



# SAFE MOVEMENT

**PREVENTING FRAGILITY FRACTURES:**  
ANTIFRACTURE MEDICINE, SAFE MOVEMENT,  
EXERCISE, AND FALL PREVENTION



**YOUR HEART AND LUNGS ARE VITAL ORGANS, ALIVE AND WORKING ALL THE TIME. YOU MIGHT NOT KNOW IT, BUT YOUR SKELETON IS A VITAL ORGAN AS WELL. IT IS ALWAYS ACTIVE, REPAIRING DAMAGE, REPLACING OLD BONE WITH NEW, AND STORING MINERALS ESSENTIAL TO LIFE.**

These minerals (mostly calcium) make it possible for your heart to beat, muscles to contract, and nerves to send impulses. If there is too little in your blood, calcium is taken from your bones. This isn't a problem when it happens once in a while. However, too many withdrawals lead to bones so fragile you can break one picking up bag of groceries.

The process of bone removal and replacement is called *bone remodeling*. Removing bone that is damaged or needed for minerals is called *resorption*. During bone resorption, cells called *osteoclasts* dissolve bone, leaving little cavities on its surface. Next, cells called *osteoblasts* fill in these cavities with new bone in a process called *formation*. In healthy bone, resorption and formation are perfectly balanced. One offsets the other. Unfortunately, this balance can be upset by aging, menopause, inactivity, illness, medications, and other common conditions. When more bone is lost than formed, the result is osteoporosis and fractures.



# DO YOU HAVE OSTEOPOROSIS?

The best way to find out if you have osteoporosis is to get a bone mineral density (BMD) test on a dual-energy x-ray absorptiometry (DXA) machine. Bone density test results fall into three categories: normal density, low density (osteopenia), and osteoporosis. These results are reported as T-scores, based on comparison with healthy normal bone. A normal T-score is 0 or higher; a low-density (osteopenic) T-score is between -2 and 0, and an osteoporosis T-score is -2.5 and below.

Your T-score is a good indicator of your bone health, but it doesn't tell the whole story. A lot of other contributors to bone strength that are not measured by DXA. These are called risk factors. Even with normal BMD T-scores, people with multiple risk factors may need treatment to avoid breaking a bone.

### Do you have risk factors for fractures? Ask yourself:

- Have you broken a bone at age 50 or older?
- Did your parents have osteoporosis or broken bones as adults?
- Are you small and thin?
- Do you have type 2 diabetes?
- Do you take bone-damaging medicines (such as steroids for asthma)?

- Have you broken a bone or gotten shorter ( $\geq 1.5''$  from young adult height)?
- Do you smoke or drink too much alcohol ( $\geq 2$ -3 drinks a day)?

If you answered yes to any of these questions, you have an increased risk factor for fragility fractures. If you answered yes to more than one, you should talk with your doctor about getting screened for osteoporosis.

# WHO SHOULD GET SCREENED?

The National Osteoporosis Foundation (NOF) recommends BMD measurement by DXA for women age 65 and older and younger postmenopausal women with clinical risk factors for bone loss. NOF also recommends testing for women approaching menopause in whom bone loss is suspected, men age 70 and older, men age 50-69 with clinical risk factors, adults with a condition or taking a medication associated with low bone mass or bone loss, and adults who have experienced a fracture over the age of 50. BMD measurement is not recommended for children or adolescents and is not routinely indicated in healthy young men or premenopausal women.

Bone Density Category	When for Postmenopausal Women and Men Age 50 and Older to Consider Treatment with an Osteoporosis Medicine	T-SCORES	
		Scores Range	Possible Score
Normal Bone Density	Most people with T-scores of -1 or higher do not need to consider a medicine.	-1 and higher	+1.0 +0.5 0 -0.5 -1.0
Low Bone Density (Osteopenia)	People with T-scores between -1.0 and -2.5 should consider a medicine when there are certain risk factors suggesting an increased chance of breaking a bone in the next 10 years.	-1.1 to -2.4	-1.1 -1.5 -2.0 -2.4
Osteoporosis	All people with osteoporosis should consider a medicine to reduce the risk of broken bones	-2.5 and lower	-2.5 -3.0 -3.5 -4.0
Severe Osteoporosis	All people with severe osteoporosis should consider a medicine to reduce the risk of additional broken bones	-2.5 and lower plus a broken bone	-2.5 -3.0 -3.5 -4.0

TABLE 1: When to consider treatment with an osteoporosis medicine.

# PREDICTING YOUR FRACTURE RISK: FRAX, VFA, AND TBS

The *majority* of fractures occur in individuals who have BMD above the -2.5 diagnostic threshold. Clearly, BMD by DXA doesn't tell us everything we need to know to prevent fractures in everyone at risk. Something besides the density of bone mineral contributes to bone strength. That something can be summed up as *bone quality* — its physical and biomechanical properties (shape, size, behavior). In the past, the only way to evaluate bone quality was to take a sample and examine it under a microscope. Today, we have several tools for predicting bone quality and how likely it is to break. These tools include the Fracture Risk Assessment Tool (FRAX®), vertebral fracture assessment (VFA), and trabecular bone score (TBS).

## FRACTURE RISK ASSESSMENT TOOL (FRAX®).

Some basic biological facts of our lives — things like sex, age, and genetic heritage — are strongly linked with weak bones and osteoporosis. Adding these clinical risk factors to BMD measurement significantly improves the accuracy of fracture prediction. FRAX®, the Fracture Risk Assessment Tool, is a computer-based algorithm that uses a person's BMD results, age, and major risk factors for fracture to estimate their risk of breaking a bone in the next 10 years. A FRAX® score provides information to guide healthcare providers and patients making decisions about how best to preserve bone health. Some DXA machines calculate a person's score at the same time as measuring bone density. A FRAX® score can also be computed using an online version of the FRAX® tool. The FRAX® tool is intended for postmenopausal women and men age 50 and older, not for younger adults or children.

