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Community based screening and intervention to optimize preventive care of osteoporosis

Amatul Baseer[1*], M. A. Raqeebuddin[1], Syed Salman[1], V. Badri[1], Dr. K. Lankeswar Rao[1]
[1]*Department of Pharmacy Practice,*
MNR College of Pharmacy, Sangareddy-502294, Telangana, India

Abstract

Aim: To assess the impact of pharmacist educational interventions and risk evaluation to enhance early diagnosis of osteoporosis by optimizing screening in community pharmacies and improving preventive care of osteoporosis in a community setting.

Materials and Methods: A prospective educational interventional study conducted over 6 months in areas surrounding Sangareddy district. In this study, 350 study participants were evaluated for risk of major osteoporotic fracture using FRAX-WHO tool, and tested for patient knowledge of osteoporosis both before and after patient education using Osteoporosis Knowledge Assessment Tool (OKAT) scores. They were also assessed for reduction in modifiable risk factors (like calcium and vitamin D intake and weight-bearing exercises) after pharmacist intervention.

Results: This study evaluated the effect of a multifaceted intervention (screening and patient education) by community pharmacists on testing of osteoporosis. Osteoporosis knowledge showed improved scores ($p<0.001$, 95% CI) using OKAT. The mean calcium and vitamin D intake increased significantly in study participants after pharmacist intervention ($p<0.001$, 95% CI). Of 82 cases recommended for Bone Mineral Density (BMD) testing, 7(2%) went on to have a BMD scan performed.

Conclusion: Pharmacists can improve patient's understanding of osteoporosis and early diagnosis and treatment rates along with a reduction in modifiable risk factors by pharmacist education and patient counseling. The study also confirmed that patients with fragility fractures are not being referred for assessment of osteoporosis along with BMD scanning which should become standard of care after a fragility fracture.

Keywords: osteoporosis, FRAX-WHO, Bone Mineral Density scan, Osteoporosis Knowledge Assessment Tool, fragility fracture

INTRODUCTION

Osteoporosis is a bone disorder characterized by low bone density, impaired bone architecture, and compromised bone strength predisposing to fracture. Bone mineral density (BMD) is reduced and bone structural integrity is impaired due to increased immature bone that is not yet properly mineralized. Osteoporotic fractures occur on slight falls and can cause severe pain, disability, emotional distress, economic burdens, and hospitalizations [1, 2].

Men and women begin to lose bone mass starting in the third or fourth decade of their life. More than 50% of cases can be entirely prevented beforehand. Since bone loss starts as early as 35-40 years of age, strategies to improve peak bone mass can prevent osteoporosis when older [3]. Optimizing peak bone mass when young reduces the future incidence of osteoporosis. Osteoporotic fractures can also lead to adverse psychological impact on patients and increased chance of subsequent fractures and mortality. It also burdens the healthcare system consequently [4, 5, and 6].

Patient care for bone health is needed in people of all ages. The development of osteoporosis and osteoporotic fractures is due to influence of various factors, like genetics and other lifestyle behaviors that affect bone growth and maintenance including skeletal factors that lead to compromised bone strength, and non-skeletal factors that lead to falls. It is the responsibility of all healthcare providers to educate everyone about preventive measures encouraging them to practice a bone-healthy lifestyle, monitor patients at risk of osteoporosis, and initiate treatment for patients with osteoporosis along with better adherence to osteoporotic medications [7, 8, and 9].

According to the International Osteoporosis Foundation Asian Audit (2013) conducted every 10 years, there are 36 million patients of osteoporosis in India. Recent studies have shown that 80% of the urban Indian population is vitamin D deficient, constituting a large proportion of India. 1 in 3 females and 1 in 8 males are affected, making India one of the largest affected countries in the world [10].

Pharmacists' role in community screening of osteoporosis

Pharmacists play a key role as drug experts in many healthcare systems. Over the last 20 years, the pharmacist's role in many settings has shifted from drug dispensing to pharmaceutical patient care. Pharmacist interventions such as patient counseling, education, medication management, and referrals to other healthcare professionals have shown significant improvements in blood glucose levels in diabetic patients, blood pressure levels in hypertensive patients, and cholesterol levels in hyperlipidemic patients [11, 12]. Compared to regular care, a pharmacist intervention that includes patient counseling, education, quantitative ultrasound (QUS), and physician referrals have increased central Dual X-ray Absorptiometry (DXA) testing and calcium intake among individuals at high risk for osteoporosis [13,14].

Since pharmacists in community pharmacies are more accessible, they can be more involved in prior screening of osteoporosis that enhances patient knowledge [15], recommend testing for osteoporosis [16], risk factor assessment [17], preventive strategies to be taken [18], initiate supplementation of calcium and vitamin D in low-risk patients [19] and use of osteoporotic medications in

high-risk patients [20] along with an improved understanding of the need for BMD testing in indicated patients [21].

Pharmacists are in a unique position to help reduce the burden of osteoporosis by identifying high-risk patients for treatment, especially those on corticosteroid therapy and thereby preventing fractures [22, 23]. Pharmacist counseling and identification of patients at risk of osteoporosis resulted in higher DXA testing [24].

