

# WHO World Report on Ageing and Health

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## Background Paper on Musculoskeletal Health and the Impact of Musculoskeletal Disorders in the Elderly

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## Organisations supporting this document

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### Executive Summary

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#### Overview

This background paper defines musculoskeletal (MSK) health and considers the importance of a functional and pain-free MSK system for active healthy ageing. It provides evidence for: the high prevalence and burden of MSK disorders in the elderly; the important interactions between MSK pain and mobility restrictions and other chronic non-communicable diseases (NCDs); and the interventions that can improve person-centred health outcomes and quality of life in the elderly. Determinants and demographic trends of MSK disorders are considered. Evidence-based interventions for primary, secondary and tertiary prevention are reviewed and effective strategies for their implementation identified. Examples from different economic and geographic settings are given. Socio-political and research priorities are identified.

#### Specifically, this background paper considers:

- Major disorders affecting MSK health in the elderly, including prevalence, disability levels and impact on key person-centred outcomes (such as pain, fatigue, quality of life, participation and occupation), determinants (risk factors) and epidemiologic trends including:
  - Low back and neck pain
  - Regional pain conditions
  - Osteoarthritis
  - Rheumatoid arthritis and other inflammatory joint diseases
  - Osteoporosis, falls and fragility fractures
- Importance of MSK health for functioning (body functions and structure, activities, participation and occupation) in the elderly and throughout the life-course with a focus on person-centred outcomes including the impact on quality of life and social participation
- Importance of MSK health to enable effective prevention and management of other major chronic conditions, particularly in the elderly
- Effective interventions for primary, secondary and tertiary prevention
- Strategies for the implementation of evidence-based interventions considered separately for

low, middle and high-income countries

- Current status of how evidence is being implemented and health needs being met, with case studies which identify barriers and facilitators
- Aspects of health systems that act positively or as a barrier to improving MSK health across the life course and specifically for older individuals
- Global inequities in access to evidence-based health care services for MSK conditions
- Recommendations for priorities in research and strategies to be implemented.

## Summary of Evidence

Musculoskeletal (MSK) disorders incorporate more than 150 different conditions affecting bones, joints, ligaments and muscles ranging from inflammatory joint diseases such as rheumatoid arthritis, gout, psoriatic arthritis and autoimmune connective tissue disorders such as systemic lupus erythematosus, to very common conditions such as osteoarthritis, low back pain, neck pain, soft tissue and regional pain problems often related to injuries, and fragility fractures due to osteoporosis. Populations within both the developed and developing countries are affected by the profound current and future impact from MSK conditions. The prevalence and impact of MSK conditions increase with age and while both men and women are impacted, the burden is greater amongst women. The current burden of MSK disease far exceeds service capacity in most countries. Population growth, ageing and sedentary lifestyles, particularly in developing countries, will result in a crisis for the population health that requires a multi-system response with musculoskeletal health services as a critical component.

The impact of MSK conditions overall in terms of disability is high globally, causing 21.3% of the total years lived with disability (YLDs), second only to the grouping of mental health and behavioural problems, as defined and estimated in the Global Burden of Disease 2010 Study (GBD 2010). In GBD 2010, low back pain ranked highest in terms of global disability, and sixth in terms of overall burden (Disability-Adjusted Life Years (DALYs)). Neck pain, osteoarthritis, rheumatoid arthritis and gout were also significant contributors to global disability burden. Within the 50 to 69 years age group where people are likely to still be actively participating in the workforce, MSK conditions are the leading contributor to global YLDs, accounting for 33% of global YLDs in developed countries and 27% in developing countries.

Globally there is an emphasis on maintaining an active lifestyle to reduce the impact of obesity, cardiovascular conditions, cancer, osteoporosis and diabetes. Painful MSK conditions, however, profoundly limit the ability of people to make these lifestyle changes that are necessary for good health. A strong relationship exists between arthritis and MSK pain and a lack of physical activity in the elderly resulting in functional decline, frailty, loss of well-being and loss of independence.

Whilst effective strategies are available to address the impact of MSK conditions, including some low-cost primary care interventions, others come at a high cost and are currently not an option for developing nations. Integrated multi-level strategies and approaches to care that adopt a whole person approach are needed. Many resource-constrained countries are unable to provide disease-specific prevention and management policies and programs, so it is important that MSK health initiatives in these settings integrate well within existing health systems. Individually, lower socioeconomic status is a risk factor for the development of disability related to arthritis and MSK

conditions. This is in part due to the inability of people to access the best care, coupled with their higher exposure to manual work, injuries and life conditions that predispose to them to the MSK conditions.

There is increasing global recognition of the multi-morbidity of aging populations, including the effects of MSK conditions. Participation and occupation in its broader definition, namely keeping older people active in all the things they need, want and are expected to do as individuals, in families and with communities to bring meaning and purpose to life, will be negatively impacted by MSK conditions. It is well recognised that many opportunities exist to better harmonise global health policy and programmes to incorporate MSK conditions in efforts to address the burden of non-communicable disease.

It is important to acknowledge and recognise the broad range of health care professionals (HCPs) both medical (e.g. family general practitioners (GP), specialist physicians, rheumatologists, rehabilitation specialists, endocrinologists, geriatricians, orthopaedic, trauma and spinal/neurosurgeons) and non-medical (e.g. physiotherapists, occupational therapists, nurses, pharmacists, dieticians/nutritionists, orthotists, podiatrists, psychologists, chiropractors, exercise physiologists/kinesiologists, social workers, naturopaths, osteopaths, acupuncturists and etc.) who, if appropriately trained, can contribute to the MSK health and well-being of the community at all ages. Persons with MSK conditions should have the right of access to the individual care and HCPs they require. While not all people will require the whole range of HCPs, invariably persons with chronic MSK conditions will gain greater benefit when at least two (and preferably more) HCPs contribute to their care. Throughout this document, just as it is not possible to address the complete range of MSK conditions that can affect the elderly, it is not possible to list all care professionals who can provide advice and management to improve MSK health.

## Recommendations

Recommendations in this report include i) strategies to improve MSK health in older people and, ii) priorities for research in this context. The guiding principles underpinning these recommendations are listed below – recommendations should be:

- evidence-informed;
- person/client-centred;
- multi-disciplinary and inclusive of all relevant stakeholders, achieved by engaging local communities, families, persons with MSK-related pain and disability, their carers and the general population;
- respectful of beliefs, preferences and traditions currently in place in those communities.

## STRATEGIES TO IMPROVE MUSCULOSKELETAL HEALTH IN OLDER PEOPLE

### 1. Greater recognition of musculoskeletal health in policy and public health initiatives

- 1.1 Ensure global health policies recognize the importance of MSK health for overall health, wellbeing and economic prosperity for the individual and society.
- 1.2 Raise awareness of the need for MSK health for maintenance of functional independence, mobility, dexterity, participation, occupation and mental wellbeing at all ages.
- 1.3 Promote MSK health at all levels of society including healthy lifestyles and injury prevention to reduce the likelihood of developing disabling MSK conditions in older age (e.g. promote safe physical activity, prevent and reduce obesity, prevent and manage MSK occupational and sporting injuries early to reduce risk of long-term disability)
- 1.4 Inform policy-relevant, evidence-based reports to governments that emphasize the need for MSK health in older populations and promote evidence translation of current and future effective strategies into policies.
- 1.5 Encourage multiple stakeholders (including funders, insurers, policy makers, educators, researchers, consumers and carers) to co-operatively develop and implement Models of Care to manage MSK problems, based on best evidence and consultation.
- 1.6 Raise awareness of the particular impacts of MSK health on all other non-communicable chronic diseases and the impact of multi-morbidity on important health behaviours in the elderly, such as physical activity.

### 2. Improve health service delivery for musculoskeletal health conditions across the continuum of care

- 2.1 Encourage all health programs addressing chronic conditions in the elderly to include MSK health. Further, ensure that MSK-focused services are available, such as rehabilitation services, chronic pain management services, and rheumatology clinics in ambulatory care settings.
- 2.2 Prioritise and develop a clearer set of pathways for new and sustainable MSK services in low/middle income countries that align with the principles of development effectiveness.
- 2.3 Promote a common goal between public health, primary care, specialized health and social services to reduce disability across all ages and MSK conditions.
- 2.4 Advocate for health funding and data sharing models that support the delivery of integrated, interdisciplinary care for people with chronic MSK conditions.
- 2.5 Advocate for a pathway of care across the whole patient journey as a continuum across primary, secondary care and into aged care settings.

- 2.6 Support approaches where third party funders reward the implementation of evidence-based practices in payment and reimbursement schedules.
- 2.7 Disseminate and implement the effective evidence-based strategies that are currently available for the prevention and treatment of MSK conditions. For example:
- Promote and provide services for early diagnosis and pro-active management of rheumatoid and other inflammatory arthritis;
  - Implement appropriate guidelines and support for individuals with back pain to stay active and working; avoiding bed rest; and minimising the use of medical imaging; and provide access to short-term use of simple analgesics and/or anti-inflammatories and manual therapy where appropriate;
  - Provide treatment and monitoring of osteoporosis in those who have sustained a fracture and are at high risk of re-fracture (e.g. through development of fracture registers and Fracture Liaison Services);
  - Provide integrated care for people with osteoarthritis to optimise pain management and psychosocial wellbeing, improve physical activity and to achieve a healthy weight;
  - Promote and provide injury prevention in sporting activities early in life to avert long-term disability;
  - Promote strength and balance exercises and other falls prevention strategies;
  - Provide timely access to joint replacement surgery as required

### **3. Develop interdisciplinary workforce capacity to address musculoskeletal health conditions**

- 3.1 Highlight the importance of training a health professional workforce (medical and non-medical) capable of providing care to the growing number of older persons with MSK problems with a particular focus on widespread implementation of inter-professional learning. Here, a focus on primary care providers is critical.
- 3.2 Raise awareness among health professionals and the general population that disability and functional decline in older age groups may be reversible or modified with timely management of MSK conditions that adopts a whole-person approach to care.
- 3.3 Ensure that health professional training at all levels has appropriate MSK health and health care principles embedded in programs and practice, promotes competency-based MSK training, and adopts contemporary inter-professional education (IPE) approaches that support integrated, interdisciplinary chronic disease management.
- 3.4 Ensure the health workforce includes provisions for a broad range of medical and non-medical healthcare professionals specialising in MSK care in the elderly (such as rheumatologists, orthopaedic practitioners, rehabilitation specialists, physiotherapists, occupational therapists, MSK nurses, psychologists, podiatrists, chiropractors, etc.)

- 3.5 Ensure frameworks are developed and implemented to support extended and alternative roles for health workforce, such as physician assistants, extended scope of practice roles in allied health, nurse practitioner roles.

#### **4. Empower older people to optimise musculoskeletal health**

- 4.1 Link MSK health with general public health messages about healthy and productive ageing.
- 4.2 Foster public empowerment to enable the general public, older persons with MSK conditions, and carers to fully and effectively participate in their MSK healthcare.
- 4.3 Enable the older person to be financially independent and participate in work despite declining MSK health with age.
- 4.4 Include a greater focus on the design of residential and community environments that promote MSK health in older populations e.g. architecture of exercise-friendly environments for older people.
- 4.5 Synthesise and disseminate existing research on effective and efficient approaches for the prevention, management and control of musculoskeletal pain and disability in older populations.

#### **5. Prioritise research and innovation**

- 5.1 Identify evidence-gaps and research priorities for improving MSK health in older populations.
- 5.2 Establish population-based, integrated information systems for monitoring MSK-related disability in older people.
- 5.3 Support development of technologies that deliver evidence-based and clinically-appropriate information and skills to consumers to support co-care and technologies that facilitate delivery of clinical services through digital means (e.g. telehealth).

### **RESEARCH PRIORITIES**

1. To encourage worldwide epidemiological research on the status of MSK conditions and MSK health in older populations to accurately define the burden of disease and life-course of disability associated with MSK conditions and reduced MSK health.
2. To conduct further research to improve the understanding of how health services are used by older persons and identify barriers and potential solutions to accessing care, with particular attention to cognitive impairment, health literacy and varying socio-economic and cultural groups.
3. To evaluate the most effective methods for implementing evidence-based, low-cost interventions for the management of MSK conditions in low-income countries.



4. To conduct research on the cost effectiveness of existing and emerging OA therapies and models of care for OA that adopt a chronic care framework.
5. To promote the importance of and support research that evaluates the long-term effect of potential biotherapies (including cell-based therapies) for MSK conditions.
6. To evaluate benefits of managing MSK health in aged care settings.
7. To identify modifiable predictors of reduced physical function in the elderly.
8. To understand from an etiological perspective the association between MSK conditions and psychological health in the older population.
9. To research the aetiology of sporting and occupational injury among younger individuals and the role injury plays in older persons' reduced MSK health.
10. To research, design and evaluate prevention and rehabilitation strategies across the life-course to enhance MSK health and prevent disability in older people (e.g. strategies to prevent and / or reduce severity of future osteoarthritis, back pain and osteoporotic fractures)
11. To determine the effectiveness of conservative care for MSK health in improving the rehabilitation outcomes of patients with cardiovascular and other chronic diseases.
12. To develop better data systems to evaluate different models for delivery of secondary fracture prevention and other MSK-related interventions.
13. To develop data strategies and tool kits for on-going surveillance to characterize burden of poor as well as document benefits from improving MSK health in older persons in all countries.
14. To undertake implementation research that evaluates strategies to improve the use of best evidence for management of MSK conditions in practice by practitioners and consumers, including the use of evidence for discontinuing practices that are ineffective and/or potentially harmful.

# Report

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## 1. Introduction

***Musculoskeletal health is critical for people's mobility and their ability to work and actively participate in all aspects of life, and to maintain economic, social and functional independence across their life-course. Musculoskeletal health enables physical activity to reduce risk of other non-communicable diseases. It is central to active healthy ageing<sup>1-4</sup>.***

### 1.1 Musculoskeletal health is a foundation for active healthy ageing

Musculoskeletal (MSK) health refers to the health of the locomotor apparatus (i.e. bones, joints, muscles, cartilage, tendons, ligaments and nerves) that allows the individual to independently perform all daily activities without pain or functional restrictions. Impairments of musculoskeletal health can be the cause of acute and chronic pain, physical limitation that involves loss of participation and withdrawal from usual social, community and occupational activities, possible burden in other health domains, and decreased quality of life and well being.

Impaired MSK health has substantial personal, community and societal consequences which increases substantially in older people<sup>5</sup>. Epidemiologic studies confirm the strong relationship between arthritis and MSK pain with lack of physical activity and resulting functional decline, frailty, loss of well-being and loss of independence<sup>1,6-10</sup>. Older people with arthritis and MSK disorders are less active than their peers without arthritis and this lack of regular physical activity is the most prevalent risk factor associated with functional decline. A frail elderly person is more likely to report MSK pain than the more robust<sup>11</sup>. Rheumatoid and other inflammatory arthritis are associated with significant muscle deconditioning and sarcopenia in part mediated through systemic inflammatory cytokines, while osteoarthritis and other age-related MSK disorders can also exacerbate sarcopenia progression in older adults as a result of avoidance of activity due to the pain experience<sup>12</sup>.

Poor MSK health, reflected in reduced physical capability (grip strength, walking speed, chair rising, and standing balance times) has been repeatedly and consistently related to mortality<sup>13</sup>, in fact, gait speed is one of the best predictors of mortality. MSK pain, either localised or generalised, cannot always be attributed to a specific condition but the impact on the individual through disability and loss of function is just as evident as for when it can be attributed to defined conditions. This is particularly evident in the elderly where MSK pain is a strong predictor of reduced physical activity and frailty<sup>14</sup>.

## 1.2 Impaired musculoskeletal health is manifested by a range of conditions and injuries that are characterised by pain and reduced physical function across the life-course, greatest in older ages.

MSK disorders cover a spectrum of more than 150 different conditions including inflammatory joint diseases such as rheumatoid arthritis and gout, autoimmune connective tissue disorders, osteoarthritis, painful spinal problems including low back pain, neck pain and lumbar disc disorder, regional pain problems often related to injuries at work, during sports, or from falls and fragility fractures due to osteoporosis as occur more frequently in the elderly (Table 1.1). In senior populations, falls and fragility fractures, with an incidence that steeply increases with age, are strong predictors of loss of independence and institutionalization.<sup>15,16</sup>

**Table 1.1: Types of musculoskeletal conditions.**

Source: Arthritis Foundation; <http://www.arthritis.org/about-arthritis/types/>

Adult-onset Still's disease	Inflammatory Arthritis	Pseudogout
Ankylosing Spondylitis	Inflammatory Bowel Disease	Psoriatic Arthritis
Back Pain	Juvenile Arthritis	Raynaud's Phenomenon
Behçet's Disease	Juvenile Dermatomyositis (JD)	Reactive Arthritis
Bursitis	Juvenile Idiopathic Arthritis (JIA)	Reflex Sympathetic Dystrophy
Calcium Pyrophosphate Deposition Disease (CPPD)	Juvenile Scleroderma	Reiter's Syndrome
Carpal Tunnel Syndrome	Kawasaki Disease	Rheumatic Fever
Chondromalacia Patella	Lumbar Disc Disorder	Rheumatism
Chronic Fatigue Syndrome	Lupus	Rheumatoid Arthritis
Complex Regional Pain Syndrome	Lupus in Children & Teens	Scleroderma
Cryopyrin-Associated Periodic Syndromes (CAPS)	Lyme Disease	Sjögren's Disease
Degenerative Disc Disease	Mixed Connective Tissue Disease	Spinal Stenosis
Developmental-Dysplasia of Hip	Myositis (inc. Polymyositis, Dermatomyositis)	Spondyloarthritis
Ehlers-Danlos	Neck Pain	Systemic Juvenile Idiopathic Arthritis
Familial Mediterranean Fever	Osteoarthritis	Systemic Lupus Erythematosus
Fibromyalgia	Osteoporosis	Systemic Lupus Erythematosus in Children & Teens
Fifth Disease	Pagets	Systemic Sclerosis
Giant Cell Arteritis	Palindromic Rheumatism	Temporal Arteritis
Gout	Patellofemoral Pain Syndrome	Tendinitis
Hemochromatosis	Pediatric Rheumatic Diseases	Vasculitis
Infectious Arthritis	Pediatric SLE	Wegener's Granulomatosis
	Polymyalgia Rheumatica	

MSK conditions are typically associated with pain and loss of physical function, limitation of activities and restricted participation with a range of severity that is often unpredictable<sup>17</sup>. They are often chronic and progressive, although modern management can reduce the impact of many of these conditions. Some MSK conditions can be life-threatening and result in death if left untreated<sup>18-21</sup>. People living with rheumatoid arthritis, osteoarthritis and those who have sustained an osteoporotic fracture have higher mortality rates than the age and gender matched peers<sup>18,22-24</sup>.

