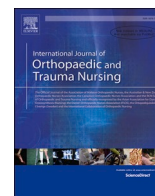




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Assessment of rehabilitation nurses' knowledge and results of nurse educational programme (C2F) regarding osteoporosis and fragility fractures

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ABSTRACT

Background: Providing adequate care for the person with a fragility fracture is essential to prevent recurrences. A key strategy involves training by improving nursing care in the fields of osteoporosis and fragility fractures. However, in Portugal, there is no report on the level of knowledge of nurses, nor experimental studies on how to improve it.

Objective: The study aimed to assess the knowledge of Rehabilitation Nurses in Portugal on osteoporosis and fragility fractures. Additionally, it sought to evaluate the impact of a specific educational programme on nurses' knowledge.

Methods: In Phase I, a cross-sectional study involved 452 participants, utilizing a 26-question knowledge test. In Phase II, a quasi-experimental study included 42 nurses from 28 hospitals, subjected to a 30-h hybrid educational programme. The program comprised 9 online (2 h 30 min each) and 2 live sessions, covering assessment, pharmacological and non-pharmacological treatment, monitoring, project planning, consultations, and outcome indicators measurement. A before-and-after programme knowledge test was administered.

Results: Phase I revealed an average knowledge score of 69.6%. In Phase II, there was a significant improvement with programme (70.4% vs. 85.8%, $p < 0.01$). Specialized nurses performed better than non-specialized nurses (80% vs. 75%, $p = 0.011$), and those from orthopaedic services showed the greatest improvement (92% vs. 83%, $p = 0.014$).

Conclusions: Rehabilitation Nurses in Portugal have room to improve their knowledge of osteoporosis and fragility fractures. The hybrid educational programme proved effective in improving nurses' knowledge, especially among specialist and orthopaedic service nurses. We hope that this knowledge can be translated into continuous improvement in healthcare provision.

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1. What we know

- Nurses' knowledge about Osteoporosis and FF is considered insufficient, even among professionals directly dealing with these patients, as evidenced by international data.
- When considering the level of competence in management and rehabilitation care, Rehabilitation Nursing Specialists in Portugal stand out as the most qualified to lead and implement Fragility Fracture Consultations, as well as to provide specialized care to individuals with Osteoporosis and a risk of FF.
- Various experiences with the implementation of educational programmes, even when conducted remotely, have proven effective in improving the knowledge of professionals caring for people with Osteoporosis and a risk of FF.

2. What we want to know

- The level of knowledge of Rehabilitation Nursing Specialists about Osteoporosis and FF in Portugal.
- How academic background, length of service, professional category, and workplace location influence the level of knowledge.
- The effectiveness of an educational programme on Osteoporosis and FF in nurses' satisfaction and knowledge levels.
- How academic background, length of service, and workplace location influence knowledge increase after the educational programme.

3. The obtained results indicate that

- The knowledge of Portuguese Rehabilitation Nursing Specialists about Osteoporosis and FF can be improved (69.6%). Epidemiology and nutrition are identified as areas with the lowest levels of knowledge. Academic background has a significant influence on the level of knowledge.
- An educational programme consisting of 9 online modules and 2 in-person modules has proven effective in increasing knowledge and satisfaction among a group of nurses working in orthopedic emergency hospitals. Knowledge increase was influenced by academic background and workplace location. Once again, epidemiology and nutrition showed the lowest levels of knowledge.

4. Introduction

Fragility fracture (FF) is the most obvious clinical outcome of osteoporosis (WHO, 1998; Stolnicki and Oliveira, 2016), characterised by increased bone fragility. After a first FF, the risk of refracture increases substantially (Marques, 2020).

More than 4 million FF occur each year in Europe, with a direct cost of 57 billion euros to union healthcare systems. In Portugal, it is estimated that over 70,000 FF occur annually (1 every 7.5 min), resulting in over 4000 deaths and tangible costs exceeding 1003 billion euros (Kanis et al., 2021). Moreover, hip fractures are associated with a significant increase in mortality and have a substantial impact on the quality of life, especially during the first year following the fracture (Marques et al., 2015).

