

Original Research Article

Examining the 2019 Novel Coronavirus Disease (COVID-19) Pandemic on Traumatic Hip and Lower Extremity Orthopedic Cases: A Systematic Review and Meta-analysis

Ahmadin Y. R. Susatyo^{1,2}, Ridha A. Dalimunthe³, Farhan H. F. Rahman^{1,2}, Ismail H. Dilogo⁴

¹General Practitioner, Faculty of Medicine Universitas Airlangga, Surabaya, Indonesia

²General Practitioner, Metropolitan Medical Center Hospital, Jakarta Indonesia

³General Practitioner, Faculty of Medicine Universitas Prima Indonesia, Medan, Indonesia

⁴Orthopedic and Traumatology Departement, Cipto Mangunkusumo National Hospital, Jakarta, Indonesia

ABSTRACT

Background: The 2019 novel coronavirus disease (COVID-19) pandemic made a significant impact on daily traumatic orthopedic practice. Specifically, recent studies reported a notable reduction in traumatic hip and lower extremity orthopedic case admission. This study aims to examine the impact of the COVID-19 pandemic on traumatic hip and lower extremity orthopedic cases and surgery compared to the pre-pandemic period.

Methods: A systematic literature search was conducted through PubMed, ScienceDirect, and Cochrane Library, published up to January 2022 following the PRISMA guideline. We assessed the study quality using the Newcastle-Ottawa scale (NOS). The primary outcome analyzed in this study was traumatic hip and lower extremity admission case number and surgical case number, both measured as risk ratio (RR) with 95% confidence intervals (CIs). The analysis was performed using Review Manager 5.4 and STATA 17.

Results: A total of 17 studies met the inclusion criteria for the analysis. The overall analysis reported an estimated 52.7% reduction in traumatic hip and lower extremity admission during the COVID-19 pandemic, which was indicated by our pooled analysis (RR 0,89, 95% CI 0.82, 0.96, p=0.002). Meanwhile, there is no significant difference for the surgical cases (RR 1.01, 95% CI 0.94, 1.08, p=0.80). Egger's test result showed no evidence of small-study effects (p=0.22).

Conclusion: This study showed that traumatic hip and lower extremity admission significantly decreased during the pandemic period compared to the pre-pandemic period. Meanwhile, the surgical case was not significantly affected

Keywords: COVID-19; hip and lower extremity; trauma; surgery
<https://doi.org/10.31282/joti.v5n1.85>

Corresponding author: Ridha A. Dalimunthe, MD. Email: ridhaswina@gmail.com

INTRODUCTION

The 2019 novel coronavirus disease (COVID-19) outbreak is an ongoing global pandemic caused by the SARS (severe acute respiratory syndrome) CoV-2 virus.¹ It has rapidly spread to more than 200 countries and territories worldwide, infecting around six million people.² This outbreak has caused a shift of habit in the population that people tend to stay at home. This outbreak started from the report of the first case at the end of December 2019 in the city of Wuhan. The Chinese people had a great reaction trying to contain the virus in a first red zone, progressively blocking the social and work activities in the whole country and activating extraordinary health measures such as the construction of new “COVID-19” hospitals.³

The initial rapid increase in the number of cases had a huge impact on worldwide medical and public health institutions.⁴ Subsequently, the government took a series of measures to respond to the outbreak, including the establishment of new hospitals for infected patients and square cabin hospitals to quarantine suspected patients. A strategy of community quarantine was also widely adopted in urban populations for medical observation.⁴

Furthermore, governments across the world, have put in place various restrictions on the mobility of populations to limit the spread of COVID-19.⁵ For example in France, the authorities decided to impose a lockdown period for three months to reduce contact rates in the population.⁶ As the population is confined, a major decrease in road traffic, workers at risky workplaces, and outdoor leisure activities were observed. Conversely, the risk of domestic accidents and acts of violence seemed to increase. These social changes can have an impact on the type of lower extremity injuries requiring emergency room.

