

University of Groningen

International comparative study of low back pain care pathways and analysis of key interventions

Coeckelberghs, Ellen; Verbeke, Hilde; Desomer, Anja; Jonckheer, Pascale; Fourney, Daryl; Willems, Paul; Coppes, Maarten; Rampersaud, Raja; van Hooff, Miranda; van den Eede, Els

Published in:
European Spine Journal

DOI:
[10.1007/s00586-020-06675-2](https://doi.org/10.1007/s00586-020-06675-2)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2021

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Coeckelberghs, E., Verbeke, H., Desomer, A., Jonckheer, P., Fourney, D., Willems, P., Coppes, M., Rampersaud, R., van Hooff, M., van den Eede, E., Kulik, G., de Goumoens, P., Vanhaecht, K., & Depreitere, B. (2021). International comparative study of low back pain care pathways and analysis of key interventions. *European Spine Journal*, 30(4), 1043-1052. <https://doi.org/10.1007/s00586-020-06675-2>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.


Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.



International comparative study of low back pain care pathways and analysis of key interventions

Ellen Coeckelberghs¹ · Hilde Verbeke² · Anja Desomer³ · Pascale Jonckheer³ · Daryl Fourney⁴ · Paul Willems⁵ · Maarten Coppes⁶ · Raja Rampersaud⁷ · Miranda van Hooff⁸ · Els van den Eede⁸ · Gerit Kulik⁹ · Pierre de Goumoëns¹⁰ · Kris Vanhaecht¹ · Bart Depreitere¹¹ 

Received: 30 August 2020 / Accepted: 20 November 2020 / Published online: 11 January 2021
© Springer-Verlag GmbH Germany, part of Springer Nature 2021

Abstract

Purpose Low back pain (LBP) is a major public health problem worldwide. Significant practice variation exists despite guidelines, including strong interventionist focus by some practitioners. Translation of guidelines into pathways as integrated treatment plans is a next step to improve implementation. The goal of the present study was to analyze international examples of LBP pathways in order to identify key interventions as building elements for care pathway for LBP and radicular pain.

Methods International examples of LBP pathways were searched in literature and grey literature. Authors of pathways were invited to fill a questionnaire and to participate in an in-depth telephone interview. Pathways were quantitatively and qualitatively analyzed, to enable the identification of key interventions to serve as pathway building elements.

Results Eleven international LBP care pathways were identified. Regional pathways were strongly organized and included significant training efforts for primary care providers and an intermediate level of caregivers in between general practitioners and hospital specialists. Hospital pathways had a focus on multidisciplinary collaboration and stepwise approach trajectories. Key elements common to all pathways included the consecutive screening for red flags, radicular pain and psychosocial risk factors, the emphasis on patient empowerment and self-management, the development of evidence-based consultable protocols, the focus on a multidisciplinary work mode and the monitoring of patient-reported outcome measures.

Conclusion Essential building elements for the construction of LBP care pathways were identified from a transversal analysis of key interventions in a study of 11 international examples of LBP pathways.

Keywords Low back pain · Radicular pain · Care pathway · Primary care · Hospital care · Triage · Multidisciplinary work · Patient reported outcome measures

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s00586-020-06675-2>) contains supplementary material, which is available to authorized users.

✉ Bart Depreitere
bart.depreitere@uzleuven.be

¹ Leuven Institute for Healthcare Policy, KULeuven, Leuven, Belgium

² Leuven Center for Algology and Pain Management, University Hospitals Leuven, Leuven, Belgium

³ Belgian Health Care Knowledge Centre, Brussels, Belgium

⁴ Division of Neurosurgery, Department of Surgery, University of Saskatchewan, Saskatoon, Canada

⁵ Department of Orthopedic Surgery, Maastricht University Medical Centre, Maastricht, The Netherlands

⁶ Groningen Spine Center, University Medical Center Groningen, Groningen, The Netherlands

⁷ Department of Surgery, Division of Orthopaedics, University Health Network Toronto, Toronto, Canada

⁸ Radboud University Medical Center, Nijmegen, The Netherlands

⁹ Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland

¹⁰ Department of Rheumatology, Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland

¹¹ Neurosurgery, University Hospital Leuven, Herestraat 49, 3000 Leuven, Belgium

Introduction

Low back pain (LBP) is a major public health problem worldwide, affecting the majority of humanity at some point in their lives [1]. LBP is ranked first for disability-adjusted life years throughout the world [2] and affects general well-being and performance at work. As a consequence, LBP results in a tremendous cost for society in terms of direct medical costs and costs resulting from loss of productivity [3–5]. Costs for spine care equal costs for cancer and diabetes care [6]. In Belgium, the global direct cost for the management of LBP is estimated to be 187 million Euros each year [7]. LBP affects people of all ages and is an utmost frequent reason for medical consultation. Recurrence and chronicity occur frequently and are associated with worse results in main outcome measures like pain intensity and general health perception [8–10]. It has been acknowledged that LBP management is characterized by a tendency for over-medicalization and medical over-consumption and that, instead, low back pain should be accepted as a condition rather than a disease [11].

Over the past decades, guidelines have introduced a shift toward better patient education and to the creation of a coherent conceptual management framework including accurate triage. Such triage includes the ruling out of red flags, the detection of radicular symptoms and the screening for psychosocial risk factors [12]. In clinical practice, however, large practice variation continues to exist, with a strong focus on interventional treatments by part of the caregivers [13]. A likely contributor to this variability is the large amount of caregivers that are involved in the management of low back pain and lumbar radicular pain, in primary care as well as in specialist and reintegration care. It has been acknowledged that guideline development is only a first step in the chain reaction of change [14, 15]. Therefore, the translation of guidelines into care pathways as integrated treatment plans is an extremely helpful next step [16]. The elaboration and implementation of a care pathway on LBP should allow to (1) improve the quality of care and the patient's satisfaction by selecting the best therapeutic option at the best time for each patient; (2) decrease the "translation gap" between guidelines and clinical practice by filling evidence gaps with knowledgeable interventions; (3) reduce the practice variation between practitioners and settings; (4) optimize the use of resources by avoiding unnecessary examinations and interventions; (5) decrease the risk of chronic low back pain and long-term absence from work.

