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### Moving from evidence to practice: Models of care for the prevention and management of musculoskeletal conditions



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## A B S T R A C T

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With musculoskeletal conditions now identified as the second highest cause of the morbidity-related global burden of disease, models of care for the prevention and management of disability related to musculoskeletal conditions are an imperative. Musculoskeletal models of care aim to describe how to operationalise evidence-based guidelines for musculoskeletal conditions and thus support implementation by clinical teams and their health systems. This review of models of care for musculoskeletal pain conditions, osteoarthritis, rheumatoid arthritis, osteoporosis and musculoskeletal injuries and trauma outlines health system and local implementation strategies to improve consumer outcomes, including supporting access to multidisciplinary teams, improving access for vulnerable populations and leveraging digital technologies to support access and self-management. However, the challenge remains of how to inform health system decision-makers and policy about the human and fiscal benefits for broad implementation across health services. Recommendations are made for potential solutions, as well as highlighting where further evidence is required.

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**Introduction**

The perceived burden of disease attributed to chronic musculoskeletal conditions and the sequelae from musculoskeletal injury and trauma have been lower relative to other diseases more closely associated with mortality, such as cancer, kidney disease and ischaemic heart disease. However, the emerging evidence now unequivocally and consistently identifies the profound prevalence, socio-economic impact and burden of disease imposed by chronic musculoskeletal conditions and their associated pain burden and functional impairments. These outcomes are particularly relevant in conditions such as osteoarthritis (OA), rheumatoid arthritis (RA), osteoporosis (OP) and pain of musculoskeletal origin, especially low back pain [1–7].

In the most recent Global Burden of Disease Study, musculoskeletal conditions including RA, hip and knee OA, low back and neck pain, gout and other musculoskeletal disorders represented the second highest burden of disease globally, when expressed as years lived with disability – an index representing morbidity. At the condition level, low back pain was the leading global cause of years lived with disability across all 289 diseases and injuries examined [6]. Even when mortality was considered with morbidity (expressed as disability-adjusted life years), the burden of disease for musculoskeletal conditions was still substantial, representing the fifth highest condition group [5]. In developed nations, however, this ranking is substantially higher owing to a greater disease burden attributed to morbidity rather than mortality. Even more striking are the projections for the future burden of disease associated with musculoskeletal conditions. For example, a recent Australian socio-economic impact report based on Australian Health Survey data conservatively estimated that the prevalence of cases of musculoskeletal conditions will soar by 43% by 2032 [1]. Population modelling suggests that although the steepest trajectory will be in cases of OA (58%), the greatest absolute number of people will live with chronic back problems. More recent estimates of the projection of osteopenia and OP in Australia highlight a striking 31% increase in the number of Australians affected by these conditions by 2022 [7].

Despite the identified burden of musculoskeletal conditions, a substantial burden–service gap persists in most developed nations. Not only is the access to care variable according to geography, ethnicity and socio-economic status, thus creating care disparities [8–11], but also the delivery of care from practitioners and health systems inadequately aligns with the best available evidence for what works [12,13]. The burden–service gap is not easily solved as it is driven by a myriad of complex

interdependencies at multiple levels: macro (health systems, organisations, health policy and socio-economic factors), meso (delivery systems, infrastructure and the volume and competencies and training of health practitioners) and micro (participation by consumers in co-care of their conditions). Access to, and delivery of, care is further complicated by the chronicity of musculoskeletal conditions. Health-care systems in developed nations are oriented towards acute care services and respond to mortality risk rather than long-term morbidity associated with musculoskeletal conditions and their co-morbidities, which stymies opportunities for service development. A fundamental change in the manner in which health-care systems and services are planned, implemented, delivered and evaluated is therefore needed to address disability associated with musculoskeletal ill health.

Models of Care (MoCs) can help to address the burden–service gap in musculoskeletal health [14]. A MoC is an evidence-informed strategy, framework or pathway that outlines the optimal manner in which care for specific types or groups of conditions should be made available and delivered to consumers. A MoC aims to include contemporary evidence with a framework to meet the current and projected community need, in the context of local operational requirements [182]. Importantly, a MoC is not a clinical practice guideline. While a high level of evidence, such as that contained in clinical practice guidelines, should underpin a MoC, the fundamental purpose of a MoC is to operationalise ‘what works’ into practice, rather than to appraise and to grade evidence and develop specific clinical practice recommendations [14]. MoCs may address service planning, implementation, delivery and evaluation at multiple levels, according to the contextual factors associated with the condition and with the intended implementation environment. While MoCs are increasingly accepted as a contemporary vehicle to drive evidence into practice; for example, in Australia [14,182], a review of MoCs for musculoskeletal health conditions and injury and trauma has not been undertaken at an international level. Therefore, the aim of this chapter was to convene a multidisciplinary, international team to analyse this knowledge gap for specific musculoskeletal conditions including chronic pain of musculoskeletal origin, OA, RA, OP and musculoskeletal injury and trauma. We sought to provide an overview of current MoCs for these specific conditions across care settings and to offer recommendations for future policy and practice initiatives that reduce the burden–service gap for consumers with, or at risk of, musculoskeletal conditions.

## Methods

A narrative review was undertaken of peer-reviewed published literature and relevant grey literature relating to MoCs for the suite of relevant musculoskeletal conditions and injuries. Search terms relevant to each of the specific conditions (chronic pain of musculoskeletal origin, OA, RA and OP) and musculoskeletal injury and trauma were developed and used in scholarly databases to identify published literature. Relevant grey literature was identified through Internet searches and knowledge of the international team. Writing groups followed a structured approach to review and synthesise literature relating to MoCs, and these findings are presented in Section C.

## MoCs for musculoskeletal conditions

### *Chronic musculoskeletal pain*

#### *Epidemiology and impact*

Chronic musculoskeletal pain (CMP) is one of the most common reasons that people seek medical help, is costly, and yet still goes under-recognised and under-treated. The health and economic burdens associated with CMP are substantial for health consumers and for society [1,15]. The scale of chronic pain is enormous, affecting the lives of one in five people globally including children and adolescents, with CMP contributing a significant proportion of this burden [15–17]. People living with CMP face a constant daily 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. The impact of CMP on the individual consumer is further exacerbated by an increase in prevalence of co-morbidities such as anxiety, depression and decreased physical and mental functioning [18].

**Table 1**

Examples of Models of Care for managing chronic pain including chronic musculoskeletal pain are shown. The Table format is adapted from the O'Donnell framework [178].  
QoL: quality of life; ED: emergency department; QALY: quality-adjusted life year

Pain MoC	Where	What (components of model)	Who	How	Outcome (where reported)
Kaiser Permanente, USA: Oregon and Washington <sup>a</sup>	Initially 14 primary care sites (GP clinics)	<ul style="list-style-type: none"> <li>• Pain management groups</li> <li>• Multidisciplinary pain clinic (specialist care; peer consultation/mentoring through e-records/ telephone)</li> <li>• Website (community info)</li> <li>• Web-based educational program available (face-to-face or online)</li> <li>• Advice nurses available for phone call mentoring patient</li> </ul>	Pain management team (social worker trained in mental health, physiotherapist, pharmacist, nurse)	Specialist nurse triage; pathways to: primary care medical care tertiary care	<ul style="list-style-type: none"> <li>• Increase no. of patients seen</li> <li>• Improved patient outcomes (QoL; satisfaction, reduced suffering)</li> <li>• 43% decrease in ED visits for people in pain programs</li> </ul>
Calgary Health Region Chronic Pain Program <sup>a</sup>	Regionally coordinated hub and spoke model; Primary care (max 6 months before on-referral to tertiary) Tertiary care	<ul style="list-style-type: none"> <li>• Musculoskeletal, neuropathic, pelvic and headache pain</li> <li>• Community-based group education generic and condition specific; skill development in small group; lecture formats, in collaboration with the 'Living Well' program (community-based: online or face-to-face)</li> <li>• Focus on self-management (education sessions, goal setting, and exercising)</li> <li>• Education for all primary care physicians on-referring</li> <li>• Also develops educational programs and practice guidelines for clinicians</li> </ul>	Comprehensive inter-professional team (medical, allied health): Primary care: nurse-led, physiotherapist, pharmacist, behavioural health consultant	Referral by GP; The Chronic Pain Centre has joined the Calgary Zone: Central Access and Triage project	No data available
Nova Scotia, Canada Chronic Pain Collaborative Care Network <sup>a</sup>	Province wide network Primary care (collaborative emergency centres collaborative care clinics, and community health centres)	<ul style="list-style-type: none"> <li>• Enhancing pain management at primary care, secondary and tertiary units across province;</li> <li>• Consumers: (self-management programme: lifestyle</li> </ul>	Collaborative interdisciplinary team (different in different communities): doctors, nurse practitioners, family practice nurses, paramedics,	Triage system	<p>Aims (no data):</p> <ul style="list-style-type: none"> <li>• Reduce chronic pain care wait lists</li> <li>• Reduce health costs</li> </ul>

	Secondary care Tertiary care	changes: healthy eating, activity; symptom management, self-efficacy, mood management, goal setting, problem solving)	midwives and/or mental health workers.		
British Columbia Pain Initiative, Canada <sup>a</sup>	Regionally coordinated hub and spoke model; Alignment of pain services with integrated primary care networks	<ul style="list-style-type: none"> <li>• Learning community of practice: mentor: mentee model; primary care physicians rotated through pain centres (16 trained p/yr); mentorship (6–10 primary care physicians to 1 pain specialist)</li> <li>• Communication by phone, fax, email using proforma</li> <li>• Peer to peer and expert-led self-management with chronic disease focus</li> <li>• Stratified needs</li> <li>• Centralised telephone 'hot-line' for peer to peer support</li> <li>• Shared website, chronic pain registry</li> </ul>	Inter-professional	Organised referral system	No data available
Pain Collaboration and Exchange initiative, South Hampton, United Kingdom <sup>a</sup>	Primary care based with service redesign based on chronic disease management principles	<ul style="list-style-type: none"> <li>• Primary care pain services with referral pathways to specialist services for complex patients</li> <li>• Self-management</li> <li>• Patient toolkit for pain management</li> <li>• Patient and carer education</li> <li>• Policy guide</li> <li>• Business toolkit (for developing pain management services)</li> <li>• Treatment guidelines with consultant back up</li> <li>• Network directory of health professionals, professional, manager and consumer organisations</li> <li>• Primary care physicians have tools to manage back</li> </ul>	Inter-professional	Triage strategy (stratification done by non-medical members of team) Aim: clinically appropriate specialist-led care within 18 weeks from initial referral	<ul style="list-style-type: none"> <li>• Waiting lists consistently around 6–8 weeks and high patient satisfaction (85%)</li> <li>• Measured patient outcomes and the effectiveness of pain interventions, providing evidence to support the value that the service brings</li> </ul>
Sheffield Back Pain, United Kingdom <sup>b</sup>	Primary care based	<ul style="list-style-type: none"> <li>• Primary care physicians have tools to manage back</li> </ul>	Inter-professional	1. Referral process (Primary care physician)	No data available

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Table 1 (continued)

Pain MoC	Where	What (components of model)	Who	How	Outcome (where reported)
		<p>pain in practice and access to multidisciplinary care for back pain</p> <ul style="list-style-type: none"> <li>• Timescales and triggers for referral to a multidisciplinary back pain specialist team and referral to secondary care</li> <li>• Importance of early intervention to help reduce chronicity, and patient education and self-care</li> <li>• Online resource with information for the public on self-care and prevention <a href="https://www.sheffieldpersistentpain.com/">https://www.sheffieldpersistentpain.com/</a></li> <li>• Tools for health care professionals to manage back pain in practice <a href="https://www.sheffieldpersistentpain.com/professional-resources/resources/professional-resources">https://www.sheffieldpersistentpain.com/professional-resources/resources/professional-resources</a></li> </ul>		<p>2. Risk stratification (STarT tool: 1-min self-check)</p> <p>3. Simplified two item screen for other musculoskeletal problems (hip, knee, foot and ankle, hand and elbow, shoulder)</p>	
Chronic Pain Scotland Service Model <sup>c</sup>	Primary care-based Community settings	<ul style="list-style-type: none"> <li>• Musculoskeletal pain self-management support via web-based access to new innovative services throughout NHS Scotland, for example, the Working Backs Scotland site and home-based back pain rehabilitation made available over the Internet.</li> <li>• Population-based pain education (24-h phone support); pain workforce competency frameworks; improve awareness of post-surgical pain; Working</li> </ul>	Integrated multidisciplinary teams in community settings carry protocol-led triage with onward referral to most appropriate service	Self-referral; centralised referral management system to expert physiotherapy advice to reduce primary care physician consultation rates and speed up referral for orthopaedic surgery	No data available

Hunter Integrated Pain Service, New South Wales, Australia <sup>d</sup>	Regional city; tertiary and primary care	<p>Backs Scotland; Media campaigns; claims industry; employers</p> <ul style="list-style-type: none"> <li>• Pain with &gt;12 weeks duration or &lt;12 weeks if persisting beyond normal tissue healing time; tiered approach all tiers with referral triage (red/yellow flags), multidisciplinary teams (primary care physician teams/integrated musculoskeletal teams);</li> <li>• Tier 1 (Living with Pain self-management program (local/remote); Level 1 pain management program (simple messages and self-management strategies))</li> <li>• Tier 2 (Tier 1 + specialist medicines review ± procedures)</li> <li>• Tier 3 (Tier 1, 2 and procedures + residential pain management program)</li> <li>• Inpatient and outpatient services for patients and carers</li> <li>• Initial 90-min group education session with focus on active management</li> <li>• Choice of either early community link with generic management or individual assessment (interdisciplinary or medical only)</li> <li>• 3 targeted programs</li> <li>• Strong community links</li> <li>• Online resources</li> </ul>	Referral and triage with standardised screening questionnaire;	No data available
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Table 1 (continued)

Pain MoC	Where	What (components of model)	Who	How	Outcome (where reported)
The STEPS model Perth, Western Australia [26]	Metropolitan tertiary initially; now many other sites including in primary care	Two types of group education programmes for patients, partners and carers <ul style="list-style-type: none"> <li>• 8-hr self-training educative pain sessions over 2 days (integrated whole person approach to pain); program undertaken prior to any face-to-face consultation with specialist (45%);</li> <li>• 40-h intensive cognitive behavioural therapy with pre assessment by physiotherapist and psychologist with focus on mood and physical conditioning</li> <li>• Online web resources for co-care <a href="http://painhealth.csse.uwa.edu.au/index.html">http://painhealth.csse.uwa.edu.au/index.html</a></li> </ul>	Interdisciplinary	Referral from any health professional to service Triage with capture of standardised data across all pain dimensions	<ul style="list-style-type: none"> <li>• Fourfold increase in capacity</li> <li>• Reduction in wait times from &gt;2 years to &lt;2 months</li> <li>• Reductions in unit cost</li> <li>• Promising preliminary health outcome data (health behaviours)</li> </ul>
Pain Management Research Institute, Royal North Shore Hospital, Sydney Australia	Tertiary	<ul style="list-style-type: none"> <li>• Flexible with integration of novel therapies (e.g. mirror box for complex regional pain syndrome)</li> <li>• Group and individual programs for patients and carers</li> <li>• Pain introduction days</li> <li>• Cognitive behavioural therapy (5 h)</li> <li>• Occupation therapy/Physiotherapy groups (4–12 sessions)</li> <li>• Case conferencing</li> <li>• Training for pain fellows and allied health professionals and postgraduate studies</li> </ul>	Multidisciplinary	Referral and triage	Data are collected. Average levels of depression pre intervention were moderate to severe and fell to mild levels at post intervention. No other data accessible.