The population ageing and the estimated increase in the prevalence of falls in the coming years (Baixinho et al., 2020), reinforce that fractures will increase and that it is necessary to change the paradigm of providing care to these people to control this serious public health problem. Some defend a need for orthogeriatric intervention in patients with FF, in order to decrease the incidence of in-hospital postoperative complications, promote self-care, decreasing the functional decline associated with this diagnosis and hospitalization (Abrahamsen et al., 2019).

Nurses, as health promoters, are in a strategic position to play a significant role in osteoporosis and subsequent fracture prevention (Santy-Tomlinson, 2017; Meehan et al., 2019). However, the lack of

knowledge among healthcare professionals is evident in the literature, especially regarding risk factors and prevention (Fourie et al., 2015; Peng et al., 2020; Mahdaviyazad et al., 2021).

In Portugal, there is still no study that has elucidated the level of knowledge of Portuguese nurses about osteoporosis and fragility fractures. Furthermore, when we look at the clinical context, we find that graduate nurses and Rehabilitation Nurse Specialists (RNS) are present in all orthopaedic services. The latter have added competences in the area of musculoskeletal rehabilitation, care management and are responsible for discharging patients after fractures. It is also unclear whether nurses who have obtained specialized training, such as RNSs, have better knowledge of osteoporosis and the prevention of FF.

Currently, we do know that continuing professional training can contribute to improving the quality of care for individuals who have experienced a FF through the implementation of educational programs (Peng et al., 2020). The use of synchronous video conferencing technology appears to be effective in increasing knowledge about osteoporosis treatment (Lewiecki et al., 2017). However, there is a paucity of programmes like this (McWilliam Ross and Gilder, 2023).

The objective of this study was to evaluate the knowledge of Rehabilitation Nursing Specialists (RNS) in Portugal regarding osteoporosis and FF. Additionally, the study aimed to assess the effectiveness of an educational programme focused on Osteoporosis and FF for nurses, while also exploring the influencing factors associated with its effectiveness.

5. Methods

This research was divided in two phases: first an observational study, and then a quasi-experimental study, using different samples and methods, described below and depicted in Fig. 1.

5.1. Phase I: observational study: knowledge assessment

The first phase of this study adopted a quantitative cross-sectional design to evaluate the baseline knowledge of RNSs in Portugal regarding osteoporosis and FF. The study population was drawn from RNSs actively practicing in Portugal and registered with the Board of Nurses. The data collection process commenced on June 1, 2021 and concluded on August 1, 2021 and consisted of a self-administered questionnaire shared via email by the Portuguese Board of Nurses. This questionnaire encompassed two main components. The first was sociodemographic and professional information, composed of 8 questions and developed by the research team and pre-tested with 6 other colleagues. The second part was "The Knowledge Assessment of Rehabilitation Nursing Specialists on Osteoporosis and Fragility Fracture Prevention and Treatment" adapted from Berarducci et al. (2002). Psychometric evaluation of the original questionnaire showed a content validity of 0,955 and a reliability using Pearson's correlation of 0,77.

The translation of the questionnaire into Portuguese was carried out using the translation and re-translation process. The adaptation of the questionnaire consisted of adding 4 questions related to assessment and physical activity. The consensus version was achieved by 7 experts in the field. This test has 26 multiple-choice questions, with the same score value (1 point), categorically organized into five distinct areas of knowledge: Epidemiology (Q1; Q2; Q3; Q4; Q5); Assessment of osteoporosis and fragility fracture risk (Q6; Q7; Q8; Q9; Q10); Nutrition (Q11; Q12; Q13); Physical Activity (Q14; Q15; Q16; Q17; Q18; Q19); Prevention of complications (Q20; Q21; Q22; Q23; Q24; Q25; Q26) (Supplement 1). The range of possible scores for the instrument is 0–26, with higher scores indicating greater knowledge.