Further evidence is necessary to determine feasibility of osteoporosis management in department of pharmacy practice, to compare the effectiveness of different pharmacist interventions, and to assess the impact of pharmacist interventions on osteoporosis treatment adherence [24].

MATERIALS AND METHODS

Study Design: This study was a prospective evaluation of a pharmacist educational intervention conducted in a community setting in areas in and around Sangareddy from December 2019 to May 2020. It was to determine the impact of pharmacist-initiated patient education on osteoporosis knowledge, lifestyle modification, and treatment after an osteoporotic fracture.

Obtaining clearance from the institutional ethical committee: For obtaining the ethical clearance, an application along with study protocol, which included the proposed title, study site, inclusion and exclusion criteria, objective and methodology about work to be carried out, was submitted to the chairman of the Institutional Ethical Committee of MNR hospital. This study was approved by the MNR College of Pharmacy and Affiliated Teaching Hospitals Institutional Ethics Committee. Privacy and confidentiality were ensured during pharmaceutical care services. Discrepancies were identified and resolved and appropriate patient education provided so that better health and economic outcomes are obtained.

Eligibility criteria of study participants: Study subjects were selected prospectively from a group of patients both males and females above 30 years of age with due consent obtained. Patients with hearing difficulty or mentally impaired were also included if a guardian was there to receive pharmacist education on their behalf. The educational intervention was conducted in English and other regional languages. Patients were also excluded if they were below 30 years of age, females on hormone replacement therapy (since it had a significant impact on bone health), and patients undergoing treatment for osteoporosis since it wouldn't be necessary for them to undergo screening procedures. Special groups like pregnant women were also excluded since their bone requirements vary for the gestation period. Eligibility was determined by direct questioning of subjects. All eligible patients were invited to participate in the study.

All the aspects of the study protocol including access to and use of patient information were authorized by the ethics committee and informed consent was taken. At the end of study period, data was analyzed statistically.

Data Collection and Intervention: Patient data was obtained through data collection forms. Patient's family history, medical history and demographic details were hence obtained. Patient was followed up to study improvement after pharmacist intervention.

Data entry proforma A separate data entry form was prepared for incorporating details of study participants. It included demographic details, family history, previous history of fractures, comorbidities, medication use, lifestyle habits, and intake of calcium and vitamin D through diet and supplementation and details of the latest BMD scan.

Collection of data Patient details were obtained by construction of a patient-oriented questionnaire relating to the parameters needed for our study and entry into the FRAX tool, from among both rural and urban populations.

Materials used:

- Informed consent form detailing procedures, risks and benefits of study along with voluntary participation and confidentiality
- Data collection form: Demographic information about the participants was obtained along with necessary parameters for FRAX-WHO (Fracture Risk Assessment) tool.
- Osteoporosis Knowledge Assessment Tool (OKAT): A validated osteoporosis knowledge assessment instrument by Winzerberg, T. M. and others (2003) [25]
- Patient Information Leaflets (PIL) including bone-healthy diet (calcium, phosphorous and vitamin D enriched) and weight-bearing exercise charts.

Steps in data collection process:

1. Collecting patient demographic details and Family history
2. Assessing patient knowledge on osteoporosis (OKAT Score) before and after pharmacist education.
3. Assessing an individual's percentage of risk of osteoporotic fracture using FRAX-WHO tool
4. Pharmacist educational interventions including patient education regarding calcium, phosphates, and vitamin D in diet, weight-bearing exercises to improve bone density, calculation of vitamin D and calcium intake, assess the need for a prescription based on FRAX score, indicate BMD testing for those in whom it is recommended.
5. Evaluate the endpoint- intake of calcium and Vitamin D supplementation, patient knowledge, risk assessed, those who went for BMD scan, those initiated on osteoporosis therapy.

Follow-up assessment: All patients were asked to participate in a follow-up telephone interview within 12 to 14 weeks after the educational intervention. Questions were asked to determine whether the participant had discussed osteoporosis with the family physician, if a BMD scan had been ordered, and if the participant had taken any active measures to prevent or treat osteoporosis, including diet modifications. Participants were also asked to answer the OKAT again.

Outcome Measures: The required details from the study subjects were collected paying due attention to inclusion and exclusion criteria and were evaluated prospectively for

impact of pharmacist intervention on the following variables:

• Overall reduction of modifiable osteoporosis risk factors-inadequate calcium intake [supplements or dietary sources] and vitamin D supplementation, smoking, medications, and alcohol consumption

• Proportion of subjects whose OKAT score has increased after the educational intervention by the pharmacist

• Proportion of patients who discussed osteoporosis with the physician and/or were assessed with a BMD scan.