<p>Integrated Managed Care Company, Germany<sup>e</sup> [Collaboration with German Pain Association and National Compulsory Health Insurer]</p>	<p>Multi centres</p>	<ul style="list-style-type: none"> <li>• Integrated health care for low back pain workers with &gt;28 days sick leave; Multi-modal treatment tailored to person's needs</li> <li>• Duration of 4 weeks (total 8.5 h pain therapy, 17.5 h physiotherapy, and 10.75 h psychotherapy with educative elements, relaxation techniques, behaviour therapy, and strength, cardio and coordination training alongside individual therapy)</li> <li>• Bonus incentive for return to work</li> </ul>	<p>Interdisciplinary</p>	<p>Referral from specialised case managers</p>	<p>7627 patients were allocated to 36 centres; 5751 patients participated in the treatment period; 52.6% were back to full-time work after 4 weeks; non-responders underwent another 4-week programme with a success rate of 81.1%. The one-year-follow-up of the QoL showed good sustainability</p>
<p>Swedish National Rehabilitation Guarantee<sup>e</sup></p>	<p>The programme is generating opportunities for closer collaboration between Swedish Country Councils, primary health care centres, and universities.</p>	<ul style="list-style-type: none"> <li>• The programme was an agreement between the government and the Swedish Association of Local Authorities and Regions and aimed to: <ul style="list-style-type: none"> <li>• prevent and reduce sickness absence</li> <li>• to offer early intervention</li> <li>• to enhance availability of evidence-based rehabilitation.</li> </ul> </li> <li>• The program focused on establishing the best methods of retaining and restoring working capacity in people who have developed mental ill-health and unspecified pain in neck and back, and to establish a network</li> </ul>	<p>Interdisciplinary</p>	<p>Patients with mental illnesses and pain in neck and back, who were already off sick or were at risk of sick leave.</p>	<p>Currently, 24 projects are running all over Sweden. Results will be available early 2015.</p>

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**Table 1** (continued)

Pain MoC	Where	What (components of model)	Who	How	Outcome (where reported)
Netherlands <sup>e</sup>	University-based comprehensive multispecialty spine centre	Offer coordinated and comprehensive interdisciplinary care	Interdisciplinary team of medical and non-medical specialists derived from 7 departments	Referral to the centre	On referral to the spine centre, 35% worked, at discharge 60% and at 3 months follow-up 77% were working again. The mean cost per patient in this centre is € 1123, with a cost/benefit estimate of € 0.22 (cost/added QALY € 1123/€ 5000).

<sup>a</sup> Adapted from National Pain Strategy and Cousins 2009, 'Australian National Pain Summit: Fact finding visits to USA, Canada, UK – Report on key findings and associated resource materials', available at [www.painsummit.org.au/news](http://www.painsummit.org.au/news).

<sup>b</sup> <http://www.sheffieldbackpain.com/>.

<sup>c</sup> The Scottish Government Health Delivery Directorate, Improvement and Support Team, Long Term Conditions Collaborative Improving Care Pathways, The Scottish Government, Edinburgh 2010 (appendix 3) <http://chronicpainscotland.org/patients-area/living-well-with-chronic-pain/>.

<sup>d</sup> <http://www.hnehealth.nsw.gov.au/pain>.

<sup>e</sup> <http://www.sip-platform.eu/>.

### *Management of CMP*

Although not everyone with musculoskeletal conditions experiences CMP, it is those with chronic pain and high disability who consume the most resources and who carry the most substantial burden [1,2,16,19]. In this population, the management of pain and disability is less than optimal. Chronic pain, defined as “pain without apparent biological value that has persisted beyond the normal tissue healing time (usually taken to be three months),” [20] is a multidimensional process not only affecting sensory and emotional processing but also producing an altered brain state considered by some as representing a chronic degenerative disease. The mechanisms underlying chronic pain include a complex interaction of physiological, emotional, cognitive, social and environmental factors highlighting the need for integrated care delivered through MoCs that address these multidimensional aspects of the lived experience of pain.

Overall, the present treatment options for CMP result in modest improvements at best [21], highlighting the crucial need for assessment of the effectiveness of combination (multimodal) treatments appropriate to the individual. These include early intervention, identification of indicators of treatment response and the use of risk classification strategies [22,23]. Further, as the complexity of CMP is poorly understood across the community, and by educators, researchers and trainee and trained health professionals alike, obtaining timely, integrated, effective, evidence-informed care is challenging. Care disparities result, but these may be amenable to policy shifts that promote team management, support consumers with the knowledge and skills to take an active role in their care and implement digital technologies to overcome access difficulties attributed to geography [8,11,24].

The burden of chronic pain associated with musculoskeletal disorders can, however, be substantially reduced when available evidence-based management is implemented [25]. Health and economic benefits of best-practice care have been highlighted by the Societal Impact of Pain Group Report on Pan-European health policy initiatives [19], innovative Australian models [26] and systematic reviews such as that by Lin and colleagues [27]. In this context, the adoption of a biopsychosocial approach using evidence-informed interventions is consistently recommended [2,16,17]. This approach provides a useful clinical framework for addressing the multidimensional nature of CMP and making sense of the variable and often incongruent relationship between pain severity, physical pathology findings and disability. Multidimensional domains are addressed using multimodal approaches tailored to the individual, including self-management support strategies, psycho-education (neurophysiology of pain), use of active strategies such as pacing (time-contingent graded activity), behavioural approaches to pain (e.g., addressing catastrophising, distress, unhelpful beliefs and fear-avoidance behaviours), and active movement-based strategies. These may need to be combined with pharmacologic and interventional procedural options, as appropriate [28]. The integrative biopsychosocial approach is ideally delivered by an inter-professional team with the consumer being a key team member [28].

### *MoCs for CMP*

Given the breadth of CMP and its relevance to other condition-specific foci in this chapter, here we address the development and implementation of MoCs from a health systems' perspective. Developing innovative MoCs based on a contemporary perspective of CMP and aligning these MoCs with a skilled workforce, and building capacity for co-management by consumers, are widely acknowledged as being essential to the sustainable delivery of best-practice musculoskeletal pain management [2,16,17]. Cross-sector engagement and collaboration is critical for the implementation of best-practice MoCs for CMP. The frameworks for the implementation of MoCs range from health networks [14] to regionally coordinated hub and spoke models (British Columbia Pain Initiative, Canada) and province-wide networks (Nova Scotia Chronic Pain Collaborative Network (<http://communitypainnetwork.com/>)) (Table 1). Frameworks that align evidence, policy and practice can facilitate the implementation of integrated, high-quality services by multidisciplinary and multi-agency teams as a standard feature of care [19]. 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 musculoskeletal pain [14]. The Western Australian Spinal Pain MoC has been developed, implemented and evaluated using this framework across care settings [24,28,29].

**Table 2**

Summary of target areas for systems change to facilitate improvement of the delivery of effective musculoskeletal pain management.

Target areas	What needs changing	How to change
Education about chronic musculoskeletal pain	<ul style="list-style-type: none"> <li>Upskilling of:               <ul style="list-style-type: none"> <li>• Health professionals</li> <li>• Consumers</li> <li>• General public</li> <li>• Policymakers</li> <li>• Industry (employers)</li> <li>• Insurers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• University curricula which reflect current best evidence practice and link across professions (interdisciplinary)</li> <li>• Public health campaigns, supported across the service delivery sector</li> <li>• Policy–practice engagement</li> <li>• Policy–practice–educational institution–industry engagement</li> <li>• Education about chronic musculoskeletal pain within a biopsychosocial (whole person) rather than a disease focussed context</li> </ul>
Health policy	<ul style="list-style-type: none"> <li>• Recognition by government of the socio-economic impact of chronic musculoskeletal pain</li> <li>• MoCs, aligned with policy that reflect current best practice and provide funding and systems to help deliver best care</li> <li>• Identification of potential health savings</li> <li>• Accessible resources</li> </ul>	<ul style="list-style-type: none"> <li>• Engage with multi-stakeholders to develop MoCs that are context relevant and implementable</li> <li>• Evaluate the implementation of the MoCs (health and economic data at systems level to inform cost benefit)</li> <li>• Policy-into-practice initiatives that create shared health delivery systems</li> <li>• Use of e-health and novel technologies that encourage co-care (including self-management)</li> </ul>
Appropriate pain management	<ul style="list-style-type: none"> <li>• Implementation of current best practices and resources to facilitate practical, real-world clinical solutions</li> <li>• Approaches that acknowledge the multidimensional nature of pain and address all components using a 'whole person' approach</li> <li>• Funding and governance, self-management support to facilitate optimal care, such as resourcing of appropriate care pathways</li> </ul>	<ul style="list-style-type: none"> <li>• Multi-stakeholder engagement in implementing shared solutions (for example, policy platforms such as the Societal Impact of Pain initiative)</li> <li>• Risk stratification approaches</li> <li>• Health policy to direct funding</li> <li>• Professional bodies continuing education for current health workforce; inform university curricula for emerging health workforce using a holistic chronic disease framework</li> <li>• Use of technologies (webinars; tele-health); web platforms that provide accessible best-practice guidance in line with health systems</li> </ul>
Service delivery – provision of person-centred integrated pain management	<ul style="list-style-type: none"> <li>• Health system plasticity to facilitate horizontal and vertical integration of care</li> <li>• System inversion (e.g., group education prior to consultation for complex pain presentations)</li> <li>• Funding self-management support that facilitate cross-sector coordinated care for complex problems</li> <li>• Access to specialist care without prolonged waiting</li> </ul>	<ul style="list-style-type: none"> <li>• Implementation of MoCs such as health networks; hub and spoke models</li> <li>• Development and strengthening of interdisciplinary (including 'virtual') networks and communities of practice</li> <li>• Implementation of triage-based systems to identify risk of chronicity and disability</li> <li>• Identification of and accessibility to clear clinical pathways identified and accessible</li> <li>• Use of telemedicine; e-health technologies to facilitate access to specialist care</li> </ul>
Health outcomes and economic data	<ul style="list-style-type: none"> <li>• Inadequate data on health and economic aspects of musculoskeletal pain</li> <li>• Inform health budgets and health policy directions</li> <li>• Match resources to complexity</li> <li>• Ensure accessible and sustainable resources allocation</li> </ul>	<ul style="list-style-type: none"> <li>• Standardised (minimum) data sets to better evaluate cost benefit and effectiveness</li> <li>• Health policy engagement with researchers and health service delivery</li> <li>• Risk stratification data to inform resource allocation</li> <li>• Use of e-health to monitor data</li> </ul>

**Table 2** (continued)

Target areas	What needs changing	How to change
Prevention	<ul style="list-style-type: none"> <li>• Inadequate strategies targeting prevention of chronicity and disability across the lifespan</li> </ul>	<ul style="list-style-type: none"> <li>• School education</li> <li>• Community-based prevention awareness and wellness programmes</li> <li>• Industry (insurers and employers) programmes to encourage healthy behaviour that may mitigate against chronic pain (lifestyle, exercise, diet)</li> <li>• Health-care professionals targeting prevention rather than focus on medicalising management on a per episode basis</li> <li>• Reducing stigmatisation of chronic musculoskeletal pain by educating the community and health professionals and promoting helpful (positive) beliefs regarding pain and disability</li> </ul>

*Service delivery inversion for CMP.* A further example of opportunity afforded through a network model is the initiation of a system inversion in service delivery for pain (including CMP) management in Western Australia. In this model, inter-professional consumer group education sessions are delivered *prior* to individual practitioner appointments. The MoC has delivered reduced wait times and costs at public pain medicine units and increased use of active pain management strategies by consumers with fewer requiring individual consultations [26]. Given the alignment with policy, this MoC has recurrent resourcing and has now been adopted in a number of primary care sites throughout Australia.

*Risk identification in primary care settings and articulation with tertiary and specialist care.* Primary care-based MoCs that articulate with tertiary centres are becoming more common and most involve triage systems with risk stratification and tiered management. For example, The Sheffield Back Pain model (<http://www.sheffieldbackpain.com/>) focuses on early recognition of the risk of progression to chronicity by using a validated risk stratification tool (the STarTBack screening tool [30]). Intervention approaches are matched to the complexity of an individual's symptoms with tools for primary care practitioners to manage low-risk back pain, while there are also triggers for referrals to multidisciplinary care for high-risk consumers. The Chronic Pain Scotland Service Model (<http://www.knowledge.scot.nhs.uk/pain/scottish-service-model.aspx>) [2] (Table 1) has also implemented a similar primary care-based approach.

Other initiatives include system redesigns with implementation of a MoC based on chronic disease management principles, such as the Southampton Pain Clinic. Here, primary care practitioners have been upskilled with resources to manage the majority of consumers and only a minority are taken into specialist care for treatment with clear end points [17]. Treatment and referral guidelines for primary care physicians, a care pathway bridging primary and secondary care, effective triage of referrals and an increased focus on a self-management programme in the community, along with effective cross-sector communication, have resulted in reduced wait times, reduced use of medications and cost savings of £204 per consumer [31].

*Building consumer capacity in musculoskeletal pain.* Care disparities (e.g., due to geographic barriers, financial or health literacy) may be moderated through MoCs that use information and communications technologies such as telehealth (Table 1), online media and smart devices to lever the dissemination of consumer-oriented evidence. For example, the *painHEALTH* policy-into-practice initiative funded by the Western Australian government (<http://painhealth.csse.uwa.edu.au/index.html>) is a web-based platform providing inter-professional, evidence-based consumer information and

integrated pain management modules; the National Health Service (NHS)-supported website Sheffield, UK, <https://www.sheffieldpersistentpain.com/>; and in Scotland a site for consumers and health professionals, <http://chronicpainscotland.org/>, and for teenagers with chronic pain: <http://chronicpainscotland.org/teenagers-living-with-pain/>. The Chronic Pain Scotland Service Model (<http://www.knowledge.scot.nhs.uk/pain/scottish-service-model.aspx>) [2] is supplemented by population-based pain education (including media campaigns and phone support) with parallel pain workforce competency frameworks. These platforms are sustainable and widely accessible, although standardised data to inform health and economic benefit as a component of co-care need to be collected and published.

*Building primary care workforce capacity in musculoskeletal pain.* The Nova Scotia Chronic Pain Collaborative Network has tackled the issue of inadequate professional skills in pain management by implementing a collaborative (generalist–specialist) learning community of practice as part of the total MoC. Primary care physicians and pain specialists develop shared clinical solutions that acknowledge the complexities of integrated care with up to 16 primary care physicians trained each year [2]. Shared solutions can help to strengthen clinical pathways and facilitate a more seamless transition of care [32] while moderating tension between the generalist–specialist interface. Similar community-based MoCs with upskilled health professionals working in partnership with primary care physicians have demonstrated promising outcomes such as faster, local and evidence-based care for consumers with improved efficiencies and positive health outcomes [33] (Table 1).