Following the development of the 2017 Belgian guideline on the assessment and management of LBP and radicular pain [17], it was decided to integrate its elements into a pathway in order to provide a practical and user-friendly

navigator to the relevant caregivers and thereby facilitate the implementation process. Although patients with LBP represent a heterogeneous group, the initial triage and diagnostic process might be amenable for implementation into a standardized pathway. Moreover, it may be that also elements of therapeutic strategies and associated rationales further down the stream can be conceptualized in a common pathway format. Therefore, experiences with evidence-based LBP care pathways from elsewhere were considered useful templates for bridging evidence gaps in the creation of such pathway.

Hence, the goal of the present study was to identify and analyze international examples of LBP pathways and to derive key interventions to serve as building elements for the generic construction of a care pathway for LBP and for lumbar radicular pain. In the context of the development of a Belgian national care pathway, this pathway was intended to cover all stages (acute, subacute, chronic) and care levels (primary, hospital and reintegration care). Therefore, all pathways fitting within this wide scope were subject for study.

Methods

A literature search was performed by the Belgian Health Care Knowledge Center (KCE) investigator AD, based on the search strategy from the systematic review of Fourney in 2011 [18]. First, the following databases were searched up to April 2016: the Cochrane Database of systematic reviews, Medline, Embase and Cinahl. We limited our results to articles published in the English language. Reference lists of identified articles were systematically screened by 3 independent investigators (EC, HV and AD). All published articles that described a care pathway for low back disorders (considering both LBP and lumbar radicular pain) were included. Second, the 'grey literature' (institutional and governmental websites, websites and publications from scientific societies) was searched by two independent investigators (EC and HV). Third, all relevant scientific and/or professional societies (in the field of specialist spine care) were addressed to query for colleagues that authored a LBP/radicular pain care pathway. This was done by email messages to all Belgian, European transnational and European national orthopedic, neurosurgical, algological and physical and rehabilitation medicine societies. Also, all members of the European Pathway Association were contacted by email. Next, corresponding authors of papers with eligible care pathways, or coordinators/representatives of otherwise identified pathways, were contacted and asked if they were willing to participate in the study.

Information on variables of interest found in the literature was often insufficient, and the content of the care

pathways varied greatly. A structured questionnaire was developed to map the essential characteristics of the retrieved pathways in detail in terms of their targets of action: identification of the pathway and organizational items; patient selection; team composition and roles; evidence and implementation process; triage and diagnosis; therapeutic actions; patient items; caregiver items; pathways monitoring; return to work program; and financial aspects. This questionnaire underwent face validation by 3 international experts in the field of LBP care pathways. The questionnaire is available in Supplementary Text 1. Coordinators of the pathways fitting the scope (relevant to acute, subacute and/or chronic stages of low back pain and/or radicular pain, including one or more care levels and being effectively implemented) were contacted by email with a request to complete the questionnaire through a digital link. Next, they were contacted for an in-depth telephone interview (between August and October 2016). Additionally, we asked coordinators to provide us with any written protocols/algorithms or any additional pathway documents available. After all information was obtained, pathways were analyzed and the degree of maturity was assessed. All pathway components were listed and, in order to enhance comparison and quantitative analysis of common elements, re-listed in standardized intervention tables and standardized flowcharts. In addition, a qualitative analysis of the telephone interviews was performed based on the QUAGOL guide for qualitative data analysis [19] in order to identify pathway interventions that appeared to be crucial. Interventions that emerged as both crucial and common were further labeled as key interventions. The

entire workflow is outlined in Fig. 1. Finally, key interventions were checked to ensure they were not in conflict with existing clinical practice guidelines.

Results

Pathway retrieval

Through literature, 11 publications were retrieved describing 8 pathways [18, 20–29]. Figure 2 outlines the search results. Six pathways were added through grey literature search and information obtained through scientific societies. For two pathways, the coordinators indicated that the pathway had arrested or had not been implemented. Hence, 12 operational pathways were identified, originating from 7 countries. For one pathway (Kansas, USA), the coordinators eventually ceased collaboration. As a result, 11 pathways could be analyzed in depth (Table 1).

Content and transversal analysis

All pathways had become part of normalized care (Table 2). Supplementary Tables 2 and 3 provide a schematic overview of pathway elements resp. the standardized intervention tables. An example of a standardized flowchart is provided in Fig. 3. Based on the quantitative and qualitative assessment, a list of key interventions was constructed, as presented in Box 1.

