

1 Increased proportion of alcohol-related trauma in a South London Major 2 Trauma Centre during lockdown, a cohort study

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31

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33

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35 the manuscript. Toby O Smith performed statistical analysis and wrote the manuscript.
36 Andrew Gaukroger collected data and wrote the manuscript. Prodromos Tsinaslanidis
37 collected data and wrote the manuscript. Caroline B Hing wrote the manuscript.

38

39 Ethical approval: Local ethical approval was sought from St George's Hospital, and approval
40 as a service evaluation was granted with sign-off from the care group lead ethical committee
41 as per local trust guidelines.

42

43 Consent to participate/publication: This was a retrospective service evaluation, and patient
44 details were anonymised from the outset. Patients were not contacted specifically for consent
45 to participate

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51 **Abstract**

52

53 **Background**

54 Alcohol has been associated with 10-35% trauma admissions and 40% trauma-related
55 deaths globally. In response to the Covid-19 pandemic, the United Kingdom (UK) entered a
56 state of 'lockdown' on 23rd March 2020. Restrictions were most significantly eased on 1st
57 June 2020, when shops and schools re-opened. The purpose of this study was to quantify
58 the effect of lockdown on alcohol-related trauma admissions.

59

60 **Methods**

61 All adult patients admitted as 'trauma calls' to a London Major Trauma Centre (MTC) during
62 April 2018 and April 2019 (pre-lockdown; N=316), and 1st April – 31st May 2020 (lockdown;
63 N=191) had electronic patient records (EPRs) analysed retrospectively. Patients' blood
64 alcohol level and records of intoxication were used to identify alcohol-related trauma.
65 Trauma admissions from pre- and post-lockdown cohorts were compared using multiple
66 regression analyses.

67

68 **Results**

69 Alcohol-related trauma was present in a significantly higher proportion of adult trauma calls
70 during lockdown (lockdown 60/191 (31.4%), versus pre-lockdown 62/316 (19.6%); (Odds
71 Ratio (OR) 0.83, 95% CI 0.38 to 1.28, p<0.001). Lockdown was also associated with increased
72 weekend admissions of trauma (lockdown 125/191 weekend (65.5%) vs pre-lockdown
73 179/316 (56.7%); OR -0.40, 95% CI -0.79 to -0.02, p=0.041). No significant difference existed
74 in the age, gender, or mechanism between pre-lockdown and lockdown cohorts (p>0.05).

75

76 **Conclusions**

77 UK lockdown was independently associated with an increased proportion of alcohol-related
78 trauma. Trauma admissions were increased during the weekend when staffing levels are
79 reduced. With the possibility of further global 'waves' of Covid-19, the long-term
80 repercussions of dangerous alcohol-related behaviour to public health must be addressed.

81

82

83 **Keywords**

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85 Trauma; alcohol; lockdown; Covid-19; Major Trauma Centre

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92 **1.1: Introduction**

93 Alcohol-related trauma accounts for 10-35% of all trauma admissions and as many as 40% of
94 trauma related deaths ¹⁻⁶. As such, it is a significant global health burden, although alcohol
95 consumption and alcohol-related trauma vary widely by country ^{2,5,7}. In the United Kingdom
96 (UK), mean adult alcohol consumption is 9.7L alcohol/year (global mean 8.2L alcohol/year)
97 and 27% of UK alcohol users consume to excess, termed 'binge drinking' ^{8,9}. Patients
98 admitted with alcohol-related trauma are more likely to require immediate treatment, and
99 are at greater risk of COVID-19 infection in hospital ^{1,10}.

100

101 As well as increasing the risk of injury, alcohol plays an important role in the outcome of
102 major trauma. Detectable blood alcohol concentration (BAC) has been associated with an
103 increased Injury Severity Score (ISS), and has been associated with a 15% increased risk of
104 infective complications and increased length of stay ¹¹⁻¹⁴. The effect of alcohol on overall
105 trauma survival is unclear however, with some studies indicating improved survival with
106 alcohol while others showing no correlation ¹⁵⁻¹⁸.

