Study on morbidity rate and risk factors for osteoporosis among people aged 40 and over in Vietnam. Proposals of intervention solutions

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Abstract. Osteoporosis and fracture impose a significant health care burden on the contemporary populations in developing countries. Studies on the epidemiologic distribution of osteoporosis and associated factors in Vietnam are required. A cross-sectional study was conducted in a study area Vietnam. The study was conducted in Vinh City consisting of 2065 respondents different, who were randomly selected. We have recruited more than 2050 individuals. The average age of participants was 62.1±10.3 (male) and 59.3±10.1 (female). All of them were over 40. Among those aged 50 years and older, approximately 40% of women and 37% of men had osteoporosis. Osteoporosis in male is 1.5 times higher than in female. The osteoporosis is increased with advancing age. 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. 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. Our study lends support that some related lifestyle and metabolic factors may be the predictive factors for the development of osteoporosis and the underlying biological roles needed to reveal by further studies. Calcium and vitamin D intake, moderate physical activity, pregnancies and breast feeding, use of progestogens, either alone or in addition to estrogens could prevent osteoporosis.

Key words: osteoporosis, T-score, prevalence, cross- sectional, lifestyle, exercise, Calcium and vitamin D, menopause, Fosamax drug

INTRODUCTION

Osteoporosis is a metabolic, systemic skeletal disorder characterized by low bone density and micro-architectural deterioration causing bone fragility and increased risk of fractures as a result of even minor falls or injuries (On Osteoporosis, 2001). Osteoporosis-related fractures commonly occur in the hip, wrist, or spine (Harvey et al., 2010; Greenwood, 2015). It is well known, that bone strength and quality mainly depends on the three dimensional micro architectural of bone and also properties of material constituents. Type 1 collagen and hydroxyapatite crystals are the main constituents of bone (Reznikov et al., 2014; Saeed et al., 2019). Osteoporosis and its related fractures

have become a rapidly increasing health problem threatening millions of people across the world. Today it is estimated to affect over 200 million people worldwide (Tomishige-Mukai et al., 2016). The World Health Organization defines osteoporosis as epidemic of the twenty- first century together with obesity, diabetes, and cardiovascular disease (Khan et al., 2019), contributing to mortality and morbidity among the elderly (Bliuc and Center, 2016; von Friesendorff et al., 2016). According to WHO statistics one in three women and one in five men over 50 years of age will have an osteoporotic fracture in their lifetime (Hernlund et al., 2013). Especially, Asia is predicted to bear most of this burden as the projected incidence of hip fracture in this region will account for 37% of all hip fractures by 2025 (Johnell and Kanis, 2006). The reported prevalence of osteoporosis in Caucasians women older than 50 years of age varies from 7.9% to 22.6% depending on the study population and design (Shin et al., 2010).

Osteoporotic fractures cause enormous healthcare costs and reduce quality of life. In addition, osteoporotic are associated with increased mortality, functional decline, loss of quality of life, and a need for institutionalization in older subjects (Olmos et al., 2018; Bartosch et al., 2018). Conventional risk factors for osteoporosis include: advancing age, smoking, alcohol intake, low weight, physical inactivity, low calcium intake, low vitamin D status and estrogen status (You et al., 2019). Recent systematic reviews have summarized the risk factors related to low bone mass where the evidence of associations with familial history of osteoporosis, history of fragility fracture, physical activity, smoking, alcohol intake, age at menarche, numbers of offspring, menopause state or year since menopause were discussed (Dargent-Molina, 2004; Thomas, 2008). Sex steroids, e.g., estrogen and testosterone, are other important factors for bone metabolism in both women and men (Kuchuk et al., 2007). In women, reduced estrogen levels, e.g., following oophorectomy or natural menopause, are well known to increase bone loss, reduce bone mass, and increase the risk of osteoporosis and fracture (Riggs et al., 2002). In men, the relation between sex hormone levels, bone loss, and risk of osteoporosis is more uncertain (Nguyen et al., 2015).

