

Original Paper

A Web-Based Clinical Decision Support Tool for Primary Health Care Management of Back Pain: Development and Mixed Methods Evaluation

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Abstract

Background: Many patients with back pain do not receive health care in accordance with best practice recommendations. Implementation trials to address this issue have had limited success. Despite the known effectiveness of clinical decision support systems (CDSS), none of these are available for back pain management.

Objective: The objective of our study was to develop a Web-based CDSS to support Australian general practitioners (GPs) to diagnose and manage back pain according to guidelines.

Methods: Asking a panel of international experts to review recommendations for sixteen clinical vignettes validated the tool. It was then launched nationally as part of National Pain Week and promoted to GPs via a media release and clinic based visits. Following this, a mixed methods evaluation was conducted to determine tool feasibility, acceptability, and utility. The 12 month usage data were analyzed, and in-depth, semistructured interviews with 20 GPs were conducted to identify barriers and enablers to uptake.

Results: The tool had acceptable face validity when reviewed by experts. Over a 12 month period there were 7125 website visits with 4503 (63.20%) unique users. Assuming most unique users are GPs, around one quarter of the country's GPs may have used the tool at least once. Although usage was high, GP interviews highlighted the sometimes complex nature of management where the tool may not influence care. Conversely, several "touch-points", whereby the tool may exert its influence, were identified, most notably patient engagement.

Conclusions: A novel CDSS tool has the potential to assist with evidence-based management of back pain. A clinical trial is required to determine its impact on practitioner and patient outcomes.

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KEYWORDS

clinical decision support systems; back pain; primary care

Introduction

Global Disease Burden From Back Pain

Back pain is the number one ranked disabling health condition worldwide [1]. Across 21 regions, the lowest ranking of burden was 4th of 291 diseases in both the Caribbean and Southern sub-Saharan Africa. This makes a compelling case for increased efforts to improve health care for this condition.

Back pain is best conceptualized as a chronic disease. Although symptoms usually improve quickly after onset, pain and disability frequently persist at low to moderate levels [2]. We found that nearly one third of the people with reported acute back pain still experienced pain one year later [3]. Around one quarter of those who recovered had a recurrence within one year [4], and the majority of those with a prolonged initial course of pain (> 3 months) reported persisting pain 12 months later [5]. Similar findings were noted in a UK study [6]. Thus, back pain is commonly a long term health condition with an unpredictable pattern of acute episodes, remission, and recurrence [7,8].

Evidence-Practice Gaps in Management of Back Pain

Despite high health care expenditure for back pain, clear improvements in outcomes do not necessarily follow. In the United States, back pain expenditure increased by 65% (inflation adjusted) in the period 1997-2005, yet the health status for people with back pain fell [9]. Further, 16.7% of visits for back pain include inappropriate imaging tests, resulting in over \$175 million per year of unnecessary expenditure [10]; the principal driver for this is that people with back pain are not receiving the care endorsed in guidelines. Our large survey of Australian primary health care providers revealed that few patients received the care recommended in the nationally endorsed guideline [11]. Less than 10% of the patients received appropriate analgesia, and just 20% were provided with appropriate advice. Additionally, over one quarter of the patients were referred for diagnostic imaging. Crucially, this pattern of care was essentially the same in the periods before and after the guideline was released in 2004 [11]. Similar evidence-practice gaps have been reported in other countries [12-14].

Health Care Intervention Studies

Several health care intervention studies to improve back pain management have resulted in minimal or no improvements in mainly process outcome measures [15-20]. Clinical decision support systems (CDSS) are one of the most promising interventions to improve uptake of guideline recommendations. In two recent systematic reviews, around two thirds of CDSS trials demonstrated improvements [21,22]. In the broader eHealth arena, there is now growing evidence that interactive Internet and mobile interventions improve outcomes from

chronic conditions. A Cochrane review of 124 studies concluded that computer based "Interactive Health Communication Applications" could improve cognitive and social support outcomes in patients with chronic conditions [23]. Despite this, we are not aware of any CDSS that have been trialed for back pain management.

