Bone Across a Long Life

What drives bone density, decade by decade

An Infuse Health publication

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1. Introduction

Most adults under fifty don't think about their bones. Bones, in the everyday imagination, are the inert scaffolding the rest of the body hangs off — a fixed thing, set in childhood, not a tissue that responds to anything you do or don't do. That picture is wrong. The longer you carry it, the later you arrive at the conversation about bone density — and the less of your peak you have left to work with by the time you get there.

This guide is for the reader who wants a working understanding of bone density across a long life, whether or not a recent scan has prompted the question. It assumes you've heard the word *osteoporosis*, the brittle-bone diagnosis most people have at least a vague picture of. It doesn't assume you've heard *osteopenia* — the earlier, less severe stage of the same condition — or *DEXA*, the scan that measures bone density and reports a result against age and sex-matched comparisons. The guide defines those terms as it uses them.

The angle is wider than the standard got-a-result, what-now conversation. It looks at bone across the whole arc — the years before perimenopause when peak density is still being held; the steep stretch around menopause when changes accelerate; the decades after, when training stops being insurance and starts being the active lever; and the older years, when the conversation broadens out from density alone to include the falls that cause most fractures. The aim is a working mental model of bone over decades, so the choices you make about training at any stage are made in context rather than in response to a number on a recent scan.

If you've already had a low DEXA result, the rest of this guide still applies — bone responds to load at every stage, and the model in the chapters that follow is what underpins the training. For a more focused walk-through of what to do

next specifically with osteopenia, our blog post *Strength training for osteopenia: what actually helps* is the companion piece, and worth reading alongside this one.

One last thing before we start. This guide is written by a senior coach explaining something to a smart adult who asked. It's not a textbook, it's not a sales pitch, and it's not the kind of motivational piece that promises a rebuilt skeleton in six weeks. Bone responds to load. The mechanisms are real, the evidence is solid, and the practical work is available. The honest version is also the useful one.

2. How bone actually works

The most important thing to understand about bone is also the thing most people don't know: it is alive.

Bone is not the dry, set-in-childhood scaffolding most people picture. It is a living tissue, biologically active in the same sense that muscle and skin are biologically active, and it is in continuous turnover throughout your entire life. Two cell populations do this work. *Osteoclasts* break down old bone, dissolving the mineralised matrix and clearing the site. *Osteoblasts* follow behind, laying down new bone in its place. The skeleton you have today is not the same skeleton you had ten years ago. Most of its mineral content has been replaced, brick by brick, in a process running quietly beneath everything else your body does.

Through your twenties and into your early thirties, the laying-down outpaces the breaking-down. Bone mass climbs to a peak somewhere in the late twenties to early thirties. From that peak, almost everything that follows is a story about how slowly — or how quickly — density is given up. The peak you build sets the ceiling. Most of what training does after that is influence the slope of the line down.

> *The skeleton you have today is not the same skeleton you had ten years ago.*

What drives the cells to act

If bone is in continuous turnover, the question is what drives the balance between the breaking-down and the laying-down. The answer is mechanical load. Bone is a tissue that adapts to the forces it is asked to carry — more accurately, to forces *above what it has already adapted to*. The technical name for this is *unaccustomed strain*. Loads the bone is used to are filed under

maintenance. Loads that exceed what the bone has previously adapted to are read as a signal: more material is needed here. Osteoblasts get the message, and density goes up.

This is the same mechanism that drives muscle adaptation. Lift a load you've never lifted before, the muscle adapts. Lift the same load every week for a year, it doesn't. The body responds to challenge, not to repetition of the familiar. Bone follows the same logic, on a much slower timeline, in a tissue that is rebuilt over months rather than weeks.

Two consequences follow from this directly, and they are worth holding clearly because the rest of the guide turns on them.

First: walking, for most adults, does not drive bone density adaptation. It is weight-bearing in the loose sense, in that your bones carry your bodyweight as you move, but the loads involved are well within what the skeleton has long since adapted to. Walking maintains. It does not generally build. (For a profoundly deconditioned adult, walking is meaningfully better than nothing, and the evidence on falls and general health is unambiguous. But walking is not, on its own, a bone density intervention.)

Second: because the body keeps adapting, training that worked five years ago may not be enough now. The load that was *unaccustomed* in 2019 is, by 2024, what the bone is used to. The training has to keep moving. This is why the structure of effective programs is *progressive*: load goes up over time as adaptation occurs. It is also why a coach watching the load and adjusting it matters more, not less, the longer you train.

How bone is loaded

Bone responds not just to the *amount* of load but to the *direction* of it. There are four loading directions that matter. Different training inputs hit different directions, and a complete program addresses more than one.