#### *Barriers to implementation of MoCs for CMP*

Despite progress in the implementation of best practice for CMP management, system barriers often fail to enable integrated care across health sectors. Further, access to pain management services is inconsistent both within and across nations, and available health services differ markedly in the type of care they offer and MoCs by which they are delivered [2,16,17,19,34]. The result is fragmented care for consumers, and variable outcomes and significant avoidable health-care costs for governments [2,16,17,19]. Primary care consultation and funding models do not consistently align with treatment pathways, highlighting the imperative for MoCs to enable effective, streamlined participation from all service providers, which a centralised (e.g., tertiary pain clinic) model often fails to do. Many practising and emerging health professionals have little or no training to help them address the complex nature of pain and disability [28,29,35], and training is often delivered within a discipline-specific (e.g., medical) curriculum model, thereby failing to capture the multidimensional aspects of pain, including frequent co- or multi-morbidities that require cross-discipline attention.

So, what can be done? A systems approach is required with a focus on solutions that are implementable, flexible, sustainable and practically oriented to support and strongly encourage adoption by clinicians working at the coalface (Table 2). Systems that recognise the fundamentally different work patterns and demands of general practice and specialist teams [32] and that are consumer centred, rather than disease or symptom oriented, are needed and will help to moderate friction at the specialist–generalist interface. MoCs also need to be flexible in order to meet contextual requirements such as the local needs of developing/developed nations, address care disparities and bridge the lifespan. MoCs need to identify clear care pathways; facilitate timely assessment and management; ensure training is adequate and consistent; and provide practical strategies, remain sustainable and address prevention and rehabilitation to reduce disease burden and lost productivity. The use of e-health technologies can help to bridge the primary care–tertiary care gap and provide an efficient use of resources. Standardised data on CMP must be captured, monitored and evaluated.

To effectively manage the scope of MoCs, agreements across jurisdictions are an obvious implementation mechanism. For example, the Societal Impact of Pain Group is a multi-stakeholder platform in Europe that aims to exchange information and share best practices and solutions across all member states of the European Union. Further, together they have developed and fostered European-wide strategies and activities for improved pain care in Europe (<http://www.sip-platform.eu/sip-mission.html>). Within such frameworks, new MoCs that are underpinned by high-quality evidence are required, for example, randomised controlled trials where available and practical [36] and pragmatic

trials allowing real-world practices to be investigated and incorporated into these models [37], and evaluation of health and economic benefits.

## *Osteoarthritis*

### *Epidemiology and impact*

OA is the most common form of arthritis and represents the most substantial public health issue in developed nations, highlighting the urgency for system reform to support the implementation of effective MoCs to optimise management approaches and consumer outcomes [1,38]. In the United States of America, knee OA is the leading cause of impaired mobility-related activities of daily living in older adults [39]. The worldwide prevalence and incidence of OA have been increasing, largely attributed to ageing populations and rising obesity rates. For example, Lawrence et al. reported that the prevalence of symptomatic OA in the United States of America increased by 30% from 1995 to 2005, from 21 to 27 million people [40]. Current Australian modelling predicts an increase in cases of OA of 58% by 2032 [1]. These trajectories will have substantial implications for health-care services, particularly orthopaedic surgery and conservative care specialists. Importantly, OA is not just a disease of ageing. Established risk factors for OA including joint trauma, obesity, physical inactivity and occupational joint loading commonly occur in younger age. A recent United States of America-based study identified that the incidence of knee OA using the 2007–2008 population health data was greatest for ages 55–64 years, with the mean age of diagnosis at 53 years [41]. Australian data support this observation, where a peak in the number of people with OA was evident at age 55–64 years [1]. These data also explain an increased proportion of arthroplasties being performed in younger age groups [42].

Similar to other chronic musculoskeletal conditions discussed in this chapter, the psychosocial burden associated with OA is profound, particularly in advanced OA where pain and impaired function become substantial barriers to physical and mental well-being. For example, people with knee or hip joint OA waiting for joint replacement surgery in Australia reported profound psychological distress and a quality of life worse than death [43]. Importantly, many people with OA also live with physical and mental co-morbid conditions which have important implications for management approaches and consumers' responses to them.

### *Management of OA*

The rising health and economic burden of OA reinforces the need for timely, effective management strategies. The current goal of treatment is to reduce the impact of OA on the individual and society, by reducing symptoms (mainly pain), improving function and preventing and reducing functional and work disability; hence, pain management is mostly considered within a biopsychosocial framework. Although pain can be associated with an increasing severity of radiographic OA changes, there is also evidence for central sensitisation which helps to explain the inconsistent pain–pathology relationship [44]. Current guidelines for the treatment of OA recommend a combination of pharmacologic and non-pharmacologic treatments [45–49]. For example, in the United Kingdom, Porcheret et al. developed a four-step MoC for managing older adults (aged >50 years) with knee pain and OA based on a systematic review of treatments and recommendations from a nominal group consensus panel [50]. This model provides recommendations for primary care physicians to escalate treatment based on symptom control, from Step 1 (exercise, weight management, analgesic and written information about OA) to Step 4 (surgery such as arthroplasty).

Currently, there are no effective therapies that modify structural progression in OA; hence, pharmacologic treatments are recommended for pain relief with good to excellent levels of evidence, including simple analgesia with paracetamol and oral non-steroidal anti-inflammatory drugs (NSAIDs). Corticosteroid injections and opioids (for severe pain) are recommended in the short term [47,48,51]. Non-pharmacologic treatments with good to excellent levels of evidence include weight loss and land-based exercise. Interventions with satisfactory levels of evidence include multimodal physiotherapy, aquatic exercise, tai chi, thermotherapy, transcutaneous electrical nerve stimulation and acupuncture [51]. Self-management programmes appear to be effective in reducing pain and several have demonstrated modest and sustainable improvements in self-efficacy and function [51,52].

**Table 3**

Examples of MoCs for people with osteoarthritis. The table format is adapted from the O'Donnell framework [178].

Model of Care	Where	What	Who	When	Outcome (where reported)
Elective Joint Replacement Service Model of Care [75]	Hospitals in Western Australia	Multidisciplinary team assessment and interventions across the patient journey	Primary care physician, multidisciplinary orthopaedic clinical team	Pre-admission (including conservative care), perioperative, post-operative and follow-up evaluation over the long term	No data available
Osteoarthritis Chronic Care Program (OACCP) [70]	Hospital and community-based settings in New South Wales, Australia	Chronic care assessment with patient developed care plan guiding interventions	Physiotherapist, other allied health, nurse, primary care physician and specialists	OA of hip or knee rated 4 or more out of 10 on VAS and pain most days of last month	Over 5000 people have participated to January 2014. Over 13% of the cohort who have knee arthritis determine they do not require joint replacement surgery after about 26 weeks of participation. Over 12% of those with hip arthritis gain access to early joint replacement because of identified need in OACCP. Up to 20% of those who are overweight/obese/ morbidly obese at entry lose >5% of their body weight after 52 weeks of implementing their care plans.
Service model for community-based musculoskeletal health in Western Australia [76]	Health services across Western Australia, including public and private	Coordinated and interdisciplinary chronic care with acute care as required	Multidisciplinary teams	For people of any age living with chronic musculoskeletal conditions	No data available
Osteoarthritis Hip and Knee Service [71]	Hospitals across Victoria, Australia	Initial assessment by a physiotherapist, a care plan developed and referrals to other health professionals as required.	Physiotherapist, other allied health as required, nurse, primary care physician and specialists	For people referred for elective joint replacement of hip or knee	No data available
Self-management for people awaiting elective joint replacement [82]	Adelaide, Australia	A range of self-management support interventions delivered by clinicians or peers, across	Project officer, nurse, peers trained in self-management support	Elective surgery waitlist for hip or knee joint replacement	After 6 months of intervention, outcomes revealed modest but improved health-directed



		all domains of OA interventions.			behaviours, skill acquisition and stiffness in participants on a joint replacement waiting list. There was no significant effect on pain, function or QoL in the short term.
Quality care management of people with hip and knee arthritis [62]	Hospital based in Adelaide, Australia	Prehabilitation and discharge planning, dedicated clinics with surgical management and waitlist prioritisation optimised, extended physiotherapy-led clinics.	Nurse, occupational therapist, physiotherapist, pharmacist, orthopaedic surgeons, primary care physician	Waiting list cohort	Reduced wait times for first assessment – 10 months to 3 months. Wait for surgery decreased – 18 months to 8 months. Decreased need for rehabilitation post operation – 44% to 8%. Decreased average length of stay in hospital. Not implemented to date.
Development of a model for OA care delivery [80]	Primary care settings in the United Kingdom	Identified 25 key assessments and interventions to be conducted in the management of people with OA.	Primary care physicians, patients, physiotherapists, nurses, occupational therapists, rheumatologists, social scientists	People presenting to their primary care physician with OA.	
Self-management support programme delivered by health professionals [81]	Community-based settings in Western Australia	Self-management support programme delivered by health professionals to groups of 12 participants through six weekly 2.5-h sessions with a pre-programme assessment the week before and a second assessment in the week after the six group sessions. A final assessment was conducted at 6 months after the programme. Group sessions are supplemented with written information concerning that week's topic.	Nurses, physiotherapists, and occupational therapists	People with knee osteoarthritis presenting to their primary care physician	The intervention group had statistically significant improvements in pain, QoL and function compared to the control group including out to the 6-month timeframe.

QoL: quality of life.

Nevertheless, there are disparities in the management of OA, with suboptimal use of evidence-based guidelines [53,54], inappropriate use of arthroscopy [55] as well as medication safety concerns for the elderly [54]. Arthroplasties are indicated for advanced symptomatic OA and their rates have risen significantly [56].

#### *MoCs for OA*

With current evidence demonstrating that conservative care options are effective for many people with OA, and concerns about the appropriateness of surgical intervention in people without severe radiologic OA, this section will discuss MoCs that primarily focus on conservative care and those that incorporate surgical intervention where clinically indicated [57,58].

As a complex chronic disease often associated with other co-morbidities, the delivery of care for people with OA is ideally provided using the principles of chronic care as described by Wagner, including care coordination, multidisciplinary team interventions and collaborative care planning with the person who has OA as an equal partner in its development and implementation, and underpinned with the philosophies of self-management support [59,60]. These principles are appropriate across care settings and the OA disease continuum [61,62]. Established MoCs that embrace these principles are summarised below.

*Multidisciplinary teams across care settings.* Care settings in many countries such as the United Kingdom, Canada, Australia and the United States of America have demonstrated the benefits of access to multidisciplinary teams for OA management, especially teams working in an interdisciplinary manner [63,64]. Through these MoCs, consumers gain on-site access to the expertise of several professional groups that each address important aspects of OA and its co-morbidities. Specific to OA, these components of care include weight loss, pain management, psychosocial health support strategies, and supporting improvements in functional capacity [65]. However, globally, there are challenges in the availability of skilled team members. For example, in hospital settings, those available are often fully engaged in acute care services, while in non-hospital care settings, team members are rarely co-located, making interdisciplinary care and communication more difficult. Other barriers to implementing this MoC include the volume of specific health professionals available, discrepancies in funding models to support multi-professional care, service sites in rural and remote settings and outer urban fringes being less attractive for practitioners and the need to support health professionals to appreciate the benefits of team care for people with OA. Schofield et al. described their experiences in supporting interdisciplinary health-care providers in a rural setting. Their work resulted in better outcomes for their cohort, health system advantages and better supported team members as evidenced by skill development and reduced feelings of isolation [64].

*Extended scope of practice MoCs.* In efforts to address the complex nature of management approaches for people with OA and improve access to, and coordination of, best-practice care, some health systems and service sites have developed MoCs with extended scope of practice [66–71]. In these MoCs, a team member, often a nurse or physiotherapist, is supported to expand their knowledge and skills to deliver and coordinate best-practice care for people with OA. Extended scope of practice roles include determining a care pathway after cross-discipline assessments are completed, ordering of investigations, prescribing from an agreed formulary of medications and referrals to medical specialists. Outcomes for consumers include increased and earlier access to care usually provided in a setting convenient to the consumer, for example, in their home or in a community setting away from hospitals, improved understanding of their disease and a high level of satisfaction with the care provided [67].

*Pharmacist-initiated care.* Pharmacists have played an active role in identifying consumers who are not seeking necessary physician attention for managing chronic diseases, including OA. Observational data have suggested that knowledge of having OA, as determined by pharmacist screening, might be a motivation for individuals to seek help and adopt a healthy lifestyle [72]. A recent randomised controlled trial evaluated a pharmacist-initiated intervention involving the use of an OA screening questionnaire, education on pain medication, physiotherapy-guided exercise and communication with

the primary care physician. Compared to the control group, which only received an education pamphlet, participants in the intervention group received more appropriate care (as measured by OA quality indicators) and demonstrated greater improvement in function, pain and quality of life [73]. The promising results suggest that non-physician health professionals can play a key role in improving OA care.

*System-level MoCs for OA.* While guidelines for the management of OA in consideration of both non-surgical and surgical care are available in many areas of the globe (e.g., Refs. [47,51,52,74]), there are few descriptions of how to implement these guidelines in order to ensure chronic disease care principles and quality processes are followed. However, examples of how MoCs have been successfully implemented across a health system include the Osteoarthritis Hip and Knee Service (OAHKS) in Victoria, which was the first Australian system-level MoC for OA. The OAHKS provides multidisciplinary care for people with OA, including surgical and conservative care [71]. Latterly, the Osteoarthritis Chronic Care Program was introduced in New South Wales [70], and the MoC for Elective Joint Replacement in Western Australia [75] with its complementary model on how to implement musculoskeletal health care in community-based settings [76].

*MoCs for OA in the digital age.* Access to care is often impeded by the distances some people live from health-care services. People living in rural and remote areas are often those who need access to health care the most [8]. Telephone, video conferencing and other web-based modes are proving to be successful in the delivery of OA care, especially in consideration of self-management support. In one example, Sperber et al. conducted a randomised controlled trial using telephone-based self-management support compared to usual care in a cohort of United States of America veterans with OA attending a primary care service [77,78]. Monthly phone calls from a health educator were supplemented with mailed educational tools, and the participants were supported to set goals and develop action plans. In another study, Lorig and colleagues reported on their randomised controlled trial that utilised an Internet-based self-management support programme [79]. Self-management support content included appropriate OA management to be read online by participants at least three times a week for the first 6 weeks. After reading each week's information, the participants would develop and log their action plans for the next week. After 12 months, both studies found that participants reported clinically meaningful improvements in symptoms and general well-being when compared to their matched control study participants.

In Australia, the national consumer organisation for people with arthritis has developed a website, *MyJointPain* (<https://www.myjointpain.org.au/>), to provide education and support of people with OA. Other examples of OA MoCs that are site specific or involve particular health professional groups are summarised in Table 3 [62,80–82].

