Prevention and treatment of low back pain: evidence, challenges, and promising directions

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Many clinical practice guidelines recommend similar approaches for the assessment and management of low back pain. Recommendations include use of a biopsychosocial framework to guide management with initial non-pharmacological treatment, including education that supports self-management and resumption of normal activities and exercise, and psychological programmes for those with persistent symptoms. Guidelines recommend prudent use of medication, imaging, and surgery. The recommendations are based on trials almost exclusively from high-income countries, focused mainly on treatments rather than prevention, with limited data for cost-effectiveness. However, globally, gaps between evidence and practice exist, with limited use of recommended first-line treatments and inappropriate high use of imaging, rest, opioids, spinal injections, and surgery. Doing more of the same will not reduce back-related disability or its long-term consequences. The advances with the greatest potential are arguably those that align practice with the evidence, reduce the focus on spinal abnormalities, and ensure promotion of activity and function, including work participation. We have identified effective, promising, or emerging solutions that could offer new directions, but that need greater attention and further research to determine if they are appropriate for large-scale implementation. These potential solutions include focused strategies to implement best practice, the redesign of clinical pathways, integrated health and occupational interventions to reduce work disability, changes in compensation and disability claims policies, and public health and prevention strategies.

Introduction

Despite the plethora of treatments and health-care resources devoted to low back pain, back-related disability and population burden have increased.1,2 The first paper3 in this Series describes the global burden and effect of low back pain and provides an overview of the causes and course of low back pain. In this Series paper, we summarise the evidence for effectiveness of interventions for the prevention and treatment of low back pain and the recommendations from best practice guidelines. Despite generally consistent guideline recommendations around the world, clear evidence exists of substantial gaps between evidence and practice that are pervasive in low-income, middle-income, and high-income countries. Different response strategies are needed that prevent and minimise disability and promote participation in physical and social activities. Here we highlight examples of effective, promising, or emerging solutions from around the world and make recommendations to strengthen the evidence base for them.

Prevention

By contrast with the large number of trials that assess treatments for low back pain, evidence about prevention, particularly primary prevention, is inadequate (table 1). Most of the widely promoted interventions to prevent low back pain (eg, work-place education, no-lift policies, ergonomic furniture, mattresses, back belts, lifting devices) do not have a firm evidence base. A 2014 systematic review4 analysed only 11 randomised controlled trials with 2700 children (one in a low-middle-income country [Brazil]). The authors of the review in adults concluded that moderate quality evidence existed that exercise alone, or in combination with education, is effective for prevention; and poor to very-poor quality evidence existed that education alone, back belts, shoe insoles, and ergonomic programmes might not be effective.5 The preventive effect of exercise and education was large, with a pooled relative risk of 0·55 (95% CI 0·41–0·74); however, the trials were mainly of secondary prevention and the effective programmes were quite intensive (eg, 20 1-hour sessions of supervised exercise in one trial).6 The authors of the review in children concluded that moderate quality evidence existed that education is not effective and very low quality evidence existed that...
ergonomically designed furniture could prevent low back pain compared with conventional furniture.1

## Treatment

Low back pain without a known cause is referred to as non-specific low back pain and guidelines2–4 recommend use of a biopsychosocial model to inform assessment and management in view of associations between behavioural, psychological, and social factors and the future persistence of pain and disability. Guidelines also recommend that laboratory tests and imaging should not be routinely used as part of early management, but rather reserved for patients for whom the result is likely to change management (eg, if a serious condition, such as infection, is suspected).

During the past three decades, changes have been made to key recommendations in national clinical practice guidelines. Greater emphasis is now placed on self-management, physical and psychological therapies, and some forms of complementary medicine, and less emphasis on pharmacological and surgical treatments. Guidelines encourage active treatments that address psychosocial factors and focus on improvement in function. The changed understanding of how best to manage low back pain is shown in three current guidelines, from Denmark,6 the USA,7 and the UK.8 The reduced emphasis on pharmacological care is shown by the US guideline,7 which recommends non-pharmacological care as the first treatment option and reserves pharmacological care for patients for whom non-pharmacological care has not worked. These guidelines endorse the use of exercise (Danish, US, and UK guidelines) and a range of other non-pharmacological therapies, alone and in combination, such as massage (US and UK), acupuncture (US), spinal manipulation (Danish, US, and UK), Tai Chi (US), and yoga (US).

Table 2 summarises the key recommendations of the three clinical guidelines for the management of low back pain and radicular pain,4,9 separated by duration of symptoms when information is available. Consistent recommendations for early management are that individuals should be provided with advice and education about the nature of low back pain and radicular pain; reassurance that they do not have a serious disease and that symptoms will improve over time; and encouragement to avoid bed rest, stay active, and continue with usual activities, including work.4 Early supervised exercise therapy is typically unnecessary;9 however, it can be considered if recovery is slow or for patients with risk factors for persistent disabling pain.9 For acute radiculopathy without severe or progressive motor weakness, data are insufficient to suggest that initial management should differ from that of acute non-specific low back pain.9

Recommended physical treatments, particularly for persistent low back pain (>12 weeks duration), include a graded activity or exercise programme that targets improvements in function and prevention of worsening disability. Since evidence showing that one form of exercise is better than another is not available, guidelines recommend exercise programmes that take individual needs, preferences, and capabilities into account in deciding about the type of exercise. Some guidelines do not recommend passive therapies, such as spinal manipulation or mobilisation, massage, and acupuncture, some consider them optional, and others suggest a short course for patients who do not respond to other treatment.10 Other passive electrical or physical modalities, such as ultrasound, transcutaneous electrical nerve stimulation,

