Assessing Physicians' Knowledge, Attitudes, Beliefs, and Guideline Adherence in the Management of Low Back Pain: A Multidimensional Evaluation

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Abstract

Purpose: This study explored physicians' ability to suspect/identify specific low back pain (LBP); assess their knowledge, attitudes, and beliefs regarding non-specific LBP and self-reported knowledge of LBP guidelines; and identify physician-related factors associated with both specific and non-specific LBP management.

Methods: This cross-sectional study targeted first-line care physicians. A vignette depicting lumbar spinal stenosis (LSS) assessed the ability to suspect/identify a specific underlying cause of LBP, while the Rainville-vignette evaluated whether non-specific LBP management is guideline-consistent. Knowledge, attitudes, and beliefs were assessed using the Back Pain Attitudes Questionnaire (Back-PAQ), Health Care Provider's Pain and Impairment Relationship Scale (HC-PAIRS), and Neurophysiology of Pain Questionnaire. Physicians self-reported their guideline knowledge.

Results: Of 100 physicians, 42 correctly mentioned LSS; 31 did so without considering other neurological or vascular causes. Eighty-two percent and 36% gave guideline-consistent recommendations for activity and work. Physicians with helpful Back-PAQ scores had higher odds (OR: 3.23) of providing guideline-consistent activity recommendations, while those with unhelpful HC-PAIRS outcomes had lower odds (OR: 0.47). Yet, 56% viewed the spine as generally vulnerable, and 94% agreed that LBP leaves a lasting weakness.

Conclusion: Managing LBP in first-line care remains challenging. The ability to identify specific LBP was limited and the analyses provided no clear evidence of associations with guideline knowledge or the other examined factors. Unhelpful beliefs about spinal vulnerability were also observed alongside guideline-consistent activity advice. These findings should not be interpreted as causal and point to a need for qualitative research when investigating clinical decision-making to inform targeted educational interventions.

1. Introduction

Low back pain (LBP) remains one of the foremost global contributors to disability, imposing a substantial economic burden [1-3], reflected in high rates of sick leave and early retirement [4,5]. Adequate LBP management is critical to avoid exacerbations through timely referral and unnecessary investigations. Clinical guidelines recommend an initial diagnostic triage allocating patients to one of three broad categories: specific LBP, non-specific, and radicular syndrome [6]. The majority (90%) are classified as non-specific LBP, where no specific nociceptive source can be identified [7,8], while 5-10% present with radicular syndrome [6]. The prevalence of serious spinal pathology varies according to the population and clinical setting [9,10], with estimates ranging from <1% in primary care [6,7,11], 2.1% in emergency department, 4.6% in secondary care and 6.9% in tertiary care [10].

However, differentiating specific from non-specific LBP remains challenging. Initial assessment requires clinical reasoning to determine whether a specific underlying pathology should be suspected, integrating the clinical history, physical examination, and relevant contextual factors [12]. Red flags may contribute to this process by raising suspicion of potentially serious underlying spinal pathology, but should not be interpreted as standalone diagnostic tools or used in isolation [13-15]. Their diagnostic value varies considerably, and definitions and recommendations regarding their use are inconsistent across guidelines [16-18]. Rather, their interpretation should be guided by the broader clinical context and other relevant findings as part of clinical reasoning [12]. Few studies have examined physicians' ability to correctly suspect specific causes of LBP, leaving a critical gap in our understanding [19-22]. Therefore, the first aim of this study is to **assess physicians' ability to suspect specific LBP based on a clinical vignette simulating a case with an underlying spinal pathology.**

Guidelines emphasize screening for psychosocial risk factors (e.g., unhelpful beliefs, attitudes, emotions, behaviour, social factors), which predict poor outcome in non-specific LBP [11,23-29], prompting a Lancet-series call to challenge inaccurate beliefs about LBP [30]. Despite international clinical guidelines and implementation initiatives [31,32], many physicians do not, or only partially, adhere to these recommendations [33]. Clinicians retaining a biomedical model tend to give advice that discourages activity and work participation and emphasises avoidance and harm [23,25,29,34,35], patients receiving such advice report inconsistent messages about activity participation and are frequently offered biomedically-oriented care options with low likelihood of benefit [33,36-41]. This pattern persists even among newly trained general practitioners (GPs) [41] (expected to reflect current biopsychosocial-informed training), suggesting that these misbeliefs become entrenched early in a clinician's career, with potential long-term implications for patient advice. This sequence illustrates how beliefs can translate into practice. However, it remains unclear how these factors relate to guideline-consistent recommendations, a link that should be established in order to develop targeted educational interventions. Therefore, the second aim of the study **is to explore physicians' knowledge, attitudes, beliefs, and self-reported knowledge of the LBP guidelines.**

