Royal Osteoporosis Society

Better bone health for everybody

Strong, Steady and Straight

An Expert Consensus Statement on Physical Activity and Exercise for Osteoporosis

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An Expert Consensus Statement on physical activity and exercise for osteoporosis

Expert Exercise Steering Group

CHAIR: Professor Dawn Skelton, Professor in Ageing and Health, Glasgow Caledonian University

Coordinator and project lead: Sarah Leyland, Osteoporosis Nurse Consultant, Royal Osteoporosis Society

Project officer: Virginia Wakefield, Royal Osteoporosis Society

Professor Karen Barker, Professor of Physiotherapy, University of Oxford

Kate Bennett, Clinical Lead Physiotherapist, Solent NHS Trust, and AGILE Vice Chair, Southampton

Dr Katherine Brooke-Wavell, Senior Lecturer in Human Biology, Loughborough University

Dr Emma Clark, Reader in Rheumatology, University of Bristol, and Consultant Rheumatologist, North Bristol NHS Trust

Rachel Lewis, Clinical Specialist Physiotherapist in Rheumatology, North Bristol NHS Trust

Dr Zoe Paskins, Senior Lecturer and Honorary Consultant in Rheumatology at the Arthritis Research UK Primary Care Centre, Keele University

Professor Jon Tobias, Professor in Rheumatology, University of Bristol; Honorary Consultant North Bristol NHS Trust

Dr Kate Ward, Associate Professor in bone and muscle physiology at the MRC Lifecourse Epidemiology Unit, University of Southampton

Dr Julie Whitney, National Institute for Health Research (NIHR) clinical lecturer (physiotherapy), Kings College Hospital, London

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Contents

Background

Fragility or osteoporotic fractures are common, especially in older age, and have a huge personal impact and economic cost to society.

Fragility fractures cost the NHS an estimated
£4.4 billion per annum

For the individual, these fractures, especially in the hip and spine, can lead to loss of independence, disability and reduced life expectancy.[1] Vertebral fractures[i] in particular are associated with long-term pain and other physical and psychological symptoms.[1 2]

It is widely understood that physical activity and exercise help to make bones strong; however, there is lack of clarity about their role in bone health and the prevention of frailty, and for people with osteoporosis in particular.

Definition of osteoporosis

The term osteoporosis is used throughout this statement as an umbrella term to include someone with low bone mineral density(BMD) in the osteoporosis range (measured using dual X-ray absorptiometry (DXA)) *or* a significant fracture risk (based on fracture risk assessment) *with or without* fragility (low trauma) fractures, including vertebral.

Many guidance documents warn against 'forward-bending', high-impact exercise (often interpreted as anything more than brisk walking) and lifting weights. This is based on a theoretically increased risk of vertebral fracture due to increased force through the bones by high-intensity resistance or impact exercise or increased load on the spine. Previous guidance, originally developed for those with vertebral fracture, has been generalized to all people with osteoporosis.[3] For some health and exercise professionals, uncertainty around what is appropriate or safe persists, and may be accompanied by concerns about liability. As a result, people with osteoporosis often find the advice provided to be inadequate, confusing, varied or inconsistent.[4 5 6]

> *"I paid a personal trainer but he didn't seem to have enough understanding of osteoporosis so I then joined a gym but found the same thing... My main problem is knowing which exercises are best and more importantly, that I am doing them correctly. I'm really struggling with this as I need to get it right."*

Even where the evidence is inconclusive, people with osteoporosis are keen to incorporate non-drug approaches and take control of the management of their condition.

People with osteoporosis want to know:

- whether some types of physical activities and exercise interventions are unsafe and may cause fractures, especially in the spine. [5 6]
- what type of physical activity and exercise they need to do to effectively maintain or improve their bone strength.[7]
- whether and how, they should modify moving, lifting, sports and leisure activities to prevent a vertebral fracture occurring.
- about specific exercise interventions to relieve the pain of painful vertebral fractures.

Without this information, people significantly reduce activity levels, limiting both function and enjoyment.[8] This has adverse implications for their bone health, falls and future fracture risk.

In fact, for the vast majority of adults and older adults, taking part in activities that promote muscle and bone strength is safe and will help maintain or improve function, irrespective of age or health.[9 10 11]

Giving people confidence about physical activity and exercise for osteoporosis by means of authoritative and effective guidance may also prompt an increase in physical activity and exercise. This will have wider beneficial effects on physical, social and psychological health, wellbeing and self-efficacy.[9 12]

i Vertebral (or spinal) fractures as a result of osteoporosis can be 'silent' and cause no pain or symptoms. However, some vertebral fractures cause acute pain at the time of the fracture. In addition (and particularly after multiple fractures), people with a vertebral fracture may experience shortening of the trunk and height loss, leading to abdominal discomfort, long-term back pain, breathlessness, issues with body image and low self-esteem.

Purpose and objective

This document is intended for UK medical and allied health professionals, physiotherapists and other exercise professionals.

It was developed by an Expert Group of clinicians, scientists and practitioners from the UK. The objectives of this document are to:

- clarify the role of physical activity and exercise for bone strength, reducing falls and fracture risk reduction. The focus is on information relevant for those with osteoporosis, although most principles will also be appropriate in terms of wider 'prevention' messages, recognising the importance of physical activity and exercise, together with other lifestyle approaches, to build and maintain bone strength throughout the life course
- explain any safety issues for those with osteoporosis, and especially to address fears of causing fracture (particularly in the spine) whilst engaging in exercise or day-to-day physical activities
- clarify the role of physical activity and exercise to help with the pain and symptoms of vertebral fracture
- promote confidence and a positive approach so that people with osteoporosis do *more* rather than *less* exercise and physical activity
- ensure consistent advice for people with osteoporosis so that they exercise safely and effectively.

This document updates the principles underpinning previous guidance on exercise and physical activity and distils current research evidence on the subject.[13] It is designed for UK health and exercise referral systems.[14] It integrates as far as possible with broader UK Chief Medical Officer (CMO) recommendations about physical activity for health.[9]

Physical activity refers to any bodily movement produced by skeletal muscles that results in energy expenditure.[15] This can be anything from walking to the shops, taking part in activities of daily living such as gardening, or taking part in occasional leisure or sporting activities.

Exercise is defined as physical activity that is planned, structured, repetitive and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective.[15] This could include regular gym or exercise classes or regular and repetitive sporting activities.

This document supplements existing UK clinical guidance with regard to the role of physical activity and exercise in osteoporosis management.[16 17] It endorses the current clinical approach to osteoporosis management – that physical activity and exercise should complement rather than replace the use of pharmacological therapies recommended to improve bone strength for those with a significant fracture risk.

Current empirical evidence

The authors recognise the current limitations of the research evidence as identified in existing guidance.[10] Trials investigating the effectiveness of exercise interventions rarely have clinical primary outcomes (fracture), and rely on proxy measures e.g. BMD measured by DXA or quantitative computed tomography (QCT).

There is also a lack of data relating to men, people with osteoporosis and older frailer people. Research indicates that those with the lowest bone density may have the greatest potential for improvement through exercise; however, those who have frequent fractures may still, in practical terms, not be able to exercise at a frequency, intensity or duration necessary to improve their bone strength to the extent that they no longer experience fractures.[18]

Given the lack and limitation of the research evidence confirming the benefits of physical activity and exercise, the phrase 'promote bone strength' rather than 'improve bone strength' is used throughout this document, unless there is discussion about a specific aspect, such as changes or improvements in BMD, preventing loss of or maintaining bone strength, or reduction in fracture risk. Where the evidence was insufficient or conflicting, the Expert Group reached a consensus based on potential benefits and the key principles derived from other national statements, in order to make recommendations.

Further research is recognised as important;[11 19] research recommendations will be developed in a future document.

