

What is ACCORDS?

Adult and Child Center for Outcomes Research and Delivery Science

ACCORDS is a 'one-stop shop' for pragmatic research:

- A multi-disciplinary, collaborative research environment to catalyze innovative and impactful research
- Strong methodological cores and programs, led by national experts
- Consultations & team-building for grant proposals
- Mentorship, training & support for junior faculty
- Extensive educational offerings, both locally and nationally



ACCORDS Upcoming Events – mark your calendars!

February 5, 2025 AHSB Room 2002	Transforming and Advancing a Learning Health System: Multiple Perspectives for Mutual Gain The Case of Value in Learning Health Systems Presented by: Katy Trinkley, PharmD, PhD; Mark Gritz, PhD; Liza Creel, PhD
March 5, 2025 Ed 2 North Room 1107	Transforming and Advancing a Learning Health System: Multiple Perspectives for Mutual Gain Building Synergy Across Academic and Operational Programs in a Learning Health System Presented by: Sunil Kripalani, MD, MSc
April 2, 2025 AHSB Room 2200/2201	Transforming and Advancing a Learning Health System: Multiple Perspectives for Mutual Gain Next Steps for Learning Health Systems in Colorado Presented by: Jean Kutner, MD, MSPH
May 12, 2025 AHSB Room 2200/2201	Emerging Topics in Digital Health & Clinical Informatics Real World Augmented Supportive Care: Tech to Touch Presented by: Matt Loscalzo, MSW
Annual Conference June 4-5, 2025 9:00-3:30pm MT	Colorado Pragmatic Research in Health Conference Future of Pragmatic Research: Building Multidisciplinary Teams for Innovation and Impact <i>Call for abstracts closes TODAY: visit COPRHcon.com for more information!</i>





Enabling a Learning Health System: The University of Utah Experience

Presented by:

Kensaku Kawamoto, MD, PhD, MHS





ENABLING A LEARNING HEALTH SYSTEM: THE UNIVERSITY OF UTAH EXPERIENCE

**UNIVERSITY OF COLORADO SCHOOL OF MEDICINE
JANUARY 15, 2025**

***KENSAKU KAWAMOTO, MD, PHD, MHS, FACMI, FAMIA
PROFESSOR AND VICE CHAIR OF CLINICAL INFORMATICS, DEPT. OF BIOMEDICAL INFORMATICS
ASSOCIATE CHIEF MEDICAL INFORMATION OFFICER
DIRECTOR, REIMAGINE EHR INITIATIVE
CO-SENIOR DIRECTOR, DIGITAL HEALTH INITIATIVE***

REIMAGINEEHR

DISCLOSURES

- I report honoraria, consulting, sponsored research, licensing, or co-development in the past 24 months with Hitachi, Pfizer, Beckman Coulter, NORC, RTI International, Surescripts, University of Pennsylvania, Yale University, MD Aware, Elsevier, Custom Clinical Decision Support, and the U.S. Office of the National Coordinator for Health IT (via Security Risk Solutions)
- Some of the EHR apps described are or may be commercialized to enable wider impact

AGENDA

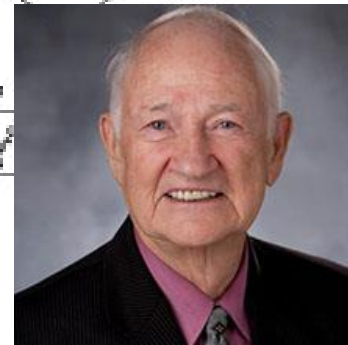
- Personal and topic background
- Exemplars of Univ. of Utah LHS capabilities:
 - ReImagine EHR: enabling LHS capabilities beyond the EHR
 - CDS Committee: responsive health IT governance
 - VDO: enterprise platform for understanding & improving care value
 - NIH Genomics-Enabled Learning Health System Network
- Key challenges and enablers of a LHS
- Discussion

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THE
UNIVERSITY
OF UTAH



What is a Learning Health System (LHS)?

Learning health systems are organizations or networks that continuously self-study and adapt using data and analytics to generate knowledge, engage partners, and implement behavior change to transform practice.

According to the National Academy of Medicine, which first expressed the concept of the learning health system in 2007, “In an LHS, science, informatics, incentives, and culture are aligned for continuous improvement and innovation, with best practices seamlessly embedded in the delivery process, patients, and families are active participants in all elements and new knowledge is captured as an integral by-product of the delivery experience.”

<https://medschool.cuanschutz.edu/accords/cores-and-programs/learning-health-system-core#ac-what-is-a-learning-health-system-lhs-0>

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UNIVERSITY OF UTAH REIMAGINE EHR INITIATIVE

- Multi-stakeholder initiative started in 2016
- Goal is to improve patient care and the provider experience through interoperable EHR apps that convert data to actionable insight
- >15 solutions
- >\$60M in grants
- Multiple awards
- Pillar of Digital Health Initiative



JAMIA Open, 4(3), 2021, 1–15
doi: 10.1093/jamiaopen/ooab041
Research and Applications

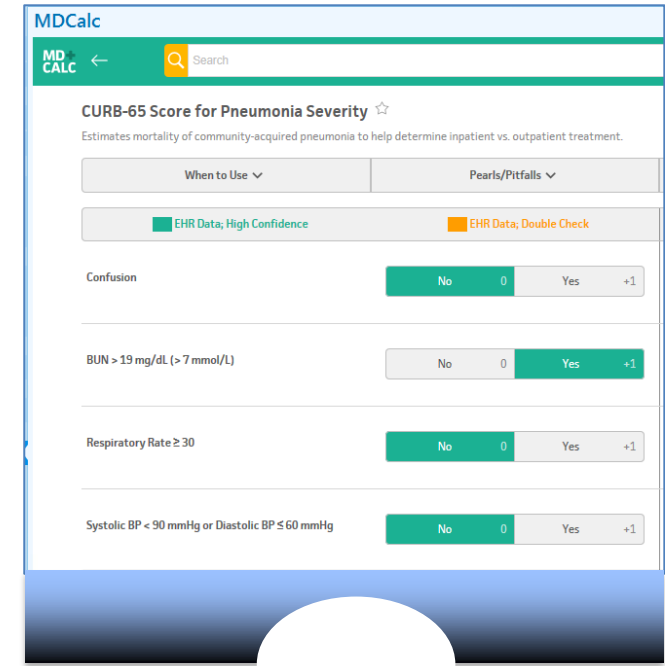
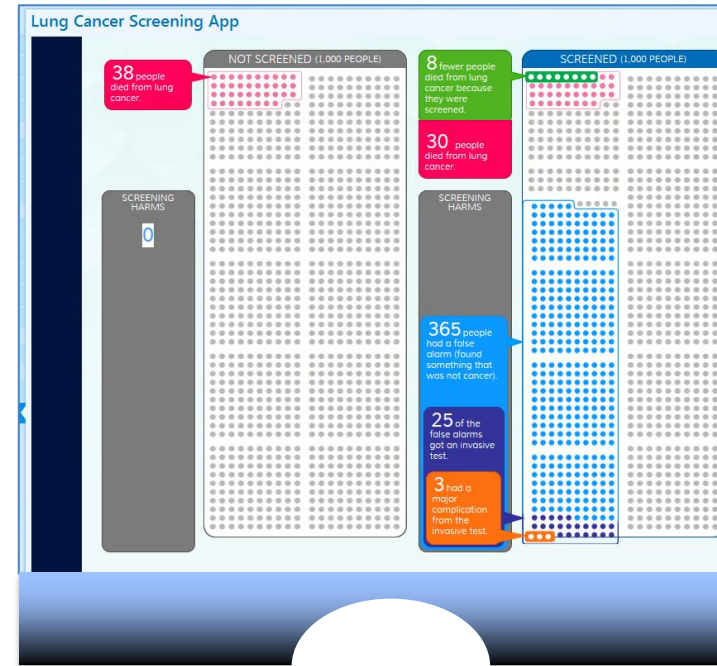
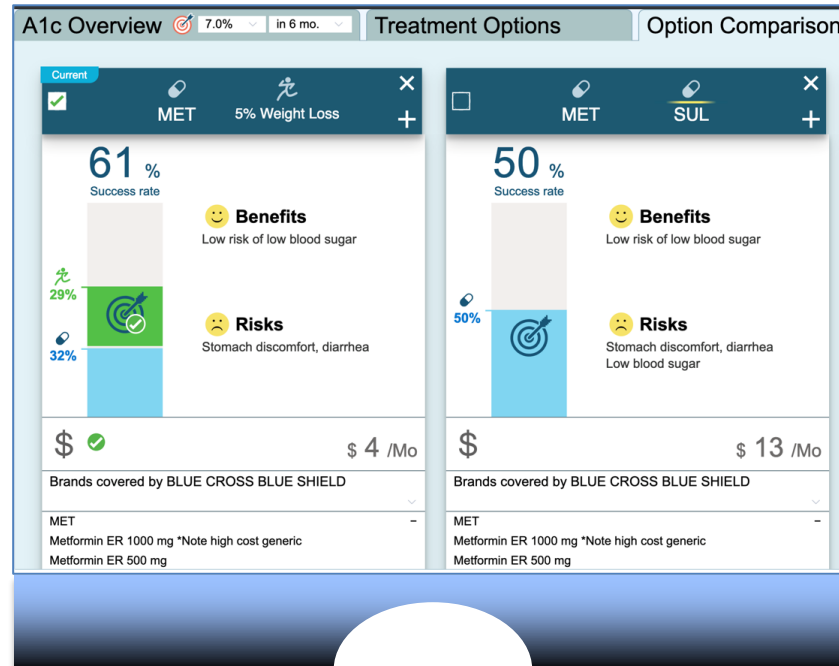
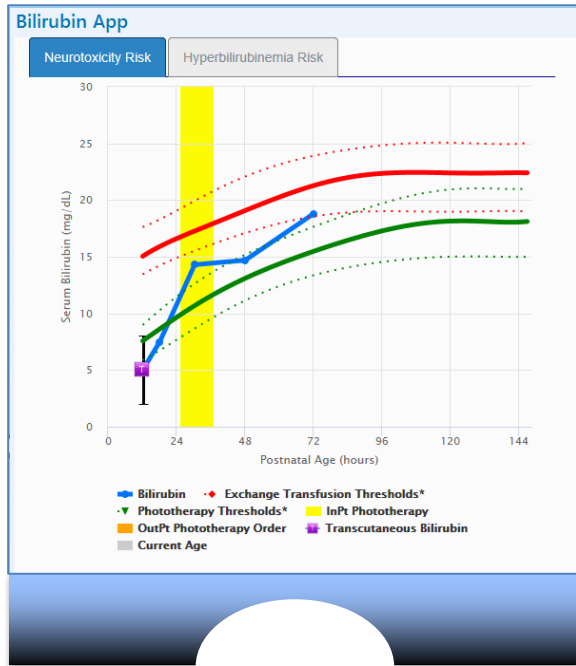
AMIA
INFORMATICS PROFESSIONALS. LEADING THE WAY.

