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BJO



## ■ GENERAL ORTHOPAEDICS

# Effects of the COVID-19 lockdown on orthopaedic trauma: a multicentre study across Scotland

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### Aims

The UK government declared a national lockdown on 23 March 2020 to reduce transmission of COVID-19. This study aims to identify the effect of lockdown on the rates, types, mechanisms, and mortality of musculoskeletal trauma across Scotland.

### Methods

Data for all musculoskeletal trauma requiring operative treatment were collected prospectively from five key orthopaedic units across Scotland during lockdown (23 March 2020 to 28 May 2020). This was compared with data for the same timeframe in 2019 and 2018. Data collected included all cases requiring surgery, injury type, mechanism of injury, and inpatient mortality.

### Results

A total of 1,315 patients received operative treatment from 23 March 2020 to 28 May 2020 compared with 1,791 in 2019 and 1,719 in 2018. The numbers of all injury types decreased, but the relative frequency of hip fractures increased (36.3% in 2020 vs 30.2% in 2019,  $p < 0.0001$  and 30.7% in 2018,  $p < 0.0001$ ). Significant increases were seen in the proportion of DIY-related injuries (3.1% in 2020 vs 1.7% in 2019,  $p = 0.012$  and 1.6% in 2018,  $p < 0.005$ ) and injuries caused by falls (65.6% in 2020 vs 62.6% in 2019,  $p = 0.082$  and 61.9% in 2018,  $p = 0.047$ ). Significant decreases were seen in the proportion of road traffic collisions (2.6% in 2020 vs 5.4% in 2019,  $p < 0.0001$  and 4.2% in 2018,  $p = 0.016$ ), occupational injuries (1.8% in 2020 vs 3.0% in 2019,  $p = 0.025$  and 2.3% in 2018,  $p = 0.012$ ) and infections (6.8% in 2020 vs 7.8% in 2019,  $p = 0.268$  and 10.3% in 2018,  $p < 0.012$ ). Cycling injuries increased (78 in 2020 vs 64 in 2019 vs 42 in 2018). A significant increase in the proportion of self-harm injuries was seen (1.7% in 2020 vs 1.1% in 2019,  $p = 0.185$  and 0.5% in 2018,  $p < 0.0001$ ). Mortality of trauma patients was significantly higher in 2020 (5.0%) than in 2019 (2.8%,  $p = 0.002$ ) and 2018 (1.8%,  $p < 0.0001$ ).

### Conclusion

The UK COVID-19 lockdown has resulted in a marked reduction in musculoskeletal trauma patients undergoing surgery in Scotland. There have been significant changes in types and mechanisms of injury and, concerningly, mortality of trauma patients has risen significantly.

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### Introduction

The World Health Organization (WHO) declared the outbreak of the SARS-CoV-2 (COVID-19) virus a global pandemic on 11 March 2020. The UK and devolved governments declared a national lockdown on 23 March 2020.<sup>1</sup> All UK residents, including those in Scotland, were told that they should not go outside except to buy food and

medicine, to exercise once a day, or to go to work if they absolutely could not work from home. In addition to the planned aim of reducing the transmission of COVID-19, these measures are also likely to affect the nature and volume of musculoskeletal injuries requiring surgical treatment in UK hospitals.

Initial reports from Italy<sup>2</sup> and New Zealand<sup>3</sup> suggested that lockdown might result in as much as a 50% reduction in musculoskeletal trauma, possibly due to reduced road traffic accidents, sporting injuries, and injuries related to alcohol consumption. However, it is possible that the rates of some injuries might increase, perhaps due to increased time spent at home. Societies such as the British Society for Children's Orthopaedic Surgery and the British Society for Surgery of the Hand have even released guidance for the public on how to avoid injury during the lockdown period.<sup>4,5</sup>

This study aimed to determine the effects of the full period of nationwide lockdown on the rates, types, mechanisms, and mortality of musculoskeletal trauma requiring operative treatment in orthopaedic units across Scotland. This information may be useful to other centres, and even worldwide, for predicting workload and rationalizing planning in future pandemics or lockdowns.