## VERTEBRAL FRACTURE ASSESSMENT (VFA).

Your spinal column has 33 small bones (vertebrae) stacked up from skull to tailbone. Vertebrae protect your spinal cord, support your head, and attach to muscles and tendons that let you move. Normal vertebrae are shaped a bit like marshmallows. Inside, they are filled with a honeycomb of tiny connected bones, called *trabeculae*. These bones are rich in calcium and other essential minerals. If your body is running short of these minerals, they are taken from vertebral bone. When more

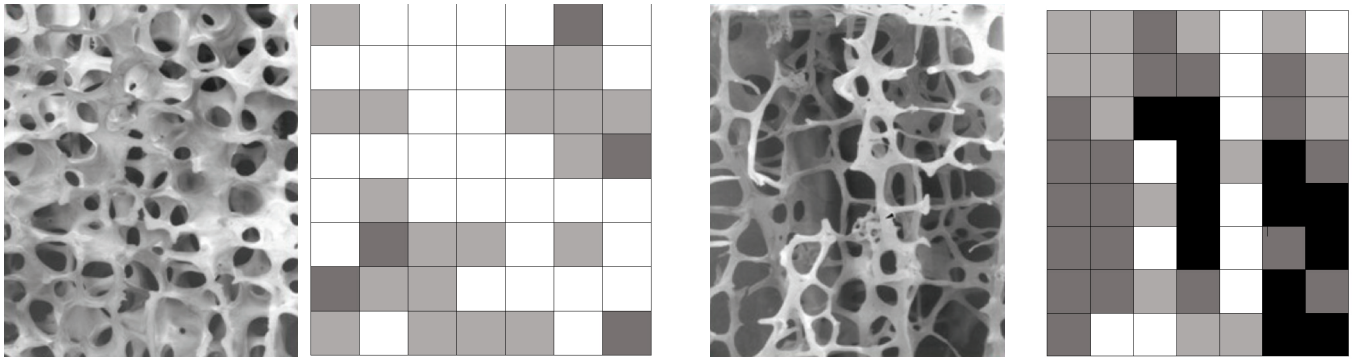
is withdrawn than replaced, the trabecular honeycomb gets thinner and weaker. The connecting branches break. When enough bone is lost, cracks form and the vertebra collapses. This is called a *vertebral compression fracture* (VCF). Most of the time, vertebrae collapse toward their more heavily loaded side. This creates a wedge shape that shifts spinal load forward or to one side. Shifting more weight onto other vertebrae makes them more likely to collapse as well. And they do. The majority of people have a second VCF within a year of their first one. In fact, if you have one VCF you are 5 times more likely to have another one and over twice more likely to break a hip.

At any BMD, VCFs are very good predictors of fractures. If you have one, you probably need treatment to avoid having more. The problem is that most of the time VCFs occur without any injury or pain. These “silent” VCFs can be caused by something as harmless as a sneeze. Most people don't even notice these “red flag” fractures, which means they miss the opportunity to get treatment before their bones get worse.

This is where vertebral fracture assessment (VFA) comes in. Vertebral fracture assessment detects hidden vertebral fractures so that treatment can started to prevent more. Vertebral fracture assessment can be done on the latest generation of densitometry (DXA) devices as well as using conventional lateral x-rays of the spine. Getting VFA at the same time you have your bone density measured makes it quick and easy.

## TRABECULAR BONE SCORE (TBS).

Inside bones, the honeycomb of bone called trabeculae is very important to bone strength. If the trabeculae are broken, poorly formed, or otherwise defective, your bone is much more likely to break. Trabecular bone score (TBS) is a technology that uses images from DXA to estimate bone strength by calculating trabecular number, thickness, connectivity, and spacing. With TBS added to DXA, people with poor bone quality but normal BMD are much easier to identify and treat before more damage occurs.



**Trabecular bone score uses DXA images to characterize bone microarchitecture that is not measured directly by DXA. (Left)**

**This microscopic architecture is imaged directly by microphotography of bone biopsy sample. (Right)**

**The left is an image of healthy trabecular bone. Notice the overall lighter shading reflecting the distribution of intact bone in the top image as compared with the darker shading in the right image. The strong and weak segments of bone are obvious.**

## MEDICINES TO PREVENT FRACTURES

Popular media and dietary supplement manufacturers have contributed to the widespread belief that — on their own — diet and exercise can reverse osteoporotic bone loss and fractures. It is easy to see why this myth is so persuasive. Most people do not like to take medications, and certainly not medications that have been linked (again in the popular media) to adverse events such as osteonecrosis of the jaw (ONJ) and atypical femur fracture (AFF). The trouble is there is no credible evidence that osteoporosis can be reversed with exercise and diet alone. People who rely on so-called “natural” treatment for osteoporosis break bones at rates hundreds of times greater than these rare side effects.

Luckily, there are dozens of effective treatments proven to slow bone loss and lower risk of broken bones in people with osteoporosis. Prescription drugs approved by the US Food and Drug Administration (FDA), along with healthy lifestyle behaviors, including getting enough calcium, vitamin D and regular exercise, can prevent broken bones due to osteoporosis.

There are two basic categories of medications to prevent bone loss and treat osteoporosis: antiresorptives and anabolics. Antiresorptive drugs include bisphosphonates, calcitonin, denosumab, estrogen/estrogen-progestin, and estrogen agonists/antagonists. All of these drugs work by slowing the breakdown part of the remodeling cycle. Bone removal declines, while bone replacement stays the

same. Reducing bone loss makes bones stronger and less likely to break. Anabolic medicines increase formation of new bone. Teriparatide, a form of parathyroid hormone, is the only FDA-approved anabolic medicine available at this time. It works by stimulating the formation part of the remodeling process. More bone is formed than is taken away. The result is stronger bone that is less likely to break.

### WEIGHING RISKS AND BENEFITS OF ANTIRESORPTIVE MEDICATIONS

You may have heard about sudden thigh bone fractures in people who are taking bisphosphonate drugs (and denosumab). This rare side effect is called an atypical femur fracture (AFF). People who have had an AFF report experiencing a dull pain in their upper leg or groin for weeks before the fracture. If you have been taking a bisphosphonate or denosumab for several years and have an unusual ache or pain in your thigh bone, tell your doctor. Risk factors for AFF are not yet fully understood.

An even less common side effect reported in people taking very high doses of bisphosphonates is a painful deterioration of the jawbone called osteonecrosis of the jaw (ONJ). Although it has been reported in people on lower doses for shorter periods, ONJ is almost always seen only in people being treated with very high doses for cancer, especially following oral surgery. Good dental care is a reasonable precaution for anyone being treated for osteoporosis.