There is much demand for hospitals to suspend their elective surgery case.⁷ In addition, orthopedic scientific societies published guidelines specific to orthopedic surgery during the COVID-19 outbreak and developed protocols for evaluating which operations should be done urgently and which should be delayed.^{8,9} In the end, surgeons have been redeployed to different units to provide medical and paramedical assistance in emergency departments, COVID-19 units, and intensive care units.¹⁰ In Paris hospitals, for example, surgical activity has drastically decreased. As much as 65% less activity in scheduled orthopedic surgery was

observed.¹¹

The present study was performed to evaluate the impact of the COVID-19 pandemic on activity related to the emergency case in hip and lower extremity trauma, specifically the surgical case.

MATERIAL AND METHODS

A literature search was performed across electronic databases, such as Cochrane Library, PubMed, and Science Direct published up to January 2022. The literature search was performed according to the preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines.

ELIGIBILITY CRITERIA

Study inclusion criteria were all-accessible retrospective studies written in English, studies evaluating the impact of COVID-19 on hip and lower extremity trauma cases, and studies published in the past three years. Meanwhile, the exclusion criteria were inaccessible full text and irrelevant outcomes. The evaluated outcomes should include at least one traumatic hip and lower extremity admission case number or surgical case number.

DATA COLLECTION & STATISTICAL ANALYSIS

All studies were included based on eligibility criteria assessed using the Newcastle-Ottawa scale (NOS). Study heterogeneity was evaluated using the I^2 test. We considered a quantitative analysis as statistically significant if the p-value is less than 0.05. All analyses were performed using statistical software STATA 17 and Review Manager 5.4.

RESULTS

The article selection process was carried out according to PRISMA guidelines. Initial study searching resulted in 128 articles, which all were processed using the EndNote application for study duplication. According to our inclusion criteria, the remaining 92 studies were then assessed manually by all authors. As many as 28 articles were further analyzed for eligibility, resulting in seventeen studies analyzed for final qualitative and quantitative analysis.

1. Traumatic Hip & Lower Extremity Admission Case

A total of 17 studies met the inclusion criteria for the first outcome pooled analysis. The overall analysis

Author	Year	Country	Study Design	Average Age in Years (Mean±SD)	
				Pre-Pandemic	During Pandemic
Alonso, et al	2020	Spain	Retrospective	58.45 ± 16.78	
Andreozzi, et al	2020	Italy	Retrospective	51.9 ± 24.8	41.4 ± 25.7
Frink, et al	2021	Germany	Retrospective	45.13 ± 23.61	50.53 ± 23.85
Giuntoli, et al	2020	Italy	Retrospective	N/A	N/A
Hampton, et al	2020	United Kingdom	Retrospective	55 ± 10.62	66 ± 9.25
Heaps, et al	2021	USA	Retrospective	N/A	N/A
Karia, et al	2020	United Kingdom	Retrospective	57 ± 13.19	70.5 ± 9.44
Lubbe, et al	2020	USA	Retrospective	45 ± 23.5	44.9 ± 24
Luceri, et al	2020	Italy	Retrospective	41.2 ± 23.5	56.3 ± 23.9
Mitcovic, et al	2020	Serbia	Retrospective	66.1 ± 15.6	63.7 ± 18.1
Park, et al	2020	United Kingdom	Retrospective	43.5 ± 19	50 ± 20
Reddy, et al	2020	India	Retrospective	N/A	N/A
Ribau, et al	2021	Portugal	Retrospective	67.1 ± 20.5	70.7 ± 19.8
Sugand, et al	2020	United Kingdom	Retrospective	52.2 ± 27.9	55.8 ± 27.9
Waghmare, et al	2020	India	Retrospective	N/A	N/A
Wong, et al	2020	Australia	Retrospective	N/A	N/A
Yu, et al	2020	China	Retrospective	76.7 ± 12.4	77.3 ± 14.9

Table 1. Summary of the study included in the meta-analysis.

reported an estimated overall 52.7% reduction in traumatic hip and lower extremity orthopedic case admission during the COVID-19 pandemic.

