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Guideline concordant care for acute low back pain: A mixed-methods analysis of determinants of implementation

Kate I. Minick [a,*], Ashley Krueger [b], Amelia Millward [a], Kristy Veale [c], Joseph Kamerath [a], Devyn Woodfield [d], Preston Cook [e], Timothy R. Fowles [b], Joseph Bledsoe [f], Adam Balls [f], Raj Srivastava [b,g], Andrew J. Knighton [b]

[a] Rehabilitation Services, Intermountain Health, Salt Lake City, UT, United States of America
[b] Intermountain Healthcare Delivery Institute, Intermountain Health, Salt Lake City, UT, United States of America
[c] Neurosciences Clinical Program, Intermountain Health, Salt Lake City, UT, United States of America
[d] Enterprise Analytics, Intermountain Health, Salt Lake City, UT, United States of America
[e] Musculoskeletal Service Line, Intermountain Health, Salt Lake City, UT, United States of America
[f] Emergency Medicine, Trauma, and Urgent Care Service Line, Intermountain Health, Salt Lake City, UT, United States of America
[g] Division of Pediatric Hospital Medicine, Department of Pediatrics at Intermountain's Primary Children Hospital, Salt Lake City, UT, United States of America

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ABSTRACT

Introduction: We conducted an explanatory, sequential mixed-methods study to measure variation in the use of imaging and physical therapy (PT) for acute low back pain (LBP) and to identify implementation determinants that might explain variation in use across 22 EDs and 27 urgent cares in urban and rural locations within a community-based health system.

Methods: We described the patient population and measured concordance with LBP guideline recommendations on imaging and PT referral from January–June 2023. We conducted key informant interviews with physicians and advanced practice providers (APPs), $n = 30$, from these 49 sites between July – September 2023 and performed content analysis to identify implementation determinants to guideline concordance.

Results: From January–June 30, 2023, 1047 Intermountain Health employed or affiliated physicians and APPs at the 22 adult EDs and 27 adult UCs cared for 8047 patient encounters involving acute LBP with no red flags. 29% of acute LBP patient encounters included an imaging order (ED: 43%; UC: 18%) and 5% included a PT order (ED: 7%; UC: 4%). 17 ED and 13 UC physicians and APPs participated in semi-structured interviews. Their patient encounters represent 6% of the overall study population (ED: 5%; UC: 7%) with order rates and patient population characteristics similar to the full study population. ED and UC clinicians were generally familiar with LBP guideline recommendations but varied significantly in their knowledge and beliefs of the appropriate application of guidelines in evaluation and treatment plans.

Discussion: Guideline concordance for use of imaging and PT varied substantially across physicians and advance practice providers providing care at EDs and UC centers within a community-based health system. Implementation strategies that address barriers identified by this study, including varied understanding of the PT discipline, complex workflows for placing PT referrals, the medico-legal assurance that imaging provides, and the lack of feedback loops in ED and UC centers should be tested in future hybrid implementation-effectiveness trials to increase concordance to LBP guidelines and minimize harm related to overuse of imaging and underuse of conservative first-line treatment approaches.

1. Introduction

Low back pain (LBP) is the number one cause of disability worldwide and the most costly medical condition in the US, with spending on spine pain over 134 billion dollars per year [1,2]. Guidelines for managing LBP consistently recommend prioritizing non-pharmacological treatments, such as spinal manipulation and exercise, as first-line approaches. Additionally, these guidelines discourage the early use of advanced diagnostic imaging [3-5]. Despite the longstanding guidelines, recent systematic reviews and pragmatic implementation trials have found that both simple and complex implementation strategies designed to improve physician adherence to LBP guidelines have been ineffective [6-8]. One challenge may be related to how guideline concordance is measured as certain actions, such as making a physical therapy (PT) referral, is

* Corresponding author at: 383 W Vine Street Murray, UT 84123, United States of America.
E-mail address: kate.minick@imail.org (K.I. Minick).

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aligned with first-line non-pharmacologic approaches of exercise [9-14], manipulation [15-18], and education [19-21] but many providers lack a clear understanding of the PT scope of practice [22].

Non-adherence with LBP guidelines is associated with unnecessary, low-value care and subsequent poor health outcomes [23-25]. One multi-center pragmatic study found that 46% of patients received guideline discordant care during an initial encounter for LBP. Exposure to guideline discordant care was an independent risk factor for the transition from acute to chronic LBP [8]. Specifically, there is significant variability in adherence to consistent recommendations across guidelines regarding the routine use of imaging and initial referral to PT, which encompasses spinal manipulation, supervised exercise, and education components [26-29]. Additionally, these components have a large impact on downstream care utilization [30-35].

