The significance of cognitive modeling in building healthcare interfaces

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- ▶ There is an already emergent need in health care to standardize and promote the EMR (electronic medical record).

- ▶ The EMR has yet to be adopted for a number of reasons:

  - ■ financial expense

  - ■ organizational buy-in

  - ■ technological hurdles
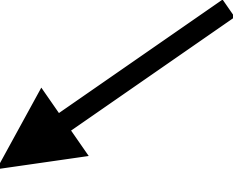
  - ■ *deficiency in user-centered interface design*

Introduction

▶ Though standardization is important, it should not mean *simplification* in the case of EMRs. Nor should it lead to a one-size-fits-all user interface design.

▶ **Hypothesis:** ***Different clinician types have different usage patterns and therefore need different interfaces to the data.***

Introduction

While there is an understanding about the differences between the roles of physicians and nurses, no empirical studies document the differences between physicians and nurses in their understanding of patients. A review of the literature showed that the majority of research on the roles of physicians and nurses focuses on their divergent professional roles as exemplified in the cure versus care paradigm [22,23]. This paper examines the cognitive tasks of the users from a cognitive perspective. Healthcare users have many different needs, capabilities, and background knowledge. To ensure that the design of healthcare information system matches the tasks of the intended users, we begin with a basic approach of the cognitive task analysis.

Note: Isn't this exactly what they end up saying?

Introduction

Methodology

- 48 clinicians

  - 24 RN, 24 MD

  - gastrointestinal medicine

  - English-speaking

  - Number of practice years
    as delimitation (significance?)

Table 1 Demographics of all subjects

Demographics	RN	MD
Male	1 (4%)	18 (75%)
Female	23 (96%)	6 (25%)
Average age	45.41 ± 7.45	36.39 ± 10.34
Range	28−60	26−61
Associates degree	7 (29%)	
Diploma degree	4 (17%)	
Bachelors degree	10 (42%)	
Masters degree	3 (12%)	
MD degree		24 (100%)
Average practice years	20.62 ± 7.35	11.00 ± 10.06[a]
		3.58 ± 1.58[b]
Range	5−32	1−29[a]
		1−6[b]

[a] Attendings: physicians in practice.
[b] PGY: resident physicians.

▶ Three mock cases developed & reviewed, with 12 axes:

- appendicitis (training), gastroenteritis, pancreatitis

- demographics, present illness, histories/habits, current medications, allergies, systems review, vital signs, I/O, physical exam, nursing notes, assessment, initial physician orders

▶ Think-Aloud technique applied (just what it sounds like)

Methodology

Methodology

▶ Original think-aloud monologues were transcribed to MS Word, then separated into sentences, then into "idea units or propositions." (Text of original cases was also broken down in this way for comparison.)

▶ Pattern that emerged after iterative decoding:
recalls, inferences, negatives, assumptions, conditionals, interventions, errors/uncoded.

Data Collection & Analysis

Table 2 Examples of coding scheme

Propositions	Code
32.1 He has some tremors	Recall
53.1 Patient may simply have gastritis	Inference
3.1 She did not have any surgical history	Assumption
12.1 Surgical history not given	Negative
21.1 If his LFT's seem to be increasing then, . . .	Conditional
59.1 We will get an ultrasound of the right upper quadrant	Intervention
5.1 She denies temperature	Error/uncoded