Pooled analysis in figure 1 showed a significant reduction in traumatic hip and lower extremity admission cases between the pandemic era and before the pandemic era (RR 0,89, 95% CI 0.82, 0.96, p=0.002). A random-effect analysis model was chosen because of significant heterogeneity in both groups ($I^2=68\%$).

2. *Traumatic Hip & Lower Extremity Admission Case*
Six studies, including 2384 participants, allocated into the COVID-19 pandemic group (n=821) and pre-pandemic COVID-19 group (n=1563) described the traumatic hip and lower extremity surgical case. However, in the perspective of traumatic hip and lower extremity surgical cases, the pooled analysis didnot show any significant difference between bothperiods (RR 1.01, 95% CI 0.94, 1.08,p=0.80). A random-effect model was selected for the

calculation due to significant heterogeneity among the trials ($I^2=37\%$). Egger's test result showed no evidence of small-study effects ($p=0.22$).

DISCUSSION

The COVID-19 pandemic quickly spread around the world in early 2020, leading to major changes in healthcare delivery.² In this study, it is shown that covid reduced the number of traumatic cases in hospital admission by 52.7% when compared to the pre-pandemic period, especially for hip and lower extremity trauma.

Consequently, as the Government restricted people's outdoor activity during the pandemic, the number of traffic accidents on the road was decreasing. Nunez et al. reported a 78.6% reduction in traffic accident admissions at a tertiary trauma center in Spain.¹² Other studies from Italy, the UK, India, and the USA confirmed these findings with similar data.^{13,14,15} These findings are from a study by, Zhu et al., which reported that the highest cause of the trauma is due to traffic accidents on the road.¹⁶

Similarly, there was a decrease in the number of sports injuries that could be attributed to the cessation of outdoor activity.¹⁷ This is also illustrated by several articles that during the pandemic, people's activities

outside the home are notably reduced, while the cause of the trauma cases in hospitals often comes from road accidents.

Data obtained from Giuntoli et al. shows a 57.2% decrease in domestic accidents, but on the contrary, according to Andrea et al., the number of domestic hand and wrist injuries increased threefold.^{18,19} It is likely that this increase was because people spent more time at home. Besides, people injured at home might not seek healthcare due to fear of contracting COVID-19. Some injuries might require immediate local treatment, so telemedicine could be an option for providing safe and effective healthcare services in the outpatient setting.²⁰

In this study, it was also found that even though the number of trauma visits in the hospital was decreasing and there was a relative decline in surgical cases, in quantitative analysis there is no significant difference in the pre-pandemic and during the COVID-19 pandemic period for surgical cases.

There are still few studies that report the number of hips and lower trauma surgery cases during the COVID-19 pandemic, which is a limitation of this study. In addition to the lack of exclusion criteria and low evidence from the included studies. Most research specifically referred to the first major wave of the COVID-19 pandemic. As a result, the impact may seem excessive in the current