MSK pain is the most common form of chronic pain, even greater than cancer pain<sup>25</sup>. Chronic MSK pain is one of the most common reasons that people seek medical help, is costly<sup>26,27</sup>, but is under-recognised and under-treated. People living with chronic MSK pain have a constant struggle to affirm their self, confront stigma, reconstruct a sense of self through time, find an explanation, navigate the health-care system and prove legitimacy<sup>28</sup>.

### **1.3 Musculoskeletal health is determined throughout the life-course by an inter-play between genetic and environmental factors and by specific conditions and injuries.**

MSK health at all ages is dependent on the normal development and maintenance of the MSK system and the determinants of this, that is the interaction of genetics and environmental factors such as physical activity, body weight, and nutrition. These determinants may affect MSK health in general or increase risk of the occurrence or the course and severity of various established MSK conditions. MSK health may be affected by various conditions or injuries during the lifecourse that will often have an impact in later life. This accumulation over time makes age one of the strongest risk factors for MSK conditions and injuries<sup>29</sup>.

The epidemiological evidence confirms the dramatic increase in the majority of MSK disorders with age, a phenomenon that is occurring in all parts of the world, particularly among females.<sup>30-35</sup> Yet evidence also suggests that the disability related to MSK disorders should not be considered an inevitable consequence of ageing with recognition that the disorders affect males and females, all ethnic groups and can have considerable impact among those still in the workforce. The cause of MSK conditions is complex with variable contributions from genetics, environment and lifestyle. Important modifiable risk factors exist for the common MSK disorders, including smoking for rheumatoid arthritis, weight-gain and physical inactivity for osteoarthritis of the knees<sup>36,37</sup> and low back pain and sciatica<sup>38</sup>. Being overweight or obese accounted for 24.6% of new onset knee pain among men and women over 50 years of age in a recent meta-analysis, while injury accounted for 5%<sup>36</sup>. Exercise and weight-loss can make an important difference for improving MSK pain and function across all ages and have been shown also to apply to 70 and 80 year olds<sup>39</sup>

### **1.4 Musculoskeletal conditions are commonly associated with other chronic morbidities, and can be associated with increased all-cause mortality.**

MSK conditions, by virtue of their chronicity, pain and associated disability, are frequently associated with mental health impairments such as depression and anxiety as well as other comorbidities<sup>40-42</sup>. For example, a Canadian primary care-based study identified that 70% of people who presented with a MSK condition had at least one other chronic health condition<sup>43</sup>. It is well documented that the physical scores for function and participation in any generic quality of life measure when tested in populations declines with age and that for people with arthritis and MSK conditions this decline is even greater than their aged and gender-matched peers<sup>44-46</sup>. Physical performance parameters and number of comorbidities are clearly related to falls incidence, injurious falls and fatal outcomes.<sup>47,48</sup> The risk of falling in seniors with cognitive impairment, for example, is estimated to be two to three times higher compared to seniors with normal cognitive function, at the time that serious injury after a fall occur more than twice compared with people whose cognitive function is normal<sup>49,50</sup>. Symptomatic hip and knee osteoarthritis has also been shown to significantly increase the risk of falling in a community-dwelling prospective cohort study with the odds of falling showing a 'dose-response' with an increasing number of lower limb symptomatic OA joints: those with 1 joint had 53% higher odds, those with 2 joints had 74% higher odds, those with 3-4 OA joints had 85% higher odds<sup>51</sup>. A new phenotype of combined osteoporosis and sarcopenia (osteosarcopenia) has been

described in older persons with a history of falling. These patients were older, mostly women, at high risk for depression and malnutrition, with body mass index lower than 25, and a higher prevalence of peptic disease, inflammatory arthritis, maternal hip fracture, history of atraumatic fracture, and impaired mobility<sup>52</sup>.

Although more commonly associated with morbidity, many MSK conditions are also associated with an increased risk of mortality, for example, rheumatoid arthritis, systemic lupus erythematosus and the consequences of osteoporotic fractures<sup>53,54</sup>. Recent population-based studies with long follow up periods have estimated that mortality rates remain significantly higher than in the general population up to 5-15 years after the fracture event, and that includes not only hip fractures, but also most of the other sites for osteoporotic fractures (vertebral, pelvis, distal femur, proximal tibia, proximal humerus, multiple ribs)<sup>23,55</sup>. Part of the excess mortality is highly related to baseline frailty<sup>56-58</sup>. People living with chronic pain over many years have also been shown to have increased all-cause mortality when compared with the pain-free population<sup>59</sup>.

A curable MSK condition, gout, is related to cardiovascular mortality, via the accumulation of uric acid in the bloodstream and other organs, and through the provoked inflammation<sup>60,61</sup>. Gout and other MSK conditions, such as psoriatic arthritis, are associated with obesity and metabolic syndrome<sup>62</sup>. Rheumatoid arthritis and other inflammatory arthritides are related directly to cardiovascular inflammation and risk<sup>63</sup>.

## **1.5 Musculoskeletal health is important for prevention and management of other chronic health conditions**

The majority of chronic health conditions can be improved through participating in healthy levels of physical activity and healthy lifestyle habits, including diet and minimising alcohol and smoking<sup>64</sup>. However, arthritis is very common among older people with non-communicable chronic diseases (NCDs) such as heart disease<sup>8</sup>, chronic respiratory conditions<sup>65</sup>, diabetes<sup>65</sup> and disorders affecting the neurological system such as spinal cord injury and stroke<sup>66</sup> and has been identified as a potential barrier to the physical activity interventions for these conditions with significant impact on well-being and rehabilitation strategies<sup>7-9</sup>. For example, people with lower limb osteoarthritis cannot optimally participate in rehabilitation programmes, such as cardiac rehabilitation<sup>67,68</sup>. If one does not have good MSK health, people will be less able to address risk factors for other NCDs<sup>69</sup>. It has been demonstrated that the physical and mental aspects of quality of life related to health are greatly impaired in persons with multimorbidity, but this impairment is even greater when one of the diseases the person suffers is a MSK condition<sup>70</sup>. However, most doctors intervene on the comorbid condition rather than the MSK condition, as they consider it a normal process of ageing.

## **1.6 Impaired musculoskeletal health is having a growing impact on societies**

The burden from NCDs has increased and now accounts for the majority of the global burden of disease<sup>71,72</sup>. MSK conditions are a major contributor to this NCD epidemic, and account for a much larger global burden than what had previously been realised<sup>30-35</sup>. This transition of burden to long-term disabling conditions such as MSK conditions is well recognised in developed countries. There is now a growing body of research demonstrating the enormous future impact from MSK conditions

such as osteoporotic fragility fractures and low back pain in low- and middle-income countries<sup>30-35,71,73-81</sup>. This increased burden from MSK conditions is largely driven by population growth and ageing<sup>30-35</sup>. Age is one of the most common risk factors for MSK conditions<sup>29</sup>, and by 2050, it is predicted there will be five times as many people over 40 years living in developing countries compared to wealthier countries<sup>82</sup>. Obesity is also expected to rise dramatically in the developing world over the coming two decades<sup>83</sup>. People are changing to sedentary occupations and lifestyles and not undertaking as much physical activity<sup>84</sup>. One paradigm of this is the fast changes observed for health burden in the Middle East, where in the last two decades, dietary risk factors and high BMI have substituted undernutrition as leading risk factors for the health burden<sup>85</sup>. Further to this, increased use of motor vehicles is not only reducing physical activity but also increasing the numbers of motor accidents and resulting MSK disorders<sup>86</sup>.

## 1.7 Musculoskeletal health is vital for active and productive participation in occupational and vocational activities.

MSK health is particularly important for maintaining active productive and prolonged working life. Most work requires dexterity, mobility, carrying, lifting or standing. Some occupations and work-related activities are associated with MSK disorders, with low back pain and shoulder disorders probably the most common and most debilitating.<sup>87-91</sup> MSK conditions prevent productive work. In high-income countries, MSK conditions are one of the major causes of work loss and early retirement. In subsistence communities in developing countries, MSK conditions have been shown to have a major impact on livelihoods. Reduced MSK health therefore results in reduced productivity and economic loss to society. These costs far outweigh healthcare costs, by a factor of about five<sup>27</sup>. A healthy MSK system is vital for a healthy economy for society and financial security for individuals. Similarly, a healthy work environment is necessary to avoid injury and adequately rehabilitate following injury to maintain a healthy MSK system and worker satisfaction and productivity.

Participation and occupation in its broader definition, namely keeping older people active in all the things they need, want and are expected to do as individuals, in families and with communities to bring meaning and purpose to life<sup>92</sup>, will be negatively impacted if MSK health is poor.

### Examples:

A recent study using 2003 population-based data identified that by age 65, both men and women who were out of the workforce due to back problems were far less likely to have accumulated adequate wealth than those who were in the workforce with no health impairment. For example, men aged 45-54 years who retired early from work due to back problems were expected to have a median value of wealth by age 65 of just 1.5% of what would otherwise be expected by age 65<sup>93</sup>.

A survey in Tibet found that one fifth of people 15 years and older were restricted by low back pain in their abilities to perform subsistence activities such as collecting water and harvesting<sup>79</sup>

## 1.8 Musculoskeletal conditions are strong drivers to inequity in health and healthy ageing

Multiple MSK conditions expose people to inequitable experiences and consequences in their daily life. Such health inequities are conditioned on a wide list of determinants.<sup>94</sup> Lower socioeconomic status is a risk factor for the development of disability related to arthritis and MSK conditions, in part due to the inability of people to afford the best care, coupled with their higher exposure to manual work, injuries and life conditions that predispose to them to the MSK conditions.

The burden of MSK disease far exceeds service capacity in most countries<sup>95</sup> We will need to look increasingly to solutions outside the traditional public health system and widen the engagement with the primary care sector and community based rehabilitation strategies.

### Examples:

Aboriginal Australians have a significantly poorer health state and life expectancy than non-Aboriginal Australians. Despite this, the impact of low back pain among Aboriginal Australians has for a long time been perceived to be low and not associated with disability. However, recent data using a culturally-secure framework has disputed this long-held perception, identifying that the impact of chronic low back pain among Aboriginal Australians is profound<sup>2</sup>

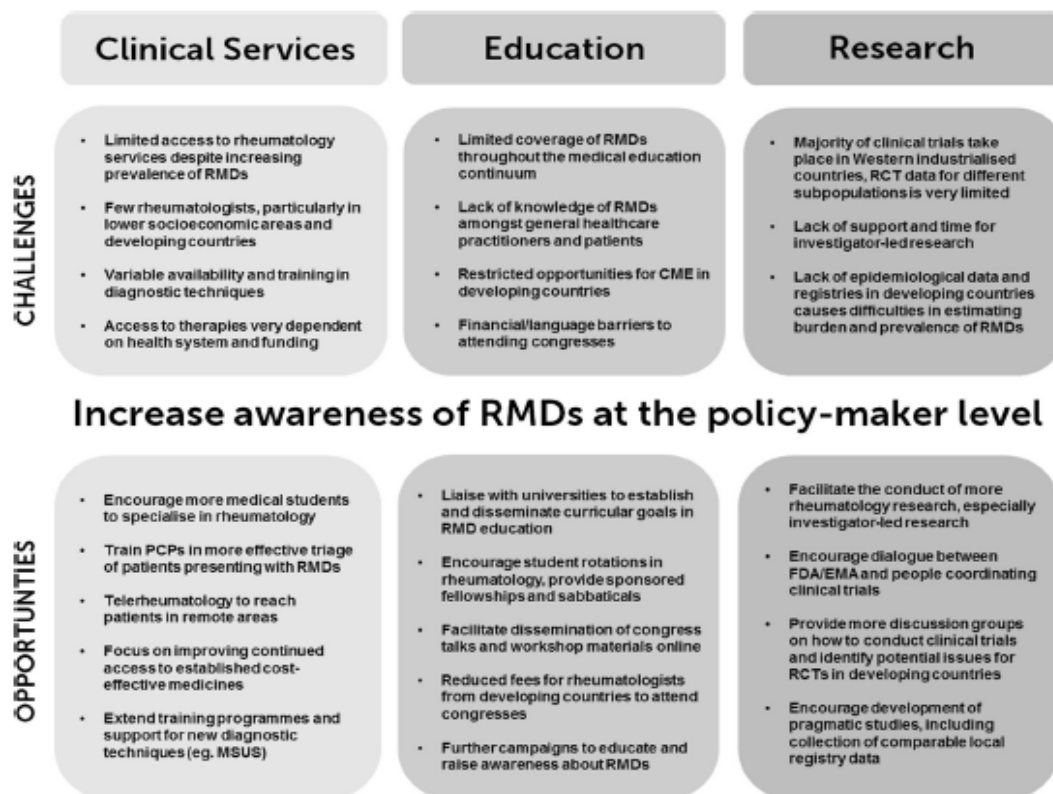
A study in rural subsistence communities in Tibet found that 33% of people suffer from low back pain at any one point in time. Over half of these people have some form of functional disability that impacts their livelihoods because of this e.g., unable to harvest, unable to collect water<sup>79</sup>.

A study performed in Melbourne identified that people waiting for hip or knee replacement surgery due to osteoarthritis reported profound psychological distress and a quality of life worse than death<sup>96</sup>.

A review of interventions to limit inequity in OA and RA has shown effective actions exist toward improving access to care.<sup>94,97</sup> Experiments in changing health care systems in Ireland, Finland and Thailand have shown that it is possible to turn pro-rich inequity into pro-poor distribution of care.<sup>98-100</sup>

Health systems in developed countries are gradually responding to the rising burden and the complex needs of people with MSK disorders through the implementation of multi-disciplinary, patient-centred models of care<sup>28</sup> however these are far from universal in the developed world and are almost non-existent in developing countries. Many primary care services that people with MSK conditions would like to access (such as those provided by osteopaths, naturopaths, acupuncturists, chiropractors and other manual care providers) are not publicly funded and are out of financial reach. In September 2014, rheumatology experts from five different continents met at the World Forum on Rheumatic and Musculoskeletal Disorders (WFRMD) to discuss the main challenges and opportunities facing the global rheumatology community today (Figure 1.1). World-wide inequalities in access to clinical care for rheumatic and MSK disorders were identified, at the same time recognising that the burden of disease is often higher in developing countries<sup>94,95</sup>. While the number of rheumatologists in developed countries far exceeds that in developing countries there remain world-wide and regional shortfalls in the provision of rheumatologists and the many other

health professionals integral to the provision of evidence-based best care for the MSK disorders. Progress in technology, drug development and diagnostic capabilities in the past two decades has resulted in major improvements in health outcomes for patients in developed countries but the cost of these innovations including joint prostheses and inflammatory arthritis medications and the lack of trained health personnel to deliver the specialised care puts these out of the reach of people with MSK disorders in most low and middle income countries. Education and training of health professionals remains a key priority.



[RMD = Rheumatic and Musculoskeletal Disorders]

**Figure 1.1:** Summary of the global challenges and opportunities facing rheumatology today<sup>95</sup>

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Due to the current and future impact from MSK conditions in developing settings, health systems need to develop coherent policies for dealing with this burden<sup>71</sup>. In these countries, synergies with other NCDs are important to explore given the inherent link between MSKs and these conditions. Further research is urgently needed in this area and to better inform policy for dealing with MSK conditions in these settings.

Optimising MSK health at every stage of the life-course has potential benefits for reducing not only the global burden of MSK health, but also burden from other NCDs. However, there is generally a paucity of data on the health impacts of MSK conditions in low- and middle-income countries. For example, a review of osteoarthritis (OA) in Asia found that very few studies had researched the impact of knee or hip pain or joint-specific OA on physical disability or health-related quality of life<sup>101</sup>. Further research is needed in this area.