In this paper, we outline the development of a Web-based CDSS for back pain management. We also discuss the development and validation of an algorithm, in addition to a feasibility study examining the acceptability and utility of the tool following national deployment for use by Australian general practitioners (GP). Our objective was to determine whether the tool had the potential to support GPs to diagnose and manage back pain in accordance with guideline recommendations, and to identify barriers and enablers to uptake. The study was designed to inform a future large scale trial evaluation.

Methods

Tool Development

First, our recent systematic search of relevant guidelines was drawn on to inform development of the decision support algorithm [24]. In this review, we searched for guidelines in MEDLINE, PEDro, the US Agency for Health Care Research and Quality National Guideline Clearinghouse, and the UK National Institute for Health and Clinical Excellence, and used backward and forward citation tracking, retrieving 15 eligible guidelines. A key finding from the review was that there was a high level of consistency in recommendations from all 15 guidelines. These recommendations were converted to plain language rules, hardcoded into an algorithm, and a prototype tool was developed. Figure 1 illustrates the key variables in the algorithm and treatment recommendations provided.

Second, the algorithm was validated as follows. There were 16 hypothetical cases representing all permutations of the algorithm that were entered into the tool to generate management recommendations. The output was compared to an expert's clinical decisions for each case based on their interpretation of the guidelines. Additionally, a panel of four experts who developed the UK, US, and Australian guidelines [25-27] reviewed the prototype and commented on the recommendations. Any misinterpretations were reviewed and inconsistencies resolved by a consensus process.

Third, a user interface was designed, resulting in a four step process of excluding serious pathology, clinical assessment, establishing treatment options, and building a personalized, patient information sheet (Figures 2-5 show this interface). Technical user acceptance testing was conducted to ensure the tool functioned as specified.

