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**Original research: Management of acute non-specific low back  
pain in the emergency department - do emergency physicians  
follow the guidelines? Results of a cross-sectional survey**

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# BMJ Open Management of acute non-specific low back pain in the emergency department: do emergency physicians follow the guidelines? Results of a cross-sectional survey

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## ABSTRACT

**Objectives** Clinical guidelines for acute non-specific low back pain (LBP) recommend avoiding imaging studies or invasive treatments and to advise patients to stay active. The aim of this study was to evaluate the management of acute non-specific LBP in the emergency departments (ED).

**Setting** We invited all department chiefs of Swiss EDs and their physician staff to participate in a web-based survey using two clinical case vignettes of patients with acute non-specific LBP presenting to an ED. In both cases, no neurological deficits or red flags were present. Guideline adherence and low-value care was defined based on current guideline recommendations.

**Results** In total, 263 ED physicians completed at least one vignette, while 212 completed both vignettes (43% residents, 32% senior/attending physicians and 24% chief physicians). MRI was considered in 31% in vignette 1 and 65% in vignette 2. For pain management, non-steroidal anti-inflammatory drugs, paracetamol and metamizole were mostly used. A substantial proportion of ED physicians considered treatments with questionable benefit and/or increased risk for adverse events such as oral steroids (vignette 1, 12% and vignette 2, 19%), muscle relaxants (33% and 38%), long-acting strong opioids (25% and 33%) and spinal injections (22% and 43%). Although guidelines recommend staying active, 72% and 67% of ED physicians recommended activity restrictions.

**Conclusion** Management of acute non-specific LBP in the ED was not in agreement with current guideline recommendations in a substantial proportion of ED physicians. Overuse of imaging studies, the use of long-acting opioids and muscle relaxants, as well as recommendations for activity and work restrictions were prevalent and may potentially be harmful.

## INTRODUCTION

Low back pain (LBP) is among the 10 most common reasons for emergency department (ED) visits.<sup>1–3</sup> LBP is defined as pain located between the lower rib margins and

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ We invited all physicians working in Swiss emergency departments (ED) with all levels of training and professional expertise to participate in this electronic survey.
- ⇒ We did not use a registry of board-certified ED physicians, because physicians registered in the database may no longer be actively working at the hospital. Furthermore, we may potentially miss physicians in training. We had no data on total number of available ED physicians to calculate response rate.
- ⇒ Two case vignettes were developed that describe two different patients with acute non-specific low back pain: they do not objectively assess real-time clinical care; however, ED physicians rated the clinical vignettes to be representative of their clinical practice.

the buttock creases with or without pain radiation in one or both legs.<sup>4 5</sup> In the general population, the mean point prevalence of LBP was 18.3%<sup>6</sup> and the lifetime prevalence up to 80%.<sup>7</sup> LBP is the number one condition that results in pain-related disability worldwide.<sup>5 8 9</sup> The economic burden of LBP is significant, where two-thirds originate from indirect costs (eg, loss of productivity).<sup>5 10</sup> The costs for the management of LBP in the ED are significantly higher per visit than in the primary care setting.<sup>11</sup>

During the first 6 weeks of a new LBP episode, a high recovery rate without specific treatment has been observed.<sup>12</sup> The prevalence of serious spinal disease that required immediate or urgent treatment in the primary care setting was <1%<sup>13</sup> and in the ED between 2% and 7%.<sup>14</sup> Therefore, the majority of patients presenting to the ED with acute LBP

will have non-specific or non-urgent conditions. Treatment guidelines recommend for an acute LBP episode reassurance and pain medications as needed and to avoid overtreatment.<sup>5–9</sup> Spine imaging is not recommended during the first 6 weeks unless there is a severe or progressive neurological deficit or a suspected serious underlying disease.<sup>15–17</sup> Early imaging in acute LBP has both little impact on the management and also potentially negative consequences because of psychological distress, fear, incidental findings and overtreatment.<sup>9 18–24</sup>

In a call for action published in the *Lancet*, health-care professionals are asked to improve access to effective care and to avoid ineffective or low-value care in LBP.<sup>5 8 9 25</sup> Inadequate and ineffective management may by itself result in an increased risk for chronic LBP.<sup>12 26</sup> Thus, management of acute LBP in the ED may have downstream effects with potentially relevant individual and economic consequences. Most clinical guidelines for the management of LBP are aimed at primary care physicians<sup>27–30</sup> and do not address diagnostic strategies for life-threatening and rare diseases that are more likely to occur in an ED (eg, epidural abscess and rupture of an aortic aneurysm).<sup>31</sup> Further diagnostic strategies to non-spinal causes that present with back pain are not included in LBP-specific guidelines.<sup>32</sup> Thus, ED physicians may perceive guidelines for acute LBP not to be representative for the ED setting.

Only limited studies address LBP management in the ED.<sup>33–36</sup> How guideline recommendations are implemented in clinical ED practice is currently not well understood. Therefore, the aim of this study was to assess the management of acute LBP in the ED. We hypothesised that a substantial proportion of ED physicians do not follow guideline recommendations.

## METHODS

### Patient and public involvement

There are no patients involved.

### Study design

We conducted an electronic survey among physicians working in Swiss EDs. We invited the chief physicians of EDs of all acute care Swiss hospitals to participate in the study. We asked them to forward an electronic survey to all physicians working in their ED. The survey was administered using a web-based survey tool.

### Participants

We invited all physicians working in an ED with all levels of training and professional expertise to participate in the survey. Participation was voluntary, anonymous and confidential. Hospitals were identified through the published hospital list of the Swiss Federal Office of Public Health.

The two principal investigators (MMW and IJG) invited 105 ED chiefs of 16 category 1 (defined below), 30 category 2 and 59 category 3 EDs on 13 May 2021. Two reminders were sent out (22 June and 7 July 2021). The

end date of the survey was on 29 September 2021. The survey was developed in German and translated into French and Italian to cover the three main languages spoken in Switzerland.

### Study setting

In Switzerland, the emergency services are organised by 26 cantons (administrative units).<sup>37</sup> Each canton delegates emergency care to the ED of public or private hospitals.<sup>38</sup> Most EDs are run by teaching hospitals (95%) and also offer walk-in services (80%) for non-urgent conditions.

