



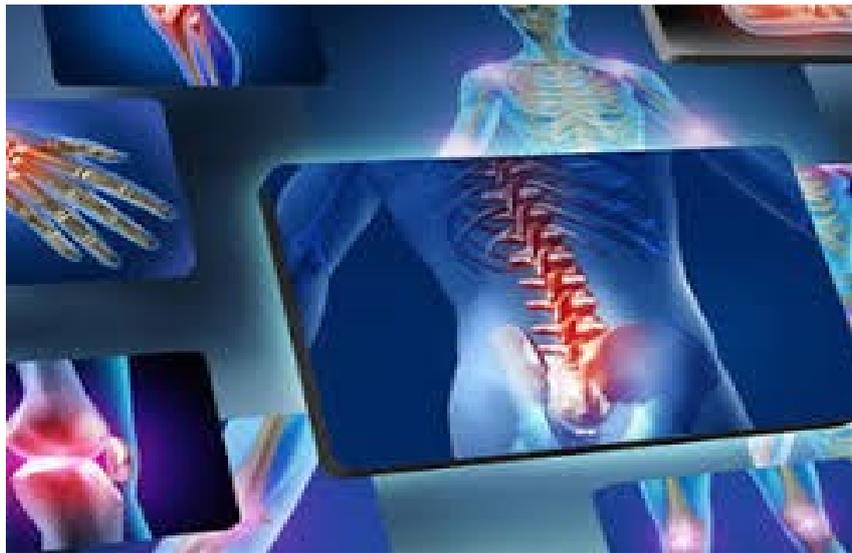
National Guideline for Primary Health care workers

Osteoporosis

Prevention and Management

Directorate of Public Health

Non communicable Disease Department



IRAQ 2021

National Guideline for Primary
Health care workers



Osteoporosis

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ABBREVIATIONS

BMD	Bone Mineral Density
DEXA	Dual-Energy X-Ray Absorptiometry
DV	Dietary Value
DXA	Dual-Energy X ray Absorptiometry
ET/HT	Estrogen / Hormones therapy
FDA	Food and Drug Association
FRAX	Fracture Risk Assessment
FAO	Food and Agriculture Organization
GNRH	Gonadotropin Releasing Hormone
NOF	National Osteoporosis Foundation
SD	Standard Deviations
SERMs	Selective Estrogen Receptor Modulators
WHI	Woman's Health Initiative
WHO	World Health Organizations



OSTEOPOROSIS DEFINITION: -

Osteoporosis, which literally means porous bone, is a disease in which the density and quality of bone are reduced. As bones become more porous and fragile, the risk of fracture is greatly increased. The loss of bone occurs silently and progressively. Often there are no symptoms until the first fracture occurs. Osteoporosis affects an enormous number of people, of both sexes and all races. It's estimated over 200 million women have osteoporosis

OSTEOPOROTIC FRACTURES: -

Around the world, 1 in 3 women and 1 in 5 men are at risk of an osteoporotic fracture. In fact, an osteoporotic fracture is estimated to occur every 3 seconds. The most common fractures associated with osteoporosis occur at the hip, spine and wrist. The likelihood of these fractures occurring, particularly at the hip and spine, increases with age in both women and men.

Fractures may be followed by full recovery or by chronic pain, disability and death.

The economic costs of osteoporotic fractures include expenses for surgery and hospitalization, rehabilitation, long-term care, medications, and loss of productivity.

Osteoporosis is preventable and treatable, but due to the absence of warning signs prior to a fracture, many people are not diagnosed in time to receive effective therapy during the early phase of the disease.

PATHOPHYSIOLOGY: -

The process of bone remodeling that maintains a healthy skeleton may be considered a preventive maintenance program (continually removing older bone and replacing it with new bone). Bone loss occurs when this balance is altered, resulting in greater bone removal than replacement, bones weaken (osteopenia) and over time can become brittle and prone to fracture (osteoporosis)

Bone mass in older adults equals the peak bone mass achieved by the age 18-25 years minus the amount of bone subsequently lost. Peak bone mass is determined largely by genetic factors, with contributions from nutrition, endocrine status, physical activity and health during growth.

The pathophysiologic basis of osteoporosis is multifactorial and includes the genetic determination of peak bone mass, subtle alteration in bone remodeling due to changes in systemic and local hormones (estrogen, parathyroid hormone, and to a lesser extent testosterone), and environmental influence (Fig1).



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Normal Bone

Osteoporotic Bone

Fig (1) Micrographic of Normal vs. Osteoporotic Bone

Source: NOF Clinician Guide to Prevention and Treatment of Osteoporosis 2010.

Osteoporosis fractures result from a combination of decreased bone strength and an increased incidence of falls with aging.

TYPES OF OSTEOPOROSIS: -

1- Primary osteoporosis

- Juvenile osteoporosis this is a condition in which osteoporosis develops in a previously healthy child or teenager and often no clear reason can be found.
- Idiopathic osteoporosis can be further subdivided into postmenopausal (type I) due to estrogen deficiency and age-associated or senile (type II) osteoporosis due to an aging skeleton and calcium deficiency.

2- Secondary osteoporosis

Medical conditions resulting in secondary osteoporosis may include: -

- Serious kidney failure
- Cushing's disease (a tumor of the pituitary gland, responsible for secreting some of the body's hormones)
- Liver impairment
- Anorexia nervosa and bulimia
- Rheumatoid arthritis
- Malabsorption syndromes such as celiac disease
- Multiple sclerosis
- Chronic obstructive pulmonary disease



- Scurvy

Secondary osteoporosis can also have hormonal causes: -

- Hyperparathyroidism: increased activity of the parathyroid glands
- Hyperthyroidism: an excessive secretion of the thyroid glands
- Diabetes
- Hypercortisolism: a result of systemic illness or long-term use of oral corticosteroid
- Other links to secondary osteoporosis
- Thalassemia: a hereditary form of anemia
- Multiple myeloma: multiple tumors within the bone and bone marrow
- Leukemia: a serious disease that is characterized by unrestrained growth of white blood cells in the tissues
- Metastatic bone diseases

