



## Original Article

## Increased proportion of alcohol-related trauma in a South London major trauma centre during lockdown: A cohort study

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## ABSTRACT

**Purpose:** Alcohol has been associated with 10%–35% trauma admissions and 40% trauma-related deaths globally. In response to the COVID-19 pandemic, the United Kingdom entered a state of “lockdown” on March 23, 2020. Restrictions were most significantly eased on June 1, 2020, when shops and schools re-opened. The purpose of this study was to quantify the effect of lockdown on alcohol-related trauma admissions.

**Methods:** All adult patients admitted as “trauma calls” to a London major trauma centre during April 2018 and April 2019 (pre-lockdown,  $n = 316$ ), and 1st April–31st May 2020 (lockdown,  $n = 191$ ) had electronic patient records analysed retrospectively. Patients' blood alcohol level and records of intoxication were used to identify alcohol-related trauma. Trauma admissions from pre-lockdown and lockdown cohorts were compared using multiple regression analyses.

**Results:** Alcohol-related trauma was present in a significantly higher proportion of adult trauma calls during lockdown (lockdown 60/191 (31.4%), vs. pre-lockdown 62/316 (19.6%); (odds ratio (OR): 0.83, 95% CI: 0.38–1.28,  $p < 0.001$ ). Lockdown was also associated with increased weekend admissions of trauma (lockdown 125/191 weekend (65.5%) vs. pre-lockdown 179/316 (56.7%); OR: 0.40, 95% CI: 0.79 to –0.02,  $p = 0.041$ ). No significant difference existed in the age, gender, or mechanism between pre-lockdown and lockdown cohorts ( $p > 0.05$ ).

**Conclusions:** The United Kingdom lockdown was independently associated with an increased proportion of alcohol-related trauma. Trauma admissions were increased during the weekend when staffing levels are reduced. With the possibility of further global “waves” of COVID-19, the long-term repercussions of dangerous alcohol-related behaviour to public health must be addressed.

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## Introduction

Alcohol-related trauma accounts for 10%–35% of all trauma admissions and as many as 40% of trauma related deaths.<sup>1–6</sup> As such, it is a significant global health burden, although alcohol consumption and alcohol-related trauma vary widely by country.<sup>2,5,7</sup> In the United Kingdom (UK), mean adult alcohol consumption is 9.7 L per year (global mean 8.2 L alcohol per year) and 27% of UK alcohol users consume to excess, termed “binge drinking”.<sup>8,9</sup> Patients admitted with alcohol-related trauma are more

likely to require immediate treatment, and are at greater risk of COVID-19 infection in hospital.<sup>1,10</sup>

As well as increasing the risk of injury, alcohol plays an important role in the outcome of major trauma. Detectable blood alcohol concentration (BAC) has been associated with an increased injury severity score, and has been associated with a 15% increased risk of infective complications and increased length of stay.<sup>11–14</sup> The effect of alcohol on overall trauma survival is unclear, however, with some studies indicating improved survival with alcohol while others showing no correlation.<sup>15–18</sup>

Plurad et al.<sup>15</sup> investigated 3025 motor vehicle injury (MVI) patients over 10 years old in Los Angeles, California, the USA, finding that blood alcohol levels were not related to injury severity or intensive care length of stay. Patients with BAC greater than 0.08% had a higher incidence of severe head trauma, but a better survival rate compared to severely injured patients with no alcohol.

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Conversely, Mann et al.<sup>16</sup> studied 2323 MVI patients from Vancouver, Canada, finding no relationship between positive blood alcohol and mortality or length of stay. This is supported by Stoduto et al.,<sup>17</sup> investigating 854 MVI patients in Toronto, Canada, where BAC positive patients were more likely to be male and not wearing seatbelts but injury severity measures were similar between groups. Harada et al.<sup>18</sup> studied bicycle trauma related to alcohol over a 10-year period in Los Angeles, with over one third of patients testing positive for alcohol although no difference in outcome was found compared to BAC negative patients.

Between 23rd March and 1st June, 2020, a state of “lockdown” was imposed in the UK in response to the global COVID-19 pandemic. This involved the closure of schools and many workplaces, with citizens expected to remain at home apart from trips to buy food and medicine or to exercise.<sup>19</sup> Restrictions were gradually eased, but at the end of May 2020 much of the population remained working at home with many confined to their houses.