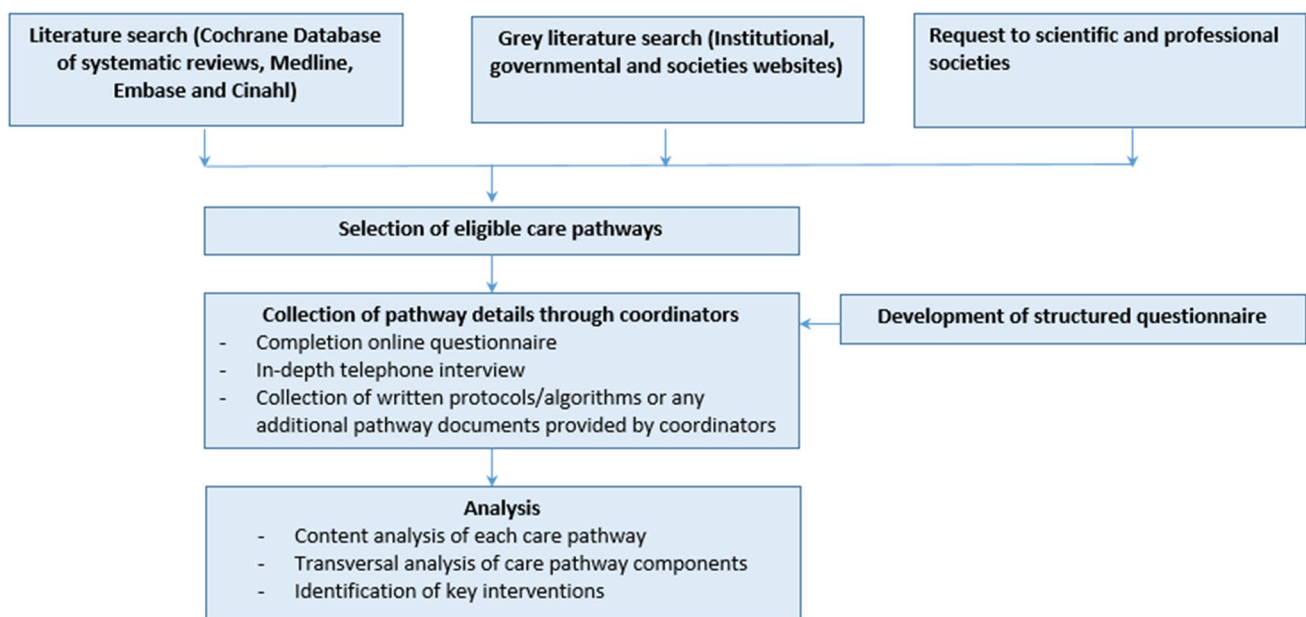


Fig. 1 Flowchart of the entire methodological workflow

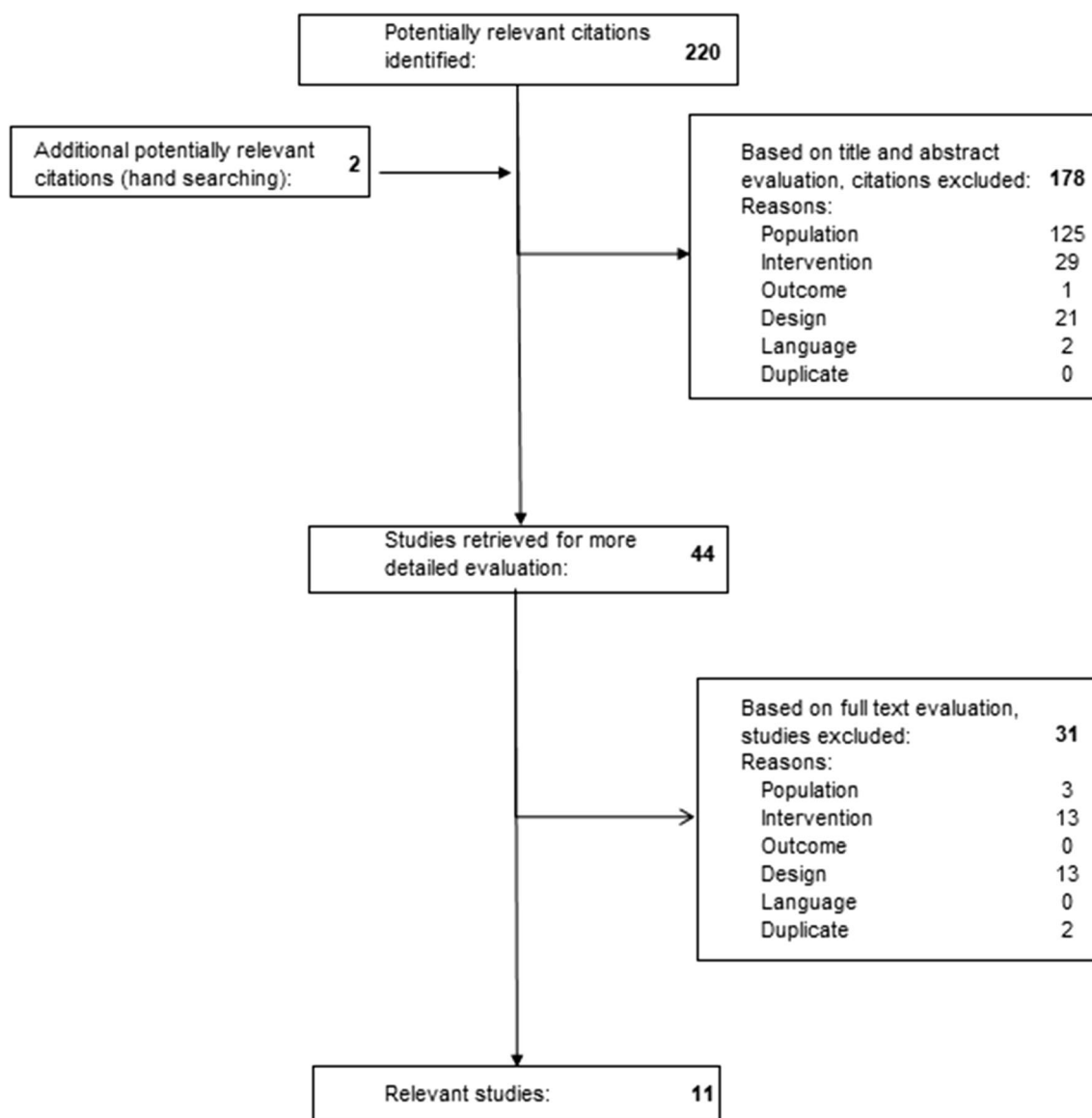


Fig. 2 Literature search results

Descriptive analysis and differences between pathways

All pathways dated from after 2000 and 8/11 were developed after 2010. All pathways originated from the same 2 goals, i.e., to improve both quality and efficiency of delivered care. Although some pathways admitted that ‘eminent’ and/or local habits had played a role in their development, they all included evidence, and usually referred to international guidelines [30–35]. Most pathways excluded children. Inclusion was never compulsory, and both doctor and patient could opt not to follow the instructions of the pathway. Dropout rates were estimated to be low in all pathways.