PT interventions cover many nonpharmacologic treatments including exercise, spinal manipulation, biopsychosocial education, and activity guidance with low risk of harm. Spinal manipulation is part of entry-level physical therapy curriculum and is regularly practiced by physical therapists, permitted in all 50 state practice acts (though a few states have regulations around specific techniques), and is included in PT clinical practice guidelines for LBP [19,36].

PT is typically not included as an explicit intervention in clinical practice guidelines because PT is not a monolithic treatment and is not represented as such in high-quality studies. Rather a PT plan of care would include numerous guideline-based interventions based on the evaluation of the patient, including exercise (aerobic, multimodal, stabilization, neuro muscular, strengthening, etc.), appropriate spinal manipulation, biopsychosocial education and guidance on activity. There are limitations to how we measure guideline-concordant behavior in this study. The use of PT referral as a proxy for the prior guideline-based behavior is not a perfect substitute but one that is reliably measured in the electronic health system. Assessing PT referrals alongside other behaviors (e.g. routine imaging) allows for the evaluation of potentially high-value and low-value services in a real-world environment [37].

This health system recently initiated a clinical improvement initiative for spine care. The purpose of this mixed methods study was to identify implementation determinants (intervention, individual and contextual) to the use of routine imaging and first-line referral to PT in emergency departments (EDs) and urgent care (UC) facilities for patients with uncomplicated acute LBP.

2. Methods

2.1. Study design and setting

In preparation for a future hybrid implementation-effectiveness trial, we conducted a sequential, explanatory mixed-methods investigation from January 1, 2023 to September 30, 2023, at 22 adult EDs and 27 UCs (including a direct-to-consumer telemedicine UC clinic called Connect Care) in Utah and Idaho that are part of Intermountain Health, a not-for-profit, community-based health system in the western United States. This study was approved by Intermountain Health's Institutional Review Board (#1052377).

Intermountain Health's Emergency Department physicians and advanced practice providers (APPs) are staffed predominantly by affiliated groups. Urgent care facilities are staffed by employed physicians and APPs. Connect Care is staffed primarily by APPs. Intermountain Health also operates 39 outpatient PT clinics in Utah and Idaho that are staffed by employed physical therapists. LBP is the most common condition treated in outpatient PT. Patients seeking care for acute LBP can access PT either through a physician referral or directly without a referral with most insurance providers. The referral process to send a patient to an external PT clinician involves a written prescription; conversely, to send a patient to an internal Intermountain Health PT the physician places an order in the electronic health record.

In 2013, Intermountain Health implemented an evidence-based care process model (CPM) for LBP in the ED and UC study sites, to guide diagnosis and treatment of LBP generally applicable for most patients [38]. The CPM recommends capturing patient history and conducting a physical exam. Absent red flags, true lower motor weakness and lumbar radiculopathy, conservative treatment is recommended. Physicians are encouraged (1) to avoid routine imaging and (2) to provide education and reassurance that patients are likely to recover in a few weeks and that staying active (walking and aerobic exercises, core strengthening exercises, et al.) will help them recover. Unless contraindicated, acetaminophen and non-steroidal anti-inflammatory drugs (NSAIDS) are the recommended first-line medications, specifically avoiding narcotic medications. Physicians are to consider referral for PT noting that early PT can decrease the likelihood of subsequent back surgery, injections or frequent LBP-related physician visits [39-41]. Other interventions (injection therapy, et al) should be delayed until after conservative treatments and time have failed. The CPM includes an LBP self-history form, an LBP physical exam form and patient fact sheet to assist in diagnosis and treatment. The implementation strategies to promote use of guideline concordant care for acute uncomplicated LBP in these settings included the development of education materials, including the CPM guidelines, didactic education, communication, and executive leadership emphasis. Despite these efforts to standardize practice, variability in practice persists.

