

AGENCY FOR HEALTHCARE RESEARCH AND QUALITY

AHRQ

Transforming Guidelines Into Action: Clinical Decision Support at the Point of Care

Presented by:
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Moderated by:
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Agency for Healthcare Research and Quality

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Agenda

- Welcome and Introductions
- Presentations
- Q&A Session With Presenters
- Instructions for Obtaining CME Credits

Note: You will be notified by email once the slides and recording are available.

Presenter and Moderator Disclosures

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Learning Objectives

At the conclusion of this webinar, participants should be able to:

1. Discuss the historical path for developing CDS tools and the data-related issues that limit sharing CDS across organizational boundaries.
2. Identify new modalities for CDS development and implementation that offer true vendor-agnostic capabilities, such as service-oriented architectures (SOAs) that are capable of Fast Healthcare Interoperability Resources (FHIR) standards.
3. Demonstrate an understanding of how shareable tools can be adapted for integration into an electronic health record (EHR) system.



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ASPIRE:
Patient-Centered Fall Prevention Clinical Decision Support

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Objectives

1

Discuss the historical path for developing clinical decision support (CDS) tools and their limitations for data sharing across organizational boundaries.

2

Describe the ASPIRE* project and how it aims to overcome traditional primary care fall prevention and CDS limitations.

**Advancing Fall ASsessment and Prevention PatIent-Centered Outcomes REsearch Findings into Diverse Primary Care Practices*

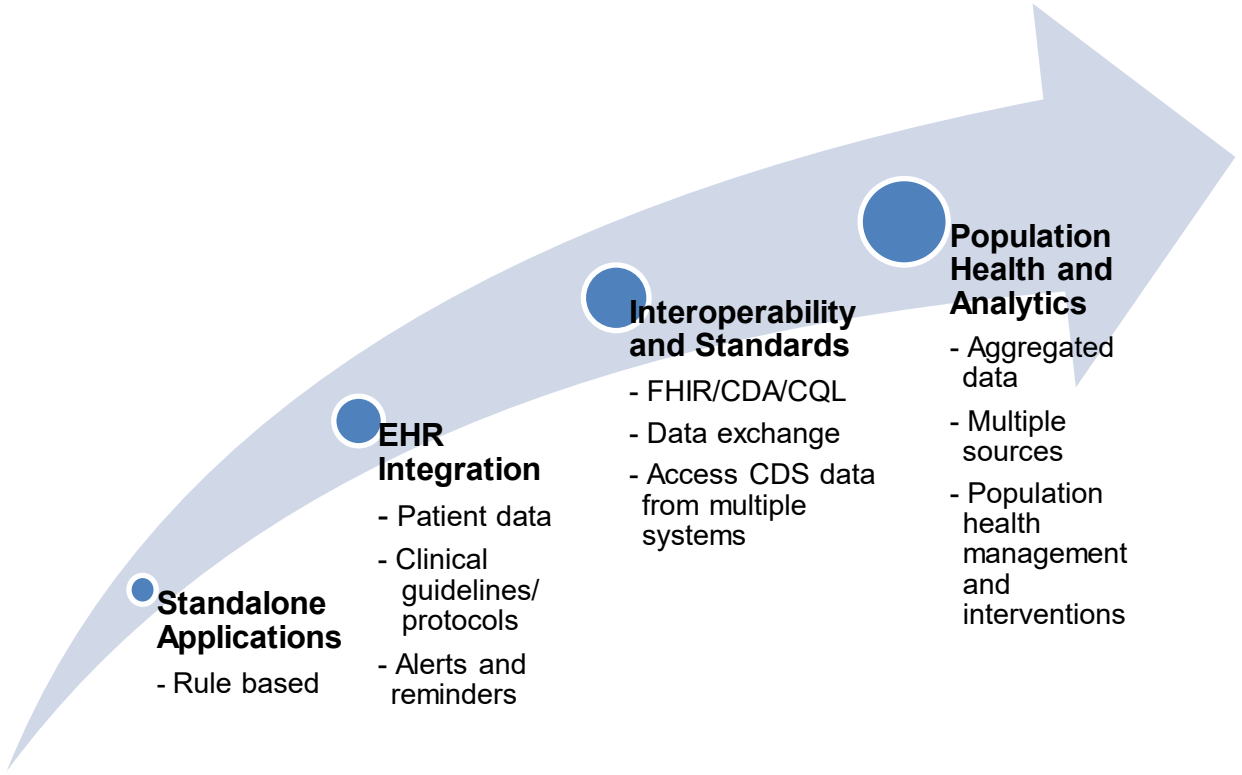
ASPIRE Research Impact

Clinical decision support that guides primary care providers and patients to the most effective *individualized* fall prevention strategy may ensure that patients are able to actively participate in minimizing the risk of having a fall and suffering its devastating consequences.

Background: CDS, Interoperability, and Data Sharing

- Pre-Meaningful Use
  - Limited data/data exchange frameworks, uneven adoption of standards
- 2009: HIGHTECH Act: Adoption of EHRs and health information technology (HIT) systems
  - EHR adoption office-based physicians 48.3%
- 2011: Stage 1 Meaningful Use- *data capture*
- 2014: Stage 2 Meaningful Use- *improve outcomes/care coordination*
- 2017: Stage 3 Meaningful Use- *HIE, patient engagement*
- 2019: Promoting Interoperability- *data sharing and interoperability*
  - EHR adoption office-based physicians 78%, hospitals 96%

Development of CDS tools has followed a historical path evolving alongside advancements in healthcare technology.



STRIDE = STrategies to Reduce Injuries and Develop confidence in Elders

Background: Fall Prevention in Community-Dwelling Older Adults

- Community-based falls are a leading cause of death and disability in older Americans.
- Decades of evidence exist to support the use of interventions tailored to patient-specific risk factors.
  - Not integrated into clinical practice.
- The NIA/PCORI-funded STRIDE study developed algorithms linking fall risk factors to evidence-based fall prevention care.
  - Limitations preclude routine use in primary care.
- Today fall risk screening is routinely done, but there is often no CDS to address fall risk when present.

STrategies to Reduce Injuries and Develop confidence in Elders

ASPIRE Goals and Specific Aims

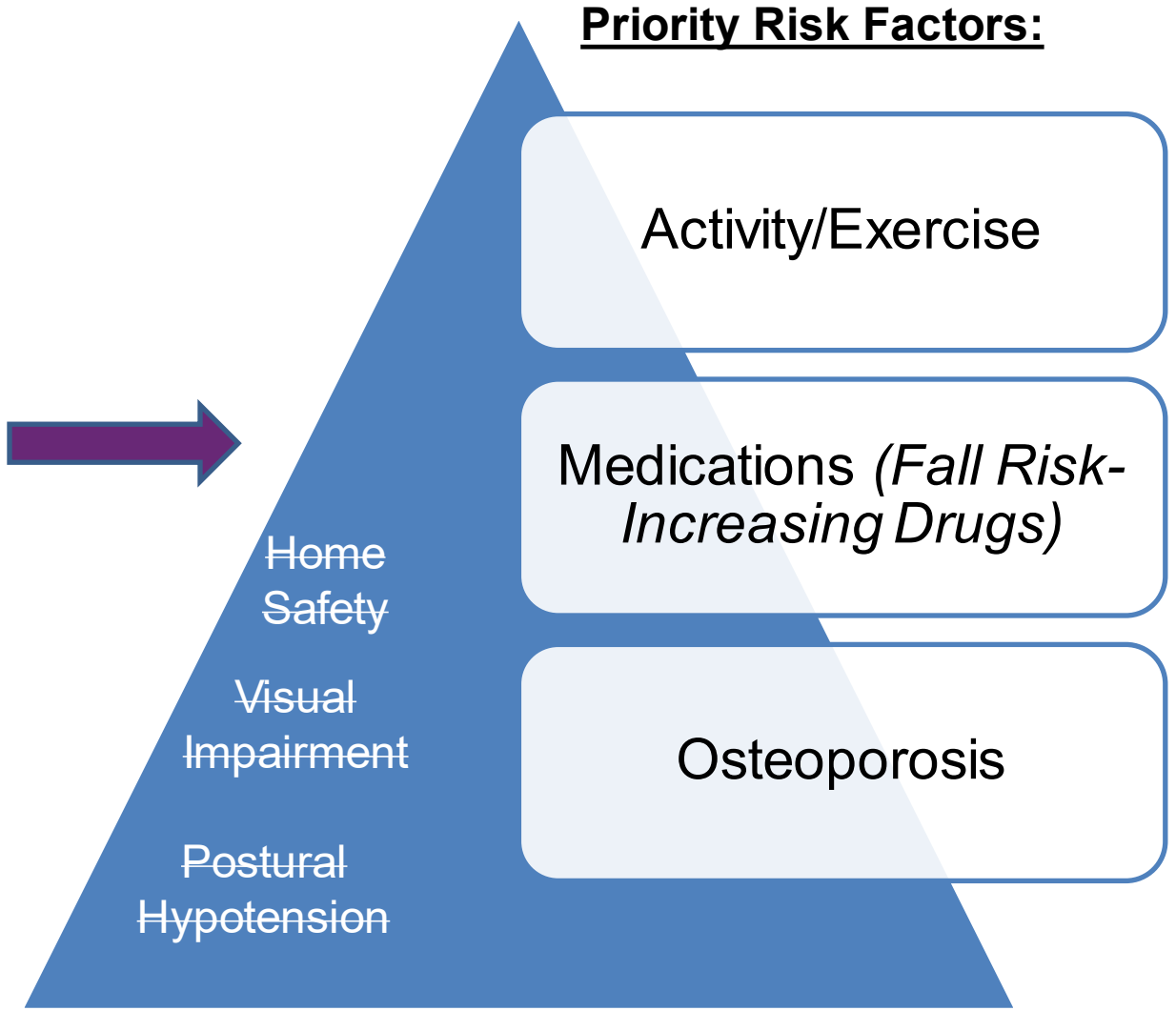
To develop fall prevention CDS that can be integrated into primary care practice to guide providers to the most effective fall-prevention strategies for an *individual* patient and to engage patients and family in fall prevention decision making.

Specific Aims:

1. Prioritize the use of the STRIDE evidence-based fall prevention guidelines to be translated and disseminated via the ASPIRE CDS.
    a) Author and test ASPIRE CDS computable fall prevention guideline algorithms to generate actionable, implementable patient-centered CDS using CDS Connect resources and Clinical Quality Language (CQL).
2. Conduct formative and summative evaluations of the ASPIRE CDS and care plan collaboration tool in rural and urban primary care clinics.

Prioritizing STRIDE Algorithms for CQL Translation

1. Summarized evidence from STRIDE* study for each risk factor.
2. Examined the evidence in the literature for each risk factor.
3. Performed gap analysis of EHR data needed vs. available for CDS.
4. Presented and discussed strength of evidence/data availability with team/advisory board.
5. Selected priority risk factors.

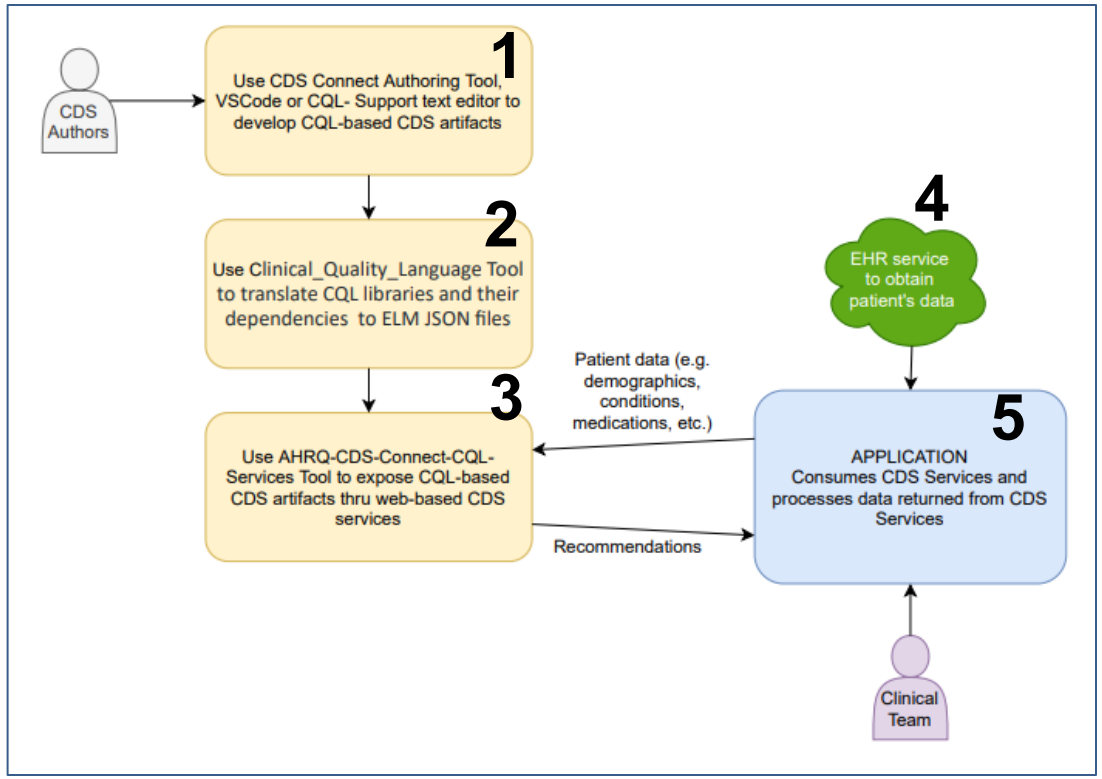


*Bhasin S, et. al. A Randomized Trial of a Multifactorial Strategy to Prevent Serious Fall Injuries. *N Engl J Med*. 2020 Jul 9;383(2):129-140.

AHRQ CDS Connect

1. **CDS Authoring Tool/VS Code/Clinical Quality Language (CQL) Support Text Editor:** Develop CQL-based CDS artifacts.
2. **CQL Tool:** Translate CQL-based CDS artifact into a standardized machine-readable file called Expression Logical Model (ELM).
3. **CDS-Connect-CQL-Services Tool:** Exposes the CQL-based CDS artifact thru a web-based API (CDS service) so it can be consumed by applications.
4. **EHR services:** Pull patient's data from database and feeds them to the application.
5. **Application:** Consumes CDS service by feeding patient data required by the CDS service and then returns the recommendation back to the application.

CQL-based CDS Service Workflow



ASPIRE CDS Connect Artifact "Products"
Event-Condition-Action (ECA) Rules

- ✓ **CDS Artifact #1:** Exercise Guidance for Primary Care Fall Prevention
- ✓ **CDS Artifact #2:** Primary Care Management Guidance for Fall Risk-Increasing Drugs
- ✓ **CDS Artifact #3:** Osteoporosis Management Guidance for Primary Care Fall Prevention

ASPIRE Aim 2 Methods

Participatory, iterative design process of the ASPIRE CDS and Care Plan Collaboration Tool. Integration with EHR (Epic/Centricity).

