The effects of a UK lockdown on orthopaedic trauma admissions and surgical cases

A MULTICENTRE COMPARATIVE STUDY

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Aims
The current global pandemic due to COVID-19 is generating significant burden on the health service in the UK. On 23 March 2020, the UK government issued requirements for a national lockdown. The aim of this multicentre study is to gain a greater understanding of the impact lockdown has had on the rates, mechanisms and types of injuries together with their management across a regional trauma service.

Methods
Data was collected from an adult major trauma centre, paediatric major trauma centre, district general hospital, and a regional hand trauma unit. Data collection included patient demographics, injury mechanism, injury type and treatment required. Time periods studied corresponded with the two weeks leading up to lockdown in the UK, two weeks during lockdown, and the same two-week period in 2019.

Results
There was a 55.7% (12,935 vs 5,733) reduction in total accident and emergency (A&E) attendances with a 53.7% (354 vs 164) reduction in trauma admissions during lockdown compared to 2019. The number of patients with fragility fractures requiring admission remained constant (32 patients in 2019 vs 31 patients during lockdown; p > 0.05). Road traffic collisions (57.1%, n = 8) were the commonest cause of major trauma admissions during lockdown. There was a significant increase in DIY related-hand injuries (26% (n = 13)) lockdown vs 8% (n = 11 in 2019, p = 0.006) during lockdown, which resulted in an increase in nerve injuries (12% (n = 6 in lockdown) vs 2.5% (n = 3 in 2019, p = 0.015) and hand infections (24% (n = 12) in lockdown vs 6.2% (n = 8) in 2019, p = 0.002).

Conclusion
The national lockdown has dramatically reduced orthopaedic trauma admissions. The incidence of fragility fractures requiring surgery has not changed. Appropriate provision in theatres should remain in place to ensure these patients can be managed as a surgical priority. DIY-related hand injuries have increased which has led to an increased in nerve injuries requiring intervention.

Cite this article: Bone Joint Open 2020;1-5:137–143.

Keywords: Trauma, COVID-19, Pandemic, Fragility fractures, Hand trauma, Paediatric trauma

Introduction
On 11 March 2020, the World Health Organization (WHO) declared the outbreak of the SARS-CoV-2 (COVID-19) virus a global pandemic. The rising number of new cases and hospital admissions in the UK resulted in increased pressures on hospitals within the NHS. In a pre-emptive response to this, on 16 March 2020 the UK government released measures to try and reduce pressures on the NHS. These included social distancing and advising people to avoid busy public venues. The requirements for a UK national lockdown were issued on 23 March 2020, whereby...
people were told that they should only go outside to buy
food, to exercise once a day, or go to work if they absolutely
cannot work from home.

The COVID-19 pandemic has led to all non-urgent
elective orthopaedic surgery in the UK being post-
poned for the foreseeable future. The British Ortho-
paedic Association (BOA) and the NHS have released
guidance to advise on management of orthopaedic
trauma during these unprecedented times.1,3 The guid-
ance favours non-operative management of fractures
where appropriate. The goal of this is to reduce the
demand on anaesthetic services during the pandemic
and to minimize patient exposure to COVID-19 in a
hospital setting. Furthermore, this reduces the risk of
disease transmission to staff through aerosol-generating
procedures (AGP), such as intubation and extubation
of patients for general anaesthesia. Similarly, surgical
techniques such as the use of high-speed drills and
reamers are classed as aerosol-generating due to their
potential to aerosolise blood particles thus increasing
risk of transmission.4

To ensure optimal patient flow, reduce the risk of viral
transmission and allow for healthcare workforce shortages
due to viral infection, all non-urgent elective orthopaedic
clinic lists were either reduced or changed to telephone/
video consultations where appropriate. These measures
have enabled orthopaedic staff to be redeployed to help
our colleagues in accident and emergency (A&E) depart-
ments, medical inpatient wards and intensive therapy
units (ITUs) where the intensity of work has significantly
increased while caring for patients with COVID-19.

Despite these actions, trauma admissions and cases
continue to present to orthopaedic departments. The
exact effects of social distancing and lockdown on the
orthopaedic workload within the UK remains unknown.

