



**I-PrACTISE**

Improving PrimAry Care Through  
Industrial and Systems Engineering

# Roadblocks to Situation Awareness in Primary Care Settings

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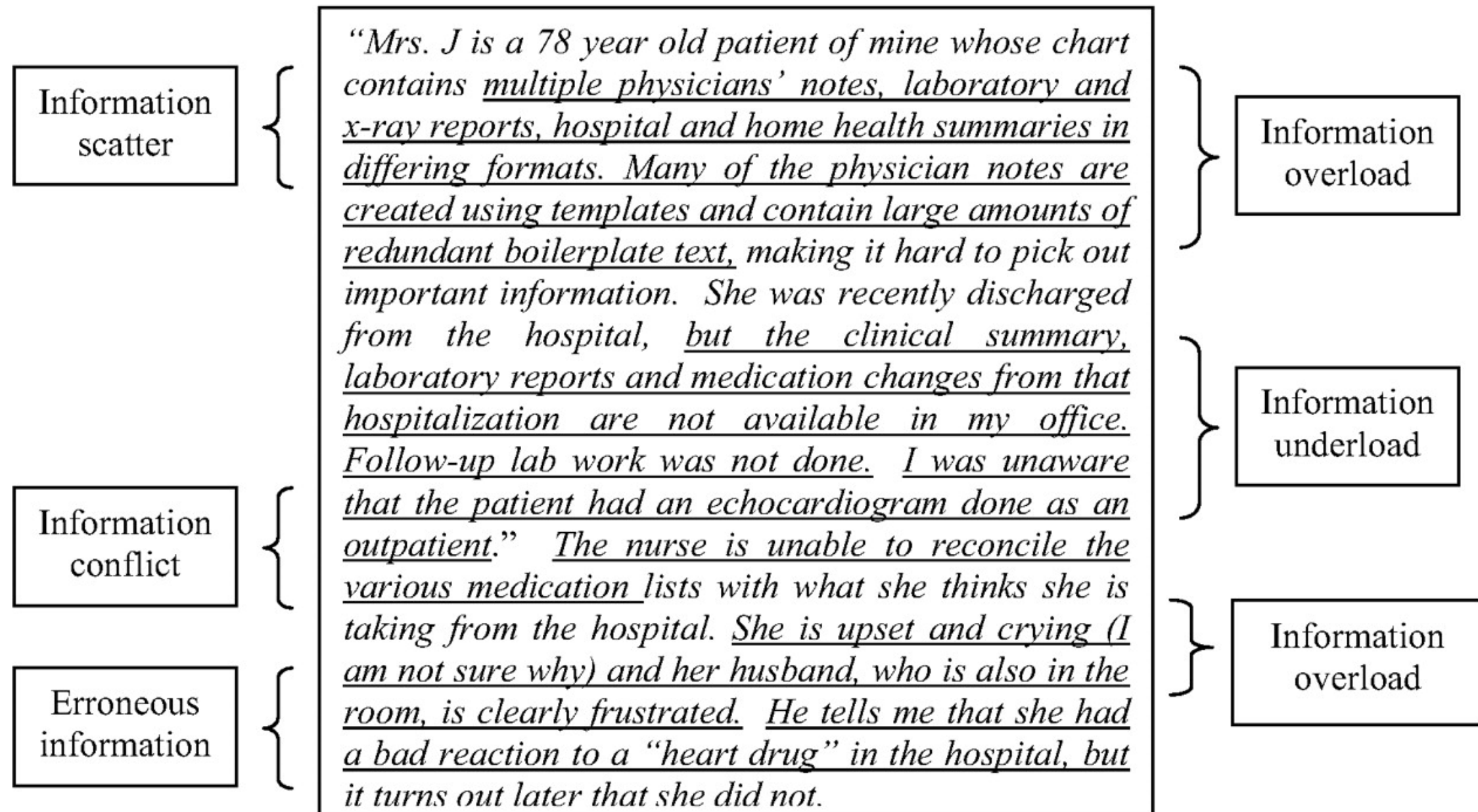
# Information Chaos

- Is a hazard in Primary Care (anywhere, for that matter)
- Makes the establishment of the Situation Awareness (SA) more difficult
- We Need the EHR and its use by systems to calm the chaos.h

