ORIGINAL ARTICLE

Assessment of Knowledge on Osteoporosis and Prevention Among Caregivers in Institutions for The Elderly

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ABSTRACT

Introduction: Osteoporosis, a disease characterized by reduced bone mass and increased fracture risk, significantly affects millions worldwide and is notably underdiagnosed, particularly among the ageing population. Caregivers, including nurses and therapists, play a vital role in the care and education of osteoporosis prevention among the elderly. Nevertheless, the knowledge gap in osteoporosis and its prevention among healthcare providers globally remains. In response to the escalating global health concern posed by osteoporosis, this study aimed to assess the knowledge of osteoporosis and its prevention among caregivers in the institutions for the elderly in Selangor, Malaysia, and examine how this knowledge correlates with their educational background and work experience. **Materials and methods:** This study employed convenience sampling to survey caregivers from 26 registered institutions for the elderly using the Osteoporosis Prevention and Awareness Tool (OPAAT). Chi-square test was used to test the association of the variables. **Results:** Approximately 136 participants were recruited in this study. The findings revealed that caregivers' overall knowledge was moderate, with higher educational qualifications linked to better understanding, while work experience showed no significant impact. Meanwhile caregivers with fewer years of experience demonstrated better knowledge. **Conclusion:** This study found that while osteoporosis knowledge among caregivers in institutions for the elderly in Selangor was moderate, those with higher educational achievements had better awareness. It emphasizes the need for continuous education and targeted training to address knowledge gaps, particularly in osteoporosis prevention and management.
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INTRODUCTION

Osteoporosis represents a significant and growing global health concern, affecting an estimated 200 million women worldwide (1). This condition is characterized by diminished bone mass and structural deterioration, leading to increased fragility and a heightened risk of fractures, which can result in significant disability, morbidity, and even mortality (2). Despite its prevalence, osteoporosis frequently remains underdiagnosed and undertreated due to its asymptomatic nature until a low-trauma fracture occurs. Such fractures, particularly prevalent among the ageing population, necessitate hospitalization and are a significant contributor to the global burden of disease, with more than 8.9 million fractures annually.

The incidence of osteoporosis-related hip fractures is notably on the rise in Asia, attributed to the ageing demographic and urbanization trends. Malaysia is witnessing a pronounced increase in hip fracture rates, anticipated to escalate more than threefold by 2050, alongside a corresponding surge in treatment costs (3). This situation underscores a critical need for enhanced osteoporosis diagnosis and management strategies, especially given the evidence of systemic underdiagnosis and undertreatment across various regions, including Asia and Malaysia.

Amidst these challenges, Malaysia's demographic shift towards an ageing population place growing demands on institutions for the elderly, which play a pivotal role in providing long-term care. The workforce within these

facilities comprises caregivers with diverse professional backgrounds, such as nurses, occupational therapists, physiotherapists, and dietitians (4, 5). These caregivers are instrumental in the daily management and well-being of the elderly residents. Given the escalating rates of osteoporosis and fragility fractures among the elderly, caregivers are crucial in offering comprehensive care, which includes education on health awareness and osteoporosis prevention.

However, studies indicate a concerning lack of osteoporosis knowledge among healthcare providers, including caregivers, which can hinder effective management and prevention efforts. This knowledge gap is evident in various contexts, for example in Saudi Arabia, general practitioners demonstrated poor knowledge of osteoporosis diagnosis, risk factors, and preventive measures, particularly regarding the use of bone mass density (BMD) testing and the importance of calcium and vitamin D intake (6). Similarly, in the United Kingdom, healthcare professionals exhibited a suboptimal understanding and lack of confidence in identifying at-risk patients and initiating appropriate preventive interventions, leading to delays in diagnosis and treatment (7). Meanwhile in Spain, a study among postmenopausal women in primary care revealed moderate knowledge gaps among healthcare providers, particularly regarding osteoporosis risk factors, such as the role of physical activity, calcium intake, and sunlight exposure (8). A survey among public health nurses in Taiwan further revealed low osteoporosis knowledge, underscoring the critical need for improved education and training to enhance prevention and management efforts globally (9).

Considering Malaysia's burgeoning elderly care institutions and its demographic shift towards an ageing population, up to the present, no studies have looked at the knowledge of osteoporosis among caregivers in institutions for the elderly in Malaysia. Therefore, this study investigated the association between the caregiver's knowledge of osteoporosis and its prevention and their educational background and work experience in elderly care settings.

