

Off-Hours Outcomes of Hypotensive Trauma Patients in Pennsylvania Level 1 and 2 Trauma Centers

¹Jacqueline Speer, DO, ²Adrian Ong, MD, ³Alison Muller, MLS, MSPH, ⁴Niels Martin, MD, ⁵Anthony Martin, RN, BSN, ⁶Amanda McNicholas, CRNP, ⁷Patrick Kim, MD, ⁸Forrest Fernandez, MD

¹ Dept. of Surgery, Philadelphia College of Osteopathic Medicine

^{2,3,5,6,8} Dept. of Surgery, Section of Trauma and Acute Care Surgery, Reading Hospital

^{2,4,7,8} Division of Traumatology, Surgical Critical Care and Emergency Surgery, Dept. of Surgery, University of Pennsylvania



No Disclosures



Introduction

- Hospitalized patients admitted during the weekends may have a higher mortality rate than those admitted during the weekdays (Bell et al 2001, Meacock et al, 2017).
- For surgical patients, however, the “weekend effect” has not been convincingly demonstrated (Papachristofi et al, 2018, Nijland et al 2017, Rezaie et al, 2018).

Introduction

- Information from large trauma databases is conflicting.
- A study of PA level 1-3 trauma centers showed that patients presenting at night had an equivalent risk of dying than those presenting during the day (Carr BG et al, 2011).
 - Patients presenting in weekends were less likely to die than those presenting in the weekdays.
 - Admission time of day was not studied.

Introduction

- A study based on the National Trauma Data Bank revealed that admissions from 6 pm to 6 am had a higher adjusted mortality risk compared to the daytime counterparts (Egol KA et al, 2011).
- The risk of death was highest in the midnight to 6 am period.
- The study could not distinguish weekend vs weekday admissions.

Introduction

- Evaluation of high risk trauma subgroups may be more likely to demonstrate an after-hours effect.
- A single center study of patients with hemorrhage secondary to pelvic fractures suggests near 100% increase in mortality in the “after hours” group (Schwartz DA et al, 2014).
- Patients admitted at night and on weekends had a significant increase in time to angioembolization compared to weekdays and daytime.

Introduction

- The prior large multicenter studies reported on aggregated outcomes which did not take into account clustering of patients in individual TCs.
- Consequently, variability in TC outcomes was not studied, and the impact of this variability on the aggregate outcome was unclear.

Introduction

- We sought to determine if trauma centers were capable of managing hypotensive patients regardless of arrival time and day.

Hypothesis

- Hypotensive patients arriving at level 1 and 2 centers have equivalent mortality risks irrespective of time or day of arrival.

Power Analysis

- Assumptions:
 - 30% mortality in the reference group
 - Odds ratio of 1.3 for the other groups (corresponding to approx. 35% mortality)
 - Alpha =0.05, 1-beta of 0.8
 - N=557 in each group

Methods

- Retrospective review of data from 2012 to 2016 of patients with systolic blood pressure (SBP) of ≤ 90 mmHg arriving at level 1 and 2 trauma centers (TC) in Pennsylvania.
- **Exclusions:**
 - TC with < 10 patients, burns and skin diseases, transfers in or out, injury to arrival of > 2 days, patients < 16 years of age.

Methods

- Time and day of arrival were categorized as follows:
 - **Weekday day:** Mon to Fri, 0700-1859
 - **Weekday night:** Mon to Fri, 1900-0659 Sat
 - **Weekend day:** Sat and Sun, 0700-1859
 - **Weekend night:** Sat and Sun, 1900-0659 Mon
- **Primary Outcome:** In-hospital mortality

Methods

- Plausible variables were each analyzed to determine association with the outcome.
- **Logistic regression** was performed incorporating significant variables on univariate analysis with **mortality** as the **dependent variable**.
- **Nominal independent variables:** gender, mechanism of injury (blunt /penetrating), intubation or assisted ventilation on admission (yes/no), time and day of arrival (stratified).
- **Continuous variables:** Age, Injury Severity Score, Glasgow Coma Scale score, heart rate, systolic blood pressure.
- Regression with the same variables was applied separately to each trauma center sample.
- SPSS v.25 used.

