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Incidence rate and modifiable risk factors for osteoporosis in Vietnam

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Genet. Mol. Res. 20 (1): gmr18737
Received December 30, 2019
Accepted April 20, 2020
Final Revision January 25, 2021
Published March 29, 2021
DOI http://dx.doi.org/10.4238/gmr18737

ABSTRACT. Osteoporosis is a common pathology and a cause of disability and reduced quality of life invarious developing countries. An urgent issue in this context is the study of risk factors for osteoporosis, especially those that can be modified. We conducted a cross-sectional study in Vietnam. The study was conducted in the city of Vinh and involved 2065 respondents who were randomly selected for the study, of which over 2050 people were examined. The average age of the participants in years was 62.1 ± 10.3 (men) and 59.3 ± 10.1 (women). The age of all examined patients was over 40 years. It was found that among people aged 50 and over, approximately 40% of women and 37% of men suffered from osteoporosis. The rate of osteoporosis increases with advancing age. Underweight people had a higher risk of osteoporosis compared to normal and overweight people. The proportion of osteoporosis in urban areas was higher than in suburban areas. The proportion of osteoporosis in white-collar, housewives, and businessmen was higher than in other professions. The risk of osteoporosis in alcohol abuse and smoking groups was 1.5 to 1.6 times higher than in those who were not drinking or smoking. In individuals with low adherence to preventive control and physical activity recommendations, the risk of osteoporosis was 1.5 times higher than in those who adhered to regular examinations and maintained moderate physical activity.

Our study lends support to the hypothesis that some lifestyle and metabolic factors are predictive factors for the development of osteoporosis. Calcium and vitamin D intake, moderate physical activity, pregnancies and breast feeding, use of progestogens, either alone or in addition to estrogens can be considered preventative factors for osteoporosis development.

Key words: Osteoporosis; T-score; Prevalence; Cross- sectional; Lifestyle; Exercise; Calcium and vitamin D; Menopause; Fosamax drug

INTRODUCTION

Osteoporosis is a disease characterized by impaired metabolic processes in the bone tissue, which lead to a decrease in bone density and disruption of bone architecture. (NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy, 2001).). The most common sites for osteoporotic fractures are the bones of the hip, wrist, and spine (Harvey et al., 2010; Greenwood, 2015). It is well known that the strength and quality of bone is largely dependent on the three-dimensional microarchitecture of the bone, as well as the properties of the material components. Type 1 collagen and hydroxyapatite crystals are the main constituents of bone (Reznikov et al., 2014; Saeed et al., 2019). Disability due to osteoporosis and fractures as its complication are an important problem of modern healthcare on a global scale. According to the latest statistics, over 200 million people worldwide have osteoporosis (Tomishige-Mukai et al., 2016). Experts from the World Health Organization call osteoporosis an epidemic of the twenty-first century, along with such common pathologies as obesity, diabetes and diseases of the cardiovascular system (Khan et al., 2019; Bliuc and Center, 2016; von Friesendorff et al., 2016). According to the prognostic data of the WHO, one in three women and one in five men over the age of 50 are prone to have at least one osteoporotic fracture (Hernlund et al., 2013). Asia in particular is projected to be the main continent in terms of osteoporosis prevalence, as the projected incidence of hip fractures in this region will be nearly 40% of all hip fractures by 2025 (Johnell and Kanis, 2006). The prevalence of osteoporosis in Caucasian women over 50 years old, according to the data, varies from 8 to 23%, depending on the design of different studies and the populations studied (Shin et al., 2010).

