Measuring the Continuum of Trauma Bay Strain and its Impact on Nursing Resources

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BACKGROUND

Trauma strain (TS), defined as a complement of patients or events in the trauma bay requiring intense resource utilization, is associated with negative patient outcomes. Characteristics contributing to strain include multiple simultaneous patients, those with severe injuries, and those requiring massive transfusion or intensive care. These combinations of patient needs are variable and difficult to predict. Centers may allocate trauma nurses using scheduling models agnostic to TS, but this approach can lead to both over and under resourcing.

PURPOSE

- To empirically derive metrics of TS under the hypothesis that TS would be greater during nights than days and greater during weekends than weekdays.
- To predict nursing resource allocation and staffing models.

METHODS

- For each hour of the year, we calculated measures of cumulative trauma bay occupancy (∑(patients in bay)), cumulative physiologic derangement (∑(7.8409-Revised Trauma Score/7.8409)), and cumulative injury severity (∑(Injury Severity Score/75)) with higher scores representing increased strain.
- We collapsed this data by hour and day of the week to generate visual displays of TS and used t-test or Mann-Whitney test to compare measures of strain between nights (19:00-06:59) vs. days (07:00-18:59) as well as weekdays (07:00 Monday to 18:59 Friday) vs. weekends (19:00 Friday to 06:59 Monday).

DESIGN

- **Study Design:** Retrospective single center cohort study with IRB approval.
- **Setting:** Trauma resuscitation bay of an urban academic level 1 trauma center.
- **Sample:** All trauma activations (2,698 patients) presenting in CY2020 were included (mean age 41 (SD 19) years, 72% male, 68% blunt trauma) representing 8,760 trauma bay hours.

RESULTS

Strain was unevenly distributed throughout the week (**FIGURE 1**).

- Nights had higher mean cumulative hourly occupancy (0.34 vs 0.28, p<0.001), injury severity (0.068 vs 0.027, p<0.001), and physiologic (0.038 vs. 0.031, p<0.001) strain scores.
- Multiple activation scenarios (arrival within 35min) occurred in 38% of the population.
- Of those arriving in hemorrhagic shock requiring massive transfusion protocol, 64% arrived during night hours.
- No significant differences in cumulative hourly physiologic or injury severity strains between weekends or weekdays, but hourly occupancy strain was higher on weekdays (0.31 vs 0.29, p<0.001).
- Summer accounted for the largest proportion of patients (34%, Fall 28%, Winter 21%, Spring 18%) but the lowest average ISS of all seasons (7.8, Fall 9.9, Winter 8.3, Spring 8.2).

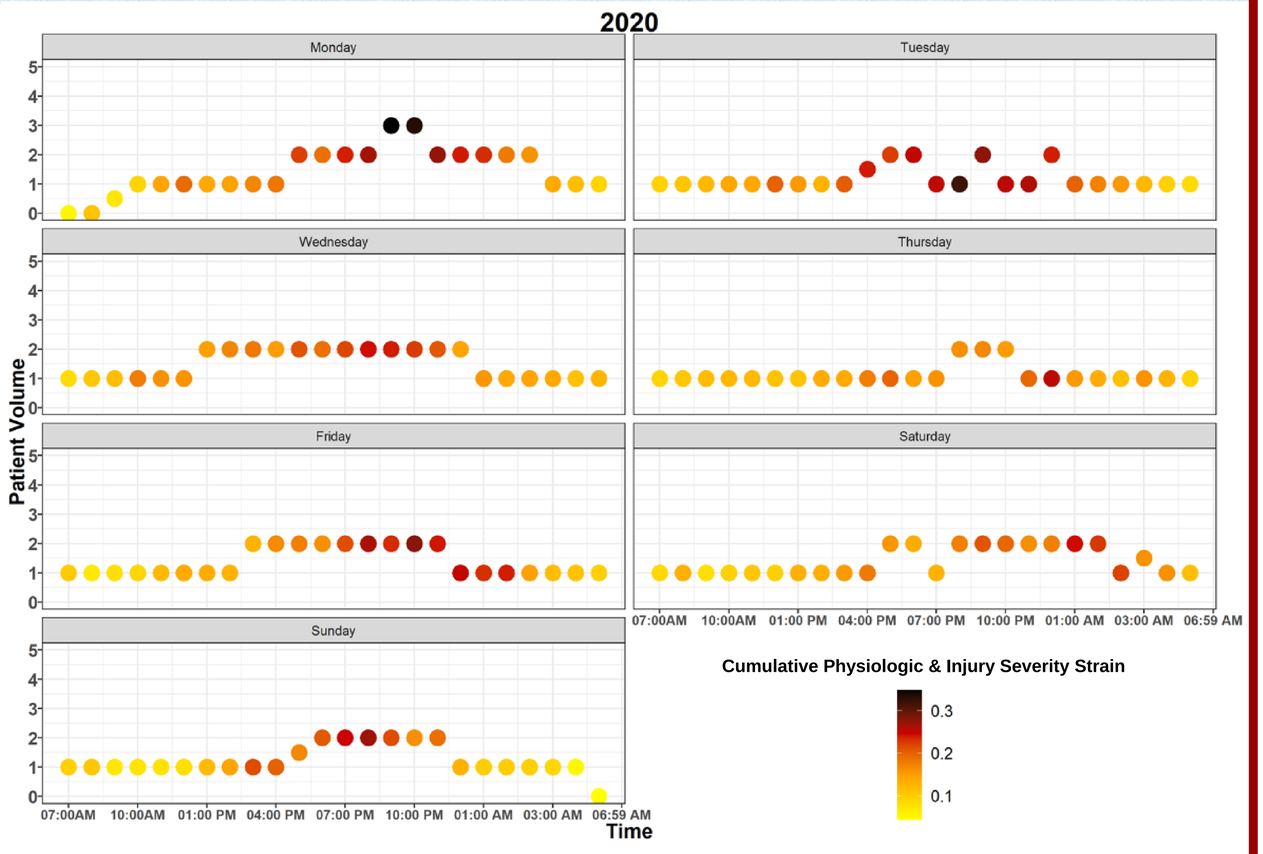

FIGURE 1: Measures of cumulative trauma bay occupancy, physiologic derangement & injury severity with higher scores representing increased strain on resources.

Staffing Algorithm for Trauma Resuscitations						
No. Activations	Scribe	RN	MTP RN/Tech	Float RN/Tech (Monitor Existing Patients/ Runner)	Total FTE	
Single	A	A	E		F	F= A+A+E
Double	B	B	E	E	G	G=B+B+E+E
Triple	C	C	E	E	H	H=C+C+E+E
Quadruple	D	D	E	E	I	I=D+D+E+E

Rubric: A=1, B=2, C=3, D=4, E= + 1 if needed

SCAN ME

FIGURE 2: Suggested algorithm for calculating nursing resources during trauma activations.

CONCLUSION

Trauma bay strain varies during the day, week, and year, and constant or reductive scheduling models may not be optimized to adapt to fluctuating need. Assessment of staffing resources should account for the entire continuum of patient care needs including both new activations and existing patients remaining in the trauma resuscitation area. Developing individualized flexible staffing models (**FIGURE 2**) and examining their effect on patient outcomes, resuscitation end points and staff wellness for efficacy are indicated next steps.