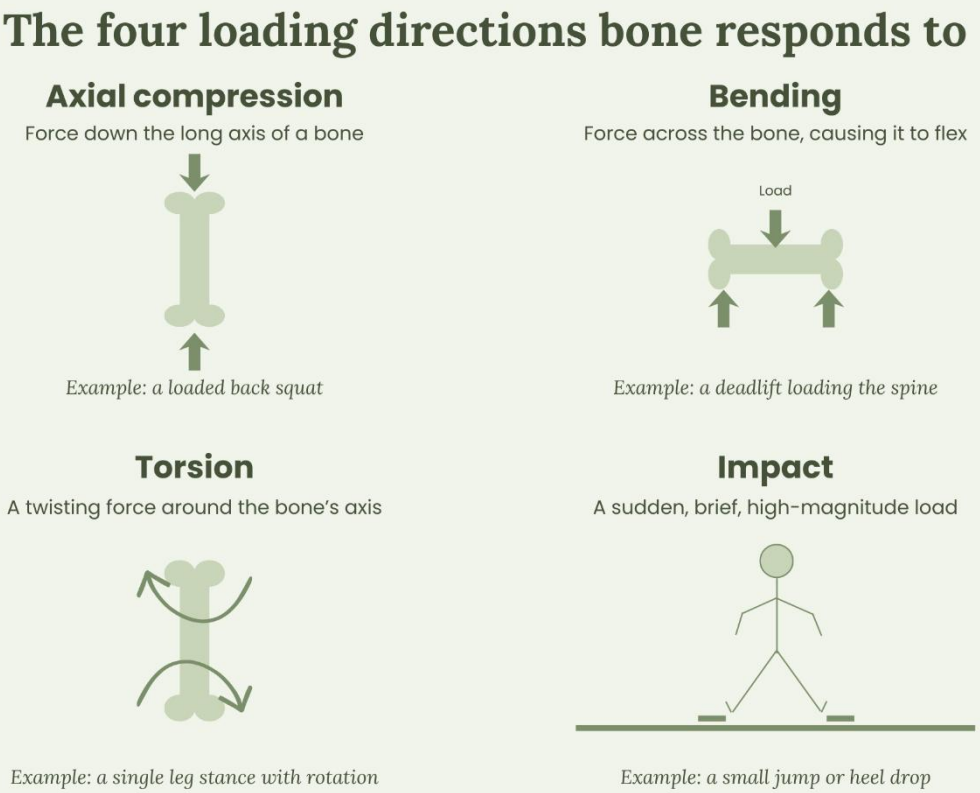

Figure 1 — The four loading directions bone responds to.

Axial compression is force directed down the long axis of a bone. A loaded back squat compresses the spine and the long bones of the legs along their axes. *Bending* is force applied across the bone's length, asking the bone to flex slightly the way a beam flexes under a load placed across it. A deadlift loading the lumbar spine creates significant bending forces. *Torsion* is twisting force around the bone's axis — a single-leg stance with rotation, or a controlled change of direction. *Impact* is a sudden, brief, high-magnitude load — the vertical ground reaction force when you land from a jump, even a small one. Each of these registers as a slightly different signal in the bone, and each contributes to the overall adaptation picture.

Bone density measurements — the kind you get from a DEXA scan — capture the cumulative effect of these loads over time, expressed as bone mineral content per unit area. The DEXA reports a *T-score*, which compares your density to the average for a healthy young adult of the same sex. A T-score above -1.0 is in the normal range. Between -1.0 and -2.5 is *osteopenia* — bones thinner than the young-adult average, but not yet at the threshold for the formal osteoporosis diagnosis. Below -2.5 is *osteoporosis*.

These are statistical categories, not biological cliffs. A T-score of -2.4 and a T-score of -2.6 describe functionally the same skeleton. What matters is the trajectory the number is on, what your overall fracture risk actually is, and — most of all — what you do about it. The score is the prompt. The work is the response.

3. The arc across the decades

Bone density follows a recognisable arc across a long life. The shape is roughly the same for most people — a rise in the early decades, a plateau, a steep drop around menopause for women, and a more gradual decline after. The detail varies. Genetics, body size, training history, nutritional status, hormonal context, and medications all shift the line up or down or change its slope. But the broad shape holds, and knowing where you are on the arc tells you most of what you need to know about what your training should be doing.

The arc described below is the typical *untrained* trajectory — what happens to bone density across a long life when no specific load-based intervention is being applied. The deliberately-trained version of the same arc looks different. From a similar peak, the trained line plateaus longer, drops less steeply through menopause, and in the post-menopausal years (where the evidence is strongest) can hold density at levels the untrained line is well below. The diagram makes the contrast visible.

