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# Awareness and Knowledge of Osteoporosis among Medical Students at a Private Medical College in Lahore, Pakistan: An Assessment Using the Osteoporosis Knowledge Assessment Tool (OKAT)

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## Abstract

**Background:** The study aimed to assess knowledge and perception regarding osteoporosis among medical students at a private medical college in Lahore, Pakistan, using the Osteoporosis Knowledge Assessment Tool (OKAT).

**Methodology:** This descriptive cross-sectional study was conducted from February to April 2024 at Azra Naheed Medical College, Superior University, Lahore. The validated OKAT was employed to measure osteoporosis awareness. Institutional Ethical Board approval was obtained, and 323 medical students aged 18 years and above were recruited through non-probability consecutive sampling. Data were collected via an online Google Form and analyzed using descriptive statistics and chi-square tests, with a significance threshold of $p < 0.05$.

**Results:** Of the 323 participants, 176 (54.5%) were female, and 147 (45.5%) were male, with a mean age of 20.9 ± 2.1 years. The majority (169, 52.3%) were aged 22 years or older. A family history of osteoporosis was reported by 66 (20.4%) participants. Most respondents were final-year MBBS students (129, 39.9%), followed by first-year students (117, 36.2%). The mean OKAT score was 11.0 ± 3.6, with 155 (48.0%) demonstrating average and 115 (35.6%) acceptable knowledge about osteoporosis. Stratification revealed significant associations between osteoporosis knowledge and age ($p < 0.001$), family history of osteoporosis ($p = 0.006$), and MBBS year ($p < 0.001$), but no significant association with gender ($p = 0.299$).

**Conclusion:** The majority of participants exhibited average to acceptable levels of osteoporosis knowledge based on their OKAT scores. Further educational initiatives may enhance awareness and prevention efforts among medical students.

**Keywords:** Fractures; bone density; calcium; vitamin D; medical students; prevention; health awareness

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## Introduction

A major global health issue, osteoporosis causes porous bones leading to reduced bone strength (1). Reduction in bone mass and density subsequently results in increased incidence of fractures which leads to a significant health burden especially in women. It has been estimated that more than 8.9 million fractures are caused by osteoporosis annually, equating to an osteoporotic fracture every 3 seconds. Females have an increased risk to develop osteoporosis but males are also affected (2,3). It has been reported that prevalence of osteoporosis is on the rise, affecting over 75 million people in the US, Europe and Japan. Furthermore, it is being predicted that by 2050 more than half of the global osteoporotic fractures would be reported in Asia alone. Additionally, majority of patients suffering osteoporotic fractures do not have a pre-existing diagnosis and therefore do not take any preventive medicine. Osteoporotic fractures cause a significant socio-economic burden on patients' families and healthcare resources. Americans paid approximately 17 billion dollars in prescription bills for osteoporotic fractures in 2005 which has been predicted to triple by 2040 due to increased aging population. From Iran, Soheili-Azad et al. reported total expenditure for 16 days of hospitalization due to a single pelvic fracture as $ 588 (4).

Osteoporosis, in Pakistan, presents a pressing health concern due to prevalent nutritional deficiencies in addition to lack of diagnostic facilities. Limited data is available about osteoporosis prevalence in Pakistan. Furthermore, premenopausal Pakistani females having osteopenia are at an increased risk to suffer osteoporosis later in life (5). Reliable data regarding socio-economic burden of osteoporosis in Pakistan is also missing.

There is scarcity of studies regarding osteoporosis in Pakistan and those that have been concluded did not translate to develop practices for prevention of the disease (6). A study conducted on students regarding osteoporosis awareness in Quetta called for further large scale studies to determine osteoporosis awareness and its parameters (7). A sound knowledge regarding osteoporosis and its preventive strategies in students can play a significant role to subsequently educate the general population and spread awareness (8,9). Furthermore maintenance of bone mass and strength in young age of students helps to lower risk of osteoporosis in later on in life. To develop of preventative strategies, assessment of awareness and knowledge regarding osteoporosis and its current practice is required especially in young women (9,10).

