

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

journal homepage: [www.JournalofSurgicalResearch.com](http://www.JournalofSurgicalResearch.com)

## Association for Academic Surgery

## Drug and Alcohol Use in Trauma Patients Before and During the COVID-19 Pandemic



Merry Zhai, BS,<sup>a</sup> Kristy Bono, MS,<sup>a</sup> Wei Wei Zhang, MD,<sup>b</sup>  
Stephanie Bonne, MD,<sup>b</sup> Emily Gordon, MD,<sup>c</sup> Erin Zerbo, MD,<sup>d</sup>  
Harrison Quijote, MPH,<sup>b</sup> and Nina Glass, MD<sup>b,\*</sup>

<sup>a</sup> New Jersey Medical School, Newark, New Jersey<sup>b</sup> New Jersey Medical School, General Surgery, Newark, New Jersey<sup>c</sup> New Jersey Medical School, Medicine, Newark, New Jersey<sup>d</sup> New Jersey Medical School, Psychiatry, Newark, New Jersey

## ARTICLE INFO

## Article history:

Received 1 March 2022

Received in revised form

14 November 2022

Accepted 20 November 2022

Available online 25 November 2022

## Keywords:

Alcohol abuse

COVID-19

Psychiatric disorder

Substance use disorder

Traumatic injuries

## ABSTRACT

**Introduction:** Since the implementation of national stay-at-home orders during the COVID-19 pandemic, there has been rising concerns regarding prolonged social isolation that many individuals face. Given the link between increased stress and alcohol and drug use, our study investigated admission trends and patterns of alcohol and drug use in trauma patients.

**Methods:** This was a single center, retrospective cohort study comparing trauma patients admitted before the pandemic and during the first wave. We compared patient demographics, injury characteristics, and outcomes of substance screen negative, positive, and unscreened patients admitted. Patients screened positive if they had a positive urine drug screen (UDS) and/or a blood alcohol concentration (BAC)  $\geq 10$  mg/dL.

**Results:** There were 3906 trauma admissions in the year prior to and 3469 patients in the first year of the pandemic. No significant demographic differences were presented across time periods. Rates of UDS and BAC screening remained consistent. Equivalent rates of alcohol and drug positivity occurred (34% versus 33%, 17% versus 18%,  $P = 0.49$ ). The total prevalence of alcohol use disorders (4% versus 5%,  $P < 0.001$ ) and psychiatric disorders (6% versus 7%,  $P = 0.02$ ) increased during the pandemic.

**Conclusions:** The prevalence of diagnosed alcohol use and psychiatric disorders in trauma patients increased during the COVID-19 pandemic while rates of acute alcohol and drug screen positivity remained the same. These observations suggest a possible link between pandemic stressors and exacerbation of alcohol use and psychiatric conditions in trauma patients. During a changing pandemic landscape, it remains pertinent to increased screening for these conditions regardless of substance screen positivity upon admission.

© 2022 Elsevier Inc. All rights reserved.

\* Corresponding author. New Jersey Medical School, General Surgery, 150 Bergen Street, Newark, NJ 07101. Tel.: +1 973 972 6293.

E-mail address: [ng470@njms.rutgers.edu](mailto:ng470@njms.rutgers.edu) (N. Glass).

0022-4804/\$ – see front matter © 2022 Elsevier Inc. All rights reserved.

<https://doi.org/10.1016/j.jss.2022.11.059>

## Introduction

The US Centers for Disease Control and Prevention confirmed the first case of COVID-19 on January 20, 2020.<sup>1</sup> In the months following, states around the country issued stay-at-home orders that limited social gathering at public locations with New Jersey's orders being issued on March 21, 2020.<sup>2</sup> Since the implementation of national stay-at-home orders, there has also been rising concerns regarding the prolonged social isolation that many individuals face. Although the strictest orders waned following the early months of the pandemic, levels of socialization have not returned to baseline levels. Consequences of this added mental burden include increased alcohol and drug consumption. Use of nonprescribed fentanyl, heroin, and drug combinations increased early in the pandemic.<sup>3</sup> Respondents of a national survey reported consuming more drinks per day and increased binge drinking.<sup>4</sup>

