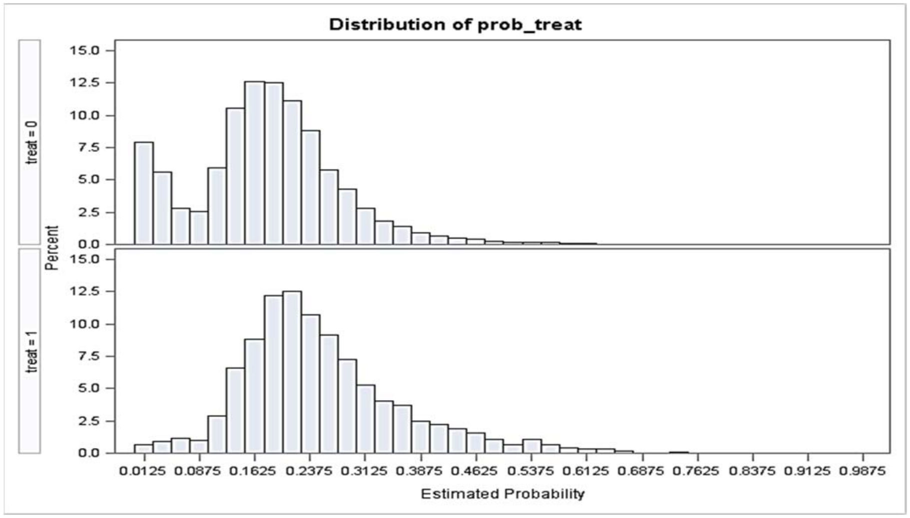
	Control N=28546	Exposure N=6167	P-Value	Standardized Difference
Gender			0.7934	
1	11531 (40.4%)	2480 (40.2%)		0.0041
2	17015 (59.6%)	3687 (59.8%)		-0.0041
Race			<.0001	
African American	8869 (31.1%)	2051 (33.3%)		-0.0471
American Indian/Eskimo/Aleut	50 (0.2%)	8 (0.1%)		0.0258
Asian/Pacific Islander	636 (2.2%)	89 (1.4%)		0.0602
other	1489 (5.2%)	281 (4.6%)		0.0278
unknown	117 (0.4%)	21 (0.3%)		0.0169
white	17385 (60.9%)	3717 (60.3%)		0.0123
Ethnicity			0.0026	
Hispanic	1315 (4.6%)	236 (3.8%)		0.0399
not Hispanic	26834 (94.4%)	5862 (95.4%)		-0.0455
unknown	292 (1.0%)	45 (0.7%)		0.0327
Marital Status			<.0001	
divorced	2685 (9.4%)	636 (10.3%)		-0.0302
married	13091 (45.9%)	2619 (42.5%)		0.0685
separated	561 (2.0%)	149 (2.4%)		-0.0273
single	8923 (31.3%)	2218 (36.0%)		-0.0996
unknown	240 (0.8%)	31 (0.5%)		0.0373
widow/widower	3046 (10.7%)	514 (8.3%)		0.0819
Primary Payer			<.0001	
charity/self pay	1102 (3.9%)	157 (2.6%)		0.0734
commercial	9972 (34.9%)	2265 (36.7%)		-0.0376
Medicaid	5090 (17.8%)	1307 (21.2%)		-0.0859
Medicare	11786 (41.3%)	2283 (37.0%)		0.0882
other	581 (2.0%)	150 (2.4%)		-0.0273

Lightly Matched (As delivered)

	Control N=28546	Exposure N=6167	P-Value	Standardized Difference
APR Severity			**<.0001**	
extreme	1533 (5.4%)	286 (4.6%)		0.0367
major	7251 (25.4%)	1558 (25.3%)		0.0023
moderate	12305 (43.1%)	2851 (46.2%)		-0.0624
minor	7457 (26.1%)	1472 (23.9%)		0.0508
APR Mortality Risk			<.0001	
1	16028 (56.2%)	3652 (59.2%)		-0.0608
2	6515 (22.8%)	1426 (23.1%)		-0.0071
3	4745 (16.6%)	835 (13.5%)		0.0868
4	1258 (4.4%)	254 (4.1%)		0.0149
Length of Stay Mean(SD)	3.8 (4.2)	3.8 (3.7)	0.8789	0
Total Charges Mean(SD)	15611.6 (14,562.1)	16513.9 (12,799.3)	<.0001	-6.5818

Propensity Score Matching

- The propensity scores calculated in a logistic regression model predicting "treat" = 1 (being in exposure group vs control) which adjusted for: gender, age, admit type, discharge disposition, major service, admit source, ethnicity, marital status, primary payer, race, APR severity, APR mortality risk, Length of Stay, total charges, top 20 diagnosis codes and top 20 DRG codes.