The subject of implementation was either one hospital or a region/city area. The regional pathways all had their main focus on the primary care management, while the hospital pathways had their focus on the organization of multi-/interdisciplinary care among the specialists in the hospital setting. The size of regional pathways being much larger, these pathways often received help from their Ministry of Health (Canada) or received appropriate grants (North East England). The North East England, Plymouth and Canadian pathways also invested extensive effort in training care providers (including CME credits in some), while this was absent in the hospital pathways, except for one. Interestingly, the Lausanne/Geneva pathway includes a fast track clinic to avoid chronification of complaints

Table 1 List of 11 studied international low back pain pathways

Pathway denominator	Hospital/region of implementation	Country
Groningen	University Hospital Groningen	The Netherlands
Maastricht	University Hospital Maastricht	The Netherlands
Nijmegen	Sint-Maartens Kliniek Nijmegen	The Netherlands
Lausanne/Geneva	University Hospitals of Lausanne and Geneva	Switzerland
North East England	North East England	United Kingdom
London	National Hospital for Neurology and Neurosurgery	United Kingdom
Waterford	City of Waterford	Ireland
Ontario	Toronto area, Hamilton area Thunderbay area (Ontario)	Canada
Saskatchewan	Saskatchewan province	Canada
Plymouth	Plymouth area	United States
Nuremberg	General Hospital Nuremberg	Germany

Table 2 Maturity of the 11 studied pathways

Pathway	Con-sensus based	Written protocols	Imple-mented and tested	Normalized
Groningen	+	+	+	+
Maastricht	+	+	+	+
Nijmegen	+	–	+	+
Lausanne/Geneva	+	+	+	+
North East England	+	+	+	+
London	+	+	+	+
Waterford	+	–	+	+
Ontario	+	+	+	+
Saskatchewan	+	+	+	+
Plymouth	+	+	+	+
Nuremberg	+	–	+	+

that is supervised by senior specialist and staffed with general practitioners in training. The Canadian pathways were coordinated by a committee that also included representatives from the Ministry. The hospital pathway in Groningen, the Netherlands, was also steered by a committee. Surprisingly, in regional pathways focusing on primary care, the driving force was often a spine specialist. A common characteristic of all 5 regional pathways (Saskatchewan, Ontario, Plymouth, North East England and Waterford) was the establishment of an intermediate level of care in between general practitioners and the hospital specialists. These were staffed by specifically trained physiotherapists and/or chiropractors, who could offer more specialized treatment in patients with higher risk factors or that were getting closer to chronicity. Hospital pathways were largely similar in their multidisciplinary collaboration, usually including multidisciplinary team meetings,

and including agreement on stepwise trajectories for more advanced rehabilitation and surgical/pain interventions.

Some pathways offered a flowchart without allocation of specific tasks to the different disciplines of care providers, while other pathways allocated a specific role to each provider. The hospital example of Groningen is highlighted in this regard: a group of 4 physician assistants was responsible for triaging the patients, and they also acted as case managers. Most pathways worked with consultable protocols. However, in Waterford, Nijmegen and Nuremberg, an organizational *modus operandi* existed without such guidance. A strategy for reducing numbers of unnecessary imaging was present in several pathways, but not in all. The implementation of pathways was easier when incentives for care providers existed. In the Canadian pathways, general practitioners participating in the pathway could get faster access to spine specialists for their patients. Accessibility problems were the trigger for three regional pathways.

Pathway outcomes

All pathways but one systematically kept record of one or more patient reported outcome measures (PROM) and pre-defined process indicators. However, none of the pathways had monitored data on the situation before the implementation of the pathway. An exception to this was Ontario, but pre-implementation data were restricted to waiting times and MRI consumption. As a consequence, the added value of the pathways in terms of improved patient outcomes could not be analyzed. In addition, post-implementation outcome data had not been processed systematically. For that reason, none of the pathways could provide us with PROM data for benchmarking. Nevertheless, pathway developers considered the reduction of practice variation and the introduction of patient empowerment (including de-medicalization of non-alarming situations) as the main elements strongly related