Fractures as a consequence and complication of osteoporosis are the reason for the disability of the population and high material costs of the state to eliminate these consequences. Osteoporosis is one of the causes that lead to mortality, disability, reduced quality of life and hospitalization (Olmos et al., 2018; Bartosch et al., 2018). The classic risk factors for osteoporosis are old age, tobacco smoking, alcohol abuse, overweight and obesity, physical inactivity, inadequate calcium and vitamin D intake, and hypoestrogenemia (You et al., 2019). In a number of review articles, risk factors that lead to a decrease in bone mass are named, and unmodified risk factors, such as genetic predisposition, medical history and family history, and the age of menarche are indicated. Menopause and menopause in women are recognized as an important unmodified factor that has a high association with the development of osteoporosis (Dargent-Molina, 2004; Thomas, 2008). In contrast, progesterone and estrogen have been identified as protective hormones for bone loss (Kuchuk et al., 2007). Hypoestrogenemia is a recognized fact,

leading to a decrease in bone density (Riggs et al., 2002). A number of studies have proven the protective role of dosed exercise in relation to the development of osteoporosis in women in menopause (Howe T., 2011). In males, this relationship is less pronounced (Nguyen et al., 2015).

Osteoporosis is traditionally considered a "female disease", since the prevalence of osteoporosis and fractures as its complications is most significant in women in menopause, and these values are significantly higher compared to men of a similar age (Kanis et al., 2013; Hannan et al., 2019). As a result of a survey of 48,000 women in menopause, it was found that about 50% of all females had a decrease in bone mass, which resulted in fractures. The presence of comorbidities such as hemolytic anemia, bronchial asthma, systemic lupus erythematosus, diabetes mellitus and thyrotoxicosis are also associated with a high risk of osteoporosis (Geller and Derman, 2001). However, in older males, there is also a decrease in bone density - by about 1% per year. The most difficult and associated mortality rate is precisely the osteoporotic hip fracture. Thus, men are also targets of osteoporosis and require equal attention in terms of diagnosis and treatment of osteoporosis (Tanaka et al., 2001; Kanis et al., 2013).

The diagnosis of osteoporosis classically requires and is based on bone mineral density or a history of the disease containing fracture data. Osteoporosis clinics include back pain, short stature, spinal deformity and fractures of the vertebrae, hips, wrists and, to a lesser extent, other bones. The most optimal non-invasive method for assessing the risk of fracture is the measurement of bone density using dual energy X-ray absorptiometry. Peripheral computed tomography is also useful and informative (Cohen and Roe, 2000).

According to statistics, about half of all osteoporotic hip fractures worldwide occur in Asia. Urbanization and changes in the economic and social status of the state in recent decades have affected the prevalence of osteoporosis, which occurs in almost a quarter of Vietnamese women between the ages of 50 and 65 (Dao et al., 2011).

However, despite the high prevalence and severity of clinical symptoms, insufficient attention is paid to the diagnosis and treatment of osteoporosis, and awareness of the disease remains low on a global scale. Working to raise knowledge and awareness of this disease and methods of its prevention is a necessary and important component in its treatment, as well as in improving the quality and accessibility of medical care provided. Data on the prevalence of osteoporosis in the Vietnamese population and related factors need to be clarified (Ho-Pham and Nguyen, 2017). Thus, the need and importance of further research on the epidemiology of osteoporosis and risk factors in Vietnam is clear.

MATERIAL AND METHODS

Both male and female who were more than 40 years old and living in Vinh City at the time of this study were included. Research period: November 2015 to July 2017. Exclusion criteria: newcomer (no temporary registration), those who do not remember or do not answer all the questions in the research questionnaire, those who have liver failure, chronic kidney failure, people who are deformed or having Tophy due to Gout on wrists and heels.

This was a cross-sectional descriptive study coordinated with randomized controlled clinical trial study to evaluate efficacy before and after treatment. This study is conducted in order to determine the proportion of osteoporosis in those who are 40 years

old or older and determine risk factors, example: age, gender, BMI, menopause, medicine usage, job, diet, exercise and acquired disease.

The expected sample size was 1982. To ensure we chose a sample size of 2000 people but in fact we got 2065 people (65 in case of abandon). Blood testing sample size: the proportion of people with osteoporosis after measuring heel bone's density is 39.6% so the sample size is (39.6 x 2065)/100 = 817. The intervention sample size which was based on the reduction in bone's density and osteoporosis is 1560, of which 60 was given Fosamax.