- Opted for a 2:1 match using a caliper of 0.05

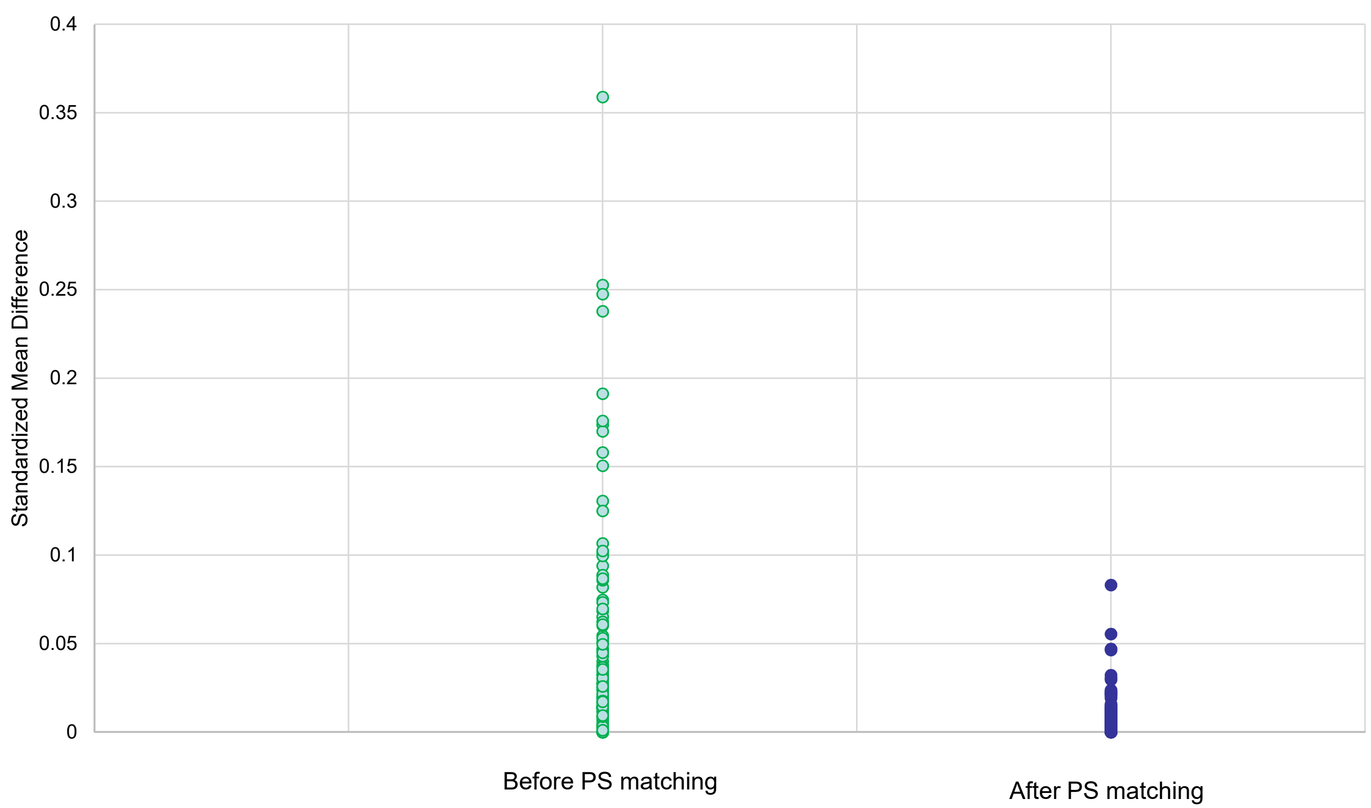
Propensity Score Matched 2:1

	Control N = 11,354	Exposure N= 6,009	P-Value	Standardized Difference
Gender			0.5643	
1	4586 (40.39%)	2400 (39.94%)		0.0092
2	6768 (59.61%)	3609 (60.06%)		-0.0092
Race			0.9397	
African American	3720 (32.76%)	2000 (33.28%)		-0.01105
American Indian/Eskimo/Aleut	14 (0.12%)	8 (0.13%)		-0.00275
Asian/Pacific Islander	158 (1.39%)	83 (1.38%)		0.00088
other	549 (4.84%)	272 (4.53%)		0.01462
unknown	26 (0.23%)	15 (0.25%)		-0.00422
white	6887 (60.66%)	3631 (60.43%)		0.00473
Ethnicity			0.3272	
Hispanic	491 (4.32%)	234 (3.89%)		0.02168
not Hispanic	10788 (95.01%)	5730 (95.36%)		-0.01598
unknown	75 (0.66%)	45 (0.75%)		-0.01056
Marital Status			0.9993	
divorced	1204 (10.6%)	628 (10.45%)		0.00499
married	4856 (42.77%)	2565 (42.69%)		0.00168
separated	274 (2.41%)	144 (2.4%)		0.0011
single	4039 (35.57%)	2147 (35.73%)		-0.00326
unknown	53 (0.47%)	29 (0.48%)		-0.0023
widow/widower	928 (8.17%)	496 (8.25%)		-0.00295
Primary Payer			0.9862	
charity/self pay	303 (2.67%)	156 (2.6%)		0.00453
commercial	4234 (37.29%)	2232 (37.14%)		0.00303
Medicaid	2332 (20.54%)	1257 (20.92%)		-0.00936
Medicare	4195 (36.95%)	2216 (36.88%)		0.00144
other	282 (2.48%)	143 (2.38%)		0.00675
unknown	8 (0.07%)	5 (0.08%)		-0.0046

Propensity Score Matched 2:1

	Control N = 11,354	Exposure N= 6,009	P-Value	Standardized Difference
APR Severity				
extreme	503 (4.43%)	265 (4.41%)	0.8232	0.00098
major	2800 (24.66%)	1517 (25.25%)		-0.01351
minor	2801 (24.67%)	1454 (24.2%)		0.011
moderate	5250 (46.24%)	2773 (46.15%)		0.00184
APR Mortality Risk			0.9833	
1	6719 (59.18%)	3570 (59.41%)		-0.00475
2	2655 (23.38%)	1391 (23.15%)		0.00557
3	1538 (13.55%)	811 (13.5%)		0.00145
4	442 (3.89%)	237 (3.94%)		-0.00264
Length of Stay Mean(SD)	3.6 (3.7)	3.8 (3.5)	0.0503	-0.0555
Total Charges Mean(SD)	16,152.53 (12805.78)	16,439.63 (12666.40)	0.1584	-0.0225

Standardized Mean Differences



Who are these patients?

Top 5 DRGs (making up about 20% of sample)

- –Total knee or total hip replacement
- –Bariatric surgery
- –Psychosis
- –Spinal fusion (combined)
- –Spinal fusion (excluding cervical)

Underway

- Crude estimates of relative risk of readmission
- Propensity score matched relative risk of readmission
- Propensity score weighted relative risk of readmission
- Stratify results by highly prevalent DRGs or diagnoses (exploratory)

- Generate a “disease risk score” which will be risk of readmission
- Weight participants by risk of readmission and examine relative risk associated with intervention
- Examine results in strata of risk of readmission