Primary Care Patient Fall Prevention User Requirements (Themes)

- Workload Burden
- Systematic Communication
- In-person Assessment of Patient Condition
- Personal Support Network
- Motivational Tools
- Patient Understanding of Fall Risk
- Individualized Resources
- Evidence-based SAFE Exercises/Expert Guidance

ASPIRE Journey Map

Fall Prevention Care Planning Journey Map

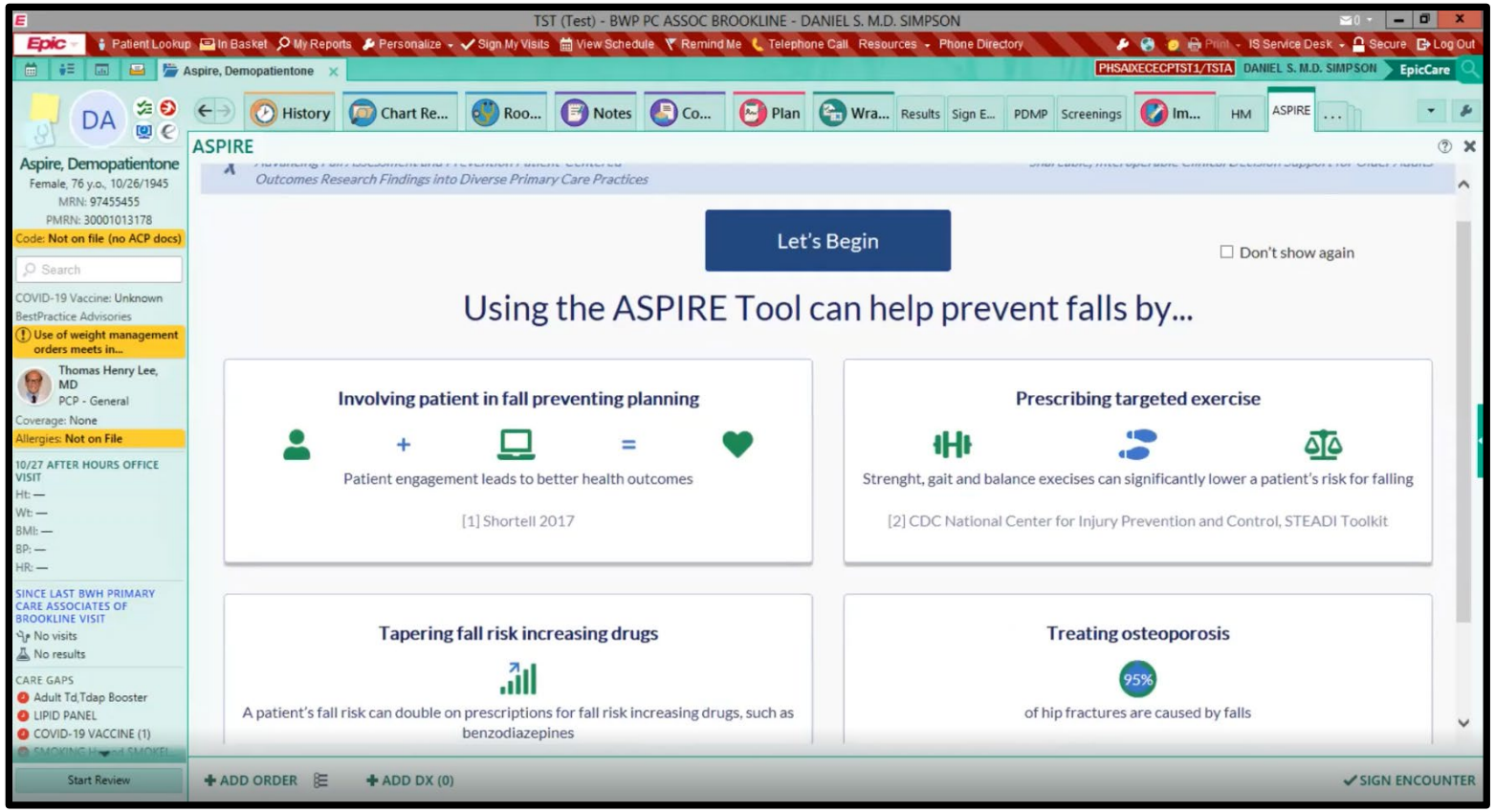
Guiding Principles:

- **Falls can be prevented**
- **Patient engagement is critical**
- **Increase strength and mobility**
- **Deprescribe Fall Risk-Increasing Drugs (FRIDS)**
- **Maximize bone health**

		Visit Prep	Screening	PCP Visit	Follow-up
Activities		• Chart review • Fall risk screening (portal)	• Initial intake • Risk assessment • Meds	• Changes since last visit • Assessments • Care plan generation • Education	• Schedule next visit • Referrals
Motivation/ Thoughts	*Staff*	• Prior risk? • Previous plan?	• Clinical flow/pace • Risks identified	• Conflicting clinical concerns • Resources/insurance	• Build on fall prevention plan next visit
	Patients	• Improve/Maintain health independence	• What "counts" as fall? • Independence	• Fear of falling • Loss of independence • Lifestyle changes	• Following plan at home • Lifestyle changes
Barriers	*Staff*	• Time • No show risk	• Provider preferences • Time pressures	• Competing demands • Limited resources • EHR functionality	• Communication • Referrals • Follow-up
	Patients	• Transportation • Cost/co-pay	• Fear of loss of independence	• Fear of loss of independence • Pain • Cognition	• Cost • Transportation • Insurance
Resources	*Staff*	• EHR • Phone	• Complete/validate FRA • Patient-PCP relationship	• Education • Motivational interviewing	• Team • Portal • Phone
	Patients	• Portal • Family	• Patient-PCP relationship • Trust	• Support system • Relationship/trust	• Handouts • Community

Shear, K. Participatory development of a computerized clinical decision support system for evidence-based fall prevention in primary care (UFL PhD Thesis 2022)

ASPIRE Fall Prevention Care Plan Collaboration Tool *(Embedded in EHR)*

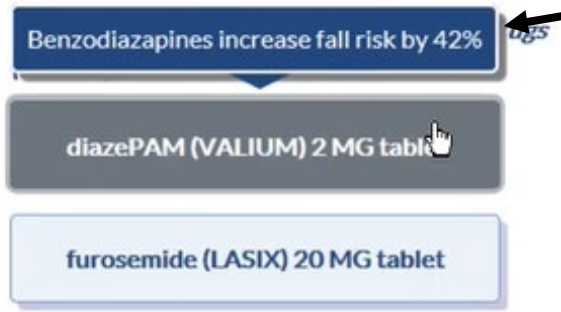


ASPIRE 3-Step Fall Prevention Care Planning Process

- ✓ **Step 1**: Confirm the details of patients fall risk factors based on patient's data in EHR.
- ✓ **Step 2:** Generate recommendations based on the selections made in Step 1.
- ✓ **Step 3:** Review/implement recommendations, talking points, and handouts provided in Step 2.

ASPIRE Step 1

- ✓ Confirm patient's fall risk factors (mobility, medications, osteoporosis).
- ✓ Pre-selected based on the patient's EHR data.



Step 1: Select Risk Factors | Step 2: Recommendations | Step 3: Document and Print

Select your Patient's Mobility Limitations
Pre-selected indicates it is documented in the EHR

- Patient is Homebound
- Patient has Gait Disturbance
- Patient has symptoms/diagnoses that interfere with exercise

Why should I recommend exercise?

Exercise reduces falls by 24%. For patient receiving PT, these exercises will prevent regression between sessions. You'll receive recommendations in Step 2 on how to help your patients with their mobility.

Select your Patient's Fall Risk Increasing Drugs (FRIDs) you want to address

- diazePAM (VALIUM) 2 MG tablet
- furosemide (LASIX) 20 MG tablet

Why should I address FRIDs?

Research has shown that FRIDS can lead to harmful side effects, including falls and fractures and other medication specific harms.

Based on your selections, you'll receive information about tapering your patient's medications.

Select your Patient's Risk Factors for Fractures
Pre-selected indicates it is documented in the EHR

- Osteoporosis
- Osteoporotic fracture

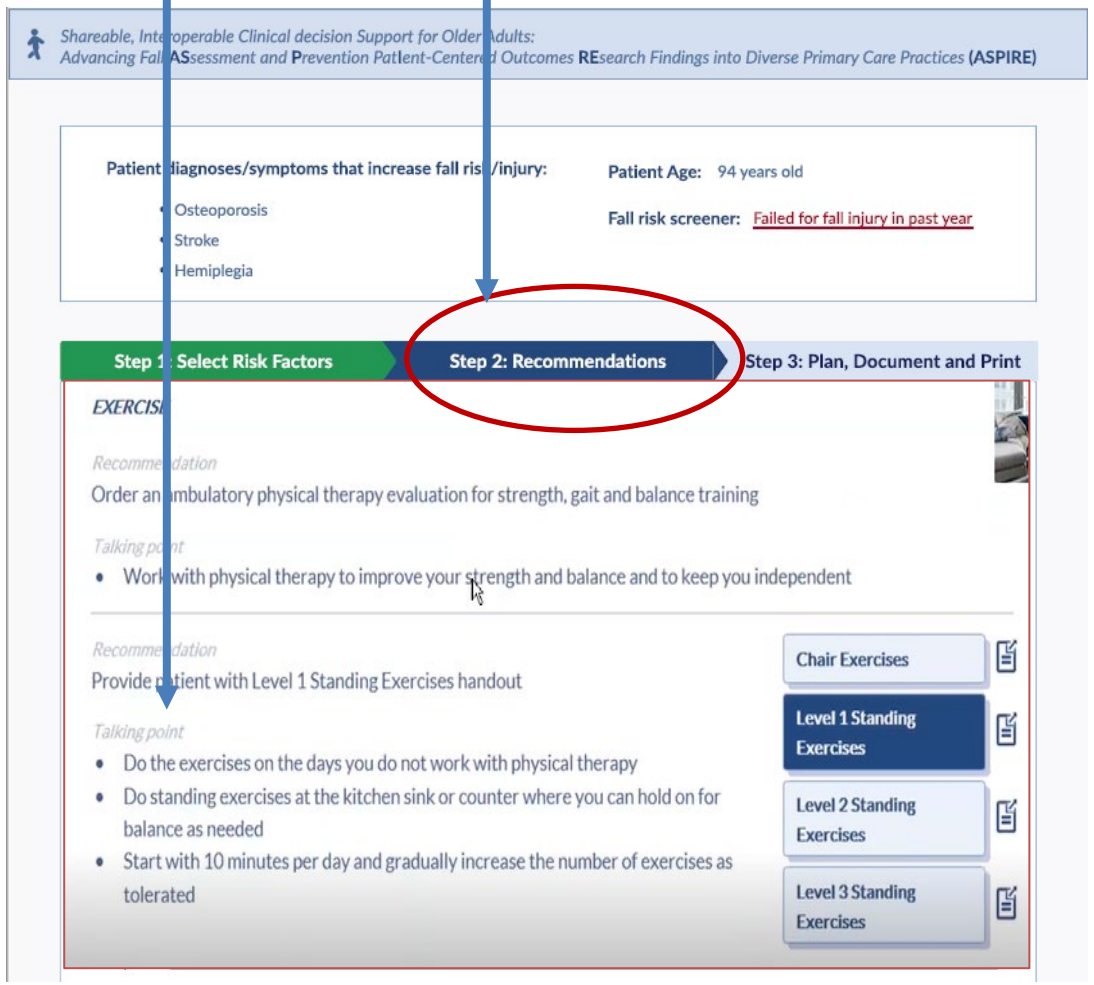
Why should I address fracture risk?

Osteoporosis and osteopenia are well documented risk factors for fall injury, including fractures, with significant associated morbidity and mortality.

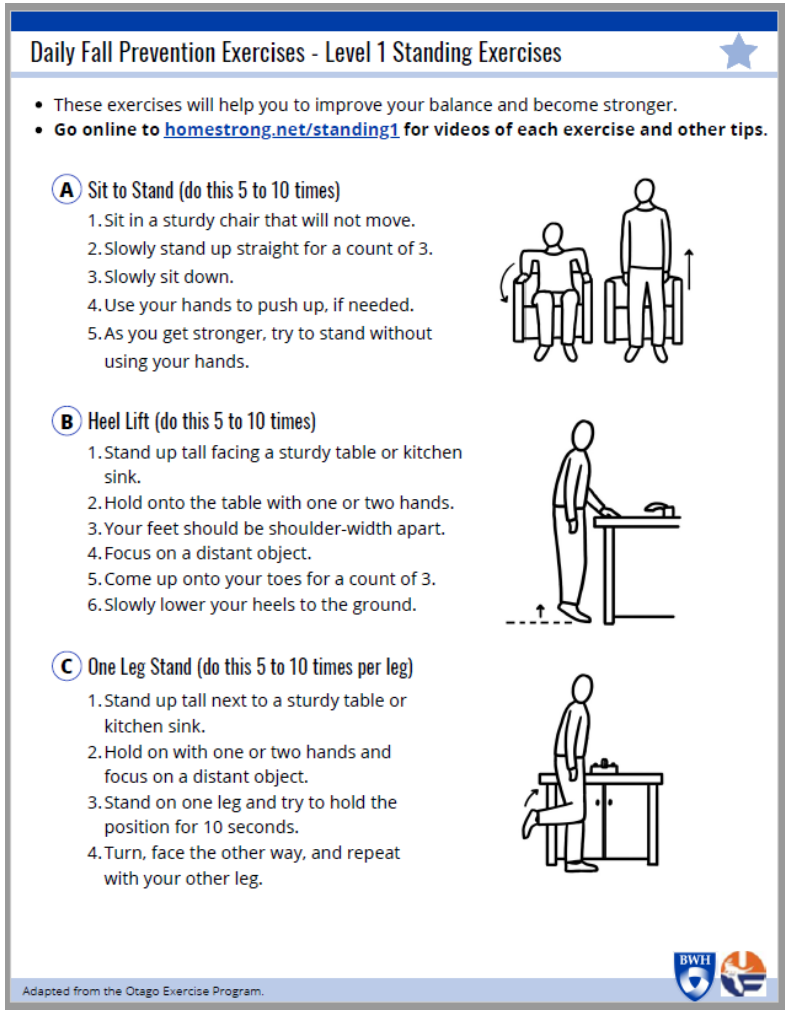
Based on your selections, you'll receive recommendations about osteoporosis education for your patients and/or treatment recommendations.

ASPIRE Step 2

- ✓ Recommendations
- ✓ Talking points

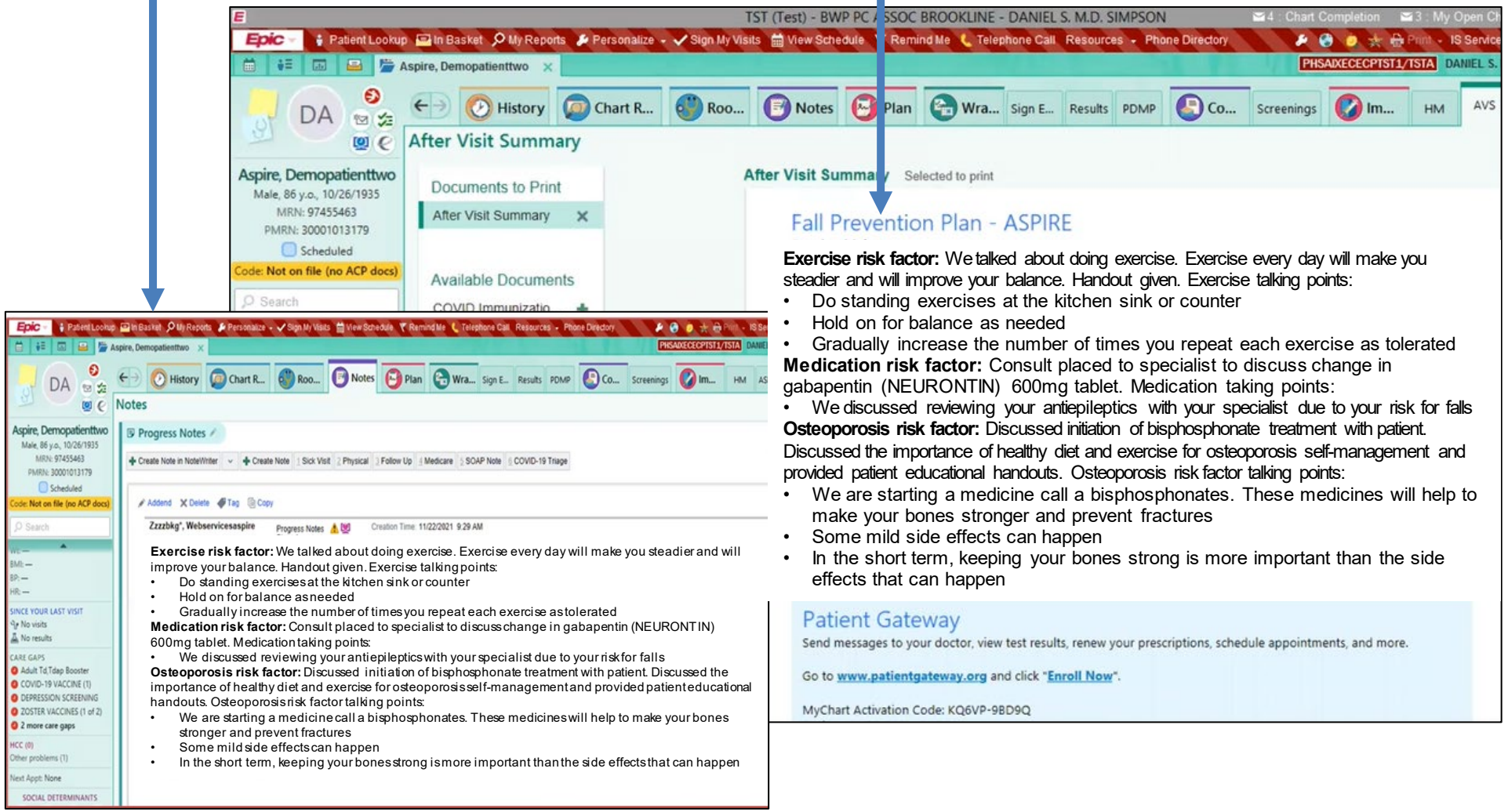


- ✓ Patient education



ASPIRE Step 3

- ✓ Review recommendations
- ✓ Save prepopulated progress note
- ✓ Send fall prevention plan to patient-facing After Visit Summary



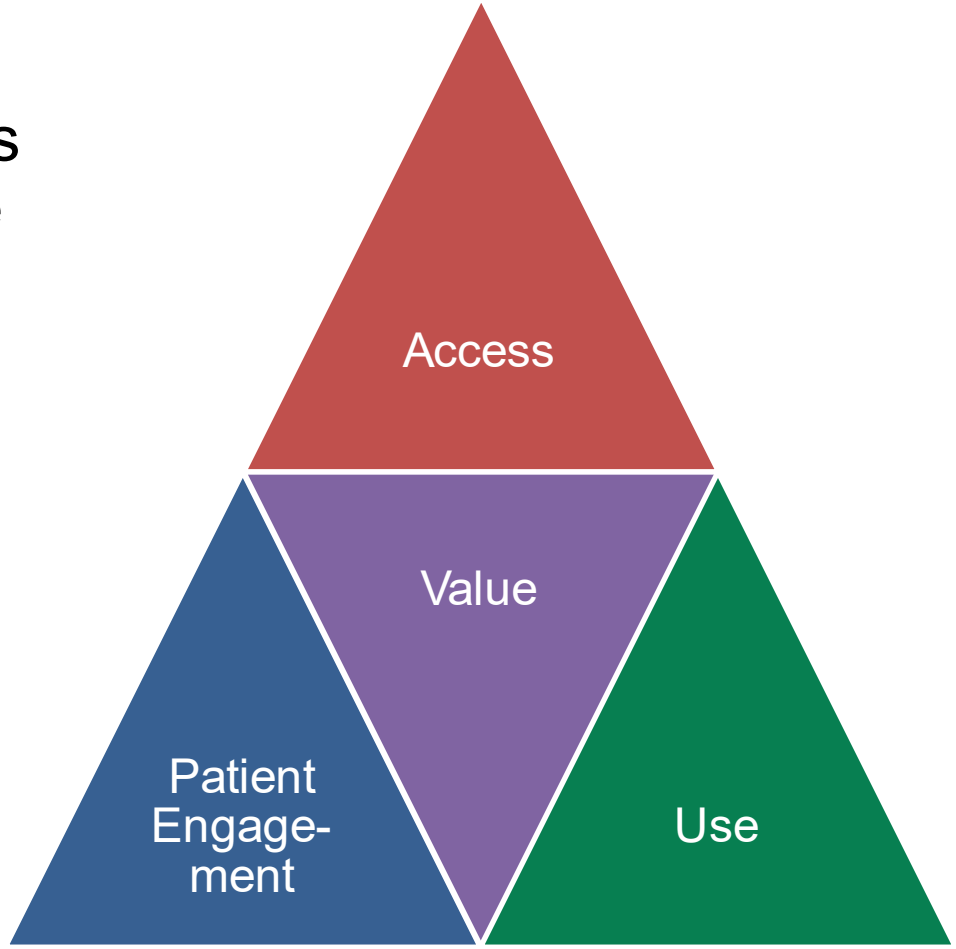
ASPIRE Summative Evaluation

- Implement ASPIRE in 2 primary care practices (Boston-urban/Florida-rural).
  - Pilot
  - 6-month evaluation
- Research questions:
  - What is the usability, use, efficiency, and user satisfaction of the ASPIRE CDS in the primary care setting?
  - What are patient perceptions of shared decision making and healthcare relationship trust?
- Identify stakeholder perceptions of the facilitators and barriers to use of ASPIRE CDS and recommendations for improvement.
- Evaluate use of the software in practice (patient/provider perspectives).

