

# The Lancet Series call to action to reduce low value care for low back pain: an update

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## 1. Introduction

The 2018 *Lancet* Low Back Pain Series, comprising 3 papers written by 31 authors from disparate disciplines and 12 different countries, raised unprecedented awareness of the rising global burden of low back pain partly attributable to poor quality health care.<sup>12,30,44</sup> Many people with low back pain get the wrong care, causing harm to millions across the world and wasting valuable health care resources. Based upon an up-to-date, evidence-based synthesis, the series described current guideline recommended care of low back pain, and new strategies that show promise, but require further testing, to reduce low value care. We also proposed a series of actions needed to reverse the alarming global rise in low back pain disability. A better understanding of low back pain in different cultures and changes to the way care for low back pain is delivered and the way clinicians are reimbursed are key to reversing this problem.

To reach all relevant stakeholders, we devised a well-planned and thorough media strategy to facilitate promotion of the series. This included not only *Lancet* staples such as a *Lancet* social media card, structured press release, and *Lancet* podcast distributed to about 2000 journalists but also email banners, country media focal points who could provide country-specific information, a set of global key messages that were modified for country-level use, a twitter hashtag of the series, #LowBackPain, and a schedule of suggested tweets to be used by authors over the 48 hours before and after the publication of the series. The series was also made free to download (see <https://www.thelancet.com/series/low-back-pain>). The success of this approach is evident by the unprecedented media coverage it received with all 3 articles achieving Altmetric scores in the 99th percentile. There was media

coverage in at least 17 countries including wall-to-wall coverage in the United Kingdom, Australia, and Denmark. Furthermore, interest in *The Lancet* Low Back Pain Series has persisted as evident by continued attention from major media outlets. For example, *The Economist* published an article entitled “Back pain is a massive problem which is badly treated” on 18 Jan 2020,<sup>17</sup> accompanied by a “Leader” (editorial opinion) on the topic.

This review, invited to coincide with a plenary at the 2020 World Congress on Pain, outlines and discusses some of the main messages from *The Lancet* Low Back Pain Series, with a focus on pertinent positive and negative developments since it was published.

## 2. Low back pain is still the number one cause of disability in the world

Low back pain is a common problem affecting all age groups from children to the elderly. While highly disabling in only a very small proportion of those affected, its high prevalence means that in 2015, low back pain was responsible for 60.1 million disability-adjusted life-years; a 54% increase since 1990, with the biggest increase seen in low-income and middle-income countries.<sup>44</sup> In the latest data from the Global Burden of Disease Project published in 2017, the global point prevalence of low back pain was 7.8%, meaning that 577 million people are affected at any one time.<sup>38,37</sup> Focusing on Africa, a 2018 systematic review (65 studies) found the lifetime, annual, and point prevalence of low back pain was 47% (95% confidence interval [CI] 37-58), 57% (95% CI 51-63) and 39% (95% CI 30-47), respectively, comparable or higher than what has been observed in population studies in high income countries.<sup>67</sup>

Low back pain remains the leading global cause of disability overall and in both males and females, accounting for 7.6% or 42.5 million years lived with disability across all age groups, topping the list of causes of disability in 126 of 195 countries and territories in 2017.<sup>38</sup> It is also very costly. For example, a recent study estimated that US\$134.5 billion was spent on health care for low back and neck pain in 2016 in the United States, the most out of 154 conditions studied, and this had increased by 6.7% annually between 1996 and 2016.<sup>25</sup>

As we outlined in the first article in *The Lancet* Series,<sup>44</sup> disability from low back pain is highest in working age groups worldwide. It is the commonest cause of medically certified sick leave and early retirement in Europe<sup>4</sup> and accounts for more lost workdays than any other musculoskeletal condition in the United States.<sup>57</sup> It also hampers productivity growth. For example, Schofield et al. demonstrated that back pain is the most common health condition forcing older Australians to retire involuntarily.<sup>75</sup> Both the development of disabling low back pain, as well as early retirement due to chronic symptoms, is overrepresented among people with lower socioeconomic status and education attainment,<sup>59,80</sup> The condition contributes to the cycle of poverty and