MATERIALS AND METHODS

Data collection

The data were collected through convenience sampling from caregivers working in 26 registered elderly care institutions across Selangor (Figure 1). Convenience sampling was chosen due to the ease of access to caregivers across registered institutions within Selangor, given logistical constraints and the nature of the caregiving workforce. The institutions included in this study were Amazing Grace Senior Home, Alzheimer's Disease Foundation Malaysia, Attia Care Centre, Bait Al-Mawaddah by Lembaga Zakat Selangor, Calvary Sunshine Home, Darul Insyirah, Grace Home Klang, Noble Care Home, Pusat Jagaan Siti Nor Aini, Pusat Jagaan OKU Nur, Pusat Jagaan Satu Warga Emas Serendah, Persatuan Kebajikan Rumah Victory Malaysia, Pusat Jagaan Husna Arrashid, Pusat Jagaan Warga Emas Murni Kaseh, Pusat Jagaan Persatuan Rumah Warga Emas Klang, Pusat Jagaan Warga Tua Jashiera, Pusat Jagaan Warga Emas Air Tenang, Pusat Jagaan Warga Emas Mahmudah, Pusat Jagaan Warga Emas Yi Xing, Rainbow Care Centre, Rumah Rawatan Al-Ikhlas, Rumah Jagaan & Rawatan Orang Tua Al-Ikhlas, Rumah Seri Kenangan Cheras, St Marks Cozy Home, Tree Retirement Home, and Zara Aisyah Care Centre. The inclusion criteria for this study required caregivers to be literate in English, actively engaged in caregiving at one of the institutions, willing to provide informed consent, and able to complete the questionnaire. To ensure the study focused on individuals directly involved in caregiving, administrative staff from these institutions were excluded from participation.

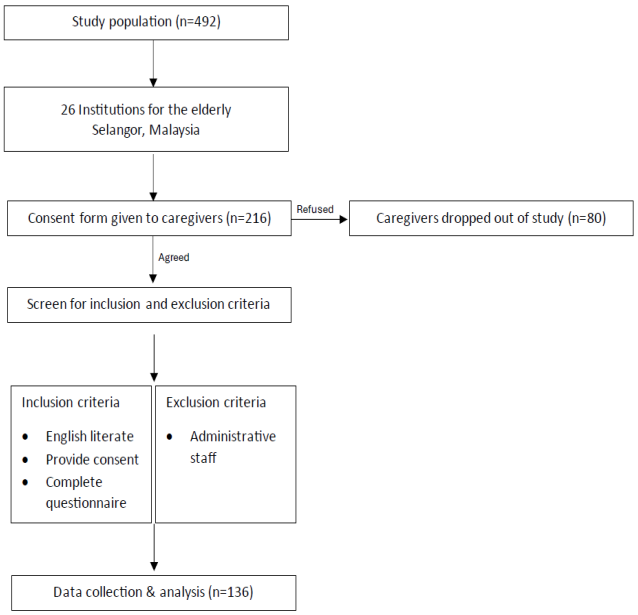

Figure 1: Flow diagram of the study

Sample size

The sample size was calculated using an online sample size calculator by Raosoft, Inc. According to the Department of Statistics Malaysia, the number of caregivers in registered care centres for the elderly in Selangor is 492. The margin of error set in this study was 5%, with a confidence level of 95%. Setting the population size of 492 and the respondent distribution of 50%, the total number of representative samples needed in this study was 216.

Instrument

A questionnaire consisting of two sections was constructed and adopted from a validated questionnaire to assess the knowledge about osteoporosis and its prevention in Malaysia (10). In the first section, demographic information such as age, gender, professional status, level of education, and years of

working experience was asked. Meanwhile, the second section consists of a questionnaire about osteoporosis knowledge and prevention.

Osteoporosis Prevention and Awareness Tool (OPAAT) Questionnaire

In section two, the Osteoporosis Prevention and Awareness Tool (OPAAT) Questionnaire was adopted from Toh et al., 2015. The OPAAT consists of 30 items and is categorized into three domains: osteoporosis in general (11 items), consequences of untreated osteoporosis (5 items), and osteoporosis prevention (14 items). The questionnaire has three possible responses, 'True', 'False' and 'Do not know'. Each correct response was scored 1 point while the incorrect answer was scored 0 (False and Do not know). The minimum and maximum scores of the OPAAT are 0 and 30, respectively. The questionnaire has been tested for reliability and validity. The Cronbach's α for the first domain (osteoporosis in general) was 0.668, second domain (consequences of untreated osteoporosis) was 0.286, and third domain (osteoporosis prevention) was 0.748. All items were highly correlated (Spearman's rho: 0.761-0.990, $p<0.05$) with no significant change in the overall test-retest scores, indicating that OPAAT has achieved stable reliability.

