

The global burden of trauma during the COVID-19 pandemic: A scoping review



S. Waseem ^a, S.K. Nayar ^b, P. Hull ^a, A. Carrothers ^a, J. Rawal ^a, D. Chou ^a, V. Khanduja ^{a,*}

^a Major Trauma Centre, Cambridge University Hospitals NHS Foundation Trust, Hills Road, Cambridge, CB20QQ, United Kingdom

^b Department of Trauma and Orthopaedics, Whittington Hospital, Madgala Avenue, London, N195NF, United Kingdom

ARTICLE INFO

Article history:

Received 23 October 2020

Received in revised form

8 November 2020

Accepted 9 November 2020

Available online 14 November 2020

Keywords:

Trauma

COVID-19

Coronavirus

Pandemic

Lockdown

ABSTRACT

Purpose; The COVID-19 pandemic has necessitated profound adaptations in the delivery of healthcare to manage a rise in critically unwell patients. In an attempt to slow the spread of the virus nationwide lockdown restrictions were introduced. This review aims to scope the literature on the impact of the pandemic and subsequent lockdown on the presentation and management of trauma globally.

Methods; A scoping review was conducted in accordance with PRISMA-ScR guidelines. A systematic search was carried out on the Medline, EMBASE and Cochrane databases to identify papers investigating presentation and management of trauma during the COVID-19 pandemic. All studies based on patients admitted with orthopaedic trauma during the COVID-19 pandemic were included. Exclusion criteria were opinion-based reports, reviews, studies that did not provide quantitative data and papers not in English.

Results; 665 studies were screened, with 57 meeting the eligibility criteria. Studies reported on the footfall of trauma in the UK, Europe, Asia, USA, Australia and New Zealand. A total of 29,591 patients during the pandemic were considered. Mean age was 43.7 years (range <1–103); 54.8% were male. Reported reductions in trauma footfall ranged from 20.3% to 84.6%, with a higher proportion of trauma occurring secondary to interpersonal violence, deliberate self-harm and falls from a height. A decrease was seen in road traffic collisions, sports injuries and trauma occurring outdoors. There was no significant change in the proportion of patients managed operatively, and the number of trauma patients reported to be COVID-19 positive was low.

Conclusion; Whilst the worldwide COVID-19 pandemic has caused a reduction in the number of trauma patients; the services managing trauma have continued to function despite infrastructural, personnel and pathway changes in health systems. The substantial effect of the COVID-19 pandemic on elective orthopaedics is well described, however the contents of this review evidence minimal change in the delivery of effective trauma care despite resource constraints during this global COVID-19 pandemic.

© 2020

1. Introduction

Since its characterisation in December 2019¹, COVID-19 has swept across the world, altering the practice of medicine and surgery in health systems worldwide. Coronavirus was first described in Wuhan, China as a condition causing-most commonly- a fever and dry cough.^{1–3} It relentlessly spread across the world, and was declared a pandemic by the World Health Organisation on 11th March 2020.⁴ In response, worldwide governments orchestrated

'lockdowns', placing severe restrictions on the free movement of society in an attempt to curtail the virus' spread.

The effects of the worldwide lockdown are yet to be fully understood; however research suggests that it has led to significant changes in the presentation of medical and surgical conditions, including changes in the aetiology of trauma,⁵ late presentations of common conditions,⁶ and higher surgical morbidity in surgical patients with concomitant COVID-19 infection.⁷ Furthermore, COVID-19 fundamentally changed demand on healthcare services; with a proportionally higher demand on medical and critical care specialities compared to surgical specialities. This resulted in an adaptive redistribution of resources to meet demand; including infrastructure, healthcare workers and patient pathways.

* Corresponding author. Institutional address: Cambridge University Hospitals NHS Foundation Trust, Hills Road, Cambridge, CB20QQ, United Kingdom
E-mail address: vikas.khanduja@addenbrookes.nhs.uk (V. Khanduja).

Redeployment of surgical trainees to medical specialties is an example of such adaptations.^{8,9}

There is an emerging body of evidence which documents the footfall and management of musculoskeletal trauma globally during the COVID-19 pandemic. Specifically, data exists from hospitals across the world on the change in the presentation of major trauma^{10–15} and trauma to the lower limbs,^{10,11,16–18} hand^{19,20} and spine.^{21,22} In this study, we aimed to perform a scoping review to assess evidence in the current literature from around the world on the footfall, aetiology, operative volume and treatment of musculoskeletal traumatic injuries in adults and children during the COVID-19 pandemic. In doing this, we aimed to improve the literature base to inform clinicians about demands on musculoskeletal trauma service provision in the instance of a 'second wave' and further national lockdowns.

2. Material and methods

2.1. Protocol

A scoping review was decided to be undertaken to allow the authors to gain a broad overall view of how the COVID-19 pandemic has affected all aspects of the presentation and management of musculoskeletal trauma. This was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) statement.²³

2.2. Eligibility criteria

Inclusion criteria were studies looking at patients that suffered from trauma during the COVID-19 pandemic. No restrictions were placed on study design, age or injury type. Exclusion criteria were studies not related to the COVID-19 pandemic, studies reporting solely on fragility neck of femur fractures, studies reporting solely on COVID positive patients sustaining trauma, studies not relating to musculoskeletal trauma, studies that did not give quantitative data on the presentation of trauma, reviews, conference abstracts, opinion-based reports and articles in languages other than English.

2.3. Search strategy and information sources

A comprehensive search of the published literature on the Medline, EMBASE and Cochrane databases from inception to October 30, 2020 was carried out. The following search terms were used: (trauma OR polytrauma) AND (COVID-19 OR coronavirus OR pandemic OR lockdown OR quarantine).

2.4. Study selection

Two reviewers (SW and SN) independently performed eligibility assessment of the articles. This was initially carried out through screening of the article titles and abstracts; the process was completed by full text evaluation. Disagreements between reviewers were resolved by consensus with the senior author. Citation searches were subsequently undertaken to identify any papers not picked up from the initial search. Specifically, a backward citation search was carried out to review papers cited by each article, and a forward citation search to review other papers that have cited the included articles.