### Table 1: Evidence of prevention strategies for low back pain: conclusions on effectiveness (and GRADE strength of evidence ratings) from systematic reviews

<table>
<thead>
<tr>
<th>Prevention Strategy</th>
<th>Effect in Adults</th>
<th>Effect in Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise and education</td>
<td>Effective (moderate quality)</td>
<td>No trials available</td>
</tr>
<tr>
<td>Exercise</td>
<td>Effective (low quality)</td>
<td>No trials available</td>
</tr>
<tr>
<td>Education</td>
<td>Ineffective (moderate quality)</td>
<td>Ineffective (moderate quality)</td>
</tr>
<tr>
<td>Back belt</td>
<td>Ineffective (very low quality)</td>
<td>No trials available</td>
</tr>
<tr>
<td>Shoe insoles</td>
<td>Ineffective (low quality)</td>
<td>No trials available</td>
</tr>
<tr>
<td>Ergonomic interventions at workplace</td>
<td>Ineffective (moderate quality)</td>
<td>No trials available</td>
</tr>
<tr>
<td>Ergonomic school furniture</td>
<td>NA</td>
<td>Effective (very low quality)</td>
</tr>
</tbody>
</table>

NA—not applicable; 1—both adults and children; 2—children only.
traction, interventional therapy, short-wave diathermy, and back supports are generally ineffective and not recommended.14

Guidelines also recommend consideration of psychological therapies—eg, cognitive behavioural therapy, progressive relaxation, and mindfulness-based stress reduction—and combined packages of physical and psychological treatment, for those with persistent low back pain or radicular pain who have not responded to previous treatments.6–8 For patients who have not responded to first-line treatments, and who are substantially functionally disabled by pain, multidisciplinary rehabilitation programmes with coordinated delivery of supervised exercise therapy, cognitive behavioural therapy, and medication are more effective than standard treatments.5–8

Guidelines now recommend pharmacological treatment only following an inadequate response to first-line non-pharmacological interventions. Paracetamol was once the recommended first-line medicine for low back pain; however, evidence of absence of effectiveness in acute low back pain and potential for harm has led to recommendations against its use.14 Health professionals are guided to consider oral non-steroidal anti-inflammatory drugs (NSAIDs), taking into account risks, including gastrointestinal, liver, and cardiorenal toxicity, and if using, to prescribe the lowest effective dose for the shortest possible time.6 Routine use of opioids is not recommended, since benefits are small and substantial risks exist, including overdose and addiction potential, and poorer long-term outcomes than without use.6,10 Guidelines caution that opioid therapy should be used only in carefully selected patients, for a short duration,6,10 and with appropriate monitoring. The role of gabapentin drugs, such as pregabalin, is now being reconsidered after a 2017 trial showed pregabalin to be ineffective for radicular pain.11 Guidelines generally suggest consideration of muscle relaxants for short-term use, although further research is recommended.6

The role of interventional therapies and surgery is limited and recommendations in clinical guidelines vary. Recent guidelines6–8 do not recommend spinal epidural injections or facet joint injections for low back pain but do recommend consideration of epidural injections of local anaesthetic and steroid for severe radicular pain.15 Epidural injections are associated with small short-term (<4 weeks) reductions in pain, do not seem to provide long-term benefits or reduce the long-term risk of surgery,15,16 and have been associated with rare but serious adverse events, including loss of vision, stroke, paralysis, and death.16 The UK guideline5 suggests consideration of radiofrequency denervation for chronic low back pain that is unresponsive to non-surgical treatments; however, the subsequently published MINT trials17 challenge this recommendation.

The benefits of spinal fusion surgery for non-radicular low back pain thought to originate from degenerated lumbar discs (known as discogenic) are similar to those of intensive multidisciplinary rehabilitation and only modestly greater than standard non-surgical management.18 Surgery is also more costly and carries a greater risk of adverse events than non-surgical management. The UK guidelines recommend that patients are not

| Table 2: Overview of interventions endorsed for non-specific low back pain in evidence-based clinical practice guidelines (Danish,1, US,5, and UK6 guidelines) |
|---|---|---|
| **Education and self-care** | Acute low back pain (<6 weeks) | Persistent low back pain (>12 weeks) |
| Advice to remain active | First-line treatment, consider for routine use | First-line treatment, consider for routine use |
| Education | First-line treatment, consider for routine use | First-line treatment, consider for routine use |
| Superficial heat | Second-line or adjunctive treatment option | Insufficient evidence |
| **Non-pharmacological therapy** | | |
| Exercise therapy | Limited use in selected patients | First-line treatment, consider for routine use |
| Cognitive behavioural therapy | Limited use in selected patients | First-line treatment, consider for routine use |
| Spinal manipulation | Second-line or adjunctive treatment option | Second-line or adjunctive treatment option |
| Massage | Second-line or adjunctive treatment option | Second-line or adjunctive treatment option |
| Acupuncture | Second-line or adjunctive treatment option | Second-line or adjunctive treatment option |
| Yoga | Insufficient evidence | Second-line or adjunctive treatment option |
| Mindfulness-based stress reduction | Insufficient evidence | Second-line or adjunctive treatment option |
| Interdisciplinary rehabilitation | Insufficient evidence | Second-line or adjunctive treatment option |
| **Pharmacological therapy** | | |
| Paracetamol | Not recommended | Not recommended |
| Non-steroidal anti-inflammatory drugs | Second-line or adjunctive treatment option | Second-line or adjunctive treatment option |
| Skeletal muscle relaxants | Limited use in selected patients | Insufficient evidence |
| Selective norepinephrine reuptake inhibitors | Insufficient evidence | Second-line or adjunctive treatment option |
| Antiseizure medications | Insufficient evidence | Role uncertain |
| Opioids | Limited use in selected patients, use with caution | Limited use in selected patients, use with caution |
| Systemic glucocorticoids | Not recommended | Not recommended |
| **Interventional therapies** | | |
| Epidural glucocorticoid injection (for herniated disc with radiculopathy) | Not recommended | Limited use in selected patients |
| **Surgery** | | |
| Discectomy (for herniated disc with radiculopathy) | Insufficient evidence | Second-line or adjunctive treatment option |
| Luminecctomy (for symptomatic spinal stenosis) | Insufficient evidence | Second-line or adjunctive treatment option |
| Spinal fusion (for non-radicular low back pain with degenerative disc findings) | Insufficient evidence | Role uncertain |