Statistical analysis

Data obtained from this study was analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistical analysis was used to calculate the mean, median, and percentage of the demographic data and the scores obtained from the OPAAT questionnaire. An inferential statistic was used to analyze the association between caregivers' knowledge level on osteoporosis and their level of education and years of working experience. The Chi-square test of independence was chosen to test the association of these variables with a statistical significance at $p<0.05$.

Ethical Clearance

The ethics approval for this research was obtained from the UiTM Research Ethics Committee (Reference no: REC/586/19). Permission was also obtained from all 26 registered institutions for the elderly to conduct the research.

RESULTS

Demographic characteristics of respondents

Initially, the study aimed to recruit 216 participants across 26 elderly care institutions registered with the Department of Social Welfare in Selangor. However, a 37% dropout rate occurred, primarily due to refusal to respond or submission of incomplete questionnaires, resulting in a final recruitment of 136 participants. Despite this, the final sample size remained adequate for analysis based on the calculated sample size using Raosoft. The revised margin of error was approximately ±7.5%, which is within an acceptable range for exploratory studies. Additionally, the final sample maintained a diversity across educational levels, professional backgrounds, and work experience, as participants were recruited from 26 institutions. This diversity helps mitigate potential sampling bias and supports the representativeness of the study findings.

The gender distribution revealed a predominance of female caregivers, accounting for 86.8% (n=118) of the sample, compared to 13.2% (n=18) who were male (Table I). Meanwhile for age, most respondents fell into the 21-25 age bracket, comprising 57.4% (n=78) of the sample. This was followed by those aged 26-30 years (20.6%, n=28), 31-40 years (10.3%, n=14), 51 years and above (5.9%, n=8), 41-50 years (3.7%, n=5), and the least represented group was 18-20 years at 2.2% (n=3).

Table I: Demographic Data

Variables	Frequency (n=136)	Percentage (%)
Gender		
Male	18	13.2
Female	118	86.8
Age		
18-20 years	3	2.2
21-25 years	78	57.4
26-30 years	28	20.6
31-40 years	14	10.3
41-50 years	5	3.7
51 years and above	8	5.9
Professional Status		
Nurse	50	36.8
Occupational Therapist	13	9.6
Physiotherapist	17	12.5
Social Workers	42	30.9
Others	14	10.3
Education Level		
PMR	3	2.2
SPM	25	18.4
Diploma	69	50.7
Degree	39	28.7
Years(s) of experiences		
Less than one year	52	38.2
1-2 years	32	23.5
2-5 years	36	26.5
5-10 years	9	6.6
More than ten years	7	5.1

In terms of professional status, nurses represented the largest group at 36.8% (n=50), followed by social workers (30.9%, n=42), physiotherapists (12.5%, n=17), occupational therapists (9.6%, n=13), and other professions (10.3%, n=14). The educational background of the participants varied, with the majority holding a diploma (50.7%, n=69), followed by those with a degree (28.7%, n=39), SPM qualification (18.4%, n=25), and the fewest had PMR as their highest educational level (2.2%, n=3).

Experience in their field showed a diverse range, with 38.2% (n=52) of the respondents having less than one year of experience. This was closely followed by those with 1-2 years (23.5%, n=32), 2-5 years (26.5%, n=36), 5-10 years (6.6%, n=9), and more than ten years (5.1%, n=7) of experience. This demographic profile provides a comprehensive overview of the caregivers' backgrounds in the study, indicating a predominantly young and female workforce.

Knowledge of Osteoporosis among Caregivers in the Institutions for the Elderly

The assessment of caregivers' knowledge of osteoporosis in institutions for the elderly using the Osteoporosis Prevention and Awareness Tool (OPAAT), resulted in an average score of 18.03 (SD = 3.85) out of a possible 30. The distribution of correct and incorrect responses across individual questions is detailed in Table II.

