

# EVALUATION OF MANAGEMENT OF PATIENTS WITH OSTEOPOROTIC FRACTURES BY ORTHOPEDIC RESIDENTS: A CROSS-SECTIONAL OBSERVATIONAL STUDY

## AVALIAÇÃO DO MANEJO DE PACIENTES COM FRATURAS OSTEOPORÓTICAS POR RESIDENTES DE ORTOPEDIA: UM ESTUDO TRANSVERSAL OBSERVACIONAL

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### ABSTRACT

**Objective:** To assess whether residents (R1, R2, or R3 - according to the year of residency) of a tertiary orthopedic service investigate, treat and/or refer the patient with osteoporotic fracture for osteoporosis (OP) treatment and whether this learning is improved over the years of residency. **Methods:** Residents answered diagnostic and therapeutic questions related to a clinical case of osteoporotic fracture (OF) in 4 settings, which were initial care in the emergency room, at discharge, during outpatient follow-up at 3 and 6 months. Responses were compared between years of residency. **Results:** Twenty R1, 21 R2, and 19 R3 raised the questions. One resident treated osteoporosis in R1, two in R2, and four in R3. Seventy-five percent of R1, 90.5% of R2, and 68% of R3 referred patients for OP treatment. Over the years, there has been improved prescribing lab tests for osteoporosis ( $p = 0.028$ ), with 52.6% of third-year residents prescribing adequate lab tests. In the same period, 100% of R3 correctly prescribed prophylaxis for deep vein thrombosis ( $p = 0.001$ ). **Conclusion:** There is learning, but not enough, for secondary prevention of FO. **Level of Evidence I; Prospective Comparative Study.**

**Keywords:** Osteoporotic fracture. Secondary Prevention. Brazil. Orthopedics. Health knowledge, Attitudes and Practice.

### RESUMO

**Objetivo:** Avaliar se residentes (R1, R2 ou R3 - de acordo com o ano de residência) de um serviço ortopédico terciário, investigam, tratam e/ou encaminham o paciente com fratura osteoporótica para tratamento de osteoporose (OP) e se esse aprendizado é melhorado ao longo dos anos de residência. **Métodos:** Os residentes responderam a questões diagnósticas e terapêuticas relacionadas a um caso clínico de fratura osteoporótica (OF) em 4 cenários, que foram o atendimento inicial no pronto-socorro, no momento da alta hospitalar, durante o acompanhamento ambulatorial em 3 e 6 meses. As respostas foram comparadas entre os anos de residência. **Resultado:** Vinte R1, 21 R2 e 19 R3 levantaram as questões. Um residente tratou osteoporose em R1, dois em R2 e quatro em R3. Setenta e cinco por cento de R1, 90,5% de R2 e 68% de R3 encaminharam pacientes para tratamento com OP. Há melhora na prescrição de exames laboratoriais para investigação de osteoporose ao longo dos anos ( $p = 0,028$ ) com 52,6% dos residentes do terceiro ano que prescrevem exames laboratoriais adequados. No mesmo período, 100% de R3 prescreveram corretamente a profilaxia para trombose venosa profunda ( $p = 0,001$ ). **Conclusão:** Há aprendizado, porém insuficiente, para a prevenção secundária da FO. **Nível de Evidência I; Estudo Prospectivo Comparativo.**

**Descritores:** Fraturas por osteoporose. Prevenção secundária. Brasil. Ortopedia. Conhecimentos. Atitudes e Prática em Saúde.

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### INTRODUCTION

Osteoporosis is the most common bone disease,<sup>1</sup> characterized by a progressive decrease in bone mass, leading to decreased bone strength and an increased risk of fractures<sup>1</sup> being considered a public health problem, since 50% of women and 20% of men over 50 years old will suffer osteoporotic fractures (OF) at some

point,<sup>2</sup> being responsible for an expenditure of USD \$ 310 million in 2018 in Brazil.<sup>3</sup>

With the aging of the Brazilian population, the incidence of OF is expected to increase dramatically. It is estimated that the number of proximal femur fractures will increase from 80,640 in 2015 to 198,000 in 2040.<sup>4</sup>

All authors declare no potential conflict of interest related to this article.

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In addition to the economic impact, OFs have a high social cost, since they are associated with an increase in the mortality rate, decreased independence,<sup>5</sup> loss of self-esteem, depression and distortion of body image.<sup>6</sup>

Despite the fact that osteoporosis treatment has been available since the 1990s, up to 80% of eligible patients do not receive treatment.<sup>7</sup> To reduce the impact of OF two intervention models have been proposed.