Data Analysis: All data collected were entered into an MS Excel spreadsheet and imported into a statistical program (SPSS v.26) for analysis. Descriptive statistics were generated for all variables, including frequency tables for dichotomous and categorical variables and means, standard deviations (SD), standard errors, and ranges for continuous data. Paired t-tests were used to compare scores on the OKAT before and after the educational intervention. To analyze the number of patients who took measures to decrease modifiable risk factors for osteoporosis, patient proportions (percentages) were calculated for the presence of each outcome measure before and after an intervention. Paired t-tests were used to test the significance of the changes for continuous data such as calcium and vitamin D intake. Improved statistics in weight-bearing exercise after patient education were assessed. Statistical significance was defined as a p-value of 0.05 or less with a confidence interval of 95%.

RESULTS AND DISCUSSION

Osteoporosis is an insidious progressive chronic disease of the skeletal system characterized by deteriorating bone architecture, where the patient does not realize at the onset of the disease until it progresses to fragility fractures. Though osteoporosis could be a condition with significant implications, it often goes undiagnosed because it's not related to obvious symptoms until a fragility fracture occurs. Even then, many patients aren't investigated for osteoporosis. This study has demonstrated that pharmacists can have a positive impact in educating patients about osteoporosis and might encourage them to talk to their physicians about it. Evidence-based guidelines encourage early identification of patients at high risk of fracture, but applying of those recommendations into practice has been neglected.

Demographic Data

Out of 350 cases, 180 (52%) were females and 170 (48%) were male participants. The mean weight of all the study participants was 60.8kg (±15.3) and mean height is found to be 155.9 cm (±41.2). Mean body mass index (BMI) is found to be 25 kg/m^2(±9.8). Based on menopausal status, among 180 (52%) of female study participants, 47 (14%) were pre-menopausal and 133 (38%) were post-menopausal. Of these 70 (20%) cases had at least one previous fracture, with 50 (14.9%) cases with a family history of fractures.The majority of the fractures were in the hip (24), followed by vertebrae (15) and wrist (12), femur (8) and shoulder (5), ankle (3) and tibia (3).

Comorbidities that cause an increased risk of osteoporosis found in the cases include asthma (11), diabetes mellitus type 2 (67), malignancy (1), epilepsy (1), hypothyroidism (24), kidney disease (4), rheumatoid arthritis (13), stroke (6), hypertension (65), paralysis (4) and hysterectomy (2) (that causes early surgical menopause).Medications used that increase risk of osteoporosis found among the cases include aspirin (2), non-steroidal anti-inflammatory drugs (NSAID) (14), statins (3), anti-neoplastic (1), systemic corticosteroids (7), anti-epileptic drugs (1), hormone replacement therapy (6), high doses of thyroid medication (24), antacids (8) and proton pump inhibitors (17).The baseline patient characteristics are given in table 1.

Risk factor assessment

The mean risk in cases was found to be 6% and the standard deviation is 0.0043 (refer Table 1). The risk of osteoporosis was found higher in females as compared to males. Females in the high-risk category are 11 (3.1%) whereas there are 10 (2.9%) males. In the low-risk category, the number of females is 93 out of 350 (26.6%), whereas the number of males is 118 out of 350 (33.7%). In the moderate-risk category, there are 52 (14.9%) females and 24 (6.9%) males (Fig. 1). There were no high-risk cases in the age group of 30-39 years. High-risk cases were majorly found in cases greater than 70 years of age. There are no very-low risk category cases above 60 years of age. Risk increases above 40 years of age subsequently. (Table 2)

Based on BMI, 209 (60%) cases have normal BMI, 30 (9%) have low BMI, 39 (11%) cases are obese and 72 (21%) cases are overweight. Cases with low BMI show a higher percentage (17) in the high-risk category, whereas most cases in low-risk category (133) are from normal BMI. A greater percentage of moderate-to-high risk cases were found in cases that had low BMI (Table 3). The majority of low-risk cases are found in cases with normal BMI. Based on menopausal status, the average percentage of risk is found to be 1.367 in pre-menopausal women, and 11.944 in post-menopausal women, which is considerably lower in pre-menopausal women when compared to post-menopausal women with higher mean risk (Table 4). Based on the distribution of subjects area-wise, 104 (29.7%) cases are from Sangareddy, 90 (25.7%) cases are from Hyderabad, 50 (14.3%) cases are from Kalpaguru, 40 (11.4%) cases are from Kullabgur, 19 (5.4%) cases are from Sadashivnagar, 15 (4.3%) cases are from Fasalwadi, 14 (4%) from Ismailkhanpet, 11 (3.1%) from Angadipet, 5 (1.4%) from Isnapur and 2 (0.6%) from Rajampet. The average percentage of risk was highest in urban areas of Hyderabad (6.833) and Sangareddy (5.811) followed by lower average risk in rural areas of Kullabgur (2.874), Kalpaguru (2.825), Sadashivnagar (1.425), Ismailkhanpet (1.335), Angadipet (0.591), Fasalwadi (0.481), Isnapur (0.158) and Rajampet (0.131). Based on the type of area, cases from urban areas are at considerably higher risk probably due to lack of exposure to sunlight and inadequate physical activity. Rural areas showed lesser consumption of calcium and vitamin D in diet due to poor financial conditions and issues pertaining to availability of food (Table 5).