#### *Implementation of MoCs for OA*

There remain many internationally consistent challenges to achieve sustainable and broad implementation of MoCs for OA [83] and these are summarised below.

*Workforce needs in the implementation of OA contemporary care.* Many of the MoCs reviewed hinge on a skilled workforce, including advanced practice, to provide care to people with OA [66,69]. Specific upskilling is often required to enable the workforce to deliver the right care. For example, primary care physicians and other clinical team members have identified the need for ongoing and contemporary understanding of OA care. In addition to disease management, they have identified the need to learn about and implement improved methods in engagement of the person with OA [61,63]. The primary care team members have realised that the principles of chronic care, inclusive of techniques often referred to as health coaching or motivational interviewing, are critical in order for people with chronic conditions such as OA to be engaged in their health care [84]. Dennis et al. [61] extended the discussion on how primary care practitioners can implement chronic care strategies, using specific practice incentives within the Australian Medicare system, and suggested how these could be enhanced to further facilitate chronic disease care in primary care.

*Reaching vulnerable populations.* While care disparity is a common problem across chronic diseases, special consideration needs to be given to the large and increasingly complex service delivery requirements for people with OA in population groups such as indigenous peoples, various cultural groups from across the globe and people who are living with socio-economic disadvantage and other co-morbidities. Many of those who remain under-represented in services providing OA care have the largest morbidity burden with the rates of obesity, inactivity and poor access to specialty services, exceeding other peer groups [85]. OA MoCs need to consider their needs and include strategies that enable access and active participation. Examples include having a variety of ways to access care, settings that are perceived as culturally safe (e.g., away from hospitals if possible or in cultural community centres) and consideration of who provides the service.

#### *Practice point*

Considering the prevalence of OA, it is critical that in developing a MoC for local settings, a scan of the population demographics is undertaken to ensure the MoC is accessible and appropriate for all, particularly considering socio-economic and cultural needs.

### *Rheumatoid arthritis*

#### *Epidemiology and impact*

RA is a chronic, systemic autoimmune disease characterised by joint pain, stiffness and swelling, especially affecting the hands and feet. Extra-articular manifestations such as interstitial lung disease may be present and complications include the development of cardiovascular disease, OP and premature mortality. The prevalence of RA ranges from 0.5% to 1% and occurs more frequently in women than men, with a ratio of 3:1 [86]. In the recent Global Burden of Disease Study, the years lived with disability for RA rose by 13.2% from 1990 to 2010 [6].

The impact of RA on those with this disease and their families is significant, as it can result in progressive functional and work disability and reduced quality of life. In early RA (defined as disease duration of <2 years), symptoms of persistent pain, loss of function and impaired quality of life are attributed to persistent joint inflammation. A recent multinational study reported that 80% of persons with RA were likely to continue working at 2 years, with the proportion reducing to 68% at 5 years [87]. In their systematic review, Lenssinck et al. reported that sick leave varied from 3.7% in the past 4 days to 84% in the past 2.5 years, with the duration of sick leave ranging from 0.1 to 11 days over 1 month [88]. A multidimensional approach to management that addresses the physical and psychosocial aspects of the condition is therefore considered best practice.

#### *Management of RA*

The goal of RA management is early suppression of inflammation, with a treatment target of clinical remission or low disease activity. If successful, this will prevent progressive joint damage and disability, and reduce the incidence of long-term complications. A good response to treatment in early RA predicts better 5-year clinical and radiographic outcomes [89]. This underscores the importance of early detection and initiation of therapy for people with RA. By contrast, a prolonged symptom duration is associated with radiographic progression and a reduced likelihood of developing sustained remission [90]. Treating to the target of remission in early RA is cost effective and may even be cost saving in the third year [91]. Thus, MoCs that facilitate early identification of RA and early initiation of therapy are considered best practice and are more likely to facilitate improved consumer- and system-related outcomes.

Other non-pharmacological interventions with moderate to strong evidence for improving outcomes in RA include dynamic exercise therapy, which improves muscle function, joint stability and physical performance [92,93]; occupational therapy; foot orthoses; and orthopaedic shoes [94,95]. These interventions are mainly provided by rheumatology multidisciplinary teams, commonly in hospital outpatient settings.

Studies of formal arthritis self-management support programmes demonstrate efficacy in reducing pain, functional disability, helplessness, depression and anxiety, and in increasing an internal sense of control of the disease, self-efficacy and coping ability [96].

## MoCs for RA

*Multidisciplinary team across care settings.* Multidisciplinary team care is considered the gold standard for managing RA [97]. Davis et al. interviewed 79 health professionals and programme managers in Canada and identified a variety of team care models, varying from multi-professional models (i.e., health professionals independently working with consumers) to cohesive interdisciplinary models (i.e., health professionals working collaboratively with consumers and with each other) [98]. Several systematic reviews have concluded that inpatient multidisciplinary team care was more effective than usual single-discipline outpatient care for improving RA disease activity and functional ability, albeit more expensive. This outcome likely reflects the advantage of having team members working in close proximity, which facilitates communication and collaboration. The benefits of outpatient multidisciplinary team care was, however, less remarkable when compared with usual care. Several uncontrolled studies also support the positive effects of team care for people with RA [99–102]. Contemporary health policy for RA (and chronic diseases generally) supports a multidisciplinary approach to care [103,104]. Considering the resource constraints of hospitals, particularly tertiary hospitals, there is now a policy emphasis on delivering care outside tertiary hospitals with MoCs to support this [76,103]. For example, in Western Australia, multidisciplinary team care has been historically delivered in hospital settings. A lack of health professional volume, rising costs of health-care services for chronic diseases and an ageing population has led to the development of a MoC that integrates specialist secondary care with primary care and community-based services [14], with the aim of providing sustainable cost-effective care.

*Shared-care model.* The shared-care model has been used for some time to improve timely access to appropriate care. The original model involved rheumatologists providing consultations in family physicians' offices, sometimes co-located with a physiotherapist. In the United Kingdom, Hewlett et al. [105] evaluated a shared-care model that involved family physicians initiating access to a rapid review by a multidisciplinary team, versus routine rheumatologist follow-up every 3–6 months. The results of this 2-year randomised controlled trial showed that consumers receiving shared care had less pain, a smaller increase in pain over time and greater self-efficacy. Furthermore, they used less health-care resources and were more confident in navigating the system. Symmons et al. [106] evaluated another shared-care model for RA symptom control, which involved home visits by a rheumatology nurse every 4 months and an annual rheumatologist visit, against 'aggressive care', in which consumers received comprehensive clinical and laboratory assessment every 4 months. The aggressive care group had better results in the physician global rating and disease activity, although there was no difference in pain, joint count and joint erosion between the models. An economic evaluation showed that the shared-care model was more cost effective than aggressive care [106]. Given the current standard of 'treating to target', however, a combination of the shared-care model with aggressive management of disease activity will likely further improve consumer outcomes and is supported by policy [103].

With the advancement in communication technology, the shared-care model has been adapted to provide RA care in rural and remote communities. Using video conferencing, consumers and their primary care physician can connect with a rheumatologist at a different location in real time. Primary care physicians can also consult with rheumatologists and send referrals via a secure e-mail messaging system. Satisfaction from consumers and primary care physicians was found to be high using this MoC [107]. This MoC for RA offers substantial benefits to consumers who experience care disparity due to geographic isolation in nations such as Canada and Australia.

*Extended scope practice models.* After starting RA treatment, consumers require ongoing monitoring of their disease activity. Monitoring can be assumed by rheumatology-trained nurses and rehabilitation professionals. In Europe, some clinical nurse specialists and nurse practitioners provide supplementary services to rheumatology care. These include performing musculoskeletal examination, monitoring and recommending changes in medication and referring to other health professionals. Physiotherapists and occupational therapists also assume extended roles. For example, The Arthritis

Society in Ontario, Canada, uses a primary therapist model [108] and similar nurse or allied health professional-led roles are recommended in Australian MoCs [76,103]. There is also a growing interest among rehabilitation professionals to become extended-scope practitioners [109]. A 2012 systematic review found that physiotherapy extended-scope practitioners performed a variety of tasks, such as administering injections and requesting investigative tests [110]. Several studies have examined the effectiveness of extended-scope physiotherapist practitioners in arthritis care. Research from the United Kingdom showed that extended-scope physiotherapists could competently triage cases referred for specialist consultations and reduce orthopaedic and rheumatology waiting lists [111]. In Canada, a few facilities have developed training programmes and new extended scope physiotherapist positions in rheumatology. The development of international standards for training and practice, however, is still in the early stages, particularly for inflammatory joint diseases.

*RA care in the digital age.* In the past 10 years, there has been an increase in the use of digital media technologies, such as websites, mobile applications, social networking tools and online games, to deliver self-management interventions. For example, *RAHelp* is a 10-week Internet-based programme consisting of self-management modules, a personalised 'to do' list, a news feature, a resource library and a journal for tracking the level of pain and stress. In addition, it included an interactive area, the *RAHelp Village*, where participants could effectively engage in group or individual discussions [112]. A similar Australian-developed platform, *painHEALTH* (<http://painhealth.csse.uwa.edu.au/>), includes a focus on RA. Recently, Li et al. developed an online decision aid, called *ANSWER*, for consumers who are considering whether to use methotrexate, with the effectiveness demonstrated [113].

#### *Implementation of MoCs for RA*

While MoCs for the delivery of care for RA have been developed, there are several important factors that influence access to coordinated, integrated and community-based care for consumers which appear to have international consistency [114–116], and these are summarised below.

*Policy and societal barriers.* The population-based burden of disease associated with RA is less substantial than other musculoskeletal conditions. This is largely a consequence of a lower prevalence, rather than an attribute of the disease per se. Consequently, the relatively lower perceived societal and health system impacts of RA, despite evidence [1], stymie the development and systematic implementation of MoCs for the management of RA relative to the other musculoskeletal conditions considered in this chapter. For example, a recent systematic synthesis of qualitative studies relating to barriers to early initiation of treatment for RA identified that consumers viewed RA as a rare condition associated with the aged [117]. Further, unlike other conditions, where there have been calls for systemic reform in peer-reviewed literature [2,38,118–121], no such advocacy has occurred specifically for RA, other than an RA service model published in 2008 [122]. Consequently, there are minimal policy initiatives to support the implementation of MoCs for RA.

*Workforce capacity.* A workforce of adequate volume and skills is a key requirement for supporting any systematic implementation efforts for MoCs in RA. For RA in particular, an understanding of the importance of early intervention and addressing co-morbid conditions is critical [123]. While expert interdisciplinary practice skills are readily accessible in the context of tertiary hospitals by virtue of collocation of multidisciplinary teams, this same situation is rarely available in community settings, despite the benefits of community-based care. Consequently, clinical teams located in primary care such as primary care physicians, allied health professionals and community nurses are not routinely engaged in service delivery, and thus lack the knowledge and skills to deliver best-practice care [123,124]. Further, clinical champions to drive service reform initiatives in community-based care for RA service are few. The inadequacy of knowledge and skills stems from limited opportunity to practice in the context of RA as well as limited educational opportunities both at undergraduate and post-graduate levels [125,126]. This situation will become more problematic as health policy, which promotes the transfer of management of chronic health conditions from tertiary hospital to community settings, is progressively implemented. Nonetheless, this situation is being addressed with the

introduction of contemporary policy for community-based musculoskeletal health care in Australia [76] and professional development initiatives.

### Recommendation

- Health policies that address musculoskeletal diseases should explicitly include RA in service and programme development. Particular foci should include early diagnosis, initiation of treatment and disability related to RA.
- Maintain inclusion of rheumatology in university curriculum across clinical disciplines, including disability associated with rheumatic diseases.
- Provide RA-focussed professional development opportunities focussing on disease knowledge and skills for clinicians in community-based care, particularly related to early diagnosis and initiation of treatment, and managing disability associated with RA.
- Invest in digital-based strategies to upskill consumers in effective co-management for RA.

*Consumer capacity for effective co-care.* Active participation of consumers in the co-management of their RA is critical to the success of any MoC and health outcomes. While research suggests it is feasible to upskill consumers in knowledge about effective management for RA [127], substantial knowledge gaps persist [128], and consumers of lower socio-economic standing experience information and care disparities. Programmes or resources that upskill consumers in effective co-management are therefore needed, in particular those that lever digital technologies and effectively engage those of lower socio-economic standing.

### Osteoporosis

#### *Epidemiology and impact*

OP is a chronic disease characterised by reduced bone density and strength which predisposes to fragility fractures. Half of women and a fifth of men will suffer a fragility fracture in their lifetime [129]. In 2000, there were an estimated 9.0 million osteoporotic fractures globally, of which 1.6 million were at the hip, 1.7 million at the forearm and 1.4 million were clinical vertebral fractures. The greatest number of osteoporotic fractures occurred in Europe (34.8%) [130]. However, with the ageing of the population and increased longevity, by 2050 it is expected that >50% of the world's hip fractures will occur in Asia [131], as the population of those aged >50 years in that region is expected to grow an average of 144% by the year 2050 [132].

#### *Socio-economic impact of fractures*

Costs associated with fragility fractures are already enormous for Western populations and will increase dramatically in Asia, Latin America and the Middle East as these populations age. Several data sets have been published including 2002 data from the United States of America, which revealed the combined cost of all osteoporotic fractures in that country to be \$USD20 billion [133]. Data from Europe have found the total direct cost of osteoporotic fractures in 2010 to be 37 billion euros per year [134]. In Singapore, in 1998 the total cost of managing hip fractures within the first year after fracture was \$USD 17 million; with estimates, this will rise to \$USD 145 million in 2050, while Japan has an annual expenditure of >\$USD 4.9 billion per year for hip fracture care alone [135]. In Australia, it was revealed in 2012 that the combined cost of all osteoporotic fractures was \$AUD 2.75 billion, which is projected to rise to \$AUD 3.84 billion by 2022 [7].

#### *Effective management across the disease continuum*

OP is often termed a 'silent disease', and often a fragility fracture will be the first sign of disease. Almost half of individuals who will break their hip in the future can be targeted for assessment and treatment by identifying people with a prevalent fragility fracture [119,136,137]. People presenting

**Table 4**

Examples of MoCs for osteoporosis re-fracture prevention. The table format is adapted from the O'Donnell framework [178].