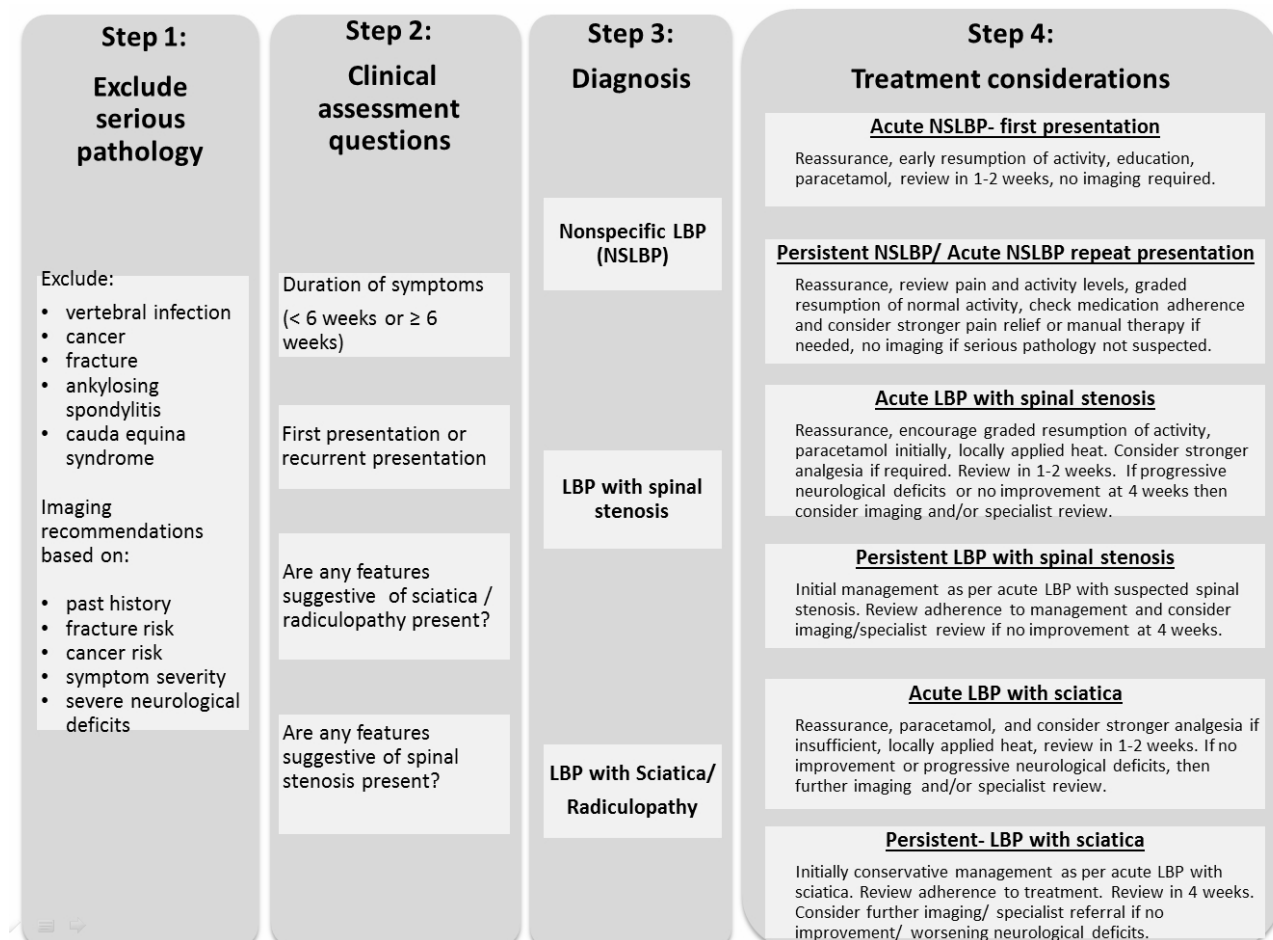
Figure 1. Decision support flowchart for management of low back pain (LBP). Nonspecific LBP (NSLBP).

Figure 2. Screenshot Step 1 - Exclude serious pathology.

Back pain choices

1 Assess for serious pathology

2 Clinical assessment

3 Treatment considerations

4 Build patient information sheet

Assess for serious pathology

Serious conditions such as vertebral infection, cancer, fracture, ankylosing spondylitis or cauda equina syndrome are rare causes of back pain (<1% of cases) in Australian primary care. Imaging and laboratory tests are only required when you suspect that the cause of the patient's low back pain is a serious condition or the patient has radiculopathy or spinal stenosis AND is a candidate for surgery. The table below outlines these clinical scenarios and an appropriate imaging strategy.

Note: Imaging is not required for patients with non-specific low back pain.

Timing	Imaging strategy	Clinical Situation
Immediate imaging	Radiography plus erythrocyte sedimentation rate†	Major risk factors for cancer (new onset of low back pain with history of cancer, multiple risk factors for cancer, or strong clinical suspicion for cancer)
	Magnetic resonance imaging	Risk factors for spinal infection (new onset of low back pain with fever and history of intravenous drug use or recent infection) Risk factors for or signs of the cauda equina syndrome (new urine retention, faecal incontinence, or saddle anaesthesia) Severe neurologic deficits (progressive motor weakness or motor deficits at multiple neurologic levels)
Defer imaging after a trial of therapy	Radiography with or without erythrocyte sedimentation rate	Weaker risk factors for cancer (unexplained weight loss or age >50 y) Risk factors for or signs of ankylosing spondylitis (morning stiffness that improves with exercise, alternating buttock pain, awakening because of back pain during the second part of the night, or younger age [20 to 40 y]) Risk factors for vertebral compression fracture (history of osteoporosis, use of corticosteroids, significant trauma, or older age [>65 y for women or >75 y for men])
	Magnetic resonance imaging	Signs and symptoms of radiculopathy (back pain with leg pain in an L4, L5, or S1 nerve root distribution or positive result on straight leg raise or crossed straight leg raise test) in patients who are candidates for surgery or epidural steroid injection Risk factors for or symptoms of spinal stenosis (radiating leg pain, older age, or pseudoclaudication) in patients who are candidates for surgery
No imaging		No criteria for immediate imaging and back pain improved or resolved after a 1-month trial of therapy Previous spinal imaging with no change in clinical status

† Consider magnetic resonance imaging if the initial imaging result is negative but a high degree of clinical suspicion for cancer remains.