Study participants that do not smoke show a greater percentage of the population at low risk compared to those

that smoke. There are 91 out of 350 (26%) cases that smoke. There are no cases of very low risk in smokers compared to the increased number of cases (40) of very low-risk category in non-smokers (Fig. 2). Similar results are observed in non-alcoholics compared to alcoholics. Out of 350 cases, 40 (11.4%) are found to consume more than 3 alcoholic drinks per day. Study participants that do not consume alcohol show a greater percentage of the population at low-risk (151) compared to those that consume alcohol (62). There are no cases of very low risk in alcoholics compared to 40 cases of very low risk category in non-alcoholics (Fig. 3).

Based on the occupation of the study population, we have found that it consists of 154 out of 350 housewives, followed by 58 farmers, 44 employees, 26 out of them are workers, 24 cases are businessmen, 22 of them are retired employees, 9 drivers, 3 are in the unemployed category, 4 maids, 2 each of government employees, milkman and fisherman. The highest risk is found in drivers, employees, retired persons, housewives and the unemployed. Housewives (47) are the ones mostly found in the moderate-risk category. It signifies probable increased risk in those with least exposure to sunlight and prolonged physical inactivity. Moderate-risk categories are mostly found in housewives. (Refer Table 6)

Subjects with symptomatic bone pain showed higher risk among study subjects compared to low risk found in asymptomatic cases as shown in table 7. Clinical parameters must also be considered while diagnosing osteoporosis and can be an important parameter in the FRAX tool.

Table 1: Baseline Patient Characteristics

Characteristic	**Number (%) of patients**
Sex (n=350)	
Male	170 (48)
Female	180 (52)
Age (n=350)	
30-39	28 (8)
40-49	110 (31.4)
50-59	84 (24)
60-69	71 (20.2)
70-79	37 (10.5)
80-89	17 (4.8)
90-100	3 (0.8)
Mean weight (in kgs)	60.8±15.3
Mean height (in cms)	155.9±41.2
Mean Body Mass Index (in kg/m^2)	25.0± 9.8
BMI Category (n=350)	
Low (<18.5 kg/m^2)	30 (9)
Normal (18.5-24.9 kg/m^2)	209 (60)
Overweight (25-29.9 kg/m^2)	72 (21)
Obese (>30 kg/m^2)	39 (11)
Mean FRAX risk percentage (SD)	6% (0.0043)
Menopausal status (n=180)	
Premenopausal	47 (26.1)
Postmenopausal	133 (73.9)
Type of area (n=350)	
Urban	192 (55)
Rural	158 (45)
Previous fracture in study participants (n=350)	70 (20)
Family history of fractures (n=350)	50 (14.9)
Site of fractures	
Hip	24 (6.8)
Vertebrae	15 (4.2)
Wrist	12 (3.4)
Femur	8 (2.2)
Shoulder	5 (1.4)
Ankle	3 (0.8)
Tibia	3 (0.8)
Comorbidities	
Asthma	11 (3)
Diabetes Mellitus Type 2	67 (19.1)
Malignancy	1 (0.2)
Epilepsy	1 (0.2)
Hypothyroidism	24 (6.8)
Kidney disease	4 (1.1)
Rheumatoid arthritis	13 (3.7)
Stroke	6 (1.7)

Characteristic	Number (%) of patients
Hypertension	65 (18.5)
Paralysis	4 (1.1)
Hysterectomy	2 (0.5)
Medications	
Aspirin	2 (0.5)
NSAID	14 (4)
Statins	3 (0.8)
Antineoplastic drugs	1 (0.2)
Systemic corticosteroids	7 (2)
Antiepileptic drugs	1 (0.2)
Hormone replacement therapy	6 (1.7)
High doses of thyroid medication	24 (6.8)
Antacids	8 (2.2)
Proton pump inhibitors	17 (4.8)
Symptomatic bone pain (n=350)	73 (20.9)

