

Literature Review

Musculoskeletal Health Conditions Represent a Global Threat to Healthy Aging: A Report for the 2015 World Health Organization World Report on Ageing and Health

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Abstract

Persistent pain, impaired mobility and function, and reduced quality of life and mental well-being are the most common experiences associated with musculoskeletal conditions, of which there are more than 150 types. The prevalence and impact of musculoskeletal conditions increase with aging. A profound burden of musculoskeletal disease exists in developed and developing nations. Notably, this burden far exceeds service capacity. Population growth, aging, and sedentary lifestyles, particularly in developing countries, will create a crisis for population health that requires a multisystem response with musculoskeletal health services as a critical component. Globally, there is an emphasis on maintaining an active lifestyle to reduce the impacts of obesity, cardiovascular conditions, cancer, osteoporosis, and diabetes in older people. Painful musculoskeletal conditions, however, profoundly limit the ability of people to make these lifestyle changes. A strong relationship exists between painful musculoskeletal conditions and a reduced capacity to engage in physical activity resulting in functional decline, frailty, reduced well-being, and loss of independence. Multilevel strategies and approaches to care that adopt a whole person approach are needed to address the impact of impaired musculoskeletal health and its sequelae. Effective strategies are available to address the impact of musculoskeletal conditions; some are of low cost (e.g., primary care-based interventions) but others are expensive and, as such, are usually only feasible for developed nations. In developing nations, it is crucial that any reform or development initiatives, including research, must adhere to the principles of development effectiveness to avoid doing harm to the health systems in these settings.

Key Words: Arthritis, Pain, Osteoporosis, Impact, Epidemiology, Models of care, Burden of disease

Background and Context

Musculoskeletal health is critical for people's mobility and dexterity, their ability to work and actively participate in all aspects of life, and to maintain economic, social, and functional independence across their life course. Adequate musculoskeletal health is essential to enable physical activity, an essential strategy to reduce risk of other noncommunicable diseases (NCDs). The profound impact of impaired musculoskeletal health, characterized by morbidity and mortality, is now globally recognized. The World Health Organization (WHO) commissioned a report describing the impact of impaired musculoskeletal health on healthy aging in order to inform the 2015 WHO World Report on Ageing and Health (World Health Organization, 2015). This paper summarizes the pertinent information contained in that musculoskeletal-specific report. Although the focus of this report is on older age, the impact of musculoskeletal health condition and musculoskeletal-related pain in younger people is also profound (King et al., 2011).

The Impact of Impaired Musculoskeletal Health

Impaired musculoskeletal health can be the cause of acute and chronic pain, burden in other health domains, physical limitation that involves loss of participation and withdrawal from usual social, community, and occupational activities, and decreased quality of life and well-being, including mental well-being. Some musculoskeletal conditions can be life-threatening and result in death if left untreated. People living with rheumatoid arthritis (RA), osteoarthritis (OA), and those who have sustained an osteoporotic fracture have higher mortality rates than their age- and gender-matched peers (Bliuc et al., 2009; Dadoun et al., 2013; Nüesch et al., 2011; Widdifield et al., 2015). Impaired musculoskeletal health has substantial personal, community, and societal consequences, which increases substantially in older people (Arthritis and Osteoporosis Victoria, 2013; Song, Chang, & Dunlop, 2006). Epidemiologic studies confirm the strong relationship between painful musculoskeletal conditions, lack of physical activity and resulting functional decline, frailty, loss of well-being and loss of independence, and depressive symptoms (Bolen et al., 2008; 2009; Hootman, Murphy, Helmick, & Barbour, 2011; Klinedinst, Resnick, Yerges-Armstrong, & Dorsey, 2015; Wilcox et al., 2006). Older people with arthritis and musculoskeletal 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. Moreover, impaired musculoskeletal health, reflected in reduced physical capability (grip strength, walking speed, chair rising, and standing balance times) has been repeatedly and consistently related to increased mortality (Cooper et al., 2010). Musculoskeletal health is, therefore, a key component of frailty.