OXFORD

Research and Applications

Establishing a multidisciplinary initiative for interoperable electronic health record innovations at an academic medical center

Kensaku Kawamoto ^{1,2} Polina V. Kukhareva ^{1,2} Charlene Weir,¹
Michael C. Flynn,^{2,3,4} Claude J. Nanjo,^{1,2} Douglas K. Martin,^{1,2} Phillip B. Warner,^{1,2}
David E. Shields,^{1,2} Salvador Rodriguez-Loya,^{1,2} Richard L. Bradshaw,^{1,2}



SMART on FHIR
EHR 1
(e.g., Epic®)

SMART on FHIR
EHR 2
(e.g., Cerner®)

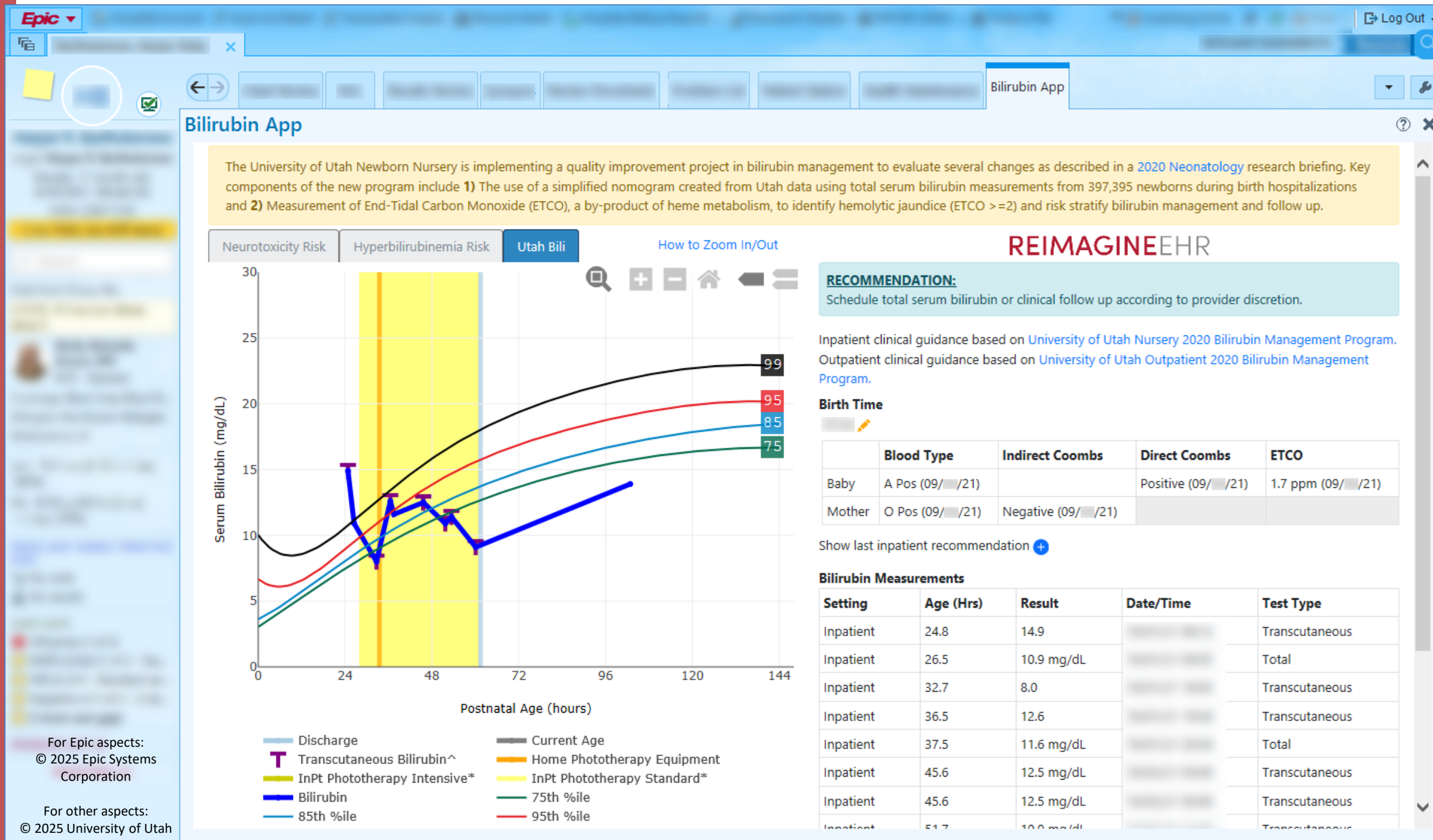
SMART on FHIR
EHR 3
(e.g., Allscripts®)

THE VISION

- Imagine as a doctor...
 - It is a joy to use the EHR
 - The EHR is constantly saving you time
 - It is easy to do the right thing, every time
 - When you imagine how the EHR *should* work, it soon becomes how it *does* work

REIMAGINEEHR

BILIRUBIN APP

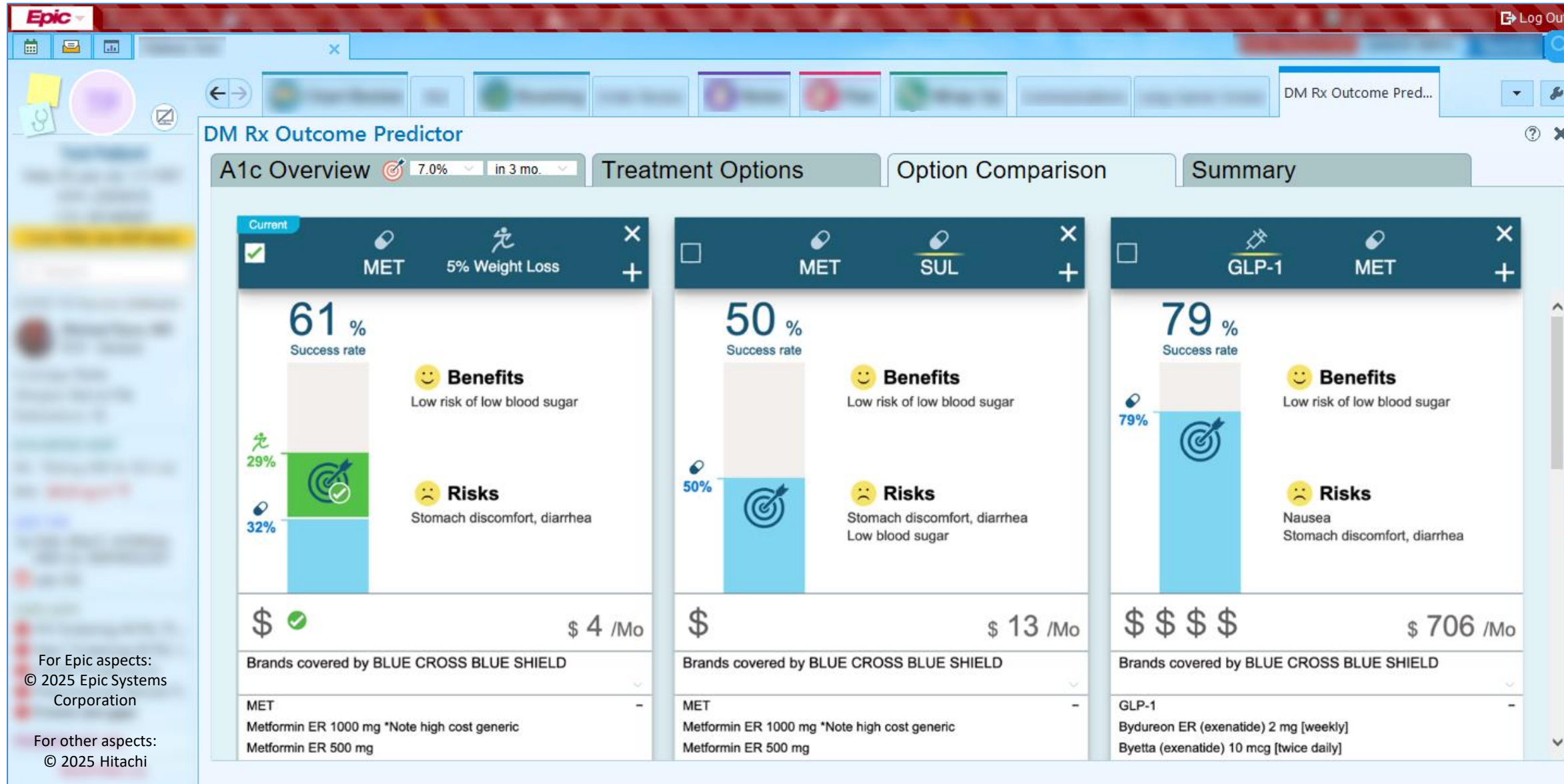


- Goal: prevent brain damage in newborns
- Impact: (*JAMA Open*. 2019;e1915343)
 - Odds of clinically appropriate phototherapy \uparrow 84%
 - Clinician time required \downarrow 3 fold
 - Attending provider usability rating: "best imaginable"
- Iterative enhancements
- Winner, 2019 HL7/AMIA FHIR App Showcase

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For other aspects:
© 2025 University of Utah

DIABETES RX SHARED DECISION MAKING APP



- Collaboration with Hitachi
- AI-driven Rx guidance (predictive model, AUC 0.84)
- Accounts for insurance for cost info
- Multiple adaptations

Leveraging Artificial Intelligence to Improve Chronic Disease Care: Methods and Application to Pharmacotherapy Decision Support for Type-2 Diabetes Mellitus

Methods Inf Med 2021; 60(S 01): e32-e43

Predicting pharmacotherapeutic outcomes for type 2 diabetes: An evaluation of three approaches to leveraging electronic health record data from multiple sources

Journal of Biomedical Informatics 129 (2022) 104001

PREDICTION MODEL-DRIVEN LUNG CANCER SCREENING SHARED DECISION MAKING APP

Lung Cancer Screening

LUNG CANCER SCREENING RISK CALCULATOR

About the patient

This patient is **eligible** according to the USPSTF guidelines

[View eligibility criteria](#)

Demographics

Age	65
Sex	Male
Race or Ethnicity	Other

Smoking History

Years Smoked	40
Has quit smoking?	No
Average packs per day	2
Pack years	80

Additional Factors

COPD or Emphysema?	Yes
--------------------	-----

[Other Factors](#) [Edit Values](#)

Personalized Risk Assessment

Screening benefits likely outweigh harms

- Risk of developing lung cancer in 5 years: **5.65%**
- Patients needed to screen to avoid 1 lung cancer death: **124 patients**
- Life expectancy without screening: **11.3 years**
- Due to very high lung cancer risk and reasonable life expectancy, screening benefits likely outweigh harms like **false positive findings** leading to invasive tests

Discourage Screening | **Preference Sensitive** | **Encourage Screening**

Screening is likely high benefit for this patient

[30-second Example Script](#) [CMS-required note for initial screen](#) [Brief note](#)

Among 1,000 people like this person...

Not screened: 1000 (represented by 1000 red dots)

Screened: 1000 (represented by 1000 dots, with 565 colored in green and 435 in yellow)

Last shared decision making: none on record

Shared decision making done. Patient declines screening.

Shared decision making done. Patient elects screening.

Close Refresh Order LDCT

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For other aspects: © 2025 University of Utah

- AHRQ R18 HS026198
- Low-dose CT screening could save more lives than breast cancer screening (10,000/yr)
- Driven by 23-variable NCI predictive model of individual outcomes
- Odds of screening referral \uparrow 5x in primary care clinics (Kukhareva et al., CHEST 2023, JAMA Open 2024)
- Free app & integration support; patient-facing app undergoing RCT (AHRQ R18 HS028791)

MYLUNGHEALTH

MyLungHealth Español

Welcome to MyLungHealth

This tool will help you decide if lung cancer screening is right for you.

- It should take about 5 minutes to complete
- You will **NOT** be asked to decide now
- If you are interested in being screened, please bring it up to your doctor

[Next](#)

Contact/Support:ReImagineEHR@utah.edu

MyLungHealth Español

How would you like to review the educational content?

You can switch at any time

[Video](#)


[Text](#)

[Back](#)

Contact/Support:ReImagineEHR@utah.edu

MyLungHealth Español

[Switch to text](#)




[Back](#) [Next](#)

Contact/Support:ReImagineEHR@utah.edu

MyLungHealth Español

Personalized Risk & Benefits:

Based on what we know about your risk for lung cancer, there's a good chance that screening is right for you. As shown below, it is **very important** to talk to your doctor.