Summative Evaluation Results

Clinic Observations (n=21)

- Most exercise recommendations accepted/implemented, variable adherence with FRIDS and osteoporosis recommendations.
- Health ITUES (providers): median 4/5.
- Patient/provider trust (patients): mean 51.5/60.
- Shared decision making (patients): 93/100.



Provider experience using ASPIRE

Discussion

- Fall prevention CDS currently lacking in primary care.
- ASPIRE provides evidence-based CDS that was integrated into clinical workflow and rated highly by providers and patients.
  - Interoperable with diverse EHR systems.
  - Targets common fall risk factors that can be addressed in the context of a visit.
  - Provider and patient-facing tools integrated into the software; can be shared with the patient during a visit or within the patients after visit documentation.
  - Sharable: Event-Condition-Action (ECA) Rules available on CDS Connect Website.
- Participatory design approach is useful.
  - Integrates usability evaluation methods (workflow observations, task analysis, journey mapping, participatory design and usability testing) into each stage of the project.
- Recognition of value of patient engagement in use of health IT and impact on workflow is needed.
  - Attention to clinician “readiness” and “logistical” skills are key to success.
- Implementation is not without real-world challenges,
  - True stakeholder involvement in designing the data, information, and workflows is needed.

ASPIRE Team

Brigham and Women's Hospital

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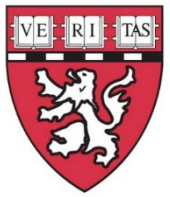

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Development, Implementation, and Impact Analysis of an Electronic Health Record Agnostic Clinical Decision Support Tool:

A case study of the IMPROVE-DD Venous Thromboembolism CDS Tool

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Learning Objectives

- Identify new modalities for clinical decision support (CDS) development and implementation that offer true vendor agnostic capabilities such as service-oriented architecture (SOA) that are capable of Fast Healthcare Interoperability Resources (FHIR) standards.

- Conducting a large impact analysis with a cluster randomized trial to test CDS implementation of a venous thromboembolism (VTE) risk CDS tool.

Introduction

- The practice of evidence-based medicine (EBM) at the point of care has well-established benefits, particularly when implemented in the form of software-based CDS that has been smoothly integrated into clinical workflows within electronic health record (EHR) software systems.

- Previous work by our team funded by an AHRQ grant (1R18HS026196-01A1) included the conceptualization and development of EvidencePoint, an EHR-independent CDS software capable of being integrated into clinical workflows within various EHRs, at various clinical sites, without requiring the solutions to be "rebuilt" for each deployment.
  - Easier to create and disseminate software-based CDS solutions that help promote the practice of EBM at the point of care.
  - High adoption.

- VTE risk assessment of hospitalized medical patients using a validated risk assessment model (RAM) represents a classic "test case" of the use of our EHR-independent CDS platform.
  - Heterogenous population with varying risk of VTE.
  - Studies reveal consistent over-thromboprophylaxis of low-VTE-risk patients and under-thromboprophylaxis of high-VTE-risk patients

McGinn TG et al JAMA Intern Med 2013; McGinn T et al J Am Med Inform Assoc 2013; Spyropoulos C et al Thromb Haemost 2017

Health Informatics Technology/Electronic Alerts and VTE RAMs in Hospitalized Patients

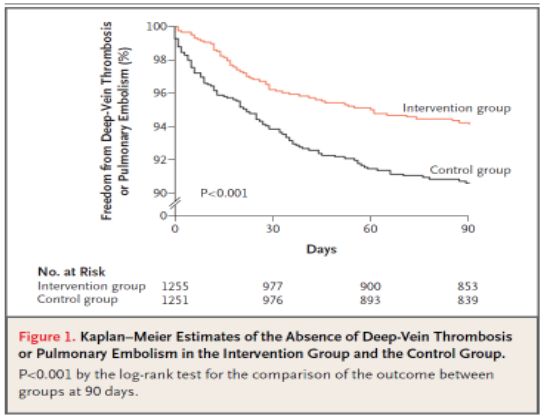


Figure 1. Kaplan–Meier Estimates of the Absence of Deep-Vein Thrombosis or Pulmonary Embolism in the Intervention Group and the Control Group.
P<0.001 by the log-rank test for the comparison of the outcome between groups at 90 days.

Electronic Alert at Admission using VTE RAM[1]
The computer alert system resulted in a 10% increase in rate of pharmacologic prophylaxis (23.6% versus 13%, P <0.001) and reduced risk of VTE by 41%

Table 2 Venous Thromboembolism Prophylaxis at Discharge

Prophylactic Measures	Alert	Control
Any prophylaxis, n (%)	278 (22)	122 (9.7)
Mechanical prophylaxis, n (%)	46 (3.7)	31 (2.5)
Pneumatic compression device	6 (13)	2 (6.5)
Graduated compression stockings***	29 (63)	7 (23)
Inferior vena cava filter***	13 (28)	22 (71)
Pharmacological prophylaxis, n (%)***	234 (19)	97 (7.7)
Unfractionated heparin	15 (6.4)	12 (12)
Enoxaparin	130 (56)	52 (54)
Warfarin***	123 (53)	29 (30)
Fondaparinux	8 (3.4)	3 (3.1)

Means are tested with 2-sample *t* test; medians are tested with the Mann-Whitney *U* test; proportions are tested with the chi-squared test or Fisher's exact test.
Patients could receive more than one type of prophylaxis.
P ≥.05 unless otherwise noted.
***P* <.001.

Physician Alert at Discharge using VTE RAM[2]
12% increase in rate of pharmacologic prophylaxis (22% vs 9.7% , P<0.001)

Limitations of electronic alerts/ passive systems

1. Operator fatigue
2. Lack of interchangeability among EHRs
3. Major resources (human, IT)

1. Kucher N et al *NEJM* 2005 2. Piazza G et al *Am J Med* 2013

CDS Tools in an EHR-agnostic Environment

Substitutable Medical Applications, Reusable Technologies on Health Level 7 (HL7) Fast Healthcare Interoperability Resource: SMART on FHIR

or

“SMART on FHIR –like”

CDS Tool Integration vs Dissemination

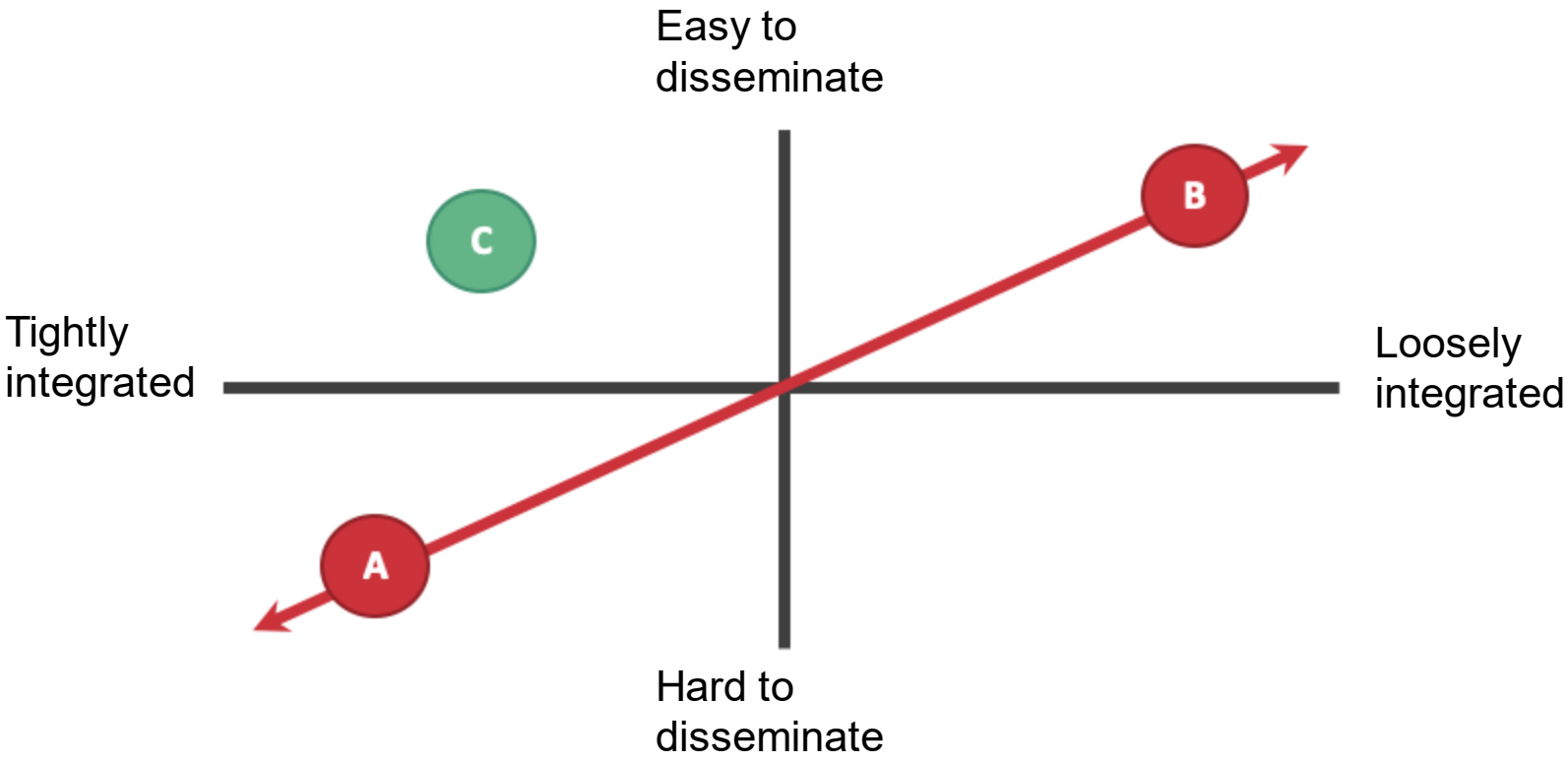
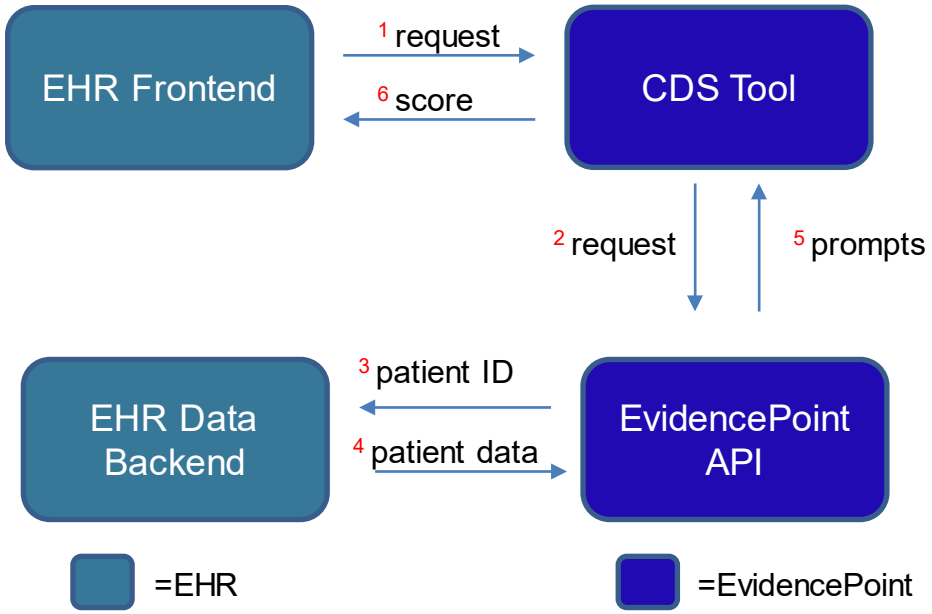


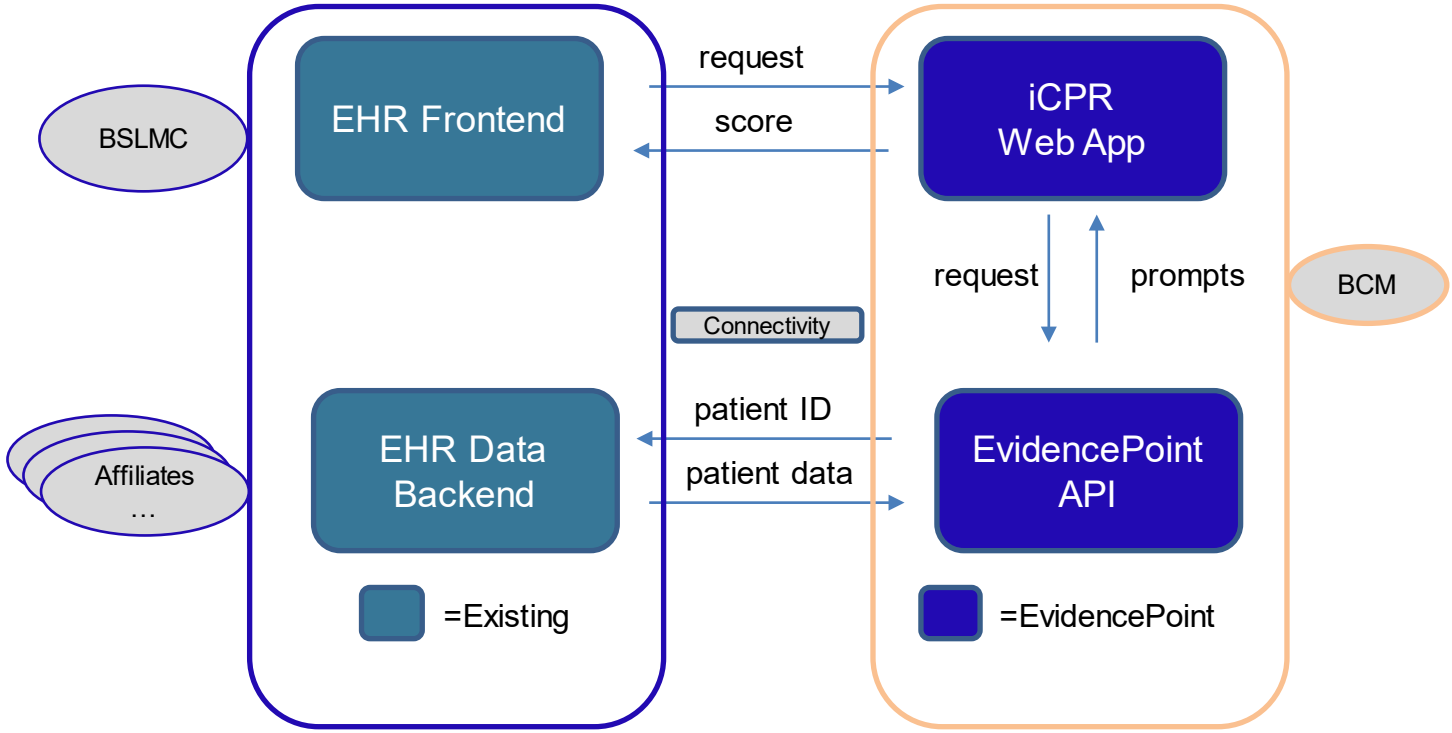
Figure 1. Tension between CDS that is tightly integrated but hard to disseminate (A) and CDS that is easy to disseminate but loosely integrated (B). The innovations in this proposal will create a platform for CDS that is both tightly integrated and easy to disseminate (C).