5.2. Phase II: quasi-experimental study: educational programme

The quasi-experimental phase of this study was a before-after design with a single group to test the efficacy of an educational intervention to

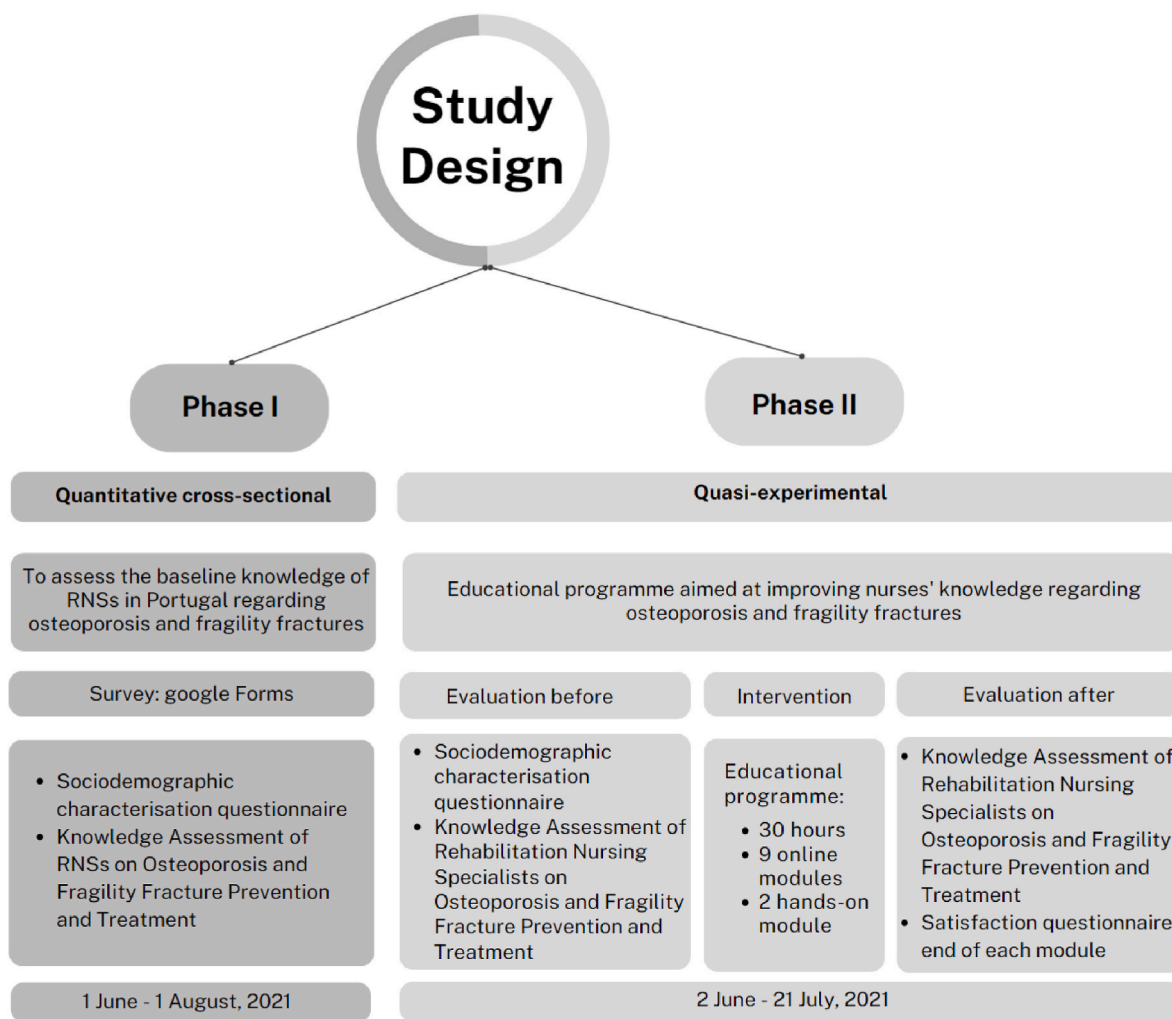


Fig. 1. Study design.

improve nurses' knowledge of osteoporosis and fragility fractures. Participants were recruited by formal contact with the head of the orthopaedic service nursing team at all hospitals with an orthopaedic emergency department in Portugal (41 hospitals). The process of contacting the hospitals began in May 2021 and the training activity started on June 2, 2021 and ended on 21 July 2021. More than one nurse per hospital was accepted for participation.