Subacute low back pain is a transition period between acute and chronic low back pain; evidence on optimal therapies for subacute low back pain is scarce but a reasonable approach is to shift towards therapies recommended for chronic low back pain.
offered disc replacement or spinal fusion surgery for low back pain, and instead recommend offering fusion surgery only as part of a randomised trial. Patients with severe or progressive neurological deficits require surgical referral. Spinal decompression surgery can be considered for radicular pain when non-surgical treatments have been unsuccessful and clinical and imaging findings indicate association of symptoms with herniated discs or spinal stenosis. For a herniated disc, early surgery is associated with faster relief of radiculopathy than with initial conservative treatment with the option of delayed surgery, but benefits diminish with longer (>1 year) follow-up. For symptoms associated with lumbar spinal stenosis, benefits of surgery over conservative care are not clear but some beneficial effects have been shown. However, patients tend to improve with or without surgery and, therefore, non-surgical management is an appropriate option for patients who wish to defer or avoid surgery.

The evidence underpinning low back pain guidelines is drawn almost exclusively from clinical trials of adults. A 2014 systematic review found only four paediatric trials, so great uncertainty exists about the treatment of back pain in children. The trial evidence is also mainly from high-income countries and, therefore, whether these guideline recommendations are appropriate for low-income and middle-income countries is not known. Guidelines developed in low-income and middle-income countries (eg, Philippines, Brazil) provide near identical recommendations to those in high-income countries. Factors such as cultural acceptability of treatments, patient attitudes towards and adherence to treatment, and treatment providers could vary systematically between countries and influence treatment outcomes. Furthermore, in some countries access to some treatments endorsed in guidelines is poor or non-existent.

The global gap between evidence and practice

Despite multiple clinical guidelines providing similar recommendations for managing low back pain, a substantial gap between evidence and practice exists worldwide in high-income as well as low-income and middle-income countries. Problems include both overuse of low-value care and underuse of high-value care. Panel 1 shows studies of clinical practice and highlights the disparity between ten guideline recommendations and the reality of current health care. Tremendous opportunity exists to improve health-care outcomes and potentially reduce costs by effectively implementing known best practice recommendations.

In high-income countries, guidelines recommend education and advice to keep active and at work; yet, data from Australia and Qatar show that such advice is provided only in a few consultations. By contrast with the guideline message that first-line care should be non-pharmacological, a study from the USA showed that only about half of people with chronic low back pain are prescribed exercise. In Australian primary care and in the emergency department setting in Canada, the most common treatment is prescribed medication. Although physical therapists are in an excellent position to provide exercise advice, surveys from Sweden, the USA, and Australia show high rates of use of electrical modalities, which the evidence shows are ineffective.

Despite the guideline message that low back pain should be managed in primary care, since few cases constitute medical emergencies, studies from France, Australia, Italy, and the USA show that patients often present to the emergency department. Although imaging has a very limited role, imaging rates are high; 39% of patients with low back pain are referred for imaging by general practitioners in Norway, 54% in the USA, and 56% in Italy. Although guidelines discourage the use of opioids, they are widely used in many high-income countries, especially in, but not limited to, North America. Although data for effects of opioids for acute low back pain are sparse, one study showed that they were prescribed for around 60% of emergency department presentations for low back pain in the USA. More than half the total number of people taking opioids long-term have low back pain, although no randomised controlled trial evidence is available about long-term effects. Surgery has, at best, a very limited role for low back pain, but studies from the USA, Australia, and the Netherlands show frequent use of spinal fusion. Interventional procedures are also overused, with studies showing 990 lumbar or sacral facet neurotomy procedures funded by Medicare in the USA in 2011.

The waste of health-care resources is an obvious consequence of overuse, but implications for patients also exist. The most obvious consequence of unnecessary lumbar imaging is exposure to radiation, but studies also suggest that more liberal use of imaging triggers additional medical care (eg, additional testing, specialist referral, surgery, and interventional procedures) and increases the risk of adverse outcomes, such as absence from work. The most disturbing risks related to use of opioids are addiction, overdose, and death. In the USA, prescription opioid-related deaths were around 15000 in 2015. The growing use of complex fusion procedures in patients older than 60 years undergoing decompressive surgery for spinal stenosis is concerning, since fusion operations are three times more expensive than decompression alone, and have double the rates of wound complications, cardiopulmonary complications (such as stroke), and 30-day mortality. Importantly, trials have clarified that adding fusion to decompressive surgery for symptomatic spinal stenosis does not improve outcomes.