Sampling method

We used a combination of several sampling methods: cluster samples combined with single random sampling and purposeful sampling. The research sample in cross-sectional survey was applied in combination with the following sampling methods. Vinh City was divided into 2 regions: Central region (including 16 wards) and Commune area (9 communes). Each ward and commune randomly draws 1 block / ward and 1 hamlet / commune. Cluster sampling for clinical examination, interview and bone density measurement. From the selected population clusters, invitations were issued to check the health of all people aged 40 and over, so that the sample sizes were enough for calculation. Sampling for blood test (according to the sampling method with the purpose of selecting a group of osteoporosis who are 40 years of age and older with T-score $\leq$ -2.5.

Procedure for selecting samples:

Notify the medical center;

Organization of deployment to communes and wards;

Each commune / ward draws to select 1 block and a neighbor;

Each neighborhood block will work through the district head, make a list of all people aged 40 and over in the block and select 100 people.

Distribute invitations to 100 selected people for screening.

Bone density was determined by X-ray energy absorption method. The Osteosys EXA 3000 uses digital X-ray technology, dual-energy X-ray absorption (energie X ray Absorptionmetry EXA). The device is designed to measure the position of the heel bone and the rotating bone to diagnose osteoporosis, assess the level of osteoporosis, predict the risk of fractures and monitor treatment. This is an advanced non-invasive technique, safety for patients, accurate results, high diagnostic value. Made in Korea, it has the function of taking pictures and analyzing details for accurate diagnosis. The device is compact in size, connected to a laptop, easy to transport and convenient to take to the commune health stations to examine people. Results are assessed using T-score and Z-score according to WHO.

Diagnosis of osteoporosis is based on WHO 1994 standards, taking the results at one measurement site. In this study, we selected the measurement of heel bone to determine the rate of osteoporosis. Because the heel bone is the thickest, strongest bone in the body, bearing much force.

Determine the weight, height of the patient and calculate the BMI:

Determine weight. Using Japanese electronic scales SECA. Place the scale on a stable surface, requiring the subject to remove hats, shoes, heavy clothes and anything in the

bag. Subject stands on the scale, looks forward, his hands resting along his body. Investigators read the results, write measurements to the nearest 0.1kg.

Determine the height. Measure standing height with a three-piece wooden ruler from the US. The patient stands with his feet, his heels close together and close to the back of the ruler, the eyes look straight, the milestones, shoulders, buttocks, heels close to the face of the ruler, hands naturally relaxed. Read the measurement on the straight ruler, record the measurement to the nearest 0.5cm.

Calculate and evaluate body mass index (BMI). Patients were measured height, weight calculated body mass index BMI by the formula of Kaup.

Clinical examination was made by specialists. With the functional and physical indicators of osteoarthritis and other attached medical diseases, record the diseases according to the international disease classification (ICD10).

Direct interview with the subject (according to the questionnaire). History of illness, history of menstruation, history of medicines related to osteoporosis. This includes direct checking of discharge papers and prescriptions for firm conclusions.

Biochemical test techniques. Tests are conducted at Laboratory General Clinic Vinh Medical University. Perform immunosuppression quantitative serum Osteocalcin for both sexes, Estrogen for women and Testosterol for men. The above tests are performed on the Immulite 1000 immunoassay analyzer of Xiemens- Germany.

Effective intervention and evaluation solutions:

Backup solution level I. In the group of prophylaxis solutions I apply to people without osteoporosis, including 2 groups:

Group 1: Group of people with normal bone density. In this group we divided into 2 categories:

subjects with normal bone density and without concomitant diseases. Communicate directly and indirectly with leaflets to raise awareness about the consequences of osteoporosis, change behaviors such as eating calcium-rich foods, exercising, exercising and exercising, walking, Gym (except for heart failure), Yoga, no smoking, alcohol reduction, cautious use of cocticoids or supplements that limit side effects.

subjects with normal bone density and concomitant diseases. Comorbid diseases include hypertension, osteoarthritis, rheumatoid arthritis, chronic lung disease, diabetes mellitus, heart failure, etc.