These trends in increased alcohol and drug consumption have not spared the trauma population. Existing studies show increased rates of alcohol and/or drug use in patients presenting after trauma.<sup>5-8</sup> Variations in COVID-19 cases and state mandates may contribute greatly to differences in alcohol and drug use in trauma patients. We also wondered how existing psychiatric disorders including substance use disorders would correlate with these trends. Given our trauma center's differing patient demographics, substance use habits, and COVID-19 case volume when compared to existing literature, our study sought to describe patterns in trauma admissions during the pandemic. Furthermore, few studies have been done on patterns of substance use in trauma patients beyond the first 6 mo of the pandemic.

This study investigates trends in patients presenting to a single American College of Surgeons designated Level 1 Trauma Center and compares injury patterns as well as alcohol and drug use as factors that may complicate patient care. Study results may inform resource allocation as patient volume stays high during a changing pandemic landscape and give insight into trends that may occur in future pandemics. While lock down and social distancing policies aim for preventing COVID-19 spread, any negative impacts on other areas of health should be studied. Such public health measures present with risks along with the benefits, and we hope this study adds to the developing literature on the cumulative effect of lock down measures on trauma patients. We hypothesized that acute levels of alcohol and drug positivity upon admission as well as the incidence of diagnosed alcohol and drug use disorders increased in trauma patients during the pandemic.

## Methods

This was a single center, retrospective cohort study of trauma patients admitted to University Hospital, an urban public hospital. Two, 1-y time periods were defined as pCOV ("pre-COVID-19": March 16, 2019-March 15, 2020) which represented the year prior to the pandemic and dCOV ("during COVID-19": March 16, 2020-March 15, 2021) which represented the first

year of the pandemic. Data collection started in March to align with the start of New Jersey's lock down policy and the beginning of the surge of COVID-19 patients seen at our hospital. All study data comprised of data from our trauma registry. Study protocols were approved by the institutional review board at Rutgers University with a waiver of consent.

We compared total admission volume, patient outcomes, and injury characteristics of substance screen positive, negative, and unscreened patients admitted before and during the pandemic. Patients screened positive if they had a positive urine drug screen (UDS) and/or a blood alcohol concentration (BAC)  $\geq 10$  mg/dL. Unscreened patients received neither a UDS nor BAC. Our study compared the prevalence of documented medical histories of alcohol use and/or psychiatric disorder as well. The psychiatric disorders included those identified in the National Trauma Data Standard dictionary categories of mental/personality disorder and attention deficit disorder/attention deficit hyperactivity disorder. Psychiatric disorders did not include alcohol or substance abuse disorders and were limited to mental/personality disorders per American Psychiatric Association definition.

## Statistical analyses

$\chi^2$  and Fisher's exact tests were used for categorical variables and the median and Kruskal-Wallis tests were used for continuous variables, as needed. The significance level was set as  $\alpha = 0.05$ . The study used SPSS 25.0 (Copyright IBM Corp 1989, 2017; Armonk, NY) to conduct all statistical analyses.

## Results

The pCOV period observed 3906 trauma admissions and the dCOV period observed 3469 trauma admissions. Rates of overall trauma admissions decreased substantially during the early months of the pandemic (March-April 2020), however rebounded to levels comparable to the year prior to the pandemic within 2 mo (Fig.). Consistent with our normal demographic, trauma patients were majorly male across all three groups of substance negative, positive, and unscreened patients in both time periods (Table 1). In both time periods, substance negative patients were older while the average age of substance positive and unscreened patients presented similarly. We saw shifts in mechanism of injury between the pre and during COVID time periods, including decreases in fall across all groups, decreases in assault in the substance positive group, increases in gunshot wounds in the unscreened group, and decreases in pedestrian struck injuries in all groups except for the substance positive group in which the proportion remained consistent before and during the pandemic. Other mechanisms did not see the same consistent trends (Table 1). The injury characteristics and outcomes remained consistent across our patient groups in both time periods (Table 1).

