REGION V COT RESIDENT PAPER COMPEITION

DECEMBER 3, 2021

ABSTRACT #1

MICHIGAN, CLINICAL

Solhee Lee MD

Shelter-in-Place Did Not Reduce Burn Service Volume in a Regional Burn Center

Solhee Lee MD, Janie Faris PharmD, Andrew R. Isaacson MD, Heather S. Dolman MD, Roozbeh Mansour MD, Jessica D. McGee MD, Alfred E. Baylor MD, James G. Tyburski MD, Michael T. White MD

Highlights:

1) *The Covid-19 pandemic led to a shelter-in-place order in Michigan during which time there was an increase in opioid overdoses by 33% and an increase in fires by 30%.*
2) *Previous burn literature reports up to a 50% decrease in burn admission due to the pandemic which was not observed in a regional burn center in Michigan.*
3) *The rates of tobacco and substances use including cocaine, methamphetamines, heroin and marijuana increased during the shelter-in-place time period, but the use of alcohol were similar pre and post the shelter-in-place order.*

Introduction:

During the COVID-19 pandemic, Michigan experienced a surge in the rates of severe respiratory syndrome coronavirus 2 (SARS-CoV-2) in February and March of 2020. The state of Michigan, in efforts to slow the transmission of SARS-CoV-2, declared a State of Emergency beginning March 10, 2020. Under the State of Emergency, a shelter-in-place order was mandated, resulting in the closure of numerous non-essential businesses. Reports have documented the adverse impact of the shelter-in-place order on mental health. Also observed during this time was a large surge of drug and alcohol use. The Michigan Department of Health and Human Services (MDHHS) released a statement reporting that Emergency Medical Services (EMS) responses to opioid overdoses increased by 33% during the shelter-in-place. Additionally, the Centers for Disease Control and Prevention (CDC) reported a 26% increase in alcohol binge drinking. According to the WHO, alcohol and substance use increases the risk of burns.

There is scarce data regarding the impact of the shelter-in-place order on burn-related hospital admissions throughout the literature. Reports in the United States and Morocco found that burn-related admissions decreased by 7-50%. Contrary to these outcomes, the Michigan Fire Inspectors Society (MFIS) reported a 30% increase in total fire fatalities from January to September 2020 compared to the same time frame in 2019. Based on previous findings and emerging statistics, we aimed to evaluate the number of adult burn-related admissions and visits to the burn clinic in an inner-city burn center during the shelter-in-place order.

Methods:

This IRB-approved retrospective review compares the patients seen at a single urban burn center from March 1 to August 31, 2020 to the same time period in 2019. Patients were included if they were greater than 18 years of age and seen in the burn clinic, hospital emergency department or admitted to the hospital secondary to injury. Relevant burn data collected included: baseline demographics, past medical history, toxicology screen on admission, percent total body surface area burn (TBSA), causes of burn injury, hospital and ICU length of stays, disposition at hospital discharge, and in-hospital mortality. Statistical analysis was completed using IBM SPSS version 17. Nominal data was analyzed using Chi squared and Fisher's exact test while Mann-Whitney U test was utilized for continuous variables. All p-values < 0.05 were considered significant.

Results:

Our burn center evaluated 365 patients in the PCOV group vs. 384 in the SIP group. This increase was not statistically significant. The toxicology screen for substances including cocaine, methamphetamines, marijuana, and heroin was significantly different between the two groups with 24 (6.6%) in the PCOV group versus 44 (11.5%) in the SIP group ($p = 0.020$). Median (IQR) levels of alcohol were 180 (156) in the PCOV group compared to 149 (137) SIP group ($p = 0.509$). Interestingly, although not significantly different, there were more patients in the SIP group with a reported psychiatric disorder: 6% versus 4% in the PCOV group. There were significantly more non-burn injuries (i.e. Steven's Johnson, toxic epidermal necrolysis, DRESS syndrome, etc.) in the SIP group ($p< 0.05$). The hospital LOS was 5 vs. 1 day in the SIP vs. PCOV group ($p= 0.005$).

Conclusion:

Even with the restrictions on social gathering associated with the Shelter-In-Place orders, there was no reduction in the number of burn patients seen at our institution. The rate of burns seen in the emergency department, outpatient burn clinic, and admissions to the hospital increased but were not statistically significantly when comparing the two time periods. The rates of tobacco and substances use including cocaine, methamphetamines, heroin and marijuana increased during the shelter-in-place time period but the use of alcohol were similar. There were more non-burn wound admissions to our center during the shelter-in-place time period which may have been due to bed availability and/or outside facilities' limited ability to manage extensive wound care in patients with SJS/TENS/DRESS syndrome. The rates of burn injuries and the rates of alcohol use and substance use have not decreased despite the state of emergency orders, restrictions on travel and socializing.

ABSTRACT #2

CHICAGO, CLINICAL

Arielle Thomas, MD MPH

ACS COT Residents Trauma Papers Competition Title Page

Principal Author's Information

Name and degree(s): Arielle Thomas, MD MPH

Title of the Abstract: THE IMPACT OF STAY-AT-HOME ORDERS ON VOLUME AND MECHANISM OF INJURY: A RETROSPECTIVE ANALYSIS OF TQIP HOSPITALS ACROSS THE US

Institution: Northwestern University Department of Surgery

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Please check the category of the paper below:

☐Basic Laboratory Science **☒Clinical Research/Investigation**

Please check the box after reading each statement below:

☒It is understood that the primary author is a surgery resident, surgical sub- specialty resident or trauma fellow.

☒It is also understood that although the abstract can be presented elsewhere, it cannot be published prior to March 30, 2022.

Specifications for abstracts

Abstracts cannot be more than three pages (this title page is not included in that count). Winners of regional paper competitions that require one-page abstracts are allowed to submit a three-page (maximum) version for review by the ACS COT judges in the national competition.