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social inequality. In Australia, regardless of labour force participation, those with back problems are more likely to be in income poverty compared to those without chronic health problems.<sup>76</sup> Compared to those with back problems who remain in the work force, those who are not working due to back problems are 90% more likely to be in income poverty.<sup>76</sup>

In poorer regions of the world, the contribution of disabling low back pain to the poverty cycle is worse because of the greater prevalence of informal employment, limited possibilities for job modification, absent or poorly monitored occupational musculoskeletal health policies, and the lack of social support systems. For example, in a study of 500 farmers in rural Nigeria, more than half had reduced their farming workload and one in 3 had been absent from work in the past year because of low back pain.<sup>28</sup> An ethnographic study of villagers in Botswana found that low back pain as well as other musculoskeletal symptoms results in both economic and subsistence consequences.<sup>64</sup>

For the vast majority of people with low back pain, it is currently not possible to accurately identify specific causes or nociceptive sources. Risk factors and triggers for episodes of nonspecific low back pain include previous episodes of back pain, the presence of other chronic conditions such as asthma, headache, and diabetes, poor mental health (including psychological distress and depression), genetic influences, as well as awkward postures, lifting, bending and heavy manual tasks, and being tired or being distracted during an activity.<sup>44</sup> Smoking, obesity, and low levels of physical activity, all related to poorer general health, are also associated with occurrence of low back pain episodes.<sup>77–93</sup>

Low back pain is a chronic condition with a variable course characterised by often recurrent but transient episodes of low back pain.<sup>44</sup> Across all categories of low back pain, there are multiple factors that can contribute to the persistence of disabling pain including genetic, biophysical, psychological, and social factors and coexisting comorbidities. Many of these prognostic factors are shared with other regional musculoskeletal conditions,<sup>41</sup> and co-occurrence of low back pain with pain at other sites is also common. How pain is processed, experienced, and understood has a central role in the development and maintenance of disabling pain.<sup>60</sup> Studies of Latino-American immigrants in the United States and of Australian Aboriginals also found that exposure to a more biomedical interpretation of low back pain increased disability by shifting previous beliefs that back pain is a benign and normal part of everyday life towards back pain being a medical condition that requires attention and treatment.<sup>13,62</sup>

### 3. Many patients with low back pain are still receiving the wrong care

A 2018 systematic review that included 14 studies mostly from the United States (6 studies), United Kingdom (3 studies), and other high-income countries found that overall more than 50% of people with low back pain seek care annually and 30% have sought care within the past month.<sup>5</sup> Proportions were similar irrespective of whether the study included workers or the general population, but rates did vary by setting, eg, 67% (95% CI 50–84) in the United States vs 48% (95% CI 33–63) in Europe. These data are very concerning as much of modern back pain care is ineffective and some care is harmful.

The surge in global low-value care for low back pain that includes presentations to emergency departments, liberal use of diagnostic imaging, opioids, spinal injections, and surgery has also led to skyrocketing medical and human costs. A 2012 study in a US Veterans Affairs Health Care facility found that 59% of outpatient lumbar spine scans were inappropriate.<sup>3</sup> This suggests that

unnecessary lumbar spine magnetic resonance imaging scans for people not suspected of having a serious condition cost \$US300 million per year in the United States. This is supported by a 2019 systematic review (14 studies) which found evidence that imaging is associated with higher medical costs, increased health care utilization and more work absence compared with nonimaged groups.<sup>61</sup> Despite little evidence to support its use for most back conditions,<sup>43</sup> and a 20% failure rate,<sup>91</sup> another US study estimated that \$US12.8 billion was spent on spinal fusion surgery in 2011, the highest aggregate hospital costs of any surgical procedure.<sup>92</sup>

As outlined in the second article in *The Lancet Series*, the global gap between evidence and practice relates to both overuse of low-value care as well as underuse of high-value care and is apparent across all income settings.<sup>30</sup> We highlighted the discordance between 10, highly consistent, international guideline recommendations and current clinical practice, by providing examples from both high-income and low-income or middle-income settings.