Rates of UDS and BAC screening remained consistent across both time periods with a pCOV UDS rate of 26%, dCOV UDS rate of 27%, pCOV BAC screening rate of 60%, and dCOV BAC screening rate of 62%. Both time periods presented with

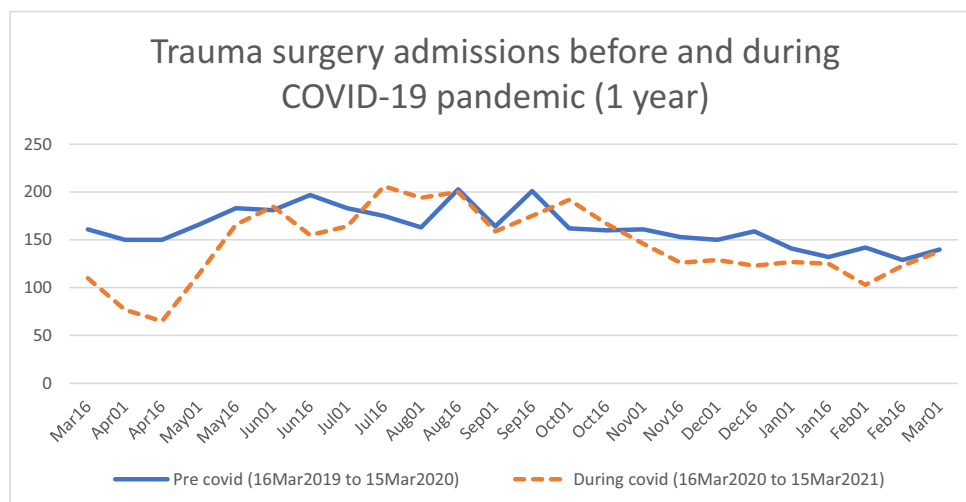


Fig. – Trauma surgery admissions before and during the COVID-19 pandemic.

equivalent rates of alcohol and drug positivity (34% versus 33%, 17% versus 18%,  $P = 0.49$ , Table 2). The pCOV time-period consisted of 827 BAC positive and 414 UDS positive, which comprised 1088 either BAC or UDS positive patients (labeled “substance positive” patients). The dCOV time-period consisted of 724 BAC positive, 401 UDS positive, or 973 total substance positive patients. Among patients who received a BAC screen, fewer had a result  $\geq 200$  mg/dL in the dCOV group, while more had a result of 10-79 (19% versus 15%, 5% versus 7%,  $P < 0.05$ ).

The total prevalence of alcohol use disorders (137 or 4% versus 184 or 5%,  $P < 0.001$ ) and psychiatric disorders (224 or 6% versus 244 or 7%,  $P = 0.02$ ) increased in the dCOV period in admitted trauma patients. Among substance positive trauma patients, the prevalence of alcohol use disorder increased (9% versus 14%,  $P = 0.001$ , Table 1); however, the prevalence of psychiatric disorders stayed equivalent across both time periods (8% versus 8%,  $P = 0.89$ ). In the unscreened patients, pCOV and dCOV rates of alcohol use disorder presented similarly (1% versus 2%,  $P = 0.08$ ), while prevalence of psychiatric disorder increased in dCOV (4% versus 7%,  $P < 0.001$ ).

## Discussion

During the first year of the COVID-19 pandemic, we saw increased rates of documented psychological disorder and alcohol use disorder diagnoses compared to before the pandemic. This could have stemmed from a variety of factors including increased mental health strain due to the significant social isolation that came with restrictions, the widespread prevalence of disease, and/or the uncertainty of the ongoing trajectory of the pandemic. Such increased mental health burden may lead to extreme stress relief methods, including substance use and also increasing the risk of injury.