## Information Chaos in Primary Care: Implications for Physician Performance and Patient Safety

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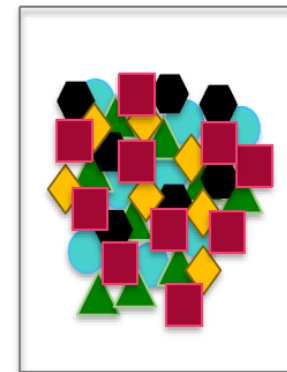
## Clinical Vignette Illustrating Information Hazards



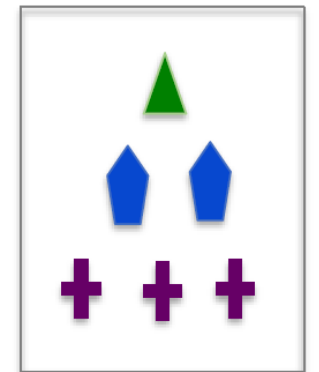
# Situation Awareness (SA)

- Critical for making good decisions – in any field
  - Aviation (AF Flight 447, Boeing 737 Max)
  - Military
  - Medical Care – Primary care is especially complex
- Depends on good, relevant information (not just data)
  - Narrative is important to making sense of data
  - We can't predict what information we will need when
    - Workflow, Schmerkflow!
- Some data are quantifiable, some are not.
  - How important is it to Walter to continue to live on his farm?

Information  
available in  
the EHR



Information  
team member  
must extract



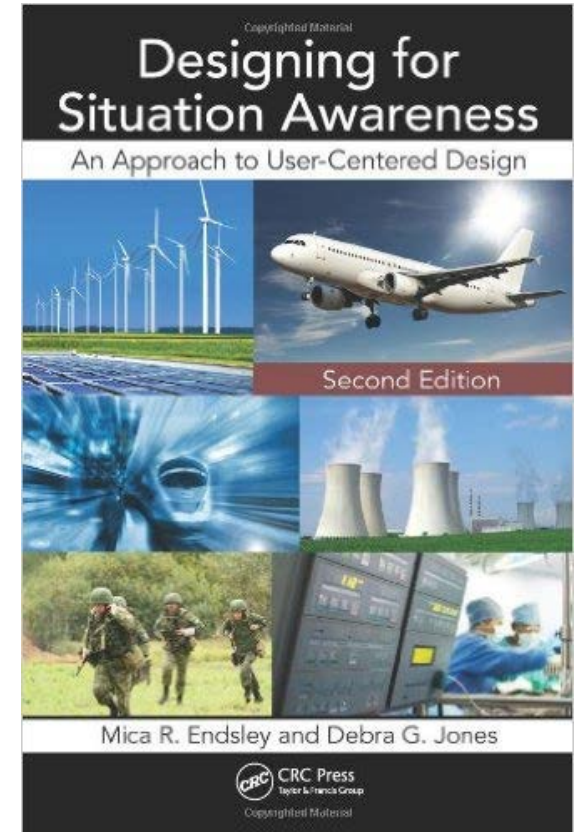
# Situation Awareness (SA) (2)

- Our mental models give meaning to data (or lead us astray)
  - Mental model of “viral infection” can lead to missing diagnosis of pulmonary embolism.
- Feedback may let us modify search
  - I decide that we should just do symptomatic treatment
  - Patient states, “But I’ve not had any fever.”
- Data driven versus task driven
  - The elevated d-dimer suggests pulmonary embolus. My task is to start treatment. I need to find out if we have the needed medication in stock.