Source: This table is adapted from The American College of Physicians Clinical Guideline for Diagnostic Imaging for low back pain (Ann Intern Med 2011; 154:181-189.)

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Figure 3. Screenshot Step 2 - Clinical assessment.

Back Pain Choices

1 Assess for serious pathology

2 Clinical assessment

3 Treatment considerations

4 Build patient information sheet

Clinical assesment

Answer the following questions and a suggested diagnosis will show.
You can see alternative diagnoses by changing the clinical variables at any time.

Duration of symptoms

☐ Less than 6 weeks
☐ Greater than 6 weeks

Are any features suggesting sciatica / radiculopathy present?

☐ Back pain with multiple leg symptoms in a nerve root distribution
☐ Paraesthesia and motor loss or diminished reflex
☐ Yes
☐ No

Are any features suggesting spinal stenosis present?

☐ Radiating leg pain
☐ Older age
☐ Pseudoclaudication
☐ Yes
☐ No

This is

☐ The first visit for this presentation
☐ A repeat visit for this presentation

[◀ Assess for serious pathology](#)



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Figure 4. Screenshot Step 3 – Treatment considerations.

Diagnosis: Persistent non-specific low back pain — repeat visit

1 Assess for serious pathology → 2 Clinical assessment → **3 Treatment considerations** → 4 Build patient information sheet

▼ SUMMARY

Imaging not required (unless serious pathology is now suspected).
 Check compliance with management.
 Review patient's progress (pain, activity levels).
 Reassure the patient: recovery likely with treatment, serious disease rare.
 Encourage graded resumption of normal activity.
 First choice for pain control is regular paracetamol; if insufficient consider a stronger pain medicine.
 Consider simple physical therapies such as manual therapy or exercise before more intensive treatment options.
 Review as required.

▶ GENERAL INFORMATION
 ▶ INVESTIGATION
 ▶ TREATMENT
 ▶ REVIEW

◀ Assessment Patient information sheet ▶

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Figure 5. Screenshot Step 4 – Build information sheet.

Diagnosis: Persistent non-specific low back pain (common back ache)

1 Assess for serious pathology → 2 Clinical assessment → 3 Treatment considerations → **4 Build patient information sheet**

Low back pain (LBP) is very common; around 80% of Australians experience back pain at some point in their life.

It is not possible to determine what causes LBP — many of the structures in your lower back, such as muscles, ligaments, discs, joints and bones may be the cause of pain but there are no tests to determine which. Importantly it is not necessary to know this to treat your back pain effectively.

It is extremely rare for low back pain to be caused by a serious medical condition and permanent damage is rare.

▼ INVESTIGATIONS REQUIRED
▼ TREATMENT PLAN
▼ REVIEW
▼ COMMON QUESTIONS AND CONCERNS
▼ INFORMATION ON TREATMENT

◀ Diagnosis Build information sheet ▶

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Implementation

The tool was published on the Internet in June 2012, accompanied by a media release issued to coincide with Australian National Pain Week [28]. The tool was subsequently mentioned in several leading GP focused periodicals, the Royal Australian College of General Practitioners electronic newsletter, sent to over 20,000 GPs, the Australian Medicare Local Alliance newsletter, and circulated to all 61 Medicare Locals, which are government funded, middle tier primary health care organizations. The tool was also directly promoted via a NPS MedicineWise “visiting topic”, in which physiotherapist educators conducted small clinic based workshops to support GPs in improved health care quality.