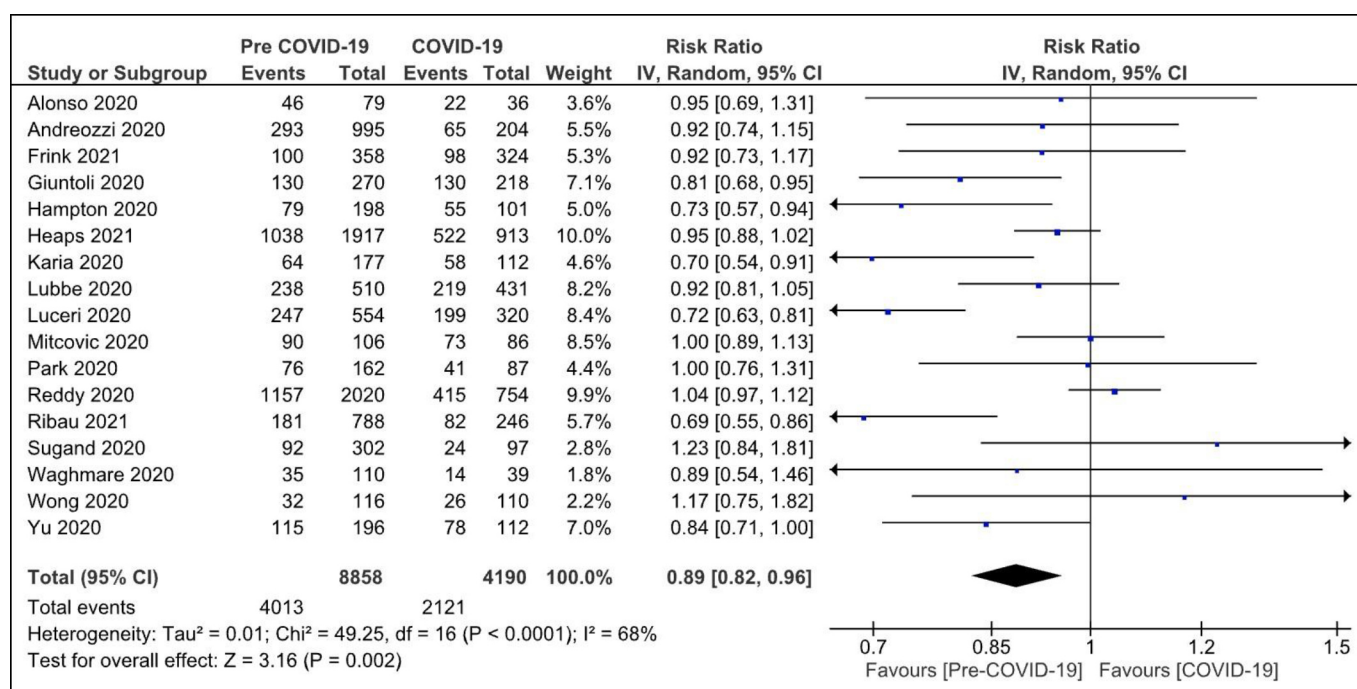


Figure 1. The forest plot of the COVID-19 pandemic affects the traumatic hip and lower extremity admission cases

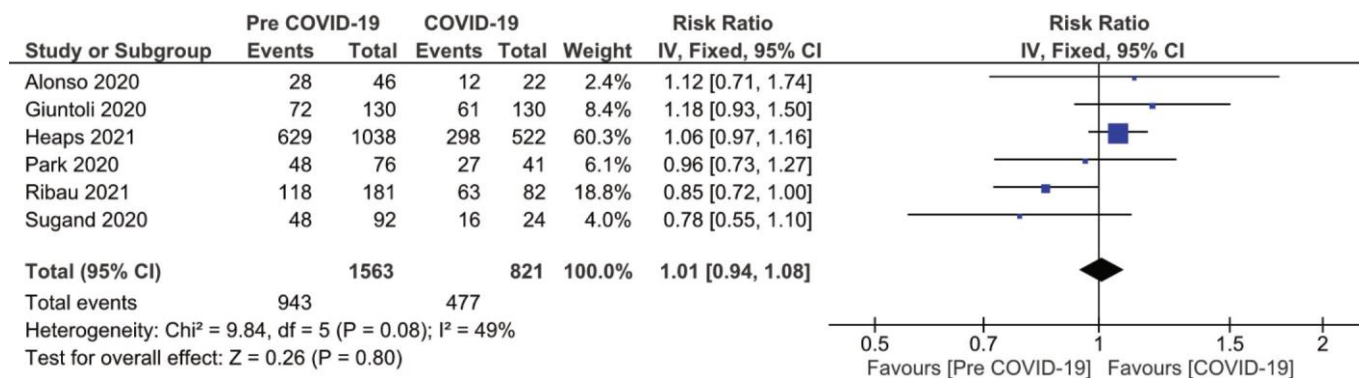


Figure 2. Forest plot of the COVID-19 pandemic effect on traumatic hip and lower extremity surgical case

situation. A major strength is multivarious of the included literature, which can provide an overall view and point of view on the impact of the COVID-19 pandemic on hip and lower extremity trauma cases and surgery. Our Suggestions for the next studies with broader demographics are needed to improve the accuracy of the existing studies with more updated timelines.