Osteoporosis is generally thought as a “woman’s disease” because the prevalence of osteoporosis and the rate of fractures are much higher in postmenopausal women than in older men (Kanis et al., 2013; Hannan et al., 2019). A recent report of more than 48,000 post-menopausal women found that more than one-third to one half of the women studied had low bone mass which placed them at increased risk of osteoporotic fracture. Women with chronic diseases such as sickle-cell anemia, childhood and adult asthma, systemic lupus erythematosus, diabetes mellitus, and hyperthyroidism comprise another high-risk group (Geller and Derman, 2001). However, older men still suffer from poor health outcomes related to osteoporosis and fractures. Aging men lose bone mineral density at a rate of approximately 1% per year. Among many different sites of osteoporotic fracture, the hip fracture contributes to the greatest morbidity and mortality. Thus, it is important to pay attention not only to

women but also to men as regards osteoporosis, its diagnosis, prevention and treatment (Tanaka et al., 2001; Kanis et al., 2013).

Osteoporosis diagnosis is typically based on bone mineral density measurements or a history of fracture following minimal trauma. The main clinical manifestations are back pain, loss of height, spinal deformity and fractures of the vertebrae, hips, wrists and, to a lesser extent, other bones. Assessment of bone density by dual-energy X-ray absorptiometry provides the best non-invasive measure of future fracture risk; peripheral quantitative computed tomography can also be used (Cohen and Roe, 2000).

It is estimated that approximately half of all hip osteoporotic fractures in the world occur in Asia. During the last decades, the socioeconomic condition and lifestyle have profoundly changed with a rapid urbanization being taken place in the entire country, and these changes had strong effects on disease patterns in the population. Osteoporosis is increasingly recognized as a major public health concern in Vietnam because 23% of women between 50 and 65 years are classified as osteoporosis (Dao et al., 2011).

Despite its adverse effects, osteoporosis is often overlooked and undertreated and worldwide, public awareness of osteoporosis is low. Raising awareness of osteoporosis among the general population and health care workers is an important step in its prevention and treatment and improving the quality and accessibility of health services. The prevalence of osteoporosis in Vietnam and its related factors remains unclear (Ho-Pham and Nguyen, 2017). Thus, further studies on the epidemiologic distribution of osteoporosis and associated factors in Vietnam are required. Although osteoporosis can affect both men and women of any age, women are four times more likely than men to develop osteoporosis.

MATERIALS AND METHODS

Both male and female who are more than 40 years old and living in Vinh City at the time of this study have been 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 is 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

Use 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:

1) Notify the medical center;
2) Organization of deployment to communes and wards;
3) Each commune / ward draws to select 1 block and a neighbor;
4) 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 the 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:

A) 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.

B) 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 UI 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

Cleaning the data before importing computers, the survey data will be processed by EPI-INFO, EXEL, Medcal and SPSS 20.0, performed on computers at Vinh Medical University. The continuously variable data are checked before normal distribution kurtosis test analysis, the average value, median, maximum value, minimum value, standard deviation. If the normal distribution data will use 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 is not distributed according to the standard rules using 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 use the odds ratio OR (Odds - Ratio), OR> 1, which demonstrates the risk factors related to sick. 95% confidence intervals are applied to all tests. Comments are different 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 are female, 2/3 were white-collar, ¼ were farmer and most of them have 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 BMI of male and female are similar to each other.

Table 1. Proportion of people with osteoporosis, reduced bone's density and normal people. Mean bone density and T-score distribution.