Although physician-related factors, including beliefs, attitudes, knowledge, and demographic characteristics, have previously been examined as determinants of LBP guideline adherence [22,42], their association with the diagnostic triage of LBP has not been specifically investigated. In particular, it is unknown whether these factors are associated with physicians' ability to suspect specific LBP and to provide guideline-consistent activity recommendations for patients with non-specific LBP. This may identify targets for interventions aimed at improving diagnostic decision-making and guideline-consistent care. Therefore, the third aim of the study **is to identify physician-related factors associated with the ability to suspect specific LBP and to make guideline-consistent activity recommendations for non-specific LBP.**

2. Methods

2.1. Study Design

This descriptive, exploratory cross-sectional study reports baseline data from a larger prospective study (clinicaltrials.gov: NCT05284669). Ethical approval was provided by the ethics committee of Antwerp

University Hospital (registration number 20/51/714 February 2021). Written informed consent was obtained from all participants. The study adhered to the General Data Protection Regulation and followed the STROBE guidelines for reporting observational studies [43].

2.2. Setting

Participants completed the survey online via Qualtrics (https://qualtrics.com) using their own personal devices (computer, tablet or smartphone). After providing informed consent, participants accessed the full survey, including vignettes and questionnaires. Data collection occurred between August 2021 and January 2025.

2.3. Participants

GPs and trainees (i.e., graduated physicians in further training with an interest in musculoskeletal complaints) working in Belgium or France were invited via national professional associations, university departments, and hospital collaborations [44], using Dutch and French invitations. Recruitment was voluntary and continued during the study recruitment period, to obtain the largest feasible sample size of eligible physicians. Eligibility criteria included fluency in Dutch or French, active medical practice in Belgium or France, and access to an internet-connected device. Professional-network recruitment and voluntary participation may have introduced participation bias towards physicians with greater interest in musculoskeletal complaints.

2.4. Outcomes

The survey, available in Dutch or French, included two clinical vignettes and five questionnaires to collect socio-demographic data and assess diagnostic and treatment decision-making, knowledge, attitudes, beliefs about LBP, and self-reported guideline knowledge.

2.4.1 Vignettes

A lumbar spinal stenosis (LSS) vignette assessed physicians' ability to suspect and identify **a specific underlying cause of LBP**. This vignette (Appendix A), developed by an experienced orthopaedic surgeon, matched textbook LSS symptoms [45] following the methodology of Jette et al [46], and was subsequently reviewed by an expert team consisting of clinicians and academics (GPs and physiotherapists) and external experts to reach consensus. Its development and prior use have been reported previously [47,48]. Physicians then answered an open question: *"In your opinion, what are the causes and/or contributing factors to this patient's pain?"*. Responses were analysed stepwise using the classification framework in table 1, with each category ('1', '2', '3') and subcategory ('A', …, 'Bc') counted by frequency overall and by GPs/trainees.

Table 1: Stepwise framework of the clinical LSS vignette analysis

	Total (n)	GP / Trainees: (n)
1) Physicians giving no answer or stated to not know the answer		
2) Physicians giving reasons for pain, often related to non-specific LBP		
3) Physicians suspecting "something specific" *(i.e., describing clinical signs linked with specific LBP)*		
3A) Physicians identifying LSS		
Aa Physicians only identifying LSS		
Ab Physicians considering LSS and "something neurological"		
Ac Physicians considering LSS and "something vascular"		
3B) Physicians not identifying LSS		
Ba Physicians considering "something neurological"		
Bb Physicians considering "something vascular"		
Bc Physicians considering "something neurological and vascular"		

LSS: lumbar spinal stenosis; n: amount; LBP: low back pain

A second vignette (Rainville), depicting **chronic non-specific LBP** [49], assessed guideline-consistent activity and work recommendations using a 5-point Likert scale ranging from 1 ("no activity limitations" or "full-time, full duty") to 5 ("limit all physical activities" or "remain out of work"). Scores of '1' and '2' were coded guideline-consistent (1) and '3' to '5' guideline-inconsistent (0) [47,50].