Before lockdown, alcohol intoxication was associated with an increased risk of trauma.<sup>20</sup> Unsurprisingly, alcohol-related trauma was more common at weekends and during the evening/night, reflecting when most alcohol is consumed normally.<sup>2,4,5,11</sup> Alcohol-related trauma has also been associated with sports games and off-site consumption of alcohol.<sup>21,22</sup> Off-licence consumption of alcohol has previously shown a greater association with violent crime than on-site consumption.<sup>22</sup>

With sports games cancelled and bars closed, patterns of alcohol consumption and consequent trauma were likely to be drastically altered by lockdown. Increased alcohol abuse has been observed in survivors of stressful events, such as terrorist attacks or natural disasters, as well as those who have become socially isolated.<sup>23–25</sup> Indeed, binge drinking was significantly increased during COVID-19 lockdown in Hubei province, China as well as in the UK.<sup>26,27</sup> The UK lockdown was also associated with an increase in domestic violence, with a 25% increase in calls to the UK domestic violence helpline during the first week of lockdown.<sup>28</sup> Whether alcohol-related trauma admissions as a result of COVID-19 UK lockdown will reflect such findings is unclear.

We aimed to investigate whether alcohol-related trauma was associated with a greater proportion of trauma calls at a London major trauma center (MTC) during UK lockdown. We also aimed to understand whether outcomes were altered by the monumental changes in healthcare provision associated with the COVID-19 pandemic. We will investigate whether alcohol-related trauma admissions occur at different times of day or during weekends, reflecting altered working patterns during UK lockdown.

## Methods

### Study population and inclusion criteria

We conducted a retrospective case-controlled analysis of all adult patients admitted as trauma calls to the emergency department (ED) at St George's University Hospitals National Health Service Foundation Trust, a level one MTC in London. Patients admitted during April and May 2020 formed the lockdown cohort (cases), and those admitted during April 2018 and April 2019 formed the non-lockdown cohort (control). Local ethical approval was not required as the study was classified as a service evaluation.

Patients are “trauma called” when they fit criteria outlined in the London Major Trauma Decision Tool.<sup>29</sup> We included patients 16 years of age or over admitted to ED directly, as well as those transferred from other EDs. We did not include patients under 16 years, or patients admitted directly to inpatient wards under the orthopaedic team. Three authors (Brown OS, Tsinaslanidis P and Gaukroger AJ) retrospectively analysed patient records from the

hospital's trauma register and individual electronic patient records (EPR) to obtain this data.

### Outcome measurement

The hospital's trauma database was examined, and patient details were anonymised immediately following extraction to preserve confidentiality. Our primary outcome was the proportion of patients with BAC level greater than zero or, if no BAC recorded, those with intoxication recorded in their ED notes. Patients were identified as trauma calls from the trauma database, with their BAC level of ED and ED notes found on the EPR.

Data for secondary outcomes was obtained from the EPRs. This included: patients' age, gender, mechanism of injury, length of stay, mortality, and the time and weekday of arrival to ED. Time of day was separated into day and night, with 06:00–21:00 constituting daytime. Weekends were categorised as Friday at 17:00 until Monday at 06:00.

### Statistical analysis

Data were descriptively analysed to describe the cohort using mean and SD for continuous outcomes and frequency and percentages for categorical data. A univariate regression analysis (logistic for categorical variables and linear for continuous variables) was conducted to explore potential relationships between lockdown status and explanatory variables. These included: age ( $\leq$ / $>$ 60 years old), gender (male/female), alcohol use pre-admission (yes/no), mechanism of injury, mortality, admission on weekend, admission day/night. A multivariate regression analysis was undertaken to assess the relationship between COVID lockdown (yes/no) and potential explanatory variables which may have been associated with injury. All regression model results were presented as odd ratio (OR), 95% confidence intervals (CI) and *p* values. A *p* value of  $< 0.05$  was deemed statistically significant. All analyses were conducted on STATA version 16.0 (Stata Corp, Dallas, Texas, USA).

## Results

### Demographics

In total, 549 patients were identified. Of these, 42 were under 16 years old and were excluded, leaving 507 adult trauma calls as seen in Fig. 1. A summary of pre-lockdown and lockdown cohorts is presented in Table 1. In brief, mean age of all adult trauma calls (pre-lockdown and during lockdown) was 50.2 (SD: 23.2,  $n = 507$ ) years with the mean age of all alcohol-related trauma calls (pre-lockdown and during lockdown) 43.1 (SD: 16.7,  $n = 122$ ) years. The ages of one male patient in 2018 and one female patient in 2019 were not available as they self-discharged from the ED before this was obtained. Sixty-eight percent of all adult trauma calls were male, compared to 79% in all alcohol-related trauma calls. A summary of the univariate and multi-variate analyses is presented in Table 2. Alcohol-related admissions and weekend admissions were significantly altered by lockdown.