The educational programme consisted of 30 h of training delivered through 11 modules/topics: 9 online sessions of 2 h and 30 min each and two practical face-to-face modules at the end of the programme of 7 h and 30 min in total (Supplement 2). These modules emphasized several critical aspects, including epidemiological insights, interdisciplinary care provision, pharmacological and non-pharmacological interventions, and the active involvement of caregivers. Furthermore, the educational programme provided guidance on methodologies for the development of projects aimed at establishing specialized nursing consultations for fragility fractures.

The educational programme underwent a rigorous certification process, obtaining formal accreditation from the Board of Nurses.

The knowledge of nurses was evaluated before programme and immediately after, at the end of the last module, by employing the knowledge questionnaire developed in phase I of this study. Additionally, a satisfaction questionnaire was also applied at the end of each module, asking participants to score their satisfaction from 1 ("not satisfied at all") to 5 ("very much satisfied"). This satisfaction questionnaire consisted of 16 questions regarding the program content, the

methods employed, the organization of the training, and the evaluation of each speaker.

Ethical approval

The study was approved by an ethics committee and informed consent was obtained from the participants.

5.3. Statistical methods

Descriptive statistical analyses, including percentages and mean with standard deviation (mean ± SD), were employed to examine the demographic data at baseline. The statistical software SPSS® version 24 was utilized, and a significance level of $p < 0.05$ was established. To ensure appropriate test selection, the normality of data distribution was assessed. In the initial phase of the study, Pearson Correlation was employed to assess the relationship between nurses' knowledge and responses to the time in professional practice. Additionally, the Kruskal-Wallis test was applied to compare knowledge across different education, place of working and professional category. Moving to phase II of the study, the *t*-test was utilized to investigate changes in knowledge following the intervention. Spearman's Correlation was employed to analyze the association between nurses' time in professional practice and knowledge levels. Furthermore, the Kruskal-Wallis test was used to compare knowledge across various place of working, and the Mann-Whitney *U* test was implemented to assess the knowledge disparity

between specialist and non-specialist nurses.

6. Results

6.1. Phase I

6.1.1. Participant characteristics

A total of 452 RNS (constituting 10.3% of the total 4397 registered with the Board of Nurses in 2021) completed the survey. The participants were on average 43.8 (SD 8,5) years old and had on average 20.9 (SD 1,3) years of professional practice. Are predominantly female (74,6%), 16.8% were working in orthopedic or traumatology services. About half had a postgraduate degree (49,3%), about a third had a master's degree (27,9%), and the remainder had a doctorate (3,5%). In terms of professional category, the majority of participants assumed performed professional functions as specialized nurses in the clinic (91,6%). The remainder were linked to management functions (5,7%) or were professors at nursing schools (2%). Only 3 nurses did not align with the previously outlined categories (0,7%). Participant characteristics are presented in Table 1.

6.2. Phase II

6.2.1. Participant characteristics

A study that involved the collaboration of public and private health institutions, which were interested in participating. It had the participation of twenty-five hospitals from the public sector and three from the private sector.

Of the 42 participants included in the educational activity, we observed an average age of 43.7 years (SD 8). The majority of those involved were women (83,3%), the participants' professional experience was on average 21 years (SD 7,8). A significant proportion had completed specialized training in the field of Nursing (66,7%) and half of these were rehabilitation nurses (50%). Occupational affiliations were diverse, with the majority associated with orthopedics or traumatology services (59,5%). The remainder worked in outpatient consultations (11,9%), rheumatology (4,4%) or emergency services (2,4%) (Table 3).

6.2.2. Evaluation of the educational programme

In terms of knowledge, assessed using the "The Knowledge Assessment of Rehabilitation Nursing Specialists on Osteoporosis and Fragility Fracture Prevention and Treatment", the participants had an average

Table 1

Characterization of the Portuguese Rehabilitation Nursing Specialists who answered the questionnaire (Phase I)

Results are expressed as n (%) unless stated otherwise.