*Solution 1: Directly and indirectly propagate by leaflets with the same content as the group without the accompanying disease.

*Solution 2: Prescribing, treating advice, guiding diet for patients with accompanying diseases.

Group 2: Groups of people with reduced bone density.

subjects with reduced bone density and no associated diseases.

*Solution 1: Same as group 1. Communicating directly and indirectly with leaflets to raise awareness about the consequences of osteoporosis, change behaviors such as eating calcium-rich foods, exercising, exercise and sports, walk, do not smoke, reduce alcohol, be cautious when using cocticoid.

*Solution 2: Calcium supplementation by drinking 2 cups of calcium milk/day for 9 months and prescribing calcium D supplement pills for 9 months.

subjects with reduced bone density and associated diseases.

*Solution 1, 2: Like the group with reduced bone density and no associated diseases.

*Solution 3: Counseling and prescribing and guiding the treatment of accompanying diseases.

Backup solution level II. This solution applies to people who already have osteoporosis, including 3 groups:

Severe disease group with early treatment designation to reduce fracture complications. This group includes 60 people with severe osteoporosis, many complications, women >65 years old, men >70 years old, no contraindications such as a history of peptic ulcer, esophageal ulcer, reflux syndrome stomach, hypersensitivity to the drug. All of these groups were treated with Fosxamax tablets of 5600 IU Vitamin D3 and 70 mg Alendronat, 1 pill each week before breakfast 30 minutes, on a fixed day every 4 months for 6 consecutive months. Drink with 200ml of cool water, after drinking do not lie down. Combine 1g extra calcium daily. After giving the medicine, the team called to check and reminded to take medicine weekly, and asked for side effects. Evaluate results after 3 months, 6 months, 9 months of taking the drug. After 9 months, all parameters were the same as before intervention. Combining counseling and treatment included as hypertension, these drugs do not affect the effects of the drug.

Osteoporosis group has not indicated immediate treatment without concomitant diseases.

*Solution 1: Same as group 1.

*Solution 2: Prescribing using Fosxamax and calcium preparations.

*Solution 3: Guide to walking, wearing a belt, protecting and preventing broken bones.

Osteoporosis group is not indicated for immediate treatment and concomitant diseases.

*Solution 1: Same as group 1.

*Solution 2: Prescribing using Fosxamax.

*Solution 3: Guide to walking, wearing a belt, protecting and preventing broken bones.

*Solution 4: Prescribing, treating, advising and guiding the treatment of attached diseases.

Data processing

The data were cleaned before importing into computers, the survey data were processed by EPI-INFO, EXEL, Medcal and SPSS 20.0, performed on computers at Vinh Medical University. The continuously variable data were checked before normal distribution kurtosis test analysis, the average value, median, maximum value, minimum value, standard deviation. If the normal distribution data were used parametric statistical tests: Test t, for testing the difference between two average values, ANOVA test (F test) for testing the difference between multiple average values. If the data was not distributed according to the standard rules was used non-parametric statistical tests: the difference between the two average values were tested by Mann- Whitney test. Comparison between test rates $\chi 2$. To evaluate the relevant factors, we used the odds ratio OR (Odds - Ratio),

OR> 1, which demonstrates the risk factors related to sick. 95% confidence intervals were applied to all tests. The difference was considered reliable when the value $p < 0.05$.