It is well recognised that many opportunities exist to better harmonise global health policy and programmes to incorporate MSK conditions in efforts to address the burden of NCDs<sup>102-104</sup>. Physical activity, for example, can help to prevent cardiovascular disease, colon and breast cancers, type 2 diabetes, osteoporosis, and disabling OA and LBP<sup>105-107</sup>. Collaboration between groups working on these diseases will lead to more consistent public health messaging and more efficient use of resource<sup>108</sup>. Inter-professional collaboration in care delivery improves access to care and can lead to improvements in health outcomes and both client and health worker satisfaction<sup>109</sup>.

## 2. Epidemiology of common and major musculoskeletal conditions and injuries

### 2.1 Musculoskeletal conditions and injuries contribute significantly to global burden

#### 2.1.1 Combined MSK conditions

The Global Burden of Disease Study 2010 (GBD 2010) made estimates for 291 conditions, including OA of the hip and knee, rheumatoid arthritis (RA), gout, low back pain (LBP), neck pain (NP), and all other MSK disorders, captured in a group titled 'other MSK disorders'. The burden related to osteoporotic fractures was not included in the MSK grouping in the GBD 2010 Study, but would be represented in the injury grouping. The results of GBD 2010 study show that the prevalence and burden from MSK conditions are exceptionally high throughout the world<sup>30-35,71,74,77,80</sup>. Of the top 10 causes of burden from NCDs in developing countries, three were MSK conditions; LBP caused the highest disability (years lived with disability (YLDs)) and the fourth highest overall burden (disability-adjusted life years (DALYs)) in developing countries<sup>110</sup>.

Globally, the impact of MSK conditions in terms of disability is high, causing 21.3% of the total YLDs, second only to mental and behavioural problems<sup>71,72</sup>. When death and disability are considered, MSK conditions rank fourth in global burden, accounting for 6.7% of the total global DALYs<sup>71,72</sup>. In GBD 2010, LBP ranked highest in terms of global disability, and sixth in terms of overall burden. Neck pain, OA, RA and gout were also significant contributors to global disability burden<sup>71,72</sup>.

The burden in developing countries attributable to MSK conditions increased 60% from 1990 to 2010. This increase in burden was relatively consistent across MSK conditions, and was due to population growth and ageing and potentially to improved surveillance capabilities<sup>30-35,71,74,77,80</sup>. Disability from MSK made up 16.8% of all YLDs in developing countries in 1990, and this increased to 19.2% in 2010 (see Table 2.1). It is predicted that burden from MSK conditions will increase dramatically in developing countries over the coming decades given the predicted population growth and ageing in these populations<sup>76</sup>. MSK conditions make up a higher proportion of the total YLDs in developed countries and the rate of increase is slightly slower rising from 27.3% in 1990 to 28.1% in 2010.

**Table 2.1: Proportion of YLDs (with 95% confidence intervals (CI)) attributable to musculoskeletal conditions, by level of development and year, for all ages, men and women combined, GBD 2010.**

MSK YLDs	% of YLDs	Lower CI	Upper CI
<b>Developing countries</b>			
1990	16.8	13.6	20.1
2000	18.0	14.6	21.5
2010	19.2	15.9	22.6
<b>Developed countries</b>			
1990	27.3	22.9	31.4
2000	27.8	23.3	31.8
2010	28.1	23.5	32

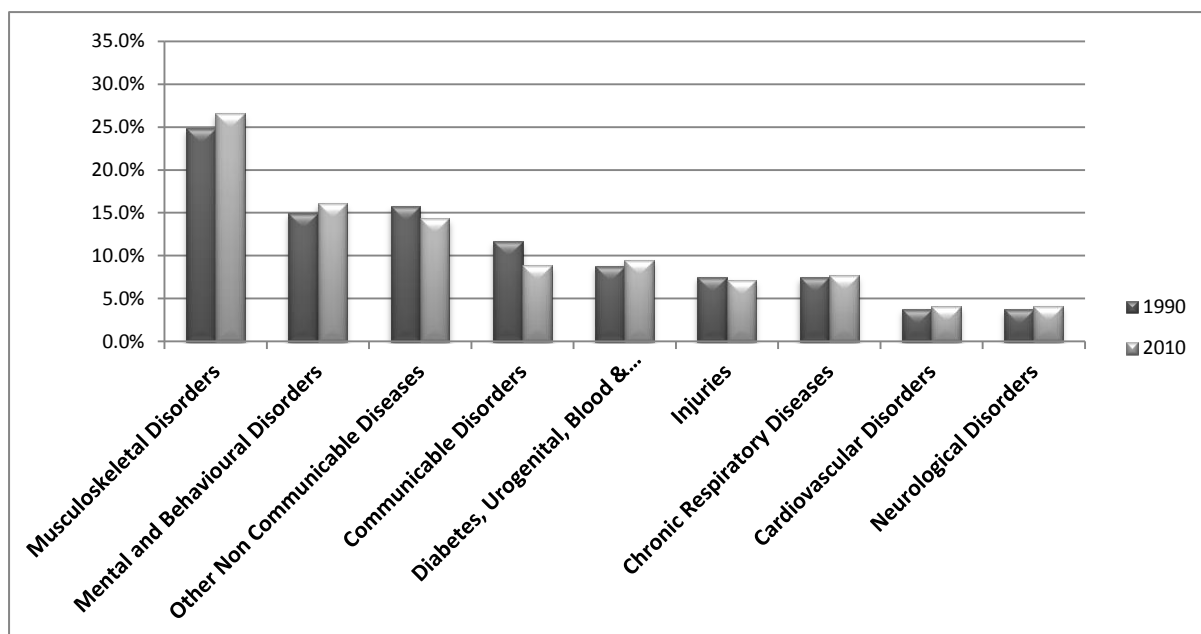
The proportion of YLDs attributable to MSK conditions is higher in the older age groups (see Figures 2.1a and 2.1b). In 2010 globally, MSK conditions accounted for 28.5% of YLDs for the 50-69 year age group and 23.4% in those aged 70 years and over. This is particularly seen in developed countries, where MSK condition accounted for 33% of total YLDs (Figure 2.1b and Table 2.2). It should be noted that the MSK disorder grouping in these figures do not include the YLDs associated with osteoporotic fracture. These are likely to make up a significant proportion of the Injury YLDs, particularly in the 70 years and over age group. Overall, MSK conditions were the leading contributor to YLDs in the elderly, well ahead of mental and behavioural disorders (16.6%) which ranked 2<sup>nd</sup> in the 50-69 year age group and neurological disorders (18.7%) which ranked 2<sup>nd</sup> in the 70 years and over age group.

Women are more commonly disabled by MSK conditions than men, accounting for a greater proportion of total YLDs. This is seen in both developed and developing countries and the difference is seen in both the 50-69 year and 70+ age groups (Table 2.2).

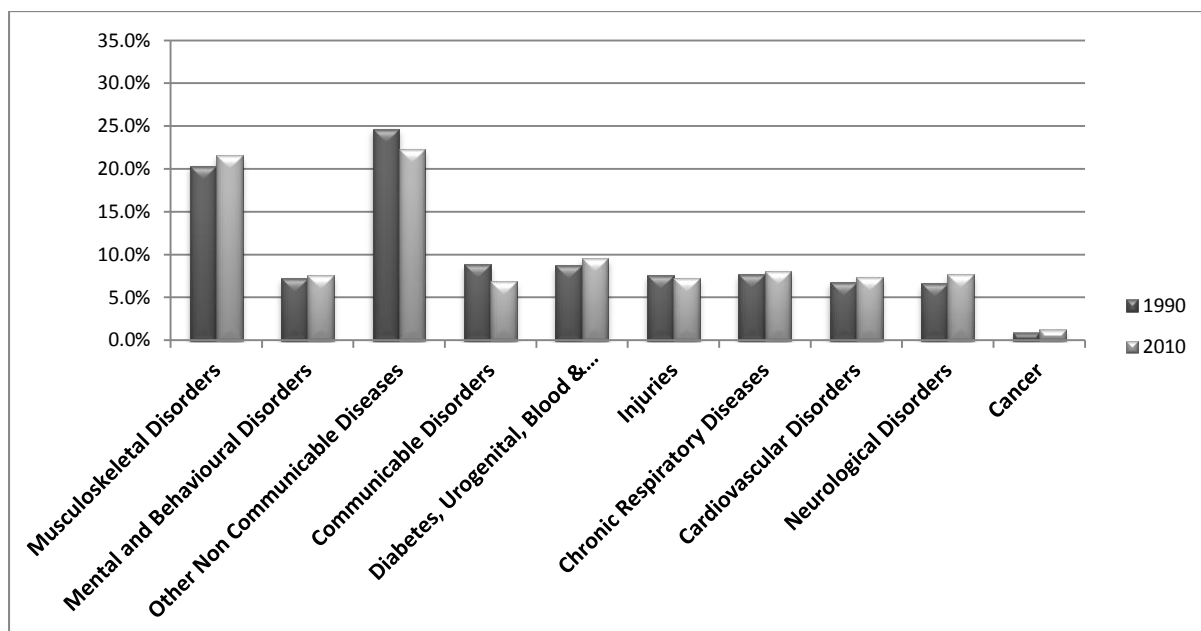
**Figure 2.1a: Proportion of total Global YLDs attributable to each major set of health conditions in Developing countries, 50-69 and 70+ age groups, men and women combined, 1990 and 2010, GBD 2010. Source GBD 2010**

**a. DEVELOPING COUNTRIES**

**Age 50-69 years**



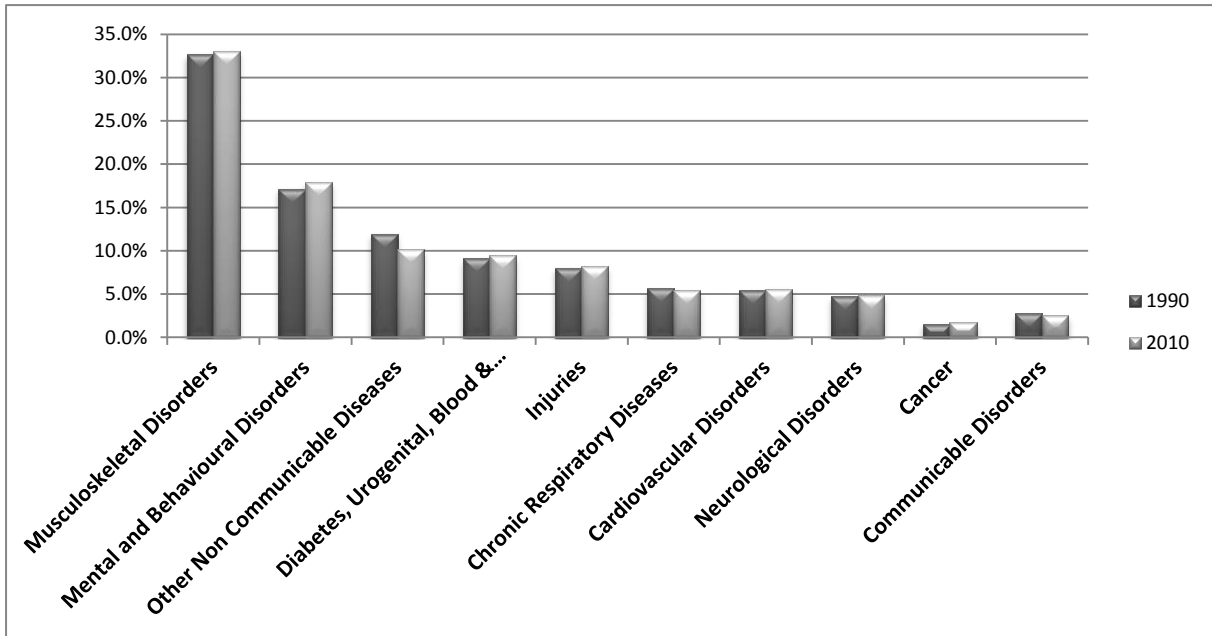
**Age 70+ years**



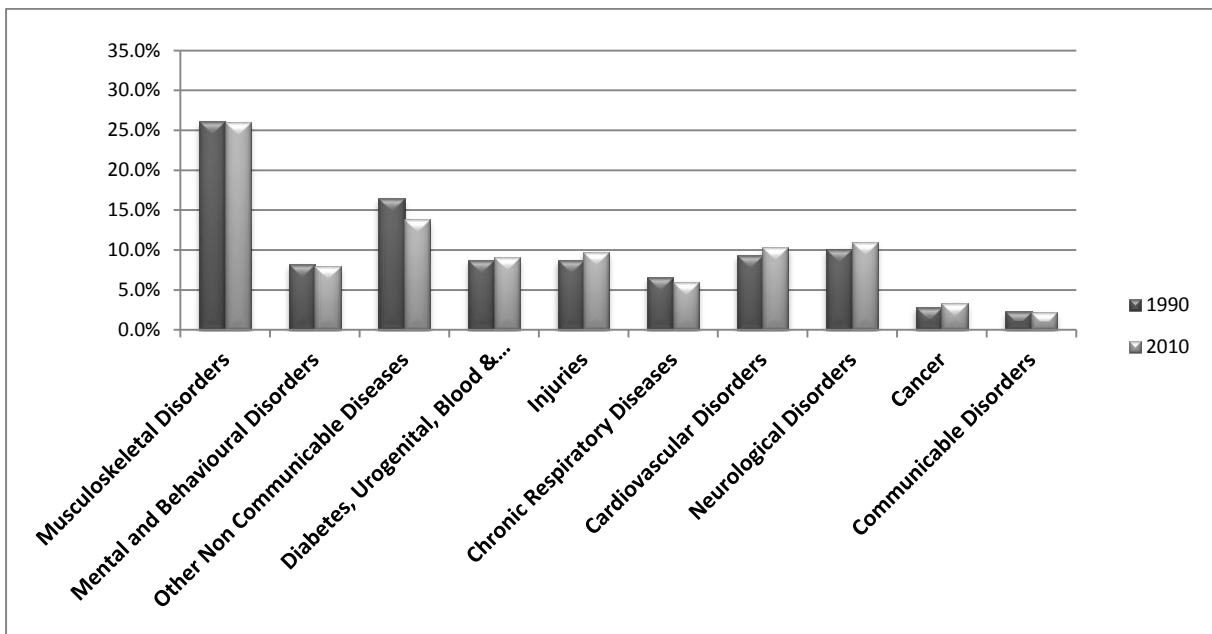
**Figure 2.1b: Proportion of total Global YLDs attributable to each major set of health conditions in Developed countries, 50-69 and 70+ age groups, men and women combined, 1990 and 2010, GBD 2010. Source GBD 2010**