Most of the initial patient evaluations are done by residents and are supervised by an attending physician and more than half (58%) of all EDs have no requirements for prior postgraduate training before working in an ED.<sup>38</sup> EDs are categorised into three categories (category 1–3). Category 1 EDs have the highest level of specialisation, with at least 20 000 annual emergency visits, a trauma centre, access to an intensive care unit, a stroke unit and an invasive cardiac centre. Staff requirements include the 24-hour presence of an anaesthesiologist and nursing staff that is at least 60% specialised in emergency care. Category 2 EDs have at least 8000 annual visits, access to an intensive care unit, 24-hour presence of an anaesthesiologist and nursing staff that is at least 40% specialised in emergency care. Category 3 EDs provide more basic care.<sup>39</sup>

Since 2009, physicians working in EDs can apply for a certificate in emergency medicine.<sup>40</sup> The certificate of emergency medicine requires 24 months of additional training in addition to a board-certified specialty in internal medicine, surgery, anaesthesiology, intensive care, orthopaedic surgery, traumatology or cardiology and focuses on in-hospital emergency care. Education of physicians working in emergency medicine in Switzerland is regulated through the Swiss Society of Emergency and Rescue Medicine (SSERM). The SSERM offers a certificate for clinical and preclinical emergency medicine.

Two case vignettes were developed to assess physicians' clinical approach to patients presenting to the ED with acute LBP. The development of the vignettes was inspired by an earlier study which used three vignettes<sup>41</sup> and based on current recommendations for the development and use of vignettes in clinical practice.<sup>42</sup> The two vignettes represented two different patients with acute non-specific LBP without 'red flags'. According to current guideline recommendations, in both cases, no diagnostic tests are required and recommended treatments are pain control and recommendations to stay active. An English translation of the vignettes and the questions with response options are provided in online supplemental appendix 1. Patients varied in their age, job, pain duration, clinical presentation and medical history. The vignettes were developed in a stepwise process by the interdisciplinary research team (ie, physicians specialised in ED medicine and internal medicine, epidemiologists, methodologists and physical therapists). The vignettes were pilot tested by a panel of clinicians (general internists and rehabilitation

specialists) not involved in the study. Based on their feedback, the vignettes were improved and tested until all members of the research team agreed on the final version.

Vignette 1 was a 35-year-old male warehouse operator who presented with history of acute LBP. The pain started 10 days ago after he lifted heavy boxes. The pain increases during movements (up to 10 on the visual analogue scale (VAS)) and radiates to the knees, especially on the left side, with slight tingling. There were no red flags in the personal history and clinical examination. The clinical findings were non-specific.

A 54-year-old female computer scientist presented because of LBP that started 3–4 weeks ago and gradually progressed during the last 2 days (currently VAS 6, during movement up to VAS 10). The intermittent use of non-steroidal anti-inflammatory drugs (NSAID) or paracetamol resulted in a short relief of the symptoms. The patient's history revealed a past LBP episode 8 years ago. An MRI performed 8 years ago showed degenerative changes and a disk protrusion without disc herniation. The patient feels increasingly impaired in her daily activities and is worried that her disc protrusion may have increased. She asks about 'an injection to control the pain'. On clinical examination, no neurological deficits were observed. During the straight leg raising test and the crossed straight leg raising test, the patient reports pain in the lumbosacral junction without pain referral into the legs.

### Procedure

ED physicians were asked about different diagnostic and treatment modalities: diagnostic tests, pharmacological and non-pharmacological treatments, referral to specialty physicians and recommendations for activity and work capacity certification with possible answers on a five-point Likert scale. At the end of the survey, we asked ED physicians if they perceive the vignettes as representative for their clinical practice. Further, we assessed whether physicians knew guidelines for LBP and the 'Smarter Medicine—Choosing Wisely Switzerland' recommendations.<sup>43</sup> ED physicians completed additional questions about their sex, age, language, years in clinical practice, specialty and certificate for emergency medicine, position and type of employment (full-time or part-time). The final section of the survey covered information about the ED (eg, ED category, availability of MRI and CT), and access to specialised care (eg, availability of spine surgeons and pain services). Physician and workplace characteristics were asked at the end of the survey to avoid any bias in the responses.

### Definition of guideline adherence

We used current guidelines to define guideline adherence for patients presenting to the ED for acute, non-specific LBP.<sup>17 29 36 44–48</sup> In online supplemental appendix 1, the definitions of non-adherence/low value care for diagnostic approaches, pharmacological and non-pharmacological treatments, referral and recommendations for activity

and work are provided. Because both cases had no red flags, neurological deficits and no previous treatment, we considered responses as guideline adherent if physicians 'never or rarely' performed imaging studies, laboratory tests, prescribed steroids, muscle relaxants, long-acting strong opioids, homeopathy, local infiltration, massage and acupuncture. For pain medication use, we considered the use of NSAIDs and metamizole as guideline adherent. Due to additional high-quality evidence published in 2014<sup>49</sup> and the subsequential changes in guideline recommendations, we considered paracetamol use as guideline adherent if it was never, rarely or occasionally used. We further assessed coprescription of paracetamol with NSAIDs. We defined guideline adherent if physical and manual therapy were considered occasionally or more in both vignettes because some evidence indicates that manual and physical therapy may be effective to rapidly decrease pain and educate patients.<sup>50</sup> Most guidelines recommend physical therapy and manual therapy in selected patients.<sup>14</sup> Patients presenting to the ED may report higher pain levels,<sup>51</sup> may be afraid and request quicker resolution of symptoms<sup>32 52</sup> as compared with patients presenting to the general practitioner (GP).<sup>49</sup>

### Statistical analysis

We calculated descriptive statistics and reported values as absolute numbers with percentage. We compared responses for male and female ED physicians by using  $\chi^2$  test for categorical data. The level of significance was determined at  $p < 0.05$ . Because not all ED physicians completed both vignettes, characteristics for ED physicians were only available for those who did complete the survey ( $n=212$ ). We performed a sensitivity analysis for guideline adherence in the subset of those ED physicians who completed both vignettes ( $n=212$ ). Statistical analyses were performed using R V.4.0.3.<sup>53</sup>

## RESULTS

### Baseline characteristics

In total, 263 ED physicians completed at least one vignette and were analysed (online supplemental figure 1). Excluded were 10 surveys that completed only a few questions. A subset of 212 ED physicians completed both vignettes and provided information on their characteristics. **Table 1** summarises the characteristics of the 212 ED physicians.