## Methods

Four Scottish health boards contributed data to this study, with an overall population of 2,507,990<sup>6</sup> and an area of 43,091 km<sup>2</sup>. At the time of writing, there have been a total of 8,568 confirmed cases of COVID-19 across the four health boards: 4,957 in NHS Greater Glasgow and Clyde (GG&C); 1,785 in NHS Tayside; 1,445 in NHS Grampian; and 381 in NHS Highland.<sup>7</sup>

Data on musculoskeletal trauma requiring operative treatment were prospectively collected from 23 March 2020 (the date of the announcement of UK lockdown) until 28 May 2020 (the date of the first easing of lockdown measures). Patients under 16 years of age were excluded from the study. Five key orthopaedic trauma units from a combination of urban and rural areas with varying socioeconomic status, including three of four Major Trauma Centres, supplied data for the current analysis. These were Queen Elizabeth University Hospital (QEUH) and Glasgow Royal Infirmary (GRI) (NHS Greater Glasgow and Clyde), Aberdeen Royal Infirmary (ARI) (NHS Grampian), Ninewells Hospital (NHS Tayside), and Raigmore Hospital (NHS Highland).

Demographic data collected included age, sex, and Scottish Index of Multiple Deprivation (SIMD) quintile.<sup>8</sup> The SIMD ranks the deprivation of geographical areas defined by postcode. Once ranked nationally, these are divided into population-weighted quintiles with quintile five being the least deprived and quintile one the most deprived.

Injuries sustained were categorized according to six anatomical regions (Table I). Mechanism of injury was subdivided into nine categories (Table II). Falls were subdivided, with low-energy falls defined as falls from standing height or less, and high-energy falls defined as a fall from greater than standing height. Road traffic collisions (RTCs) were subdivided by type of collision

(Table III), and sporting injuries were subcategorized according to sport involved (Table IV). The presentation of the patient to hospital with multiple orthopaedic injuries was identified as a "polytrauma"; the involvement of alcohol and whether the injury was caused by self-harm were all recorded as independent variables.

Overall, 60-day mortality following operative treatment was recorded, and deaths related to COVID-19 following operative treatment were quantified. Deaths associated with COVID-19 were recorded as such if the patient had died within the 60-day period and had tested positive for COVID-19.

In each participating hospital, equivalent data on orthopaedic trauma requiring surgical treatment were collected retrospectively for the corresponding time periods for the previous two years (23 March to 28 May) and anonymized. Electronic trauma theatre planning lists identified trauma patients during these periods, and electronic medical records were also used to extract information. Data on demographics, mortality, mechanism of injuries, and treatment were recorded. The SIMD score was collected for each patient and recorded in quintiles.

The number of fracture clinic attendances of both new and return patients in the same time period for each year was obtained for three of the four health boards. Due to the method of clinic coding, one health board was unable to separate fracture clinic patients from elective patients and so was not included.

Ethical approval was not required for this study. The data collection was carried out in accordance with General Medical Council (GMC) guidelines for good clinical practice and adhered to UK General Data Protection Regulation (GDPR). The study was completed without funding.

**Statistical analysis.** Statistical analysis was performed using SPSS version 26.0 (IBM, Armonk, New York, USA). A chi-squared test (or Fisher's exact test if cell frequencies were small) was used to examine the differences in both types and mechanisms of injury, sex, deprivation, and mortality rates in 2020 compared with each of 2019 and 2018. Age of patients in 2020 was compared with that in 2019 and 2018 using a two-sample *t*-test. A *p*-value  $\leq 0.05$  was used throughout to denote statistical significance.

## Results

From 23 March 2020 to 28 May 2020, 1,315 patients required operative treatment for musculoskeletal trauma across the five centres included in the study. This was significantly reduced from 1,791 and 1,719 cases during the same periods in 2019 and 2018 (Table V).

**Patient demographics.** The mean age of patients treated in 2020 was significantly higher compared with those in 2019 and 2018. In 2020, a significantly higher percentage of patients were female compared with those in 2019 and 2018 (Table VI).