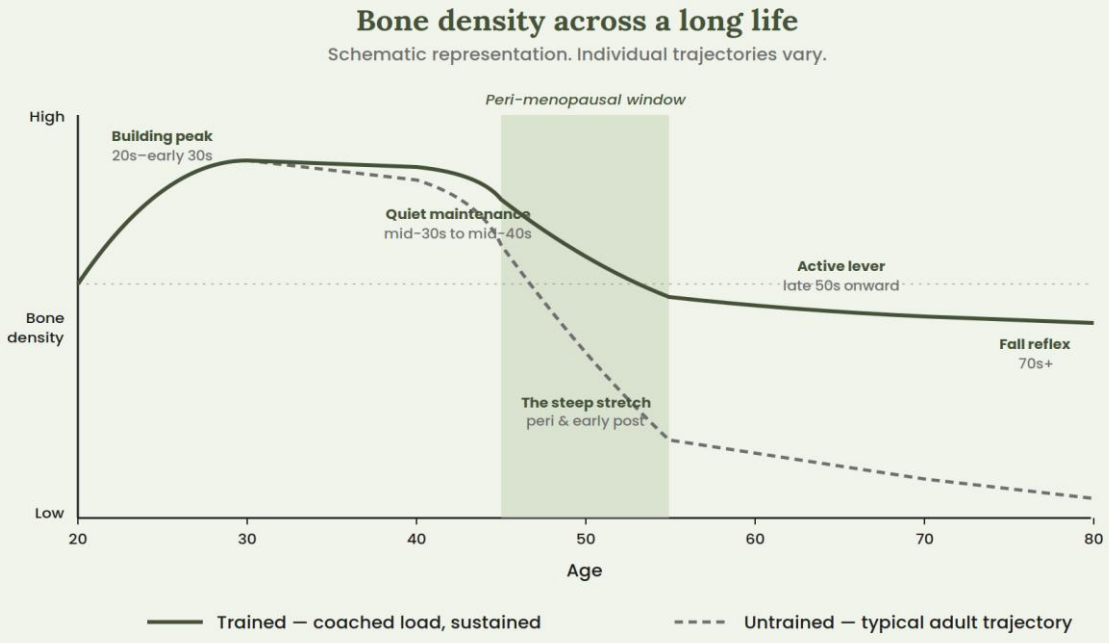

Figure 2 — Bone density across a long life, trained and untrained.

Twenties to mid-thirties: building the peak

Peak bone mass is built in the first three decades. The window closes, for most people, somewhere in the late twenties to early thirties. After that, the question is no longer how much further density can climb but how much of the peak you've built can be held.

The bones laid down in this window matter for the next sixty years, which is a hard thing to feel the urgency of when you are in your twenties. The things that build a high peak are unsurprising: adequate calcium and vitamin D, regular load-bearing activity (sport, lifting, anything that asks the skeleton to carry significant load), enough food to support growth and remodelling. The factors that pull the peak down are just as important to name. Chronic underfeeding (including disordered eating or prolonged restrictive dieting), smoking, long-term use of certain medications (corticosteroids in particular), prolonged amenorrhea, and chronic high-stress states all reduce the peak the bones will reach. If some of these describe your twenties and thirties, that isn't a reason to be discouraged — bone responds to load at every stage. It's a reason to take the training that follows seriously.

If you've not yet had a DEXA scan, the question that's most useful to sit with is what your twenties and thirties were actually like. If you trained regularly, ate enough, didn't smoke, and weren't on long-term medication affecting bone, your peak is probably close to what your genetics allowed. If one or more of those wasn't the case, the peak you built may be lower than it could have been. That doesn't change what you do next, but it does change how seriously you take it. A lower peak means less margin before the post-menopausal slope starts to matter.

Mid-thirties to mid-forties: quiet maintenance

From the early thirties to the mid-forties, density typically holds roughly steady for adults who are reasonably active. The osteoclast-osteoblast balance stays close to neutral. Modest loss is normal in some studies; modest gain is documented in others. The decade is, for most people, quiet.

It is also the window where training habits matter most for what comes after. The body that walks into perimenopause having lifted regularly through its forties is in a different position from the body that walks in deconditioned. The principle of *unaccustomed strain* applies cumulatively. The bone density you carry into the steeper part of the curve is the density you have to work with.

Without training, the arc through this decade is gently downward: small annual losses, well within the normal range, often imperceptible. The trained version of the same arc is held flat or slightly higher, depending on what's loaded and how often.

Perimenopause through the first post-menopausal years: the steep stretch

This is the most aggressive period of bone loss in a woman's life. Oestrogen exerts a protective effect on bone, modulating osteoclast activity and slowing the breakdown side of the turnover equation. As oestrogen declines through perimenopause and crashes through menopause, that brake comes off. Osteoclast activity rises, and bone density falls.

Many women lose roughly 10% of their bone mass in the five-to-seven-year window around the menopausal transition (Ji & Yu, 2015). The annual rate of loss in this window is several times higher than the slow loss of the years before or after. Training that was *fine* in your thirties and forties can fall short here, because the system is now actively losing density at a rate the previous training stimulus wasn't sized to push back against.

The good news, and it is genuine good news, is that this is also the stretch where the *trained* version of the arc starts to depart most visibly from the *untrained* version. The same training principle applies — unaccustomed strain drives adaptation — but the bar for *unaccustomed* has moved up. Training has to actually push the system. Heavy compound lifting, calibrated impact, and consistent progression earn their place here. The published evidence on heavy resistance and impact training in postmenopausal women with low bone density is the strongest evidence we have that the slope of this stretch can be changed.

Late fifties and the post-menopausal settled period

After the steepest part of the menopausal transition passes, the rate of loss slows. The post-menopausal years that follow are characterised by a more gradual decline in untrained adults. Density continues to drop, but more slowly than during the transition itself.

In this window, training stops being insurance and starts being the active lever. The oestrogen-mediated protection is gone. There is no longer a hormonal backstop quietly maintaining density on its own. Whatever density work the bone is going to do, it is going to do in response to mechanical load, and that load now has to come from training. For untrained adults, the line continues drifting down. For trained adults, the published evidence (including the LIFTMOR trial described in the next chapter) shows that density can be held, and in some cases regained, in this window.

Seventies and beyond

In the older years, the conversation broadens out. Density still matters and continues to respond to training, but it is no longer the only variable. The dominant cause of fragility fractures in older adults is not low density alone — it

is *falls*. Most hip fractures, most wrist fractures, and a meaningful share of vertebral fractures happen during a fall that the body did not catch in time.