### Primary outcome

Alcohol-related trauma was present in a significantly higher proportion of adult trauma calls during lockdown compared to pre-lockdown period (60/191 (31.41%) vs. 62/316 (19.62%),  $n = 507$ ; multivariate: OR: 0.83, 95% CI: 0.38–1.28,  $p < 0.001$ ).

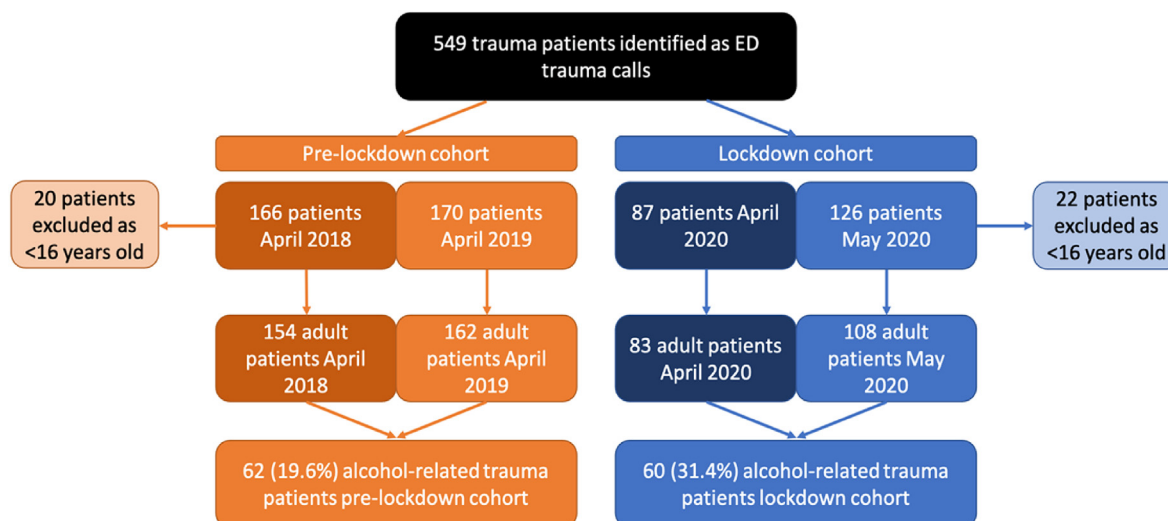


Fig. 1. Flowchart showing full data set with excluded patients and make-up of pre-lockdown and lockdown cohorts.

Table 1

Demographic data, showing a significantly higher proportion of alcohol-related trauma during lockdown.

| Variables                  | Total Cohort (n = 507) | Pre-lockdown (n = 316) | Lockdown (n = 191) |
|----------------------------|------------------------|------------------------|--------------------|
| Lockdown, n (%)            |                        |                        |                    |
| Yes                        | 191 (37.7)             |                        | 191 (37.7)         |
| No                         | 316 (62.3)             | 316 (62.3)             |                    |
| Age (years)                |                        |                        |                    |
| Mean (SD)                  | 50.2 (23.2)            | 48.9 (24.3)            | 52.4 (21.1)        |
| ≤60, n (%)                 | 338 (66.7)             | 213 (67.4)             | 123 (64.4)         |
| >60, n (%)                 | 169 (33.3)             | 103 (32.6)             | 68 (35.6)          |
| Gender, n (%)              |                        |                        |                    |
| Male                       | 347 (68.4)             | 218 (69.0)             | 129 (67.5)         |
| Female                     | 160 (31.6)             | 98 (31.0)              | 62 (32.5)          |
| Alcohol status, n (%)      |                        |                        |                    |
| Yes                        | 122 (24.1)             | 62 (19.6)              | 60 (31.4)          |
| No                         | 385 (75.9)             | 254 (80.4)             | 131 (68.6)         |
| Mechanism of injury, n (%) |                        |                        |                    |
| Fall >2 m                  | 114 (22.5)             | 73 (23.1)              | 41 (21.5)          |
| Fall <2 m                  | 120 (23.7)             | 77 (24.4)              | 43 (22.5)          |
| Self-inflicted             | 21 (4.1)               | 11 (3.5)               | 10 (5.2)           |
| Road injury                | 150 (29.6)             | 82 (26.0)              | 68 (35.6)          |
| Assault/stabbing           | 80 (15.8)              | 56 (17.7)              | 24 (12.6)          |
| Other                      | 22 (4.3)               | 17 (5.4)               | 5 (2.6)            |
| Mortality, n (%)           |                        |                        |                    |
| Yes                        | 25 (4.9)               | 12 (3.8)               | 13 (6.8)           |
| No                         | 482 (95.1)             | 304 (96.2)             | 178 (93.2)         |
| Admission timing, n (%)    |                        |                        |                    |
| Day                        | 314 (61.9)             | 189 (59.8)             | 125 (65.4)         |
| Night                      | 193 (38.1)             | 127 (40.2)             | 66 (34.6)          |
| Weekend                    | 203 (40.0)             | 179 (56.6)             | 125 (65.4)         |
| Weekday                    | 304 (60.0)             | 137 (43.4)             | 66 (34.6)          |