Other types of osteoporosis occur during or soon after pregnancy in otherwise apparently healthy women (Osteoporosis associated with pregnancy)

RISK FACTORS OF OSTEOPOROSIS: -

1- Fixed risk factors (factors can't change)

- Age
- Female gender
- Family history
- Previous fracture
- Ethnicity
- Menopause or hysterectomy
- Hysterectomy, if accompanied by removal of the ovaries,
- Primary or secondary hypogonadism in men
- Secondary Risk Factors include: -

1- Disorders that affect the skeleton

- Asthma
- Nutritional/gastrointestinal problems (e.g. Crohn's or celiac disease)
- Rheumatoid arthritis
- Haematological disorders/malignancy
- Some inherited disorders
- Hypogonadal states (e.g. Turner syndrome/Klinefelter syndrome, amenorrhea)
- Endocrine disorders (e.g. Cushing's syndrome, hyperparathyroidism, diabetes)
- Immobility

2- Medical treatments affecting bone health

- Long term glucocorticoid therapy
- Certain immunosuppressant (calmodulin/calcineurine phosphatase inhibitors)
- Thyroid hormone treatment (L-Thyroxine)
- Certain steroid hormones (medroxyprogesterone acetate, leutenising hormone releasing hormone agonists)
- Aromatase inhibitors
- Certain antipsychotics



- Certain anticonvulsants
- Certain antiepileptic drugs
- Lithium
- Methotrexate
- Antacids
- Proton pump inhibitors

2- modifiable risk factors (factors can change)

- Alcohol
- Smoking
- Low Body Mass Index
- Poor nutrition
- Vitamin D deficiency
- Eating disorders
- Estrogen deficiency
- Insufficient exercise
- Frequent falls

OSTEOPOROSIS FRACTURE RISK PREDICTION: -

The Fracture Risk Assessment (FRAX) tool has been developed by WHO to evaluate fracture risk of patients. It is based on individual patient models that integrate the risks associated with clinical risk factors as well as bone mineral density (BMD) at the femoral neck. The algorithms give the 10-year probability of fracture. The output is a 10-year probability of hip fracture and the 10-year probability of a major osteoporotic fracture (clinical spine, forearm, hip or shoulder fracture). (Annex1).

CLINICAL ASSESSMENT OF OSTEOPOROSIS: -

History: -

- Careful evaluation should include:
- Life style factors including exercise, dietary intake of calcium and caffeine, smoking, alcohol consumption, level of sun exposure.
- Changes in height and weight.
- Previous fractures.
- Risk factors of osteoporosis.
- Bone pain. Usually osteoporosis is not painful until fracture occurs.
- Family history of metabolic bone disease other than osteoporosis like hyperparathyroidism or osteomalacia.

Physical examination: -

- The following should be considered:
- Height measurement in comparison with standard height. The loss of 5 cm is sensitive indicator to vertebral compression.
- Presence of kyphosis may indicate pulmonary compression.
- Signs of associated conditions.
- Observation of gait.



DIAGNOSIS OF OSTEOPOROSIS AND RELATED FRACTURE: -

Traditional X-rays can't measure bone density, but they can identify spine fractures. Bone mineral density (BMD) has to be measured by more specialized techniques. A number of different types of BMD tests are available, but the most commonly used is DEXA (dual-energy X-ray absorptiometry)

DXA is a low radiation X-ray capable of detecting quite small percentages of bone loss. It is used to measure spine and hip bone density, is the most common technique for assessing the risk of osteoporosis and can also measure bone density of the whole skeleton.

Peripheral devices include: -

- Quantitative ultrasound.
- Peripheral quantitative computed tomography.
- Peripheral DXA.

Objectives for BMD measurement: -

The main objectives for BMD measurement are:-

- To diagnose Osteopenia or osteoporosis.
- To predict fracture risk.
- To monitor the response of BMD to therapy.



Diagnostic criteria for osteoporosis: -

BMD criteria is used for the diagnosis of osteoporosis. Two types of scores are used to quantify BMD.

T score: is the number of Standard Deviations SD the person's BMD measurement as compared to the "young normal adults" mean BMD of Caucasian women of the same sex (table 2).

Z score: is the number of Standard Deviations SD the person's BMD measurement as compared to the "age-matched" expected mean BMD (table 3).

A change of 1 SD in either the T or Z score corresponds to a change of BMD of approximately 10%.

The World Health Organization (WHO) provided criteria for the diagnosis of normal bone mass, low bone mass in osteopenia and osteoporosis. These criteria are based on comparisons to peak adult bone mass density (BMD) from population of Caucasian postmenopausal women.



Table (1) World Health Organization (WHO) Criteria for diagnosis of osteoporosis.

Classification	T Score(SD below BMD)
Normal	≥ -1
Osteopenia	Between -1 to -2.5
Osteoporosis	≤ -2.5
Severe osteoporosis	≤ -2.5 plus fracture

In premenopausal women, men less than 50 years of age and children, the WHO BMD diagnostic classification should not be applied. Instead, ethnic or race adjusted age matched Z scores should be used (table3).

Table (2) BMD classification based on Z score

Classification	Z Score (SD below BMD)
Within expected range for age	> -2
Below expected range for age	≤ -2.5

BMD measured by DXA is the strongest known predictor of hip and spinal fractures. For each decline of approximately 1 standard deviation of BMD there is 1.3 to 3 fold increase in the risk of fractures.

Although fracture risk at any site can be assessed accurately by DXA, BMD at the femoral neck is a better predictor of hip fracture than BMD at the spine, radius, or calcaneus.