Although most is known about the size and nature of the evidence-practice gaps in high-income countries, and particularly in the United States due to a number of large robust studies, emerging evidence from low-income and middle-income countries indicates similar problems in these settings. A 2020 population study in Central Ethiopia (N = 1812) found that 30% (95% CI 27.9–33.2) of the population had sought health care for low back pain in the previous year.<sup>6</sup> Of these 77% were treated with injected medications. There was a strong relationship between educational level and receiving back pain treatment, with those with a degree more likely to receive treatment compared to people with no education (adjusted proportion ratio = 1.68 [95% CI 1.44–1.99]). Surprisingly and unexplained, health care use was higher in rural compared with urban populations (adjusted proportion ratio = 1.69 [95% CI 1.44–1.99]).

A 2019 systematic review (6 studies) found that management pathways in African countries typically favour treatment approaches with ineffective passive treatment modalities.<sup>1</sup> The authors identify a need for culturally sensitive and context-specific biopsychosocial interventions. A 2020 survey of physiotherapists in Nigeria found that although 79% were aware of clinical practice guidelines for treatment of low back pain, just 28% reported adhering to these when treating people with low back pain.<sup>2</sup> A 2018 qualitative study of unconventional healers in rural Nigeria found that passive treatments linked to a spiritual or biomedical understanding were typically advised.<sup>51</sup> At the other end of the health care spectrum, invasive non-evidence-based treatments, such as sacroiliac joint injections, are being offered to some people with low back pain in Ghana.<sup>81</sup>

Major international clinical guidelines have moved away from medicalized management of low back pain and prioritized non-pharmacological approaches as first line care.<sup>82,83</sup> However, a recent consensus statement for the assessment and management of chronic nonspecific low back pain by the Chinese Association for the Study of Pain recommended pharmacological therapy as first-line treatment and continue to recommend medicines and interventional therapies that have either been proven to be ineffective and where harms may outweigh benefits, or are of unknown efficacy.<sup>63</sup> With increasing development and improved educational attainment in low-income and middle-income countries, there is a real risk that there will be massive increases in inappropriate care for low back pain and increased disability.

#### 3.1. Opioids and gabapentinoids

We highlighted in *The Lancet Series* one of the most disastrous examples of harmful medical care for low back pain—prescription

opioids. We identified extreme overuse in some (eg, United States) but not all (eg, Japan) high-income countries, but lower income countries appeared to have very low rates of use.<sup>30</sup> Now, a Los Angeles Times investigation has revealed that aggressive marketing appears to be leading to new epidemics of opioid prescribing in low-income and middle-income countries.<sup>73</sup> There is also evidence of illicit trade, particularly of the drug tramadol in Africa.<sup>86</sup> For example, in Egypt, about 100,000 people are addicted to opioids, with half of them using tramadol, while two-thirds of people treated for addiction in Egypt's state institutions are addicted to Tramadol.<sup>86</sup>

We also now have more evidence that adding opioids to a nonsteroidal anti-inflammatory drug does not improve outcomes for people with low back pain. This was most convincingly demonstrated in a series of trials by Friedman et al examining patients presenting to the emergency department with low back pain.<sup>31,32,34,33</sup> The SPACE trial also showed that an opioid strategy was not more effective than a nonopioid strategy in patients with chronic low back pain (or moderate to severe pain from knee or hip osteoarthritis), while it was also more likely to cause adverse events.<sup>58</sup>

