



Epic Safety Net User Group (eSNUG) Predictive Models

Tuesday, February 18, 2020
1-2pm

[Recording Link](#)

Agenda

Time	Topic	Lead(s)
5 min	Welcome, Logistics & Introductions	Kristina Mody
35 min	Santa Clara Presentation: Predictive Models	Phil Strong, MD CMIO, County of Santa Clara Health System
15 min	Peer Discussion	All
5 min	Wrap-up & Announcements <ul style="list-style-type: none">• Upcoming SNI events• Post Event Survey	Kristina

Logistics



Please mute yourself! (We'll have to mute lines if there is background noise)



Please feel free to chime in for questions, and especially for the discussion



At any time, feel free to chat your question & we will read out



Webinar will be recorded and saved on [SNI Link/Data/EHR User Groups](#)



Please complete our pop-up survey

Intros



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Epic SNI Group (eSNUG): Predictive Models

Philip Strong MD

SCVMC CMIO

February 18, 2020

Poll



What predictive models are you using at your organization?

- Epic
- Homegrown
- Other

County of Santa Clara Health System

Safety Net with Independent Residency Programs | San Jose, CA

3 HOSPITALS

13 CLINICS

>1000 PHYSICIANS

1025 BEDS

>970K OUTPATIENT VISITS

>700K PATIENTS

Until **3/1/2019**, A One-Hospital Health System with 11 Clinic Facilities

- Then Acquired O'Connor Hospital, Saint Louise Regional Hospital and De Paul Urgent Care Center out of Bankruptcy
- Went Live with Epic at the new facilities **8/17/2019**



O'CONNOR HOSPITAL
A COMMUNITY HOSPITAL



**SANTA CLARA
VALLEY MEDICAL CENTER**
Hospital & Clinics



**ST. LOUISE
REGIONAL HOSPITAL**
A COMMUNITY HOSPITAL

Clinical Decision Support

- Your <federal> government at work:
- <https://www.healthit.gov/topic/safety/clinical-decision-support>

The screenshot shows the HealthIT.gov website. The header includes the HealthIT.gov logo, the text "Official Website of The Office of the National Coordinator for Health Information Technology (ONC)", and social media icons for LinkedIn, Twitter, and Facebook. A navigation menu contains "TOPICS", "HOW DO I?", "BLOG", "NEWS", and "ABOUT ONC". A search bar is located on the right. The breadcrumb trail reads: "Home > Topics > Clinical Quality and Safety > Health IT Safety > Clinical Decision Support". A sidebar on the left lists various topics under "Clinical Quality and Safety" and "Health IT Safety". The main content area is titled "Clinical Decision Support" and includes a sub-header "What is Clinical Decision Support (CDS)?". Below this is a paragraph explaining CDS. There are two callout boxes: "Clinical Decision Support Promotes Patient Safety" and "Why CDS?". The "Why CDS?" box contains a list of benefits and a paragraph about CDS. At the bottom of the page, there is a photograph of a healthcare professional examining a young child.

HealthIT.gov

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TOPICS | HOW DO I? | BLOG | NEWS | ABOUT ONC

Search

Home > Topics > Clinical Quality and Safety > Health IT Safety > Clinical Decision Support

For Individuals

Clinical Quality and Safety +

- Measure Results
- Prioritize Improvements
- Implement and Monitor Improvements
- eCQI Resource Center
- eCQM Issue Tracking

Health IT Safety -

- Clinical Decision Support**
- Implementing Health IT
- SAFER Guides
- Selecting or Upgrading Health IT
- Using Health IT
- Foundational EHR Safety Literature

Clinical Decision Support

What is Clinical Decision Support (CDS)?

Clinical decision support (CDS) provides clinicians, staff, patients or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care. CDS encompasses a variety of tools to enhance decision-making in the clinical workflow. These tools include computerized alerts and reminders to care providers and patients; clinical guidelines; condition-specific order sets; focused patient data reports and summaries; documentation templates; diagnostic support, and contextually relevant reference information, among other tools.

Clinical Decision Support Promotes Patient Safety

Clinical decision support (CDS) can significantly impact improvements in quality, safety, efficiency, and effectiveness of health care. The Office of the National Coordinator for Health IT (ONC) supports efforts to develop, adopt, implement, and evaluate the use of CDS to improve health care decision making.