Results

- N= 5282 after exclusions
- Level 1 TC: 62%
- Volume per TC: median, 179 (max 630, min 67)
- Male: 72%
- Penetrating: 35%
- Median (IQR) heart rate (HR): 78 (0-103)/minute
- Median (IQR) SBP: 72 (0-84) mmHg
- % SBP 0 mmHg: 32%
- Median (IQR) GCS: 10 (3-15)
- Intubated or assisted ventilation on arrival: 35%
- Arrival by day and time: (WDD) 37%, (WDN) 30%, (WED) 13%, (WEN) 20%.
- 76% had highest level trauma alert called
- Median (IQR) ISS: 17 (9-27)
- Mortality: 46%

Results- characteristics of the 4 groups

	WDD (n=1955)	WDN (n=1604)	WED (n=697)	WEN (n=1026)	P
Age (median, IQR), y	56 (33-72)	38 (25-98)	51 (31-68)	34.5 (24-52)	<0.0001
Male gender	1318 (67%)	1224 (76%)	492 (71%)	786 (77%)	<0.0001
GCS score, median (IQR)	13 (3=15)	3 (3-15)	13 (3-15)	6 (3-15)	<0.0001
% Penetrating mechanism	481 (25%)	723 (45%)	172 (25%)	453 (44%)	<0.0001
ISS, median (IQR)	17 (9-26)	17 (9-29)	17 (9-27)	18 (9-29)	0.0009
SBP, median (IQR), mmHg	75 (0-85)	70 (0-84)	76 (0-85)	73 (0-85)	<0.0001
% SBP of 0 mmHg	29%	37%	29%	32%	<0.0001
HR, median (IQR)	78 (0-102)	76 (0-105)	77 (0-100)	81 (0-107)	0.1
% Intubated/assisted ventilation	669 (34%)	616 (38%)	235 (34%)	376 (37%)	0.03
% Level one TC designation	1167 (60%)	788 (64%)	418 (60%)	669 (65%)	0.006
Mortality	862 (44%)	808 (50%)	294 (42%)	443 (43%)	<0.0001
Deaths ≤24 hours/All deaths	734 (85%)	703 (87%)	250 (85%)	389 (88%)	0.4

Results – characteristics of survivors and those who died

	Survived (n=2875)	Died (n=2407)	p
Age, median (IQR)	50 (29-65)	41 (26-62)	<0.0001
% male gender	1917 (67%)	958(79%)	<0.0001
GCS score, median (IQR)	15 (15-15)	3 (3-15)	<0.0001
SBP, median (IQR), mmHg	82 (73-88)	0 (0-62)	<0.0001
HR, median (IQR)	91 (74-110)	0 (0-83)	<0.0001
% intubated or assisted ventilation	339 (12%)	1557(65%)	<0.0001
ISS, median	13 (6-22)	25 (10-35)	<0.0001
% penetrating mechanism	763 (27%)	1066 (44%)	<0.0001
Level one TC designation	1708 (59%)	1570 (65%)	<0.0001
Time of admission :			
Weekday day	1093 (38%)	862 (36%)	<0.0001
Weekday night	796 (28%)	808 (34%)	
Weekend day	403 (14%)	294 (12%)	
Weekend night	583 (20%)	443 (18%)	