Even in high-income countries, access to best practice can be constrained by availability (eg, in rural and remote regions), payment models (eg, health-care systems’
coverage of medication and surgery, but not physical and psychological treatments), and patients’ uncertainty about when or where to seek care. A systematic review of 21 studies from 12 countries, four of which were medium-income (Cambodia, Cameroon, Barbados, Brazil), and eight high-income (Australia, Canada, Greece, Italy, France, Spain, the USA, and the UK) showed that many people go straight to emergency departments for their low back pain. The authors estimated the prevalence of low back pain in the emergency department setting to be 4.39% (95% CI 3.67–5.18), similar to that of shortness of breath and fever and chills. Many high-income countries, such as Australia and Canada, have culturally diverse populations with both an indigenous population and a large migrant population. The guideline-recommended treatments present real challenges in these diverse populations; for example, delivery of cognitive behavioural therapy or mindfulness-based stress reduction could be challenging if the therapist does not speak the same language as the patient, or does not appreciate the various ways low back pain could be conceptualised in different cultural groups.

For low-income and middle-income countries, although much less published evidence is available about current practice for low back pain, available data show that gaps between evidence and practice are also apparent in these countries (panel 1). For example, in Cambodia, Brazil, and Argentina, it is not uncommon for people with low back pain to present to the emergency department and then stay in hospital for several days. The previously mentioned systematic review of low back pain in the emergency department showed that middle-income countries have prevalences that are similar to those in high-income countries (eg, Cambodia 5.6%, Italy 4.9%). In Iran, most people with low back pain consult with specialists (eg, an orthopaedic surgeon, neurosurgeon, or rheumatologist) in view of the paucity of patient referral systems from general practice. A South African study showed that 90% of patients with low back pain seen in primary care received pain medicines as the only form of treatment. Imaging rates for low back pain also seem to be inappropriately high in several low-income and middle-income countries, including India, China, Iran, Brazil, and Russia, and although the availability of published data is limited, those that are available (from Brazil) suggest large increases in spinal surgery costs over the past 20 years.

The paucity of comparative data makes comparisons of treatment challenging. However, the examples in panel 1 seem to suggest greater use of advice to rest and of passive electrical modalities in low-income and middle-income countries. In all countries, access to structured exercise programmes is variable, and poor access to cognitive behavioural therapy and multidisciplinary rehabilitation programmes remains a barrier to widespread use. Clear evidence exists of lower consumption of opioids in low-income and middle-income countries than in high-income countries; but examples exist of high-income countries (eg, Japan) that have very low rates of opioid use, so the high consumption in countries such as the USA and Canada is not fully explained by the countries’ wealth. The above information shows that many of the mistakes of high-income countries are already well established in low-income and middle-income countries. Initiatives are urgently needed that both reduce low-value health care for low back pain and help health-care professionals, patients, and policy makers make decisions more in line with best available evidence. The following section provides examples of effective, promising, and emerging directions.

Promising directions
Examples of effective, promising, and emerging solutions that target health care, public health, or both, are summarised in table 3. We particularly searched for examples from low-income and middle-income countries but found very few assessments of solutions within these countries that suggest they might offer helpful alternatives to current care. More data are urgently needed about effective and affordable strategies for prevention and management of low back pain in such countries. In these settings, strategies probably need to be integrated with other musculoskeletal and non-communicable disease initiatives to ensure maximum benefit from available resources. The examples in table 3 are mainly drawn from high-income countries, and for each we have added a judgment about the amount of evidence, which shows that many are still understudied or are confined to single, often observational, studies. Even those judged to be effective have underpinning evidence for effectiveness from only one country, and many were the focus of a research study, and not implemented or tested in new contexts outside a research setting. Therefore, important questions remain about effectiveness, cost-effectiveness, and scalability of these innovations.

Implementation of best available evidence
That guidelines without effective strategies to implement their recommendations have little or no effect on clinical practice has been repeatedly shown. Implementation strategies need to be tailored to overcome specific barriers to change and feature education and training, social interaction, clinical decision support systems, and targeted reminders. Some of the key challenges to implementing best practice for low back pain are known, including short consultation times, clinicians’ poor knowledge of and misconceptions about clinical guidelines, fear of litigation in the event of missed, rare, serious pathology, and a desire to maintain harmonious relationships with patients. Yet, successful examples exist of focused guideline implementation efforts (table 3). In the USA and UK, approaches that better support clinical decision making have changed clinical practice; use of a special radiograph requisition form that
Panel 1: Gaps between evidence and practice in the management of low back pain

**Guideline message: low back pain should be managed in primary care**
Practice: in high-income, low-income, and middle-income settings, people with low back pain present to emergency departments or to a medical specialist

**High-income settings**
- A 2003 study of an emergency department in Paris, France, found that the proportion of presentations in which low back pain was the primary complaint was 11%46
- In Victoria, Australia, between 2009 and 2012, 14,568 calls were made to 000 for an emergency ambulance for low back pain; in 22.3% of these cases, an emergency ambulance was dispatched and in 38.8%, a non-emergency ambulance was dispatched45
- In the 10 years from 2004–05 to 2013–14, the age-standardised rate of admissions to hospital for back problems in Australia increased by 20%46
- Low back pain results in 2.6 million visits to emergency departments a year in the USA42
- Of the 944 presentations for low back pain to an Italian emergency department in a year, six (0.6%) were diagnosed with a condition that was regarded as an emergency (defined as associated with high morbidity or mortality risk, requiring prompt assessment and hospital admission)41

**Low-income or middle-income settings**
- A 2011 study showed that 38.9% of patients with low back pain to an emergency department of an Italian academic hospital in 201341
- Imaging was done for 56.4% of 764 patients who presented with low back pain to an emergency department of an Italian academic hospital in 201341
- A 2011 Norwegian study showed that 38.9% of patients with low back pain were referred for imaging by their general practitioner42

**Guideline message: remain active and stay at work**
Practice: in high-income, low-income, and middle-income settings, many clinicians and patients advocate rest and absence from work

