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Patient Safety Tip of the Week

July 8, 2025

Applying Human Factors Concepts to Radiology

Distractions, interruptions, workload, fatigue, System 1 vs System 2 thinking, cognitive biases – these are all factors we consider when we are doing an incident investigation, root cause analysis, or planning a patient safety intervention. So, it's no surprise that these would play prominent roles in a new paper on human factors in radiology. The excellent paper by Cowen et al. (Cowen 2025) has concepts and recommendations that could easily be applied to most specialties.

They begin with a discussion on **distractions and interruptions**. They note studies show radiologists are interrupted on average every 12.1 min during daytime hours, and as frequently as every 10 min during a 12-hour night shift (see our July 1, 2014 Patient Safety Tip of the Week "Interruptions and Radiologists" and our November 2014 What's New in the Patient Safety World column "More Radiologist Interruptions"). They further note that, in real practice, the frequency of interruptions is likely to be even greater during peak times and at particularly busy centers which are often staffed out of hours by a single radiologist. They go on to discuss how the set-up of the reporting room or environment influences the number of possible distractors. They show a diagram of a typical "open-plan" reporting room that has a radiologist(s), coordinator, and resident(s), each with a telephone, plus clinicians waiting to discuss cases and foot traffic through the room.

They cite research by Williams and Drew showing that interruptions force individuals to engage in task-switching, leading to cognitive fatigue and decreased efficiency. An interruption can cause a radiologist to lose their place in the image review process. Eye-tracking software utilized during the interrogation of CT images for lung nodules demonstrated that following an interruption, the search for nodules was resumed in the same quadrant of the image only 23.1 % of the time, which is essentially equivalent to chance.

Potential interventions and solutions to reduce interruptions suggested:

- ‘isolating’ the reporting radiologist by creating a ‘sterile flight deck’ akin to the aviation industry with a duty radiologist (or radiographer) taking clinician enquiries can reduce unwarranted reporting interruptions
- streamlining electronic vetting processes
- electronic instant alert systems for issuing critical reports to referring clinicians
- use of digital messaging systems to defer non-urgent enquiries to a more appropriate time

Next, they note that **workload** of radiologists has increased significantly in the past two decades with demand for diagnostic imaging rising rapidly. Studies have shown that increased workload and reporting time pressures have resulted in increased rates of error. They cite a study by Davenport et al (Davenport 2010) that analyzed over 13,000 cross-sectional studies and found that of all the variables considered, the most significant impact on rates of discordant reports was caseload, with reporting discrepancy risk increasing with the number of cases read per hour.

The authors admit that potential solutions to the workload issue “are more easily suggested than they are implemented.” Hiring more radiologists, using teleradiology for night shifts, and overlapping staff during busy hours were some suggestions. Reducing demand via better utilization of imaging guidelines is a difficult task.

The impacts of **fatigue** and **burnout** were addressed. Multiple studies have demonstrated that fatigue negatively impacts reporting accuracy in diagnostic radiology. They note the importance of recognition of individual limitations, taking regular short breaks, and ensuring adequate hydration during a prolonged reading session in order to maintain an optimal level of concentration and performance. Likewise, burnout has been repeatedly shown to reduce work quality and contribute to medical error. They also have a brief discussion about the potential role of artificial intelligence (AI) in addressing these issues.

Then they move on to cognitive biases. They begin with a discussion on **System 1** (fast, pattern recognition) and **System 2** (slow, analytical) thinking. They acknowledge that radiologists often rely heavily on System 1 (or ‘heuristic’) thinking − rapid, intuitive pattern recognition honed through years of training and experience. But System 1 thinking can also lead to errors. They note cognitive biases such as confirmation bias, anchoring, satisfaction of search, inattention bias, and several others that may contribute to errors.

One suggested strategy to activate System 2 thinking and reduce error is use of the SCAN mnemonic for cognitive debiasing. SCAN stands for:

S Systemic approach
C Clinical context/Compare with previous
A Alternative diagnoses
N Never assume

As we noted earlier, most of the concepts in this paper can be applied to almost any specialty. The authors have done a good job of identifying the many factors that contribute to errors.