[Back](#) [Next](#)

More Information [v](#)

*Your risk is based on the information we have on file for you. If the information is incorrect or if you would like to see your risk given differing information, you can change it below.

Race or Ethnicity

Non-Hispanic White [v](#)

Have you quit smoking?

No [v](#)

For how many years have you smoked?

40

Do you have COPD or Emphysema?

No [v](#)

Contact/Support:ReImagineEHR@utah.edu

MyLungHealth Español

Next Steps

If you think lung cancer screening is something you are interested in, please bring it up with your doctor at your upcoming appointment.

Also, please remember, the most important thing you can do is to quit smoking. Whether you decide to get lung cancer screening or not, quitting smoking is the best way to improve your health.

The Tobacco Quit Line can provide coaching and resources to help you quit.

1-800-QUIT-NOW
<https://waytoquit.org/>

[Back](#) [Return to MyChart](#)

Contact/Support:ReImagineEHR@utah.edu

MDCALC FOR EHR

This is an unprecedented time. It is the dedication of healthcare workers that will lead us through this crisis. Thank you for everything you do. [COVID-19 Resource Center](#)

Search "QT interval" or "QT" or "EKG"

ROX Index for Intubation after HFNC

Predicts high-flow nasal cannula (HFNC) failure/need for intubation.

When to Use ▼ Pearls/Pitfalls ▼ Why Use ▼

Relevant EHR Data ↻

SpO ₂	<input type="text" value="92"/> % Suggested: 92 %	O₂ Sat (SpO₂) - 92 % - an hour ago - 92 % - 2 hours ago - 92 % - 3 hours ago - 93 % - 4 hours ago
FiO ₂ <small>See Evidence for estimating FiO₂ from oxygen flow/delivery rates</small>	<input type="text" value="69"/> % Suggested: 69 % <small>Review how oxygen delivery type/rate impacts FiO₂</small>	FiO₂ - 69 - 39 minutes ago - 50 - an hour ago - 50 % - an hour ago - 50 - 2 hours ago
Respiratory rate	<input type="text" value="21"/> breaths/min Suggested: 21 breaths/min	Respiratory Rate - 21 /min - an hour ago - 24 /min - 2 hours ago

6.35 points
ROX Index
Low risk of progressing to intubation

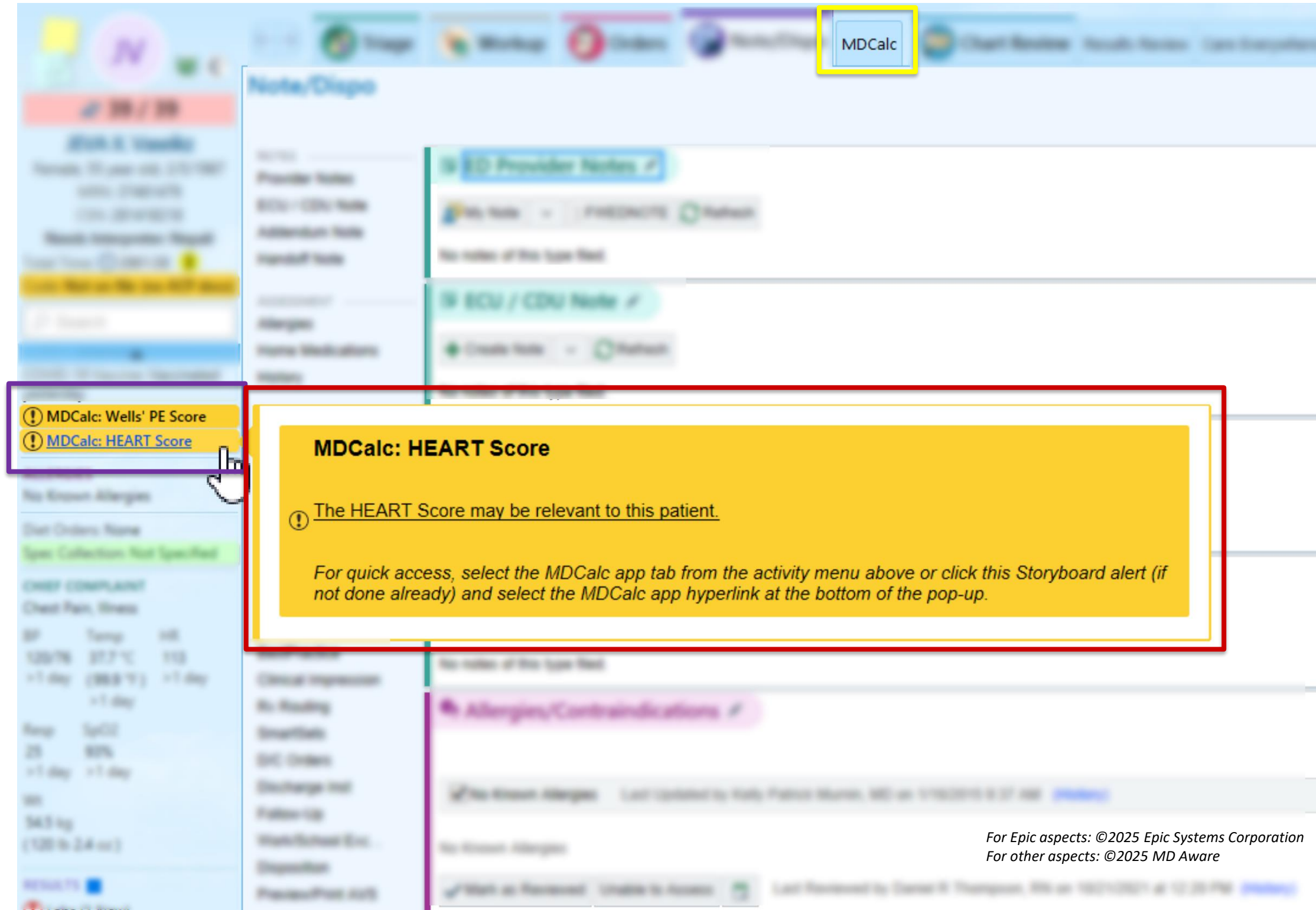
[Copy to Clipboard](#)

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For other aspects:
© 2025 MD Aware

- MDCalc: leading calculation tool
 - Used by 80% of US clinicians
- Many prediction rules, including those leveraging ML
- Auto-fills inputs and integrates with documentation
- Improves accuracy
(Abedin et al. *Circ Cardiovasc Qual Outcomes*. 2020.13(2):e006286)
- Can be enhanced with CDS Hooks
(Morgan et al. *J Am Med Inform Assoc*. 2022. 29(9):1461-70)

CDS HOOKS PROMPTING FOR SMART ON FHIR APP



- A primary motivation for CDS Hooks
- First reported RCT to formally evaluate: (Morgan et al. *J Am Med Inform Assoc.* 2022. 29(9):1461-70)
- 130% increase in use of context-relevant MDCalc calculator in ED (odds ratio 2.45, $p = 0.02$)

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DISEASE MANAGER

The screenshot shows the REIMAGINE EHR Disease Manager interface. At the top, there's a navigation bar with 'Disease Manager' selected. Below it, a filter bar shows 'All', 'Hypertension', 'Diabetes', 'COPD' (selected), and 'HM'. The main content area is divided into 'Relevant Info' and 'Recommended Actions'. The 'Relevant Info' section includes four sub-sections: 'COPD Status and Medications', 'Oxygen Supplementation', 'Pulmonary Rehabilitation', and 'Smoking Cessation'. Each sub-section provides clinical recommendations and patient data. The 'Recommended Actions' section on the right lists three medication options: (LABA-ICS) vilanterol-fluticasone DPI [Breo], (LABA-ICS) formoterol-mometasone MDI [Dulera], and (LABA-LAMA-ICS) vilanterol-umeclidinium-fluticasone DPI [Trelegy]. Below these are buttons for 'Order Home O2', 'varenicline (starter month pack) [Chantix]', 'varenicline (continuing month pack) [Chantix]', and 'bupropion starter month [Zyban]'. The bottom of the interface has a footer with copyright information: 'For Epic aspects: © 2025 Epic Systems Corporation' and 'For other aspects: © 2025 University of Utah'.

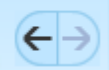
- Target: chronic diseases (70% of deaths, 90% of \$)
- Ever-growing disease modules
- Synthesizes data from across EHR
- Multiple time-saving features
- Completion of recommended care 81% vs. 48% (JAMIA. 2020. 27:1225-34)
- Winner, 2021 HL7/AMIA FHIR App Showcase



Dmd T. Patient

Male, 66 year old, 1/2/1956

For Epic aspects: © 2025 Epic Systems Corporation
For other aspects: © 2025 University of Utah and Hitachi



Disease Manager

Filters: Show only favorites

REIMAGINEEHR

- All
- Hypertension
- Diabetes**
- Trends
- CKD
- COPD
- HM

Relevant Info Recommended Actions

HbA1c Goal

Goal: < 7 % (2022-09-07)
HbA1c: **8.4 %** (2022-09-02)

Diabetes Status and Medications

- Recommendation:**
- Compliance <80% -- review medications
 - If adding med, consider GLP-1 (55% predicted chance of reaching goal A1c, \$\$\$\$) due to ASCVD and eGFR < 60
 - May need to adjust dose for decreased kidney function (eGFR = 33)
 - 5% weight loss predicted to increase success rate by 12%

[Click here for predicted impact of weight loss or Rx adjustment](#)

HbA1c: **8.4 %** (2022-09-02)

Active Rx:

Biguanide

- METFORMIN HCL 500 MG PO TABLET [Take 2 tablets (1,000 mg) by mouth 2 times daily with meals.] 0% compliance (low confidence)

- Perform DM Rx shared decision making
- (Insulin - Long Acting) Insulin glargine 10 units daily
- (SGLT2i) empagliflozin (Jardiance) 10 mg
- (GLP-1 RA) dulaglutide (Trulicity) 0.75 mg SQ weekly
- (DPP-4i) sitagliptin 100 mg
- (TZD) pioglitazone 15 mg
- (Sulfonylurea) glipizide ER 5 mg

Creatinine/eGFR

Creatinine: 1.6 mg/dL (2022-06-02)
eGFR: 33 mL/min (2022-06-02)

Hyperlipidemia

Recommendation: High-intensity statin recommended as LDL >= 190
ASCVD 10-year risk: Calculation not applicable; patient already has ASCVD
LDL: 220.0 mg/dL (2022-02-28)

- (High intensity statin) Atorvastatin 40mg
- (High intensity statin) Atorvastatin 80mg
- (High intensity statin) Rosuvastatin 20mg
- (High intensity statin) Rosuvastatin 40mg

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▶ AMIA Annu Symp Proc. 2018 Dec 5;2018:624–633.