Musculoskeletal health is particularly important for maintaining an active, productive, and prolonged working life. As the global retirement age extends, this issue will become increasingly important for older workers. Many occupations and work-related activities are associated with musculoskeletal disorders, with low back pain (LBP) and shoulder disorders the most common and most debilitating (Driscoll, 2011; Driscoll et al., 2014; Shanahan & Sladek, 2011). Identifying and implementing effective interventions for people with musculoskeletal conditions to remain productive at work is therefore important (Oakman, Keegel, Kinsman, & Briggs, 2016). In high-income countries, musculoskeletal conditions are one of the major causes of work loss and early retirement, lost retirement wealth (Schofield et al., 2012) and reduced national productivity (Schofield et al., 2015). In subsistence communities in developing countries, musculoskeletal conditions have been shown to have a major impact on livelihoods (Hoy, Toole, D. Morgan, & C. Morgan, 2003). Further, the impact of musculoskeletal conditions on indigenous communities, historically perceived to be minimal, is now understood to be equally profound across the lifespan (Eckhoff & Kvernmo, 2014; Jimenez, Garrouette, Kundu, Morales, & Buchwald, 2011; Lin et al., 2012; LoGiudice et al., 2012; Ng, Chatwood, & Young, 2010). Some evidence suggests that disability and unhelpful beliefs about musculoskeletal pain may in fact be iatrogenic in nature, possibly due to exposure to Western health practices (Lin et al., 2013). Reduced musculoskeletal health, therefore, results in reduced productivity and economic loss to society at all levels. These indirect costs far outweigh direct healthcare costs, by a factor of about five (Arthritis and Osteoporosis Victoria, 2013).

Pain of musculoskeletal origin is the most common form of chronic pain (Access Economics, 2007). Chronic musculoskeletal pain is one of the most common reasons that people seek medical help, is costly (Access Economics Pty Ltd., 2007; Arthritis and Osteoporosis Victoria, 2013), yet is under-recognized and undertreated. People living with chronic musculoskeletal 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 (Speerin et al., 2014; Toye et al., 2013). The impact of chronic pain is profound across the lifespan and on a global scale (Australian and New Zealand College of Anaesthetists, 2010; Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006; Goldberg & McGee, 2011; Institute of Medicine [IOM], 2011; Schopflocher, Taenzer, & Jovey, 2011). A recent Swedish population-based registry study examined the impact of chronic pain in the elderly Swedish population. The prevalence of moderate or severe chronic pain was 23.1% in those aged 65 years and older, and there was a strong relationship between the severity of chronic pain and resource use and quality of life (Bernfort, Gerdle, Rahmqvist, Husberg, & Levin, 2015). While the prevalence of chronic widespread pain is less than non-widespread chronic pain,

it is still significant (up to 24% or 12% when only studies with low risk of bias are considered in pooled prevalence estimates), particularly in people aged older than 40 years (Mansfield, Sim, Jordan, & Jordan, 2015).

Musculoskeletal conditions, by virtue of their chronicity, pain and associated disability, and social disengagement, are frequently associated with mental health impairments such as depression and anxiety as well as other comorbidities (Britt, Harrison, Miller, & Knox, 2008; Dominick, Blyth, & Nicholas, 2012; Murphy, Bolen, Helmick, & Brady, 2009). While it has been demonstrated that the physical and mental aspects of quality of life related to health are greatly impacted in persons with multimorbidity, this impact is even greater when one of the conditions the person suffers is a musculoskeletal condition (Loza, Jover, Rodriguez, Carmona, & Group, 2009). Further, multimorbidity associated with arthritis has significant financial implications for consumers (Schoenberg, Kim, Edwards, & Fleming, 2007; Schofield et al., 2014).

The Burden of Disease Related to Musculoskeletal Conditions

The increasing burden from NCDs now accounts for most of the global burden of disease (Murray et al., 2013; Vos et al., 2013). Musculoskeletal conditions are a leading contributor and account for a much larger global burden than was previously realized (Cross, Smith, Hoy, Carmona, et al., 2014; Cross, Smith, Hoy, Nolte, et al., 2014; Hoy, March, Brooks, et al., 2014; Hoy, March, Woolf, et al., 2014; Smith, Hoy, Cross, Merriman, et al., 2014; Smith, Hoy, Cross, Vos, et al., 2014). This transition of burden to long-term disabling conditions is well recognized in developed countries. There is now additional increasing evidence demonstrating the enormous future impact from musculoskeletal conditions such as osteoporosis and LBP in low- and middle-income countries, largely driven by population growth and aging. Age is one of the most common risk factors for musculoskeletal conditions (Hoy, Brooks, Blyth, & Buchbinder, 2010), 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 (The World Bank, 2011). Obesity, a risk factor for many musculoskeletal conditions, is also expected to rise dramatically in the developing world over the coming two decades (Kelly, Yang, Chen, Reynolds, & He, 2008). Further to this, increased use of motor vehicles is not only reducing physical activity but also increasing the numbers of motor vehicle accidents and resulting musculoskeletal trauma and disorders (Ngo et al., 2012).