CONCLUSION

During the COVID-19 pandemic, there was a significant decrease in the admission of patients with hip and lower extremity trauma when compared to the pre-pandemic period, although the number of hips and lower extremity surgeries was not significantly affected.

REFERENCES

- Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, Zhao X, Huang B, Shi W, Lu R, Niu P, Zhan F, Ma X, Wang D, Xu W, Wu G, Gao GF, Tan W (2020) China novel coronavirus investigating and re- search team. A novel coronavirus from patients with pneumonia in China. *N Engl J Med* 382(8):727–733.
- COVID-19 Map [Internet] (2020) Johns Hopkins Coronavirus Resource Center. [cited 7 June 2020]. Available from: <https://coronavirus.jhu.edu/map.html>
- Wang LS, Wang YR, Ye DW, Liu QQ. A review of the 2019 Novel Coronavirus (COVID-19) based on current evidence". *Int J Antimicrob Agents*. 2020 Mar;19: 105948. <https://doi.org/10.1016/j.ijantimicag.2020.105948>.
- Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med* 2020;
- Vaughan A. Italy in lockdown. *New Sci* 2020; 245 (3273):7.
- Décret n° 2020-293, du 23 mars 2020 prescrivant les mesures générales nécessaires pour faire face à l'épidémie de covid-19 dans le cadre de l'état d'urgence sanitaire
- Gregory TM, Bihel T, Guigui P et al (2016) Terrorist attacks in Paris: surgical trauma experience in a referral center. *Injury* 47: 2122–2126. <https://doi.org/10.1016/j.injury.2016.08.014>
- Ministère des solidarités et de la santé (2020) Préparation à la phase épidémique de Covid-19. Établissements de sante Médecine de ville Établissements et services médico-sociaux. Guide Méthodologique
- Sarac NJ, Sarac BA, Schoenbrunner AR et al (2020) A review of state guidelines for elective orthopedic procedures during the COVID-19 outbreak. *J Bone Joint Surg Am* 0(0):1–4. <https://doi.org/10.2106/JBJS.20.00510>
- DePhillipo NN, Larson CM, O'Neill OR, LaPrade RF (2020) Guidelines for ambulatory surgery centers for the care of surgically necessary/time-sensitive orthopedic cases during the COVID-19 pandemic. *J Bone Joint Surg Am* 0(0):1–4. <https://doi.org/10.2106/JBJS.20.00489>.
- Ghogawala Z, Kurpad S, Falavigna A et al (2020) Editorial. COVID-19 and spinal surgery. *J Neurosurg Spine*:1–3. <https://doi.org/10.3171/2020.4.SPINE20468>
- Nuñez JH, Sallent A, Lakhani K, Guerra-Farfan E, Vidal N, Ekhtiari S and Minguell J: Impact of the COVID-19 Pandemic on an Emergency Traumatology Service: Experience at a tertiary trauma centre in Spain. *Injury* 51(7): 1414-1418, 2020. PMID: 32405089. DOI: 10.1016/j.injury.2020.05.016
- Benazzo F, Rossi SMP, Maniscalco P, Moretti B, Vaienti E, Ruggieri P, et al (2020) The orthopedic and traumatology scenario during Covid-19 outbreak in Italy: chronicles of a silent war. *Int Orthop*. 2020 Aug;44(8):1453-1459. doi: 10.1007/s00264-020-04637-3. Epub 2020 Jun 26. PMID: 32591960; PMCID: PMC7319215..