The rationale for this study stems from the significant global burden of osteoporosis, particularly among women, who are at a higher risk for developing the condition as they age. Osteoporosis can lead to severe complications, including fractures that significantly impact quality of life and increase healthcare costs. Despite the availability of effective prevention strategies, awareness of osteoporosis and its risk factors remains low, particularly among young adults and women. Medical students, as future healthcare providers, play a crucial role in educating patients about bone health and osteoporosis prevention. By assessing their knowledge and awareness, this study aims to identify gaps in understanding and inform targeted educational interventions. The findings will not only enhance the students' knowledge but also contribute to developing comprehensive health education programs that promote preventive behaviors in the general population. Ultimately, this study seeks to reduce the incidence of osteoporosis-related complications and improve overall public health outcomes.

## Methodology

This descriptive cross-sectional study was carried out at Azra Naheed Medical College, Superior University Lahore from February to April 2024 to determine the knowledge and awareness regarding osteoporosis among medical (MBBS) students. Osteoporosis Knowledge Assessment Tool (OKAT) is a validated tool to assess osteoporosis awareness and was employed in this study. The OKAT is a 20-point questionnaire with 'true', 'false' and 'I don't know' options; and assesses various aspects including osteoporosis risk factors, methods of prevention and treatment (11). The maximum possible score on OKAT is 20. Based on the OKAT score, the osteoporosis knowledge is categorized as poor (score 0-5), acceptable (score 6-10), average (score 11-15) and good (score 16-20) (10). Keeping 5% margin of error and 95% confidence interval, a sample size of 255 was calculated using expected frequency 50% for a descriptive survey (12). OpenEPI online calculator was used for sample size calculation.

After Institutional Ethical Review Board approval (Ref No. IRB/ANMC/2024/03), data collection was done using non-probability consecutive sampling technique. Medical (MBBS) students of both genders aged 18 years and older who gave informed consent were included in this study. Students with present or history of osteoporosis were excluded. Demographic information including age, gender, discipline of study and family history of osteoporosis was noted. The OKAT questionnaire was distributed among the students in the form of an online Google form through WhatsApp groups and weekly reminders were sent. A total of 323 responses were received and included in the study. All the data were recorded and analyzed using SPSS version 23. Mean and standard deviation were generated for qualitative data whereas quantitative data were represented as frequency and percentage. Chi-Square test was applied keeping p-value <0.05 as significant.

## Results

Out of the total 323 participants, 176 (54.5%) were female and 147 (45.5%) were male. Mean age of the participants was 20.9±2.1 years and majority of the participants (169, 52.3%) were aged 22 years or more as shown in Table 1. A positive family history of osteoporosis was reported by 66 (20.4%) participants. Majority of the participants were from final year MBBS (129, 39.9%) followed by 117 (36.2%) first year MBBS as shown in Table 1. The mean OKAT score of the participants was 11.0±3.6 with 155 (48.0%) and 115 (35.6%) participants having average and acceptable knowledge about osteoporosis as shown in Table 1. The OKAT questionnaire, correct answers and individual question response of the participants are shown in Table 2. Stratification of data reveal significant statistical association of Osteoporosis knowledge with age (p-value=<0.001), family history of osteoporosis (p-value=0.006) and MBBS year (p-value=<0.001) but not with gender (p-value=0.299) as shown in Table 3.

**Table 1: Demographic information of the participants**

| Demographic Variables | Freq. (n) | Percent. (%) |
|---|---|---|
| **Age:** | | |
| 18-21 years | 154 | 47.7% |
| 22-25 years | 169 | 52.3% |
| **Gender:** | | |
| Male | 147 | 45.5% |
| Female | 176 | 54.5% |
| **Family History of Osteoporosis:** | | |
| Present | 66 | 20.4% |
| Absent | 257 | 79.6% |
| MBBS year: | | |
| First year | 117 | 36.2% |
| Second year | 10 | 3.1% |
| Third year | 23 | 7.1% |
| Fourth year | 44 | 13.6% |
| Final year | 129 | 39.9% |
| **OKAT Score Category:** | | |
| Poor Knowledge (score 0-5) | 21 | 6.5% |
| Acceptable Knowledge (Score 6-10) | 115 | 35.6% |
| Average Knowledge (score 11-15) | 155 | 48.0% |
| Good Knowledge (score 16-20) | 32 | 9.9% |