2.5. Data extraction

A pilot of the data proforma was initially conducted using 5 randomly chosen papers to develop a final proforma. Information collected included: study design, sample size, patient demographic

information, trauma location and aetiology, management and outcomes.

2.6. Summary measures

The primary outcomes of this scoping review were to assess how the COVID-19 pandemic has affected the presentation and management of trauma. Narrative synthesis of results was undertaken.

3. Results

A summary of the search strategy used is shown in Fig. 1. 574 records were returned from Medline, 573 from EMBASE and 13 from the Cochrane Library. 665 records were screened after duplicates were removed, with 533 excluded as they did not meet the inclusion criteria. The full text was then extracted for 132 papers, with a final 57 accepted for analysis.

3.1. Study characteristics

A summary of the characteristics for the included studies is shown in Table 1. Of the studies selected, 50 were case control and 7 were cohort studies. The case control study design was used to compare the lockdown period in the corresponding country with the same period 1–12 years previously. A summary of the available literature on trauma during COVID-19 including in this scoping review is shown in Table 1.

3.2. Patient demographics

29,591 patients were studied during the COVID-19 pandemic, with reported ages ranging from under one to 103 years. The mean age was reported for 3236 patients and was 43.7 years.^{11,13,16,18,19,22,26–40} An average of 54.8% were male.

3.3. Trauma footfall

There was a worldwide reduction of between 20.3% and 84.6% in trauma patients compared to a pre-COVID control period.^{10–15,17,19,20,27,34,35,37,41–46} Hernigou et al.¹⁶ reported a concomitant increase in paediatric trauma and reduction in adult trauma during the pandemic at their centre in Belgium, a finding replicated in one Australian centre.⁴⁷ Additionally, Wong et al.'s centre based in Australia reported no change in paediatric trauma requiring acute admission.⁴⁸ Of the 7 studies reporting the injury severity score (ISS) of patients presenting during the pandemic, 5 reported a similar or slightly reduced presenting ISS during the pandemic, when compared with pre-pandemic years.^{34,40,49–51} However, 2 centres in the United States (US) reported an increase in presenting ISS of 13.7–33%.^{29,52}

3.4. Aetiology of trauma

35 studies reported on the aetiology of trauma in the lockdown period.

3.4.1. Interpersonal violence and self-harm

The literature reported disputable changes in the prevalence of traumatic injuries secondary to assault during the pandemic, summarised in Fig. 2a. Increases in trauma secondary to assault were reported in hospitals by Rhodes et al. in the US (7.28% v 4.95%, $p = 0.038$)⁵¹, Dhillon et al. in India,⁵³ Pichard et al. in Paris (7.2% v 4.5%, $p = 0.0967$)¹⁹, the US (33.9% v 20.5%)²⁶ and UK (2.8% v 1.6%).⁴⁵ Olding et al.'s United Kingdom (UK) centre reported a reduction in

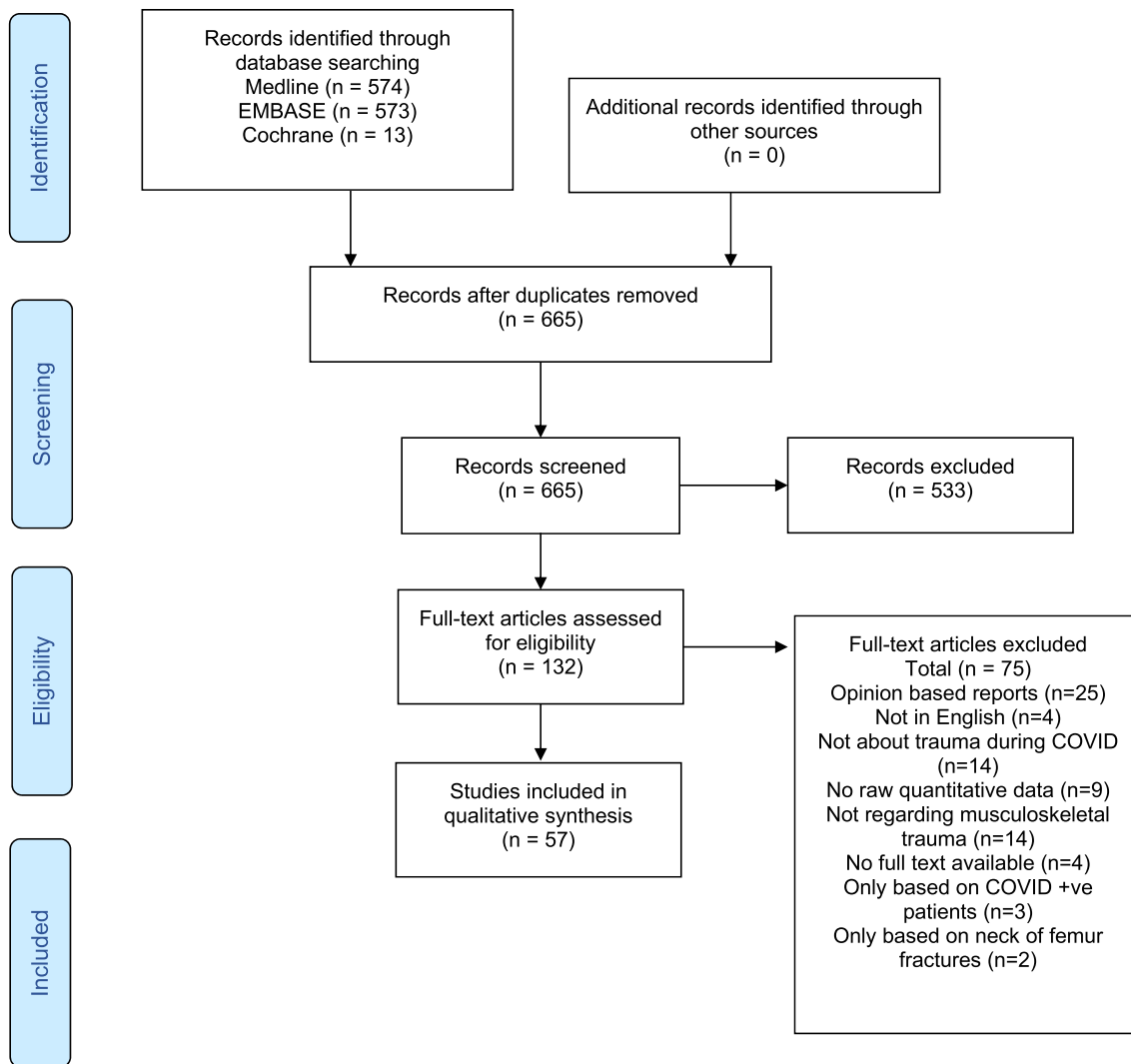


Fig. 1. PRISMA Flow Diagram outlining the search strategy.

