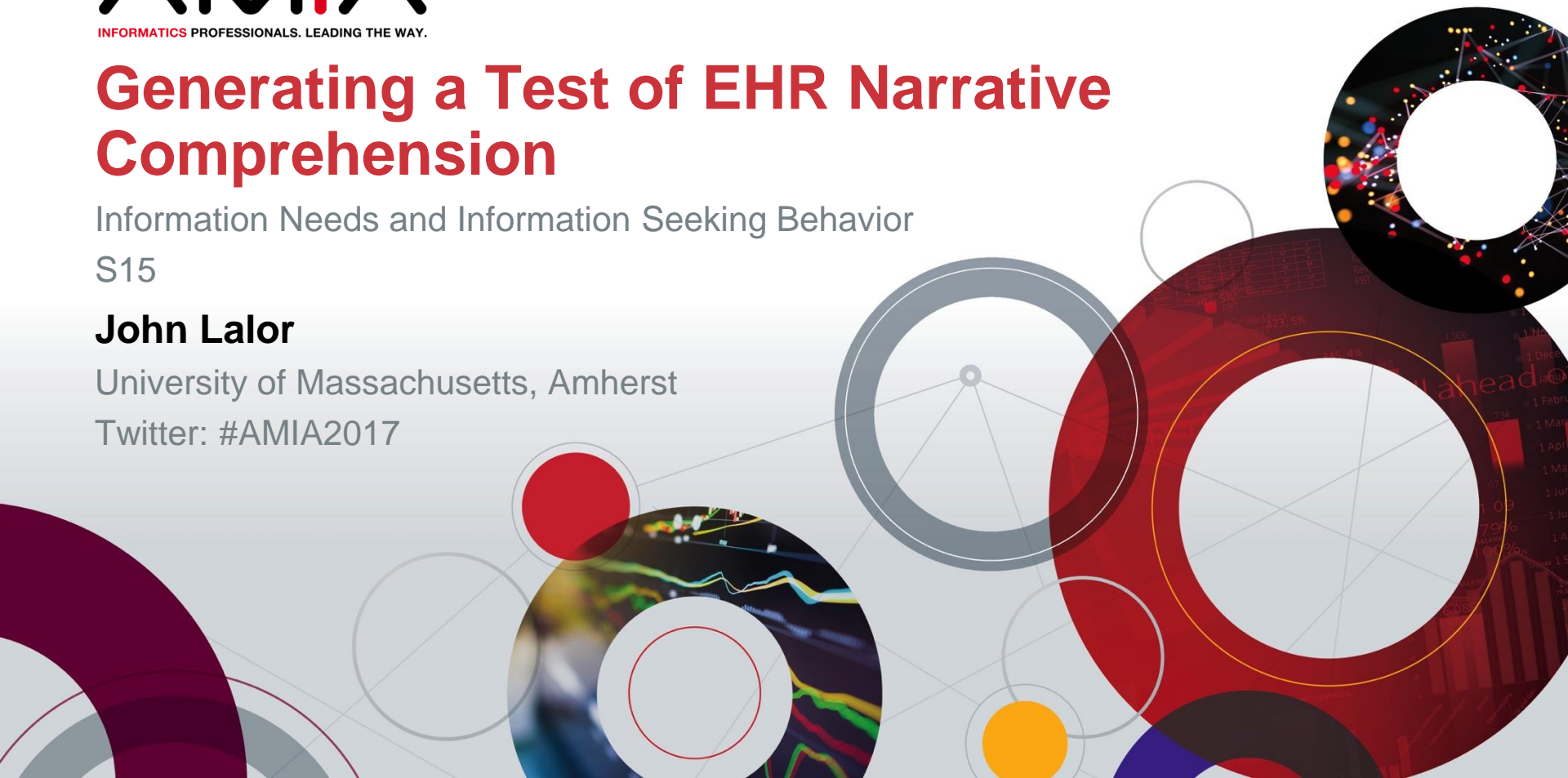# Generating a Test of EHR Narrative Comprehension

Information Needs and Information Seeking Behavior

S15

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Disclosure

I and my spouse have no relevant relationships with commercial interests to disclose.

