



Reduction prevalence of fragility fracture hospitalisation during the COVID-19 lockdown

Philippe de Souto Barreto^{1,2,3} · Didier Fabre⁴ · Bruno Vellas^{1,2} · Hubert Blain⁵ · Laurent Molinier⁴ · Yves Rolland^{1,2}

Received: 5 November 2021 / Accepted: 15 March 2022
© International Osteoporosis Foundation and National Osteoporosis Foundation 2022

Abstract

Summary Fracture hospitalizations of people ≥ 65 years old living in France increased annually from 2015 until 2019 (average: 1.8%), until being reduced in 2020 (−1.4%) with an abrupt decrease during the lockdown period. Decreased exposure to the risk of falling during COVID-19 year 2020 may have reflected in lower incidence of fractures.

Keywords Older adult · Fracture · Lockdown · COVID

Introduction

Stay-at-home measures during COVID-19 have resulted in sedentary lifestyle and have limited individuals' opportunity to do regular physical activity (PA) in daily life, including leisure-time, occupational and commuting PA. By doing so, containment decreased the exposure to potential fall-related situations and, probably, fractures. However, this measure possibly contributed in older adults to de-training consequences, including decreased mobility, muscle strength and bone health; these deleterious consequences, in turn, might increase the risk of falls and fractures. Therefore, stay-at-home measures represent an ideal real-life situation to test the benefit-risk balance of an extreme public health initiative. Beyond the prevention of infection, what has been the impact of these unprecedented lockdown measures on fractures?

The French lockdown was reported to be the strictest and the best followed. This health situation reduced exposure to the risk of falling but raised fears of an epidemic of fractures, due to sedentary-related decreases in mobility and bone health, after containment as an insidious consequence of stay-at-home measures. Indeed, rebound effects after severe reductions in physical activity (prolonged bed rest during hospitalization, physical or drug restraint) are frequently feared in geriatric medicine [1]. It leads to decreases in physical and functional performances such as decrease in walking speed, time to rise from a chair, grip strength, and finally results in falls and fractures [1]. Even a decrease in walking speed as low as 0.1 cm s^{-1} per week predict falls in older adults [2]. The prevention of iatrogenic dependence in geriatric medicine [3] is based, in particular, on physical mobilization. During the COVID-19 outbreak, international geriatric recommendations highlighted the importance of maintaining physical activity at home during lockdown [4] as well as in hospitalized or long-term care (LTC) patients with COVID, sometimes isolated in their rooms [5]. In the 1990s, 25 to 85% of residents of LTC facilities were physically contained in bed or chair to prevent falls. Tinetti et al. demonstrated that physical restraint ultimately increased the risk of falls and injury, probably due to the loss of muscle strength, coordination and balance during the restraint period. Such observations led to the development of good practice recommendations and allowed a radical reduction of restraint practices in LTC facilities [6]. To a lesser extent, the stay-at-home measures also contained elderly people in their homes. If the periods before, during and after the stay-at-home measures were leading to more or less falls and

✉ Philippe de Souto Barreto
philipebarreto81@yahoo.com.br

¹ CERPOP UMR1295, University of Toulouse III, Inserm, UPS, Toulouse, France

² Gerontopole of Toulouse, Institute of Aging, Toulouse University Hospital (CHU Toulouse), Toulouse, France

³ Gérontopôle de Toulouse, Institut du Vieillessement, 37 Allées Jules Guesde, 31000 Toulouse, France

⁴ Department of Medical Information, Toulouse University Hospital (CHU Toulouse), Toulouse, France

⁵ Department of Internal Medicine and Geriatrics, MUSE University, Montpellier, France

fractures at the population level remains to be ascertained. Currently, the few investigations looking at fractures [7–9] during COVID-19 reported a reduction of fracture during the lockdown. On the other hand, some authors from various European countries have reported no changes in low-energy fractures rate during lockdown period [10–13]. These studies have however, small sample size, were not focused on older adults, did not investigate the rebound effect (i.e. potential increase in fractures immediately after stay-at-home measures) or have not compared fracture trends over several years.

The aim of the study was to describe the number of hospitalizations for fracture per month and per year from 2015 to 2020 with a focus on the COVID-19 lockdown period (March 17, 2020–May 10, 2020) and after this period in people ≥ 65 years old in France.