The aim of this multicentre study is to gain a greater
understanding of the impact that a nationwide lockdown
has had on the rates, mechanisms, and types of inju-
ries together with their management across a regional
trauma service.

Methods
Retrospective data for the study was collected from an
adult major trauma centre (aMTC), a paediatric major
trauma centre (pMTC), a district general hospital (DGH)
and a regional hand trauma centre (HTC) all within the
UK. Data on A&E attendances and orthopaedic admis-
sions were collected over three, two-week periods, to
 correspond with the two weeks leading up to govern-
ment advised lockdown in the UK (10 March 2020 to 23
March 2020), two weeks during lockdown (24 March
2020 to 7 April 2020), and the same two-week period
the year previously as a control (24 March 2019 to 7 April
2019).

Medical records and electronic trauma handover lists
were used to identify patients who had been referred to
each of the individual units over these time points.

All patients admitted under the orthopaedic team
were included in the study, irrespective of the treatment
received. Patients who were not seen by the accepting
team but had telephone advice provided were not
included. Likewise, patients seen in the minor injuries
department and not admitted under orthopaedics were
excluded from the study, as the aims of the study were
specifically to gain an understanding on trauma admis-
sions and surgical cases.

The HTC receives acute hand trauma from both the
local area and as tertiary referrals from throughout the
region. As the requirement for admission to hospital is
rare for acute hand injuries, we collected data on all hand
trauma referrals to the HTC which underwent assessment
during the study periods.

Demographic data were collected along with nature
of injury, mechanism of injury, treatment provided and
whether it was a fragility-related injury. Any patients with
incomplete data for analysis were excluded from the study.

Patients were grouped into three broad categories
including adult orthopaedic trauma (aMTC and DGH),
paediatric orthopaedic trauma (pMTC and DGH), and
hand trauma (HTC). Injury type was subcategorized
into hip fracture, upper limb injury, lower limb injury,
ataumatic spinal pathology, spinal trauma, suspected or
confirmed infection and multiply injured patients.

Mechanism of the injury was subcategorized into fall
(including slip, trip), do it yourself (DIY)-related injury
(including manual work and gardening), animal or
human bite, infection, assault (including documented
punching), accidental laceration, crush injury, road traffic
collisions (RTC), sports-related injury, and atraumatic.
Patients who presented as a major trauma to the regional
major trauma centre were also analyzed independent of
adult orthopaedic trauma admissions.

Treatment given was subcategorized into surgical
intervention in theatre, antibiotics as primary treatment,
further orthopaedic investigation, splintage or casting,
wound care or minor procedure out of theatre, and
transfer of care to a different speciality or another unit.

Statistical analysis. The data were checked for normal
 distribution with the D’Agostino and Pearson normality
test. Data are presented as median (inter-quartile range)
for non-normally distributed data and mean (standard
development) for normally distributed data. The differenc-
es between the groups for continuous data were com-
pared using the Kruskal-Wallis test and Dunn’s test that
corrects for multiple comparisons. Grouped categorical
data were compared with the Pearson’s chi Squared
test. The Fisher’s exact test (FET) was used to compare
two groups of categorical data. All analyses were com-
pleted on GraphPad Prism version 8.4.2 (San Diego,
California, USA). Results were considered significant for p < 0.05.

**Results**

There was a reduction in the total number of patients who attended A&E during lockdown (Table I). The total number of patients across all centres dropped from 12,935 patients in 2019 to 5,733 patients during the lockdown period, representing a 55.7% reduction.

Across all four units including each time period, there were 805 orthopaedic trauma patients available for final analysis. This included 459 (57%) adult trauma cases, 67 (8.3%) paediatric trauma cases, and 279 (34.7%) hand trauma cases. There were 467 (58%) male patients and 338 (42%) female patients. All patients had complete datasets. There was a 53.7% reduction in the number of cases from the two-week period in 2019 to the 2 week period in 2020 corresponding to the national lockdown (2019 group n = 354 vs lockdown group n = 164). A similar reduction in cases was seen across all subcategories of patients (Table II).