	Nurses N = 452
Age, years, mean (SD)	43,8 (8,5)
Women	337 (74,6%)
Time in professional practice, mean (SD)	20,9 (1,3)
Professional experience as a specialist, years, mean (SD)	9,4 (7)
Education	
Specialist	87 (19,3%)
Postgraduate	223 (49,3%)
Master	126 (27,9%)
Doctorate	16 (3,5%)
Place of working	
Orthopedics/Traumatology	76 (16,8%)
Physical Medicine and Rehabilitation	20 (4,4%)
Rheumatology	3 (0,7%)
Other	353 (78,1%)
Professional category	
Nurse Specialist	414 (91,6%)
Chief Nurse	26 (5,7%)
Teacher	9 (2%)
Other	3 (0,7%)

Table 2

Differences in the nurses' knowledge level of osteoporosis and fragility fractures based on their characteristics (Phase I).

	Nurses N = 452	Correct answers (mean)	P-value
Education			
Specialist	87	18	0,015^a
Postgraduate	223	18	
Master	126	21	
Doctorate	16	21	
Place of working			
Orthopedics/Traumatology	76	19	0,771^a
Physical Medicine and Rehabilitation	20	18	
Rheumatology	3	19	
Other	353	18	
Professional category			
Nurse Specialist	414	18	0,875^a
Chief Nurse	26	19	
Teacher	9	18	
Other	3	20	

p-value is significant at ≤ 0.05 level.

^a Kruskal-Wallis test.

Table 3

Characterization of the Nurses who participated in the educational programme (Phase II)

Results are expressed as n (%) and mean (SD).

	Nurses N = 42
Age, years	43,7 (8)
Sex, women	35 (83,3%)
Time in professional practice	21 (7,8)
Education	
Graduate	10 (23,8%)
Postgraduate	4 (9,5%)
Specialist	16 (38,1%)
Master	12 (28,6%)
Place of working	
Orthopedics/Traumatology	25 (59,5%)
Outpatient	20 (4,4%)
Rheumatology	5 (11,9%)
Urgency	1 (2,4%)
Professional category	
Nurse	16 (38,1%)
Nurse Specialist	5 (11,9%)
Specialist Nurses in Rehabilitation Nursing	21 (50%)

score of 18.3 points "before-evaluation", which increased to an average of 22.3 points "after-evaluation", with a percentage of correct answers of 70.4% before vs 85.8% after.

Areas of lower proficiency were identified, particularly with regard to epidemiology (30,9% before vs 83,3% after) and dietary (45,2% before vs 76,2% after) considerations. By applying the t-test, a statistically significant improvement ($p < 0.001$) in the difference in the level of knowledge before and after the education programme, as can be seen in Fig. 3.

Specialized nurses exhibited a more pronounced knowledge differential compared to their non-specialized counterparts (80% vs 75%, $p = 0.011$). Furthermore, the location of professional practice significantly influenced knowledge differential (92% vs 83%, $p = 0.014$), with orthopedic services demonstrating the most substantial knowledge enhancement (Table 4). There was no correlation between the duration of professional practice and the enhancement of knowledge, as evidenced by Spearman's correlation coefficient ($r = 0.132$; $p = 0.425$).

6.2.3. Satisfaction with educational programme

Participants demonstrated a considerable level of satisfaction, giving a score of 5 ("very much satisfied") in 81.5% of the responses to the satisfaction questionnaire. No participant reported a score of 1 ("not

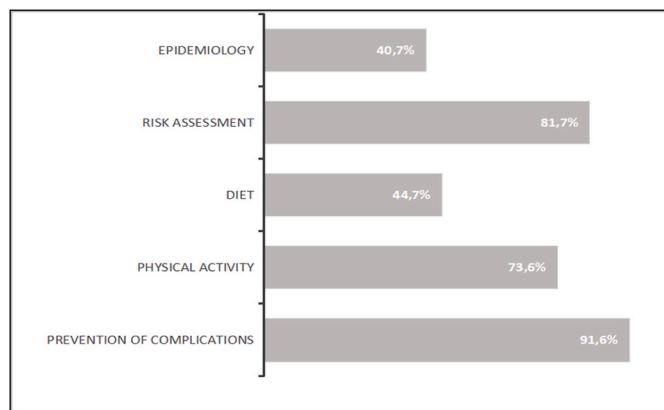


Fig. 2. Percentage of correct answers provided by nurses by topic (Phase I).