The majority of ED physicians were between 30 and 40 years old (44%), residents (43%), worked in the Swiss German part (77%), full-time (64%) and in a category 1 ED (52%). ED physicians were 52% ED board certified. A senior physician was present during 24-hours in 47%. Further, most ED physicians had access to specialists (spine surgeon in 67%, rheumatologist in 61% and a pain clinic in 72%) and imaging (MRI in 77%, CT-scans in 97%). Compared with male ED physicians, female ED physicians were younger (50% aged between 30 and 40

**Table 1** Baseline characteristics of the study population (n=212)

Characteristics	All,* n=212 (100%)	Female, n=103 (100%)	Male, n=109 (100%)
Age (years)			
<30	48 (23)	24 (23)	24 (22)
30–40	93 (44)	51 (50)	42 (39)
41–50	46 (22)	22 (21)	24 (22)
51–65	24 (11)	5 (5)	19 (17)
>65	1 (0)	1 (1)	0 (0)
Missing	0 (0)		
Position			
Resident	91 (43)	47 (46)	44 (40)
Senior/attending physician	68 (32)	37 (36)	31 (28)
Chief	51 (24)	18 (17)	33 (30)
Missing	2 (1)		
ED category†			
Category 1	110 (52)	55 (53)	55 (50)
Category 2	65 (31)	30 (29)	35 (32)
Category 3	22 (11)	11 (11)	11 (10)
Walk-in clinic	10 (5)	3 (3)	7 (6)
Missing	5 (2)		
Employment			
Full time	136 (64)	56 (54)	80 (73)
Part time	71 (33)	44 (43)	27 (25)
Missing	5 (2)		
Graduation year			
1–7 years ago	85 (40)	45 (44)	40 (37)
8–20 years ago	86 (41)	42 (41)	44 (40)
≥20 years ago	37 (17)	12 (12)	25 (23)
Missing	4 (2)		
Work experience (years)			
≤1	30 (14)	16 (16)	14 (13)
1–7	88 (42)	48 (47)	40 (37%)
>8	91 (43)	36 (35)	55 (50)
Missing	3 (1)		
EM-certified physicians	111 (52)	49 (48)	62 (57)
Missing	2 (1)		
Language (262 ED)‡			
German	202 (77)	83 (81)	84 (77)
French	31 (12)	9 (9)	16 (15)
Italian	29 (11)	11 (11)	9 (8)
Missing	0 (0)		
24 hours presence of senior emergency physician	99 (47)	44 (43)	55 (50)
Missing	3 (1)		
In-house spine surgeon	142 (67)	72 (70)	70 (64)
Missing	2 (1)		
In-house rheumatologist	130 (61)	65 (62)	65 (60)

Continued

**Table 1** Continued

Characteristics	All,* n=212 (100%)	Female, n=103 (100%)	Male, n=109 (100%)
Missing	2 (1)		
In-house pain clinic	152 (72)	72 (70)	80 (73)
Missing	2 (1)		
MRI available in ED	164 (77)	80 (78)	84 (78)
Missing	2 (1)		
CT available in ED	205 (97)	100 (97)	105 (96)
Missing	2 (1)		
Vignettes are representative for your clinical practice	208 (98)	100 (97)	108 (99)
Missing	3 (1)		
Knowledge of current guidelines on low back pain management	102 (48)	49 (48)	53 (49)
Missing	5 (2)		
Knowledge of 'Choosing Wisely—Smarter Medicine'	136 (64)	67 (65)	69 (63)
Missing	3 (1)		

\*Baseline characteristics were only available for ED physicians who completed the survey (n=212).  
 †ED category 1, highest level of specialisation ( $\geq 20\,000$  annual visits); category 2,  $\geq 8000$  visits and category 3, basic care.  
 ‡Language area was defined by the language in which the survey was completed and was available for all 263 ED physicians.  
 ED, emergency department; EM, emergency medicine.

years vs 39%), less likely chief physicians (17% vs 30%) and worked part-time (43% vs 25%).

The vignettes were considered to be representative of the current work situation (98%), 102 ED physicians (48%) reported to know clinical guidelines and 136 (64%) were aware of the Smarter Medicine—Choosing Wisely Switzerland recommendations.

### Diagnostic approach

In agreement with current guidelines, 55% in vignette 1 and 22% in vignette two would not perform additional diagnostic testing (table 2).

The majority of ED physicians would not perform laboratory tests, X-rays and MRI in vignette 1 (52%, 66% and 61%, respectively). In vignette 2, the majority of ED physicians was not in agreement with guidelines and considered laboratory tests and MRI (laboratory test in 50% and MRI in 65%). Figure 1 depicts the proportion of ED physicians who were not in agreement with guideline recommendations for diagnostic testing.

### Pharmacological treatment

For pain management, NSAIDs and metamizole were used (table 2). Paracetamol remains a very frequently prescribed pain medication (vignette 1, 232 (89%) and vignette 2, 190 (90%) ED physicians). The majority of ED physicians used paracetamol often or always (vignette 1, 66% and vignette 2, 69%). Paracetamol was rarely used without a coprescription of NSAIDs. Coprescription of paracetamol with NSAIDs was reported in 78% in vignette 1 and 80% in vignette 2. Further, a large proportion not

in agreement with guidelines was observed for the use of muscle relaxants and long-acting strong opioids (vignette 1, 33% and 25% and vignette 2, 38% and 33%). Oral steroids were considered by 12% in vignette 1 and by 19% in vignette 2. Spinal injections were considered by 22% in vignette 1 and by 43% in vignette 2. Figure 2 depicts the proportion of ED physicians not in agreement with guideline recommendations for pharmacological treatments.

### Non-pharmacological treatment and referral

The majority of ED physicians considered physical therapy (both vignettes 92%). Manual therapy was considered by 34% in both vignettes. The majority of ED physicians would not use acupuncture or massage in both vignettes. The majority of ED physicians would not refer patients to a rheumatologist (vignette 1, 82% and vignette 2, 71%) or to a spine surgeon (vignette 1, 73% and vignette 2, 60%). Figure 3 depicts the proportion of ED physicians not in agreement with guideline recommendations for non-pharmacological treatments and referral.