2.4.2 Questionnaires

Participants reported **socio-demographic information** ("population" [GPs and trainees], "gender", "age", "work experience"). The following questionnaires, available in Dutch or French, assessed "self-reported knowledge of the guidelines" , and knowledge, attitudes, and beliefs about LBP:

The **10-item Back Pain Attitudes Questionnaire** (Back-PAQ) [51-53] assesses attitudes and underlying beliefs about back pain across five two-item components, with good-to-excellent internal consistency and validity [51-53]. Items are scored '-2' to '+2' (items 6-8 reverse-scored), yielding a total score ranging from '-20' to '+20', with negative scores reflecting unhelpful beliefs [53].

The modified 13-item **Health Care Providers' Pain and Impairment Relationship Scale** (HC-PAIRS), using a seven-point Likert scale ('completely disagree' to 'completely agree'), assesses attitudes and beliefs about the relationship between LBP and physical impairments [50,54,55]. Scores range from 13-91 (items 1,6, and 12 reverse-scored), with higher scores indicating stronger beliefs that chronic LBP justifies disability and activity limitation [54]. This questionnaire has good reported psychometric properties [54].

The **revised Neurophysiology of Pain Questionnaire** (NPQ) [56,57] comprises 19 true/false/undecided items assessing conceptualisation of pain's biological mechanisms [56], scored 1 ('correct') or 0 ('incorrect'/'undecided'), with higher scores (maximum 19) reflecting better pain neurophysiology knowledge.

Self-reported guideline knowledge was assessed via the unvalidated question *"Are you familiar with the recommendations (from the guidelines) to manage LBP?"* (response options: 'yes'/'not sure'/ 'no'), previously used by the research team [47].

2.5. Statistical methods

Data were exported from Qualtrics (https://qualtrics.com) to Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) and analysed using R (version 4.3.3., https://www.r-project.org/).

No formal minimum sample size was prespecified based on statistical power because the analyses were primarily descriptive and exploratory, with the logistic regression analyses and odds ratios (ORs) intended to explore associations rather than to test prespecified hypotheses.

2.5.1 Unadjusted association analysis

Unadjusted associations between selected physician-related variables and Suspecting something specific, Identifying LSS and Activity recommendations were examined descriptively. For continuous variables (i.e., HC-PAIRS, Back-PAQ, NPQ, and Age), univariate logistic regression models were fitted after standardising the variables to z-scores using the R scale() function. Thus, the corresponding ORs represent the change in odds associated with a one-standard-deviation increase in the respective continuous variable. No additional rescaling was applied.

Binary variables (i.e., Population, Gender, and Self-reported guideline knowledge), unadjusted ORs were calculated from 2x2 contingency tables using the Wald method. ORs represent the odds for the coded category relative to the reference category.

For each variable, the unadjusted log(OR), OR, and 95% confidence interval (95%CI) were obtained. These analysis were intended to describe the direction and magnitude of individual unadjusted associations and were not intended to estimate independent effects or establish a hierarchy of predictor importance.

'Self-reported guideline knowledge' was binarized: only participants firmly stating they knew the guidelines were coded '1', others were coded '0'.

3. Results

In total, 119 physicians consented. After removing missing data and duplicate entries (figure 1), data from 100 physicians from Belgium (75%) and France (25%) were analysed: 54 GPs (median experience 10 years, max: 41 years) and 46 trainees, with an overall gender distribution of 38% male/ 62% female. Median age was 36.5 years (GPs) and 27 years (trainees). Further details are provided in table 2.

Figure 1. Flowchart recruitment and eligibility process
n: number of participants