This shifts the training emphasis. Density work continues. But alongside it, the training that earns its place hardest in this stretch is the kind that develops the trunk and hip reflex that recovers a stumble before it becomes a fall. The protective reflex is trainable. Static balance work — standing on one leg in a quiet kitchen — helps, but isn't the most effective stimulus on its own. The reflex develops most strongly in response to *unpredictable* load. Perturbation drills, where the load on the body is intentionally variable, are what train it most directly.

A note on men

The arc described above is calibrated to the female reader, because the steepest stretch — the perimenopausal window — is hers. Men follow a parallel curve, slower and without the menopausal acceleration, but the principles are the same. Worldwide, roughly one in five men over fifty will experience an osteoporotic fracture in their lifetime (International Osteoporosis Foundation). The signal that drives bone density in men is the same signal that drives it in women: heavy load, applied progressively, sustained over time. The training that works for the women this guide is written for works for men too.

4. What training actually drives bone density

If bone responds to mechanical load, the next question is what kind of load, and how much, and how often. The answers turn out to be more specific than the general advice on most fitness websites. They also have a clear evidence base, much of it gathered in the last decade by researchers who were specifically interested in what kind of training drives density adaptation in adults at risk of osteoporosis.

The LIFTMOR finding, in plain terms

The most-cited piece of recent evidence is the *LIFTMOR trial*, conducted at Griffith University in Queensland and published in 2018 (Watson et al., *Journal of Bone and Mineral Research*). The trial recruited postmenopausal women with low bone mass and randomised them into two groups. One group did eight months of high-intensity resistance and impact training: heavy deadlifts, overhead presses, back squats, and jumping chin-ups with drop landings (the calibrated impact-loading exercise of the protocol), all under coaching. The other group did a low-intensity home-based exercise program, the kind of activity that would be unobjectionable to a cautious clinician.

After eight months, the high-intensity group showed significant improvements in bone mineral density at the spine and femoral neck, both regions of high clinical concern. The low-intensity control group lost density over the same period. The high-intensity group also showed improvements in functional measures (back-extensor strength, leg strength, the timed-up-and-go test). The injury rate in the heavy-lifting group was very low, despite the population being the exact group previously assumed to be too fragile for heavy load.

Some clinicians argue this safety profile reflects the unusually tight supervision of the trial setting, and that community delivery requires equally careful coaching to replicate it.

The framing this trial overturned was the assumption that women with osteopenia or osteoporosis should avoid heavy lifting because their skeletons were too fragile to tolerate it. The trial's finding was the opposite. The heavy lifting was specifically what drove adaptation, and the alternative (light, cautious, home-based exercise) was associated with continued density loss. The signal the bone needed was the signal the cautious approach wasn't delivering.

LIFTMOR is not the only piece of evidence in this picture, and a single trial is never the whole story. But it is the cleanest demonstration of the principle, and the follow-on work in the years since (including extension trials looking at maintenance and at male populations) has generally supported it.

The four training inputs that matter

The training that drives bone density adaptation, and the training that protects against the falls that cause most fractures in older adults, can be reduced to four inputs. Two of them work primarily on density itself. One works primarily on fall prevention. The fourth multiplies all three by sustaining them over time. The matrix below makes the distinction visible.

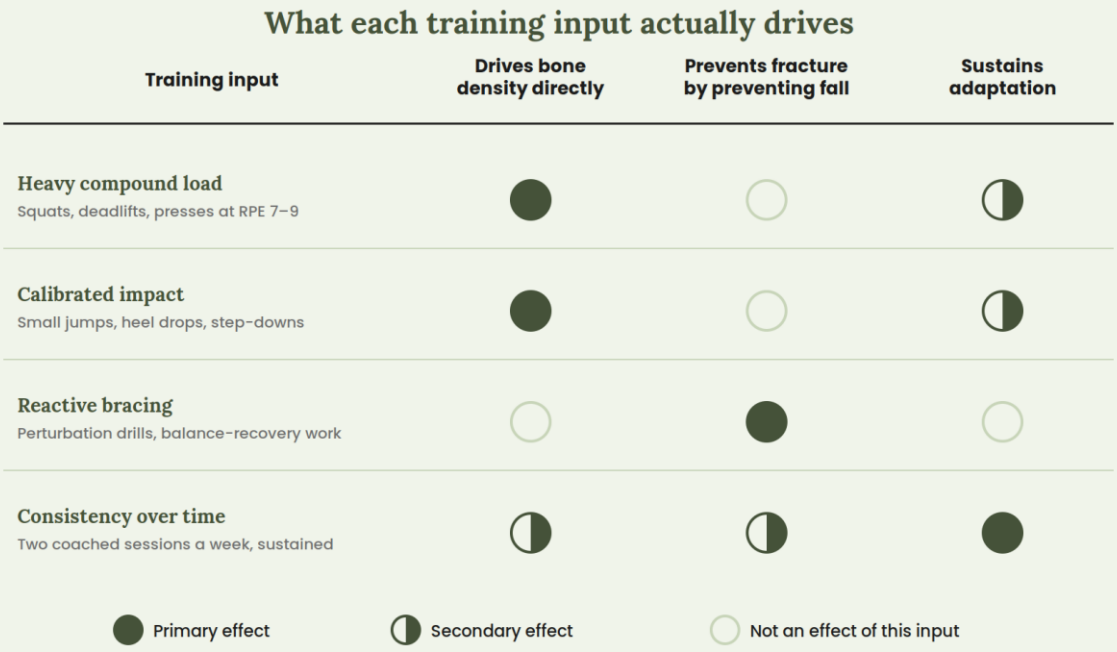

Figure 3 — What each training input actually drives.