### Recommendations for activity and work

The minority of ED physicians were in agreement with guidelines recommending not to restrict activity (vignette 1, 28% and vignette 2, 32%). Most ED physicians recommended some restrictions in activity (bed rest 0.7% and 0.5%, avoid all physical activities 5% and 4%, avoid all painful activities 51% and 53%). ED physicians were more likely to issue a certificate for absence from work in vignette 1 (90%) compared with vignette 2 (47%).

**Table 2** Management of non-specific acute low back pain in agreement with clinical guidelines

Guideline recommendation (response categories)‡	Vignette 1		Vignette 2	
	All (n=263)	Missing (%)	All (n=212)*	Missing (%)
<b>Diagnostic</b>				
No further diagnostic	144 (55)	22 (8)	46 (22)	14 (7)
No laboratory test	135 (52)	22 (8)	100 (47)	5 (2)
No X-rays	173 (66)	17 (6)	117 (55)	9 (4)
No MRI	160 (61)	21 (8)	68 (28)	6 (3)
<b>Pharmaceutical treatment</b>				
No medication	11 (4)	83 (32)	12 (6)	50 (23)
Use of NSAID	259 (99)	0 (0)	209 (98)	1 (0.5)
Use of metamizole	236 (90)	9 (3)	194 (91)	4 (2)
No use of paracetamol	174 (66)	22 (8)	147 (69)	9 (4)
Coprescription paracetamol and NSAID†	204 (78)		171 (80)	
NSAID, no paracetamol	33 (13)		30 (14)	
Paracetamol, no NSAID	1 (0.4)		1 (0.5)	
No use of muscle relaxants	169 (65)	5 (2)	125 (59)	6 (3)
No use of steroids	209 (80)	22 (8)	160 (75)	11 (5)
No use of weak opioids	204 (78)	17 (6)	161 (76)	10 (5)
No use of short-acting strong opioids	227 (87)	21 (8)	183 (86)	10 (5)
No use of long-acting strong opioids	176 (67)	20 (8)	131 (62)	10 (5)
No use of homeopathy	234 (89)	22 (8.4)	189 (89)	16 (8)
No local infiltration	87 (71)	18 (7)	108 (51)	12 (6)
<b>Non-pharmacological treatment</b>				
Use physical therapy	240 (92)	2 (1)	195 (92)	2 (1)
Use manual therapy	89 (34)	18 (7)	73 (34)	12 (6)
No massage	161 (61)	19 (7.3)	128 (60)	15 (7)
No acupuncture	215 (82)	22 (8.4)	174 (82)	17 (8)
<b>Referral</b>				
No referral to a rheumatologist	242 (82)	26 (10)	150 (71)	11 (5)
No referral to a spinal surgeon	190 (73)	24 (9)	127 (60)	10 (5)
<b>Recommendations</b>				
Activities of daily life	73 (28)	1 (1)	68 (32)	0 (0)
Work capacity	27 (10)	0 (0)	110 (52)	2 (1)

\*Number of surveys with at least one answered question

†Coprescription of paracetamol and NSAID: occasionally, often or always

‡Definition of adherence to guidelines and low value care are provided in online supplemental appendix 1

NSAID, non-steroidal anti-inflammatory drugs.

### Differences between male and female ED physicians

We compared responses between female and male ED physicians (online supplemental appendix 2). There was no significant difference in the use of diagnostic tests between female and male ED physicians, except in vignette 1, where female ED physicians performed laboratory tests less often compared with males (49% vs 33%,  $p=0.03$ ). Responses were also comparable with regard to pharmacological treatments except for the use of paracetamol and muscle relaxants. Female ED physicians were less likely to prescribe paracetamol compared with male (2% vs 9%,  $p=0.03$ ) in vignette 2 and more muscle relaxants in both vignettes (vignette 1, 45% vs 27%,  $p=0.01$  and

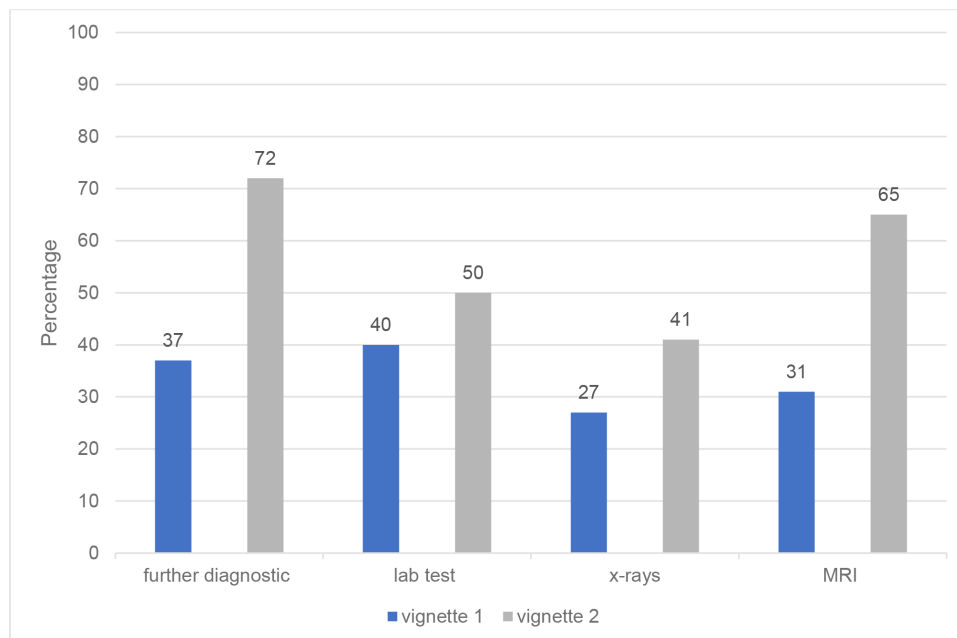
vignette 2, 47% vs 32%,  $p=0.03$ ), not in agreement with guidelines. Male ED physicians considered more often a short course of steroids in vignette 1 (18% vs 8%,  $p=0.04$ ). No difference between male and female ED physicians was observed for non-pharmacological treatments, referral and activity restrictions.