Table 1
Study characteristics.

Characteristic	Number of studies
Study Design	
Case control	50
Cohort	7
Location	
United Kingdom	10
Europe	18
United States	13
China	2
New Zealand	2
Australia	4
Hong Kong	1
India	3
Iran	2
Pakistan	1
South Africa	1
Speciality	
Paediatric Orthopaedics	9
Spinal Trauma	2
Upper limb Trauma	8
General trauma	38

penetrating trauma caused by assault (63% vs 89%),³⁸ and Leichtle et al. reported a reduction of injuries from assault (12.6% v 17.6%, $p = 0.09$)⁵². Reductions were reported elsewhere in the UK by Murphy et al. (1 v 2 cases, $p = 1.00$)⁵⁴, New Zealand by Christey et al. (2.82% v 4.03%)¹² and the US by Lubbe et al. (1.2% v 3.1%).³²

During lockdown a reported increase in injuries from deliberate self-harm (DSH) was found in Paris (2.9% v 2.0%),¹⁹ the UK,^{38,49} Australia^{47,50} and the US.^{40,52} A large reduction was reported in diamond et al.'s US centre²⁹ (0 v 8%), with a milder reduction in Murphy et al.'s UK centre⁵⁴ (0.2% v 1%, $p = 1.0$). In the US Sherman et al. reported an increase in the rate of non-accidental injury (NAI) during the pandemic,⁵⁵ and an increase in domestic violence was observed in Rhode's centre.⁵⁶

3.4.2. Vehicle accidents

A summary of road traffic collisions (RTCs) during the COVID-19 pandemic is shown in Fig. 2b. A reduction in trauma occurring secondary to RTCs was reported in the UK,^{10,20,45,49} US^{17, 26, 40, 51, 52, 55}, New Zealand,¹² Australia,^{31,50} India,^{53,57} Iran,³⁷ Hong Kong⁵⁸ and Europe.^{13,19,22,36,59,60} These reductions reached statistical significance in Jacob et al.'s Australian centre (34% v 46%, $p = 0.025$), and

A) Trauma secondary to assault

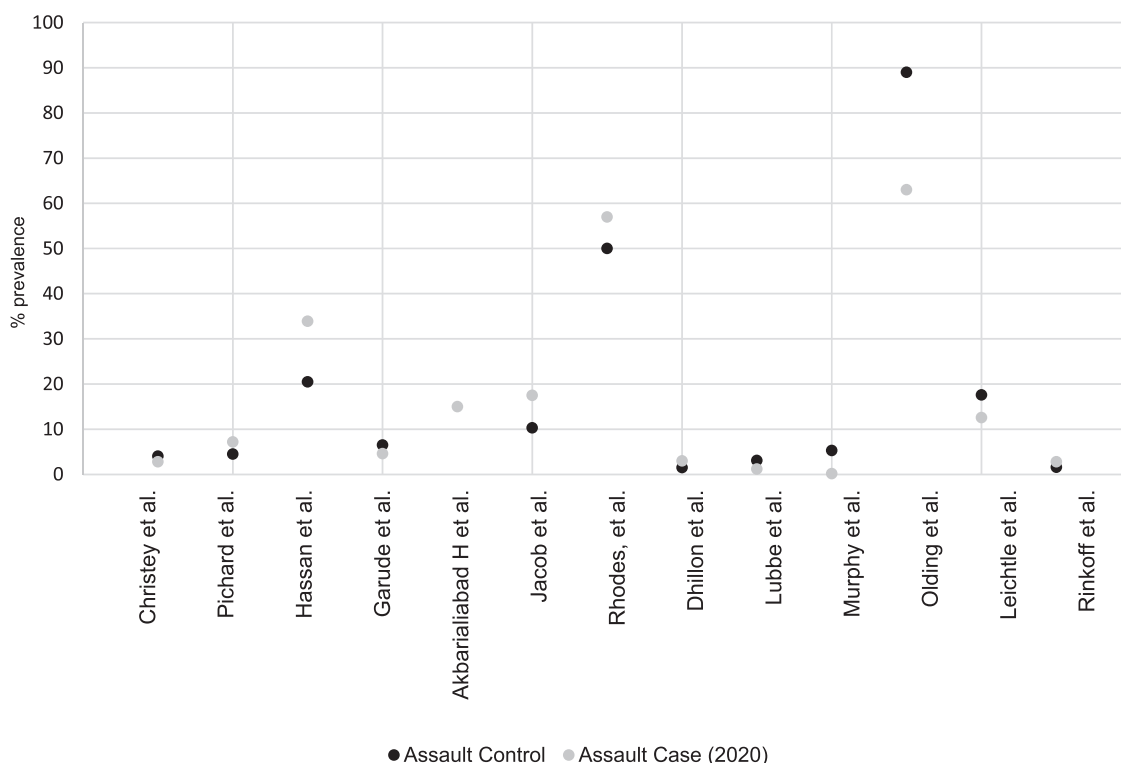


Fig. 2. Aetioloogy of Trauma during the global COVID-19 pandemic.

