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2019 ACS Surgical Simulation Summit

AN INTERNATIONAL MULTI-PROFESSIONAL MEETING

MARCH 15-16, 2019 | Swissôtel, Chicago, IL

Pre-Meeting Activities: Thursday, MARCH 14, 2019

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Using Causal Models in Psychomotor Performance Assessment

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Medical School

Driven to DiscoverSM

Funding Source for Research Project

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	Potential Funding Sources	Check all that apply
1	Sim center operational funds	X
2	Intramural grant	
3	Clinical Departmental funds	
4	Hospital operations	
5	School of Medicine	
6	Hospital QI/PI Process	
7	Philanthropy	
8	Insurance Company	
9	Industry	
10	NIH/AHRQ or other governmental funding source	
11	DoD	
12	Not for Profit or Professional Society	
Other		

- Allow us to draw qualitative assumptions about cause-effect relationships between various experiments and data
- Why are they useful?
 - Analyze the same variables within different groups
 - Draw useful assumptions when we cannot influence populations or data sets

Pearl J. Causal diagrams for empirical research. *Biometrika* [Internet]. 1995 Dec 1 [cited 2018 Nov 14];82(4):669–88.

- We propose using a causal model in psychomotor performance assessment to
 - Identify outliers in our learner group
 - Reduce the need for expert faculty involvement
- We hypothesized that a clinically novice (C_N) group will show greater variance in the actions taken to deliver a RSII than a clinically proficient (C_p) group

- Established an ideal practice sequence to create the model
 - Number of ETI attempts, limiting apnea duration, and $\text{preO}_2 \geq 3\text{min}$
- Clinically Proficient (C_p) Group
 - Clinical setting, N=45, CRNAs and Anesthesiologists
 - Live recorder timestamping event sequences
- Clinically Novice (C_N) Group
 - Simulation setting, N=15, CA-1 anesthesia residents
 - AV recording for simulation

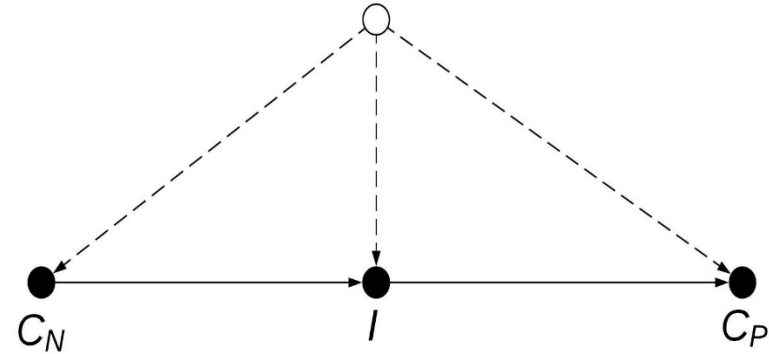
- The Model's Assumption

- $\{\mu, \sigma\}: C_N \rightarrow C_P$

- Our causal model allows us to estimate the total effect of C_N and I on the probability distribution of C_P