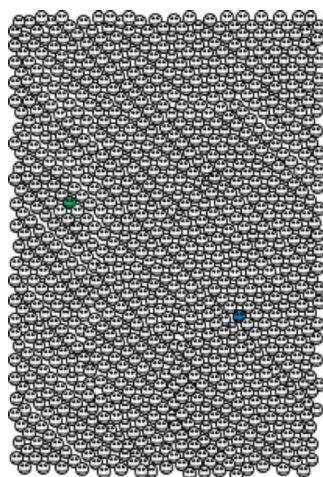


## Risk of ONJ and AFF with Osteoporosis Medication

Out of 1,000 people on osteoporosis medication for 5 years:

☹️ <1 osteonecrosis of the jaw (.01/1000)

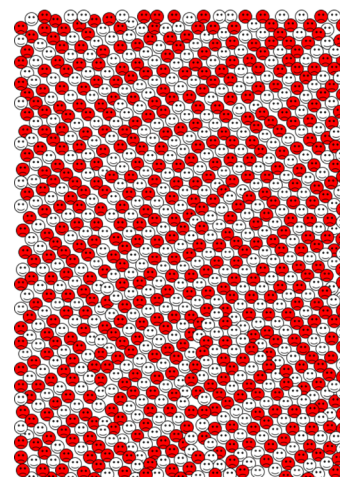
☹️ <1 atypical femur fracture (.16/1000)



## Risk of Fracture without Osteoporosis Medication

Out of 1,000 women:

☹️ 500 will suffer a fracture without treatment for osteoporosis during their lifetime.



Graphic Source: Kaiser Permanente of Southern California, January 2013. Used with permission

Class/Drug Name	Brand Name	Form	Frequency	Gender
<b>Bisphosphonates</b>				
Alendronate	Generic Alendronate and Fosamax®, Fosamax Plus D™	Boniva®	Daily/Weekly	Women & Men
Alendronate	Binosto®	Effervescent tablet	Weekly	Women & Men
Ibandronate	Boniva®	Boniva®	Monthly	Women
Ibandronate	Boniva®	Intravenous (IV) injection	Four Times a Year	Women
Risedronate	Actonel®	Oral (tablet)	Daily/Weekly/ Twice Monthly/Monthly	Women & Men
Risedronate	Actonel® w/ Calcium	Oral (tablet)	Weekly	Women & Men
Risedronate	Atelvia™	Oral (tablet)	Weekly	Women & Men
Zoledronic Acid	Reclast®	Intravenous (IV) infusion	Once a Year/Once every two years	Women & Men
<b>Calcitonin</b>				
Calcitonin	Fortical®	Nasal spray	Daily	Women
Calcitonin	Miacalcin®	Nasal spray	Daily	Women
Calcitonin	Miacalcin®	Injection	Varies	Women
<b>Estrogen* (Hormone Therapy)</b>				
Estrogen	Multiple Brands	Oral (tablet)	Daily	Women
Estrogen	Multiple Brands	Transdermal (skin patch)	Twice Weekly/Weekly	Women
*Estrogen is also available in other preparations including a vaginal ring, as a cream, by injection and as an oral tablet taken sublingually (under the tongue). The vaginal preparations do not provide much bone protection.				
<b>Estrogen Agonists/Antagonists also called selective estrogen receptor modulators (SERMs)</b>				
Raloxifene	Evista®	Oral (tablet)	Daily	Women
<b>Parathyroid Hormone (Anabolic Agent)</b>				
Teriparatide	Forteo®	Injection	Daily	Women & Men
<b>RANK ligand (RANKL) inhibitor</b>				
Denosumab	Prolia™	Every 6 Months	Daily	Women & Men

**TABLE 2:** Osteoporosis medicines approved by the FDA. \*Generic versions of these drugs may be available. Check with your healthcare provider and pharmacist to find out more information about dosages, pricing and availability.

At the doses used for osteoporosis, AFF and ONJ are very rare. Fragility fractures from osteoporosis, on the other hand, are very common. The graphic below represents actual risk for treatment-related AFF and ONJ on the left with the risk for fractures without treatment on the right. The gray dots are people who don't fracture. The red dots are fractures and the green and blue dots are ONJ and ATF. As you can see, for people with osteoporosis, risk without treatment is much higher.

### **WHAT YOU SHOULD KNOW ABOUT TAKING BISPHOSPHONATES**

Bisphosphonate drugs taken by mouth are very poorly absorbed (alendronate, ibandronate, risedronate). This means they will bind to anything in your stomach and get flushed out of your system. As a consequence, they cannot be taken with anything but plain water and must stay in your empty stomach for quite awhile in order to be absorbed.

Regular-release bisphosphonates (not delayed-release risedronate) need to be taken first thing in the morning after waking up and on an empty stomach. Tablets must be swallowed whole with 6-8 ounces of plain water (no other liquid). Effervescent alendronate tablets should be dissolved in 4 ounces of plain water. If you take alendronate or risedronate, you must wait at least 30 minutes before having anything to eat or drink. If you are taking ibandronate, you must wait a full hour. During this time, you need to remain upright (sitting, standing, or walking).

Delayed-release risedronate tablets need to be taken **immediately after breakfast** with at least 4 ounces of plain water (no other liquid). Patients must remain upright (sitting, standing or walking) for at least 30 minutes after taking Atelvia.

Two bisphosphonates are delivered by intravenous (IV) infusion, ibandronate and zoledronic acid. Zoledronic acid is given once a year as an intravenous (IV) infusion of 5mg to treat osteoporosis or every two years as an IV infusion of 5mg to prevent osteoporosis. A healthcare professional gives zoledronic acid as an intravenous (IV) infusion in a doctor's office or other outpatient setting.

Common side effects of oral bisphosphonates include nausea, heartburn, and gastric ulcer. It is not uncommon

for people taking IV bisphosphonates to have flu-like symptoms following their first couple infusions. Chills, fever, and joint pain usually clear up in two or three days and become less likely with each subsequent treatment. Pain in bone, joints, and muscles is also a common side effect for all drugs in this class. In rare cases, inflammation of the eye (uveitis) may occur. Rare side effects, ONJ and AFF, are discussed earlier in this article.

All medications should be taken on a regular schedule, on the same day at the same time, whether daily, weekly, monthly, or annually. Any calcium must be taken at a different time of day with a meal or snack.

### **WHAT YOU SHOULD KNOW ABOUT TAKING CALCITONIN**

Calcitonin is not considered a first-line option for preventing bone loss and fractures because bisphosphonates and other drugs are much more effective. A small increase in cancer has been associated with long-term calcitonin use. Short-term use is preferable. Common side effects with nasal calcitonin are a runny nose, headache, back pain and nosebleed (epistaxis). Injectable calcitonin may cause an allergic reaction and unpleasant side effects including flushing of the face and hands, urinary frequency, nausea and skin rash.