A Pragmatic Guide to Establishing Clinical Decision Support Governance and Addressing Decision Support Fatigue: a Case Study

[Kensaku Kawamanto](#)¹, [Michael C Flynn](#)^{2,3}, [Polina Kukhareva](#)¹, [David ElHalta](#)⁴, [Rachel Hess](#)^{2,5}, [Travis Gregory](#)⁶,
[Chris Walls](#)⁶, [Angela M Wigren](#)⁶, [Damian Borbolla](#)¹, [Bruce E Bray](#)^{1,2}, [Mary H Parsons](#)², [Brett L Clayson](#)⁷, [Melissa S Briley](#)⁷, [Carole H Stipelman](#)³, [Dean Taylor](#)⁶, [Carrie S King](#), [Guilherme Del Fiol](#)¹, [Thomas J Reese](#)¹, [Charlene R Weir](#)¹, [Teresa Taft](#)¹, [Micheal B Strong](#)²

▶ [Author information](#) ▶ [Article notes](#) ▶ [Copyright and License information](#)

PMCID: PMC6371304 PMID: [30815104](#)

PROBLEM ADDRESSED: CLINICAL DECISION SUPPORT (CDS) FATIGUE

- CDS fatigue
 - A systemic lack of response to alerts and reminders
 - Results from desensitization, lack of relevancy, lack of accuracy, mismatch with workflow
 - Can cause vicious cycle where new CDS – however accurate and valuable – leads to more CDS fatigue, reduced overall CDS effectiveness, and provider dissatisfaction
- A major problem for health systems
 - Limits ability to optimize care/enable a LHS via CDS

CDS FATIGUE AT UNIVERSITY OF UTAH HEALTH

- CDS fatigue identified as major issue in late 2014, particularly with regard to pop-up alerts
- Many competing priorities (MU, ICD10, etc.)
 - Needed solution compatible with existing resources (~2 FTEs for CDS development and management)

ENTERPRISE CDS COMMITTEE

- Core of new CDS governance
- Includes clinical, quality, and IT leaders
- Charge: oversee CDS strategy and execution, with a specific focus on reducing CDS fatigue
- Scope:
 - Medication alerts
 - Custom EHR alerts and reminders (BPAs)
 - Health Maintenance
 - Clinicians (physicians, APCs, pharmacists)

CORE PRINCIPLES

- Add new CDS only if it is actually desired by intended recipients
- Use most appropriate and least disruptive workflow integration approach
- Ensure benefits achieved from CDS outweigh costs
 - May request additional data review (e.g., turning on CDS in “silent mode” to assess firing frequency)
 - May approve for pilot use in limited clinical area, with further expansion contingent on pilot findings

LIFECYCLE OF NEW CDS REQUEST

- User request received
 - For BPAs, structured request form used
 - Engaged clinical champion required
- CDS Working Group review
 - Preliminary assessment
 - Suggestions for alternatives if appropriate
- CDS Committee review
 - Requestor asked to attend if potentially controversial
 - Approved requests prioritized for build

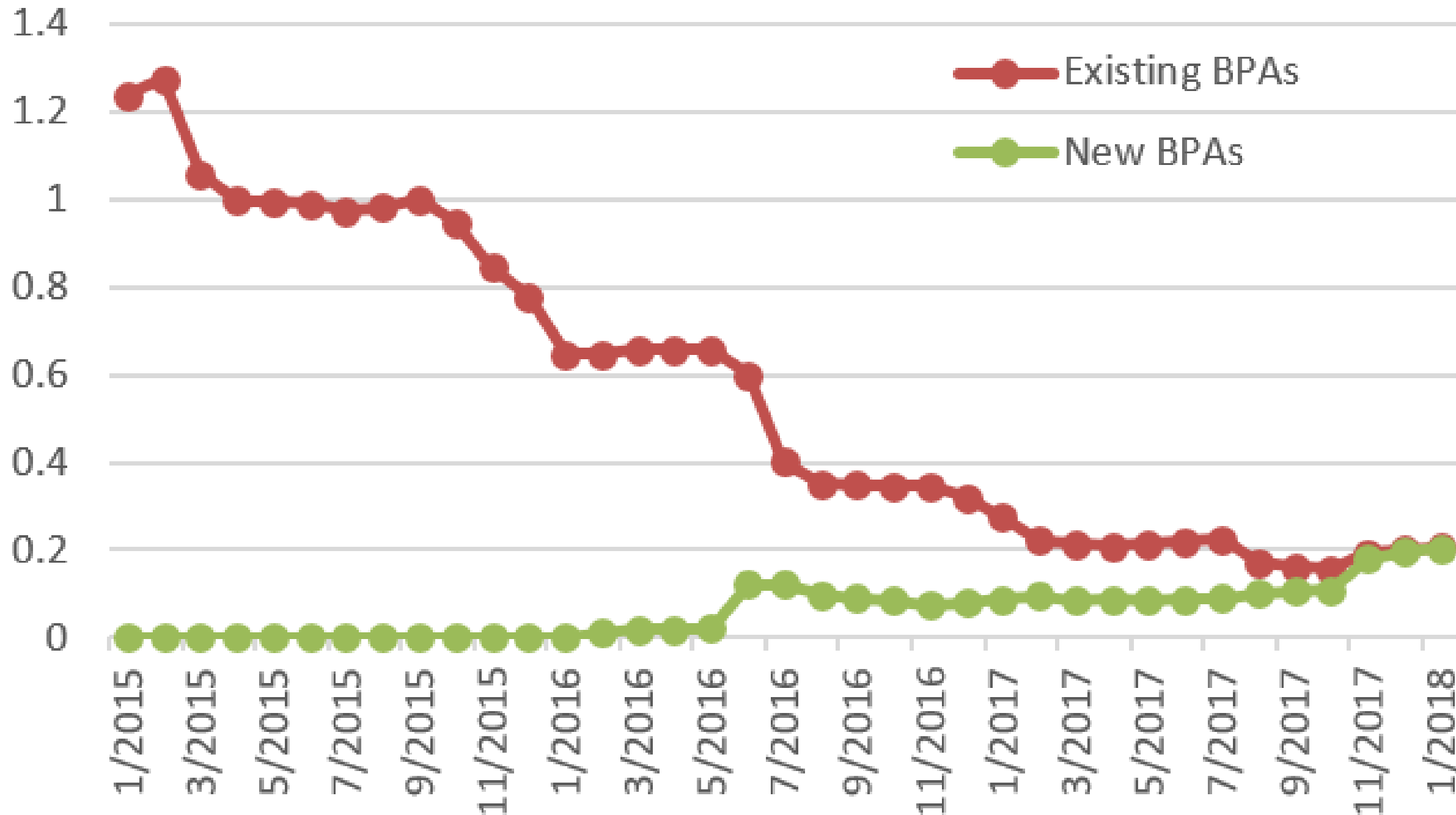
REVIEW OF EXISTING CDS CONTENT

- Active solicitation of feedback
 - CDS Committee, Chief Value Officers, BPA feedback
- Basic data analytics and monitoring
 - Volume and user response
 - Review of highest-volume CDS by MDs, pharmacists
- Actions for problematic CDS
 - Improve specificity, targeting
 - Transition to more appropriate areas of EHR (e.g., Epic® Health Maintenance module)
 - Retire

JUDICIOUS USE OF EXPERIMENTAL TRIALS

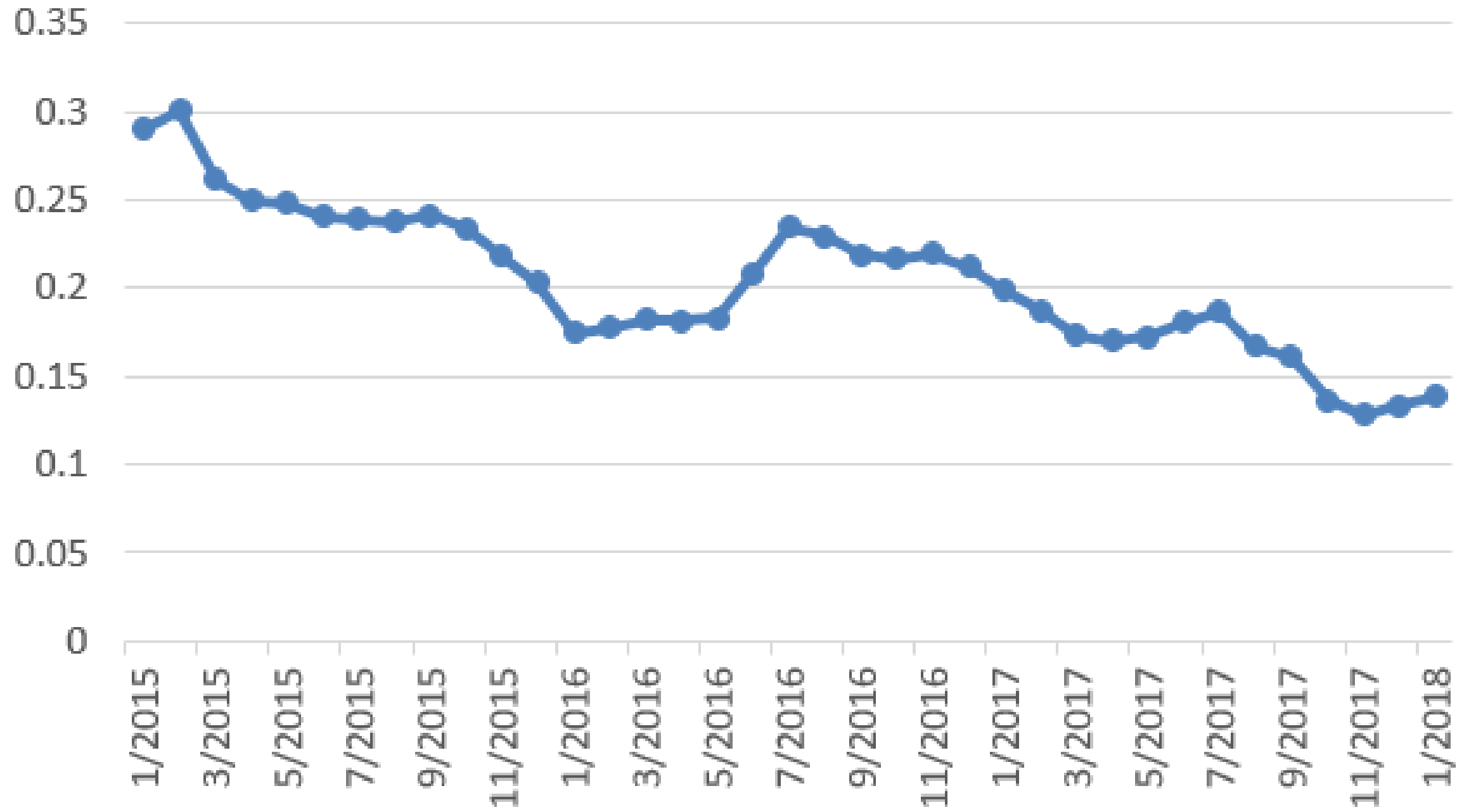
- For resolving cases of significant clinical uncertainty
- Approved by CDS Committee & exempted by IRB for QI
- E.g., clinic-randomized controlled trial for turning off BPA reminders for breast cancer screening, colorectal cancer screening, and fall risk screening
 - Duplicate content in Health Maintenance
 - No clinically significant difference in target care performance rates → turned off for all clinics