**a. DEVELOPED COUNTRIES**

**Age 50-69 years**



**Age 70+ years**



**Table 2.2: Proportion of total YLDs of leading conditions, by level of development and ages, GBD 2010.**

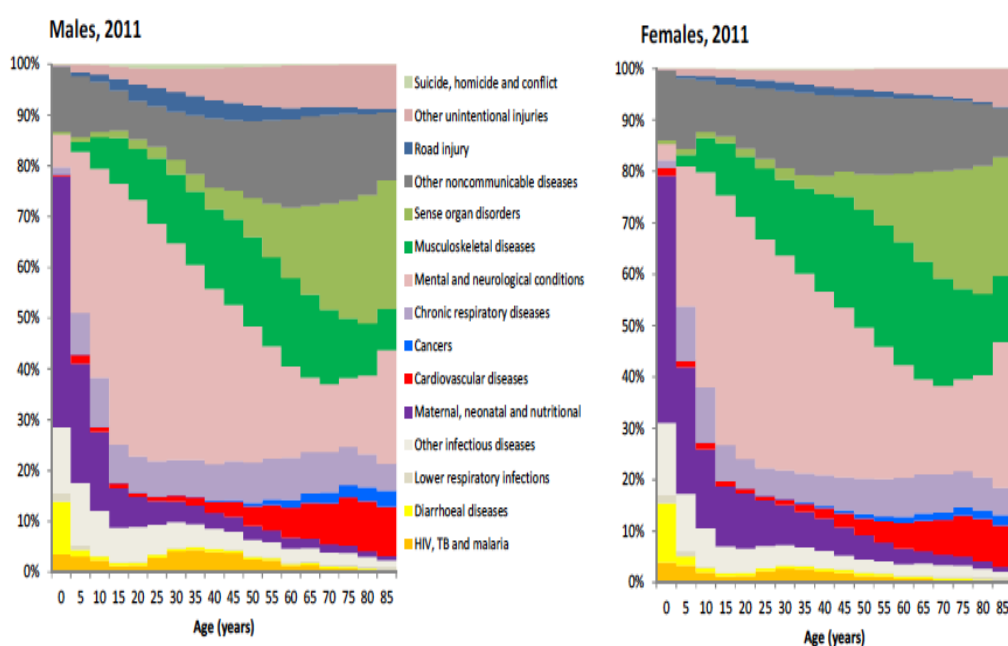
DEVELOPED	50-69 years						70+ years					
	1990			2010			1990			2010		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Musculoskeletal Disorders	32.7%	29.5%	35.3%	33.1%	29.8%	36.0%	26.1%	22.5%	28.0%	26.0%	22.4%	28.3%
Mental and Behavioural Disorders	17.2%	16.0%	18.1%	17.9%	16.5%	19.2%	8.2%	6.7%	9.0%	8.0%	6.5%	8.9%
Injuries	8.0%	10.6%	5.9%	8.2%	10.8%	5.9%	8.8%	11.0%	7.6%	9.8%	11.8%	8.5%
Cancer	1.6%	1.7%	1.5%	1.8%	1.9%	1.7%	2.8%	3.7%	2.4%	3.4%	4.4%	2.7%
Cardiovascular Disorders	5.4%	6.1%	4.9%	5.6%	6.3%	5.0%	9.4%	10.8%	8.6%	10.3%	11.8%	9.3%
Chronic Respiratory Diseases	5.6%	5.9%	5.4%	5.4%	5.7%	5.2%	6.5%	6.6%	6.4%	6.0%	6.3%	5.8%
Neurological Disorders	4.8%	3.9%	5.5%	4.9%	4.0%	5.7%	10.1%	8.4%	11.1%	11.0%	9.2%	12.2%
Diabetes, Urogenital, Blood & Endocrine Disorders	9.1%	10.6%	7.9%	9.5%	11.1%	8.1%	8.7%	11.3%	7.3%	9.1%	11.5%	7.5%
Other Non Communicable Diseases	11.9%	12.0%	11.9%	10.1%	10.3%	10.0%	16.4%	16.0%	16.6%	13.8%	13.3%	14.0%
Communicable Disorders	2.8%	2.9%	2.7%	2.6%	2.6%	2.5%	2.3%	2.2%	2.3%	2.2%	2.1%	2.2%
<b>DEVELOPING</b>	<b>50-69 years</b>						<b>70+ years</b>					
	<b>1990</b>			<b>2010</b>			<b>1990</b>			<b>2010</b>		
	<b>Total</b>	<b>Males</b>	<b>Females</b>	<b>Total</b>	<b>Males</b>	<b>Females</b>	<b>Total</b>	<b>Males</b>	<b>Females</b>	<b>Total</b>	<b>Males</b>	<b>Females</b>
Musculoskeletal Disorders	24.8%	22.7%	26.9%	26.6%	24.4%	28.8%	20.3%	18.1%	22.2%	21.6%	19.4%	23.4%
Mental and Behavioural Disorders	15.0%	13.7%	16.3%	16.1%	14.8%	17.3%	7.2%	6.1%	8.2%	7.6%	6.3%	8.6%
Injuries	7.6%	9.8%	5.3%	7.2%	9.4%	5.0%	7.5%	9.5%	5.9%	7.3%	9.3%	5.6%
Cancer	0.6%	0.6%	0.6%	0.8%	0.8%	0.7%	0.9%	1.0%	0.8%	1.2%	1.9%	1.0%
Cardiovascular Disorders	3.8%	4.0%	3.6%	4.1%	4.4%	3.8%	6.8%	7.1%	6.5%	7.4%	8.0%	6.9%
Chronic Respiratory Diseases	7.5%	7.7%	7.3%	7.7%	8.1%	7.4%	7.7%	7.9%	7.5%	8.1%	8.2%	8.1%
Neurological Disorders	3.8%	3.1%	4.4%	4.2%	3.5%	4.9%	6.7%	5.6%	7.6%	7.6%	6.4%	8.7%
Diabetes, Urogenital, Blood & Endocrine Disorders	8.8%	9.8%	7.8%	9.5%	10.6%	8.4%	8.7%	10.5%	7.2%	9.5%	11.6%	7.9%
Other Non Communicable Diseases	15.8%	15.8%	15.8%	14.4%	14.4%	14.4%	24.7%	24.4%	24.9%	22.3%	21.9%	22.7%
Communicable Disorders	11.7%	12.0%	11.4%	8.9%	8.9%	8.9%	8.9%	9.2%	8.6%	6.8%	6.9%	6.8%

The WHO has recently produced their Global Burden of Disease for 2011 report and this showed MSK disorders to be the second greatest cause of years living with disability globally<sup>111</sup>. These data reflect OA hip and knee, RA, Gout and Spinal pain (Low Back and Neck) and do not include the wide range of MSK problems that are represented by “Other MSK” in GBD 2010.

The following figure from WHO Global Health Estimates 2011 show the proportion of YLDs attributable to common grouping of causes across the life course for males and females separately in 2011<sup>112</sup>. YLDs due to MSK conditions combined, are represented by the darker green shading (Figure 2.2).

Females have a higher proportion of YLDs than males and a stronger association with age. It should be noted that the MSK conditions in these figures do not include *all* MSK but a subset of LBP, NP, OA hip and knee, and RA. Osteoporotic fractures would be represented as a subset of the dark pink shading of the other unintentional injuries category.

**Figure 2.2:** Proportional age distribution of global YLDs by cause and sex<sup>112</sup>



### 2.1.2 Burden of Common MSK Conditions

The burden of each MSK condition will be described here.

#### Low Back Pain

The internationally recommended definition for LBP is ‘activity-limiting LBP ( $\pm$  pain referred into one or both lower limbs) that lasts for at least one day’. The ‘low back’ is defined as the area on the posterior aspect of the body from the lower margin of the twelfth ribs to the lower gluteal folds<sup>32,113</sup>

The GBD 2010 Study estimated the global age-standardised point prevalence of activity-limiting low back pain that had lasted for at least one day was 9.4% (95% Uncertainty interval (UI): 9.0 to 9.8). It was higher in men (10.1%; 95% UI 9.4 to 10.7) than women (8.7%; 95% UI 8.2 to 9.3). Prevalence amongst those aged 65-74 years was 22.9% (95% UI: 19.0 to 21.1), and for those aged 85 years and above prevalence was 23.3% (95% UI: 22.3 to 24.6%) (Table 2.3). The age and sex distribution across GBD regions was similar<sup>32</sup>. Overall burden was greatest in Asia. These findings are comparable with a systematic review that was undertaken on the global prevalence of low back pain. This review used multivariate regression analysis to determine the global point prevalence of activity-limiting low back pain that had lasted for at least one day, which was found to be 11.9% (95% UI: 9.9 to 13.9).<sup>75</sup>

**Table 2.3: Global prevalence (with 95% uncertainty intervals) of activity-limiting low back pain and neck pain that had lasted for at least one day, by age group, GBD 2010**

Age (years)	Low Back Pain			Neck Pain		
	Prevalence (%)	Lower UI (%)	Upper UI (%)	Prevalence (%)	Lower UI (%)	Upper UI (%)
All ages	9.4	9.0	9.8	4.9%	4.6%	5.3%
55-64	16.9	16.0	17.9	8.2%	7.6%	8.8%
65-74	20.0	19.0	21.1	8.0%	7.5%	8.6%
75-84	22.9	21.8	24.2	7.8%	7.2%	8.4%
85+	23.3	22.3	24.6	7.3%	6.8%	7.8%

### Neck Pain

The internationally recommended definition for neck pain is ‘activity-limiting NP ( $\pm$  pain referred into one or both upper limbs) that lasts for at least one day’<sup>32</sup>.

GBD 2010 Study estimates found that the global age-standardised point prevalence of activity-limiting neck pain that had lasted for at least one day was 4.9% (95% UI: 4.6 to 5.3)<sup>33</sup>. It was higher in women (5.8%; 95% UI: 5.3 to 6.4) than in men (4.0%; 95% UI: 3.7 to 4.4). Prevalence increased with age, reaching 8% in those aged 65 to 74 years (95% UI: 4.5 to 8.6) (Table 2.3). The age and sex distribution across GBD regions was similar<sup>33</sup>. As with LBP, overall burden was greatest in Asia.

### Osteoarthritis

Osteoarthritis (OA) is a condition that affects the whole joint including bone, cartilage, ligaments and muscles. It can affect any joint but occurs most often in the knees, hips, finger joints, big toe and spine. Current evidence on risk factors for developing pain from knee OA in older adults found 5.1% of cases were due to previous knee injury and 24.6% was related to being overweight or obese. Prevention or the early treatment of injuries and obesity represent an opportunity to reduce the occurrence of OA<sup>36</sup>.



Data from the GBD 2010 study, that used a restricted case definition of only hip and knee OA where both symptoms and radiological signs were present, showed that globally around 3.7% of the population have knee OA (95% UI 3.5% to 4.0%), affecting approximately 268 million people<sup>31</sup>. Around 0.85% of the population have hip OA (95% UI 0.74% to 1.02%), equivalent to 60 million people globally<sup>31</sup>. The hand is also a common site of OA, and causes considerable disability and difficulty with activities of daily living additional to the mobility-related disability seen in hip and knee OA<sup>114</sup>.

Knee OA is more common in females (4.8%; 95% UI 4.4% to 5.2%) than in males (2.8%; 95% UI 2.6% to 3.1%). Similarly, hip OA is also more common in females (0.98%; 95% UI 0.82% to 1.29%) than in males (0.70%; 95% UI 0.58% to 0.90%). OA can develop at any age but tends to be more common in people aged over 50 years or those who have had joint injuries. While the overall prevalence of knee OA is 3.7%, prevalence in the 55-64 year age group is 13%, rising to 15% in those 85 years and older (Table 2.4). Similarly, while the prevalence of hip OA is 0.9% overall, a higher prevalence is seen in those aged over 55 years reaching almost 8% in those aged 85 years and over. This increase in prevalence of OA with age will contribute to the future crisis in treatment and management of OA that will occur with the aging global population. For example, the prevalence of OA in Australia is expected to rise by 58% between 2012 and 2032<sup>27</sup>.

OA can affect many other joints, including the spine, hands and feet that were not included in the prevalence estimates and as such the real burden of OA globally is likely to be significantly underestimated.<sup>31</sup>

In the recent WHO global burden of disease estimates for 2012 reported OA ranked as the 11<sup>th</sup> leading cause of years lived with disability globally accounting for 2.4% of all YLDs.<sup>115</sup> The contribution of OA to overall YLDs increased with age. For males aged 50-59 years, OA accounted for 4.4% of total YLDs, females 7.0%. For males aged 60-69 years, OA accounted for 4.0% of YLDs and for females 6.6%.

**Table 2.4:** Global prevalence of Knee OA and Hip OA overall and in ages over 55 years (source GBD 2010)

Age (years)	Knee OA			Hip OA		
	Prevalence (%)	Lower UI (%)	Upper UI (%)	Prevalence (%)	Lower UI (%)	Upper UI (%)
All ages	3.7	3.5	4.0	0.9	0.7	1.0
55-64	13.1	12.3	14.0	2.8	2.4	3.3
65-74	14.2	13.4	15.2	4.1	3.6	4.9
75-84	14.9	14.1	15.9	5.8	5.1	6.9
85+	15.4	14.5	16.4	7.9	6.9	9.3

## Rheumatoid arthritis

Rheumatoid arthritis (RA) is an autoimmune disease that causes pain and swelling of the joints whereby the immune system targets the lining of the joints, causing inflammation and joint damage. The systemic inflammation is associated with potential damage to other body systems and possible death. While there is no cure for RA, early diagnosis and treatment is shown to limit permanent joint damage and damage to other body systems. Smoking has emerged as an important risk factor for the development and progression of RA and represents an opportunity for prevention<sup>116</sup>. Other similarly preventable emerging risk factors are obesity and salt consumption<sup>117,118</sup>.

From the GBD 2010 study the global prevalence of RA was estimated to be 0.24% (95% UI 0.23% to 0.25%), equal to 17 million people globally and was approximately two times higher in females (0.35%; 95% UI 0.34 to 0.37) than males (0.13%; 95% UI 0.12 to 0.13).<sup>30</sup> Prevalence of RA increases with age, reaching 1.4% in those aged 85 years and older for males and females combined (Table 2.5). For females aged 60-69 years, RA accounted for 1.3% of total YLDs and 1.4% in females aged 80 years and over.

**Table 2.5:** Global prevalence of RA overall and in ages over 55 years (source GBD 2010)

Age (years)	Prevalence (%)	Lower UI (%)	Upper UI (%)
All ages	0.24	0.23	0.25
55-64	0.53	0.51	0.55
65-74	0.78	0.75	0.82
75-84	1.06	1.01	1.11
85+	1.35	1.28	1.43

YLDs from the WHO estimates for 2012 for RA were 3.9 million accounting for 0.5% of total YLDs. YLDs for RA in low income countries were 254,000 (0.3% of total), 865,000 in lower middle income countries (0.5% of total), 1,160,000 in upper middle income (0.5% of total) and 1,652,000 in high income countries (1.1% of total)<sup>111</sup>.

## Gout

Gout is a common and extremely painful condition that affects the joints. Small crystals of uric acid form in and around the joint, causing inflammation, pain and swelling. Anyone can get gout, however it is rare in premenopausal women. Gout normally affects one joint at a time, often the joint of the big toe.<sup>119</sup> Other joints, such as the hands, wrists, knees, ankles and elbows, can also be affected by gout. There are some modifiable lifestyle factors which may increase the risk of developing gout, including being overweight or obese, having high cholesterol, high blood pressure or glucose intolerance, having kidney disease or taking diuretics.

From the GBD 2010 study, the global prevalence of gout was 0.076% (95% UI 0.072 to 0.082), equivalent to 5 million people globally (Table 2.6)<sup>35</sup>. Prevalence was greater in men (0.125%; 95% UI 0.116 to 0.136) than in women (0.032%; 95% UI 0.030 to 0.035). WHO global burden of disease estimates for 2012 reported global DALYs for gout as 0.1 million. YLDs from the WHO estimates for 2012 for gout were 119,318. YLDs for gout in low income countries were 4,000, 12,000 in lower middle income countries, 33,000 in upper middle income and 71,000 in high income countries.<sup>35</sup>

**Table 2.6:** Global prevalence of Gout overall and in ages over 55 years (source GBD 2010)

Age (years)	Prevalence (%)	Lower UI (%)	Upper UI (%)
All ages	0.1	0.1	0.1
55-64	0.2	0.2	0.2
65-74	0.3	0.3	0.3
75-84	0.4	0.3	0.4
85+	0.4	0.4	0.4

### Other musculoskeletal disorders

Other MSK conditions includes a wide range of specific conditions such as the autoimmune and other inflammatory disorders such as systemic lupus erythematosus, ankylosing spondylitis and psoriatic arthritis, as well as the wide range of joint, ligament, tendon or muscle problems that cause regional or generalised pain, such as shoulder problems and fibromyalgia. A common symptom of these conditions is pain and stiffness in the joints, although the effects on the body are wide-ranging.<sup>34</sup>

Generally, other MSK conditions are common. The prevalence of other MSK conditions in the GBD 2010 Study was estimated to be 8.2% (95% UI 8.0% to 8.5%), equivalent to almost 600 million people globally<sup>34</sup>. It was slightly higher in females (mean 8.7%; 95% UI 8.4% to 9.1%) than in males (mean 8.0%; 95% UI 7.7% to 8.3%). The prevalence of Other MSK conditions was considerably greater at older ages, with a prevalence of 16% at ages 55-64 years, increasing to 24.9% at age 85 years and over (Table 2.7).

WHO global burden of disease estimates for 2012 reported YLDs for other MSK disorders of 29.4 million accounting for 4% of total YLDs. YLDs for other MSK conditions in low income countries were 2.4 million (2.7% of total), 7.9 million in lower middle income countries (2.9% of total), 10 million in upper middle income (4.3% of total) and 9 million in high income countries (6.1% of total).<sup>115</sup>

**Table 2.7:** Global prevalence of Other Musculoskeletal Disorders overall and in ages over 55 years (source GBD 2010)

Age (years)	Prevalence (%)	Lower UI (%)	Upper UI (%)
All ages	8.2	8.0	8.5
55-64	16.5	16.0	17.2
65-74	22.4	21.4	23.4
75-84	24.8	23.7	26.0
85+	24.9	23.7	26.3

### Osteoporosis, fragility fractures and falls

Falls constitute one of the greatest health burdens in elderly populations worldwide. In the GBD 2010 Study, falls represented the first injury type with the major global health burden and deaths in population 70 years and above<sup>71,72,120</sup>. Moreover, falls ranked in the three top causes for disability in the world both for 1990 and 2010 estimates in this age group, more than chronic conditions such as diabetes or ischemic heart disease<sup>71,72,120</sup>, and their absolute burden almost doubled in the 20-year period studied. The major component of the health burden due to falls was attributable to the consequences of fractures (personal communication, GBD 2013).

Prospective studies in North America and Europe have shown that at least 30% of people 75 years and over living in the community report having had a fall during the past year. This proportion is greater in females and increases to 40-50% in seniors 80 years or older<sup>48,121</sup>. Twenty percent of falls-related injuries require medical attention, and include lacerations, dislocations, contusions, and in 5-10% of the cases, more severe injuries such as head traumas and osteoporotic fractures<sup>122</sup>.

For a person aged over 50 years living in a developed country, the lifetime risk of sustaining any fracture has been estimated to be approximately 50% for women and 20% for men, most of these occurring after a low energy fall and therefore related to osteoporosis<sup>123,124</sup>.

In the year 2000 there were an estimated 9.0 million osteoporotic fractures globally, of which 1.6 million were at the hip (70% women), 1.7 million were at the forearm (80% women) and 1.4 million were clinical vertebral fractures (58% women). Although hip fractures only accounted for 18.2% of all fractures, they represented 40% of all global health burden (DALYs) due to fractures, reflecting the higher mortality and disability of hip fractures compared to other sites.<sup>125</sup> The greatest number of fractures was in Europe, followed by the Western Pacific region, Southeast Asia and the Americas. Collectively, these regions accounted for the 97% of the overall numbers of fractures worldwide, highlighting the influence of the aging populations on the incidence of osteoporotic fractures, in particular on hip fracture rate, with a peak number between 75 and 79 years for both men and women. In Europe, osteoporotic fractures accounted for more DALYs lost than rheumatoid arthritis and all sites of cancer, with the exception of lung cancer.<sup>125</sup>

Considering the ageing of the global population, the worldwide incidence of hip fracture is projected to increase by three-fold by 2050 compared to 1990<sup>126</sup>.