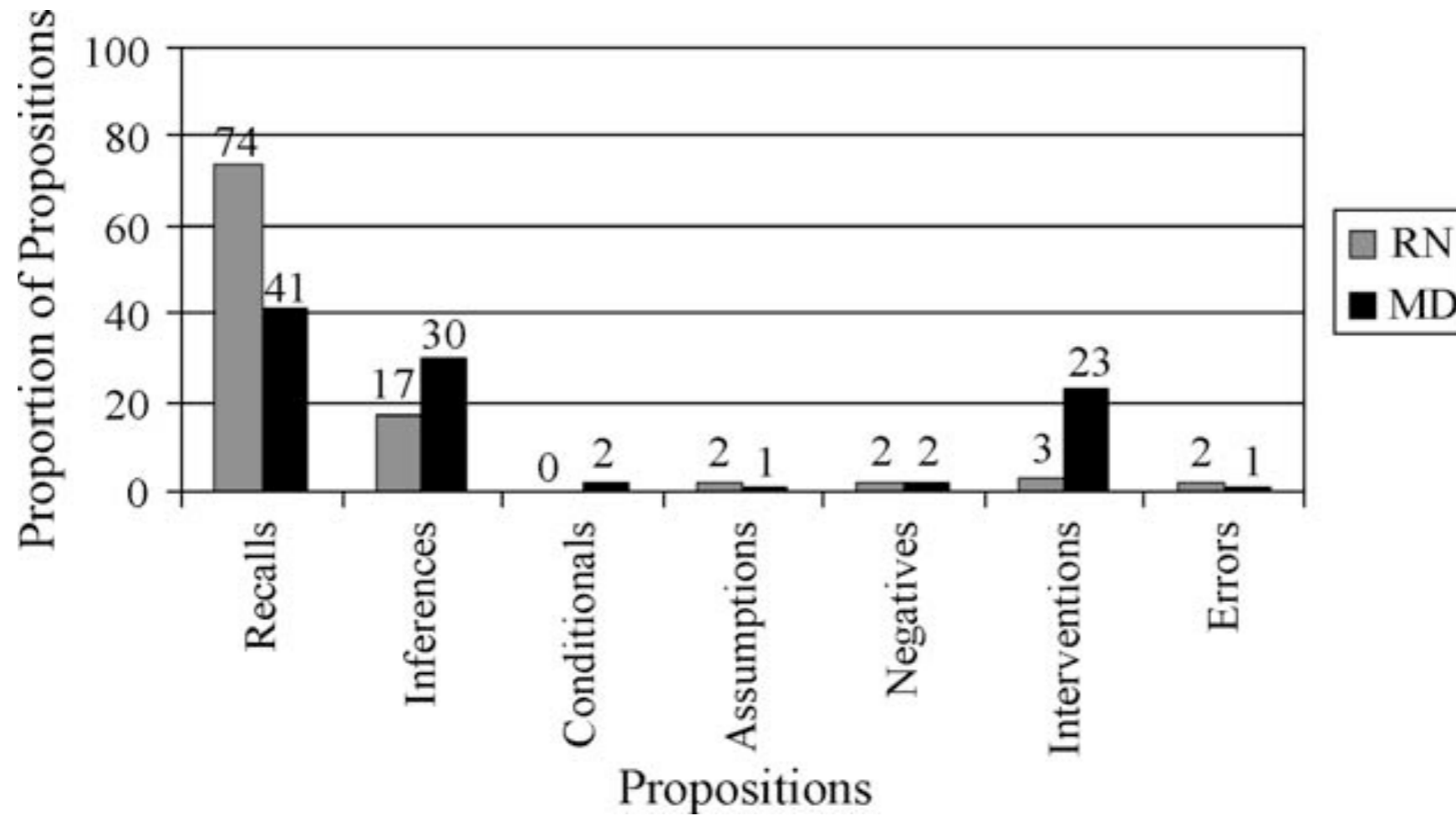# Data Collection & Analysis

Fig. 2 Mean proportion of