Using this document

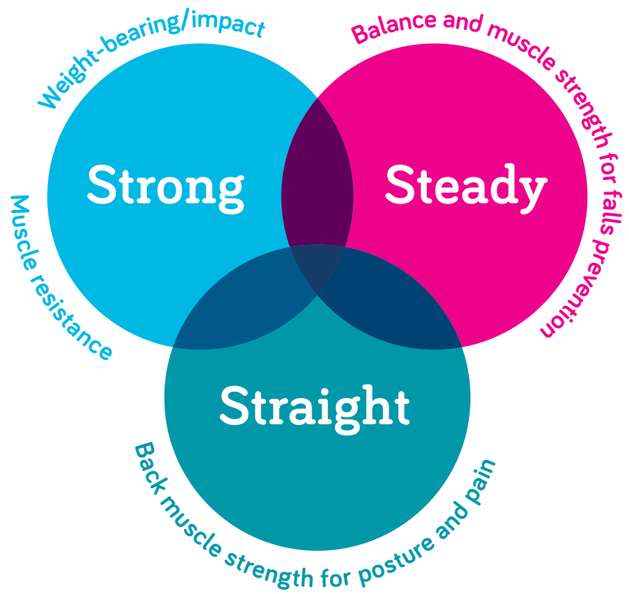
This document is structured around three themes for physical activity and exercise for osteoporosis – **Strong, Steady & Straight** (Figure 1). Recommendations are specified under each theme, where appropriate, for:

- all people with osteoporosis (see p. 4 for definition)
- people with vertebral fractures or multiple low-trauma fractures[ii]
- people who are frail and unsteady or those experiencing falls.

Individual themes will have particular relevance for some individuals according to their needs or preferences, but all are important and should be considered.

Recommendations are made in each section based on either the **evidence reviewed**, marked **E** or **expert consensus**, marked **C** where limited or no research evidence was available.

Figure 1: Physical activity and exercise themes – Strong, Steady and Straight



ii This group has been identified as potentially at more significant risk of vertebral fracture during exercise so some recommendations provided are more cautious.

Executive summary

Principles

Physical activity and exercise have an important role in the management of osteoporosis, promoting bone strength, reducing falls risk, and the management of vertebral fracture symptoms. They should form part of a broad approach that includes other positive lifestyle changes, combined with pharmacological treatment where appropriate.

People with osteoporosis should be encouraged to do *more* rather than *less*. This requires professionals to adopt a positive and encouraging approach, focusing on 'how to' messages rather than 'don't do'. Although specific levels and types of physical activity and exercise are likely to be most effective, even a minimal increase in activity should be encouraged to provide at least some benefit.

The evidence indicates that **physical activity and exercise is not associated with significant harm, including vertebral fracture;** in general, the benefits of physical activity and exercise outweigh the potential risks.

Professionals should **avoid restricting physical activity and exercise unnecessarily according to BMD** or fracture risk thresholds, as this is often unhelpful and may discourage exercise or activities that promote bone as well as other health benefits.

People with painful vertebral fractures need clear and prompt guidance on how to adapt movements involved in day-to-day living, including how exercises can help with posture and pain. Anyone with osteoporosis may benefit from guidance on amending some postures and movements to care for their back.

Key recommendations

STRONG

Outlines the type, intensity (including duration and frequency) or amount of physical activity and exercise needed **to promote bone strength**.

It also addresses safety concerns about the effect of increased impact or muscle loading in causing vertebral or other fractures. This section is relevant for all groups seeking information about how to be physically active and exercise to promote bone strength (see page 10).

Key recommendations

For all people with osteoporosis

- A combination of weight-bearing (with impact) and muscle strengthening exercise is recommended to promote bone strength. Either type alone may provide some benefit, and individual skeletal sites may benefit from one type more than another. **E**
- Variety is important to load the relevant skeletal sites with forces in different directions. People should gradually build up levels of activity and exercise, according to ability and experience, and aim to maintain an exercise regime in the long term. **E**
- Muscle strengthening exercise is recommended to maintain bone strength and, to promote maximum benefit to bone strength, should include progressive muscle resistance training; up to moderate or high intensity is recommended. **E**
- Daily physical activity is recommended, spread across the day, and avoiding prolonged periods of sitting. **C**

In addition:

For people with osteoporosis who do not have vertebral fractures or multiple low-trauma fractures

- Impact exercise up to a moderate level is recommended (e.g. jogging, low-level jumping, hopping). **C**

For people with vertebral fractures or multiple low-trauma fractures

- Exercise at a lower impact level (e.g. brisk walking rather than jumping) is recommended. This a precautionary measure because of potential (but unproven) risks of causing further vertebral fracture in this group.[iii] **C**
- Individualised advice from a physiotherapist at the start of a new programme of exercise or physical activity is recommended to ensure correct technique, at least for those with painful vertebral fractures. **C**

For people with osteoporosis who are frail and/or less able to exercise

- Physical activity and exercise to maintain bone strength should be adapted according to individual ability. **C**
- Strength and balance exercise to prevent falls may be needed to develop confidence and stability before increasing physical activity to promote bone strength. **C**

Full recommendations on pages 13 and 18

iii Moderate impact might be appropriate in some situations for people with good general fitness, if the vertebral fracture didn't occur during impact exercise, if exercise doesn't cause pain, and levels are increased gradually (see p 17 for further details). [C]

STEADY

Describes the importance of physical activity and exercise **to reduce falls and resulting fractures**. This section will be most relevant for people who are frail and/or less able to exercise, people who are prone to falls, and those who have a significant fracture risk and want to increase their physical activity and exercise levels (see page 19).

Key recommendations

For all people with osteoporosis, particularly those with balance problems or over 65 years who don't exercise regularly

- Exercise to improve balance and muscle strength is recommended. **E**

For people with osteoporosis who are already having falls

- Specific and highly challenging balance and muscle strengthening exercises, supervised by a trained health or exercise professional, are recommended. **E**

Full recommendations on page 22

STRAIGHT

Focuses on spine care – keeping the back straight – in a positive approach to bending, lifting and moving safely in order **to reduce the risk of vertebral fracture** associated with day-to-day activities. It also includes advice on developing muscle strength **to improve posture and relieve pain after vertebral fractures**. This section will be most relevant for: 1) people who have concerns about how to adapt movements to reduce vertebral fracture risk, and 2) people with symptomatic vertebral fractures causing pain or postural problems (see page 23).

Key recommendations

For all people with osteoporosis

- Safe techniques for day-to-day moving and lifting are recommended. **C**
- Movements or exercise that involve sustained, repeated or end-range flexion should be amended or avoided unless someone is already practiced with very good muscle tone. **C**
- Exercises to strengthen back muscles are recommended to promote best possible posture and to support the spine. **C**

In addition:

For people with a vertebral fracture causing pain and posture problems

- Daily exercises to strengthen back muscles (focusing initially on endurance by exercising at low intensity) are recommended to reduce muscle spasm, relieve pain, and improve flexibility and posture, with referral to a physiotherapist for tailored advice. **C**

Full recommendations on pages 25-27

STRONG

Physical activity and exercise to promote bone strength and prevent fractures

Muscles, bones and joints are interconnected systems. As we age, maintaining muscle strength helps to prevent bone loss, keep bones strong, and reduce falls risk. Levels of activity may be reduced, but keeping muscles healthy and working well should help to keep bones strong.

Bone is strengthened when muscles and impact forces create a 'load' on the bone that causes adaptations inside.[20 21] Bone is constantly repairing and regenerating, so it can adapt and respond to the regular pulling, twisting and bending that muscles exert on it. This adaptive response is greater the higher the intensity and frequency of force, and in response to force that is 'variable and dynamic'.[22]

Immobility has been established as a major risk factor for fracture. Without the pull of gravity, bone density is reduced. Even with short periods of bed rest for example, bone density and strength are lost rapidly, although this is reversible to some extent with remobilisation.[23]

Impact exercise levels

Lower-impact activity or exercise is a broad term that includes activity in which there is a small amount of impact through the bones, such as walking, side steps and gentle heel drops. Usually, at least one foot remains on the ground.

Moderate-impact activity or exercise* is when a moderate force is created by pushing off and returning to the ground; usually both feet leave the ground but with less height and force than with high impact activity. Examples include running, stride jumps, jump rope, Highland-type dancing, jumps and hops. Some exercise, such as stamping and heel drops with sufficient force, can create moderate impact even though one foot remains on the ground. Sports such as racquet sports, track events, most ball games and martial arts may include moderate impact activity.[11]

High-impact activity or exercise is when a large force is created on returning to the ground, usually from a greater height (e.g. from a higher jump or from a higher jump to a lower level). This includes landings from exertional jumps such as high vertical jumps, star jumps, tuck jumps and drop landings. Sports such as volleyball, basketball and gymnastics may include high-impact activity.[11]

* *In this statement, 'moderate impact' includes running, jogging, skipping, hopping and low-level jumping (from the ground, as opposed to a raised surface, and without exertion, as in star jumps). Although the distinction between moderate and high impact is subjective, a pragmatic distinction is made to aid advice giving.*

Types of exercise

A combination of weight-bearing (with impact) and muscle strengthening (resistance) exercise is important for building, maintaining and improving bone strength (both are sometimes described as 'load-bearing' exercise).