Burden of Disease of Musculoskeletal Conditions

The Global Burden of Disease Study 2010 (GBD 2010) made estimates for 291 conditions, including OA of

the hip and knee, RA, LBP, neck pain, and all other musculoskeletal disorders, captured in a group titled "other musculoskeletal disorders." Although data from GBD 2010 relating to the burden of musculoskeletal conditions has been published previously, highlighting the burden specifically in older people has not been undertaken. Data from GBD 2013 are now also available reflecting 301 diseases across 188 countries, although those data have not yet been disaggregated by age and condition (Vos et al., 2015). Importantly, the findings from GBD 2013 are very similar to GBD 2010, where the global morbidity burden attributed to musculoskeletal conditions was again enormous, further reinforcing the burden of musculoskeletal conditions. This paper adds to the body of evidence from GBD 2010 by discussing the impact of musculoskeletal conditions on older people. Although gout has been studied (Smith, Hoy, Cross, Merriman, et al., 2014) it is not included in this paper. The burden related to osteoporotic fractures was not included in the "musculoskeletal" grouping in GBD 2010 but was represented in the "injury" grouping. The results show that the prevalence and burden from musculoskeletal conditions are exceptionally high throughout the world.

Globally, the disability impact of musculoskeletal conditions is high, causing 21.3% of the total years lived with disability (YLDs), second only to mental and behavioral problems (Murray et al., 2013; Vos et al., 2013). When death and disability are considered as a composite, musculoskeletal conditions rank fourth in global burden, accounting for 6.7% of the total global disability-adjusted life years (DALYs) (Murray et al., 2013; Vos et al., 2013). 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 (Murray et al., 2013; Vos et al., 2013).

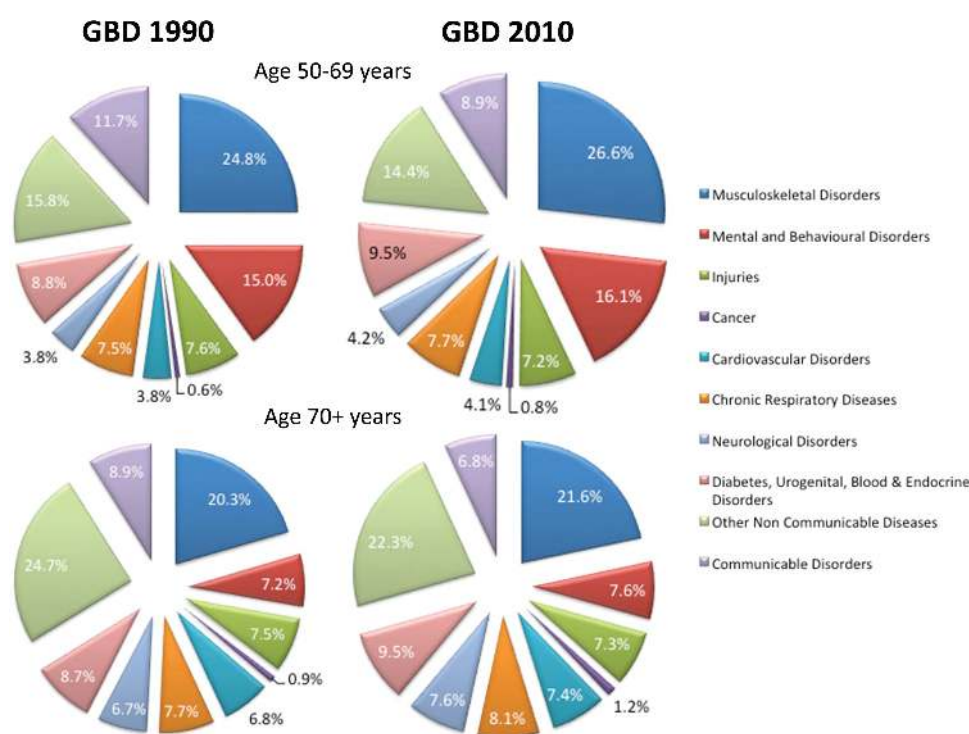
The burden in developing countries attributable to musculoskeletal conditions increased 60% from 1990 to 2010. This increase was relatively consistent across musculoskeletal conditions and was due to population growth and aging and potentially to improved surveillance capabilities. Disability from musculoskeletal-derived YLDs made up 16.8% of all YLDs in developing countries in 1990, and this increased to 19.2% in 2010 (Table 1). It is predicted that this burden from musculoskeletal conditions will increase dramatically in developing countries in coming decades, given the predicted population growth and aging (Hoy, Geere, Davatchi, Meggitt, & Barrero, 2014). Musculoskeletal 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.