Sherman et al.'s US centre (42% v 49%, $p = 0.03$). An increase in injuries from RTCs in children was reported by Bram et al. in the US (5.2% v 1.8%)¹¹ and UK by Sugand et al. (2% v 1%).⁶¹ Further increases were reported in centres in the US by Lubbe et al. (12.9% v 10.9%),³² and in Italy by Giuntoli et al. (21.6% v 19.3%).³⁰

3.4.3. Falls

The incidence of falls is summarised in Fig. 2c. Park et al. reported an increase in falls at home during the pandemic (57.5% v 49.4%),¹⁰ as did Waghmare et al. (64% v 42%).⁵⁷ A significant increase was also shown in Rhodes et al.'s US centre (0.77% v 0.1%, $p = 0.025$), Jacob et al. in Australia (35.1% v 34.9%, $p = 0.02$)⁵¹ and Dhillon's centre in India (20% vs 5.49%).⁵³ Smaller increases were reported in the UK,²⁰ Australia^{50,61} and the US.³² Reductions in the proportion of falls were reported by Staunton et al. in Ireland (36% vs 45%),³³ Nabian et al. in Iran (49.3% v 58.9%, $p = 0.008$)³⁷, New Zealand¹² and centres in the UK^{45,49} and US.^{11,26,40}

There was a global increase in injuries occurring from falls from a height during the pandemic. This was particularly prevalent in the paediatric proportion, as reported by Bram et al. (33.7% v 21.7%)¹¹ and Sugand et al. in the UK (6% v 3%).⁶¹ Further increases in falls from height were reported in the spinal department in Italy (55.6% v 16.7%),²² Australia (12.3% v 11.6%, 0.83)³¹, India (25% v 13.5%),⁵³ the UK (17.4% v 12.4%).¹⁰

3.4.4. Hobbies and leisure

There was a worldwide reduction in the proportion of injuries occurring secondary to sporting activities, with the exception of the paediatric population described by Raitio et al.'s centre in Finland.⁶⁰ This is summarised in Fig. 2d.

3.5. Location of trauma

16 studies reported on the prevalence of injuries occurring at home during the pandemic. Of the 12 case control studies which included the incidence of trauma sustained indoors, 11 reported an increase.^{11,12,19,20,22,33,45,47,49,52,62} This was reported to be statistically significant in studies from France ($p < 0.0001$)¹⁹, Ireland ($p < 0.001$)³³, US ($p < 0.001$)⁵² and Australia ($p < 0.002$)⁴⁷. Of the cohort studies included, the prevalence of indoor trauma ranged from 14.9 to 54.9%.^{36,63,64} A graphical summary of injuries occurring at home is shown in Fig. 3.

Moreover, the reported prevalence of incidents occurring outdoors ranged from 0% to 51.6%.^{11,12,26,65} An overall increase of 3.82%–6.1% was reported in incidents occurring on the street from studies based in New Zealand¹² and the USA.^{11,26} An overall reduction in incidents occurring at work of between 3% and 12.6% was reported in France,¹⁹ UK²⁰ and the USA,²⁶ with a small increase in incidents occurring at work reported in Spain (2.1% vs 1.52%).¹³

3.6. Trauma management

3.6.1. Operative volume and type

The reported proportion of patients undergoing operative management during the pandemic ranged from 1.4 to 90.4%. Reductions of between 18.9 and 44.2% were reported in centres in the UK,^{54,66} US¹¹, Europe^{36,39,60,67} and Hong Kong.⁵⁸ However, increases in the proportion of patients managed operatively were noted in the UK,¹⁰ Paris,¹⁹ the US,^{29,32} Australia⁵⁰ and India.⁵³

The reported proportion of patients undergoing closed reduction and open reduction and internal fixation (ORIF) and external fixation remained largely comparable before and after the

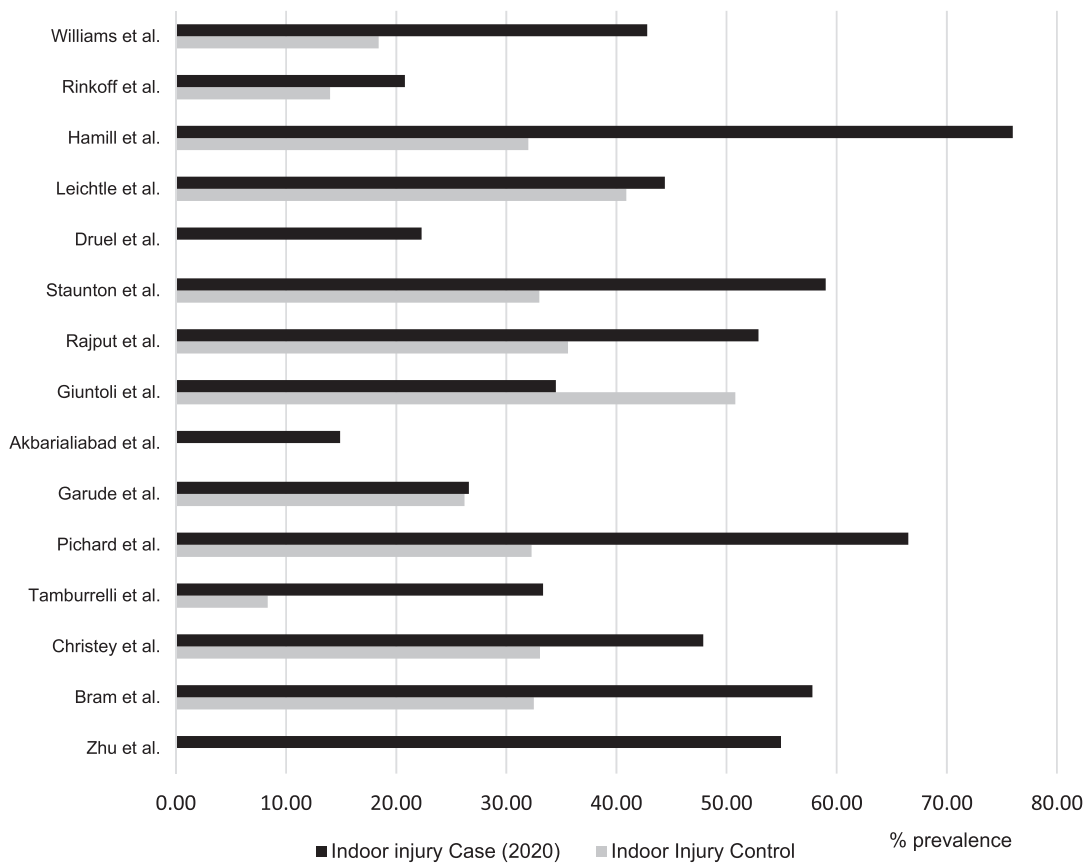


Fig. 3. Graphical representation of injuries occurring at home during the COVID-19 pandemic (Case), compared with before lockdown measures were introduced (control).