Both impact and muscle strengthening exercise can be provided by day-to-day physical activities, leisure and sports activities or by a specific exercise programme. Moderate-intensity aerobic exercise, as recommended in UK CMO guidance for general health, may strengthen muscles but may *not* involve sufficient resistance to promote bone strength and may not provide weight-bearing impact (e.g. swimming).

UK Chief Medical Officer physical activity guidelines[9]

The guidelines recommend that, to maintain or improve physical and mental health, adults and older adults aim to accumulate 150 minutes a week (20 minutes a day) of moderate-intensity physical activity (i.e. that makes the person feel warmer and slightly out of breath), engage in muscle strengthening activities at least 2 days a week, and avoid prolonged periods of sitting. The guidelines also recommend that older adults at risk of falls engage in balance training activities on at least 2 days a week.

Weight-bearing exercise involves the skeleton bearing the whole weight of the body ('load'), usually through the lower limbs (feet and legs). Moving the body, such as when walking, increases the load and force through the skeleton. This is described as 'impact'. Throughout this document the term 'impact exercise' is used to describe weight-bearing exercise with impact. Impact activity or exercise can be stratified according to the intensity of the impact (see above).

Muscle strengthening (or resistance) exercise is another way to add load, by contracting muscles against an external resistance. This could be applied externally by using lifting a weight, weights machines, wearing a weighted vest, using resistance bands etc. Alternatively, the body's weight provides the resistance, such as in a 'wall press-up' or raising the upper body from a prone position to strengthen back extensors.

Muscle strengthening exercise may help to prevent loss of bone strength; however, progressive resistance training (sometimes called PRT) is necessary to maximise improvements in bone strength.[24]

Progressive resistance training (or progressive overload) involves a gradual increase in resistance or weight in training over time as muscle strength increases, in order to stimulate continued adaptation. In practice, this means exercising to muscle fatigue; for instance, when a weight can be comfortably lifted 12 or more times with good form, the load is increased so that it can only be lifted 8 times.[35]

Progressive resistance training should ideally be supervised, at least initially, by an exercise professional to ensure good technique, both for effectiveness and safety (e.g. how best to avoid exacerbating concommitant arthritic conditions).

Professionals need to help people to find the most beneficial *combination* of exercise, bearing in mind that personal preference and enjoyment are important for successful participation. Those who cannot incorporate both impact and muscle strengthening exercise should nevertheless be encouraged to do what they can, as some benefit to bone strength may be provided by one type of exercise.

Promoting bone strength at specific skeletal sites

As the effects of exercise on bone are site specific, exercises may be needed for different skeletal sites. Whilst not all published studies have clearly indicated the specific exercises employed, examples of some of the exercises that increased bone density (or reduced rates of loss) at particular sites are listed in Figure 2 on page 18.

Research evidence

Types of exercise

- The combination of impact and muscle strengthening exercise best promotes bone strength,[25] as reflected in other national guidance.[10 11 26 27]

Specific sites

- Impact exercise alone maintains or improves BMD in the hip.[28]
- High-intensity muscle strengthening exercise alone may maintain or improve BMD at the hip[25] and spine.[29 30]
- High-intensity muscle strengthening exercise in combination with impact exercise maintains or improves spine BMD.[25 31]
- Improving the strength of back muscles may maintain or improve BMD in the spine and reduce the risk of vertebral fracture.[32]
- There is moderate quality evidence that resistance training with high or low force has a small to medium effect on bone mass in the forearm.[33 34]

Recommendations: Types of exercise

- A combination of weight-bearing (with impact) and muscle strengthening exercise is recommended to promote bone strength. Either type alone may provide some benefit, and individual skeletal sites benefit from one type more than another. **E**
- Variety is important to load the relevant skeletal sites with forces in different directions. People should build up their levels of physical activity and exercise gradually, **according to their ability and experience**, and aim to maintain an exercise regime in the long term. **E**

Site-specific recommendations

- All sites: muscle strengthening exercise that targets all the main muscle groups is recommended to maintain bone strength across the skeleton, and in particular to promote bone strength at key fracture sites (the wrist, spine and hip). **E**
- Spine: A combination of impact and muscle strengthening exercise is recommended, with specific exercises targeting the spinal muscles. **E**
- Hip: impact exercise is recommended. **E**

Exercise intensity, frequency, duration or amount

There is considerable evidence on the effect of increased impact and progressive resistance training on BMD (although evidence on fracture risk is limited).

Frailty and other health conditions may reduce the ability to be active and exercise, especially at higher levels of intensity or impact, although some evidence is reassuring.[36 37] In addition, frail individuals are at a higher risk of fracture but are less likely to undertake physical activity. Reassurance is required to dispel the idea that physical activity and exercise is only useful if vigorous. Bone is lost rapidly during inactivity, and preventing this inactivity-related loss should be a priority. However, it has to be acknowledged that although muscle strengthening exercise improves physical function and maintains independence, the evidence for physical activity and exercise as an intervention to promote bone strength for frail older people remains weak.

> *"A few months after spinal fractures my physio advised using hand weights and gradually increasing the amount I lifted. The hospital doctor disagreed and was firm I should never lift more than a kilo."*

Research evidence

Optimum levels of intensity (both impact or muscle strengthening) and frequency have been described in national guidance from the USA, Canada and Australia and are reflected in this statement.[10 11 26]

Intensity

- Recent evidence suggests that healthy women over 60 years of age with low to very low BMD gained improvements in BMD using high-impact and high-intensity muscle strengthening exercise.[38] However the benefits of high-impact exercise (e.g. exertion jumps, jumping from a height) over moderate impact exercise (e.g. running, jogging, hopping) is unclear.
- Moderate-impact weight-bearing exercise is more effective than low-impact exercise in maintaining improvements in measures such as BMD.[39 40 41 42 43]
- There is evidence that high-intensity progressive resistance training increases spine and hip BMD.[25 44 45 46]
- Observations from population studies suggest that keeping physically active in later life decreases the risk of hip fracture[47] and that less sitting is associated with higher BMD.[48] This suggests that standing and weight-bearing activities may have a protective role in maintaining BMD.[49] However, in the context of an exercise intervention, walking may need to brisker than a usual pace to generate sufficient force to improve BMD.[50] *(Note caution on page 15 about improving stability first.)*
- A recent study found that it was difficult to modify and increase levels of impact in day-to-day weight-bearing activity because of intrinsic factors linked to frailty and sarcopenia, such as gait speed and muscle strength.[51] However, a further study found that reductions in fracture seen with day-to-day physical activity remained after adjustment for risk factors for frailty, such as age, comorbidities, smoking and socio-economic status.[52]

Frequency/duration/amount

- Physical activity and exercise on a day-to-day basis are associated with improved bone strength and a lower risk of hip fracture.[47 53 54] For example, a study of men and women aged 49–83 years identified that regular walking or cycling reduced fracture risk by up to 23% relative to hardly ever walking or cycling.[52]
- Intermittent bursts (1–2 minutes) of moderate impact exercise may be more beneficial to maintain or improve BMD than longer periods of low-impact exercise.[55]
- Two sessions per week of a combination of moderate-impact and high-intensity muscle-resistance exercise,[56] or more frequently for impact exercise alone,[57] was needed to improve bone density.

Other considerations

- There are many groups with different risk factors for fracture for whom this information will be appropriate. Some groups – those with anorexia and 'over exercisers'[58] – will need specific advice. Excessive physical activity and exercise can increase negative energy balance and delay recovery in individuals with anorexia nervosa, who will need an exercise programme individualised by a multidisciplinary eating disorders team.[59] Similarly, those who may be 'over exercisers'/elite athletes will need advice from medical advisers within a sports specialty.

Addressing safety concerns – does exercise cause fragility fractures?

Encouraging people with osteoporosis to participate in physical activity and exercise will, in many cases, require professionals to be reassured (and provide reassurance) that it will not cause a fracture, particularly in the spine. To address these concerns, the Expert Group specifically investigated the question of whether physical activity and exercise may be associated with any harms.

Research evidence and implications for practice

The Expert Group conducted a series of mini reviews of the literature[60 61 62] to support this document and to add to existing guidance[27] that has considered harms.

First, a review was conducted of observational studies, case reports, case studies and non-randomised controlled trials that reported adverse events and safety issues associated with a wide spectrum of physical activities and exercise interventions in people with osteoporosis.[60] The majority of studies reported no adverse events during the physical activity or exercise intervention, apart from muscle soreness and joint discomfort. In two small studies, vertebral fractures were associated with end-range, sustained, repeated or loaded flexion exercises, including sit-ups[63] and some yoga positions.[64] There was also one other fracture (dropping a weight on the foot).