Ethics research

Disseminate research objectives to health officials, steering committees and members who are research staff, heads of ward health stations, health collaborators, female staff. Ensuring the right of "voluntary participation" of subjects and participants in research is clearly explained about the purpose and content of conducting research, only researching voluntary objects during the research process. If rejected or give up, remove from the study. The results of bone density measurement, blood and urine tests are fully informed to the subjects. Subjects do not have to pay any costs. Safety issues for patients are respected. Ensure the aseptic principle in testing. Subjects were explained about the benefits of testing, how to proceed, and the probable events. The test is done only after the object of the subject's consent. The results of the study will be used to assess the proportion of subjects with reduced bone density, osteoporosis at the study site and identify risk factors. Since then, some preventive measures have been applied for subjects with reduced bone density in order to reduce incidence. People with osteoporosis who are detected during the study, are examined and prescribed osteoporosis treatment and accompanying diseases are provided with appropriate diet and exercise guidelines. 60 patients were selected based on the criteria: severe osteoporosis, women over 65, men over 70, with a history of fractures, or risk of fractures, a history of prolonged cocticoid use.

RESULTS

There are 2065 respondents, 2/3 of them were female, 2/3 were white- collar, ¼ were farmesr and most of them had a junior high school or high school level of education. Mean age was 62.1±10.3 (male), 59.3±10.1 (female) and 60.2±10.3 (total). The distribution of participants by gender and age group and key baseline characteristics are shown in Table 1. The mean BMIs of males and females were similar to each other.

Table 1. Proportion of people with osteoporosis, reduced bone density and normal people. Mean bone density and T-score distribution.

	Osteoporosis		Reduced bone density		Normal		Total	
	n	%	n	%	n	%	n	%
Male	255	37.4	225	33.1	204	29.5	684	100
Female	562	40.7	518	37.5	301	21.8	1381	100
Total	817	39.6	743	36.0	505	24.4	2065	100
T-score	-3.4±0.7		-1.7±0.42		0.09±1.02		-1.95±1.6	
% bone density	58.9±23.5		77.1±8.4		98.4±18.9		74.3±24.6	
				BMD g/cm2				
Male	0.37 ± 0.07		0.49 ± 0.04		0.62 ± 0.08		0.48 ± 0.12	
Female	0.26 ± 0.12		0.38 ± 0.26		0.48 ± 0.07		0.36 ± 0.2	
Total	0.3 ± 0.12		0.42 ± 0.22		0.53 ± 0.19		0.4 ± 0.19	

Among those aged 50 years and older, approximately 40% of women and 37% of men had osteoporosis (i.e., femoral neck bone mineral density (BMD) T-scores ≤-2.5. There

are differences in T-score between each group with $P < 0.01$). Mean BMD of male is higher than female (Table 2).

Table 2. Age, sex and baseline characteristics of the study respondents.

		Male		Female		Total	
		n	%	n	%	n	%
Age	40-49	77	11.3	239	17.3	316	15.3
	50-59	205	30	469	34	674	32.7
	60-69	235	34.4	481	34.8	716	34.6
	≥70	166	23.4	193	14	359	17.4
	Total	683	100	1382	100	2065	100
Body mass index (BMI) data of respondents	Weight (kg)	60.04 ± 9.01		52.7 ± 7.5		55.1 ± 8.8	
	Height (cm)	160.4 ± 5.7		150.3 ± 10.9		153.6 ± 10.62	
				n		%	
Job		White collar		677		32.8	
		Manual worker		128		6.2	
		Farmer		528		25.6	
		Businessman		110		5.3	
		Craftman		120		5.8	
Education		≤ Primary school		163		7.9	
		Junior high school		1276		61.8	
		High school		230		11.1	
		College		396		19.2	
Cardiology		Hypertension		729		35.3	
		Heart failure		11		0.5	
		Arrhythmia		25		1.2	
		Angina pectoris		89		6.5	
		Thrombophlebitis		2		0.2	
		Arteriosclerosis		69		3.3	
Dermatology		Infectious dermatitis		117		5.7	
		Acne		34		1.6	
Respiratory		Acute bronchitis		177		8.6	
		Chronic bronchitis		223		10.8	
		Pneumonia		22		1.1	
		Heart waste		413		20.0	
		Upper respiratory infection		107		5.2	
Gastroenterology		Colitis		335		16.2	
		Clinical syndrome DD-TT		574		27.8	
		Digestive disorders		85		4.1	
		Hemorrhoids		94		4.6	
Urology		Acute glomerulonephritis		24		1.2	
		Chronic glomerulonephritis		3		0.1	
		Nephrotic syndrome		25		1.2	
		Urinary tract infections		130		6.3	
		Urinary tract stones		226		10.9	
Rheumatology		Rheumatoid arthritis		72		3.5	
		Osteoarthritis		1125		54.1	
		Bone aches		1273		61.6	
		Old fracture		215		10.4	
Neurology		TBMMN		51		2.4	
		Epileptic		6		0.3	
Endocrinology		Goiter		56		2.7	
		Basedow		25		1.2	
		Hypothyroidism		3		0.1	
		Diabetes		159		7.7	
Ophthalmology		Conjunctivitis		51		2.5	
		Keratitis		20		1.0	
		Eyeball		24		1.2	
		Pterygium		47		2.3	