In the first model, there is a health professional dedicated to assessing patients and initiating treatment, when indicated. This model is commonly known as *fracture liaison service* (FLS).<sup>8</sup> Although these programs have proven to be cost effective<sup>9</sup> and capable of reducing mortality,<sup>10</sup> they are not easy to implement,<sup>11</sup> they have not been able to decrease the incidence of new proximal femur fractures, probably due to problems in the adherence to the program,<sup>12,13</sup> a problem faced by the program conceived by the group of osteometabolic diseases.<sup>14</sup>

The other model is based on the orthopedist's privileged position to diagnose osteoporosis, inform the patient about the disease, initiate investigation and treatment of osteoporosis when necessary.<sup>15,16</sup> The advantages of this type of approach are its ease of implementation by the orthopedist and the lack of necessity of a specific professional for this purpose, since protocols and strategies to assist the orthopedist already exist.<sup>17-20</sup>

Bearing in mind the importance of secondary prevention, this cross-sectional observational study aims to assess whether orthopedics residents of a tertiary service initiate the correct investigation and treatment, and / or refer the patient during OF care for the treatment of osteoporosis. To assess whether the training in orthopedics improves the management of osteoporosis, the responses of residents of the three years of specialization will be compared.

## METHODS

Institute of Orthopedics and Traumatology, Hospital das Clínicas, Faculty of Medicine, University of São Paulo (IOT-HC-FMUSP) with approval by the Ethics Committee under the decision number: 4.334.441, and Ethics Committee for Analysis Certificate (CAAE) number: 38218820.1.0000.0068. Registered on the clinicaltrials.org website under the number: NCT 04911946.

Resident of the first, second and third year of orthopedics and traumatology at IOT-HC-FMUSP.

## Inclusion criteria

Physicians enrolled in the medical residency program in orthopedics and traumatology at IOT-HC-FMUSP.

## Exclusion criteria

Abandonment or transfer of, or withdrawal or eviction from the medical residency program in orthopedics and traumatology at IOT-HC-FMUSP.

## Questionnaire

After signing the informed consent form agreeing to participate in the study, the participants answered the questionnaire summarized in (Appendix 1).

All residents answered the questionnaire after a preceptorship meeting in June 10, 2021.

The responses were divided into "Adequate", "Inappropriate" and "Absent", based mainly on the Brazilian consensus for diagnosis and treatment of osteoporosis after menopause (routine tests: complete blood count, calcium, phosphorus, alkaline phosphatase, thyroid function tests, 25 hydroxy-vitamin D, densitometry)<sup>21</sup> (Figure 1).

The questionnaires were digitized and stored on the Google drive, in addition to being filed in the osteometabolic disease group room. The responses to the questionnaires were tabulated on a google spreadsheet, with an updated copy kept in the cloud and another copy kept in the computer of the group of osteometabolic disease group.