Team

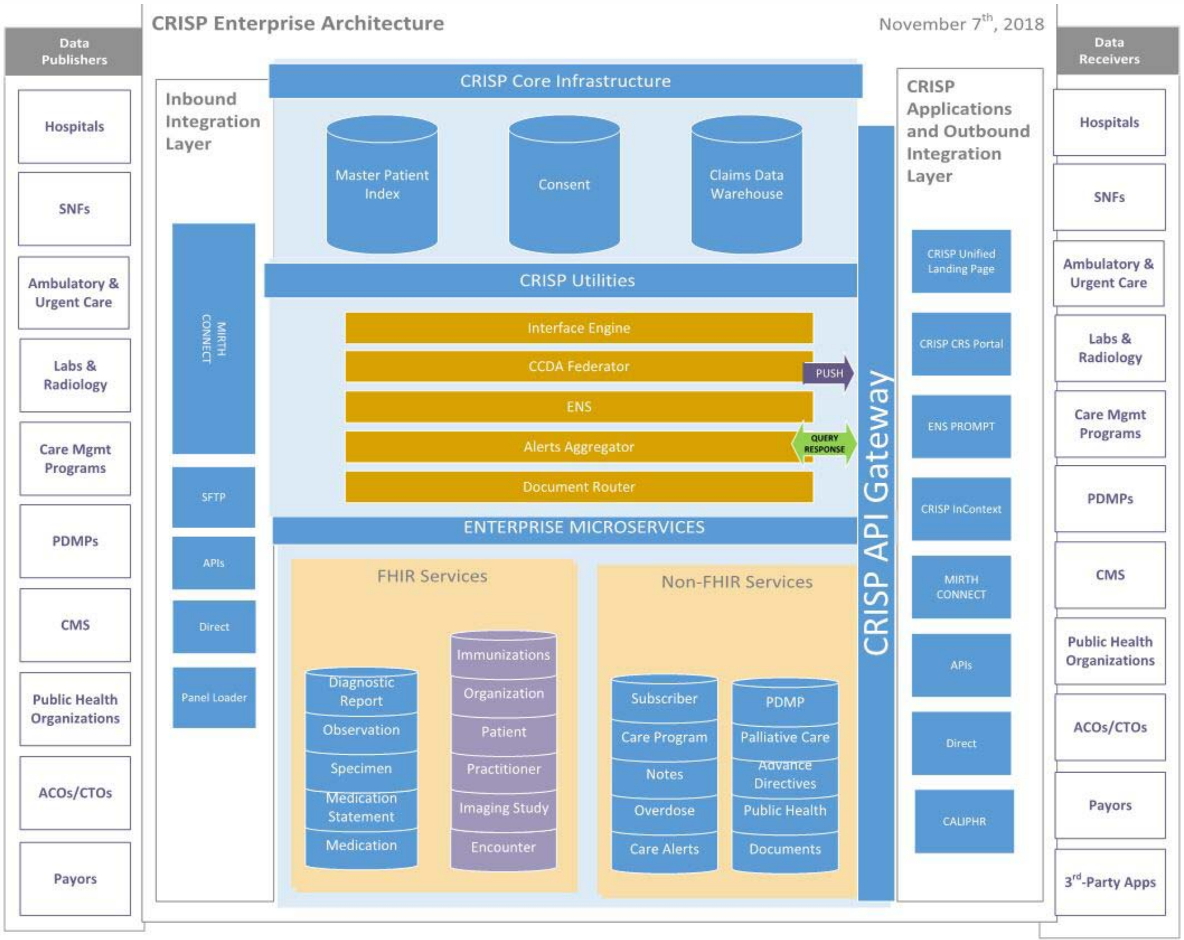
- Ariella Apfel, MS
- Jeanne Clark, MD, MPH
- Daniel Brotman, MD
- Kenneth Shermock, PharmD, PhD

- Ross Martin, MD, MHA
- HSCRC staff
- H-metrix (Audrey Speter and team)
- Walgreens (Heather Kirkham, Ed Witt and team)

CRISP TECHNICAL FRAMEWORK

Michael Berger, MBA
CIO, CRISP
Ryan Bramble, MS
Executive Director CRISP DC
Sr. Director of Product Development

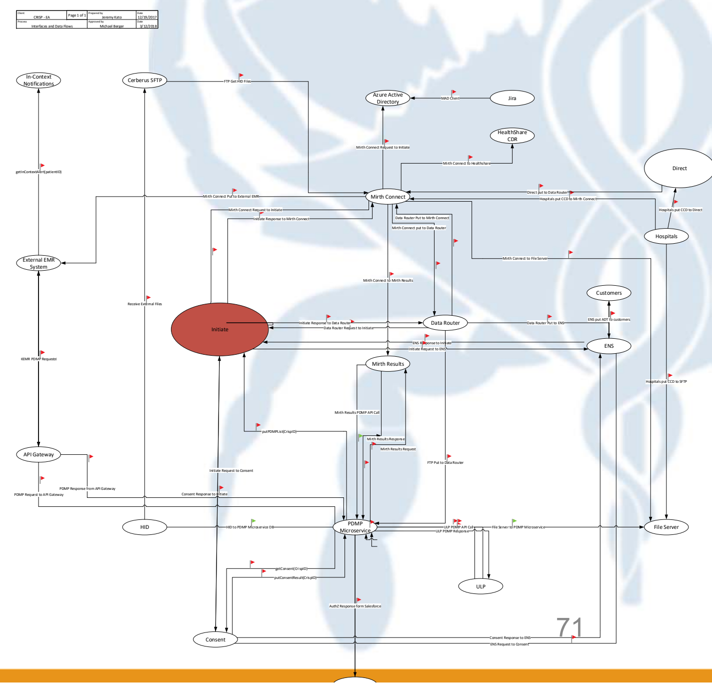
Architecture



The ‘glue’ for all services - MPI

85 Million Patients at a specific Point of Care (MRN’s)

- Nancy Regan Visited Hopkins (JHH:1234)
  - Regan, Nancy 06/06/1921
  - 1600 Pennsylvania Ave, DC
- Nancy Davis Physician is DR Patel (DRPat:w4w9)
  - Davis, Nancy 06/06/1921
  - 915 Capital Mall Sacramento, CA
- Nancy Davis-Regan has 1 immunization (IMMUNET:39480)
  - Davis-Regan, Nancy 06/06/1921
  - 915 Capital Mall Sacramento ,CA
- On a typical day CRISP receives 90,000 new MRN’s like these.
  - Each of those must compare to all 85 Million existing MRN’s to find a match.



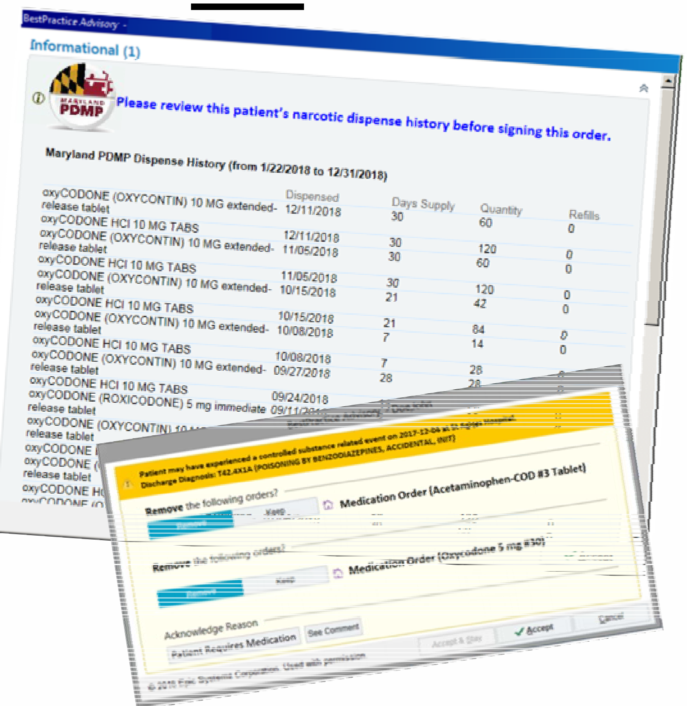
Combine into 18M distinct Enterprise ID”s

- Roughly speaking … People
- Typical day CRISP creates 6,000 new people.