Although the high rates of opioid prescribing are now beginning to fall in some high-income countries such as the United States<sup>74</sup> and the United Kingdom,<sup>22</sup> worryingly, opioid medication is being substituted for or used with gabapentinoids.<sup>40</sup> In England, the number of prescriptions for gabapentin and pregabalin were 30% and 56% more, respectively, in the 12 months to December 2019 than the 12 months to December 2015.<sup>73</sup> In one study of 251 patients referred to a pain service in the Northeast of England, 82.5% were taking an opioid, over half of whom (56.2%) were also on gabapentinoids, while 16% of those on dual therapy were on high doses of both drugs.<sup>71</sup> Not only does the evidence not support use of gabapentinoids for nonspecific low back pain (or sciatica),<sup>27</sup> studies in both Canada and Australia have reported an increased number of overdose deaths associated with dual opioid and gabapentinoid use.<sup>14,39</sup>

This increase in prescribing may be driven by a perception that these are nonaddictive drugs with some authors articulating the view that gabapentinoids are rarely addictive in the general population.<sup>7,35</sup> This is reminiscent of the genesis of the US opioid-prescribing epidemic where Ronald Melzack in an article in the *Scientific American* entitled "The Tragedy of Needless Pain" asserted that it was rare to see addiction in people using opioids for chronic pain based on very limited data.<sup>65</sup> The World Health Organization recently rescinded 2 guidelines relating to opioid use, now conceding that they had been influenced by industry.<sup>69</sup>

### **3.2. Newly accepted but unproven therapies for low back pain: medicinal cannabis and regenerative medicine**

In many high-income countries, there has been an increased acceptance of the use of medicinal cannabinoid preparations. It is now possible to obtain these on prescription in some jurisdictions. UK National Institute for Health and Social Care Excellence did not find any randomised controlled trials of cannabinoids to treat low back pain and advised against their use for chronic pain in adults.<sup>68</sup> Nevertheless, the Centre for Medical Cannabis, an industry membership body based in the United Kingdom, produced a report in 2019 asserting there was evidence that several cannabis products had a beneficial effect for pain.<sup>70</sup> However, another report from the same body asserted that "*The best evidence now available confirms that pure CBD is not addictive, is well tolerated by the human body and presents no health risks from sustained use.*"<sup>36</sup>

Studies already report concomitant use of recreational cannabis and opioids among people with chronic noncancer pain.<sup>15,20</sup> A four-year prospective observational study found cannabis users had greater pain and lower self-efficacy in managing pain, and there was no evidence it reduced pain severity or interference or exerted an opioid-sparing effect.<sup>15</sup> There is therefore an urgent need to address politician and public misconceptions about cannabinoids and preventive action to limit the same aggressive marketing approaches for medicinal cannabinoids that enabled the opioid epidemic; a new prescribing epidemic may be imminent.

Regenerative medicines such as autologous platelet-rich plasma or stem cell injections into degenerated lumbar discs or facet joints aims to help discs and/or joints regenerate. However, there is only a weak relationship between radiological change and the presence/absence of low back pain (eg, disc degeneration is present in 54% of those symptomatic with low back pain and 34% of those who are symptom free<sup>11</sup>), which means that even if these products successfully produce regeneration they are unlikely to affect low back pain for most people. A 2019 systematic review of regenerative studies identified 9 studies reporting on clinical outcomes from autologous biologic treatments for low back pain.<sup>88</sup> However, these were heterogenous in terms of both patient group and intervention, and only one randomised controlled trial (n = 58) was found. The trial authors reported small benefits of intradiscal platelet-rich plasma over 8 weeks with no long-term follow-up.<sup>85</sup> The current evidence base is therefore insufficient to support the use of autologous biological products for people with low back pain.

