AI and Machine Learning

Health TechNet,
Joe Bormel, MD, MPH — Friday March 15, 2019
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Moderators Introduction

Meeting Announcement:

This meeting of Health TechNet is being held Friday, March 15, 2019 from noon to 2 pm at Nelson Mullins' offices on Capital Hill in Washington, D.C.

Our feature topic is **AI and machine learning**: both a summary of the concept and issues it presents, as well as some new concerns relating to security that it engenders.

The discussion will be moderated by **Joe Bormel, MD, MPH**; and the primary speaker will be **Leo Scanlon**, CISSP, and we expect to have other speakers and commenters as well. Leo is currently employed by DHHS as a cybersecurity expert and has headed a number of risk management initiatives at federal agencies. He will provide a basic set of definitions that clarify the terms AI, Machine Learning, etc., and how they differ; provide a quick review of the identified limitations (bias issues) in AI modeling; and then go through the basic types of attacks that can be made on these systems and models.

Simply

AI, present in many industries outside of health*, is ***essential*** to making IT work effectively, achieving these goals:

1. fast
2. easy
3. safe (ensure good things happen), and
4. avoiding hazards

Fully

AI in HIT has not been a priority

Requirements / Incentives:

➜ commitment to abandon magical thinking about core info
➜ necessary context (e.g. intent)
➜ clinical content
➜ trust & culture (think PSO)
➜ complicated by legit. privacy and confidentiality issues

Missing technologies

➜ computational, voice, immersiveness,
➜ suitable summary displays
➜ documentation support linked with quality measurement and workflow grounded in standards, aligned with payer models for VBP

Simply

"**Absent information**" is ubiquitous, so that AI notions like applying NLP to clinical data will "unlock" huge value and lead to new cures is not only magical thinking, it's misguided **although not entirely wrong**

Fully

AI needs to be able to **read relevant data**, that is "fit for purpose", **surface critical missing data, and intelligently summarize what is vital**. (e.g. 911 to fire team)

Core to data limitations:

➜What gets said by patient

➜What gets heard and documented by provider

➜How hard is it to document

➜How safe is it to document
e.g. "Suicide Attempt" versus "Intentional Overdose"

Other important factors

➜Provenance of the information

➜How aligned is information with what is required for decision making

Simply Fully

DHHS / CMS, through a contract called QSRS, did some vitally important NLP expectation-setting work

ORIGINAL ARTICLE

Assessment of Automating Safety Surveillance From Electronic Health Records: Analysis for the Quality and Safety Review System

Allan Fong, MS, Katharine Adams,* Anita Samarth,† Laura McQueen, RN, MSN,† Manan Trivedi, MD, MPP,† Tahleah Chappel,‡ Erin Grace,‡ Susan Terrillion,‡ and Raj M. Ratwani, PHD**

Background and Objectives: In an effort to improve and standardize the collection of adverse event data, the Agency for Healthcare Research

Conclusions: Although EHRs contain a wealth of information, abstracting information from these records is still very challenging,

Relative Complexity Value

TABLE 1. Summary of NLP Attributes and RCVs With QSRS Examples

Attribute	Examples	RCV
Presence of a concept/entity	"Did the patient have a urinary tract catheter inserted during the stay?"	Low
	"Was an opioid administered to the patient?"	
Numeric value extraction	"During this hospitalization, did the patient have a PTT value greater than 100 seconds?"	Low
	"What was the birth weight of the neonate?"	
Multiple concept detection	"Which secondary morbidities developed?"	Low
	"Which combination of anesthesia and sedation was used?"	
Temporal occurrence of a concept	"On or within the first 24 hours of admission, was a history of allergies and/or sensitivities documented?"	Medium
	"What was the baby's Apgar score 5 minutes after birth?"	
Conditional	"Did bleeding develop more than 24 hours after admission and within 1 day of ('PTT' > 100 seconds) OR ('Protamine administration') OR …?"	Medium
	"On any day that the blood glucose was less than 50 mg/dl, which of the following were noted?"	
"Fuzzy" concepts	"Did the patient undergo an unplanned transfer to a higher level care area within the facility or to another facility?"	High
		High

https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/qsrs/qsrs-final-report-feasibility-508.pdf