Epidemiology of osteoporosis was recently gathered from 58 countries around the world from an important systematic review on hip fracture incidence<sup>127</sup>. Prevalence of osteoporosis defined by T score of -2.5 or less using international reference standard (white 20-29 females from NHANES III), was around 3% and 10 % in men and women 50-59 years of age, respectively. This percentage increased to 6% and 19% respectively in population aged 60-69, followed by 9% and 35% respectively in those aged 70-79, and finally, 19% and 51% respectively in people aged 80 or over. The countries included in such study accounted for around four fifths of the world population aged 50 years or more. Extrapolating the data to the world, the authors estimated that approximately 2.7 million hip fractures took place in 2010, of which approximately half were attributable to osteoporosis (264,000 for men and 1.10 million for women), and therefore potentially preventable.

A recent report from the GBD 2010 initiative, where low bone mineral density (BMD) was analyzed as a risk factor for falls burden (through its strong relationship with osteoporotic fractures)<sup>128</sup>, found that around one third of all falls-related deaths in the world were attributable to low BMD when the latter was compared to an hypothetical ideal scenario where all population aged 50 years and over had an optimal level of BMD according to their gender and age group<sup>80</sup>. When compared with other risk factors, low BMD ranked at a medium-high level in aged populations, being the 7<sup>th</sup> cause of disability (YLDs) among 20 risk factor categories in people 80 years and over ([www.healthdata.org](http://www.healthdata.org)).

## 3 Responding to the burden of musculoskeletal conditions in older adults

### 3.1 A systems approach

The magnitude of the disability burden associated with MSK conditions, as outlined in Section 2, demands a whole system response, involving multiple levels (Table 3.1)<sup>28</sup>. While there is good evidence for ‘what works’ to improve MSK health, chronic pain, and co-morbid mental health impairment in older age, the implementation of that knowledge into health system policy and resourcing, clinical practice behaviours and the lifestyles of older people’s remains grossly inadequate in most countries. This is further complicated by a recognised dearth of implementation research for MSK health in particular<sup>129</sup>, and a notable absence of MSK health issues in policies related to NCDs<sup>28</sup>. Indeed, the absence of MSK health in health policy and community service delivery remains a key barrier to sustainable implementation of effective programs. In the context of research, a key priority is the development and evaluation of initiatives aimed at implementing evidence into policy and practice.

Currently, older people are not receiving effective and efficient care and in some cases are receiving interventions that are potentially harmful. For example, in developed nations such as Canada, while up to 80% of consumers with chronic pain could feasibly receive effective care, only 10% gain access to evidence-informed management<sup>130</sup>. Further examples include the overuse of X-ray imaging for back pain in older people<sup>131</sup>; grossly inadequate treatment for osteoporosis, despite eligibility for subsidised therapies<sup>132</sup>; and care for knee OA and chronic pain that is discordant with best-practice, person-centred care<sup>133-136</sup>. This situation, however, is being redressed with the introduction of Models of Care for MSK health conditions, decision aids for consumers and clinicians and initiatives such as Choosing Wisely ([www.choosingwisely.org](http://www.choosingwisely.org)); initially launched in the United States in 2012, and now being adopted in 12 nations<sup>137</sup>. In low- and middle-income countries, there is a particular need for research on effective and efficient approaches for the prevention, management and control of MSK conditions<sup>76</sup>.

Importantly, no single health discipline or one sector of the community can address all the needs of the older person given the widespread prevalence of MSK problems and complex relationships between MSK disorders and other chronic health conditions. Inter-professional collaboration in care delivery and broader community solutions are needed to reduce mortality and morbidity, improve access, reduce cost, improve patient satisfaction and improve health worker satisfaction<sup>138,139</sup>. Despite contemporary health policy supporting this approach to care, implementation of such workforce models are often stymied due to limitations in workforce volumes, competencies and distributions and funding models that inadequately support interdisciplinary care, especially for allied health professionals<sup>139</sup>.

Addressing these issues requires fundamental systemic and sector-wide changes in the way health services are delivered and funded, the manner in which health professionals are trained and provide care, and participation by older people in co-management of their MSK conditions<sup>140</sup>. Importantly, the manner in which interventions at any level are applied will necessarily vary according to the

setting. These principles align with the WHO guidelines for Community Based Rehabilitation (<http://www.who.int/disabilities/cbr/guidelines/en/>). In developing countries, for example it is highly important that any initiatives, including research, must adhere to the principles of *development effectiveness* to avoid doing harm to the health systems in these settings<sup>76</sup>. These principles are based on lessons learned from the global development community over past decades. They aim improve the quality and effectiveness of development cooperation<sup>141-143</sup>. The three most critical principles are:

- **Local ownership:** Developing countries should have leadership over setting strategies for dealing with the burden of MSK conditions in their countries.
- **Alignment:** All MSK health initiatives should be based on the developing country's development priorities, policies and strategies; for example, national health or development strategies. Related to this, all MSK health initiatives should utilise the developing country's systems rather than implementing stand-alone projects. Inter-professional training and collaboration is an important component.
- **Harmonisation:** Given that multiple initiatives by different external partners can be very draining for developing countries, cooperation between external partners in the broader community is needed to minimise this effect, avoid duplication and improve efficiency.

Related to the above principles is the importance of taking an integrated approach to health systems strengthening. Many resource-constrained countries cannot afford the luxury of disease-specific prevention and management policies and programs. Therefore, it is important that MSK health initiatives in these settings integrate well within health systems. For example, inclusion of MSK conditions within NCD initiatives will avoid duplication of efforts, wasting of resources, and will help to promote a more-integrated and cost-effective approach to health system strengthening<sup>76</sup>. Given, MSK health affects and is affected by a broad range of sectors beyond the health sector, multi-sectoral approaches should be explored and encouraged.

### Example

One example was collaboration between the health and environmental sectors in Tibet to develop a series of Back-Happy Tapstands given that the collection of water had been reported by village populations as one key activity they felt contributed to their pain and disability. This is a creative adaptation of knowledge of biomechanics, anatomy, ergonomics and human factor analysis that incorporates occupational therapy and rehabilitation principles. The Tapstand was extremely popular and many women rated it as the most significant improvement to their lives in the previous three years (Figure 3.1)<sup>79,144</sup>.

**Figure 3.1: A Traditional and Back-Happy Tapstand demonstrating the value of multi-sectoral engagement for reducing the burden of musculoskeletal conditions, Tibet**





Table 3.1: A systems approach to addressing the burden of musculoskeletal conditions in older people

<i>System level factors</i>	<i>Determinants of musculoskeletal health</i>	<i>What needs to change</i>
<b>Macro</b>	<p>The macro level considers the functionality and scope of health systems or organisations, health policy, infrastructure and resource allocation, and socioeconomic factors. Health systems/organisations and their governance through health policy play a critical role in the planning and delivery of MSK healthcare for older people. Healthcare systems in developed nations are usually oriented towards acute care services and respond to mortality risk rather than long-term morbidity associated with MSK conditions and their co-morbidities which stymies opportunities for service development in ambulatory and primary care – arguably, the setting where MSK healthcare is most needed. Given the MSK conditions are less frequently associated with mortality, health systems and policy tend to be less responsive to these conditions and place lower importance on the development of policies and programmes to address them. This contributes to a general lack of population awareness concerning the burden an impact associated with musculoskeletal conditions. Further, access to MSK healthcare is variable according to geography, ethnicity and socioeconomic status, thus creating care disparities<sup>95,145-148</sup>.</p>	<ul style="list-style-type: none"> <li>• The impact of impaired MSK health on function, mobility, quality of life, mental health and economic prosperity of the individual and their society should be communicated at a societal level – governments, employers, educators and to communities. The inaccurate perception that pain and disability is an inevitable part of ageing or MSK ‘wear and tear’ should be addressed.</li> <li>• Given populations are ageing and becoming more obese and less active, the impacts on the MSK system will be profound<sup>149</sup>. Primary prevention initiatives for chronic diseases should include messages about preventing disease in the MSK system. Mass media campaigns for back pain, for example, are known to be effective in this regard<sup>150-152</sup>.</li> <li>• MSK health should be explicitly included in policies and frameworks that address chronic diseases or ageing<sup>28,95</sup>.</li> <li>• Developing system capacity (governance, resourcing, infrastructure) to support MSK healthcare delivery in community or ambulatory care settings in urban and rural locations is important for system sustainability. Operationally, this is likely to be achieved by implementing evidence-based Models of Care at the community level and in retirement facilities (see Table 3.2)<sup>28,140</sup>.</li> <li>• Encourage multidisciplinary stakeholders (including funders, insurers, policy makers, educators, consumers and carers) to</li> </ul>

		<p>co-operatively develop and implement Models of Care<sup>153</sup>. The IOF Capture the Fracture initiative is an example of global cooperation in this regard.</p>
<p>Meso</p>	<p>The meso level considers health services, the clinical workforce volume and competencies, health professional and student/trainee education, service delivery systems, funding models, and clinical infrastructure. Despite the identified burden of disease, the delivery of MSK care from practitioners and health systems inadequately aligns with best available evidence for what works<sup>136,154</sup>. This may be attributed, in part, to deficiencies in knowledge and skills of health professionals, but is also largely influenced by funding and service models that inadequately support effective co-care. Access to, and delivery of, care is further complicated by the chronicity of MSK conditions and the high prevalence of comorbid conditions, particularly mental health conditions, in older people.</p>	<ul style="list-style-type: none"> <li>• Development of knowledge and skills among health professionals to manage MSK health conditions using a best practice, person-centred approach is required<sup>95,136</sup>. In high-income countries, this is particularly required amongst family physicians<sup>136</sup>.</li> <li>• Professional bodies representing MSK health should support curriculum development and delivery for junior health professionals. For example, the leadership and advocacy work undertaken in China by the Chinese Rheumatology Association.</li> <li>• Develop capacity of the non-medical health workforce to contribute to the management of MSK health conditions in an interdisciplinary, inter-professional and non-hierarchical manner<sup>155,156</sup>. Further, it is important, where feasible, to work towards achieving a level of specialist medical oversight to ensure access to the latest specialist evidence. For the many geographic regions where this is not feasible, given the vast MSK health burden and high service need, access to evidence-based guidelines and inter-disciplinary collaboration is crucial.</li> <li>• Given the known workforce shortages of medical specialists such as rheumatologists, endocrinologists and pain medicine specialists<sup>95</sup>, further extend scopes of practice of other health professionals such as nurses, allied health professionals and pharmacists, are needed to deliver best-practice care to older people with MSK health conditions. Formal online and course-based training is now available, for</li> </ul>

		<p>example, for nurses (<a href="http://www.acn.edu.au/postgraduate">http://www.acn.edu.au/postgraduate</a>); physiotherapists (<a href="http://www.rap-el.com.au/">http://www.rap-el.com.au/</a>); pharmacists (<a href="http://www.osteoporosis.org.au/pharmacists">http://www.osteoporosis.org.au/pharmacists</a>).</p> <ul style="list-style-type: none"> <li>• Develop activity-based funding models that appropriately support interdisciplinary care that is required for older people with MSK health conditions and their co-morbidities.</li> <li>• Extend reach of telehealth to provide multidisciplinary clinical services to older people who live in rural and remote areas</li> <li>• Ensure curricula for a broad range of relevant non-medical students as well as medical students align with contemporary best practice and minimum standards for adequacy of skills and knowledge in MSK healthcare<sup>157-160</sup>. For rheumatology education in particular, the disproportionate emphasis on autoimmune and inflammatory conditions to detriment of higher burden conditions such as MSK injury, OA, osteoporosis and fracture, low back and neck pain needs to be addressed.</li> <li>• Resource health and rehabilitation services in community based settings with minimum standards for service delivery of MSK healthcare<sup>161,162</sup>.</li> <li>• Undertake more health services research relating to the implementation best practice Models of Care that incorporates program evaluation, health economic evaluation and consumer-centred outcomes<sup>28,163</sup>.</li> <li>• Encourage employers to support older employees with MSK health conditions maintain productive employment and promote safe workplaces.</li> <li>• Improve referral networks and pathways between providers, especially between those in primary and secondary care (e.g. between family physicians, hospital- and primary-care based allied health practitioners, rehabilitation services and medical</li> </ul>
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		<p>specialists such as rheumatologists and orthopaedic surgeons). For example, there is emerging evidence from the United States that organised systems of care, e.g. Veteran’s Administration, Kaiser-Permanente, are better able to streamline referrals.</p>
<p><b>Micro</b></p>	<p>The micro level refers to the participation by the person in their care. The extent to which older people participate in their care is largely dependent on their health literacy as it relates navigating the health system and MSK health. While all clinical guidelines recommend self-management by consumers, implicit in this expectation is that consumers have the knowledge and skills to do so. In many cases, this may not be the case, particularly for those people who live in socioeconomic disadvantage or in rural and remote settings. It is critical, therefore, for meso- and macro-level systems and services to build capacity in older people to effectively participate in the management of their MSK health condition.</p>	<ul style="list-style-type: none"> <li>• Develop skills in a broad range of health professionals, particularly in developing nations, around supporting older people to actively engage in their healthcare, including primary prevention initiatives, supporting self-management, behaviour change, and improving health literacy related to MSK health</li> <li>• Educate older people and society in general about MSK health, particularly MSK pain and physical activity, within a bio-psychosocial rather than biomedical context and provide information about best practice management and system navigation relevant to their country</li> <li>• Support development of technologies that deliver evidence-based and clinically appropriate information and skills to consumers to support co-care (e.g. <a href="http://painhealth.csse.uwa.edu.au/">http://painhealth.csse.uwa.edu.au/</a>; <a href="https://www.myjointpain.org.au/">https://www.myjointpain.org.au/</a>).</li> </ul>

### 3.2 Interventions for musculoskeletal conditions

The Cochrane Musculoskeletal (<https://musculoskeletal.cochrane.org/>) and Back (<http://back.cochrane.org/>) review group provide an excellent resource for the evidence base underlying a range of interventions for MSK conditions (See Appendix for Cochrane Reviews for low back pain, neck pain, RA, OA, osteoporosis, and gout). There remains a substantial gap, however, in the translation of this evidence base into policy and practice. Increasingly, developed nations are designing and implementing models of care to close these evidence-practice and evidence-policy gaps<sup>28,140,164,165</sup>. Models of Care are evidence-informed policies or frameworks that outline the optimal manner in which condition-specific care (e.g. MSK care) should be made available and delivered to consumers while considering the practicalities of the local environment. Models of Care for common MSK disorders have been reviewed recently at an international level and are summarised in Table 3.2<sup>28</sup>. The Table also identifies key intervention strategies for people at risk of developing, or living with, common musculoskeletal conditions based on a recent European Bone and Joint Health Strategies Project<sup>166</sup>.

The success and sustainability of Models of Care for MSK health relies not only on their evidence-based and clinically-feasible content, but also sector wide engagement and support<sup>167</sup>. Content must reflect a contemporary perspective of MSK health and pain and support care delivery by health professionals while supporting older people to take an active role in the management of their MSK health condition. Contemporary management approaches for persistent musculoskeletal pain are an excellent example of how such models could be effectively operationalized<sup>168,169</sup>. Sector-wide buy in around Models of Care is critical. Emerging evidence suggests that Network-based models of engagement and collaboration for clinicians, consumers and other stakeholders such as managers and policy makers are a key enabler to the adoption and systematic implementation of models of care<sup>140,167</sup>.

In the developed world frameworks for implementation of Models of Care range from health networks<sup>167,170-172</sup>, to regionally-coordinated hub and spoke models (e.g. British Columbia Pain Initiative, Canada) and province-wide networks (Nova Scotia Chronic Pain Collaborative Network (e.g. <http://communitypainnetwork.com/>)). For example, in Australia, Health Networks in Western Australia and New South Wales have provided a sustainable mechanism to engage consumers, carers, clinicians and other stakeholders; provided a forum to exchange ideas, information and evidence; and collaboratively plan and deliver evidence-based and contextually-appropriate health system improvements for consumers with MSK pain<sup>167</sup>. In the developing world, however, structures, processes and resources to support implementation of musculoskeletal Models of Care are less well developed and in many cases not available at all. World Spine Care ([www.worldspinecare.org](http://www.worldspinecare.org)) is a global charity that aims to improve lives in under-served communities through sustainable, integrated, evidence-based, spine care. Populations in under-served areas of the world, especially rural populations and in particular, the elderly, often have no access to conventional healthcare resources to care for spinal conditions. Most are currently treated by traditional healers or in hospitals where they receive pain/anti-inflammatory medication only. There are no comprehensive protocols or Models of Care available to enable health care workers to treat the spectrum of spinal conditions common in underserved areas of the world. The result is that individuals have to contend with pain and disability which affects their daily lives in many cases making manual tasks impossible, thus reducing their productivity and even their ability to maintain

their standard of life. World Spine Care has clinics currently operating, in collaboration with local governments and communities, in Botswana and Dominican Republic where data are being collected regarding utilization and clinical outcomes. Research is on-going with collaboration between several academic institutions around the world. Programs in India and Tanzania are currently in development.

