



Tomorrow's Doctors, Tomorrow's Cures®

Simulation to Assess and Improve EHR Safety

Learn

Serve

Lead

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10/18/17



Association of
American Medical Colleges

Disclosures

- No Commercial Conflicts of Interest
- Research Funding from AHRQ, AAMC/Donaghue Foundation

Patient Safety and EHRs

- Cognitive overload with excessive data
 - >2000 data pt/day
- Facilitates selective data gathering and processing
 - Associated 3-fold increase in patient morbidity
 - Delayed and Missed diagnosis are top patient safety threat
- Significant impacts on efficiency
 - Dramatic rise in number of professional groups which enter and view patient data
- Facilitates increased test ordering
- New data on new med mal threats from all of the above

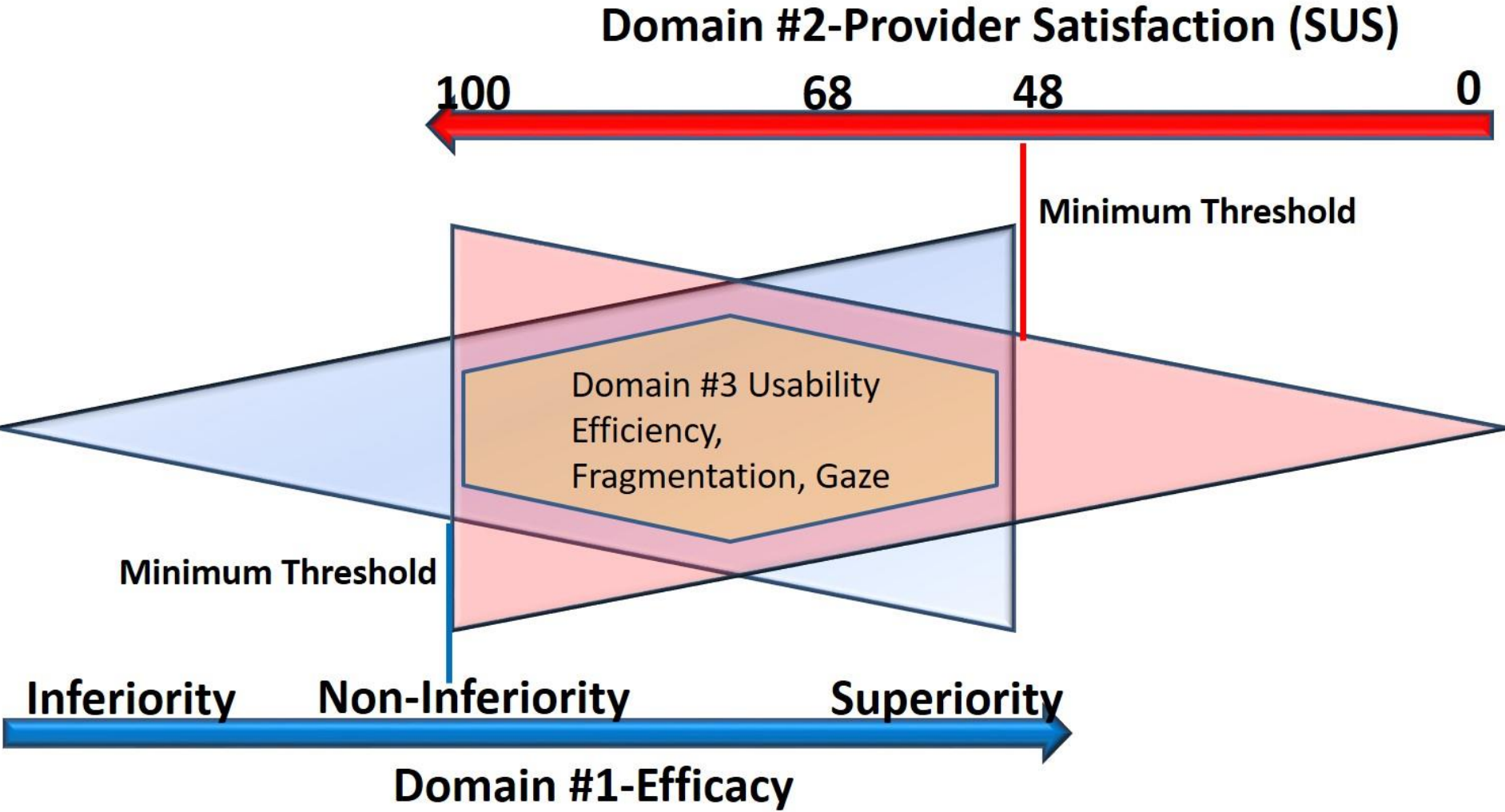
Barriers to Safe and Effective EHR Use

- Little user interface design science focused on data management
- Large amount of data per patient