Simply

Human language is deliberately ambiguous

Expressive narratives do not reduce cleanly and completely to codes

Story telling is not photography

Fully

Many words and grammatical elements are ambiguous.
➜75 words are their own opposites.
Called “Janus words” after two-faced Roman god:

40. **Overlook**: To supervise, or to neglect
41. **Oversight**: Monitoring, or failing to oversee
…
73. **Weather**: To withstand, or to wear away
74. **Wind up**: To end, or to start up
75. **With**: Alongside, or against

➜Use of copy/paste is extensive and error prone.
➜Punctuation including commas and periods (e.g. Oxford comma) frustrate NLP.
➜Enunciation changes meaning:
“*I never said she stole my money*”

https://www.dailywritingtips.com/75-contronyms-words-with-contradictory-meanings/

Simply

Properly deployed, Artificial Intelligence and Machine Learning are our best hopes to improvement:

➜**<u>improve fidelity</u>** by ***dynamically surfacing and closing*** the quality gaps

➜making HIT better & easier to use

Fully

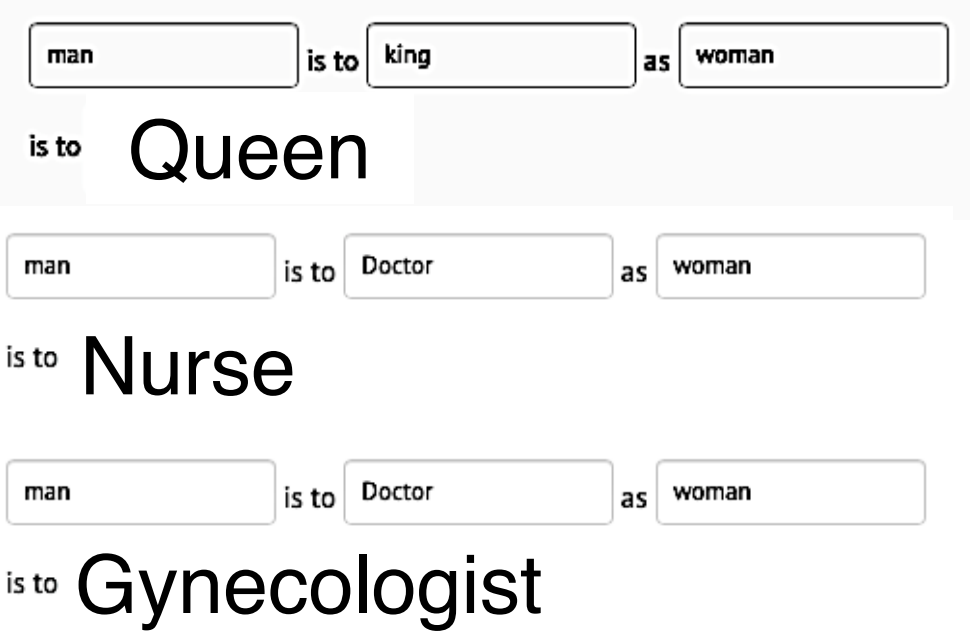
These slides elaborate some of the issues that make AI and Machine Learning both powerful and challenging, in the context of today's deployments of HIT.

At HIMSS 2019, in 338 educational sessions, **<u>148</u>** (44%) **<u>explicitly called out AI</u>** as vital to health improvement.

Focusing on the appropriate use and soci-technical-cultural issues of implementation are vital to improving the quality, cost and access to better health and effective healthcare.

Simply Fully

Example 1: Word-to-Vec



These AI algorithms illustrate that they are **informed** by their training data and entirely literal (i.e. *the intelligence is artificial)*.