Beginning in January 2023, EDs and UCs in the Salt Lake City metropolitan area, piloted the use of a spine navigation function staffed by a nurse with expertise in spine care, including acute LBP. Under the spine navigation workflow, ED and UC physicians and APPs in the Salt Lake Valley who have patients with spine pain, including patients with acute uncomplicated LPB, can place an order in the electronic health record requesting that the navigator contact their patient directly within 48 hours of the ED or UC encounter. The navigator will then contact the patient directly to further evaluate their situation and help them navigate the best next steps in their care under a physician's direction. As part of the navigation clinical workflow, for acute LBP patients with no red flags, the navigator encourages eligible patients to pursue conservative treatment including PT first.

2.2. Study population

Our study population consisted of ED and UC physicians and APPs that had at least 10 adult (18 years and older) acute LBP patient encounters in the first 6 months of 2023. Inclusion and exclusion criteria for LBP encounters are included in Table 1. A LBP encounter was considered acute if the patient had no preceding LBP encounter in the 12 months prior to the visit.

2.3. Measuring guideline concordance

Physician guideline concordance was measured separately for avoidance of routine diagnostic imaging and referral to PT overall and by physician. Concordance with imaging guidelines during the measurement period was calculated by dividing the encounters with an imaging order by the total number of study encounters. Concordance with PT guidelines was defined broadly here to include exercise, manipulation and education and measured by dividing the number of encounters with a referral to PT by the total number of study encounters. The median rate for imaging concordance was then calculated for the study population and physicians and APPs were classified as being above or below the median adherence rate during the measurement period. For referral to PT, physicians and APPs were differentiated between those having ordered PT at least once during the measurement period and those never ordering PT. Guideline concordance was presented using bubble plot chart, an extension of the scatterplot for visualizing three numeric variables for each physician or APP: the imaging concordance

Table 1
Encounter inclusion and exclusion criteria.

Inclusion	Exclusion
• All encounters for a patients 18 years or older • Seeking initial care for low back pain (LBP) • At an emergency department or urgent care facility • From January 1, 2023 to June 30, 2023 With: • A primary diagnosis code for LBP based on first listed International Classification of Disease, 10th Edition (ICD-10) in at least one of the following: o The electronic medical record encounter record o The billing system encounter record o A primary ordering diagnosis of LBP or thoracic pain	• LBP visits in the 12 months leading up to their index visit Patient encounters with red flags: • Recent history of lumbar surgery • Stenosis, spondylolisthesis, lumbar spondylosis with myelopathy • Spinal fracture, cauda equina syndrome, osteomyelitis, spinal neoplasm • Symptoms documented as red flag by nurse navigator including: new leg/foot weakness, new loss of balance or ability to walk, new fever, new night sweats, new severe fatigue, new unintended weight loss, new urinary retention, new loss of bowel/bladder control • Trauma registry or classified as a trauma patient; Head CT ordered with Lumbar CT • Other non-musculoskeletal exclusions (cancer, IV drug use, long-term steroid use, etc.) identified in the Healthcare Effectiveness Data and Information Set (HEDIS) LBP imaging quality measure [42]

rate on the horizontal axis; the PT ordering rate on the vertical axis; and the encounter volume reflected in the radius of the point [43].

2.4. Key informant interviews and qualitative data analysis

To conduct key informant interviews, we developed a tailored interview guide for each using a previously published methodology [44-49]. We validated the interview guides through cognitive testing with content experts, and questions were refined based on participant feedback [50]. A field team of trained, experienced qualitative researchers (AEK, AM, KM and AJK) conducted semi-structured virtual interviews July to September 2023 using a purposive sample of 30–35 key informants based upon adherence level (above/below median), encounter service type (ED vs urgent care) and clinical role/medical specialty. With the support of system leadership, participants were recruited via email to participate in a 15–30 minute virtual interview to discuss the clinician's experience diagnosing and treating patients with acute LBP. Interested participants could immediately set up their interview appointment using a calendaring link or notify the study team of their interest in scheduling an interview time [51]. Individuals within each role varied in terms of years of experience and attitudes and beliefs regarding treatment for acute LBP. Informed consent was obtained for voluntary interview participation and recording. Interviews were conducted via videoconference, were scheduled for 30 minutes [average interview length: 23 minutes, range (11–40 minutes)], and were recorded for deidentified transcription using a virtual meeting application (Teams, Microsoft, Washington, USA). Transcripts were generated utilizing an automated transcription service available with the virtual meeting application. Interviews were continued by site type (ED and UC) until thematic saturation was reached [52].