 - Can you see the forest through the trees?
- Need for standardization of patient care coupled with uniqueness of each individual/environment
- Training cases are simple, data poor, specialty/environment agnostic and don't test cognitive processing
- Alert Fatigue (ICU pt 150-200 EHR alerts/day) (kizzier 2015)
- Data fragmentation/over₄ customization
- Cognitive errors – knowing what's important

Simulation

- Allows for controlled investigation of the EHR-provider-patient relationship
- Provides a valuable means for deliberate practice and training
 - Demonstrated effectiveness across wide range of procedures and delivery pathways
- Goal is for activities to be patient NOT provider centered
- Requires the ideal degree of fidelity to reproduce clinical complexity, cognitive load and workflow
- Should be designed to “stress” the system

Testing and Evaluation Paradigm



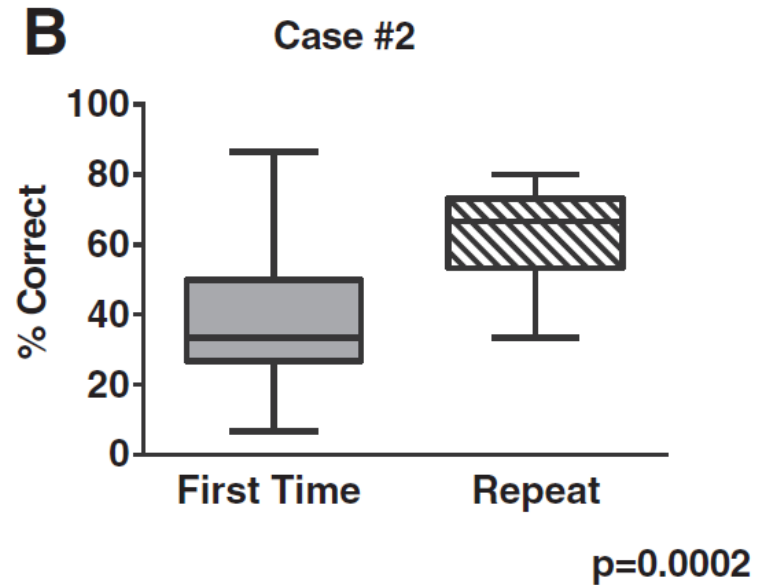
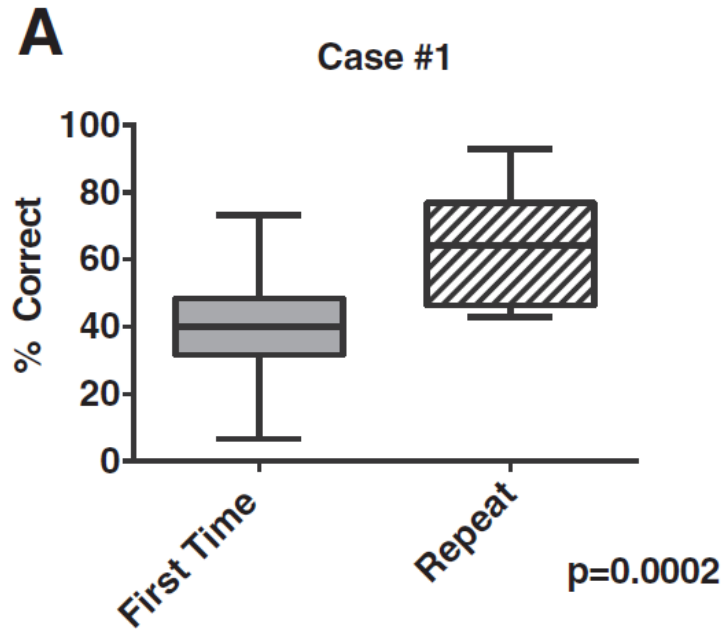
Development of EHR Simulation-Residents First