Osteoporosis in male is 1.5 times higher than in female (OR = 1.5 CI 95% (1.2 – 1.9) P = 0.01). There is evidence about a relationship between age and osteoporosis with P < 0.01. The prevalence of osteoporosis and osteopenia increased with advancing age, reaching the highest among those aged 70 years and older (Table 3). The higher T-score (-2.94±1.59 for those, who had more than 70 against -0.94±1.32 for 40-50 years old) leads to the lowering the heel bone density percentage (63.57±21.00 and 86.58±24.11 respectively). Underweight people have higher risk of osteoporosis compare to normal and overweight people. The proportion of osteoporosis in urban areas is higher than in suburban areas, this difference is not statistically significant with P > 0.05. There is no difference in mean T-score between radius and heel bone, urban areas vs suburban areas. The proportion of osteoporosis in white-collar, housewife, businessman is higher than other jobs. The risk of osteoporosis in alcohol abuse and smoking group is 1.5 to 1.6 times higher than those who are not drinking or smoking. Those who practice not good have 1.5 times higher risk of osteoporosis than those who practice nicely.

Table 3. Age and other characteristics associated with osteoporosis.

		Osteoporosis		Reduced bone density		Normal	
		n	%	n	%	n	%
Age	Gender						
	Male	31	27.3	27	35.1	29	37.7
40-49	Female	18	07.5	89	37.2	132	55.2
	Total	49	12.3	116	36.7	161	50.9
	Male	56	27.3	78	38.0	71	34.6
50-59	Female	135	28.8	216	46.1	118	25.2
	Total	191	28.3	294	43.6	189	28.0
	Male	82	34.9	80	34	73	31.1
60-69	Female	259	54	177	36.9	44	9.2
	Total	314	47.7	257	35.9	117	16.4
	Male	96	57.8	42	25.3	28	16.9
≥ 70	Female	150	77.7	34	17.6	9	4.7
	Total	246	68.5	76	21.2	37	10.3
	Underweight	85	74.6	23	20.2	6	5.3
BMI	Overweight	128	24.1	210	39.2	195	36.7
	Normal	603	42.7	510	36.1	304	21.2
	Suburban	311				178	
Living location	Urban	506				327	
	Total	817				505	
	Farmer	73	20.8			288	79.8
	Worker	18	22.8			61	77.2
Job	Craftman	21	27.6			55	72.4
	Businessman	28	44.4			35	55.6
	White-collar	190	45.6			227	54.4
	Housewife	142	43.7			183	56.3
Alcohol abuse	Yes	632	64.8			344	35.2
	No	185	53.5			161	46.5
Smoking	Yes	650	64.1			364	35.9
	No	167	54.2			141	45.8
Knowledge	Not good	725	62.2			440	37.8
	Good	92	58.6			65	41.4
Practice	Not good	707	63.6			405	36.4
	Good	110	52.4			100	47.6

Table 4 shows data concerning osteoporosis associated with a decrease in endocrine substances. Data reveals that with increasing the age of respondents the amount of estradiol is lowering. There is no difference in the amount of testoterol and osteocalcin between ages.