Note: Alcohol status taken from blood alcohol concentration (BAC) greater than zero, or documented evidence of intoxication in ED. For the pre-lockdown cohort 5 patients had haemolysed/not taken BAC. Three patients had evidence of alcohol related trauma documented, and 2 did not. For the lockdown cohort 10 patients had haemolysed/not taken BAC. Six patients had evidence of alcohol related trauma documented and four did not.

### Secondary outcomes

There was no significant difference in age between adult trauma calls between pre-lockdown and lockdown cohorts (pre-lockdown mean 48.9 years (SD: 24.3) years vs. lockdown 52.4 years (SD: 21.1); multivariate: OR: 0.20, 95% CI: 0.22–0.61,  $p = 0.356$ ). There was no difference between the gender split of adult trauma calls pre-lockdown and during lockdown (pre-lockdown 218/316 (69.0%) male vs. lockdown 129/191 (67.5%) male, multivariate: OR: 0.11, 95% CI: 0.30 – 0.53,  $p = 0.597$ ).

The proportion of patients admitted during the weekend period (Friday 17:00 - Monday 6:00 was increased during lockdown (pre-lockdown 179/316 (56.7%) vs. lockdown 125/191 (65.5%), multivariate: OR: 0.40, 95% CI: 0.79 to –0.02,  $p = 0.041$ ). This is seen in Fig. 2 and denoted with an asterisk. The proportion of patients admitted during the day (between 6:00 a.m. and 9:00 p.m.) was not significantly increased during lockdown (pre-lockdown 189/316 (59.8%) vs. lockdown 125/191 (65.5%), multivariate: OR: 0.37, 95% CI: 0.77 – 0.03,  $p = 0.041$ ).

There was no significant difference between the mechanisms involved in alcohol-related trauma admissions pre-lockdown and

**Table 2**  
Univariate analysis results assessing the association between lockdown and trauma admissions.

| Variables                    | OR    | 95% CI         | p value |
|------------------------------|-------|----------------|---------|
| <b>Univariate analysis</b>   |       |                |         |
| Age (categorised)            | 1.17  | 0.80 to 1.70   | 0.428   |
| Age (continuous)             | 0.00  | −0.00 to 0.00  | 0.100   |
| Gender                       | 1.07  | 0.73 to 1.57   | 0.734   |
| Alcohol present              | 1.88  | 1.24 to 2.84   | 0.003   |
| Mechanism injury             | −0.02 | −0.13 to 0.10  | 0.790   |
| Mortality                    | 1.85  | 0.83 to 4.14   | 0.135   |
| Admission: day/night         | 0.79  | 0.54 to 1.14   | 0.206   |
| Admission: weekend/weekday   | 0.69  | 0.48 to 1.00   | 0.051   |
| <b>Multivariate analysis</b> |       |                |         |
| Age                          | 0.20  | −0.22 to 0.61  | 0.356   |
| Gender                       | 0.11  | −0.30 to 0.53  | 0.597   |
| Alcohol present              | 0.83  | 0.38 to 1.28   | <0.001  |
| Mechanism injury             | −0.02 | −0.13 to 0.10  | 0.781   |
| Mortality                    | 0.52  | −0.31 to 1.35  | 0.217   |
| Admission: day/night         | −0.37 | −0.77 to 0.03  | 0.069   |
| Admission: weekend/weekday   | −0.40 | −0.79 to −0.02 | 0.041   |

OR: odd ratio; CI: confidence intervals.

during lockdown (OR: 0.02, 95% CI: 0.13–0.10,  $p = 0.781$ ) as seen in Fig. 3. Mortality data indicated that there was no significant difference in the mortality rate between pre-lockdown and lockdown

cohorts (12/316 pre-lockdown (3.8%) vs. 13/191 (6.8%) lockdown, OR: 1.85, 95% CI: 0.83–4.14,  $p = 0.135$ ).