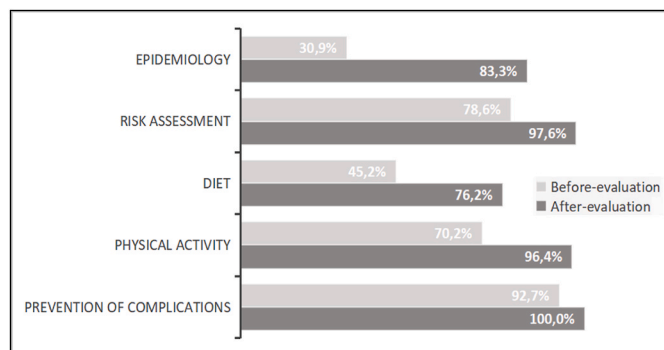


Fig. 3. Percentage of correct answers provided by nurses by topic (Phase II).

Table 4

Differences in the nurses’ knowledge level of osteoporosis and fragility fractures based on their characteristics, before and after educational programme (Phase II)

Results are expressed as n (%) and mean (SD).

	Nurses N = 42	Before Correct answers (mean)	After Correct answers (mean)	P-value
Place of working				
Orthopedics/ Traumatology	25	19	24	0,014 ^a
Outpatient	10	19	19	
Rheumatology	5	19	21	
Emergency	1	13	19	
Professional category				
Nurse	16	17	19	0,011 ^b
Nurse Specialist	26	19	24	

p-value is significant at ≤ 0.05 level.

^a Kruskal-Wallis test.

^b Mann-Whitney U.

satisfied at all”) or 2. Of note is Module 8, which focused on "Implementation of the Fragility Fracture Service and Engagement with Policy Makers", and achieved the highest levels of satisfaction among participating nurses, as 91.4% expressed being “very much satisfied”.

6.1.2. Knowledge assessment

With regard to knowledge about osteoporosis and FF, the participants obtained an average score of 18.1 points (69.62%), out of maximum possible score of 26. The areas of lowest proficiency concern knowledge relating to epidemiology and dietary considerations (Fig. 2.

The data (Table 2) demonstrated a statistically significant

relationship between knowledge and academic qualifications (p = 0.015), nurses with a master’s degree or doctorate have the highest levels of knowledge, while their counterparts with postgraduate training have the lowest levels of knowledge (Table 2).

There was no correlation between time of professional practice and level of knowledge, as shown by Pearson’s correlation coefficient (r = 0.04; p = 0.356).

7. Discussion

Phase I of the study aimed to evaluate the RNS’s knowledge about osteoporosis and fragility fractures in Portugal. We found that in our sample (which has a similar geographic and gender distribution of the population) 69.6% of the answers were correct when applying the Knowledge questionnaire. The main areas with knowledge deficit were related to epidemiology and nutrition. RNS knowledge of osteoporosis and FF was positively influenced by higher academic degrees. However, no statistically significant influence was observed in relation to professional categories, years of service or experience in orthopedic service.

When comparing these results, involving nurses from different international backgrounds, it is essential to take into account educational and contextual differences for adequate interpretation of the data. In Portugal we have graduate nurses, post-graduate nurses and rehabilitation specialists in clinical practice. Academic training also progresses to master’s degrees and doctorates. We don’t have postgraduate training in osteoporosis in Portugal as we do in other European countries like the UK, for example.