- 5 day real life ICU stay created in EPIC simulation environment
 - Cloned from Production Q3 months to maintain realism and customization
- Every data point created and entered by hand in relative real time (no way to download data into system)
- Patient “cloned” forward to day of testing so can be used in real time (temporally “In-Step”)
- Case contains clinical decompensation with purposely designed patient safety issues
 - Vitals trends, medication misdosing, lack of best practices

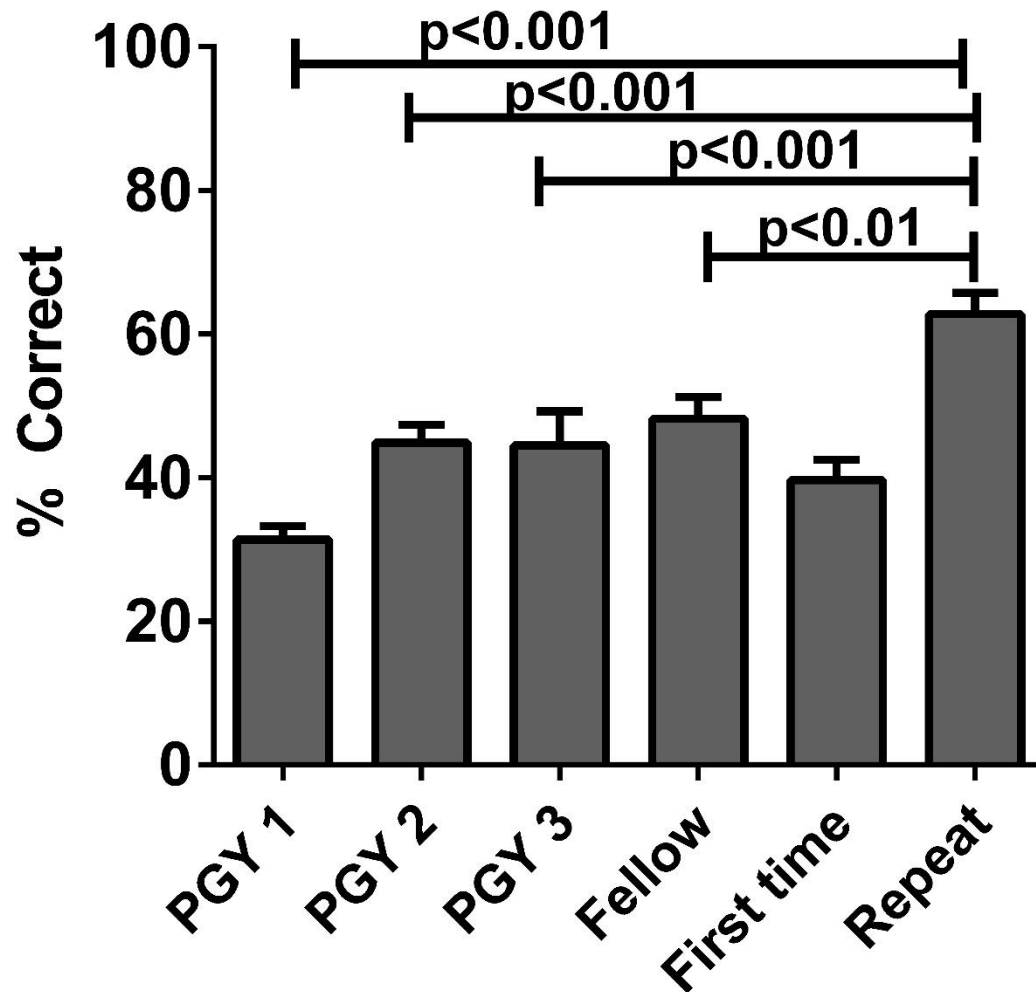
Use of Case in Actual Work Flow

- Done In Situ with ICU residents