pandemic in reporting centres based in Australia,³¹ US,¹¹ Europe⁵⁹ and the UK.^{10,54}

A preponderance to using local or regional anaesthesia as opposed to general anaesthesia was reported by Park et al. from their London centre.¹⁰

3.7. COVID-19 positive trauma patients

The proportion of COVID-19 positive patients presenting with non-proximal femoral fractures was reported in 15 studies. Of the 6566 patients in these studies, 128 (1.9%) patients tested positive for COVID-19. 33 patients were COVID-19 positive on their first presentation, and 10 acquired COVID-19 after admission to hospital. The reported prevalence of COVID-19 in trauma patients ranged from zero in a District General Hospital in the UK¹⁸ to 5.68% over multiple hospitals in Belgium.¹⁶ 3 studies reported on mortality in non-proximal femur trauma patients; Sobti et al.¹⁸ reported that none of their patients died, whereas Hernigou et al.¹⁶ reported two deaths in COVID-19 positive patients (2.27%), with a COVID-19 negative patient death after 14 days. Lastly, a study by Zagra et al. reported 7 deaths (0.7%) of their trauma and orthopaedic patients, 6 of which were positive for COVID-19. There were no studies comparing the mortality of COVID-19 positive patients with negative patients with non-proximal femoral fractures.

4. Discussion

This review of the global burden of trauma during the COVID-19 pandemic has shown an overall reduction in the footfall of trauma, with an increase in incidents occurring at home. Whilst COVID-19

negated systemic changes in the delivery of elective surgery⁶⁸ and cancer care, this study has shown that the care of patients sustaining trauma was largely unchanged during the pandemic. This may be due to reductions in the absolute numbers of trauma being compensated for by concomitant increases in paediatric trauma, interpersonal violence, DSH, and high energy trauma such as falls from height. Whilst COVID-19 has persisted at the forefront of global healthcare over recent months, the burden of trauma to the health system remains. Multiple studies have been published on how trauma has impacted different regions and healthcare systems around the world, however, the worldwide burden of trauma during this pandemic has yet to be fully determined.

As illustrated in the included studies which compared trauma patients during the COVID-19 pandemic to a matched historical cohort, there has been reported reductions in the absolute numbers of trauma patients by an average of 52.68%. Considering the trauma aetiologies during the pandemic, there has been an increase in the proportion of trauma due to assaults and high-energy falls, as well as a general increase in the proportion of trauma that occurred indoors. This is coupled with a decrease in other aetiologies including road traffic accidents and sports injuries. This change reflects the lockdown measures put in place. The rise in assaults, domestic violence and non-accidental injury is likely a result of the well documented increase in domestic abuse and alcohol consumption.^{41,69,70} Falls from less than 2 m continue to be the most common mechanism of injury in trauma, which generally occur in the elderly.⁷¹ These injuries tend to occur indoors and therefore the stimulus for such injuries remains unchanged. Furthermore, an increase in falls from height in the paediatric population has been demonstrated, which in part has been attributed to trampoline

injuries, and reflects the closure of schools across countries.¹¹ The decrease in road traffic accidents reflects the fall in travel secondary to lockdown measures, and similarly the reduction in sports injuries can be attributed to the cessation of group sports activities as well as closure of gyms, sports clubs and leisure centres. Paradoxically, some studies reported an increase in the proportion of injuries occurring in the street, which may be due to more children and young people spending free time in the street in the absence of scheduled school or work.

Whilst a reduction of trauma patients is a welcome finding to healthcare systems struggling to manage a viral pandemic; it is clear that national lockdown measures can dictate the number and type of trauma seen. Government public health advice and messaging can significantly alter the burden of trauma to health systems across the globe. It is crucial for government offices to appreciate the impact of their decisions on the distribution of burden to healthcare systems. Equally, public health measures should be considered to minimise the significant increase in trauma due to domestic abuse and alcohol consumption.

Regarding the management of trauma during the COVID-19 pandemic, in general a trend towards a higher proportion of trauma patients undergoing operative management was identified. This may reflect a higher threshold for trauma patients with more 'minor' trauma that would have previously been admitted to hospital being managed in primary care or the emergency department, as well as a reluctance for patients to present to hospital in fear of the virus. Considering management of orthopaedic limb injuries, a slight decrease in the proportion of patients undergoing fracture fixation was identified, however more research is required to ascertain the effects of the pandemic on decision for operative intervention, and comparison between countries. In such cases where surgery is not life or limb saving, there are instances where the risk of surgery in the context of COVID-19 may outweigh the benefits of 'optimal' fracture fixation. This is consistent with guidelines released on fracture fixation in the context of the COVID-19 pandemic, including the British Orthopaedic Associated Standards for Trauma guidelines.⁸ Indeed, the detrimental outcomes from emergency surgery in patients with COVID-19 has been documented.⁷

Data from the UK from Park et al. shows a preference towards local or regional anaesthesia prior to surgery.¹⁰ Furthermore, the benefits from Wide Awake Local Anaesthesia no Tourniquet (WALANT) surgery in hand trauma are increasingly apparent in the context of the COVID-19 pandemic.¹⁹ Increased study in this field from multiple hand trauma centres will give further insight into the effectiveness of this method when used during the pandemic.

National guidelines for the management of fractures during COVID-19 tended towards non-operative management options.⁸ This is clearly a deviation from current well-established gold standard treatment of fractures in the light of resource re-allocation to treat patients with COVID-19. Many theatre suites were converted to intensive care facilitates to cope with the burden of COVID-19 patients requiring invasive ventilation. Anaesthetists and other personnel were re-deployed from theatre duties which resulted in a reduced capacity for surgical fixation of fractures. Whilst it is entirely understandable that these changes were made to support the pandemic; it is important for health systems now to utilise data and learnings from the last few months to ensure they are fully prepared for a second wave. Prioritising the treatment of COVID-19 whilst at the same time striving to provide gold standard treatment for trauma. It is important that the attention and volume of resources directed to dealing with COVID-19 does not indirectly harm other patients, for example patients with active malignancy who face rationing of services and delays to treatment during the pandemic.^{72–74}

This study is not without limitations. The study is prone to selection bias; however, this was minimised by carrying out a search on multiple databases (Medline, Embase and Cochrane). This was then followed by a backward citation search to review papers sites by each article and a forward citation search to identify any papers not picked up from the initial search. Furthermore, eligibility assessment of the article was carried out by two independent reviewers and any disagreements were resolved by discussion with the senior author. In addition, due to heterogeneity in outcome measures there was a risk of interpretation bias, but this was minimised by using a standardised proforma for data extraction.