CLINICIAN-FACING BPAS/VISIT



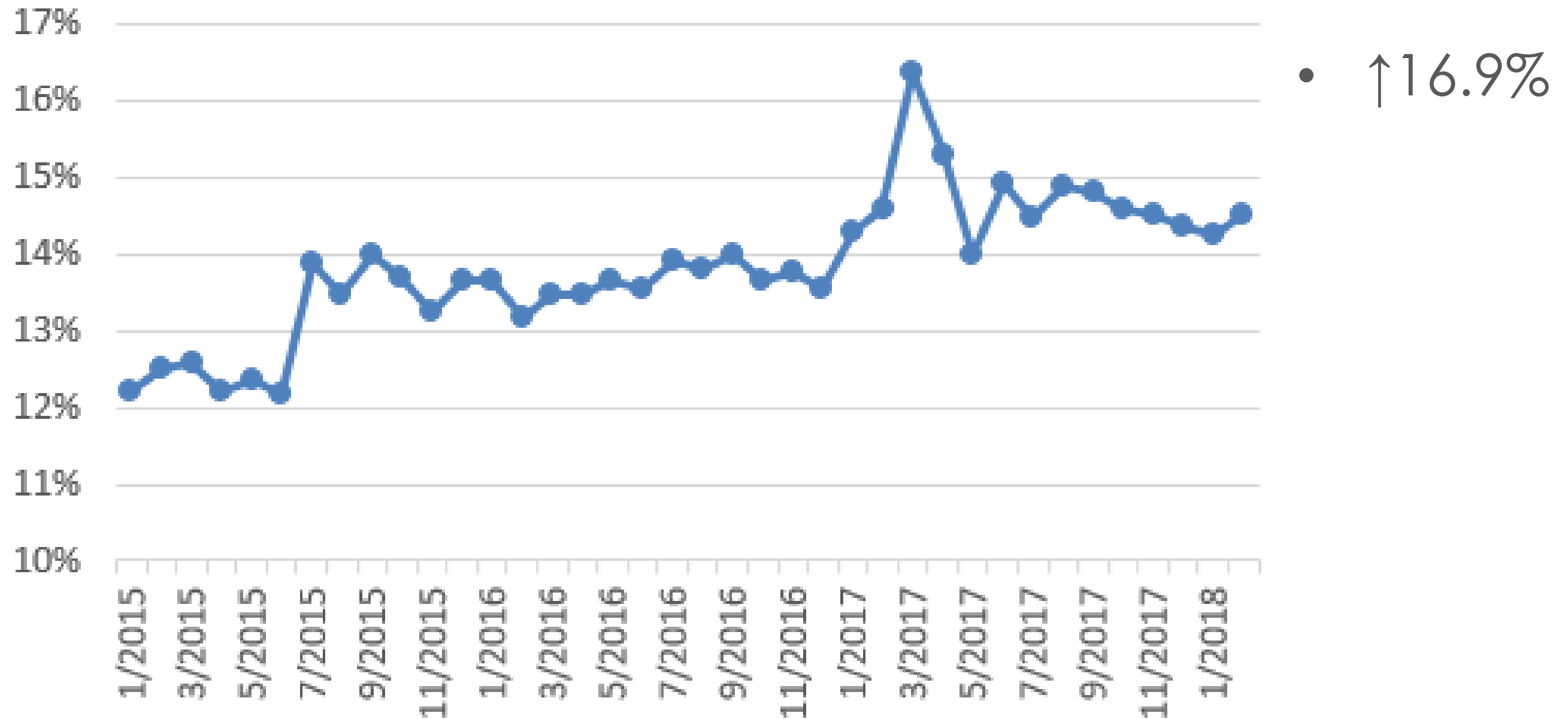
- Overall ↓66.9%
- Existing ↓83.4%
- 178 new BPAs added

CLINICIAN-FACING POP-UP BPA ALERTS/VISIT

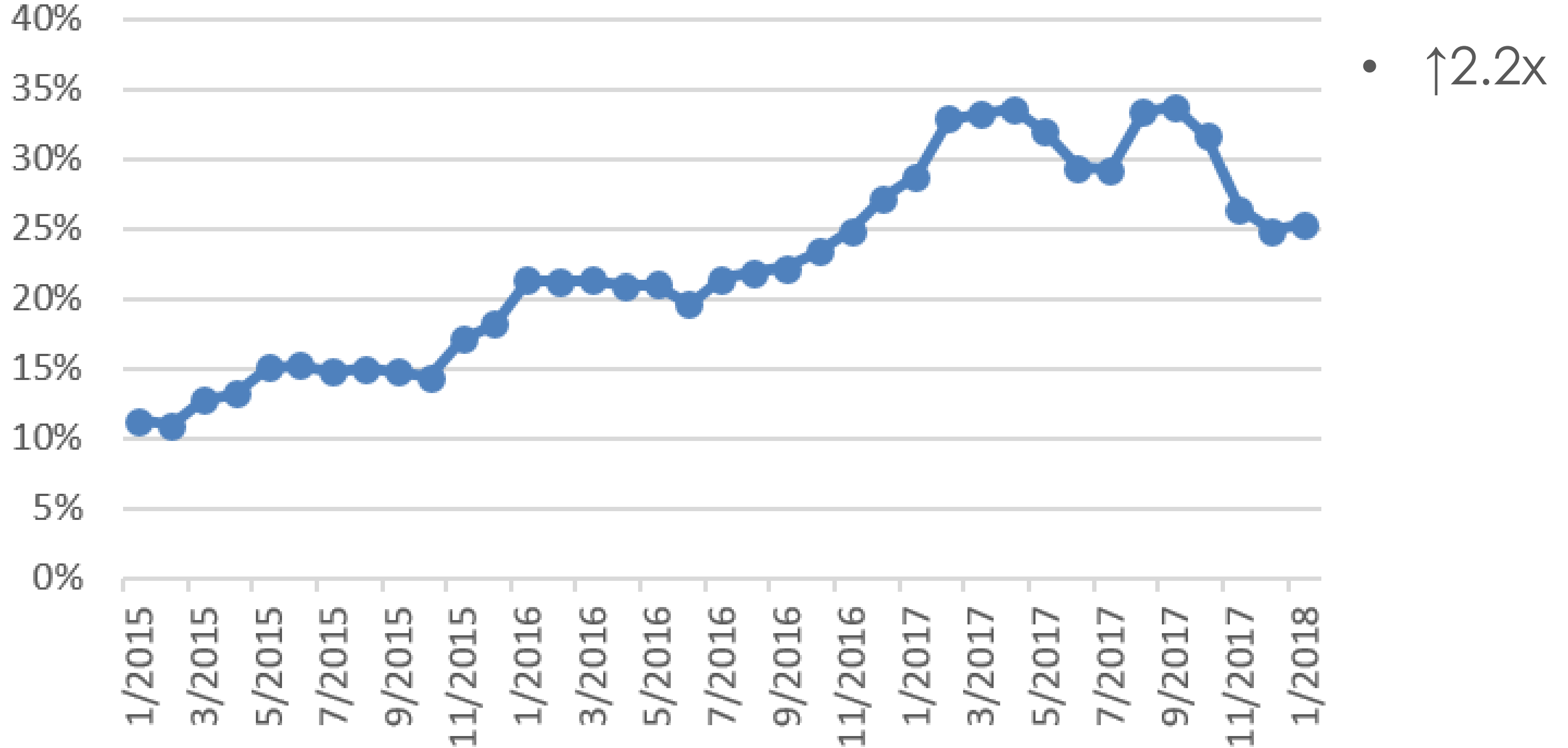


- ↓52.3%
- Overall (med alerts + BPAs): ↓53.8%

MED ALERTS FOLLOWED BY DISCONTINUATION OF TRIGGERING DRUG WITHIN ONE HOUR



BPAS WITH EFFECTIVE INTERACTION



SUMMARY OF FINDINGS

- Pragmatic CDS governance implemented for commercial EHR with existing resources (~2 FTEs)
- Overall CDS burden ↓53.8%
- % of med alerts leading to discontinuation of triggering med within 1 hour ↑16.9%
- % of BPAs with effective user interaction ↑2.2x

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FOUNDATIONAL PROBLEM FOR A LHS: MEASURING VALUE

“... A fundamental and largely unrecognized problem: We don’t know what it costs to deliver health care to individual patients, much less how those costs compare to the outcomes achieved.”

“Understanding costs could be the single most powerful lever to transform the value of health care.”

- Robert S. Kaplan, Michael E. Porter



Implementation of a Value-Driven Outcomes Program to Identify High Variability in Clinical Costs and Outcomes and Association With Reduced Cost and Improved Quality

Vivian S. Lee, MD, PhD, MBA; Kensaku Kawamoto, MD, PhD, MHS; Rachel Hess, MD, MS; Charlton Park, MBA, MHSM; Jeffrey Young, MS; Cheri Hunter, BS; Steven Johnson, LSMBB, MBA; Sandi Gulbransen, BSIE; Christopher E. Pelt, MD; Devin J. Horton, MD; Kencee K. Graves, MD; Tom H. Greene, PhD; Yoshimi Anzai, MD, MPH; Robert C. Pendleton, MD

JAMA. 2016;316(10):1061-1072. doi:10.1001/jama.2016.12226

Kawamoto K, et al. J Am Med Inform Assoc 2015;22:223–235. doi:10.1136/amiajnl-2013-002511, Research and Applications

Value Driven Outcomes (VDO): a pragmatic, modular, and extensible software framework for understanding and improving health care costs and outcomes

RECEIVED 24 November 2013
REVISED 8 August 2014
ACCEPTED 22 August 2014
PUBLISHED ONLINE FIRST 16 October 2014



Kensaku Kawamoto, Cary J Martin, Kip Williams, Ming-Chieh Tu, Charlton G Park, Cheri Hunter, Catherine J Staes, Bruce E Bray, Vikrant G Deshmukh, Reid A Holbrook, Scott J Morris, Matthew B Feddersen, Amy Sletta, James Turnbull, Sean J Mulvihill, Gordon L Crabtree, David E Entwistle, Quinn L McKenna, Michael B Strong, Robert C Pendleton, Vivian S Lee

VALUE-DRIVEN OUTCOMES (VDO)

- Kicked off May 2012 by senior executive leadership of University of Utah Health
- Objective: to establish an analytical foundation for understanding and improving care value (costs relative to outcomes)
- Resourced and managed as a top institutional priority
- Expectations for prototype in 3 months, operational system in 6 months

VDO METHODOLOGY AND PRINCIPLES

- In-house development
 - Off-the-shelf products considered but insufficiently flexible
- “Agile” development approach
 - Focus on rapid implementation of working software
 - Iterative enhancement of functionality
- Principles
 - Modularity/extensibility
 - Cost effectiveness – implement new features only if benefits outweigh resource needs
 - Minimize need for manual collection of additional data

VDO SEQUESTER TEAM

IT and Informatics

Ken Kawamoto, M.D., Ph.D.

Cheri Hunter

Ming Tu, MS

Cary Martin, MS

Reid Holbrook, M.D.

Bruce Bray, M.D.

Chris Fillmore, M.D.

Catherine Staes, BSN, MPH,
Ph.D.

Michael Sherwood

Michael White, M.D.