Consistent features have been observed across the various models; including the importance of primary and secondary prevention, early intervention, care coordination, access to a multidisciplinary team to address the bio-psychosocial aspects of chronic MSK conditions and injury and trauma sequelae, self-management support, and care planning that is inclusive of the person with the conditions as an equal team member with respect for their cultural background and consideration of comorbidities, mental health and socioeconomic status. While the focus of this report is on the older person, it is important to highlight that prevention across the life-course, with a particular emphasis on injury prevention and management, such as that related to anterior cruciate ligament and cartilage injury in sporting, recreational and occupational activities, has potential to significantly reduce future MSK disability<sup>173</sup>.

A workforce of adequate volume and competencies is critical for effective and sustainable implementation of MoCs. MSK healthcare can be delivered effectively and efficiently by a wide range of health professionals, including some with extended scopes of practice, particularly when the principles of chronic care are adopted and are inclusive of interdisciplinary team involvement. The use of digital technologies to support healthcare delivery and self-management is becoming increasingly accepted as an effective strategy to overcome care disparities due to geography and support consumers to become informed and active participants in their healthcare. Importantly, early intervention for elderly people who have been identified with sub-acute disability from MSK conditions has been associated with improved outcomes<sup>174</sup>.

Again, for low-income settings, principles of development effectiveness should be applied to interventions and initiatives to strengthen local systems.

**Table 3.2 Interventions for older people at risk of developing, or living with, common musculoskeletal health conditions. Implementation of interventions via Models of Care is also summarised**

<b>Musculoskeletal Condition</b>	<b>Key strategies for prevention, early identification, and management of established disease <sup>166</sup></b>	<b>Key components in Models of Care for implementing interventions relating to early identification and management of established disease <sup>28</sup></b>
<b>Osteoarthritis</b>	<ul style="list-style-type: none"> <li>• Programs to promote the importance of avoiding and managing obesity with ageing and safe and appropriate physical activities for older people</li> <li>• Education programs to encourage self-management, including information on the condition, lifestyle and its treatment and how to implement coping strategies into practice, particularly within the context of dealing with other comorbid conditions. These programs should focus on providing not only knowledge, but skills to implement that knowledge.</li> <li>• Pain management including the use of topical analgesics, simple analgesics and NSAIDs.</li> <li>• Normal biomechanics should be restored, including interventions such as osteotomy, ligament and meniscal surgery where indicated, or external braces or modified footwear.</li> <li>• Environmental adaptations in the home and workplace and the use of aids, braces or devices should be considered.</li> <li>• The use of some nutraceuticals such as glucosamine sulphate, chondroitin sulphate, ginger, etc. and of intra-articular therapies (including corticosteroids and hyaluronic acid) may be considered for symptomatic relief, although evidence remains uncertain for some of these agents.</li> <li>• Joint replacement surgery should be considered for end-stage joint damage that is causing unacceptable pain or limitation of</li> </ul>	<ul style="list-style-type: none"> <li>• Training of primary care doctors in the identification of inflammatory joint problems, and establishment of agreed referral criteria.</li> <li>• Multidisciplinary teams working across care settings to address weight, pain management, function, psychosocial health, co-morbidities in an integrated manner with the person at the centre and an active partner in the care team <sup>162,179</sup></li> <li>• Extended scope of practice roles for nurses, physiotherapists, occupational therapists and other health professionals <sup>180</sup></li> <li>• Pharmacist-initiated screening and launch of care from community settings <sup>156</sup></li> <li>• System-level redesign for referral processing, triage and care coordination within hospitals, particularly at orthopaedic departments <sup>181</sup></li> <li>• Digital technologies for assessment, follow-up, care delivery and self-management support <sup>182</sup></li> <li>• A range of solutions to disseminate and implement the latest evidence based guidelines for osteoarthritis management in all parts of the world. <sup>183</sup></li> </ul>

Musculoskeletal Condition	Key strategies for prevention, early identification, and management of established disease <sup>166</sup>	Key components in Models of Care for implementing interventions relating to early identification and management of established disease <sup>28</sup>
	<p>function. Surgery should be timely. Earlier in the disease course, a conservative approach to care should be trialled that is focused on lifestyle modification, exercise and addressing mental health conditions.</p> <ul style="list-style-type: none"> <li>• There should be rehabilitation services pre and post-operatively, drawing on expertise from a multi-disciplinary team to ensure continuity of services across the continuum of care from hospital to the home environment and the community, aimed at improving function, activities and participation. <sup>175-178</sup></li> </ul>	
<b>Rheumatoid arthritis</b>	<ul style="list-style-type: none"> <li>• People with three or more persistently inflamed joints should be assessed expertly as soon as possible, at least within 6 weeks of onset of symptoms. If diagnosed as rheumatoid arthritis, early treatment is imperative.</li> <li>• For those with the early stages of rheumatoid arthritis it is important that a correct diagnosis is made by expert assessment within 6 weeks of onset of symptoms.</li> <li>• Disease modifying anti-rheumatic drug (DMARD) treatment should be started in addition to symptomatic therapy and rehabilitative interventions as soon the diagnosis of RA is established. The choice of treatment should take into account the presence of prognostic indicators supporting the use of more aggressive therapy. Treatment should be closely monitored to ensure ideal disease control.</li> <li>• There should be education programmes to encourage self-management. These should include information on the condition, lifestyle and its treatment with a focus on practical skills.</li> <li>• People with RA should be enabled to participate as fully as</li> </ul>	<ul style="list-style-type: none"> <li>• Training of primary care doctors in the identification of inflammatory joint problems, and establishment of agreed referral criteria.</li> <li>• Multidisciplinary teams working across care settings to initiate DMARDs, and address pain management, function, psychosocial health, co-morbidities <sup>164,184</sup></li> <li>• Extended scope of practice roles for nurses, physiotherapists, occupational therapists, pharmacists and other health workers</li> <li>• Shared-care models between GPs and rheumatologists in primary care <sup>185</sup></li> <li>• Digital technologies for assessment, care delivery and clinical training <sup>186-188</sup></li> <li>• A range of solutions to disseminate and implement the latest evidence based guidelines for rheumatoid arthritis management in all parts of the world <sup>189</sup>.</li> </ul>



Musculoskeletal Condition	Key strategies for prevention, early identification, and management of established disease <sup>166</sup>	Key components in Models of Care for implementing interventions relating to early identification and management of established disease <sup>28</sup>
	<p>possible through rehabilitation and modification of the work, home and leisure environment.</p> <ul style="list-style-type: none"> <li>• Treatment should be expertly monitored to ensure ideal disease control. The choice of treatment should take into account the presence of prognostic indicators supporting the use of more aggressive therapy.</li> <li>• Surgery should be considered for end-stage joint damage that is causing unacceptable pain or limitation of function. Those with late stage RA may have greater surgical needs and a co-ordinated approach is required. Surgery should be timely.</li> <li>• Treatment should consider all aspects of the effect of the condition on the person.</li> <li>• There should be rehabilitation programmes and modification of the work, home and leisure environment to enable people with RA to participate as fully as possible.</li> </ul>	
<b>Osteoporosis</b>	<ul style="list-style-type: none"> <li>• Education and lifestyle advice should be provided, together with the correction of calcium and vitamin D deficiency and risk factor modification, where possible.</li> <li>• Case-finding strategies should be implemented to identify individuals with a high fracture probability, eg identifying those who have sustained a low trauma fracture; using fracture risk calculators such as FRAX and Garvan. <a href="https://www.shef.ac.uk/FRAX/">https://www.shef.ac.uk/FRAX/</a>; <a href="https://www.garvan.org.au/bone-fracture-risk">https://www.garvan.org.au/bone-fracture-risk</a>. Interventions should be initiated for those with a high fracture probability.</li> <li>• For the population with osteopenia (BMD T score between -1 and -2.5<sup>190</sup>) and osteoporosis (BMD T score <math>\leq</math> -2.5<sup>190</sup>) there should be</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated fracture liaison and osteoporotic refracture prevention services across care settings and geographies<sup>191-194</sup> (eg <a href="#">ACI Osteoporotic Refracture Prevention.pdf</a>; <a href="http://www.iofbonehealth.org/capture-fracture">http://www.iofbonehealth.org/capture-fracture</a>)</li> <li>• Dissemination of user-friendly guidelines and practice enablers for improved management of osteoporosis, as it relates to early identification and management of skeletal fragility and improvement management after minimal trauma fracture<sup>195-203</sup>.</li> </ul>

Musculoskeletal Condition	Key strategies for prevention, early identification, and management of established disease <sup>166</sup>	Key components in Models of Care for implementing interventions relating to early identification and management of established disease <sup>28</sup>
	<p>educational and lifestyle advice programmes. For those who have had a low trauma fracture, regardless of BMD T score or are identified as having a high risk of fracture there should be appropriate pharmacological interventions provided in combination with lifestyle optimisation interventions (e.g. nutrition, physical activity).</p> <ul style="list-style-type: none"> <li>• For people at high risk of falling there should be in addition a falls prevention programme.</li> <li>• For those with established osteoporosis there are a number of key strategies that depend on the severity and stage of the disease. The appropriate strategy will consist of one or a combination of the following: <ul style="list-style-type: none"> <li>○ education and lifestyle advice</li> <li>○ analgesia when indicated</li> <li>○ physiotherapy when indicated</li> <li>○ pharmacological intervention with bone active drugs</li> <li>○ falls prevention programme in older people at high risk of falling</li> <li>○ calcium and vitamin D supplementation in frail older people</li> <li>○ orthopaedic management of fracture when indicated</li> <li>○ multi-disciplinary rehabilitation</li> </ul> </li> </ul>	

Musculoskeletal Condition	Key strategies for prevention, early identification, and management of established disease <sup>166</sup>	Key components in Models of Care for implementing interventions relating to early identification and management of established disease <sup>28</sup>
	<ul style="list-style-type: none"> <li>○ nutritional support</li> <li>○ hip protectors for frail older people in residential care or nursing homes</li> </ul>	
<b>Low Back pain</b>	<ul style="list-style-type: none"> <li>• There should be a strategy to encourage the population to change behaviour and beliefs about low back pain, its consequences and natural history, and on the importance of maintaining physical activity and employment by those with acute or sub-acute back pain <sup>150-152</sup>.</li> <li>• On a background of public awareness, health care professionals should follow the appropriate guidelines which recommend supporting individuals to stay active and working; avoiding bed rest; minimising the use of medical imaging; short-term use of simple analgesics and/or NSAIDs where appropriate or manual therapy and addressing “red” and “yellow” flags <sup>204-206</sup>.</li> <li>• Effective treatments for sub-acute and chronic non-LBP (about 80% of cases) are exercise therapy, behavioural therapy including person-centred pain management, some manual therapies or a combination of these matched to the needs of the person.</li> <li>• Multi-disciplinary programs should be delivered for non-specific LBP if there is no improvement with exercise or behavioural therapy. It is as yet unclear what the optimal content of these programs is.</li> <li>• Rehabilitation should be undertaken with consideration and involvement of the workplace.</li> <li>• Back pain of known cause (specific back pain) needs specific management, although this constitutes the minority of cases</li> </ul>	<ul style="list-style-type: none"> <li>• Service delivery inversion where patients participate in group-based pain education and cognitive behavioural therapy before accessing clinical pain medicine services <sup>207,208</sup></li> <li>• Primary care-led risk identification with links to specialist or network care <sup>209-211</sup></li> <li>• ICT initiatives to improved consumer capacity for co-care and system navigation (e.g. <i>painHEALTH</i>).</li> <li>• Capacity building in primary care via peer support and clinical networks</li> </ul>

## Sources for evidence

In addition to published reports and systematic reviews that met quality criteria (see References), data were obtained from the following sources:

- WHO Global Health Estimates 2011 burden of disease data and background research
- The Cochrane Library and Cochrane MSK Group
- The World Forum for Rheumatic and Musculoskeletal Disorders White Paper
- National and International Health Surveys and data collections including
  - Center for Disease Control (CDC), USA,
  - Australian Institute of Health and Welfare (AIHW),
  - Arthritis Research United Kingdom (ARUK),
  - International Osteoporosis Foundation (IOF),
  - Global Burden of Diseases Study (GBD) 2010.

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## APPENDIX: COCHRANE REVIEWS

### COCHRANE REVIEWS: LOW BACK PAIN

Title	Review Byline	Review DOI
Acupuncture and dry-needling for low back pain	Furlan AD, van Tulder MW, Cherkin D, Tsukayama H, Lao L, Koes BW, Berman BM, Cheng K	10.1002/14651858.CD001351.pub2
Advice to rest in bed versus advice to stay active for acute low-back pain and sciatica	Dahm KT, Brurberg KG, Jamtvedt G, Hagen KB	10.1002/14651858.CD007612.pub2
Antidepressants for non-specific low back pain	Urquhart DM, Hoving JL, Assendelft WJJ, Roland M, van Tulder MW	10.1002/14651858.CD001703.pub3
Back schools for chronic non-specific low-back pain.	Heymans MW, van Tulder MW, Esmail R, Bombardier C, Koes BW, Poquet N, Parreira P	10.1002/14651858.CD000261.pub2
Behavioural treatment for chronic low-back pain	Henschke N, Ostelo RWJG, van Tulder MW, Vlaeyen JWS, Morley S, Assendelft WJJ, Main CJ.	10.1002/14651858.CD002014.pub3
Botulinum toxin injections for low-back pain and sciatica	Waseem Z, Boulias C, Gordon A, Ismail F, Sheean G, Furlan AD, Kumbhare DA	10.1002/14651858.CD008257.pub2
Combined chiropractic interventions for low-back pain	Walker BF, French SD, Grant W, Green S	10.1002/14651858.CD005427.pub2
Exercise therapy for treatment of non-specific low back pain	Hayden JA, van Tulder MW, Malmivaara A, Koes BW	10.1002/14651858.CD000335.pub2
Exercises for prevention of recurrences of low-back pain	Van Rijn RM, Choi BKL, Verbeek JH, Tam W, Jiang JY	10.1002/14651858.CD006555.pub2
Herbal medicine for low-back pain	Oltean H, Robbins C, van Tulder MW, Berman BM, Bombardier C, Gagnier JJ	10.1002/14651858.CD004504.pub3
Individual patient education for low back pain	Engers AJ, Jellema P, Wensing M, van der Windt DAWM, Grol R, van Tulder MW	10.1002/14651858.CD004057.pub3
Injection therapy for subacute and chronic low-back pain	Staal JB, de Bie R, de Vet HCW, Hildebrandt J, Nelemans P	10.1002/14651858.CD001824.pub3
Insoles for prevention and treatment of back pain	Sahar T, Cohen MJ, Ne'eman V, Kandel L, Odebiyi DO, Lev I, Brezis M, Lahad A	10.1002/14651858.CD005275.pub2
Low level laser therapy for nonspecific low-back pain	Yousefi-Nooraie R, Schonstein E, Heidari K, Rashidian A, Pennick V, Akbari-Kamrani M, Irani S, Shakiba B, Mortaz Hejri S, Jonaidi A-R, Mortaz-Hedjri S	10.1002/14651858.CD005107.pub4
Lumbar supports for treatment of low back pain	van Duijvenbode I, Jellema P, van Poppel M, van Tulder MW	10.1002/14651858.CD001823.pub3
Manual material handling advice and assistive devices for preventing and treating back pain in workers	Verbeek JH, Martimo K-P, Karppinen J, Kuijer PPFM, Viikari-Juntura E, Takala E-P	10.1002/14651858.CD005958.pub3
Massage for low-back pain	Furlan AD, Giraldo M, Irvin E, Baskwill A, Imamura M	10.1002/14651858.CD001929.pub2
Minimally invasive discectomy versus microdiscectomy/open discectomy for symptomatic lumbar disc herniation	Rasouli MR, Rahimi-Movaghar V, Shokraneh F, Moradi-Lakeh M, Chou R	10.1002/14651858.CD010328.pub2
Multidisciplinary biopsychosocial rehabilitation for chronic low back pain	Kamper SJ, Apeldoorn AT, Chiarotto A, Smeets R.J.E.M., Ostelo RWJG, Guzman J, van Tulder MW	10.1002/14651858.CD000963.pub3
Multidisciplinary biopsychosocial rehabilitation for subacute low-back pain	Marin TJ, Van Eerd D, Couban R, Irvin E, Michael R, Koes BW, Malmivaara A, van Tulder MW, Kamper SJ	10.1002/14651858.CD002193
Muscle relaxants for non-specific low-back pain	Imamura M, van Tulder MW, Furlan AD, Solway S	10.1002/14651858.CD004252