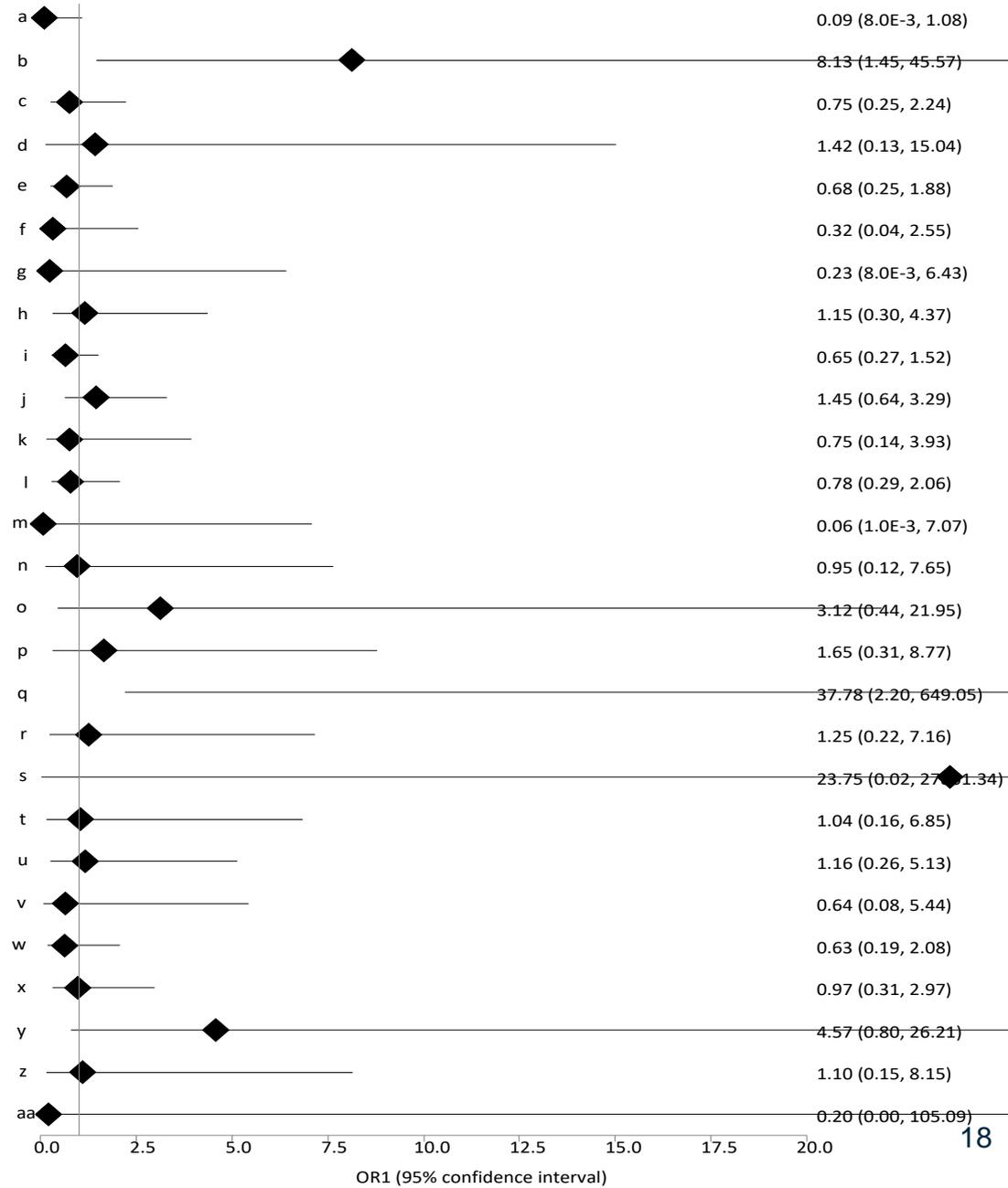
Results: Logistic Regression of Entire Cohort

Variable	Beta	p-value	Odds ratio	95% CI
Weekday night	0.017	0.893	1.02	0.796-1.30
Weekend day	-0.103	0.519	0.90	0.66-1.24
Weekend night	-0.447	0.002	0.649	0.48-0.84
Heart rate	-0.006	<0.001	0.99	0.99-1.00
Systolic blood pressure	-0.038	<0.001	0.96	0.96-0.97
Intubated or with assisted ventilation on arrival	0.406	0.008	1.50	1.11-2.03
GCS	-0.207	<0.001	0.81	0.79-0.84
ISS	0.050	<0.001	1.05	1.04-1.06
Gender (Male)	0.082	0.475	1.09	0.86-1.36
Age	0.025	<0.001	1.03	1.02-1.03
Injury Type (Penetrating)	0.653	<0.001	1.92	1.50-2.54

Results – adjusted risk of death for each TC

- Weekday night:
 - 2 TC with significantly higher risk of death

WEEKDAY NIGHT (REF:WEEKDAY DAY)

