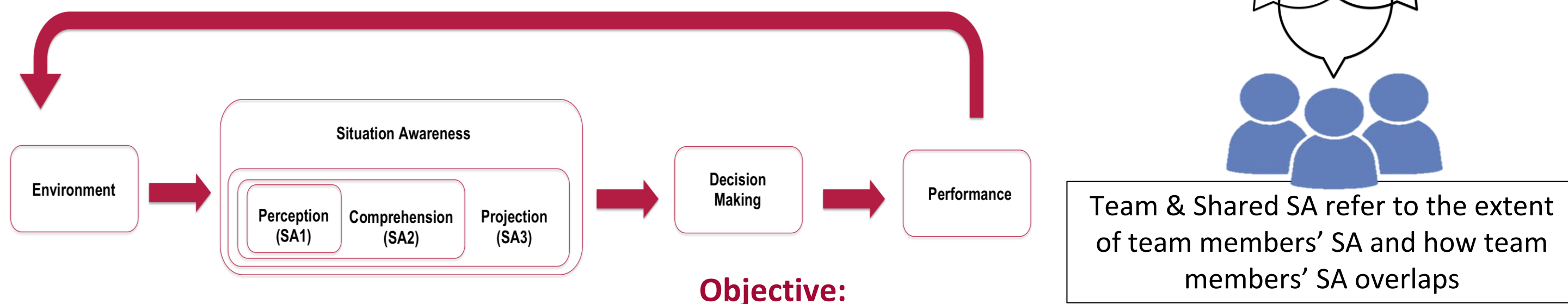


## CONTEXT

- Situation awareness (SA) is the central basis for effective decision-making or how someone understands what is happening around them<sup>1</sup>
- Electronic health records (EHR) fail to meet the cognitive needs of primary care teams, including SA.<sup>2</sup> This produces cognitive overload, reduced team cohesion, and decreased patient care quality<sup>3</sup>
- Primary care teamwork requires complex cognitive problem-solving,<sup>4</sup> yet SA-based decision-making has not been explored in this context
- Designers must understand SA needs of primary care team members to build EHRs that support decision-making and optimize patient outcomes

### Situation Awareness (SA)<sup>5</sup>



### Objective:

- Understand primary care team members' SA interactions surrounding the EHR as a tool within the complex system of primary care

## METHODS

- **Setting:**
  - Midwestern internal medicine clinic within a large urban multi-specialty health center. Met meaningful use stage 2 criteria
- **Participants:**
  - 20 primary care professionals in various roles
  - 3 MDs/APPs, 4 Medical Assistants (MAs), 3 Registered Nurses (RNs), & 10 others (e.g., Pharmacist, Social Worker, Scheduler)
- **Data collection:**
  - Observations of work for 2-4 hours
  - Up to 3, 90-min semi-structured interviews on work-related goals & information requirements guided by Goal-Directed Task Analysis (GDTA)<sup>5</sup> methodology
  - Identified the information users need to perform a task and how the information is integrated to address a particular decision (SA requirements)<sup>2</sup>
- **Data analysis:**
  - Iterative analysis of 19 interviews & 15 observations
  - Identified excerpts pertaining to EHR design & EHR functionality
  - Guided by SA theory, deductive content analysis<sup>6</sup> was used to categorize responses for
    - 1) Perceptions of EHR related to tasks and goals:
      - Positive/Facilitator
      - Negative/Barrier
      - Desired/gaps in functionality
    - 2) SA required to complete task: Levels 1-3 (perception, comprehension, projection), decisions, goals, shared & team SA
    - 3) Topic categories: work-related goal categories, e.g. preventive care, triage
    - 4) SA design principles related to SA requirements

**Supporting Team Operations**  
Ex: avoid advanced queuing of tasks, enforce automation consistency

**Principles for Complex Domains**  
Ex: organize info around goals, enable schema activation

**Supporting Information Uncertainty**  
Ex: identify missing info, use data salience to indicate certainty

**SA – Design Principle Categories**

**Supporting Alarm Management**  
Ex: make alarms unambiguous, minimize disruptions to ongoing activities

**Supporting Automation**  
Ex: avoid display overload in shared displays, build common picture for teams

**Taming System, Operational, or Apparent Complexity**  
Ex: minimize feature creep, minimize task complexity

## RESULTS

- 125 unique perceptions of EHR design and functionality (Table 1, examples)
- Gaps in EHR capabilities & level 1 SA (perception) commonly absent

Table 1: Perceptions of EHR as a Facilitator/Barrier to Meeting Care Goals

	Physicians/APPs	RNs/MAs	Other Care Team Members
Perception of EHR	Current EHR Gaps (46)	Current EHR Gaps (20)	Current EHR Gaps (24)
Task Category	Assess Preventive/Chronic Needs (41%)	Address Medication Needs (45%)	Assess Needs in Context (30%)
Sample Excerpt	Lack of up-to-date medical guidelines hinders ability for physician to decide best practices: <i>INTERVIEWER: ...what parts of the chart would you read before the visit?</i>  <i>Physician: When did I see them last? What did I see them for last? What health maintenance is due?...when did we last check, what are their meds, what are their goals?...And that's...something...I think we need more help on, we can't remember all this stuff...information in medicine doubles every three months or something, and I'm amazed how dramatic changes have been with meds, with tests, longevity, expectations, with, interventions"</i>	Lack of medication indication led to use of a tool outside the EHR. The RN also lacks Shared SA with the physician regarding indication:  <i>"...in our dot phrase, we have to put why the patient is taking it. So if it's...a medication I've never heard of, I have to...Google it...it would be so nice to, if something popped up and said, this medication helps treat...then I can look on their problem list and be like...so they're taking it for..."</i>	Lack of information on social stressors led to unsuccessful goal completion, and another team member (RN) had to repeat work: <i>INTERVIEWER: Can you give us a kind of an example that you might get from a triage nurse? Or...</i>  <i>Case Manager: A patient I thought understood my instruction...called the nurse, asking questions...he didn't understand. And...[triage nurse is] able to give me background information, oh, he takes care of his wife who's got ALS...so he can spin out of control...I don't think there's good places to document it in [the EHR] that everybody can see. There needs to be...a spot in the chart...should be in front of your face. Eighty-four-year-old lives at home with wife who...kind of brief...adding to everything he's calling about."</i>
SA Requirement	SA1 (perception); test year not readily available	SA1 (perception); medication indication	SA1 (perception) - social factors
SA Impacted	Decision: what should I recommend to patient/How should I treat the patient?	SA2 (comprehension): reason for medication	Goal: Patient education Shared SA with RN
SA Design Principle	Principles for Complex Domains	Principles for Complex Domains Supporting Team Operations	Supporting Team Operations

## KEY TAKEAWAYS

**Decision Support** Primary care team members make decisions while navigating a complex work domain. Certain team members may operate without all cognitive tools needed for effective decision-making, impacting patient care. EHRs should attend to SA needs by utilizing SA design principles

**Inadequate Team Process Support** Examining the dynamics of team members' cognition aids our understanding of individual cognitive requirements, how SA impacts teamwork, and how EHRs can differentially impact team members within the system. Current EHRs are not designed for teams, but should be designed to facilitate teamwork and improve team functioning

**Future Design Needs** EHRs should be designed to primary care teams' actual work & decisions. SA design principles provide a way to understand and address design needs. If EHRs were designed using SA design principles, team member's specific cognitive needs would be met and team-based patient care would improve

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