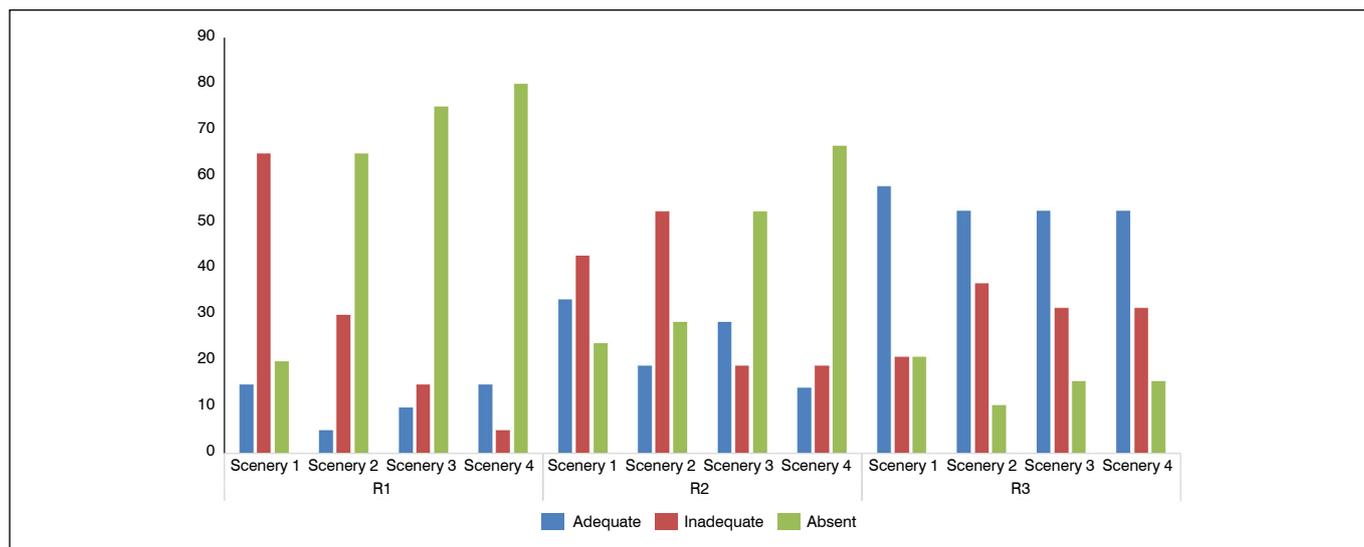
## Outcomes

### Primary

- Assess whether the residency program is enabling the resident of IOT-HC-FMUSP to carry out secondary prevention of osteoporotic fracture, by investigating and treating osteoporosis appropriately, based mainly on the Brazilian consensus for the diagnosis and treatment of osteoporosis after menopause.<sup>21</sup>

### Secondary

- Assess whether the residents of the IOT-HC-FMUSP, when not starting the investigation and treatment of osteoporosis, refer the patient to another professional to conduct the case.
- Assess whether more senior residents master the osteoporosis treatment.



**Figure 1.** Percentage of adequate, inadequate and absent conducts written by residents of the first (R1) and third year (R3) of training.

## Risk of bias

To reduce the chance of bias, all residents answered the questionnaire during a meeting between the residents and the preceptor.

## Calculation of the sample

The sample of 60 residents was obtained for convenience, as this is the number of residents of the IOT-HC-FMUSP in 2021, except for the resident who executed the study.

## Randomization

Due to the nature of the study, randomization was not performed.

## Blinding

Due to the nature of the study, blinding is impossible.

## Statistical analysis

Ages were described according to groups using means and standard deviations and compared between groups using analysis of variances, whereas the other characteristics of residents, as well as the adequacy of the conducts in different scenarios were described according to groups using frequencies. Associations of residents' characteristics were assessed between groups using likelihood ratio tests or chi-square test of trend.

The conducts taken were compared between groups of residents using generalized estimation equations with marginal Poisson distribution and identity link function, assuming a first-order auto-regressive correlation matrix between the scenarios for all analyzes and followed by Bonferroni's multiple comparisons to identify between which groups of residents there were differences in behavior when significant.

The analyzes were performed using the *software IBM-SPSS for Windows* version 22.0 and tabulated using the *software Microsoft-Excel* 2003 and the tests were performed with a significance level of 5%.

## RESULTS

Sixty residents (20 R1, 21 R2, and 19 R3) answered the questionnaire. There was no loss in the number of residents. Their baseline data are shown in (Table 1). The longer the residence time, the better the training and the ability to properly classify the fracture of the clinical case in scenario 1.

The description of the levels of adequacy of the conducts for the criteria evaluated according to the groups of residents and scenarios with the comparative tests are shown in (Table 2). One resident treated appropriately (prescribed correct dosages of calcium, vitamin D and bisphosphonate, in addition to referral for clinical treatment) osteoporosis in R1, 2 in R2 and 4 in R3. Over the years, there was an improvement in the request for laboratory tests that included the analysis of the bone metabolic profile for osteoporosis ( $p = 0.028$ ) and in the prescription of anticoagulant for the

prophylaxis of deep vein thrombosis (knowing when to prescribe and when to stop) (Table 2).

Among the R1, 4 residents in 20 (20%) requested laboratory tests and referred for osteoporosis treatment. One resident (5%) requested laboratory tests but did not refer for treatment or prescribe treatment for osteoporosis. Eleven (55%) did not request tests but referred for osteoporosis treatment and four residents (20%) did not order tests, did not prescribe treatment or referred for osteoporosis treatment. Fifteen of 20 residents (75%) referred for the treatment of osteoporosis.

Nine out of 21 second-year residents (43%) requested laboratory tests and referred for osteoporosis treatment. Two (9.5%) requested laboratory tests and did not refer for osteoporosis treatment. One of these two prescribed only calcium. Ten R2 (47.5%) did not request blood tests but referred for the treatment of osteoporosis. Nineteen out of 21 (90.5%) referred for the treatment of osteoporosis.