### **YOU SHOULD KNOW ABOUT TAKING ET AND HT**

Taking estrogen alone can increase the risk of endometrial cancer (uterine lining). To reduce this risk, the hormone progesterone is prescribed in combination with estrogen (HT) for those women who have a uterus. Estrogen therapy (ET) is prescribed for women who have had hysterectomies. Possible side effects include vaginal bleeding, breast tenderness and gallbladder disease. Hormone therapy (HT) is associated with a slight increase in the risk of breast cancer, strokes, heart attacks, blood clots, and cognitive (mental) decline. Estrogen therapy (ET) is associated with a similar increase in the risk of strokes, venous blood clots, and cognitive decline, but not breast cancer or heart attacks. More information is available in NOF's Hormones and Healthy Bones brochure.

## **WHAT YOU SHOULD KNOW ABOUT TAKING RALOXIFENE**

Raloxifene is an estrogen agonist/antagonist, the type of drug that used to be called a selective estrogen receptor modulator (SERM) for the impact it has on some but not all estrogen-sensitive tissues, such as bone.

Raloxifene increases bone density and reduces the risk of fractures in the spine. It also reduces risk of invasive breast cancer in postmenopausal women with osteoporosis. Raloxifene is taken daily as a 60mg tablet with or without meals. Reported side effects include hot flashes, leg cramps, deep vein thrombosis (blood clots), swelling and temporary flu-like symptoms. Raloxifene should not be taken by women with a history of stroke, transient ischemic attack (TIA), atrial fibrillation, or uncontrolled high blood pressure.

## **WHAT YOU SHOULD KNOW ABOUT TAKING DENOSUMAB**

Denosumab reduces bone loss, increases bone density, and reduces the risk of fractures in the spine, hip and other bones. A healthcare professional gives denosumab by injection every six months. Denosumab is approved for women and men at high risk for fracture. It is effective in men taking androgen deprivation therapy to treat prostate cancer (such as Lupron® and Zoladex®) and in women taking aromatase inhibitors for breast cancer (such as Arimidex®, Aromasin® and Femara®) who are at high risk of breaking a bone.

Denosumab can lower calcium levels in the blood. Patients need to have their blood calcium checked before each dose. Denosumab raises risk for infections.

Although anyone taking denosumab is at increased risk. This is of particular concern to people with immune system disorders or on immunosuppressant drugs. If signs of infection occur (abdominal pain, fever, chills, and/or hot, red, or swollen skin), patients should contact their healthcare provider right away. Denosumab can also cause minor skin rash and pain in the back, arms, and legs. Rare cases of ONJ and AFF have been reported in patients taking denosumab.

## **WHAT YOU SHOULD KNOW ABOUT TAKING TERIPARATIDE**

Teriparatide, a variant of the naturally occurring parathyroid hormone, rebuilds bone and increases bone mineral density, especially in the spine. Teriparatide reduces the risk of fractures in the spine and other bones. Candidates for teriparatide include patients who have broken a bone due to osteoporosis and those with very low bone mineral density (T-scores lower than -3.0). Teriparatide is also an option for patients who continue to lose bone density or break bones while taking other osteoporosis medicines.

Teriparatide is self-administered as a daily injection. It can be taken for a maximum of two years. At the end of two years, to retain the benefits of treatment with teriparatide, most experts recommend taking an antiresorptive medicine.

Reported side effects include leg cramps and dizziness. Modest elevations in serum and urine calcium can occur, but there is no documented increase in the risk of kidney stones. Use is limited by the FDA to two years as a precaution because studied rats given very high doses for long periods got bone cancer more often than untreated rats. There have been no reports of osteosarcoma in humans taking teriparatide.

**DO NOT** take teriparatide if you: 1. Have Paget's disease; 2. Are a child with growing bone; 3. Have unexplained serum alkaline phosphatase elevations; 3. Have had radiation treatment involving your skeleton; 4. Have a metabolic bone disease like hyperparathyroidism or cancer that has spread to the bone; and 5. Have abnormal blood tests, including increased calcium levels.

## **TAKING OSTEOPOROSIS MEDICINES? WHAT NOW?**

Numerous anti-fracture prescription drugs can cut your risk for fractures by 50%-75% — but not without adequate blood levels of calcium and vitamin D. Calcium is obvious: it's the main ingredient of bone. Vitamin D? Vitamin D helps your body absorb calcium. Without enough, your blood calcium drops. And when this happens, calcium is taken from bone.



It is best to get your calcium from food. Dairy products, fortified cereals, and leafy greens are good sources. Supplemental calcium is recommended only to make up the difference between what you eat and what you need. Vitamin D is harder to get from food. It is naturally produced by your skin in reaction to sunlight. As we get older, our skin loses its ability to produce vitamin D. Many older people need supplemental vitamin D to get enough. Ask your doctor if your blood levels of calcium and vitamin D are healthy and, if not, how much you should take and for how long.

**HOW CAN YOU TELL IT'S WORKING?**

A medicine that is appropriate and effective for one person may not be the best choice for someone else. People can respond differently to treatment with the same medicine. No matter what the treatment, to be effective, an osteoporosis medicine must be taken as prescribed. It is important to stay with the plan that you and your healthcare provider have selected. Most people cannot feel their bones getting stronger. If you decide that a particular treatment is not right for you, discuss your concerns with your healthcare provider before stopping or interrupting treatment.

Bone density testing should be repeated every two years to monitor the effectiveness of treatment. Assessments of bone quality, such as TBS, can be performed at the same time if needed. Some patients need repeat bone density testing after one year. Healthcare providers

may also elect to measure biochemical markers of bone turnover, another indicator of response to treatment.

With antiresorptive medicines (bisphosphonates, calcitonin, estrogen and estrogen agonists/antagonists), the goal of treatment is to prevent further bone loss and reduce the risk of fractures. You know the drug is working when your bone mineral density remains stable or improves and you have no additional broken bones.

With anabolic medicine (teriparatide) the goal of treatment is to rebuild bone, increase bone mass, repair microscopic defects in bone and reduce the risk of fractures. You know it's working when your bone quality and bone mineral density improve and you have no additional broken bones.

**HOW LONG TO TAKE THEM?**

There are currently no evidence-based recommendations for how long to take most osteoporosis drugs except for teriparatide (Forteo®). After patients stop taking a bisphosphonate medicine, they may continue to experience some of the drug's benefits for several years or even longer. Other osteoporosis medicines like denosumab and teriparatide stop working quickly. This can lead to rapid bone loss in some patients when these medicines are stopped.