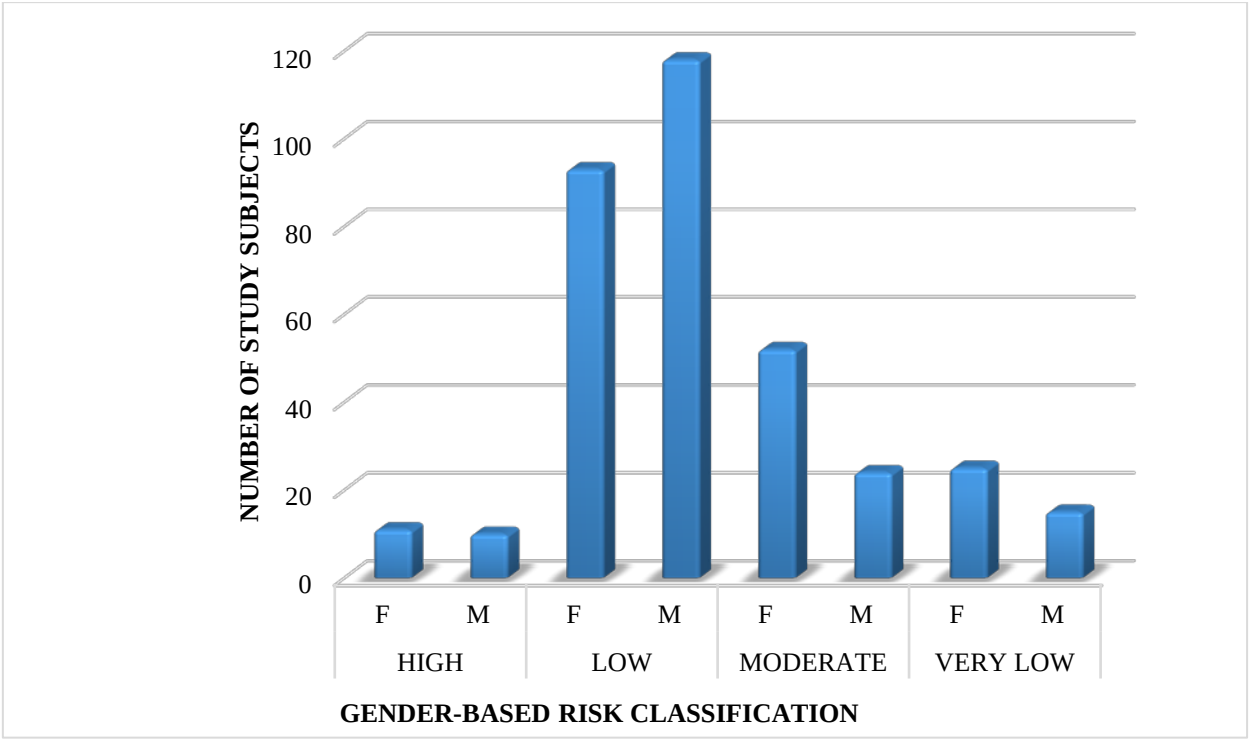

Fig.1: Risk assessment of osteoporosis based on gender

Assessment of risk comparison in males (M) and females (F) residing in areas in and around Sangareddy and Hyderabad districts. Total numbers

Table 2: Risk of osteoporosis based on age

Age groups	Classification of risk
30-39	**28**
Low	20
Moderate	2
Very low	6
40-49	**110**
High	1
Low	70
Moderate	11
Very low	28
50-59	**84**
High	4
Low	56
Moderate	19
Very low	5

Age groups	Classification of risk
60-69	**71**
High	4
Low	44
Moderate	23
70-79	**37**
High	5
Low	17
Moderate	15
80-89	**17**
High	6
Low	6
Moderate	5
90-100	**3**
High	2
Moderate	1

Risk of osteoporosis as percentagesare associated with each age group as obtained using FRAX-WHO tool. Very low risk- <1% risk of major osteoporotic fracture; Low risk- 1-10%; Moderate risk- 11-20%; High risk- >20%.

Table 3: Risk of osteoporosis based on Body Mass Index (BMI) values

Body Mass Index (BMI) category	No. Of subjects
Low (<18.5 kg/m^2)	**91**
High	17
Low	20
Moderate	51
Very low	3
Normal (18.5-24.9 kg/m^2)	**158**
High	1
Low	133
Moderate	4
Very low	20
Obese (>30 kg/m^2)	**38**
High	1
Low	17
Moderate	11
Very low	9
Overweight (25-29.9 kg/m^2)	**63**
High	2
Low	43
Moderate	10
Very low	8

Table 4: Risk of osteoporosis based on menopausal status

Menopausal status	Mean percentage of risk
Pre-menopausal	1.367
Post-menopausal	11.944

Average percentage of risk obtained by FRAX-WHO tool in premenopausal women was 1.367 and in post-menopausal women was 11.944.

Table 5: Risk of osteoporosis based on area-wise distribution

Name of area	Mean percentage of risk (%)
Angadipet (R)	0.591
Fasalwadi (R)	0.481
Hyderabad (U)	6.833
Ismailkhanpet (R)	1.335
Isnapur (R)	0.158
Kalpaguru (R)	2.825
Kullabgur (R)	2.874
Rajampet (R)	0.131
Sadashivnagar (R)	1.425
Sangareddy (U)	5.811

Risk associated with study participants in different areas including both urban (U) and rural (R) areas.