Following this, a convenience sample of twenty GPs in the Sydney area were invited to use the tool over a four week period in order to provide further insights into its utility, barriers, and enablers to uptake.

Evaluation

A mixed methods evaluation was conducted of the tool. Usage data were collected using Google Analytics over a 12 month period. Data included visit frequency, number of unique visitors, number of page views, and average visit duration. The qualitative component involved in-depth, semistructured interviews with all 20 GPs who had trialed the tool. A GP interviewer who was not involved in tool development conducted the semistructured interviews (see [Multimedia Appendix 1](#) for the interview guide). The interviews covered four key domains: (1) opinions on back pain management, (2) a “live walk-through” of the website, (3) clinical and patient

perspectives on utility, and (4) recommendations for improvements. The interviews were digitally recorded, transcribed, and imported for analysis into NVivo 10 (QSR International). An inductive approach was taken, with thematic content analysis conducted contemporaneously with data collection. A preliminary coding framework was collaboratively derived from the analysis of four interviews, discussed by the broader project team, and revised accordingly. There were two researchers that then independently coded the remaining interviews (eight each), and discussed new themes not previously identified. Saturation of themes occurred after around 15 interviews. At the end of the interview coding, final findings were again discussed by the project team and key themes were further refined.

The University of Sydney Human Research Ethics Committee approved the study.

Results

Website Usage Data

Figure 6 shows the usage data from June 2012 to May 2013 of the tool. The peak in early August 2012 coincides with the media release; subsequent to this usage, patterns remained relatively constant. The average time spent per visit was just over four minutes and the average number of pages viewed per visit was six pages. Almost all visitors clicked through to at least the second page of the back pain assessment.

Qualitative Evaluation

Table 1 outlines the characteristics of the GPs interviewed that had trialed use of the tool.

Figure 6. Usage patterns of the decision support tool for June 2012-May 2013.