Abstracts must be submitted to the ACS Trauma Programs office as Word documents. Single spacing is permitted. Charts and graphs may be embedded in the document as .jpeg files.

Principal Author's Name: Arielle Thomas
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Thomas, A, Campbell, BT, Stey, A, Subacius, H, Nathens, A

Title of Abstract: THE IMPACT OF STAY-AT-HOME ORDERS ON VOLUME AND MECHANISM OF INJURY: A RETROSPECTIVE ANALYSIS OF TQIP HOSPITALS ACROSS THE US

Begin abstract here:

Introduction: The COVID-19 pandemic has had numerous negative effects on the US healthcare system. Due to the lack of definitive knowledge of the virus and to avoid the possibility of an overwhelmed hospital system, many states responded with stay-at-home (SAH) orders. These orders varied in duration and intensity but had the ultimate goal of encouraging people to cease non-essential travel, business, and interpersonal interactions to decrease the incidence of virus transmission. We postulated that these orders with their broad societal impact, might alter the rate and type of injuries treated at American trauma centers. Thus, we sought to measure the impact of the stay-at-home orders on trauma center volume and injury mechanism. We also considered the possibility that stay-at-home orders, with their negative impact on social support networks, might disenfranchise selected high-risk populations, and increase their risk of injury.

Methods: Utilizing the ACS Trauma Quality Improvement Program, we analyzed years 2018-2020 using start and end dates for each stay-at-home order for each state. Patient demographics and injury characteristics compared across the corresponding stay at home time periods from each year using chi-square tests of association for categorical and one-way ANOVA for continuous variables. Standardized differences were reported due to large sample size. Patient volume was modeled using a harmonic regression model and a random hospital effect.

Results: There were 877,323 injured patients admitted to 504 ACS verified Level 1 and 2 centers and state designated trauma centers participating in ACS TQIP from January 2018 to September 2020. There were 166,773 patients treated in 2020 after a stay-at-home order and an average of 160,962 patients were treated over the corresponding time periods in 2018 and 2019 in 474 centers. The time intervals following a SAH order were characterized by 4.5% fewer patients admitted to the hospital from motor vehicle crashes, 33% higher rates of firearm injury, and a 16% increase in assaults. There was a 19% increase in Black patients and a 26% increase in those with a pre-existing diagnosis of alcoholism over these periods. This translated to 4,397 more Black patients, 2,674 more assaulted patients, and 3,520 more firearm injured patients on top of what would be expected given 2018-19 rates (Table 1). Furthermore, there was a 2.2% increase in individuals injured in their home zip codes. In the weeks before the SAH orders were issued, trauma center admission volume declined which roughly coincided with the onset of the pandemic. By contrast, one week subsequent to the implementation of the SAH, there was a linear increase in the rate of admissions per trauma center ($p<0.0001$, Figure 1) until it plateaued about 10 weeks later. The increase corresponded with a higher rate of penetrating injury due to assaults.

Conclusion: Volume decreased in the weeks leading up to implementation of the SAH order and increased steadily in the weeks following. After the SAH orders were issued in 2020, there was an increase in assaults from penetrating injury compared to the same period in the two previous years.

Table 1: Patient Demographic Characteristics Presenting After Stay-at-home Order Compared to the Corresponding 2018-19 Time Period

	2018-19 Average (n=160,962)	2020 (n=166,773)	Standardized Differences
Age, mean (SD)	**54.2 (21.9)**	**52.8 (22.0)**	**-0.06**
Sex, n(%)			
Male	**104,860 (65.2)**	**111,299 (66.8)**	**0.03**
Comorbidities, n(%)			
Alcohol	**10,440 (6.6)**	**13,611 (8.3)**	**0.07**
Mental Illness	**17,309 (11.0)**	**19,369 (11.8)**	**0.03**
Substance Abuse	**12,243 (7.8)**	**14,736 (9.0)**	**0.04**
Race, n(%)			
Black	**23,007 (14.6)**	**28,176 (17.3)**	**0.07**
White	**118,638 (75.1)**	**117,753 (72.2)**	**-0.07**
Hispanic	**17,468 (11.3)**	**18,561 (11.6)**	**0.01**
Asian	**3,324 (2.1)**	**3,021 (1.9)**	**-0.02**
American Indian	**1,328 (0.8)**	**1,342 (0.8)**	**0.002**
Pacific Islander	**411 (0.3)**	**405 (0.3)**	**-0.002**
Matched Home and Injury Zip Codes, n(%)	**71,628 (56.9)**	**77,943 (58.2)**	**0.03**
Insurance, n(%)			
Government	**77,682 (49.4)**	**83,334 (51.1)**	**0.03**
Self-Pay	**17,150 (10.9)**	**19,045 (11.7)**	**0.02**
Private	**57,486 (36.6)**	**56,211 (34.5)**	**-0.05**
Other	**4,792 (3.1)**	**4,533 (2.8)**	**-0.02**

*Standardized differences, difference in means or proportions divided by the standard deviation, were calculated along with p-values due to the large sample numbers. This was done by averaging means or proportions for 2018-2019 and compared to 2020. For standardized differences, if SMD=0.2, small, medium= 0.5, and large=0.8.