- The fit of C_N to C_P

- Normalization with increased experience

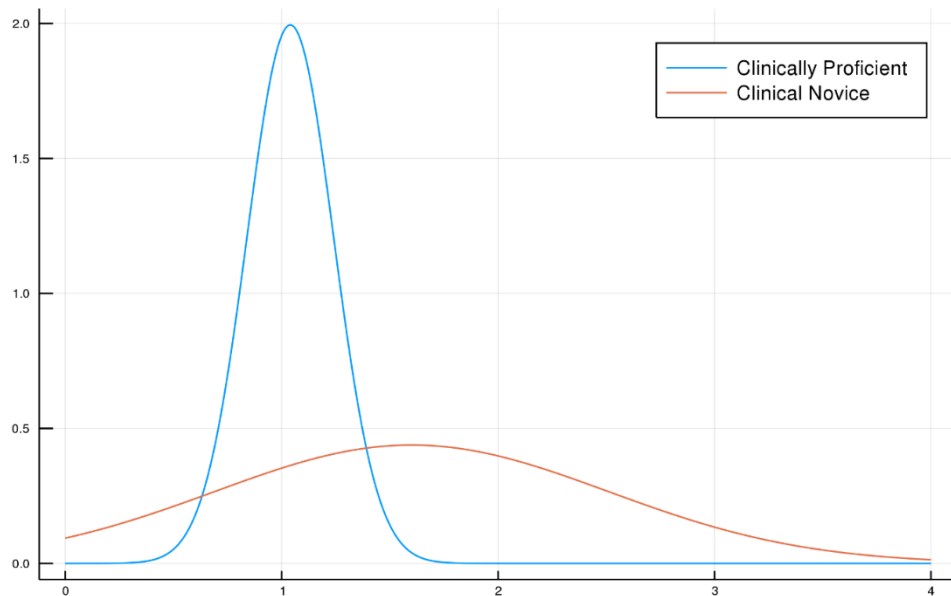


Results: ETI Attempts

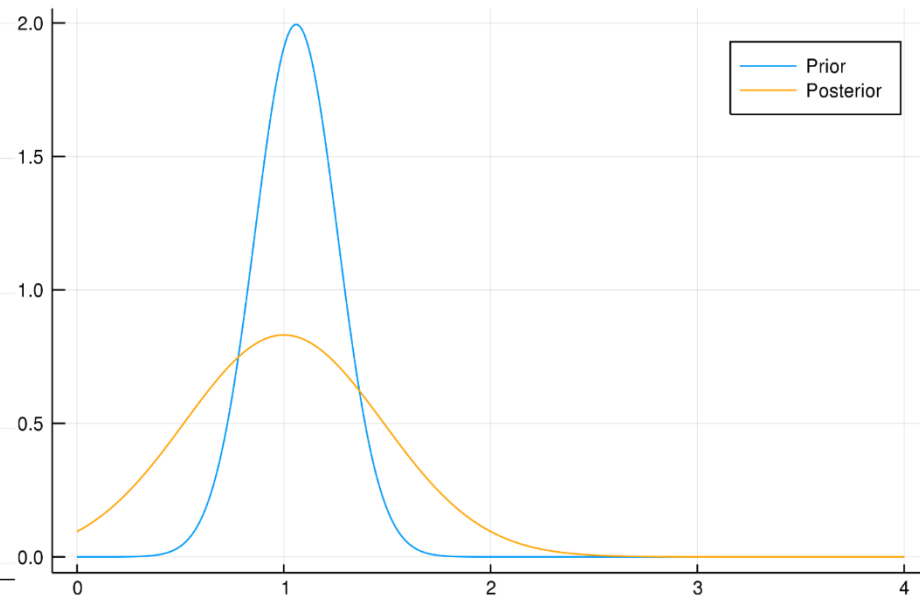
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ETI Attempts