The proportion of YLDs attributable to musculoskeletal conditions is higher in older age groups (Figures 1 and 2). In 2010, globally, musculoskeletal conditions accounted for 28.5% of YLDs for the 50–69 year age group and 23.4% in those aged 70 years and older. In developed countries, musculoskeletal condition accounted for 33% of total YLDs

Table 1. Proportion of YLDs With 95% UIs Attributable to Musculoskeletal Conditions and Injuries, by Level of Development and Year, for All Ages, Men and Women Combined

	Musculoskeletal YLDs			Injuries YLDs		
	% of YLDs	Lower UI	Upper UI	% of YLDs	Lower UI	Upper UI
Developing countries						
1990	16.8	13.6	20.1	5.3	6.6	4.0
2000	18.0	14.6	21.5	5.2	6.5	4.0
2010	19.2	15.9	22.6	5.4	7.1	4.0
Developed countries						
1990	27.3	22.9	31.4	6.9	9.1	4.9
2000	27.8	23.3	31.8	7.0	9.3	5.1
2010	28.1	23.5	32.0	7.4	9.8	5.4

Note: Source: GBD 2010. UI = uncertainty interval; YLDs = years lived with disability.

**Figure 1.** Proportion of total global years lived with disability attributable to each major set of health conditions in developing countries, 50–69 and 70+ age groups, men and women combined, 1990 and 2010 from GBD 2010. Source: GBD 2010.

(Figure 2 and Table 2). Notably, the musculoskeletal conditions included in these figures exclude osteoporotic fractures, which are likely to make up a significant proportion of injury YLDs, particularly in those 70 years and older. Overall, musculoskeletal conditions were the leading contributor to YLDs in older people, well ahead of mental and behavioral disorders (16.6%), which ranked second in the 50–69 year age group, and neurological disorders (18.7%), which ranked second in the 70 years and older age group. Women are more commonly disabled by musculoskeletal conditions than men, accounting for a greater proportion of total YLDs, although this gender differential varies between the conditions. 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).

The following section summarizes the prevalence among older people of some of the key specific musculoskeletal conditions that were systematically reviewed for the GBD 2010 study. It is not a comprehensive review of all musculoskeletal conditions that affect the elderly.

Low Back and Neck Pain

GBD 2010 estimated the global age-standardized point prevalence of “activity-limiting LBP that had lasted for at least 1 day” was 9.4% (95% uncertainty interval [UI]:

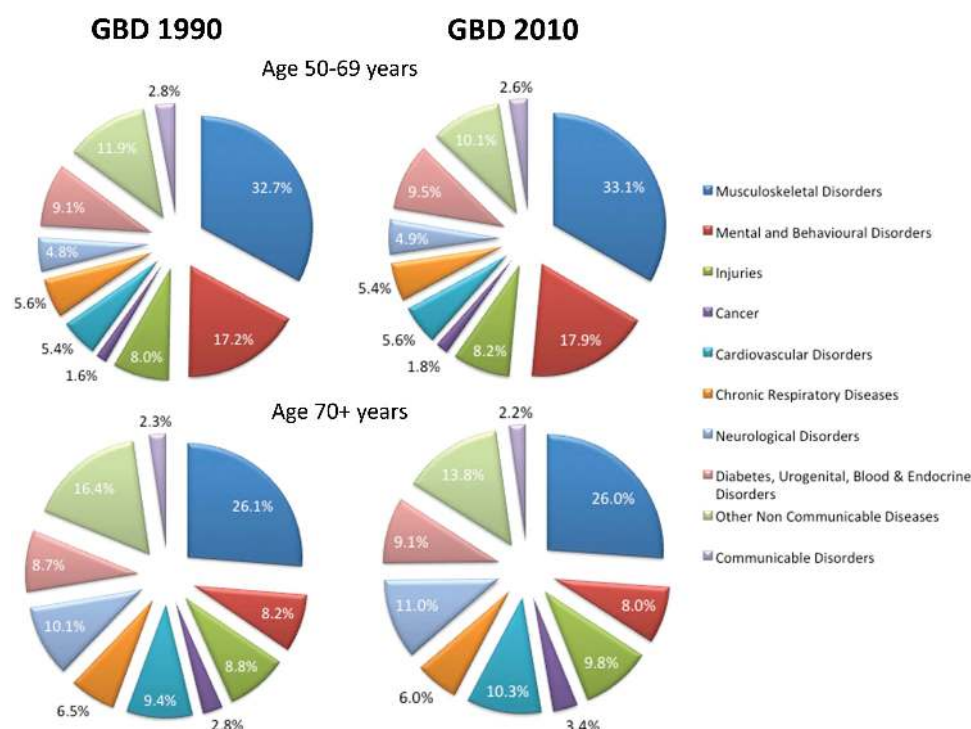


Figure 2. Proportion of total global years lived with disability attributable to each major set of health conditions in developed countries, 50–69 and 70+ age groups, men and women combined, 1990 and 2010 from GBD 2010. Source: GBD 2010.

9.0–9.8). The definition included “activity-limiting” and “at least 1 day” to ensure only disabling rather than “fleeting” pain was included. Prevalence in age groups above 65 years was 20% or greater (Table 3). The global age-standardized point prevalence of “activity-limiting neck pain that had lasted for at least 1 day” was 4.9% (95% UI: 4.6 to 5.3) (Hoy, March, Woolf, et al., 2014) and this increased to over 7% in those age groups above 65 years (Table 3). The age and sex distribution for LBP and neck pain across GBD regions was similar. A recent study among a cohort of older persons also showed the disabling back pain increases significantly across the older age groups (Docking et al., 2011).

Osteoarthritis

For OA, GBD 2010 estimates were limited to the hip and knee joints. The case definition required symptoms and radiological signs to be present. The global age-standardized point prevalence of knee OA was found to be 3.7% of the population, translating to approximately 268 million people (Cross, Smith, Hoy, Nolte, et al., 2014). This increased in age groups above 65 years to over 14%. Knee OA was more common in females (4.8%; 95% UI: 4.4%–5.2%) than in males (2.8%; 95% UI: 2.6%–3.1%). Around 0.85% of the population had hip OA, equivalent to 60 million people globally (Cross, Smith, Hoy, Nolte, et al., 2014). Hip OA was also more common in females (0.98%; 95% UI: 0.82%–1.29%) than in males (0.70%; 95% UI: 0.58%–0.90%), and increased with age, reaching almost 8% in those aged 85 years or older (Table 3). As OA can affect many other joints, including the spine, hands and

feet, the GBD 2010 study underestimated the true burden of OA, representing an important area for future research.

Rheumatoid Arthritis

GBD 2010 estimated that the global age-standardized point prevalence of RA was 0.24% (95% UI: 0.23%–0.25%), equal to 17 million people globally. Prevalence was approximately two times higher in females (0.35%; 95% UI: 0.34–0.37) than males (0.13%; 95% UI: 0.12–0.13). Prevalence was also found to increase with age, reaching 1.0% in those aged 75 years and older (Table 3) (Cross, Smith, Hoy, Carmona, et al., 2014).

Other Musculoskeletal Disorders

Other musculoskeletal conditions encompasses a wide range of specific conditions including the autoimmune and other inflammatory disorders such as systemic lupus erythematosus, ankylosing spondylitis, and psoriatic arthritis, as well as a wide range of joint, ligament, tendon, or muscle problems that cause generalized or regional pain, such as shoulder pain. The age-standardized point prevalence of other musculoskeletal conditions in GBD 2010 was estimated to be 8.2% (95% UI: 8.0%–8.5%), equivalent to almost 600 million people globally (Smith, Hoy, Cross, Vos, et al., 2014). It was slightly higher in females (mean 8.7%; 95% UI: 8.4%–9.1%) than in males (mean 8.0%; 95% UI: 7.7%–8.3%) and was considerably greater in older age groups, with a prevalence of 16% at ages 55–64 years, increasing to 24.9% at age 85 years and older (Table 3).