Methods

We report the month-by-month evolution of fracture hospitalizations over the 5 years before COVID-19 (2015–2019) and the year 2020 for people ≥ 65 years old living in France, with a particular attention for the strictest lockdown period between mid-March and mid-May. Using aggregated data from the French national database PMSI, which compiles all hospitalizations in France, we selected hospital admissions due to the following fractures (ICD-10 code): femur neck (S72.0), trochanter (S72.1), sub-trochanter (S72.2), diaphysis (S72.3), lower extremity of femur (S72.4), upper

(S42.2) and lower end of humerus (S42.4), lower end of radius (S52.5) and ulna (S52.6).

We performed pairwise comparisons of proportions between consecutive years as well as regarding the lockdown months (i.e. March, April, May) between the year 2019 and the COVID year 2020. In these proportions, the numbers of fractures were the numerator and the exposed population (i.e. total number of French individuals 65 or over) was the denominator. The number of people aged 65 or over across the years 2015–2020 were obtained from the official French Institute of Statistics INSEE [14]; this data was released in 2021 in a publication of the projections of the French population for the next decades up to the year 2070. We applied the chi-square test using the command “tabi” in Stata version 17 (StataCorp LLC, College Station, Texas, USA), with $p < 0.05$ defining statistically significant differences.

Results

Figure 1 shows the total number of fracture hospitalizations per month and year and percentage of hospitalizations of fracture in that month of the years 2015 to 2020 in people 65 years or older living in France. Table 1 reports the daily number of fracture admissions before, during, and after the first lockdown in France (and data for the same period in 2019), which occurred from March 17, 2020 to May 10, 2020. In the 11th of May, France was no longer in lockdown. Fracture hospitalizations increased annually from 2015 until 2019 (between 1.3% and 2.3% per year; average: 1.8%), until

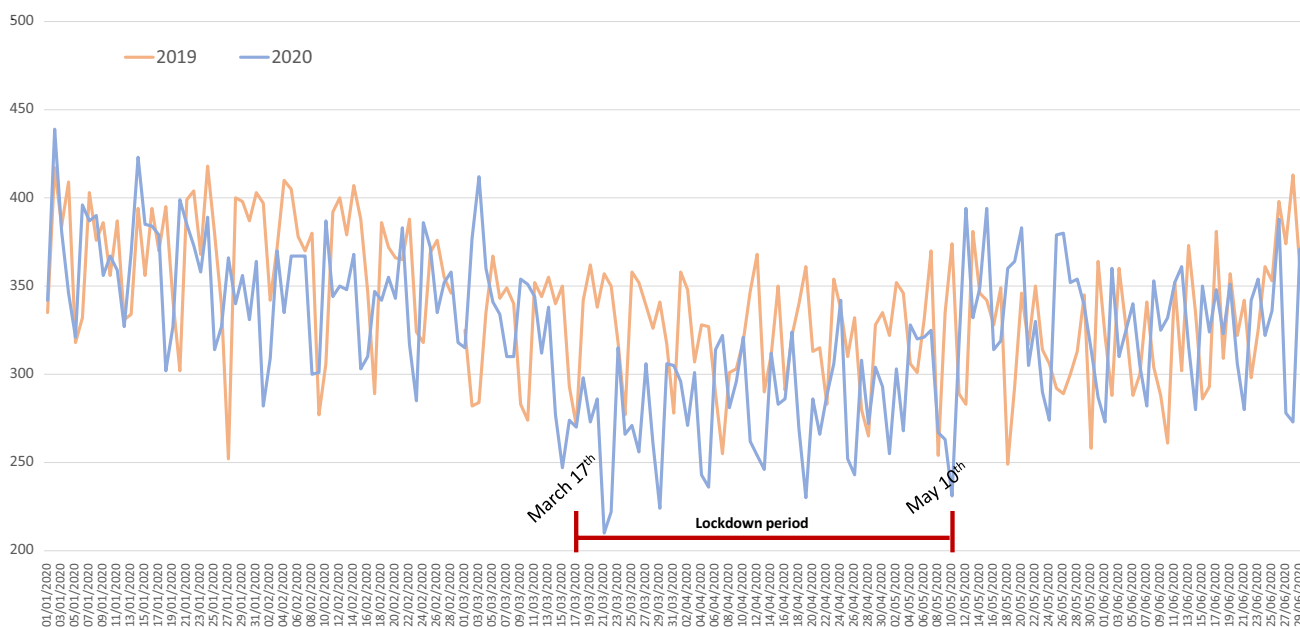


Fig. 1 Daily number of fracture admissions before, during, and after the first lockdown in France (and data for the same period in 2019), which occurred from March 17, 2020 to May 10, 2020 (in the 11th May, France was no longer in lockdown)