The field team analyzed the interview content using a hybrid deductive-inductive approach, incorporating both conventional and directed content analysis [53-55]. Four experienced researchers trained in qualitative coding (AEK, AM, KM and AJK) coded interview content using open coding at the question level. Discrepancies were then discussed between coders until consensus was reached. All questions regarding transcription content and language were resolved by reviewing the original recorded interview. Identified implementation determinants were summarized by domain, adherence level (above/below median) and encounter service type (ED vs urgent care) using the Consolidated Framework for Implementation Research (CFIR) [56,57]. The CFIR framework consists of five domains from which we used four to categorize determinants to implementation effectiveness, including individual (clinical characteristics), intervention (diagnosis and treatment protocol for acute LBP without red flags), external setting and inner setting (organization context). The implementation domain was not explored specifically in this study. Coding was performed using a spreadsheet program (Excel, Microsoft, Washington, USA).

3. Results

From January 1–June 30, 2023, 1047 Intermountain Health employed or affiliated clinicians at the 22 adult EDs and 27 adult UCs cared for 8047 patient encounters involving acute LBP with no red flags. 29% of acute LBP patient encounters included an imaging order (ED: 43%; UC: 18%) and 5% included a PT order (ED: 7%; UC: 4%) (Table 2). During the study period, 125 physicians in the pilot market submitted 672 referrals to the spine navigator for follow up care of acute LBP, representing 8.35% of the total system acute LBP encounters without red flags during the 6 months study period. The bubble plot distribution of imaging and PT order rates by clinician is reflected in Fig. 1. The population of acute LBP patients with no red flags treated by the study population was 50% male. Mean acute LBP patient age was 42 years (SD: 16) (Table 3). 17 ED and 13 UC professionals participated in semi-structured interviews from July 1, 2023 – September 30, 2023 (Fig. 2). These professionals represented 6% of the overall study population (ED: 5%; UC: 7%) with consistent order rates and patient population characteristics as compared to the full study population (Table 4).

The implementation determinants identified through the qualitative analysis are organized below according to the four in-scope CFIR domains. The physician/APP setting, imaging adherence, and PT adherence rate are indicated in paratheses below with a '↑'to indicate performance above the median and a '↓'to indicate performance below the median for the provider population (Imaging median: 40% ED, 15.5% UC; PT median: 0% ED and UC), respectively. Expanded tables with CFIR determinants are available in the **Supplemental File.**

3.1. ED and UC clinician characteristics

All clinicians, regardless of service location and adherence level, were familiar with and could articulate red flags for acute LBP.

> *"…I define [a red flag] as anything that would make me concerned about spine infection syndromes…if I had something from the history that made me concerned about trauma, fracture, spinal cord injury due to trauma…I would include…not just spinal cord compression syndromes, but also radiculopathy…where there were motor deficits… oncology or neoplasm…those typically would be the red flags."*
>
> [(ED, ↑↑)]

3.1.1. Diagnostic imaging

Individual physician and APP perceptions of when to order diagnostic imaging are influenced by (1) their knowledge and understanding of care guidelines; (2) their perception of the patient's individual needs and circumstances, along with (3) practical considerations. Regarding physician/APP knowledge and understanding of care guidelines, variation persists across providers as to whether good clinical judgment regarding diagnosis of acute LBP requires imaging.

> *"Before I did my training, I was it was ingrained in me that X rays have no place in neck or back pain because of the low sensitivity of catching any kind of pathology…."*
>
> [(ED, ↑↑)]

Table 2
Clinician imaging and PT ordering characteristics of all acute LBP encounters at study sites.

	Emergency Department	Urgent Care	Combined
Overall			
Encounters for acute LBP treated with no red flags (1/1/2023–6/30/2023), n (%)	3475	4572	8047
Total imaging orders placed, n (%)	1493(43)	827(18)	2320(29)
Total PT orders placed, n (%)	229 (7)	169(4)	398(5)
Median rate, imaging ordering, % (IQR)	40% (0,63)	15.5% (0,27)	NA
Median rate, PT ordering, % (IQR)	0.0% (0,0)	0.0% (0,2)	NA
Respondents Only $n = 30$			
Respondent encounters for acute LBP treated with no red flags (1/1/2023–6/30/2023), n (%)	178 (38)	294 (62)	472 (100)
Imaging orders placed - respondents only, n (%)	56 (31)	75(26)	131 (28)
PT orders placed - respondents only, n (%)	10 (5)	10 (3)	20 (4)
Median rate, imaging ordering - respondents only, % (IQR)	31 (18,35)	25 (10,38)	25 (17,36)
Median rate, PT ordering - respondents only, % (IQR)	0 (0,7)	0 (0,3)	0 (0,5)

Abbreviations: LBP, low back pain; PT, physical therapy; IQR, interquartile range.