Male ED physicians were more likely to issue a certificate for work absences in vignette 1 (94% vs 84%,  $p=0.03$ , not significant in vignette 2).

### Sensitivity analysis

We compared responses between those who completed both vignettes of the survey ( $n=212$ ) and those who did



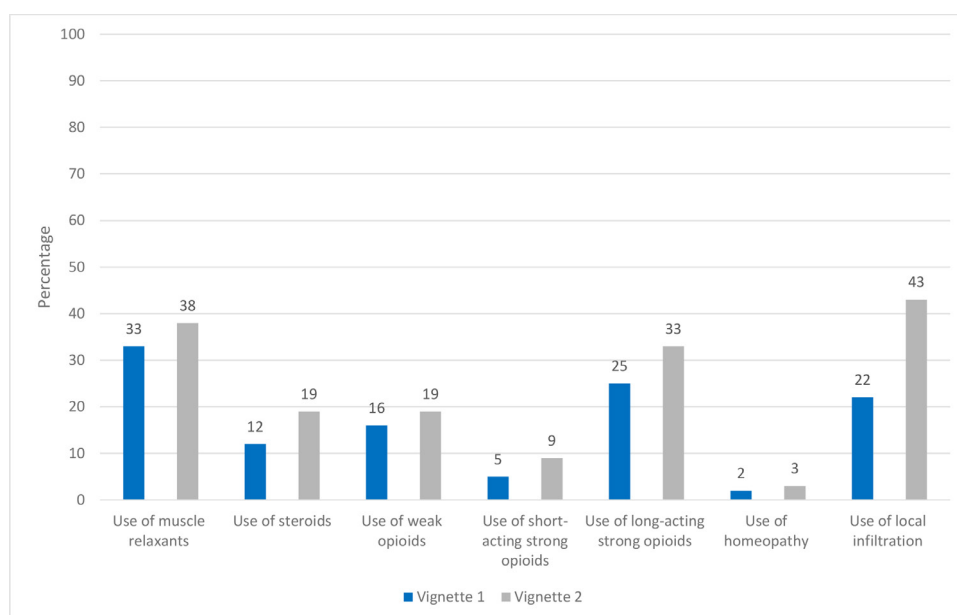


**Figure 1** Disagreement with guidelines in the diagnostic assessment of acute non-specific low back pain (n=263 in vignette 1, n=212 in vignette 2). Any additional diagnostic test: often or always performed. Laboratory test, X-rays or MRI were occasionally, often or always performed. Questions, response options and the definitions for guideline adherence are provided in online supplemental appendix 1.

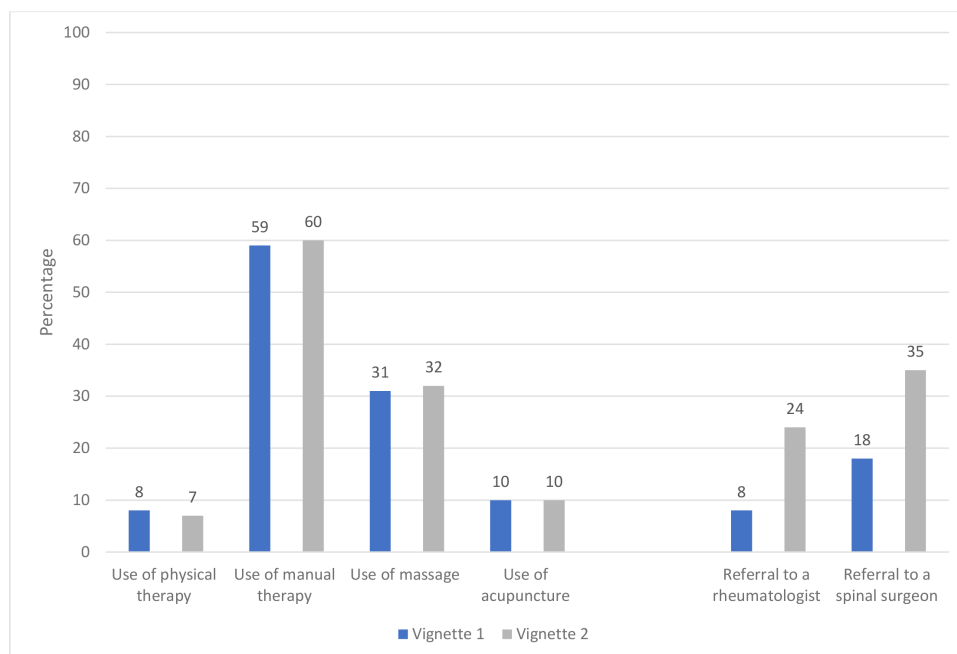
not (n=51). Responses for vignette 1 were not different except for lab tests, and recommendations for activity (online supplemental appendix 3). Non-completers were more likely to perform laboratory tests (58% vs 41%,  $p=0.04$ ) and also recommended more activity restrictions (84% vs 69%,  $p=0.04$ ).

## DISCUSSION

In this study of two case vignettes with acute non-specific LBP, we observed that a substantial proportion of ED physicians' diagnostic, pharmacological and non-pharmacological management was not in agreement with current guideline recommendations. Although both



**Figure 2** Disagreement with guidelines in the pharmacological management of acute non-specific low back pain (n=263 in vignette 1, n=212 in vignette 2). Use of muscle relaxants, steroids, long-acting strong opioids, homeopathy, local infiltration occasionally, often or always. Use of weak opioids and short-acting opioids often or always. Questions, response options and the definitions for guideline adherence are provided in online supplemental appendix 1.