Heavy compound load

Deadlifts, squats, and presses are the central lifts in any program oriented toward bone density. They are *compound*, in that multiple joints move together, and they load the spine and hips axially, in the directions where density loss is most consequential. The load has to be heavy enough to provide an unaccustomed strain signal. In practice, that's usually expressed as RPE 7 to 9, a rate of perceived exertion where the last repetition of a set of five is genuinely difficult, on a scale where 10 is the absolute maximum effort the lifter could give.

Light weights for high reps do not deliver the same stimulus. They build muscular endurance. They do not, in adults whose skeletons have long since adapted to bodyweight loads, push bone toward density adaptation. The intensity has to be real, and the rep range has to be low enough that the intensity can actually be sustained for the working sets.

The published evidence is most consistent on this point: heavy, low-rep, compound work, applied progressively over months. Sets of five at high effort, three lifts a session, two or three sessions a week. The specifics of programming get adjusted to the person; the principle stays the same.

Calibrated impact

Vertical ground reaction force (the load that arrives in the bones when a foot strikes the ground after a fall, a jump, or even a step down from a height) is its own bone density signal. The brief, high-magnitude nature of impact loading appears to register in bone tissue separately from the slower, sustained loads of resistance training. Including impact alongside heavy compound lifts produces a more complete stimulus than either alone.

The word *calibrated* is doing real work in this section. Impact for an adult with significant fracture risk is not the same as impact for a forty-year-old returning to training after a quiet decade. For some readers, calibrated impact is a small jump and a controlled landing. For others, it is heel drops: rising onto the balls of the feet and dropping the heels firmly to the floor. For others still, it might be controlled step-downs from a low box. The progression matters, and the starting point matters more. Coached settings exist precisely so the progression and the starting point can be matched to the individual rather than the average.

Reactive bracing

Reactive bracing is the input most often missed in general fitness advice, and the one that becomes most important in the older years. Most fragility fractures in older adults do not happen during exercise. They happen during a fall: a stumble on a kerb, a slip in the kitchen, a misjudged step in a dim hallway. The fracture is the consequence of the body not catching the fall in time.

The protective reflex (the trunk and hip muscles bracing fast enough to recover balance, or the arms extending to break a fall in a way that protects the wrist and hip) is trainable. *Reactive* is the operative word. The reflex develops in response to *unpredictable* load. Static balance work, where the body knows what's coming, helps — but it's not the most effective way to train the reflex on its own. Perturbation drills, where the load on the body changes in a way the trainee can't fully anticipate, are what reach it most directly.

Reactive bracing does not drive bone density. That is worth saying directly because the four inputs are sometimes lumped together as if they all do the same thing. Reactive bracing prevents the fall that causes the fracture. It is the second half of the bone safety equation, and a complete program addresses it deliberately.

Consistency over time

Bone remodels slowly. Meaningful changes take months, not weeks. Most clinical guidance, and most of the published trial evidence including LIFTMOR, points to at least two coached sessions a week as the working minimum to drive adaptation, with the adaptation continuing as long as the training does.

Stop training, and the adaptation reverses. The skeleton goes on responding to whatever load it is asked to carry, and load that has been removed is read as a signal in the other direction: the bone is no longer being asked to support what it was, so density drifts back toward what the new lower load demands. The implication is that bone density training is not a course you complete. It is a habit that earns dividends as long as it is sustained.

Coached intensity is the safety variable

Worth stating explicitly, because it inverts the common assumption that *light is safer than heavy*. The published evidence on heavy lifting in older adults with

low bone density is clear: heavy lifting in a coached, observed, progressively-loaded setting is safer than light lifting done with poor positions and no oversight. The intensity is real, but the load is calibrated to the person, not to the average of the room. Form is observed every set. Progression is paced.

The training that drives density and the training that injures someone are not the same training; they only look similar from the outside. The variable that separates them is coaching. It is also why the practical advice in this guide stops short of prescribing a program. The guide describes the qualities effective training has. The program (which lifts, in which order, with what loads, progressing how) is a coached decision, calibrated to the individual.

A brief word on calcium, vitamin D, and walking

Calcium and vitamin D supply the raw materials for bone formation. Without adequate intake, the body cannot rebuild bone effectively. The Australian guidance, as summarised by the RACGP osteoporosis guidelines, recommends around 1,300 mg of calcium per day for adults at higher risk of osteoporosis, primarily through diet, with adequate vitamin D (supplemented if blood levels are low) and adequate protein. Protein matters for the bone matrix as well as for the muscle that loads it.

These are necessary inputs. They are not sufficient on their own. Supplying raw materials is not the same as triggering construction: you can have plenty of bricks and no instruction to build a wall. The instruction (the signal that tells bone to actually adapt) is mechanical load. Walking, calcium, and vitamin D are upstream of the signal. They support whatever density work the load actually drives. They do not replace it.