EvidencePoint Platform EHR Integration



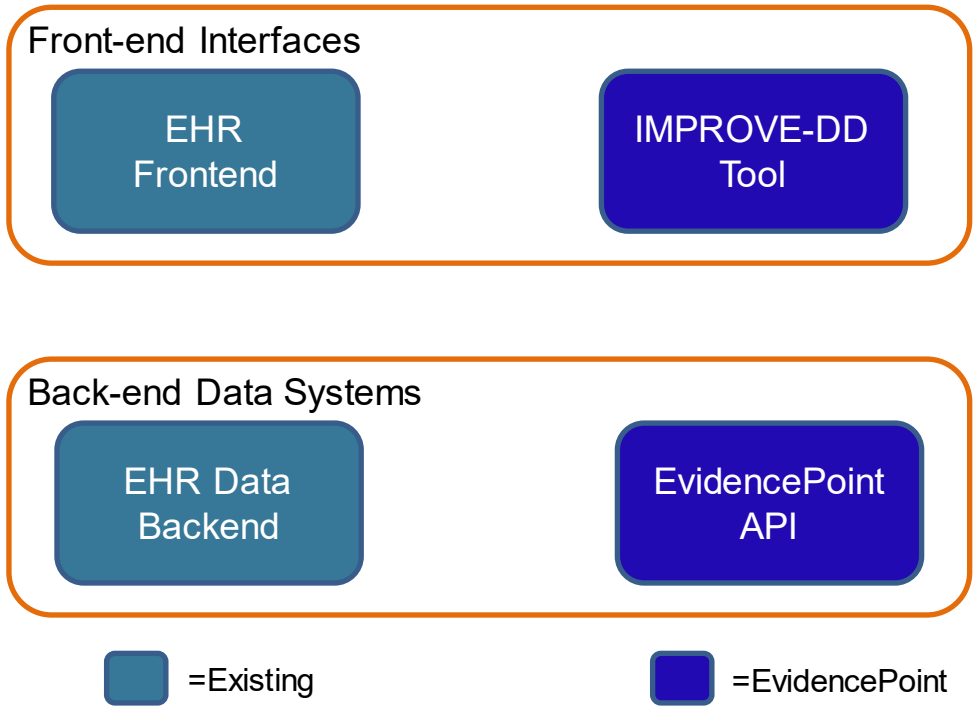
Users launch the CDS tool from a typical EHR workflow, or the tool is triggered automatically. The launch request includes the patient's visit-specific ID [1]. The CDS tool forwards the request to the EvidencePoint API [2], which retrieves the patient's data from the EHR data backend [3,4] and pre-populates the tool with patient data where possible [5]. The user fills in any remaining information and the tool calculates a personalized risk score for the patient, which is in turn sent back to the EHR [6] to be incorporated into the patient's medical record, as well as trigger any resulting next steps in the EHR, such as opening an order set.

Implementation of Evidence Point at BSMLC

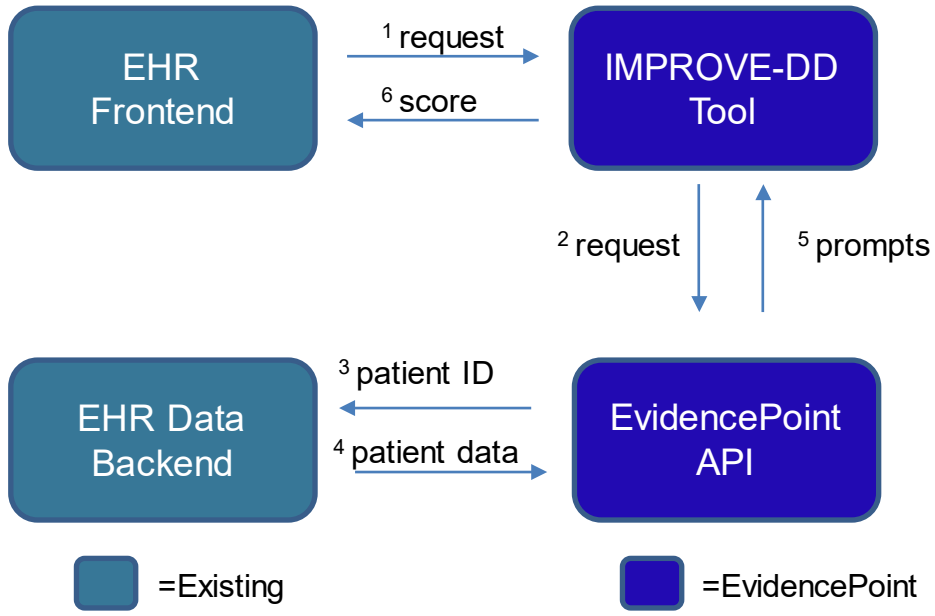


IMPROVE-DD VTE CDS Integration

EvidencePoint Platform Structure



EvidencePoint Platform Communication



Proctor's Implementation Outcomes

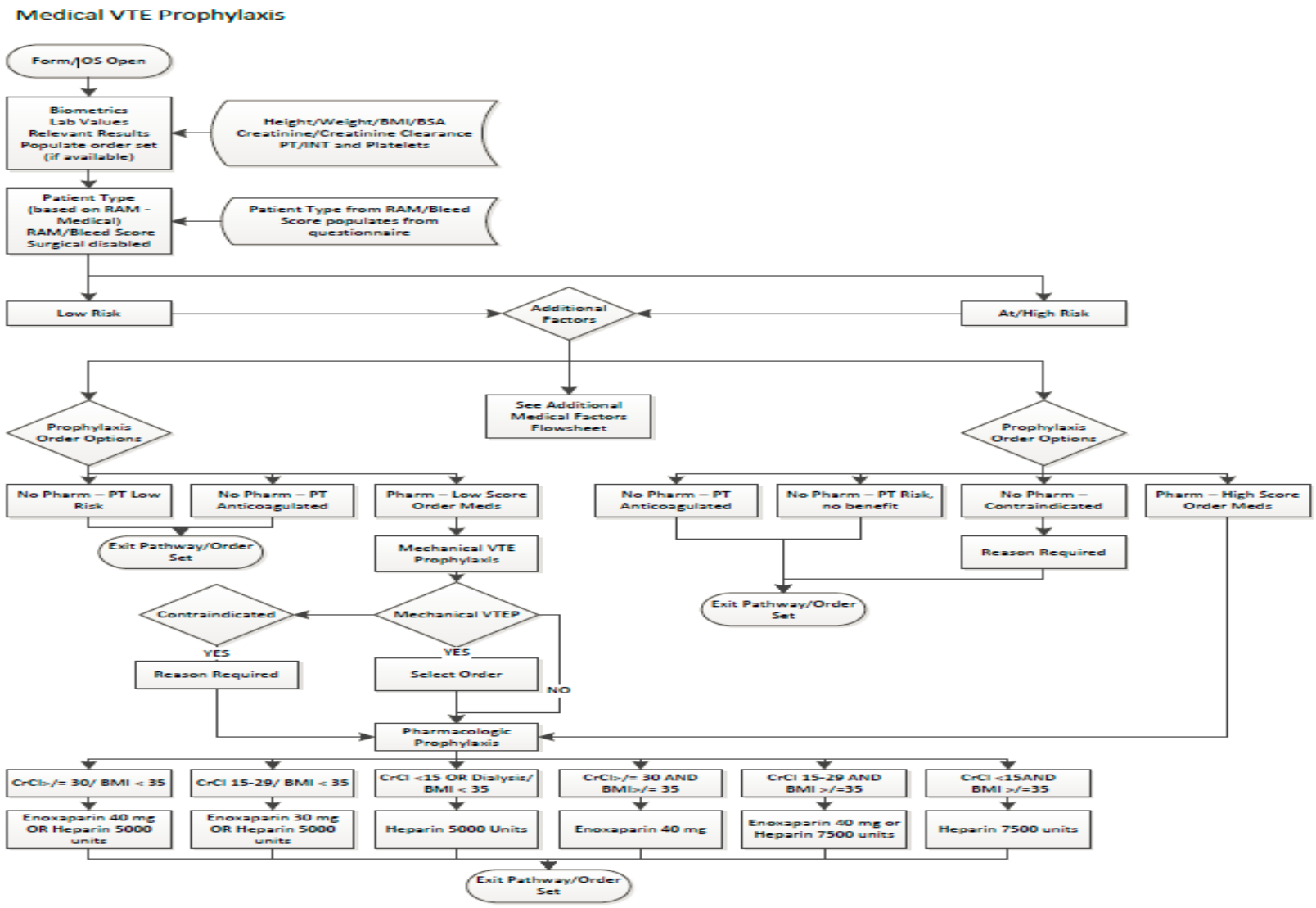
Implementation Outcome	Data Collection Time Point(s)	Data Source	Measure
Adoption (Primary)	Post-Implementation	EHR	Proportion of providers using the IMPROVE-DD tool to document a VTE risk assessment on admission in >60% of opportunities for use Proportion of providers using the IMPROVE-DD tool to document a VTE risk assessment on discharge in >60% of opportunities for use
Acceptability	Post-Implementation	Survey	Mean (SD) score of the Acceptability of Intervention Measure
Appropriateness	Post-Implementation	Survey	Mean (SD) score of the Intervention Appropriateness Measure
Feasibility	Post-Implementation	Survey	Mean (SD) score of the Feasibility of Intervention Measure
Fidelity (Delivery as Intended)	Post-Implementation	EHR	Proportion of admitted patients with a completed IMPROVE-DD VTE score Proportion of admitted patients with VTE prophylaxis appropriate for IMPROVE-DD VTE Score Total # of orders for pharmacologic VTE prophylaxis
Penetration (Reach)	Post-Implementation	EHR	Proportion of admitted patients where the IMPROVE-DD tool for VTE risk assessment was used on admission Proportion of admitted patients where the IMPROVE-DD tool for VTE risk assessment was used on discharge Proportion of admitted patients with mechanical VTE prophylaxis Proportion of admitted patients with pharmacologic VTE prophylaxis

Proctor's E et al Adm Policy Ment Health. Mar 2011;38(2):65-76

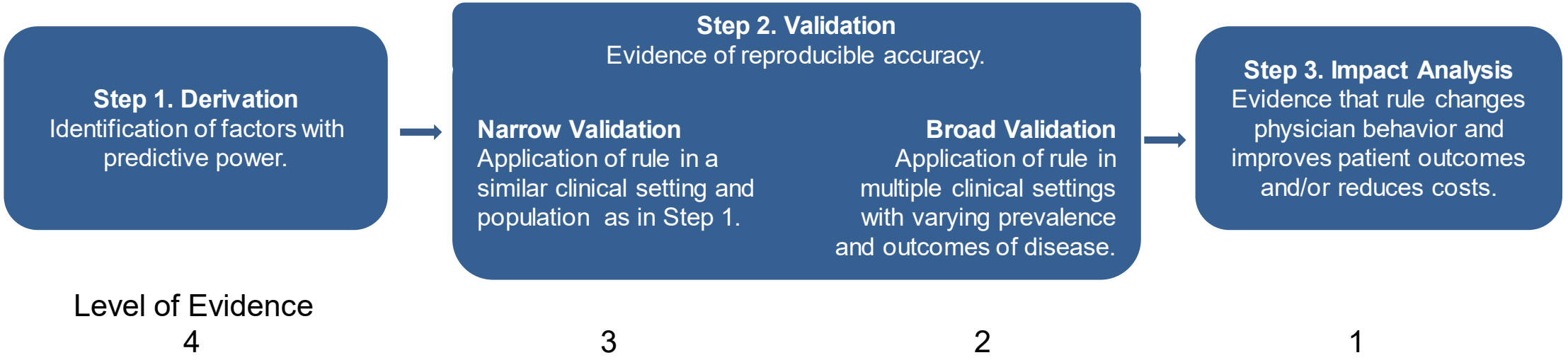
Usability Outcomes – Usability Lab

Usability Outcome	Testing Round(s)	Data Source	Measure
User success rate	Think Aloud, Near Live, Live	Visual recording of tool use	% of times users successfully completed discrete tasks
User error rate	Think Aloud, Near Live, Live	Visual recording of tool use	% of times users failed to complete discrete tasks
Time on task	Think Aloud, Near Live, Live	Visual recording of tool use	Amount of time users required to complete discrete tasks
Overall usability	Think Aloud, Near Live, Live	Survey	Validated System Usability Scale (SUS) survey to measure overall system usability
Design feedback	Think Aloud	Transcripts	Coded into discrete categories to capture feedback related to tool Usability, Visibility, Workflow, Content, Understandability, Usefulness, and Navigation

Informatics Architecture for VTE Prophylaxis



Derivation and Validation of a Clinical Prediction Rule



McGinn TG et al JAMA 2000; 284(1):79-84

An Ideal RAM for DVT Prophylaxis in Medical Inpatients

- Enable clinicians to accurately identify patients who meet a threshold risk of developing a DVT in the absence of prophylaxis.
- Predict correct risk level (disease-specific and predisposing risk factors) allowing more tailored thromboprophylactic strategies.
- Reliably exclude patients without a beneficial risk:benefit ratio.
- Evidence-based and validated.
- Methodologically transparent.
- Simple to use in clinical practice.

Spyropoulos AC Curr Opi Pulm Med 2010; 16:419-425

External Validation of VTE RAMs in Medically Ill

Derivation Population	N	Threshold Score	Symptomatic VTE (~90d)*	Percent Population at Risk	AUC or c-statistic	NPV
Padua VTE	1180	4	7.5%	40%		–
IMPROVE	15,125	2	2.0%	31%	0.69	–
Validation Population						
Padua (Geneva)	1478	4	3.5%	31%	-	98.9%
IMPROVE (VALOUR)	20,321	2	4.24%	37%	0.77	99.5%
IMPROVE (NSLIJ)	19,217	3	1.29%	32%	0.70	99.0%
Padua (Michigan)	63,548	4	2.97%	16%	0.60	-
IMPROVE 4 (Michigan)	63,548	2	3.39%	11%	0.57	-

Spyropoulos AC, et al. Chest. 201;140(3):706-714. Barbar S, et al. J Thromb Haemost. 2010;8:2450-7. Mahan CE, et al. Thromb Haemost. 2014;112(4):692-9. Greene MT, et al. Am J Med. 2016;129(9):1001.e9-1001.e18. Nendaz M, et al. Thromb Haemost. 2014;111(3):531-8. Rosenberg D, et al. J Am Heart Assoc. 2014;3(6):e001152.

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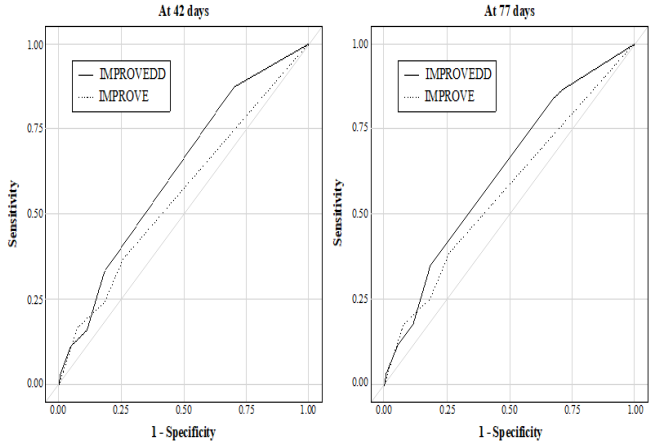
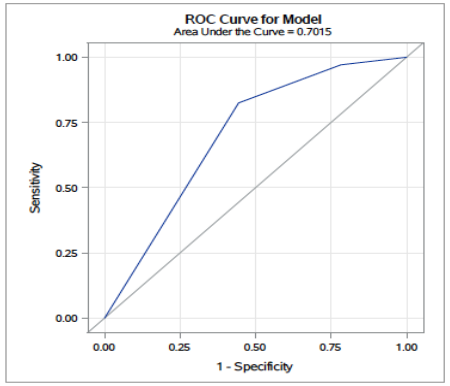
Validation Population						
Padua (Michigan)	63,548	4	2.97%	16%	0.60	-
IMPROVE 4 (Michigan)	63,548	2	3.39%	11%	0.57	-

Clinical VTE RAMs suggest that we are over-prophylaxing about 50 – 65% of low VTE risk medical patients and likely under-prophylaxing ~10% - 25% of high VTE risk medical patients.

Spyropoulos AC, et al. Chest. 201;140(3):706-714. Barbar S, et al. J Thromb Haemost. 2010;8:2450-7. Mahan CE, et al. Thromb Haemost. 2014;112(4):692-9. Greene MT, et al. Am J Med. 2016;129(9):1001.e9-1001.e18. Nendaz M, et al. Thromb Haemost. 2014;111(3):531-8. Rosenberg D, et al. J Am Heart Assoc. 2014;3(6):e001152.