80%, 20% , 10%

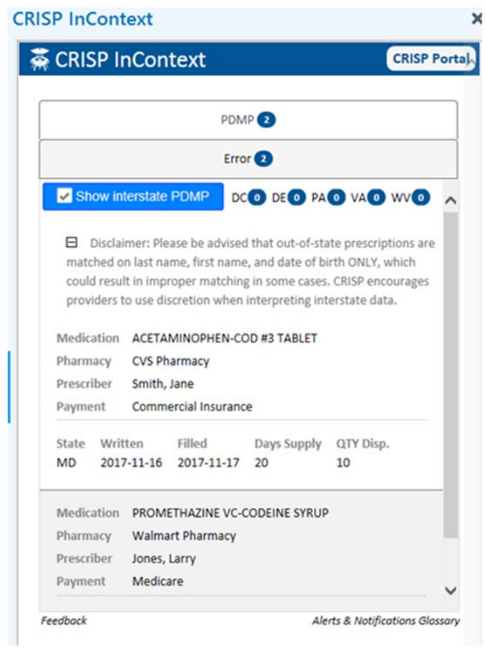
Most important

Data **into** customer EHR



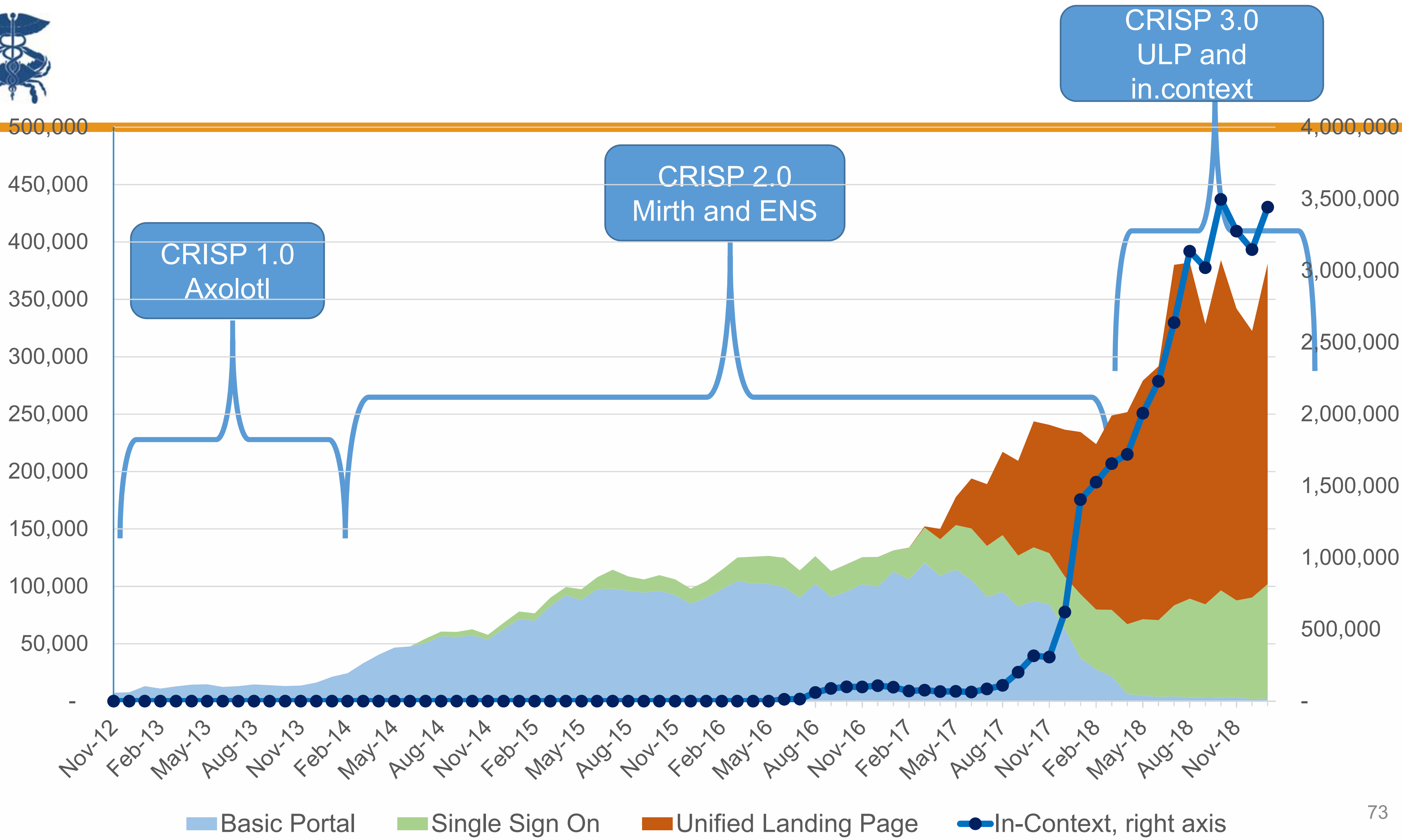
Some data

In FHIR App



Very detailed

In Portal


CRISP 1.0
Axolotl
CRISP 2.0
Mirth and ENS
CRISP 3.0
ULP and
in.context
500,000
450,000
400,000
350,000
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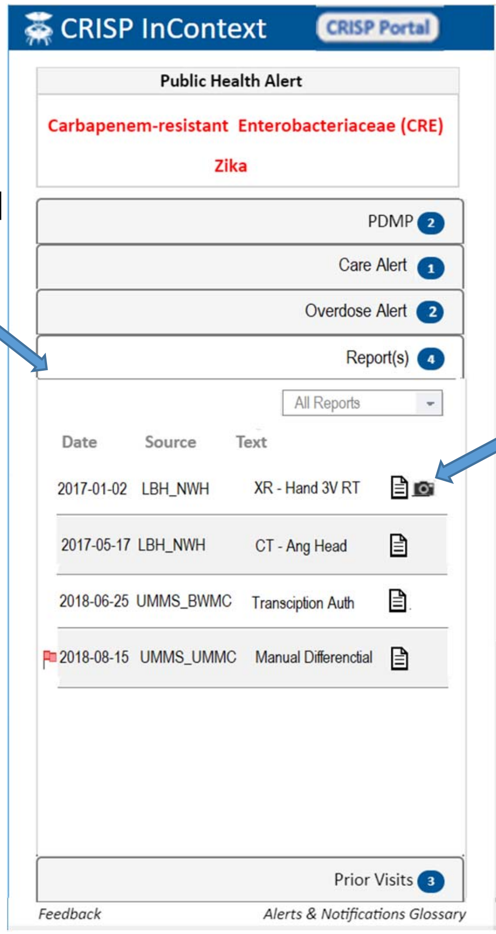
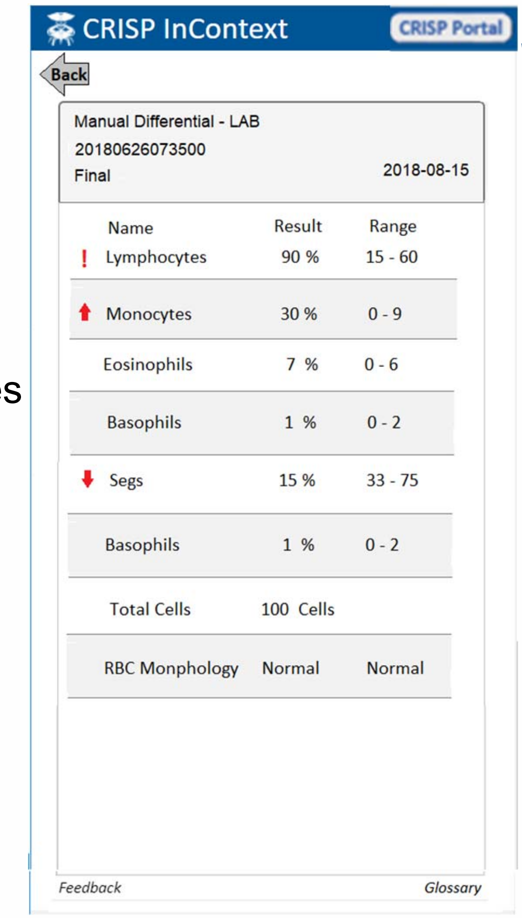
May-18
Aug-18
Nov-18
Basic Portal