Table 2: Patient Injury Characteristics Presenting After the Stay-at-home Order Implementation Compared to the Corresponding 2018-2019 Time Periods

	2018-19 Average (n=160,962)	2020 (n=166,773)	Standardized Differences
AIS (≥3) , n(%)			
Head	**55,948 (34.8)**	**55,507 (33.3)**	**-0.03**
Face	**1,420 (0.9)**	**1,516 (0.9)**	**0.003**
Neck	**2,256 (1.4)**	**2,584 (1.6)**	**0.01**
Chest	**54,822 (34.1)**	**56,941 (34.1)**	**0.002**
Spine	**16,650 (10.4)**	**17,701 (10.6)**	**0.01**
Abdomen	**14,429 (9.0)**	**15,633 (9.4)**	**0.01**
Lower Extremity	**44,049 (27.4)**	**47,501 (28.5)**	**0.03**
Upper Extremity	**5,081 (3.2)**	**5,865 (3.5)**	**0.02**
ISS, mean (SD)	**16.0 (8.6)**	**16.1 (8.6)**	**0.005**
Intent, n(%)			
Unintentional	**141,139 (88.2)**	**144,070 (86.4)**	**-0.05**
Self-Inflicted	**2,284 (1.4)**	**2,355 (1.4)**	**-0.002**
Assault	**15,605 (9.8)**	**19,056 (11.4)**	**0.06**
Undetermined	**722 (0.5)**	**1,035 (0.6)**	**0.02**
Mechanism, n(%)			
Fall	**70,213 (43.6)**	**70,639 (42.4)**	**-0.03**
Firearm	**10,316 (6.4)**	**14,246 (8.5)**	**0.08**
MVC	**35,660 (22.2)**	**35,387 (21.2)**	**-0.02**
Motorcycle	**12,337 (7.7)**	**12,779 (7.7)**	**0.001**
Pedestrian[£]	**12,070 (7.5)**	**12,058 (7.2)**	**-0.01**
Stab	**4,433 (2.8)**	**5,038 (3.0)**	**0.02**
Struck	**8,138 (5.1)**	**7,493 (4.5)**	**-0.03**
Other	**7,779 (4.8)**	**9,089 (5.5)**	**0.03**
Shock in ED, n(%)	**7,000 (4.4)**	**7,559 (4.5)**	**0.01**
Transfer, n(%)	**48,285 (30.0)**	**48,750 (29.2)**	**-0.02**
Major Complications[¥], n(%)	**7,855 (5.1)**	**8,336 (5.2)**	**0.005**
Mortality, n(%)	**11,666 (7.3)**	**12,688 (7.6)**	**0.01**

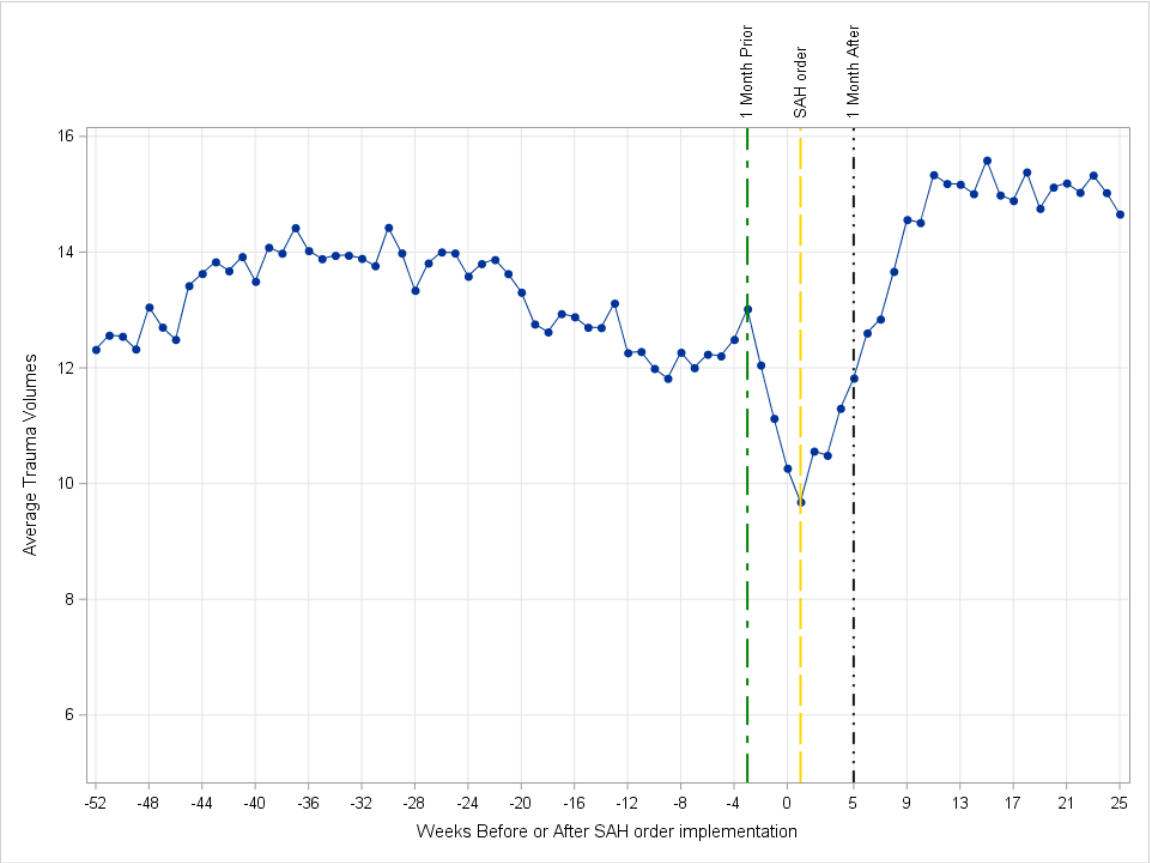
*Standardized differences, difference in means or proportions divided by the standard deviation, were calculated along with p-values due to the large sample numbers. This was done by averaging means or proportions for 2018-2019 compared to 2020. For standardized differences, if SMD=0.2, small, medium= 0.5, and large=0.8.