Indications for Referral for BMD measurement: -

- 1-Women aged 65 and older
- 2-For post-menopausal women younger than age 65 a bone density test is indicated if they have a risk factor for low bone mass such as:
 - Low body weight
 - Prior fracture



- High risk medication use
 - Disease or condition associated with bone loss
- 3- Women during the menopausal transition with clinical risk factors for fracture, such as low body weight, prior fracture, or high-risk medication use
 - 4- Men aged 70 and older
 - 5- For men < 70 years of age a bone density test is indicated if they have a risk factor for low bone mass such as:
 - Low body weight
 - Prior fracture
 - High risk medication use
 - Disease or condition associated with bone loss
 - 6- Adults with a fragility fracture
 - 7- Adults with a disease or condition associated with low bone mass or bone loss
 - 8- Adults taking medications associated with low bone mass or bone loss
 - 9- Anyone being considered for pharmacologic therapy
 - 10- Anyone being treated, to monitor treatment effect
 - 11- Anyone not receiving therapy in whom evidence of bone loss would lead to treatment
 - 12- Women discontinuing estrogen

MANAGEMENT OF OSTEOPOROSIS: -

The main goal of osteoporosis management is to prevent occurrence of the first fracture or recurrence of fractures:

NONPHARMACOLOGIC THERAPY: -

Lifestyle modification Aspects for bone health include:

1- Adequate intake of calcium and vitamin D: -

- Calcium

is important for preventing osteoporosis and bone disease, the amount of calcium we need to consume changes at different stages in our lives. Calcium requirements are high in our teenage years with the rapid growth of the skeleton with age, the body's ability to absorb calcium declines, some examples of the approximate calcium content in common foods are shown in (annex 2).

Recommended daily calcium intakes: -

Recommended daily calcium allowances for populations vary between countries. The IOM 2010 (Institute of Medicine of the US National Academy of Sciences) recommendations are as follows:



infancy to adolescence		calcium (mg/day)
0-6 months		*
6-12 months		*
1-3 years		700
4-8 years		1000
9-13 years		1300
14-18 years		1300
Women		calcium (mg/day)
19 - 50 years		1000
Post-menopause (51+ years)		1200
During pregnancy/lactation 14-18 years old		1300
During pregnancy/lactation 19-50 years old		1000
Men		calcium (mg/day)
19-70 years		1000
70+ years		1200

* For infants, adequate intake is 200 mg/day for 0 to 6 months and 260 mg/day for 6 to 12 months of age.

-Vitamin D

is essential for the development and maintenance of bone, both for its role in assisting calcium absorption from food in the intestine, and for ensuring the correct renewal and mineralization of bone tissue.

Sources of vitamin D: -

➤ Vitamin D from sunlight exposure

Vitamin D is made in the skin when it is exposed to ultraviolet B rays; in children and adults exposure of the hands, face and arms to the sun for 10 to 15 minutes per day is usually sufficient for most individuals. However, how much vitamin D is produced from sunlight depends on the time of day, where you live in the world and the color of your skin.

➤ Vitamin D from food, and dietary supplements

Food sources are rather limited, and include oily fish such as salmon, sardines and mackerel, eggs, liver, and in some countries fortified foods such as margarine, dairy foods and cereals. Some examples of the approximate vitamin D levels in foods are shown in (annex 3).

Recommended vitamin D intake: -



Because the sun provides a source of vitamin D in varying amounts for different individuals, dietary recommendations for vitamin D are approximate. Many countries advise a dietary intake of 200 IU/day (5 µg/day) * for children and young adults, and 400-600 IU/day (10-15 µg/day) for older persons, to augment that derived via sun exposure. The Institute of Medicine (IOM) dietary intake recommendations are shown below.

Dietary Reference Intakes for Vitamin D

age group	recommended dietary allowance (IU/day)	recommended dietary allowance (µ/day)
Infants 0-6 months	**	10 µg/day
Infants 6-12 months	**	10 µg/day
1-70 years	600 ***	15 µg/day
>70 years	800	20 µg/day

Source: Institute of Medicine (IOM), USA with modification

*To convert from IU of vitamin D3 to µg of vitamin D3, multiply by 0.025

*For infants, Adequate Intake is 400 IU/day for 0-12 months of age

** IOF recommendations for adults aged 60 years and over are 800 to 1000 IU/day for falls and fracture protection

There is as yet no common definition of 'optimum' vitamin D status, although there is emerging evidence and expert opinion that the minimum blood level of 25-hydroxyvitamin D that would be optimal for fracture prevention is 70-80 nmol/l¹. To achieve this, an average older man or woman would need a vitamin D intake of at least 800-1000 IU/day (20-25 µg/day), which is approximately double the intake recommended in most countries.

For seniors (60 yrs. and older)- Given the indoor-lifestyle of most seniors, little sunshine in winter months, and the various physiological factors related to ageing, it is very common for seniors to have poor vitamin D status. **IOF therefore recommends that seniors aged 60 years and over take a supplement at a dose of 800 to 1000 IU/day.** Vitamin D supplementation at these levels has been shown to reduce the risk of falls and fractures by about 20%.

There are a number of foods, nutrients and vitamins, that help to prevent osteoporosis and contribute to bone, muscle and joint health, including protein, fruits and vegetables, and other vitamins and minerals. (annex 4)

Vitamin D deficiency: -

- In children, severe vitamin D deficiency results in inadequate mineralization of the bone matrix, leading to growth retardation and bone deformities known as rickets.



- In adults, the same condition is known as osteomalacia. In industrialized countries.
- Maintaining adequate vitamin D status during pregnancy is important, as there is some evidence that mothers deficient in 25-hydroxyvitamin D in pregnancy give birth to children with reduced bone mass, which could in turn be a risk factor for osteoporosis later in life.

2-Active lifestyle including regular exercise: -

Exercise plays an important role in building and maintaining bone and muscle strength. Lifelong physical activity at all ages is strongly recommended, both for osteoporosis prevention and overall health, as benefits are lost when the person stops exercising. (annex5)

Exercise is vital for bone and muscle health: -

- It builds strong bones in youth. It's estimated a 10% increase of peak bone mass in children can reduce the risk of an osteoporotic fracture during adult life by 50%.
- Exercise plays a key role in adults preventing bone loss and maintaining muscle strength.
- It helps prevent weak bones and falls in the elderly. One-third of people over 65 have a fall each year and the risk of falling increases as age rises.
- People who have suffered fractures can benefit from special exercises and training (under medical supervision) to improve muscle strength and muscle function for greater mobility and improved quality of life.