**Figure 3** Disagreement with guidelines for non-pharmacological management and referral (n=263 in vignette 1, n=212 in vignette 2). Definition of non-adherence to guidelines/low value care: referral to physical therapy and manual therapy never or rarely. Referral to massage and acupuncture occasionally, often or always. Referral to rheumatologist or spinal surgeon occasionally, often or always. Questions, response options and the definitions for guideline adherence are provided in online supplemental appendix 1.

vignettes were without red flags, MRI was considered in 31% in vignette 1 and 65% in vignette 2. A substantial proportion of ED physicians considered treatments with questionable benefit and/or increased risk for adverse events such as oral steroids (up to 19%), muscle relaxants (up to 38%), long-acting strong opioids (up to 33%) and spinal injections (up to 43% in vignette 2). Further, the majority physicians prescribed paracetamol despite the recommendations of newer guidelines against the use of paracetamol.<sup>49</sup> Although guidelines recommend staying active, a majority of ED physicians recommended activity and work capacity restrictions.

### Comparison with existing literature

Although our study may not reflect current clinical practice of all ED physicians and we were not able to assess the response, the findings are in line with other studies and raise important aspects that should be addressed and may ED management. According to a systematic review, one in three patients presenting to the ED for LBP underwent some type of imaging, between 20% and 60% were prescribed opioids, and only 20% received education, reassurance and advice regarding exercise.<sup>23</sup> Low value care for LBP in the ED may have relevant downstream implications. The individual and societal implications of LBP are enormous.<sup>5 8-10</sup> Although physicians may be aware of LBP guidelines, many physicians seem not to adhere to the recommendations.<sup>23 54-56</sup> Studies have shown a mismatch between guideline recommendations and routine practice among primary care practitioners and ED physicians.<sup>23</sup> Barriers to adhere to guidelines

include a lack of awareness, lack of familiarity or agreement, insufficient competence to assess and treat LBP, overestimation of the risk for serious diseases, inertia due to previous practice or lack of motivation to change.<sup>57</sup> Indeed, most guidelines do not address diagnostic strategies for life-threatening and rare diseases that are more likely to occur in an ED (eg, epidural abscess and rupture of an aortic aneurysm).<sup>31</sup> Further diagnostic strategies to non-spinal causes that present with back pain are not included in LBP-specific guidelines. Thus, it may be very difficult to write ED-specific guidelines that address all aspects.

Lack of agreement with guideline recommendations are often due to recommendations that are based on low-quality evidence and may differ from personal experience. In particular for pain medications, limited high-quality studies exist that assess the efficacy of frequently used pain medications alone and in combinations.<sup>28</sup> Although newer guidelines do not recommend the use of paracetamol because of the negative Paracetamol in Acute LowBack Pain (PACE) trial that found paracetamol no more effective than placebo,<sup>49</sup> only very few studies assessed the effectiveness of a combination of paracetamol and NSAID during the acute LBP phase. Two clinical trials compared the efficacy of paracetamol in combination with ibuprofen to ibuprofen alone and came to different conclusions. While Ostojic and colleagues observed a faster and longer analgesia in patients with acute LBP with a combination therapy compared with ibuprofen alone,<sup>58</sup> Friedman and colleagues found no additional

benefit.<sup>59</sup> Conflicting results of studies may further fuel disagreement with guideline recommendations.

For LBP, studies suggest that ED physicians overestimate the risk for an underlying severe disease. A systematic review of studies performed in the ED setting found a prevalence of serious spinal diseases that require immediate or urgent treatment of between 2% and 7%.<sup>14</sup> Therefore, more than 90% of patients with LBP presenting to the ED will have non-urgent conditions that do not require immediate imaging or treatments other than pain control. Furthermore, in asymptomatic patients, the prevalence of disc herniation in MRIs was between 2% and 19%,<sup>5</sup> indicating a high rate of overdiagnosis with a potential for overtreatment. ED physicians should both be trained how to detect and treat disaster and emergencies and also how to identify non-urgent conditions and provide guidance for safe and effective management. Studies showed, that for example, the presence of sciatica increased non-adherence with guidelines in particular in ED physicians compared with GPs.<sup>31 60</sup> Patients presenting to the ED may differ in their presentation and this may explain an increased use of diagnostic tests in the ED compared with the GP setting. A systematic review of 10 studies found some indication that patients presenting with acute LBP to the ED had higher pain scores and more disability compared with patients presenting to a GP.<sup>51</sup> Furthermore, patients may have different expectations and request quicker answers and resolution of symptoms.<sup>61–66</sup>

In the ED setting, matching patients' expectations with guideline recommendations may be perceived as burdensome and time consuming.<sup>31</sup> Additional external barriers include short consultation times, ED crowding, fear of litigation in the event of missed serious diseases and a desire to maintain harmonious relationships with patients.<sup>67 68</sup> Individual factors, such as personal beliefs, may also influence treatment recommendations. For example, physicians with high personal fear avoidance beliefs were more likely to advise patients to limit work and physical activities and were less likely to adhere to treatment guidelines.<sup>69</sup>

Adhering to clinical recommendations may be particularly challenging for ED physicians<sup>70</sup> because they are trained to expect the worst possible outcome.<sup>71</sup> Further, time pressure, ED crowding and lack of personal expertise may be additional factors why referral to imaging and specialty physicians may be preferred.<sup>72 73</sup>

Low value care in acute non-specific LBP with a high potential of harm include the use of early imaging and recommendations for activity restrictions. Evidence suggests that the early use of imaging studies may result in overdiagnosis, overtreatment, poorer patient reported outcomes and delayed return to work (such as days of continuous paid indemnity, ie, lost wage replacement for temporary total or temporary partial lost days).<sup>18 27 74</sup> MRI in acute LBP did not change the diagnosis and clinical management.<sup>75</sup> Early MRI was also not associated with better outcomes in acute LBP patients with or

without disc herniation and resulted in worse well-being of patients and delayed return to work.<sup>76</sup> The American College of Radiology appropriateness criteria,<sup>17</sup> the American College of Emergency Physicians<sup>15</sup> and the Swiss Society of General Internal Medicine<sup>16</sup> among other guidelines and societies do not recommend imaging in patients with acute LBP without red flags or severe or progressive neurological deficits. Activity restrictions may be harmful and result in avoidance with an increased risk for chronic LBP,<sup>77</sup> reduced efficacy of treatments, lower recovery rates and more disability.<sup>78–81</sup> Further, a summary of high-quality guidelines encourages early resumption of work.<sup>82</sup> Thus, activity restrictions are not recommended.<sup>9 28–30 47 83 84</sup>

### Limitations of our study

The following limitations need to be discussed: first, although clinical vignettes to assess choices in medical practice are well established,<sup>85</sup> they do not objectively assess real-time clinical care and thus, management may be different than that reported in our study. However, ED physicians rated the clinical vignettes to be representative of their clinical practice in over 90%. Second, response bias needs to be considered because physicians participating in the study may be more aware of current guidelines. Considering the high proportion of non-adherence with guidelines, we expect that non-adherence with guidelines may be underestimated in this study. Third, we used cut-off points for low-value care which may not be in agreement with all guidelines for the use of pain medication (ie, recommendations for paracetamol use changed over time, and no recommendations for metamizole use exist).<sup>86</sup> Fourth, we cannot exclude by chance findings in our exploratory analyses due to multiple testing. Future studies may need to explore differences between female and male ED physicians in more detail.