Neuroreflexotherapy for non-specific low-back pain	Urrútia G, Burton AK, Morral Fernández A, Bonfill Cosp X, Zanoli G	10.1002/14651858.CD003009.pub2
Nonoperative treatment for lumbar spinal stenosis with neurogenic claudication	Ammendolia C, Stuber KJ, Rok E, Rampersaud R, Kennedy CA, Pennick V, Steenstra IA, de Bruin LK, Furlan AD	10.1002/14651858.CD010712
Non-steroidal anti-inflammatory drugs for low back pain	Roelofs PDDM, Deyo RA, Koes BW, Scholten RJPM, van Tulder MW	10.1002/14651858.CD000396.pub3
Opioids compared to placebo or other treatments for chronic low-back pain	Chaparro LE, Furlan AD, Deshpande A, Mailis-Gagnon A, Atlas S, Turk DC	10.1002/14651858.CD004959.pub4
Physical conditioning as part of a return to work strategy to reduce sickness absence for workers with back pain	Schaafsma FG, Whelan K, van der Beek AJ, van der Es-Lambeek LC, Ojajärvi A, Verbeek JH	10.1002/14651858.CD001822.pub3
Physical examination for lumbar radiculopathy due to disc herniation in patients with low-back pain	van der Windt DAWM, Simons E, Riphagen II, Ammendolia C, Verhagen AP, Laslett M, Devillé W, Deyo RA, Bouter LM, de Vet HCW, Aertgeerts B	10.1002/14651858.CD007431.pub2
Prolotherapy injections for chronic low-back pain	Dagenais S, Yelland MJ, Del Mar C, Schoene ML	10.1002/14651858.CD004059.pub3
Red flags to screen for malignancy in patients with low-back pain	Henschke N, Maher CG, Ostelo RWJG, de Vet HCW, Macaskill P, Irwig L	10.1002/14651858.CD008686.pub2
Red flags to screen for vertebral fracture in patients presenting with low-back pain	Williams CM, Henschke N, Maher CG, van Tulder MW, Koes BW, Macaskill P, Irwig L	10.1002/14651858.CD008643.pub2
Rehabilitation after lumbar disc surgery	Oosterhuis T, Costa LOP, Maher CG, de Vet HCW, van Tulder MW, Ostelo RWJG	10.1002/14651858.CD003007.pub3
Rehabilitation following surgery for lumbar spinal stenosis	McGregor AH, Probyn K, Cro S, Doré CJ, Burton AK, Balagué F, Pincus T, Fairbank J	10.1002/14651858.CD009644.pub2
Spinal manipulative therapy for acute low-back pain	Rubinstein SM, Terwee CB, Assendelft WJJ, de Boer MR, van Tulder MW	10.1002/14651858.CD008880.pub2
Spinal manipulative therapy for chronic low-back pain	Rubinstein SM, van Middelkoop M, Assendelft WJJ, de Boer MR, van Tulder MW	10.1002/14651858.CD008112.pub2
Superficial heat or cold for low back pain	French SD, Walker BF, Cameron M, Reggars JW, Pirota M	10.1002/14651858.CD004750.pub2
Surgery for degenerative lumbar spondylosis	Gibson JA, Waddell G	10.1002/14651858.CD001352.pub3
Surgical interventions for lumbar disc prolapse	Gibson JA, Waddell G	10.1002/14651858.CD001350.pub4
Therapeutic ultrasound for chronic low-back pain	Ebadi S, Henschke N, Nakhostin Ansari N, Fallah E, van Tulder MW	10.1002/14651858.CD009169.pub2
Traction for low-back pain with or without sciatica	Wegner I, Widyahening IS, van Tulder MW, Blomberg SEI, de Vet HCW, Brønfort G, Bouter LM, van der Heijden GJ	10.1002/14651858.CD003010.pub5
Transcutaneous electrical nerve stimulation (TENS) versus placebo for chronic low-back pain	Khadiolkar A, Odebiyi DO, Brosseau L, Wells GA	10.1002/14651858.CD003008.pub3



## COCHRANE REVIEWS: NECK PAIN

<b>Title</b>	<b>Review Byline</b>	<b>Review DOI</b>
Acupuncture for neck disorders	Trinh K, Graham N, Irnich D, Cameron ID, Forget M	10.1002/14651858.CD004870.pub3
Arthroplasty versus fusion in single-level cervical degenerative disc disease	Boselie TFM, Willems PC, van Mameren H, de Bie R, Benzel EC, van Santbrink H	10.1002/14651858.CD009173.pub2
Botulinum toxin for subacute/chronic neck pain	Langevin P, Peloso PMJ, Lowcock J, Nolan M, Weber J, Gross A, Roberts J, Goldsmith CH, Graham N, Burnie SJ, Haines T	10.1002/14651858.CD008626.pub2
Conservative treatments for whiplash	Verhagen AP, Scholten-Peeters GGGM, van Wijngaarden S, de Bie R, Bierma-Zeinstra SMA	10.1002/14651858.CD003338.pub3
Electrotherapy for neck pain	Kroeling P, Gross A, Graham N, Burnie SJ, Szeto G, Goldsmith CH, Haines T, Forget M	10.1002/14651858.CD004251.pub5
Manipulation or mobilisation for neck pain	Gross A, Langevin P, Burnie SJ, Bédard-Brochu M-S, Empey B, Dugas E, Faber-Dobrescu M, Andres C, Graham N, Goldsmith CH, Brønfort G, Hoving JL, LeBlanc F	10.1002/14651858.CD004249.pub3
Massage for mechanical neck disorders	Patel KC, Gross A, Graham N, Goldsmith CH, Ezzo J, Morien A, Peloso PMJ	10.1002/14651858.CD004871.pub4
Mechanical traction for neck pain with or without radiculopathy	Graham N, Gross A, Goldsmith CH, Klaber Moffett J, Haines T, Burnie SJ, Peloso PMJ	10.1002/14651858.CD006408.pub2
Medicinal and injection therapies for mechanical neck disorders	Peloso PMJ, Gross A, Haines T, Trinh K, Goldsmith CH, Burnie SJ, Cervical Overview Group	10.1002/14651858.CD000319.pub4
Multidisciplinary biopsychosocial rehabilitation for neck and shoulder pain	Van Eerd D, Marin TJ, Irvin E, Couban R, Vasanthan LT, Malmivaara A, Koes BW, van Tulder MW	10.1002/14651858.CD002194
Patient education for neck pain	Gross A, Forget M, St George K, Fraser MMH, Graham N, Perry L, Burnie SJ, Goldsmith CH, Haines T, Brunarski D	10.1002/14651858.CD005106.pub4
Single or double-level anterior interbody fusion techniques for cervical degenerative disc disease	Jacobs W, Willems PC, van Limbeek J, Bartels R, Pavlov P, Anderson PG, Oner FC	10.1002/14651858.CD004958.pub2
Surgery for cervical radiculopathy or myelopathy	Nikolaidis I, Fouyas IP, Sandercock PAG, Statham PF	10.1002/14651858.CD001466.pub3
Workplace interventions for neck pain in workers	Aas RW, Tuntland H, Holte KA, Røe C, Lund T, Marklund S, Moller A	10.1002/14651858.CD008160.pub2

## COCHRANE REVIEWS: RHEUMATOID ARTHRITIS

Title	Review Byline	Review DOI
Abatacept for rheumatoid arthritis	Maxwell L, Singh JA	10.1002/14651858.CD007277.pub2
Acupuncture and electroacupuncture for the treatment of rheumatoid arthritis	Casimiro L, Barnsley L, Brosseau L, Milne S, Welch V, Tugwell P, Wells GA	10.1002/14651858.CD003788.pub2
Adalimumab for treating rheumatoid arthritis	Navarro-Sarabia F, Ariza-Ariza R, Hernandez-Cruz B, Villanueva I	10.1002/14651858.CD005113.pub2
Adverse effects of biologics: a network meta-analysis and Cochrane overview	Singh JA, Wells GA, Christensen R, Tanjong Ghogomu E, Maxwell LJ, MacDonald JK, Filippini G, Skoetz N, Francis DK, Lopes LC, Guyatt GH, Schmitt J, La Mantia L, Weberschock T, Roos JF, Siebert H, Hershan S, Cameron C, Lunn MPT, Tugwell P, Buchbinder R	10.1002/14651858.CD008794.pub2
Anakinra for rheumatoid arthritis	Mertens M, Singh JA	10.1002/14651858.CD005121.pub3
Antidepressants for pain management in rheumatoid arthritis	Richards BL, Whittle SL, Buchbinder R	10.1002/14651858.CD008920.pub2
Antimalarials for treating rheumatoid arthritis	Suarez-Almazor ME, Belseck E, Shea B, Homik J, Wells GA, Tugwell P	10.1002/14651858.CD000959
Assistive technology for rheumatoid arthritis	Tuntland H, Kjekken I, Nordheim LV, Falzon L, Jamtvedt G, Hagen KB	10.1002/14651858.CD006729.pub2
Auranofin versus placebo in rheumatoid arthritis	Suarez-Almazor ME, Spooner C, Belseck E, Shea B	10.1002/14651858.CD002048
Azathioprine for treating rheumatoid arthritis	Suarez-Almazor ME, Spooner C, Belseck E	10.1002/14651858.CD001461
Balance training (proprioceptive training) for patients with rheumatoid arthritis	Silva KNG, Mizusaki Imoto A, Almeida GJM, Atallah AN, Peccin MS, Fernandes Moça Trevisani V, Mayhew A	10.1002/14651858.CD007648.pub2
Balneotherapy (natural mineral waters, gases and mudpacks) for rheumatoid arthritis	Verhagen AP, Bierma-Zeinstra SMA, Boers M, Cardoso JR, Lambeck J, de Bie R, de Vet HCW	10.1002/14651858.CD000518
Biologics for rheumatoid arthritis: an overview of Cochrane reviews	Singh JA, Christensen R, Wells GA, Suarez-Almazor ME, Buchbinder R, Lopez-Olivo MA, Tanjong Ghogomu E, Tugwell P	10.1002/14651858.CD007848.pub2
Celecoxib for rheumatoid arthritis	Garner SE, Fidan D, Frankish RR, Judd M, Shea B, Towheed T, Tugwell P, Wells GA	10.1002/14651858.CD003831
Cemented, cementless or hybrid fixation options in total knee arthroplasty for osteoarthritis and other non-traumatic diseases	Nakama GY, Peccin MS, Almeida GJM, Lira Neto OdA, Queiroz AAB, Navarro RD	10.1002/14651858.CD006193.pub2
Certolizumab pegol (CDP870) for rheumatoid arthritis in adults	Ruiz Garcia V, Jobanputra P, Burls A, Cabello JB, Vela Casasepere P, Bort-Marti S, Kynaston-Pearson FJB	10.1002/14651858.CD007649.pub3
Combination therapy for pain management in inflammatory arthritis (rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, other spondyloarthritis)	Ramiro S, Radner H, van der Heijde D, van Tubergen A, Buchbinder R, Aletaha D, Landewé RBM	10.1002/14651858.CD008886.pub2
Continuous passive motion for preventing venous thromboembolism after total knee arthroplasty	He ML, Xiao ZM, Lei M, Li TS, Wu H, Liao J	10.1002/14651858.CD008207.pub3
Cyclophosphamide for treating rheumatoid arthritis	Suarez-Almazor ME, Belseck E, Shea B, Tugwell P, Wells GA	10.1002/14651858.CD001157
Cyclosporine for treating rheumatoid arthritis	Wells GA, Haguenaue D, Shea B, Suarez-Almazor ME, Welch V, Tugwell P, Peterson J	10.1002/14651858.CD001083
Dietary interventions for rheumatoid arthritis	Hagen KB, Byfluglien MGjeitung, Falzon L, Olsen SURke, Smedslund G	10.1002/14651858.CD006400.pub2
Down-titration and discontinuation strategies of tumor necrosis factor–blocking agents for rheumatoid arthritis in patients with low disease activity	van Herwaarden N, den Broeder AA, Jacobs W, van der Maas A, Bijlsma JWW, van Vollenhoven RF, van den Bemt BJF	10.1002/14651858.CD010455.pub2
Dynamic exercise programs (aerobic capacity and/or muscle strength training) in patients with rheumatoid arthritis	Hurkmans E, van der Giesen FJ, Vliet Vlieland TPM, Schoones J, Van den Ende ECHM	10.1002/14651858.CD006853.pub2
Effects of glucocorticoids on radiological progression in rheumatoid arthritis	Kirwan JR, Bijlsma JWW, Boers M, Shea B	10.1002/14651858.CD006356
Electrical stimulation for the treatment of rheumatoid arthritis	Pelland L, Brosseau L, Casimiro L, Welch V, Tugwell P, Wells GA	10.1002/14651858.CD003687
Erythropoiesis-stimulating agents for anemia in rheumatoid arthritis	Martí-Carvajal AJ, Agreda-Pérez LH, Solà I	10.1002/14651858.CD000332.pub3

Etanercept for the treatment of rheumatoid arthritis	Lethaby A, Lopez-Olivo MA, Maxwell LJ, Burls A, Tugwell P, Wells GA	10.1002/14651858.CD004525.pub2
Folic acid and folinic acid for reducing side effects in patients receiving methotrexate for rheumatoid arthritis	Shea B, Swinden MV, Tanjong Ghogomu E, Ortiz Z, Katchamart W, Rader T, Bombardier C, Wells GA, Tugwell P	10.1002/14651858.CD000951.pub2
Golimumab for rheumatoid arthritis	Singh JA, Noorbaloochi S, Singh G	10.1002/14651858.CD008341
Herbal therapy for treating rheumatoid arthritis	Cameron M, Gagnier JJ, Chrubasik S	10.1002/14651858.CD002948.pub2
Infliximab for the treatment of rheumatoid arthritis	Blumenauer BBTB, Judd M, Wells GA, Burls A, Cranney A, Hochberg MC, Tugwell P, Lopez-Olivo MA	10.1002/14651858.CD003785
Injectable gold for rheumatoid arthritis	Clark P, Tugwell P, Bennett KJ, Bombardier C, Shea B, Wells GA, Suarez-Almazor ME	10.1002/14651858.CD000520
Leflunomide for the treatment of rheumatoid arthritis	Osiri M, Shea B, Welch V, Suarez-Almazor ME, Strand V, Tugwell P, Wells GA	10.1002/14651858.CD002047
Low level laser therapy (Classes I, II and III) for treating rheumatoid arthritis	Brosseau L, Welch V, Wells GA, de Bie R, Gam A, Harman K, Morin M, Shea B, Tugwell P	10.1002/14651858.CD002049.pub2
Methotrexate for treating rheumatoid arthritis	Lopez-Olivo MA, Siddhanamatha HR, Shea B, Tugwell P, Wells GA, Suarez-Almazor ME	10.1002/14651858.CD000957.pub2
Methotrexate monotherapy versus methotrexate combination therapy with non-biologic disease modifying anti-rheumatic drugs for rheumatoid arthritis	Katchamart W, Trudeau J, Phumethum V, Bombardier C	10.1002/14651858.CD008495
Mobile bearing vs fixed bearing prostheses for posterior cruciate retaining total knee arthroplasty for post-operative functional status in patients with osteoarthritis and rheumatoid arthritis	Hofstede SN, Nouta KA, Jacobs W, van Hooff ML, Wymenga AAB, Pijls BG, Nelissen RGHH, Marang-van de Mheen P	10.1002/14651858.CD003130.pub2
Moderate-term, low-dose corticosteroids for rheumatoid arthritis	Criswell L, Saag K, Sems KM, Welch V, Shea B, Wells GA, Suarez-Almazor ME	10.1002/14651858.CD001158
Muscle relaxants for pain management in rheumatoid arthritis	Richards BL, Whittle SL, Buchbinder R	10.1002/14651858.CD008922.pub2
Neuromodulators for pain management in rheumatoid arthritis	Richards BL, Whittle SL, Buchbinder R	10.1002/14651858.CD008921.pub2
Non-pharmacological interventions for fatigue in rheumatoid arthritis	Cramp F, Hewlett S, Almeida C, Kirwan JR, Choy EHS, Chalder T, Pollock J, Christensen R	10.1002/14651858.CD008322.pub2
Non-pharmacological interventions for preventing job loss in workers with inflammatory arthritis	Hoving JL, Lacaille D, Urquhart DM, Hannu TJ, Sluiter JK, Frings-Dresen MHW	10.1002/14651858.CD010208.pub2
Occupational therapy for rheumatoid arthritis	Steultjens EEMJ, Dekker JJ, Bouter LM, Schaardenburg DD, Kuyk M-AMAH, Van den Ende ECHM	10.1002/14651858.CD003114.pub2
Opioid therapy for treating rheumatoid arthritis pain	Whittle SL, Richards BL, Husni E, Buchbinder R	10.1002/14651858.CD003113.pub3
Pain management for inflammatory arthritis (rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis and other spondyloarthritis) and gastrointestinal or liver comorbidity	Radner H, Ramiro S, Buchbinder R, Landewé RBM, van der Heijde D, Aletaha D	10.1002/14651858.CD008951.pub2
Pain management for rheumatoid arthritis and cardiovascular or renal comorbidity	Marks JL, Colebatch AN, Buchbinder R, Edwards CJ	10.1002/14651858.CD008952.pub2
Paracetamol versus nonsteroidal anti-inflammatory drugs for rheumatoid arthritis	Wienecke T, Gøtzsche PC	10.1002/14651858.CD003789.pub2
Patient education for adults with rheumatoid arthritis	Riemsma RP, Kirwan JR, Taal E, Rasker HJ	10.1002/14651858.CD003688
Penicillamine for treating rheumatoid arthritis	Suarez-Almazor ME, Belseck E, Spooner C	10.1002/14651858.CD001460
Post-operative therapy for metacarpophalangeal arthroplasty	Massy-Westropp N, Johnston RV, Hill CL	10.1002/14651858.CD003522.pub2
Rofecoxib for rheumatoid arthritis	Garner SE, Fidan D, Frankish RR, Judd M, Towheed T, Tugwell P, Wells GA	10.1002/14651858.CD003685.pub2