Table 1 Number (% of hospitalizations in that month/year) of hospitalizations due to fracture per month and year (2015–2020) in people 65 years or older living in France

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (100%)
2015	7696 (8.1)	7208 (7.6)	8122 (8.5)	8079 (8.5)	7435 (7.8)	8151 (8.6)	8366 (8.8)	7795 (8.2)	7939 (8.3)	8067 (8.5)	7698 (8.1)	8465 (8.9)	95,021
2016	7678 (7.9)	7841 (8.1)	8317 (8.6)	7782 (8.0)	8133 (8.4)	7886 (8.1)	7871 (8.1)	8479 (8.7)	7948 (8.2)	8275 (8.5)	8187 (8.4)	8729 (9.0)	97,126
2017	9033 (9.1)	7823 (7.9)	8535 (8.6)	7715 (7.8)	8235 (8.3)	8114 (8.2)	7882 (7.9)	8350 (8.4)	7947 (8.0)	8503 (8.6)	8568 (8.6)	8619 (8.7)	99,324
2018	8838 (8.8)	7986 (7.9)	8798 (8.7)	7820 (7.8)	8625 (8.6)	7862 (7.8)	8427 (8.4)	8337 (8.3)	7913 (7.9)	9111 (9.0)	8301 (8.2)	8584 (8.5)	100,602
2019	9240 (9.1)	8169 (8.0)	8292 (8.1)	8325 (8.1)	8431 (8.2)	7794 (7.6)	9134 (8.9)	8336 (8.2)	8201 (8.0)	8900 (8.7)	8227 (8.0)	9048 (8.9)	102,097
2020	9265 (9.2)	8025 (8.0)	8719 (8.6)	7269 (7.2)	7703 (7.6)	8503 (8.4)	8756 (8.7)	8010 (7.9)	8776 (8.7)	8787 (8.7)	7987 (7.9)	8894 (8.8)	100,694

being reduced in 2020 (1.4% reduction). Although a reduction in the number of fracture hospitalizations is observed in most of the years between March and April, this decrease was steeper for the year 2020. The percentage of fracture hospitalizations in April was the lowest in the COVID year 2020 (7.2%) compared to the 2015–2019 period (range from 7.8 to 8.5%). Fracture hospitalization proportions were not different between the years 2018 and 2019, but differences were very significant ($p < 0.001$) between 2019 and 2020, with lower fracture hospitalisation proportion for the COVID-19 year 2020. Furthermore, when comparing the same lockdown months between 2019 and 2020, we found no differences for March ($p = 0.058$), but significant differences for both April ($p < 0.001$) and May ($p < 0.001$) which lower proportions for these months in the COVID-19 year 2020.

Considering the mean + 1.8% annual increased number of fracture hospitalizations between 2015 and 2019, it would be expected an increase of 1838 fracture hospitalizations above the numbers of 2019, which suggests we observed a reduction of 3241 fracture hospitalizations during the COVID-19 pandemic for the year 2020 in people ≥ 65 years old living in France. From May 11, 2020, the number of fracture hospitalizations increased to the levels before lockdown (similar to the levels found in 2019). Therefore, after the decrease in the number of fracture hospitalizations in older adults living in France during a strict COVID-19 lockdown, an increase in fracture hospitalizations was not observed.