5. How to think about training at your stage

The arc and the four training inputs together give a model. A model is only useful if it lets the reader make a different decision than they would have made without it. This chapter is the conversion: how the model translates into a way of thinking about your own training, knowing your stage on the arc.

The point is not to prescribe a program. It is to tell you what the priority is at your stage, what changes about the training as you move through the stages, and what the cost is of treating an earlier stage's advice as if it were still good enough.

In your forties: getting ahead

If you are in your forties and your DEXA is normal, or you've never had one, you are almost certainly still in the *quiet maintenance* part of the arc. Density is broadly being held. The window before perimenopause is the cheapest insurance available, in this sense: the unaccustomed-strain signal works just as well in your forties as it does later, and acting on it now means you arrive at the steeper part of the curve from a higher starting point.

The priority at this stage is to establish the loading habit. Two coached sessions a week with compound lifts, progressed steadily, supplemented with some form of impact work and some form of balance-recovery training. Nothing in the prescription is dramatic; the work is in the consistency and the progression. The cost of waiting is that the same intervention applied later starts from a lower base, and the years between when it could have started and when it did are years of small, accumulating losses that didn't have to happen.

Late forties through mid-fifties: through the steep stretch

This stage is where the model matters most, because it is where the intervention has to actually push the system. The general fitness training that was sufficient through your forties — the group fitness routine, the regular walks, the weights workout that hasn't really progressed in five years — was sufficient against a slow-moving baseline. The baseline is no longer slow-moving. Active loss is happening. Training that holds steady against a steady baseline does not hold steady against a falling one.

The training that earns its place in this window is heavy, progressive, and sustained. It does not have to be six days a week. Two or three coached sessions consistently is the working figure from the published evidence. The intensity, though, has to be real: RPE 7 to 9 sets of five on the central lifts, loads tracked, progression visible, calibrated impact alongside the lifts. Introducing reactive bracing work is also worthwhile in this stretch, even though falls are not yet the dominant fracture mechanism, because the reflex develops slowly. Arriving at seventy with twenty years of trained reactive bracing is a different proposition from starting it then.

Hormonal therapy decisions sit in this window for many readers, and they are the doctor's lane. HRT has documented effects on bone density and is part of the conversation many women have with their clinician about what to do across the menopausal transition. This guide stays out of that conversation, except to note that exercise and pharmacological options are not in opposition to each other. For some women an integrated approach involving both is the right answer. The question of *whether* and *which* belongs with your doctor.

Late fifties onward: the active lever

Past the steepest part of the menopausal transition, density loss continues at a slower rate in untrained adults. The hormonal protection is gone; what density

work the bone does is going to come from mechanical load. Training in this window stops being insurance and starts being the active lever. It is doing the job nothing else is doing.

The training principle is unchanged from the earlier stage: heavy compound load, calibrated impact, reactive bracing, sustained over time. The starting point is wherever the reader is, which for many adults in this window is *deconditioned*, having not lifted heavy in a long time, or ever. Coached settings exist for exactly this. The first six to twelve weeks of training in this window are rebuilding tolerance to load and re-learning movement patterns; the density-driving work happens in the months after that, sustained for years.

The published evidence (LIFTMOR and its successors) is most directly applicable to this stage. The trial population was post-menopausal women with established low bone density. The result was that density was gained, not just held, over eight months of coached heavy training. That finding sits underneath this stage's priority: the work is real, the timeline is months not weeks, and the population in front of the coach is the population the evidence was generated in.

Seventies and beyond

In the older years, training continues to drive density. The relationship doesn't switch off. But the dominant fracture mechanism shifts to falls, and the highest-leverage training input shifts with it. Reactive bracing, perturbation work, and the strength that supports a fall-recovery reflex earn more emphasis. Density work continues alongside, on the same compound-lift logic, calibrated to where the lifter is.

The cost of *not* training in this window is the cost of arriving at a fall in a body that hasn't been prepared for it. The cost of training is, at this stage, very nearly always lower than the alternative.

A note on individual training history

The arc described in Chapter 3 is the typical curve. Individual trajectories vary substantially. Someone who has lifted regularly for thirty years arrives at fifty differently from someone who hasn't. The principle of unaccustomed strain is individual: the load that pushes adaptation in a long-time lifter is different from the load that does it in someone returning. This is part of why coached settings are doing real work. They read the individual and calibrate to them, rather than apply the average prescription to everyone.

Wherever you are starting from, the right starting point is the one that meets the body where it is and progresses from there. The first weeks are about establishing positions and tolerance to load. The months that follow are where the density-driving work compounds. The pattern is the same across stages. The starting line is what shifts.

6. What to approach carefully

Heavy load, applied progressively in a coached setting, is appropriate for most adults with low bone density. *Most* is not *all*, and the adults for whom the picture is different deserve direct treatment. This chapter names them.

A history of vertebral fracture changes the picture

Vertebral fracture history, particularly more than one previous vertebral fracture, moves the conversation into clinical territory. So does any unhealed fracture of any kind. Heavy axial loading of a previously fractured vertebra is not the right starting point, and the imaging and clearance that would precede a return to loaded training in this context belongs with a clinician, not with a coach.

That reader is different from the *I'm nervous about heavy lifting* reader who might also be reading this guide. Nervousness, for most adults with osteopenia or even osteoporosis, is not a clinical reason to avoid coached heavy lifting; it is a reason coaching exists, and the published evidence on injury rates in coached high-intensity training in this population is reassuringly low. A history of vertebral fracture is a clinical reason. The two should not be confused. If you have one, the right next step is your treating doctor or an exercise physiologist, not a strength class.