A change in patients’ age at time of presentation was observed in the adult trauma group (H(2) = 11.54, p = 0.003). The median age of patients admitted with adult trauma was greater in the lockdown group versus the 2019 control group (2019 median age = 55 (interquartile range (IQR) 35.8 to 78.3) versus lockdown 66 (IQR 46.5 to 83.5), mean rank difference 71.3, z = 3.40, p = 0.002). The opposite was seen in paediatric trauma patients, with the median age decreasing from 9 (IQR = 5 15 years) years in 2019 to 5 (IQR 2 to 10.5 years) years during lockdown (H(2) = 6.41, p = 0.04, Table III). There was a trend in the hand trauma centre to observe a similar pattern to that of the adult trauma centre with age. However, this was not significant (2019 group median age = 38.5 years (IQR 25.0 to 59.5) versus 51.5 years (IQR 26.8 to 64) during lockdown, p = 0.05).

**Adult orthopaedic trauma.** The total number of adult trauma cases decreased from 198 patients in 2019, 160 patients pre-lockdown, to 101 patients in lockdown.

Although we have seen a dramatic decrease in the volume of adult trauma during the first two weeks of lockdown, the incidence of fragility fractures remains constant with 43 fractures seen in 2019 compared to 48 during lockdown. Hip fractures accounted for the majority of fragility fractures seen during each two-week period (32 patients 2019 vs 31 patients during lockdown). Given the persistence of these injuries, they now account for a greater proportion of our admission and operative caseload compared with 2019 (21.7% in 2019 compared to 47.5% during lockdown, p < 0.0001). Despite a decrease in total numbers, the overall percentage of other injury types admitted remain constant over each time period (Table IV).

Mechanism of injury differed between time periods (Table V). During lockdown, there was an increase in proportion of low energy falls from standing height with 67% (n = 68) of patients sustaining an injury from falls during lockdown compared to 44% (n = 87) of patients in 2019 (p < 0.0001). There was a reduction in RTCs causing trauma admissions, 6.9% (n = 7) in lockdown versus 18% (n = 35) in 2019 (p = 0.01). There was also a reduction in orthopaedic infections requiring admission, 2.9% (n = 3) during lockdown compared to 11% (n = 21) in 2019 (p = 0.002). Other mechanisms were similar between the groups (p > 0.05 for all).

We also observed that a higher proportion of patients admitted to hospital required surgical intervention during the lockdown period. During lockdown 68% (n = 69) patients admitted required surgery compared to 48% (n = 95) in 2019 (p < 0.001). There was a significant reduction in patients admitted who required no intervention during their inpatient stay during lockdown (3.9% (n = 4) lockdown vs 17% (n = 33) 2019, p = 0.0013).

**Adult major trauma.** There was a reduction in major trauma cases which presented to the aMTC, 51 patients in 2019, 21 pre-lockdown and 14 during lockdown. During lockdown, 57.1% (n = 8) of major trauma cases were due to RTCs, all of these patients sustained multiple orthopaedic injuries requiring extensive surgery. Other reasons for major trauma admissions during lockdown were three elderly fall downstairs (21.4%), two assaults (14.3%), and a single suicide attempt (7.1%).

**Paediatric trauma.** Paediatric trauma cases also decreased with 26 patients in 2019; 28 pre-lockdown and 13 in lockdown. There were no significant changes in injury types during time periods. Due to the numbers being low it is difficult to draw conclusions on a change in mechanism of injury, however there was a trend towards...
reduction in number of sports-related injuries during the lockdown period (Table VI). Common injuries admitted were upper limb fractures to the distal radius, forearm and supracondylar elbow fractures. There was no difference between percentage of cases admitted which required surgical intervention between time periods.