(AIS=Abbreviated Injury Score, ISS=Injury Severity Score, MVC=Motor Vehicle Crash)

[¥]Major Complications: composite score including presence of acute renal failure, acute respiratory distress syndrome, cardiac arrest with CPR, decubitus ulcer, deep surgical site infection, myocardial infarction, organ/space surgical site infection, ventilator associated pneumonia/pneumonia, pulmonary embolism, stroke/CVA, catheter-related bloodstream infection, unplanned return to the OR, unplanned return to the ICU, severe sepsis

[£]Pedestrian and Cyclist injuries

Figure 1: Average trauma volume in the weeks before and after SAH order implementation from January 2019-September 2020. 2018 is not included for brevity of graph but pattern is identical to 2019. The month before and after implementation of SAH are marked for clarity.



ABSTRACT #3

MINNESOTA, CLINICAL

Derek C. Lumbard, MD

READMISSIONS FOLLOWING ASSAULT-RELATED FIREARM INJURY: AN EXAMINATION OF THE NATIONAL READMISSION DATABASE

Derek C. Lumbard, MD; Chad J. Richardson, MD; Frederick W. Endorf, MD; Rachel M. Nygaard, PhD

Background: Firearm injuries remain a national crisis in the United States. Certain proportions of the U.S. population, particularly minority populations, continue to be disproportionally impact by firearm violence. Continued exposure to risk factors associated with firearm violence increase the likelihood of repeat injury. This recidivism often escalates in severity and results in worse outcomes compared to prior hospitalizations.

Objective: The aim of the study was to identify and assess factors associated with unplanned readmission following assault-related firearm injury in a national sample of hospitalizations.

Methods: The 2016-18 Nationwide Readmission Database (NRD) of the Healthcare Cost and Utilization Project (HCUP) was used to identify hospital admissions with assault-related firearm injury in patients over age 14. Overnight/next-day transfers were combined to not over-report readmission events. Multivariable logistic regression assessed factors associated with 90-day unplanned readmission in those that survived their first firearm injury.

Results: Over 3 years, 19,112 assault-related firearm injury admissions were identified that resulted in 1,524 injuries with subsequent 90-day unplanned readmissions. Those with readmissions tended to be older, have a drug or alcohol diagnosis at the primary hospitalization, and have longer hospital stays at the primary hospitalization (Table 1). Overall cost of the primary hospitalization was significantly higher than those without readmissions ($137,476 vs 250,467). The mortality rate in the primary hospitalization was 4.6%. The primary readmission diagnosis included: complications (27.5%), infection (14.8%), mental health (4.2%), trauma (17.1%), and chronic disease (28.4%). 14.7% of readmission diagnosis included an additional ‘initial’ firearm injury diagnosis. After adjusting for severity, comorbidity index, patient location and clustering by hospital, factors associated with unplanned readmission are shown in Figure 1.

Conclusions: More than a quarter of unplanned readmissions following assault-related firearm injury were attributed to complications associated with prior hospitalization. Medicare or Medicaid insurance, living in a low-income zip code, living in a larger urban region, and discharge AMA were independent predictors of unplanned readmissions. Supportive resources, particularly hospital-based violence intervention programs that include social support and case management, may reduce unplanned readmissions of firearm injured patients with those additional risk factors.

Table 1. 2016-18 National Readmission Database 90-day Unplanned Readmission Following Assault-Related Firearm Injury

	Cohort	No Readmission	Readmission	P value[a]
	19112	17588	1524	
Age years, mean (SD)	30.4 (12.0)	30.3 (11.5)	31.8 (12.0)	<0.001
Female, N (%)	2134 (11.2)	1954 (11.1)	180 (11.8)	0.404
NCHS Urban-Rural, N (%)				0.003
Central	8618 (45.8)	7921 (45.7)	697 (46.8)	
Fringe	3568 (19.0)	3239 (18.7)	329 (22.1)	
metro 250-999k	4111 (21.8)	3815 (22.0)	296 (19.9)	
metro 250-999k	1126 (6.0)	1055 (6.1)	71 (4.8)	
micropolitan	815 (4.3)	756 (4.4)	59 (4.0)	
not metro or micro	583 (3.1)	545 (3.1)	38 (2.6)	
Patient zip-code income quartile, N (%)				0.209
Lowest	10472 (55.6)	9609 (55.5)	863 (57.4)	
2	4275 (22.7)	3942 (22.8)	333 (22.1)	
3	2810 (14.9)	2586 (14.9)	224 (14.9)	
Highest	1275 (6.8)	191 (6.9)	84 (5.6)	
Insurance, N (%)				<0.001
Private	3282 (17.2)	3051 (17.4)	231 (15.2)	
Medicaid/Medicare	10333 (54.1)	9425 (53.6)	908 (59.6)	
Self-pay/No Charge	3959 (20.7)	3678 (20.9)	281 (18.4)	
Other/Unknown	1538 (8.1)	1434 (8.2)	104 (6.8)	
Severity Risk, N (%)				<0.001
Minor loss of function	3360 (17.6)	3231 (18.4)	129 (8.5)	
Moderate loss of function	6275 (32.8)	5911 (33.6)	364 (23.9)	
Major loss of function	4888 (25.6)	4464 (25.4)	424 (27.8)	
Extreme loss of function	4589 (24.0)	3982 (22.6)	607 (39.8)	
Charlson Comorbidity Index group, N (%)				<0.001
0	17878 (93.5)	16548 (94.1)	1330 (87.3)	

	1	659 (3.5)	570 (3.2)	89 (5.8)	
	2	575 (3.0)	470 (2.7)	105 (6.9)	
Drug or alcohol abuse diagnosis, N (%)		4815 (25.2)	4256 (24.2)	559 (36.7)	<0.001
LOS, mean (SD)		8.8 (14.2)	8.2 (13.0)	15.7 (22.5)	<0.001
Total Charges, mean (SD)		146468 (143126, 149809)	137476 (134284, 140668)	250467 (231202, 269732)	<0.001
Disposition, N (%)					<0.001
	Home	14457 (75.6)	13465 (76.6)	992 (65.1)	
	Home with care	1928 (10.1)	1707 (9.7)	221 (14.5)	
	Short-term hospital	230 (1.2)	192 (1.1)	38 (2.5)	
	Other center	1184 (6.2)	973 (5.5)	211 (13.9)	
	AMA	443 (2.3)	381 (2.2)	62 (4.1)	
	Expired	870 (4.6)	870 (5.0)	0 (0)	