Learning Objectives

After participating in this session the learner should be better able to:

- Generate comprehension questions from Electronic Health Records.
- Evaluate the quality of questions using Item Response Theory and crowdsourced responses.

Acknowledgements

- Hao Wu and Li Chen, Boston College

- Kathy Mazor and Hong Yu, UMMS

Motivation

Patients are being given access to their Electronic Health Records (EHRs)

EHR notes include medical terms and are difficult to understand, particularly for individuals with low health literacy

Tests of health literacy exist, but none are specific to testing a patient's ability to read and comprehend EHR notes
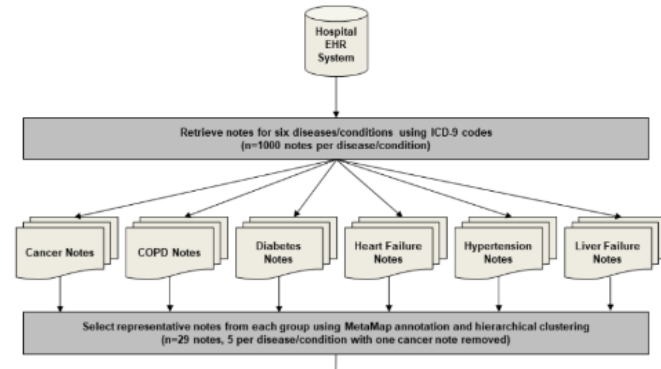
The *monitor* has not shown any **dysrhythmias** or **arrhythmia** either *prior to or during any of his spells*
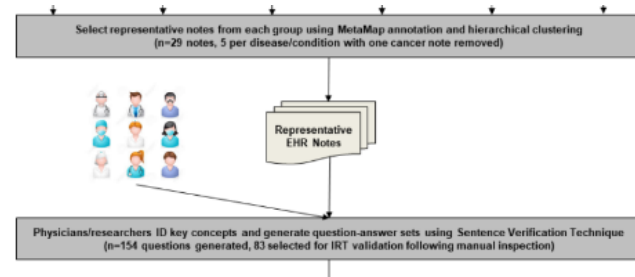
Process Overview
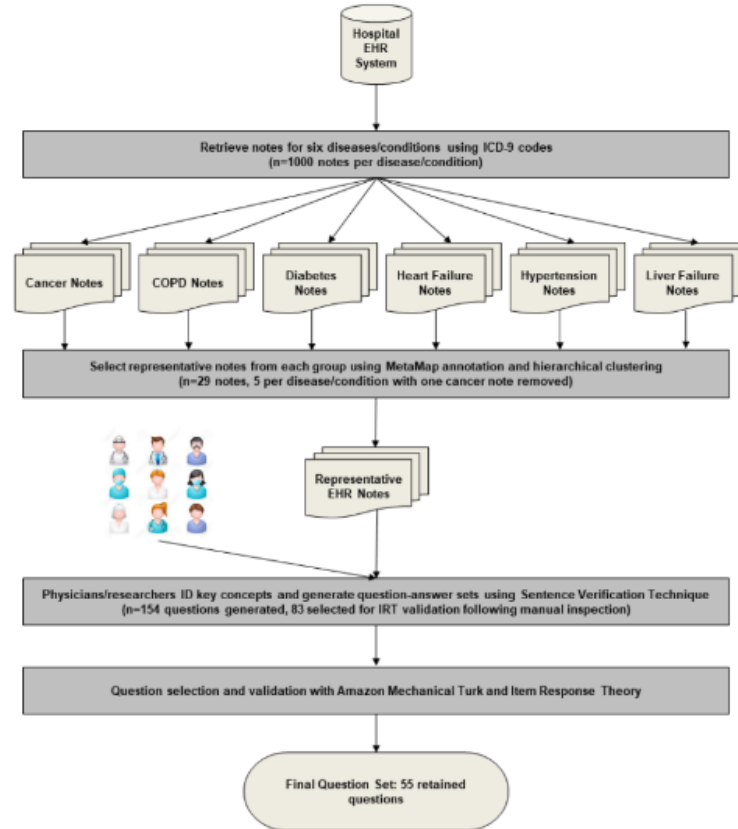
EHR Note Identification