While several studies found that acute alcohol and/or drug positivity upon admission increased in the trauma population, our center did not see dramatic changes.<sup>5,7,8</sup> Even among these studies, however, variability in substance use patterns were observed. For example, in the trauma population described by McGraw *et al.* from Colorado, Texas, Kansas, and Missouri, both alcohol and drug screen positive admissions increased during the pandemic, trauma populations from Los Angeles described by Ghafil *et al.* and Chiba *et al.* observed only increases in drug screen positivity during the pandemic with no changes in rates of alcohol screen positivity.<sup>5,7,8</sup> These studies hypothesize that the isolation from lock-down mandates could have exacerbated alcohol and drug use. Differences in patient demographics, COVID-19 caseload, and underlying alcohol and drug use in our trauma population may explain the variability in our study results. Early in the pandemic, COVID-19 cases first appeared on the West Coast, but then increased at a greater rate in the New Jersey/New York area.<sup>9</sup> Many local factors could affect our study observations including compliance with lock downs and proportion of patients working professions deemed essential. Additionally, financial loss could have affected drug and alcohol use in many ways and the intensity of the case load seen at various times and locations during the first year of the pandemic may have contributed to the effects seen. Although the strictest lock down measures eased after 2 mo of the pandemic, long-term pandemic stressors have not disappeared and continue to affect psychiatric conditions in trauma patients regardless of substance use.

Although alcohol and drug screen positivity in our population did not change during the pandemic, fewer presented with levels  $\geq 200$  while the proportion with results between 10 and 79 increased. This may suggest that binge drinking decreased in our trauma population while chronic drinking increased. The closure of bars during the stay-at-home mandate may have caused a shift in alcohol and drug

**Table 1 – Characteristics and outcomes of trauma patients by year and admission substance screening.**

Characteristics, n (%)	pCOV, substance neg, n = 351 (%)	dCOV, substance neg, n = 320 (%)	P-value	pCOV, substance pos <sup>†</sup> , n = 1088 (%)	dCOV, substance pos, n = 973 (%)	P-value	pCOV, unscreened <sup>‡</sup> , n = 2467 (%)	dCOV, unscreened, n = 2176 (%)	P-value
Sex (male)	234 (67%)	233 (73%)	0.08	869 (80%)	786 (81%)	0.62	1688 (68%)	1501 (69%)	0.48
Age median [IQR]	48 [63-31]	47 [62-31]	0.91	39 [52-30]	39 [52-30]	0.88	38 [58-23]	37 [57-25]	0.28
Relevant medical history									
Alcohol use disorder	11 (3%)	15 (5%)	0.30	98 (9%)	131 (14%)	<b>0.001</b>	28 (1%)	38 (2%)	0.08
Psychiatric disorder	32 (9%)	18 (6%)	0.09	89 (8%)	78 (8%)	0.89	103 (4%)	148 (7%)	<b>&lt; 0.001</b>
MOI			<b>0.02</b>			<b>0.001</b>			<b>&lt; 0.001</b>
Fall	130 (37%)	99 (31%)		310 (29%)	234 (24%)		807 (33%)	646 (30%)	
Motor vehicle crash	59 (17%)	73 (23%)		192 (18%)	208 (21%)		328 (13%)	335 (15%)	
Motorcycle crash	14 (4%)	15 (5%)		34 (3%)	53 (5%)		85 (3%)	83 (4%)	
Assault	32 (9%)	33 (10%)		230 (21%)	162 (17%)		243 (10%)	203 (9%)	
Pedestrian struck	66 (19%)	39 (12%)		129 (12%)	103 (11%)		320 (13%)	211 (10%)	
Gunshot wound	14 (4%)	25 (8%)		58 (5%)	80 (8%)		181 (7%)	226 (10%)	
Stab wound	7 (2%)	7 (2%)		54 (5%)	59 (6%)		85 (3%)	91 (4%)	
MOI overall			0.41			0.71			<b>&lt; 0.001</b>
Blunt total	309 (88%)	274 (86%)		915 (84%)	786 (81%)		2007 (81%)	1663 (76%)	
Penetrating total	27 (8%)	34 (11%)		139 (13%)	158 (16%)		333 (13%)	381 (18%)	
Other injury MOI	15 (4%)	12 (4%)		33 (3%)	27 (3%)		122 (5%)	106 (5%)	
ISS			<b>0.02</b>			0.34			<b>0.01</b>
1-9	238 (68%)	186 (58%)		796 (73%)	696 (72%)		19,778 (80%)	1658 (76%)	
10-15	49 (14%)	53 (17%)		123 (11%)	114 (12%)		201 (8%)	213 (10%)	
≥16	60 (17%)	69 (22%)		145 (13%)	149 (15%)		205 (8%)	226 (10%)	
ISS mean (±SD)	9 (±8)	10 (±10)	0.09	8 (±8)	8 (±9)	0.34	6 (±6)	7 (±8)	<b>0.05</b>
Work-related	21 (6%)	20 (6%)	0.99	14 (1%)	8 (1%)	0.39	194 (8%)	144 (7%)	<b>&lt; 0.001</b>
GCS			0.41			0.13			<b>&lt; 0.001</b>
≤ 8	25 (7%)	31 (10%)		63 (6%)	75 (8%)		76 (3%)	89 (4%)	
9-12	18 (5%)	17 (5%)		53 (5%)	34 (4%)		28 (1%)	31 (1%)	
13-15	299 (85%)	268 (84%)		954 (88%)	844 (87%)		2282 (93%)	1965 (90%)	
AIS head ≥ 3	67 (19%)	63 (20%)	0.94	119 (11%)	123 (13%)	0.47	184 (7%)	174 (8%)	0.63
Outcomes									
LOS, median (d) [IQR] *patient deaths excluded	6 [12-3]	7 [14-3]	<b>0.03</b>	5 [10-3]	4 [10-3]	0.83	4 [7-2]	4 [7-2]	0.26
ICU admission	84 (24%)	75 (23%)	0.12	148 (14%)	136 (14%)	0.25	243 (10%)	229 (11%)	0.49