We aim to help the health care industry create the technical infrastructure needed to allow health systems to share data with each other electronically to provide the most complete information possible into CDS systems. Complete records allow CDS systems to help with diagnoses and track for negative drug interactions by having a better view of a patient's whole health.

Why CDS?

CDS has a number of important benefits, including:

- Increased quality of care and enhanced health outcomes
- Avoidance of errors and adverse events
- Improved efficiency, cost-benefit, and provider and patient satisfaction

CDS is a sophisticated health IT component. It requires computable biomedical knowledge, person-specific data, and a reasoning or inferring mechanism that combines knowledge and data to generate and present helpful information to clinicians as care is being delivered. This information must be filtered, organized and presented in a way that supports the current workflow, allowing the user to make an informed decision quickly and take action. Different types of CDS may be ideal for different processes of care in different settings.

Health information technologies designed to improve clinical decision making are particularly attractive for their ability to address the growing information overload clinicians face, and to provide a platform for integrating evidence-based knowledge into care delivery. The majority of CDS applications operate as components of comprehensive EHR systems, although stand-alone CDS systems are also used.

Definitions

Clinical Decision Support (CDS): provides clinicians, staff, patients or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.

CDS Tool	Examples in HealthLink	Comments
computerized alerts and reminders	BPAs, Health Maintenance Reminders: New CURES BPA, "silent BPAs" (that appear in navigators) +/- preferred.	Too much of a good thing? TJC is now making sure we have programs that monitor and reduce alert fatigue
clinical guidelines	Some order sets maintain references to them. A good source for physicians – UpToDate	Each professional society publishes them; they sometimes appear as links in order sets/risk assessment tools. FYI: ... "guidelines.gov" shutdown in 2018.
condition-specific order sets	These are not often used in HL : there are 5 for stroke, including stroke admission orders sets, several other "add-ons" for specific circumstances	At VMC, "generic" order sets are MOST commonly used. After that: blood products. Yet stroke, AMI/UA, HF, etc. are important for us for value-based care.
focused patient data reports and summaries	Best example is: Synopsis but not frequently used. Patient summary reports are the best source (e.g Glucose Mgt)	Build for synopsis is difficult, so we haven't done much. Storyboard is going to force more of this on us.
documentation templates	Notewriter smartforms (e.g. bedside procedure documentation) vs. smarttext/smartphrase templates; RNs: doc flowsheets	Free text: easy to use/personalize; SmartForms: (at least some) discrete data capture. Doc flowsheets: wonderfully/terrible customizable – no hard stops(!)
diagnostic support	Most work for this is done for reporting: diagnosis groupers ; consider the "Care Gaps" score	Initial application areas for predictive models, machine learning (60s, 70s) ... difficult without a lot of successful outcomes
contextually relevant reference information	Automatic inclusion of patient instructions for particular patients based on diagnosis	In Epic, can leverage "CER rules" to automate these associations
predictive models	SCVMC Clinical Complexity to start	Designed as an extension to LACE+; predictor of readmission for adult patients

Description vs. Prediction

Description:

- Provides a summary of what has happened to date
- NEVER evaluated for predictive value
- So should NOT be used at such (without validation)
- Example: HUMS Score

Prediction:

- HAS been evaluated for predictive value
- Typically against a development data set
- Then applied to the larger population
- Example SCVMC Clinical Complexity; caution:
 - Predicts risk of readmission
 - Title may be misleading (e.g. should NOT be used to balance primary care panels UNTIL validation has occurred)

Statistical Model vs. Machine Learning

Statistical Model:

- Trying to use various factors to remove “unexplained variation” and therefore predict an outcome
- These factors typically derive from a causal model
- There are typically a small number of factors: sample size for validation increases linearly with the number of independent factors
- E.g. linear regression, multivariate regression, polynomial regression, bayes models, decision trees

Machine Learning:

- Trying to use various factors to predict an outcome
- Learns itself how best to use these factors to predict an outcome
- Wants to use an enormous number of factors
- Believes that an enormous sample size will validate the result
- E.g. neural networks, time-series models, tensor flow models