**Table 2: Osteoporosis Knowledge Assessment Tool (OKAT) Responses**

| OKAT Statement | Correct Answer | Frequency (n) | Percentage (%) |
|---|---|---|---|
| "Osteoporosis leads to an increased risk of bone fractures." | True | 313 | 96.9% |
| "Osteoporosis usually causes symptoms (e.g. pain) before fractures occur." | False | 44 | 13.6% |
| "Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life." | False | 103 | 31.9% |
| "Osteoporosis is more common in men." | False | 263 | 81.4% |
| "Cigarette smoking can contribute to osteoporosis." | True | 187 | 57.9% |
| "White women are at highest risk of fracture compared to other races." | True | 154 | 47.7% |
| "A fall is just as important as low bone strength in causing fractures." | True | 221 | 68.4% |
| "By age 80, the majority of women have osteoporosis." | True | 289 | 89.5% |
| "From age 50, most women can expect at least one fracture before they die." | True | 142 | 44.0% |
| "Any type of physical activity is beneficial for osteoporosis." | False | 63 | 19.5% |
| "It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors." | True | 220 | 68.1% |
| "Family history of osteoporosis predisposes a person to osteoporosis." | True | 213 | 65.9% |
| "An adequate calcium intake can be achieved from two glasses of milk a day." | True | 240 | 74.3% |
| "Sardines and broccoli are good sources of calcium for people who cannot take dairy products." | True | 211 | 65.3% |
| "Calcium supplements alone can prevent bone loss." | False | 181 | 56.0% |
| "Alcohol in moderation has little effect on osteoporosis." | True | 153 | 47.4% |
| "A high salt intake is a risk factor for osteoporosis." | True | 135 | 41.8% |
| "There is a small amount of bone loss in the 10 years following the onset of menopause." | False | 49 | 15.2% |
| "Hormone therapy prevents further bone loss at any age after menopause." | True | 225 | 69.7% |
| "There are no effective treatments for osteoporosis available in Pakistan." | False | 148 | 45.8% |

**Table 3: Stratification of Osteoporosis Knowledge according to demographic variables**

| Demographic Variables | OKAT Osteoporosis knowledge category | | | | p-value |
|---|---|---|---|---|---|
| | Poor | Acceptable | Average | Good | |
| **Age:** | | | | | |
| 18-21 years | 16 (10.4%) | 67 (43.5%) | 66 (42.9%) | 05 (3.2%) | <0.001 |
| 22-25 years | 05 (3.0%) | 48 (28.4%) | 89 (52.7%) | 27 (16.0%) | |
| **Gender:** | | | | | |
| Female | 14 (8.0%) | 58 (33.0%) | 83 (47.2%) | 21 (11.9%) | 0.299 |
| Male | 07 (4.8%) | 57 (38.8%) | 72 (49.0%) | 11 (7.5%) | |
| **Family history of Osteoporosis:** | | | | | |
| Absent | 20 (7.8%) | 96 (37.4%) | 122 (47.5%) | 19 (7.4%) | 0.006 |
| Present | 01 (1.5%) | 19 (28.8%) | 33 (50.0%) | 13 (19.7%) | |
| **MBBS year:** | | | | | |
| Senior (final & fourth) | 05 (2.9%) | 53 (30.6%) | 86 (49.7%) | 29 (16.8%) | <0.001 |
| Junior (first, second & third) | 16 (10.7%) | 62 (41.3%) | 69 (46.0%) | 03 (2.0%) | |

## Discussion

In the present study, 32 (9.9%) participants had good knowledge (OKAT score 16-20) regarding osteoporosis while 21 participants (6.5%) had poor knowledge (OKAT score 0-5). The majority of the participants had average (155, 48.0%, OKAT score 11-15) and acceptable (115, 35.6%, OKAT score 6-10) knowledge about osteoporosis. Although 96.9% of the study population correctly stated that osteoporosis leads to an increased risk of bone fractures, only 13.6% participants were aware of the fact that osteoporosis does not cause any symptoms (e.g. pain) before fracture occurs. Similarly, only 15.2% participants knew the impact of bone loss in 10 years following the onset of menopause was substantial. It should be noted that only 31.9% of participants knew that having a higher peak bone mass at the end of childhood gave protection against the development of osteoporosis in later life. Although the importance of increasing age and fall in causing osteoporotic bone fractures were correctly answered by 89.5% and 68.4% participants respectively, when questioned about the role of exercise only 19.5% participants knew that not all types of exercise were beneficial in osteoporosis. Regarding dietary factors, 74.3% participants knew the importance of 2 glasses of milk while 65.3% knew the role of sardines and broccoli as adequate sources of calcium. Furthermore 57.9%, 47.4% and 41.8% participants correctly answered about association of cigarette smoking, alcohol use and high salt diet with osteoporosis respectively. Almost two-thirds (65.9%) of the participants knew that having an osteoporotic family member increased their own risk of

osteoporosis later in life. However, knowledge regarding osteoporosis treatment availability in Pakistan was seen in 45.8% participants only.