Table II: Caregivers response to the OPAAT questionnaire

No.	Item	Participants (n=136)		
		Correct Answer	Right, n (%)	Wrong, n (%)
	A. **Osteoporosis in general** **What can you tell me about osteoporosis?**			
1	Makes bones weaker, more brittle, and more likely to break	True	130 (95.6)	6 (4.4)
2	Everybody will get osteoporosis as it is part of aging	False	52 (38.2)	84 (61.8)
3	Osteoporosis occurs because bone is removed faster than it is formed	True	76 (55.9)	60 (44.1)
4	Osteoporosis and osteoarthritis are different names we can use to describe the same disease	False	78 (57.4)	58 (42.6)
5	Osteoporosis usually has no symptoms	True	43 (31.6)	93 (64.4)
6	Postmenopausal women are not at risk for osteoporosis	False	95 (69.9)	41 (30.1)
7	Osteoporosis is an untreatable disease	False	64 (47.1)	72 (52.9)
8	A bone mineral density test is used to diagnose osteoporosis	True	110 (80.9)	26 (19.1)
9	I do not need a bone mineral density test unless I fracture my bones	False	80 (58.8)	56 (41.2)
10	A bone mineral density test is high in radiation	False	34 (25)	102 (75)
11	A bone mineral density test should be performed monthly to monitor bone loss	False	57 (41.9)	79 (58.1)
	B. Consequences of osteoporosis **What will happen if osteoporosis is left untreated?**			
12	Results in back pain	True	105 (77.2)	31 (22.8)
13	Loss of height or hunchback	True	102 (75)	34 (25)
14	Loss of mobility (unable to move around myself)	True	115 (84.6)	21 (15.4)
15	Results in tooth loss	False	50 (36.8)	86 (63.2)
16	Results in joint pain or swelling of fingers	False	39 (28.7)	97 (71.3)
	C. Osteoporosis prevention **What can you tell me about osteoporosis prevention?**			
17	The recommended daily intake for calcium in women above 50 years of age is 1000mg	True	78 (57.4)	58 (42.6)
18	It is too late to increase calcium intake after the age 50	False	75 (55.1)	61 (44.9)
19	Glucosamine can help prevent osteoporosis	False	29 (21.3)	107 (78.7)
20	Calcium supplements can help prevent osteoporosis	True	122 (89.7)	14 (10.3)
21	The regular dose of calcium supplements can cause kidney stones	False	46 (33.8)	90 (66.2)
22	Foods such as milk, tofu, anchovies (ikan bilis), yellow dhal and spinach are rich in calcium	True	105 (77.2)	31 (22.8)
23	You can obtain your recommended daily intake of vitamin D by exposing your skin to sunlight for about 15 minutes a day	True	82 (60.3)	54 (39.7)
24	Increasing coffee and tea intake can help in osteoporosis prevention	False	99 (72.8)	37 (27.2)
25	Weight bearing exercise (such as brisk walking and line dancing) can decrease bone loss	True	75 (55.1)	61 (44.9)
26	Exercise will wear out bones	False	118 (86.8)	18 (13.2)
27	Certain medications (such as sleeping tablets or high blood pressure medications) may reduce the risk of falling	False	79 (58.1)	57 (41.9)
28	To prevent falls, comfortable shoes with a good grip should be used	True	122 (89.7)	14 (10.3)
29	Poor vision may lead to falls	True	128 (94.1)	8 (5.9)
30	Being under-weight helps prevent osteoporosis	False	65 (47.8)	71 (52.2)

General Information on Osteoporosis

Caregivers showed a firm grasp of osteoporosis fundamentals, with 95.6% correctly acknowledging its effect on bone fragility and fracture risk. However, misconceptions were apparent, as only 38.2% correctly dismissed the inevitability of osteoporosis with ageing. A little over half recognized osteoporosis's accelerated bone loss characteristic (55.9%) and the distinct difference between osteoporosis and osteoarthritis (57.4%). Knowledge gaps persisted, notably with 64.4% unaware of the asymptomatic nature of osteoporosis. Most were informed about postmenopausal women's risk (69.9%) and the treatability of osteoporosis (47.1%), demonstrating a balanced understanding of osteoporosis basics.

A majority, 80.9%, correctly identified that a bone mass density (BMD) test is pivotal in diagnosing osteoporosis, illustrating a high awareness of its diagnostic significance. Conversely, misconceptions regarding the necessity and frequency of BMD tests and their safety were notable.

The misconception that a BMD test is only warranted following a bone fracture was evident, with only 58.8% of participants accurately recognizing this statement as false. This indicates that a significant portion of caregivers, 41.2%, may underestimate the preventive and early diagnostic value of bone mass density testing in the absence of acute symptoms.

Additionally, there was a considerable gap in knowledge regarding the safety of BMD tests, with only 25% of caregivers correctly dispelling the misconception that these tests are high in radiation. This suggests a widespread belief among 75% of the participants that BMD tests pose a high radiation risk.