[a]Student's T-test for continuous variable and Chi2 for categorical variables
Abbreviations: AMA, against medical advice

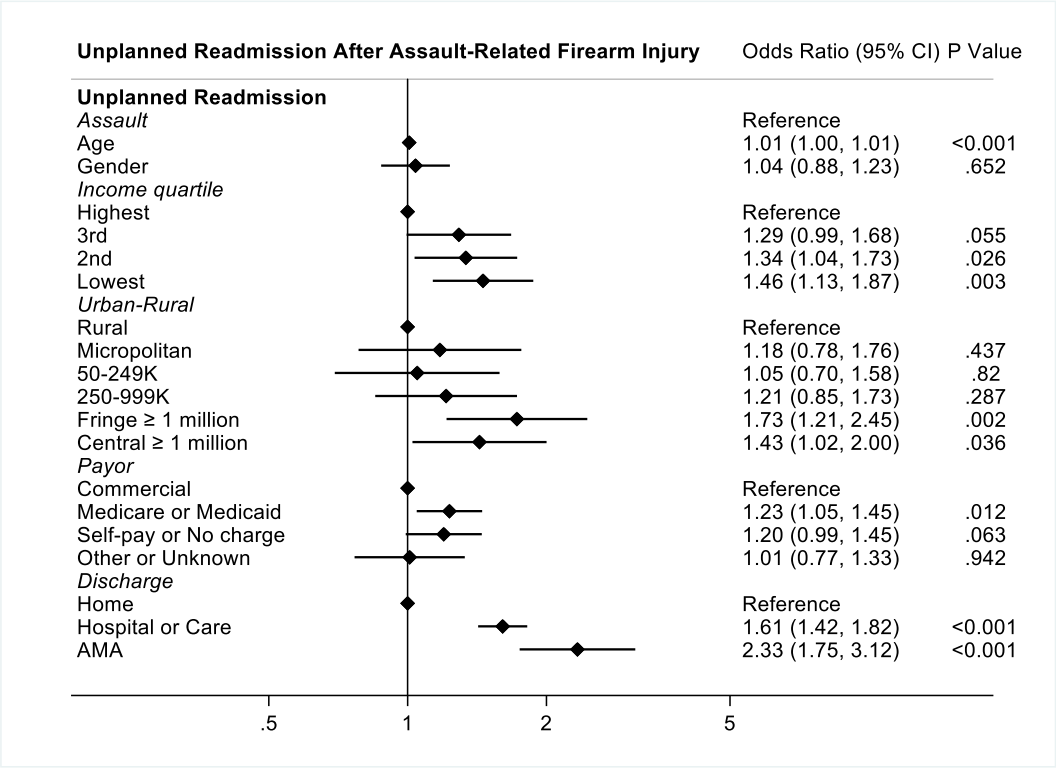


Figure 1: Multivariable logistic regressions of factors associated with 90-day unplanned readmission following firearm injury. Model is additional adjusted for comorbidities, severity of injury, and clustered by hospital to account for center specific differences.

ABSTRACT #4

WISCONSIN, CLINICAL

Courtney Pokrzywa M.D.

ACS COT Residents Trauma Papers Competition Title Page

Principal Author's Information

Name and degree(s): Courtney Pokrzywa M.D.

Title of the Abstract: Positive Pressure Ventilation is not an Independent Predictor of Pneumothorax Observation Failure in Severely Injured Patients.

Institution: Medical College of Wisconsin

Preferred Mailing Address: 8701 W Watertown Plank Rd, Wauwatosa, WI 53226

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Please check the category of the paper below:

☐Basic Laboratory Science **☒Clinical Research/Investigation**

Please check the box after reading each statement below:

☒It is understood that the primary author is a surgery resident, surgical sub- specialty resident or trauma fellow.

☒It is also understood that although the abstract can be presented elsewhere, it cannot be published prior to March 30, 2022.

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Abstracts must be submitted to the ACS Trauma Programs office as Word documents. Single spacing is permitted. Charts and graphs may be embedded in the document as .jpeg files.

Principal Author's Name: Courtney J. Pokrzywa
Title of Abstract: Positive Pressure Ventilation is not an Independent Predictor of Pneumothorax Observation Failure in Severely Injured Patients

Begin abstract here:

Introduction:
Many practitioners feel that mechanical ventilation (MV) is associated with an increased risk of failure when observing a traumatic pneumothorax (PTX). We hypothesized that mechanical ventilation (MV) was not an independent predictor of observation failure in patients with a traumatic PTX when compared to those not on MV (NMV).

Methods:
This is a single-center retrospective study of all trauma patients ≥18 years old who had a PTX diagnosed on computed tomography (CT) between 2015-2019 who were initially observed for the first 24 hours following admission. Those on MV were compared to those NMV. Patients who received a chest tube, had concurrent hemothorax, or died in the first 24 hours were excluded. Failure of observation was defined as those patients who required subsequent intervention secondary to PTX progression.

Results:
Of 331 patients who met inclusion criteria, 63 of them were on MV. The MV group more frequently presented with higher ISS scores, were hypotensive, had longer length of stay, and had smaller PTX sizes (**Tables 1 & 2**). The observation failure rate was 6.3% vs 1.5% for patients on MV and NMV, respectively (p=0.04). On multivariate analysis for observation failure, PTX size >15mm was a predictor for failure (OR: 23.3, 95% CI: 2.6-203; p=0.004), but MV was not (OR: 4.1, 95% CI: 0.33-50; p=0.27). On a separate multivariate analysis assessing for pulmonary-related complications, patients on MV were 12 times more likely to develop these complications when compared to NMV patients (p=0.001). Readmission rates were similar between both groups.