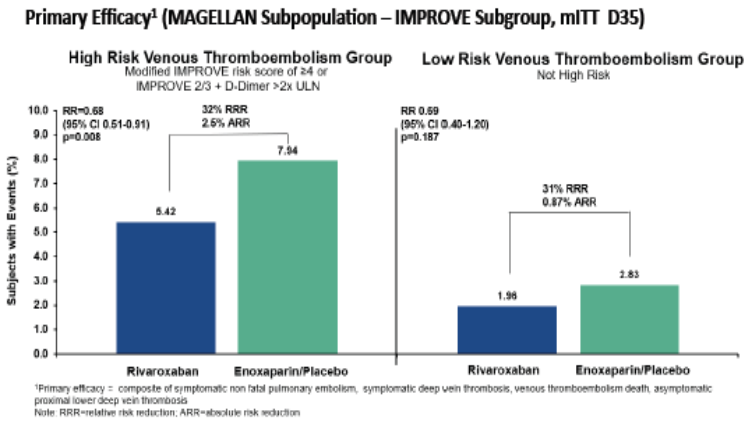
IMPROVE-DD VTE Score – Derivation and Validation





Incorporation of D-dimer into the IMPROVE score improved VTE risk discrimination (ΔAUC 0.06 [95% CI 0.02 – 0.09], P = 0.0006)

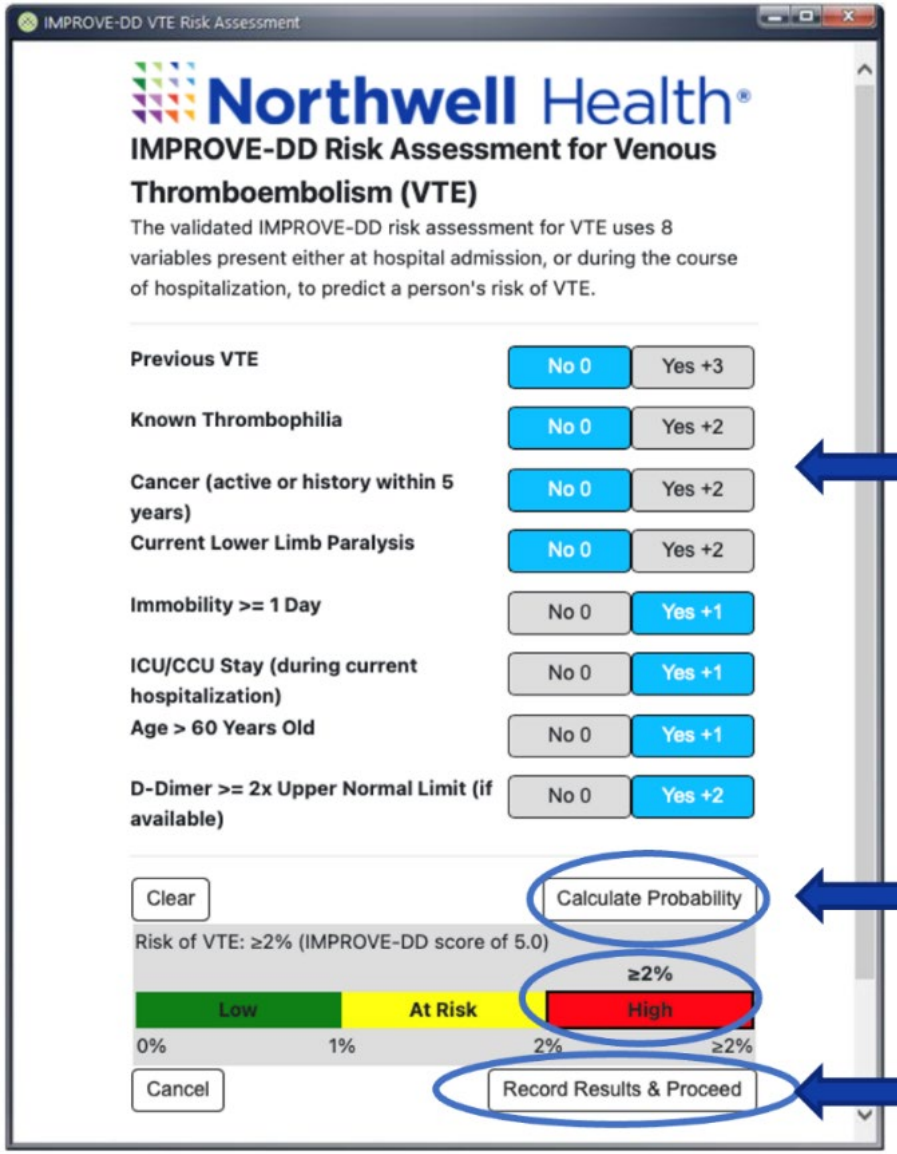
Table of IMPROVE_DD by vte			
	vte		
IMPROVE_DD	No	Yes	Total
0-1, Low Risk	1988 99.60	8 0.40	1996
2-3, Moderate Risk	3093 98.72	40 1.28	3133
4-12, High Risk	4052 94.72	226 5.28	4278
Total	9133	274	9407



Factor	Points
Previous VTE	3
Known thrombophilia	2
Current lower-limb paralysis	2
Current cancer	2
Immobilized ≥ 7 days	1
ICU or CCU stay	1
Age > 60 years	1
D-dimer ≥ 2 × ULN	2

Gibson M et al 2017 TH Open 2017
Spyropoulos AC et al Res Pract Thromb Haemost 2021
Spyropoulos AC et al TH Open 2020

Front-End IMPROVE-DD VTE RAM CDS Tool



When the IMPROVE-DD tool launches, the answers to the yes/no risk factors are pre-populated based on existing patient-specific data in the EHR.

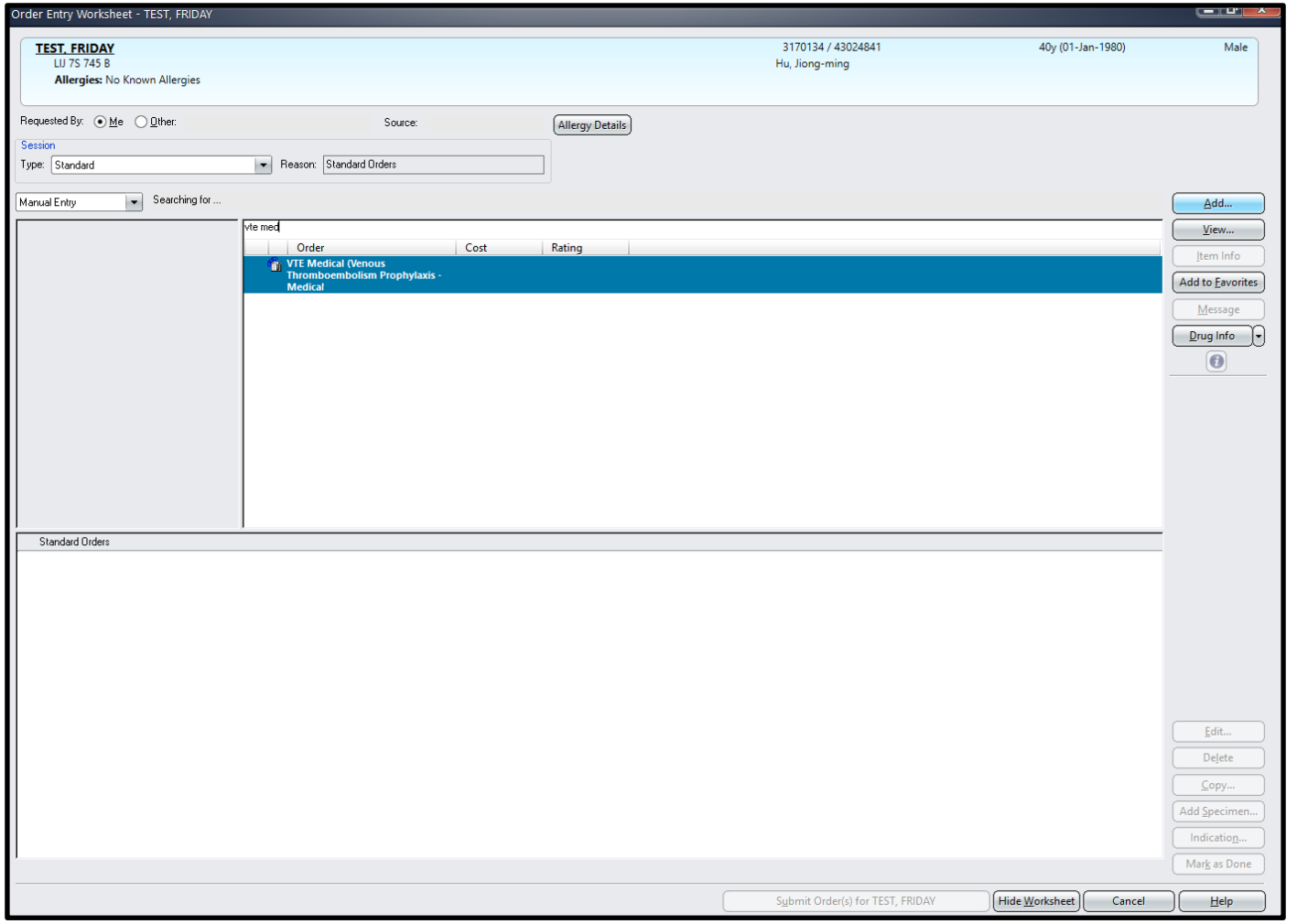
The user is able to manually adjust the individual risk factors as needed.

When the user clicks “Calculate Probability”, the IMPROVE-DD score and 3-month VTE risk percentage are displayed.

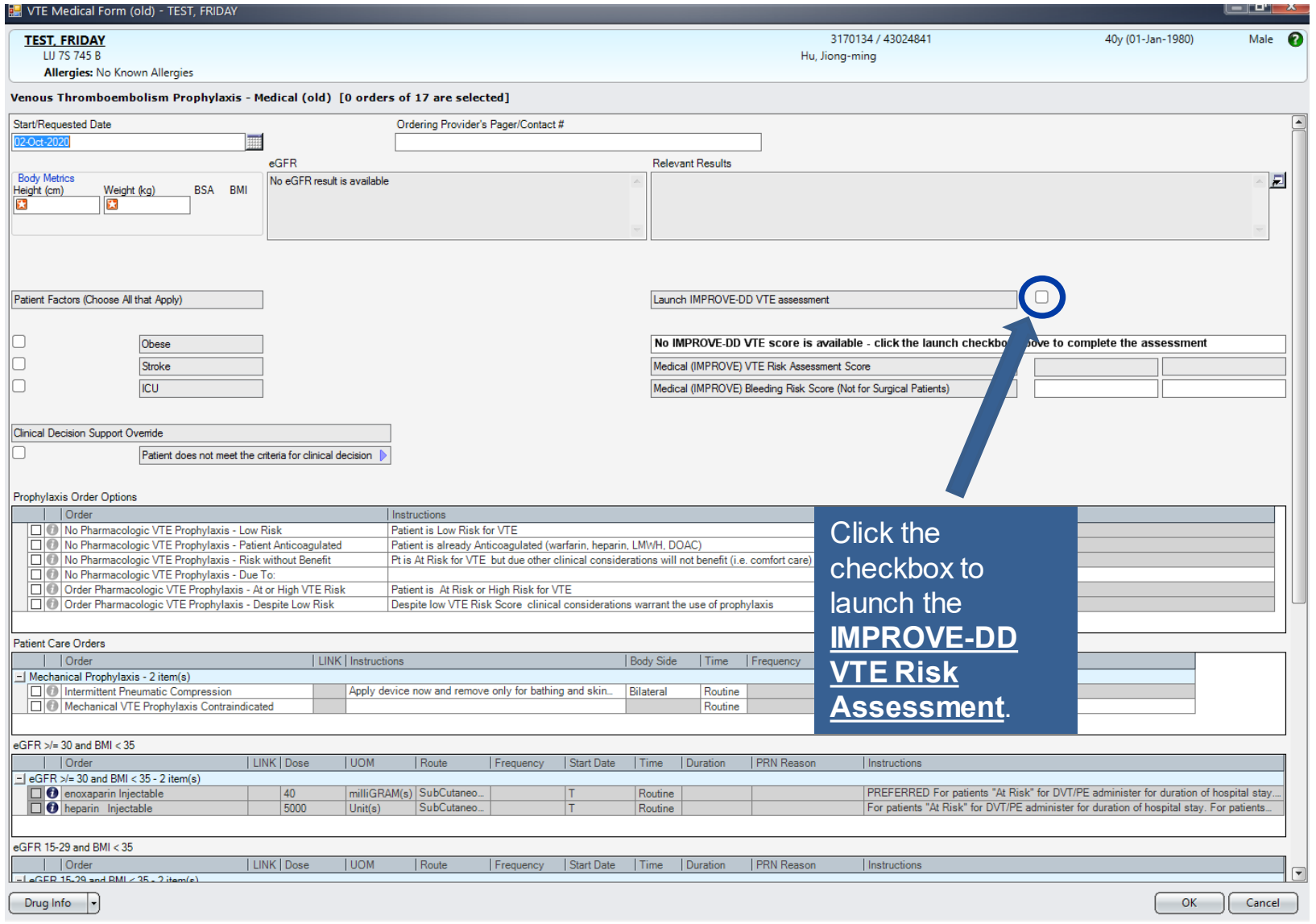
When the user clicks “Record Results & Proceed”, the tool closes, the IMPROVE-DD score is written to the EHR, and an appropriate prophylaxis recommendation is displayed in the EHR.

IMPROVE-DD VTE CDS Workflow #1: VTE Prophylaxis Order Set

Open the VTE Prophylaxis (Medical) order set.

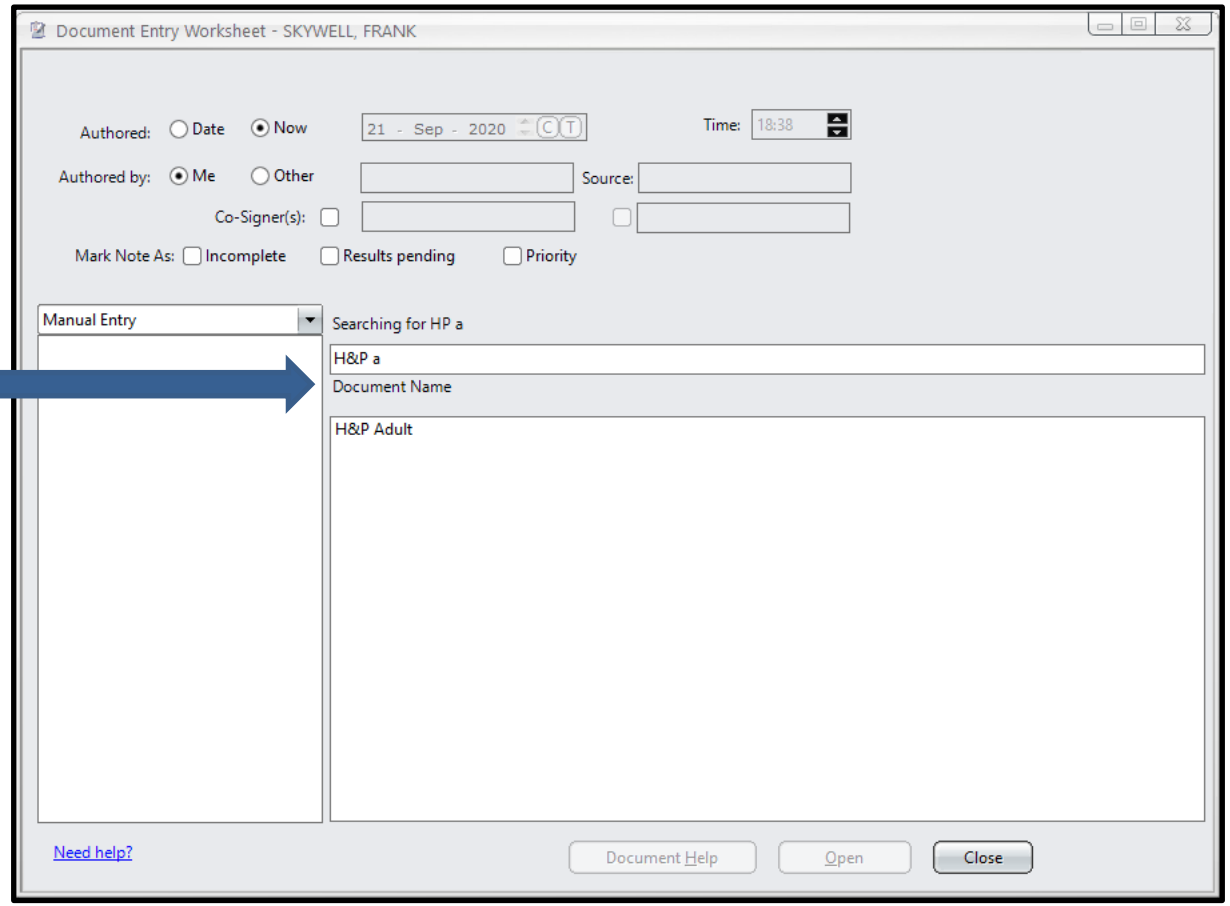


IMPROVE-DD VTE CDS Workflow #1: VTE Prophylaxis Order Set (Cont'd)