14. Lubbe RJ, Miller J, Roehr CA, Allenback G, Nelson KE, Bear J, Kubiak EN. Effect of Statewide Social Distancing and Stay-At-Home Directives on Orthopedic Trauma at a Southwestern Level 1 Trauma Center During the COVID-19 Pandemic. *J Orthop Trauma*. 2020 Sep;34(9):e343-e348. doi: 10.1097/BOT.0000000000001890. PMID: 32815849; PMCID: PMC7446999.
15. Dhillon MS, Kumar D, Saini UC, Bhayana H, Gopinathan NR, Aggarwal S. Changing Pattern of Orthopedic Trauma Admissions During COVID-19 Pandemic: Experience at a Tertiary Trauma Centre in India. *Indian J Orthop*. 2020 Aug 28;54(Suppl 2):374-379. doi: 10.1007/s43465-020-00241-0. PMID: 32873987; PMCID: PMC7453127.
16. 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 Oct;38(10):2230-2231. doi: 10.1016/j.ajem.2020.03.027. Epub 2020 Mar 20. PMID: 3222316; PMCID: PMC7270509.
17. Park C, Sugand K, Nathwani D, Bhattacharya R, Sarraf KM. Impact of the COVID-19 pandemic on orthopedic trauma workload in a London level 1 trauma center: the "golden month". *Acta Orthop*. 2020 Oct;91(5):556-561. doi: 10.1080/17453674.2020.1783621. Epub 2020 Jun 23. PMID: 32573331; PMCID: PMC8023929.
18. Giuntoli, Michele, Enrico Bonicoli, Giulia Bugelli, Massimo Valesini, Mario Manca and Michelangelo Scaglione. "Lessons learnt from COVID 19: An Italian multicentric epidemiological study of orthopaedic and trauma services." *Journal of Clinical Orthopaedics and Trauma* 11 (2020): 721 - 727.
19. Poggetti A, Del Chiaro A, 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*. 2021 Jan;12(1):22-26. doi: 10.1016/j.jcot.2020.08.008. Epub 2020 Sep 9. PMID: 32921952; PMCID: PMC7480256.
20. 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):373e379.
21. Luengo-Alonso G, Pérez-Tabernerero FG, Tovar-Bazaga M, Arguello-Cuenca JM, Calvo E. Critical adjustments in a department of orthopaedics through the COVID-19 pandemic. *Int Orthop*. 2020 Aug;44(8):1557-1564. doi: 10.1007/s00264-020-04647-1. Epub 2020 May 30. PMID: 32474718; PMCID: PMC7260474.
22. Andreozzi V, Marzilli F, Muselli M, Previ L, Cantagalli MR, Princi G, Ferretti A. The impact of COVID-19 on orthopaedic trauma: A retrospective comparative study from a single university hospital in Italy. *Orthop Rev (Pavia)*. 2021 Jan 28;12(4):8941. doi: 10.4081/or.2020.8941. PMID: 33585026; PMCID: PMC7874950.
23. Hampton M, Clark M, Baxter I, Stevens R, Flatt E, Murray J, Wembridge K. The effects of a UK lockdown on orthopaedic trauma admissions and surgical cases: A multicentre comparative study. *Bone Jt Open*. 2020 Jul 21;1(5):137-143. doi: 10.1302/2633-1462.15.BJO-2020-0028.R1. PMID: 33241224; PMCID: PMC7684391.
24. Heaps BM, Ladnier K, Haselman WT, Limpisvasti O, Banffy MB. Epidemiologic impact of COVID-19 on a multi-subspecialty orthopaedic practice. *J Orthop*. 2021 May-Jun;25:151-154. doi: 10.1016/j.jor.2021.05.011. Epub 2021 May 6. PMID: 33972818; PMCID: PMC8099547.
25. 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 Aug;44(8):1473-1480. doi: 10.1007/s00264-020-04619-5. Epub 2020 May 25. PMID: 32451655; PMCID: PMC7247744.
26. Karia M, Gupta V, Zahra W, Dixon J, Tayton E. The effect of COVID-19 on the trauma burden, theatre efficiency and training opportunities in a district general hospital: planning for a future outbreak. *Bone Jt Open*. 2020 Aug 18;1(8):494-499. doi: 10.1302/2633-1462.18.BJO-2020-0074.R1. PMID: 33215144; PMCID: PMC7659630.
27. Lubbe RJ, Miller J, Roehr CA, Allenback G, Nelson KE, Bear J, Kubiak EN. 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 Sep;34(9):e343-e348. doi:10.1097/BOT.0000000000001890. PMID:32815849;PMCID: PMC7446999.
28. 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 Aug 14;15(1):323. doi: 10.1186/s13018-020-01816-1. PMID: 32795347; PMCID: PMC7426894.
29. Frink M, Ketter V, Klama N, Knauf T, Betz S, Ruchholtz S, Aigner R. Effect of coronavirus (COVID-19) pandemic on orthopedic trauma patients presenting in the emergency department of a maximum care hospital and level 1 trauma center. *Arch Orthop Trauma Surg*. 2021 Nov 9:1-6. doi: 10.1007/s00402-021-04234-y. Epub ahead of print. PMID: 34751810; PMCID: PMC8576456.
30. Mitkovic MM, Bumbasirevic M, Milenkovic S, Gajdibranski D, Bumbasirevic V, Mitkovic MB.