Model of Care	Where	What (components of model)	Who	How	Outcome (where reported)
Model of care for osteoporotic re-fracture prevention [148]	New South Wales, Australia	<ul style="list-style-type: none"> <li>• Implementation of Fracture Liaison Services in all districts of New South Wales</li> <li>• Coordination by a <i>Fracture Liaison Coordinator</i></li> <li>• Link people with osteoporotic fractures to investigation and treatment as appropriate</li> <li>• Follow-up over time</li> </ul>	Fracture Liaison Coordinator, primary care and specialty physicians, allied health team, community services e.g., exercise groups	Identified through a range of strategies including emergency department lists, ward rounds, primary care physician referral: interventions align with principles of chronic care	<p>Formative evaluation has revealed:</p> <ul style="list-style-type: none"> <li>• 46.5% of people over 50 years of age with a 'first' minimal trauma fracture are likely to re-fracture again over a 24-month period.</li> <li>• Of this patient cohort around 10% of readmitted re-fractures could be prevented.</li> <li>• Patient reported increase in understanding re positive bone health behaviours</li> <li>• 40+% reduction in expected hip fractures in 2009</li> </ul>
Kaiser Permanente Healthy Bones Program [150]	Southern California, United States of America	<ul style="list-style-type: none"> <li>• Identify people with osteoporosis and/or minimal trauma fractures</li> <li>• Close the care gap – investigation and treatment for osteoporosis</li> </ul>	Healthy Bones Team Care Managers Other clinical team members identify patients opportunistically	Lists generated from the electronic patient encounters record	<ul style="list-style-type: none"> <li>• 40+% reduction in expected hip fractures in 2009</li> </ul>
Hospitalist-Orthopaedic Surgeon Integrated Model of Care [179]	Mayo Clinic, Jacksonville, Florida, United States of America	<ul style="list-style-type: none"> <li>• All hip fracture patients assessed for surgery and osteoporosis at the initial consult</li> <li>• Investigation and treatment for osteoporosis commenced during hospital admission</li> <li>• Standardised protocol for assessment and investigation</li> <li>• Patient education strategies</li> </ul>	Orthopaedic surgeons and hospitalists	All admissions to the orthopaedic department are assessed for osteoporosis as a part of the medical clearance for surgery	<ul style="list-style-type: none"> <li>• Increase from 24% to 89% of patients assessed for osteoporosis after introduction of MoC</li> <li>• Patient education increased from 0% to 89%</li> </ul>
Osteoporosis Model of Care [140]	Western Australia	<ul style="list-style-type: none"> <li>• Inclusive of health promotion, lifetime risk assessment, fracture prevention, workforce needs, and research and evaluation</li> <li>• Primary recommendation for re-fracture prevention is to establish fracture liaison</li> </ul>	Hospital-based fracture liaison coordinators Other health professionals also acknowledged as critical to identification and management of people at risk	Identification primarily through emergency department presentations	<ul style="list-style-type: none"> <li>• Nil reported (currently being evaluated)</li> </ul>



Own the Bone [149]	Numerous orthopaedic units across the United States of America	<p>positions across health services</p> <ul style="list-style-type: none"> <li>Identifying people with fragility fractures and entering them on a specific data system so their intervention and outcomes can be addressed and monitored</li> </ul>	Physicians and nurses	<p>The data system includes a patient assessment form which becomes the formal patient history in their medical record. The fracture episode is seen as 'teachable moment' so patient education is incorporated. Letters are generated for follow-up with patient and primary care team</p>	<p>As at 2009, &gt;85 sites had implemented the MoC and two sites have reported on the increase in bone mineral density and commencement of treatment, especially if started in the hospital setting [180]</p>
The Fracture Liaison Service [151]	Glasgow, Scotland	<ul style="list-style-type: none"> <li>Agreed standards of care between orthopaedic surgeons and primary care physicians</li> <li>Osteoporosis Specialist Nurse to coordinate the Service, assess and make recommendations for the required management based on the agreed standards of care</li> <li>Primary care physicians instigate treatment and on-going follow-up</li> </ul>	Orthopaedic surgeons, primary care physicians, Osteoporosis Specialist Nurse	<p>All patients aged 50 years or more with a fracture mechanism that is highly suspicious of fragility fracture are offered the Service</p>	<ul style="list-style-type: none"> <li>Cost-effectiveness of this MoC reveals the nurse-led model of Fracture Liaison Service is the most cost-effective [147]</li> <li>Further system analysis of the Glasgow service is required to determine fracture prevention rates and its cost-effectiveness.</li> </ul>
Geisinger Health System Osteoporosis Program [152]	Pennsylvania, United States of America	<ul style="list-style-type: none"> <li>At risk groups are assessed using DXA scanning</li> <li>Inclusive of fracture patients aged 50 plus, women aged over 65 years and men over 70 years, plus others with high risk factors</li> <li>Treatment as per algorithm with follow-up included to monitor adherence</li> </ul>	Orthopaedics, rheumatology, primary care physicians	<p>Multi-prong interventions depending on risk assessment, aiming for seamless care across hospital, outpatient and primary care settings</p>	<ul style="list-style-type: none"> <li>High treatment initiation rate and adherence to therapy but higher in outpatient clinics than in primary care</li> </ul>

with a fragility fracture today are twice as likely to suffer future fractures compared with peers that have not suffered a fracture [136,138]. Crucially, from the obverse view, amongst individuals presenting with a hip fracture, almost half have previously broken another bone. A broad range of effective drugs that reduce fractures by 40–70% may now be employed to prevent future fractures amongst those presenting with new fragility fractures, and can be administered as daily, weekly or monthly tablets, or as daily, 6-monthly or annual injections. Early diagnosis and treatment following a fragility fracture are critical as the risk of re-fracture is highest in the first 12 months post fracture [139].

A multidisciplinary approach across care providers is required to ensure timely initiation of treatment for people with OP and a seamless transition in care between providers and care settings. A dedicated coordinator (e.g. nurse, allied health professional or doctor) can act as the link between the consumer, the orthopaedic team, the OP and falls prevention services and the primary care physician.

#### *MoCs for OP*

The primary prevention of OP is a vital public health issue that is advocated through policy and programme by bodies such as the International Osteoporosis Foundation and relevant national organisations. MoCs for the primary prevention of OP have also been developed by some jurisdictions [140]. However, health systems struggle to provide adequate management and secondary prevention support to people with established OP, particularly those who have already sustained an incident fracture and are at a substantial risk of re-fracture. This is a critical area of OP management as morbidity, mortality and system costs rise exponentially with each re-fracture sustained [141–143]. For this reason, most of the contemporary MoCs for clinical settings focus on secondary prevention of OP, especially secondary re-fracture prevention strategies [139].

Across the globe, only 10–20% of individuals presenting with fragility fractures are currently being assessed or treated for OP. Four general MoCs have been developed as interventions for people with fragility fractures [144]: Firstly, identification, assessment and treatment of people with fragility fractures as part of a fracture liaison service; secondly, a similar service, but without treatment initiation; thirdly, alerting consumers plus their primary care physicians; and, finally, patient education only. Many examples of the first service type have been shown to be effective in re-fracture prevention. Data have been published to show a significant decrease in fractures when compared to control groups [145]. Moreover, both the first and second service types have been shown to be cost effective [146,147]. This indicates that identification, assessment and treatment initiation are all critical elements of successful fracture liaison services.

Unlike other musculoskeletal disorders, there are many MoCs available internationally to support the implementation of re-fracture prevention guidelines, and examples of these for system implementation are summarised in Table 4 [140,148–153]. While some health systems are slowly making progress, implementation of any of these MoCs is generally fraught with the same inertia as those for people with arthritis, back pain and other musculoskeletal conditions [120,154]. While compelling data exist to justify a clinical focus on osteoporotic re-fracture prevention and management such as those shown in Glasgow and Australia [146,147], systemic implementation is slow [120].

*Fracture liaison services.* Re-fracture prevention MoCs across the world, first employed in Glasgow [151], are commonly centred on the fracture liaison service model. While various methods of providing the fracture liaison service have been described, a meta-analysis of the level of re-fracture prevention afforded by the differing methods has shown remarkably better outcomes when a dedicated fracture liaison coordinator is employed. The fracture liaison coordinator guides people with OP and their health-care team members in provision of best-practice re-fracture prevention through case identification, appropriate investigations, early initiation of multimodal treatment and linkage with community services and primary care providers [144].

While many teams recognise shared care as a key element of any MoC for OP re-fracture prevention in order to maintain a seamless approach to care, Bunta and colleagues have made this concept very clear in describing the evolution of their programme to prevent fragility fractures. To

solidify this approach, they have named their programme ‘Own the Bone’, so all stakeholders are made to think about what they can do to address OP management [149]. Likewise in Australia, the MoC introduced across New South Wales is named the ‘Osteoporotic Refracture Prevention’ MoC [148]. This also stamps a clear message of what is to be achieved: that re-fractures are not an option as we know >50% of those currently occurring can be prevented. Many sites have shown improved outcomes from the shared-care model, underpinned by the fracture liaison coordinator, including the Glasgow team, the large health management systems in the United States of America and the settings in Australia [151,152,155].

#### *Implementation of the fracture liaison service model of care*

In implementing fracture liaison service MoCs, there are several issues to consider, many of which are common across all chronic diseases. Some to consider are discussed here.

*Considerations for rural and remote area services.* In consideration of rural services and for those who live remote from specialty care, many researchers and clinical teams have reviewed methods on how to implement guidelines for evidenced-based OP care in these localities. MoCs that rely on patient education concerning OP disease management and alerting primary care physicians of the diagnosis and need for intervention have been trialled in some areas [156,157]. However, the meta-analysis of the various modes of re-fracture prevention services by Ganda and colleagues concluded the dedicated fracture liaison coordinator model yields the best treatment rates, irrespective of geography [144]. This service model has been trialled in a rural setting in Australia, following the New South Wales MoC which centres on the ‘must have’ fracture liaison coordinator [148]. The rural MoC included a fracture liaison coordinator and shared ownership of the re-fracture prevention programme between specialty and primary care services. The team used a quality cycle approach to implement the New South Wales MoC to suit their community needs. Activities coordinated by the fracture liaison coordinator that met their needs included community messages in local media and charity events, use of mobile bone density scanning (with reporting and quality check processes provided centrally), working with clinical team members in small communities to support their efforts and spread the clinical load and, importantly, working from the local primary care organisation so the work is centred on primary care physician leadership. Outcomes to date have included increased rates of bone mineral density scanning, increased initiation of anti-resorptive agents and improved knowledge of OP management by the people accessing the service [156]. This example affirms that while fracture liaison service MoCs can be implemented in rural communities, the nature of the fracture liaison coordinator role needs to be flexible to meet local needs and resources. However, more work needs to occur to reaffirm the MoCs required, particularly in nations like Australia, United States of America and Canada where vast geographies can lead to care disparities.

#### *Practice point*

Fracture liaison service-based MoCs need to not only include the ‘must have’ – the dedicated fracture liaison coordinator – to achieve the best outcomes for consumers but also remain flexible enough so that specific practice settings can provide services according to their needs and resources.

*Workforce capacity.* The MoCs for re-fracture prevention reviewed in this chapter have revealed the capacity of nurses and physiotherapists to work as the fracture liaison coordinator with support from the multidisciplinary team [156,158]. Most require mentoring in the early months of the tenure, so the concepts of chronic disease care underpin the service and the management of OP is clearly understood. However, the identified need to take the fracture liaison service to all areas across the globe means more training and support is required. To deliver the fracture liaison service in some communities, the fracture liaison coordinator will require advanced practice skills. At present, some fracture liaison coordinators are undertaking postgraduate training, but as this can be costly, it may preclude many from committing to this level of further education. In the United Kingdom and Australia, specific courses of study in OP management as stand-alone subjects are available for nurses and allied health

professionals. However, these courses are often costly in consideration of remuneration of these health professionals.

In some areas, the lack of appropriate health professionals across the multidisciplinary team can be an inhibitor of appropriate service provision, especially in relation to specialty care and access to diagnostic tools such as bone densitometry. Such care disparities occur most commonly in rural and remote areas, but can also occur in low socio-economic areas of cities as well [159].

#### *Research agenda*

While this review has found many examples of MoCs for delivering evidenced-based care for people with OP, it has failed to find an evaluation of a phone, Internet or other electronic-based MoC based on a fracture liaison service that successfully delivers a re-fracture prevention service to people who have experienced a fragility fracture.

### *Musculoskeletal injury and trauma*

#### *Defining musculoskeletal injury and trauma*

This subsection will focus on aspects of musculoskeletal injury and trauma related only to bone and muscle, tendon and ligament tissue as defined by the International Classification of Disease (ICD)-10 coding subsets [160]. This includes a wide variety of trauma and mechanisms of injury, such as traffic accidents associated with multiple fractures, sports accidents associated with meniscus and cruciate ligament injuries, work-related injuries such as strain and sprain and common injuries incurred at home, such as traumatic and fragility fractures in the elderly.

#### *Epidemiology and impact of musculoskeletal injury and trauma*

Injuries are a major public health issue and account for nearly one out of every 10 deaths worldwide. In 2010, 5.1 million people died following an injury, one million more than in 1990 (+24%). This was driven primarily by road traffic deaths (1.3 million, +46%) and fall-related deaths (540,000; +55%). While premature death due to road traffic accidents affects primarily young people (18–39), fall-related death occurs especially in the very old (above 75 years) [161].

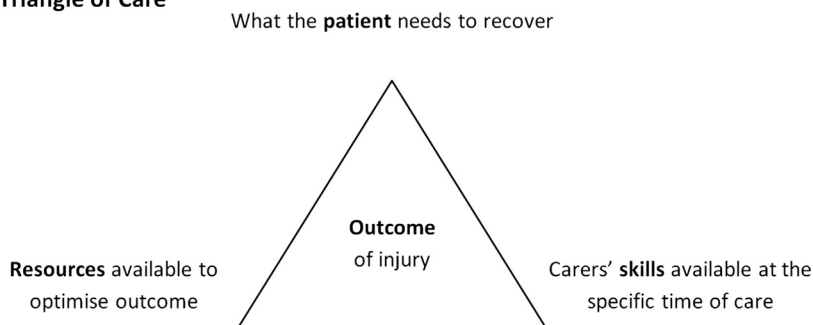
Injuries collectively caused 6.1% of global years lost to disability. Fall-related injuries account for 41% and road traffic injuries for 28% of the total years lost to disability caused by injuries [6]. Premature mortality and prevalence and severity of ill health when combined are expressed as disability-adjusted life years. Injuries collectively account for 11.2% of all disability-adjusted life years, with road safety trauma (27%) and falls (13%) accounting for the largest sections [5].

The epidemiology of injuries is closely related to socio-demographic factors of a society or a country even though data projections show a steep increase in trauma cases worldwide. While in the high-income countries roads and vehicles, as well as passive protection, improve, in many other parts of the world the amount of traffic is dramatically increasing without extensive safety measures. This leads to further increases in traffic-related trauma. Simultaneously, the demographic shift and increased life expectancy worldwide result in an enormous growth of the elderly generation suffering from fragility fractures.

#### *MoCs for injury and trauma*

*The principles of care for musculoskeletal injury and trauma.* It is easy to become distracted by policy based on infrastructure, injury severity scores and mechanism of injury when designing a MoC. The optimal management of musculoskeletal injury and trauma care are defined by the three principles within the 'Triangle of Care' (Fig. 1). Here, achieving the best outcomes from the consumer's perspective are dependent on three principles that can be addressed in any setting: consumer's needs in order to recover, the on-site carers' skills and resources available on-site at the time of injury. Early triage and care planning inclusive of early rehabilitation, discharge and secondary prevention messages, by a locally credentialed health-care provider using a standardised and systematic approach, are hallmarks

### Triangle of Care



**Fig. 1.** Triangle of Care outlining principles for delivering person-centred, best-practice MoC for injury and trauma [164].

of what works best to achieve optimal clinical and psychosocial outcomes for people with musculoskeletal injury and trauma [162].