**Hand trauma.** The same trend of overall decrease in case volume was observed with hand trauma cases, we saw 130 patients in 2019, 99 pre-lockdown and 50 in lockdown. There was an observed difference in the causes of hand injuries between periods (Table VII). During lockdown there was a significant increase in hand injuries caused by DIY-related injuries (26% (n = 13) lockdown vs 8% (n = 11) 2019, p = 0.006) and animal bites (14% (n = 7) lockdown vs 5% (n = 6) 2019, p = 0.049). Conversely, there was a decrease in sports-related injuries (0% lockdown vs 13% (n = 17) 2019, p = 0.0038) and crush injuries (6% (n = 3) vs 19% (n = 25) p = 0.037). There was no difference in injuries caused by assaults/punches, falls, or accidental lacerations sustained at home (p > 0.05 for all).

During lockdown there was a significant increase in both nerve injuries (12% (n = 6) lockdown vs 2.5% (n = 3) 2019, p = 0.015) and infections (24% (n = 12) lockdown vs 6.2% (n = 8) 2019, p = 0.002). There was a decrease in hand fractures presenting to the HTC (18% (n = 9) lockdown vs 45.4% (n = 59) 2019, p < 0.001). Rates of soft tissue injury, tendon injury, tip injury, and amputation were similar (p > 0.05 for all comparisons). Although fewer patients presented to the HTC during lockdown, there was a greater proportion of patients who required surgical intervention for their injuries (38% (n = 19) lockdown vs 16% (n = 21) 2019, p = 0.0025).

**Discussion**

Attendances to the emergency department in the UK have decreased considerably since lockdown began. Figures from Public Health England showed week 14 attendance of 156,717 patients during 20196 compared to 57,993 in 2020.4

This multicentre study demonstrates that the enforced UK national lockdown has so far led to a 53.7% reduction in orthopaedic trauma admissions in comparison to the same time period in 2019. Prior to this, the social distancing measures led to a 18.9% decrease in orthopaedic admissions. This reduction in volume has been invaluable to the NHS, allowing orthopaedic staff to become available for redeployment to help hospital departments struggling with COVID-19. The reduction in trauma, along with cancellation of elective workload, has allowed for increased presence of senior orthopaedic clinicians in minor injuries.
units, which in turn has diminished the requirement for new patient fracture clinics. Early senior decisions and interventions are also likely to be contributory towards reduced admissions during the lockdown period. We saw an increase in the proportion of patients admitted who required surgical intervention (68% lockdown vs 48% 2019), but a reduction in patients requiring no intervention (4% lockdown vs 17% 2019). We postulate that this is multifactorial, due to early senior decision-making, reduction in injuries sustained during lockdown and a possible reluctance of patients to present to hospitals during the COVID-19 pandemic.

Although we have seen a dramatic reduction in trauma admissions, the amount of fragility fractures, predominantly proximal femoral fractures, has remained constant. There are clear benefits to performing early surgery in patients with hip fractures, delaying surgery in these patients increases the number of serious complications encountered, increases length of stay and mortality. This is supported by the updated BOA guidance for management of trauma during COVID-19, stating that fragility fractures should still be managed as a surgical priority. It is therefore important that despite the significant pressures on anaesthetic and theatre departments there should still be urgent provision to manage patients with fragility fractures.

There has been a reduction in major trauma cases presenting to the aMTC as part of the regional major trauma network. The predominant mechanism during lockdown was RTCs, leading to multiply injured patients, all of whom required extensive surgical intervention. There is a significant morbidity and mortality associated with multiply injured patients secondary to trauma, it also places a significant burden on the health system with prolonged surgical times, inpatients stay and increased risk of complications. This compliments the governments advice that travel by road should only be for essential trips.

Lockdown has seen a reduction in paediatric trauma admitted to the pMTC. Both the types and mechanisms of injury sustained have remained relatively constant, however we have noted the decrease in team sport-related injuries which may have led to a reduction in the average age of patients requiring admission. Paediatric trauma has the advantage of allowing for some incomplete reductions due to the remodelling potential of immature bone, but it will take many months to determine the true impact of the current guidance on this population. The reduction in surgical cases and admissions is only partly explained by the increased preference to nonoperative management of paediatric trauma. It is also apparent that the lockdown has had its desired effect in the paediatric population.