Safety of non-steroidal anti-inflammatory drugs, including aspirin and paracetamol (acetaminophen) in people receiving methotrexate for inflammatory arthritis (rheumatoid arthritis, ankylosing spondylitis, psoriatic arthritis, other spondyloarthritis)	Colebatch AN, Marks JL, Edwards CJ	10.1002/14651858.CD008872.pub2
Short-term low-dose corticosteroids vs placebo and nonsteroidal antiinflammatory drugs in rheumatoid arthritis	Gøtzsche PC, Johansen HK	10.1002/14651858.CD000189.pub2
Splints and Orthosis for treating rheumatoid arthritis	Egan M, Brosseau L, Farmer M, Ouimet M-A, Rees S, Tugwell P, Wells GA	10.1002/14651858.CD004018
Stretch for the treatment and prevention of contractures	Katalinic OM, Harvey LA, Herbert RD, Moseley AM, Lannin NA, Schurr K	10.1002/14651858.CD007455.pub2
Sulfasalazine for treating rheumatoid arthritis	Suarez-Almazor ME, Belseck E, Shea B, Tugwell P, Wells GA	10.1002/14651858.CD000958
Surgical interventions for the rheumatoid shoulder	Christie A, Dagfinrud H, Engen Matre K, Flaatten HI, Ringen Osnes H, Hagen KB	10.1002/14651858.CD006188.pub2
Tai chi for treating rheumatoid arthritis	Han A, Judd M, Welch V, Wu T, Tugwell P, Wells GA, Singh JA, Mudano AS	10.1002/14651858.CD004849
Therapeutic ultrasound for the treatment of rheumatoid arthritis	Gutiérrez HJ, Aguilera RA, Rada G, Casimiro L, Welch V, Milne S, Judd M, Wells GA, Tugwell P, Shea B, Brosseau L	10.1002/14651858.CD003787
Thermotherapy for treating rheumatoid arthritis	Welch V, Brosseau L, Casimiro L, Judd M, Shea B, Tugwell P, Wells GA, Suresh S	10.1002/14651858.CD002826
Tocilizumab for rheumatoid arthritis	Singh JA, Beg S, Lopez-Olivo MA	10.1002/14651858.CD008331.pub2
Transcutaneous electrical nerve stimulation (TENS) for the treatment of rheumatoid arthritis in the hand	Brosseau L, Yonge K, Welch V, Marchand S, Judd M, Wells GA, Tugwell P	10.1002/14651858.CD004377

## COCHRANE REVIEWS: OSTEOARTHRITIS

Title	Review Byline	Review DOI
Acetaminophen for osteoarthritis	Towheed T, Maxwell LJ, Judd M, Catton M, Anjum M, Foote M, Hochberg MC, Wells GA	10.1002/14651858.CD004257.pub2
Aquatic exercise for the treatment of knee and hip osteoarthritis	Bartels EM, Juhl CB, Christensen R, Hagen KB, Danneskiold-Samsøe B, Dagfinrud H, Lund H	10.1002/14651858.CD005523.pub2
Arthroscopic debridement for knee osteoarthritis	Laupattarakasem W, Laupattarakasem P, Laopaiboon M	10.1002/14651858.CD005118.pub2
Balneotherapy for osteoarthritis	Verhagen AP, Bierma-Zeinstra SMA, Boers M, Cardoso JR, Lambeck J, de Bie R, de Vet HCW, Pereira LM	10.1002/14651858.CD006864
Braces and orthoses for treating osteoarthritis of the knee	Duivenvoorden T, Brouwer RW, van Raaij TM, Verhagen AP, Verhaar JAN, Bierma-Zeinstra SMA	10.1002/14651858.CD004020.pub2
Cemented, cementless or hybrid fixation options in total knee arthroplasty for osteoarthritis and other non-traumatic diseases	Nakama GY, Peccin MS, Almeida GJM, Lira Neto OdA, Queiroz AAB, Navarro RD	10.1002/14651858.CD006193.pub2
Continuous passive motion following total knee arthroplasty in people with arthritis	Harvey LA, Brosseau L, Herbert RD	10.1002/14651858.CD004260.pub3
Continuous passive motion for preventing venous thromboembolism after total knee arthroplasty	He ML, Xiao ZM, Lei M, Li TS, Wu H, Liao J	10.1002/14651858.CD008207.pub3
Cryotherapy following total knee replacement	Adie S, Kwan A, Naylor JM, Harris IA, Mittal R	10.1002/14651858.CD007911.pub2
Diacerein for osteoarthritis	Fidelix TS.A., Macedo CR, Maxwell LJ, Fernandes Moça Trevisani V	10.1002/14651858.CD005117.pub3
Doxycycline for osteoarthritis of the knee or hip	da Costa BR, Nüesch E, Reichenbach S, Jüni P, Rutjes AWS	10.1002/14651858.CD007323.pub3
Electromagnetic fields for treating osteoarthritis	Li S, Yu B, Zhou D, He C, Zhuo Q, Hulme JM	10.1002/14651858.CD003523.pub2
Exercise for osteoarthritis of the hip	Fransen M, McConnell S, Hernandez-Molina G, Reichenbach S	10.1002/14651858.CD007912.pub2
Exercise for osteoarthritis of the knee	Fransen M, McConnell S, Harmer AR, Van der Esch M, Simic M, Bennell KL	10.1002/14651858.CD004376.pub2
Glucosamine therapy for treating osteoarthritis	Towheed T, Maxwell LJ, Anastassiades TP, Shea B, Houpt J, Welch V, Hochberg MC, Wells GA	10.1002/14651858.CD002946.pub2
Home versus center based physical activity programs in older adults	Ashworth NL, Chad KE, Harrison EL, Reeder BA, Marshall SC	10.1002/14651858.CD004017.pub2
Interventions for the management of temporomandibular joint osteoarthritis	de Souza RF, Lovato da Silva CH, Nasser M, Fedorowicz Z, Al-Muharraqi MA	10.1002/14651858.CD007261.pub2
Interventions for treating osteoarthritis of the big toe joint	Zammit GV, Menz HB, Munteanu SE, Landorf KB, Gilheany MF	10.1002/14651858.CD007809.pub2
Interventions to improve adherence to exercise for chronic musculoskeletal pain in adults	Jordan JL, Holden MA, Mason EEJ, Foster NE	10.1002/14651858.CD005956.pub2
Intraarticular corticosteroid for treatment of osteoarthritis of the knee	Bellamy N, Campbell J, Welch V, Gee TL, Bourne R, Wells GA	10.1002/14651858.CD005328.pub2
Joint lavage for osteoarthritis of the knee	Reichenbach S, Rutjes AWS, Nüesch E, Trelle S, Jüni P	10.1002/14651858.CD007320.pub2
Mobile bearing vs fixed bearing prostheses for posterior cruciate retaining total knee arthroplasty for post-operative functional status in patients with osteoarthritis and rheumatoid arthritis	Hofstede SN, Nouta KA, Jacobs W, van Hooff ML, Wymenga AAB, Pijls BG, Nelissen RGHH, Marang-van de Mheen P	10.1002/14651858.CD003130.pub2
Multidisciplinary rehabilitation programmes following joint replacement at the hip and knee in chronic arthropathy	Khan F, Ng L, Gonzalez S, Hale T, Turner-Stokes L	10.1002/14651858.CD004957.pub3

Operative and non-operative treatment options for dislocation of the hip following total hip arthroplasty	Khan RJK, Carey Smith RL, Alakeson R, Fick DP, Wood DJ	10.1002/14651858.CD005320.pub2
Oral herbal therapies for treating osteoarthritis	Cameron M, Chrubasik S	10.1002/14651858.CD002947.pub2
Oral or transdermal opioids for osteoarthritis of the knee or hip	da Costa BR, Nüesch E, Kasteler R, Husni E, Welch V, Rutjes AWS, Jüni P	10.1002/14651858.CD003115.pub4
Osteotomy for treating knee osteoarthritis	Brouwer RW, Huizinga MR, Duivenvoorden T, van Raaij TM, Verhagen AP, Bierma-Zeinstra SMA, Verhaar JAN	10.1002/14651858.CD004019.pub4
Posterior versus lateral surgical approach for total hip arthroplasty in adults with osteoarthritis	Jolles BM., Bogoch ER.	10.1002/14651858.CD003828.pub3
Preoperative education for hip or knee replacement	McDonald S, Page MJ, Beringer K, Wasiak J, Sprowson A	10.1002/14651858.CD003526.pub3
Processed versus fresh frozen bone for impaction bone grafting in revision hip arthroplasty	Board TN, Brunskill S, Doree C, Hyde C, Kay PR, Meek RD, Webster R, Galea G	10.1002/14651858.CD006351.pub2
Retention versus sacrifice of the posterior cruciate ligament in total knee arthroplasty for treating osteoarthritis	Verra WC, van den Boom LGH, Jacobs W, Clement DJ, Wymenga AAB, Nelissen RGHH	10.1002/14651858.CD004803.pub3
Rofecoxib for osteoarthritis	Garner SE, Fidan D, Frankish RR, Maxwell L	10.1002/14651858.CD005115
S-Adenosylmethionine for osteoarthritis of the knee or hip	Rutjes AWS, Nüesch E, Reichenbach S, Jüni P	10.1002/14651858.CD007321.pub2
Self-management education programmes for osteoarthritis	Kroon FPB, van der Burg LRA, Buchbinder R, Osborne RH, Johnston RV, Pitt V	10.1002/14651858.CD008963.pub2
Stretch for the treatment and prevention of contractures	Katalinic OM, Harvey LA, Herbert RD, Moseley AM, Lannin NA, Schurr K	10.1002/14651858.CD007455.pub2
Surface neuromuscular electrical stimulation for quadriceps strengthening pre and post total knee replacement	Monaghan B, Caulfield B, O'Mathúna DP	10.1002/14651858.CD007177.pub2
Surgery for shoulder osteoarthritis	Singh JA, Sperling J, Buchbinder R, McMaken K	10.1002/14651858.CD008089.pub2
Surgery for thumb (trapeziometacarpal joint) osteoarthritis	Wajon A, Vinycomb T, Carr E, Edmunds I, Ada L	10.1002/14651858.CD004631.pub3
Therapeutic ultrasound for osteoarthritis of the knee or hip	Rutjes AWS, Nüesch E, Sterchi R, Jüni P	10.1002/14651858.CD003132.pub2
Thermotherapy for treatment of osteoarthritis	Brosseau L, Yonge K, Welch V, Marchand S, Judd M, Wells GA, Tugwell P, Van de Velde S, Bekkering GE	10.1002/14651858.CD004522
Topical herbal therapies for treating osteoarthritis	Cameron M, Chrubasik S	10.1002/14651858.CD010538
Tramadol for osteoarthritis	Cumberbatch C, April KToupin, Welch V, Toupin April K	10.1002/14651858.CD005522.pub2
Transcutaneous electrostimulation for osteoarthritis of the knee	Rutjes AWS, Nüesch E, Sterchi R, Kalichman L, Hendriks E, Osiri M, Brosseau L, Reichenbach S, Jüni P	10.1002/14651858.CD002823.pub2
Viscosupplementation for the treatment of osteoarthritis of the knee	Bellamy N, Campbell J, Welch V, Gee TL, Bourne R, Wells GA	10.1002/14651858.CD005321.pub2

## COCHRANE REVIEWS: OSTEOPOROSIS

<b>Title</b>	<b>Review Byline</b>	<b>Review DOI</b>
Alendronate for the primary and secondary prevention of osteoporotic fractures in postmenopausal women	Wells GA, Cranney A, Peterson J, Boucher M, Shea B, Welch V, Coyle D, Tugwell P, Hsieh S-C	10.1002/14651858.CD001155.pub2
Bisphosphonate therapy for children and adolescents with secondary osteoporosis	Ward L, Tricco A, Phuong P-N, Cranney A, Barrowman N, Gaboury I, Rauch F, Tugwell P, Moher D	10.1002/14651858.CD005324.pub2
Bisphosphonates for osteoporosis in people with cystic fibrosis	Conwell LS, Chang AB	10.1002/14651858.CD002010.pub4
Bisphosphonates for osteoporosis in primary biliary cirrhosis	Rudic JS, Giljaca V, Krstic MN, Bjelakovic G, Gluud C	10.1002/14651858.CD009144.pub2
Bisphosphonates for steroid induced osteoporosis	Homik J, Cranney A, Shea B, Tugwell P, Wells GA, Adachi J, Suarez-Almazor ME, Yeung JHS, Allen CS	10.1002/14651858.CD001347
Calcitonin for preventing and treating corticosteroid-induced osteoporosis	Cranney A, Welch V, Adachi J, Homik J, Shea B, Suarez-Almazor ME, Tugwell P, Wells GA	10.1002/14651858.CD001983
Calcium and vitamin D for corticosteroid-induced osteoporosis	Homik J, Suarez-Almazor ME, Shea B, Cranney A, Wells GA, Tugwell P	10.1002/14651858.CD000952
Calcium supplementation for improving bone mineral density in children	Winzenberg TM, Shaw KA, Fryer J, Jones G	10.1002/14651858.CD005119.pub2
Chinese herbal medicines for treating osteoporosis	Liu Y, Liu JP, Xia Y	10.1002/14651858.CD005467.pub2
Etidronate for the primary and secondary prevention of osteoporotic fractures in postmenopausal women	Wells GA, Cranney A, Peterson J, Boucher M, Shea B, Welch V, Coyle D, Tugwell P, Hsieh S-C	10.1002/14651858.CD003376.pub3
Exercise for improving outcomes after osteoporotic vertebral fracture	Giangregorio LM, MacIntyre NJ, Thabane L, Skidmore CJ, Papaioannou A	10.1002/14651858.CD008618.pub2
Exercise for preventing and treating osteoporosis in postmenopausal women	Howe TE, Shea B, Dawson LJ, Downie F, Murray A, Ross C, Harbour RT, Caldwell LM, Creed G	10.1002/14651858.CD000333.pub2
Fluoride for treating postmenopausal osteoporosis	Haguenauer D, Shea B, Tugwell P, Wells GA, Welch V	10.1002/14651858.CD002825
Hormone replacement for osteoporosis in women with primary biliary cirrhosis	Rudic JS, Poropat G, Krstic MN, Bjelakovic G, Gluud C	10.1002/14651858.CD009146.pub2
Preoperative education for hip or knee replacement	McDonald S, Page MJ, Beringer K, Wasiak J, Sprowson A	10.1002/14651858.CD003526.pub3
Risedronate for the prevention of osteoporotic fractures in postmenopausal women	Wells GA, Cranney A, Peterson J, Boucher M, Shea B, Welch V, Coyle D, Tugwell P, Hsieh S-C	10.1002/14651858.CD004523.pub3
Strontium ranelate for preventing and treating postmenopausal osteoporosis	O'Donnell S, Cranney A, Wells GA, Adachi J, Reginster J-Y	10.1002/14651858.CD005326.pub3
Vitamin D supplementation for improving bone mineral density in children	Winzenberg TM, Powell S, Shaw KA, Jones G	10.1002/14651858.CD006944.pub2

## COCHRANE REVIEWS: GOUT

<b>Title</b>	<b>Review Byline</b>	<b>Review DOI</b>
Allopurinol for chronic gout	Seth R, Kydd ASR, Buchbinder R, Bombardier C, Edwards CJ	10.1002/14651858.CD006077.pub3
Colchicine for acute gout	van Echteld I, Wechalekar MD, Schlesinger N, Buchbinder R, Aletaha D	10.1002/14651858.CD006190.pub2
Dietary supplements for chronic gout	Andrés M, Sivera F, Falzon L, Buchbinder R, Carmona L	10.1002/14651858.CD010156.pub2
Febuxostat for treating chronic gout	Tayar JH, Lopez-Olivo MA, Suarez-Almazor ME	10.1002/14651858.CD008653.pub2
Interleukin-1 inhibitors for acute gout	Sivera F, Wechalekar MD, Andrés M, Buchbinder R, Carmona L	10.1002/14651858.CD009993.pub2
Interventions for tophi in gout	Sriranganathan MK, Vinik O, Bombardier C, Edwards CJ	10.1002/14651858.CD010069.pub2
Intra-articular glucocorticoids for acute gout	Wechalekar MD, Vinik O, Schlesinger N, Buchbinder R	10.1002/14651858.CD009920.pub2
Lifestyle interventions for acute gout	Moi JHY, Sriranganathan MK, Edwards CJ, Buchbinder R	10.1002/14651858.CD010519.pub2
Lifestyle interventions for chronic gout	Moi JHY, Sriranganathan MK, Edwards CJ, Buchbinder R	10.1002/14651858.CD010039.pub2
Non-steroidal anti-inflammatory drugs for acute gout	van Durme CMPG, Wechalekar MD, Buchbinder R, Schlesinger N, van der Heijde D, Landewé RBM	10.1002/14651858.CD010120.pub2
Pegloticase for chronic gout	Anderson A, Singh JA	10.1002/14651858.CD008335.pub2
Systemic corticosteroids for acute gout	Janssens HJ, Lucassen PLBJ, Van de Laar FA, Janssen M, Van de Lisdonk EH	10.1002/14651858.CD005521.pub2
Uricosuric medications for chronic gout	Kydd ASR, Seth R, Buchbinder R, Edwards CJ, Bombardier C	10.1002/14651858.CD010457.pub2