Furthermore, the frequency of BMD testing was another area of confusion. Only 41.9% correctly refuted that BMD tests should be conducted monthly to monitor bone loss, leaving a majority with the incorrect belief that such frequent testing is necessary.

Consequences of Osteoporosis

The participants demonstrated awareness of osteoporosis' implications if untreated, correctly identifying its association with back pain (77.2%), height reduction or hunchback formation (75%), and mobility loss (84.6%). Misunderstandings were noted regarding osteoporosis' relationship with tooth loss (36.8%) and joint pain or finger swelling (28.7%), where a significant proportion of participants could not correctly recognize the condition's direct outcomes.

Knowledge of Osteoporosis Prevention

Caregivers' knowledge of the prevention of osteoporosis varied, with 57.4% accurately identifying the calcium intake recommendation for women over 50 years and 55.1% incorrectly believing in the ineffectiveness of increasing calcium intake past this age. There was a notable discrepancy in the understanding of glucosamine's inefficacy in preventing osteoporosis, with 21.3% correctly identifying this. High agreement was found on the effectiveness of calcium supplements (89.7%). In contrast, misunderstandings about calcium supplements' side effects, the benefits of specific foods, and vitamin D exposure through sunlight were evident. Exercise misconceptions were also addressed, with a large majority recognizing the non-detrimental effects of exercise on bones (86.8%) and the importance of comfortable shoes in fall prevention (89.7%).

Level of Knowledge on Osteoporosis and Prevention among Caregivers

Based on the cumulative scores from OPAAT, caregivers' knowledge levels were classified into three distinct categories: low (score <10), moderate (10-20), and high (>20). The analysis revealed that a predominant portion of caregivers, accounting for 71.3%, demonstrated a moderate level of osteoporosis knowledge (Table III). Approximately 26.5% of the caregivers were identified as having a high level of knowledge of osteoporosis, while the remaining 2.2% fell into the low knowledge category.

Table III: Level of knowledge on osteoporosis and prevention among caregivers in the institutions for the elderly

Level of knowledge on osteoporosis	Frequency (n=136)	Percentage %
Low Knowledge	3	2.2
Moderate Knowledge	97	71.3
High Knowledge	36	26.5

Association of Osteoporosis Knowledge and Prevention with Caregivers' Education Level

Pearson Chi-Square test demonstrated an association between the knowledge of osteoporosis and the caregivers' level of education. The results showed a significant association with a $p<0.01$ (Table IV).

Table IV: Association between knowledge of osteoporosis and prevention with the education level of caregivers in the institutions for the elderly

Variable	Frequency (%)			χ^2 Statistics (df)	p-value
Level of Education	Low	Moderate	High		
PMR	0 (0)	1 (1)	2 (5.6)	17.88	0.007
SPM	3 (75)	20 (20.8)	2 (5.6)		
Diploma	0 (0)	52 (54.2)	17 (47.2)		
Degree	1 (25)	23 (24)	15 (41.7)		

Association Between Osteoporosis Knowledge and Prevention with Caregivers' Work Experience

The results of the chi-square test indicated no significant association between the caregivers' knowledge of osteoporosis and their years of working experience, with a p-value of 0.412 (Table V)

Table V : Association between knowledge of osteoporosis and prevention with the years of working experiences of the caregivers in the institutions for the elderly

Variable	Frequency (%)			χ^2 Statistic (df)	p-value
Years of experience	Low	Moderate	High		
Less than one year	2 (50)	37 (38.5)	13 (36.1)	8.218	0.412
1-2 years	1 (25)	23 (24)	8 (22.2)		
2-5 years	0 (0)	27 (28.1)	9 (25)		
5- 10 years	0 (0)	4 (4.2)	5 (13.9)		
More than ten years	1 (25)	5 (5.2)	1 (2.8)		

DISCUSSION

Given the global recognition of osteoporosis as a significant public health issue, the role of caregivers, particularly within the institutions for the elderly, is crucial.

These caregivers are health practitioners, including nurses, occupational therapists, physiotherapists, nutritionists, and social workers, who are entrusted with the comprehensive care and well-being of the elderly (4). Therefore, good knowledge of osteoporosis is necessary as the caregivers not only manage the daily activities of the elderly but are also responsible for identifying and managing individuals with osteoporosis. Moreover, research finding found that osteoporotic patients accompanied by caregivers to doctor's appointments exhibited better adherence to osteoporosis therapy than those alone or with relatives (11). This was attributed to caregivers' assistance in managing technicalities such as medication procurement, dietary calcium calculation, and provision of educational resources like physical education video courses.