**Table I.** Number of cases per type of injury requiring operative treatment.

| Injury                  | 2020, n (%) | 2019, n (%) | 2018, n (%) | p-value 2020 versus 2019* | p-value 2020 versus 2018* |
|-------------------------|-------------|-------------|-------------|---------------------------|---------------------------|
| Hip fractures           | 477 (57.4)  | 541 (47.8)  | 527 (47.8)  | < 0.0001                  | < 0.0001                  |
| Pelvic fractures        | 19 (2.3)    | 19 (1.7)    | 21 (1.9)    | 0.334                     | 0.558                     |
| Ankle fractures         | 128 (15.4)  | 207 (18.3)  | 187 (17.0)  | 0.093                     | 0.361                     |
| Wrist fractures         | 128 (15.4)  | 214 (18.9)  | 227 (20.6)  | 0.043                     | 0.0040                    |
| Hand fractures          | 11 (1.3)    | 57 (5.0)    | 48 (4.4)    | < 0.0001                  | < 0.0001                  |
| Hand soft-tissue injury | 68 (8.2)    | 94 (8.3)    | 93 (8.4)    | 0.923                     | 0.845                     |
| Total                   | 831         | 1,132       | 1,103       | 1                         | 0.591                     |

\*Chi squared test.

**Table II.** Number of cases per mechanism of injury.

| Mechanism              | 2020, n (%) | 2019, n (%)  | 2018, n (%)  | p-value 2020 versus 2019* | p-value 2020 versus 2018* |
|------------------------|-------------|--------------|--------------|---------------------------|---------------------------|
| Fall                   | 863 (66.0)  | 1,121 (62.9) | 1,064 (62.5) | 0.082                     | 0.047                     |
| High-energy fall       | 86 (6.5)    | 99 (5.5)     | 104 (6.1)    | 0.355                     | 0.601                     |
| Low-energy fall        | 775 (58.9)  | 1,019 (56.9) | 909 (52.8)   | 0.257                     | 0.001                     |
| Occupational injury    | 23 (1.8)    | 54 (3.0)     | 40 (2.3)     | 0.025                     | 0.012                     |
| Assault/violence       | 33 (2.5)    | 61 (3.4)     | 48 (2.8)     | 0.149                     | 0.619                     |
| Infection              | 89 (6.8)    | 140 (7.9)    | 177 (10.4)   | 0.268                     | 0.001                     |
| Road traffic collision | 34 (2.6)    | 102 (5.7)    | 72 (4.2)     | < 0.0001                  | 0.016                     |
| Sporting injury        | 111 (8.5)   | 145 (8.1)    | 139 (8.2)    | 0.731                     | 0.749                     |
| DIY/gardening          | 41 (3.1)    | 31 (1.7)     | 27 (1.6)     | 0.012                     | 0.005                     |
| Atraumatic             | 72 (5.5)    | 80 (4.5)     | 90 (5.3)     | 0.199                     | 0.791                     |
| Other                  | 42 (3.2)    | 47 (2.6)     | 46 (2.7)     | 0.348                     | 0.410                     |
| No mechanism recorded  | 7 (0.5)     | 10 (0.6)     | 16 (0.9)     | 1                         | 0.291                     |
| Total                  | 1,315       | 1,791        | 1,719        | 0.034                     | 0.031                     |

\*Chi squared test.

DIY, Do It Yourself (e.g. home repairs, renovations)

**Injury types.** The absolute number of operative cases for the five specific injury types examined decreased in 2020 compared with 2019 and 2018. Although the absolute numbers of hip fractures fell by 11.8% from 2019 and 9.5% from 2018 values, there was a significant increase in the proportion of hip fractures in 2020 compared with either 2019 or 2018 ( $p < 0.0001$ ) (Table I). A significant reduction in wrist fractures and hand fractures was noted in 2020 compared with each of 2019 and 2018 ( $p < 0.0001$ ). When hand injuries were examined independently, a lower proportion were fractures in 2020 (13.9% fractures/86.1% soft tissue) compared with 2019 (37.7% fractures/62.3% soft tissue) and 2018 (34.0% fractures/66.9% soft tissue).

**Mechanism of injury.** With the exception of DIY/gardening-related case numbers, which increased, the absolute number of operative cases for each mechanism of injury decreased in 2020 compared with other years (Table II). The relative frequency of DIY/gardening-related injuries increased significantly in 2020 compared with both of the previous years ( $p = 0.012$  and  $0.016$ ). Although the absolute numbers of fall injuries decreased markedly in 2020 compared with 2019 and 2018, their relative frequency increased, reaching significance when compared with 2018 ( $p = 0.047$ ).

The relative frequency of RTCs and occupational injuries decreased significantly in 2020 ( $p < 0.05$ ). The relative frequency of infections decreased in 2020 compared with 2019 and 2018, reaching significance for 2018 ( $p < 0.0001$ ).