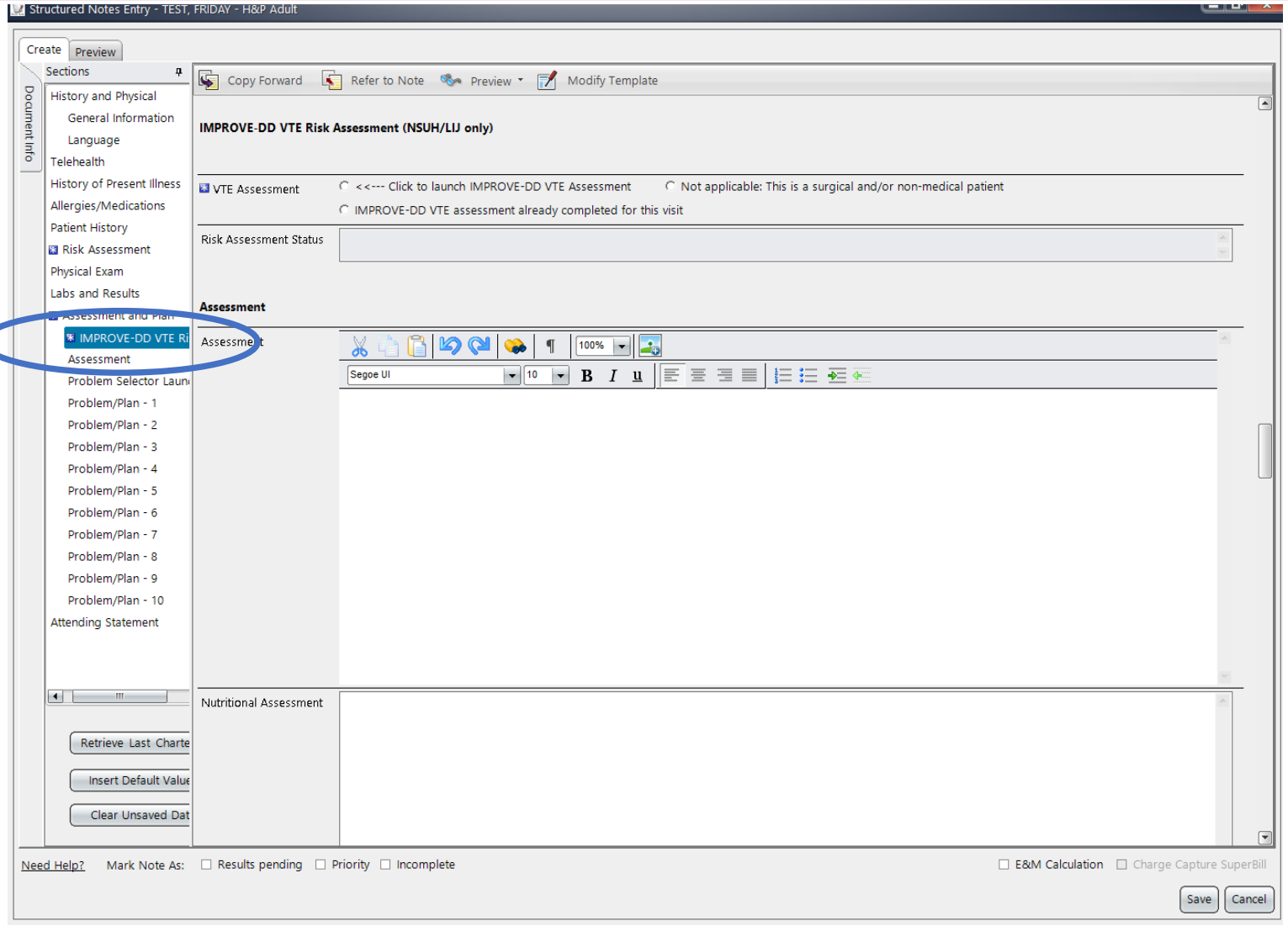
IMPROVE-DD VTE CDS Workflow #2 – History and Physical

Search for and create a new **H&P Adult** note.



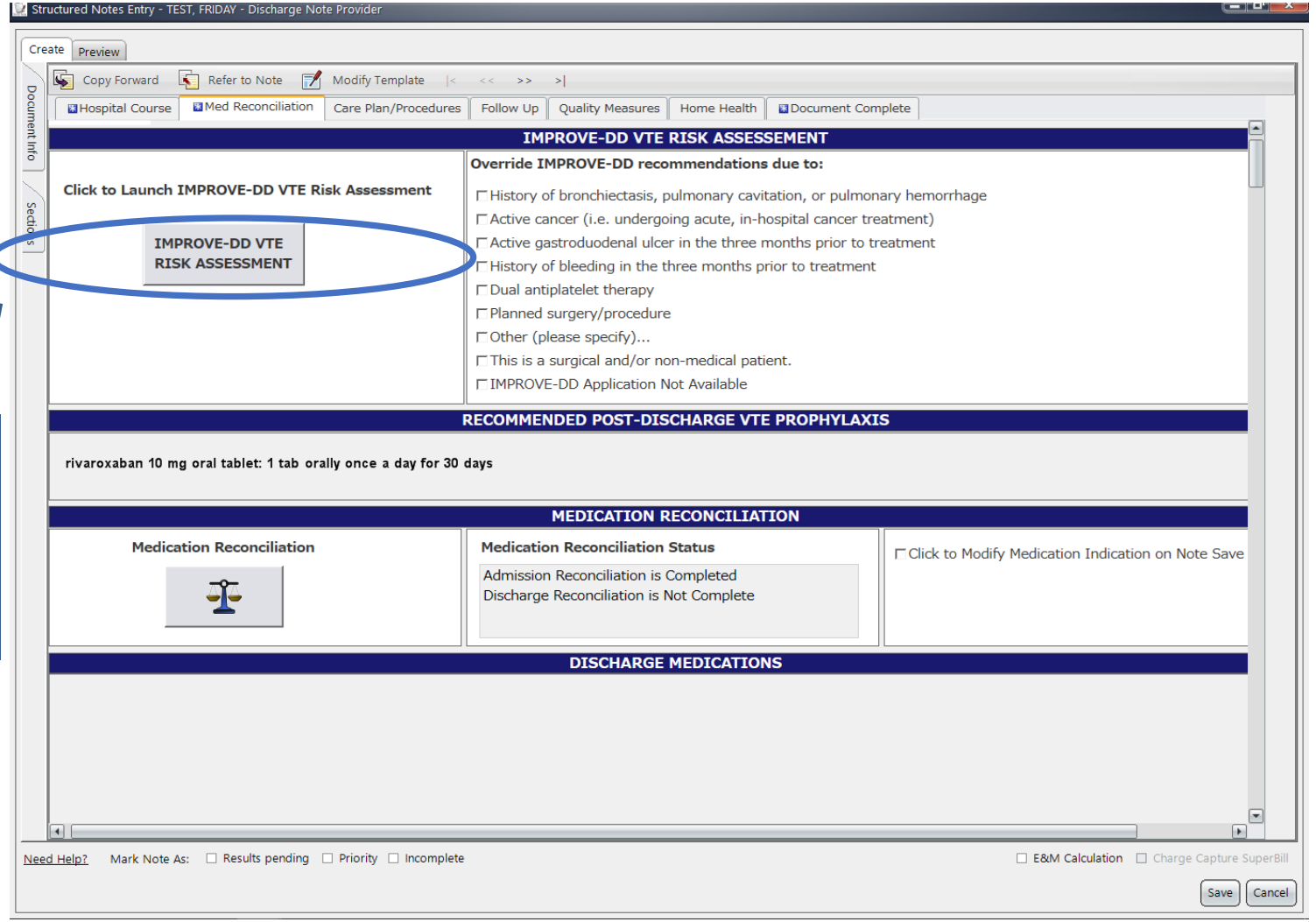
IMPROVE-DD VTE CDS Workflow #2– History and Physical (Cont'd)

In the History & Physical window, select **IMPROVE-DD VTE Risk Assessment** from the Create tab.



IMPROVE-DD VTE CDS Workflow #3 - Discharge

Based on the IMPROVE-DD score, you will see post-discharge VTE prophylaxis



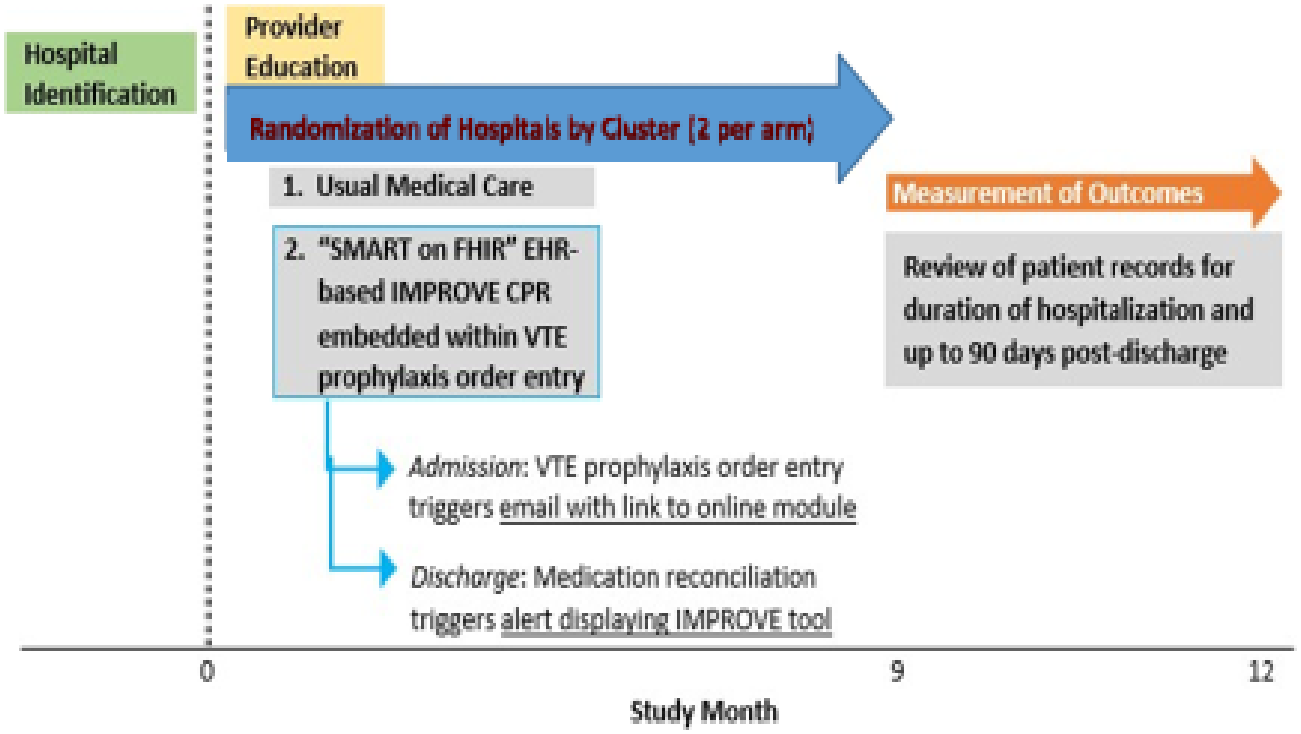
#AHA22

Universal Electronic Health Record Clinical Decision Support for Prevention of Thromboembolism in Hospitalized Medically-Ill Patients: The IMPROVE-DD VTE Cluster Randomized Trial

Alex C. Spyropoulos, M.D.; Mark Goldin, M.D.; Ioannis Koulas, M.D., M.Sc.; Jeffrey Solomon, B.F.A.; Michael Qiu, M.D., Ph.D.; Sam Ngu, M.D.; Kolton Smith, D.O.; Tungming Leung, Ph.D.; Kanta Ochani, M.B.B.S.; Fatima Malik, M.H.A.; Stuart L. Cohen, M.D., M.P.H.; Dimitrios Giannis, M.D., M.Sc.; Sundas Khan, M.D.; Thomas McGinn, M.D.

American Heart Association.

Clustered Randomized Trial at Level of Hospital (4 Academic Tertiary Hospitals)



Primary Endpoint:

- Rate of thromboprophyaxis
- Score 2-3: UFH/LMWH
- Score ≥4 rivaroxaban 30d

Secondary Endpoints:

- Major thromboembolism at 30 days
- Major Bleeding at 30 days

December 21, 2020 to January 21, 2022
N= 10,699 medical inpatients (including ~23% COVID-19)

Spyropoulos AC et al AHA Oral Session LBCT Nov 5-7, 2022

Primary Outcomes

CDS Tool Adoption Rate: 77.8%

Outcome	Intervention Group (N=5249)	Control Group (N= 5450)	Odds Ratio (95% CI)	P-Value
	No of patients/total no (%)			
Appropriate in-hospital thromboprophylaxis	4203/5249 (80.1%)	3951/5450 (72.5%)	1.52 (95% CI, 1.39 - 1.67)	p<0.001
Appropriate at-discharge extended thromboprophylaxis	331/2433 (13.6%)	195/2588 (7.5%)	1.93 (95% CI, 1.60 - 2.33)	p<0.001

Spyropoulos AC et al LBCT AHA Oral Session Nov 5-7, 2022

Secondary Outcomes

Secondary outcomes	Intervention Group	Control Group	Odds ratio (95% CI)	P-value
VTE	141/5249 (2.7%)	182/5450 (3.3%)	0.80 (95% CI, 0.64 – 1.00)	p=0.048
ATE	13/5249 (0.25%)	38/5450 (0.70%)	0.35 (95% CI: 0.19 - 0.67)	p<0.001
Total TE**	152/5249 (2.9%)	219/5450 (4.0%)	0.71 (95% CI, 0.58 - 0.88)	p=0.002
Major Bleeding	8/5249 (0.15%)	12/5450 (0.22%)	0.69 (95% CI, 0.28 – 1.69)	p=0.42
All-cause mortality	478/5249 (9.1%)	383/5450 (7.0%)	1.32 (95% CI, 1.15 -1.53)	p<0.001

Spyropoulos AC et al LBCT AHA Oral Session Nov 5-7, 2022

Evidence Point EHR-agnostic CDS platform: IMPROVE-DD VTE CPR - Research Impact

Our study has major health system implications, as it has shown that a novel universal platform-agnostic tool for clinical decision support for VTE risk assessment integrated into clinician workflow demonstrated effectiveness in increasing adoption of evidence-based best practice (77.8%)

AND

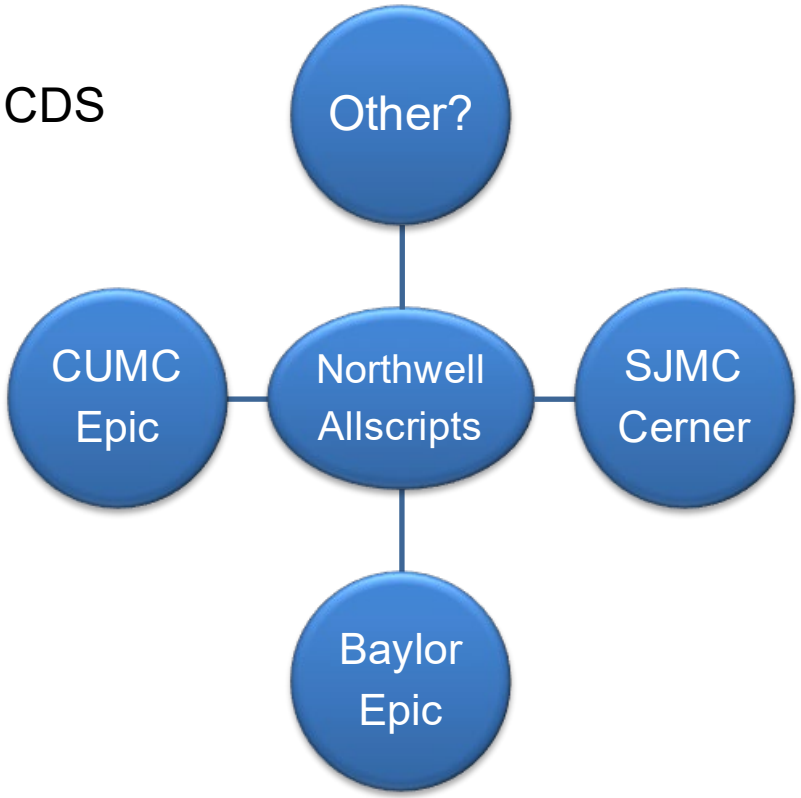
significantly **increased appropriate thromboprophylaxis <u>and</u>** significantly **reduced hard outcomes** – namely venous and arterial thromboembolism – in hospitalized medical patients.