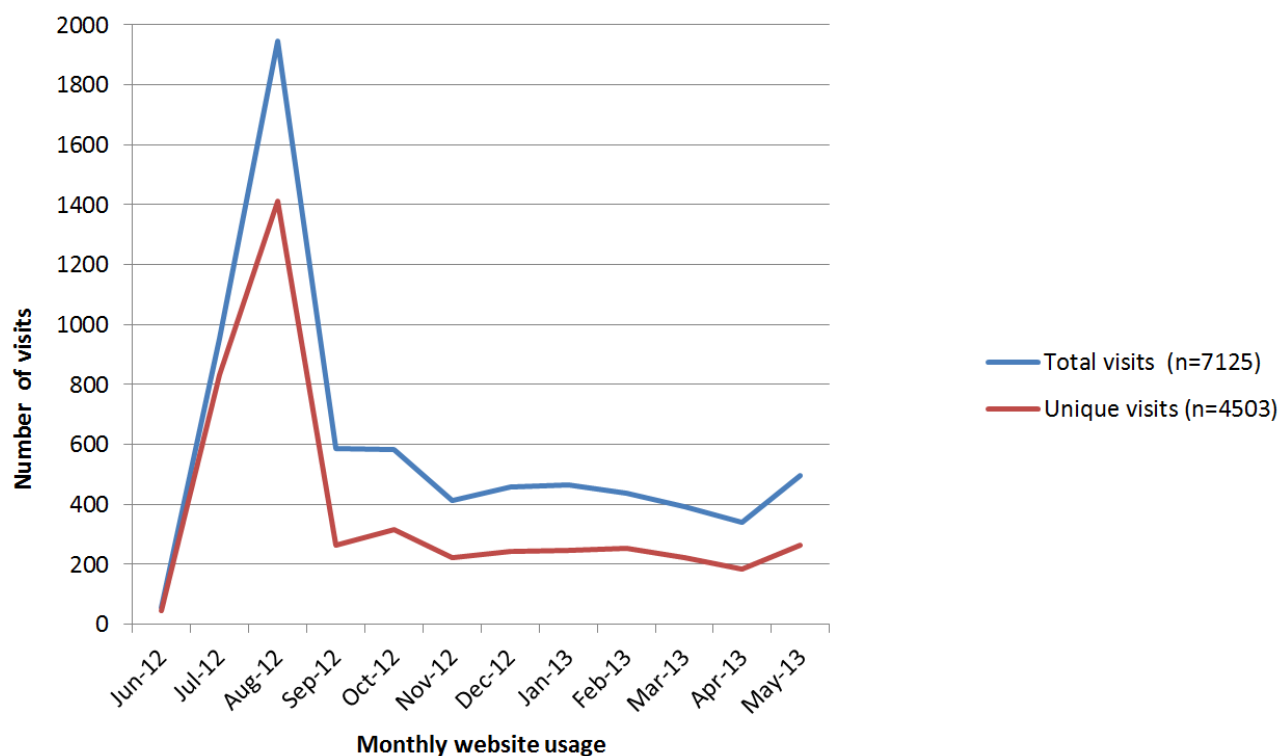


Table 1. GP and practice characteristics.

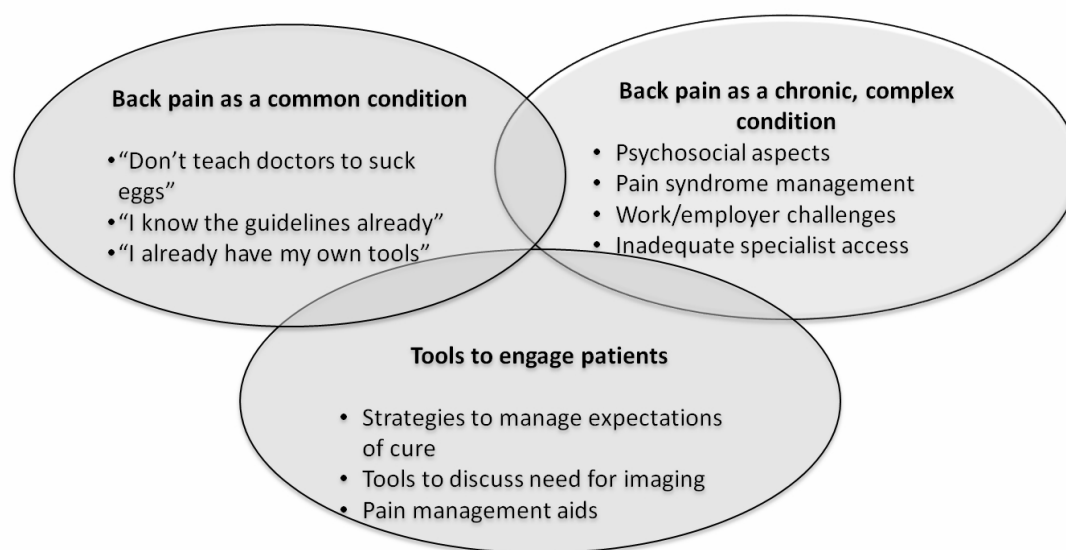
Characteristics	Total=20, n (%)
GP characteristics	
Age, years ^a	
<50	8 (40)
50-59	8 (40)
60+	3 (15)
Male	13 (65)
English primary language spoken at home	14 (70)
Australian university graduate	15 (75)
Vocationally registered	20 (100)
Number of sessions worked per week	
2-5	4 (20)
>5	16 (80)
Participates in research often or very often	6 (30)
Conducts own research	8 (40)
Daily use of Internet or email for work purposes	20 (100)
Practice characteristics	
Number of patients registered	
1001-3000	1 (5)
3001-5000	7 (35)
>5000	12 (60)
Number of doctors	
1-5	9 (45)
6-10	9 (45)
>10	2 (10)
Number of nurses	
0	2 (10)
1-3	15 (75)
>3	3 (15)
Practices with a practice manager	17 (85)
GP registrar placement	4 (20)

^aOne response missing

Identified Themes

There were three interrelated themes on the management of back pain and the role of tools that were identified. An additional

theme, focused on the functional aspects of the tool, also yielded important information on recommendations for improvement. [Figure 7](#) shows the key thematic domains and related subthemes.