Ten out of 19 R3 (53%) requested laboratory tests and referred for the treatment of osteoporosis. Three out of 19 (15.75%) did not request exams but referred for the treatment of osteoporosis. Another 3 (15.75%) requested laboratory tests and did not refer for clinical treatment and 6 (31.5%) did not ask for tests or referred for the treatment of osteoporosis. Among the R3, 13 out of 19 (68%) referred for clinical treatment of osteoporosis.

The improvement in the prescription of laboratory tests can be seen in (Table 3) where the difference is only between R1 and R3. It has been progressively improving in such a way that there are no significant differences between R1 and R2 and between R2 and R3, only between R1 and R3 (Table 3). Enoxaparin really should not be in the prescriptions for scenarios 3 and 4, but more among the R1 the absence was at all times and not only in the scenarios 3 and 4, a fact that the R2 and R3 comment that it is no longer indicated and had been prescribed in scenarios 1 and 2.

## DISCUSSION

Postmenopausal osteoporosis has a major impact on the health budget worldwide. Undertreatment of osteoporosis is a well-known phenomenon, especially in elderly patients. Hospital initiation is one of the options to increase treatment rates and improve control of osteoporosis. However, several factors contribute to the failure to initiate adequate treatment of osteoporosis in patients with fragility fractures. This includes the lack of knowledge about osteoporosis and the lack of treatment guidelines among family doctors and orthopedic surgeons.<sup>16, 17, 19, 22, 23</sup> In addition, orthopedic surgeons hardly accept their responsibility for the treatment of osteoporosis, as they are not familiar with the treatment of osteoporosis.<sup>19</sup>

According to DataSUS,<sup>24</sup> in 2020 hospitalizations and surgeries were recorded for 34,430 patients with osteoporotic fractures (femoral neck and transtrochanteric) in Brazil. In 2019, that number was 34,841. However, outpatient follow-up for these patients in 2020 was hampered by the COVID pandemic<sup>19</sup>. The initiation of treatment at the hospital is necessary when all outpatient support is restricted. Knowing what should be done and guiding the patient in the hospital environment is a great chance, even though knowing that less than half will continue the oriented treatment in the hospital environment.<sup>16</sup>

With this study we were able to assess whether residents had adequate knowledge and used it to initiate or institute secondary prevention of osteoporotic fractures and whether more advanced residents initiated the investigation, treatment and / or referral of patients with OF more frequently than first year residents.

Our sample is small (60 residents comprised of 20 R1, 21 R2 and 19 R3 that add up to the total number of residents in training in this tertiary care service) and, as expected, there is a direct relation between the resident's graduation and the ability to classify the fracture of the clinical case appropriately (Table 1).

**Table 1.** Description of residents' characteristics according to groups and result of statistical tests.

Variable	R1	R2	R3	Total	P
	(N = 20)	(N = 21)	(N = 19)	(N = 60)	
Age (years)					0.286**
average SD	27.9 ± 1.8	28.8 ± 2.5	28.7 ± 1.5	28.4 ± 2	
Nationality					0.904#
Brazilian	17 (85)	18 (85.7)	17 (89.5)	52 (86.7)	
Foreign	3 (15)	3 (14.3)	2 (10.5)	8 (13.3)	
Classification					0.007
Adequate	10 (50)	16 (76.2)	17 (89.5)	43 (71.7)	
Inadequate	10 (50)	5 (23.8)	2 (10.5)	17 (28.3)	

Chi-square trend test; # Likelihood ratio test; \*\* ANOVA

**Table 2.** Description of the levels of adequacy of the conducts for the criteria evaluated according to groups of residents and scenarios and the result of the comparative tests.