**High-income settings**
- Three surveys of Australian general practitioners in the period 1997–2004 revealed that 24.5% of them who had a special interest in low back pain, endorsed the incorrect view that “Patients should not return to work until they are almost pain free” compared with 15.8% of those who did not have a special interest46
- A 2012 survey of primary care patients with low back pain in Qatar revealed that the most common treatment was bed rest (67.2% of 1829 patients)47

**Low-income or middle-income settings**
- A 2008 survey of all registered physiotherapists in the state of Maharashtra, India, (n=186, 70% response rate) showed that 46% of physiotherapists advised patients with low back pain to rest48
- 63% of Indians believe that bed rest is the mainstay of therapy49
- 90% of Brazilian rheumatologists advised patients with acute low back pain to rest40
- In Iran, “extended bed rest and reduction of physical activity are generally recommended by many clinicians, especially for patients with acute episodes of low back pain”49

**Guideline message: imaging should only occur if the clinician suspects a specific condition that would require different management to non-specific low back pain**
Practice: although such specific causes of low back pain are rare, in high-income, low-income, and middle-income settings, imaging rates are high

**High-income settings**
- Imaging was done for 56.4% of 764 patients who presented with low back pain to an emergency department of an Italian academic hospital in 201341
- A 2011 Norwegian study showed that 38.9% of patients with low back pain were referred for imaging by their general practitioner42

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(Panel 1 continued from previous page)

- In the USA, a study of insurer data revealed that the rate of imaging for low back pain without red flag conditions was not influenced by the Choosing Wisely campaign: the baseline rate in 2010 was 53.7% (95% CI 52.5–54.9), and by the end of 2013 it was exactly the same, at 53.7% (52.5–54.9)75
- A survey of all Australian chiropractors (n=4859, 10% response rate) showed that 54% agreed that lumbar radiography is indicated for acute low back pain72

Low-income or middle-income settings

- A prospective study in the period 2008–10, of 251 patients with chronic low back pain reviewed in an Indian orthopaedic clinic, reported that 100% of patients underwent imaging, with 76% diagnosed with non-specific low back pain and 10% with spondylosis74
- A review of the lumbar spine MRI scans of 3107 patients from Hangzhou, eastern China, in 2013, showed that simple back pain was the most common reason for ordering an MRI (41.3%)75
- 400 consecutive patients with low back pain referred to four radiology clinics for MRI scans in Tehran, Iran, in 2012, completed a questionnaire to establish if the imaging was indicated; of these, only 187 (46.7%) had an indication for MRI76
- 70% of Brazilian rheumatologists order imaging at first visit for a patient with acute low back pain77
- A study in hospital outpatients with low back pain in Moscow, Russia, (n=1300) concluded that the most frequent diagnostic method used was radiography of the spine80

Guideline message: first choice of therapy should be non-pharmacological

Practice: surveys of care show that this approach is usually not followed

High-income settings

- A survey of Australian general practice care from 2000 to 2010 (21 350 patient encounters) showed that 64.5% of patients were prescribed a medicine at the first visit for a new episode of low back pain81
- A potential reason is the way in which health-care systems preferentially fund surgery and medicines over physical and psychological therapies

Low-income or middle-income settings

- 90% of primary care patients in South Africa received pain medicines as their only form of treatment81
- A potential reason is that health-care systems do not have the capacity to deliver non-pharmacological care

Guideline message: most guidelines advise against electrical physical modalities (eg, short-wave diathermy, traction)

Practice: worldwide these ineffective treatments are still used by the professionals who administer physical therapies

High-income settings

- A survey of Swedish physiotherapists (n=271, 65% response rate) showed that around 38% advocated transcutaneous electrical nerve stimulation for low back pain83
- A 2013 survey of US orthopaedic physical therapists (n=1001, 25% response rate) showed that 75% used lumbar traction84
- A 2009 survey in three Australian states (n=203, 36% response rate) asked for treatment choices for five patient vignettes and showed that 17–34% of physiotherapists advocated physical modalities for low back pain depending on the vignette85

Guideline message: due to unclear evidence of efficacy and concerns of harm, the use of opioid analgesic medicines is now discouraged

Practice: these medicines have been overused in some, but not all, high-income countries; low-income and middle-income countries seem to have very low rates of use

High-income settings

- In 2009, opioids were prescribed for around 60% of presentations to emergency departments for low back pain in the USA86
- An Italian study of 746 patients with low back pain presenting to an emergency department showed that 42% were prescribed an opioid87
- A 2006 US population-based survey of people with chronic low back pain (n=706, mean pain duration 9.8 years), showed that of those who had seen a provider in the past year, 47.0% had taken a strong narcotic and 32.8% a weak narcotic (60.5% took some sort of narcotic) in the month before survey; of those who had not seen a provider, 5.9% had taken a strong narcotic and 14.7% had taken a weak narcotic88
- A 2004 US study based on health-care insurer data of 26 014 patients with low back pain managed in primary care, showed that 61.0% were prescribed an opioid and 18.8% were on long-term opioid therapy89

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allowed only three guideline-appropriate indications led to a 36.8% reduction in lumbar spine imaging, and the addition of short educational messages to all reports of lumbar spine MRIs significantly reduced imaging rates by 22.5%. In Denmark, a multifaceted implementation strategy consisting of outreach visits, reports about the quality of care, and a self-completed questionnaire to help general practitioners to identify patients’ risk of persistent pain led to reduced referral to secondary care and was cost-saving. Reviews have shown no differences in effect on practice between multifaceted strategies compared with minimal, single, or no implementation strategy, and the ineffectiveness of one-off implementation efforts, such as a single educational event. Rather, it seems that implementation efforts need regular repetition or to be continuous to effectively change practice for low back pain.