The Expert Group also updated three previously published systematic reviews (to March 2018) looking at exercise for bone strength,[61 25] improving symptoms after vertebral fracture,[65 66] and reducing falls,[62 67] with a view to both efficacy of and harms associated with the interventions. New studies added since the original reviews confirmed efficacy. Overall, there were no reports of significant harms (fractures) associated with the exercise interventions. In particular, there was no evidence of symptomatic vertebral fracture in association with impact exercise or moderate to high intensity muscle strengthening exercise.[61 60] There were, however, modest improvements in quality of life, balance, pain and fear of falling.[65]

In a recent study of high-impact and high-intensity muscle-resistance exercise for people with significantly low BMD, there were no reports of fractures, although the sessions were supervised by an instructor for technique and overall safety (including falls risk).[38] Further follow-up and assessment has not identified any evidence of vertebral fracture in the study group (personal correspondence with Belinda Beck). In a further study, adverse events (both falls and fractures) did not differ significantly between the control and the intervention groups but were more common in those undertaking unsupervised exercise (strength, balance and daily moderate to vigorous physical activity), although still relatively rare.[68]

There is some evidence that brisk walking increased fracture risk in a population already at risk of falls and fracture and who required strength and balance exercises to improve stability before embarking on brisk walking or fatiguing exercise.[67]

Overall, there is little evidence of harm, including fractures, occurring whilst exercising. Furthermore, cases that were identified comprised a mixture of people with and without osteoporosis (as defined by DXA). Bone strengthening exercises are therefore unlikely to cause a fracture (and specifically a vertebral fracture) and do not need to be adapted for those with osteoporosis according to fracture risk or low BMD (including osteoporosis or osteopenia determined by DXA). C

When starting an impact or muscle strengthening programme, factors such as general fitness, previous exercise and comorbidities must be considered. Building up gradually, employing good technique and monitoring both progress and any adverse effects is the best approach. Learning best possible posture and correct technique is recommended as part of any progressive muscle resistance training.

Some sports and leisure activities involve an inherent risk of injurious impact, falling and fracture, such as contact sports, horse riding and skiing. However, for those who practice these activities regularly, the benefits, including enjoyment and benefits to muscle and bone strength, are likely to outweigh the risks, unless people have had multiple fragility fractures or painful spinal fractures. People with osteoporosis may need some reassurance to continue with activities they enjoy.

The Expert Group recommends more caution, however, for people with vertebral fractures or multiple low-trauma fractures, who will have greater general bone fragility and a higher risk of further fracture. A discussion about personal preferences and concerns is recommended to aid decisions about amending or excluding specific leisure or sports activities. An individualised progressive tailoring of intensity, including both impact and muscle strengthening exercise, under supervision would often be appropriate. Gradually increasing impact up to 'moderate' could be appropriate depending on:

- the number of vertebral fractures and symptoms experienced
- other medical conditions, level of fitness and muscle tone
- previous experience of moderate-impact activity prior to the vertebral fracture
- back pain from fractures

For some individuals, progressive muscle resistance training in combination with lower-impact exercise will be preferable.

Recommendations: Intensity, frequency, duration, amount (volume)

For all people with osteoporosis

- Muscle strengthening physical activity and exercise is recommended on two or three days of the week to maintain bone strength either via leisure or sports activity or structured exercise. **E**
- To promote bone strength (for maximum benefit), muscle strengthening should include progressive muscle resistance training. In practice, this is the maximum that can be lifted 8–12 times (building up to three sets for each exercise). Lower intensity exercise ensuring good technique is recommended before increasing intensity levels. **E**
- All muscle groups should be targeted, including back muscles to promote bone strength in the spine. **C**
- Daily physical activity is recommended as a minimum, spread across the day and avoiding prolonged periods of sitting. **C**

In addition:

For people with osteoporosis who do not have vertebral fractures or multiple low-trauma fractures

- Moderate* impact exercise is recommended on most days to promote bone strength (e.g. stamping, jogging, low-level jumping, hopping) to include at least 50 impacts per session (jogs, hops etc.). **C**

Brief bursts of moderate[iv] impact physical activity should be considered: about 50 impacts (e.g. 5 sets of 10) with reduced impact in-between (e.g. walk-jog). **C**

For people with osteoporosis who have vertebral fractures or multiple low trauma fractures

- Impact exercise on most days at a lower level[v] up to brisk walking is recommended, aiming for 150 minutes over the week (20 minutes per day). This a precautionary measure because of theoretical (unproven) risks of further vertebral fracture in this group. **C**
- Individualised advice from a physiotherapist is recommended for both impact and progressive resitance training to ensure correct technique, at least at the start of a new programme of exercise or activity. **C**

For people with osteoporosis who are frail and/or less able to exercise

- Physical activity and exercise to help maintain bone strength should be adapted according to individual ability. **C**
- Strength and balance exercise to prevent falls will be needed for confidence and stability before physical activity levels are increased. In practice, falls prevention may be a priority. **C** (see p 19)

iv High impact is not included as there is a lack of information about bone benefit or safety, although it may be appropriate for someone practised to continue.

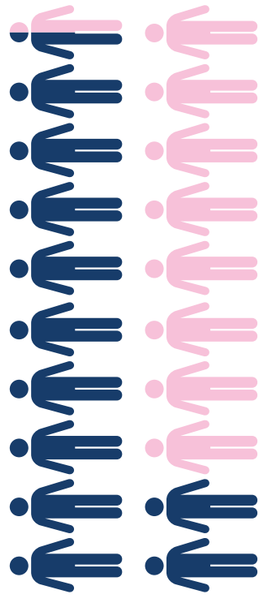
v Moderate impact might be appropriate for some people with good general fitness, if the vertebral fracture didn't occur during impact exercise, exercise doesn't cause pain, and levels are increased gradually (see p 17 for further details). [C]

STEADY

95% of non-vertebral fractures

and

20% of vertebral fractures occur after a fall[69]



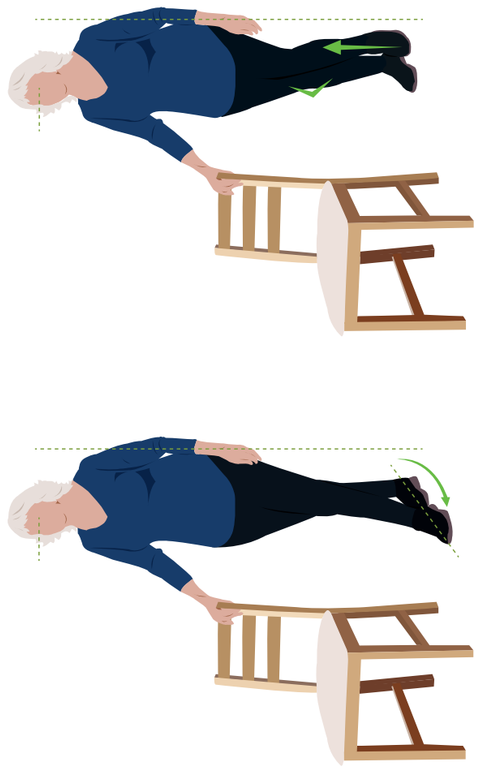
Considering falls and fractures

Falls and injurious falls are a significant problem in older age, with a third of people over the age of 65 years falling every year.[69,70] The incidence of fractures at different sites changes as people age. Younger people who fall may put out a hand to try to break the fall; thus, wrist fractures are more common in younger people. In older people, perhaps as result of slower reactions, hip fractures are more prevalent. Hip fractures are associated with increased mortality and morbidity – 20% of people die within a year of a hip fracture, 30% have permanent disability, 40% are unable to walk independently and 80% are unable to carry out activities of daily living one year after the fracture.[1]

Falls: causes and risk factors

Risk factors for falls include: having had a fall in the last year; poor strength, balance, posture, eyesight or foot health; continence; and health issues, such as Parkinson's disease, prior stroke, or dementia. With an ageing body, fear of falling and comorbidities can lead to a vicious spiral of inactivity. This in turn leads to a reduction in the ability to maintain an independent lifestyle and increases the risk of injury.[70]

Gait problems and use of walking aids, along with difficulties in everyday tasks and fear of falling, almost double the risk of a fall.[71] Furthermore, people with vertebral fractures are more likely to have kyphosis or forward-flexed posture, which is associated with impaired balance[72] – 64% of people with kyphosis have had a fall in the previous year.[73]