- Influence of coronavirus disease 2019 pandemic state of emergency in orthopaedic fracture surgical treatment. *Int Orthop*. 2021 Apr;45(4):815-820. doi: 10.1007/s00264-020-04750-3. Epub 2020 Jul 29. PMID: 32728928; PMCID: PMC7389160.
31. Maryada VR, Mulpur P, Guravareddy AV, Pedamallu SK, Vijay Bhasker B. Impact of COVID-19 Pandemic on Orthopaedic Trauma Volumes: a Multi-Centre Perspective From the State of Telangana. *Indian J Orthop*. 2020 Aug 13;54(Suppl 2):368-373. doi: 10.1007/s43465-020-00226-z. PMID: 32836367; PMCID: PMC7423500.
 32. Onafowokan OO, Atypical bilateral femoral fractures: a rare adverse effect of long-term bisphosphonate use *BMJ Case Reports CP* 2021;14:e246156.
 33. Ribau A, Vale J, Xará-Leite F, Rodrigues-Pinto R. Impact of COVID-19 pandemic and national lockdown in an orthopaedic and traumatology department-a comparison with the homologous period of 2019. *Porto Biomed J*. 2021 Jan 18; 6(1):e109. doi: 10.1097/j.pbj.000000000000109. PMID: 33490702; PMCID: PMC7817277.
 34. Sugand K, Park C, Morgan C, Dyke R, Aframian A, Hulme A, Evans S, Sarraf KM, Baker C, Bennett-Brown K, Simon H, Bray E, Li L, Lee N, Pakroo N, Rahman K, Harrison A. 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 Dec;91(6):633-638. doi:10.1080/17453674.2020.1807092. Epub 2020 Aug 24. PMID: 32835573; PMCID: PMC8023947.
 35. Waghmare, Antariksh & Shrivastava, Sandeep & Date, Swapnil. (2020). Effect of Covid-19 lockdown in trauma cases of Rural India. *International Journal of Research in Pharmaceutical Sciences*. 11. 365-368. 10.26452/ijrps.v11iSPL1.2727.
 36. 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 Aug 1;14(4):245-251. doi: 10.1302/1863-2548.14.200140. PMID: 32874355; PMCID: PMC7453176.
 37. Yu P, Wu C, Zhuang C, Ye T, Zhang Y, Liu J, Wang L. The patterns and management of fracture patients under COVID-19 outbreak in China. *Ann Transl Med*. 2020 Aug;8(15):932. doi: 10.21037/atm-20-4174. PMID: 32953732; PMCID: PMC7475431.