Public awareness regarding osteoporosis is inadequate especially in underdeveloped countries like Pakistan. Health education strategies play an influential role in improving knowledge of general population and sustain it long-term (13,14). Knowledge and awareness regarding osteoporosis focuses primarily on risk factors of disease development and the extent to which this is employed in preventive measures and practices. Attitude regarding a disease is usually dependent on the study participants' beliefs and perceived susceptibility (15). Osteoporosis preventive strategies rely on increasing bone mass and density at a young age. These strategies involve adequate physical activity and exercise, proper intake of vitamin D with calcium and abstinence from alcohol and smoking (16,17). Knowledge and awareness regarding osteoporosis also help in disease prevention. There are numerous studies which document knowledge and awareness regarding osteoporosis from different countries. Lack of knowledge on osteoporosis was reported in females aged more than 25 years in United States (18). Ghaffari et al. demonstrated poor awareness of osteoporosis in 55% of female students in Kolaleh Gorgan, Iran (19). Similarly female students in Tehran also had poor awareness of osteoporosis (20). Liew et al. reported low calcium intake and poor knowledge of osteoporosis among Asian women residing in Australia (21). From Karachi, Ahmed et al. reported low knowledge in 22%, average knowledge in 44% while 34% had good knowledge of osteoporosis among Pakistan women (5). From Quetta, Haq et al. demonstrated 17.9% female University students had poor knowledge while 82.1% had good knowledge about osteoporosis (7). Low knowledge was seen in 32.6% lady health workers from Sind, 48.6% had average knowledge while good understanding of osteoporosis prevention and awareness was found in only 18.7% (22). Low osteoporosis awareness was reported in 73.1% postmenopausal Indian women (15).

Most of the Asian countries are underdeveloped and rise in osteoporosis puts a significant strain on the already limited healthcare resources (7). Therefore, osteoporosis may often be left undiagnosed and thus untreated in Asian countries. Even the patients at highest osteoporosis risk and those with previous osteoporotic fractures may be unable to attain proper management due to lack of both resources and awareness. In rural settlements, this issue is especially severe (22,23). In countries like India, China and Pakistan, majority of the population lives in rural areas where people tend to manage hip fractures from home by local healers rather than at hospitals (22,23). Osteoporosis affects both genders and all races. Its prevalence increases with age, especially in women. Low bone density is often asymptomatic and progressive and usually osteoporotic fracture is the first presentation. In addition to increasing age and female gender, there are numerous factors that affect bone health and fracture risk. Prolonged immobilization and neuromuscular disorders also contribute to disease progression. Other non-modifiable risk factors include positive family history, previous osteoporotic fractures, Caucasian race, post-menopause, ovo-hysterectomy, long-term glucocorticoid treatment and systemic illness such as rheumatoid arthritis (24). Modifiable risk factors include alcohol consumption, cigarette smoking, poor diet, eating disorders, low body mass index, lack of exercise, physical inactivity, inadequate calcium and vitamin D intake, frequent falls and poor awareness regarding osteoporosis (14).

The current study presents several strengths and limitations. Among its strengths is the use of the validated Osteoporosis Knowledge Assessment Tool (OKAT), which ensures the reliability and accuracy of the data collected. With a substantial sample size of 323 medical students, the findings are robust and statistically powerful. Additionally, the online data collection method facilitated a wide reach and convenience for participants, potentially enhancing response rates. However, the study is limited by its focus on a single institution, which may affect the generalizability of the results to the broader population. The cross-sectional design also restricts the ability to establish causal relationships. Despite these limitations, the research underscores the urgent need to raise osteoporosis awareness among young people and promote preventive measures. To improve osteoporosis awareness among young people, it is essential to implement comprehensive educational programs in medical curricula that focus on the importance of bone health. Health campaigns should target modifiable risk factors, such as promoting adequate calcium intake, encouraging regular physical activity, and raising awareness about the dangers of smoking and excessive alcohol consumption (25,26,27). Collaboration with community organizations can enhance public education efforts, ensuring that information reaches a broader audience and fosters proactive behaviors to prevent osteoporosis (25,26,27).