Table 3. Global Prevalence (%) (Lower, Upper 95% Uncertainty Intervals) of Activity-Limiting Low Back Pain and Neck Pain That Had Lasted for At Least 1 Day, Knee Osteoarthritis, Hip Osteoarthritis, Rheumatoid Arthritis, and Other Musculoskeletal Conditions, by Age Group

Age group	Low back pain	Neck pain	Knee osteoarthritis	Hip osteoarthritis	Rheumatoid arthritis	Other musculoskeletal conditions
All ages	9.4 (9.0, 9.8)	4.9 (4.6, 5.3)	3.7 (3.5, 4.0)	0.9 (0.7, 1.0)	0.24 (0.23, 0.25)	8.2 (8.0, 8.5)
55–64 years	16.9 (16.0, 17.9)	8.2 (7.6, 8.8)	13.1 (12.3, 14.0)	2.8 (2.4, 3.3)	0.53 (0.51, 0.55)	16.5 (16.0, 17.2)
65–74 years	20.0 (19.0, 21.1)	8.0 (7.5, 8.6)	14.2 (13.4, 15.2)	4.1 (3.6, 4.9)	0.78 (0.75, 0.82)	22.4 (21.4, 23.4)
75–84 years	22.9 (21.8, 24.2)	7.8 (7.2, 8.4)	14.9 (14.1, 15.9)	5.8 (5.1, 6.9)	1.06 (1.01, 1.11)	24.8 (23.7, 26.0)
85+ years	23.3 (22.3, 24.6)	7.3 (6.8, 7.8)	15.4 (14.5, 16.4)	7.9 (6.9, 9.3)	1.35 (1.28, 1.43)	24.9 (23.7, 26.3)

Note: Source: GBD 2010.

Osteoporosis, Fragility Fractures, and Falls

In 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 (Johnell & Kanis, 2006). 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. A recent systematic review on hip fracture incidence (Oden, McCloskey, Johansson, & Kanis, 2013) estimated that approximately 2.7 million hip fractures took place globally in 2010 in populations aged 50 years and older (83% of those occurred in people aged 70 years and older), of which approximately half were attributable to osteoporosis (264,000 for men and 1.10 million for women), and therefore potentially preventable with appropriate pharmacologic management and falls prevention strategies including lifestyle modifications and balance and strengthening exercise.

In GBD 2010, falls represented the leading injury type with the major global health burden and deaths in population aged 70 years and older (Institute for Health Metrics and Evaluation, 2015; Murray et al., 2013; Vos et al., 2013). The major component of the health burden due to falls is attributable to the consequences of fractures from osteoporosis or osteopenia. Low bone mineral density was responsible for one third of all DALYs and half of all mortality, respectively, attributable to falls in population aged 70 years and older (Sánchez-Riera et al., 2014).

Responding to the Burden of Musculoskeletal Conditions in Older Adults

A Systems Approach

The magnitude of the disability burden associated with musculoskeletal conditions, as outlined in Burden of Disease of Musculoskeletal Conditions section, demands

a whole-of-system, multilevel response (Speerin et al., 2014) that considers a life course approach to musculoskeletal health, inclusive of primary prevention, detection, and early intervention, established condition management. A multilevel approach can be considered in the following way (refer to [Supplementary Appendix 1](#) for further detail):

- **Macro-level:** The macro-level considers the functionality and scope of health systems or organizations, health policy, infrastructure and resource allocation, and socioeconomic factors. Health systems/organizations and their governance through health policy play a critical role in the planning and delivery of musculoskeletal 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 musculoskeletal conditions and their comorbidities, which stymies opportunities for service development in ambulatory and primary care—arguably, the settings where musculoskeletal healthcare is most needed. Given that musculoskeletal 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 programs to address them. This contributes to a general lack of population awareness concerning the burden an impact associated with musculoskeletal conditions. Further, access to musculoskeletal healthcare is variable according to geography, ethnicity, and socioeconomic status, thus creating care disparities (Al Maini et al., 2015; Anderson, Green, & Payne, 2009; Briggs, Slater, et al., 2012; Jacobi et al., 2003; Meghani et al., 2012).
- **Meso-level:** 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 musculoskeletal care from practitioners and health systems inadequately aligns with best available evidence for what works (Duckett, Breadon, & Romanes, 2015; Grol & Grimshaw, 2003; Runciman et al., 2012). 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 musculoskeletal conditions and the high prevalence of comorbid conditions, particularly mental health conditions, in older people.