proposition types between nurses and physicians.
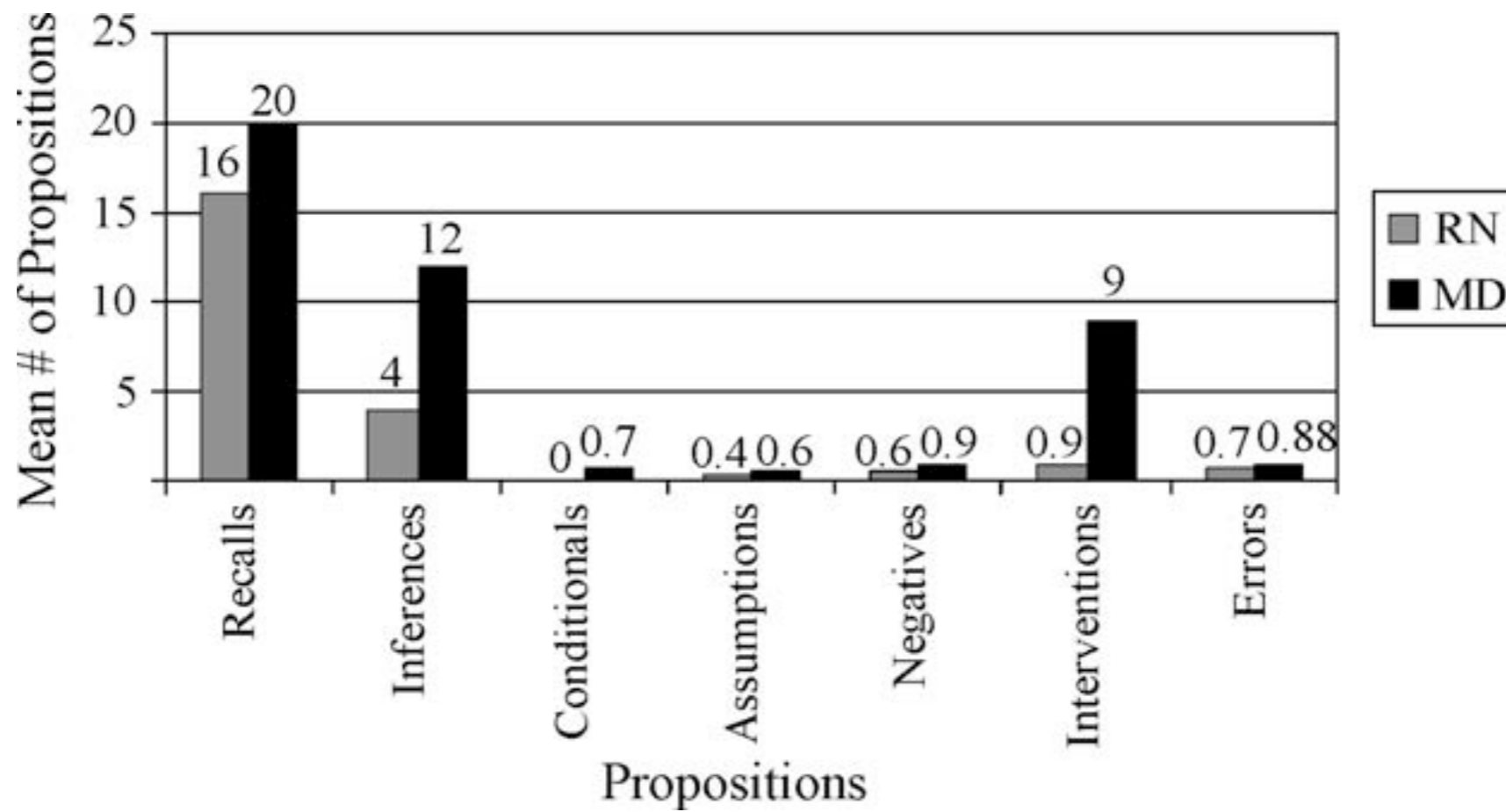
Results