Conclusion:
MV was not an independent predictor of failure for those trauma patients with PTX who were initially observed. A larger prospective trial is needed to validate this finding.

Table 1. Descriptive characteristics of mechanically ventilated and non-mechanically ventilated patients with traumatic pneumothorax.

Variables	Mechanical Ventilation	Non-Mechanical Ventilation	Total	p-value
	n= 63	n= 268	n= 331	
Age (yrs)	32 (±15.3)	33 (±19.4)	33 (±18.7)	0.279
Male	51 (81%)	165 (61.6%)	216 (65.3%)	**0.004**
Injury Type				0.599
Blunt	63 (100%)	262 (97.8%)	325 (98.2%)	
ED SBP Classification				**0.001**
<90	8 (12.7%)	12 (4.5%)	20 (6.1%)	
90 - 110	12 (19%)	22 (8.2%)	34 (10.3%)	
>110	43 (68.3%)	233 (87.3%)	276 (83.6%)	
ED Heart Rate	91 (±24.4)	90 (±16.8)	90 (±18.5)	0.471
BMI Median	25.4 (±7.9)	25.7 (±5.3)	25.5 (±5.9)	0.476
ISS Median	29 (±10.9)	14 (±7.9)	17 (±10)	**0.0001**
PTX Size				**0.047**
1 - 15	59 (93.7%)	225 (84%)	284 (85.8%)	
16 - highest	4 (6.3%)	43 (16%)	47 (14.2%)	
Bilateral PTX	21 (33.3%)	69 (25.7%)	90 (27.2%)	0.223
Pulmonary Contusion	53 (84.1%)	168 (62.7%)	221 (66.8%)	**0.001**
Abdominal Injury	27 (42.9%)	75 (28%)	102 (30.8%)	**0.02**

Table 2. Outcomes of mechanically ventilated patients and non-mechanically ventilated patients with traumatic pneumothorax

Variables	Mechanical Ventilation	Non-Mechanical Ventilation	Total	p-value
	n= 63	n= 268	n= 331	
Median LOS	15 (±18)	3.5 (±4.6)	4 (±10.6)	**0.0001**
Median ICU days	6 (±7.8)	0 (±1.7)	1 (±4.9)	**0.0001**
Observation Failure	4 (6.3%)	4 (1.5%)	8 (2.4%)	**0.046**
Pulmonary Complications	13 (20.6%)	3 (1.1%)	16 (4.8%)	**0.0001**
Pneumonia	12 (19%)	2 (0.7%)	14 (4.2%)	**0.0001**
Pulmonary Embolism	1 (1.6%)	2 (0.7%)	3 (0.9%)	0.47
Lung Abscess	1 (1.6%)	0 (0%)	1 (0.3%)	0.19
Empyema	1 (1.6%)	0 (0%)	1 (0.3%)	0.19
Readmission	1 (1.6%)	7 (2.6%)	8 (2.4%)	0.53

Table 3. Multivariate regression for Observation Failure.

Variable	B	S.E.	OR	95% C.I.for OR		p-value
				Lower	Upper	
Black Race	-3.387	1.67	0.034	0.001	0.893	0.043
ISS	-0.018	0.05	0.983	0.89	1.085	0.728
PTX Size >15mm	3.151	1.104	**23.355**	**2.683**	**203.327**	**0.004**
Pulmonary Contusion	-1.161	1.409	0.313	0.02	4.952	0.41
Abdominal Injury	-1.675	0.985	0.187	0.027	1.291	0.089
Bilateral PTX	-0.8	0.967	0.45	0.068	2.99	0.408
BMI	-0.13	0.107	0.878	0.713	1.082	0.223
Use of Mechanical Ventilation	1.413	1.28	4.107	0.334	50.449	0.27
Pulmonary-related Complications	-3.312	1.315	0.036	0.003	0.48	0.012
Constant	5.086	3.399	161.783			0.135

ABSTRACT #5

CHICAGO, BASIC SCIENCE

Jessie Ho, MD

ACS COT Residents Trauma Papers Competition Title Page

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Title of the Abstract: Treatment with a recombinant cell repair protein attenuates brain lesion size in a large animal model of traumatic brain injury
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Please check the category of the paper below:
☒**Basic Laboratory Science** ☐**Clinical Research/Investigation**

Please check the box after reading each statement below:
☒**It is understood that the primary author is a surgery resident, surgical sub- specialty resident or trauma fellow.**

☒**It is also understood that although the abstract can be presented elsewhere, it cannot be published prior to March 30, 2022.**

Specifications for abstracts
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Abstracts must be submitted to the ACS Trauma Programs office as Word documents. Single spacing is permitted. Charts and graphs may be embedded in the document as .jpeg files.

Principal Author's Name: Jessie Ho
Title of Abstract: Treatment with a recombinant cell repair protein attenuates brain lesion size in a large animal model of traumatic brain injury
Begin abstract here:

Treatment with a recombinant cell repair protein attenuates brain lesion size in a large animal model of traumatic brain injury

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Introduction: Traumatic brain injury (TBI) remains a leading cause of trauma related deaths. For the millions who survive TBI, there is an increase in long-term disability, and a significant cost to the society. The most effective intervention for TBI is prevention. Our medical management essentially consists of supportive care with the goal to attenuate secondary brain injury, but none of these treatments specifically target the underlying mechanisms. Currently, there are no effective "neuroresuscitative" therapies for TBI, making development of novel cellular protective strategies a critical and continued need in the treatment paradigm of TBI.