Single Sign On
Unified Landing Page
In-Context, right axis

InContext App –Clinical Data, Images and SSO to ULP

View rad, lab, and transcribed reports

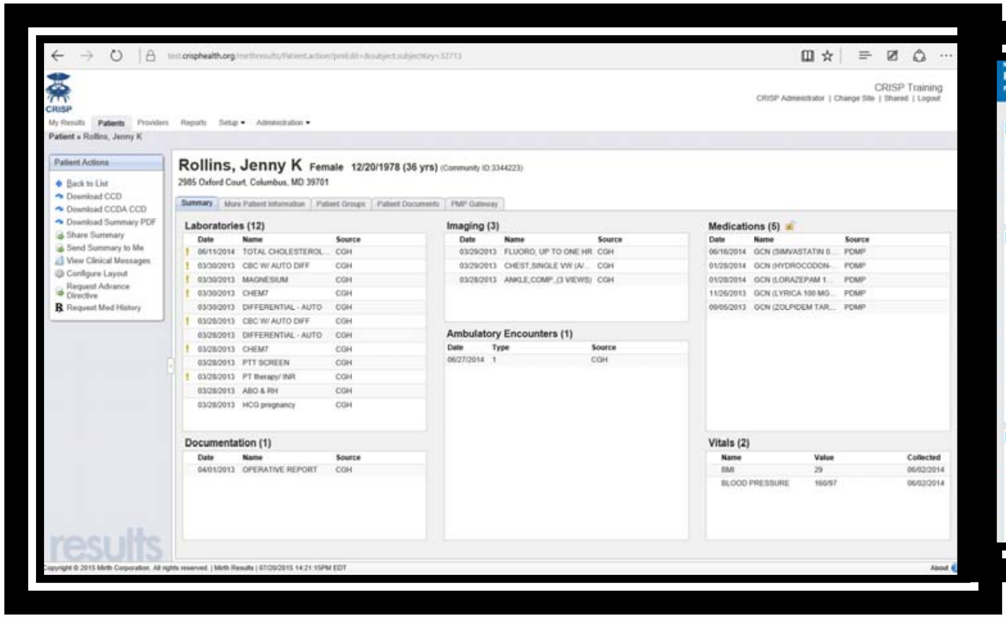
View diagnostic quality images



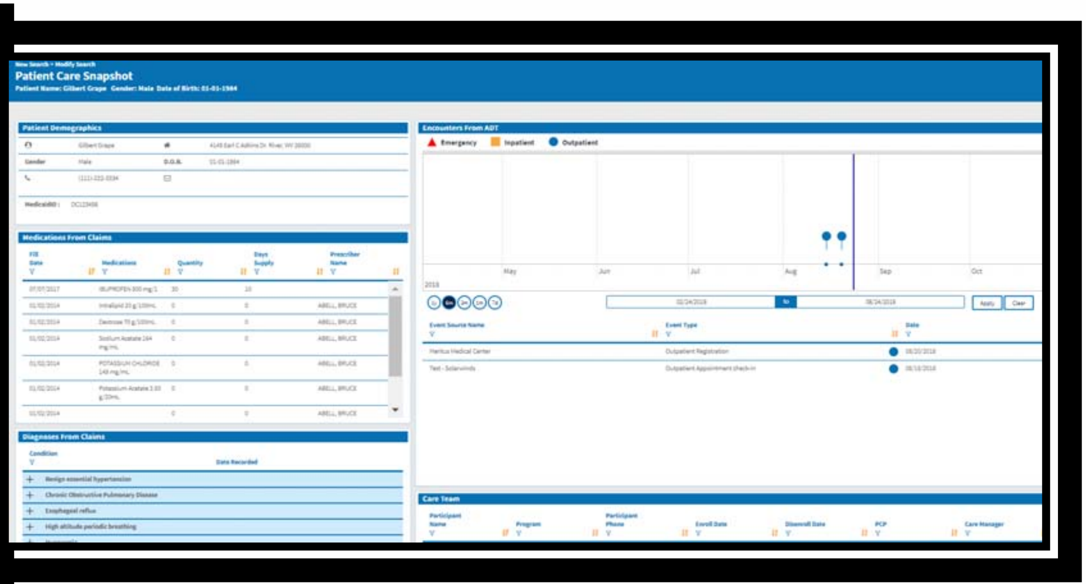


SSO into full patient record in ULP

Clinical Query Portals



Mirth Results



ULP

Encounter Notification Service

CRISP currently receives Admission Discharge Transfer messages in real-time from:

- All 48 Maryland acute care hospitals
- 9 D.C. acute care hospitals
- 6 Delaware acute care hospitals
- 17 Virginia acute care hospitals
- 29 West Virginia acute care hospitals
- 1 Ohio acute care hospital
- Almost 2/3 of Long Term Care Sites in Maryland

Through ENS, CRISP generates **real time hospitalization notifications** to PCPs, care coordinators, and others responsible for patient care.

Patient List

•CRISP receives that initial patient list, changes must be submitted to CRISP on a monthly basis.

•Examples of changes to the list can include add patient, remove patient, and update patient's demographics.

•A practice can choose to send CRISP an ADT feed of its own in lieu of a patient list.

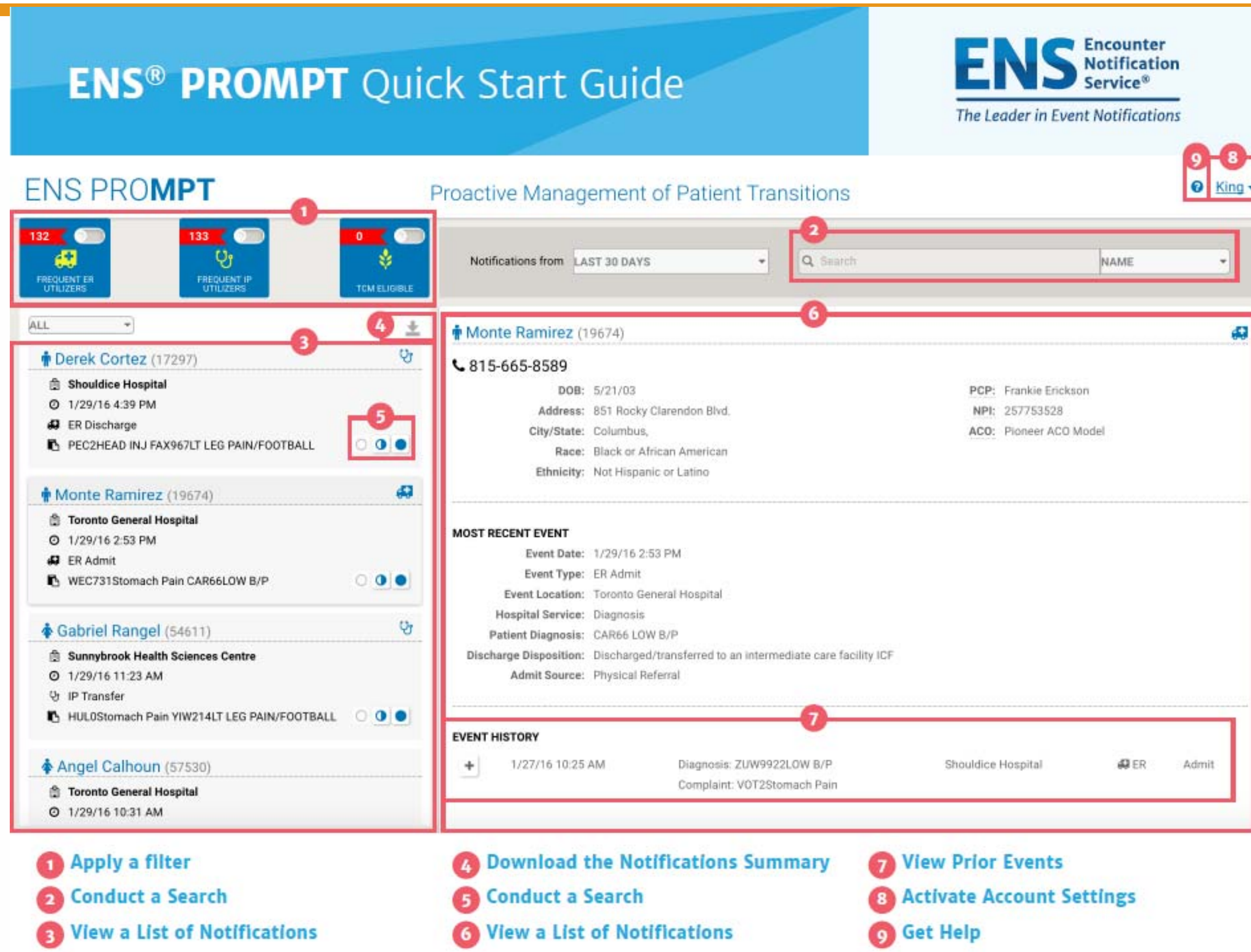
Member_status	Facility_code	PCP	MRN	first_name	middle_name	last_name	address_line_1	address_line_2	city	state	zip	date_of_birth	gender	ssn
ADD	FACILITY	Dr. Jones	999999	John	K	Doe	33 main st	apt 45	baltimore	MD	21230	19990101	M	999999999
UPDATE	FACILITY	Dr. Jones	1000000	Jane	K	Doe	34 main st	apt 46	baltimore	MD	21230	19990101	M	999999999
DELETE	FACILITY	Dr. Jones	1000001	Jim	K	Doe	35 main st	apt 47	baltimore	MD	21230	19990101	M	999999999

ENS PROMPT

- PROMPT – "Proactive Management of Patient Transitions"
- Web-based user interface for clinicians to access notifications (especially non-EP or non-EH members of the Care Team)

<u>Use Case Examples:</u>

- Detect recent admits (IP, ED)
- Detect recent discharges
- Find High Utilizers
- Find Care Team Members
- Perform analytics (utilization by condition, facility, zip code, etc.)
- Manage notifications by status with PROMPT's real-time status tracking feature
- View patients across multiple patient panels



CRISP Unified Landing Page

HOME QUERY PORTAL PATIENT SNAPSHOT HEALTH RECORDS

User Guide HELP SANDRINE EMAMBU (SIGN OUT)