- *Micro-level:* 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 musculoskeletal 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 (Briggs et al., 2010; Briggs, Slater, et al., 2012). 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 musculoskeletal health condition.

Effectiveness in Musculoskeletal Healthcare

While there is good evidence for “what works” to improve musculoskeletal health, chronic pain, and comorbid mental health impairment in older age, the implementation of that knowledge into health systems, clinical practice behaviors, and the lifestyles of older people remains grossly inadequate in most countries. A sizable proportion of musculoskeletal health conditions could be prevented through primary prevention initiatives delivered at a population level through public health initiatives. Mass media campaigns for improving population-level beliefs concerning back pain is one example (Buchbinder & Jolley, 2005). Evidence-practice and policy-practice gaps are further complicated by a dearth of implementation research for musculoskeletal health in particular (Bourne, Whittle, Richards, Maher, & Buchbinder, 2014), and a notable absence of musculoskeletal health issues in NCD policies (Speerin et al., 2014). A key research priority, therefore, is the development and evaluation of initiatives aimed at implementing evidence into policy and practice, in developed and developing nations, underpinned by appropriate behavior change models (Michie, van Stralen, & West, 2011).

Currently, older people are not receiving effective and efficient care and in some cases are receiving potentially harmful interventions. For example, in Canada, while up to 80% of consumers with chronic pain could feasibly receive effective care, only 10% gain access to evidence-informed management (Henry, 2008). Further examples include the overuse of X-ray imaging for back pain in older people (Pham, Landon, Reschovsky, Wu, & Schrag, 2009); grossly inadequate treatment for osteoporosis, despite eligibility subsidized therapies (Eisman, Clapham, & Kehoe, 2004);

and care for knee OA, osteoporotic fractures, and chronic pain that is discordant with best-practice, person-centered care (Brand et al., 2014; Duckett et al., 2015; Hunter, 2010; Runciman et al., 2012; Tai-Seale, Bolin, Bao, & Street, 2011). 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 musculoskeletal conditions (Hoy, Geere, et al., 2014) as many low- and middle-income countries lack the financial and workforce resources and necessary infrastructure to implement best-practice services that have been developed for high-income nations. Research examining *what* and *how* to implement musculoskeletal services for low- and middle-income countries remains critically important.

In developing countries, for example, it is crucial that any initiatives, including research, follow the principles of development effectiveness to avoid harming local health systems (Hoy, Geere, et al., 2014). These principles, based on lessons learned from the global development community over decades, aim to improve the quality and effectiveness of development cooperation.

Improving musculoskeletal health care in high-income nations requires fundamental systemic and sector-wide changes in the way musculoskeletal health services are delivered and funded, how health professionals are trained and provide care, and participation by older people in co-management of their musculoskeletal conditions (Briggs, Towler, Speerin, & March, 2014). The majority of research available in this area is based on implementation outcomes in high-income settings. Therefore, while clinical best-practice may be similar between nations, the manner in which services are implemented will necessarily vary according to setting and socioeconomic status. Given the majority of the evidence base in this area relates to the developed world, the interventions outlined in the subsequent section are mostly relevant to those nations.

Interventions for Musculoskeletal Conditions in Developed Nations

The Cochrane Musculoskeletal (<https://musculoskeletal.cochrane.org/>) and Back (<http://back.cochrane.org/>) review groups provide an excellent resource for the evidence base underlying a range of interventions for musculoskeletal conditions. A substantial gap remains, however, in translating 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 (Briggs et al., 2014; Li et al., 2008; MacKay, Veinot, & Badley, 2008; Speerin et al., 2014). Specifically, Models of Care serve to close the “know” – “do” gap in service delivery. Models of Care are evidence-informed policies or frameworks that outline the optimal manner in which condition-specific care should be made available and delivered to consumers while considering the practicalities of the local environment. Models

of Care for common musculoskeletal disorders have been reviewed recently at an international level (Speerin et al., 2014) and nationally (Briggs et al., 2014; Li et al., 2008). [Supplementary Appendix 2](#) identifies key intervention strategies for people at risk of developing, or living with, common musculoskeletal conditions based on a recent European Action Towards Better Musculoskeletal Health report ([The European Bone and Joint Health Strategies Project, 2004](#)). Importantly, while the principles of care relate to both high-income and low- and middle-income nations, the implementation strategies presented relate primarily to high-income nations. While similar interventions may be indicated in low- and middle-income nations, the manner in which they are implemented will vary and should be aligned to the principles of development effectiveness.