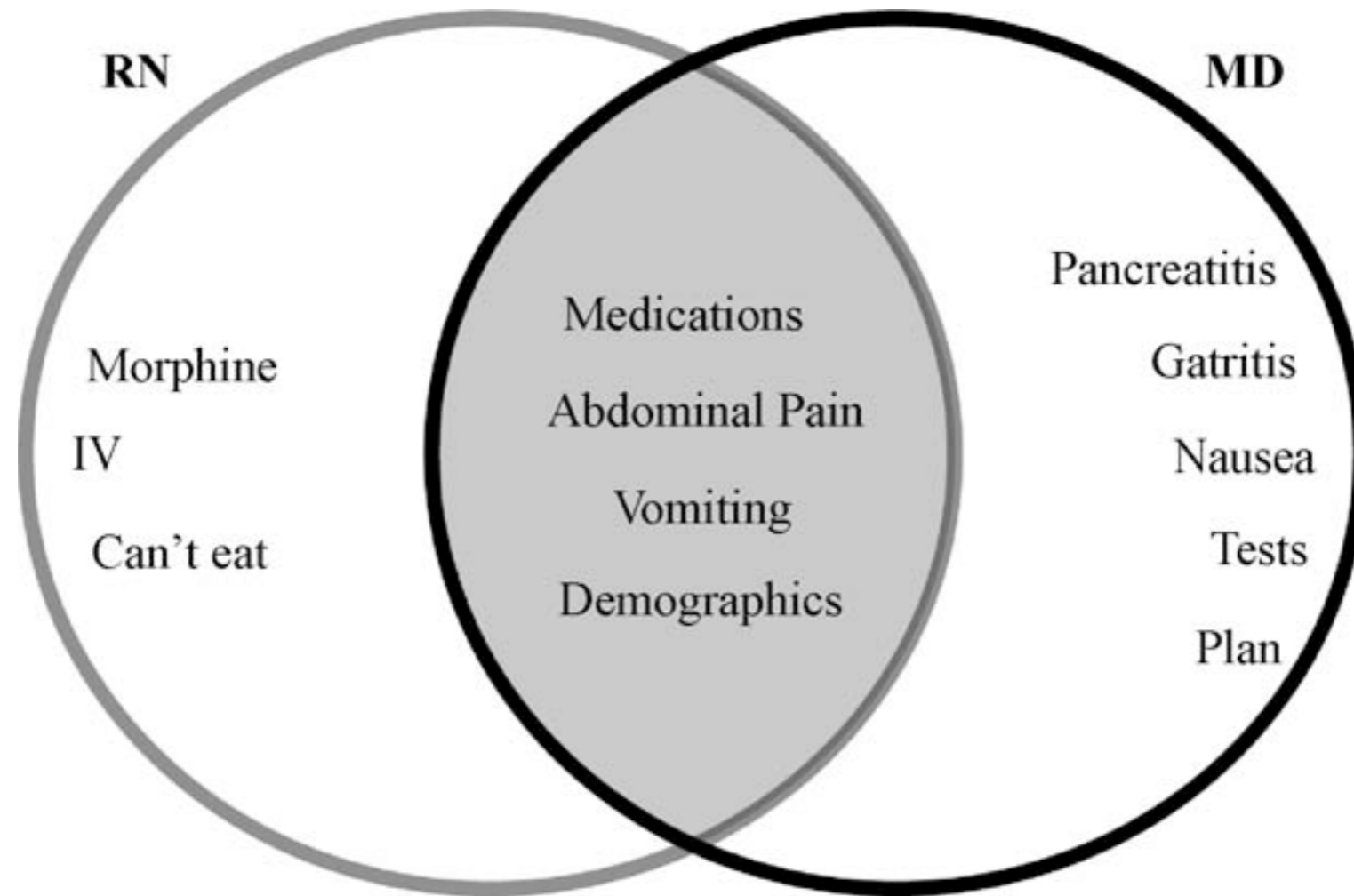**Fig. 3** Mean number of propositions between nurses and physicians.