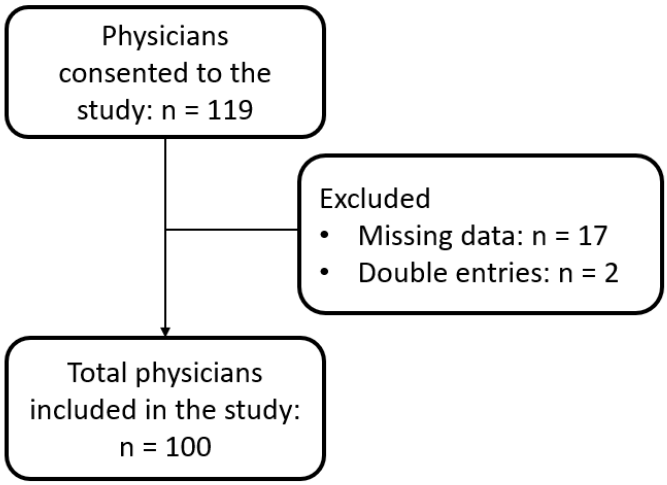


Table 2: Socio-demographic information

	GPs n [%]	**Trainees n [%]**	**Total n [%]**
Population	54 [54%]	46 [46%]	100 [100%]
Male	21 [39%]	17 [37%]	38 [38%]
Female	33 [61%]	29 [63%]	62 [62%]
	GPs median [IQR]	**Trainees median [IQR]**	**Total median [IQR]**
Age (years)	36.5 [16.8]	27 [3.8]	31 [11.2]
Work experience (years)	10 [17.8]	0	-

N: amount; LBP: low back pain; IQR: interquartile range; GPs: general practitioners

3.1. Descriptive statistics of the vignette depicting **specific LBP**

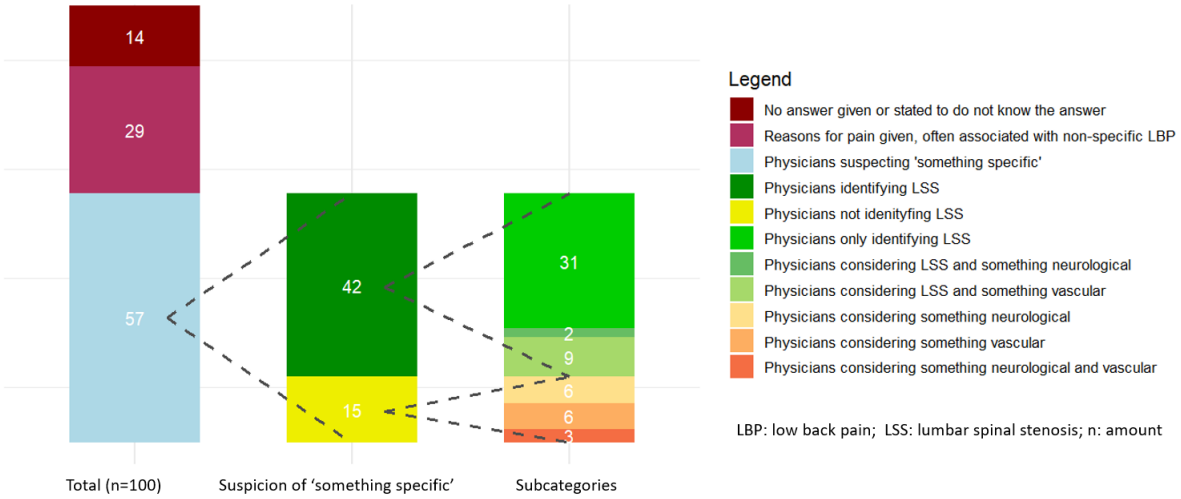
Physicians' ability to identify specific LBP is detailed in table 3 and figure 2. Fifty-seven percent (n=37 GPs, 20 trainees) suspected something specific. Less than half (42%, n=25 GPs, 17 trainees) correctly identified signs of LSS, of whom 31% (n=19 GPs, 12 trainees) did not simultaneously consider neurological or vascular causes. Fourteen percent gave an empty response (e.g., answering with " / ") or stated to not know the answer (n=9 GPs, 5 trainees).

Table 3: The ability of physicians to identify the presence of specific LBP (lumbar spinal stenosis)

	Total n	GP n	Trainees n
1) Physicians giving no answer or stated to not know the answer	14	9	5
2) Physicians giving reasons for pain, often related to non-specific LBP	29	8	21
3) Physicians suspecting "something specific"	57	37	20
3A) Physicians identifying LSS	42	25	17
Aa Physicians only identifying LSS	31	19	12
Ab Physicians considering LSS and something neurological	2	1	1
Ac Physicians considering LSS and something vascular	9	5	4
3B) Physicians not identifying LSS	15	12	3
Ba Physicians considering something neurological	6	4	2
Bb Physicians considering something vascular	6	5	1
Bc Physicians considering something neurological and vascular	3	3	0

LBP: low back pain; GP: general practitioner; n: amount; LSS: lumbar spinal stenosis