Future Directions

Dissemination and Implementation Research in Health (R01 Clinical Trial Optional) (nih.gov) (PAR-22-105)

Widespread implementation of the IMPROVE-DD VTE CDS on the Evidence Point EHR-agnostic Platform

1. CDS tool refinement and usability testing
2. Evaluate usability and implementation of CDS tool
3. Evaluate use of evidence-based thromboprophylaxis
4. Develop shareable CDS artifacts



Acknowledgements

- Department of Medicine – Northwell Health
  - Tom McGinn, M.D. (project co-PI) now Department of Medicine, Baylor College of Medicine
  - Mark Goldin, M.D.
  - Ioannis Koulas, M.D.
  - Michael Qiu, M.D.
  - Sam Ngu, M.D.
  - Kolton Smith, M.D.
- Institute of Health Systems Science – Feinstein Institutes for Medical Research
  - Jeff Solomon, B.F.A.
  - Sundas Khan, M.D. now Department of Medicine, Baylor College of Medicine
  - Fatima Malik, M.H.A.
- Biostatistics Unit Office of Academic Affairs – Northwell Health
  - Marty Lesser, Ph.D.
  - TungMing Leung, Ph.D.

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AGENCY FOR HEALTHCARE RESEARCH AND QUALITY

AHRQ

Improving Lung Cancer Screening Through an EHR-Integrated Everyday Shared Decision Making Tool and Clinician-Facing Prompts

Kensaku Kawamoto, M.D., Ph.D., M.H.S., F.A.C.M.I., F.A.M.I.A.
Professor of Biomedical Informatics,
Associate Chief Medical Information Officer,
Director, ReImagine EHR Initiative,
Co-Senior Director, Digital Health Initiative
University of Utah

Everyday Shared Decision Making Tool Research Impact

An EHR-integrated Everyday shared decision making tool and clinician-facing prompts can significantly improve screening for lung cancer, the leading cause of cancer deaths in the United States and around the world.

Disclosures

- Outside of this work, I report honoraria, consulting, sponsored research, writing assistance, licensing, or co-development with a number of organizations.
- I have no conflicts with direct relevance to this work.
- The Everyday shared decision making tool described in this presentation (Decision Precision+) is available for free.
- This work was made possible by AHRQ R18HS026198.

Key Clinical Need: Improved Lung Cancer Screening

- Lung cancer: #1 cause of cancer deaths in United States for both men and women (~1 in 5 of all cancer deaths; ~127,000 in 2023).[1]
- By catching lung cancer early at a more treatable stage, lung cancer screening (LCS) with annual low-dose CT scans can reduce lung cancer deaths by ~20%.[2,3]
- The US Preventive Services Task Force (USPSTF) has recommended offering screening to high-risk patients (older patients with a history of heavy smoking) since 2013.[4,5]
  - 2013: 55-80, 30+ pack-years; 2021: 50-80, 20+ pack-years; current tobacco user or quit for less than 15 years.
- The vast majority of eligible patients in the United States are not screened.
  - 2020: 6.5% screening rate nationwide; < 2% in Utah.[6]

1. https://www.cancer.org/cancer/types/lung-cancer/about/key-statistics.html
2. Aberle DR et al. *N Engl J Med.* 2011;365(5):395-409.
3. De Koning HJ et al. *N Engl J Med*. 2020;382(6):503-513.
4. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening-december-2013
5. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening
6. Fedewa SA et al. *Chest*. 2022;161(2):586-589.

Provider Barriers to Screening[1]

- Lack of familiarity with eligibility criteria and insurance coverage.
- Difficulty identifying eligible patients.
- Need for guidance on management of screening results.
- Skepticism about benefits of screening.
- Insufficient time or knowledge to conduct shared decision making (SDM).
  - Important due to potential downsides (e.g., biopsy complications) and wide individual variation in expected benefit (e.g., reduction in lung cancer deaths was ~60x higher in patients at the highest vs. lowest quintile of risk in the National Lung Screening Trial[2]).
  - Recommended by clinical guidelines.[3,4]
  - Required by CMS prior to initiating screening; includes need to use a decision aid.[5]

1. Wang GX et al. *Radiology.* 2019;290(2):278-287.
2. Kovalchik SA et al. *N Engl J Med.* 2013;369(3):245-254.
3. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening
4. https://info.chestnet.org/screening-for-lung-cancer-chest-guideline-and-expert-panel-report
5. https://www.cms.gov/medicare-coverage-database/view/ncacal-decision-memo.aspx?proposed=N&ncaid=304

Project Objective

- Design, develop, and evaluate a widely scalable approach to enabling LCS that addresses key barriers to screening.

Intervention Goals

- Integrate with routine primary care workflows.
  - Routine counseling in primary care has been central to the wide adoption of other USPSTF-recommended cancer screening procedures (e.g., for breast, cervical, and colorectal cancer).
- Make it easy for providers to identify patients who are eligible for LCS.
- Make it easy and fast for providers to conduct SDM.
  - Support an Everyday SDM model that can be completed within 1-2 minutes, while supporting Full SDM when the time is available.[1,2]
- Use an approach that can be widely scaled.

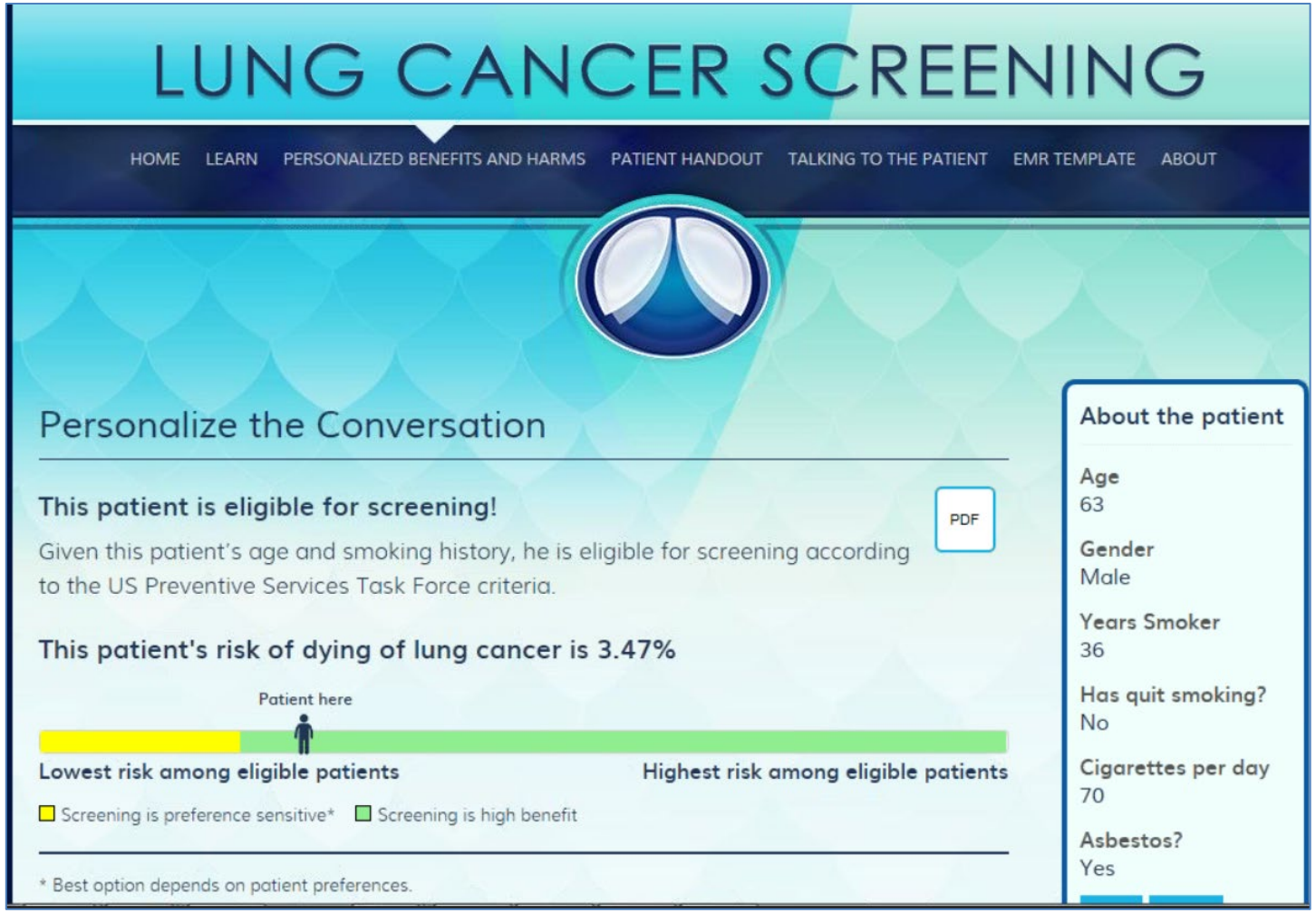
1. Caverly TJ et al. *J Gen Intern Med*. 2020;35(10):3045-3049.
2. Caverly TJ et al. *MDM Policy Pract*. 2021;6(2):23814683211055120.

Everyday vs Full SDM

Key characteristics	Everyday SDM	Full SDM
Time for initial presentation	< 30 seconds	3-5 minutes or more
Clinician recommendation	Highly tailored recommendation, provided as part of initial presentation.	The clinician either refrains from giving a recommendation, offers it if requested by the patient, or provides it only after presenting neutral information and clarifying values.
Supporting patient autonomy	Respectful guidance is offered by the clinician while supporting the patient's right to decline initial recommendations.	The clinician shows respect for the patient by providing complete information and maintaining neutrality.
Patient's values and preferences clarification	The consideration of values and preferences can be either implicit or explicit, as per the patient's direction.	The aim is to consider values and preferences explicitly.

Adapted from Caverly TJ et al. *MDM Policy Pract*. 2021;6(2):23814683211055120.

Key Starting Resource: Decision Precision



Web-based LCS SDM tool developed with VA funding by Drs. Tanner Caverly and Angie Fagerlin at Univ. of Michigan and Ann Arbor VA

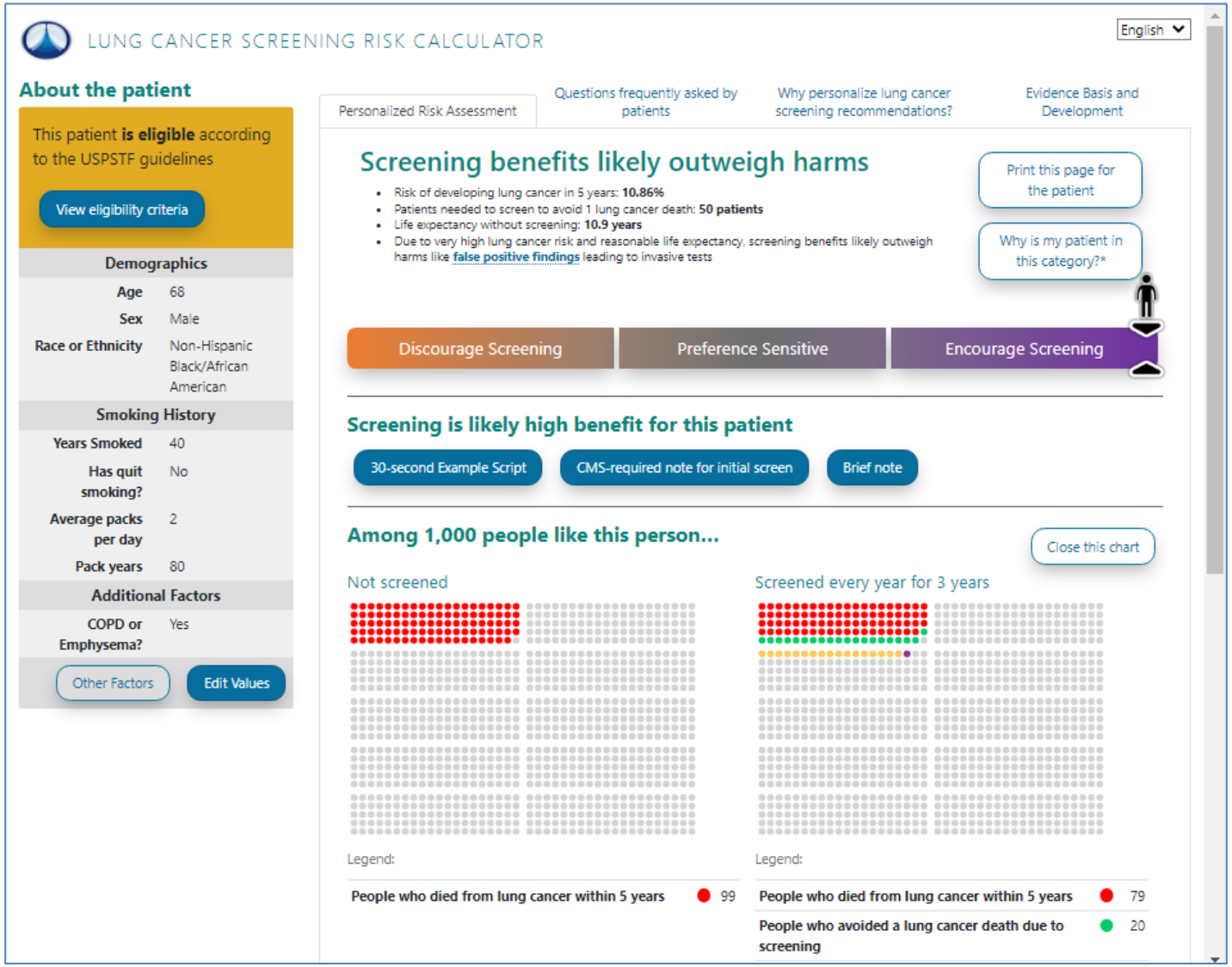
Originally designed to support Full SDM

Worked well when used by full-time LCS coordinators in the context of dedicated LCS SDM sessions at the VA[1]

Too time-consuming to use routinely in primary care settings

1. Lowery J et al. *JMIR Hum Factors*. 2022;9(2):e32399.

Enhancement of Decision Precision to Support Everyday SDM



- Only elements needed for Everyday SDM kept on main Web page
- Content relevant to Full SDM moved to supplemental tabs
- Replete with numerous time-saving features
- Available for free at https://screenlc.com
- Incorporated in the Foundation (default recommended) LCS module of Epic electronic health record (EHR) system

Decision Precision+: EHR Integration with SMART on FHIR

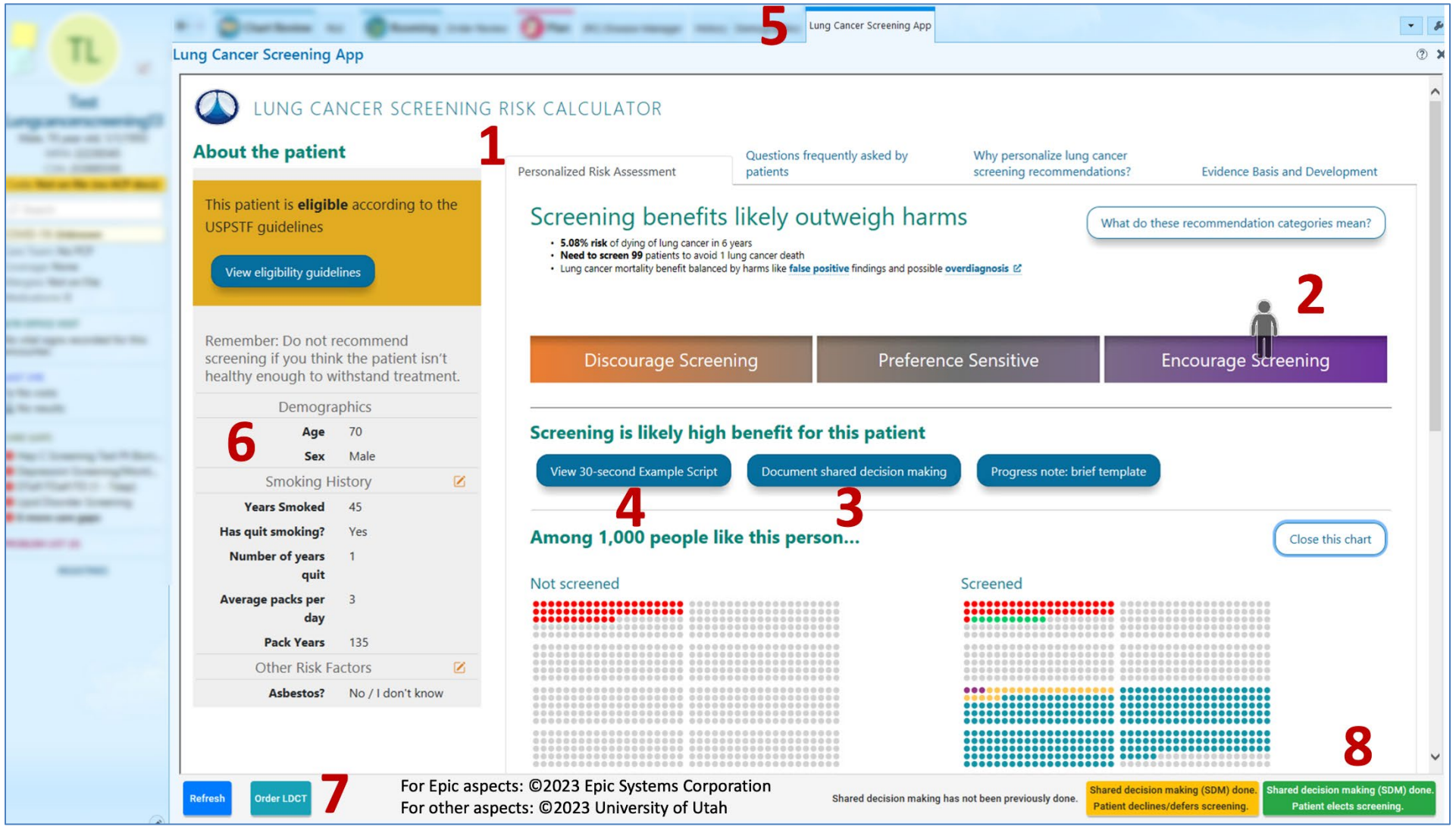


Figure 3 from Kukhareva PV et al. *Chest*. 2023 May 2;S0012-3692(23)00641-4. doi: 10.1016/j.chest.2023.04.040.