Regular Weight-Bearing and Muscle-Strengthening Exercise: -

It is recommended to practice regular weight-bearing and muscle-strengthening exercise to reduce the risk of falls and fractures:

- **Weight-bearing exercise:** in which bones and muscles work against gravity as the feet and legs bear the body's weight including walking, jogging, stair climbing and tennis.
- **Muscle-strengthening exercise:** includes weight training and other resistive exercises

3-Avoiding unhealthy habits: -

- **Coffee**
Coffee-based drinks are increasingly popular among adolescents. Studies in adults have shown that drinking more than three cups of coffee daily may interfere with calcium absorption and have a negative impact on bone health
- **Soft drinks**
It has been suggested that excessive consumption of carbonated soft drinks, particularly cola, can damage bone health due to their high phosphate content. While there is no scientific evidence to support this claim, soft drinks definitely do not contribute to good bone health. They have no nutritional value, and young people who drink more sodas have a correspondingly lower intake of milk or



other calcium-rich drinks, contributing to the so-called “milk-displacement effect”.

➤ **Body weight and bone health**

A healthy body weight during childhood and adolescence is required for optimal bone health. Having a body mass (BMI) at either end of the spectrum can pose a threat into the development of the skeleton. Anorexia nervosa is especially damaging to bone mass and strength in the young. Overweight children have low bone mass for their weight and are more likely to suffer wrist fractures.

Pharmacologic Therapy: - (prescribe by specialist in secondary level)

Treatments have been shown to reduce the risk of hip fracture by up to 40%, vertebral fractures by 30-70% and, with some medications, reduce the risk for non-vertebral fractures by 15-20%.

Medically approved drug therapies for the treatment of osteoporosis and prevention of fractures (annex6).

FOLLOW-UP AND MONITORING EFFECTIVENESS OF TREATMENT

It is important to follow-up with the patient:

- Encourage continued and appropriate compliance with their osteoporosis therapies to reduce fracture risk.
- Review their risk factors and encourage appropriate calcium and vitamin D intakes with exercise,
- Ensure Fall Prevention and other lifestyle measures.
- Serial central DXA BMD testing in accordance with medical necessity, expected response and in consideration of local regulatory requirements.
- IOF recommends repeated BMD assessments every two years, but recognizes that testing more frequently may be warranted in certain clinical situations.

PREVENTING OF OSTEOPOROSIS

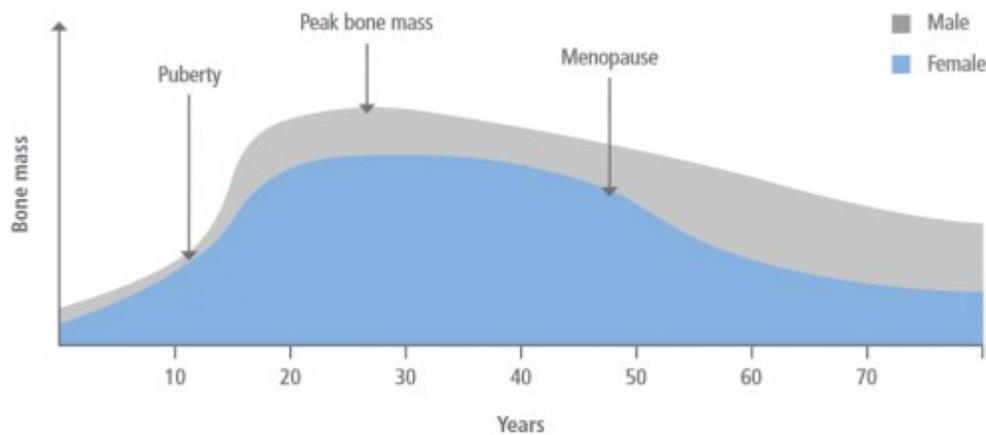
osteoporosis may be prevented by adopting a bone healthy lifestyle at all stages of life.

In fact, osteoporosis prevention begins in childhood, when a bone-healthy diet and plenty of exercise helps children achieve their highest possible ‘peak bone mass’. This is important because the more bone mass you have when you reach adulthood, the less likely you are to have weak and breakable bones at older age.

For women early prevention is especially important. The diagram below shows how bone loss occurs rapidly after menopause, at around the age of 50, when the protective



effect of estrogen is lost.



Osteoporosis prevention in adults

- Ensure a healthy diet which includes enough calcium and protein, two key nutrients for bone health.
- Get enough vitamin D - made in the skin after exposure to sunlight, the average young adult needs about 15 minutes of daily sun exposure. You can boost your vitamin D intake through some foods like oily fish, eggs, mushrooms, and fortified dairy foods or juices.
- Maintain a healthy body weight - being too thin (BMI under 19) is damaging to your bone health.
- Keep active Take regular weight-bearing and muscle strengthening exercise.
- Avoiding smoking and drinking
- Be aware of your osteoporosis risk factors, and get an early diagnosis, and treatment if needed.

Osteoporosis prevention in seniors (60 years and older)

Older adults are at highest risk of osteoporosis, with nearly 75% of hip, spine and wrist fractures occurring in people aged 65 years old or over. The prevention advice listed below applies to all adults, but at older age one should pay special attention to the following:

- Ensuring enough calcium, protein, vitamin D and other nutrients: With age, your ability to absorb vitamins and minerals may be reduced. In fact, older adults often suffer from malnutrition as they may not be eating enough and getting enough protein and vitamins in their diets. A calcium and vitamin D supplement should be considered when dairy consumption is low, and little time is spent outdoors.
- Practicing exercise activities that improve balance, posture, coordination, and muscle strength.
- cautious should be taken to prevent falls inside and out home.(annex 7)
- assessment for the presence of risk factors for osteoporosis (table 1).



FALL PREVENTION

One-third of people over 65 have a fall each year globally and the risk of falling increases as age rises. Falls can seriously impact independence, resulting in ongoing disability, changes in lifestyle, reduced activity and as a result social isolation and death.