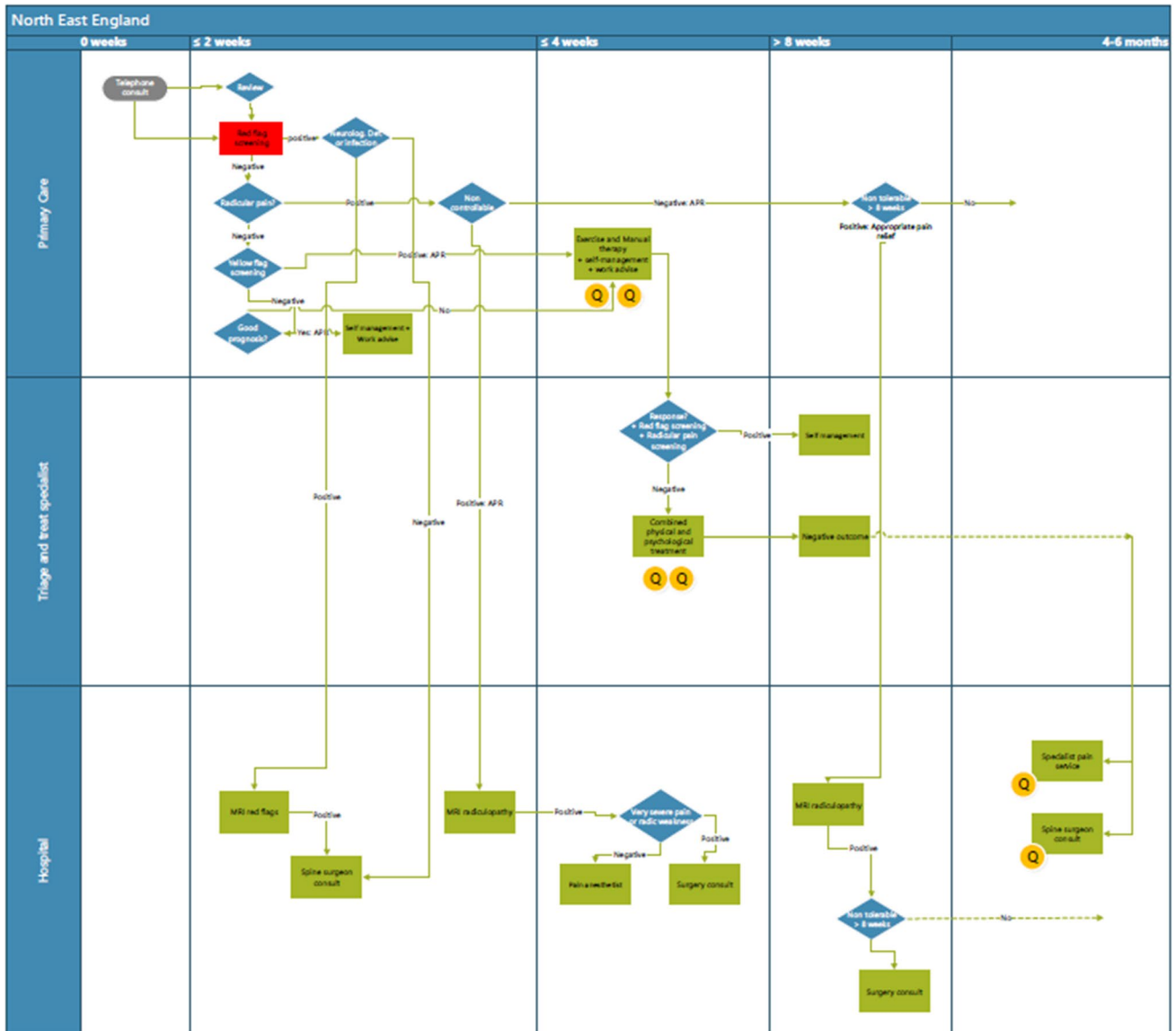


Fig. 3 North East England standardized pathway flowchart

Box 1 Key interventions for the development of a care pathway for low back pain and radicular pain

Triage elements at each contact:

Rule out red flags;

Separate radicular pain (both discogenic and stenotic) from back pain without dominant leg pain.

Screening for psychosocial risk factors (yellow, orange, blue and black flags) based on validated tools and offering more support (cognitive and behavioral therapy, coaching) in patients at higher risk of poor outcome.

Paradigm shift in the message to the patient. Patient education is an essential element: patients need to learn self-management and understand their condition. Self-management is the only required management in patients with estimated good prognosis.

Intermediate level in between general practitioner level and hospital specialist level, consisting of specifically trained physiotherapists and/or chiropractors (Canada, US and UK).

The availability of clear consultable protocols/flowcharts for all team members seems preferable.

Multidisciplinary mode of working, both in the development stage and in the implementation of the pathway.

Sufficient effort in training of care providers, if possible associated with learning incentives.

Monitoring of outcome and process indicators.

to the quality of provided care. They were also confident that the pathway implementation had positive effects on efficiency of care. Overshooting in specialist referral labels the patient as having a serious disease, and may render the problem chronic if waiting lists for specialist advice are long. In parallel with the paradigm shift to patient empowerment, capacity of imaging and specialist care will be used more efficiently. Outcome data on process and associated indicators that were communicated to us or have been published are listed in Box 2.

Discussion

In the present study, an in-depth comparison of 11 operational care pathways for LBP originating from 7 countries was performed. Pathway maturity was high in all studied. By analyzing key components, building elements for LBP pathways could be identified, for which there was large agreement between pathways: initial triage ruling out red flags and differentiating dominant radicular pain from dominant LBP, screening for psychosocial risk factors, paradigm shift emphasizing self-management and patient empowerment, sticking to evidence in consultable protocols, multidisciplinary mode of work, sufficient training of care providers and monitoring of PROMs. Regional pathways, primarily focusing on primary care, and hospital pathways, focusing on multidisciplinary organization of specialist care, could be differentiated, and no examples could be found of operational pathways covering full integration at both levels. As for the regional pathways Saskatchewan, Ontario, Plymouth,

Waterford and North East England, differences were minor and organizational in nature, with most of the essential content and structure of the pathways being remarkably similar. It is no surprise that all regional pathways found their origin in countries with strongly managed care systems, with a strong focus on ensuring qualitative management at the primary care level, thereby reducing the need for the more expensive and less accessible further levels of care. In contrast to the regional pathways, the hospital pathways were less elaborated.