**Road traffic collisions.** In 2020, there were 34 cases requiring operative intervention caused by RTCs (Table III). This represented an absolute decrease in comparison with 102 cases in 2019 and 72 cases in 2018. The greatest decrease in both absolute numbers and proportion of RTCs was seen in multivehicle RTCs. In contrast, although the absolute number of car versus cyclist collisions was lower in 2020 compared with 2019, it was higher than in 2018. The relative proportion of car versus cyclist collisions was significantly higher in 2020 compared with 2018 ( $p = 0.015$ ).

**Sporting injuries.** There were 111 sporting injuries in 2020, down from 145 cases in 2019 and 139 cases in 2020. The greatest reductions were seen in numbers and proportions of football and rugby injuries (Table IV). In contrast, there was an increase in the absolute numbers of cycling injuries in 2020, with the proportion of cycling-related injuries also significantly increased in 2020 in comparison with both 2019 and 2018 (both  $p < 0.0001$ ).

**Table III.** Number of cases per road traffic collision.

| Road traffic collision | 2020, n (%) | 2019, n (%) | 2018, n (%) | p-value 2020 versus 2019* | p-value 2020 versus 2018* |
|------------------------|-------------|-------------|-------------|---------------------------|---------------------------|
| Car versus cyclist     | 11 (32.4)   | 18 (17.6)   | 9 (12.5)    | 0.070                     | 0.015                     |
| Car versus pedestrian  | 9 (26.5)    | 20 (19.6)   | 11 (15.3)   | 0.398                     | 0.169                     |
| Motorcycle             | 5 (14.7)    | 15 (14.7)   | 17 (23.6)   | 1.000                     | 0.291                     |
| Multivehicle           | 7 (20.6)    | 48 (47.1)   | 21 (29.2)   | 0.006                     | 0.350                     |
| Other                  | 2 (5.9)     | 1 (1.0)     | 14 (19.4)   | 0.154                     | 0.069                     |
| Total                  | 34          | 102         | 72          | < 0.0001                  | 0.021                     |

\*Chi squared test.

RTC, Road traffic collision

**Table IV.** Number of cases per sporting injury.

| Sporting injury | 2020, n (%) | 2019, n (%) | 2018, n (%) | p-value 2020 versus 2019* | p-value 2020 versus 2018* |
|-----------------|-------------|-------------|-------------|---------------------------|---------------------------|
| Cycling         | 67 (60.4)   | 46 (31.7)   | 33 (23.7)   | < 0.0001                  | < 0.0001                  |
| Football        | 7 (6.3)     | 35 (24.1)   | 44 (31.7)   | < 0.0001                  | < 0.0001                  |
| Rugby           | 1 (0.9)     | 7 (4.8)     | 8 (5.8)     | 0.143                     | 0.046                     |
| Horse riding    | 5 (4.5)     | 5 (3.4)     | 9 (6.5)     | 0.750                     | 0.501                     |
| Racket sports   | 2 (1.8)     | 3 (2.1)     | 2 (1.4)     | 1.000                     | 1.000                     |
| Other sports    | 29 (26.1)   | 49 (33.8)   | 43 (30.9)   | 0.187                     | 0.404                     |
| Total           | 111         | 145         | 139         | 0.729                     | 0.749                     |

\*Chi squared test.

**Cycling.** When cycling-related injuries were combined from the sporting and RTC groups, the total number of 78 in 2020 was markedly greater than the 64 in 2019 and 42 in 2018. The relative frequency of cycling injuries was significantly higher in 2020 (5.9%) than in 2019 (3.6%,  $p < 0.002$ ) and 2018 (2.4%,  $p < 0.0001$ ).

**Polytrauma.** In 2020, 55 polytrauma cases requiring operative intervention were recorded. This represented a reduction in absolute numbers compared with 2019 (97) and 2018 (65). However, the proportion of total operative cases that were polytrauma cases in 2020 (4%), was not significantly different to that in 2019 (5%,  $p = 0.115$ ) and 2018 (4%,  $p = 0.574$ ).

**Alcohol.** In 2020, there were 63 alcohol-related cases that required operative intervention. This represented a decrease in comparison with 2019 (98) and 2018 (103). However, there was no significant difference in the proportion of alcohol-related cases each year, which was 5% in 2020, 5% in 2019 ( $p = 0.615$ ) and 6% in 2018 ( $p = 0.149$ ).