	Osteoporosis		Reduced bone's 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 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). 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 an 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 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) of respondents	Weight	60.04 ± 9.01		52.7 ± 7.5		55.1 ± 8.8	
	Height	160.4 ± 5.7		150.3 ± 10.9		153.6 ± 10.62	
Job				n		%	
		White collar		677		32.8	
		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	
		and high school		230		11.1	
		Trung cấp		396		19.2	
		College					

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	117	5.7
	dermatitis	34	1.6
	Acne		
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	574	27.8
	DD-TT	85	4.1
	Digestive disorders	94	4.6
	Hemorrhoids		
Urology	Acute	24	1.2
	glomerulonephritis	3	0.1
	Chronic	25	1.2
	glomerulonephritis	130	6.3
	Nephrotic	226	10.9
	syndrome		
	Urinary tract infections		
	Urinary tract stones		
Rheumatology	Rheumatoid	72	3.5
	arthritis	1125	54.1
	Osteoarthritis	1273	61.6
	Bone aches	215	10.4
	Old fracture		
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

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	7.5	89	37.2	132	55.2
	Total	49	12.3	116	36.7	161	50.9
50-59	Male	56	27.3	78	38.0	71	34.6
	Female	135	28.8	216	46.1	118	25.2
	Total	191	28.3	294	43.6	189	28.0
60-69	Male	82	34.9	80	34	73	31.1
	Female	259	54	177	36.9	44	9.2
	Total	314	47.7	257	35.9	117	16.4
≥ 70	Male	96	57.8	42	25.3	28	16.9
	Female	150	77.7	34	17.6	9	4.7
	Total	246	68.5	76	21.2	37	10.3
BMI	Underweight	85	74.6	23	20.2	6	5.3
	Overweight	128	24.1	210	39.2	195	36.7
	Normal	603	42.7	510	36.1	304	21.2
Living location	Suburban	311				178	
	Urban	506				327	
	Total	817				505	
Job	Farmer	73	20.8			288	79.8
	Worker	18	22.8			61	77.2
	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 demostrates 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 age associated with it in osteoporosis people.

	Testoterol		Estradiol		Osteocalcin	
Amount of endocrine substances	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 $p < 0.01$).

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.

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
Number of children	≥4 con	231	84	44	16	275
	<4 con	309	55.2	251	44.8	560

Menopause	Early	75	88.2	10	11.8	85
	In time	425	79.1	112	20.9	537
Bone fracture	Yes	124	73.81	44	26.19	
	No	693	60.05	461	39.95	
Hysterectomy	Yes	26	66.67	13	33.33	
	No	534	64.88	289	35.12	
Oophorectomy	Yes	18	64.29	10	35.71	
	No	538	64.82	292	35.18	
Diabetes	Yes	52	53.61	45	46.39	
	No	765	62.45	460	37.55	
Family history of osteoporosis	Yes	25	51.02	24	48.98	
	No	792	62.22	481	37.78	
Used corticoid	Yes	115	80.99	27	19.01	
	No	450	38.14	730	61.86	
Height loss	Yes	726	63.85	411	36.15	
	No	91	49.19	94	50.81	
Exercise	Yes	535	55.2	434	44.8	
	No	297	84	56	16	
Drink milk	Yes	289	72.80	108	27.20	
	No	526	57.11	395	42.89	

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 of people (90%) who had including diseases got prescriptions and direct consult (Table 6). Those who are in reduced bone density group do more exercise than those in osteoporosis group. More than 1/3 of respondents who are in osteoporosis and reduced bone density group use 2 cup 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.

	Osteoporosis		Reduced bone's density		Normal density		Total density	
	n	%	n	%	n	%	n	%
Rate of people who got direct and indirect communication								
Don't have	187	22.9	183	24.6	105	20.8	475	23.0

including disease								
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								
	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 grop 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 total population, male population and female population. The risk for osteoporosis was significantly associated with age, vitamin D intake, weight. In male population, osteoporosis was associated with age, weight and condition of erectile dysfunction. The results suggest that erectile dysfunction was associated with high risk of osteoporosis in male population. The osteoporosis risk factors in female population were similarly with total population, but there were two different points would be note, including drinking and menopause. Drinking was protection factor only in female population and the menopause was independent risk factor. Our study lends support that some related lifestyle and metabolic factors may be the predictive factors for the development of osteoporosis and the underlying biological roles needed to reveal by further studies. The roles of fat distribution, erectile dysfunction, menopause and drinking in osteoporosis should be given more consideration in the clinical practice.

CONCLUSION

In summary, increasing age, female sex, oophorectomy, 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.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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