Figure 7. Thematic domains from in-depth interviews with twenty GPs.

Theme 1: Low Back Pain Is a Common Condition

Our motivation for developing the CDSS tool was to improve adherence to guideline recommendations. Many of the GPs interviewed, however, considered back pain diagnosis and management to be common and relatively straightforward. It was viewed as integral to being a competent practitioner, and, therefore, the notion that GPs might need a tool to assist them seemed to indicate that “something was wrong” with their skills.

You can’t have a tool for every presentation in general practice...this is something that should be up there (pointing to his head) rather than “Oh wait a second, let me use this tool...” [GP 3]

Similarly, one GP was worried that the use of such a tool during a consultation would make him look “a bit strange” in the eyes of his patient, while another felt it was condescending and that he did not need “a step-by-step approach on how to suck an egg.” These accounts highlight the tension between a perceived, sound knowledge of best practice and the published data demonstrating large evidence-practice gaps.

Theme 2: Low Back Pain Is a Complex, Chronic Condition

Juxtaposed with the notion that back pain is common, was a more nuanced appreciation that it may have a complex, chronic course. This course can be characterized by relapse and setbacks, psychosocial and work related repercussions, and fragmented health care experiences. Most GPs acknowledged that under these circumstances back pain management was challenging and required considerable effort to ensure satisfactory health care. These challenges are particularly pronounced with work related back pain, where health care costs are subsidized in Australia by the government worker’s compensation schemes.

For one patient injured at work...he seems to be using it to get back at his employer...It also looks as though his relationship (with his partner) is going to break down...and he fosters a sense of entitlement through his back pain... [GP 2]

In such circumstances, GPs may be more likely to conduct imaging tests or prescribe complex pain relief medications, while cognizant that these are not routinely indicated.

I tried to get (him) managing the pain, but he was also a very anxious man. He went to my colleague, had a CT scan, which then showed something he fixated on. It’s been years to get him to a point where he’s not obsessing about every twinge in his back. [GP14]

Theme 3: Tools to Engage Patients

We came to appreciate that the tool was situated amid highly varied clinical contexts, ranging from where GPs required minimal additional support, through to complex situations where new resources were desirable. This helps to explain why at times the tool was seen as superfluous, and at other times it had the potential to assist with management dilemmas.

The tool was perceived to be the most useful in situations where patient reassurance and avoidance of complex tests or medicines were recommended. The GPs used the tool as a source of authoritative advice to support their recommendations. The patient information sheet was a particularly useful component, as it synthesized the key messages that would otherwise take some time to explain.

Well, I suppose we tended to make the patients feel happy if they want x-rays...Now at least we can say, “This is the evidence. You’ve got to wait for a while...” [GP 3]

Similarly, in the context of a work related injury, one GP used the tool to communicate with the patient’s employer.

I used the tool for the employer because the patient refused to go back to work...So I copied a few things from the tool and emailed it to the employer and they were quite happy. [GP 5]

Theme 4: Recommendations to Improve Tool Content

While the tool had the potential to be of value, some GPs found that it was not sufficiently dynamic to be of use in the long term. Once the core components became clear, there was perceived to be little variation in the content. This was not necessarily an adverse finding, as many GPs felt that over time the recommendations would be “incorporated as part of their normal skills.” Some GPs, however, wanted more detailed advice for complex pain management and indications for referral, whereas others wanted more autonomy in customizing the patient information.