Micky Daurelle

Mike Crotty

Financial Planning & Decision Support

Charlton Park,
MBA, MHSM

Kip Williams,
MBA

Scott Morris,
MBA

Eric Lund, MBA

Matt
Fedderson

Medical Group

Kristin Acree,
MPH

Brian
Nordberg

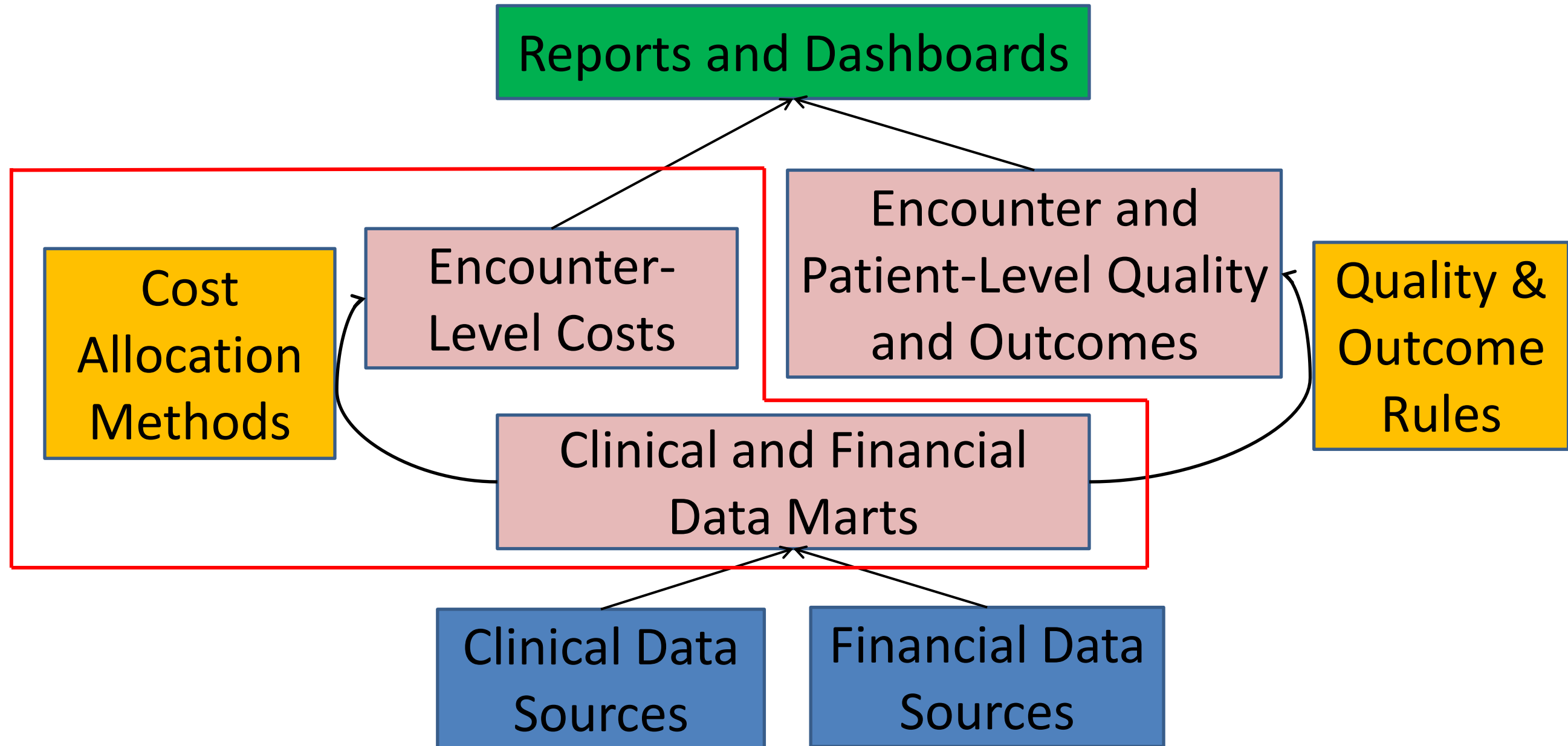
Consultant & Intern

Amy Sletta, Project
Manager

David Ryerse



VDO OVERVIEW



CENTRAL QUESTIONS

- Question 1: which General Ledger (GL) costs are attributable to direct patient care?
 - Esp. challenging for School of Medicine costs due to overlapping clinical, research, and education missions
- Question 2: to which encounters should direct patient care costs on the GL be allocated? And how much? E.g.:
 - Staff and facility costs in a hospital unit
 - Supply and medication costs
 - Physician costs

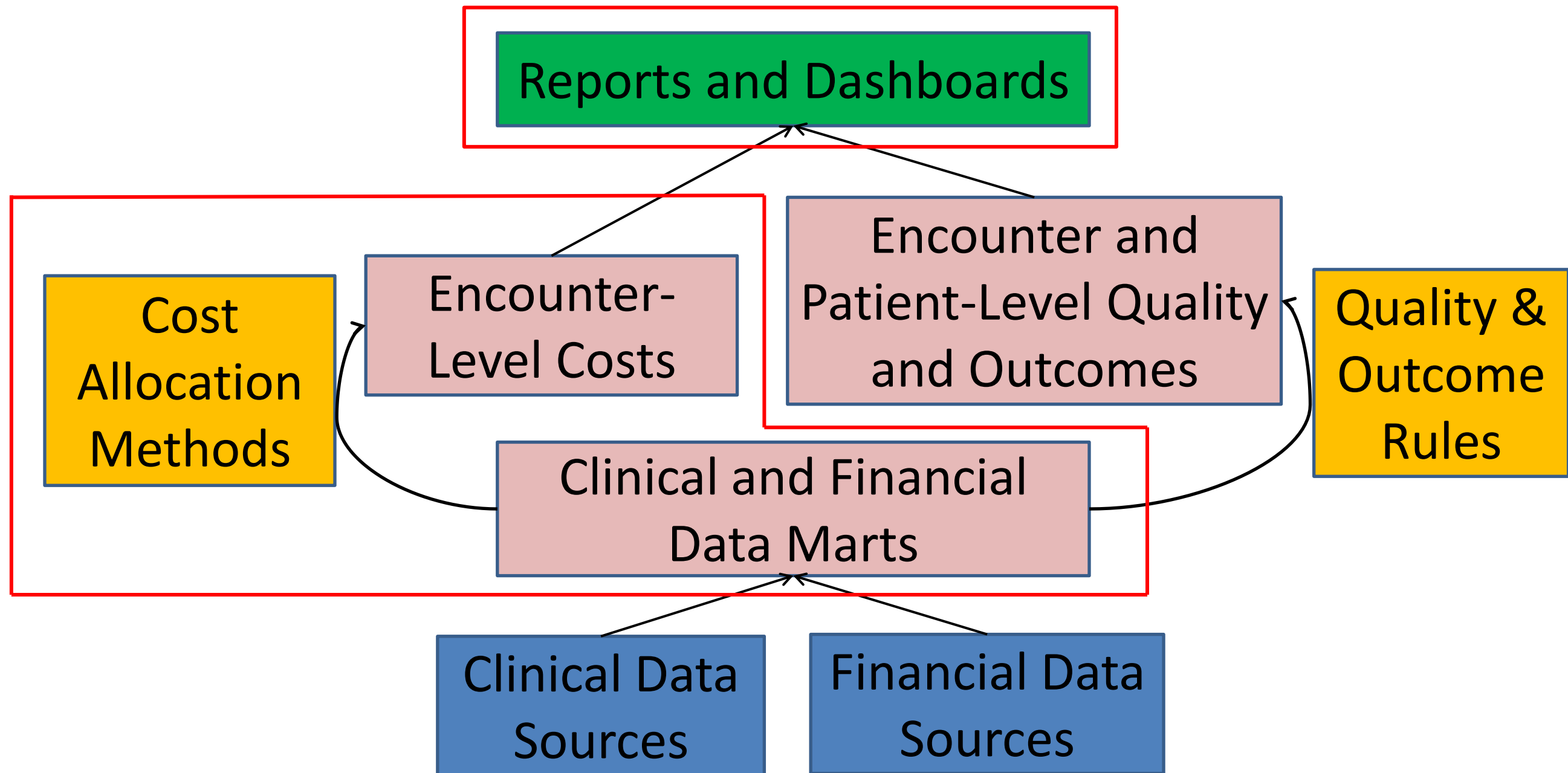
COST ALLOCATION BY ACTUAL COST

- Take actual cost and apply it based on actual use
- Example:
 - Cost of a surgical implant is determined from the supply management system and assigned to a given encounter based on actual use
- Use:
 - Most supplies, medications, and labs (30.5% of direct facility costs)

TIME-BASED COST ALLOCATION

- Use time as a proxy for resource utilization
- Example:
 - Cost of operating the MICU is identified by adding up all costs involved in running the unit (labor, office supplies, equipment, etc.)
 - Per-hour cost calculated as $\text{Total Cost} / \text{Total \# Pt. Hrs}$
 - Cost allocated to patients based on hours on unit
- Use:
 - Hospital, ED, OR facility utilization, radiology (32.6% of direct facility costs)

VDO OVERVIEW



OPPORTUNITY IDENTIFICATION

Select a Site of Service

$\frac{\sigma}{\mu}$
Use the Coefficient of Variation to identify opportunities

Performing Provider Department Name (All values) | CARDIOTHORACIC SURGERY | Cost Category (All values)

Performing Provider Division Name (All values)
 CARDIOTHORACIC SURGERY
 EMERGENCY MEDICINE
GENERAL SURGERY
 ORTHOPEDIC SURGERY
 OTOLARYNGOLOGY
 OTOLARYNGOLOGY SURGERY
 PEDIATRIC SURGERY
 PLASTIC SURGERY
 UROLOGY
 VASCULAR SURGERY
 (Remove)

Dept: SURGERY
 Division: CARDIOTHORACIC SURGERY
 Site Code: Multiple Sites
 Care Classifier: ICD PROC1
 Cost Category: Multiple Cost Categories

Index Rank	Care Classifier	Average Cost	Visit Count	Total Cost	Performing Provider Count	Coefficient of Variation	Relative Rank
1	37.66 - INSERTION OF IMPLANTABLE HEART ASSIST SYSTEM	\$175,100	26	\$4,552,600	2	0.33	16.76
2	35.21 - OPEN & OTH REPLACMNT AORTIC VALVE W/TISSUE GRAFT	\$171,600	25	\$4,290,000	4	0.38	16.76
3	38.85 - OTHER SURGICAL OCCLUSION OTHER THORACIC VESSEL	\$128,400	12	\$1,540,800	2	0.40	16.27
4	37.51 - HEART TRANSPLANTATION	\$171,000	18	\$2,958,000	2	0.33	8.87
5	35.23 - OPEN & OTH REPLACMNT MITRL VALVE W/TISSUE GRAFT	\$80,000	15	\$1,200,000	2	0.75	8.76
6	36.11 - (AORTO)CORONARY BYPASS OF ONE CORONARY ARTERY	\$84,000	17	\$1,428,000	2	0.68	8.75
7	36.10 - (AORTO)CORONARY BYPASS OF TWO CORONARY ARTERIES	\$84,000	28	\$2,352,000	4	0.48	8.76
8	36.12 - (AORTO)CORONARY BYPASS OF THREE CORONARY ARTERIES	\$78,000	15	\$1,170,000	2	0.58	8.68
9	36.13 - (AORTO)CORONARY BYPASS OF FOUR CORONARY ARTERIES	\$77,000	27	\$2,079,000	4	0.67	8.68
10	36.14 - (AORTO)CORONARY BYPASS OF FIVE CORONARY ARTERIES	\$77,000	12	\$924,000	4	0.58	8.68
11	32.45 - OTHER LOBECTOMY OF LUNG	\$80,000	22	\$1,760,000	4	0.67	8.68
12	33.51 - UNILATERAL LUNG TRANSPLANTATION	\$180,000	4	\$720,000	2	0.75	8.17
13	39.65 - EXTRACORPOREAL MEMBRANE OXYGENATION	\$200,700	2	\$401,400	1	0.00	8.17
14	36.31 - OPEN CHEST TRANSMYOCARDIAL REVASCULARIZATION	\$80,000	2	\$160,000	2	0.68	8.17
15	35.22 - OPEN AND OTHER REPLACEMENT OF AORTIC VALVE	\$84,000	14	\$1,176,000	4	0.38	8.68

Input Controls
 Site Code: All values
 Select a Care Classifier: All values, MS-DRG, ICD DX1, DRG, APR-DRG, ICD PROC1
 Start: Discharge Date (M/d/yyyy)
 End: Discharge Date (M/d/yyyy)