Spinal flexion under load

Loaded spinal flexion — toe-touches with weight, weighted sit-ups, loaded crunches — is the training pattern most often singled out as inadvisable for severely low-density spines. The mechanism is straightforward: vertebral bodies are weakest in flexion, and adding load to a flexed spine concentrates compressive force at the front of the vertebra in a way that has been associated with vertebral wedge fractures in vulnerable populations.

This does not mean spinal flexion is forbidden in any context. Day-to-day life involves spinal flexion routinely, and an unloaded spine moving through a normal range under control is not a risk situation. *Loaded* flexion (adding external weight while the spine is flexed) is the pattern that warrants caution in adults with significant density loss. Coached programs for this population avoid it as a default.

Other clinical situations that change the calculation

A T-score deep into the osteoporotic range, particularly when combined with other risk factors — long-term corticosteroid use, certain medications affecting bone metabolism, family history of significant fracture, prior fragility fracture of any kind — calls for clinician involvement before the start of a heavy training program. So does any condition that affects balance independently of bone density (vestibular disorders, certain neurological conditions, some cardiac conditions affecting blood pressure on standing). The line is not that training is contraindicated in any of these situations; it is that the entry point is different and the program design has to account for the additional variable.

In Australia, the clinical pathway for adults whose situation is more complex than what a general strength program can handle is most often via an *exercise physiologist*, a university-trained allied health professional who specifically programs exercise for clinical populations. Where the person in front of a coach has clinical complexity beyond what's appropriate for a general class, the right move is to refer to an exercise physiologist; that is the pathway this guide endorses for readers in that situation.

Pharmacological treatment and HRT

Bisphosphonates and other anti-resorptive medications, denosumab, romosozumab, and (for some women) hormonal therapy are part of the clinical bone-health picture for many people, particularly those with

established osteoporosis or high fracture risk. They are not in opposition to load-based training; the published evidence supports the two working together rather than as alternatives. An integrated approach (appropriate medication where indicated, appropriate training in parallel) is the position most clinical guidance now reflects.

Decisions about whether and which medication are conversations to have with your doctor. This guide stays out of that lane. What it can say plainly is that being on a relevant medication is not a reason to avoid coached heavy training; if anything, the trial evidence suggests that combining medication and load-based training tends to produce better bone outcomes than either alone, though the picture varies across drug classes and study designs.

When to be nervous and when to actually pause

Two things often get confused. *I'm nervous about lifting heavy* is a normal feeling for an adult who has been told their bones are thin, has not lifted before or in a long time, and is being asked to do something that runs against years of cautious advice. That nervousness is what coaching addresses. The first sessions are about establishing positions and getting comfortable with the load and the language. Most adults move through the nervousness in a handful of sessions.

I have a clinical reason to pause is different. A vertebral fracture history. An unhealed fracture. A T-score and risk-factor combination that calls for clinical co-management. A medication context that has flagged specific cautions. These are the reasons for an exercise physiologist or a treating doctor to be in the conversation before the strength program starts. The clinical pause is not a permanent stop — most readers in this situation can train, often well, with the right supervision. It is a different starting point.

7. Training at Infuse Health

Who we are and what we do

Infuse Health is a boutique movement and wellness studio at 4/10 William Street in Adamstown, Newcastle. We work predominantly with adults in their forties, fifties, sixties, and beyond: people who are serious about moving well and staying strong across a long life. The studio is small. Classes are small. Coaching contact is high. Programming is built around the physiology of the people in front of the coach, not generic class plans.

Four programs in the studio's regular timetable connect directly to the topic of this guide. *Bone Defence* is the program built around the LIFTMOR-style evidence: a strength program designed around the movements most predictive of bone density outcomes in post-menopausal women — loaded spinal extension, single-leg work, overhead pressing, and balance-recovery reflex training. It is not a generic strength class with a different name. The class is 45 minutes, capped at eight participants, and runs multiple sessions a week (the current schedule is on the timetable at infusehealth.au).

Movement & Strength is our coached, full-body class built around bodyweight strength and movement skill — pulling, pressing, hanging, squatting, locomotion — with selective external load through barbells, kettlebells and dumbbells where bodyweight scaling can't create enough stimulus. Programmed in six-week blocks. It builds the joint resilience, balance, and movement quality that loaded strength work draws on. *Longevity* is the program for the wider physical-capability arc: the broader picture of what training for life past fifty looks like, on the same coached basis.

Iyengar yoga sits alongside the strength work as the discipline that develops mobility, body awareness, and breath in a structured, classical form. Pranayama is taught as a distinct and structured component, with the

classical Iyengar sequence preserved: asana, then breath, then stillness. The disciplines share a space and a philosophy at Infuse Health, not a syllabus. Each is taught by practitioners specifically qualified in it, and the depth lives within each practitioner's lane rather than being spread across generalists.

Sessions are coached, not supervised — there is a difference, and members notice it. Classes are deliberately small, sized so technique can actually be observed and adjusted rather than cued generically. Programming is periodised in six-week blocks for the strength classes, with load tracked session to session so progression is visible.