The employment of the Osteoporosis Prevention and Awareness Tool (OPAAT) questionnaire was considered suitable for this study due to its comprehensive coverage of essential osteoporosis knowledge areas. The instrument assessed the general knowledge, consequences of untreated osteoporosis, and preventive measures (10). In this study, the demographic composition of the respondents was predominantly females aged 21 to 25 years with a nursing background. Based on the OPAAT scores, our findings demonstrated that caregivers in elderly care institutions across Selangor know moderately about osteoporosis and its prevention. Similarly, research conducted among nurses in Jordan exhibit moderate knowledge, attitudes, and practices (KAP) regarding osteoporosis (12).

Similarly, a study that surveyed 465 caregivers across seven disability care institutions in Taiwan demonstrated moderate osteoporosis health literacy, indicating that knowledge gaps among caregivers are not distinctive to Malaysia (9). This aligns with findings from Iraq, where research involving health workers at the Al Fallujah Teaching Hospital reported good to moderate knowledge about osteoporosis and preventive measures but revealed weak understanding of risk factors and treatments (13). This lack of comprehensive knowledge mirrors our findings, where 64.4% of caregivers wrongly believed osteoporosis is asymptomatic, and 78.7% incorrectly believed glucosamine supplements to be a preventative measure.

However, in alignment with the knowledge of health providers' at the Al Fallujah Teaching Hospital (13), our study also demonstrated that caregivers could correctly recognize that anchovies contain calcium and accurately dismissed the notion that increasing coffee and tea intake could prevent osteoporosis. Approximately 89% of caregivers are aware that calcium supplements can aid in osteoporosis prevention, potentially safeguarding the health of the elderly and preventing severe complications among the elderly in the institutions. Unlike the study conducted among the Jordanian nurses, a lack of knowledge regarding the benefits of calcium and vitamin D intake was found (12). Consequently, this could profoundly impact patient health and lead to severe complications in some instances.

Moreover, our results showed that 77.2% of caregivers were aware of back pain as a result of osteoporosis, closely mirroring the 74.3% correctness rate among health providers at the Al Fallujah Teaching Hospital (13). This finding suggests a shared understanding among caregivers and healthcare providers regarding one of the most common and recognizable symptoms of osteoporosis. A notable knowledge gap in our study was observed regarding osteoporosis and tooth loss, where only 36.8% of caregivers demonstrated awareness. This contrasts sharply with the healthcare providers in the Al Fallujah study, where 74.3% correctly identified this association (13). The discrepancy may stem from variations in professional training and exposure to osteoporosis-related education (14). In contexts where osteoporosis education is limited or inconsistent, caregivers may focus predominantly on widely recognized symptoms like back pain while overlooking lesser-known signs such as tooth loss, which is linked to reduced bone density in the jaw.

Likewise, research conducted on 75 general medical practitioners and 120 nurses from hospitals and private clinics in Igatpuri, Nasik, India demonstrated a notable deficit in osteoporosis knowledge (15). A common misconception among these nurses is that osteoporosis predominantly affects postmenopausal and elderly women. While this group is at high risk, the condition also significantly impacts ageing men due to physiological and anatomical changes associated with ageing, such as declining bone mass and hormonal changes, which escalate the likelihood of osteoporosis. Interestingly, our findings indicated that 69.9% of caregivers are aware of the risk osteoporosis poses to postmenopausal women. These findings underscore a pressing need for enhanced education and training focused on osteoporosis among caregivers and health practitioners (13). Such initiatives should address common misconceptions, improve awareness of at-risk populations, and emphasize the importance of early prevention and management strategies for both men and women.

Nurses must possess comprehensive knowledge, attitudes, and practices (KAP) related to osteoporosis prevention, understanding of risk factors, and nutritional advice to effectively fulfil their educational roles (16). A deficiency in KAP regarding osteoporosis can adversely impact nurses' engagement in preventive behaviors, potentially compromising the management and outcome of osteoporosis in their care recipients.

Moreover, insufficient training in caregiving services could be a crucial factor affecting caregivers' knowledge of osteoporosis (14). The lack of standardized

educational programs limits their ability to prevent and manage the condition, impacting elderly care. Implementing evidence-based interventions, such as interactive workshops and seminars in collaboration with healthcare institutions, can address this gap. These sessions should cover key topics like calcium and vitamin D intake, physical activity, BMD testing, and fall prevention (17). Similar programs in Taiwan and Saudi Arabia have shown notable improvements in osteoporosis knowledge among healthcare providers (9, 18).