The main influence to future tool uptake appeared to be integration into routine workflow. Integration with clinical software systems and the ability to rapidly navigate to the parts of immediate interest were frequently recommended by the GPs. They were also concerned with the growing number of tools that compete for their attention. Many described a process by which they establish their own “tool box” of resources, often compiled over many years. Tool developers therefore need to make new tools that complement rather than compete with existing tools.

Discussion

Principal Results

This study examined the development, uptake, and acceptability of an Australian GP Web-based CDSS for the management of back pain. There were three key findings that were observed. First, the algorithm underpinning the tool appeared to have acceptable face validity when reviewed by experts in the field and when implemented among GPs. This reflects consistency in guideline recommendations over several years. Second, we identified an effective implementation mechanism for rapid dissemination of the tool, drawing on a multi-pronged approach of media releases in target periodicals, alignment with National Pain Week, and promotion via an existing national network of facilitators who conduct face-to-face GP visits. Assuming that most unique visits were GPs, and that there are 20,360 GPs in Australia [29], then, over a 12 month period, around one quarter of the GPs in the country used the tool. Moreover, the ratio of new to returning users has remained constant, indicating the tool has not yet reached full market saturation. Third, and perhaps most importantly, the qualitative component revealed the complexities of managing low back pain and the “touch-points”, whereby a CDSS tool may exert its influence.

Limitations

This study was exploratory in nature and did not assess the clinical effectiveness of the tool. The focus was to look at

usability factors, identify enhancements needed, and further refine the tool. Further, although the usage data are useful, we were unable to analyze use by provider type, and to examine in more detail which parts of the tool were most/least popular. A final limitation was that we did not examine the perspectives of patients and other health care providers, such as physiotherapists and specialists.

Comparison With Prior Work

To our knowledge, this is the first CDSS for back pain to be evaluated. Although uptake and general satisfaction was encouraging, ongoing usage patterns are likely to be highly variable. Our findings resonate with our recent study of a cardiovascular CDSS tool and outline that GPs adopt guideline recommendations judiciously, depending on multiple social and environmental factors [30,31]. This may partly explain why interventions, including Internet interventions to improve back pain management, have thus far yielded small effects at best [32,33]. The notion that GPs establish their own “tool box” to conduct their work is useful in understanding how a new tool will be perceived. For common conditions like back pain, this compendium of existing tools tends to be well established, and, consequently, a tool that covers only the basics is likely to be less effective. Conversely, GPs clearly experience challenges in effectively managing back pain for their patients. If a CDSS tool can support GPs in these domains, especially complex pain management, psychosocial impact, and work related issues, then such a tool is likely to be concordant with their needs. Tool customization was of particular importance to the GPs. In a model akin to a mobile “app store”, GPs could select and modify their preferred “apps” on the basis of personal interest, user feedback, or endorsement by trusted organizations.

Conclusions

Despite the existence of clear and consistent recommendations from national and international guidelines for the management of back pain, large evidence-practice gaps exist. Our findings suggest that decision support tools have the potential to serve as an effective dissemination mechanism for the implementation of guidelines. This study represents the initial stage of a research translation program to improve health care quality for back pain. Several tool features were identified to be useful, but, importantly, a number of contextual factors affecting how back pain is managed were also noted. These factors may require additional tools with a different focus. Further work with care providers and consumers is planned to develop and test these enhancements. The system will then be assessed for its effectiveness in improving health care for the world’s most disabling health condition.

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Authors' Contributions

DP, CM, and CW designed the study. RH, RL, and JR led the implementation of the intervention and were responsible for the acquisition of quantitative data. AD was responsible for the acquisition of qualitative data. DP wrote the first draft of the study manuscript. All authors critically reviewed the manuscript and reviewed the final draft prior to submission.

Conflicts of Interest

None declared.

Multimedia Appendix 1

Interview guide.

[\[PDF File \(Adobe PDF File\), 109KB-Multimedia Appendix 1\]](#)

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Abbreviations

CDSS: clinical decision support system

GP: general practitioner

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