#### Practice points

The health-care provider's credentialing and a systematic approach must be standardised and 'agreed' upon by all stakeholders involved in a person's health-care journey in order to meet the needs of the local area. When designing the agreed MoC, stakeholders should have an acute awareness that every intervention from the time of injury influences the scar or disability worn for life, and as such, planning for optimal long-term outcomes should commence early in the person's journey.

The Western Australian Non-Major Trauma framework seeks to provide a definition of non-major trauma, describing the key elements and concepts related to service delivery. The framework provides an algorithm inclusive of co-morbidity for determining if a trauma is major or minor, and treatable at the current site, based on the principles within the Triangle of Care. The framework also acts as a guide in developing MoCs, guidelines, care pathways and protocols for non-major trauma prevention, treatment, rehabilitation and palliation in Western Australia [163].

For example, a person may incur a fractured neck of femur, secondary to falling, and be transferred to a major trauma unit with services ranging from acute to rehabilitation orthopaedic services. Applying the principles of the Triangle of Care: the consumer will need specialist orthopaedic surgical and rehabilitation health care to recover. If the health service employs health-care providers with the necessary skill sets, and has all of the necessary equipment and facilities to enable recovery, the consumer can expect optimum recovery and good injury outcomes from this facility. Alternatively, if the consumer also has a co-morbidity of full-thickness burns because they fell onto a fire and the necessary equipment is not available on site, or the staff do not have the specialist skills required to manage this co-morbidity intra-operatively, then transfer to an alternative health site with services for the burn injury may need to be considered. The initial site may also use the Triangle of Care principles, coupled with case study review, to identify gaps in their service delivery and develop a MoC to meet the recovery needs of future consumers.

*Musculoskeletal injury and trauma hospital-based care.* The structure needed to provide trauma care with the lowest mortality rates is secured in highly organised regional trauma systems that have been implemented in many countries. The positive effects of this organisational structure on survival rates have been clearly demonstrated [164,165]. In Germany, despite the high quality of medical care, regional differences exist due to geographical and infrastructural conditions. In addition, discrepancies in human resources and technical equipment in hospitals influence diagnostics and treatment of severely injured people. Based on these findings, trauma networks of the German Trauma Association DGU were founded to guarantee nationwide, high-quality medical care. The TraumaNetwork DGU<sup>®</sup> connects hospitals with different capacities for the treatment of severely injured people. The connected hospitals work together as supra-regional, regional and local trauma centres. The standards of treatment and equipment are

defined on the basis of the ‘White book of the Treatment of Severely Injured Patients’ [166]. A guideline defines the key criteria for referral based on the type and severity of the injuries, and definition of the need for treatment in a supra-regional or regional trauma centre [167]. Having secured the survival of the person, the next goal is the best possible restoration of the functional and psychological integrity. For this reason, rehabilitation centres and outpatient treatment facilities are also integrated into the TraumaNetzwerk DGU<sup>®</sup>. Based on the German experience, the network model such as TraumaNetzwerk DGU<sup>®</sup> has the potential to improve care coordination in other nations.

#### *Practice points*

Trauma teams and localities are encouraged to use an external audit process to evaluate their organisations and the structure of participating hospitals with cooperation of the trauma centres within a regional network.

It is recommended to align audit processes with successful examples such as the DGU Trauma Registry that records diagnostic, treatment and outcome data for severely injured people in Germany [168]. This provides reliable data to guide research, risk management and continuous quality improvement activities.

#### *Injury and trauma care outside hospitals*

The boundaries on where care occurs and who delivers care are changing, largely in response to increasing population demand, technological advances and evolving health-carer skill sets [169]. Musculoskeletal injury and trauma are considered highly treatable in various community and outpatient settings across the care continuum with little or no connection to hospital-based services. Care can be delivered closer to home by a diversity of health-care providers in collaboration with multidisciplinary team members and the consumer or carer. In many countries, definitive treatment of minor musculoskeletal injury and trauma is routinely delivered at the place of injury, such as the sporting field or roadside, by a broad range of health-care providers, particularly primary care providers. The competent use of new technologies enables the person to recover without attending inpatient services. Examples that facilitate this care are online radiological diagnostics, point-of-care testing, removable and self-adjustable splinting and remote telehealth advice systems. These are ably delivered with follow-up care from a primary care physician, nurse practitioner or rehabilitation-in-the-home specialist. Locally credentialed autonomous skill sets are easily provided as ‘stand-alone’ services or as part of a multidisciplinary team approach. This MoC promotes access to best-quality care [170,171] for individuals who have difficulty attending a clinical setting or those with special needs such as being homeless [172], legally or socially incarcerated, the mentally ill [173], rural and remote area dwellers and those living with non-musculoskeletal disability.

#### *Practice point*

MoCs for the clinically stable can enable people to remain in their usual environment and receive rehabilitative care aimed at returning to optimal function within that environment.

#### *Primary and secondary prevention for musculoskeletal injury and trauma*

While hospital-based trauma services have always addressed acute health-care needs, contemporary MoCs also include prevention services within the inpatient setting. This innovation could be attributed, in part, to a community education programme being a criterion for gaining trauma verification administered by peak bodies such as the American College of Surgeons. It may also be attributed to the increasingly common practice of a multidisciplinary team approach to care that invites input from care providers across the entire care continuum. Prevention programmes, such as Prevent Alcohol and Risk-related Trauma in Youth (P.A.R.T.Y) that originated in Canada and the Stay On Your Feet<sup>®</sup> falls prevention programme from Australia, have enjoyed international success in this regard. Their successes are largely due to the early delivery of cohort-specific injury prevention messages in hospitals and the collaborative engagement of community members in the delivery of the programme external to the hospital environment. The health-care consumer and carer have access to support from linked clinical and population health specialists delivering consistent, evidenced-based messages.

### *Practice point*

In the interest of maintaining sustainable, safe and quality services, the development of alternative practice settings and increasing consumer demand for evidence-based, easily affordable and accessible care, it is paramount that the musculoskeletal injury and trauma community develop the agreed credentials and standards for service providers.

### *Barriers to system-wide implementation of MoCs for musculoskeletal injury and trauma*

#### *Nomenclature, scores and definitions*

A notable gap in service delivery from a musculoskeletal injury and trauma perspective is a lack of common nomenclature, trauma severity scores, diagnostic and data definitions, outcome measures and translational research in musculoskeletal injury and trauma from a systems perspective. The published literature contains prolific commentary and research on musculoskeletal injury and trauma in terms of specific body parts, mechanisms of injury and therapeutic regimens. The presence of nomenclature and outcome measures to guide overarching discussion, care planning and research for musculoskeletal injury and trauma as a construct is absent, or delivered with inadequate academic rigour, due to the lack of an agreed framework [174,175].

#### *Recommendation*

While clinical speciality- and condition-specific frameworks exist, developing an internationally acceptable musculoskeletal injury and trauma framework with agreed principles and measures of best practice is arguably the most fundamental requirement to influence the reliable transition of research into MoCs for musculoskeletal injury and trauma [176,177].

### **Summary**

The socio-economic and personal burden attributed to chronic musculoskeletal conditions and the sequelae of musculoskeletal injury and trauma are profound. Despite the burden of these conditions, the right care is not consistently delivered at the right time, in the right place or by the right team. Contemporary MoCs provide one solution to this burden—service gap [182]. Consistent features are observed across the various MoCs reviewed, including 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 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 co-morbidities, mental health and socio-economic status. A workforce of adequate volume and competencies is critical for effective and sustainable implementation of MoCs. Musculoskeletal health care 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 health-care 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 health care. Emerging evidence suggests that network-based models of engagement and collaboration for clinicians, consumers and other stakeholders such as managers and policymakers are a key enabler to the adoption and systematic implementation of MoCs [181]. It is imperative this collaborative approach to health care continues and that the implementation research on MoCs continues, focussing on formal evaluation, program logic and cost effectiveness, in order to minimise the global disability attributed to musculoskeletal health conditions.

### **Conflict of interest statement**

The authors declare no conflicts of interest.

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## References

- \*[1] Arthritis and Osteoporosis Victoria. A problem worth solving. The rising cost of musculoskeletal conditions in Australia. Melbourne: Arthritis and Osteoporosis Victoria; 2013. Accessed on 05/03/2014 at: <http://www.arthritisvic.org.au/Useful-Information/About-Us/A-Problem-Worth-Solving>.
- [2] Australian and New Zealand College of Anaesthetists. National pain strategy. Melbourne: Faculty of Pain Medicine; 2010. p. 104. Accessed on 05/03/2014 at: <http://www.painaustralia.org.au/the-national-pain-strategy/national-pain-strategy.html>.
- [3] Dall TM, Gallo P, Koenig L, et al. Modeling the indirect economic implications of musculoskeletal disorders and treatment. *Cost Eff Resour Alloc* 2013;11:5.
- [4] Henderson JV, Harrison CM, Britt HC, et al. Prevalence, causes, severity, impact, and management of chronic pain in Australian general practice patients. *Pain Med* 2013;14:1346–61.
- [5] Murray CJ, Vos T, Lozano R, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2013;380:2197–223.
- \*[6] Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2013;380:2163–96.
- [7] Watts JW, Abimanyi-Ochom J, Sanders K. Osteoporosis costing all Australians. A new burden of disease analysis – 2012–2022. Sydney: Osteoporosis Australia; 2013. p. 80. Accessed on 05/03/2014 at: <http://www.osteoporosis.org.au/news/latest-news/new-research-report-launched-4-december-2013/>.
- [8] Briggs AM, Slater H, Bunzli S, et al. Consumers' experiences of back pain in rural Western Australia: access to information and services, and self-management behaviours. *BMC Health Serv Res* 2012;12:357.
- [9] Anderson KO, Green CR, Payne R. Racial and ethnic disparities in pain: causes and consequences of unequal care. *J Pain* 2009;10:1187–204.
- [10] Jacobi CE, Mol GD, Boshuizen HC, et al. Impact of socioeconomic status on the course of rheumatoid arthritis and on related use of health care services. *Arthritis Rheum* 2003;49:567–73.
- [11] Meghani SH, Polomano RC, Tait RC, et al. Advancing a national agenda to eliminate disparities in pain care: directions for health policy, education, practice, and research. *Pain Med* 2012;13:5–28.
- [12] Runciman WB, Hunt TD, Hannaford NA, et al. Caretrack: assessing the appropriateness of health care delivery in Australia. *Med J Aust* 2012;197:100–5.
- [13] Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *Lancet* 2003;362:1225–30.
- \*[14] Briggs AM, Bragge P, Slater H, et al. Applying a health network approach to translate evidence-informed policy into practice: a review and case study on musculoskeletal health. *BMC Health Serv Res* 2012;12:394.
- [15] MBF Foundation. The high price of pain: the economic impact of persistent pain in Australia. Sydney, Australia; 2007. p. 101. Accessed on 05/03/2014 at: <http://apo.org.au/research/high-price-pain-economic-impact-persistent-pain-australia>.
- [16] Portenoy RK, Zeltzer L. A call to revolutionize chronic pain care in America: an opportunity in health care reform. New York: The Mayday Fund; 2009. p. 17. Accessed on 05/03/2014 at: <http://www.maydayfund.org/maydayofnote.html>.
- [17] The Pain Proposal Steering Committee. The pain proposal: improving the current and future management of chronic pain. A European consensus report. European Federation of IASP Chapters in Partnership with Pfizer; 2010. p. 19. Accessed on 05/03/2014 at: <http://www.efic.org/index.asp?sub=B57HFCF6J40431>.
- [18] Breivik H, Collett B, Ventafridda V, et al. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *Eur J Pain* 2006;10:287–333.
- [19] Societal Impact of Pain Group. Societal impact of pain focus group report. Belgium: SIP; 2013. Accessed on 05/03/2014 at: <http://www.sip-platform.eu/sip-2013.html>.
- [20] Merskey H, Bogduk N. Classification of chronic pain, part iii: pain terms, a current list with definitions and notes on usage. Seattle, USA: IASP Press; 1994.
- \*[21] Turk DC, Wilson HD, Cahana A. Treatment of chronic non-cancer pain. *Lancet* 2011;377:2226–35.
- [22] Sowden G, Hill JC, Konstantinou K, et al. Targeted treatment in primary care for low back pain: the treatment system and clinical training programmes used in the IMPaCT Back Study (ISRCTN 55174281). *Fam Pract* 2012;29:50–62.
- [23] Foster NE, Hill JC, O'Sullivan P, et al. Stratified models of care. *Best Pract Res Clin Rheumatol* 2013;27:649–61.
- [24] Slater H, Briggs AM, Bunzli S, et al. Engaging consumers living in remote areas of Western Australia in the self-management of back pain: a prospective cohort study. *BMC Musculoskelet Disord* 2012;13:69.
- [25] Henry JL. The need for knowledge translation in chronic pain. *Pain Res Manag* 2008;13:465–76.
- [26] Davies S, Quintner J, Parsons R, et al. Preclinic group education sessions reduce waiting times and costs at public pain medicine units. *Pain Med* 2011;12:59–71.
- [27] Lin CW, Haas M, Maher CG, et al. Cost-effectiveness of guideline-endorsed treatments for low back pain: a systematic review. *Eur Spine J* 2011;20:1024–38.
- [28] Slater H, Davies SJ, Parsons R, et al. A policy-into-practice intervention to increase the uptake of evidence-based management of low back pain in primary care: a prospective cohort study. *PLoS One* 2012;7:e38037.
- [29] Slater H, Briggs AM, Smith AJ, et al. Implementing evidence-informed policy into practice for health care professionals managing people with low back pain in Australian rural settings: a preliminary prospective single-cohort study. *Pain Med* 2014. <http://dx.doi.org/10.1111/pme.12351>.