Despite the reduction in cases presenting to the HTC, we observed a significant change in the mechanisms of injury involved in sustaining hand injuries. There was a substantial increase in the proportion of DIY/garden-related injuries (26% in lockdown vs 8.5% in 2019) and animal bites (14% in lockdown vs 5% in 2019) during lockdown. This change in mechanism of injury also led to a change in the injury types treated. We saw a significant increase in nerve injuries requiring nerve repair (12% in lockdown vs 2.3% in 2019) and hand infections requiring surgical drainage and/or admission for intravenous antibiotics (24% in lockdown vs 6.2% in 2019) during lockdown. Hand lacerations sustained during gardening or DIY activities can undoubtedly be significant, but they now require urgent management in the trauma setting.

### Table VII. Hand trauma mechanisms and injuries observed between the groups.

| Mechanism of injury                      | 2019 (%) n = 130 | Pre-Lockdown (%) n = 99 | Lockdown (%) n = 50 |
|-----------------------------------------|------------------|-------------------------|---------------------|
| Fall/slip/trip                           | 37 (28.5)        | 23 (23.2)               | 13 (26)             |
| DIY-related/gardening/work*             | 11 (8.5)         | 17 (17.2)               | 13 (26)             |
| Animal bite*                            | 6 (4.6)          | 3 (3)                   | 7 (14)              |
| Infection                               | 0 (0)            | 6 (6.1)                 | 5 (10)              |
| Assault/punching/violence              | 19 (14.6)        | 19 (19.2)               | 5 (10)              |
| Knife accident/laceration              | 9 (6.9)          | 11 (11.1)               | 3 (6)               |
| Crush injury/trapped finger*           | 25 (19.2)        | 10 (10.1)               | 3 (6)               |
| RTC                                     | 2 (1.5)          | 2 (2)                   | 0 (0)               |
| Sports-related injuries*               | 17 (13.1)        | 8 (8.1)                 | 0 (0)               |
| No trauma                               | 4 (3.1)          | 0 (0)                   | 1 (2)               |

*Fishers exact test for 2019 versus lockdown group p < 0.05.
nerve injuries can cause extreme long-term dysfunction in the hand with suboptimal outcomes even with surgical repair.\textsuperscript{18,20} The increase in hand infections can be explained by the increasing amount of animal bites during lockdown and increasing DIY activities leading to lacerations and foreign bodies. Delayed presentation of hand infections can lead to tissue damage and secondary functional disability of the hand.\textsuperscript{21,22} It is imperative that hand infections present to the hospital and are promptly identified and treated.

Although the large drop in both A&E attendances and orthopaedic admissions have been inaccessible in helping the NHS during this pandemic, it is probable that the dramatic drop seen may only be partly due to the national lockdown measures. There are unquestionably concerns that patients may be refraining from presenting to the hospitals due to fear of catching COVID-19. This may have future implications and hidden burdens on the NHS while dealing with delayed presentations of a multitude of medical and surgical conditions.

This study does have limitations. The study includes a relatively small numbers of patients. By performing a multicentre study we believe adequate numbers have been included to achieve our aims of demonstrating the effects the UK lockdown has had on orthopaedic trauma workload. The retrospective nature of the study leads to potential difficulties in the data collection, however, given hospital records are stored electronically in each unit we believe this possibility to be small and our data set to be complete. This multicentre study examines the changes in trauma workload throughout a single region within the UK. However, we anticipate similar trends will have been experienced in all orthopaedic departments throughout the country. This study only accounts for the first two weeks of lockdown. It is not yet known how long it will go on for and how long the public remain compliant with the advised measures.

Conclusion

The national UK lockdown is designed to limit the spread of COVID-19. Due to the guidance measures in place it has had a secondary impact of reducing orthopaedic trauma requiring admission in our region by 53.7%. The incidence of fragility fractures being admitted and requiring surgery has not changed. Appropriate provision in theatres should remain in place to ensure these patients can be managed as a surgical priority. Road traffic collisions are still the main cause for major trauma admissions resulting in prolonged and complex surgeries. There has been a significant increase in hand trauma cases caused by DIY/garden-related injuries, which in turn has led to an increase in nerve injuries and hand infections.