Figure 2. The ability of physicians to identify the presence of specific LBP (LSS)



3.2. Physicians' knowledge, attitudes, beliefs and guideline-adherence in the management of **non-specific LBP**

Back-PAQ (median: 9; IQR: 10.2), and HC-PAIRS (median: 46; IQR: 12) scores are shown in table 4, reflecting attitudes and beliefs towards non-specific LBP. On the **Back-PAQ** (Appendix B), 94% agreed that *"Once you have had back pain there is always a weakness"*; 65% believed patients are prone to reinjury if they are not careful (item 2), and 56% viewed the back as generally susceptible to damage (item 1). Half (52%) agreed a twinge may signal serious injury (item 4). Conversely, most physicians (80-97%) agreed LBP does not equate to injury (item 3), endorsed staying active (items: 5-6), and promoted positive expectations (items: 7-8, 10).

Up to two-thirds (50-66%) held positive attitudes on several **HC-PAIRS** items (items: 1-3, 8-12; Appendix B), and agreed pain is multifaceted (item 13: 76%). However, 77% believed chronic non-specific LBP patients should not continue usual activities when their pain is bad (item 6), with related activity-limiting beliefs in items 4 (56%) and 7 (60%).

Physicians scored a median of 12/19 on the **NPQ** (IQR: 4; table 4), though correct responses on several items were low (3-49%; items: 2, 11, 14-15, 17, 19; Appendix B): only 28% and 16%, respectively, disagreed that *"the body tells the brain when it is in pain"* (item 11) and *"it is possible to have pain and not know about it"* (item 17), and only 38% considered the influence of context on pain (item 19).

Overall, 36% **self-reported knowing the LBP guidelines** (GPs: 26%, trainees: 48%), while 59% remained unsure (table 4). Although 82% gave **guideline-consistent activity recommendations**, 64% issued **guideline-inconsistent work recommendations** (table 4).

Table 4: Physicians' knowledge, attitudes, beliefs, and guideline-adherence in the management of LBP

Questionnaires		**Total population**	**GPs**	**Trainees**
Back-PAQ 10 [-20 ; +20]	Median (IQR)	9 (10.2)	11.5 (9.8)	7.5 (8.8)
HC-PAIRS [13 ; 91]	Median (IQR)	46 (12)	46.5 (12.5)	44 (13)
NPQ [0 ; 19]	Median (IQR)	12 (4)	12 (4)	12 (3)
Self-reported guideline knowledge				
	yes n(%)	36 (36%)	14 (26%)	22 (48%)
	not sure n(%)	59 (59%)	38 (70%)	21 (46%)
	no n(%)	5 (5%)	2 (4%)	3 (6%)
Third Rainville vignette		**Total population**	**GPs**	**Trainees**
Activity recommendations		n (%)	n (%)	n (%)
	Guideline-inconsistent n(%)	18 (18%)	10 (19%)	8 (17%)
	Guideline-consistent n(%)	82 (82%)	44 (81%)	38 (83%)
Work recommendations				
	Guideline-inconsistent n(%)	64 (64%)	33 (61%)	31 (67%)
	Guideline-consistent n(%)	36 (36%)	21 (39%)	15 (33%)

GPs: general practitioners; nLBP: non-specific low back pain; n: amount; Back-PAQ 10: 10-item Back Pain Attitude Questionnaire; HC-PAIRS: Health Care Providers' Pain and Impairment Scale ;NPQ: Neurophysiology of Pain Questionnaire

3.3 Unadjusted associations with identifying or suspecting **specific LBP**

Trainees had lower odds of suspecting something specific than GPs (OR: 0.35 [95%CI: 0.16 ; 0.80]; log(OR): -1.04 [95%CI: -1.86; -0.22]). No other statistical significant unadjusted associations with either suspecting something specific or identifying LSS were observed for Gender, Age, Self-reported guideline knowledge, Back-PAQ, HC-PAIRS, or NPQ (table 5).

3.4 Unadjusted associations with activity recommendations for chronic **non-specific LBP**

Helpful Back-PAQ scores had unadjusted associations with higher odds of guideline-consistent recommendations (OR: 3.23 [95%CI: 1.63 ; 6.43]; log(OR): 1.17 [95%CI: 0.47; 1.86]), whereas unhelpful HC-PAIRS scores had unadjusted associations with lower odds (OR: 0.47 [95%CI: 0.27 ; 0.82]; log(OR): -0.76 [95%CI: -1.33 ; -0.20], table 5). No other statistical significant unadjusted associations with Activity recommendations for chronic non-specific LBP were observed for Population, Gender, Age, Self-reported guideline knowledge, or NPQ (table 5).