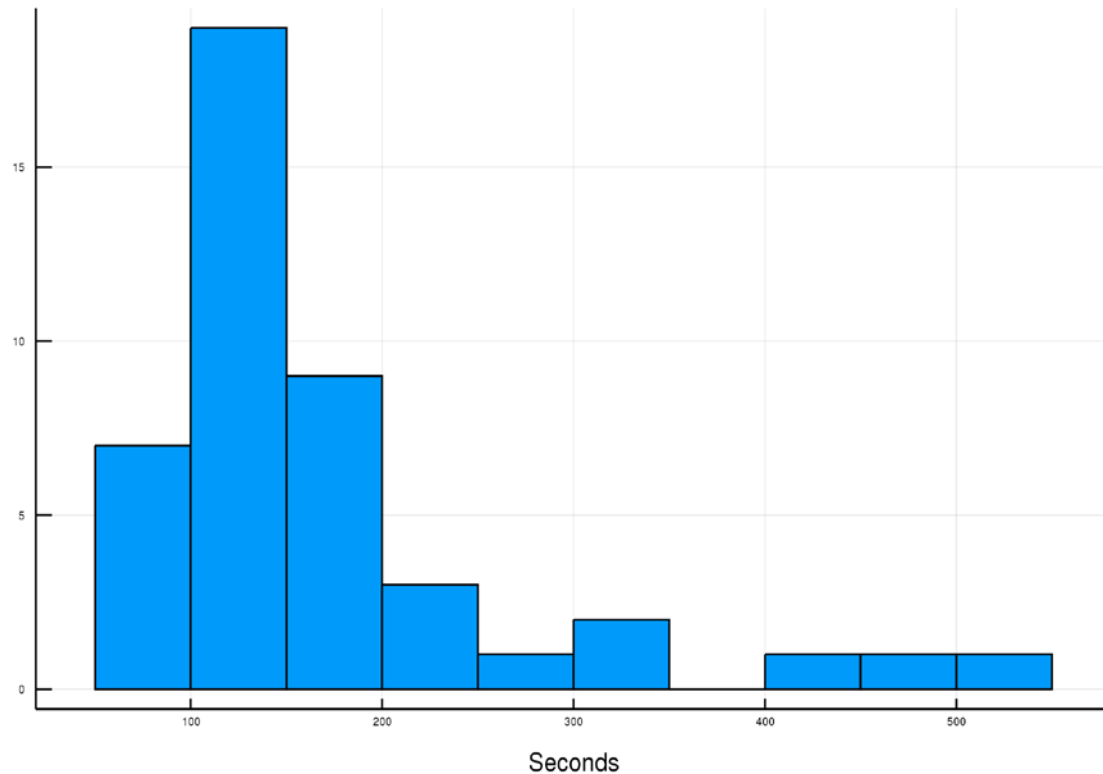


Clinically Proficient



- C_N outperform C_p
- The role of outliers
 - Clinical case difficulty

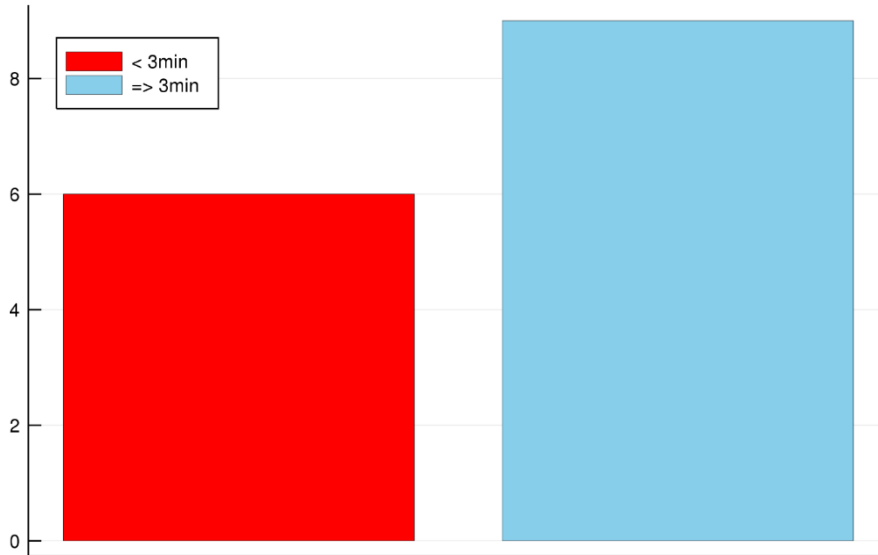
Duration of Apnea



Preoxygenation Duration by Groups

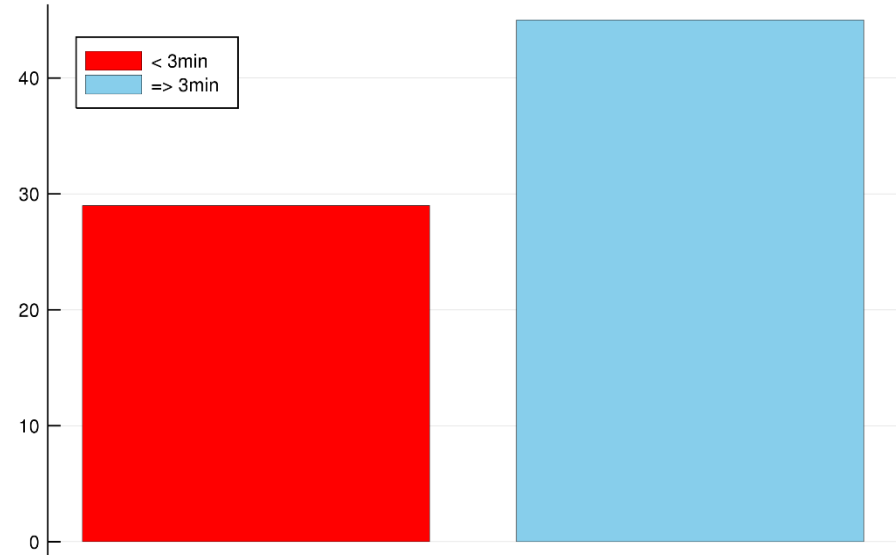
$\Theta = 0.40$

Clinical Novice



$\Theta = 0.64$

Clinically Proficient



Conclusions: ETI Attempts

	Prior	Posterior	Diff
μ	1.04	1.00	0.04
σ	0.20	0.48	0.28

- Model's normalizing effect on small sample data
- SD change and the role of changing providers
 - Range of attempts and attempts per provider
- ETI prep and setup differences

Conclusions: Duration of Apnea

	Prior	Posterior	Diff
μ	167.56	110.00	57.56
σ	99.71	110.00	10.29

- The C_N group outperformed the C_p in terms of mean apnea time experienced by their patients
- The role of large SD
 - Simulated patient had no complications
 - Fitting known low difficulty populations to mixed difficulty

Conclusions: Preoxygenation Duration

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	Prior	Posterior	Diff
θ	0.64	0.62	0.02

- C_p appears to outperform C_N reasonably well prior to modeling
 - Model does not show contribution of data structure
- The C_N group is at least able to approximate the performance of C_p in this area without much additional effort
 - Model improvement is needed

- Very little data and single institution
 - Outliers and class imbalance
- Lack of simulation patient diversity
 - Specifically for the number of ETI attempts and apnea duration
- Preoxygenation ≥ 3 min, interpreted as hit/miss
 - Unexplored points and C_N/C_P curve relation

- Reduced faculty investment
- Residents scheduled their simulation time
- Audiovisual recordings allowed offsite review
- Availability of quick reference logs

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Thank you for listening!

Questions and Suggestions?