EHR Prompts for LCS and LCS Discussion

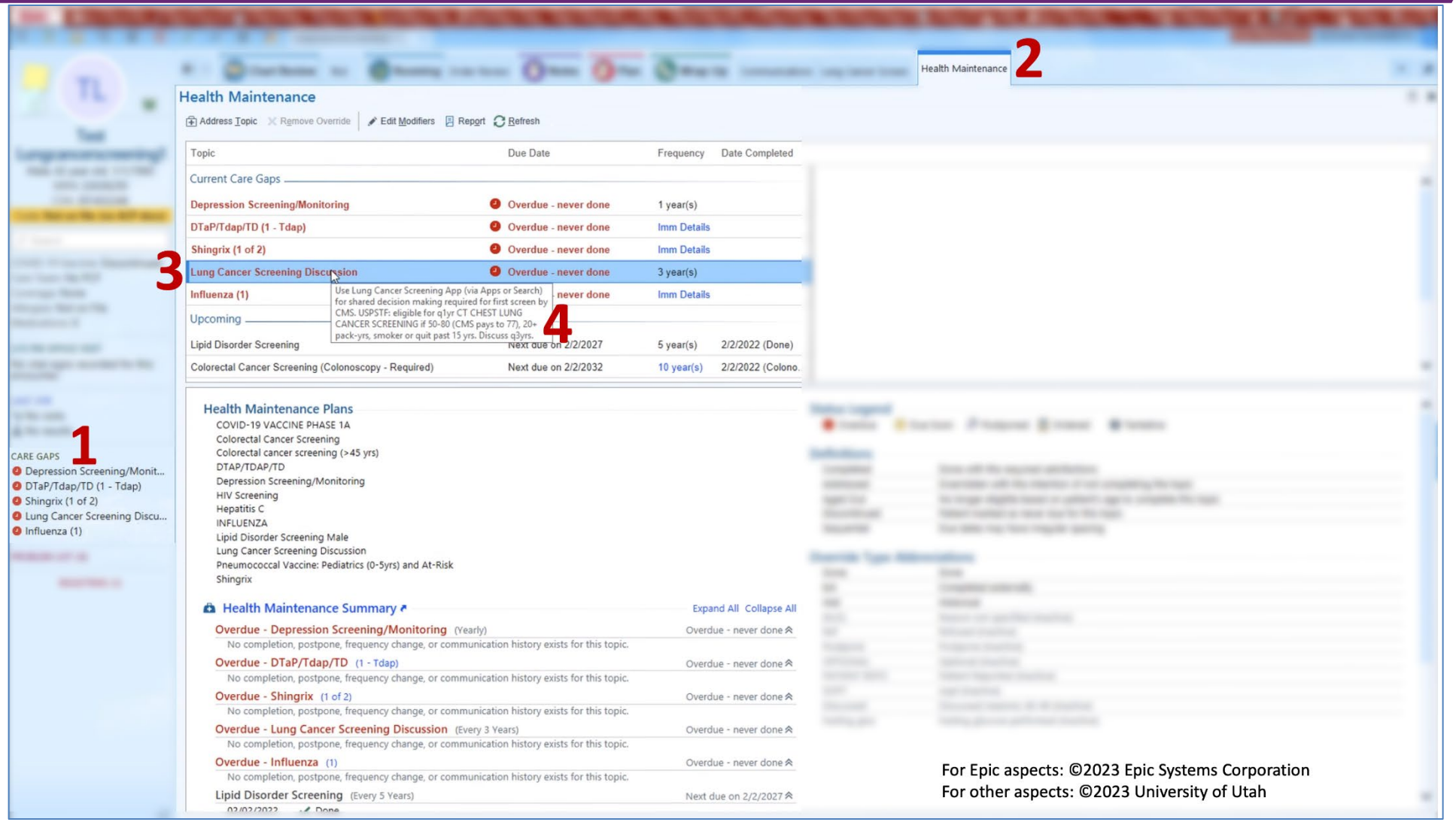


Figure 1 from Kukhareva PV et al. *Chest*. 2023 May 2;S0012-3692(23)00641-4. doi: 10.1016/j.chest.2023.04.040.

EHR Prompts on Need to Conduct SDM Prior to Initiating Screening

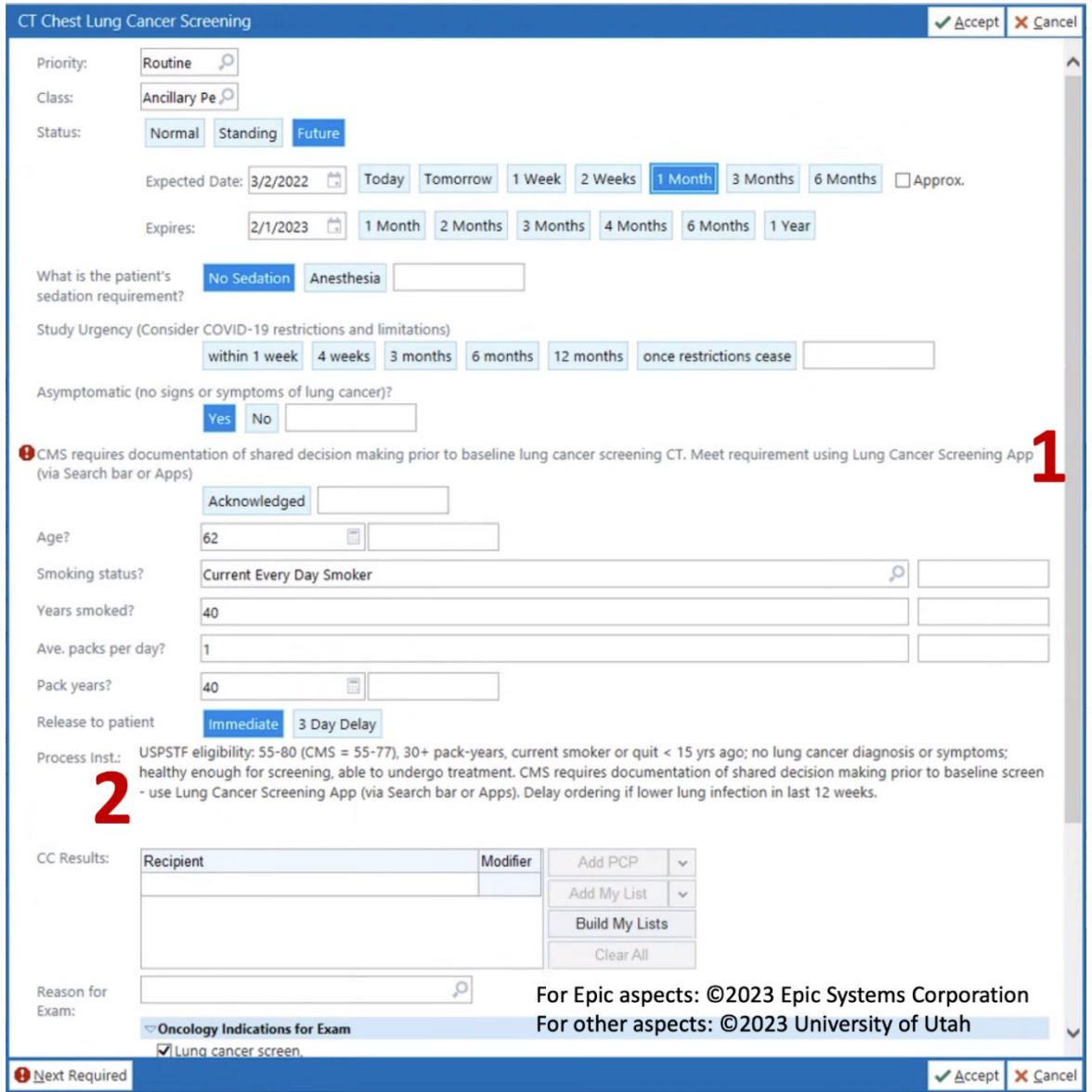


Figure 2 from Kukhareva PV et al. *Chest*. 2023 May 2;S0012-3692(23)00641-4. doi: 10.1016/j.chest.2023.04.040.

Other EHR Prompting Options

- Alerts and reminders with direct link to launch SDM tool (e.g., Epic BestPractice Advisories).
  - Can be tailored to only fire, or fire differentially, for highest risk patients.

- Direct link to launch app from within care gap closure workflows.
  - e.g., Epic Close Care Gaps order sets.

Pragmatic Clinical Trial

- Setting:
  - 30 primary care & 4 pulmonary clinics at Univ. of Utah Health (UHealth).
- Intervention:
  - EHR prompts and EHR-integrated Everyday SDM tool.
- Design:
  - Pre-post intervention analysis with 12-month pre-intervention phase (8/24/19 – 8/23/20) and 9-month intervention phase (8/24/20 – 5/23/21).
  - Conducted under IRB-approved waiver of consent.
- Statistical Methods:
  - Population: primary care patients meeting 2013 USPSTF criteria with no chest CT in past year who had not declined screening in last 3 years.
  - Primary outcomes: LCS ordering, completion, and follow-through.
  - Logistic regression with mixed-effect models and covariate adjustment.
  - Subgroup analyses for expected benefit from screening, pulmonologist involvement, sex, and race and ethnicity.

Results

- 1,435 patients included
- Low-dose CT ordering: 7.1% → 27.3% (adjusted OR 4.9, p < .001)
- Low-dose CT completion: 4.4% → 17.7% (adjusted OR 4.7, p < .001)
- No change in order follow-through rate
- Subgroup analyses
  - Low-dose CT ordering and completion higher in high-benefit patients (esitmated ≥ 16.2 days of life gained from undergoing 3 rounds of screening) vs. intermediate-benefit patients, but interaction effect not significant (p = .086).
  - Patients only seen in primary care (i.e., not by a pulmonoligst) were screened at substantially lower rates in the pre-intervention phase (6.3% vs. 15.6%).
  - Patients only seen in primary care were screened at similar rates in the intervention phase (27.1% vs. 29.7%).
  - Improvements seen across demographic subgroups (sex and race/ethnicity).
    - e.g., low-dose CT ordering for Non-Hispanic Black patients: 5.9% → 29.4%
- SDM tool used prior to low-dose CT ordering for 25.2% of patients.
  - 27.3% for high-benefit patients, 20.7% for intermediate-benefit patients

LCS Ordering and Completion Stratified by Screening Benefit Level

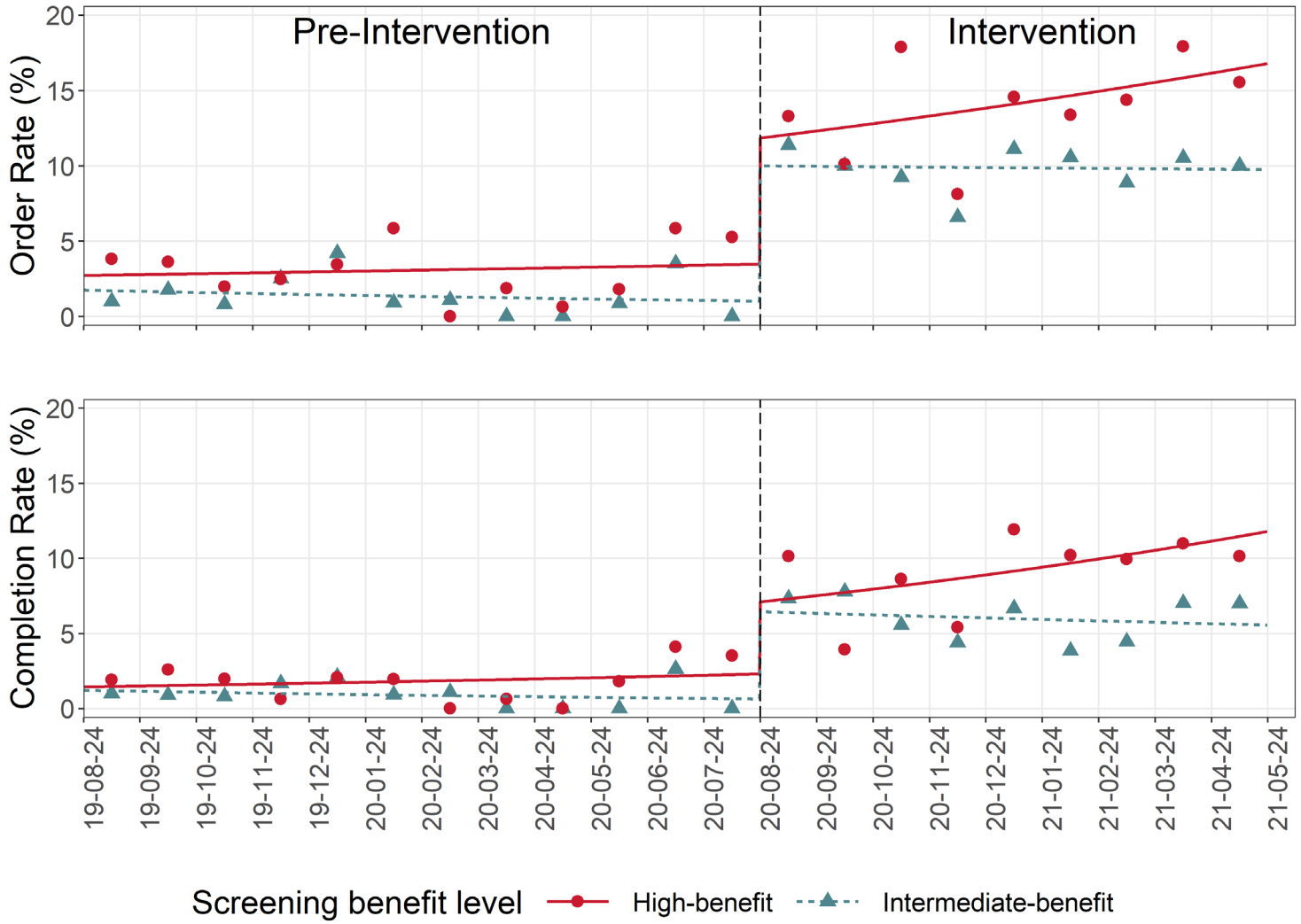


Figure 4 from Kukhareva PV et al. *Chest*. 2023 May 2;S0012-3692(23)00641-4. doi: 10.1016/j.chest.2023.04.040.

Summary

- Introduction of an EHR-integrated Everyday SDM tool and provider prompts was associated with significantly increased LCS ordering and completion at a single health system (adjusted OR of ~5).
- SDM tool use was ~25% prior to initiating screening.
  - Despite multiple prompts in the EHR to use the SDM tool.
  - Sub-optimal, but still higher than many previously reported SDM and SDM tool use rates in primary care settings.
  - Even a few minutes may be too much to add to busy primary care workflows for patients with many conditions requiring attention.
  - More stringent approaches to requiring use of the SDM tool was considered (e.g., a “hard stop” to ordering if tool was not used), but ultimately not implemented due to concern of appropriate patients not being screened due to the added burden.

Current Research Focus

- Enabled by AHRQ R18HS028791.
- Evaluation of replicable approach to real-world dissemination and implementation of interoperable decision support tools.
  - Decision Precision+ available for free for integration with any EHR.
  - Multiple implementations underway; free integration support provided.
  - Please contact us at ReImagineEHR@utah.edu if interested.
- Design, development, & evaluation of interventions to directly engage patients & overcome persistent barriers to LCS.
  - MyLungHealth: free, patient-facing SMART on FHIR tool integrated with the personal health record to educate and activate patients.
  - Engagement of patients via patient portal to address missing, stale, and inaccurate smoking history in the EHR.[1]
  - Evaluation via patient-randomized trial at UHealth and NYU.
  - Will also be shared for free following validation.

1. Kukhareva PV et al. *J Am Med Inform Assoc.* 2022 Apr 13;29(5):779-788.

For More Information…

- Decision Precision: https://screenlc.com
- Decision Precision+: ReImagineEHR@utah.edu
- Clinical Trial:

Kukhareva PV et al. Implementation of lung cancer screening in primary care and pulmonary clinics: pragmatic clinical trial of electronic health record-integrated Everyday shared decision making tool and clinician-facing prompts. *Chest*. 2023 May 2:S0012-3692(23)00641-4. doi:

- ReImagine EHR initiative:

Kawamoto K et al. Establishing a multidisciplinary initiative for interoperable electronic health record innovations at an academic medical center. *JAMIA Open*. 2021 Jul 31;4(3):ooab041. doi: 10.1093/jamiaopen/ooab041.

Acknowledgments

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- AHRQ R18HS028791 (PO: Dr. Mario Terán)
- Key collaborators

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