Epic Training for Predictive Models

The screenshot shows the Epic Course Catalog interface. At the top, there are navigation links for Forums, Galaxy, Nova, Sherlock, Community Library, Training Home, and Show All. A search bar is located in the top right corner. Below the navigation, there are tabs for Course Catalog, Train Tracks, and Calendar. The Train Tracks tab is active, showing filters for Location (United States), Version (2019 Versions), Application (All Applications), and Role (Physician Builder). A yellow banner states: "Classes in each track should be taken in the order they appear. Feb 2020 version dates coming soon." The main content area displays the "Cognitive Computing Badge" track. It includes a "Certified or Proficient in one of the following:" section with a list of 16 certifications. Below this is a "Starting Your Badge" section with a link to "Read Badges! An Overview for more information on badges and how to get started." The track details for "Cognitive Computing" (CLN2400v) are listed: 5 prerequisites to complete prior to class, 2 days of remote training (9 hours of class time), Accompanying Material, 1 required self-assessment, and 1 required project. A date box indicates "August 2019" and "Feb 20 10am-2:30pm CST". On the left side, there is a sidebar with the "Epic COURSE CATALOG UNIVERSITY" logo and a search bar. Below the search bar are buttons for "Download Upcoming Sessions" and "Class Registration Form". The sidebar also lists various certification tracks for different roles, such as "Clinical Data Model for Physician Builders", "Pathologist Builder", "Physician Builder", "Physician Builder Radiology", "Physician Builder Analytics", "Physician Builder Anesthesia", and "Physician Builder Healthy Planet".

- 2 x 4 hour sessions
- Scheduled, but remote attendance
- “Take advantage of Epic’s Data Scientists ...”

Epic's Predictive Models

Cognitive Computing Model Library

Epic has a number of models available, with new models released a few times per year*. These models can be run in one or more versions of Epic without additional hardware and do not require Clarity or Caboodle.

Population Health		Acute Care	
ED Visit or Hospitalization <ul style="list-style-type: none"> Asthma General Pediatric 	Risk of Hypertension	Deterioration Index	Risk of ICU Readmission or Mortality
Hospitalization for Heart Failure	Risk of Myocardial Infarction	Early Detection of Sepsis	Unplanned Readmission
Negative Outcomes of Type 2 Diabetes	End of Life Care Index (future)	ICU Length of Stay (Benchmarking)	Acute Kidney Injury (future)
	Opioid Abuse Risk (future)	ICU Mortality (Benchmarking)	Pediatric Deterioration Index (future)
	Pediatric Asthma Exacerbation (future)	In-Hospital Fall Risk	Surgical Site Infection (future)
			Unplanned Readmission (CHF) (future)
Operations		Workflow	
ED Likelihood of Admission	Patient Matching	Chart Review Labs Smart Filter (future)	In Basket Recipient (future)
Forecasted House Census	Remaining Length of Stay	Cogito Catalog Recommendation (future)	Orders Search Improvements (future)
No-Show Appointments			
OR Block Utilization			

*While we share future models we intend to build, we will only release models that have proven statistical performance on Epic community datasets.

Operationalizing Epic's Predictive Models

Supported Embedded Workflow Elements

- *BestPractice Advisory decision support alerts*
- *Prediction hover bubble*
- *Recommend Order Sets*
- *Print group reports and display columns*
- *Patient header*
- *After Visit Summary*
- *Navigator sections*
- *Real-time surveillance of trending scores*
- *Healthy Planet registries*
- *SlicerDicer filtering*
- *Reporting Workbench columns*
- *Patient Lists columns*
- *SmartLinks*
- *Scores available in Clarity and Caboodle*

VMC Experience with Epic Predictive Models

Predictive Model	Comments
Early Detection of Sepsis	<Before addition of Workflow Elements 11/3/2019>: non-inferior to our hard-coded first fire BPA report. Time to reassess.
Unplanned Readmission	WG: 8 mo eval -- Non-inferior to our SCVMC Clinical Complexity Score (and this is already operationalized)
Remaining Length of Stay	WG: 8 mo eval -- Inferior to VMC Hospitalist MBG (but this requires MDR)
No-Show Appointments	Running silently since 5/2019; but we haven't operationalized
Negative Outcomes Type 2 Diabetes	Running silently since 5/2019; Awaiting evaluation by "All Things Diabetes" committee
ED Visit or Hospitalization (General)	Running silently since 7/2019; WG: just established for primary care panel balancing; comparing this vs. HUMS score; vs. SCVMC Clinical Complexity vs. LACE+; wondering how this compares against a panel of <provider identified> "intense" patients
Opioid Abuse Risk	Just stood this up 11/3/2019; awaiting evaluation by "All Things Substance Use" committee
Deterioration Index	Up next: the first one we'll try to implement on cloud-based cognitive computing platform