Discussion

The decrease in fracture hospitalizations was the most evident during April 2020, the sole full-length month covered by a strict lockdown. Interestingly, the decrease in fracture hospitalizations in 2020 occurred even though the evolution trend observed in the past 5 years was in constant increase. Given the systematic increase of the French population 65 years old and over, individuals more prone to sustain fractures, observed from 2015 to 2021 [14], the reductions of fracture hospitalizations in 2020 are unlikely to have occurred in the absence of population containment. Surprisingly, after the lockdown, these numbers did not increase above the levels observed before lockdown, as it could be expected if the lockdown had had important deleterious effects on physical function and bone health. Indeed, since the selected fractures are the most serious consequence of falls due to mobility impairment in older people, it is possible that the stay-at-home measure did not have a substantial detrimental effect on physical function in people ≥ 65 years. This argument must be interpreted with caution, since individuals may have had their mobility impaired even if they did not sustain a

fracture. Another hypothesis for fracture reduction is that decreased exposure to the risk of falling remained, to some extent, even after the end of lockdown, with older adults diminishing their physical activities both voluntarily (e.g. avoiding group activities for fear of being infected) and involuntarily (e.g. facilities for the practice of physical activity remained closed for several months). This non-exposure to the risk of falling or the adjustment of risk-taking with regard to their new functional capacities could explain the non-increase in the number of fractures. This explanation is speculative because our study does not have data concerning either the functional performances of the subjects or the rate of falls. It is also important to note that these interpretations about the reduction in fracture hospitalizations in France during the COVID-19 year 2020 consider the older adult population as a whole; for specific sub-populations (e.g. individuals with osteoporosis, sarcopenia, impaired balance), this finding may not apply. Furthermore, it is crucial to highlight that, although lockdown measures seem to be associated with less fractures, these measures may negatively impact health, particularly mental-related health factors (e.g. mood, cognitive function).

Although physical health has been negatively affected during the lockdown period in older people [15], we observed a decrease in hospitalizations related to fracture during the first lockdown period set up to limit the COVID-19 transmission in France and no delayed fracture consequences of COVID-19. This result underlines the complexity of the evaluation of the public health measures to prevent fractures due to the interweaving of factors related to physical ability but also risk taking in a specific environment. In terms of public health recommendations, this unprecedented situation and our data suggest that reducing exposure such as by securing the living spaces of older individuals is associated with reduced incidence of fracture; however, the long-term health consequence is unclear.

Other interpretation of our results should be reported. We cannot exclude that the decrease in the number of fracture hospitalizations during the confinement period may also be due to the reluctance of patients to come to hospitals for fear of being contaminated. We also cannot exclude that the many subjects who died during the epidemic, mostly elderly, poly-morbid and at high risk of falling, were also those who would normally have been hospitalized for fractures. Moreover, there may be “hidden cases” of fracture among old demented resident of nursing home, or at home, treated with palliative care after fracture and not sent to the hospital or being found dead. In a recent meta-analysis, the mortality rate in patients with concomitant hip fracture and COVID-19 was found to be 36% (95% CI: 26–47%), whereas the mortality rate in hip fracture without COVID-19 was 2% (95% CI: 1–3%) [16]. Many patients with COVID may have died rapidly before fracture was diagnosed.

In conclusion, fracture in older adults is the most often dependent on both the exposure to a risk of falling and the level of physical performance in a specific environment. The lockdown period has resulted in lower physical activity and a reduced number of fractures in older adults. These results support that decreased exposure to the risk of falling during COVID-19 year 2020 may have reflected in lower incidence of fractures. A high death rate from COVID-19 among subjects usually hospitalized for fracture but also a lower use of hospitalization for patients infected with COVID-19 and fractured or by fear of being infected in hospital could also explain these results.

Author contribution PdSB and YR contributed equally to the conception and drafting of the manuscript. DF and LM collected and analysed the data and HB and BV provided advice at different stages. All the authors contributed to the drafting of the manuscript and approved the final version of the manuscript. YR is the guarantor. The corresponding author attests that all listed authors meet the authorship criteria and that no others meeting the criteria have been omitted.

Declarations

Conflict of interest Philippe de Souto Barreto, Didier Fabre, Bruno Vellas, Hubert Blain, Laurent Molinier and Yves Rolland declare that they have no conflict of interest. The authors declare no competing financial interests.