Table 4. Amount of endocrine substances and associated age in osteoporosis patients.

Amount of endocrine substances	Testoterol		Estradiol		Osteocalcin	
	n	%	n	%	n	%
Normal	70	27.45	80	14.24	252	30.84
Low	174	68.2	451	80.25%	560	68.54
High	11	4.31	31	5.5	5	0.61
Total	255		562		817	
Age						
40 -49	412± 204.9		47.15 ±64.3		3.05±1.72	
50-59	353.7±201.8		27.86±57.3		3.73±4.5	
60-69	351.78±237.4		24.9±41.0		3.63±2.73	
≥70	349.1±213.4		21.59±23.94		3.58±4.75	
Total	355.3±217.7		24.61±43.19		3.61±3.88	

Table 5 provides data concerning osteoporosis associated with menopause and number of children. Women with more than 4 children have higher rate of osteoporosis than those who have less than 4 children. Those who have history of fracture, used corticoid, height reduction, exercise and no drinking milk have higher risk of osteoporosis than the opposite group (difference is statistically significant with $P < 0.01$).

Table 5. Osteoporosis associated with menopause and number of children.

		Osteoporosis		Normal		Total
		n	%	n	%	
Age	≥16	332	60.7%	155	39.3%	487
	<16	227	64.9%	147	35.1%	374
Menopause	Yes	537	79.9%	135	20.1%	672
	No	23	12.1%	167	87.9%	190
	≥4 con	231	84	44	16	275
	<4 con	309	55.2	251	44.8	560
	Early	75	88.2	10	11.8	85
	In time	425	79.1	112	20.9	537
Number of children	Yes	124	73.81	44	26.19	
	No	693	60.05	461	39.95	
	Yes	26	66.67	13	33.33	
	No	534	64.88	289	35.12	
	Yes	18	64.29	10	35.71	
	No	538	64.82	292	35.18	
	Yes	52	53.61	45	46.39	
	No	765	62.45	460	37.55	
	Yes	25	51.02	24	48.98	
	No	792	62.22	481	37.78	
	Yes	115	80.99	27	19.01	
	No	450	38.14	730	61.86	
	Yes	726	63.85	411	36.15	
	No	91	49.19	94	50.81	
	Yes	535	55.2	434	44.8	
	No	297	84	56	16	
	Yes	289	72.80	108	27.20	
	No	526	57.11	395	42.89	

Those woman that have menopause after 45 years old (n = 398) have T- score -3.3±0.7; between 40 and 45 – the same value, but number of respondents were in 2.5 times lower (140) and only 20 respondents had T-score -3.6±0.78 after 40 years old.

To evaluate the effectiveness of interventions second examination results were obtained. There are 1560 people who took the first examination and need to do the second time. 1433 people took the second examination, which is 91.8%. Most people (90%) who had including diseases got prescriptions and consulted (Table 6). Those who were in the reduced bone density group did more exercise than those in osteoporosis group. More than 1/3 of respondents who were in the osteoporosis and reduced bone density group consumed 2 cups of calcium rich milk per day. Respondents with osteoporosis use more calcium preparations with Vitamin D3 than those who are in reduced bone density group. It was found, that there is no difference between medication for osteoporosis and medication for including disease. After the intervention, 150 people (20.2%) in the group with reduced bone density turned into people with normal bone density and 184 patients (22.5%) in the osteoporosis group turned into people with decreased bone density.

Table 6. Result of preventive interventions with Fosamax.