### **3.3. Novel new therapies or treatment approaches**

Recent trials of novel therapies such as basivertebral nerve ablation<sup>29</sup> and sacroiliac joint fusion<sup>72</sup> have been published, but it is similarly premature to endorse these therapies. Not only are independent replication trials lacking, the original trials had major concerns. For example, the basivertebral nerve ablation trial failed to meet 2 of its 3 prespecified outcomes and did not report on the third.<sup>29</sup> Nonetheless, the authors concluded that the therapy had "*sustained clinical benefits,*" which points to inadequate peer review and lack of editorial oversight. Although the randomised controlled trial of sacroiliac joint fusion showed results favouring fusion over nonoperative care,<sup>72</sup> the absence of a placebo control and lack of participant blinding may explain the observed benefit.

Recently published replication trials have also failed to confirm the promising results of the initial trials of novel therapies such as antibiotics as treatment of low back pain in people with Modic changes<sup>9</sup> and intradiscal methyl blue injections as treatment of persistent low back pain of presumed intradiscal origin.<sup>54</sup> Similarly, the Matching Appropriate Treatments to Consumer Healthcare needs trial,<sup>18</sup> which tested risk-stratification based upon physical and psychosocial obstacles to recovery combined with physical therapist training, also failed to replicate the positive findings observed in the initial UK STarT Back trial.<sup>46</sup> This reconfirms the importance of replication trials conducted in the same and different health care settings. A barrier is that funding agencies often do not see replication trials as a high priority and so obtaining funding can be challenging.

There has been aggressive promotion of "neuropathic" low back pain as a subtype of nonspecific low back pain; however, the validity of the most commonly used instrument to "diagnose" neuropathic pain, "pain DETECT," has been found to be questionable.<sup>45</sup> In addition, there is now greater certainty that antiepileptic medicines are not effective for low back pain but are associated with significant harms.<sup>14,21,27</sup>

Intensive pain neuroscience education is popular, particularly among physiotherapists, but a recent high-quality trial showed it was no more effective than sham education in patients already receiving standard first-line care (advice to stay active, avoid bed rest, option of spinal manipulation, and/or simple analgesics).<sup>84</sup>

#### 4. Much of the money spent on low back pain is wasted, and better system level and policy solutions are needed

Not enough is yet being done on a global scale to address the rising burden of low back pain. The impact and burden of noncommunicable diseases now far outweigh that of communicable, maternal, neonatal, and nutritional in most countries.<sup>38,37</sup> Yet, when describing integrated strategies for prevention and management of noncommunicable diseases, only half of Organisation for Economic Co-operation and Development member states mention musculoskeletal health and low back pain, despite those being the most burdensome noncommunicable diseases.<sup>10</sup>

*The Lancet Series* identified promising solutions that included focused implementation of best practice, the redesign of clinical pathways, integrated health and occupational care, changes to payment systems and legislation, and public health and prevention strategies.<sup>30</sup> Yet, we also indicated that most were not yet ready for widespread implementation as the evidence underpinning them was inadequate.

Targeted efforts to reduce overuse of imaging for low back pain, a major source of healthcare waste and even iatrogenesis, have not met with much success to date.<sup>26,52</sup> Lowering imaging rates is challenging, and strategies must be targeted towards the population/patients, clinicians, and health care administrators. Patients request imaging expecting to obtain a diagnosis for their pain<sup>19</sup>; clinicians order imaging because of entrenched beliefs and habits, perceived pressure from patients, fear of litigation and financial incentives<sup>42,47</sup>; and health systems continue to offer liberal access to imaging probably because of public demand and pressure from clinicians.

Global initiatives to decrease health care waste and iatrogenesis such as Choosing Wisely are therefore specifically targeting imaging for low back pain<sup>5</sup>; however, large-scale impact of these initiatives have not yet been well documented.<sup>48</sup> A 2019 times-series analysis of a national strategy designed to reduce general practitioner requests for X-rays and computed tomography (CT) scans that was implemented by the Australian National Prescribing Service in 2013 reported a 11% relative reduction in lumbar spine CT scans over that year, equating to a cost reduction to the government of AUD\$11,600,898.<sup>66</sup> Based upon an estimated cost of the program which was delivered to almost 20,000 general practitioners (60% of all registered general practitioners in Australia), the program cost \$AUD2.82 per CT scan averted. No effects on X-ray requests were observed, and it is not known whether or not there was any substitution of CT scans by medical specialist referral for magnetic resonance imaging.