- [30] Hill JC, Dunn KM, Lewis M, et al. A primary care back pain screening tool: identifying patient subgroups for initial treatment. *Arthritis Rheum* 2008;59:632–41.
- [31] Price C. Managing pain management. Setting up an effective pain service in Southampton. *R Coll Anaesth Bull* 2006;36:1830–2.
- [32] Mitchell GK. Improving coordination of care between specialist and general practice for people with chronic pain. *Med J Aust* 2013;198:301–2.
- [33] Gurden M, Morelli M, Sharp G, et al. Evaluation of a general practitioner referral service for manual treatment of back and neck pain. *Prim Health Care Res Dev* 2012;13:204–10.
- [34] Hogg MN, Gibson S, Helou A, et al. Waiting in pain: a systematic investigation into the provision of persistent pain services in Australia. *Med J Aust* 2012;196:386–90.
- [35] Briggs AM, Slater H, Smith AJ, et al. Low back pain-related beliefs and likely practice behaviours among final-year cross-discipline health students. *Eur J Pain* 2013;17:766–75.
- [36] Buchbinder R, Blyth FM, March LM, et al. Placing the global burden of low back pain in context. *Best Pract Res Clin Rheumatol* 2013;27:575–89.
- [37] Slater H, Briggs AM, Watkins K, et al. Translating evidence for low back pain management into a consumer-focussed resource for use in community pharmacies: a cluster-randomised controlled trial. *PLoS One* 2013;8:e71918.
- [38] Hunter DJ, Neogi T, Hochberg MC. Quality of osteoarthritis management and the need for reform in the US. *Arthritis Care Res (Hoboken)* 2011;63:31–8.
- [39] Suri P, Morgenroth DC, Hunter DJ. Epidemiology of osteoarthritis and associated comorbidities. *PM R* 2012;4:S10–9.
- [40] Lawrence RC, Felson DT, Helmick CG, et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the United States. Part ii. *Arthritis Rheum* 2008;58:26–35.
- [41] Losina E, Weinstein AM, Reichmann WM, et al. Lifetime risk and age at diagnosis of symptomatic knee osteoarthritis in the US. *Arthritis Care Res* 2013;65:703–11.
- [42] Kurtz SM, Lau E, Ong K, et al. Future young patient demand for primary and revision joint replacement: national projections from 2010 to 2030. *Clin Orthop Relat Res* 2009;467:2606–12.
- [43] Ackerman IN, Graves SE, Wicks IP, et al. Severely compromised quality of life in women and those of lower socioeconomic status waiting for joint replacement surgery. *Arthritis Rheum* 2005;53:653–8.
- [44] Lee YC, Nassikas NJ, Clauw DJ. The role of the central nervous system in the generation and maintenance of chronic pain in rheumatoid arthritis, osteoarthritis and fibromyalgia. *Arthritis Res Ther* 2011;13:211.
- [45] Jordan KM, Arden NK, Doherty M, et al. EULAR recommendations 2003: an evidence based approach to the management of knee osteoarthritis: report of a task force of the Standing Committee for International Clinical Studies Including Therapeutic Trials (ESCISIT). *Ann Rheum Dis* 2003;62:1145–55.
- [46] Zhang W, Doherty M, Leeb BF, et al. EULAR evidence based recommendations for the management of hand osteoarthritis: report of a task force of the EULAR Standing Committee for International Clinical Studies Including Therapeutics (ESCISIT). *Ann Rheum Dis* 2007;66:377–88.
- [47] Hochberg MC, Altman RD, April KT, et al. American College of Rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. *Arthritis Care Res* 2012;64:465–74.
- [48] Zhang W, Nuki G, Moskowitz RW, et al. OARSI recommendations for the management of hip and knee osteoarthritis: part iii: changes in evidence following systematic cumulative update of research published through January 2009. *Osteoarthr Cartil* 2010;18:476–99.
- [49] Zhang W, Doherty M, Arden N, et al. EULAR evidence based recommendations for the management of hip osteoarthritis: report of a task force of the EULAR Standing Committee for International Clinical Studies Including Therapeutics (ESCISIT). *Ann Rheum Dis* 2005;64:669–81.
- [50] Porcheret M, Jordan K, Croft P. Treatment of knee pain in older adults in primary care: development of an evidence-based model of care. *Rheumatology (Oxford)* 2007;46:638–48.
- [51] Royal Australian College of General Practitioners. Guideline for the non-surgical management of hip and knee osteoarthritis. Melbourne: RACGP; 2009. p. 70. Accessed on 05/03/2014 at: <http://www.racgp.org.au/your-practice/guidelines/musculoskeletal/hipandkneeosteoarthritis/>.
- [52] Fernandes L, Hagen KB, Bijlsma JW, et al. EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis. *Ann Rheum Dis* 2013;72:1125–35.
- [53] Li LC, Sayre EC, Kopec JA, et al. Quality of nonpharmacological care in the community for people with knee and hip osteoarthritis. *J Rheumatol* 2011;38:2230–7.
- [54] Ganz DA, Chang JT, Roth CP, et al. Quality of osteoarthritis care for community-dwelling older adults. *Arthritis Care Res* 2006;55:241–7.
- [55] Buchbinder R, Richards B, Harris I. Knee osteoarthritis and role for surgical intervention: lessons learned from randomized clinical trials and population-based cohorts. *Curr Opin Rheumatol* 2014;26:138–44.
- [56] Losina E, Thornhill TS, Rome BN, et al. The dramatic increase in total knee replacement utilization rates in the United States cannot be fully explained by growth in population size and the obesity epidemic. *J Bone Joint Surg* 2012;94:201–7.
- [57] Bennell KL, Hunter DJ, Hinman RS. Management of osteoarthritis of the knee. *BMJ* 2012;345:e4934.
- [58] Dieppe P, Lim K, Lohmander S. Who should have knee joint replacement surgery for osteoarthritis? *Int J Rheum Dis* 2011;14:175–80.
- [59] Brady T. Strategies to support self-management in osteoarthritis. *Am J Nurs* 2012;112:S54–60.
- [60] Wagner EH. Chronic disease management: what will it take to improve care for chronic illness? *Eff Clin Pract* 1998;1:2–4.
- [61] Dennis SM, Zwar N, Griffiths R, et al. Chronic disease management in primary care: from evidence to policy. *Med J Aust* 2008;188:S53–6.
- [62] Doerr C, Graves SE, Mercer GE, et al. Implementation of a quality care management system for patients with arthritis of the hip and knee. *Aust Health Rev* 2013;37:88–92.

- [63] Lineker SC, Bell MJ, Badley EM. Evaluation of an inter-professional educational intervention to improve the use of arthritis best practices in primary care. *J Rheumatol* 2011;38:931–7.
- [64] Schofield D, Fuller J, Wagner S, et al. Multidisciplinary management of complex care. *Aust J Rural Health* 2009;17:45–8.
- \*[65] March L, Amatya B, Osborne RH, et al. Developing a minimum standard of care for treating people with osteoarthritis of the hip and knee. *Best Pract Res Clin Rheumatol* 2010;24:121–45.
- [66] Creedon R, Weathers E. The impact of nurse prescribing on patients with osteoarthritis. *Br J Community Nurs* 2011;16:393–8.
- [67] Hill J, Lewis M, Bird H. Do OA patients gain additional benefit from care from a clinical nurse specialist?—a randomized clinical trial. *Rheumatology (Oxford)* 2009;48:658–64.
- [68] Li LC, Hurkmans EJ, Sayre EC, et al. Continuing professional development is associated with increasing physical therapists' roles in arthritis management in Canada and The Netherlands. *Phys Ther* 2010;90:629–42.
- [69] Passalent LA, Kennedy C, Warmington K, et al. System integration and clinical utilization of the advanced clinician practitioner in arthritis care (ACPAC) program-trained extended role practitioners in Ontario: a two-year, system-level evaluation. *Healthc Policy* 2013;8:56–70.
- [70] NSW Agency for Clinical Innovation. Musculoskeletal network: osteoarthritis chronic care program model of care. Sydney: NSW Agency for Clinical Innovation; 2012. p. 39. Accessed on 05/03/2014 at: <http://www.aci.health.nsw.gov.au/models-of-care/musculoskeletal/osteoarthritis-chronic-care-program>.
- [71] Department of Health. Osteoarthritis hip and knee service. Victoria, Australia; 2014. Accessed on 05/03/2014 at: <http://www.health.vic.gov.au/oahks/index.htm>.
- [72] Grindrod KA, Marra CA, Colley L, et al. After patients are diagnosed with knee osteoarthritis, what do they do? *Arthritis Care Res (Hoboken)* 2010;62:510–5.
- [73] Marra CA, Cibere J, Grubisic M, et al. Pharmacist-initiated intervention trial in osteoarthritis: a multidisciplinary intervention for knee osteoarthritis. *Arthritis Care Res* 2012;64:1837–45.
- [74] National Institute for Health and Clinical Excellence. The care and management of osteoarthritis in adults; 2014. p. 36. Accessed on 05/03/2014 at: <http://guidance.nice.org.uk/CG177>.
- [75] Department of Health (Western Australia). Elective joint replacement service model of care. Perth: Health Networks Branch; 2010. p. 78. Accessed on 05/03/2014 at: <http://www.healthnetworks.health.wa.gov.au/network/musculoskeletal.cfm>.
- [76] Department of Health (Western Australia). Service model for community-based musculoskeletal health in Western Australia. Perth: Health Networks Branch; 2013. p. 31. Accessed on 05/03/2014 at: <http://www.healthnetworks.health.wa.gov.au/network/musculoskeletal.cfm>.
- [77] Sperber NR, Bosworth HB, Coffman CJ, et al. Participant evaluation of a telephone-based osteoarthritis self-management program, 2006–2009. *Prev Chronic Dis* 2012;9:E73.
- [78] Allen KD, Oddone EZ, Coffman CJ, et al. Telephone-based self-management of osteoarthritis: a randomized trial. *Ann Intern Med* 2010;153:570–9.
- [79] Lorig KR, Ritter PL, Laurent DD, et al. The internet-based arthritis self-management program: a one-year randomized trial for patients with arthritis or fibromyalgia. *Arthritis Rheum* 2008;59:1009–17.
- [80] Porcheret M, Grime J, Main C, et al. Developing a model osteoarthritis consultation: a Delphi consensus exercise. *BMC Musculoskelet Disord* 2013;14:25.
- [81] Coleman S, Briffa NK, Carroll G, et al. A randomised controlled trial of a self-management education program for osteoarthritis of the knee delivered by health care professionals. *Arthritis Res Ther* 2012;14:R21.
- [82] Crotty M, Prendergast J, Battersby MW, et al. Self-management and peer support among people with arthritis on a hospital joint replacement waiting list: a randomised controlled trial. *Osteoarthr Cartil* 2009;17:1428–33.
- [83] Brand CA, Ackerman IN, Bohensky MA, et al. Chronic disease management: a review of current performance across quality of care domains and opportunities for improving osteoarthritis care. *Rheum Dis Clin N Am* 2013;39:123–43.
- [84] Linden A, Butterworth SW, Prochaska JO. Motivational interviewing-based health coaching as a chronic care intervention. *J Eval Clin Pract* 2010;16:166–74.
- \*[85] Borkhoff CM, Wieland ML, Myasoedova E, et al. Reaching those most in need: a scoping review of interventions to improve health care quality for disadvantaged populations with osteoarthritis. *Arthritis Care Res* 2011;63:39–52.
- [86] Gabriel SE. The epidemiology of rheumatoid arthritis. *Rheum Dis Clin N Am* 2001;27:269–81.
- [87] Sokka T, Kautiainen H, Pincus T, et al. Work disability remains a major problem in rheumatoid arthritis in the 2000s: data from 32 countries in the QUEST-RA Study. *Arthritis Res Ther* 2010;12:R42.
- [88] Lenssinck ML, Burdorf A, Boonen A, et al. Consequences of inflammatory arthritis for workplace productivity loss and sick leave: a systematic review. *Ann Rheum Dis* 2013;72:493–505.
- [89] Bakker MF, Jacobs JWG, Welsing PMJ, et al. Early clinical response to treatment predicts 5-year outcome in RA patients: follow-up results from the CAMERA study. *Ann Rheum Dis* 2011;70:1099–103.
- [90] van Nies JAB, Krabben A, Schoones JW, et al. What is the evidence for the presence of a therapeutic window of opportunity in rheumatoid arthritis? A systematic literature review. *Ann Rheum Dis* 2013. <http://dx.doi.org/10.1136/annrheumdis-2012-203130>.
- [91] Vermeer M, Kievit W, Kuper HH, et al. Treating to the target of remission in early rheumatoid arthritis is cost-effective: results of the DREAM registry. *BMC Musculoskelet Disord* 2013;14:350.
- [92] Stenström CH. Therapeutic exercise in rheumatoid arthritis. *Arthritis Rheum* 1994;7:190–7.
- [93] Hurkmans E, van der Giesen FJ, Vliet Vlieland TP, et al. Dynamic exercise programs (aerobic capacity and/or muscle strength training) in patients with rheumatoid arthritis. *Cochrane Database Syst Rev* 2009;CD006853.
- [94] Steultjens EMJ, Dekker J, Bouter LM, et al. Occupational therapy for rheumatoid arthritis: a systematic review. *Arthritis Care Res* 2002;47:672–85.
- [95] Farrow SJ, Kingsley GH, Scott DL. Interventions for foot disease in rheumatoid arthritis: a systematic review. *Arthritis Care Res* 2005;53:593–602.
- [96] Lorig KR, Ritter PL, Laurent DD, et al. Long-term randomized controlled trials of tailored-print and small-group arthritis self-management interventions. *Med Care* 2004;42:346–54.