## Conclusion

The majority of participants in our study displayed average and acceptable knowledge about osteoporosis based on the OKAT assessment. A smaller portion exhibited good knowledge, while a notable percentage demonstrated poor understanding of the condition. These findings emphasize the importance of improving osteoporosis awareness through targeted educational programs, health campaigns, and public strategies. By enhancing knowledge and encouraging preventive behaviors, we can help reduce the future burden of osteoporosis in the general population.

**Ethical Approval:**
This study was approved by Institutional Ethical Review Board of Azra Naheed Medical College, The Superior University Lahore.
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**Authors' Contribution:**
**NIB:** Concept and design, literature review, data collection and assembly, data analysis and interpretation, manuscript writing, critical review and revisions
**MAQ:** Concept and design, literature review, data collection and assembly, critical review and revisions
**MZL:** Concept and design, data analysis and interpretation, critical review and revisions
**OH:** Literature review, data collection and assembly, data analysis and interpretation, manuscript writing

## References

1. Gerdhem P, Akesson K. Osteoporosis and its management: An overview. Eur J Endocrinol. 2020;182(2). doi:10.1530/EJE-19-0891.
2. Compston J, McClung MR, Leslie WD. Osteoporosis. Lancet. 2019;393(10169):364-376. doi:10.1016/S0140-6736(18)31557-5.
3. Davis SR, Westbrook R. Current perspectives on osteoporosis in women: A clinical review. J Women Health. 2021;30(6):799-807. doi:10.1089/jwh.2020.8366.
4. Soheili-Azad A, Yavari H, Azami M. Assessment of the costs of hip fractures in patients who referred to the orthopedic clinic of Sina Hospital. J Tehran Univ Med Sci. 2004;12(47):83-92.
5. Ahmed S, Farooqui AJ, Pradhan NA, Zehra N, Majid H, Jafri L, et al. Assessing the knowledge, attitude and practice of osteoporosis among Pakistani women: A national social-media based survey. PLoS One. 2023;18(11):e0288057. doi: 10.1371/journal.pone.0288057.
6. Lulla D, Teo CW, Shen X, Loi ZBJ, Quek KW, Lis HLA, et al. Assessing the knowledge, attitude and practice of osteoporosis among Singaporean women aged 65 years and above at two SingHealth polyclinics. Singapore Med J. 2021;62(4):190-194. doi: 10.11622/smedj.2021039.
7. Haq N, Tahir M, Iqbal Q, Naseem Q. Exploration of Osteoporosis Knowledge and Perception among Young Women in Quetta, Pakistan. J Osteopor Phys Act. 2015;3:145.
8. Barańska A, Drop B, Religioni U, Dolar-Szczasny J, Malm M, Wdowiak K, et al. Assessment of Awareness and Knowledge about Osteoporosis in Relation to Health Prevention among Patients Treated in Osteoporosis Clinics. J Clin Med. 2023;12(19):6157. doi: 10.3390/jcm12196157.
9. Rubæk M, Hitz MF, Holmberg T, Schønwandt BMT, Andersen S. Effectiveness of patient education for patients with osteoporosis: a systematic review. Osteoporos Int. 2022;33(5):959-977. doi: 10.1007/s00198-021-06226-5.
10. Arshad A, Ibrahim MT, Arshad H, Hammad MB, Sheikh SA, Khan AH, et al. Clinical characteristics and outcomes of patients presenting with hip fractures at a tertiary care hospital in Pakistan. Arch Osteoporos. 2021;16(1):25. doi: 10.1007/s11657-021-00895-9.
11. Barik S, Raj V, Munshi BD, Rajput O, Prajapati S, Prasad SG, et al. Development and Validation of India-specific Hindi Version of Osteoporosis Knowledge Assessment Tool. J Midlife Health. 2023;14(4):252-256. doi: 10.4103/jmh.jmh_219_22.