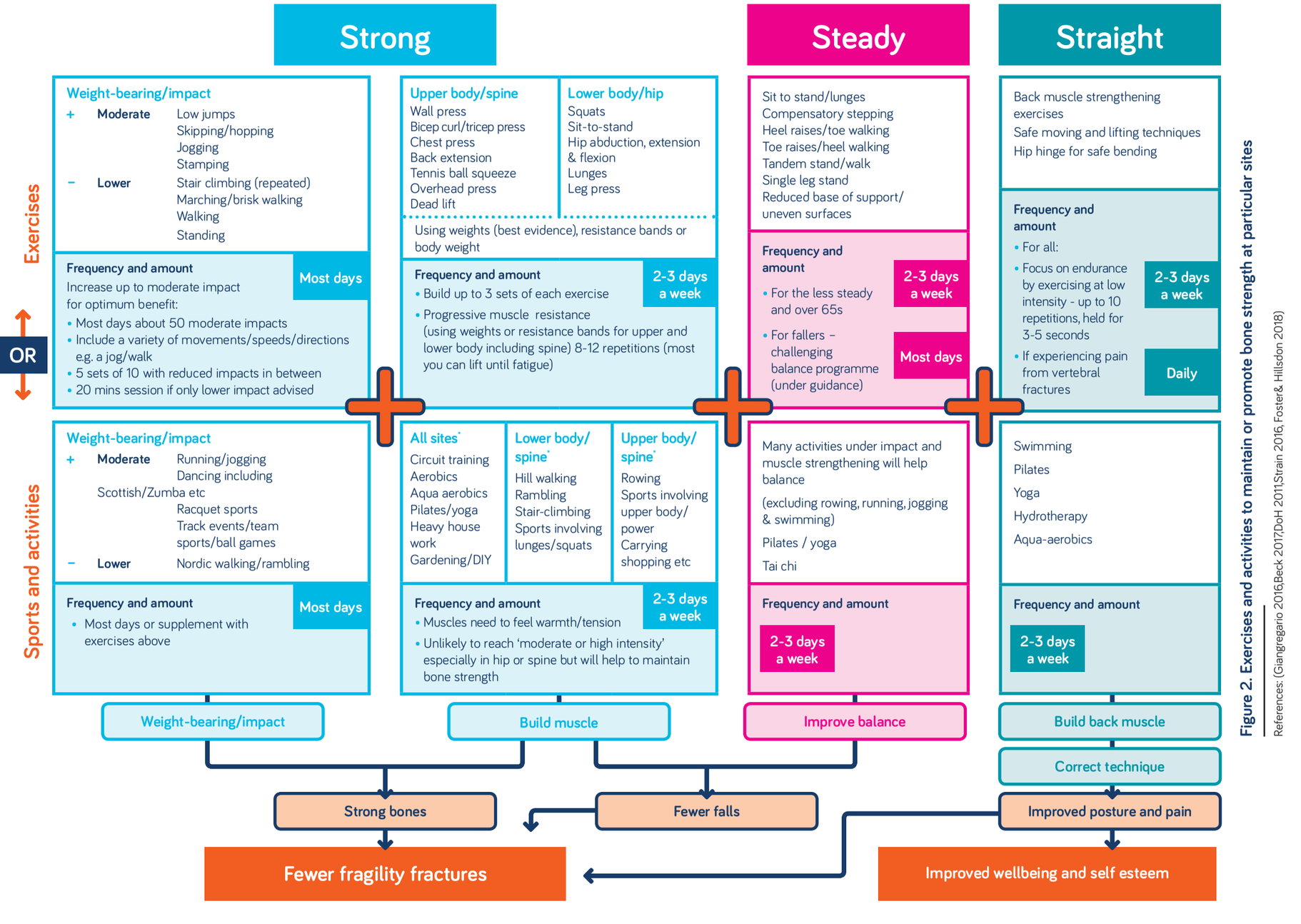


Figure 2. Exercises and activities to maintain or promote bone strength at particular sites

References: (Giangregario 2016,Beck 2017,DoH 2011,Strain 2016, Foster& Hillsdon 2018)

Integrating specific exercises to prevent falls

Falls risk, including problems with gait, muscle strength and balance, is modifiable with exercise.[67] Weight-bearing activities will help improve muscle strength and balance to some extent, although this can become more difficult in older age. Falls services should provide an assessment for multiple risk factors for falls, and advice on appropriate interventions, including a specialist falls exercise programme (with balance training) where available. A multi-factorial approach should include medication review and general health assessment (e.g. eyesight). Environmental risk factors may also need to be considered and addressed.[74]

Balance training is defined as the transfer of body weight from one part of the body to another, or exercise that challenges specific aspects of the balance systems (e.g. vestibular system). Balance retraining is defined as the re-education of basic functional movement patterns to a wide variety of dynamic activities that target more sophisticated aspects of balance.[75]

Communication

The way in which professionals communicate the benefits of falls prevention exercise is important. Most people do not perceive themselves as fallers or as frail. People need to be motivated to take part in strength and balance exercise to prevent falls by using appropriate language. Terms such as 'maintaining independence' and 'reducing the risk of fractures' (rather than 'fall prevention') are helpful. Emphasising the importance of balance to feel confident and able to enjoy other activities may also be useful.[76]

Research evidence

- Those who meet the UK CMO physical activity guidelines for health are less likely to fall or injure themselves.[9 77]
- Exercise reduces fear of falling to some extent – at least immediately after the intervention.[78]

Types of intervention

- Not all exercise modalities reduce falls.[67] Interventions that do not challenge balance sufficiently (e.g. seated programmes) have shown little or no effect on fall rates in people who are already falling, despite improvements in known risk factors such as strength.
- Individualised and supervised strength and balance interventions are most effective for those at risk of falls, including those with significant risk of fracture. Most research studies had an instructor-to-participant ratio of less than 10 in supervised sessions.[67]
- Highly challenging[vi] balance training and muscle strengthening at least three times per week reduces falls and possibly fracture risk.[67]
- Two UK programmes, the Otago exercise programme and the Falls Management Exercise (FaME) programme led by postural stability instructors (PSI) are evidence-based and cost effective.[74]
- Tai chi has been shown to reduce the risk of falls in people with mild deficits of strength and balance.[79] However, if significant modification is required for those with poor balance to participate (e.g. seated versions or versions without weight transfer), it loses its ability to improve lower limb strength, balance and falls risk.[80]
- There is currently not enough evidence to recommend dancing as a falls prevention activity for individuals with a high falls risk[81] although it may have the potential to reduce future falls risk in a general population.

Frequency and amount of intervention

- For someone with a history of falls, three hours a week of strength and balance training for at least four months (>50 hours total) is needed to effectively reduce falls.[67] The training must be ongoing, as the reduction in falls risk quickly diminishes if exercise stops.
- Interventions that are not frequent or intense enough have shown little or no effect on falls rates in people who are already falling. Trials that have shown a reduction in falls rate and risk include highly challenging balance exercise with a moderate to high-intensity muscle strengthening training component.[67]
- Walking alone does not reduce falls risk or improve strength or balance.[82] Brisk walking may increase the risk of falls and fractures in those with a falls history.[83] For the frailer adult or those with a history of injurious falls, gradual progression from strength and balance activities to brisk walking or activities that work on stamina or endurance may avoid an increase in falls risk.

Evidence specifically concerning people with osteoporosis

- A qualitative study in women with osteoporosis found that those who had completed balance training perceived improved empowerment and self-efficacy. The women resumed activities they had stopped and became more active and independent in daily life using safety precautions and fall-prevention strategies.[84]
- One study in people with osteoporosis showed that strength and balance exercise reduced pain and improved balance and coordination, without any adverse events.[85]
- In people with vertebral fractures, improving back muscle strength may indirectly help reduce falls risk by reducing kyphosis, although the research evidence is limited.[32 72]
- Integrating a falls screening programme into routine osteoporosis care is justified and feasible given the proportion of people with osteoporosis who screen positive for being at risk of falling.[86]
- Older people don't see themselves as fallers and can find messages about 'fall prevention' irrelevant or negative.[87]

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vi Challenging balance exercise means attempting a level not yet mastered (i.e. the entire time, distance or activity cannot be completed without losing balance). Highly challenging balance exercise means that the person feels more than wobbly whilst doing the activity; they may need to take a compensatory step or temporarily hold on to a support to maintain their balance.

Recommendations on strength and balance exercise to reduce falls and fractures

For all people with osteoporosis, particularly those with balance problems or over 65 years who don't exercise regularly .