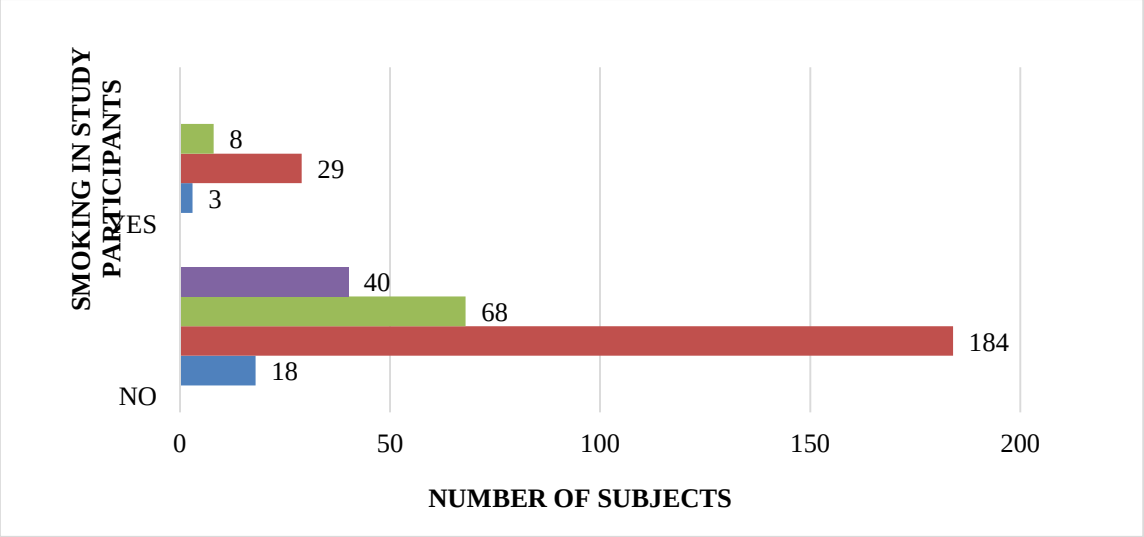

Fig.2: Risk of osteoporosis based on smoking

Risk was assessed in study participants based on their smoking behavior into YES/NO.
Very low risk; Low-risk; Moderate-risk; High.

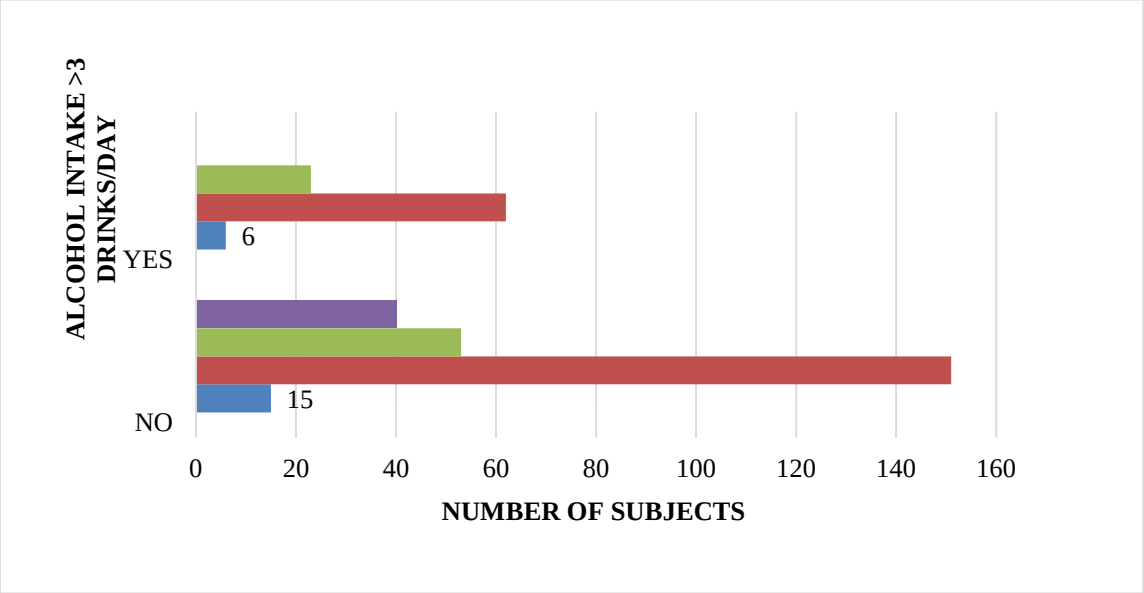

Fig.3: Risk of osteoporosis based on alcohol intake

Risk was assessed in study participants based on their alcohol intake into YES/NO.
Very low risk; Low-risk; Moderate-risk; High.

Osteoporosis Knowledge

Patient knowledge on osteoporosis before and after patient education and counseling was scored using standard Osteoporosis Knowledge Assessment Tool (OKAT) modified to suit local needs. Average of pre-test scores was 9.71 in rural areas compared to mean values of 15.26 in urban areas. Meanwhile, after patient education, OKAT was assessed again to find mean values of post-test scores of 15.13 in rural areas and 18.10 in urban areas. There was overall increase in patient OKAT score after patient education by a pharmacist with overall mean scores being 11.12 before patient counseling and 15.88 overall mean score after patient education ($p<0.001$). The mean score increased from 11.12 out of 20 (range 3 to 17, SD 4.98) at baseline to 15.88 out of 20 (range 13 to 20, SD 4.92) at follow-up (Table 8).

Raising patients' awareness of osteoporosis may motivate them to ask their physicians about the need for treatment, leading to a higher proportion of patients being treated. This is in support with study done by Winzenberg and others [25] where the OKAT was used to assess an increase in knowledge of osteoporosis among study subjects with significant values ($p<0.001$)

Educational intervention

Pharmacist intervention included reducing modifiable risk factors like adequate calcium and vitamin D through diet and supplementation and weight-bearing exercises.