Whilst the number of patients that contracted COVID-19 following admission for trauma appears low from the included studies, these figures may not reflect the true numbers and large variation exists between the number of patients being tested with either antigen or antibody testing. Furthermore, to date, morbidity and mortality outcomes from trauma in the context of COVID-19 are relatively under-reported. At the present time, whilst lockdown measures are slowly being eased across countries, the threat of the COVID-19 pandemic continues and long-term outcomes remain to be determined.

This scoping review has provided a snapshot of how the presentation and management of trauma has changed during the COVID-19 pandemic. However, its limitations must be acknowledged. Notably, to date there is a lack of evidence in the literature, with the majority of studies looking at small numbers and being retrospective in nature. Papers investigating solely fragility neck of femur fractures were excluded from this study as this was considered a separate cohort in itself, and therefore the authors would recommend a standalone review for this area.

5. Conclusions

The COVID-19 pandemic has resulted in a reduction in footfall of patients presenting with trauma. The change in the incidence of trauma aetiologies reflects lockdown measures put in place. However, constraints secondary to the pandemic have not significantly altered the management of these patients. Our data has given preliminary evidence of a shift in the presentation and management of trauma as a result of the COVID-19 pandemic. This study has given an indication of an imminent increase in trauma caused by assault during the lockdown period, accompanied by a rise in incidents occurring at home. Lastly, our data has shown that the provision of trauma care was not largely altered by the pandemic, in contrast with the changes in the delivery of elective and cancer surgery. Government and health systems should utilise available data and learnings from this period to establish strategies that optimise trauma care in preparedness for the second wave. Further research is required in order to assess long-term outcomes in these patients.

6. Funding Sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare that they have no conflict of interest.

- **Conflict of interest** The authors have no conflicts of interest to declare
- **Funding: No funding sources were received**
- **Ethical approval: Ethical approval was not required**
- **Informed consent:** Informed consent was not applicable