Table 5: Log-transformed Odds ratio and Odds ratio

	Suspecting something specific				**Identifying Lumbar spinal stenosis**				**Activity recommendations**			
			binary outcomes				*binary outcomes*				*binary outcomes*	
	log(OR) [95% CI]	OR [95% CI]	*Odds_0*	*Odds_1*	log(OR) [95% CI]	OR [95% CI]	*Odds_0*	*Odds_1*	log(OR) [95% CI]	OR [95% CI]	*Odds_0*	*Odds_1*
Population	**-1.04 [-1.86 ; -0.22]**	**0.35 [0.16 ; 0.80]**	***GPs*** **2.17**	***Trainees*** **0.77**	-0.38 [-1.18 ; 0.42]	0.69 [0.30 ; 1.52]	*GPs* 0.86	*Trainees* 0.59	0.08 [-0.95 ; 1.10]	1.08 [0.39 ; 3.01]	*GPs* 4.40	*Trainees* 4.75
Gender	-0.06 [-0.88 ; 0.76]	0.94 [0.42 ; 2.13]	*Male* 1.38	*Female* 1.3	-0.01 [-0.82 ; 0.81]	0.99 [0.44 ; 2.25]	0.73	0.72	-0.25 [-1.32 ; 0.65]	0.78 [0.27 ; 2.29]	*Male* 5.33	*Female* 4.17
Age	0.32 [-0.11 ; 0.75]	1.37 [0.89 ; 2.11]	-	-	0.26 [-0.14 ; 0.66]	1.3 [0.87 ; 1.94]	-	-	0.73 [-0.08 ; 1.54]	2.07 [0.92 ; 4.66]	-	-
Self-reported knowledge of guidelines	-0.09 [-0.92 ; 0.73]	0.91 [0.40 ; 2.08]	*no & unsure* 1.37	*yes* 1.25	-0.38 [-1.22 ; 0.46]	0.69 [0.29 ; 1.58]	*no & unsure* 0.83	*yes* 0.57	-0.43 [-1.47 ; 0.60]	0.65 [0.23 ; 1.83]	*no & unsure* 5.40	*yes* 3.50
Back-PAQ	0.12 [-0.28 ; 0.52]	1.13 [0.76 ; 1.68]	-	-	0.17 [-0.23 ; 0.57]	1.19 [0.79 ; 1.77]	-	-	**1.17 [0.47 ; 1.86]**	**3.23 [1.63 ; 6.43]**	-	-
HC-PAIRS	0.08 [-0.32 ; 0.48]	1.08 [0.72 ; 1.61]	-	-	-0.11 [-0.51 ; 0.29]	0.89 [0.60 ; 1.33]	-	-	**-0.76 [-1.33 ; -0.20]**	**0.47 [0.27 ; 0.82]**	-	-
NPQ	0.18 [-0.22 ; 0.58]	1.20 [0.80 ; 1.79]	-	-	0.09 [-0.32 ; 0.49]	1.09 [0.73 ; 1.63]	-	-	0.15 [-0.35 ; 0.65]	1.16 [0.71 ; 1.91]	-	-

Bold results: significant results; OR: Odds ratio; log(OR): log-transformed OR; [95% CI]: 95% Confidence interval; Activity recommendations: 1="Guideline consistent" ,0="Guideline inconsistent"; Suspecting something specific: 1="Yes", 2= "No" or "Not answered"; Identifying lumbar spinal stenosis: 1="Yes", 2= "No" or "Not answered"; Population: 1=Trainees, 0=General Practitioners; Gender: 1= Female, 0=Male; Self-reported knowledge of guidelines: 1= "Yes" ; 0: "Not sure" and "No"; Back-PAQ: Back Pain Attitudes Questionnaire; HC-PAIRS: Health Care Providers' Pain and Impairment Relationship Scale; NPQ: Neurophysiology of Pain Questionnaire. For continuous variables, ORs represent a one-standard-deviation increase. For binary variables, ORs represent the coded category relative to the reference category.