This study showed that the significant association between knowledge levels across different educational qualifications suggests a pattern where caregivers with higher educational achievements have a better knowledge of osteoporosis and its prevention. Caregivers with a tertiary education, such as a diploma or degree, possess moderate to high osteoporosis knowledge. This highlights the strong association between advanced education and enhanced awareness of the condition, as demonstrated by a study showing that caregivers in disability care facilities with a college education had a high literacy level of osteoporosis risk (9). On the contrary, research observed that osteoporosis awareness levels were generally moderate, with education level being a risk factor for diminished awareness (19). This indicates a clear correlation between higher educational attainment and increased knowledge regarding osteoporosis. Therefore, educational interventions targeted at caregivers with lower educational backgrounds may be pivotal in elevating their understanding of osteoporosis and fostering improved care practices within institutions for the elderly.

This study showed no significant association between working experience and the level of knowledge among caregivers in the institutions for the elderly in Selangor. However, most caregivers with moderate levels of osteoporosis knowledge fall into the group with less than five years of working experience compared to those with more than five years of working experience. Conversely, physical therapy providers in Saudi Arabia with good knowledge about osteoporosis had more than ten years of working experience (18). Almost half of these practitioners mainly treat orthopaedic-related conditions. The discrepancy with our findings is likely attributed to the heterogeneity of the study population, as only 11.7% of the participants have working experience of more than five years. A cumulative of 80% of the caregivers in our study were aged between 18 and 30 years with moderate to good knowledge of osteoporosis. Moreover, a study on medical practitioners under 40 and those with less than ten years of practice exhibited better knowledge about osteoporosis (20). The study also suggests that these younger physicians displayed a greater understanding of osteoporosis, suggesting an increased focus on this condition within healthcare education.

CONCLUSION

The level of knowledge of osteoporosis and its prevention among caregivers in institutions for the elderly in Selangor, Malaysia, was overall moderate. There was a significant association between higher educational achievements and an enhanced awareness of osteoporosis among caregivers. This highlights the pivotal role of advanced education in equipping caregivers with comprehensive knowledge about osteoporosis, which is crucial for adequate care and management among the elderly.

However, this study also identified gaps in the caregivers' knowledge, especially concerning osteoporosis prevention and its consequences, suggesting an urgent need for targeted educational interventions. Despite the moderate level of knowledge across the board, younger caregivers and those with less working experience displayed better osteoporosis knowledge. There was no significant association between years of experience and knowledge levels, emphasizing the importance of continuous education and training for all caregivers.

To address these gaps, targeted educational interventions such as structured workshops, in-service training, and community-based programs should be prioritized. These interventions can focus on critical areas, including osteoporosis risk factors, prevention strategies, and management approaches, tailored to the caregivers' needs and the Malaysian healthcare framework.

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REFERENCES

1. Shen Y, Huang X, Wu J, Lin X, Zhou X, Zhu Z, et al. The global burden of osteoporosis, low bone mass, and its related fracture in 204 countries and territories, 1990-2019. Frontiers in Endocrinology. 2022;13:882241. doi.org/10.3389/fendo.2022.882241
2. van Oostwaard M, Marques A. Osteoporosis and the Nature of Fragility Fracture: An Overview. Fragility Fracture and Orthogeriatric Nursing: Holistic Care and Management of the Fragility Fracture and Orthogeriatric Patient. 2023:17-34. https://doi.org/10.1007/978-3-319-76681-2
3. Ong T, Khor H, Kumar C, Singh S, Chong E, Ganthel K, et al. The current and future challenges of hip fracture management in Malaysia. Malaysian orthopaedic journal. 2020;14(3):16. https://doi: 10.5704/MOJ.2011.0
4. Sekanina U, Tetzlaff B, Mazur A, Huckle T, Kьhn A, Dano R, et al. Interprofessional collaboration in the