Programs consisting of guideline-based strategies to promote better clinical management and self-management for people with back pain have emerged. In New Zealand, a cluster randomised controlled trial found that a strategy that empowers general practitioners to provide evidence-based education and advice and prioritise early identification and management of barrier to recovery (the Fear Reduction Exercised Early approach) did not improve patient recovery outcomes compared with usual care.<sup>23</sup> However, it did improve general practitioner concordance with low back pain recommendations, and further trials are needed to

determine whether or not it might reduce unnecessary health care use, increase work participation, and produce economic benefits. A controlled before-after study of a spine care pathway that incorporated conservative spine care recommendations introduced in one primary care practice (with 11 primary care physicians) but not another (with 74 primary care physicians) reported a reduction in health care expenditure, mostly attributable to reduced spine surgery costs.<sup>90</sup> Opioid utilization was also reduced while manual care costs were increased.

Recent attempts have been made to provide instruction on best-practice implementation based upon theoretical frameworks underpinned by evidence for components in the programs.<sup>49,55,56</sup> For example, in Ireland, the SOLAS project demonstrated that training physiotherapists in delivering a group-based intervention consisting of information and exercises to people seeking care for persistent back pain was feasible using a mixture of face-to-face meetings and an e-learning program in a pre-post study,<sup>50</sup> providing support for a definitive trial. In Denmark, the GLA:D Back program consisting of a structured patient education and exercise intervention was found to be feasible to implement,<sup>55,56</sup> and outcomes are being monitored through a clinical registry in a hybrid effectiveness-implementation study.<sup>57</sup> Although there is no evidence yet that these approaches are superior to current usual care, they are being tested on the basis that underutilization of education and exercise may be partially explained by clinicians and/or administrators being uncertain about how to implement these strategies in their practice and/or health systems.

Several studies have evaluated alternate clinical pathways for low back pain and other musculoskeletal complaints such as physiotherapist-led direct referrals or screening and management of patients on orthopaedic waiting lists. Although the results have been favourable with respect to reduced waiting times and patient and referrer satisfaction with the care provided, there is still insufficient evidence from high quality studies that they are cost-effective and/or cost-saving compared with usual care.<sup>24,69</sup>

Sixty-six experts representing 24 countries formed the Global Spine Care Initiative to formulate principles for delivery of evidence-based care for spine pain and disability globally.<sup>53</sup> The model includes a classification system and care-pathway and outlines steps for implementation. Funding is currently being sought for implementation studies that can evaluate the feasibility and impact of this model in high-, middle-, and low-income countries. In view of the evidence that acculturation to biomedically focused views run the risk of iatrogenesis through overmedicalisation of low back pain, it will be particularly important to determine the suitability of the model in low-income and middle-income settings and the involvement of local experts and communities will be crucial.

#### 5. Maintaining the momentum of the call for action

The final paper of *The Lancet Low Back Pain Series* proposed a set of actions to meet the major global challenge of disabling low back pain. We emphasized the need to stop harmful practices while ensuring access to effective and affordable health care for all. Ten proposed actions to meet these needs are outlined in **Table 1**. Of the many actions we proposed, these were the ones that emerged as the most pressing during our many presentations and subsequent discussions of the Series. Taking action is also likely to reduce the overall burden of musculoskeletal conditions beyond that solely attributable to low back pain due to the many shared commonalities in biopsychosocial risk profiles for pain and disability.<sup>16</sup> Conversely, targeting low back pain alone may have limited impact on overall health for the same reasons.