**Self-harm.** In all, 22 patients whose injuries related to self-harm required operative intervention in 2020, in comparison with 20 and eight in 2019 and 2018, respectively. The proportion of total cases involving self-harm was higher in 2020 (1.7%) than in 2019 (1.1%,  $p = 0.185$ ), and significantly higher than in 2018 (0.5%,  $p < 0.0001$ ).

**Mortality.** In 2020 there were 50 trauma-related deaths over the study period compared with 51 in 2019 and 31 in 2018 (Table VII). The mean age of patients who died

was 82 in 2020 (43 to 99), 82 in 2019 (41 to 96) and 83 in 2018 (49 to 103).

In 2020, there were an additional 16 COVID-19-related deaths in trauma patients across all centres. Of the deaths recorded as COVID-19 deaths, there were four males and 12 females. The mean age was 84 years (67 to 98). Of these patients, 15 sustained a fracture of the neck of femur (94%), with the remaining patient suffering from a lower limb crush injury requiring an above-knee amputation. The mean number of days following operation for the COVID-19 deaths was 22 days (6 to 41).

In 2020, of the 50 patients who died due to causes other than COVID-19, 40 (80%) tested negative for COVID-19, with ten (20%) not tested.

There was a significantly higher mortality rate in patients who underwent operative treatment for musculoskeletal injury in 2020 compared with 2019 ( $p = 0.002$ ) and 2018 ( $p < 0.0001$ ). This increase was also seen when COVID-19-related deaths were excluded, and this reached statistical significance when compared with 2018 ( $p < 0.001$ ), and trended towards significance in 2019 ( $p = 0.152$ ).

Of the patients who died across all years, the most common comorbidities recorded were hypertension, ischaemic heart disease, chronic kidney disease, type 2 diabetes, and malignancy.

## Discussion

This multicentre study has demonstrated that the first phase of the national COVID-19 lockdown and its

**Table V.** Operative cases performed from 23 March to 28 May by hospital.

| Operations                          | 2020, n | 2019, n | 2018, n | p-value<br>2020 versus 2019* | p-value<br>2020 versus 2018* |
|-------------------------------------|---------|---------|---------|------------------------------|------------------------------|
| Aberdeen Royal Infirmary            | 214     | 319     | 281     | < 0.0001                     | < 0.001                      |
| Glasgow Royal Infirmary             | 269     | 386     | 365     | 0.417                        | 0.279                        |
| Ninewells Hospital                  | 259     | 362     | 331     | 0.139                        | 0.116                        |
| Queen Elizabeth University Hospital | 418     | 493     | 533     | 0.835                        | 0.254                        |
| Raigmore Hospital                   | 155     | 231     | 209     | 0.026                        | 0.013                        |
| Total                               | 1,315   | 1,791   | 1,719   | 0.034                        | 0.031                        |

\*Chi squared test.

**Table VI.** Patient demographics for each year. Scottish Index of Multiple Deprivation quintile 1 represents the most deprived and quintile 5 the least deprived.

| Variable                 | 2020<br>(n = 1,315) | 2019<br>(n = 1,791) | 2018<br>(n = 1,719) | p-value<br>2020 versus<br>2019 | p-value<br>2020 versus<br>2018 |
|--------------------------|---------------------|---------------------|---------------------|--------------------------------|--------------------------------|
| Mean age, yrs (SD)       | 63 (21)             | 60 (22)             | 60 (22)             | 0.004*                         | 0.007*                         |
| Female patients, n (%)   | 764 (58.1)          | 948 (52.9)          | 719 (41.8)          | 0.004†                         | < 0.0001†                      |
| Male patients, n (%)     | 551 (41.9)          | 843 (47.1%)         | 1000 (58.2)         | 0.004†                         | < 0.0001†                      |
| SIMD quintile 1, n (%)   | 351 (26.7)          | 455 (25.4)          | 401 (23.3)          | 0.636†                         | 0.373†                         |
| SIMD quintile 2, n (%)   | 215 (16.3)          | 268 (15.0)          | 284 (16.5)          |                                |                                |
| SIMD quintile 3, n (%)   | 213 (16.2)          | 311 (17.4)          | 302 (17.6)          |                                |                                |
| SIMD quintile 4, n (%)   | 254 (19.3)          | 352 (19.7)          | 340 (19.8)          |                                |                                |
| SIMD quintile 5, n (%)   | 255 (19.4)          | 318 (17.8)          | 317 (18.4)          |                                |                                |
| No SIMD available, n (%) | 27 (2.1)            | 87 (4.9)            | 75 (4.4)            |                                |                                |

SD, standard deviation; SIMD, Scottish Index of Multiple Deprivation.