VMC HL Risk Calculators

- An area of active development for the HL Outpatient AWG

The screenshot displays the 'Risk Calculators' interface. On the left is a navigation sidebar with icons for Snapshot, Chart Review, Care Everywhere, Rooming, Dx/Tx, Wrap-Up, Summary of C..., DataArk, and Risk Calculato... The main content area is titled 'Risk Calculators' and contains four calculator panels:

- ASCVD Risk:** Shows an 'ASCVD 10-Year Risk Score' of 18.1%. A progress bar indicates the score is in the 'High Risk' category (7.5 - 100%). Risk levels are defined as: 0 - 5%: Low Risk, 5 - 7.5%: Medium Risk, 7.5 - 100%: High Risk. A note explains that ASCVD is defined as myocardial infarction, CHD death, or stroke. Patient details include: Age: 76, Sex: Female, Non-Hispanic African American: No, Smokes Tobacco: No, Has Diabetes: No, Systolic BP: 110, HDL: 86 mg/dL, Total cholesterol: 192 mg/dL, and Is BP Treated: Yes. The score is 'Current as of today' with a 'Last Change' indicator.
- CHA2DS2-VASc:** Shows 'No data available.'
- HAS-BLED:** Shows 'No data found.' and includes a '+ New Reading' button and a 'Flowsheets' link.
- FRAX:** The panel is partially visible at the bottom.

Risk Scores visible from HL at VMC in Slicer Dicer

The image displays two overlapping screenshots of the Slicer Dicer interface. The background screenshot shows a 'Criteria' panel with a search bar and a grid of criteria categories. The foreground screenshot is a zoomed-in view of the 'Risk/Care Scores' category, showing a grid of specific risk score criteria.

Criteria Panel (Background)

- Buttons: Include, Exclude
- Search for criteria
- Criteria Categories:
 - Providers
 - Registries
 - Research Contact Preference (Current)
 - Risk/Care Scores

Risk/Care Scores Panel (Foreground)

ASCVD 10 Year Risk Score (Current)	AUDIT-C Risk Classification (Current)	CHADS2 Stroke Risk (Current)	Charlson Comorbidity Index (Current)	Complexity Score (Current)
CVD 10-Year Risk Score (Current)	Diabetes Composite Score (Current)	Diabetes Risk Score (Current)	General Risk Score (Current)	Last PHQ-9 Score (Current)

Criteria Panel (Inset)

- Buttons: Include, Exclude
- Search for criteria
- Criteria Grid:
 - MEDD (Daily Morphine Equivalent Dose) (Current)
 - MELD (Current)
 - Pediatric Risk of Hospital Admission or ED Visit (Current)
 - PELD (Current)
 - PHQ-9 Total Score
 - Preventive Care Gap Score (Current)
 - Risk of Hospital Admission for Heart Failure (Current)
 - Risk of Hospital Admission or ED Visit (Current)
 - Risk of Hospital Admission or ED Visit for Asthma (Current)
 - Risk of Negative Outcomes of Type 2 Diabetes (Current)
 - Risk of opioid abuse or overdose (Current)

Custom Predictive Models (on the Epic Platform)

Cloud-Based Machine Learning

Cogito also has the ability to deploy and execute algorithms on our cloud services platform. Allowing the execution of models to a cloud-based platform has several advantages for model performance and accuracy. Your data scientist can also use the cloud-based platform for custom models.



Cloud Services Architecture

Moving model executions to the cloud allows the ability to scale any number of models without affecting the Epic production database. Epic is using Microsoft Azure to enable elastic, scalable computing capabilities, eliminating the need to add additional hardware or support staff.