Research on nurses’ knowledge about osteoporosis and fractures dates back to 1998 when Hunt and Repa-Eschen observed that nurses themselves considered their knowledge inadequate and valued continuous education. Subsequently, Berarducci et al. (2002) underscored the need to increase nurses’ knowledge namely in issues related with prolonged use of glucocorticoids increasing the risk of osteoporosis, were only 25% answered correctly, whereas our study found a 94.9% correctness rate among RNS. This difference may be attributed to the specialization and higher level of education among our study participants. When looking at research performed in nursing students the results are very similar with the ones obtained in our study They recorded a 66.5% (Berarducci, 2004) correctness rate versus 69.6% in our study.

Based on our findings and corroborating evidence from other studies (Vered et al., 2008; Peng et al., 2020), it’s consensual that nurses exhibit comparatively lower knowledge in dietary aspects, specifically regarding calcium. This may be explained do to a lack of specific modules about nutrition in nursing degrees’. In future we suggest that such content should be added to nursing curricula. Areas such as the prevention of complications, such as fall prevention, exhibited better results, this may be attributed to the direct association between fall prevention measures and nursing competencies, unlike epidemiology or nutrition topics.

The study published in 2007 by Giangregorio et al., used the questionnaire by Berarducci et al. (2002) with adaptations to the Canadian reality. The questionnaire was applied to 179 health professionals directly involved in providing care to people with osteoporosis or fragility fractures in a hospital in Canada, and not just to nurses. The study documented 60.9% correct answers. Pharmacists, nutritionists and densitometry technicians obtained the best results and nurses had the greatest variability in results. When analyzing the data, we understood that one third of the nurses were nursing assistants.

The study by Fourie et al. (2015) explored the knowledge of orthopedic nurses in New Zealand. The average score was 14.8 (64.3%), for a total of 23 possible correct answers to the questionnaire administered. Similarly, a cross-sectional survey was conducted among orthopedic nurses in 13 tertiary hospitals in Hunan Province, China, which showed that orthopedic nurses had moderate to low levels of knowledge about osteoporosis (Peng et al., 2020).

In the study by Mahdaviadzad et al. (2021), 160 nurses from

orthopedic services responded to a knowledge questionnaire, presenting an average score of 11.60 (out of the maximum possible score of 18) and 3.47 (out of the maximum possible score of 5), respectively. The study reiterates that the lack of adequate knowledge on the part of nurses about the nature of osteoporosis, as an underlying chronic disease, puts the person at increased risk of fragility fractures (Åkesson et al., 2022).

In the subsequent phase of our study, we assessed knowledge “before” and “after” an educational programme involving 42 nurses. The primary research question in Phase II sought to discern the impact of an educational programme on nurses’ knowledge using the “The Knowledge Assessment of Rehabilitation Nursing Specialists on Osteoporosis and Fragility Fracture Prevention and Treatment” at two assessment points (before and after). Our findings indicated a significant increase in knowledge within the intervention group. Importantly, this knowledge enhancement was statistically significant among specialized nurses and nurses practicing in orthopedic services. Conversely, we did not discern any statistically significant association between knowledge improvement and years of service.

Our training strategy relied mainly on non-face-to-face synchronous sessions, held after working hours. However, the planned training activity included two face-to-face modules with a practical methodology, which facilitated discussions on strategies to face the challenges inherent to the different organizational models in Portuguese hospitals, including Hospitals, Hospital Centers and Local Health Units.

The observed knowledge augmentation aligns with findings in Lewiecki et al.’s (2017) study, where the impact of a training activity was positively correlated with nursing professionals’ knowledge through remote non-face-to-face training. Åkesson et al.’s (2022) study similarly underscores the importance of employing remote digital strategies as a means of providing education to healthcare professionals.

Empowering nurses to care for individuals post-low-impact falls, resulting in fragility fractures, emerges as a strategy for enhancing nursing care in the osteoporosis and fragility fracture domain (Berarducci et al., 2002; Senay et al., 2019; Peng et al., 2020). In addition to knowledge, there is a consistent thread in the literature emphasizing the importance of nurses’ awareness and engagement in addressing the challenges of osteoporosis and fragility fractures (Falaschi and Marsh, 2021; Åkesson et al., 2022).