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References

1. British Orthopaedic Association. Emergency BOAST: Management of patients with urgent orthopaedic conditions and trauma during the coronavirus pandemic. 2020. https://www.boa.ac.uk/resources/covid-19-boasts-combined.html

2. NHS England. (2020). Clinical guide for the management of trauma and orthopaedic patients during the coronavirus pandemic. 2020. https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/CO274-Speciality-guide-Orthopaedic-trauma-v2-14-Apri1.pdf

3. NHS England. (2020). Clinical guide for the perioperative care of people with fragility fractures during the coronavirus pandemic. 2020. https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/CO288_Speciality-guide_-Fragility-Fractures-and-Coronavirus-v1-26-March.pdf

4. Jewett DL, Heinsohn P, Bennett C, Rosen A, Neulilly C. Blood-Containing aerosols generated by surgical techniques: a possible infectious hazard. Am Ind Hyg Assoc J. 1992;53(4):228–231.

5. Emergency department. Weekly bulletins for 2020. https://www.gov.uk/government/publications/emergency-department-weekly-bulletins-for-2020

6. Emergency department. Weekly bulletins for 2019. https://www.gov.uk/government/publications/emergency-department-weekly-bulletins-for-2019

7. Klessil T, Röder C, Stotter C, Winkler B, et al. Impact of timing of surgery in elderly hip fracture patients: a systematic review and meta-analysis. Sci Rep. 2018;8(1):13933.

8. Grimes JP, Gregory PM, Noveck H, et al. The effects of time-to-surgery on mortality and morbidity in patients following hip fracture. Am J Med. 2002;113(9):702–709.

9. Siegmeth AW, Gurusamy K, Parker MJ. Delay to surgery prolongs hospital stay in patients with fractures of the proximal femur. J Bone Joint Surg Br. 2005;87(11):1123–1126.

10. Weiler I, Wai EK, Jaglal S, Kreder HJ. The effect of hospital type and surgical delay on mortality after surgery for hip fracture. J Bone Joint Surg Br. 2005;87(3):361–366.

11. Lefaivre KA, Macadam SA, Davidson DJ, et al. Length of stay, mortality, morbidity and delay to surgery in hip fractures. J Bone Joint Surg Br. 2009;91(7):922–927.

12. Haas B, Jorkovich GJ, Wang J, et al. Survival advantage in trauma centers: expedient intervention or experience? J Am Coll Surg. 2009;208(1):26–36.

13. Demetriades D, Martin M, Salim A, et al. The effect of trauma center designation and trauma volume on outcome in specific severe injuries. J Am Coll Surg. 2005;201(4):206–213.

14. Freiberg KSI. His classic three articles on remodeling of distal radius fractures. Acta chir Scand. 1979;50:537–546.

15. Vorfat P, De Boeck H. Bowing fractures of the forearm in children: a long-term followup. Clin Orthop Relat Res. 2003;413(143):233–237.

16. Do TT, Strub WM, Foad SL, et al. Reduction versus remodeling in pediatric distal forearm fractures: a preliminary cost analysis. J Pediatr Orthop B. 2003;12(2):109–115.

17. Armstrong PF, Joughin VE, Clarke HM, et al. Fractures of the forearm, wrist and hand. Chapter 8 in: skeletal trauma in children. 3rd. Phila, PA: Saunders, 2003:186–255.

18. McAllister RM, Gilbert SE, Calder JS, Smith PJ. The epidemiology and management of upper limb peripheral nerve injuries in modern practice. J Hand Surg Br. 1996;21(1):4–13.

19. Brown PW. Factors influencing the success of the surgical repair of peripheral nerves. Surg Clin North Am. 1972;52(5):1137–1156.

20. M F G, M M, S H Khan WS. Peripheral nerve injury: principles for repair and regeneration. Open Orthop J. 2014;8:199–203.

21. McDonald LS, Bavaro MF, Hofmeister EP, Kroonen LT. Hand infections. J Hand Surg Am. 2011;36(8):1403–1412.

22. Ong YS, Levin LS. Hand infections. Plast Reconstr Surg. 2009;124(4):225e–233.
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Funding statement:
- No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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