Variable	R1				R2				R3				p
	Scenery 1 Number (%)	Scenery 2 Number (%)	Scenery 3 Number (%)	Scenery 4 Number (%)	Scenery 1 Number (%)	Scenery 2 Number (%)	Scenery 3 Number (%)	Scenery 4 Number (%)	Scenery 1 Number (%)	Scenery 2 Number (%)	Scenery 3 Number (%)	Scenery 4 Number (%)	
<b>Laboratory</b>													<b>0.028</b>
Adequate	3 (15)	1 (5)	2 (10)	3 (15)	7 (33.3)	4 (19)	6 (28.6)	3 (14.3)	11 (57.9)	10 (52.6)	10 (52.6)	10 (52.6)	
Inadequate	13 (65)	6 (30)	3 (15)	1 (5)	9 (42.9)	11 (52.4)	4 (19)	4 (19)	4 (21.1)	7 (36.8)	6 (31.6)	6 (31.6)	
Absent	4 (20)	13 (65)	15 (75)	16 (80)	5 (23.8)	6 (28.6)	11 (52.4)	14 (66.7)	4 (21.1)	2 (10.5)	3 (15.8)	3 (15.8)	
<b>RX</b>													<b>0.12</b>
Adequate	17 (85)	17 (85)	15 (75)	10 (50)	21 (100)	21 (100)	19 (90.5)	16 (76.2)	19 (100)	15 (78.9)	19 (100)	18 (94.7)	
Inadequate	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Absent	3 (15)	3 (15)	5 (25)	10 (50)	0 (0)	0 (0)	2 (9.5)	5 (23.8)	0 (0)	4 (21.1)	0 (0)	1 (5.3)	
<b>BMD</b>													<b>0.626</b>
Adequate	0 (0)	2 (10)	2 (10)	2 (10)	2 (9.5)	4 (19)	4 (19)	3 (14.3)	5 (26.3)	5 (26.3)	5 (26.3)	5 (26.3)	
Inadequate	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Absent	20 (100)	18 (90)	18 (90)	18 (90)	19 (90.5)	17 (81)	17 (81)	18 (85.7)	14 (73.7)	14 (73.7)	14 (73.7)	14 (73.7)	
<b>Vitamin D</b>													<b>0.365</b>
Adequate	1 (5)	1 (5)	2 (10)	2 (10)	3 (14.3)	6 (28.6)	12 (57.1)	11 (52.4)	5 (26.3)	5 (26.3)	5 (26.3)	5 (26.3)	
Inadequate	1 (5)	1 (5)	2 (10)	2 (10)	3 (14.3)	4 (19)	2 (9.5)	2 (9.5)	2 (10.5)	3 (15.8)	3 (15.8)	2 (10.5)	
Absent	18 (90)	18 (90)	16 (80)	16 (80)	15 (71.4)	11 (52.4)	7 (33.3)	8 (38.1)	12 (63.2)	11 (57.9)	11 (57.9)	12 (63.2)	
<b>Calcium</b>													<b>0.334</b>
Adequate	1 (5)	2 (10)	4 (20)	3 (15)	5 (23.8)	8 (38.1)	11 (52.4)	11 (52.4)	4 (21.1)	4 (21.1)	4 (21.1)	4 (21.1)	
Inadequate	0 (0)	0 (0)	0 (0)	1 (5)	1 (4.8)	2 (9.5)	1 (4.8)	1 (4.8)	2 (10.5)	3 (15.8)	3 (15.8)	2 (10.5)	
Absent	19 (95)	18 (90)	16 (80)	16 (80)	15 (71.4)	11 (52.4)	9 (42.9)	9 (42.9)	13 (68.4)	12 (63.2)	12 (63.2)	13 (68.4)	
<b>Bisphosphonate</b>													<b>0.433</b>
Adequate	1 (5)	0 (0)	4 (20)	2 (10)	3 (14.3)	5 (23.8)	7 (33.3)	7 (33.3)	6 (31.6)	6 (31.6)	6 (31.6)	6 (31.6)	
Inadequate	0 (0)	0 (0)	0 (0)	0 (0)	1 (4.8)	2 (9.5)	3 (14.3)	3 (14.3)	1 (5.3)	0 (0)	0 (0)	0 (0)	
Absent	19 (95)	20 (100)	16 (80)	18 (90)	17 (81)	14 (66.7)	11 (52.4)	11 (52.4)	12 (63.2)	13 (68.4)	13 (68.4)	13 (68.4)	
<b>Enoxaparin</b>													<b>0.001</b>
Adequate	18 (90)	15 (75)	3 (15)	0 (0)	20 (95.2)	19 (90.5)	18 (85.7)	3 (14.3)	19 (100)	19 (100)	9 (47.4)	9 (47.4)	
Inadequate	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Absent	2 (10)	5 (25)	17 (85)	20 (100)	1 (4.8)	2 (9.5)	3 (14.3)	18 (85.7)	0 (0)	0 (0)	10 (52.6)	10 (52.6)	
<b>Referral</b>													<b>0.881</b>
Adequate	4 (20)	13 (65)	11 (55)	10 (50)	8 (38.1)	10 (47.6)	12 (57.1)	11 (52.4)	9 (47.4)	11 (57.9)	9 (47.4)	10 (52.6)	
Inadequate	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Absent	16 (80)	7 (35)	9 (45)	10 (50)	13 (61.9)	11 (52.4)	9 (42.9)	10 (47.6)	10 (52.6)	8 (42.1)	10 (52.6)	9 (47.4)	

Generalized estimation equations (GEE) with Poisson distribution and identity link function.

