

Laura J. Farrell, BS,<sup>1</sup> Randi S. Cartmill, MS,<sup>2</sup> John M. Beasley, MD,<sup>2</sup> Shimeng Du<sup>1</sup>, Amanda E. Hoffmann, MPH,<sup>2,3</sup> Paul D. Smith<sup>2</sup>, MD, Linsey M. Steege, PhD,<sup>1,4</sup> Jessica Tarnowski, BS<sup>2</sup>, Douglas A. Wiegmann, PhD,<sup>1</sup> Tosha B. Wetterneck, MD, MS<sup>1,2</sup>

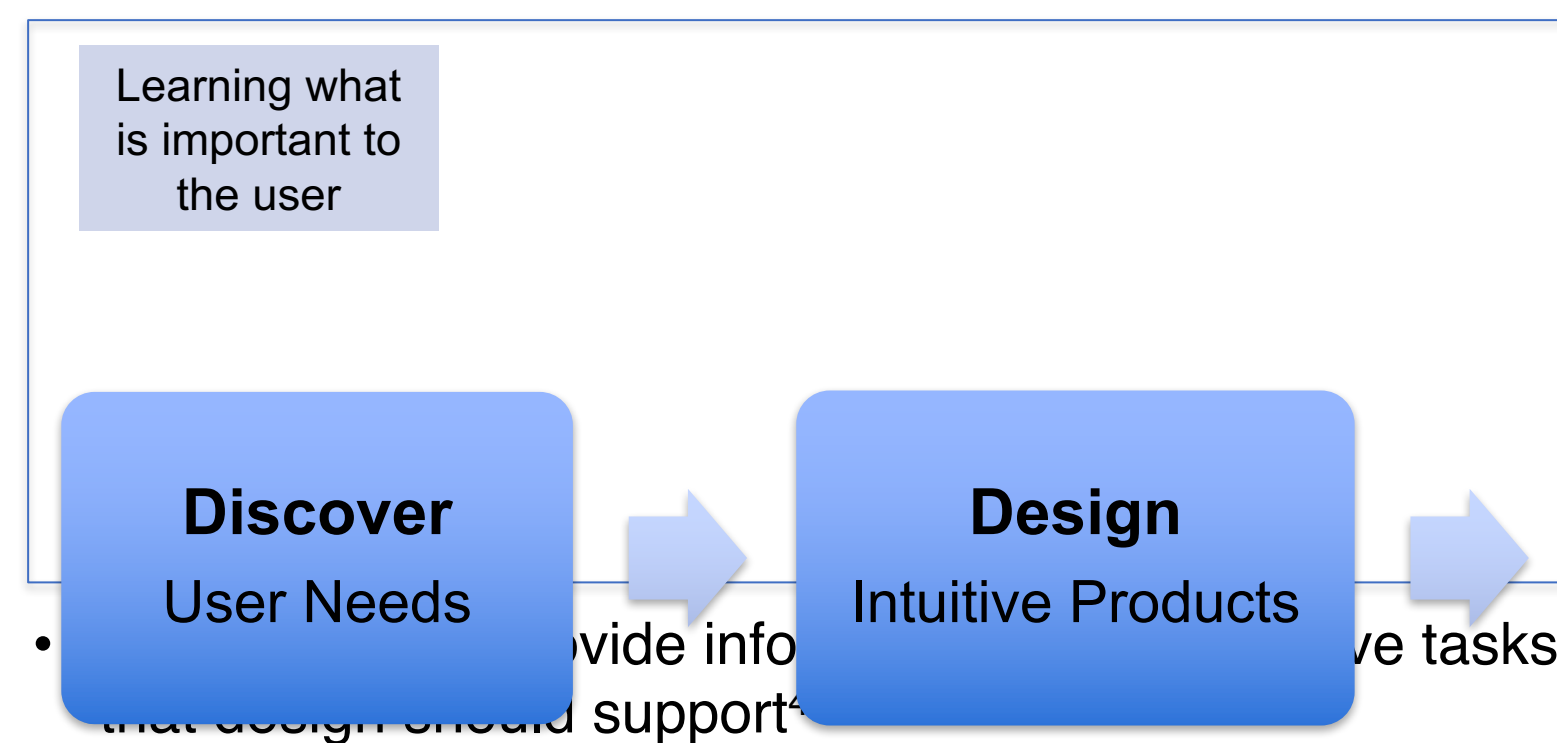
<sup>1</sup>University of Wisconsin-Madison Department of Industrial and Systems Engineering, <sup>2</sup>University of Wisconsin School of Medicine and Public Health, <sup>3</sup>Wisconsin Research and Education Network (WREN), <sup>4</sup>University of Wisconsin-Madison School of Nursing