ICU stay, median (d) [IQR]	5 [10-3]	7 [16-3]	0.04	6 [17-3]	5 [14-3]	0.24	4 [8-2]	4 [9-2]	0.61
Ventilator days (median) [IQR]	4 [8-2]	5 [13-2]	0.63	3 [10-2]	3 [11-2]	0.96	2 [8-1]	3 [9-1]	0.36
Mortality	19 (5%)	17 (5%)	0.95	19 (2%)	27 (3%)	0.23	81 (3%)	82 (4%)	< 0.001

Bolded P-values are statistically significant ( $\leq 0.05$ ).  
 ICU = intensive care unit; IQR = interquartile range; AIS = Abbreviated Injury Scale; GCS = Glasgow Coma Scale; ISS = injury severity score; MOI = mechanism of injury.  
 \* Substance negative: either UDS or BAC negative with other test not performed or both negative.  
 † Substance positive: either UDS or BAC positive or both positive.  
 ‡ Unscreened: neither UDS nor BAC performed.

**Table 2 – Rates of acute alcohol and urine drug positivity upon admission before and during COVID-19.**

Characteristics	pCOV, n = 2423*	dCOV, n = 2216*	P-value
Screening results			0.49
BAC positive†	827 (34%)	724 (33%)	
UDS positive‡	414 (17%)	401 (18%)	
Either BAC or UDS positive	1088 (44%)	973 (44%)	
BAC (mg/dL) on presentation	n = 2345§	n = 2155§	<b>&lt; 0.05</b>
<10¶	1518 (65%)	1431 (66%)	
10-79	123 (5%)	155 (7%)	
80-99	42 (2%)	34 (2%)	
100-199	223 (10%)	205 (10%)	
≥ 200	439 (19%)	330 (15%)	
Drugs	n = 1007§	n = 924§	0.28
Amphetamine	31 (3%)	33 (4%)	
Benzodiazepine	122 (12%)	137 (15%)	
Cocaine	140 (14%)	117 (13%)	
Opioids	145 (14%)	130 (14%)	
Cannabinoids	236 (23%)	261 (28%)	

Bolded P-values are statistically significant ( $\leq 0.05$ ).

\* Either alcohol or drug screened.

† BAC: Blood Alcohol Content.

‡ UDS: Urine Drug Screen.

§ Percentages listed are percentage of patients tested.

¶ Excluded as negative for Chi.†

consumption away from binge habits and towards chronic use. Our observed increase in prevalence of alcohol use and psychiatric disorder during the pandemic would also support an increase in chronic substance use.