Finally, we did not use a registry of board-certified ED physicians, because physicians registered in the database may no longer be actively working at the hospital. Furthermore, we may potentially miss physicians in training. We had no data on total number of available ED physicians to calculate response rate.

### Implications for future research

There is a lack of high-quality randomised studies for the management of acute LBP in the ED.<sup>33</sup> Studies should assess the beliefs and underlying reasons for discrepancies between guideline recommendations and clinical practice in the ED. Further, studies should assess how medical training can influence pain and LBP management of residents and staff physicians working in the ED. Guidelines that are accepted by peers need to be based on high-quality evidence from clinical studies.<sup>72</sup> Patient expectation and lack of time may be important drivers in the management of LBP in the ED. Studies should assess the impact of interventions to facilitate physician–patient communication which may reduce the use of low-value care.<sup>86</sup> Shared decision-making that facilitates patient

understanding of the recommendations may be feasible in the ED settings.<sup>87</sup>

### Implications for clinical practice

Although no ED-specific guidelines are available, two useful options for ED care include the New South Wales Emergency Care Institute flowchart to manage LBP<sup>48</sup> and an evidence-based clinical guide.<sup>44</sup> ED physicians should both be trained how to detect and treat disaster and emergencies and also how to identify non-urgent conditions and provide guidance for safe and effective management. Due to a low prevalence of serious underlying diseases, guidelines<sup>15–17</sup> do not recommend imaging in patients with acute LBP without red flags or severe or progressive neurological deficits. ED physicians should be aware that frightening messages and activity restrictions or avoidance may hold a potential for harm.<sup>22 23</sup> Hence, training targeting explicitly ED physicians for these non-dangerous LBP could be developed and implemented. Standardised clinical pathways for patients with LBP in the ED and training of communication skills for healthcare professionals may be options to improve clinical care.<sup>72 73</sup>

In clinical practice, interventions to improve health literacy of patients and to decrease the mismatch of expectations with guideline recommendations may also improve care. For example, Choosing Wisely Canada also provides a pamphlet for patients on when imaging tests for LBP are needed and when not.<sup>88</sup> Other options include patient education by other healthcare professionals, and digital video applications.<sup>36 89</sup> Educating patients and the public can make a significant contribution, providing education on pain and self-management of LBP.<sup>63 72</sup>

### CONCLUSION

Management of acute non-specific LBP in the ED was not in agreement with current guideline recommendations in a substantial proportion of ED physicians. In particular, overuse of imaging studies, the use of long-acting opioids and muscle relaxants and recommendations for activity and work restrictions may potentially be harmful.

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## Appendix 1: Case vignettes and definition of low value care

### Vignette 1

A 35-year-old male warehouse operator presents with acute severe low back pain (LBP). The pain started 10 days ago after he lifted heavy boxes. The pain increases during movements (up to 10 on the visual analogue scale (VAS)) and radiates to the knees, especially on the left side, with slight tingling. The use of 4 g paracetamol per day did not relieve the pain. The patient is unable to work, and the pain limits his daily activities. The patient is otherwise healthy and reports no previous surgeries or trauma. During the clinical examination, a pronounced paravertebral muscle tension is observed. There is no loss of motor function and no sensory deficit detectable and during the straight leg raising test the patient reports pain in the buttocks at 35° without radiation into the legs. During the crossed straight leg raising test, no pain occurred.

### Vignette 2

A 54-year-old female computer scientist presents because of LBP that started 3 to 4 weeks ago and gradually progressed during the last 2 days (currently VAS 6, during movement up to VAS 10). There is no pain referral or functional deficit and the patient does not report any recent trauma. The patient's history revealed a past LBP episode 8 years ago. An MRI performed 8 years ago showed degenerative changes and a disk protrusion without disc herniation. Local use of diclofenac gel and intermittent use of 1 g paracetamol and/or 400 mg ibuprofen only temporarily relieved the pain. The patient feels increasingly impaired in her daily activities and is worried that her disc protrusion may have increased. She asks about "an injection against the pain". The clinical examination revealed pronounced localized muscle tension and the pain increased during bending to the side. On the right lateral thigh, a slight hypoesthesia was observed without other sensory or motor deficits. During the straight leg raising test, the patient reports pain in the lumbosacral junction without pain referral into the legs. During the crossed straight leg raising test, the pain is also reported in the same place.

#### 1. What are your next steps in this and similar cases?

	never	rarely	occasionally	often	always
Do not perform further diagnostics	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lab test	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
X-rays	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MRI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Referral to a rheumatologist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Referral to a spinal surgeon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### 2. In case you prescribe medications, which medication(s) do you choose?

	never	rarely	occasionally	often	always
No medication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Paracetamol (Dafalgan®)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
NSAID (Ibuprofen, Diclofenac)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Metamizole (Novalgin®, Minalgin®)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Muscle relaxants (Sirdalud®)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weak opioids (Tramal®)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Short-acting strong opioids (Oxynorm®)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Long-acting strong opioids (Targin®)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Steroids	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Homeopathy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. What is your next therapeutic step?

	never	rarely	occasionally	often	always
Local infiltration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Massage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical therapy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Manual therapy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acupuncture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Do you recommend for this patient (vignette 1 warehouse operator, vignette 2 computer scientist) restriction with regards to the activity level?