## INTRODUCTION

### Primary Care Cognition

- Primary care (PC) teams manage all of a patient's health needs over the patient's lifetime<sup>1</sup>, making the team's cognitive requirements highly complex
- Most PC clinics have adopted electronic health records (EHRs) and Meaningful Use criteria<sup>2</sup>, but EHRs continue to fail to meet the cognitive needs of PC clinicians<sup>2,3</sup>

### User-Centered Design<sup>1,2</sup>



- Little research connecting PC teams' EHR design perceptions to cognitive needs to inform design

### Objective

- To understand PC team members' perceptions of EHR design as it relates to their cognitive goals and information needs to identify team-based design criteria for EHRs

## METHODS

### Setting & Participants

- Two PC teams (n=11) from a Midwestern internal medicine clinic, including Physicians/APPs, Nurses/MAs, & other clinic team members, e.g., health educators, as well as a commercially available EHR system

### Data Collection

- Up to three 90-minute semi-structured interviews on work-related goals, information requirements, & EHR design, based on previous observations
- 19 interview transcripts from 11 participants were collected over approximately 5 months

### Data Analysis

- Iterative review & coding identified excerpts related to EHR design or use and ways EHR influences work
- Developed themes regarding participants' positive and negative EHR perceptions using content analysis
- Coded excerpts as subthemes according to users' related patient care goals, assessments & information needs
- Analyses reviewed & validated by an interdisciplinary research team of engineers and clinicians

## RESULTS

### EHR Themes

3 themes emerged from 179 coded excerpts:

- 1) Positive statements about current EHR design [Helpful]
- 2) Negative statements about current EHR design [Not Helpful]
- 3) Projections of ideal EHR design [Would Be Helpful].

Table 1. Number of excerpts by EHR theme according to primary care team member role

Clinic Role	Excerpts by EHR Theme			Number of interviews reviewed
	Helpful	Not Helpful	Would be Helpful	
Physician / Advanced Practice Provider	17	44	41	7
Nurse / Medical Assistant	15	24	6	9
Other Clinic Team Members	9	15	8	3
Total	41	83	55	19

**Purpose of Information (POI):** subtheme based off information needs describing how the information is being used

- 12 POI codes emerged, 199 were applied
- Most frequent POI: 1) Contextual Information (57), 2) Medications (23), and 3) Evaluation/Treatment Plan (19)

Table 3. Examples EHR emergent themes in relation to emergent goals and associated EHR design

EHR Themes	Top Goals, #Excerpts & Common related POI	EHR Design Data Overview
EHR (+) Helpful	Build Relationships [9] <i>Purpose of Information: -Social</i>	<ul style="list-style-type: none"> <li>• Patient secure messaging [provides ability to communicate with patient &amp; may replace visits]</li> <li>• Sticky note or private note function [helps recall important events in the patient's life]</li> <li>• Previous history with patient [how they know the patient, whether they've seen them before for that complaint]</li> <li>• Patient preferred language listed on profile [identify cultural and communication needs]</li> </ul>
EHR (-) Not Helpful	Collect Information [18] <i>Purpose of Information: - Contextual - Outside System</i>	<ul style="list-style-type: none"> <li>• Presentation of information does not highlight important info, what's new or what's changed</li> <li>• Collecting outside hospital/clinic info for the visit is slow and tedious, not always aware they need it until patient is present</li> <li>• Need specialist's thoughts about diagnosis, recommendations in notes</li> <li>• Difficult to know if patient went to specialist appointment/follows recommendations until patient returns</li> <li>• Lack overview of current/past situation &amp; last intervention completed is difficult to find</li> </ul>
EHR (-) Would be Helpful	Determine Treatment Plan [17] <i>Purpose of Information: - Contextual - Lab/Test - Evaluation/Treatment Plan</i>	<ul style="list-style-type: none"> <li>• Ability to record patient's main goals and have this information front and center within the EHR for decision-making</li> <li>• History of patient treatments for a condition should be more clear</li> <li>• Value of specific disease treatments for a given individual patient should be more clear</li> <li>• Support decision-making for most appropriate testing based on a suspected diagnoses</li> <li>• Up-to-date information on chronic disease treatment goals and recommended therapies</li> </ul>