1- Risk factors for falls

The majority of osteoporosis-related fractures result from falls. Therefore, it is important to assess the risk of falls (table2)

Table (2) Risk Factors for Falls

- Aging
- Anxiety and agitation
- Arrhythmias
- Dehydration
- Depression
- Female gender
- Impaired transfer and mobility
- Vitamin D insufficiency
- Malnutrition
- Medications causing oversedation (narcotic analgesics, anticonvulsants, psychotropics)
- Orthostatic hypotension
- Poor vision and use of bifocals
- Previous fall
- Reduced problem solving or mental acuity and diminished cognitive skills
- Urgent urinary incontinence
- Kyphosis
- Poor balance
- Reduced proprioception
- Weak muscles
- Lack of indoor and outdoor safety measures for prevention of falls
- Fear of Falling

Source: NOF Clinician's Guide 2014 with modification

The impact of falls is compounded in people with osteoporosis, often resulting in multiple appendicular and proximal fractures. Hip fracture carries high mortality rate due to associated serious complication.

Once one fracture has occurred, the chances of having another fracture increases.

2- Steps to prevent falls

Strategies to reduce falls include, but are not limited to:



- Maintain adequate vitamin D levels and physical activity, as described earlier.
- Checking and correction of vision and hearing.
- Evaluating any neurological problems.
- Reviewing prescription medications for side effects that may affect balance
- Wearing undergarments with hip pad protectors for patients who have significant risk factors for falling or for patients who have previously fractured a hip.
- Provision of safety requirements for indoor and outdoor environments (Annex 7).

3- exercise for fall prevention

Falls and related fractures are a major health problem for older individuals and for society. Changes in sensory and musculoskeletal structure and function among older adults puts them at increased risk of falls and injuries. Many intrinsic and external risk factors for falls have been identified. Exercise can modify the intrinsic fall risk factors and thus prevent falls in older adults (annex8).

Exercises not suitable for people with osteoporosis

Several exercises are not suitable for people with osteoporosis as they can exert strong force on relatively weak bone. Dynamic abdominal exercises like sit-ups and excessive trunk flexion can cause vertebral crush fractures. Twisting movements such as a golf swing can also cause fractures. Exercises that involve abrupt or explosive loading, or high-impact loading, are also contraindicated. Daily activities such as bending to pick up objects can cause vertebral fracture and should be avoided.



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ANNEXES

Annex (1) Fracture Risk Assessment Tool (FRAX) Calculation Tool

Country: **Jordan** Name/ID: [About the risk factors](#) ⓘ

Questionnaire:

1. Age (between 40-90 years) or Date of birth
Age: Date of birth: Y: M: D:

2. Sex Male Female

3. Weight (kg)

4. Height (cm)

5. Previous fracture No Yes

6. Parent fractured hip No Yes

7. Current smoking No Yes

8. Glucocorticoids No Yes

9. Rheumatoid arthritis No Yes

10. Secondary osteoporosis No Yes

11. Alcohol 3 or more units per day No Yes

12. Femoral neck BMD (g/cm²)
Select DXA

<http://www.shef.ac.uk/FRAX/tool.jsp>



Annex (2) calcium content in food

Milk

FOOD	SERVING SIZE	CALCIUM (MG)
Milk, semi-skimmed	200 ml	240
Milk, skimmed	200 ml	244
Milk, whole	200 ml	236
Milkshake	300 ml	360
Sheep milk	200 ml	380
Coco milk	200 ml	54

yoghurt

FOOD	SERVING SIZE	CALCIUM (MG)
Yoghurt, flavored	150 g	197
Yoghurt, with fruit pieces	150 g	169
Yoghurt, natural	150 g	207

Cheese

FOOD	SERVING SIZE	CALCIUM (MG)
Hard cheese e.g. Cheddar, Parmesan, Emmental, Gruyere	30 g	240
Fresh cheese e.g. cottage cheese, ricotta, mascarpone	200 g	138
Soft cheese e.g. Camembert, Brie	60 g	240
Feta	60 g	270
Mozzarella	60 g	242
Cream cheese	portion, 30 g	180

Cream, desserts

FOOD	SERVING SIZE	CALCIUM (MG)
Cream, double, whipped	30 ml	21
Cream full	30 ml	21
Custard made with milk, vanilla	120 g	111
Ice cream, vanilla	100 g	124
Pudding, vanilla	120 g	120
Pancake	80 g	62
Cheese Cake	200 g	130
Waffle	80 g	47

Meat, fish and eggs



FOOD	SERVING SIZE	CALCIUM (MG)
Egg	50 g	27
Red meat	120 g	7
Chicken	120 g	17
Fish e.g. Cod, Trout, Herring, Whitebait	120 g	20
Tuna, canned	120 g	34
Sardines in oil, canned	60 g	240
Shrimp	150 g	45

Beans & lentils

FOOD	SERVING SIZE	CALCIUM (MG)
Lentils	80 g raw/ 200 g cooked	40
Chick peas	80 g raw/ 200 g cooked	99
White beans	80 g raw/ 200 g cooked	132
Red beans	80 g raw/ 200 g cooked	93
Green/French beans	90 g cooked	50

Starchy foods

FOOD	SERVING SIZE	CALCIUM (MG)
Pasta (cooked)	180 g	26
Rice, white (boiled)	180 g	4
Potatoes (boiled)	240 g	14
White bread	slice, 40 g	6
Whole meal bread	slice, 40 g	12
Muesli (cereals)	50 g	21
Naan	60 g	48

Fruits

FOOD	SERVING SIZE	CALCIUM (MG)
Orange	150 g	60
Apple	120 g	6
Banana	150 g	12
Apricot	3 pieces, 120 g	19
Currant (dried gooseberry)	120 g	72
Figs, dried	60 g	96
Raisins (dried grapes)	40 g	31

Vegetables

FOOD	SERVING SIZE	CALCIUM (MG)
Lettuce	50 g	19
Kale, Collard greens	50 g (raw)	32