Workshops and events run from time to time alongside the standing class timetable. Some are led by our own teachers going deeper into a specific topic — foot health, breath under load, fall prevention — the kind of subject that benefits from a few hours rather than the few minutes available within a class. Others are led by visiting teachers. Workshops are for members and prospective members who want to spend more time on a particular practice in a properly facilitated context.

Who trains with us

Some members are returning to training after a long break. Others have been training intensively in commercial-gym, F45, or CrossFit settings and have arrived at a point where what they're looking for has changed: they want something that builds the whole system, not the next personal record. Some come because they want structure to support an active life: bushwalking, tennis, pickleball, the things they actually do.

Others come with a specific medical or clinical trigger. A DEXA result showing low bone density. A physiotherapist referral for shoulder or knee or back. A GP mention of bone density, sarcopenia, blood pressure, or blood glucose. A joint or shoulder issue that's limiting other training. Post-surgical recovery. Specific

health conditions being managed: osteoporosis, hypertension, type 2 diabetes, joint replacement.

What members have in common is that they want to understand what they're doing and why. They are not in the room for novelty, intensity for its own sake, or aesthetic outcomes alone. If you've read this guide to the end, you're probably that kind of person. That's exactly who we work best with.

How to find us

The studio is at 4/10 William Street, Adamstown NSW 2289. The first step for new members is a phone or email conversation, on (02) 4049 8134 or hello@infusehealth.au. It is not a sales process. It is a conversation about what you're working with, what you're working toward, and which classes (if any) suit you. Some people who have this conversation don't end up training at the studio because the fit isn't right, and that's fine. The conversation matters because understanding the starting point makes the first few weeks materially more useful than walking in cold.

If you'd like to try the work this guide describes, the practical pathway is our 4-week intro. It gives you access to Bone Defence as the central class, with Movement & Strength, Longevity, and Iyengar yoga around it: the picture of strength, balance, mobility, and breath that a complete approach to training for the long arc actually involves. Details and the current pricing are at infusehealth.au.

8. A Final Word

Bone is responsive tissue. The skeleton you have today is not the skeleton you had ten years ago, and it is not the skeleton you will have ten years from now. What load it is asked to carry, sustained over time, is the largest single variable you have any direct say over.

The arc is real. The mechanisms are well-described. The evidence on heavy resistance and impact training in adults with low bone density, including in the population previously assumed to be too fragile for it, is the most actionable piece of evidence the field has produced in the last decade. None of that requires you to do something dramatic. It requires you to do something specific, and to keep doing it.

If you take one thing from this guide and act on it, let it be this: start loading deliberately, in a coached setting, two or three times a week, sustained. The intensity has to be real. The progression is the work. The timeline is months and years, not weeks. That is the whole prescription, in plain terms.

If you'd like coached help building that into a training life that compounds across decades, you know where we are.

For the life you actually live.

Infuse Health

4/10 William Street, Adamstown NSW 2289

(02) 4049 8134

hello@infusehealth.au · infusehealth.au

References and Further Reading

The following sources informed the research and clinical claims in this guide. Citations are kept brief — author, year, title, journal — sufficient for a reader to locate the original.

Key studies cited

Watson, S. L., Weeks, B. K., Weis, L. J., Harding, A. T., Horan, S. A., & Beck, B. R. (2018). *High-Intensity Resistance and Impact Training Improves Bone Mineral Density and Physical Function in Postmenopausal Women with Osteopenia and Osteoporosis: The LIFTMOR Randomized Controlled Trial*. Journal of Bone and Mineral Research, 33(2), 211–220. The LIFTMOR trial cited in Chapter 4.

Harding, A. T., Weeks, B. K., Lambert, C., Watson, S. L., Weis, L. J., & Beck, B. R. (2020). *A Comparison of Bone-Targeted Exercise Strategies to Reduce Fracture Risk in Middle-Aged and Older Men with Osteopenia and Osteoporosis: LIFTMOR-M Semi-Randomized Controlled Trial*. Journal of Bone and Mineral Research, 35(8), 1404–1414. The follow-on trial in men referenced in Chapter 4.

Ji, M.-X., & Yu, Q. (2015). Primary osteoporosis in postmenopausal women. Chronic Diseases and Translational Medicine, 1(1), 9–13. Source for the perimenopausal bone loss figure cited in Chapter 3.

International Osteoporosis Foundation. Epidemiology of fragility fractures. Source for the worldwide one-in-five male fracture risk figure cited in Chapter 3.

International Osteoporosis Foundation. Exercise for individuals with osteoporosis. Source for the spinal flexion contraindication and broader exercise guidance cited in Chapter 6.

Royal Australian College of General Practitioners. Osteoporosis: Calcium, protein and vitamin D. Source for the Australian dietary calcium guidance cited in Chapter 4.

For further reading

Healthy Bones Australia. The Australian peak body for osteoporosis education and advocacy, formerly Osteoporosis Australia. Their consumer-facing resources cover diagnosis, treatment options, and the conversations to have with your GP — useful follow-up for readers wanting more on the clinical management side.

Beck, B. R., and colleagues at Griffith University have published extensively on the Onero program, the clinical translation of the LIFTMOR research into a community delivery model. The peer-reviewed papers cited above are the starting points; the Onero program's own documentation provides the applied detail for readers who want to understand the program logic at greater depth.