Advanced Machine Learning Libraries

The cloud services platform supports loading machine learning libraries like SparkML, scikit-learn, and TensorFlow from Python to leverage the full power of state-of-the-art machine learning techniques. Epic data scientists are using these libraries to create models that run on the cloud services platform.



These libraries enable new categories of use cases like recommendation engines that can improve user experience and physician productivity. They have the ability to analyze the enormous audit trails we collect and generate automatic recommendations based on what the user has done in the past.

Great Website (++ Nerd warning)

- Prof Frank Herrill from Vanderbilt
- Elements of a talk at Stanford BMIR 10/31/2019
- <https://www.fharrell.com/talk/mlhealth/>



Musings on Statistical Models vs. Machine Learning in Health Research



Abstract

Health researchers and practicing clinicians are with increasing frequency hearing about machine learning (ML) and artificial intelligence applications. They, along with many statisticians, are unsure of when to use traditional statistical models (SM) as opposed to ML to solve analytical problems related to diagnosis, prognosis, treatment selection, and health outcomes. And many advocates of ML do not know enough about SM to be able to appropriately compare performance of SM and ML. ML experts are particularly prone to not grasp the impact of the choice of measures of predictive performance. In this talk I attempt to define what makes ML distinct from SM, and to define the characteristics of

Other Resources

- G James et al. An Introduction to Statistical Learning with Applications in R. Springer 2013.
- JP Lander. R for Everyone (2nd ed). Addison-Wesley 2017.
- A Geron. Hands-On Machine Learning with Scikit-Learn, Keras and Tensor Flow (2nd ed). O'Reilly 2019
- Training.epic.com: via the Epic UserWeb
- Stanford eLearning Course that maps to the James text
- Coursera
- Check out various web resources for Machine Learning and Predictive Analytics
- UC Berkeley On-Line Data Science course

Questions/Comments?

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Peer Discussion

Key Discussion Questions

1. What use cases are you most interested in for predictive models?
2. How is your organization considering changing or adapting their use of predictive models?

WRAP UP



Upcoming Event

- When: Thursday, April 2, 8:30am-3:00pm
- Where: Oakland Airport Hilton Hotel
- Who: PRIME/QIP Executive sponsors; program managers; reporting leads
- Registration and agenda available [here](#)



QIP 3.0 Readiness Summit

Thursday, April 2, 8:30am-3:00pm
Oakland Airport Hilton Hotel

eSNUG Calendar



Date (To be rescheduled as needed)	Topic (Tentative as of 1/16/20)	Presenter
Tuesday, 4/21, 1-2	MyChart: patient outreach, engagement & forms	TBD
Tuesday, 6/16, 1-2	Data sharing: Care Everywhere for quality reporting	Contra Costa
Tuesday, 8/18, 1-2	Optimization of ordering tools (SmartSet, Standard Orders, Bulk Orders) & use by care teams	TBD
Tuesday, 10/20, 1-2	Clinical decision support tools (E.g, psych)	TBD
Tuesday, 12/15, 1-2	To be determined	TBD

New Page on SNI Link

SNI Link/Data Driven Organizations/EHR User Groups

<https://safetynetinstitute.org/membersupport/datadrivenorganizations/ehr-user-groups/>



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About EHR User Groups

In 2019 and 2020, SNI is hosting peer learning sessions for reporting, analytics or clinical operations leads to hear from systems well-established on Epic and Cerner how they are addressing technical and operational practices and lessons learned.

Epic Safety Net User Group (eSNUG)

2020 Schedule

WebEx information and slides will be sent the day before the meeting. All materials will be saved on SNI Link.

A list of proposed topics and dates/times for 2020 meetings are below.

Date To be rescheduled as needed	Topic (Tentative as of 1/9/20)	Presenter
Tuesday 2/18, 1-2	Predictive Models	Santa Clara tentative

MEMBER SUPPORT

- › Value-Based Strategies
- › Ambulatory Care Redesign
- › Data Driven Organizations
- › Global Payment Program Support
- › PRIME Support
- › Whole Person Care Support
- › Waiver Integration Teams
- › SNI Link

Your thoughts, please



How did we do?

What did you learn?

Do you have suggestions for future topics or content?

**PLEASE COMPLETE
OUR POP-UP SURVEY**