FOOD	SERVING SIZE	CALCIUM (MG)
Bok Choy/Pak Choi	50 g (raw)	20
Broccoli	120 g (raw)	112
Gombo/Okra	120 g (raw)	77
Cress	120 g (raw)	188
Rhubarb	120 g (raw)	103
Carrots	120 g (raw)	36
Tomatoes	120 g (raw)	11

Nuts & seeds

FOOD	SERVING SIZE	CALCIUM (MG)
Almonds	30 g	75
Walnuts	30 g	28
Hazlenuts	30 g	56
Brazil Nuts	30 g	28
Sesame seeds	15 g	22
Tahini Paste	30 g	42

Processed foods

FOOD	SERVING SIZE	CALCIUM (MG)
Quiche (cheese, eggs)	200 g	212
Omelette with cheese	120 g	235
Pasta with cheese	330 g	445
Pizza	300 g	378
Lasagna	300 g	228
Cheeseburger	200 g	183

Note: - 1 cup = 250 ml

1 Table spoon = 15ml

1 Teaspoon = 5ml

1 piece of triangular cheese = 15ml



Annex (3) VIT D level in food

Approximate vitamin D levels in foods

FOOD	MCG PER SERVING	IU PER SERVING	RNI* (FOR AGES 51-65 YEARS)
Cod liver oil**, 1 tbsp	23.1	924	231
Salmon, grilled, 100g	7.1	284	71
Mackerel, grilled, 100g	8.8	352	88
Tuna, canned in brine, 100g	3.6	144	36
Sardines, canned in brine, 100g	4.6	184	46
Margarine, fortified, 20g	1.6	62	16
Bran Flakes***, average serving, 30g	1.3	52	13
Egg, hen, average size, 50g	0.9	36	9
Liver, lamb, fried, 100g	0.9	36	9

* The RNI (recommended nutrient intake) is defined by the FAO/WHO as “the daily intake which meets the nutrient requirements of almost all (97.5%) apparently healthy individuals in an age- and sex-specific population group”. Daily intake corresponds to the average over a period of time.

** Fish liver oils, such as cod and halibut liver oil, contain small amounts of vitamin A, which can be toxic if consumed in excess.

***Bran Flakes are given as an example of a vitamin D-fortified breakfast cereal.



Annex (4) Nutrition and bone

Protein

Adequate dietary protein is essential for optimal bone mass gain during childhood and adolescence. It's also responsible for preserving bone mass with ageing. Lack of protein robs the muscles of strength, which heightens the risk of falls, and contributes to poor recovery in patients who have had a fracture.

Lean red meat, poultry and fish, as well as eggs and dairy foods, are excellent sources of animal protein. Vegetable sources of protein include legumes (e.g. lentils, kidney beans), soya products (e.g. tofu), grains, nuts and seeds.

Fruits and Vegetables

Fruits and vegetables contain an array of vitamins, minerals, antioxidants and alkaline salts - some or all of which can have a beneficial effect on bone. Studies have shown higher fruit and vegetable consumption is associated with beneficial effects on bone density in elderly men and women.

Other vitamins and minerals

B Vitamins and Homocysteine

Some studies suggest high blood levels of the amino acid homocysteine may be linked to lower bone density and higher risk of hip fracture in the elderly. Vitamins B6 and B12, as well as folic acid, play a role in changing homocysteine into other amino acids for use by the body, so it is possible that they might play a protective role in osteoporosis. Research is ongoing as to whether supplementation with these B vitamins might reduce fracture risk.

Magnesium

Magnesium plays an important role in forming bone mineral. Magnesium deficiency is rare in well-nourished populations. The elderly are sometimes risk of mild magnesium deficiency, as magnesium absorption decreases with age. **Particularly good sources of magnesium include green vegetables, legumes, nuts, seeds, unrefined grains and fish.**

Vitamin A

The role of vitamin A in osteoporosis is controversial. **Vitamin A is present as a compound called retinol in foods of animal origin, such as liver and other offal, fish liver oils, dairy foods and egg yolk. Some plant foods contain a precursor of**



vitamin A, for example in green leafy vegetables, and red and yellow coloured fruits and vegetables. Consumption of vitamin A in amounts well above the recommended daily intake may have adverse effects on bone.

Such high levels of vitamin A intake are probably only achieved through over-use of supplements, and intakes from food sources are not likely to pose a problem. Further research is needed into the role of vitamin A in bone health, although many countries at present caution against taking a fish liver oil supplement and a multivitamin supplement concurrently.

Vitamin K

Vitamin K is required for the correct mineralization of bone. Some evidence suggests low vitamin K levels lead to low bone density and increased risk of fracture in the elderly. **Vitamin K sources include leafy green vegetables such as lettuce, spinach and cabbage, liver and some fermented cheeses and soya bean products.**

Zinc

This mineral is required for bone tissue renewal and mineralization. Severe deficiency is usually associated with calorie and protein malnutrition, and contributes to impaired bone growth in children. Milder degrees of zinc deficiency have been reported in the elderly and could potentially contribute to poor bone status. **Sources of zinc include lean red meat, poultry, whole grain cereals, pulses and legumes.**



Annex (5) exercise recommendations for prevention and treatment of osteoporosis

Recommended level of physical activity for health

5–17 years old

For children and young people of this age group physical activity includes play, games, sports, transportation, recreation, physical education or planned exercise, in the context of family, school, and community activities.

In order to improve cardiorespiratory and muscular fitness, bone health, cardiovascular and metabolic health biomarkers and reduced symptoms of anxiety and depression, the following are recommended:

1. Children and young people aged 5–17 years old should accumulate at least 60 minutes of moderate to vigorous-intensity physical activity daily.
2. Physical activity of amounts greater than 60 minutes daily will provide additional health benefits.
3. Most of daily physical activity should be aerobic. Vigorous-intensity activities should be incorporated, including those that strengthen muscle and bone, at least 3 times per week

18–64 years old

For adults of this age group, physical activity includes recreational or leisure-time physical activity, transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play, games, sports or planned exercise, in the context of daily, family, and community activities.