\*Two-sample *t*-test.

†Chi squared test.

associated behavioural changes have had a marked effect on the rates, types, mechanisms of injury, and mortality of musculoskeletal trauma requiring operative intervention across Scotland.

Operative cases were notably reduced during the lockdown period in 2020 by 27% and 24% in comparison with the same periods in 2019 and 2018, respectively. The reduction seen in our study is consistent with findings from Italy<sup>9</sup> and smaller single health board studies reported by Edinburgh,<sup>10</sup> Cardiff,<sup>11</sup> and Madrid.<sup>12</sup> In addition, several other studies have also demonstrated reductions in musculoskeletal trauma patients presenting<sup>9,10,13–15</sup> and admitted<sup>16–18</sup> to orthopaedic units during different parts of COVID-19 lockdowns.

The significant higher mean age and greater proportion of female patients in 2020 in our study is compatible with other smaller studies reporting rises in numbers of older patients,<sup>10,16,19</sup> and a study from New Zealand,<sup>17</sup> which reported a non-significant increase in proportion of female patients. This finding may be related to the relative frequency of low-energy falls increasing in Scotland during lockdown alongside the increased proportion and reduced absolute number of hip fractures in our study. This patient group are predominantly elderly females. Although the absolute numbers of falls decreased

markedly in 2020, it remained the most common mechanism of injury which is consistent with findings from Edinburgh,<sup>10</sup> Rotherham,<sup>16</sup> and Auckland.<sup>17</sup> Despite our relative proportional increase in hip fractures, the drop we observed in the absolute numbers in 2020 is in contrast to other studies,<sup>9,10,13,16</sup> where absolute and relative numbers of patients remained somewhat constant during lockdown. A possible explanation for the pattern observed in our study is that hip fractures are commonly sustained at home or in nursing homes. Although lockdown restrictions may be expected to reduce numbers of hip fractures sustained outside, they may have a lesser effect on overall numbers than for other injury types and hence result in a reduction in absolute numbers.

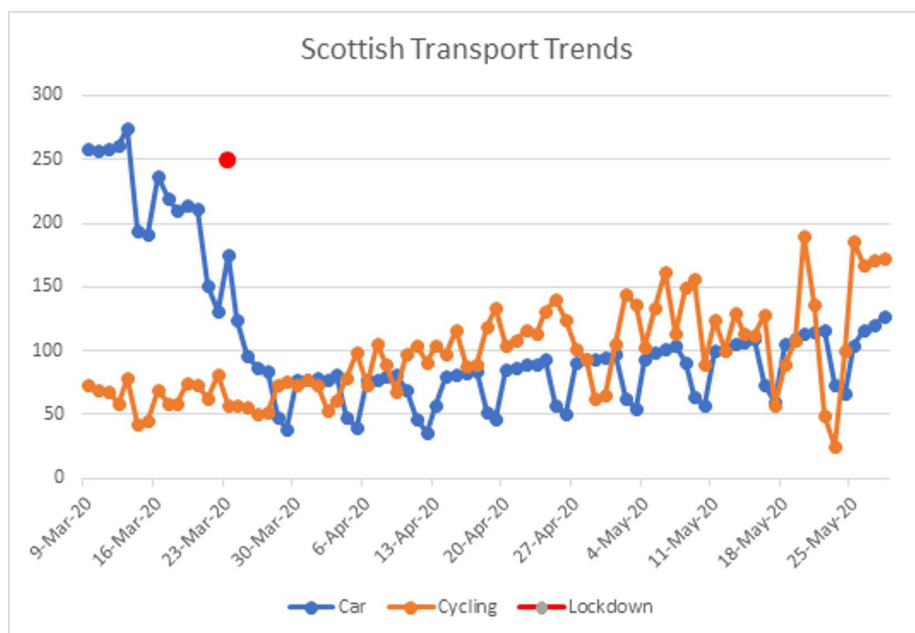
There was no significant change in the average socioeconomic status, measured through SIMD, of patients admitted for operative management of trauma in 2020, which is in keeping with findings from Edinburgh.<sup>10</sup> This finding may reflect the universality of restrictions imposed during the COVID-19 lockdown, which affected people from all socioeconomic backgrounds.