The success and sustainability of Models of Care for musculoskeletal health relies on their evidence-informed and clinically feasible content, sector-wide engagement and support and evaluation that is meaningful to end users (Briggs, Bragge, Slater, Chan, & Towler, 2012; Briggs et al., 2015; Kadu & Stolee, 2015). Content must reflect a contemporary perspective of musculoskeletal health and pain and support co-care, that is both care delivery by health professionals and an active self-management role by older people. Implicit in the delivery of person-centered care is the adoption of a tailored, biopsychosocial approach to care where the unique impairments profile of the individual is considered in identifying the appropriate components of care and their sequencing. This is particularly relevant in the management of chronic pain conditions, where a large volume of literature suggests that reliance on interventional procedures and pharmacotherapies to address structure and biology are ineffective as unimodal interventions (Loeser & Cahana, 2013; Roth, Geisser, & Williams, 2012). Further, a problematic downside of such a unimodal and reductionist approach is the inappropriate use of imaging and therapies such as opioids, which can lead to significant personal and societal problems (Manchikanti et al., 2012; Vowles et al., 2015).

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 and supporting a culture shift towards implementation of integrated models of person-centered care (Briggs, Bragge, et al., 2012; Briggs et al., 2014, 2015; Kadu & Stolee, 2015).

Frameworks for implementation of Models of Care range from Health Networks (Briggs, Bragge, et al., 2012; Cunningham et al., 2011; Cunningham, Ranmuthugala, Westbrook, & Braithwaite, 2012; Ferlie, Fitzgerald, McGivern, Dopson, & Bennett, 2013) to regionally coordinated hub and spoke models (e.g., British Columbia Pain Initiative, Canada) and province-wide networks (e.g., Nova

Scotia Chronic Pain Collaborative Network; <http://communitypainnetwork.com/>).

Consistent features across these various Models of Care include the importance of primary and secondary prevention, care coordination, access to a multidisciplinary team to address the biopsychosocial aspects of chronic musculoskeletal conditions and injury and trauma sequelae, self-management support, and tailored, person-centered care. A workforce of adequate volume and competencies is critical for effective and sustainable implementation of Models of Care. Musculoskeletal healthcare can be delivered effectively and efficiently by various health professionals, including some with extended scopes of practice, particularly when the principles of chronic care are adopted, 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.

Conclusions and Recommendations

The impact of impaired musculoskeletal health on individuals and society at all levels and all places on the planet is profound, with the magnitude of the burden of disease in terms of disability far exceeding other NCDs. Moreover, this burden is predicted to rise markedly in coming decades with further global transition in burden of disease from communicable to NCDs, overwhelmingly attributed to musculoskeletal conditions. Musculoskeletal health is critical for people's ability to work and be financially independent into older age and this issue will become increasingly relevant as retirement age extends. Responding to the increasing burden of disease demands a multilevel, integrated response, inclusive of primary prevention, early identification and intervention, and established disease management. Targeted research in specific priority areas is also important ([Supplementary Appendix 3](#)). Health systems in developed countries are gradually responding to the rising burden and the complex needs of people with musculoskeletal disorders through recognition of musculoskeletal health within health policy, funding, and service models and the implementation of multidisciplinary, patient-centered Models of Care, ideally that integrate with service models targeted towards other chronic health conditions. Clinicians and service providers in musculoskeletal healthcare have a wealth of knowledge and experience in the development and implementation of integrated, person-centered Models of Care (Briggs et al., 2015). However, these models are far from universal in the developed world and are almost nonexistent in developing countries, also emerging initiatives are promising (Haldeman et al., 2015). There is increasing global recognition of the multimorbidity of aging populations, including the effects of musculoskeletal conditions. It is

well recognized that many opportunities exist to better harmonize global health policy and programs to incorporate musculoskeletal conditions in efforts to address the burden of NCD. Collaboration between groups working on these diseases will lead to more consistent public health messaging and more efficient use of resources, particularly in developing nations.

Supplementary Material

Please visit the article online at <http://gerontologist.oxfordjournals.org/> to view supplementary material.

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