In order to improve cardiorespiratory and muscular fitness, bone health and reduce the risk of NCDs and depression the following are recommended:

1. Adults aged 18–64 years should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week, **or** do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week, **or** an equivalent combination of moderate- and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, **or** engage in 150 minutes of vigorous-intensity aerobic physical activity per week, **or** an equivalent combination of moderate- and vigorous-intensity activity.
4. Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week.

65 years old and above

For adults of this age group, physical activity includes recreational or leisure-time physical activity, transportation (e.g. walking or cycling), occupational (if the person is still engaged in work), household chores, play, games, sports or planned exercise, in the context of daily, family, and community activities.

In order to improve cardiorespiratory and muscular fitness, bone and functional health,



and reduce the risk of NCDs, depression and cognitive decline, the following are recommended:

1. Adults aged 65 years and above should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week, **or** do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week, **or** an equivalent combination of moderate- and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, adults aged 65 years and above should increase their moderate intensity aerobic physical activity to 300 minutes per week, **or** engage in 150 minutes of vigorous intensity aerobic physical activity per week, **or** an equivalent combination of moderate- and vigorous intensity activity.
4. Adults of this age group with poor mobility should perform physical activity to enhance balance and prevent falls on 3 or more days per week.
5. Muscle-strengthening activities should be done involving major muscle groups, on 2 or more days a week.
6. When adults of this age group cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow.



Annex (6) Pharmacological Therapy of Osteoporosis

A number of pharmacological agents are approved by FDA for the treatment as well as of osteoporosis. Not all of these drugs are available in every country. All increase bone mineral density and reduce the risk of fractures:

➤ ***Bisphosphonates: (alendronate, risedronate, ibandronate, zoledronic acid)***

analogues of inorganic pyrophosphate that inhibit bone resorption, Adsorbed onto hydroxyapatite crystals in bones , slowing both their rate of growth and dissolution , and therefore reducing the rate of bone turnover.

Alendronate (10 mg daily tablet, 70 mg weekly tablet or liquid formulation, and 70 mg weekly tablet with 2,800 IU or 5,600 IU of vitamin D3).

Risedronate sodium (5 mg daily tablet; 35 mg weekly tablet; 35 mg weekly tablet packaged with 6 tablets of 500 mg calcium carbonate; 75 mg tablets on two consecutive days every month; and 150 mg monthly tablet)

➤ ***Calcitonin:***

It increases deposition of calcium and phosphate in the bone and lowers levels in the blood.

It is delivered as a single daily intranasal spray that provides 200 IU of the drug. Subcutaneous administration by injection also is available.

➤ ***Estrogen/Hormone Therapy (ET/HT)***

It is approved for the prevention of osteoporosis, relief of vasomotor symptoms and vulvovaginal atrophy associated with menopause. Women who have not had a hysterectomy require HT which contains progestin to protect the uterine lining. The Woman's Health Initiative (WHI) found that five years of HT reduced the risk of clinical vertebral fractures and hip fractures by 34 percent Because of the risks of cardiovascular diseases and breast cancer, ET/HT should be used in the lowest effective doses for the shortest duration to meet treatment goals. It is no longer regarded as a front-line option for the prevention or the treatment of osteoporosis in postmenopausal women. Their use is limited to:

1. Women who have both osteoporosis and menopausal symptoms which is severe enough to affect life quality.
2. Premature menopause (if women reach menopause at age <40). Until they are 50 years old, if this is not associated with any increasing health risk

➤ ***Estrogen Agonist/Antagonist (formerly known as SERMs)***

Raloxifene: it is indicated for the reduction in risk of invasive breast cancer in postmenopausal women with osteoporosis. It does not reduce the risk of coronary heart disease. Similar to estrogen, Raloxifene may increase the risk of deep vein thrombosis. It also increases hot flashes and make it worse (which is the main symptom of menopause worsen).



➤ **Parathyroid hormone**

Teriparatide is anabolic agent administered by daily subcutaneous injection. Because of its effect on incidence of osteosarcoma in animal experimental studies, it is recommended that its use for a maximum of two years and that those at risk of malignancy should not use it.

➤ **Denosumab**

it is human monoclonal antibody that inhibits osteoclast formation , function , and survival , thereby decreasing bone resorption

SUPPLEMENTATION AND LIFESTYLE

In addition to drug therapy, calcium and vitamin D supplements can be prescribed to ensure maximum effectiveness of your medication. You should be aware that attention to lifestyle factors (including risk factors , nutrition and exercise) must go hand in hand with any drug treatment prescribed.

PRACTICAL SUPPORT

Practical and emotional support is important for anyone on osteoporosis treatment. This can be provided by health professionals, osteoporosis patient support groups, family and friends. Such support will help you manage your osteoporosis, and lessen any feelings of isolation and depression (experienced by many patients with severe osteoporosis).



Annex (7) Fall Prevention Safety Requirements

The following advices should be given:

Outdoor Safety Tips

Try the following tips to help prevent falls when you are outside:

- Wear low-heeled shoes with rubber soles for more solid footing (traction), and wear warm boots in winter.
- Use hand rails as you go up and down steps and on escalators.
- If sidewalks look slippery, walk in the grass for more solid footing.
- In winter, carry a small bag of rock salt in your pocket or car. You can then sprinkle the salt on sidewalks or streets that are slippery.
- Look carefully at floor surfaces in public buildings. Floors made of highly polished marble or tile can be very slippery. When these surfaces are wet, they may become dangerous. When floors have plastic or carpet runners in place, stay on them whenever possible.
- Keep your porch, deck, walkways and driveway free of leaves, snow, trash or clutter. Also keep them in good repair. Cover porch steps with a gritty, weather-proof paint and install handrails on both sides.
- Turn on the light outside your front door before leaving your home in the early evening so that you have outdoor light when you return after dark.
- Use a shoulder bag, fanny pack or a backpack purse to leave your hands free.
- Use a walker or cane as needed.
- Find out about community services that can provide help, such as 24-hour pharmacies and grocery stores that take orders by phone or internet and deliver, especially in poor weather.
- Stop at curbs and check the height before stepping up or down. Be careful at curbs that have been cut away to allow access for bikes or wheelchairs. The incline may lead to a fall.
- Consider wearing hip protectors or hip pads for added protection should you fall.