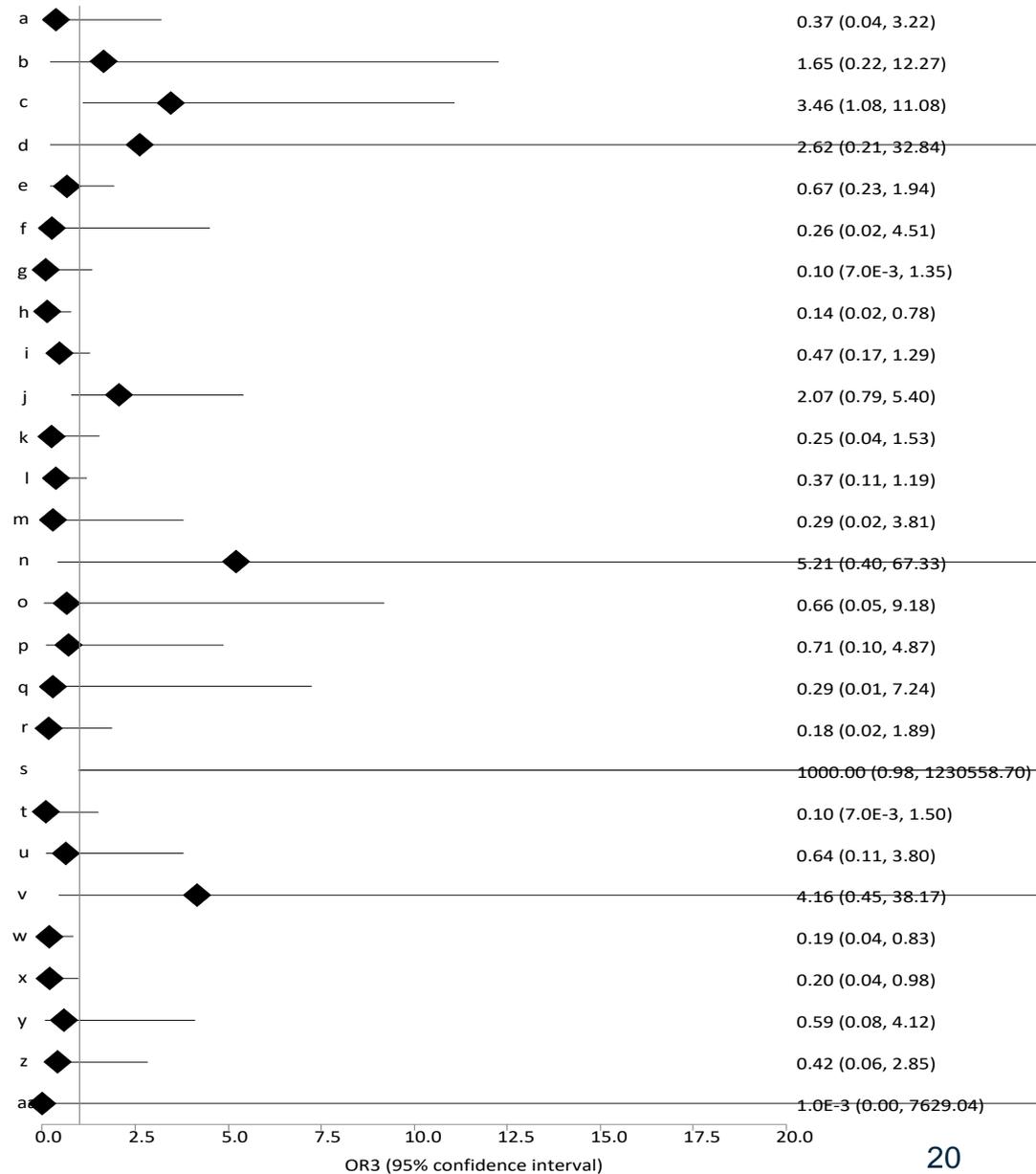


Results- adjusted risk of death for each TC

• Weekend night:

- 1 TC: higher risk of death
- 3 TC: lower risk of death

WEEKEND NIGHT (REF: WEEKDAY DAY)



Results by TC designation

- **Level 1:**

	Odds ratio (95% CI)	p
Weekday night	0.87 (0.64-1.19)	0.4
Weekend day	0.93 (0.63-1.39)	0.7
Weekend night	0.80 (0.57-1.12)	0.2

- **Level 2:**

	Odds ratio (95% CI)	p
Weekday night	1.15 (0.77-1.71)	0.5
Weekend day	0.85 (0.51-1.40)	0.5
Weekend night	0.40 (0.25-0.64)	0.0002

Results by admission volume for the top and bottom 10 TCs

• TOP 10:

	Odds ratio (95% CI)	p
Weekday night	0.95 (0.69-1.31)	0.8
Weekend day	0.91 (0.59-1.39)	0.7
Weekend night	0.68 (0.47-0.97)	0.04

• BOTTOM 10:

	Odds ratio (95% CI)	p
Weekday night	0.80 (0.44-1.47)	0.5
Weekend day	1.00 (0.53-1.91)	0.9
Weekend night	0.51 (0.27-0.98)	0.04

Limitations

- Pre-hospital characteristics such as time to TC and mode of transport not considered.
- Pre-existing conditions frequently missing (25%)
- Underpowered to evaluate each TC
- Other competing trauma and emergency surgery admissions could have affected outcomes.

Conclusions

- The overall mortality rate for hypotensive trauma patients arriving is high (46%).
 - Almost one-third of this cohort had a documented SBP of 0 mmHg on arrival.
- With weekday day arrival as the reference, weekend night arrival was associated with reduced odds of death whilst the other time periods had equivalent risks.
- Findings are consistent with those of Carr et al. which showed a reduced risk of death for weekend arrivals.

Conclusions

- The study was underpowered to detect outcome differences in each TC by time of day of arrival.
- Nonetheless, PA TCs were consistent in their outcomes, with very few TCs showing increased risk of mortality in nights or weekends.
- This data suggests satisfactory operational readiness in PA level 1 and 2 TCs during nights and weekends.

Questions ?

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