MG53 (also known as TRIM72), a member of the tripartite motif (TRIM) protein family, has been shown to play an essential role in cell membrane repair and tissue regeneration[1]. In addition to facilitating tissue repair, MG53 has also been shown to be an anti-inflammatory mediator, that may serve to decrease the neuroinflammation that is triggered by TBI[2, 3]. MG53 knockout has been shown to impair tissue regeneration and worsen cellular damage in multiple organs including skeletal muscles, heart, lung, kidney, and cornea[4, 5]. Conversely, transgenic mice with a sustained elevation of MG53 in the blood stream are resistant to ischemic brain injury[6]. Recent studies have shown that systemic delivery of recombinant human MG53 (rhMG53) protein can repair cellular membrane damage[7].

Given rhMG53's potential as a novel therapeutic agent, intravenous (IV) delivery of rhMG53 has been tested in rat and mice models of ischemic stroke and TBI, respectively. The results demonstrated improved neurologic recovery, decreased brain lesion size, and decreased cellular damage with no toxic effects[2, 8]. These promising findings suggest that MG53 can potentially be developed in to a safe and effective treatment for TBI.

Objective: The objective of this study was to test the ability of rhMG53 to attenuate brain lesion size in a clinically relevant large animal model of TBI.

Method: This study used a well-established model of TBI in female Yorkshire swine (40-45kg). Under inhaled isoflurane anesthesia, arterial (bilateral, 5-Fr) and venous (unilateral, 9Fr) catheters were placed in femoral vessels using a cutdown approach. The external jugular vein was accessed percutaneously using ultrasound guidance to place a Swan-Ganz catheter. The head was fixed in a frame, and TBI induced through a 21mm burr hole using a standardized controlled cortical impact (20-mm diameter impactor, 4 m/s velocity, 100ms dwell time, and depth of 12mm)[9]. Following TBI, the swine were randomized to the following:

1. Control (saline vehicle)

2. Experimental (rhMG53; 2mg/kg intravenously over 30 minutes)

Hemodynamics and intracranial pressure were monitored continuously for a 7-hour observation period. Arterial blood gases were checked at serial time points throughout the experiment. Upon completion of the observation period, animals were euthanized. Brains were harvested and sectioned into 5 mm slices and stained with 2, 3, 5-triphenyltetrazolium chloride. The brain lesion size was quantified through volumetric calculation of the lesion using Image J software (NIH, Bethesda, MD). Prism version 8 (GraphPad, San Diego, CA) was used for statistical analysis. Two-tailed Student's *t* test was used to compare groups for differences in brain lesion size. All hemodynamic and laboratory parameters between the groups were compared using a mixed effect model or two-way ANOVA.

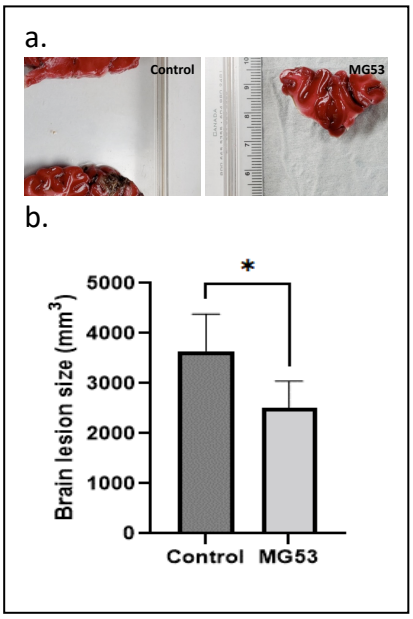

Figure 1. a. Sectioned and stained brain slices with traumatic brain injury. b. Brain lesion size in control versus MG53 treated animals

Results: A total of 10 animals were included in this study (n=5/group). All of the animals reached the pre-determined endpoint, and none were excluded from the analysis. Hemodynamic parameters, including heart rate, blood pressure, mean arterial pressure, and cardiac output were similar with no significant differences (**Figure 2**). There were no significant differences at any time points between the groups for arterial blood gas results including for pH (p=0.15), potassium (p=0.72), sodium (p=0.71), calcium (p=0.99), glucose (p=0.89), or lactate (p=0.50). The brain lesion size (**Figure 1**) in the rhMG53 treated group (2517 ± 525.4 mm^3) was significantly ($p < 0.05$) smaller than the control group (3646 ± 740.1 mm^3).

Conclusion: This is the first study evaluating the effects of rhMG53 on traumatic brain injury in a large animal model. We show that administration of rhMG53 is associated with significant attenuation in brain lesion size in the acute setting following TBI. Additionally, there were no adverse effects or significant changes in key laboratory values and hemodynamics attributable to the treatment. This study builds on a growing body of work demonstrating the potential for rhMG53 as a future therapy for the treatment of TBI.