As part of the successful implementation of pathways lies in the multidisciplinary development by relevant caregivers, the structure and key elements of the pathways provided in the present study are meant as a help and template to all who wish to engage in such endeavor. That pathway leaders in our examples were usually spine specialists, may be explained by their overview over the entire spectrum of stages, risks and complexities, including high rates of inaccurate referrals that triggered them to action. The notion that LBP is the worldwide number one cause of years lived with disability prompted the Lancet to issue a call for action, recognizing that most LBP is unrelated to specific spinal abnormalities and that low- and middle-income countries will be increasingly affected due to demographic changes and lack of adequate resources [39]. We believe that the development and implementation of multidisciplinary and multi-level consensus pathways to organize LBP care offers the most promising strategy to tackle this challenge. This is because pathways enhance the implementation of evidence-based guidelines and hence reduce consumption of non-effective treatments. Second, LBP is associated with a substantial

Box 2 Pathway indicator outcomes

Saskatchewan [20]:

71.3% of elective physician referrals initially intended for the spine surgeon were successfully managed without eventual need for seeing the surgeon;
MRI utilization was reduced by approximately 52.9% in a comparison of pathway-managed referrals versus conventional referrals to the spine surgeon.

Ontario Interprofessional Spine Assessment and Education Clinics (ISAEC) program:

Between January 2013 and August 2015, 10% of ISAEC patients were referred for surgical assessment. The average wait times for surgical consultation were less than 6 weeks, while it could be more than a year before the program started. Referral MRI usage decreased by 31%. 96% of eventual surgical referrals in the program were considered appropriate surgical referrals [36];

In the program, a rate of 0.736–0.885 surgical candidates were identified per MRI (as opposed to 0.328–0.418 in usual care). The program resulted in net cost savings of 777,282 Canadian Dollars per year [37]. The annual estimated per primary care provider cost avoidance was 3150 and 4175 Canadian Dollars in year 1 and 2, respectively, based only on imaging [38];

In 2016, 96% of primary care providers and 99% of patients were satisfied with the service provided by the pathway;

Plymouth:

91% of patients were satisfied with the services provided;

The percentage of patients returning to the emergency department for low back related problems after having been seen in the pathway dropped to 6% (control: 26%).

North East England:

Rough estimations based on Clinical Commissioning Groups level showed that in the first year the pathway yielded a break-even result, in the second year 300,000 £ were saved, and in the third year 800,000 £.

Groningen:

The average number of specialist consults per patient dropped from 3.6 to 1.4.

economic burden, particularly related to indirect costs [4] and specialist care [40] and with a higher weight of chronic patients [6, 41]. The key elements emerging from the current study emphasize the important role of primary care in correct stratification and accurate management within primary care of patients at low/moderate risk, thereby promoting activity and preventing chronicity. In a 2012 UK study, it was found that compared with standard practice, stratified primary care management for LBP was more cost-effective across all risk groups [42]. Primary care pathways adding exercises and behavioral counseling to usual care were most cost-effective in a systematic review by Lin et al. [43].

The present study was commissioned by the Belgian Healthcare Knowledge Center as initial step in the development of a national low back and radicular pain pathway for acute, subacute and chronic stages. The fruit of this work that was based on the building elements of the present study and on consensus from all relevant professional societies, can be consulted at <https://lowbackpain.kce.be/> [44, 45]. The Belgian pathway describes organization in both primary and specialist care and also includes return to work and reintegration care. While the UK National Pathfinder for Back and Radicular Pain as well as the British Pain Society pathway also intended to cover all levels of care, they were not implemented to that extent. It is clear that involving the primary care level requires a substantial effort, in terms of teaching as well as in terms of establishing an intermediate level for triaging more complex patients (a role that, in Belgium, is taken by the physical and rehabilitation medicine specialists). Such effort is not possible without involvement of all stakeholders—including the health authorities—and is not possible without dedicated funding. Implementation is currently ongoing in Belgium, funded by the Federal Service for Health and for the time being focused on primary care. So far, the Saskatchewan and Ontario pathways have been the only examples of successful implementation and normalization of spine pathways on a large regional scale. For example, based on the positive patient, provider and system impact of the Ontario pilot (2012–2018) in geographically distinct regions, the pathway now has been implemented as full provincial program with over 5000 primary care providers networked to 177 ministry funded intermediary providers and over 60 spinal surgeons.

The following limitations should be considered. First, some care pathway documents were only available in the vernacular of a specific country which limited our possibilities due to the language barrier. Since many internal hospital initiatives and associated documents are not made public, we surmise that more LBP care pathways exist, but are unreported. Also, this report reflects the results of a study performed in 2016, after which all focus went to the development of the Belgian national low back and radicular pain pathways established in 2017. Since 2016, we have

identified 1 new implemented pathway on LBP management in literature. The pathway in Salt Lake City aims at reducing inconsistencies with current LBP guidelines by screening patients scheduled for a physiatrist visit based on a triage algorithm and, when appropriate, redirecting them to physical therapy first [46]. Also the 11 pathways in the current analysis keep adhering to the key elements presented here, and all pathway leaders agreed with the current manuscript. Importantly, the present analysis represents an in-depth quantitative and qualitative analysis of a set of operational LBP pathways that were accessible to us, and does not claim to be a systematic review. Second, pathways seemed to be part of a rather heterogeneous spectrum, and hence, it was difficult to draft hard criteria to decide which pathways to include. Therefore, all pathways were included in this analysis. A focus on the regional pathways is extremely relevant with respect to a national strategy, but the hospital-based initiatives are complementary and probably as essential in terms of uniform approach and communication to patients. Third, it proved impossible to demonstrate superior patient outcomes in pathways, largely due to a lack of baseline outcome measurements before pathway implementation. Therefore, we recommend that new initiatives start with baseline measurements before implementation of interventions. In the same line, efficiency figures in the current study are merely descriptive, and conclusions on cost-utility gains cannot be drawn yet. Fourth, LBP programs predominantly focus on symptoms and disability. Return to work/participation programs were not integrated in the studied care pathways. The integration of return to work focus in LBP pathways is challenging, but essential [47]. Future efforts should focus on early detection of risk factors for delayed or compromised return to work, and implement these in integrated care pathways. Finally, this project was funded by a national institution that summarizes medical evidence to advise healthcare authorities. We do not appraise that this funding relation resulted in a potential conflict of interest.