107

108 Plurad et al investigated 3025 motor vehicle injury (MVI) patients over ten years old in Los
109 Angeles County, California, USA, finding that blood alcohol levels were not related to injury
110 severity or intensive care length of stay. Patients with BAC greater than 0.08% had a higher
111 incidence of severe head trauma, but a better survival rate compared to severely injured
112 patients with no alcohol ¹⁵. Conversely, Mann et al studied 2,323 MVI patients from
113 Vancouver, Canada, finding no relationship between positive blood alcohol and mortality or
114 length of stay ¹⁷. This is supported by Stoduto et al, investigating 854 MVI patients in
115 Toronto, Canada, where BAC positive patients were more likely to be male and not wearing

116 seatbelts but injury severity measures were similar between groups ¹⁸. Harada et al studied
117 bicycle trauma related to alcohol over a 10-year period in Los Angeles, with over one third
118 of patients testing positive for alcohol although no difference in outcome was found
119 compared to BAC negative patients ¹⁶.

120

121 Between 23rd March and 1st June 2020, a state of 'lockdown' was imposed in the UK in
122 response to the global Covid-19 pandemic. This involved the closure of schools and many
123 workplaces, with citizens expected to remain at home apart from trips to buy food and
124 medicine or to exercise ¹⁹. Restrictions were gradually eased, but at the end of May 2020
125 much of the population remained working at home with many confined to their houses.
126 We aimed to investigate whether alcohol-related trauma was associated with a greater
127 proportion of trauma calls at a London MTC during UK lockdown. We also aimed to
128 understand whether outcomes were altered by the monumental changes in healthcare
129 provision associated with the COVID-19 pandemic. We will investigate whether alcohol-
130 related trauma admissions occur at different times of day or during weekends, reflecting
131 altered working patterns during UK lockdown.

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133

134 **2.1: Materials and Methods**

135

136 **2.2: Study population and inclusion criteria**

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

143

144 Patients are 'trauma called' when they fit criteria outlined in the London Major Trauma
145 Decision Tool²⁰. We included patients 16 years or over admitted to ED directly, as well as
146 those transferred from other EDs. We did not include patients under 16 years, or patients
147 admitted directly to inpatient wards under the orthopaedic team. Three authors (OB, PT,
148 AG) retrospectively analysed patient records from the hospital's trauma register and
149 individual electronic patient records (EPR) to obtain this data.

150

151 **2.3: Outcome measurement**

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

158

159 Data for secondary outcomes was obtained from the EPRs. This included: patients' age,
160 gender, mechanism of injury, length of stay (LOS), mortality, and the time and weekday of
161 arrival to ED. Time of day was separated into day and night, with 06.00 to 21.00 constituting
162 daytime. Weekends were categorised as Friday at 17.00 until Monday at 06.00.

163

164 **2.4: Statistical analysis**

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

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182 **3.1: Theory**

183 Before lockdown, alcohol intoxication was associated with an increased risk of trauma ²¹.
184 Unsurprisingly, alcohol-related trauma was more common at weekends and during the
185 evening/night, reflecting when most alcohol is consumed normally ^{2,4,5,11}. Alcohol-related
186 trauma has also been associated with sports games and off-site consumption of alcohol ^{22,23}.
187 Off-licence consumption of alcohol has previously shown a greater association with violent
188 crime than on-site consumption ²³.

189
190 With sports games cancelled and bars closed, patterns of alcohol consumption and
191 consequent trauma were likely to be drastically altered by lockdown. Increased alcohol
192 abuse has been observed in survivors of stressful events, such as terrorist attacks or natural
193 disasters, as well as those who have become socially isolated ²⁴⁻²⁶. Indeed, binge drinking
194 was significantly increased during Covid-19 lockdown in Hubei province, China as well as in
195 the UK ^{27,28}. UK lockdown was also associated with an increase in domestic violence, with a
196 25% increase in calls to the UK domestic violence helpline during the first week of lockdown
197 ²⁹. Whether alcohol-related trauma admissions as a result of Covid-19 UK lockdown will
198 reflect such findings is unclear.

199

200

201

202 **4.1: Results**

203

204 **4.2: Demographics**

205 In total, 549 patients were identified. Of these, 42 were under 16 years old and were
206 excluded leaving 507 adult trauma calls as seen in **Figure 1**. A summary of the lockdown and
207 pre-lockdown cohorts is presented in **Table 1**. In brief, mean age of all adult trauma calls
208 (pre- and during lockdown) was 50.2 (SD 23.2, N=507) years with the mean age of all
209 alcohol-related trauma calls (pre-and during lockdown) 43.1 (SD 16.7, N=122) years. The
210 ages of one male patient in 2018 and one female patient in 2019 were not available as they
211 self-discharged from the ED before this was obtained. 68% all adult trauma calls were male,
212 compared to 79% in all alcohol-related trauma calls. A summary of the univariate and multi-
213 variate analyses is presented in **Table 2**.