home care setting: perspectives of people receiving home care, relatives, nurses, general practitioners, and therapists—results of a qualitative analysis. BMC Primary Care. 2024;25(1):1-14. doi: 10.1186/s12875-024-02313-8.
5. Geese F, Schmitt K-U, editors. Interprofessional collaboration in complex patient care transition: A qualitative multi-perspective analysis. Healthcare; 2023: MDPI. doi.org/10.3390/healthcare11030359
6. Ahmed Z, Alharbi D, Junaid AL, Shaik RA, Sami W. Knowledge, attitude and practice towards osteoporosis among general practitioners working in Al Majmaah Province, KSA. Asian Journal of Pharmaceutical Research and Health Care. 2019:45-54. DOI: 10.18311/ajprhc/2019/24437
7. Taylor J, Sterkel B, Utley M, Shipley M, Newman S, Horton M, et al. Opinions and experiences in general practice on osteoporosis prevention, diagnosis and management. Osteoporosis International. 2001;12:844-8. doi: 10.1007/s001980170035.
8. Rentero ML, Carbonell C, Casillas M, Bйjar MG, Berenguer R. Risk factors for osteoporosis and fractures in postmenopausal women between 50 and 65 years of age in a primary care setting in Spain: a questionnaire. The Open Rheumatology Journal. 2008;2:58. doi: 10.2174/1874312900802010058
9. Lin L-P, Lai W-J, Hsu S-W, Lin J-D. Health Literacy of Osteoporosis Risks among Caregivers Serving in Disability Care Facilities. International Journal of Environmental Research and Public Health. 2020;17(13):4903. doi.org/10.3390/ijerph17134903
10. Toh LS, Lai PSM, Wu DB-C, Wong KT, Low BY, Anderson C. The development and validation of the Osteoporosis Prevention and Awareness Tool (OPAAT) in Malaysia. PloS one. 2015;10(5):e0124553. doi.org/10.1371/journal.pone.0124553
11. Samieva S, Polyakova J, Seewordova L, Papichev E, Akhverdyan Y, Zavodovsky B. POS0580-Pare Patient Adherence to Osteoporosis Treatment is Higher With Caregiver Education. BMJ Publishing Group Ltd; 2023. doi.org/10.1136/annrheumdis-2023-eular.5918
12. Zaid A, Eyad AA, Hamzeh AN. Knowledge, attitude, and practices toward osteoporosis among Jordanian nurses. Frontiers of Nursing. 2023;10(3):327-33. DOI: 10.2478/FON-2023-0036
13. Al-Faluji AW, Latef KA, Nida AH. Knowledge of osteoporosis among health worker women in the Al-Fallujah Teaching Hospital. Iraqi Journal of Community Medicine. 2021;34(1):5-10. DOI: 10.4103/IRJCM.IRJCM_2_23
14. Mariani A, Salihah O, Adliah M, Mohd M. Knowledge, Attitude and Practice of Caregivers on Medication Management at Residential Aged Care Facilities in Malaysia. Medicine & Health. 2020;15(2). doi.org/10.17576/MH.2020.1502.08
15. Dange AK, Premchand P. Knowledge, attitude and practice of General Medical Practitioners and Nursing professionals regarding osteoporosis. Practitioner. 2016;75(23.53):23.53.
16. Eslami-Mahmoodabadi A, Foroughameri G, Maazallahi M, Farokhzadian J. Nurses' knowledge, attitude, and practice regarding osteoporosis prevention and its correlation with their nutritional behaviors. Journal of Preventive Medicine and Hygiene. 2023;64(4):E429. doi: 10.15167/2421-4248/jpmh2023.64.4.2709
17. Ong TIW, Lim LL, Chan SP, Chee WSS, Ch'ng ASH, Chong EGM, et al. A summary of the Malaysian Clinical Practice Guidelines on the management of postmenopausal osteoporosis, 2022. Osteoporosis and Sarcopenia. 2023;9(2):60-9. doi: 10.1016/j.afos.2023.06.002
18. Almaddah M, Alzahrani F, Gaowgzeh R, Alqarni A, Othman R, Gmmash A. Knowledge and Awareness of Osteoporosis: A Survey of Physical Therapy Providers in Saudi Arabia. International Journal of Clinical Practice. 2024;2024. doi.org/10.1155/2024/2797382
19. Oumer KS, Liu Y, Yu Q, Wu F, Yang S. Awareness of osteoporosis among 368 residents in China: A cross-sectional study. BMC musculoskeletal disorders. 2020;21:1-6. doi.org/10.1186/s12891-020-03217-1
20. Thakur P, Kuriakose C, Cherian KE, Asha HS, Kapoor N, Paul TV. Knowledge gap regarding osteoporosis among medical professionals in Southern India. Journal of Evaluation in Clinical Practice. 2020;26(1):272-80. doi.org/10.1111/jep.13164