For example, *Contextual [Information]* was defined as information related to a patient's symptoms, which involved gaining a "big picture" or "textured" sense of a complaint in relation to other relevant patient information. This may include deciding what questions to ask surrounding a patient concern. An example of *Contextual*: The interviewer asks what the participant does with the problem list, and the participant responds:

"Just to make sure all of the items on the problem list are attended to, up to date, and current. So if somebody said, if I put on there kidney stones, it would be nice to know when the last one was, what kind it was, and are they on any meds currently that are apt to do that?"

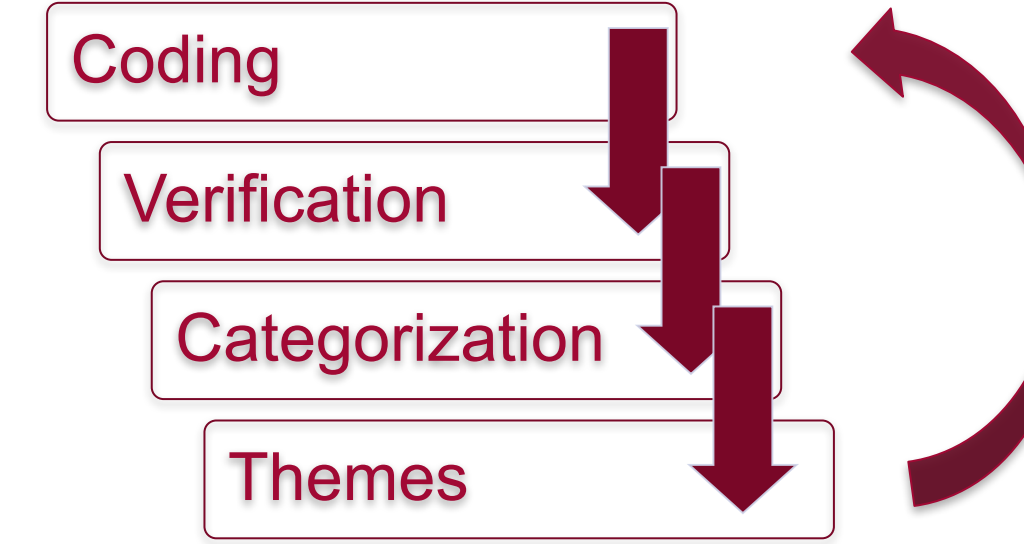


Figure 2. Iterative content analysis process

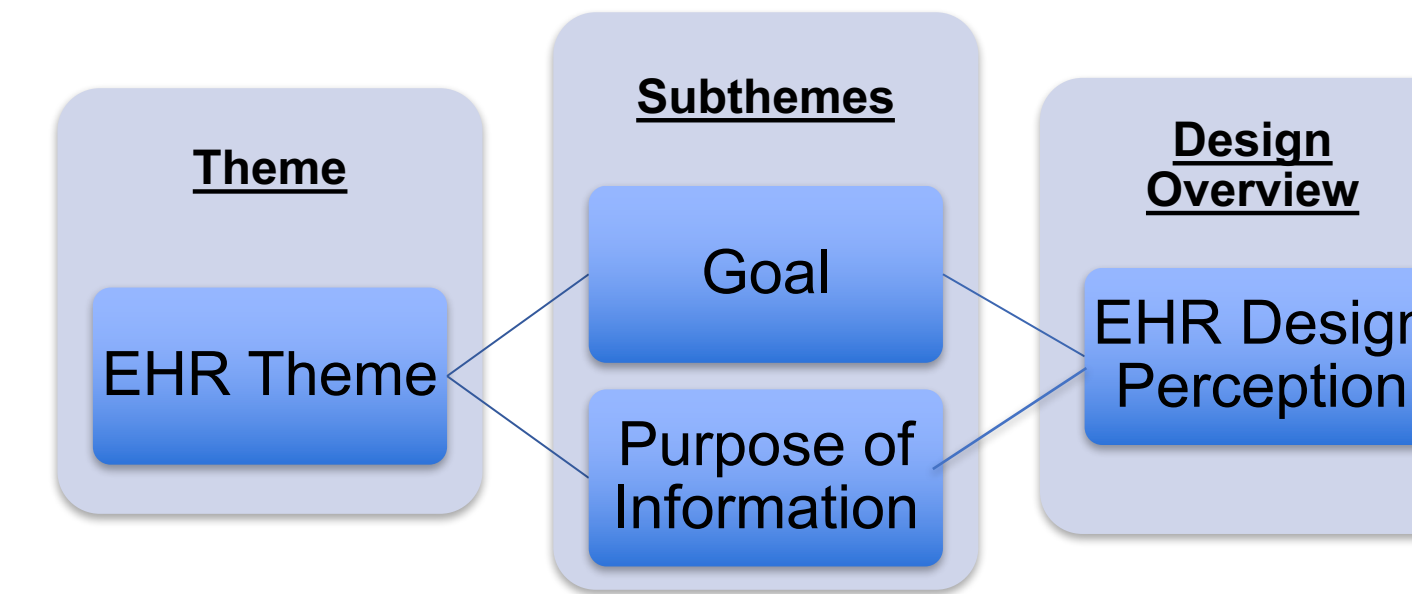


Figure 3. Hierarchical representation of data arrangement discovered

## DISCUSSION

### Findings

- Staff can give important insights into EHR design, including what design aspects are helpful / not helpful and what clinicians felt could improve design

Results	Design Application
EHR (+) Helpful: Build Relationships, Social	<ul style="list-style-type: none"> <li>• Access to malleable displays provides the capacity to keep social information separate from medical information</li> <li>• A secure format to communicate directly with the patient facilitates the relationship-building process, impacting familiarity and trust.</li> </ul>
EHR (-) Not Helpful: Collect Information, Contextual / Outside System	<ul style="list-style-type: none"> <li>• Missing information, irrelevant information, and processes to gain information that do not match current workflow all lead to end-user frustration and suboptimal EHR utilization.</li> </ul>
EHR (-) Would be Helpful: Determine Treatment Plan, Contextual / Lab / Test / Evaluation / Treatment plan	<ul style="list-style-type: none"> <li>• Efficiency of evaluation/treatment decision-making processes should be supported, including how to support decision-making at point of care</li> </ul>

Table 4. Examples of design applications related to example results

### Takeaways

- Need for more patient collaboration as a partner in their healthcare, and increased information access between team members within the clinic.