New Search

Patient Search

Last Name(Required) Testing

First Name(Required) Gail

Date Of Birth(Required) 11 25 1965

PATIENT SEARCH

Gender: Male Female

ZipCode

SSN XXX-XX-XXXX

Patient Search Results

FIRST	LAST	DATE OF BIRTH	CRISP ID	GENDER	ADDRESS	MATCH SCORE	INCLUDE
GAIL	TESTING	11/25/1965	135195209	Female	22 S Greene St Baltimore, MD	Very Likely	✔
GAIL	TESTING	11/25/1965	138295764	Female	10 E, WASHINGTON DC, 20001 ,	Very Likely	☐

Query Portal
Snapshot (MD)
Health Records

Usage Terms and Conditions

I understand that access to the health record is only available for patients with whom I have a treatment relationship and who have not opted out of the HIE, with the exception of data provided by the Maryland Prescription Drug Monitoring Program (PDMP), which is mandated by law.

I understand that as a participant in the HIE, our organization has a responsibility to make sure patients are aware, circumstances permitting, of their right to opt-out of non-PDMP clinical data prior to performing a query.

If I am authorized to access Maryland PDMP data through CRISP, I certify that I understand and will adhere to the regulations outlined in COMAR 10.47.07.

By performing a patient search I accept these terms and conditions.

Announcements

Unread | Read

Updates

As of June 8, 2018 the Interstate PDMP is querying DC, DE, VA, WV.

Patient Care Snapshot

New Search > Modify Search

Patient Care Snapshot

Patient Name: GILBERT GRAPE Gender: Male Date of Birth: 01-01-1984

Profile Sections

Collapse/Expand All

Washington Adventist	Emergency Registration	▲	10/23/2017
Providence Hospital	Inpatient Discharge	■	09/23/2017
Providence Hospital	Emergency Admission	▲	09/19/2017

Diagnoses From Claims

Condition	Date Recorded
— Abnormality of gait	
Abnormality of gait	05/06/2015
— Late effects of cerebrovascular disease, hemiplegia affecting dominant side	
Late effects of cerebrovascular disease, hemiplegia affecting dominant side	11/23/2014
Late effects of cerebrovascular disease, hemiplegia affecting dominant side	11/03/2014

Care Team

Participant Name	Program	Participant Phone	Enroll Date	Disenroll Date	PCP	Care Manager	Care Manager Phone
Providence	My Health GPS	202-555-3000	07/01/2017		Regina Jones	Betsy Smith	202-555-0982
DC Medicaid	Amerigroup		10/01/2015				

Procedures From Claims

Service From Date	Service To Date	Place of Service	Description
		N MANAGEMENT	
01/20/2015	01/20/2015	MEDICAL TRANSPORTATIO N MANAGEMENT	Subsequent hospital care
01/20/2015	01/20/2015	MEDICAL TRANSPORTATIO N MANAGEMENT	Prolonged service, inpatient