12. Althubaiti A. Sample size determination: A practical guide for health researchers. J Gen Fam Med. 2022;24(2):72-78. doi: 10.1002/jgf2.600.
13. Belgacem A, Laouani-Kechrid C, Nouira A, Ben-Dhiab M, Maatoug J, Chelbi S, et al. Effectiveness of an osteoporosis prevention educational program in Tunisian premenopausal women working in sedentary occupations: a quasi-experimental study. Arch Osteoporos. 2022;17(1):81. doi: 10.1007/s11657-022-01119-4.
14. Alghamdi A, Almutairi OA, Abu Alqam R, Jambi A, Alharthi HS, Binhamran K, et al. Evaluation of Osteoporosis Perception Among Saudi Arabian Premenopausal Women: A Cross-Sectional Survey Study Using the Osteoporosis Knowledge Assessment Tool (OKAT). Cureus. 2023;15(9):e45191. doi: 10.7759/cureus.45191.
15. Kale A, Khandelwal N, Sirohi B, Shaki O, Rai S. Knowledge, Attitudes, Practices, and Awareness Levels Among Indian Postmenopausal Women About Osteoporosis and Its Relationship With Sociodemographic Factors: A Cross-Sectional Study From Northern India. Cureus. 2024;16(5):e59606. doi: 10.7759/cureus.59606.
16. Hunt W, Smith R, Baird M. Physical activity and its impact on osteoporosis. J Musculoskelet Neuronal Interact. 2021;21(2):145-54.
17. Weng W, Li H, Zhu S. An Overlooked Bone Metabolic Disorder: Cigarette Smoking-Induced Osteoporosis. *Genes*. 2022;13(5):806. https://doi.org/10.3390/genes13050806.
18. Terrio K, Auld GN. Osteoporosis knowledge, calcium intake, and weight bearing physical activity in three age groups of women. J Community Health. 2002;27:307–320. doi: 10.1023/A:1019840709367.
19. Ghaffari M, Niazi S, Ramezankhani A, Soori H. Knowledge of female students of Kalaleh city about osteoporosis, calcium intake and physical activity: an unacceptable status. Iran J Nutr Sci Food Technol. 2013;7(5):319-326.
20. Baheiraei A, Ritchie JE, Eisman JA, Nguyen TV. Psychometric properties of the Persian version of the osteoporosis knowledge and health belief questionnaires. Maturitas. 2005;14(50):134–139.
21. Liew YL, Mann D, Piterman L. Osteoporosis risks. A comparative study of Asian Australian and Caucasian Australian women. Aust Fam Phys. 2002;31:291–297.
22. Ahmed S, Wassan SM, Ahmed J, Bashir S, Huma S, Jamali AA. Knowledge of Osteoporosis Prevention among Community Health Workers of National Program for Family Planning and Primary Healthcare. J Saidu Med Coll Swat. 2024;14(3):230-6. DOI: https://doi.org/10.52206/jsmc.2024.14.3.915.
23. Shao M, Qiu C, Song M, Tang N, Song J, Su Q, Li J, Wang Y, Chen J, Gao Y. Osteoporosis Knowledge and Its Risk Factors in Older Adults With Upper Extremity Fragility Fractures: A National Cross-Sectional Study. Nurs Health Sci. 2024;26(4):e13186. doi: 10.1111/nhs.13186.
24. Merle B, Haesebaert J, Bedouet A, Barraud L, Flori M, Schott AM, et al. Osteoporosis prevention: Where are the barriers to improvement in French general practitioners? A qualitative study. PLoS One. 2019;14(7):e0219681. doi: 10.1371/journal.pone.0219681.
25. Bronio JB, Si L, Lim D, Tang C. Translation and cross-cultural adaptation of Osteoporosis Knowledge Assessment Tool (OKAT) for Chinese populations in Australia. Arch Osteoporos. 2024;19(1):43. doi: 10.1007/s11657-024-01404-4.
26. Keerio NH, Valecha NK, Aamir N, Noor SS. Knowledge and awareness of osteoporosis in the female population of Hyderabad, Pakistan. J Pak Orthop Assoc. 2020;32(2):97-101.
27. Riley M, Crossman D, Kocis P, Hassenbein S, Fox E. Utility of a bone health clinic in bridging the osteoporosis care gap: Prescribing habit review at an academic institution. PLoS One. 2024;19(7):e0307029. doi: 10.1371/journal.pone.0307029.