- The data extracted illustrate specific areas in which the EHR should be improved, as well as design aspects clinicians feel facilitate necessary tasks within their role
- Designing an EHR to facilitate team members' goals and preferences can aid in quality patient care and cohesive teamwork

## ACKNOWLEDGMENTS

This study is a secondary analysis of a larger AHRQ study aimed at describing the cognitive-based goals, information needs, and decisions of primary care teams in order to identify design criteria for EHRs to better support both team goals and shared situation awareness. The project is supported by grant number R01HS022505 from the Agency for Healthcare Research & Quality. The content is solely the responsibility of the authors and does not necessarily represent the official views of the Agency for Healthcare Research & Quality.

## REFERENCES

- 1) Porat, T., Kostopoulou, O., Woolley, A., & Delaney, B. C. (2016). Eliciting user decision requirements for designing computerized diagnostic support for family physicians. *Journal of Cognitive Engineering and Decision Making*, 10(1), 57-73.
- 2) Krist, A. H., Beasley, J. W., Crosson, J. C., Kibbe, D. C., Klinckman, M. S., Lehmann, C. U., Fox, C. H., Mitchell, J. M., Mold, J. W., Pace, W. D., Peterson, K. A., Phillips, R. L., Post, R., Puro, J., Raddock, M., Simkus, R., & Waldren, S. E. (2014). Electronic health record functionality needed to better support primary care. *Journal of the American Medical Association*, 311(5), 764-771. DOI: <https://doi.org/10.1136/ama-2013-002229>
- 3) Phillips Jr, R. L., Bazemore, A. W., DeVoe, J. E., Weida, T. J., Krist, A. H., Dulin, M. F., & Biagioli, F. E. (2015). A family medicine health technology strategy for achieving the triple aim for US health care. *Family medicine*, 47(8), 628.
- 4) Schuler, D., & Namioka, A. (Eds.). (1993). *Participatory design: Principles and practices*. Retrieved from <http://books.google.com>
- 5) Kujala, S., & Väänänen-Vainio-Mattila, K. (2009). Value of information systems and products: Understanding the users' perspective and values. *Journal of Information Technology Theory and Application*, 9(4), 4.