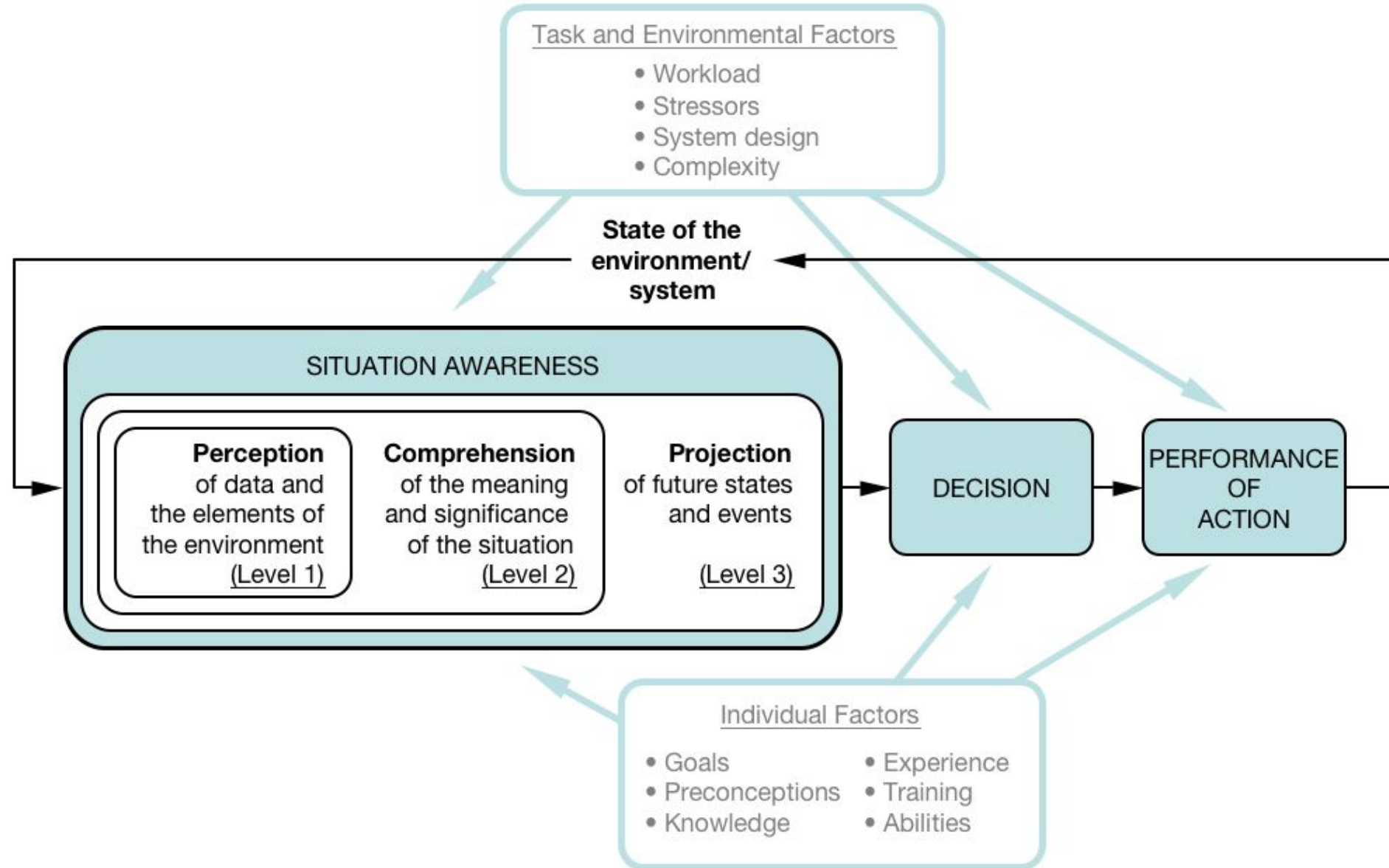
# We Establish Situation Awareness During The Visit to Inform Decision Making