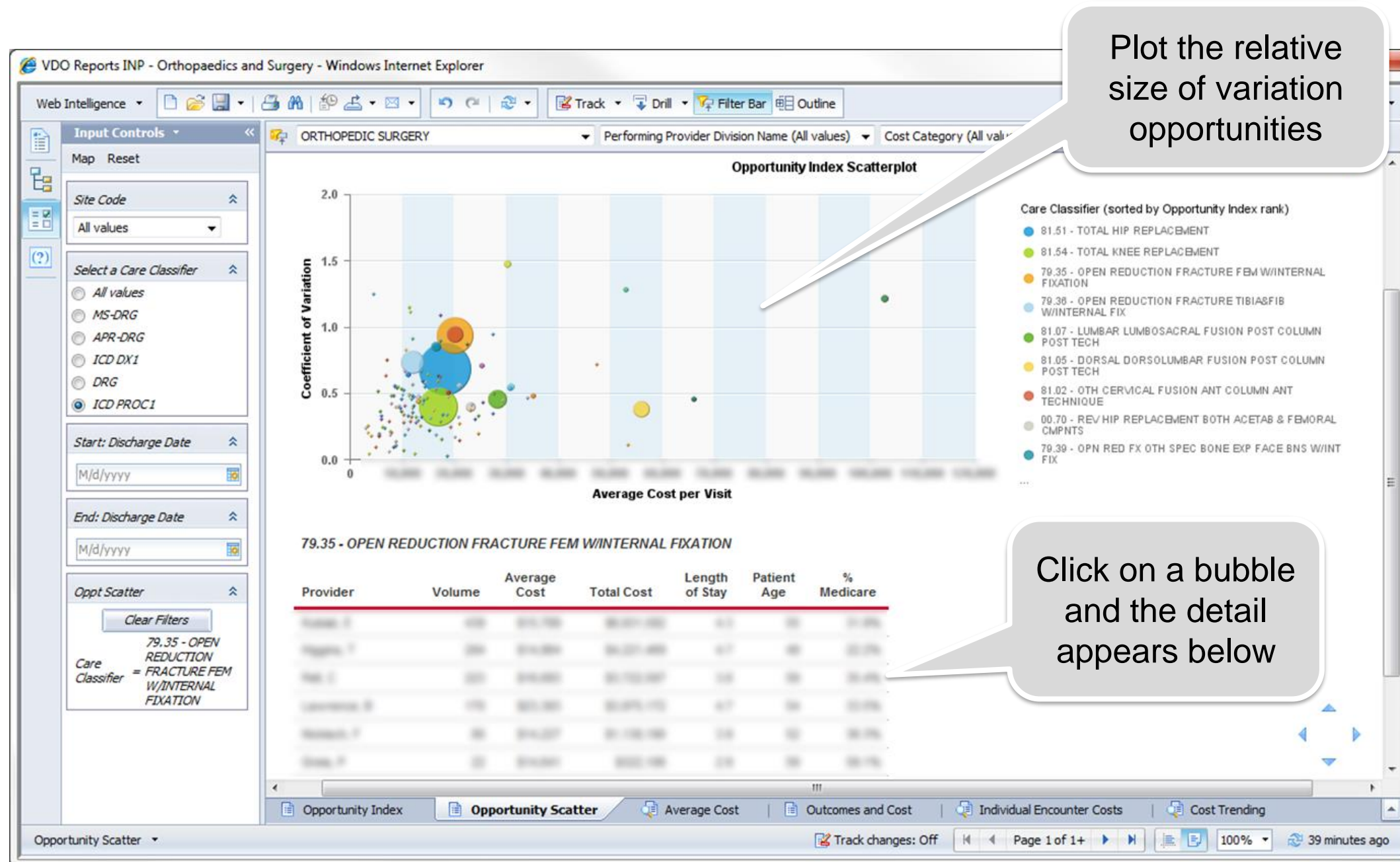
Identify by:
 • Procedure
 • Diagnosis
 • MS-DRG

Select a Date Range

Opportunity Index | Opportunity Scatter | Average Cost | Outcomes and Cost | Individual Encounter Costs | Cost Trending