- Physical activity or exercise to improve balance and muscle strength is recommended. **E**
- Balance and muscle-strength exercise (including activities such as tai chi, dance, yoga and Pilates) at least twice a week are recommended to reduce the risk of falls, especially in older age. **C**

For people with osteoporosis who are already having falls

- People who fall repeatedly, or who have started to avoid activity because of concern about falling, should be referred to a local falls service. **C**
- Exercise interventions to prevent falls should be tailored to suit the individual to ensure that they challenge balance without increasing falls risk. **E**
- Specific and highly challenging balance and muscle strengthening exercises, supervised by a trained health or exercise professional, are recommended. **E**
- Highly challenging balance and muscle strength training for three hours a week over at least four months is recommended – this could be about 25 minutes per day or three one hour sessions a week. **E**
- The Otago and FaME (PSI) exercise programmes are recommended. **E**
- Gradual progression from strength and balance exercises to higher-impact exercise (such as brisk walking) is recommended for the frailer older adult to prevent an increase in falls risk. **C**
- Exercise to strengthen back muscles and improve posture should be considered to reduce falls risk. **C**
- Advice about reducing falls risk should be communicated in a positive way to be relevant and effective. **E**

STRAIGHT

The 'spine caring' approach

This section addresses the need for people with osteoporosis to work on correct technique while lifting and moving – keeping the upper back straight. Strengthening the back muscles improves posture and reduces pain and other symptoms of vertebral fractures. It may also help to reduce the risk of vertebral fractures. These two principles of 'improved posture' and 'strong back muscles' can work together in a cycle to promote positive outcomes (see Figure 3).

Many people experience fear about simply moving, lifting and everyday living after a diagnosis of osteoporosis. They may have heard that they could cause a vertebral fracture by stretching, bending ('flexion'), lifting or twisting as part of everyday living or during exercise practices such as Pilates or yoga. Consequently, they limit what they do in order to reduce the perceived risk. As well as causing distress, this may occur at the very time that they need to increase activity to maintain muscle and bone strength. These concerns particularly affect those with painful vertebral fractures who are worried that movements may exacerbate pain as well as precipitate further fractures.[5 6]

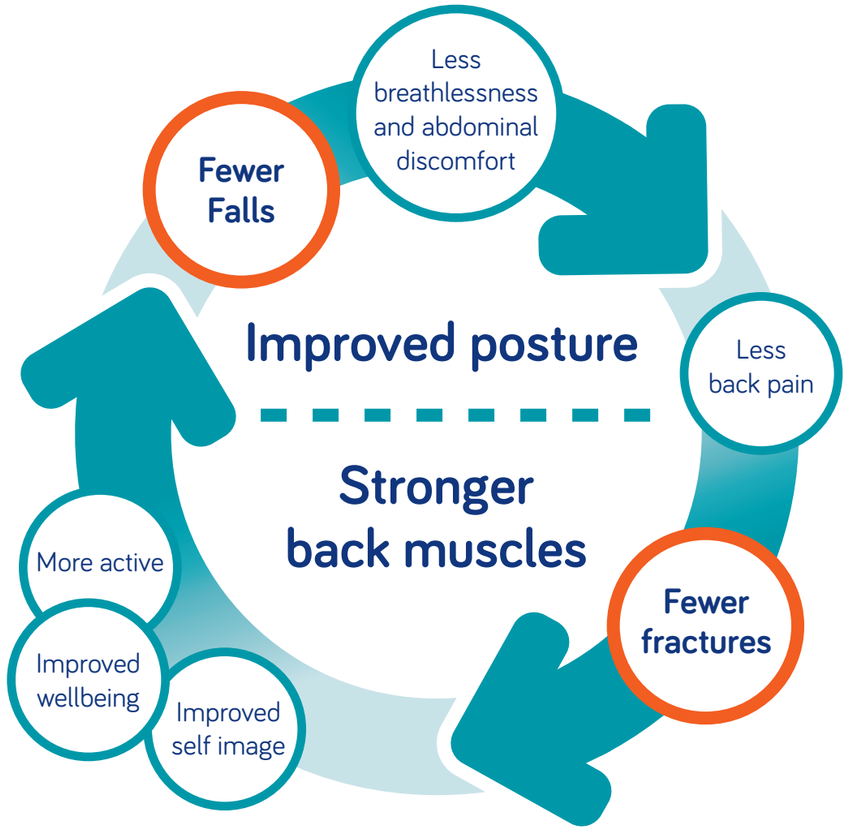
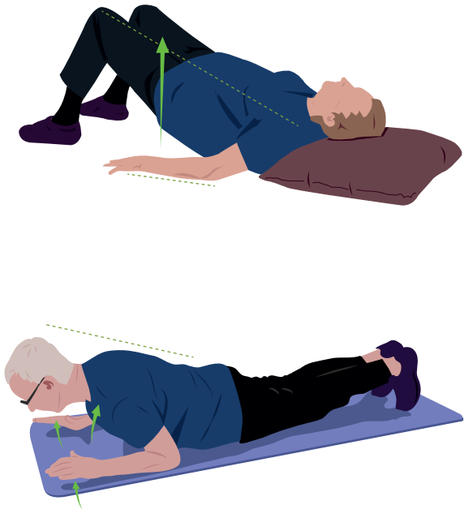


Figure 3: Creating a positive cycle of improved posture and back muscle strength.



Mechanics of spinal movement

Forward flexion of the spine puts increased force on the anterior surface of the vertebral bodies. This region of the vertebrae contains less cortical bone than the posterior surfaces and may be at a higher risk of fracture. It is the excessive, repetitive, sustained curving of the spine, paticularly with added load, that significantly increases force on the anterior vertebrae – not all 'leaning forward' movements.

Previous national guidance has recommended that people with vertebral fractures or osteoporosis avoid rapid, repetitive, weighted, end-range movements, and rotation or flexion of the spine during physical activity and exercise. This included lifting weights with a flexed spine, sit-ups and end-range yoga poses and Pilates exercises, and rapid or loaded twisting without adequate control in sports such as golf. [27]

> *"After spinal fractures the doctor said, 'don't do much – keep still until you get advice from the physiotherapist'. I waited several months for the appointment, terrified to do anything."*

Day-to-day movements – bending forward and lifting, twisting and stretching

Some degree of flexion and forward bending is unavoidable in day-to-day living. Assessing bone strength and risk of fracture in a meaningful way is difficult when providing advice about moving and lifting safely. Many older people will have undiagnosed vertebral fractures or low BMD (osteopenia or osteoporosis), and very fragile bones may break anyway, despite making modifications to movements. The recommendations in this document are pragmatic and suitable for anyone seeking advice to reduce vertebral fractures. They will be most important for those who have a significant risk of further fractures and for those with existing vertebral fractures or multiple low-trauma fractures.

Research evidence

Most vertebral fractures occur as part of everyday living. However, the evidence in relation to *particular* day-to-day movements, or amending them to avoid fracture, is limited.

Recommendations have been described in national guidance from the USA, Canada and Australia and are reflected in this statement.[3 26 88 27 11]

Recommendations about moving, lifting and day-to-day activities to reduce vertebral fracture risk whilst maintaining activity levels

For all people with osteoporosis

- A positive and reassuring approach is recommended to reduce fear and to enhance confidence and control – 'how to' rather than 'don't do' – especially as most people with osteoporosis are unlikely to experience a vertebral fracture during these activities. **C**
- Exercises to improve muscle strength in the back are recommended to improve posture and support the spine. Aim for exercises repeated 3–5 times and held for 3–5 seconds on at least two days a week. **C**
- Safe techniques for day-to-day moving and lifting are recommended (see charity information resources). **C**
  - 'Think straight' – a straight upper back (and keeping the neck in line with the spine) – is the key principle for all movements that involve bending and lifting.
  - However, recognising the natural curves in the back, flexibility and function remain important and should be encouraged.
  - Safe lifting techniques are recommended rather than instructions such as 'don't lift' or 'only lift up to a specific weight'.
  - The 'hip hinge' is a simple technique for safe bending that facilitates this and can be practised and integrated into all day-to-day movements.
  - Always move in a smooth, controlled way within a comfortable range. Rotation (twisting) movements should be safe if performed smoothly and comfortably.
  - Engage abdominal muscles during movements.