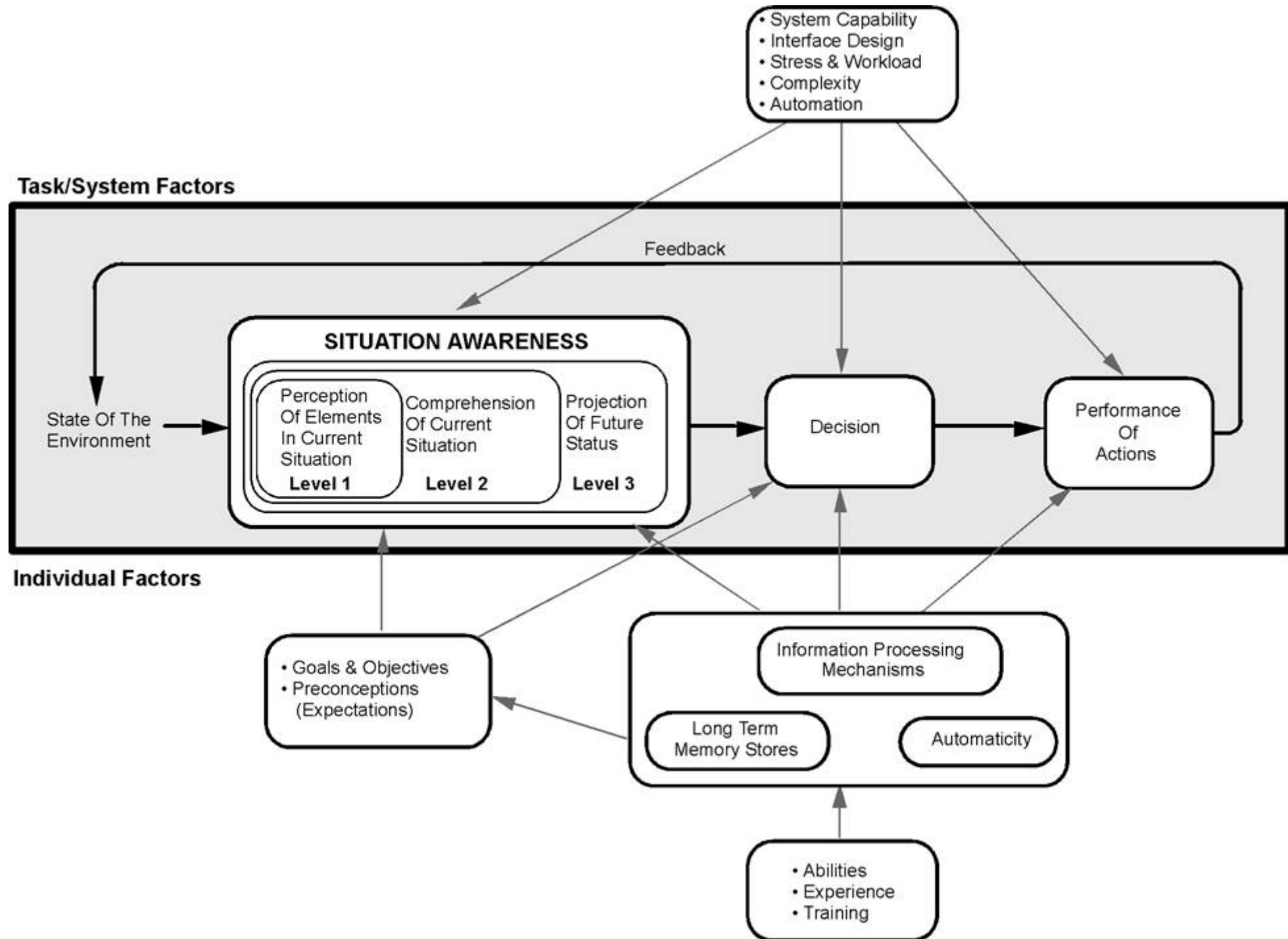
- What's going on?
- What does it mean?
- Where is it headed?
- If we change something, what will happen?

We need the system,  
including the EHR, to  
help us do this.