**Table 3.** Result of multiple comparisons of the levels of adequacy of laboratory and enoxaparin conducts between groups of residents.

Variable	Comparison	Mean difference	Standard Error	p	IC (95%)	
					Low	Upper
Laboratory	R1 vs R2	0.24	0.338	>0.999	-0.57	1.05
	R1 vs R3	0.82	0.323	0.034	0.04	1.59
	R2 vs R3	0.58	0.309	0.189	-0.17	1.32
Enoxaparin	R1 vs R2	0.51	0.226	0.069	-0.03	1.05
	R1 vs R3	0.83	0.221	0.001	0.3	1.35
	R2 vs R3	0.31	0.201	0.363	-0.17	0.79

Bonferroni's multiple comparisons.

As for the investigation, there is a learning over the years of laboratory tests necessary for the investigation of osteoporosis in patients hospitalized for osteoporotic fractures ( $P = 0.028$ , Table 2) and this difference is clear between R3 and R1 ( $p = 0.034$ , Table 3). A parallel can also be drawn by the prescription of anticoagulant where all R3 knew the dose and time of administration of enoxaparin, remembering that the questionnaire left open questions with prescription and referral guidelines and what to be prescribed for hospitalization, at discharge and at 3- and 6-months follow-ups. All R3 did not know how to treat or refer for the treatment of osteoporosis.

The correct treatment of osteoporosis was described by 4 R3 (21%), 2 R2 (9.5%) and 1 R1 (5%), showing some degree of learning during the years of residency, but still an important knowledge deficit at the time, similar to that described in orthopedics and general practice.<sup>17,19,22,23</sup> The referral for the treatment of osteoporosis, in a first analysis of responses between the different scenarios, showed no differences between years of residence and learning ( $p = 0.881$ , Table 2). However, there were residents who referred them at discharge and not at follow-ups and vice versa. Looking at who referred at some point 75% of R1, 90.5% of R2 and 68% of R3 referred for clinical treatment of osteoporosis, showing that if there was any learning from the first to the second year of residency, there was loss or no improvement over time in training for R3 or even this class of R3 was less oriented in their training than the younger classes. Thus, despite the serious medical and socioeconomic consequences of fragility fractures, efforts to optimize the treatment and prevention of osteoporosis are still insufficient.<sup>19</sup> Among the weaknesses of the study are: 1) Small sample, however the objective is to identify errors in the training of residents in orthopedics at this institution; 2) it is a cross-sectional study where we are not following the same residents in their 3-year training; 3) there is no control group from another orthopedics service or other clinical specialty. A strong point of the study is that it is an education and training service for orthopedic surgeons, who will certainly assist patients with osteoporotic fractures. This study has

the goal of identifying the flaws in the current training process, and therefore, suggesting measures to enable orthopedic surgeons in training in the management of osteoporosis.

We agree that orthopedic trauma surgeons can play a significant role in the diagnosis and treatment of osteoporosis in hospitalized patients and may be able to reduce the incidence of secondary frailty fractures,<sup>16</sup> but we still have to improve this training.

## CONCLUSION

There is learning over the years of training in the orthopedics residency, but still insufficient, for the secondary prevention of OF.

**AUTHORS' CONTRIBUTION:** Each author contributed individually and significantly to the development of this article. GPO: Conceptualization, Statistics analysis, Developed the design of methodology, Project Administration, Participated in the process review; MMP: Conducted the research and investigation process, Developed the design of methodology, Wrote the original draft of the manuscript; MUR: Conceptualization, Funding Acquisition, Developed the design of methodology, Supervision, Wrote the original draft of the manuscript, Participated in the process review; MMA and OPC: Wrote the original draft of the manuscript. All authors read and approved the final manuscript.

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### Appendix 1. Scenario 1 of osteoporotic fracture of the proximal femur.

Fracture image, diagnosis request and fracture classification (implied), and guidance on how to fill out prescriptions for blood tests and images and medications. Scenario 2 with the fracture fixed and requested discharge instructions. Scenario 3 (return of 3 months) with instructions for completing exams, drug prescriptions, referrals, guidelines. Scenario 4 (return of 6 months) and guidelines for completing possible exams, medications, referrals, therapies, care.