**Discussion**

The COVID-19 pandemic has created an unprecedented global threat to public health. This not only manifests itself in the direct viral disease, but the pandemic's economic, social, and psychological ramifications.<sup>30</sup> This study is the first to examine rates of alcohol-related trauma as a result of the COVID-19 pandemic lockdown in the UK. The proportion of alcohol-related trauma admitted to a London MTC increased significantly during the lockdown period of April–May 2020, compared with baseline measurements over 2 previous years. However, while the proportion of alcohol-related trauma increased, the absolute numbers of trauma related to alcohol remained stable.

The ban of alcohol during COVID-19 lockdown in South Africa's Western Cape was associated with a 53% reduction in trauma admissions, with a rebound effect when the ban was lifted.<sup>31</sup> Recent evidence from single-centre studies in the USA suggests that overall trauma was significantly reduced during lockdown compared with the same period in the previous year.<sup>32,33</sup> In line with our findings, previous evidence from the USA has shown the proportion of alcohol-related trauma to be significantly increased during the

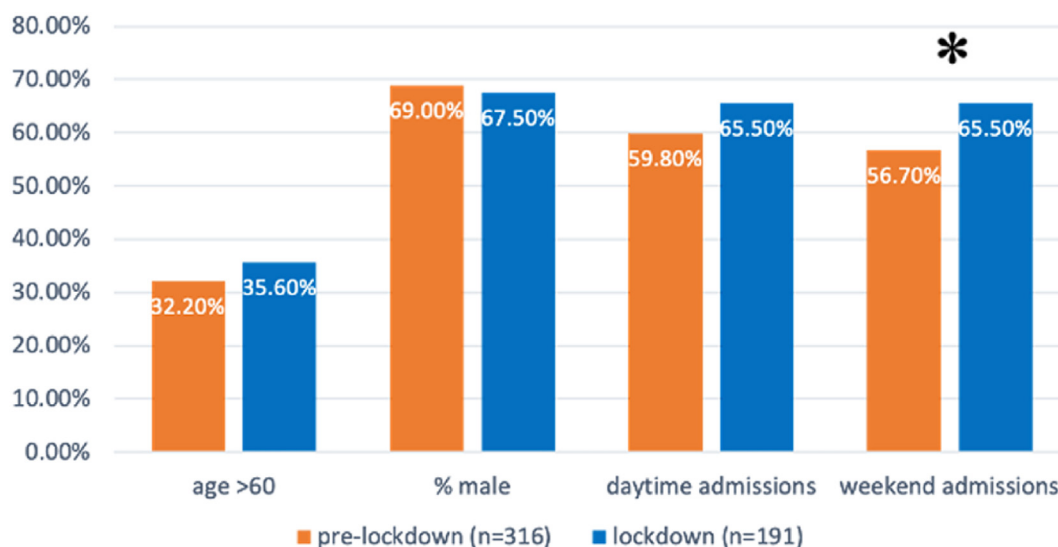


Fig. 2. Demographic data showing a significantly higher proportion of weekend trauma during lockdown.

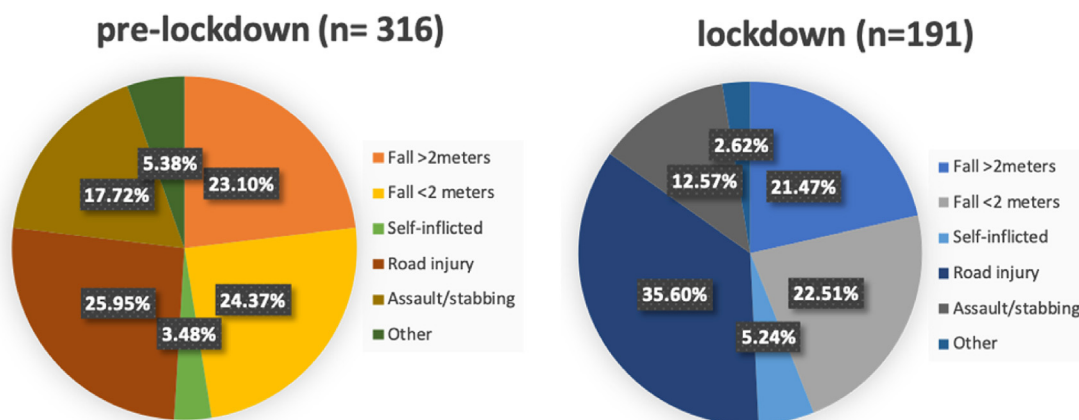


Fig. 3. Mechanism of injury data, showing no difference in mechanisms involved in alcohol-related trauma.