Key challenges include identifying ways to remove existing unhelpful but well established practice patterns, and identify the most effective and cost-effective implementation strategies that ensure improvements are sustained over time. Very few randomised trials of implementation strategies have assessed costs. Tough policy decisions are also needed that reduce the unhelpful influence of industry and reduce or remove reimbursement for low-value care.

Improved and better integrated education of health-care professionals could support implementation of best practice for low back pain, help to break down professional barriers, develop a common language, and create new and innovative strategies for practice. Examples of such support include, the integrated education of medical
null
**Health care and public health**

**Integrate health and occupational interventions**

**USA**
Quality improvement intervention of financial incentives and organisational support aimed at reducing work disability. Baseline data included 13 910 workers’ compensation claims (July, 2001, to June, 2003), and post-intervention data included 71 696 patients’ data (July, 2004, to June, 2007). Outcomes at 1-year follow-up included work disability status, number of disability days, and costs. Patients were less likely to be off work and on disability at 1 year (OR 0.79, p=0.003). The average reduction in disability days in patients with back pain was 29.5% (p<0.001). Total disability and medical costs were reduced by US$510 per claim (p<0.01). Emerging: one non-randomised before-and-after study with non-equivalent comparison group. Unknown readiness for large-scale implementation.

**Sweden**
Intervention aimed at both workers at risk of long-term impairments (n=140, 94% female) and the workplaces (55 supervisors). The intervention was manualised and based on cognitive behavioural therapy principles, and involved consultation and problem-solving skills for both the worker and supervisor. The control received evidence-based treatment as usual. The intervention showed significantly greater improvements compared with the control, in numbers of workers having work absence due to pain (intervention vs control, p=0.01), health-care use (intervention vs control, p<0.01), and perceived health (intervention vs control, p<0.01). Promising: one randomised controlled trial. Unknown readiness for large-scale implementation.

**Netherlands**
Integrated care programme for low back pain patients (n=134) sicklisted for at least 12 weeks, that involved a patient-directed and workplace intervention (ergonomics, supervisor involvement, and a graded activity programme based on cognitive behavioural therapy principles). Control group received usual care. Outcomes included duration of time off work until full sustainable return to work and functional status. Median duration of time off work until full sustainable return to work was 88 days in the intervention group vs 208 days in the control group (p<0.001). Integrated care was effective for return to work (HR 1.9, 95% CI 1.2–2.8; p=0.004) and functional status (p=0.01) vs usual care control. Total costs in the integrated care group ($13 165, SD 13 600 [US$18 229, SD 18 834]) were significantly lower than in usual care ($18 475, SD 13 616 [$25 660, SD 18 856]). The intervention resulted in a return on investment of £26 for every £1 invested ($36 for every $1 invested) vs usual care. Effective: one randomised controlled trial with health economic evaluation. Potential for testing in other countries and settings.

**Change compensation and disability policies**

**Netherlands**
Cost of illness study to investigate costs of back pain from 2002 to 2007, after introduction of new laws on health insurance and sickness benefits and new guidelines for health-care professionals. Data gathered from national registries, reports of research institutes, descriptive studies, and occupational health-care authorities. The total costs of back pain fell from €2.3 billion in 2002 to €3.5 billion in 2007. The share of these costs was about 0.9% of the GNP in 2002 and 0.6% of GNP in 2007. The ratio between direct and indirect costs did not change noticeably over the years, that is, 12% for direct and 88% for indirect costs. Promising: one randomised cost-of-illness study. Unknown readiness for large-scale implementation.

**Public health**

**Change the beliefs and behaviours of the public through mass-media campaigns**

**Australia**
In Victoria, Australia, between September, 1997, and December, 1999, the mass-media campaign Back Pain: Don’t take it lying down was delivered for 12 months (intense campaign) followed by a further 15 months (less intense campaign). It had widespread endorsement from national bodies and was primarily delivered through television advertisements aired during prime time, featuring experts, sports personalities who had successfully managed back pain, and actors, comedians, and the minister for health. It also used radio, billboard, and print advertisements, posters, seminars, and industry news and some television public service announcements. The campaign’s overall cost was US$7.6 million. Improvements in back pain beliefs in Victoria (mean scores on the Back Beliefs Questionnaire 26.5, 28.4, and 29.7) but not in control (26.3, 26.2, and 26.3). Reduction in number of claims for back pain (15%), medical payments for claims for back pain (20%), and rate of days compensated.

**Canada**
In Alberta, Canada, from May, 2005, to December, 2016, a mass-media campaign, Back Active, was delivered. It had widespread endorsement from local health associations and featured local health professionals and organisations and an Olympic gold medalist. The primary medium was radio advertisements, but also used a website, posters, pamphlets, bus and billboard advertisements, articles in the public and industry news, and some television public service announcements. The campaign’s overall cost for the first 3 years was US$723 300. Improvements in back pain beliefs in Alberta were observed since the proportion of participants agreeing with a statement about staying active rose from 55.5% to 63.4% (p=0.008) with no change in control in the Saskatchewan population (consistently 60%). No effect seen on health-care use (imaging or visits to health professionals for back pain or work disabling claims). Promising: quasi-experimental before-and-after study with adjacent Canadian province as a control.