- [97] Vliet Vlieland TP, Hazes JM. Efficacy of multidisciplinary team care programs in rheumatoid arthritis. *Semin Arthritis Rheum* 1997;27:110–22.
- [98] Davis A, Cott C, Li LD, et al. Models and processes of care for people with arthritis. *J Rheumatol* 2012;39:1749 [abstract].
- [99] Prier A, Berenbaum F, Karneff A, et al. Multidisciplinary day hospital treatment of rheumatoid arthritis patients. Evaluation after two years. *Revue Du Rhum Engl Edition* 1997;64:443–50.
- [100] Jacobsson LT, Frithiof M, Olofsson Y, et al. Evaluation of a structured multidisciplinary day care program in rheumatoid arthritis. A similar effect in newly diagnosed and long-standing disease. *Scan J Rheumatol* 1998;27:117–24.
- [101] Maravic M, Bozonnat MC, Sevezan A, et al. Preliminary evaluation of medical outcomes (including quality of life) and costs in incident RA cases receiving hospital-based multidisciplinary management. *J Bone Spine* 2000;67:425–33.
- [102] Hagel S, Lindqvist E, Petersson IF, et al. Which patients improve the most from arthritis rehabilitation? Results from patients with inflammatory arthritis in Northern Europe, the STAR-ETIC collaboration. *J Rehabil Med* 2014;46:250–7.
- [103] Department of Health (Western Australia). Inflammatory arthritis model of care. Perth: Health Networks; 2009. p. 41. Accessed on 05/03/2014 at: <http://www.healthnetworks.health.wa.gov.au/network/musculoskeletal.cfm>.
- [104] Department of Health (Western Australia). WA chronic health conditions framework 2011–2016. Perth: Health Networks Branch; 2011. p. 56. Accessed on 05/03/2014 at: <http://www.healthnetworks.health.wa.gov.au/modelsofcare/index.cfm>.
- [105] Hewlett S, Mitchell K, Haynes J, et al. Patient-initiated hospital follow-up for rheumatoid arthritis. *Rheumatology (Oxford)* 2000;39:990–7.
- [106] Symmons D, Tricker K, Roberts C, et al. The British Rheumatoid Outcome Study Group (BROSG) randomised controlled trial to compare the effectiveness and cost-effectiveness of aggressive versus symptomatic therapy in established rheumatoid arthritis. *Health Technol Assess* 2005;9:94.
- [107] Davis P, Howard R, Brockway P. Telehealth consultations in rheumatology: cost-effectiveness and user satisfaction. *J Telemed Telecare* 2001;7(Suppl. 1):10–1.
- [108] Lineker SC, Wood H, Badley EM, et al. Evaluation of the primary therapist model of service delivery as implemented by the Arthritis Society, consultation and rehabilitation service. In: Phase 1: therapist survey. Working Paper. Toronto, Ontario: Arthritis Community Research & Evaluation Unit (ACREU); 1998. p. 98–105.
- [109] Li LC, Westby MD, Sutton E, et al. Canadian physiotherapists' views on certification, specialisation, extended role practice, and entry-level training in rheumatology. *BMC Health Serv Res* 2009;9:88.
- [110] Stanhope J, Grimmer-Somers K, Milanese S, et al. Extended scope physiotherapy roles for orthopedic outpatients: an update systematic review of the literature. *J Multidiscip Healthc* 2012;5:37–45.
- [111] O' Cathain A, Froggett M, Taylor MP. General practice based physiotherapy: its use and effect on referrals to hospital orthopaedics and rheumatology outpatient departments. *Br J Gen Pract* 1995;45:352–4.
- [112] Shigaki CL, Smarr KL, Yang G, et al. Social interactions in an online self-management program for rheumatoid arthritis. *Chronic Ill* 2008;4:239–46.
- [113] Li LC, Adam PM, Townsend AF, et al. Usability testing of ANSWER: a web-based methotrexate decision aid for patients with rheumatoid arthritis. *BMC Med Inform Decis Mak* 2013;13:131.
- [114] Bernatsky S, Feldman D, De Civita M, et al. Optimal care for rheumatoid arthritis: a focus group study. *Clinic Rheumatol* 2010;29:645–57.
- [115] Pollard LC, Graves H, Scott DL, et al. Perceived barriers to integrated care in rheumatoid arthritis: Views of recipients and providers of care in an inner-city setting. *BMC Musculoskelet Disord* 2011;12:19.
- [116] Davis AM, Cott C, Wong R, et al. Models of care for arthritis: drivers, facilitators and barriers to their development and implementation. *Arthritis Rheum* 2013;65:S822–3.
- [117] Stack RJ, Shaw K, Mallen C, et al. Delays in help seeking at the onset of the symptoms of rheumatoid arthritis: a systematic synthesis of qualitative literature. *Ann Rheum Dis* 2012;71:493–7.
- [118] Briggs AM, Buchbinder R. Back pain: a national health priority area in Australia? *Med J Aust* 2009;190:499–502.
- [119] Eisman JA, Bogoch ER, Dell R, et al. Making the first fracture the last fracture: ASBMR task force report on secondary fracture prevention. *J Bone Miner Res* 2012;27:2039–46.
- [120] Seibel MJ. No more excuses: fracture liaison services work and are cost-effective. *Med J Aust* 2011;195:566–7.
- [121] Lubar D, White PH, Callahan LF, et al. A national public health agenda for osteoarthritis 2010. *Semin Arthritis Rheum* 2010;39:323–6.
- \*[122] Li LC, Badley EM, MacKay C, et al. An evidence-informed, integrated framework for rheumatoid arthritis care. *Arthritis Rheum* 2008;59:1171–83.
- [123] Briggs AM, Fary RE, Slater H, et al. Disease-specific knowledge and clinical skills required by community-based physiotherapists to co-manage patients with rheumatoid arthritis. *Arthritis Care Res* 2012;64:1514–26.
- [124] Fary RE, Slater H, Chua J, et al. Translating policy into practice for community-based management of rheumatoid arthritis: targeting professional development needs among physiotherapists. *Int J Rheum* 2012;240689. <http://dx.doi.org/10.1155/2012/240689>.
- [125] Woolf AD, Akesson K. Education in musculoskeletal health – how can it be improved to meet growing needs? *J Rheumatol* 2007;34:455–7.
- [126] Almeida C, Clarke B, O'Brien A, et al. Current provision of rheumatology education for undergraduate nursing, occupational therapy and physiotherapy students in the UK. *Rheumatology (Oxford)* 2006;45:868–73.
- [127] Brosseau L, Lineker S, Bell M, et al. People getting a grip on arthritis: a knowledge transfer strategy to empower patients with rheumatoid arthritis and osteoarthritis. *Health Educ J* 2012;71:255–67.
- [128] Meesters J, de Boer I, van den Berg M, et al. Unmet information needs about the delivery of rheumatology health care services: a survey among patients with rheumatoid arthritis. *Patient Educ Couns* 2011;85:299–303.
- [129] Strom O, Borgstrom F, Kanis JA, et al. Osteoporosis: Burden, health care provision and opportunities in the EU: a report prepared in collaboration with the International Osteoporosis Foundation (IOF) and the European Federation of Pharmaceutical Industry Associations (EFPIA). *Arch Osteoporos* 2011;6:59–155.
- [130] Johnell O, Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. *Osteoporos Int* 2006;17:1726–33.

- [131] Lau EM, Cooper C. The epidemiology of osteoporosis. The Oriental perspective in a world context. *Clin Orthop* 1996; 65–74.
- [132] United States Census Bureau. International programs. US Department of Commerce; 2013.
- [133] Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. *Lancet* 2002;359:1761–7.
- [134] Hernlund E, Svedbom A, Ivergård M, et al. Osteoporosis in the European Union: medical management, epidemiology and economic burden. *Arch Osteoporos* 2013;8:136. <http://dx.doi.org/10.1007/s11657-013-0136-1>.
- [135] International Osteoporosis Foundation. The Asian-Pacific Audit: epidemiology, costs and burden of osteoporosis in 2013; 24.02.2014. Accessed on 05/03/2014 at: <http://www.iofbonehealth.org/data-publications/regional-audits/asia-pacific-regional-audit>.
- [136] Klotzbuecher CM, Ross PD, Landsman PB, et al. Patients with prior fractures have an increased risk of future fractures: a summary of the literature and statistical synthesis. *J Bone Miner Res* 2000;15:721–39.
- [137] Port L, Center J, Briffa NK, et al. Osteoporotic fracture: missed opportunity for intervention. *Osteoporos Int* 2003;14: 780–4.
- [138] Kanis JA, Johnell O, De Laet C, et al. A meta-analysis of previous fracture and subsequent fracture risk. *Bone* 2004;35: 375–82.
- \*[139] Akesson K, Marsh D, Mitchell PJ, et al. Capture the fracture: a best practice framework and global campaign to break the fragility fracture cycle. *Osteoporos Int* 2013;24:2135–52.
- [140] Department of Health (Western Australia). Osteoporosis model of care. Perth: Health Networks Branch; 2011. p. 62. Accessed on 05/03/2014 at: <http://www.healthnetworks.health.wa.gov.au/network/musculoskeletal.cfm>.
- [141] Bliuc D, Nguyen TV, Eisman JA, et al. The impact of non-hip non-vertebral fractures in elderly women and men. *J Clin Endocrinol Metab* 2014;99:415–23.
- [142] Center JR, Bliuc D, Nguyen TV, et al. Risk of subsequent fracture after low-trauma fracture in men and women. *J Am Med Assoc* 2007;297:387–94.
- [143] Briggs AM, Greig AM, Wark JD. The vertebral fracture cascade in osteoporosis. A review of aetiopathogenesis. *Osteoporos Int* 2007;18:575–84.
- \*[144] Ganda K, Puech M, Chen JS, et al. Models of care for the secondary prevention of osteoporotic fractures: a systematic review and meta-analysis. *Osteoporos Int* 2013;24:393–406.
- [145] Lih ANH, Kim M, Yap C, et al. Targeted intervention reduces refracture rates in patients with incident non-vertebral osteoporotic fractures: a 4-year prospective controlled study. *Osteoporos Int* 2011;22:849–58.
- [146] Cooper MS, Palmer AJ, Seibel MJ. Cost-effectiveness of the concord minimal trauma fracture liaison service, a prospective, controlled fracture prevention study. *Osteoporos Int* 2012;23:97–107.
- [147] McLellan AR, Wolowacz SE, Zimovetz EA, et al. Fracture liaison services for the evaluation and management of patients with osteoporotic fracture: a cost-effectiveness evaluation based on data collected over 8 years of service provision. *Osteoporos Int* 2011;22:2083–98.
- [148] NSW Agency for Clinical Innovation. Musculoskeletal Network: NSW model of care for osteoporotic refracture prevention. Sydney: NSW Agency for Clinical Innovation; 2011. p. 33. Accessed on 05/03/2014 at: <http://www.aci.health.nsw.gov.au/models-of-care#musculoskeletal>.
- [149] Bunta AD. It is time for everyone to own the bone. *Osteoporos Int* 2011;22(Suppl. 3):477–82.
- [150] Dell R. Fracture prevention in Kaiser Permanente Southern California. *Osteoporos Int* 2011;22(Suppl. 3):457–60.
- [151] McLellan AR, Gallacher SJ, Fraser M, et al. The fracture liaison service: success of a program for the evaluation and management of patients with osteoporotic fracture. *Osteoporos Int* 2003;14:1028–34.
- [152] Newman ED. Perspectives on pre-fracture intervention strategies: the Geisinger health system osteoporosis program. *Osteoporos Int* 2011;22(Suppl. 3):451–5.
- [153] Roy A, Heckman MG, O'Connor MI. Optimizing screening for osteoporosis in patients with fragility hip fracture. *Clin Orthop* 2011;469:1925–30.
- [154] Marsh D, Akesson K, Beaton DE, et al. Coordinator-based systems for secondary prevention in fragility fracture patients. *Osteoporos Int* 2011;22:2051–65.
- [155] Barrack CE, McGirr EE, Fuller JD, et al. Secondary prevention of osteoporosis post minimal trauma fracture in an Australian regional and rural population. *Aust J Rural Health* 2009;17:310–5.
- [156] Davidson E, Seal A, Doyle Z, et al. Outcomes of a fracture liaison service for osteoporosis in regional Australia. In: NSW rural health and research congress 2013 [abstract]; 2013. Port Macquarie, NSW, Australia. Accessed on 05/03/2014 at: [https://secure.hotelnetwork.com.au/rural\\_health\\_2013/](https://secure.hotelnetwork.com.au/rural_health_2013/).
- [157] Tulk C, Lane P, Gilbey A, et al. Improving osteoporosis management following minimal trauma fracture in a regional setting: the cox's fracture card project. *Aust J Rural Health* 2013;21:343–9.
- [158] Huntjens KM, van Geel TA, Blonk MC, et al. Implementation of osteoporosis guidelines: a survey of five large fracture liaison services in The Netherlands. *Osteoporos Int* 2011;22:2129–35.
- [159] Vanasse A, Courteau J, Cohen AA, et al. Rural-urban disparities in the management and health issues of chronic diseases in Quebec (Canada) in the early 2000s. *Rural Remote Health* 2010;10:1548.
- [160] World Health Organization. ICD 10: international statistical classification of disease and related health problems: tenth revision. 2nd ed. 2010.
- [161] Lozano R, Naghavi M, Foreman K, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380:2095–128.
- [162] Fatovich DM, Phillips M, Jacobs IG, et al. Major trauma patients transferred from rural and remote Western Australia by the royal flying doctor service. *J Trauma* 2011;71:1816–20.
- [163] Department of Health (Western Australia). WA non-major trauma framework. Perth: Health Networks Branch; 2009. p. 15–8. 32p. Accessed on 05/03/2014 at: <http://www.healthnetworks.health.wa.gov.au/network/injury.cfm>.
- [164] Celso B, Tepas J, Langland-Orban B, et al. A systematic review and meta-analysis comparing outcome of severely injured patients treated in trauma centers following the establishment of trauma systems. *J Trauma* 2006;60:371–8.

- [165] MacKenzie EJ, Rivara FP, Jurkovich GJ, et al. A national evaluation of the effect of trauma-center care on mortality. *N Eng J Med* 2006;354:366–78.
- [166] Deutsche Gesellschaft für Unfallchirurgie. Whitebook medical care of the severely injured. 2nd ed. Orthopädie und Unfallchirurgie – Mitteilungen und Nachrichten; 2012.
- [167] Neugebauer E, Krettek C. s3 guidelines on treatment of polytrauma/severe injuries. What matters is the implementation! *Unfallchirurg* 2012;115:6–7.
- [168] Ruchholtz S, Lefering R, Debus F, et al. Traumaregistertraumanetwork DGU® and Traumaregister DGU®. Success by cooperation and documentation. *Chirurg* 2013;84:730–8.
- [169] World Economic Forum. Sustainable health systems: visions, strategies, critical uncertainties, and scenarios. Geneva: World Economic Forum; 2013. p. 32. Accessed on 05/03/2014 at: <http://www.weforum.org/reports/sustainable-health-systems-visions-strategies-critical-uncertainties-and-scenarios>.
- [170] Weaver FM, Hughes SL, Almagor O, et al. Comparison of two home care protocols for total joint replacement. *J Am Geriatr Soc* 2003;51:523–8.
- [171] Johnston B, Wheeler L, Deuser J, et al. Outcomes of the Kaiser Permanente tele-home health research project. *Arch Fam Med* 2000;9:40–5.
- [172] van Laere I, de Wit M, Klazinga N. Shelter-based convalescence for homeless adults in Amsterdam: a descriptive study. *BMC Health Serv Res* 2009;9:208.
- [173] Wolff H, Sebo P, Haller DM, et al. Health problems among detainees in Switzerland: a study using the ICPC-2 classification. *BMC Public Health* 2011;11:245.
- [174] Tønnesen H, Groene O, O’Riordan A, et al. An evaluation of a model for the systematic documentation of hospital based health promotion activities: results from a multicentre study. *BMC Health Serv Res* 2007;7:145.
- [175] Oliver K, Innvar S, Lorenc T, et al. A systematic review of barriers to and facilitators of the use of evidence by policymakers. *BMC Health Serv Res* 2014;14:2.
- [176] Munroe B, Curtis K, Considine J, et al. The impact structured patient assessment frameworks have on patient care: an integrative review. *J Clin Nurs* 2013;22:2991–3005.
- [177] Mitchell R, Watson WL, Curtis K, et al. Difficulties in establishing long-term trauma outcomes data collections. Could trauma outcomes be routinely monitored in New South Wales, Australia: piloting a 3 month follow-up? *Injury* 2012; 43:96–102.
- [178] O’Donnell S, Li LC, King J, et al. Development of a framework for reporting health service models for managing rheumatoid arthritis. *Clin Rheumatol* 2010;29:151–65.
- [179] Archana R, Heckman MG, O’Connor MI. Optimizing screening for osteoporosis in patients with fragility hip fracture. *Clin Orthop* 2011;469:1925–30.
- [180] Edwards BJ, Koval K, Bunta AD, et al. Addressing secondary prev osteoporos fracture care follow-up “own bone”. *J Bone Joint Surg Am* 2011;93:e87.
- [181] Department of Health (Western Australia). Results of the models of care survey. Perth: Health Networks Branch; 2012.
- \*[182] Briggs AM, Towler SCB, Speerin R, March LM. Models of care for musculoskeletal health in Australia: now more than ever to drive evidence into health policy and practice. *Aust Health Review* 2014. <http://dx.doi.org/10.1071/AH14032>.