Patients who have responded well to taking bisphosphonates and are considered at low risk of fracture may be able to take a break from treatment after

NOF Recommendations for Daily Calcium and Vitamin D			
Amounts include all sources, both food and supplements. Get as much of your calcium from food sources as you can			
	Age	Calcium	Vitamin D
Women	50 and younger	1,000 mg.	400-800 units
	51 and older	1,200 mg.	800-1,000 units
Men	50 and younger	1,000 mg.	400-800 units
	51 - 70	1,000 mg.	800-1,000 units
	71 and older	1,200 mg.	800-1,000 units



three to five years. During this break from treatment, it's important to work closely with your healthcare provider to monitor bone health and re-evaluate the need to restart an osteoporosis medicine. People who are considered at high risk for breaking a bone usually need to continue treatment with a bisphosphonate or another osteoporosis medicine to prevent fractures.

No medication is right for all people with osteoporosis. NOF encourages all healthcare providers to evaluate a patient on the basis of clinical risk factors, such as the presence or absence of broken bones, height loss, bone

density, age, weight and other factors that affect fracture risk. Length of treatment should be individualized and based on the person's medical and fracture history, as well as the initial and most recent bone density test results.

**REPORTING SIDE EFFECTS, ADVERSE EVENTS, AND DRUG COMPANY INFORMATION**

When patients have a serious reaction or problem with a drug, they or their healthcare providers should report the problem to the FDA. This can be done by calling 800/332-1088 or completing an online report at [www.fda.gov/medwatch](http://www.fda.gov/medwatch). Patients can also notify the pharmaceutical manufacturer. The information below provides the phone numbers of the pharmaceutical manufacturers and the date each medicine was approved by the FDA as an osteoporosis medicine.

NOF Contact Information for Companies that Make Osteoporosis Medicines**	
<b>Alendronate</b> (Binosto, Fosamax, Fosamax Plus D) Merck, 800/672-6372 FDA Approval: 1995 <i>Generic versions available</i>	<b>Raloxifene (Evista)</b> Eli Lilly, 800/545-5979 FDA Approval: 1997
<b>Calcitonin (Fortical, Miacalcin)</b> Upsher-Smith, 800/654-2299 (Fortical®) Novartis, 888/669-6682 (Miacalcin®) FDA Approval: 1995	<b>Risedronate (Actonel, Actonel with Calcium, Atelvia)</b> Warner Chilcott, 800/521-8813 FDA Approval: 2000 <i>Generic versions available</i>
<b>Denosumab (Prolia)</b> Amgen, (800) 772-6436 FDA Approval: 2010	<b>Teriparatide (Forteo)</b> Eli Lilly, 800/545-5979 FDA Approval: 2002
<b>Estrogen (ET) and Hormone Therapy (HT)</b> Multiple brand names are available FDA Approval: 1997 <i>Generic versions available</i>	<b>Zoledronic Acid (Reclast)</b> Novartis, 888/669-6682 FDA Approval: 2007 <i>Generic versions available</i>
<b>Ibandronate (Boniva)</b> Roche, 800/526-6367 FDA Approval: 2005 for Monthly Oral Dose and 2006 for Quarterly IV Dose <i>Generic versions available (oral only)</i>	



TABLE 3: Makers of osteoporosis medicines with contact information. \*\*

**PROTECTING FRAGILE BONES IN DAILY LIFE**

Good posture and healthy body dynamics protect your bones and allow you to stay active and independent. It starts with alignment. When you stand, align your head and shoulders over your hips, knees, and ankles. This puts less stress on your spine and improves balance by centering your body weight over your legs. When you sit, align your head, shoulders, and spine. Keep a straight back and feet flat on the floor.

How you stand and move determines how well your skeleton can distribute body weight and absorb the impacts of daily living. Overloading any one bone can exceed the strength of that bone. When this happens the bone breaks. Sudden overloading of bone, by falling for example, is obvious when it occurs. Less obvious is the slow and steady overloading done by poor posture and back-straining activities like tennis.

**MOVEMENT NO-NO'S:**

- No slouching (i.e. forward jutting head jutting, collapsed trunk (rather than upright), and forward tilted hips)
- No bending forward from the waist
- No twisting at the spine (turn at waist, shoulders rotate, hips don't)

- No leaning and reaching past your safe balanced position.

Learning spine-protective methods for performing everyday tasks can help you avoid injury. Applying bone-safe principles to daily life and recreational activities is harder than it sounds. It sometimes requires rethinking and relearning habitual behaviors and everyday activities, from climbing stairs to getting out of bed.

In the following sections, we walk you through bone-safe strategies for everyday living. You will notice that we repeat a few basics: 1) Align your body — head, nose, knees, and toes should point in the same direction. 2) Bend your knees and hip joints not your back. 3) Rotate your whole body, don't twist your back. 4) Move objects closer to you, instead of leaning in to them.

A physical therapist can work with you to build your skills and trouble-shoot individual issues.

### BONE-SAFE STANDING

- Hold your head high, chin in, and shoulder blades back and slightly pinched together.
- Maintain the natural arch of your lower back. Tighten your tummy muscles.
- Point your feet straight ahead with your knees facing forward. While standing in one place for more than a few minutes, put one foot up on a stool or in an open cabinet (if you are in the kitchen). Switch to the other foot every so often. You'll find this much less tiring for your back and legs.

### BONE-SAFE SITTING

- When sitting in a chair, try to keep your hips and knees at the same level. Place your feet flat on the floor. Keep a comfortable posture. You should have a natural inward curve to your lower back and a tall, upright upper back.
- When sitting in bucket seats or soft couches or chairs, use a rolled-up towel or pillow to support your lower back.
- When standing up from a chair, move your hips forward to the front of the chair, and use your leg muscles to lift yourself up.
- When driving, use the head rest and lumbar support for comfort.

- Use a footstool or footrest when seated for long periods of time.
- When tying your shoes or drying your feet, sit in a chair. Place one foot on a footstool, box or on your other leg. Lean forward at the hips to tie or dry. Do not bend over or slouch through your upper back. Keep the natural curve of your lower back and a straight upper back.
- When reading, set your reading material on a desk, table, or pillows on your lap.
- When sitting at a desk, position your work materials so you can work without slouching. One strategy is to prop up a clipboard so that it slants toward you, like a drafting table.