214

215 **4.3: Primary outcome**

216 Alcohol-related trauma was present in a significantly higher proportion of adult trauma calls
217 during lockdown compared to the pre-lockdown period (60/191 (31.41%) versus 62/316
218 (19.62%) N=507; multivariate: OR 0.83, 95% CI 0.38 – 1.28, p<0.001).

219

220 **4.4: Secondary outcomes**

221 There was no significant difference in age between adult trauma calls between pre- and
222 lockdown cohorts (pre-lockdown mean 48.9 years (SD 24.3) years versus lockdown 52.4
223 years (SD 21.1); multivariate: OR 0.20, 95% CI -0.22 – 0.61, p=0.356). There was no
224 difference between the gender split of adult trauma calls pre- and during lockdown (pre-
225 lockdown 218/316 (69.0%) male versus lockdown 129/191 (67.5%) male, multivariate: OR
226 0.11, 95% CI -0.30 – 0.53, p=0.597).

227

228 The proportion of patients admitted during the weekend period (Friday 5pm - Monday 6am
229 was increased during lockdown (pre-lockdown 179/316 (56.7%) versus lockdown 125/191
230 (65.5%), multivariate: OR -0.40, 95% CI -0.79 - -0.02, p=0.041). This is seen in **Figure 2**. The
231 proportion of patients admitted during the day (between 6am and 9pm) was not
232 significantly increased during lockdown (pre-lockdown 189/316 (59.8%) versus lockdown
233 125/191 (65.5%), multivariate: OR -0.37 95% CI -0.77 to 0.03, p=0.041).

234

235 There was no significant difference between the mechanisms involved in alcohol-related
236 trauma admissions pre- and during lockdown (OR -0.02, 95% CI -0.13 – 0.10, p=0.781) as
237 seen in **Figure 3**. Mortality data indicated that there was no significant difference in the
238 mortality rate between pre-lockdown and lockdown cohorts (12/316 pre-lockdown (3.8%)
239 vs 13/191 (6.8%) lockdown, OR 1.85, 95% CI 0.83 – 4.14, p=0.135).

240

241

242 **5.1: Discussion**

243 The Covid-19 pandemic has created an unprecedented global threat to public health. This
244 not only manifests itself in the direct viral disease, but the pandemic's economic, social, and
245 psychological ramifications³⁰. This study is the first to examine rates of alcohol-related
246 trauma as a result of the Covid-19 pandemic lockdown in the UK. The proportion of alcohol-
247 related trauma admitted to a London MTC increased significantly during the lockdown
248 period of April-May 2020, compared with baseline measurements over two previous years.
249 However, while the proportion of alcohol-related trauma increased, the absolute numbers
250 of trauma related to alcohol remained stable.

251

252 The ban of alcohol during Covid-19 lockdown in South Africa's Western Cape was associated
253 with a 53% reduction in trauma admissions, with a rebound effect when the ban was lifted
254 (Navsaria 2020). Recent evidence from single-centre studies in the USA suggests that overall
255 trauma was significantly reduced during lockdown compared with the same period in the
256 previous year^{31,32}. In line with our findings, previous evidence from the USA has shown the
257 proportion of alcohol-related trauma to be significantly increased during the lockdown
258 period^{31,33,34}. However, another trial found no significant association between the two³².
259 Alcohol-related trauma was identified by Rhodes et al to be significantly increased in males
260 during lockdown but not in females³¹. This contrasts with our findings, where no gender
261 discrepancy existed.

262

263 We have demonstrated an increase in the proportion of weekend alcohol-related
264 admissions during lockdown compared to pre-lockdown, but no change in the day/night
265 pattern. By the first week of April, 27% of the UK working population had been furloughed

266 and were therefore not attending work ³⁵. Thus, it is understandable that occupational
267 trauma admissions during the week would be reduced. In the UK in 2016, half of all beer
268 was drunk on premises ³⁶. Despite premises being closed during lockdown, levels of alcohol-
269 related trauma in our study remained high. This could indicate that off-licence consumption
270 increased to compensate in line with previous evidence ³⁷. The effect of lockdown on the
271 weekly pattern of alcohol-related trauma has not previously been reported. Staffing levels
272 in major trauma centres may need to reflect the change in weekly trauma patterns in the
273 event of further lockdown periods to maintain continuity of care.