Indoor Safety Tips: Fall-Proofing Home

Try the following tips to help prevent falls when you are inside your home:

Around the House

- Place items you use most often within easy reach. This keeps you from having to do a lot of bending and stooping.
- Use assistive devices to help avoid strain or injury. For example, use a long-handled grasping device to pick up items without bending or reaching. Use a pushcart to move heavy or hot items from the stove or countertop to the table.
- If you must use a stepstool, use a sturdy one with a handrail and wide steps.



- Also consider having a wireless telephone or cell phone to take from room to room so you can call for help if you fall.

Floors

Remove all loose wires, cords and throw rugs.

Keep floors free of clutter.

Be sure all carpets and area rugs have skid-proof backing or are tacked to the floor.

Do not use slippery wax on bare floors.

Keep furniture in its usual place.

Bathrooms

Install grab bars on the bathroom walls beside the tub, shower

Use a non-skid rubber mat in the shower or tub.

If you are unsteady on your feet, you may want to use a plastic back and non-skid legs in the shower or tub with and use

a handheld showerhead to bathe.



Kitchen

Use non-skid mats or rugs on the floor near the stove and sink.

Clean up spills as soon as they happen (in the kitchen and anywhere in the home).

Bedroom

Place light switches within reach of your bed and a night between the bedroom and bathroom.

Get up slowly from sitting or lying down since this may dizzyness.

Keep a flashlight with fresh batteries beside your bed.

Keep your medications and walking aid near

Stair

Keep stairwells well lit, with light switches at the top and the





Install sturdy handrails on both sides.

Mark the top and bottom steps with bright tape. Make sure carpeting is secure.

In addition to indoor and outdoor hazards, certain lifestyle behaviors can make a person more likely to fall. Here are some lifestyle tips to help you:

- Stay alert and focused when in public places.
- Remember to wear appropriate shoes both indoors and out.
- If you are in a hurry, slow down. Accidents are more likely to happen when you rush.
- Get your vision checked
- .Have an annual medication review conducted by a healthcare provider or pharmacist.
- Avoid drinking alcohol. Alcohol slows reflexes and may cause confusion, dizziness or disorientation. Too much alcohol can also cause bone loss.
- Avoid medications that increase falls risk.
- Exercise and eat healthy food at every age. A healthy diet includes having a well-balanced diet that contains the recommended amounts of calcium and vitamin D.



Annex (8) Exercise for prevention fall

Exercise 1: Single Limb Stance

It's best to start off with a simple balance exercise for seniors. Here's how you do this one: stand behind a steady, solid chair (not one with wheels), and hold on to the back of it. Lift up your right foot and balance on your left foot. Hold that position for as long as you can, then switch feet.

The goal should be to stand on one foot without holding onto the chair and hold that pose for up to a minute.



Exercise 2: Back Leg Raises

This strength training exercise for seniors makes your bottom and your lower back stronger.

Stand behind a chair. Slowly lift your right leg straight back – don't bend your knees or point your toes. Hold that position for one second, then gently bring your leg back down. Repeat this ten to 15 times per leg.



Exercise 3: Side Leg Raise

You'll need a chair for this exercise to improve balance.

Stand behind the chair with your feet slightly apart. Slowly lift your right leg to the side. Keep your back straight, your toe facing forward, and stare straight ahead. Lower your right leg slowly. Repeat this exercise ten to 15 times per leg.



Exercise 4: Toe Lifts

This strength training exercise for seniors also improves balance. You'll need a chair or a counter. Stand straight and put your arms in front of you. Raise yourself up on your toes as high as you can go, then gently lower yourself. Don't lean too far forward on the chair or counter. Lift and lower yourself 20 times.

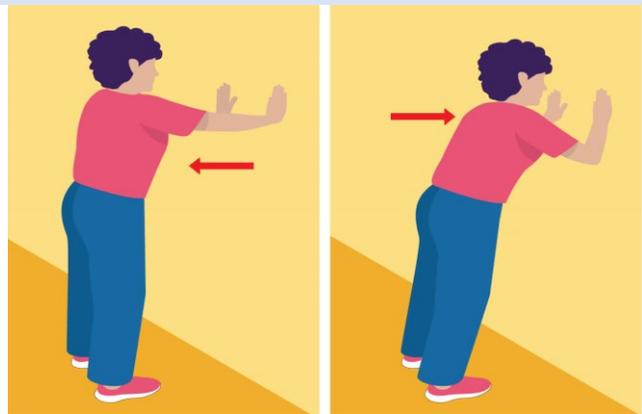




Exercise 5: Wall Pushups

As long as you've got a wall, you can do this strength training exercise for seniors.

Stand an arm's length in front of a wall that doesn't have any paintings, decorations, windows or doors. Lean forward slightly and put your palms flat on the wall at the height and width of your shoulders. Keep your feet planted as you slowly bring your body towards the wall. Gently push yourself back so that your arms are straight. Do twenty of these.



Exercise 6: Calf Stretches

These strength training exercises for seniors can be performed sitting or standing.

To do calf stretches while standing, find a wall with nothing on it. Stand facing the wall with your hands at eye level. Place your left leg behind your right leg. Keep your left heel on the floor and bend your right knee. Hold the stretch for 15 to 30 seconds. Repeat two to four times per leg.



Exercise 7: Hand and Finger Exercises

The following are exercises to improve flexibility. You don't need to stand for these.

In the first exercise, pretend there's a wall in front of you. Your fingers will climb the wall until they're above your head. While holding your arms above your head, wiggle your fingers for ten seconds. Then, walk them back down.



Exercise 8: Shoulder Rolls

This is a simple exercise for seniors. You can do it seated or standing.

Rotate your shoulders gently up to the ceiling, then back and down. Next, do the same thing, but roll them forwards and then down.