- Bed rest
- Avoid all physical activities
- Avoid all painful activities
- Avoid all strenuous activities
- Allow all activities

5. Do you issue a certificate for absence from [his/her] work?

- Yes
- No

Grey shaded areas indicate low value care / non-adherence with guideline recommendations



## Appendix 2: Agreement with clinical guidelines of male and female emergency physicians

Guideline recommendation (response categories)	Vignette 1			Vignette 2		
	Female (N=103)	Male (N=109)	p-value	Female (N=103)	Male (N=109)	p-value
<b>Diagnostic</b>						
No further diagnostic (often or always)	61 (63%)	59 (58%)	0.49	22 (24%)	23 (22%)	0.76
No lab diagnostics (never or rarely)	48 (51%)	68 (67%)	0.03	48 (48%)	51 (48%)	0.97
No x-rays (never or rarely)	67 (69%)	74 (72%)	0.71	52 (54%)	64 (60%)	0.34
No MRI (never or rarely)	66 (69%)	69 (68%)	0.9	31 (30%)	36 (33%)	0.54
<b>Pharmaceutical treatment</b>						
No medication (occasionally or more)	4 (4%)	5 (7%)	0.45	5 (6%)	7 (9%)	0.6
Use of paracetamol (rarely or more)	92 (98%)	93 (94%)	0.17	94 (98%)	96 (91%)	0.03
Use of NSAID (occasionally or more)	102 (99%)	108 (99%)	0.96	101 (100%)	107 (98%)	0.17
Use of metamizole (rarely or more)	95 (96%)	95 (90%)	0.12	96 (97%)	97 (91%)	0.06
No use of muscle relaxants (never or rarely)	56 (55%)	78 (73%)	0.01	52 (53%)	72 (68%)	0.03
No use of steroids (never or rarely)	86 (92%)	84 (82%)	0.03	75 (80%)	84 (79%)	0.96
No use of weak opioids (occasionally or less)	81 (86%)	86 (83%)	0.60	75 (79%)	85 (80%)	0.8

Guideline recommendation (response categories)	Vignette 1			Vignette 2		
	Female (N=103)	Male (N=109)	p-value	Female (N=103)	Male (N=109)	p-value
No use of short-acting strong opioids (occasionally or less)	88 (94%)	97 (95%)	0.64	84 (89%)	98 (92%)	0.58
No use of long-acting strong opioids (never or rarely)	69 (73%)	75 (73%)	0.96	63 (65%)	68 (65%)	0.95
No use of homeopathy (never or rarely)	90 (97%)	101 (99%)	0.26	88 (96%)	100 (97%)	0.58
No local infiltration (never or rarely)	70 (74%)	81 (79%)	0.49	48 (50%)	59 (57%)	0.34
<b>Non-pharmaceutical treatment</b>						
Use physical therapy (occasionally or more)	97 (94%)	98 (92%)	0.48	96 (95%)	98 (91%)	0.23
Use manual therapy (occasionally or often)	32 (33%)	38 (37%)	0.57	34 (35%)	39 (38%)	0.78
No massage (never or rarely)	58 (61%)	72 (70%)	0.20	59 (64%)	68 (65%)	0.81
No acupuncture (never or rarely)	81 (87%)	92 (90%)	0.48	81 (90%)	92 (88%)	0.73
<b>Referral</b>						
No referral to a rheumatologist (never or rarely)	82 (91%)	90 (88%)	0.53	73 (77%)	76 (72%)	0.36
No referral to a spinal surgeon (never or rarely)	75 (82%)	82 (80%)	0.74	57 (60%)	69 (66%)	0.40
<b>Recommendations</b>						
Activities of daily life (no activities restrictions)	35 (34%)	30 (28%)	0.29	36 (35%)	32 (29%)	0.41

Guideline recommendation (response categories)	Vignette 1			Vignette 2		
	Female (N=103)	Male (N=109)	p-value	Female (N=103)	Male (N=109)	p-value
Work capacities (no work capacity restrictions)	16 (16%)	7 (6%)	0.03	59 (59%)	51 (47%)	0.09

### Appendix 3: Differences in agreement with guidelines between completers and partial completers of two acute low back pain vignettes

Guideline recommendation (response categories)	Completers N=212	Partial completers N=51	p-value
<b>Diagnostic</b>			
No further diagnostic (often or always)	120 (61%)	24 (56%)	0.05
No lab test (never or rarely)	116 (59%)	19 (42%)	0.03
No x-rays (never or rarely)	141 (71%)	32 (70%)	0.09
No MRI (never or rarely)	135 (69%)	25 (56%)	0.09
<b>Pharmaceutical treatment</b>			
No medication (occasionally or more)	8 (6%)	3 (8%)	0.58
Use of paracetamol (rarely or more)	184 (96%)	48 (100%)	0.15
Use of NSAID (occasionally or more)	210 (99%)	50 (98%)	0.54
Use of metamizole (rarely or more)	191 (93%)	45 (94%)	0.89
No use of muscle relaxants (never or rarely)	135 (65%)	34 (71%)	0.41
No use of steroids (never or rarely)	170 (87%)	39 (87%)	0.92
No use of weak opioids (occasionally or less)	168 (85%)	36 (77%)	0.17
No use of short-acting strong opioids (occasionally or less)	185 (94%)	42 (93%)	0.78
No use of long-acting strong opioids (never or rarely)	143 (73%)	33 (73%)	0.92
No use of homeopathy (never or rarely)	191 (98%)	43 (96%)	0.35
No local infiltration (never or rarely)	152 (77%)	35 (76%)	0.92
<b>Non-pharmacological treatment</b>			
Use physical therapy (occasionally or more)	194 (92%)	47 (92%)	0.96
Use manual therapy (occasionally or often)	69 (35%)	20 (43%)	0.27
No massage (never or rarely)	130 (66%)	31 (67%)	0.86
No acupuncture (never or rarely)	173 (89%)	42 (93%)	0.96
<b>Referral</b>			
No referral to a rheumatologist (never or rarely)	172 (90%)	42 (95%)	0.23
No referral to a spinal surgeon (never or rarely)	157 (81%)	33 (73%)	0.23
<b>Recommendations</b>			
Activities of daily life (no activities restrictions)	65 (31%)	8 (16%)	0.03
Work capacities (no work capacity restrictions)	23(11%)	4 (8%)	0.52

**Supplemental Figure 1: Study flow**