King - Man + Woman = Queen

Doctor - Man + Woman = Nurse

represents an understandable association that is wrong.

Take Homes:

1. Results may only be directionally useful.
2. Independent validation and verification are critical; challenge persists post go-live.

The word2vec model trained by Google on the Google News dataset, on about 100 billion words:

https://rare-technologies.com/word2vec-tutorial/

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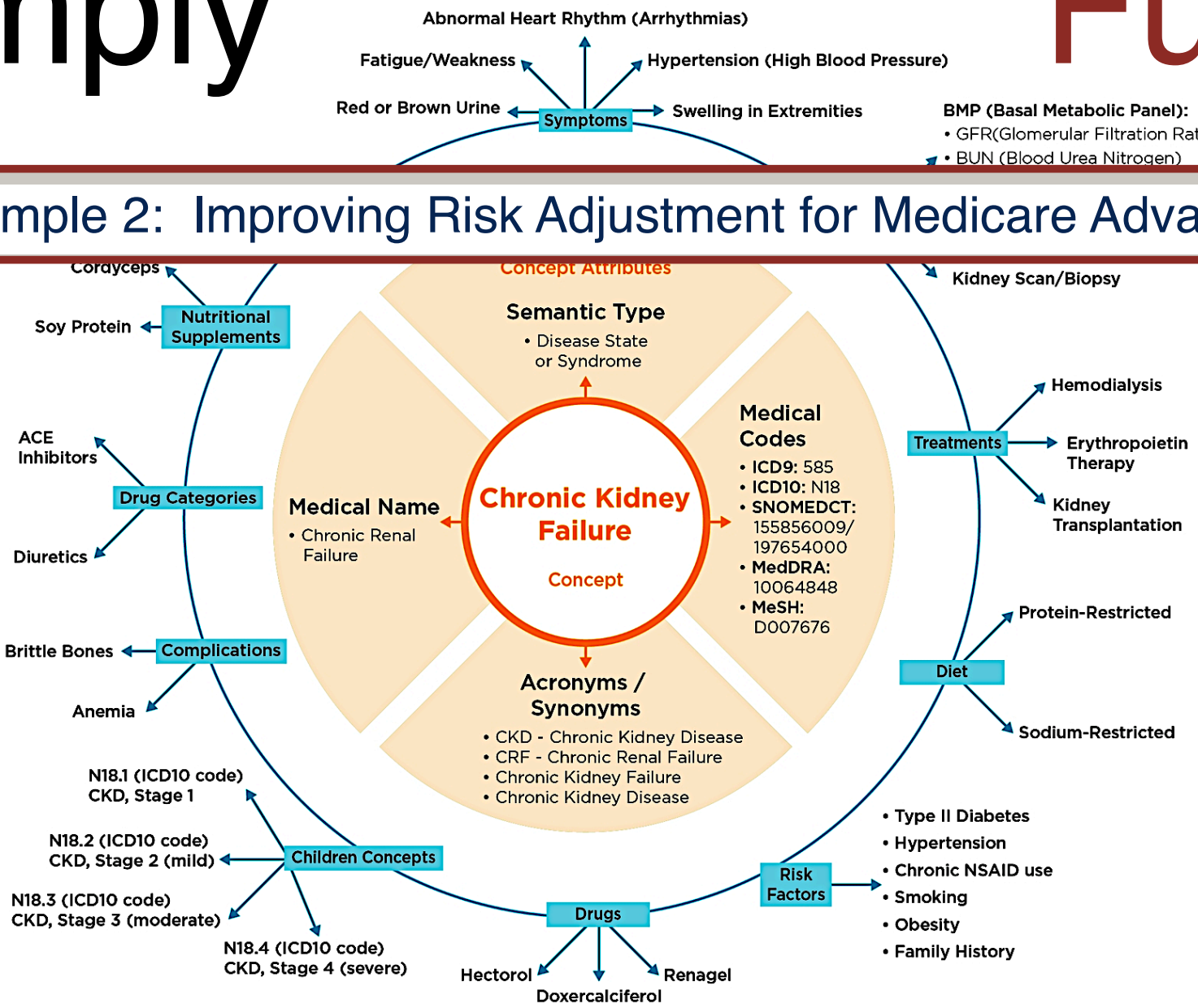
Example 2: Improving Risk Adjustment for Medicare Advantage