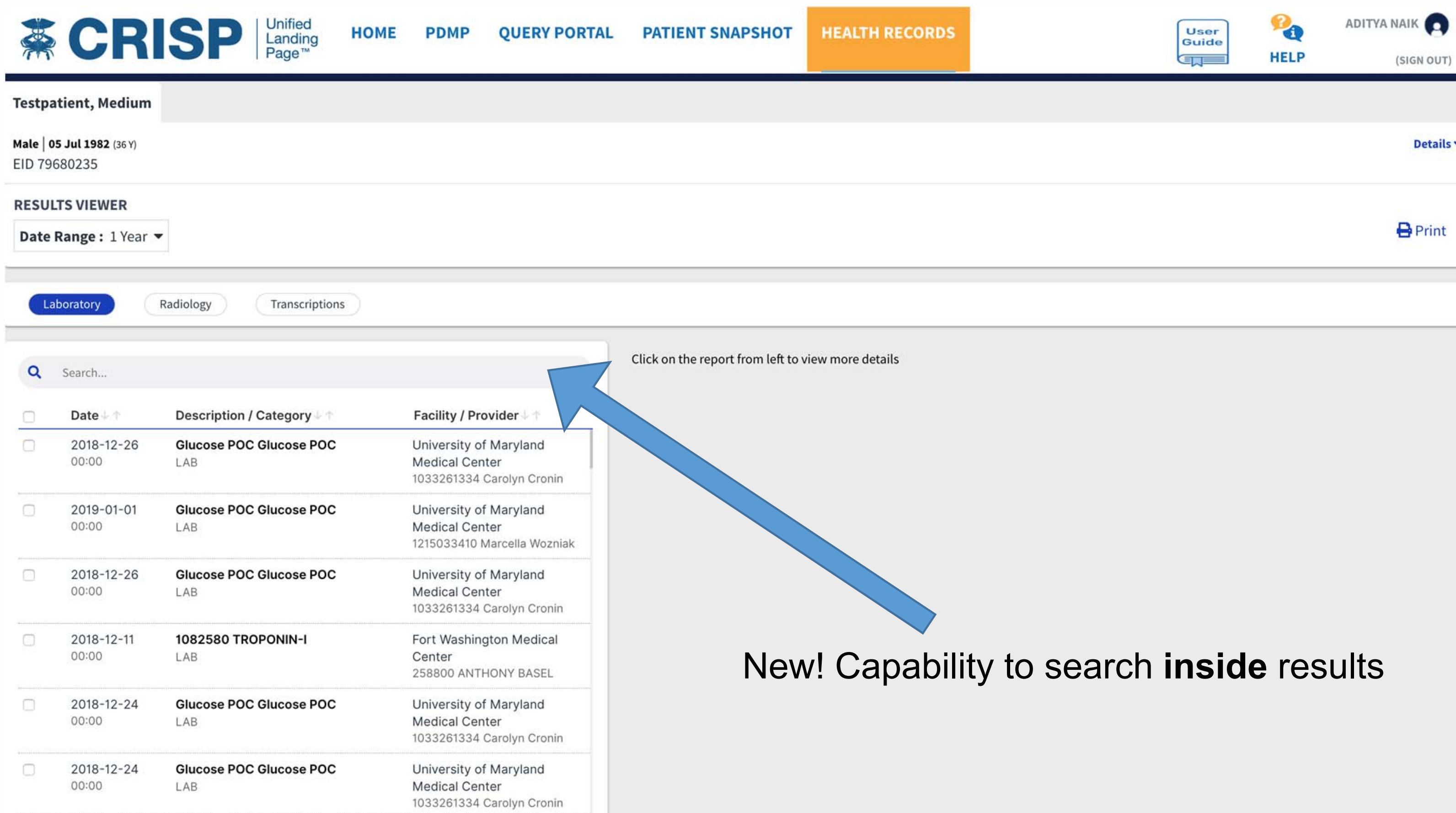
Encounters From Claims

■ **Event**

Health Records in ULP

INTERNAL USE ONLY

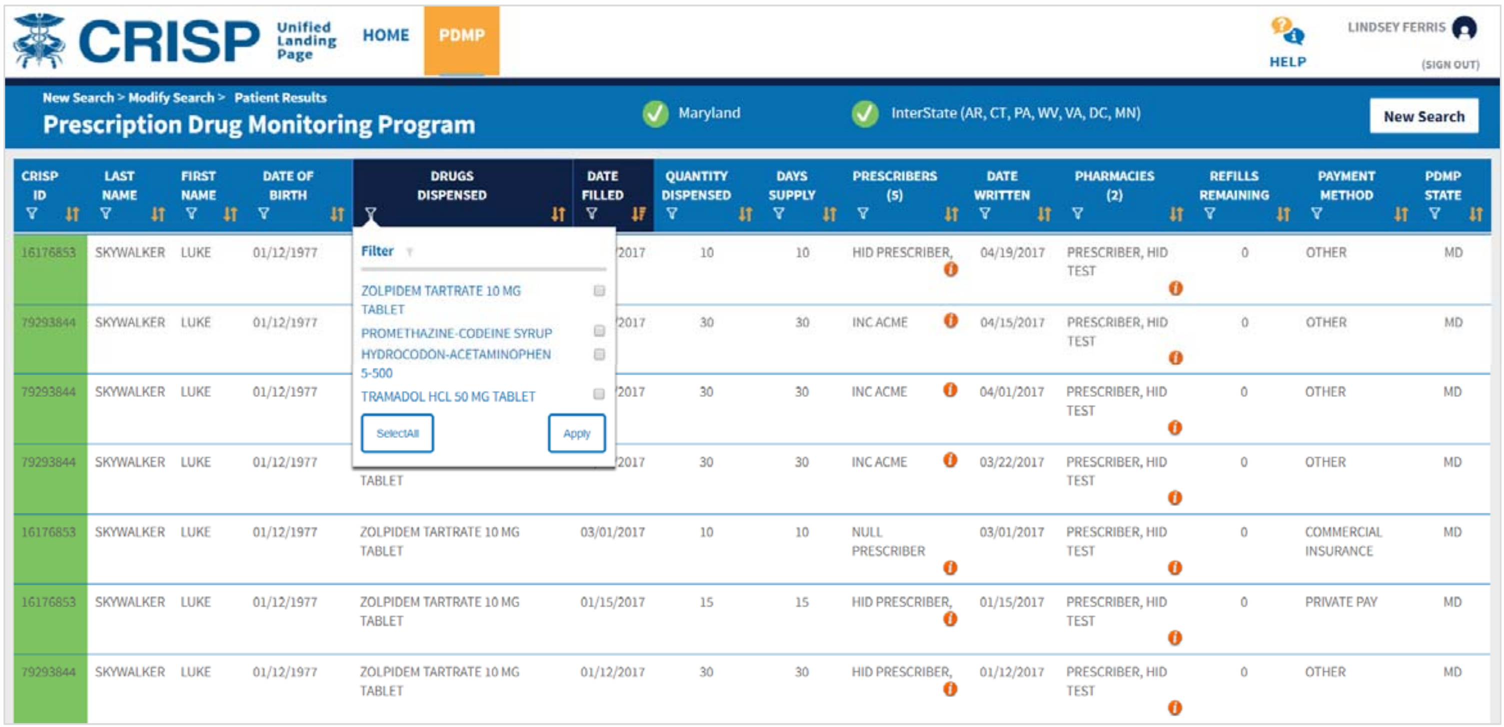
- Laboratory
- Radiology
- Transcription
- Imaging Worklist
  (In Development)



New! Capability to search **inside** results

Prescription Drug Monitoring Program (PDMP)

PDMP data available as an app in the ULP with user-friendly features such as sorting by column, inter-state search, and multiple patient selection; PDMP also available directly within certain EHRs



CRISP's involvement

- Technology partner for the Maryland PDMP Program
- CRISP serves as access point for clinical providers within:
  - EHR Workflows (InContext)
  - Unified Landing Page PDMP Search
  - Single Sign-On (Mirth Query Portal)
- Credentialing office for all eligible users
- Synergies with outreaching to providers
- Support Maryland PDMP in new technology requirements
  - Reporting & Analytics
  - Clinical user enhancements
  - Deeper integration into clinical workflows

As it relates to research…

- Controlled Patient Search
  - The ability to grant access to ULP but limit your search capability to just a consented roster of patients
- Notifications when events happen
  - Send alerts when hospitalizations happen for your consented roster of patients
- Share your program
  - At your choosing – let other providers and members of a patient's care team know that the patient is participating in a research study (via the "Care Team" widget in Snapshot

What's Coming?

- More data from C-CDAs
  - CRISP has limited capability to extract data from C-CDAs – we expect to have the capability to extract more information from those documents by the Fall
- FHIR compatibility
  - The majority of CRISP data services will be FHIR enabled – many are already – by the summer.
- Record Location
  - A service that lets consumers know where patient's have records – allows for more targeted data queries.

DISCUSSION: CURRENT CAPABILITIES AND FUTURE OPPORTUNITIES

Ross D. Martin, MD, MHA
Program Director, CRISP Research Initiative

FUTURE OPPORTUNITIES

- Potential new use case:
  HIPAA Safe Harbor de-identified data sets of CRISP-mediated data
  - Pre-requisites:
    - Research-specific Opt-Out pathway
    - Patient communications presenting the research opt-out option
    - Normalized clinical data warehouse with robust query tools for creating data sets

OTHER FUTURE OPPORTUNITIES

- Death Data
- Precision Medicine

Discussion

CRISP

CLOSING THOUGHTS

David Horrocks, MBA

President & CEO, CRISP


The TeaToaster

Thank You!

Christopher Chute, MD, DrPH

Bloomberg Distinguished Professor of Health Informatics

Professor of Medicine, Public Health, and Nursing at Johns Hopkins University

Chair of the CRISP Research Subcommittee

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