# Situation Awareness

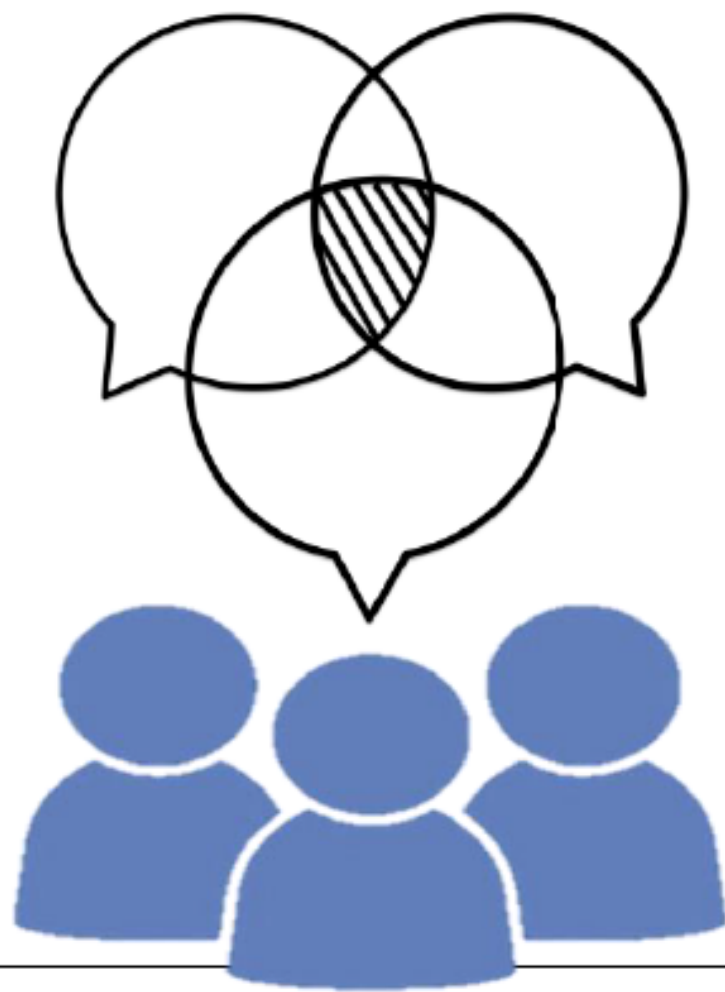






# Levels of Situation Awareness

- Level 1 SA – Perception
  - Current status of patient
    - E.g. symptoms, affect, goals vital signs, lab results, medications – a long list!
- Level 2 SA – Comprehension
  - Integrate data to
    - understand significance, the priorities of data elements, differential diagnosis, which data elements are critical, patient factors that will influence care – and more!
- Level 3 SA – Projection
  - Project the impact of the issues on patient health and probable impact of care on health.



Team & Shared SA refer to the extent of team members' SA and how team members' SA overlaps

# Problems in Establishing Situation Awareness

- “ Developing good SA has always been a challenge in primary care due to the vast amount of disparate data that need to be gathered and synthesized.”





# Goal Directed Task Analysis (GDTA)

- ***Goal Directed Task Analysis (GDTA)*** is the method used to assess individual's and team members' cognitive needs. GDTA is a cognitive task analysis technique that identifies SA requirements necessary to complete a task using information needed by users to perform tasks and how this information is combined to address a particular decision.

# Finding the Roadblocks

- Methods:

- Setting & participants: eight primary care facilities
  - 14 Physicians
  - 5 Advanced Practice Professionals
  - 18 Nurses (RN or LPN)
  - 17 Medical Assistants
  - 32 Others (e.g. Reception, Pharmacist)
- Data collection: direct observations and interviews
- Data analysis: goal-directed task analysis (GDTA) used
  - Documented the key goals and decisions of team members and SA requirements
  - Noted challenges and roadblocks to achieving SA needed to support decision making



# Roadblocks: Initial Analysis From GDTA

- Poor quality and missing information
- Poor information sharing across the health care team
- Support needed for care outside of office visits
- Lack of information on trustworthiness of data
- Information sensitivity affects recording of information
- Poor data integration and overload
- Feedback and tracking on effects of actions is slow or missing
- Little support for creating the higher levels of SA (Understanding/projection)
- Inadequate decision and task support
- Patient follow-up often missed or inconsistently applied
- Interference of technology in patient, physician and team interactions
- Physician and team overload



# Main areas of roadblocks



User-EHR interaction

User & clinic system

EHR design



# Roadblocks Related to EHR Design

- Poor data integration and overload
  - “It’s nearly impossible to tell when the dose of metoprolol was changed.”
  - “My partner used a template to document the last visit, and I have no idea what he was thinking!”
    - In part related to policies leading to “note bloat” in the EHR.
- Little support for creating higher levels of SA (Understanding/projection)
  - “I didn’t realized how depressed she was.”
  - EHR use may distract from assessment of subtle issues (e.g. Depression)
  - EHR may not provide context for care (e.g. homeless status)

# Roadblocks Related to EHR Design (2)

- Feedback and tracking on effects of actions is slow or missing
  - “I didn’t realize that he was having more hypoglycemia on the new dose of insulin.”
  - EHR has poor projection of data over time and does not clearly facilitate follow-up.
- Inadequate decision and task support
  - “I know that there is a possible allergy here, but he’s been on this medication for years and yet the allergy alert keeps firing.”
  - Diagnostic and Best Practice Alerts (BPA) of little use – and if automated often cause break-in-task and distraction.