Some of our prior columns on patient safety issues in the radiology suite:

- October 16, 2007 "Radiology as a Site at High-Risk for Medication Errors"
- February 19, 2008 "MRI Safety"
- September 16, 2008 "More on Radiology as a High Risk Area"
- October 7, 2008 "Lessons from Falls....from Rehab Medicine"
- October 2008 "Preventing Infection in MRI"
- March 17, 2009 "More on MRI Safety"
- March 2009 "Risk of Burns during MRI Scans from Transdermal Drug Patches"
- August 11, 2009 "The Radiology Suite…Again!"
- January 2010 "Falls in the Radiology Suite"
- August 2010 "Sedation Costs for Pediatric MRI"
- January 25, 2011 "Procedural Sedation in Children"
- February 1, 2011 "MRI Safety Audit"
- October 25, 2011 "Renewed Focus on MRI Safety"
- March 13, 2012 "Medical Emergency Team Calls to Radiology"
- August 2012 "Newest MRI Hazard: Ingested Magnets"
- October 22, 2013 "How Safe Is Your Radiology Suite?"
- February 25, 2014 "Joint Commission Revised Diagnostic Imaging Requirements"
- July 2014 "New MRI Risks: for Staff!"
- July 1, 2014 "Interruptions and Radiologists"
- November 2014 "More Radiologist Interruptions"
- October 21, 2014 "The Fire Department and Your Hospital"
- June 23, 2015 "Again! Mistaking Antiseptic Solution for Radiographic Contrast"
- August 25, 2015 "Checklist for Intrahospital Transport"
- March 22, 2016 "Radiology Communication Errors May Surprise You"
- August 2016 "Guideline Update for Pediatric Sedation"
- October 2016 "MRI Safety: There's an App for That!"
- January 17, ,2017 "Pediatric MRI Safety"
- August 8, 2017 "Sedation for Pediatric MRI Rising"
- November 14, 2017 "Tracking C. diff to a CT Scanner"
- March 2018 "MRI Death a Reminder of Dangers"
- March 2018 "Cardiac Devices Safe During MRI But Spinners!?"
- April 2018 "Radiologists Get Fatigued, Too"
- May 2018 "Cost of Interrupting a Radiologist"
- November 2018 "OMG! Not My iPhone!"
- December 11, 2018 "Another NMBA Accident"

- April 2, 2019 "Unexpected Events During MRI"
- September 2019 "New MRI Hazard: Magnetic Eyelashes"
- October 15, 2019 "Lots More on MRI Safety"
- November 5, 2019 "A Near-Fatal MRI Incident"
- November 12, 2019 "Patient Photographs Again Help Radiologists"
- November 26, 2019 "Pennsylvania Law on Notifying Patients of Test Results"
- January 7, 2020 "Even More Concerns About MRI Safety"
- July 14, 2020 "A Thesis on Intrahospital Transports"
- August 25, 2020 "The Off-Hours Effect in Radiology"
- October 2020 "New Warnings on Implants and MRI"
- January 2021 "New MRI Risk: Face Masks"
- May 25, 2021 "Yes, Radiologists Have Handoffs, Too"
- June 1, 2021 "Stronger Magnets, More MRI Safety Concerns"
- November 2021 "Yet Another Risk During MRI"
- January 2022 "MRI Safety Issues"
- February 2022 "Managing Incidental Findings"
- June 2022 "Where Are You Barcoding?"
- July 12, 2022 "Radiologists Racked by Interruptions"
- July 26, 2022 "More Risks in the Radiology Suite"
- May 2023 "Factors Associated with Radiology Diagnostic Errors"
- September 12, 2023 "Radiology and Hospital-Acquired Infections"
- October 24, 2012 "Serious MRI Accident at Unregulated MRI Center"
- November 21, 2023 "Another Terrifying MRI Accident"
- January 2024 "Guns and MRI Don't Mix"
- June 11, 2024 "Nursing in the MRI Suite"
- August 13, 2024 "Preventing Thermal Injury During MRI"
- October 2024 "Another MRI Accident Reveals Gap in Oversight
- October 2024 "MRI Special Patient Considerations"
- October 8, 2024 "First Responders and MRI"
- April 22, 2025 "Updated ACR Manual on MRI Safety"

References:

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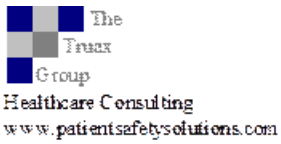

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