Roadblocks to Situation Awareness in Primary Care Settings

Mica R. Endsley, Ph.D.
Tosha B. Wetterneck, M.D., M.S.
Shimeng Du, M.S., Laura Farrell, M.S.
John W. Beasley, M.D.
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.

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

John W. Beasley, MD, Tosha B. Wetterneck, MD, MS, Jon Temte, MD, PhD, Jamie A. Lapin, MS, Paul Smith, MD, A. Joy Rivera-Rodriguez, PhD, and Ben-Tzion Karsh, PhD
Clinical Vignette Illustrating Information Hazards

“Mrs. J is a 78 year old patient of mine whose chart contains multiple physicians’ notes, laboratory and x-ray reports, hospital and home health summaries in differing formats. Many of the physician notes are created using templates and contain large amounts of redundant boilerplate text, making it hard to pick out important information. She was recently discharged from the hospital, but the clinical summary, laboratory reports and medication changes from that hospitalization are not available in my office. Follow-up lab work was not done. I was unaware that the patient had an echocardiogram done as an outpatient.” The nurse is unable to reconcile the various medication lists with what she thinks she is taking from the hospital. She is upset and crying (I am not sure why) and her husband, who is also in the room, is clearly frustrated. He tells me that she had a bad reaction to a “heart drug” in the hospital, but it turns out later that she did not.
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?
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.
Task/System Factors

State Of The Environment

Individual Factors

SITUATION AWARENESS

Level 1: Perception of Elements in Current Situation
Level 2: Comprehension of Current Situation
Level 3: Projection of Future Status

Decision

Performance Of Actions

Feedback

- System Capability
  - Interface Design
  - Stress & Workload
  - Complexity
  - Automation

- Goals & Objectives
- Preconceptions (Expectations)

- Information Processing Mechanisms
  - Long Term Memory Stores
  - Automaticity

- Abilities
- Experience
- Training
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.”

Endsley MR, Wetterneck TB, Beasley JW. Roadblocks to Situation Awareness in Primary Care Manuscript in preparation.
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)
• 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

Performance

SA principles improve performance

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