This study had several limitations. Using retrospective review of registry data from a single center limited the availability of diagnoses and labs collected. More thorough chart review may have been able to identify more patients with subtle comments in the notes about their conditions. The benefit of this limited dataset is that it may be possible to expand this sort of review across multiple sites. We were limited to data collected by the registry including results of UDS which may have resulted as positive due to medications administered in the trauma bay or medications prescribed for a particular diagnosis. However, there is no reason to think there would have been a systematic difference in those numbers compared to baseline, especially considering the percentage of patients screened remained constant throughout both time periods. Because of the low proportion of patients receiving a UDS and/or BAC screen, it is possible that some positive results were missed; most screened patients tested positive for substances, and this was clearly a selected group. However, it is clear that the numbers of patients screened in our population is quite low. Despite changes in resources during the initial months of the pandemic (short staffing, shortages of beds, and certain medications, etc.), the rates of screening remained at the same low level. Perhaps more standard screening guidelines could increase the number of patients captured who would be

eligible for brief interventions. The contrast between the increased dCOV rates of diagnosed alcohol use disorder and the constant rates of acute alcohol and drug positivity could indicate a need for increased UDS and BAC screening. Future steps include investigating barriers to UDS and BAC screening. Further, since this is a single center, the results may not be generalizable to other areas of the country.

Our access to excellent outpatient resources for patients with alcohol and substance use disorders has improved significantly over the past several years. Next, we hope to investigate how our patients are utilizing those resources and identify areas for improvement. Improved screening could identify other potential areas for intervention.

### Conclusions

This study shows that the prevalence of previously diagnosed alcohol use and psychiatric disorders in admitted trauma patients increased during the COVID-19 pandemic, while rates of acute alcohol and drug screen positivity upon admission remained the same. As waves of COVID-19 cases continue to occur, increased screening in trauma patients and arrangements for outpatient follow-up is essential.

### Author Contributions

M.Z. drafted and revised this manuscript. N.G., W.Z., S.B., E.G., and E.Z. conceptualized the design of this study. M.Z., N.G., K.B., and H.Q., acquired these data. M.Z., N.G. analyzed and interpreted these data. M.Z., K.B., W.Z., S.B., E.G., E.Z., H.Q., and N.G. were all substantially involved in the revision and final approval of this manuscript.

### Disclosure

Dr Bonne is an Associate Editor for the Journal of Surgical Research; as such, she was excluded from the entire peer-review and editorial process for this manuscript.

### Funding

None.

### Meeting Presentation

Presented at Academic Surgical Congress 2022.

### REFERENCES

1. Holshue ML, DeBolt C, Lindquist S, et al. First case of 2019 novel coronavirus in the United States. *N Engl J Med*. 2020;382:929–936.
2. Johnson BNJ. *Coronavirus Infection Rates have Fallen, Stayed Below 1-to-1 for Weeks, Murphy Says*. New Jersey: NJ Advance Media; 2020.
3. Niles JK, Gudin J, Radcliff J, Kaufman HW. The opioid epidemic within the COVID-19 pandemic: drug testing in 2020. *Popul Health Manag*. 2021;24:S43–S51.
4. Barbosa C, Cowell AJ, Dowd WN alcohol consumption in response to the COVID-19 pandemic in the United States. *J Addict Med*. 2020;15:341–344.
5. Chiba H, Lewis M, Benjamin ER, et al. “Safer at home”: the effect of the COVID-19 lockdown on epidemiology, resource utilization, and outcomes at a large urban trauma center. *J Trauma Acute Care Surg*. 2021;90:708–713.
6. Devarakonda AK, Wehrle CJ, Chibane FL, et al. The effects of the COVID-19 pandemic on trauma presentations in a level one trauma center. *Am Surg*. 2020;87:686–689.
7. McGraw C, Salottolo K, Carrick M, et al. Patterns of alcohol and drug utilization in trauma patients during the COVID-19 pandemic at six trauma centers. *Inj Epidemiol*. 2021;8:24.
8. Ghafil C, Matsushima K, Ding L, Henry R, Inaba K. Trends in trauma admissions during the COVID-19 pandemic in Los Angeles county, California. *JAMA Netw Open*. 2021;4:e211320.
9. Miguel K.M. How Close was California to Becoming a New York-Level Crisis? San Francisco, CA: ABC7.