- Pull notes from hospital database according to ICD-9 code

- Identify key medical terms in the notes and cluster according to terms

- Select note with most medical concepts from each cluster

Question-Answer Generation

- Groups of physicians and medical researchers identified important concepts in notes

- Groups wrote multiple choice questions using Sentence Verification Technique

  - Answer options: paraphrase, meaning change, and distractor

Select representative notes from each group using MetaMap annotation and hierarchical clustering
(n=29 notes, 5 per disease/condition with one cancer note removed)

Representative EHR Notes

Physicians/researchers ID key concepts and generate question-answer sets using Sentence Verification Technique
(n=154 questions generated, 83 selected for IRT validation following manual inspection)

Sentence Verification Technique

Forming Test Questions using SVT:

Please read the following question and then examine the answer choices and choose the answer that best represents the question text.

What does the following sentence mean? "The monitor has not shown any dysrhythmias or arrhythmia either prior to or during any of his spells."
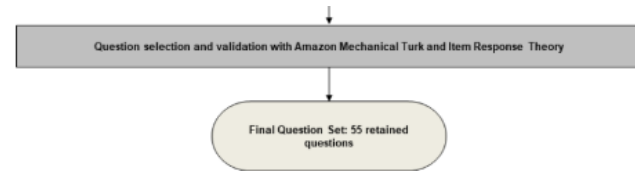
1. He has had abnormal rhythm prior to or during his spells of chest pain
2. The monitor has shown abnormal heart rhythms before and during his spells
3. His heart rhythm is normal before and during his fainting spells

What does the following sentence mean? "Patient recently presented to the hospital with shortness of breath."

1. Shortness of breath has many causes
2. She went to the hospital for trouble breathing
3. She visited the clinic due to shortness of iron

Question Validation

- Gather response patterns from Amazon Mechanical Turk to identify good items
  - 83 items → 55 items

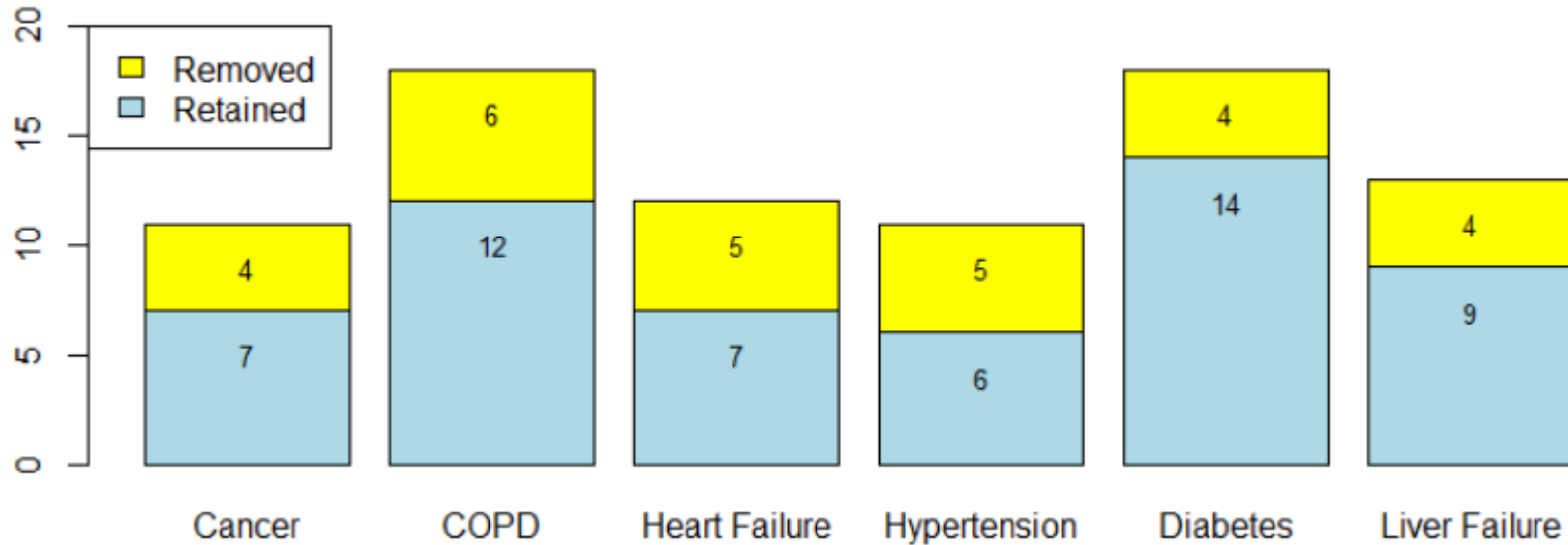- 2nd round on AMT for validation
  - All items retained