 - Ensures all subjects familiar with ICU workflow and best practices
 - Recapitulates other socio-technical factors (noise, lights)
- Trainees given written history, relevant clinical info for last 5 days, Bld Cx results and PE
- Trainees given 10 min to gather data in EPIC
 - Integrate Eye and Screen Tracking for detailed usability
- Subjects told to present case as if presenting on rounds
- Subjects could be tested again, at least 1 week later
 - Repeat testing with different case-random order

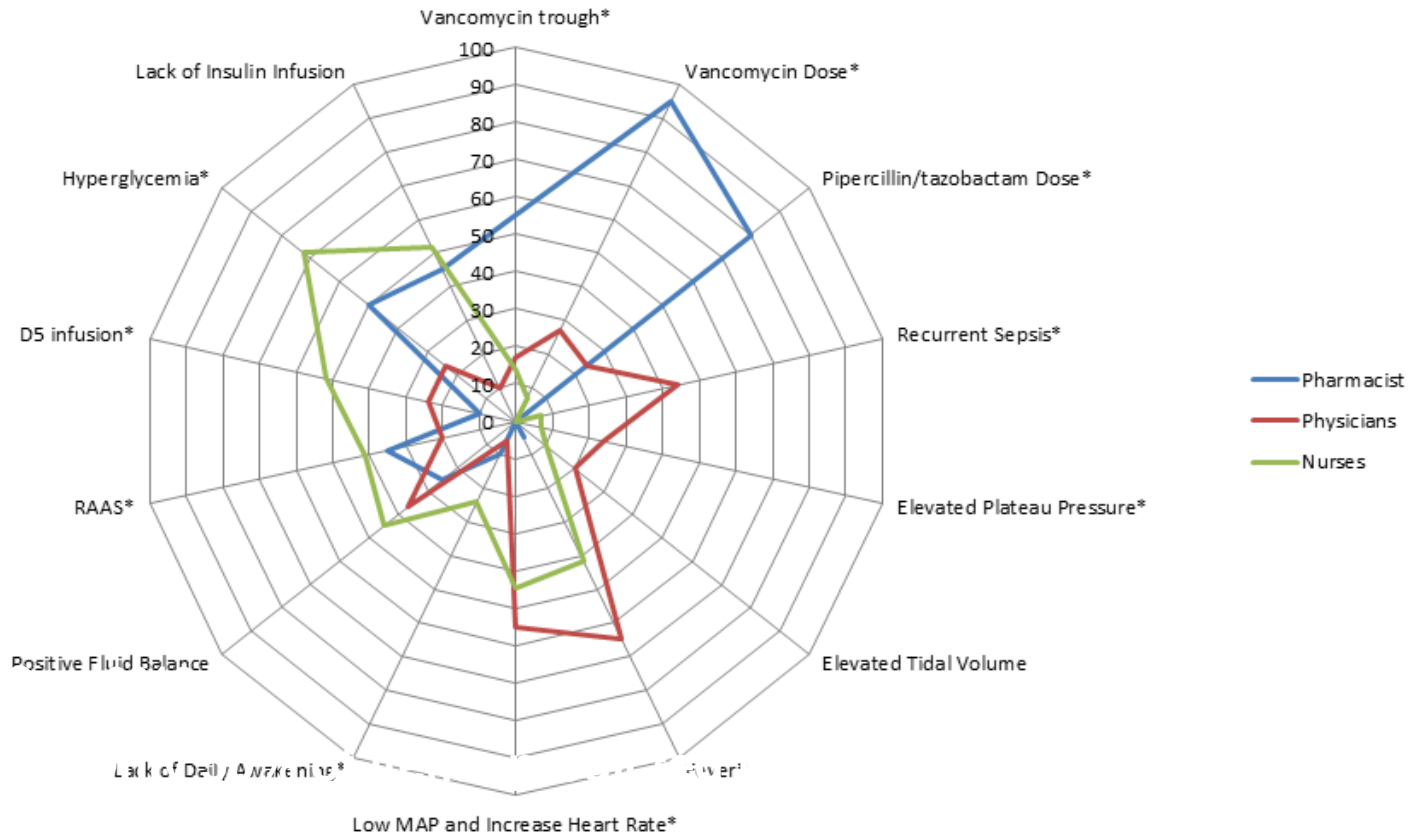
Simulation to Improves Effective EHR Use