Figures from HM Revenue and Customs indicate that, on average, 15% of workers were furloughed across the health boards included in our study during the lockdown period.<sup>20</sup> This increased time spent at home may explain

**Table VII.** Trauma deaths and 60-day mortality rates each year.

| Location                            | Trauma deaths, n |            |            | COVID-19 deaths, n | Total deaths, n |
|-------------------------------------|------------------|------------|------------|--------------------|-----------------|
|                                     | 2018             | 2019       | 2020       | 2020               | 2020            |
| Aberdeen Royal Infirmary            | 3                | 6          | 8          | 1                  | 9               |
| Glasgow Royal Infirmary             | 5                | 5          | 8          | 6                  | 14              |
| Ninewells Hospital                  | 9                | 12         | 11         | 3                  | 14              |
| Queen Elizabeth University Hospital | 6                | 19         | 16         | 6                  | 22              |
| Raigmore Hospital                   | 8                | 9          | 7          | 0                  | 7               |
| Total                               | 31               | 51         | 50         | 16                 | 66              |
| <b>Total mortality rate, %</b>      | <b>1.8</b>       | <b>2.8</b> | <b>3.8</b> | <b>1.2</b>         | <b>5.0</b>      |
| p-values including COVID-19 deaths  | p < 0.0001*      | p = 0.002* |            |                    |                 |
| p-values excluding COVID-19 deaths  | p < 0.001*       | p = 0.152* |            |                    |                 |

\*Chi squared test.

**Fig. 1**

Graph created using figures from Transport Scotland. Scottish transport trends 2020. Figures are compared against a baseline index taken from 18 to 24 May 2020 (Baseline = 100).<sup>21</sup>

**Table VIII.** Fracture clinic attendances across the lockdown period and corresponding dates in 2019 and 2018.

| Patients          | 2020, n | 2019, n | 2018, n |
|-------------------|---------|---------|---------|
| New               | 1,883   | 3,066   | 2,176   |
| Return            | 7,002   | 7,639   | 7,470   |
| Total attendances | 8,885   | 10,705  | 9,646   |

the rise in absolute numbers and relative frequency of DIY/gardening-related injuries seen in our patient group which is compatible with rises in DIY injuries in Rotherham<sup>16</sup> and the relative increase in hand injuries seen in Paris.<sup>19</sup> Our fall in absolute and relative rates of occupational injuries seen will also likely be related to furlough of workers and is consistent with findings from other studies.<sup>13,19</sup>

There was a large decrease in the absolute numbers of polytrauma patients requiring operative intervention in 2020 but there was no significant difference in the relative frequency of these patients. This is in contrast to findings from Edinburgh,<sup>10</sup> where no polytrauma patients were recorded during the lockdown period, but consistent with findings from China,<sup>15</sup> London,<sup>14</sup> Rotherham,<sup>16</sup> and Auckland.<sup>17</sup> The greatest reduction in polytrauma numbers were seen in Aberdeen Royal Infirmary and Raigmore Hospital, which serve more rural populations and polytraumas are most commonly related to RTCs. In contrast, a much lesser change in polytrauma numbers was seen in Queen Elizabeth University Hospital, which serves an urban population and polytraumas are often related to falls from height.

The absolute number and relative frequency of RTC patients requiring operative intervention also fell in 2020, consistent with findings from China,<sup>15</sup> Rotherham,<sup>16</sup> Auckland,<sup>17</sup> Barcelona,<sup>13</sup> and New Hampshire, USA.<sup>18</sup> Studies from Edinburgh<sup>10</sup> and Paris<sup>19</sup> also showed a decrease in absolute numbers of RTC patients in lockdown but described no changes in the relative frequency of RTCs. The greatest fall in type of RTC seen in our study was in multivehicle collisions. In contrast, the relative frequency of car versus cyclist collisions increased significantly. This is likely due to the relative increase in bicycle travel and relative decrease in car travel seen in Scotland during lockdown (Figure 1).<sup>21</sup>

As expected, there was a large decrease in the absolute numbers of sporting injuries during lockdown in 2020, in keeping with other studies.<sup>10,16,19</sup> However, the overall numbers of cycling-related injuries, both sporting and those involving collisions with cars, increased substantially. Although there are undoubted health and environmental benefits to the increase in cycling as a mode of transport and exercise seen during lockdown, healthcare providers and the public should be aware of the associated risk of injury.