For people with painful vertebral fractures

- Prompt moving and lifting advice is recommended soon after painful vertebral fractures, to reduce fear and maintain mobility and function. **C**
- Referral to a physiotherapist will be helpful, although some advice as soon as possible after a painful fracture will also be important. **C**

End-range or sustained flexion in exercise programmes including yoga and Pilates

Exercise routines that involve sustained, repeated end-range flexion or extension movements (such as the 'roll down' in Pilates, some yoga positions and flexion exercises such as sit-ups) are often considered contraindicated in people with osteoporosis, although there is uncertainty and controversy about the need to modify exercises and for whom.[89 90] Excessive curving of the back, or excessive strain on back muscles, may occur during other forms of exercise if performed incorrectly.

The evidence confirming the precise group that is most at risk of fracture is limited. The recommendations in this document are therefore precautionary, and reflect the fact that, in many cases, there are alternative movements or exercises that can provide similar benefits in terms of flexibility and muscle strength (see charity information resources).

Research evidence

- In one study, increased risk of vertebral fracture during flexion exercise was found in a patient with radiographic osteoporosis (not DXA). Reports of vertebral fracture linked to flexion in yoga concerned women with osteopenia.[89] The numbers of harms reported were very low (see pages 15–16).

Recommendations about forward flexion in exercise (including yoga and Pilates)

For all people with osteoporosis

- Movements or exercise that involve sustained, repeated or end-range forward flexion should be modified or avoided. C
- Any exercise that causes the back to bend forwards excessively into a 'C' shape, particularly with added load, should be modified or avoided. C
- People who are experienced, demonstrate flexibility in the spine and can manage the movements comfortably and smoothly should be advised that they can continue with these activities, as long as they are fit enough to manage them with ease. As a precaution, alternatives to exercises such as the 'roll down ' and 'curl up' in Pilates should be considered unless someone has extremely good core muscle strength and flexibility. C
- Correct form and technique are important. C

For people with osteoporosis who have vertebral fractures

- People who want to attend yoga or Pilates classes should, if possible, attend a class led by an instructor who has trained to work with older individuals and those with osteoporosis and can amend exercises according to ability and range of movement. C

Exercise interventions to improve posture and reduce pain caused by vertebral fractures

Vertebral fractures caused by osteoporosis can be symptomless, characterised only by a loss of height, but for some people they cause acute or persistent pain. Pain that persists is usually due to postural changes and kyphosis resulting in muscle spasm, ligament strain and nerve impingement.

Postural changes can result in breathlessness, continence problems, and abdominal protrusion, which affects body image and self-esteem and causes practical problems such as getting clothing to fit.

Research evidence

- There is some limited evidence that advice about posture and both generalised exercise programmes and specific exercises (e.g. to strengthen the back extensor muscles) can help with pain and symptoms of vertebral fracture.[66 84 91]
- Physical activity and exercise promotes wellbeing and helps relieve pain.[99]
- Spinal extension exercises may improve posture and help to resist kyphosis.[92 93 97]
- Water-based exercise (hydrotherapy) may help improve quality of life.[100]

Recommendations about exercise to help with pain and other symptoms of vertebral fracture (pain, height loss and kyphosis)

For people with symptomatic vertebral fractures

- Daily exercises to strengthen the back muscles (with a focus on endurance by exercising at low intensity), reduce muscle spasm, relieve pain, improve flexibility and promote best possible posture are recommended, with a referral to a physiotherapist for tailored advice. Aim for each exercise to be held for 3-5 seconds, repeated up to 10 times. C
- General advice about moving, exercise and physical activity should be provided promptly, without waiting for a referral to specialist services. C
- Maintaining physical activity and exercise is recommended to address pain and improve wellbeing. C
- Professionals should explain how exercise interventions may help with back pain, as people are fearful that exercise will make pain worse. C
- Yoga and Pilates and similar exercise programmes should be considered to help with posture and pain by teaching form, alignment, muscle strength and relaxation. C
- Breathing and pelvic floor exercises are recommended to help with other symptoms that may be exacerbated by severe spinal kyphosis. C
- Hydrotherapy should be considered to help improve quality of life. C

Appendix 1 – Glossary

Bone strength is a composite term used to describe how resistant a bone is to fracture. The strength of a bone depends on how much mineral it contains as well as the shape, size, internal architecture and metabolism (turnover). Data are limited as to whether an intervention such as physical activity reduces fractures, because large studies with a long follow-up would be needed. Bone densitometry using DXA is used instead as a surrogate measure. Other technologies such as ultrasonography and QCT may provide additional information about bone strength.

Bone mineral density (BMD or bone density) was developed to measure how much mineral a bone contains. Densitometry using DXA is the clinical gold standard for measuring BMD and provides a diagnosis of osteoporosis in older adults when BMD is significantly below the average young healthy normal range. This is a standardized World Health Organization classification used across intervention trials, including those assessing pharmacological treatment of osteoporosis. Measures of BMD predict fracture relatively well, although they provide a relative, rather than an absolute risk, and are unhelpful in stratifying people for exercise advice. DXA does have limitations, including size dependence, being influenced by variation in body composition, and being a two-dimensional technique. This means that separate bone compartments (trabecular [spongy] and cortical [shell] cannot be studied for the true cross-section of the bone. As bone strength is made up of more than BMD, other techniques such as QCT that overcome some of the limitations of DXA have been introduced.

Core muscle strength or stability: the term 'core' is used to describe all the minor and major muscle groups around the trunk, including back, abdominal and pelvic muscles. Increasing core muscle strength may help with posture and controlled movements and may provide spinal support to reduce pain or injury.

Fracture risk assessment is based on fracture and mortality data and assesses the probability of a fragility fracture, usually over the next 10 years, using clinically proven risk factors, some independent of BMD. Online tools such as FRAX® can be used by health professionals to identify those with the highest fracture risk who may benefit from pharmacological therapies.

Fragility fractures result from mechanical forces that would not ordinarily result in fracture, known as low-level (or low-energy) trauma, such as forces equivalent to a fall from a standing height or less. Vertebral fractures may occur without a fall. Not all fragility fractures are caused by osteoporosis but the term is used in this document, as is commonly accepted, to denote osteoporotic fractures.

Frailty is a distinctive health state related to the ageing process, in which multiple body systems gradually lose their in-built reserves. Older people living with frailty are at risk of adverse outcomes such as dramatic changes in their physical and mental wellbeing after an apparently minor event that challenges their health, such as an infection or fall.

Kyphosis means that the normal curve in the middle section of the spine (the thoracic vertebrae) is more pronounced than normal. There are a number of reasons for this, including postural changes caused by osteoporotic compression (wedge) fractures of the spine.

Moderate-intensity physical activity/exercise (aerobic) requires a moderate amount of effort and noticeably accelerates the heart rate and makes you feel warmer. The level of activity will be relative to a person's fitness, so an activity such as dancing may be moderate for a fitter person but vigorous for an unfit or frailer person. Examples include brisk walking, dancing, aqua aerobics, heavy gardening and housework chores.

Sarcopenia is a syndrome characterised by progressive and generalised loss of skeletal muscle mass and strength and increases the risk of adverse outcomes such as physical disability, poor quality of life, and death. The presence of both low muscle mass and low muscle function (strength or performance) need to be present for the diagnosis.

Vigorous-intensity physical activity/exercise (aerobic) requires a large amount of effort and causes rapid breathing and a substantial increase in heart rate. Examples include running, climbing or running up a hill, fast cycling, and competitive swimming. Generally a conversation cannot be held whilst doing activities at this intensity.

Appendix 2 – Methodology

This consensus statement was developed using existing systematic reviews, international guidance documents, updating of systematic review evidence and gaining consensus through expert opinion. The process is outlined in Figure 4.