274

275 This retrospective study was based on data from the hospital's trauma admission database.
276 Admissions are 'trauma called' based on criteria adhered to by the ambulance crew and ED
277 staff ²⁰. This represents a robust system to compare pre-lockdown with lockdown alcohol-
278 related trauma, although we recognise that minor alcohol trauma will have been missed
279 using this approach.

280

281 The decision to include all patients with BAC above zero was made to avoid an arbitrary cut-
282 off level, and to prevent distortion from delayed presentation to ED. Our data collection was
283 also reliant on BAC levels being taken in ED. As a retrospective study we had no ability to
284 encourage this, and data collection was made complicated when levels were not taken or
285 had haemolysed. It was decided to cross-check patient electronic notes for mention of
286 alcohol intoxication or intake to provide a substitute measure. For the pre-lockdown cohort
287 five patients had haemolysed/not taken BAC. Three patients had evidence of alcohol related
288 trauma documented, and two did not. For the lockdown cohort ten patients had
289 haemolysed/not taken BAC. Six patients had evidence of alcohol related trauma

290 documented and four did not. We recognise that patients without BAC levels in ED that had
291 not drunk enough to show intoxication and did not disclose consumption will have been
292 missed.

293

294 UK Lockdown started on 23/03/2020, and ended gradually with some school children
295 returning to classes on 01/06/2020 while shops re-opened on 15/06/2020¹⁹. Our lockdown
296 cohort was chosen to represent the two-month period (01/04/2020 – 31/05/2020) with the
297 most stringent restrictions on public liberties. This was compared to a pre-lockdown cohort
298 taken from one month from the previous two years each, to provide a similar population
299 size in both cohorts. April was chosen as the previous month from both years, as May
300 involves some early summer changes to patterns of work. The decision to not include data
301 regarding drug-related trauma was made from the outset. From pilot data, we found that
302 very few patients had narcotic toxicity screens performed in A+E, and we would be unable
303 to reliably test its prevalence.

304

305 **5.2: Conclusion**

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

313

314

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316 department at St George's Hospital for enabling this project to be undertaken.

317

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425 **7.1: Tables and Figures**

426 Table 1: Demographic data for pre-lockdown and lockdown cohorts, indicating a

427 significantly higher proportion of alcohol-related trauma during lockdown

428 Table 2: Univariate and multivariate analysis results assessing the association between

429 lockdown and trauma admissions. Alcohol-related admissions and weekend admissions

430 were significantly altered by lockdown.

431 Figure 1: Flowchart showing full data set with excluded patients and make-up of pre-

432 lockdown and lockdown cohorts

433 Figure 2: Demographic data showing a significantly higher proportion of weekend trauma

434 during lockdown

435 **Figure 3:** Mechanism of injury data, showing no difference in mechanisms involved in

436 alcohol-related trauma

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440 **Table 1:** Demographic data, showing a significantly higher proportion of alcohol-related
 441 trauma during lockdown

	Total Cohort (n =507)	Pre-lockdown (n=316)	Lockdown (n=191)
Lockdown			
Yes (%)	191 (37.7)	316 (62.3)	191 (37.7)
No (%)	316 (62.3)		
Age			
Mean age (SD)	50.2 (23.2)	48.9 (24.3)	52.4 (21.1)
≤60 years (%)	336 (66.5)	213 (67.8)	123 (64.4)
>60 years (%)	169 (33.5)	101 (32.2)	68 (35.6)
Gender			
Male (%)	347 (68.4)	218 (69.0)	129 (67.5)
Female (%)	160 (31.6)	98 (31.0)	62 (32.5)
Alcohol Status			
Alcohol: Yes (%)	122 (24.1)	62 (19.6)	60 (31.4)
Alcohol: No (%)	385 (75.9)	254 (80.4)	131 (68.6)
Mechanism of Injury			
Fall >2meters (%)	114 (22.5)	73 (23.1)	41 (21.5)
Fall <2 meters (%)	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			
Yes (%)	25 (4.9)	12 (3.8)	13 (6.8)
No (%)	482 (95.1)	304 (96.2)	178 (93.2)
Admission Timing			
Day (%)	314 (61.9)	189 (59.8)	125 (65.5)
Night (%)	193 (38.1)	127 (40.2)	66 (34.5)
Weekend (%)	203 (40.0)	179 (56.7)	125 (65.5)
Weekday (%)	304 (60.0)	137 (43.3)	66 (34.5)

442

443 Key: brackets in column one denote the meaning of brackets in other columns, either showing SD (standard deviation) or
 444 percentage.