*Right*



*Wrong*



*Right*



*Wrong*



### BONE-SAFE WALKING

- Hold your head high, chin in, and shoulder blades slightly pinched together.
- Keep your feet and knees aligned and facing forward.
- Keep your weight balanced over your feet.
- Keep your knees slightly bent. Avoid locking your knees.
- Wear rubber or other non-slip soles that fit snugly. Avoid slip-on shoes or slippers.

### BONE-SAFE STAIR CLIMBING

- Use the stairs for exercise and to help with your bone density, but only if your healthcare provider says it's safe for you. Build up gradually with this exercise.



- Keep your head high, chin in, shoulder blades slightly pinched together, and abdomen pulled in.
- Keep your feet pointed straight ahead, not to one side. Your knees should face forward. Keep your knees slightly bent.
- Keep your feet a few inches apart, lined up under your hip on that side. Extend your foot straight forward from this lined-up position (instead of putting one foot directly in front of the other).
- ALWAYS hold the rail while going up and down. Try not to pull yourself up by the railing.
- Take extra care on stairs. A fall down the stairs could cause severe injuries.



- When lifting an object off the floor, first kneel on one knee. Next, place one hand on a table or stable chair for support if you need it.
- Next, lift and draw the object close to your body at waist level. Gently pull in your abdomen to support your back. Breathe out slowly.
- Hold the object close to your body and keep your back straight. Use your leg muscles to stand up.
- When buying groceries, ask to have your bags packed lightly. Divide heavy items into separate bags. When you carry them, hold the bags close to your body. Try to balance the load by carrying the same amount in each arm.
- When unpacking, place bags on a chair or table rather than on a high counter or on the floor. This prevents unnecessary lifting and twisting.
- Carry a light-weight cross-body bag, backpack, or fanny pack rather than a heavy shoulder bag or handbag.



### BONE-SAFE BENDING AND TURNING

- Keep your feet flat and about shoulder-width apart.
- Let both upper arms fall so they are touching your sides (or one arm, if you're using one hand for support).
- Stand with your back straight and your shoulder blades pinched together.
- Bend only your knees and hips. Keep your back straight. Bending forward with a rounded back puts so much stress on your spine it can easily break a bone.
- Keep your back straight when standing to brush your teeth or to wash dishes. If you need to reach something, hinge at the hips with back straight.
- When changing direction, move your feet in alignment with your body. Pivot on your heels or toes with your knees slightly bent. Keep your nose, knees, and toes pointed in the same direction.

### BONE-SAFE PUSHING AND PULLING

- When you vacuum, rake, sweep, or mop, stand with feet a few inches apart with one foot in front of the other.
- Face your work directly. This avoids twisting your back.
- As you work, hold the tool close to your body. "Push" and "pull" by shifting your weight with your back straight. Leaning over to push or pull curves your back and strains your spine.
- Shift your weight from one foot to the other in a rocking movement. With knees bent and shoulder blades pinched, shift your weight forward and back, or side to side rhythmically.

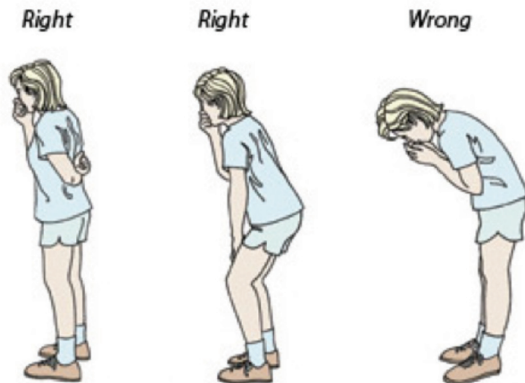
### BONE-SAFE LIFTING AND CARRYING

- Lift and carry lightweight things only: Nothing weighing more than 10 pounds. If you are unsure about how much you can lift, check with your healthcare provider or physical therapist.
- When you pick up an object, bend your knees not your back. Keep your weight balanced over your hips with your back straight to avoid excessive stress on your spine.



## BONE-SAFE COUGHING AND SNEEZING

- Pay attention to when and how you sneeze or cough.
- When you feel a sneeze coming, straighten your back and brace yourself. Stand or sit straight up and put one bent arm behind your back, or bend your knees slightly and place one hand on your thigh. This protects your spine from a sudden jerk forward.



## BONE-SAFE GETTING INTO BED

- First, sit down on the edge of the bed.
- Place your hands on the bed at your sides. Putting your weight on your hands, lean toward the head of the bed, bend your weight-bearing arm to support yourself with your elbow. Use your other hand in front of your body to keep you balanced.
- Lie down on your side, bringing both feet up onto the bed at the same time.
- Pull in your abdomen to support your back and avoid twisting.
- Keep your nose, knees, and toes pointing in the same direction.
- With your knees bent and arms in front of you, roll onto your back in one motion.
- Use your bent legs and arms to shift your position in bed. Lifting your head and upper back can overstress your back and cause spinal fractures.



## BONE-SAFE LYING DOWN AND GETTING OUT OF BED

- When lying on your side in bed, use one pillow between your knees and one under your head to keep your spine aligned and increase your comfort.
- When lying on your back in bed, use one or two pillows under your knees and one under your head. Try to avoid using extra pillows to prop your head

and upper back since this will put you into a rounded upper back position. But, if you already have a rounded upper-back posture with a forward head, you may need two pillows to support your neck comfortably.

- When getting out of bed, reverse the steps you used to get into bed (above):
  1. Keep both arms in front of you.
  2. Pull in your abdomen in and breathe as you roll onto your side toward the edge of the bed.
  3. With your abdomen tight, push yourself upright using your lower hand. As you do this, lower your feet to the floor in one smooth motion. You should now be in a seated position.
  4. Sit on the edge of the bed for a moment or two before you stand up. Always use your arms to help you sit up. This protects your back.

## SAFE EXERCISE FOR FRAGILE BONES

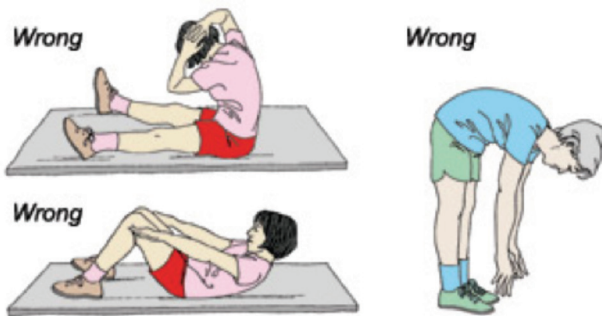
**Ask your doctor if it is safe before beginning any new exercise program.**

Exercise keeps you strong and healthy. We all need regular heart-pumping activity to build and preserve strong muscles and bones. However, some exercises can do more harm than good in people with fragile bones. Weight-bearing exercises can be dangerous for easily broken bones; so can forward bending and twisting; jerky, rapid movements; and impacts of any kind.