# Roadblocks Related to User/clinic System

- Physician and team overload
  - Burnout & fatigue
    - “I’m still doing charts at 8 PM after the kids are in bed.”
    - → less able to maintain physician’s own SA
  - Limited time for team Communication (E.g. Lunch!)
    - → less able to support other team members’ SA
- Poor quality and missing information
  - “I can’t find the ECG that was done in the other hospital.”
  - Lack of information about trustworthiness of data



# Roadblocks Related to User/clinic System (2)

- Poor Information sharing across the extended health care team
  - “I can’t get the actual tracing of the ECG that was done at the hospital.”
  - Interoperability a major issue for clinicians
- Support needed for care outside of office visits
  - “She sent me a MyChart message about her chest pain, but I didn’t see it until the end of the day.”
  - Need for better system (including clinician time) for out-of-clinic care.
    - Incidentally, more out of clinic contact appears to lead to more, not less, in-clinic contact.
- Patient follow-up often missed or inconsistently applied
  - “Did we get back to them about the abnormal lab results?”
  - “I never heard back from them about their migraines.”

# Roadblocks Related to User-EHR interaction

- Interference of technology in patient/physician interactions
  - “The doctor just spent all of his time looking at the computer – he never looked at me.”
    - More EHR features may demand more attention by clinicians and staff.
- Interference of technology on team interactions
  - “I don’t have time to talk with my nurse any more.”
  - Over-reliance on technology for communication is an issue – Lack support for “synchronous analogue communication”.
- Information sensitivity affects recording of information
  - “She never told me how much she was drinking. I only found out when her husband called.” What do patients NOT tell us?
  - We have no idea how big a problem this is – but it’s there.

# Some Other Roadblocks: Beyond Our Study

- These may be subtle.
  - Poorly designed clinics lacking co-location to facilitate dyadic team communication.
    - Increases in-basket load
    - “A handoff is not a telegram!”
  - Encouragement of use of templates/copy-paste.
  - Encouraging clinicians to keyboard in patient data
    - “The Pen is Mightier Than The Keyboard.”
  - Discouraging printing out material that requires real concentration.

# Removing Roadblocks

- Understanding that they exist is the first step
- Requires a system approach – it's not just the EHR.
  - Purpose
  - Policy (Regulatory and organizational)
  - Technology – the display of medication lists is a disaster
  - Users – allowing the EHR to be disruptive
- Need to recognize that communication has social functions as well as information transfer

# Removing Roadblock: EHR Designs

- Poor data integration and overload
  - Design for better displays, particularly over time
  - Reduce cognitive clutter (e.g. note bloat)
- Little support for creating higher levels of SA (Understanding/projection)
  - Assure all data easily available at any time.
    - Remember Workflow-Schmerkflow
  - Encourage appropriate use of direct, dyadic communication
    - (or even paper – Gasp!)



# Removing Roadblock: EHR Designs (2)

- Feedback and tracking on effects of actions is slow or missing
  - Develop better methods to assess and display care outcomes
- Inadequate decision and task support
  - Use wisely – AI may help here
  - “No false alarms!”

### **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

# Removing Roadblocks: User/Clinic System

- Physician and team overload
  - Reduce unneeded documentation tasks
  - Encourage teams (e.g. Clinical Coaches/scribes)
- Poor quality and missing information
  - Develop systems to better and validate information

# Removing Roadblocks: User/Clinic System (2)

- Poor Information sharing across the health care team
  - Use technology wisely
  - Encourage co-location
  - Encourage verbal communication
- Support needed for care outside of office visits
  - Better patient portals – and time during work hours to access them
- Patient follow-up often missed or inconsistently applied
  - Better documentation of follow-up

# Removing Roadblocks: User-EHR Interaction

- Interference of technology in patient/physician interactions
  - Reduce physicians' need to engage the EHR during patient contact.
  - Rooms arranged for screen-sharing with patients
- Interference of technology on team interactions
  - Systems must stress the wise use of various communication methods (e.g. EHR, paper, verbal)
- Information sensitivity affects recording of information
  - Assure patients of absolute confidentiality – this may mean leaving some information out of the EHR.
  - Parts of EHR data can be hidden or not part of permanent record





Quaint Bridge Over Stream by Debbie Oppermann