4. Discussion

This exploratory study identified several important gaps and inconsistencies in first-line physicians' management of both specific and non-specific LBP. Only 36% reported knowledge of the current LBP guidelines, highlighting a potentially important implementation gap. Less than half of the first-line care physicians correctly identified LSS. A notable inconsistency is that most physicians gave guideline-consistent activity recommendations for non-specific LBP but frequently held beliefs that the spine is vulnerable and prone to injury. Furthermore, 64% gave guideline-inconsistent work recommendations and appeared to adopt activity-restricting attitudes for patients with 'severe' chronic non-specific LBP. Together, these findings suggest that vignette-based guideline-consistent recommendations do not necessarily reflect underlying LBP beliefs such as spinal vulnerability.

4.1 The ability to suspect specific LBP and its contributing factors

In the LSS vignette, 42% of physicians identified clinical signs consistent with LSS, though only 31% did so without also attributing the presentation to alternative vascular or neurological causes. A further 15% did not suggest LSS but proposed alternative specific causes, potentially reflecting difficulty prioritising LSS and risking delayed care. Fourteen percent gave no response or stated they did not know. These findings may reflect diagnostic uncertainty, aligning with previous work in which GPs self-reported *"feeling unconfident in diagnosing LSS"*, and a preference to *"rather refer to a specialist"* [58,59]. Previous research reports diagnostic ambiguity in differentiating specific from non-specific LBP [19-22], but has largely focused on general uncertainty or management decisions (e.g. referrals, imaging)[22,37,42,60] rather than the ability to correctly suspect specific LBP from a clinical vignette.

Trainees had lower odds than GPs of suspecting a specific underlying cause. However, the ability to identify the specific cause represented by the vignette remained limited overall. Notably, no clear evidence of an association was observed between accurately identifying LSS and self-reported guideline knowledge certainty or other examined factors (GPs/trainees, Back-PAQ, HC-PAIRS). Although physicians have been reported to face diagnostic uncertainty [19-22], the factors underlying the ability to identify specific LBP, such as LSS, remain unclear. Furthermore, the current study cannot distinguish between diagnostic uncertainty, diagnostic difficulty, or keeping an intentionally broad differential diagnosis. These interpretations may have contributed to the findings. Therefore, future qualitative research should explore physicians' clinical reasoning when considering specific causes of LBP to better understand these different interpretations.

Taken together, these findings suggest that the availability of guidelines alone may be insufficient to improve the ability to identify LSS in first-line care. Future studies should examine physicians' ability to identify a range of overlapping specific LBP causes, assessing not only accuracy across conditions but also how physicians discriminate between overlapping presentations and where critical gaps in diagnostic triage occur, in turn informing educational strategies.

4.2 Knowledge, attitudes, and beliefs on LBP management and its association with guideline-consistent activity recommendations

Although many physicians in this study gave guideline-consistent activity recommendations, individual Back-PAQ items revealed that most physicians agreed the spinal column is inherently vulnerable or prone to injury. This disconnect between guideline-consistent recommendations and beliefs about spinal vulnerability represents an important potential educational target. These unhelpful beliefs, which may have an enduring negative impact [29] contrast with other items where physicians agreed non-specific LBP patients should be reassured and stay active. This inconsistency, aligning with previous research [22], may produce confusing messages that diminish patients' confidence in their management, which is particularly concerning in chronic non-specific LBP where restoring activity and addressing beliefs of structural harm are central to rehabilitation [25,26]. Certain HC-PAIRS items indicated that physicians were more likely to recommend reduced activity when pain intensity increased in patients with chronic non-specific LBP. While only moderate confidence exists in current evidence on physician-reported barriers to activity-recommendations [22], our findings suggested that physicians with more