References

- Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. *J Am Med Assoc*. 2020;323:1061–1069.
- Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395:497–506.
- Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. 2020;382:1708–1720.
- World Health Organization. *Coronavirus Disease 2019 (COVID-19): Situation Report*. 72. 2020.
- Hampton M, Clark M, Baxter I, et al. The effects of a UK lockdown on orthopaedic trauma admissions and surgical cases. *Bone & Joint Open*. 2020;1:137–143.
- Hammad TA, Parikh M, Tashtish N, et al. *Impact of COVID-19 pandemic on ST-elevation myocardial infarction in a non-COVID-19 epicenter*. *Catheter Cardiovasc Interv*; 2020.
- Archer JE, Odeh A, Ereidge S, et al. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. *Lancet*. 396:27–38.
- British Orthopaedic Association. *Management of Patients with Urgent Orthopaedic Conditions and Trauma during the Coronavirus Pandemic*. London: British Orthopaedic Association; 2020.
- Haffer H, Schömig F, Rickert M, et al. Impact of the COVID-19 Pandemic on Orthopaedic and Trauma Surgery in University Hospitals in Germany: Results of a Nationwide Survey. *JBJS*. 9000;Latest Articles.
- Park C, Sugand K, Nathwani D, Bhattacharya R, Sarraf KM. Impact of the COVID-19 pandemic on orthopaedic trauma workload in a London level 1 trauma center: the “golden month”. *Acta Orthop*. 2020;1–6.
- Bram JT, Johnson MA, Magee LC, et al. Where have all the fractures gone? The epidemiology of pediatric fractures during the COVID-19 pandemic. *J Pediatr Orthop*. 2020;40(8):373–379.
- Christey G, Amey J, Campbell A, Smith A. Variation in volumes and characteristics of trauma patients admitted to a level one trauma centre during national level 4 lockdown for COVID-19 in New Zealand. *N Z Med J*. 2020;133:81–88.
- Núñez JH, Sallent A, Lakhani K, et al. Impact of the COVID-19 pandemic on an emergency traumatology service: experience at a tertiary trauma centre in Spain. *Injury*. 2020;51:1414–1418.
- Forrester JD, Liou R, Knowlton LM, Jou RM, Spain DA. Impact of shelter-in-place order for COVID-19 on trauma activations: santa clara county, California, March 2020. *Trauma Surg Acute Care Open*. 2020;5, e000505–e000505.
- Yang F, Lu X. The effect of COVID-19 on trauma system in one city of China. *Scand J Trauma Resuscitation Emerg Med*. 2020;28:57.
- Hernigou J, Morel X, Callewier A, Bath O, Hernigou P. Staying home during “COVID-19” decreased fractures, but trauma did not quarantine in one hundred and twelve adults and twenty eight children and the “tsunami of recommendations” could not lockdown twelve elective operations. *Int Orthop*. 2020;44(8):1473–1480. <https://doi.org/10.1007/s00264-020-04619-5>.
- Stoker S, McDaniel D, Crean T, et al. The effect of shelter-in-place orders and the COVID-19 pandemic on orthopaedic trauma at a community level II trauma center. *J Orthop Trauma*. 2020;34(9):e336–e342.
- Sobti A, Memon K, Bhaskar RRP, Unnithan A, Khaleel A. Outcome of trauma and orthopaedic surgery at a UK district general hospital during the covid-19 pandemic. *J Clin Orthop Trauma*. 2020;11(Suppl 4):S442–S445.
- Pichard R, Kopel L, Lejeune Q, Masmoudi R, Masmajejan EH. Impact of the CoronaVirus Disease 2019 lockdown on hand and upper limb emergencies: experience of a referred university trauma hand centre in Paris, France. *Int Orthop*. 2020:1–5.
- Garude K, Natalwala I, Hughes B, West C, Bhat W. Patterns of adult and paediatric hand trauma during the COVID-19 lockdown. *J Plast Reconstr Aesthetic Surg*. 2020;73(8):1575–1592.
- Meyer M, Solène P, Farah K, et al. Spine surgical procedures during coronavirus disease 2019 pandemic: is it still possible to take care of patients? Results of an observational study in the first month of confinement. *Asian Spine Journal*. 2020:14.
- Tamburrelli FC, Meluzio MC, Perna A, et al. Spinal surgery in COVID-19 pandemic era: one trauma hub center experience in central-southern Italy. *J Orthop*. 2020;22:291–293.
- Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med*. 2018;169:467–473.
- Hassan K, Prescher H, Wang F, Chang DW, Reid RR. Evaluating the effects of COVID-19 on plastic surgery emergencies: protocols and analysis from a level I trauma center. *Ann Plast Surg*. 2020;85(2S Suppl 2):S161–S165.
- Hashmi P, Fahad S, Naqi Khan H, Zahid M, Sadruddin A, Noordin S. Covid-19 pandemic: economic burden on patients with musculoskeletal injuries in a tertiary care hospital of LMIC; retrospective cross sectional study. *Ann Med Surg (Lond)*. 2020;60:5–8.
- Trowbridge S, Wignadasan W, Davenport D, Sarker S, Hunter A, Gidwani S. Is it safe to restart elective day-case surgery? Lessons learned from upper limb ambulatory trauma during the COVID-19 pandemic. *Journal of Clinical Orthopaedics & Trauma*. 2020;11:S700–S703.
- Diamond S, Lundy JB, Weber EL, et al. A call to arms: emergency hand and upper-extremity operations during the COVID-19 pandemic. *Journal of Hand Surgery Global Online*. 2020;2:175–181.
- Giuntoli M, Bonicoli E, Bugelli G, Valesini M, Manca M, Scaglione M. Lessons learnt from COVID 19: an Italian multicentric epidemiological study of orthopaedic and trauma services. *Journal of Clinical Orthopaedics & Trauma*. 2020;11:721–727.
- Probert AC, Sivakumar BS, An V, et al. Impact of COVID-19-related social restrictions on orthopaedic trauma in a level 1 trauma centre in Sydney: the first wave. *ANZ J Surg*. 2020.
- Lubbe RJ, Miller J, Roeher CA, et al. Effect of statewide social distancing and stay-at-home directives on orthopaedic trauma at a southwestern level 1 trauma center during the COVID-19 pandemic. *J Orthop Trauma*. 2020;34:e343–e348.
- Staunton P, Gibbons JP, Keogh P, Curtin P, Cashman JP, O’Byrne JM. Regional trauma patterns during the COVID-19 pandemic. The surgeon. *Journal of the Royal Colleges of Surgeons of Edinburgh and Ireland*. 2020;S1479–1666X(1420), 30115–30113.
- Halvachizadeh S, Teuben M, Berk T, Neuhaus V, Pape HC, Pfeifer R. The impact of SARS-CoV-2 (COVID-19) pandemic on trauma bay management and guideline adherence in a European level-one-trauma centre. *Int Orthop*. 2020;44:1621–1627.
- Gumina S, Proietti R, Villani C, Carbone S, Candela V. The impact of COVID-19 on shoulder and elbow trauma in skeletally immature population. *An Italian survey*. *JSES International*. 2020.
- Druel T, Andeol Q, Rongieras F, Bertani A, Bordes M, Alverne A. Evaluation of containment measures’ effect on orthopaedic trauma surgery during the COVID-19 pandemic: a retrospective comparison between 2019 and 2020. *Int Orthop*. 2020;44:2229–2234.
- Nabian MH, Vosoughi F, Najafi F, et al. Epidemiological pattern of pediatric trauma in COVID-19 outbreak: data from a tertiary trauma center in Iran. *Injury*. 2020;S0020–1383(20):30756–30757.
- Olding J, Zisman S, Olding C, Fan K. Penetrating trauma during a global pandemic: changing patterns in interpersonal violence, self-harm and domestic violence in the Covid-19 outbreak. *Surgeon*. 2020.
- Mitkovic MM, Bumbasirevic M, Milenkovic S, Gajdobranski D, Bumbasirevic V, Mitkovic MB. Influence of coronavirus disease 2019 pandemic state of emergency in orthopaedic fracture surgical treatment. *Int Orthop*. 2020:1–6.
- DiFazio LT, Curran T, Bilaniuk JW, et al. The impact of the COVID-19 pandemic on hospital admissions for trauma and acute care surgery. *Am Surg*. 2020;86:901–903.
- Qasim Z, Sjöholm LO, Volgraf J, et al. Trauma center activity and surge response during the early phase of the COVID-19 pandemic - the Philadelphia story. *J Trauma Acute Care Surg*. 2020;89(4):821–828.
- Morris D, Rogers M, Kissmer N, Du Preez A, Dufourq N. Impact of lockdown measures implemented during the Covid-19 pandemic on the burden of trauma presentations to a regional emergency department in Kwa-Zulu Natal, South Africa. *Afr J Emerg Med*. 2020. <https://doi.org/10.1016/j.afjem.2020.1006.1005>.
- Zagra L, Faraldi M, Pregliasco F, et al. Changes of clinical activities in an orthopaedic institute in North Italy during the spread of COVID-19 pandemic: a seven-week observational analysis. *Int Orthop*. 2020:1–8.
- Wong JSH, Cheung KMC. Impact of COVID-19 on orthopaedic and trauma service: an epidemiological study. *J Bone Joint Surg Am*. 2020;102:e80.
- Rinkoff S, Jemec B. Variation in volumes and characteristics of hand trauma patients seen during the early COVID-19 lockdown in a central London Plastic Surgery Unit. *Br J Surg*. 2020.
- Luceri F, Morelli I, Accetta R, Mangiavini L, Maffulli N, Peretti GM. Italy and COVID-19: the changing patient flow in an orthopedic trauma center emergency department. *J Orthop Surg Res*. 2020;15:323.
- Williams N, Winters J, Cooksey R. Staying home but not out of trouble: no reduction in presentations to the South Australian paediatric major trauma service despite the COVID-19 pandemic. *ANZ J Surg*. 2020. <https://doi.org/10.1111/ans.16277>.
- Wong FL, Antoniou G, Williams N, Cundy PJ. Disruption of paediatric orthopaedic hospital services due to the COVID-19 pandemic in a region with minimal COVID-19 illness. *J Child Orthop*. 2020;14:245–251.
- Rajput K, Sud A, Rees M, Rutka O. Epidemiology of trauma presentations to a major trauma centre in the North West of England during the COVID-19 level 4 lockdown. *Eur J Trauma Emerg Surg*. 2020:1–6.
- Jacob S, Mwangiru D, Thakur I, Moghadam A, Oh T, Hsu J. Impact of societal restrictions and lockdown on trauma admissions during the COVID-19 pandemic: a single-centre cross-sectional observational study. *ANZ J Surg*. 2020.
- Rhodes HX, Petersen K, Biswas S. Trauma trends during the initial peak of the COVID-19 pandemic in the midst of lockdown: experiences from a rural trauma center. *Cureus*. 2020;12, e9811.
- Leichtle SW, Rodas EB, Procter L, Bennett J, Schrader R, Aboutanos MB. The influence of a statewide “Stay-at-Home” order on trauma volume and patterns at a level 1 trauma center in the United States. *Injury*. 2020;51:2437–2441.
- Dhillon MS, Kumar D, Saini UC, Bhayana H, Gopinathan NR, Aggarwal S. Changing pattern of orthopaedic trauma admissions during COVID-19 pandemic: experience at a tertiary trauma centre in India. *Indian J Orthop*. 2020:1–6.
- Murphy T, Akehurst H, Mutimer J. Impact of the 2020 COVID-19 pandemic on the workload of the orthopaedic service in a busy UK district general hospital. *Injury*. 2020;51:2142–2147.
- Sherman WF, Khadra HS, Kale NN, Wu VJ, Gladden PB, Lee OC. How did the