Healthcare professionals can improve knowledge and self-efficacy by providing education about osteoporosis to the person who has already suffered an FF (McWilliam Ross and Gilder, 2023). Although increasing individual knowledge holds promise for improved health outcomes in osteoporosis and fragility fractures, the study by Åkesson et al. (2022) highlights the importance of systemic measures in the organization of healthcare to improve health-promoting behaviors and the quality of patient care. In the same vein, nurses play a fundamental role in leading and coordinating services that lead to the integration of multidisciplinary care, with the general objective of preventing new fractures (Åkesson et al., 2013; O’Rourke, 2022).

Overall, participants expressed a high level of satisfaction with the training activity, with an average satisfaction rating of 81.5%. The training environment fostered interaction and knowledge sharing, facilitating the analysis of hospital typology specificities and reflection on contextual needs. The small cohort of participants (42) fostered the development of a trust-based relationship, collaborative idea generation, and thematic content enrichment, culminating in enhanced knowledge levels assessed after the training activity and high participant satisfaction.

Continuing education is a cornerstone for certification and skill development (Meehan et al., 2019) and a positive aspect of our study is the accreditation provided by the Portuguese Nurses Council to our education program as the quality and safety of the training, contributing to the cultivation of knowledge, attitudes and skills leading to professional excellence.

7.1. Study limitations

In our research journey, we noted a lack of studies in the domain of osteoporosis knowledge in Portugal, which served both as a limitation and motivation for our study. We adapted a questionnaire originally validated for the general population and used it to assess knowledge about osteoporosis among healthcare professionals. This could introduce potential biases or inaccuracies when comparing our data and we exercise caution in interpreting the results. Furthermore, international differences in the academic training of nurses are a reality.

During Phase II of our study, we employed a non-probabilistic convenience sampling method, which means our sample may not be representative of the entire population. Regarding knowledge assessment, we could have assessed knowledge retention over a longer period after the intervention and the results could have been different.

8. Conclusions

Our study concluded that there are knowledge gaps among RNS in Portugal regarding osteoporosis and fragility fractures. The most deficient areas of knowledge are epidemiology and nutrition. These findings highlighted the imperative need for targeted educational interventions to improve the skills of rehabilitation nurses in effectively managing care in clinical practice. Subsequently, it demonstrated the effectiveness of an educational intervention in improving knowledge levels among orthopedic nurses in the NHS with specialist nurses showing the greatest difference in knowledge in the final assessment.

In conclusion, this two-phase study highlights the importance of addressing knowledge gaps among healthcare professionals, with a specific focus on rehabilitation nurses, in the context of osteoporosis and fragility fractures. An educational programme offers a promising strategy to improve the skills of healthcare providers and, ultimately, improve patient outcomes in managing these prevalent and debilitating conditions.

Based on the results of this study we strongly recommended that all nursing degrees should incorporate a module of 40 h dedicated to osteoporosis and fragility fractures on their degrees and masters.

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Ethical approval

The study was approved by an ethics committee (P767_04_2021) and human rights and recommendations contained in national and international documents relating to the investigation were respected.

CRedit authorship contribution statement

Georgina Pimentel: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Arménio Cruz:** Validation, Supervision, Resources, Methodology, Conceptualization. **Cristina Lavareda Baixinho:** Visualization, Validation. **Maria Loureiro:** Validation, Resources, Methodology. **Sílvia Fernandes:** Validation, Resources, Methodology. **Ricardo J.O. Ferreira:** Writing – review & editing, Validation, Resources, Methodology, Investigation, Formal analysis, Conceptualization. **Andréa Marques:** Writing – review & editing, Validation, Supervision, Resources, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no competing interests.

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APPSReuma (Portuguese Association of Health Professionals in Rheumatology)

List of Abbreviations

FF	Fragility Fracture
NHS	National Health Service
RNS	Rehabilitation Nursing Specialists
SPSS	Statistical Package for the Social Sciences
SD	Standard Deviation

Appendix A Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijotn.2024.101120>.

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