### EXERCISES TO AVOID:

- Sit-ups and abdominal crunches
- Bench presses

- Standing or seated hamstring stretches
- Curls (weight lifting)
- Using elliptical trainers
- Jumping rope
- Running/jogging
- Golf (may be able to modify swing to make safer)
- Tennis/racquet ball
- Bowling
- Yoga/Pilates postures that require twisting at waist and/or forward bending



### BETTER OPTIONS FOR PEOPLE WITH FRAGILE BONES

- Controlled dance
- Back-safe yoga
- Tai Chi
- Swimming
- Balance exercises (see below)
- Posture exercises (see below)
- Functional exercises (see below)

Although beneficial to overall health, aerobic exercise, such as walking, is not enough to prevent falls and fractures if you have osteoporosis. You also need balance and strength training. Exercises that strengthen the muscles in your legs reduce your chances of falling and breaking a bone. Gentle balance and posture exercises strengthen the muscles supporting your spine. This improves balance and protects your bones from injury during normal daily activities. Some of these exercises include:

- Muscle-building, weight-bearing, and resistance exercises including:
  - Lifting weights using back-safe position and technique
  - Pulling elastic exercise bands

- Using weight machines
- Lifting your own body weight, such as one-foot stands and toe rises
- Balance exercises that strengthen legs and challenge balance, such as Tai Chi or slow/controlled dancing
- Posture exercises that strengthen back extensor muscles
- Functional exercises based on safe methods for everyday activities, such as getting up from a chair or climbing stairs



### HOW MUCH SHOULD I EXERCISE?

#### Weight-bearing exercises

30 minutes on most days of the week. Do a single 30-minute session or multiple sessions spread out throughout the day.

#### Muscle-strengthening exercises

Two to three days every week. They can be done all at once or in multiple short sessions. You can do your full body or one body part per day. *(For example, arms one day, legs the next, and trunk the next.)*

#### Balance, posture and functional exercises

Every day or as often as needed. Focus on area of most need: If you have fallen, focus on balance exercises. If your back is curved, focus on posture exercises. If you have trouble climbing stairs or getting up from the couch, do more functional exercises. Exercises can be performed at one time or spread throughout the day.

## BALANCE EXERCISES

**Ask your doctor if it is safe before beginning any new exercise program.**

Many fitness centers, community centers and other organizations offer balance exercise programs, such as Tai Chi classes. Balance exercises can also be done at home.

### WHO SHOULD DO BALANCE EXERCISES?

Balance exercises are especially important if you have fallen during the past year or if you lose your balance while doing regular daily activities.



## HOW OFTEN SHOULD YOU DO BALANCE EXERCISES?

You can do balance exercises every day. You can perform them in one session or spread them throughout the day. Below is an example of a balance progression exercise you can do at home.

### BALANCE TRAINING PROGRESSION

*Read all of the information about the Balance Training Progression before getting started.*

Your legs and feet should feel a little wobbly. This shows your balance muscles are getting a workout. However, if you ever feel like you might fall, STOP AND SIT DOWN.

#### Progression

1. The first time you do this exercise, hold onto a stable chair or table with **both hands**.
2. When you can do it all the way through without wobbling, hold on with only **one hand**.
3. When you are steady with that, progress to touching the chair or table with only your fingertips and then only one **fingertip**.
4. When you don't wobble with only one fingertip, do it with your **eyes closed** or with both **hands two inches above the chair or table**.
5. When you are solid all the way through, you can graduate to **eyes closed AND both hands above the chair or table**.

Hold each level for **20-30 seconds**

- **Level 1 Feet together:** Stand with feet next to each other, legs tight together.
- **Level 2 Semi-tandem:** Stand with one foot in front but slightly to the side of the other and the inside edge of your front heel touching the inside edge of the big toe of your back foot.
- **Level 3 Tandem:** Stand with one foot directly in front of the other like you are standing on a tight rope.
- **Level 4 Single leg stance:** Stand on one leg.
- Do this exercise once every day.

This exercise should not hurt while you do it or make your muscles sore for more than two days.

*If it hurts or if you feel like you might fall, STOP and SIT DOWN.*

## POSTURE EXERCISES

*Ask your doctor if it is safe before beginning any new exercise program.*

Good posture starts with your ears over your shoulders, your shoulders over your hips, your hips over your knees, and your knees over your ankles. Posture exercises can help you reduce rounded upper back or “sloping” shoulders. These exercises can also help prevent broken bones in your spine. Doing a variety of posture exercises can stretch and strengthen the muscles in your upper body, abdomen, back, and lower body.

### WHO SHOULD DO POSTURE EXERCISES?

Good posture is important for everyone. Posture exercises are especially important if your head is angled forward, your shoulders are rounded, or your spine is curved..

### HOW OFTEN SHOULD YOU DO POSTURE EXERCISES?

You can do posture exercises every day. You can perform these exercises at one time or spread them throughout the day.

Below is an example of a posture exercise that stretches the shoulders, flattens the upper back, and improves rounded shoulders.

### CORNER STRETCH EXERCISE EXAMPLE\*

Read all of the information about the Corner Stretch before getting started.

1. Stand in the corner of a room with your arms bent at a 90° angle at shoulder level and hands touching the walls (see picture below for proper position of head, arms and legs).
2. Step one foot forward, letting that knee bend.
3. Shift your weight onto your front leg, while pressing your head and chest toward the corner. You should feel a light stretch in your shoulders. Look at the corner of the wall at chest level to avoid overextending the neck.
4. Hold for 20-30 seconds.
5. Stand up straight and switch feet.
6. Repeat the exercise on the other side.
7. Do this exercise twice on each side three times per week.

This exercise should not hurt while you do it or make your muscles sore for more than two days.

***If it hurts or if you feel like you might fall, STOP and SIT DOWN.***

## FUNCTIONAL EXERCISES

***Ask your doctor if it is safe before beginning any new exercise program.***

Functional exercises are based on activities you do every day, such as climbing stairs.