- number and type of injuries in patients presenting to a regional level I trauma center change during the COVID-19 pandemic with a stay-at-home order? *Clin Orthop Relat Res.* 2020.
56. Rhodes HX, Petersen K, Lunsford L, Biswas S. COVID-19 resilience for survival: occurrence of domestic violence during lockdown at a rural American college of surgeons verified level one trauma center. *Cureus.* 2020;12, e10059.
 57. Antariksh Waghmare SS, Swapnil. Effect of Covid-19 lockdown in trauma cases of Rural India. *Int J Res Pharm Sci.* 2020;11:365–368.
 58. Wong JSH, Cheung KMC. Impact of COVID-19 on orthopaedic and trauma service: an epidemiological study. *J Bone Joint Surgery.* 2020;102, e80-e80. American volume.
 59. Poggetti A, Chiaro AD, Nucci AM, Suardi C, Pfanner S. How hand and wrist trauma has changed during covid-19 emergency in Italy: incidence and distribution of acute injuries. What to learn? *J Clin Orthop Trauma.* 2020. <https://doi.org/10.1016/j.jcot.2020.1008.1008>.
 60. Raitio A, Ahonen M, Jääskelä M, et al. Reduced number of pediatric orthopedic trauma requiring operative treatment during COVID-19 restrictions: a nationwide cohort study. *Scand J Surg.* 2020, 1457496920968014.
 61. Sugand K, Park C, Morgan C, et al. Impact of the COVID-19 pandemic on paediatric orthopaedic trauma workload in central London: a multi-centre longitudinal observational study over the “golden weeks”. *Acta Orthop.* 2020;1–6.
 62. Hamill JK, Sawyer MC. Reduction of childhood trauma during the COVID-19 Level 4 lockdown in New Zealand. *ANZ J Surg.* 2020. <https://doi.org/10.1111/ans.16108>.
 63. Zhu W, Yang J, Xu L, Fang S. A plunge in the number of traumatic traffic injuries in an emergency center in Anhui province, China. *Am J Emerg Med.* 2020.
 64. Akbarialiabad H, Abdolrahimzadeh Fard H, Abbasi HR, et al. Our experience of trauma management during novel coronavirus 2019 (COVID-19) pandemic in a busy trauma center in southern Iran. *Bull Emerg Trauma.* 2020;8:199–201.
 65. Zhu W, Li X, Wu Y, et al. Community quarantine strategy against coronavirus disease 2019 in Anhui: an evaluation based on trauma center patients. *Int J Infect Dis.* 2020;96:417–421.
 66. Greenhalgh M, Dupley L, Unsworth R, Boden R. Where did all the trauma go? A rapid review of the demands on orthopaedic services at a U.K. Major Trauma Centre during the COVID-19 pandemic. *Int J Clin Pract.* 2020, e13690.
 67. Luengo-Alonso G, Pérez-Tabernero FG-S, Tovar-Bazaga M, Arguello-Cuenca JM, Calvo E. Critical adjustments in a department of orthopaedics through the COVID-19 pandemic. *Int Orthop.* 2020;44:1557–1564.
 68. Oussedik S, Zagra L, Shin GY, D'Apolito R, Haddad FS. Reinstating elective orthopaedic surgery in the age of COVID-19. *Bone Joint Lett J.* 2020;102-b: 807–810.
 69. Sidpra J, Abomeli D, Hameed B, Baker J, Mankad K. Rise in the incidence of abusive head trauma during the COVID-19 pandemic. *Arch Dis Child.* 2020.
 70. Wu P, Liu X, Fang Y, et al. Alcohol abuse/dependence symptoms among hospital employees exposed to a SARS outbreak. *Alcohol Alcohol.* 2008;43: 706–712.
 71. Kehoe A, Smith J, Edwards A, Yates D, Lecky F. The changing face of major trauma in the UK. *Emerg Med J.* 2015;32:911–915.
 72. National Health Service. Clinical Guide for the Management of Noncoronavirus Patients Requiring Acute Treatment: Cancer 23 March 2020 Version 2.
 73. Saini KS, de Las Heras B, de Castro J, et al. Effect of the COVID-19 pandemic on cancer treatment and research. *Lancet Haematol.* 2020;7:e432–e435.
 74. Maringe C, Spicer J, Morris M, et al. The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population-based, modelling study. *Lancet Oncol.* 2020;21:1023–1034.