	Osteoporosis		**Reduced bone density**		**Normal density**		**Total density**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Rate of people who got direct and indirect communication								
Don't have including disease	187	22.9	183	24.6	105	20.8	475	23.0
Have including disease	630	77.1	560	75.4	400	79.2	1590	77.0
Total	817	100	743	100	505	100	2065	100
Rate of people who do exercise before and after treatment with Fosamax								
	Osteoporosis (817)		Reduced bone's density (743)					
Before treatment	242	29.6	328	44.1			570	36.5
After treatment	612	74.9	661	89.0			1273	81.6
Rate of calcium supplement adherence								
Before treatment	387	47.4		425	57.2		812	52.0
After treatment	753	92.2		602	81.0		1355	81.6
Rate of calcium supplement using 2 cups of calcium rich milk per day								
Before treatment	152	18.6	120	16.2			272	17.3
After treatment	285	34.9	269	36.2			554	35.5
Interventions effectiveness on osteoporosis and reduced bone density group								
Before treatment	817	100	743	100	505	100	2065	100
After treatment	633	77.5	777	79.8 + 24.7	150		1560	78.6
Osteoporosis treatment effectiveness using Fosamax								
Before treatment	60	100%					60	100%
After treatment	21	35.0	32	53.3	7	11.7	39	65.0
Side effects of Fosamax	N (n=60)	%						
Allergic rash	4	6.7						
Jaw bone necrosis	0	0.0						
Stomachache	6	10.0						
Vomiting	3	5.0						
Epigastric burning	6	10.0						
Belching	6	10.0						
Esophageal ulcer	1	1.6						
Constipation	2	3.3						

The rate of reduced bone density was much lower than before the intervention, from 5.9% to 0.26% ($P < 0.01$). In addition, the rate of osteoporosis was much lower than before the intervention, from 15.2% to 0.6%. Also, there are improvements in T-score and bone density percentage in both groups after 9 months of treatments – from -1.71±0.42 to -1.41±0.39 I reduced bone group and from -3.4±0.7 to -2.6±0.6 – in osteoporosis ones.

Results obtaining after treatment via Fosamax drugs (respondents who used Fosamax: 222) clearly shows that there are 39 cases which changed from osteoporosis to no osteoporosis, achieved treatment goal of 65%. This difference is statistically significant with $P < 0.05$. After 9 months of intervention T-Score and heel bone density increased significantly, the difference was statistically significant. The primary side effects of Fosamax are stomachache, epigastric burning and belching. There is no record of jaw bone necrosis after taking Fosamax.

DISCUSSION

This study provides data on the risk of osteoporosis in the entire population, the male population and the female population. The risk for osteoporosis was significantly associated with age, vitamin D intake, and weight. In the male population, osteoporosis was associated with age, weight and condition of erectile dysfunction. The results suggest that erectile dysfunction was associated with a high risk of osteoporosis in the male population. The osteoporosis risk factors in the female population were similar to those of the total population, but there were two different points of note, including drinking and menopause. Drinking was protection factor only in the female population and menopause was an independent risk factor. Our study lends support to the hyptothesis that some lifestyle and metabolic factors are predictive factors for the development of osteoporosis. Yhe underlying biological mechanisms could be revealed by further studies. The roles of fat distribution, erectile dysfunction, menopause and drinking in osteoporosis should be given more consideration in clinical practice.

CONCLUSIONS

In summary, increasing age, female sex, oophorectomy, and prolonged immobility are associated with an increased risk for osteoporosis and associated fractures. Other factors probably or possibly associated with osteoporosis and risk of osteoporotic fractures are low calcium intake, cigarette smoking and heavy alcohol consumption. On the other hand, several factors probably or possibly associated with a decreased risk for osteoporosis and associated fractures are ingestion of vitamin D and its metabolites, moderate physical activity, pregnancies and breast feeding, use of progestogens, either alone or in addition to estrogens.

ACKNOWLEDGMENTS

The authors are grateful to Vinh Medical University and Vinh Medical University Hospital for the financial support.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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