**Table 3: Examples of effective, promising, or emerging solutions, by solution target**

<table>
<thead>
<tr>
<th>Solution detail</th>
<th>Results</th>
<th>Strength of evidence* and readiness for large-scale implementation</th>
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<tbody>
<tr>
<td><strong>Health care and public health</strong></td>
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<td><strong>Integrate health and occupational interventions</strong></td>
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<tr>
<td>USA</td>
<td>Quality improvement intervention of financial incentives and organisational support aimed at reducing work disability. Baseline data included 13 910 workers’ compensation claims (July, 2001, to June, 2003), and post-intervention data included 71 696 patients’ data (July, 2004, to June, 2007). Outcomes at 1-year follow-up included work disability status, number of disability days, and costs. Patients were less likely to be off work and on disability at 1 year (OR 0.79, p=0.003). The average reduction in disability days in patients with back pain was 29.5% (p&lt;0.001). Total disability and medical costs were reduced by US$510 per claim (p&lt;0.01).</td>
<td>Emerging: one non-randomised before-and-after study with non-equivalent comparison group. Unknown readiness for large-scale implementation.</td>
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<tr>
<td>Sweden</td>
<td>Intervention aimed at both workers at risk of long-term impairments (n=140, 94% female) and the workplaces (55 supervisors). The intervention was manualised and based on cognitive behavioural therapy principles, and involved consultation and problem-solving skills for both the worker and supervisor. The control received evidence-based treatment as usual. The intervention showed significantly greater improvements compared with the control, in numbers of workers having work absence due to pain (intervention vs control, p=0.01), health-care use (intervention vs control, p&lt;0.01), and perceived health (intervention vs control, p&lt;0.01).</td>
<td>Promising: one randomised controlled trial. Unknown readiness for large-scale implementation.</td>
</tr>
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<td>Netherlands</td>
<td>Integrated care programme for low back pain patients (n=134) sicklisted for at least 12 weeks, that involved a patient-directed and workplace intervention (ergonomics, supervisor involvement, and a graded activity programme based on cognitive behavioural therapy principles). Control group received usual care. Outcomes included duration of time off work until full sustainable return to work and functional status. Median duration of time off work until full sustainable return to work was 88 days in the intervention group vs 208 days in the control group (p&lt;0.001). Integrated care was effective for return to work (HR 1.9, 95% CI 1.2–2.8; p=0.004) and functional status (p=0.01) vs usual care control. Total costs in the integrated care group ($13 165, SD 13 600 [US$18 229, SD 18 834]) were significantly lower than in usual care ($18 475, SD 13 616 [$25 660, SD 18 856]). The intervention resulted in a return on investment of £26 for every £1 invested ($36 for every $1 invested) vs usual care.</td>
<td>Effective: one randomised controlled trial with health economic evaluation. Potential for testing in other countries and settings.</td>
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<td>Promising: quasi-experimental before-and-after study with adjacent Canadian province as a control.</td>
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is a new model of stratified primary care for non-specific low back pain known as STarT Back that involves two components; first, a brief self-completed questionnaire to identify patients’ risk of persistent disabling pain (low, medium, or high risk) and second, treatments that are matched to each risk subgroup, and more cost-effective than usual primary care. On the basis of this evidence, the current UK clinical guideline now recommends risk stratification. A further promising direction could be to target both interventions. If back pain symptoms are reduced, then return to work is expected to follow. The association between compensation systems on claims for back pain showed in the USA was five to six times greater within highly developed states.

Changes to compensation and disability policies offer another potential solution. Substantial differences exist between countries in the prevalence of claims for disability benefits related to back pain, with the back claim rate in the USA being 60 times higher than in Japan, and musculoskeletal claims between states in Brazil being five to six times greater within highly developed states.

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Integrate health and occupational interventions

A further promising direction could be to target both the health-care system and, more broadly, public health through integrated health-care and occupational interventions. If back pain symptoms are reduced, then return to work is expected to follow. The association between pain, function, and return to work is, however, weak with reviews suggesting that the association changes with low back pain duration (positive association in the acute phase, no association in the subacute phase, and negative association in the chronic phase). Improvement in function and return to work even if pain remains, and evidence shows that return to work occurs before symptom recovery. Therefore, health-care and occupational health interventions should be considered together in people with low back pain and work disability issues. Examples are available from the USA and Sweden of integrated and early interventions that shift the focus to problem-solving at work, and lead to fewer disability days, earlier return to work, and reductions in use of health care.

The new Department of Health Framework and Strategy for Disability and Rehabilitation Services in South Africa includes goals to integrate comprehensive disability and rehabilitation services within priority health programmes and to foster intersectoral collaboration to address social determinants of ill health. Although low back pain is not specifically mentioned, opportunities could exist for inclusion of low back pain within their stated priority programmes of District Health Services and Health Promotion. Whether integration of health and occupational care is possible or desirable in low-income and middle-income countries with high reliance on temporary and unstable jobs, where little or no protection of employment due to low back pain exists, and where many depend on their pain as a source of income, is unknown. However, data provide evidence of the benefits of a participatory return-to-work programme for this group of workers in the Netherlands, where the programme resulted in twice as high a rate of return to work and greater societal benefit (£207 per worker) compared with usual care. Individuals with higher annual income seem more likely to believe that one should stay active during an episode of low back pain, therefore, specific targeted interventions need to be developed and tested for those from lower socioeconomic groups to reduce health disparities, address barriers to reintegration into the workforce, and facilitate getting out of poverty.

Multisystem approaches to returning and staying at work could reduce the economic and societal burden of work disability pensions due to low back pain. The example provided in table 3 is of a Dutch integrated care programme for patients with low back pain on long-term disability benefits (on average 5–6 months) that resulted in twice as high a return to work rate, 4 months earlier sustainable return to work, and a return on investment of £26 for every £1 invested compared with usual care.