Based on physical activity, physically active individuals are found at lower risk compared to those who are

physically inactive in support with the study conducted by Moreira and others [26] that showed greater BMD in physically active individuals. There are 213 out of 350 cases (61%) exercise in some form or the other on a regular basis. Based on physical activity, 276 out of 350 cases (79%) are found to be physically active and 71 cases (21%) are not much physically active (Table 9). There is a significant impact of prolonged immobility on increased risk of osteoporosis. High-risk cases were observed majorly in those with prolonged immobility and low-risk cases were mostly found in other categories (Table 10).

Calcium is a mineral that helps build and maintain strong bones and teeth. Vitamin D is necessary for calcium to be absorbed by the intestine, so it works with calcium to build and maintain bone health. It is mainly obtained from sunlight and diet enriched with vitamin D (i.e. oily fish, eggs, butter, fortified cereals and juices). There are 25 (7%) cases out of 350 are found to be taking calcium supplementation of around 500 mg per day. Additional 75 (22%) cases out of 350 are recommended to take calcium supplementation along with dietary calcium intake. At baseline, the mean value of total calcium intake before pharmacist intervention is 866.9 mg per day. At follow-up, the mean value of total calcium intake after pharmacist intervention is 1096.48 mg per day. At baseline, 27 patients (7.7%) were consuming at least the recommended daily intake of calcium (> 1200 mg/day) from diet and supplements. At follow-up, 133 out of 350 (38%) cases were consuming at least the recommended daily calcium intake (Table 11).The mean total calcium intake in study participants after pharmacist intervention is an increased overall percentage with statistically significant values ($p < 0.001$).

There is a decreased risk of osteoporosis with increased exposure to sunlight (Fig. 4) and low number of high-risk cases. Those with poor consumption of dietary Vitamin D showed an increased number of high-risk cases and adequate dietary intake showed a maximum number of low-risk cases. At baseline, the mean value of Vitamin D supplemented is an average of 94.28 units per day. At follow up, the increase in the total mean value of supplemented Vitamin D is average 540 units per day. In total, 134 (38.3%) of the patients were consuming vitamin D supplementation at follow-up ($p < 0.001$) (Table 11). This is in contrast with the study done by Yuksel and others [11] which showed significant increase in calcium intake after the intervention, but no significant increase in vitamin D was reported. However, these results indicate an ongoing need for reinforcement by all health care professionals to encourage adequate calcium and vitamin D intake. Primary care physicians and community pharmacists are well-positioned to continually emphasize the importance of calcium and vitamin D and to follow up on recommendations made to patients.

Diagnostic screening of osteoporosis

Screening rates remained below optimal in the population, even though significant patients would have been candidates for BMD testing. Of 82 (23%) cases recommended for BMD testing, 7 (2%) went on to have a BMD scan performed or scheduled. All of the 7 (2%) patients were undergoing BMD scanning for the first time. All of the scans were ordered by the family physician. Of these 6 (1.7%) patients who had a scan performed or scheduled were also started on osteoporosis drug therapy. Of the 10 (2.9%) patients who spoke to their physician but did not have a BMD scan performed or scheduled, 7 had started osteoporosis treatment (Table 12). This study has shown that educating patients alone is insufficient to significantly increase the proportion of patients being assessed for osteoporosis. This demonstrates a need for greater physician education about the criteria for osteoporosis assessment. This is in support with the study conducted by Elliott and others [27] who reported a case series using peripheral dual energy X-ray absorptiometry in five community pharmacies in rural Wisconsin where out of 133 cases, only nine women (7%) eventually received a BMD test with central DXA or started osteoporosis treatment. It is recommended that a BMD scan and calcium supplementation for patients with inadequate calcium intake becomes the minimum standard of care after a fragility fracture. Vitamin D supplementation should also be encouraged since Indian population is often vitamin D deficient. Many barriers in receiving adequate osteoporosis-related care have been reported, including medication adherence in osteoporosis. However, further study is needed to identify interventions that will help break down barriers and further narrow this gap in osteoporosis care

Table 6: Risk of osteoporosis based on occupational status

Occupation	High risk	Moderate risk	Low risk	Grand total
Business		4	20	24
Driver	1		8	9
Employee	2	7	35	44
Farmer	4	8	46	58
Fisherman			2	2
Govt. Employee			2	2
Housewife	9	47	98	154
Maid		2	2	4
Milkman		1	1	2
Retired Employee	5	3	14	22
Unemployed			3	3
Worker		4	22	26
Grand total	21	76	253	350

Table 7: Risk of osteoporosis associated with symptomatic bone pain

Symptomatic pain	High risk	Moderate risk	Low risk	Grand total
Present	11	29	33	73
Absent	10	47	220	277
Grand total	21	76	253	350

Table 8: Osteoporosis Knowledge Assessment Tool (OKAT) scores at baseline and follow-up

OKAT scores	Rural area	Urban area	Total
Average of pre-test scores	9.71	15.26	11.12
Average of post-test scores	15.13	18.10	15.88
Average of difference in scores	5.44	2.83	4.78

Pre-test scores include OKAT assessment before pharmacist education to assess patient's existing knowledge of osteoporosis. Post-test scores are those obtained by re-assessment of patient's enhanced knowledge of osteoporosis after pharmacist education. This was compared after being conducted in both urban and rural population.