Expert Groups

Two groups were formed to support development of the different components of the consensus statement, outlined below:

Expert Exercise Steering Group

See page 2

Exercise Expert Working Group

Natalie Beswetherick, Director of Practice and Development at the Chartered Society of Physiotherapy

Kirsty Carne, Specialist Osteoporosis Nurse, ROS

Will Carr, Head of Service Delivery, ROS

Dr Alex Ireland, Lecturer In Physiology at the School of Healthcare Science, Manchester Metropolitan University

Vicky Johnston, Specialist Physiotherapist at the Cumbria Partnership NHS Trust

Andrea Julius, Bone Health Specialist Physiotherapist at St George's Hospital, London

Nicola Lauchlan, Clinical Specialist Physiotherapist in Osteoporosis and Falls in the Community Falls Prevention Programme, Glasgow

Sarah Legg, Senior Physiotherapist, Rheumatology at the Royal National Hospital For Rheumatic Diseases, Bath

Dr Katie Robinson, Research Physiotherapist at the School of Medicine, University Of Nottingham

Yvonne Sadler, Public/patient representative

Ruth Sawtell, Public/patient representative

Christina Scorringe, Clinical Specialist Rheumatology Physiotherapist and Clinical Rheumatology Lead at Northwick Park Hospital, London

George Studd, Strength and Conditioning Coach at the Department of Sports Development & Recreation, Sports Training Village, University Of Bath

Ruth Ten Hove, Head of Research and Development at the Chartered Society Of Physiotherapy

Fizz Thompson, Clinical Director, NOS

Catherine Van't Riet, Physiotherapist and Clinical Team Lead at the Integrated Falls and Bone Health Service, St George's University Hospital, London

Developing the scope

The planned scope and content for the project were confirmed by evidence gathering from stakeholders. This consisted of an online survey completed by 600 people affected by osteoporosis and interested health professionals, who provided 'free text' responses about what they felt were key issues and confusions about exercise and osteoporosis.[6] Stakeholder discussion groups, two for affected people and one for physiotherapists and other health or exercise professionals, were also convened to discuss their issues and questions.[5]

Review and update of existing literature

A number of international osteoporosis guidance documents and reports have been published on exercise and physical activity to improve bone health, reduce fracture risk[26, 10, 27, 11] and help with symptomatic vertebral fractures.[66] These have examined the published evidence, agreed key principles and proposed the exercise interventions and physical activity needed. The Steering Group agreed that existing international guidance would be used as a basis for this consensus process and that a complete systematic review of all the scientific and clinical evidence was not necessary. Our statement would aim to address gaps and explore new areas, bringing existing recommendations up to date and making them relevant for the UK.

Members of the Steering Group supplemented the existing international guidance by updating key systematic reviews.[61, 62, 65] This update focused on the effectiveness of exercise and potential harms, particularly exercise interventions causing fractures. A further review of non-randomised controlled trials and case reports was completed to provide more information about the potential hazards or harms.[60]

Expert Consensus

Expert Exercise Steering Group teleconferences

The Steering Group developed the framework for the consensus statement through teleconference and email discussion. For each component of Strong, Steady and Straight and the international guidance, systematic review and updated evidence review was synthesised to answer core questions and determine a set of draft key principles. It was agreed that, as there was limited evidence to answer some of the core questions, the statement would need to base some recommendations for best practice on agreed principles using expert opinion.

Expert Exercise Working Group face-to-face meetings

Two face-to-face meetings of the Steering Group and wider Working Group were held to gather a wider representation of expert views.

Meeting 1 (September 2017): The scope of the statement and evidence synthesis were presented to provide context to the Group. The draft framework principles were presented and the experts given the opportunity to provide open feedback on:

- any areas that had not been explored
- whether the framework was appropriately constructed to be useful for the target audience
- the content of the draft principles.

Meeting 2 (January 2018): This involved a more focused discussion on the wording of the statement and draft principles.

Final agreement on principles and recommendations

After the two face-to-face meetings, the wording of the principles was agreed through email and teleconferences with the Expert Exercise Steering Group. Each member of this Steering Group was then asked to confirm if they agreed with each of the final principles and recommendations. An external consultation including partnership organisations was conducted before completion of the final draft.

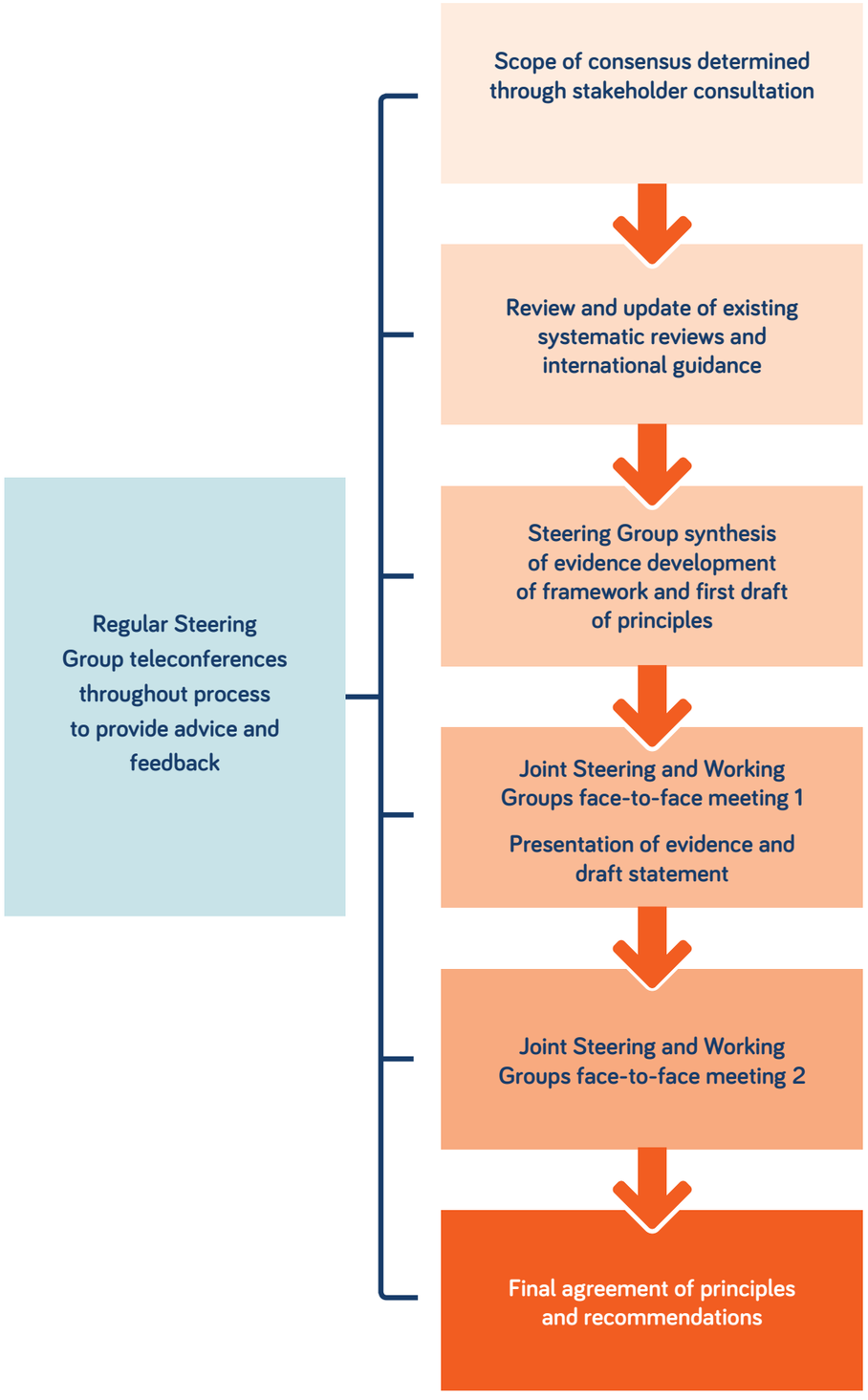


Figure 4: Consensus statement development process

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About us

The Royal Osteoporosis Society is the only UK-wide charity dedicated to ending the pain and suffering caused by osteoporosis. The Charity works tirelessly to help and support people with the condition as well as promoting good bone health to prevent osteoporosis. We do this by:

- Providing a range of information resources covering all aspects of osteoporosis for health professionals and the public
- Providing a free helpline staffed by nurses with specialist knowledge of osteoporosis and bone health
- Investing in research to ensure future generations are freed from the burden of osteoporosis
- Influencing government and campaigning to improve and maintain essential services
- Educating healthcare professionals to ensure they are kept up to date about osteoporosis – through events, accredited training courses and our leading conference on osteoporosis and bone health
- Working in partnership with the NHS to set up and improve Fracture Liaison Services which can reduce the number of fractures caused by osteoporosis

To find out more about our information, support and services, visit our website: **theros.org.uk**

Professional Membership

Professional membership of the Royal Osteoporosis Society will ensure you become better informed and able to deliver the best care possible to people with osteoporosis or fractures.

As a professional member, you'll have all the information you need at your fingertips and will stay up to date on best practice, care, delivery, new treatments and the latest news on osteoporosis research findings.

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To **join a growing network of professional members** like you, call our membership team on **01761 473287** or visit **theros.org.uk/HCPs**

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01761 471771 (General Enquiries)

0808 800 0035 (specialist nurse Helpline)

theros.org.uk

Camerton, Bath BA2 0PJ

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