Conclusion

In the current study on 11 international LBP care pathways, regional and hospital pathways were identified. Regional pathways were highly concordant, strongly organized, included significant training efforts for primary care providers, and each instituted an intermediate level between general practitioners and hospital specialists staffed by specifically trained physiotherapists/chiropractors and/or specialist nurses. The hospital pathways emphasized stepwise approach trajectories that were decided in a multidisciplinary setting and where more advanced rehabilitation and surgical/pain interventions could be coordinated. Key elements that were common to all pathways include screening

for red flags, radicular pain and psychosocial risk factors, focusing on patient empowerment and self-management, incorporating evidence in consultable protocols, working in a multidisciplinary mode and monitoring patient self-reported outcomes. These key elements should be incorporated in newly developed care pathways for the management of low back pain.

Acknowledgments We wish to thank dr. John Lee (London, UK), Dr. Charles Greenough (North East England, UK), Mrs. Susan Murphy (Waterford, Ireland), Mr. Andrew Bidos (Ontario, Canada), Mrs. Terry Blackmore (Saskatchewan, Canada), Dr. Ian Paskowski and James Berghelli (Plymouth, USA) and Dr. Susanne Schwarzkopf (Nuremberg, Germany) for their enthusiast help in providing insight into their low back pain pathways.

Funding This Project was funded by the Belgian Healthcare Knowledge Center (KCE).

Availability of data and material All data are provided in the Supplementary Materials.

Compliance with ethical standards

Conflict of interest None applicable.

References

- Hoy D, Brooks P, Blyth F, Buchbinder R (2010) The epidemiology of low back pain. *Best Pract Res Clin Rheumatol* 24:769–781
- GBD 2017 Disease and Injury Incidence and Prevalence Collaborators (2018) Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 392:1789–1858
- Hoy D, March L, Brooks P, Blyth F, Woolf A, Bain C et al (2014) The global burden of low back pain: estimates from the Global Burden of Disease 2010 study. *Ann Rheum Dis* 73:968–974
- Olafsson G, Jonsson E, Fritzell P, Hägg O, Borgström F (2017) A health economic lifetime treatment pathway model for low back pain in Sweden. *J Med Econ* 20:1281–1289
- Olafsson G, Jonsson E, Fritzell P, Hägg O, Borgström F (2018) Cost of low back pain: results from a national registry study in Sweden. *Eur Spine J* 27:2875–2881
- Martin BI, Deyo RA, Mirza SK, Turner JA, Comstock BA, Hollingworth W et al (2008) Expenditures and health status among adults with back and neck problems. *JAMA* 299:656–664
- van Zundert J, van Kleef M (2005) Low back pain: from algorithm to cost-effectiveness? *Pain Pract* 5:179–189
- Enthoven P, Skargren E, Oberg B (2004) Clinical course in patients seeking primary care for back or neck pain: a prospective 5-year follow-up of outcome and health care consumption with subgroup analysis. *Spine* 29:2458–2465
- Itz CJ, Geurts JW, van Kleef M, Nelemans P (2013) Clinical course of non-specific low back pain: a systematic review of prospective cohort studies set in primary care. *Eur J Pain* 17:5–15
- Canizares M, Rampersaud YR, Badley EM (2019) Course of back pain in the Canadian population: trajectories, predictors, and outcomes. *Arthritis Care Res* 71:1660–1670
- Deyo RA, Mirza SK, Turner JA, Martin BI (2009) Overtreating chronic back pain: time to back off? *J Am Board Fam Med* 22:62–68
- Koes BW, van Tulder M, Lin CW, Macedo LG, McAuley J, Maher C (2010) An updated overview of clinical guidelines for the management of non-specific low back pain in primary care. *Eur Spine J* 19:2075–2094
- Dubois M (2013) PhD dissertation. Causes and prevention of long-term disability due to low back pain. KULEuven, Leuven
- Vinck I, Vijverman A, Vollebregt E, Broeckx N, Wouters K, Piët M, Bacic N, Vlayen J, Thiry N, Neyt M (2018) Responsible use of high-risk medical devices: the example of 3D printed medical devices. Health Technology Assessment. Belgian Healthcare Knowledge Center Report 297A
- Scott NA, Moga C, Harstall C (2010) Managing low back pain in the primary care setting: the know-do gap. *Pain Res Manag* 15:392–400
- Vanhaecht KDWK, Sermeus W (2007) The impact of clinical pathways on the organisation of care processes. ACCO, Leuven
- Van Wambeke P, Desomer A, Ailliet L, Berquin A, Demoulin C et al (2017) Low back pain and radicular pain: assessment and management. Belgian Healthcare Knowledge Center report 287A
- Fourney DR, Dettori JR, Hall H, Hartl R, McGirt MJ, Daubs MD (2011) A systematic review of clinical pathways for lower back pain and introduction of the Saskatchewan Spine pathway. *Spine* 36(21 Suppl):S164–S171
- Dierckx de Casterlé B, Gastmans C, Bryon E, Denier Y (2012) Quagol: a guide for quantitative data analysis. *Int J Nurs Stud* 49:360–371
- Kindrachuk DR, Fourney DR (2014) Spine surgery referrals redirected through a multidisciplinary care pathway: effects of nonsurgeon triage including MRI utilization. *J Neurosurg Spine* 20:87–92
- Wilgenbusch CS, Wu AS, Fourney DR (2014) Triage of spine surgery referrals through a multidisciplinary care pathway: a value-based comparison with conventional referral processes. *Spine* 39(22 Suppl 1):S129–S135
- Harris SA, Rampersaud YR (2016) The importance of identifying and modifying unemployment predictor variables in the evolution of a novel model of care for low back pain in the general population. *Spine J* 16:16–22
- Paskowski I, Schneider M, Stevans J, Ventura JM, Justice BD (2011) A hospital-based standardized spine care pathway: report of a multidisciplinary, evidence-based process. *J Manip Physiol Ther* 34:98–106
- Arnold PM, Burton DC, Khan TW, Dixon KA, Asher MA, Varghese G (2013) Establishment of a university academic spine center: from concept to reality. *J Med Pract Manag* 28:220–224
- Klein BJ, Radecki RT, Foris MP, Feil EI, Hickey ME (2000) Bridging the gap between science and practice in managing low back pain. *Spine* 25:738–740
- Murray MM (2011) Reflections on the development of nurse-led back pain triage clinics in the UK. *Int J Orthop Trauma Nurs* 15:113–120
- de Goumoens P, Genevay S, Tessitore E, Zaarour M, Duff JM, Faundez A et al (2014) Inter-hospital CHUV-HUG medical consensus of back pain management. Its application in care pathways within CHUV of Lausanne. *Rev Med Suisse* 10:970–973
- Bramberg EB, Klinga C, Jensen I, Busch H, Bergstrom G, Brommels M et al (2015) Implementation of evidence-based rehabilitation for non-specific back pain and common mental health problems: a process evaluation of a nationwide initiative. *BMC Health Serv Res* 15:79
- van Hooff ML, Spruit M, O’Dowd JK, van Lankveld W, Fairbank JC, van Limbeek J (2014) Predictive factors for successful clinical outcome 1 year after an intensive combined physical and