helpful Back-PAQ beliefs had higher odds of providing guideline-consistent activity recommendations. Conversely, unhelpful HC-PAIRS beliefs had unadjusted associations with significantly lower odds. Together, these findings may indicate an association between attitudes and beliefs and guideline-consistent activity recommendations. Whether these unadjusted associations reflect underlying clinical knowledge regarding perceived spinal vulnerability and guideline adherence warrants further investigation. Notably, despite apparent gaps in pain neurophysiology knowledge in some fields, NPQ scores were not associated with guideline-consistent activity recommendations. Physicians in this study also provided poor guideline-consistent work recommendations, consistent with previous research [34]. Physicians' decision-making is well established to be influenced by patient expectations [22,60], and guideline-inconsistent management has been linked to uncertainty about applying recommendations to individual patients [61]. However, as physicians responded to a clinical vignette rather than an actual patient, patient expectations were not directly represented. Clinicians' difficulties may not arise solely from personal attitudes and beliefs regarding LBP management; substantial heterogeneity across clinical practice guidelines, including variation in recommended approaches during both acute and chronic management phases, may also contribute to diagnostic uncertainty [62]. Future studies may explore whether physicians' assessment of a patient's ability to continue working despite LBP is related to work recommendations, as physicians reportedly rarely inquire about work conditions or job strain [63]. This may be relevant to guideline-consistent recommendations concerning early return to work [25,64]. Taken together, these findings cautiously suggest the importance of continuing educational interventions [65,66] targeting the unhelpful attitudes and beliefs identified by the Back-PAQ and HC-PAIRS, promoting guideline-consistent work recommendations, and improving physicians' confidence in addressing patient expectations.

4.3 Implications for practice and future research

This study underscores the need for a dual focus in training and education to improve the ability to identify specific LBP and address inconsistent beliefs that may be relevant to care in non-specific LBP cases. Based on the inconsistent beliefs surrounding activity recommendations and spinal vulnerability, future educational interventions could target these beliefs, with a focus on communication strategies and raising awareness of physicians' (unintentional) conflicting messages. Given the observed unadjusted association between attitudes and beliefs and guideline-consistent activity recommendations, continuing education could incorporate reflective practice, communication strategies, and myth-debunking around LBP [67], informed by in-depth qualitative research into physicians' clinical reasoning and the sources of diagnostic uncertainty, as well as strategies to improve guideline implementation. A future study should use a larger sample for meaningful subgroup analysis and incorporate patient interactions, given the influence of patient expectations and the physician-patient relationship on decision-making [21,22,60,61,68]. Considering the multidisciplinary nature of LBP management, future studies should explore clinical reasoning for both specific and non-specific LBP among different HCPs (e.g. physicians, physiotherapists, chiropractors, etc).

4.4 Strengths and limitations

To our knowledge, this is among the first studies to investigate physicians' ability to suspect and identify specific LBP using a clinical vignette. Although the sample consisted of younger physicians, it spanned trainees through experienced GPs, offering valuable insights into current LBP management approaches. Several limitations should be acknowledged. First, the small sample size prevented statistically meaningful subgroup analyses (e.g., GPs vs trainees, regional differences), limited the ability to identify small-to-moderate associations, and may have resulted in imprecise effect estimates, limiting generalisability. Second, the open-question online-survey format prevented probing physicians' reasoning behind their decisions. Third, selection bias cannot be excluded, as participants likely had a pre-existing interest in LBP management, risking a non-random sample and limiting generalisability. It should be noted that physicians with a pre-existing interest in LBP are associated with guideline-inconsistent beliefs [69], meaning the sample still captures relevant, engaged clinical perspectives. Fourth, the online recruitment strategy may also have introduced bias, skewing the sample towards a younger population, limiting generalisability to older populations. Fifth, although the LSS vignette was

developed and reviewed by an expert panel and used previously, it was not formally validated and inherent ambiguity in the vignette cannot be excluded [47]. Sixth, physicians responded to vignettes and questionnaires rather than real patients, limiting exposure to patient expectations, which are known to influence guideline-adherence [22], and to other contextual cues informing real-world decision-making. As the vignette was administered in two languages, cross-linguistic differences in comprehension or interpretation cannot be excluded. Future studies should consider simulated patients to better capture these influences. Finally, the analyses of unadjusted associations were not adjusted for potential confounders (e.g., age, country, language) and should not be interpreted as independent effects. Furthermore, the precision of some estimates was limited, and the absence of clear evidence of an association should not be interpreted as evidence that potentially relevant associations do not exist. The findings should therefore be interpreted as exploratory and considered within the context of the sample and study design.

5. Conclusions

This study demonstrates limited ability among first-line physicians in correctly identifying LSS, highlighting the need for further research into clinical decision-making in the evaluation of specific LBP. While most physicians provided guideline-consistent activity recommendations, misconceptions regarding spinal vulnerability and activity limitation in chronic non-specific LBP persist. These conflicting beliefs warrant further research into their underlying mechanisms and may help inform targeted educational interventions in both basic and continuing education to support consistent, evidence-based messages to patients.

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