**Table 1****Ten proposed actions to improve care for low back pain.**

Health care funders should stop paying for ineffective and harmful tests and treatments, and commission research on those that are unproven
New tests and treatments should not be marketed, introduced into practice, or publicly reimbursed, before they have been adequately tested for safety, efficacy, and cost-effectiveness
Health and social services should work with employers to provide support that stimulates early return to work, and work conditions that are adapted to employee capacity
Patients should be taught to self-manage low back pain and seek care only when really needed
Widespread and inaccurate beliefs about low back pain in the population and among health professionals should be challenged, and a focus put on reducing the impact of low back pain on people's lives rather than seeking medical treatment for a "cure"
Clinical pathways, care plans, and other standardized tools for managing low back pain should be redesigned to integrate with health and occupational care but only after establishing their comparative effectiveness and cost-effectiveness
Payments systems and legislation should be changed to encourage delivery of the right care
The World Health Organization should support new public policies and urgent political action to ensure strategies are put in place to reduce global disability from low back pain as a priority
Research and funding bodies should invest in an intensified research effort to address gaps in the understanding of low back pain, as well as implementation research to determine how best to put existing knowledge and evidence to use
Journals and the media should have greater editorial and peer reviewer oversight to ensure that trial results are accurately portrayed and do not reflect unwarranted belief in the efficacy of new (or established but unproven) therapies

An open meeting of *The Lancet Series* authors and others was held in conjunction with the XVIth International Forum for Back and Neck Pain Research in Primary Care in Quebec City, Canada, in July 2019. We invited attendees to provide information about any media including social media activity and/or any health policy activity or initiatives (if any) they were aware of in their countries following publication of the Series. Small group discussions focused on ways to keep up the momentum generated by the series to reduce the burden of low back pain on a global scale and research priorities. A summary of ideas is being prepared as a separate publication.

A separate workshop at the Forum aimed to reach consensus on a plan to develop an internationally agreed minimal national data set that could be universally applied, to monitor status and changes in health care and health outcomes for people with low back pain. To understand what is currently being collected at a global national level, a scoping review of routinely collected national low back pain-specific indicators is underway.

## 6. Summary

*The Lancet Low Back Pain Series* outlined a way forward to address the increasing and costly effects of disabling low back pain. As a starting point, it garnered enormous media attention and continues to do so, but attention should now be directed towards engaging with consumers and patients, policy makers, clinicians, and researchers to identify and implement effective solutions. While effecting solutions will take time, measuring and benchmarking our progress in different countries will be crucial to these efforts.

## Conflict of interest statement

R. Buchbinder is chief investigator or coinvestigator on multiple previous and current research grants from government agencies and charities in Australia and internationally. She has received travel expenses for speaking at conferences from the professional organisations hosting the conferences. She is an investigator on the SHaPED trial which received heat wraps at no cost from Flexeze. M. Underwood is chief investigator or coinvestigator on multiple previous and current research grants from the UK National Institute for Health Research, Arthritis

Research UK, and is a coinvestigator on grants funded by the Australian NHMRC. He is an NIHR Senior Investigator. He has received travel expenses for speaking at conferences from the professional organisations hosting the conferences. He is a director and shareholder of Clinvivo Ltd that provides electronic data collection for health services research. He is part of an academic partnership with Serco Ltd, funded by the European Social Fund, related to return to work initiatives. He is a co-investigator on 2 NIHR-funded studies receiving support in kind from Stryker Ltd. He has accepted honoraria for teaching/lecturing from consortium for advanced research training in Africa. Until March 2020, he was an editor of the NIHR journal series, and a member of the NIHR Journal Editors Group, for which he received a fee. J. Hartvigsen is chief investigator or coinvestigator on multiple previous and current research grants from government research agencies and charities in Denmark and internationally. His travel expenses have been covered when he has been invited speaker at conferences and he has received honoraria for talks, reviewing of grants and theses. C. Maher is chief investigator or coinvestigator on multiple previous and current research grants from government agencies and charities in Australia and internationally. He has received travel expenses for speaking at conferences from the professional organisations hosting the conferences. He is an investigator on the SHaPED trial which received heat wraps at no cost from Flexeze.

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