- psychological programme for chronic low back pain. *Eur Spine J* 23:102–112
30. Low back pain: The early management of persistent non-specific low back pain. NICE clinical guideline 88, [guidance.nice.org.uk/cg88](https://www.nice.org.uk/cg88) (2009)
 31. van Tulder M, Becker A, Bekkering T, Breen A, Gil del Real MT et al (2006) Chapter 3: European guidelines for the management of acute nonspecific low back pain in primary care. *Eur Spine J* 15(Suppl):S169–S191
 32. Hill JC, Dunn KM, Lewis M, Mullis R, Main CJ, Foster NE et al (2008) A primary care back pain screening tool: identifying patient subgroups for initial treatment. *Arthritis Rheum* 59:632–641
 33. van Hooff ML, van Loon J, van Limbeek J, de Kleuver M (2014) The Nijmegen decision tool for chronic low back pain. Development of a clinical decision tool for secondary or tertiary spine care specialists. *PLoS One* 9:e104226
 34. American Academy of Orthopaedic Surgeons and North American Spine Society (1996) Clinical guideline on low back pain—phase 1
 35. Hall H, McIntosh G, Boyle C (2009) Effectiveness of a low back pain classification system. *Spine* 9:648657
 36. Zarrabian M, Bidos A, Fanti C, Young B, Drew B, Puskas D et al (2017) Improving spine surgical access, appropriateness and efficiency in metropolitan, urban and rural settings. *Can J Surg* 60:342–348
 37. Kim JS, Dong JZ, Brener S, Coyte PC, Rampersaud YR (2011) Cost-effectiveness analysis of a reduction in diagnostic imaging in degenerative spinal disorders. *Health Policy* 7:e105–e121
 38. Rampersaud YR, Bidos A, Schultz S, Fanti C, Young B, Drew B, Puskas D, Henry D (2016) Ontario's Inter-professional Spine Assessment and Education Clinics (ISAEC): patient, provider and system impact of an integrated model of care for the management of low back pain. *Can J Surg* 59(3 Suppl 2):S39
 39. Buchbinder R, van Tulder M, Oberg B, Costa LM, Woolf A, Schoene M et al (2018) Low back pain: a call for action. *Lancet* 391:2384–2388
 40. Davis MA (2012) Where the United States spends its Spine Dollars. expenditure on different ambulatory services for the management of back and neck conditions. *Spine* 37:1693–1701
 41. Maetzel A, Li L (2002) The economic burden of low back pain: a review of studies published between 1996 and 2001. *Best Pract Res Clin Rheumatol* 16:23–30
 42. Whitehurst DGT, Bryan S, Lewis M, Hill J, Hay EM (2012) Exploring the cost-utility of stratified primary care management for low back pain compared with current best practice within risk-defined subgroups. *Ann Rheum Dis* 71:1796–1802
 43. Lin CWC, Haas M, Maher CG, Machado LAC, van Tulder MW (2011) Cost-effectiveness of general practice care for low back pain: a systematic review. *Eur Spine J* 20:1012–1023
 44. Jonckheer P, Desomer A, Depreitere B, Berquin A, Bruneau M et al (2017) Low back pain and radicular pain: development of a clinical pathway. *Belgian Healthcare Knowledge Center Report* 295A
 45. Depreitere B, Jonckheer P, Desomer A, Van Wambeke P (2020) The pivotal role for the multidisciplinary approach at all phases and at all levels in the national pathway for the management of low back pain and radicular pain in Belgium. *Eur J Phys Rehabil Med* 56:228–236
 46. Magel J, Hansen P, Meier W, Cohee K, Thackery A, Hiush M, Firtz JM (2018) Implementation of an alternative pathway for patients seeking care for low back pain: a prospective observational cohort study. *Phys Ther* 98:1000–1009
 47. Cancelliere C, Donovan J, Stochkendahl MJ, Biscardi M, Ammendolia C, Myburgh C et al (2016) Factors affecting return to work after injury or illness: best evidence synthesis of systematic reviews. *Chiropr Man Therap* 24:32

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.