### WHO SHOULD DO FUNCTIONAL EXERCISES?

If you struggle to do everyday activities, such as standing up from a chair or climbing stairs, you should do functional exercises. Also, if you have recently been inactive due to a broken bone, surgery, an illness, or other reason, you may also benefit from these exercises.

### HOW OFTEN SHOULD YOU DO FUNCTIONAL EXERCISES?

You can do functional exercises every day. You can do them in one session or spread them throughout the day. Below is an example of a functional exercise that helps with safety when getting up from a chair to a standing position. It also strengthens legs.

#### CHAIR RISE EXERCISE EXAMPLE.\*

***Read all of the information about the Chair Rise Exercise before getting started.***

1. Sit on the front edge of a chair
2. Keep your knees and feet hip-width apart at all times.
3. Use the strength of your legs to rise to the standing position.
4. Gently sit back down without using your arms. (It may be helpful to cross your arms over your chest to prevent using them.)
5. If you can't do this without using your hands, place a pillow on the seat of the chair (underneath you) to make it a bit easier.
6. The goal is to stand and sit 10 times in a row. Once you can easily do a set of 10, remove the pillow or move the exercise to a lower chair to make it harder.
7. Do this exercise once a day.

This exercise should not hurt while you do it or make your muscles sore for more than two days. ***If it hurts or if you feel like you might fall, STOP and SIT DOWN.***

## PREVENTING FALLS TO PREVENT FRACTURES

When you prevent falls, you prevent fractures. Avoiding falls takes good balance, strong legs, and general fitness. It also takes attention to things you might not think of, things like cataracts, throw rugs, bunions, shadowy staircases, untied shoelaces, and skipping lunch (makes you lightheaded). These things have two common features: they all cause falls, and they all can be corrected. Learning the safe ways to do things, increasing strength and flexibility, correcting vision problems, and getting rid of tripping hazards can go a long way to reducing falls, fractures, and subsequent disability.

### WHY DO PEOPLE FALL?

**Some of the reasons people fall are:**

- Tripping or slipping due to loss of footing or traction
- Slow reflexes, which make it hard to keep your balance or move out of the way of a hazard
- Balance problems
- Weak muscles
- Poor vision
- Illness
- Taking medicines that cause dizziness
- Drinking alcohol

**Medicines that may increase the risk of falls are:**

- Blood pressure pills
- Heart medicines
- Diuretics (water pills)
- Muscle relaxants
- Sleeping pills

**Drinking alcohol can lead to a fall because it can:**

- Slow your reflexes
- Cause you to feel dizzy or sleepy
- Upset your balance
- Cause you to take risks that can lead to falls

## HOW CAN YOU PREVENT FALLING?

When walking outside, use a cane or walker. Be sure your snug-fitting shoes with non-slip soles. Avoid crepe and other sticky soles; they can trip you up. Be aware of your surroundings. Avoid slippery surfaces. Put down gravel on your driveway; carry kitty litter in your pocket for icy patches on the sidewalk; and/or walk on the grass when sidewalks are slick.

To prevent falls indoors, keep your house free of clutter, especially the floors. Position your furniture so there is a clear path through every room. Get rid of any and all tripping hazards. Increase the wattage in your lightbulbs. This is especially important in stairways. Stairs are a particular hazard. Handrails should be installed on both sides if possible, carpeting should be tacked down tightly with no bumps or loose edges. If you have carpeting, make sure it is tacked down securely. Make sure area rugs have skid-proof backs. In the kitchen, keep a sturdy stepstool with a handrail and wide steps to help you safely reach top shelves. In the bathroom, install grab bars near tub, shower, and toilet. Use a nonskid bath mat in the shower or tub. To avoid tripping in the dark, keep a flashlight next to your bed along with a cordless phone. This serves two purposes: you won't have to rush to the phone when it rings and you can call for help if you fall.

## HOW CAN YOU PREVENT BROKEN BONES IF YOU FALL?

Sometimes you cannot prevent a fall. However, falling the right way can help you avoid a broken bone. Try to fall forward or backward (on your buttocks). Falling to the side may break your hip. Use your hands to catch yourself or grab things around you to break a fall. Some people wear extra clothes to pad their hips or use special hip pads.

## SUMMARY

Exercise and good nutrition are critical to the health of everybody – even more important for those of us with bone loss and fractures. They are not, however, sufficient to preserve bone health and prevent fracture in people with osteoporosis. Pharmacologic antifracture therapy is necessary, in addition to identification and correction of any other modifiable causes of bone loss. Exercise

and good body mechanics can improve quality of life and prevent falls. The right kind of physical activity builds strength and improves function. NOF strongly encourages people with osteoporosis to pursue healthy physical activities that can safely be performed without overloading fragile bone.

## RESOURCES

For additional information, visit the NOF Web site at [nof.org](http://nof.org). There you will find newsletters, handbooks on exercise and safe movement, ant-fracture medications, access to support groups, and more. Additional resources are listed here.

### HOW TO SAFELY DO EVERYDAY ACTIVITIES (VIDEO)

Patient education published by Osteoporosis Canada. Online at: <http://www.osteoporosis.ca/after-the-fracture/videos/>

### WWW.NOF.ORG (WEBSITE)

National Osteoporosis Foundation's website makes available a wide range of publications for patients and professionals:

*Health Professionals Guide to Rehabilitation of the Patient with Osteoporosis*  
*Boning up on Osteoporosis: A Guide to Prevention and Treatment of Osteoporosis*  
*Protecting Your Fragile Spine* (Signs and symptoms of spine fractures and how to prevent them) available at [nof.org](http://nof.org).

### MOVE FORWARD™

Patient education website of the American Physical Therapy Association (APTA) from which you can access information on osteoporosis and physical therapy including exercise videos. [www.moveforwardpt.com](http://www.moveforwardpt.com)

### STAND TALL (EXERCISE VIDEO)

For-purchase videos produced by the APTA's Academy of Geriatric Physical Therapy. Available at [www.geriaticsppt.org/store/](http://www.geriaticsppt.org/store/)

### FRAILTY.NET (WEBSITE)

Frailty.net is an educational website on frailty for geriatricians, primary care physicians and other health



care professionals involved in the care of older persons. Frailty.net is endorsed by the International Association of Gerontology and Geriatrics and its Global Aging Research Network, and it is supported by *The Journal of Frailty & Aging*. <http://www.frailty.net/frailty-toolkit/diagnostic-tools>



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