Table 9: Risk of osteoporosis associated with physical activity in individuals

Physically active	High risk	Moderate risk	Low risk	Grand total
No	11	28	35	73
Yes	10	48	218	277
Grand total	21	76	253	350

Table 10: Risk of osteoporosis associated with prolonged immobility

Prolonged immobility	High risk	Moderate risk	Low risk	Grand total
No	7	40	223	270
Yes	14	36	30	80
Grand total	21	76	253	350

Table 11: Educational intervention for prevention of osteoporosis

Risk factor	At initiation of study	At follow-up
Calcium		
Supplementation (mg/day)	32.8 (±6.63)	86.28 (±13.6)
Dietary intake (mg/day)	837 (±13.61)	993.2 (±15.27)
Total intake (mg/day)	866.9 (±281.89)	1096.48(±276.95)
Supplementation taken (no. of patients)	25 (7%)	133 (38%)
Required daily allowance met (n=350)	27 (7.7%)	75 (22%)
Vitamin D		
Supplementation (IU/day)	94.28 (±923.48)	540 (±1937.55)
Supplementation taken (no. of patients)	15 (4.2%)	132 (37.7%)
Alcohol intake (≥3 drinks/day) (n=350)	40 (11.1%)	40 (11.1%)
Smoking (n=350)	91 (26%)	91 (26%)
Weight-bearing exercises performed (n=350)	213 (61%)	263 (75%)

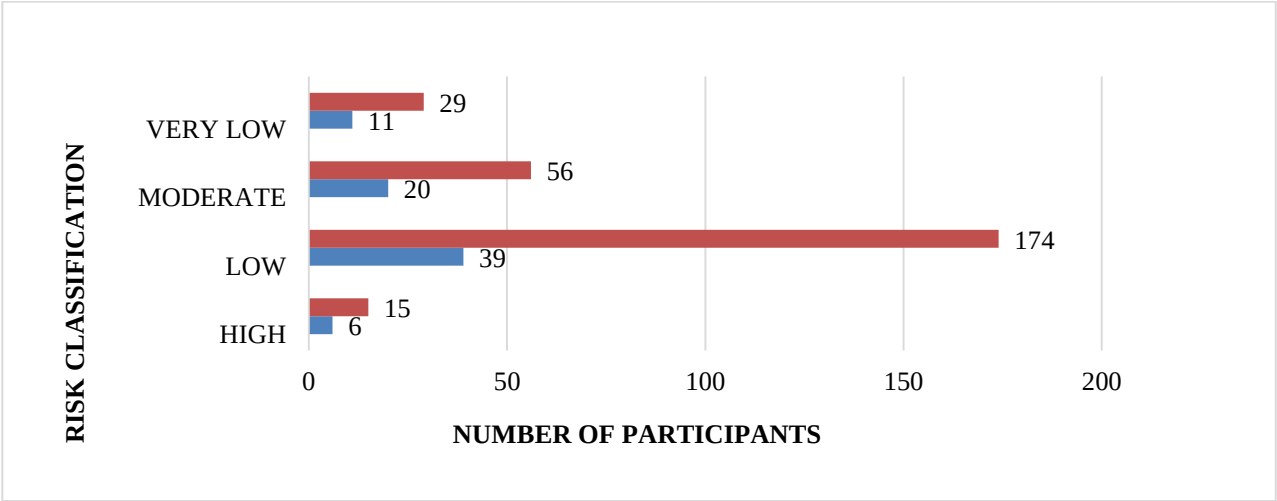

Fig.4: Risk of osteoporosis based on exposure to sunlight

Risk of osteoporosis in individuals associated with their exposure to sunlight.

Exposure to sunlight; no exposure to sunlight.

Table 12: Follow-up assessment for osteoporosis

Assessment	N**umber (%) of patients**
Bone mineral density scan recommended	82 (23)
Bone mineral density scan performed	7 (2)
Osteoporotic medications started	
With BMD	6 (1.7)
Without BMD	7 (2)
Physician consultations	
With BMD	7 (2)
Without BMD	10 (2.9)

BMD- Bone Mineral Density

CONCLUSION

Pharmacists have an important role in educating patients about the risk factors, prevention and treatment options for osteoporosis. This study demonstrated that pharmacists can increase patients' knowledge about osteoporosis and encourage them to speak to their family physician about the need for treatment and prevention. Continual encouragement to modify these risk factors is needed from all health care professionals, especially pharmacists, to intervene and provide follow-up. The study also confirmed the results of previous studies in other institutions showing that patients with fragility fractures are not being assessed for osteoporosis, nor are they being referred for assessment after discharge. This study will help improve knowledge of preventive strategies of osteoporosis in community along with enhanced screening of osteoporosis in the community pharmacies and increased patient awareness of the age to be tested for osteoporosis. It is recommended that a BMD scan and an assessment for osteoporosis therapy become the standard of care after a fragility fracture along with understanding for need for feasibility of BMD testing in high-risk patients.

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