445 Alcohol status taken from blood alcohol concentration (BAC) greater than zero, or documented evidence of intoxication in
 446 ED. For the pre-lockdown cohort five patients had haemolysed/not taken BAC. Three patients had evidence of alcohol
 447 related trauma documented, and two did not. For the lockdown cohort ten patients had haemolysed/not taken BAC. Six
 448 patients had evidence of alcohol related trauma documented and four did not.

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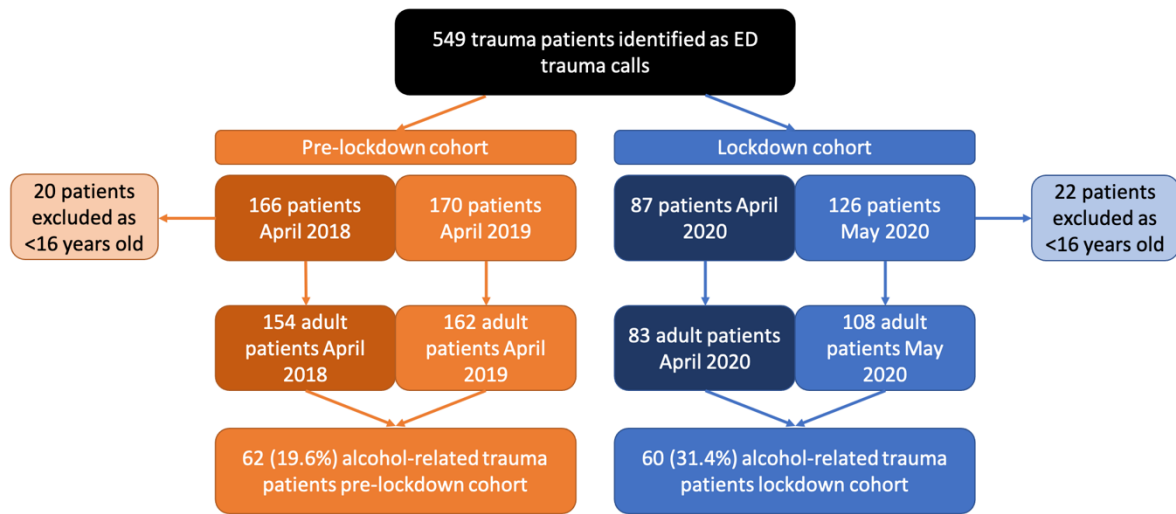
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451 **Table 2:** Univariate analysis results assessing the association between lockdown and trauma
 452 admissions. Alcohol-related admissions and weekend admissions were significantly altered
 453 by lockdown.

	Odd Ratio	95% confidence intervals	P-value
Univariate Analysis			
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
Multivariate Analysis			
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