Question selection and validation with Amazon Mechanical Turk and Item Response Theory

Final Question Set: 55 retained questions

Results

IRT Item Removal

Counts of Retained and Removed Items

Retained/Removed Examples

	Question	Paraphrase	Meaning Change	Distractor
Retained	Pegfilgrastim 6 mg subcutaneous one dose	Do an under skin injection of one dose of 6 mg pegfilgrastim	Pegfilgrastim 6 mg epidermal one dose	Pegfilgrastim may prevent neutropenia
Removed	Osteoporosis	Weakness in bones	Hardening of bones as we get older	Some bones get hard and some weak

Test Information Curve
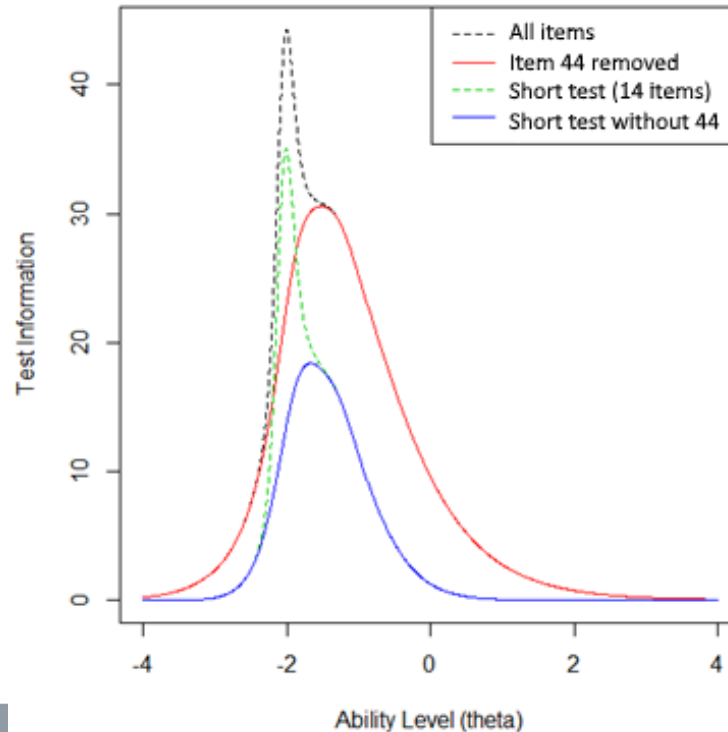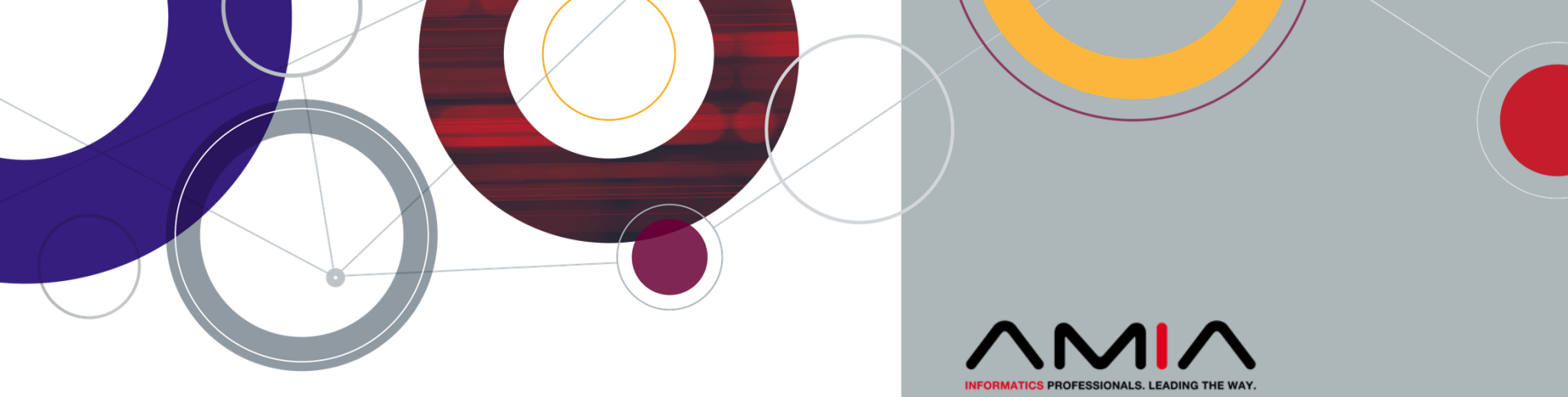
Test Information Curve
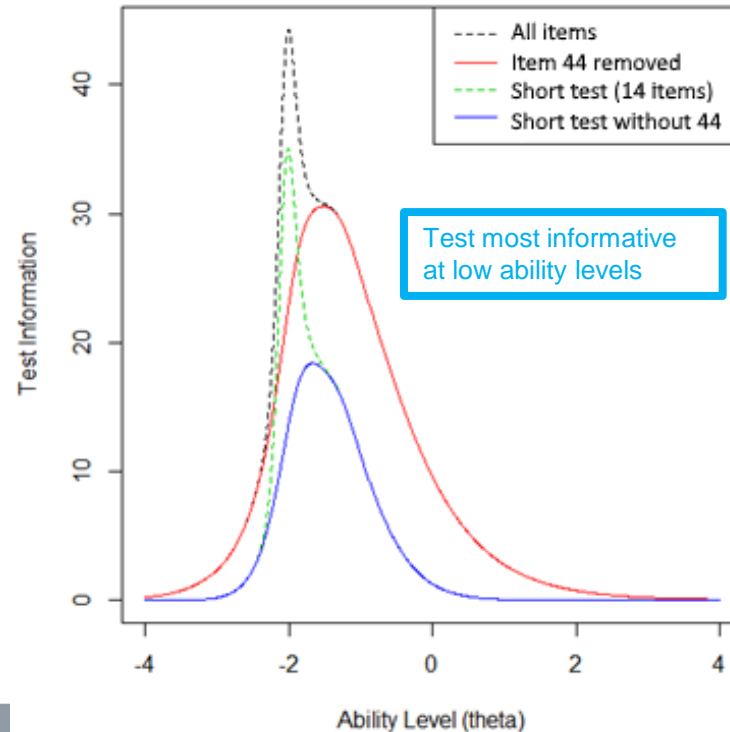
Ability by Demographic

Education Level	Less than High School	-0.899
	High School Diploma	-0.038
	Associates Degree	-0.013
	Bachelors Degree	-0.034
	Masters Degree or Higher	**0.199**
Age	18-21	-0.493
	22-34	-0.042
	35-44	-0.066
	45-54	**0.222**
	55-64	0.212
	65 and older	-0.122

Conclusion

- New instrument to assess patient EHR note comprehension

  - Generated from de-identified notes

  - Test is most informative for low ability

  - Next steps: validate test with populations where low health literacy is prevalent

- Future work: Automatic question generation for personal EHR note comprehension

  - Use patients' own notes to test comprehension

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Thank you!

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