Track changes: Off | Page 1 of 1+ | 100% | 15 minutes ago

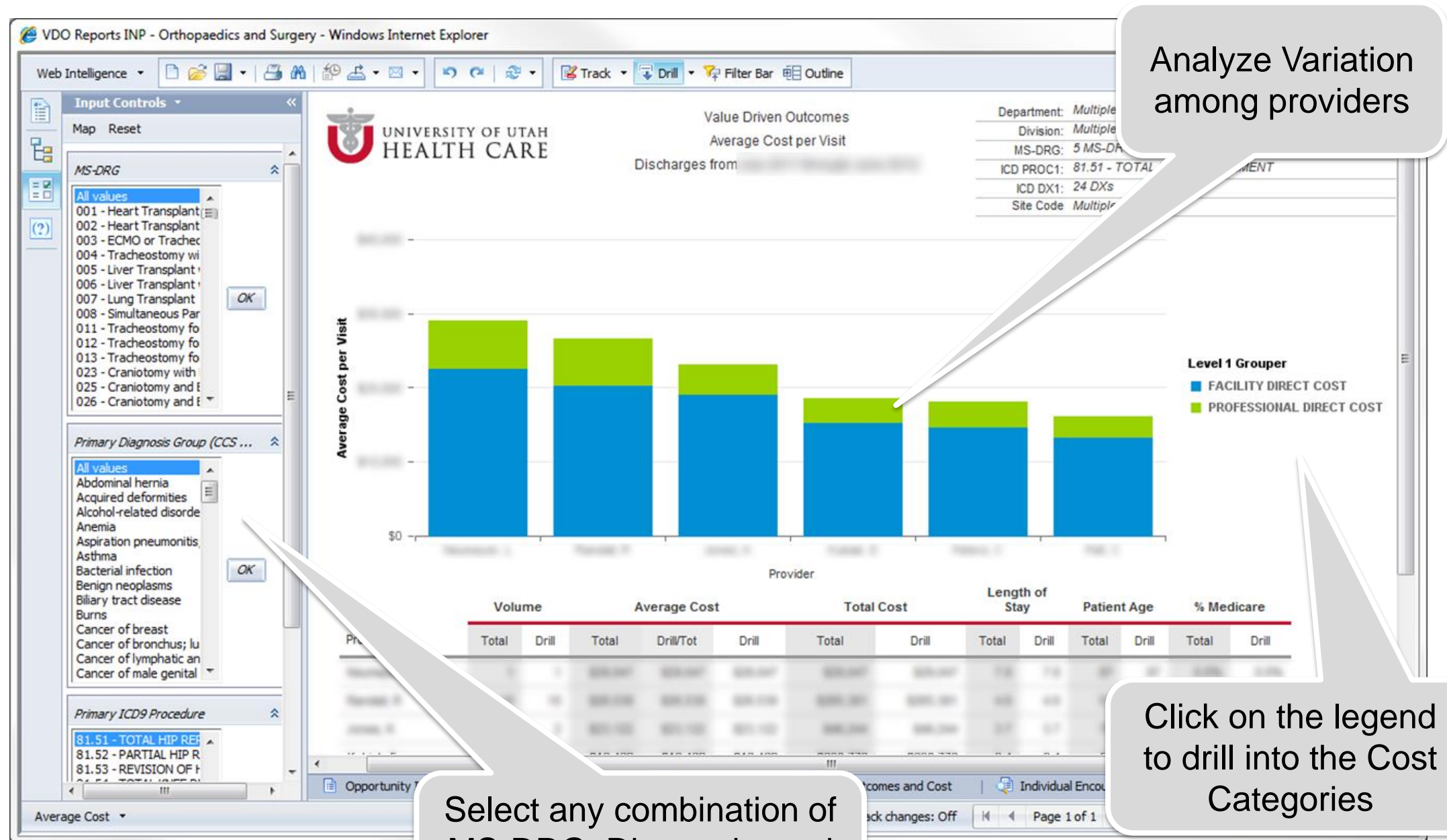
OPPORTUNITY IDENTIFICATION



Plot the relative size of variation opportunities

Click on a bubble and the detail appears below

AVERAGE COST PER CASE

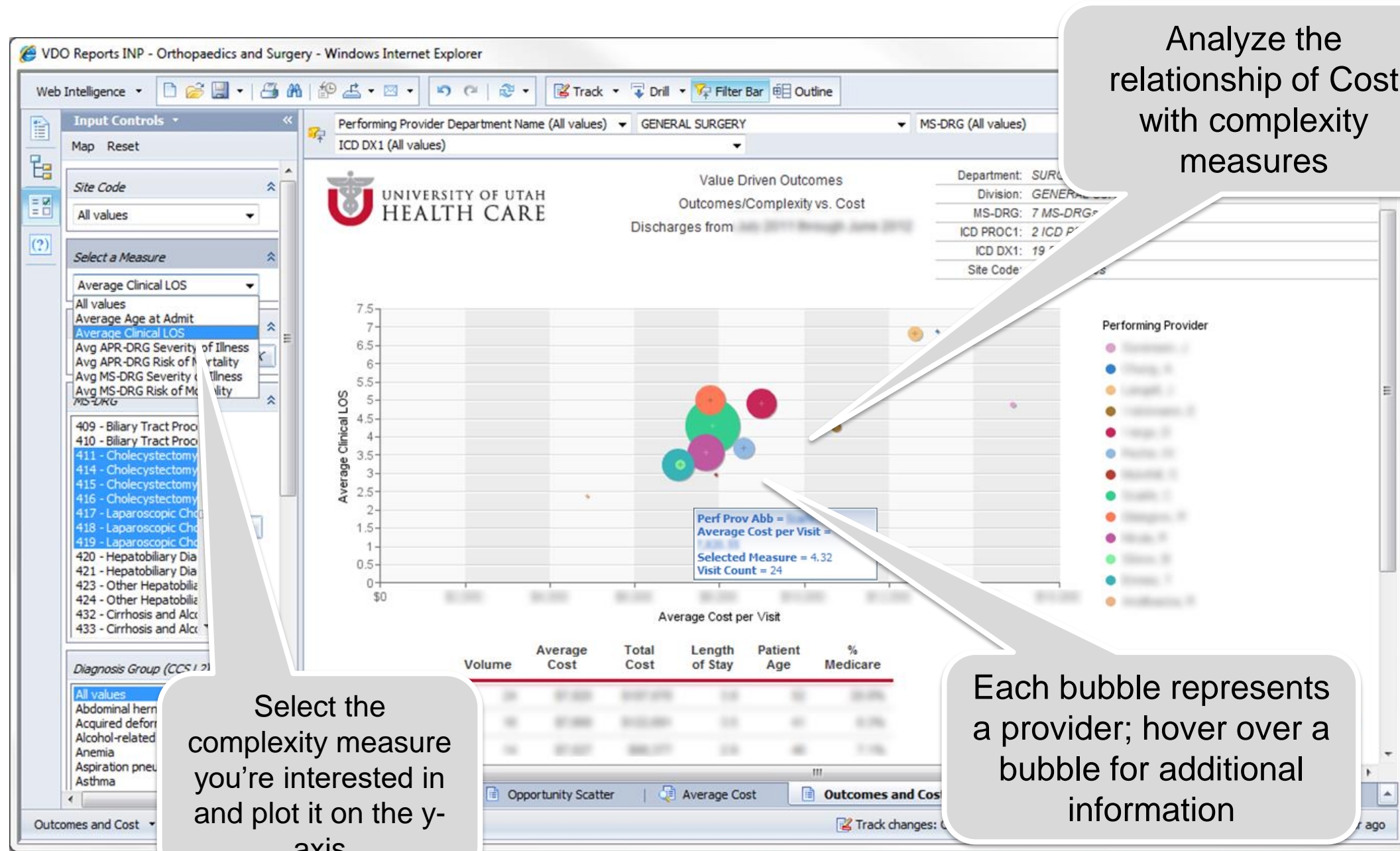


Analyze Variation among providers

Click on the legend to drill into the Cost Categories

Select any combination of MS-DRG, Diagnosis, and Procedure codes

COST VS. COMPLEXITY

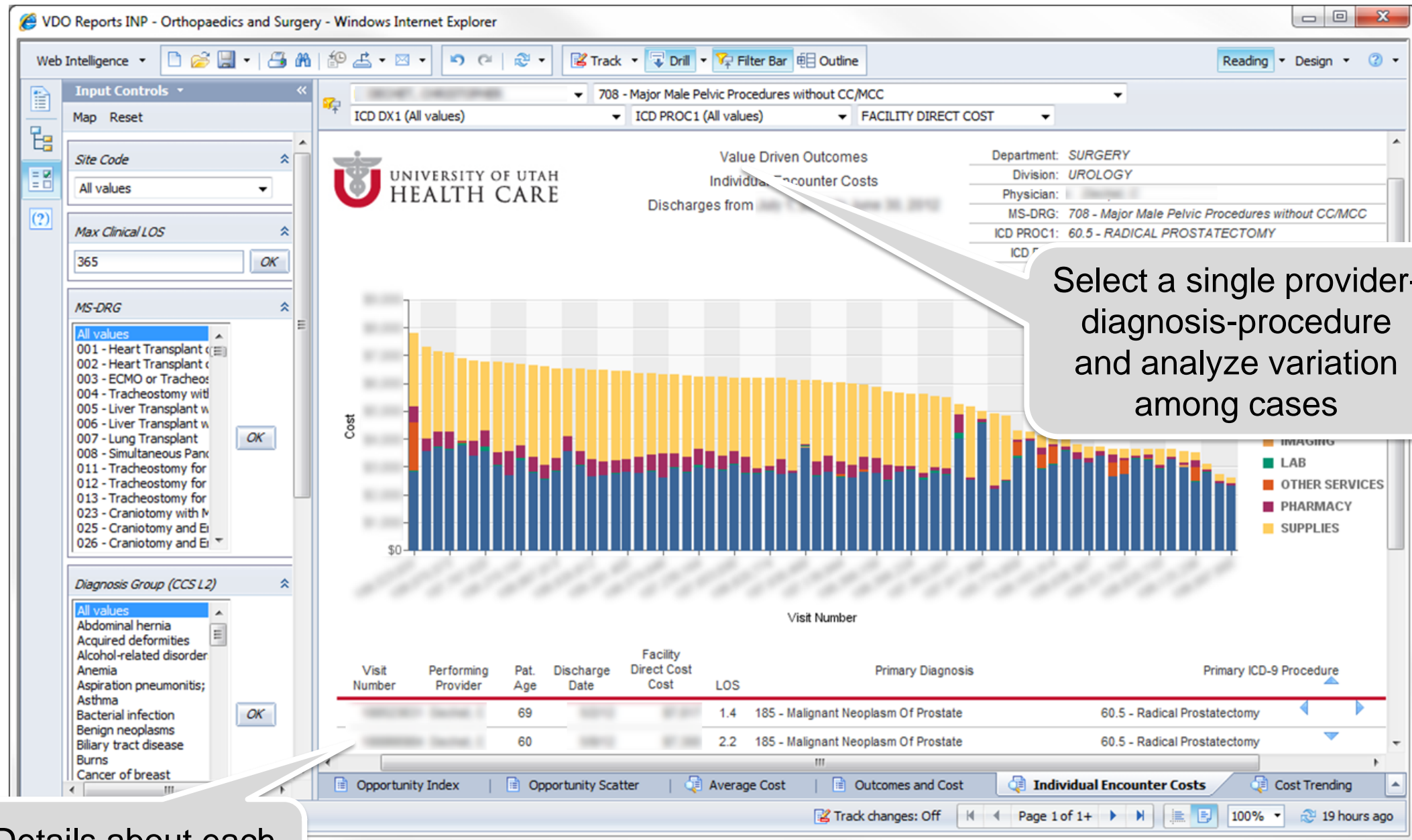


Analyze the relationship of Cost with complexity measures

Select the complexity measure you're interested in and plot it on the y-axis

Each bubble represents a provider; hover over a bubble for additional information

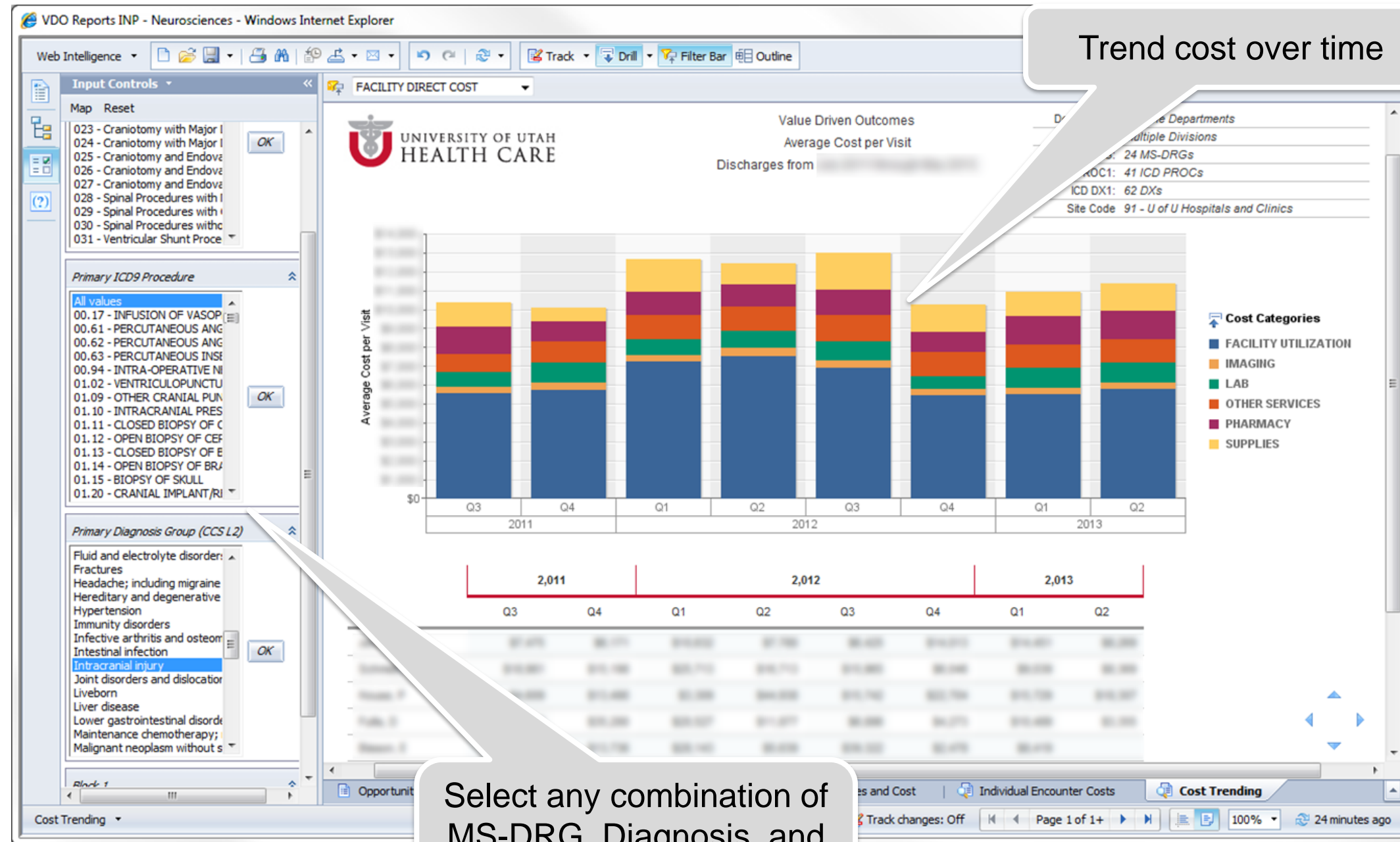
INDIVIDUAL ENCOUNTER COSTS



Details about each visit appear below

Select a single provider-diagnosis-procedure and analyze variation among cases

COST TRENDING



EXAMPLE IMPACT

- Total joint replacement¹
 - Mean direct costs: 11% reduction ($p < .001$)
 - Composite quality index: 54% → 80% ($p < .001$)
- Hospitalist laboratory testing²
 - Mean cost per day: \$138 → \$123 ($p < 0.001$)
 - No significant change in length of stay
- Sepsis care³
 - 23% reduction in median total direct cost ($p = .047$)
 - No significant change in mortality

1. Lee VS, Kawamoto K, ..., Pendleton, RC. JAMA 2016;316(10):1061-1072.

2. Yarbrough PM, Kukhareva PV, ..., Kawamoto K. J Hosp Med. 2016;11(5):348-54.

3. Horton DJ, Graves KK, ..., Kawamoto K. JAMIA Open. 2020;3(2):261-8.

AGENDA

- Personal and topic background
- Exemplars of Univ. of Utah LHS capabilities:
 - ReImagine EHR: enabling LHS capabilities beyond the EHR
 - CDS Committee: responsive health IT governance
 - VDO: enterprise platform for understanding & improving care value
 - NIH Genomics-Enabled Learning Health System Network
- Key challenges and enablers of a LHS
- Discussion



NEWS RELEASES

Monday, September 23, 2024

NIH awards \$27M to establish new network of genomics-enabled learning health systems

Network will analyze and improve how genomic information is integrated into patient care.

GENOMICS-ENABLED LEARNING HEALTH SYSTEM NETWORK

- Aim: to identify and advance approaches for integrating genomic information into existing learning health systems
- Approach: coordinated implementation of scalable genomics medicine interventions across the network
- Members:
 - Vanderbilt (also Coordinating Center)
 - Geisinger
 - Harvard/Duke/VA
 - Indiana University
 - Northwestern
 - University of Utah

GENOMICS LEARNING IN THE UTAH ECOSYSTEM (GLUE) CENTER

- Contact PI: Kensaku Kawamoto, MD, PhD, MHS
- MPI: Mark Yandell, PhD
 - Professor of Human Genetics
 - Co-Director of the Utah Center for Genetic Discovery
 - Adjunct Professor of Biomedical Informatics
 - Extensive experience leading genomics software development groups in both industry and academia
- MPI: Martin (Marti) Tristani-Firouzi, MD
 - Professor in the Division of Pediatric Cardiology, Department of Pediatrics
 - Edna Benning Presidential Chair
 - Co-Director of the Center for Genomic Medicine



AGENDA

- Personal and topic background
- Exemplars of Univ. of Utah LHS capabilities:
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KEY CHALLENGES

- Disconnect between research and operations
 - Distinct cultures, approaches, priorities, and personnel
- Challenges with data access, including cost data
 - Esp. in research, due to HIPAA guardrails
- Lack of systematic processes for learning & improvement
- Key enabling infrastructure can be costly and require institutional investment
- Current healthcare payment models may not provide sufficient incentive to enable a LHS at scale
- We are generally re-inventing the wheel across systems

ENABLERS/RECOMMENDATIONS

- Foster collaboration across research and operations
 - Invest in dual-role personnel who can act as a bridge
 - Such individuals can also help address data access issues
- Implement systematic processes for learning & improvement
- Leverage existing strengths & invest in infrastructure. E.g.:
 - UCH transfusion order set (Dr. Anstett, ACCORDS LHS): \$1.2M savings
 - CO-LAB (e.g., ped suicide screen (Drs. Gatto/Kennedy, ACCORDS LHS))
- Align with financial incentives
 - E.g., grant indirects, inpatient cost reduction, pay-for-value
 - Prepare for a future requiring a LHS & rapid care optimization
- Avoid re-inventing the wheel & collaborate across systems
 - Interoperable informatics solutions could enable such synergies

SUMMARY

- As we all strive to improve patient care as a LHS, some Univ. of Utah experiences may be helpful:
 - ReImagine EHR: enabling LHS capabilities beyond the EHR
 - CDS Committee: responsive health IT governance
 - VDO: enterprise platform for understanding & improving care value
 - NIH Genomics-Enabled Learning Health System Network
- While challenging to achieve, there are key enablers:
 - Research-operations synergy, systematic processes to learn and improve
 - Investment in key infrastructure and existing strengths
 - Aligning with financial incentives & collaborating across systems

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DISCUSSION

- What are your recommendations for strengthening LHS capabilities and improving patient care in Colorado and beyond?

THANK YOU!

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