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Panel 2: Case study: policy reform in the Netherlands

In the past two decades, new health insurance and sickness benefit laws in the Netherlands have required employers to (1) pay 70–100% wages to their sick employees for 2 years, and (2) make a return-to-work plan agreed by employer and employee, detailing all actions for the employer and employee. Medical assessments for work disability benefits are postponed to 2 years after reporting sick to give the employee and employer the opportunity to achieve full and sustainable return to work. After 2 years, an independent medical assessment is done to decide on the full benefit for workers with complete sustainable work disability, or on a partial and temporary benefit—based on limitations in functional abilities—for workers who are temporarily or partly disabled; this group is stimulated by financial incentives to resume work for their remaining work capacity. These changes led to a large drop in sickness absence and disability pensions. In line with these reductions, sick leave for low back pain fell by a third between 2002 and 2007 (figure). The total costs of back pain fell from €4·3 billion in 2002 to €3·5 billion in 2007.108

Canada that changing from a tort compensation insurance system with payments for pain and suffering to a no-fault system without such payments, led to a decrease in the incidence of claims and time to claim closure. An Australian study showed worse health outcomes in a fault-based system in New South Wales compared with a no-fault system in Victoria. In Brazil, providing a large amount of income replacement (>100%) from the National Social Security Institute resulted in workers with musculoskeletal pain claiming benefits for longer.109 Making changes to compensation systems aligns with recommendations from the Organisation for Economic Co-operation and Development (OECD). The effect of different compensation policies on return to work and claim duration is evidenced by an Australian study of all-cause work disability claimants, and a six-country study of 2825 compensation claimants with chronic low back pain who were off work for 3–4 months. In the six-country study, sustainable return to work rates ranged widely between countries, from 22% in Germany to 62% in the Netherlands. The differences were largely due to the Dutch compensation system encouraging greater work interventions than did those of the other countries. The effects of the reform of the Dutch system (panel 2 and figure), in line with OECD recommendations, are evidenced by reductions in sickness absence and disability pensions for back pain from 2002 to 2007.109,110 Although the absence of a control comparison is a limitation, this multisystem solution from the Netherlands is one that other countries could consider emulating. The Netherlands’ approach, and a 2017 international evidence synthesis, highlight the need for, and power of, policy changes that encourage work interventions supported by less strict compensation policies for disability benefits.

Public health interventions

Approaches that target public health also offer a possible solution. Public health interventions aim to change the public’s back pain beliefs and behaviours. Mass-media campaigns about back pain have been studied in four high-income countries (Australia, Scotland, Norway, and Canada), and have proved to have some success (table 3). The campaign in Alberta, Canada, had a modest effect on the public’s beliefs (regarding the importance of staying active) compared with a control population, with positive effects on beliefs persisting 7 years after the initial assessment, with annual bursts of campaign activity. The Australian mass-media campaign resulted in changes to beliefs and behaviours. The campaign was well funded, predominantly used television commercials featuring recognisable spokespeople, provided practical information about how to stay active and at work despite pain, and had clinical, employer, and employee organisations as partners. Perhaps most importantly, supportive laws and public policies were in place, including financial penalties for employers who did not provide modified work options to employees with back pain. Mass-media campaigns with a clear focus on behaviours rather than beliefs alone, and that incorporate new ways to disseminate information, such as personalised marketing, social networks, and customised digital communications, could be considered. Such campaigns might be less expensive than traditional media, and allow more direct access to the public and greater targeting of messages.

Public health strategies are likely to be especially important for low-income and middle-income countries, where, to date, greater focus and resources have centred on prevention and public health campaigns in infectious diseases. An example strategy in villages in rural Tibet, where 34% of people reported low back pain, consisted of training in back pain prevention and management in combination with a stand to support water containers. The intervention eased the burden of
collecting water with the potential to also reduce back pain prevalence and associated disability.\textsuperscript{18} In South Africa, information about back health has been integrated into the Western Cape on Wellness project, promoting healthy lifestyles to reduce the burden of non-communicable diseases across community, work, and school settings.\textsuperscript{19} However, we could not find any assessments or published data for the effectiveness of public health interventions for low back pain in low-income or middle-income countries.

Conclusions
Despite many clinical guidelines with similar recommendations for the management of low back pain, the gap between evidence and practice is pervasive. We have provided examples of effective, promising, and emerging directions that deserve greater attention and more rigorous assessment. Even the solutions judged effective draw on limited evidence, but they could potentially be replicable and cost-effective in other settings. Focusing on key principles, such as the need to reduce unnecessary health care for low back pain, support people to be active and stay at work, and reform unhelpful patient clinical pathways and reimbursement models, could guide next steps. The starting point in high-income countries will be different from low-income and middle-income countries, and their priorities are likely to differ. No single solution will be effective, and a collective, global effort will take time, determination, and organisation. Without the collaborative efforts of people with low back pain, policy makers, clinicians, and researchers necessary to develop and implement effective solutions, disability rates, and expenditure for low back pain will continue to rise.

Contributors
NEF, CGM, and DC were part of the team that developed the original proposal for the Series and coordinated production of papers. All authors drafted key sections of the paper, and NEF and CGM revised all sections. All authors have contributed to all sections of the paper and have edited it for intellectual content. NEF, CGM, DC, JRA, DPG, JMF, BWK, and PHF participated in the authors’ meeting and discussion during the drafting process. All other authors have read and provided substantive intellectual comments on the draft and approved the final version of the paper.

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Declaration of interests
Please see appendix for authors’ declaration of interests.

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References


42 Werner EL, Bilebaek C. Primary care doctors’ management of low back pain patients—ten years after. Tidsskr Nor Laegerforen 2012; 132: 2388–90.


124 Suman A, Bostick GP, Schaafsma FG, Anema JR, Gross DP. Associations between measures of socio-economic status, beliefs about back pain, and exposure to a mass media campaign to improve back beliefs. BMC Public Health 2017; 17: 304.


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