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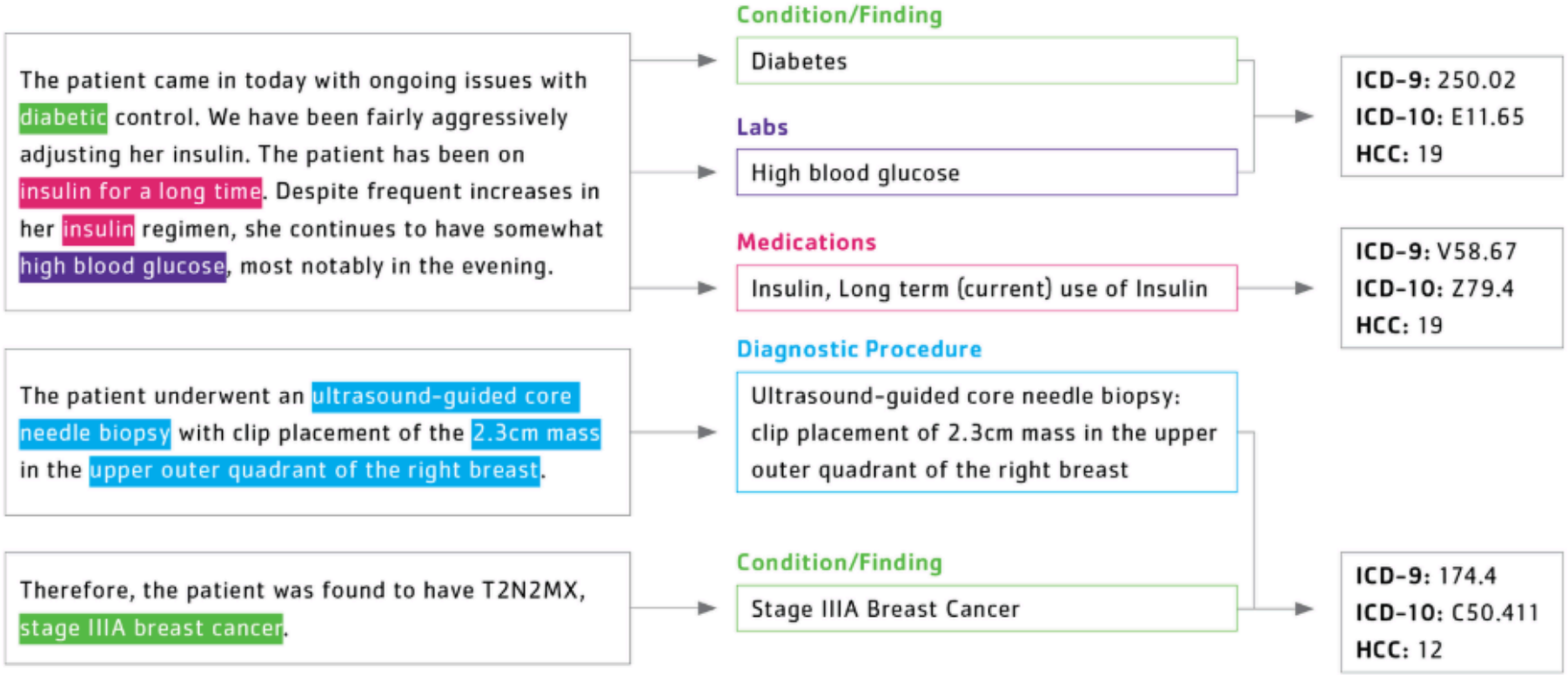

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