Results

Fig. 4 RN and MD conceptual graph of pancreatitis case.
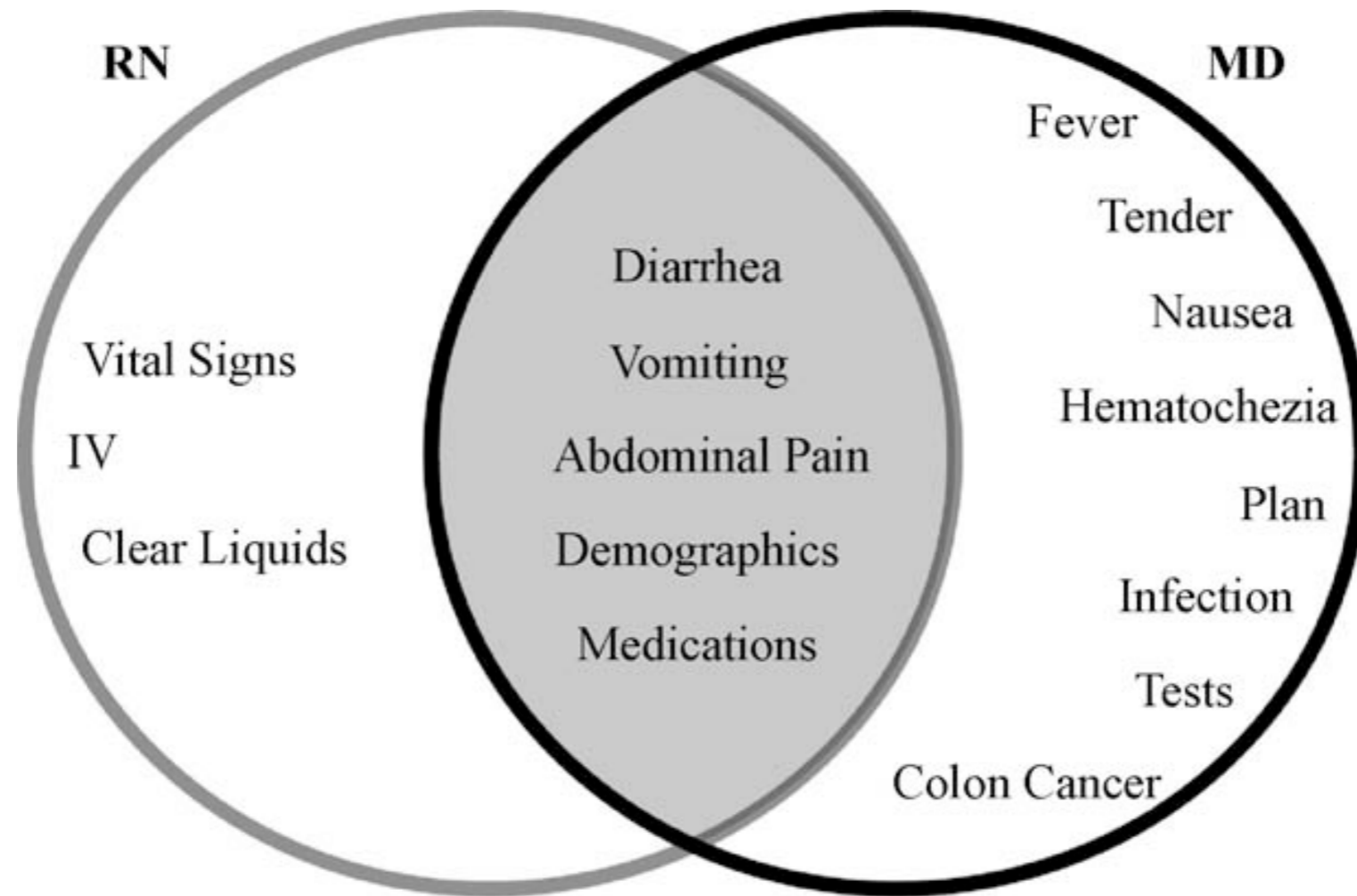
Results

Fig. 5 RN and MD conceptual graph of gastroenteritis case.

Results

"Through these coding schemes, we were able to broadly appreciate the differences between how nurses and physicians comprehend a patient problem, and thus successfully complete this cognitive task analysis. The nursing representation of the patient was mainly **observational** as shown through their large percentage of *recalls*. The physician representation of the patient was **causal** as illustrated by their inclusion of a large percentage of *inferences*. **These different patient representations reflect the differences in their respective practice models**, whereby nurses are trained to diagnose functional problems and monitor changes in physiological status and physicians are trained to diagnose, manage, and treat patients. Although it is known that the roles of each are different due to their respective practice models, the implications of these differences have not been previously reported."

Discussion

"**Electronic medical records need to be designed to achieve their goals and the goals of the users.** Although they all need to contain certain necessary information, the information must be presented in a manner that mimics the thought processes, work routines, and practices of the users. Healthcare is a heterogeneous environment in which there are many different types of clinicians, not all of whom share the same information space. Although the concept of a 'common information space' is appealing, it is not practical since nursing and medicine each have different perceptions of the patient."

Implications

- ▶ Does experience in the field affect the results of the trials? The nurse population was much more experienced on average than the physicians.

- ▶ Would a differently-focused nurse/physician population likely return different results? *i.e. non-gastroenterology-related*

- ▶ Are there other (more scientific?) methods of measuring cognitive response? Something similar to eye tracking? EEGs?

Questions & Issues