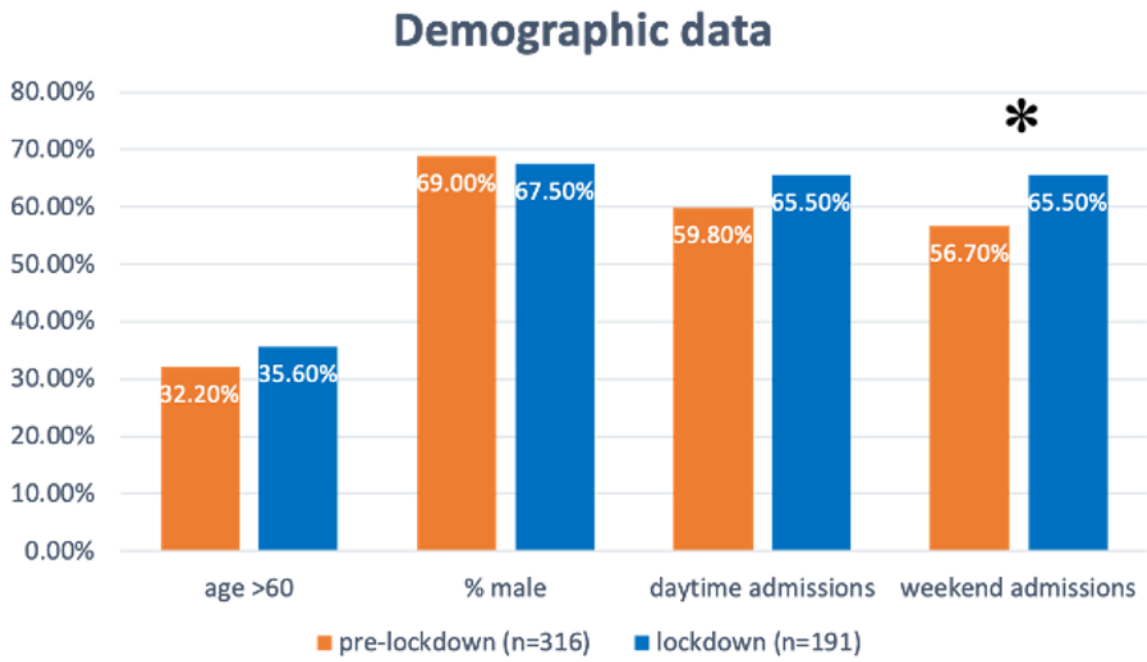
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456 Figure 1: Flowchart showing full data set with excluded patients and make-up of pre-
 457 lockdown and lockdown cohorts



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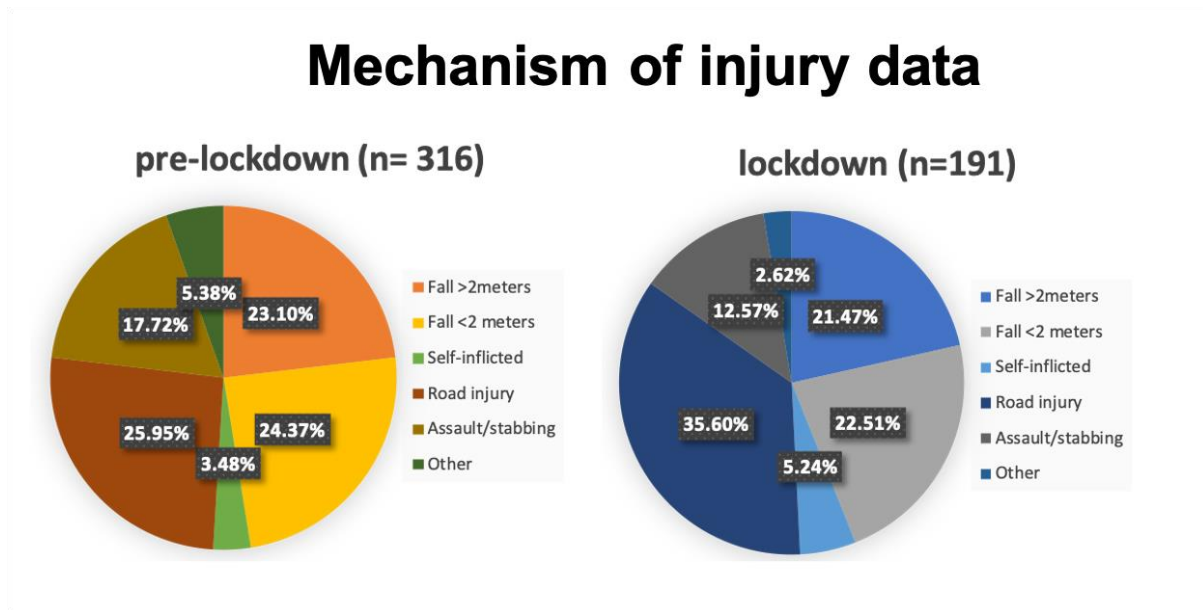
459 **Figure 2:** Demographic data showing a significantly higher proportion of weekend trauma
460 during lockdown



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462

463 **Figure 3:** Mechanism of injury data, showing no difference in mechanisms involved in
464 alcohol-related trauma



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