References

- Gardner RL, Harris F, Vittinghoff E, Cummings SR (2008) The risk of fracture following hospitalization in older women and men. *Arch Intern Med* 168(15):1671–1677. <https://doi.org/10.1001/archinte.168.15.1671>
- Piau A, Mattek N, Crissey R, Beattie Z, Dodge H, Kaye J (2020) When will my patient fall? Sensor-based in-home walking speed identifies future falls in older adults. *J Gerontol A Biol Sci Med Sci* 75(5):968–973. <https://doi.org/10.1093/gerona/glz128>
- Lafont C, Gérard S, Voisin T, Pahor M, Vellas B, Members of I.A.G.G./A.M.P.A Task Force (2011) reducing “iatrogenic disability” in the hospitalized frail elderly. *J Nutr Health Aging* 15(8):645–660. <https://doi.org/10.1007/s12603-011-0335-7>
- Blain H, Rolland Y, Schols J, Cherubini A, Miot S, O’Neill D, Martin FC, Guérin O, Gavazzi G, Bousquet J, Petrovic M, Gordon AL, Benetos A (2020) August 2020 Interim EuGMS guidance to prepare European long-term care facilities for COVID-19. *Eur Geriatr Med* 11(6):899–913. <https://doi.org/10.1007/s41999-020-00405-z>
- Aubertin-Leheudre M, Rolland Y (2020) The importance of physical activity to care for frail older adults during the COVID-19 pandemic. *J Am Med Dir Assoc* 21(7):973–976. <https://doi.org/10.1016/j.jamda.2020.04.022>
- Tinetti ME, Liu WL, Marottoli RA, Ginter SF (1991) Mechanical restraint use among residents of skilled nursing facilities. Prevalence, patterns, and predictors. *JAMA* 265(4):468–471
- Umeda-Raffa S, Pergolizzi JV Jr, Raffa RB (2021) Bone fractures during the time of coronavirus. *J Clin Pharm Ther* 46(2):543–546. <https://doi.org/10.1111/jcpt.13297>

8. Dolci A, Marongiu G, Leinardi L, Lombardo M, Dessì G, Capone A (2020) The epidemiology of fractures and musculo-skeletal traumas during COVID-19 lockdown: a detailed survey of 17,591 patients in a wide Italian metropolitan area. *Geriatr Orthop Surg Rehabil* 11:2151459320972673. <https://doi.org/10.1177/2151459320972673>
9. Wong KC, Cheok J, Tay K, Koh SB, Howe TS (2020) Where have all the hip fractures gone? *Osteoporos Int* 31(10):2057–2058. <https://doi.org/10.1007/s00198-020-05483-0>
10. Magnusson K, Helgeland J, Grøslund M, Telle K (2021) Impact of the COVID-19 pandemic on emergency and elective hip surgeries in Norway. *Acta Orthop* 92(4):376–380. <https://doi.org/10.1080/17453674.2021.1898782>
11. Malik-Tabassum K, Robertson A, Tadros BJ, Chan G, Crooks M, Buckle C, Rogers B, Selmon G, Arealis G (2021) The effect of the COVID-19 lockdown on the epidemiology of hip fractures in the elderly: a multicentre cohort study. *Ann R Coll Surg Engl* 103(5):337–344. <https://doi.org/10.1308/rcsann.2020.7071>
12. Ribau A, Vale J, Xará-Leite F, Rodrigues-Pinto R (2021) 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* 6(1):e109. <https://doi.org/10.1097/j.pbj.000000000000109>
13. Ogliari G, Lunt E, Ong T, Marshall L, Sahota O (2020) The impact of lockdown during the COVID-19 pandemic on osteoporotic fragility fractures: an observational study. *Arch Osteoporos* 15(1):156. <https://doi.org/10.1007/s11657-020-00825-1>
14. Institut national de la statistique et des études économiques. Tableaux de l'économie française, Édition 2020. Accessed on April 14th 2021 at: <https://www.insee.fr/fr/statistiques/4277619?sommaire=4318291>
15. Sepúlveda-Loyola W, Rodríguez-Sánchez I, Pérez-Rodríguez P, Ganz F, Torralba R, Oliveira DV, Rodríguez-Mañas L (2020) Impact of social isolation due to COVID-19 on health in older people: mental and physical effects and recommendations. *J Nutr Health Aging* 24(9):938–947. <https://doi.org/10.1007/s12603-020-1469-2>
16. Lim MA, Pranata R (2021) Coronavirus disease 2019 (COVID-19) markedly increased mortality in patients with hip fracture - a systematic review and meta-analysis. *J Clin Orthop Trauma* 12(1):187–193. <https://doi.org/10.1016/j.jcot.2020.09.015>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.