lockdown period.<sup>32,34,35</sup> However, another trial found no significant association between the two.<sup>33</sup> Alcohol-related trauma was identified by Rhodes et al.<sup>32</sup> to be significantly increased in males during lockdown but not in females. This contrasts with our findings, where no gender discrepancy existed.

We have demonstrated an increase in the proportion of weekend alcohol-related admissions during lockdown compared to pre-lockdown, but no change in the day/night pattern. By the first week of April, 27% of the UK working population had been furloughed and were therefore not attending work.<sup>36</sup> Thus, it is understandable that occupational trauma admissions during the week would be reduced. In the UK in 2016, half of all beer was drunk on premises.<sup>37</sup> Despite premises being closed during lockdown, levels of alcohol-related trauma in our study remained high. This could indicate that off-licence consumption increased to compensate in line with previous evidence.<sup>38</sup> The effect of lockdown on the weekly pattern of alcohol-related trauma has not previously been reported. Staffing levels in major trauma centres may need to reflect the change in weekly trauma patterns in the event of further lockdown periods to maintain continuity of care.

This retrospective study was based on data from the hospital's trauma admission database. Admissions are "trauma called" based on criteria adhered to by the ambulance crew and ED staff.<sup>29</sup> This represents a robust system to compare pre-lockdown with lockdown alcohol-related trauma, although we recognise that minor alcohol trauma will have been missed using this approach.

The decision to include all patients with BAC above 0 mg/100 mL was made to avoid an arbitrary cut-off level, and to prevent distortion from delayed presentation to ED. Our data collection was also reliant on BAC levels being taken in ED. As a retrospective study we had no ability to encourage this, and data collection was made complicated when levels were not taken or had haemolysed. It was decided to cross-check patient electronic notes for mention of alcohol intoxication or intake to provide a substitute measure. For the pre-lockdown cohort 5 patients had haemolysed/not taken BAC. Three patients had evidence of alcohol related trauma documented, and 2 did not. For the lockdown cohort, 10 patients had haemolysed/not taken BAC. Six patients had evidence of alcohol related trauma documented and 4 did not. We recognise that patients without BAC levels in ED that had not drunk enough to show intoxication and did not disclose consumption will have been missed.

UK Lockdown started on March 23, 2020, and ended gradually with some school children returning to classes on June 1, 2020 while shops re-opened on June 15, 2020.<sup>19</sup> Our lockdown cohort was chosen to represent the 2-month period (1st April 2020–31st May 2020) with the most stringent restrictions on public liberties. This was compared to a pre-lockdown cohort taken from 1 month from the previous 2 years each, to provide a similar population size in both cohorts. April was chosen as the previous month from both years, as May involves some early summer changes to patterns of work. The decision to not include data regarding drug-related trauma was made from the outset. From pilot data, we found that very few patients had narcotic toxicity screens performed in ED, and we would be unable to reliably test its prevalence.

COVID-19 lockdown in the UK independently increased the proportion of alcohol-related trauma admissions to a London MTC. This represents a public health issue, and tackling alcohol behaviour specific to COVID-19 on a nationwide level may combat associated morbidity and mortality. This study has helped to understand UK trauma demographics related to lockdown, identifying weekend trauma to be increased but day/night patterns unchanged. Staffing levels in trauma centres should reflect this pattern, in the event of further of COVID-19 lockdown periods.

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Nil.

## Ethical statement

Local ethical approval was not required as the study was classified as a service evaluation.

## Declaration of competing interest

Professor Caroline Hing has the following interests to disclose:

- Editorial Stipend from Elsevier
- NIHR RfPB grant for PEP-TALK study
- NIHR RfPB grant for STIFF-F study
- St George's Charity grant for SPRING study

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## Author contributions

Oliver S Brown designed and led the project. He collected data and wrote the manuscript. Toby O Smith performed statistical analysis and wrote the manuscript. Andrew Gaukroger collected data and wrote the manuscript. Prodromos Tsinaslanidis collected data and wrote the manuscript. Caroline B Hing wrote the manuscript.

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