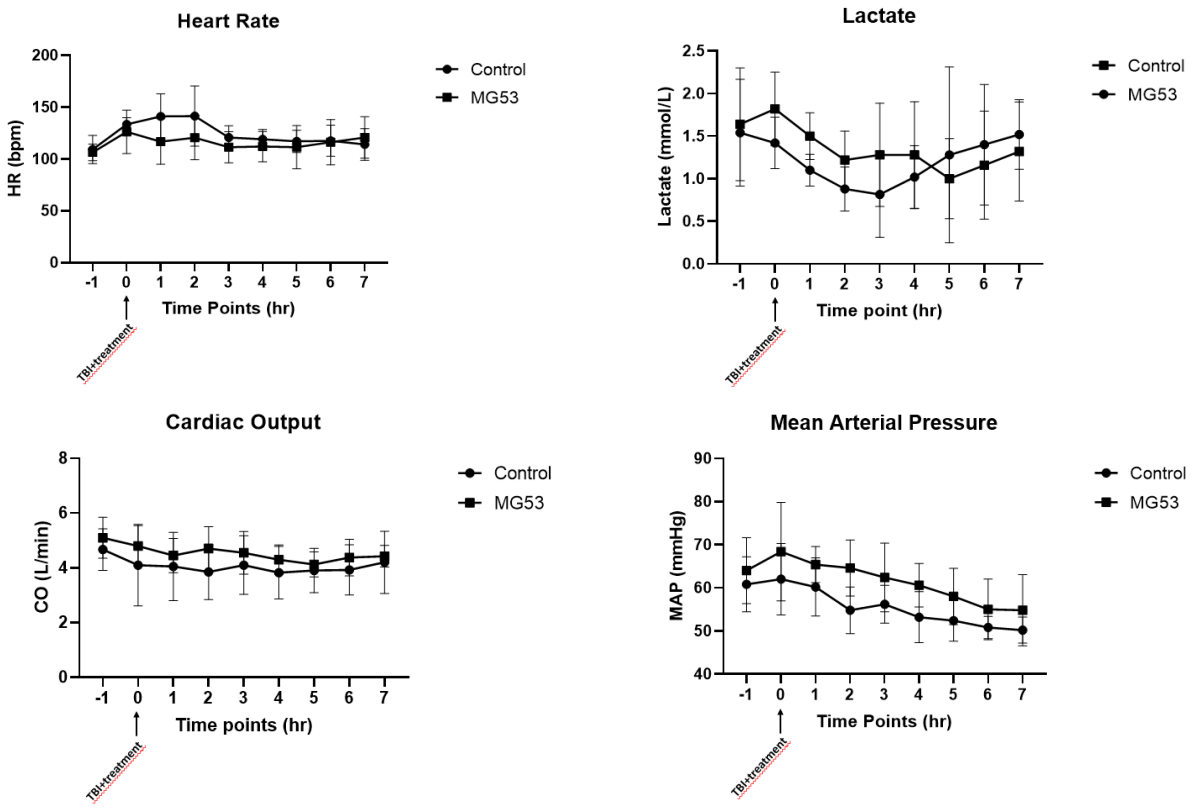

Figure 2. Hemodynamic parameters, heart rate, cardiac output, mean arterial pressure, and lactate. X axis shows hours since start of traumatic brain injury. rhMG53 vs saline was administered at time 0.

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ABSTRACT #6

MICHIGAN, BASIC SCIENCE

Michael J. Carge, DO

ACS COT Residents Trauma Papers Competition Title Page

Principal Author's Information

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Title of the Abstract: *Vascular aging increases severity of endothelial dysfunction following shock: an in vitro model*

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Please check the category of the paper below:

☒**Basic Laboratory Science** ☐**Clinical Research/Investigation**

Please check the box after reading each statement below:

☒**It is understood that the primary author is a surgery resident, surgical sub- specialty resident or trauma fellow.**

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Principal Author's Name: Michael J. Carge, DO

Title of Abstract: *Vascular aging increases severity of endothelial dysfunction following shock: an in vitro model*

Vascular aging increases severity of endothelial dysfunction following shock: an in vitro model

Michael J. Carge, DO; David Liberati, MS; Lawrence N. Diebel, MD

Introduction: Trauma is an important cause of morbidity and mortality in the elderly. Aging associated decline in cardiovascular reserve is a major factor for their poorer outcomes. Endothelial aging is a critical step in the development of age related cardiovascular disease. The endothelium is also a pathologic target of critical illness after trauma, hemorrhagic shock and sepsis. Despite similar features, the additive effects of age and trauma/hemorrhagic shock (T/HS) on endothelial dysfunction is unknown. This was studied in vitro using a microfluidic perfusion platform.

Methods: Aged and young mouse aortic endothelial cell monolayers were established using perfusion microfluidic devices. Cells were exposed to biomimetic shock conditions (hypoxic-reoxygenation, H/R + epinephrine). Endothelial activation was determined by soluble thrombomodulin (STM) and fibrinolytic phenotype was indexed by relative concentrates of tissue plasminogen activator (tPA) and plasminogen activator inhibitor 1 (PAI-1). Angiopoietin 1 and 2 (Ang-1 and Ang-2) were used as endothelial permeability parameters. Sphingosine-1-phosphate (S1-P) metabolic pathways are critical for endothelial biology. Supernatant S1-P concentrations and receptor assays were therefore performed.

Results:

Mean ± SD, N = 6 for each group *p <0.05 vs. young cells same group

Cell Condition	STM		Ang-1		Ang-2		tPA		PAI-1	
	Young	Aged	Young	Aged	Young	Aged	Young	Aged	Young	Aged
Control	22.1 ± 2.2	29.3 ± 2.7*	502 ± 6.6	410 ± 5.5*	156 ± 1.2	232 ± 4.5*	3.6 ± 1.6	10.2 ± 5.5*	2350 ± 11.2	1885 ± 8.5*
H/R	70.1 ± 3.7	84.6 ± 4.1*	240 ± 3.2	144 ± 4.2*	352 ± 5.4	258 ± 3.2*	260 ± 6.2	325 ± 8.2*	605 ± 5.4	355 ± 3.2*
Epi only	48.3 ± 2.9	63.7 ± 3.8*	375 ± 5.3	255 ± 4.9*	305 ± 7.7	287 ± 3.1*	52.4 ± 5.3	112 ± 6.9*	1250 ± 7.7	785 ± 7.1*
H/R +Epi	79.6 ± 3.9	89.6 ± 3.9*	144 ± 3.5	105 ± 2.4*	425 ± 9.7	348 ± 2.5*	289 ± 8.5	386 ± 9.4*	420 ± 9.7	265 ± 4.5*

S1-P concentrations were 34.5 ± 1.8 (aged) vs. 45.8 ± 3.2 (young).
Cellular S1-P receptor fluorescent intensity was 118.5 ± 10.5 (aged) vs. 235.6 ± 16.3 (young).
Both were statistically significantly different ($p<0.05$, $n=6$).

Conclusion: There are features of endothelial dysfunction shared by aging and T/HS. Following T/HS, dysfunction was more pronounced in the aged versus young aortic cells. S1-P is important for endothelial barrier function and may be a target for endothelial protective therapy in this setting.