Simulation Trained Novices Outperform Experts

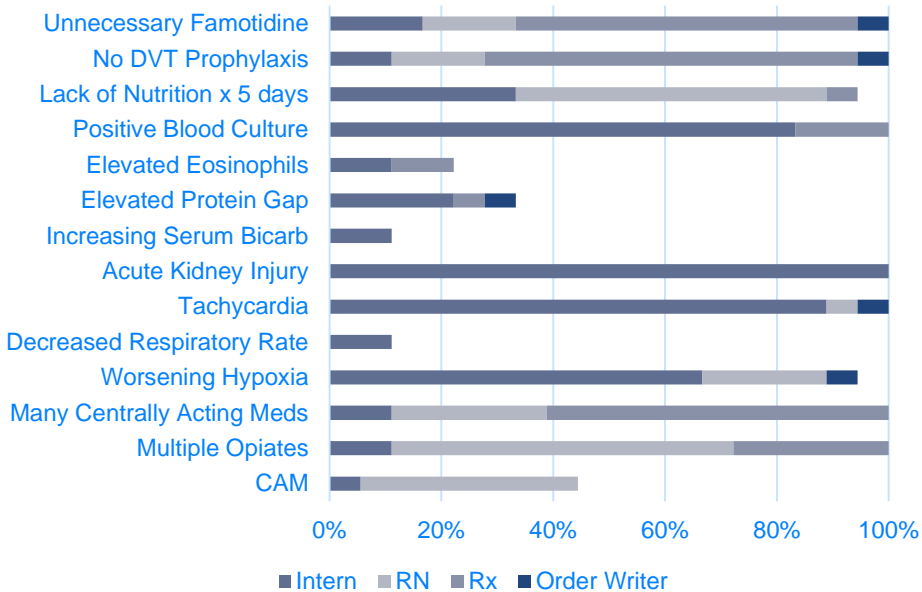


Patient Centric Simulation-Same Case, Multiple Professions

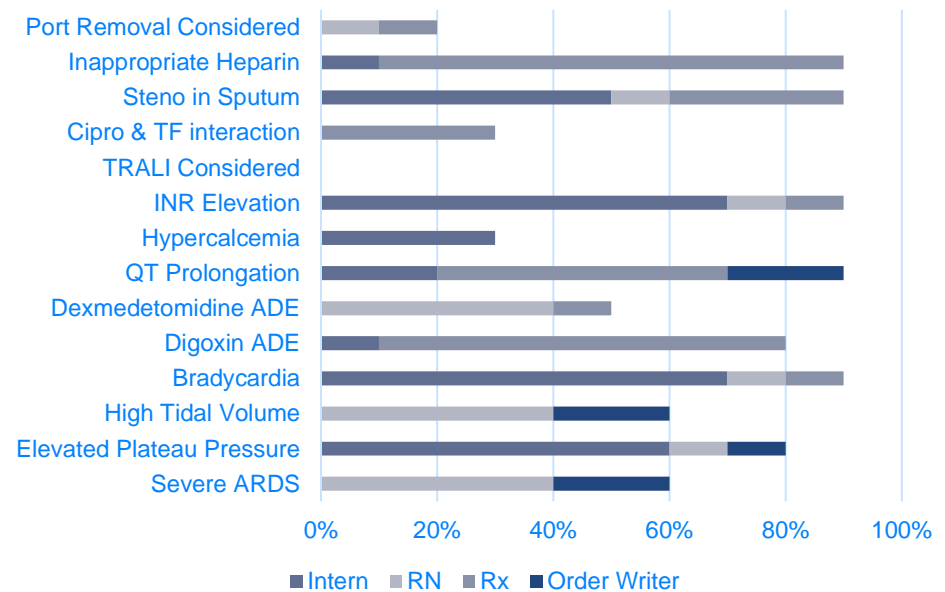


ICU Rounding Simulation-Team Based Simulation

Case 1 - Safety Issues Identified



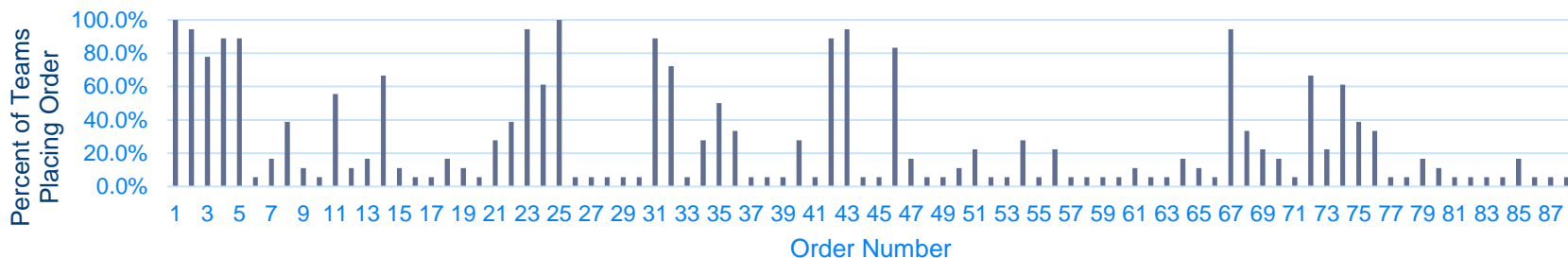
Case 2 - Safety Issues Identified



<25% with primary diagnosis in differential

Impact of Selective Data Gathering on Clinical Decision Making

Case 1

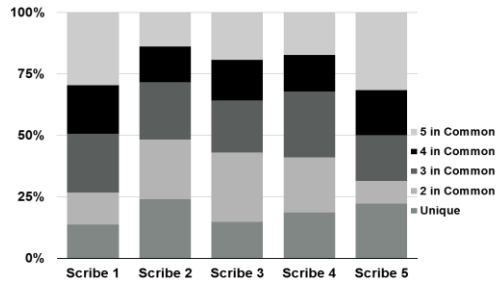


Case 2

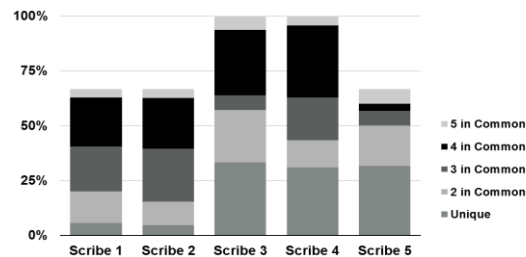


EHR and Video Based Simulation to Assess Note Creation

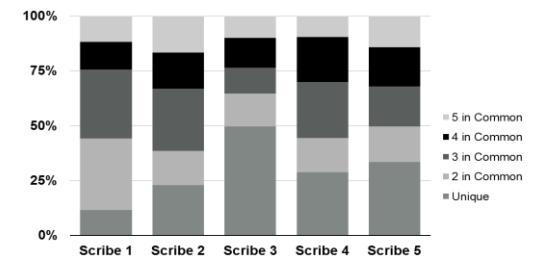
A. Subjective



Physical Exam



Assessment and Plan



Other Results

- >35% of available data misrepresented on ICU Rounds
- EHR generated rounding tool is greatest source of errors
- Used EHR based simulation to understand structure and content of Progress note
- Used EHR based simulation to “diagnose and treat” struggling learners
- Evaluating ability off simulation to improve implementation of new EHR workflow

Summary

- EHRs can have negative consequences on efficiency, efficacy and subsequently patient safety
- Simulation is a powerful tool to allow for systematic evaluation of design and improve training
- Simulation hinges upon both high-fidelity cases which reproduce the environment, EHR activity and the latent safety and efficiency issues associated with use