Concern that the mental health effects of the COVID-19 pandemic and lockdown may lead to increased rates of suicide and self-harm<sup>22</sup> has been expressed in the medical literature. We have seen an increase in the absolute numbers of self-harm-related injuries requiring operative intervention and a significant increase in relative frequency compared with 2018. This is in keeping with findings from Leeds,<sup>23</sup> which described an increase in the proportion of hand injuries caused by self-harm and in this context our findings are worrying.

Perhaps the most striking finding of our study was the significant increase in mortality rates of trauma patients undergoing operative treatment in 2020 compared with 2019 and 2018. The direct effect of the COVID-19 virus may be responsible for a large proportion of the increase, but an increase in mortality rate was also seen when COVID-19 deaths were excluded, which was significant compared with the 2018 figures. This may be due to secondary effects of the COVID-19 pandemic such as delays in operative treatment due to hospital reorganization. These delays are particularly likely to affect hip fracture patients, as delays in operative treatment are well known to increase mortality.<sup>24</sup> A study of hip fracture patients during the COVID-19 pandemic in New York found that 30-day mortality was higher in 2020 than in 2019 for all patients, and for COVID-19-negative patients.<sup>25</sup>

To the authors' knowledge, this is one of the largest published studies, over the longest time period, detailing rates, types, mechanisms of injury, and mortality of

musculoskeletal trauma during the lockdown period in the COVID-19 pandemic. In addition to its size, the completeness of our data and robust standardized data collection are major strengths of our study. We were able to identify a mechanism of injury for over 99% of patients included. Our study includes data from five centres that each serve distinctly different geographical areas and populations and is therefore likely to give a much more generalizable picture of the effect of lockdown on musculoskeletal trauma than smaller single-centre studies.

This study does have limitations. Data collection from multiple centres inherently results in variation in collection technique, however, regular videoconferencing across all centres reduced coding errors. It is possible that in 2020 surgeons may have had a higher threshold for operative treatment which may have contributed to the fall in cases seen in our study. However, we would expect that if patients were managed non-operatively for fractures that previously would be managed operatively, they would still require to be followed up in fracture clinic. Table VIII shows that the number of both new and return patients in fracture clinic reduced in 2020 compared with previous years. Specifically exploring operative cases gives a more accurate picture of the resource burden of trauma during lockdown and crystallizes the key findings. There may have been other confounding factors, such as weather conditions, that may have affected trauma numbers between years that we have not accounted for, however, as there is a large geographical area covered by our centres these variations are less likely to affect the entire population studied. Finally, our study covers the first stage of UK lockdown and, as government advice and specific restrictions change, the pattern of trauma seen may also change.

## Conclusion

Our study demonstrates that there has been a significant reduction in the number of musculoskeletal trauma cases undergoing operative intervention across Scotland during the first stage of the UK lockdown period in 2020 compared with the equivalent periods in 2019 and 2018. While the majority of mechanisms of injury have decreased, injuries related to cycling and DIY have significantly increased. The mortality rate for trauma patients has increased significantly during the lockdown period, in part due to patients with COVID-19. Worryingly, however, a non-significant rise in mortality is also seen with COVID-19 patients excluded.

Although at the time of writing the numbers of new COVID-19 cases are falling and lockdown restrictions are easing, it is highly possible that cases may rise again, and lockdown restrictions may be reintroduced. Although hospital service reorganization may once again be necessary, in future we must maintain capacity for these patients and the expertise of senior staff within trauma units. Our study highlights that during lockdown there is an ongoing burden of trauma, including polytrauma,



and we must endeavour to minimize mortality rates among our patients.



### Take home message

- This study covers a population of 2,507,990 and it is one of the largest reported worldwide and the only one currently examining the changing injury patterns seen during the whole of the initial UK lockdown period (23 March 2020 to 28 May 2020).  
- Although absolute numbers of patients requiring surgical treatment for orthopaedic trauma fell during the lockdown period, our findings show clear trends in injury that will help in the planning of hospital resource if further regional or national lockdown is required.

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- Ethical review was not required for this study.

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