"I like to get an X ray just to be like OK, I covered my bases…"
[(UC, ↓↓)]

Some physicians and APPs believe that they should provide imaging if the patients request it.

"Mostly…honestly…if they're wanting it…
[(UC, ↓↑)]

"I find that that's good patient care, allowing the patient to have some decision-making capacity… I think patients sometimes expect to have test completed when they come and see a physician "
[(UC, ↓↑)]

Patient needs and circumstances that some providers believe require adaptation in application of imaging guidelines for acute LBP include age, length of time the patient has been in pain, their ability to get the pain under control or their perception that the patient will be unsuccessful in receiving follow up care.

"There's always just higher chance of something unusual, whether it's musculoskeletal or otherwise, in someone who's…particularly old."
[(UC, ↓↑)]

"If they're here with a month of pain, I'm more likely to do [plain films]."
[(UC, ↑↓)]

"…I can't just call someone and say, hey, admit this, patient [for inpatient care]…if I can't get their pain under control…[I am] almost always doing MRI, CT imaging.
[(ED, ↑↓)]

"There might be some social factors… if I'm less confident in this patient's ability to follow up.
[(ED, ↑↑)]

Practical considerations can also impact the decision to image. Some physicians and APPs expressed concern that failure to image could lead to a negative patient experience and reflect poorly on their performance.

"…Let's say that a patient comes in and I refuse to do an MRI, and I can cite the data and the guidelines and everything like that…That has been reflected negatively on me as an individual physician, not the hospital system and the associated guidelines that are in place."
[(ED, ↑↑)]

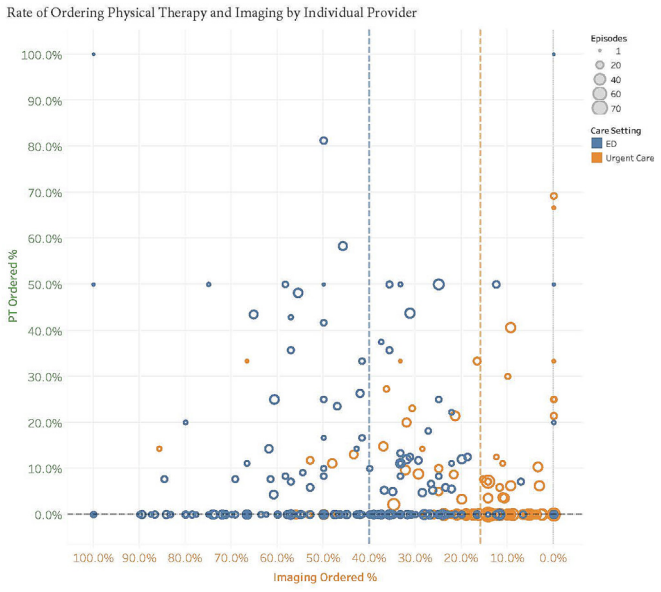

Fig. 1. Distribution of imaging and physical therapy (PT) ordering rates for acute low back pain patients treated by physicians and advanced practice providers in the emergency department and urgent care.

Table 3
Acute low back pain patient demographics.

Characteristics	Patients treated by physician or APP treating 10 or more LBP patients ($N = 8047$)	Patients treated by interviewed physicians or APP ($N = 472$)
Age, n (%)	42 (16)	43(16)
18–29	2187 (27)	113 (24)
30–39	1852 (23)	116 (25)
40–49	1491 (18)	82 (17)
50–59	1109 (14)	79 (16)
60+	1406(17)	82 (17)
Male, n (%)	3994 (50)	223 (53)
Ethnicity		
Hispanic	1645 (20)	96 (20)
Not Hispanic	6038 (75)	365(75)
Unknown	362(4)	20 (5)
Race, n (%)		
American Indian or Alaska Native	80 (1)	7 (1)
Asian	163 (2)	8 (2)
Black or African American	167 (2)	10 (2)
Multiple	59 (1)	2(0)
Native Hawaiian or Pacific Islander	155 (2)	15 (3)
Patient Declined	376 (5)	13(3)
Unavailable	299 (4)	23 (5)
White	6748 (84)	394 (83)

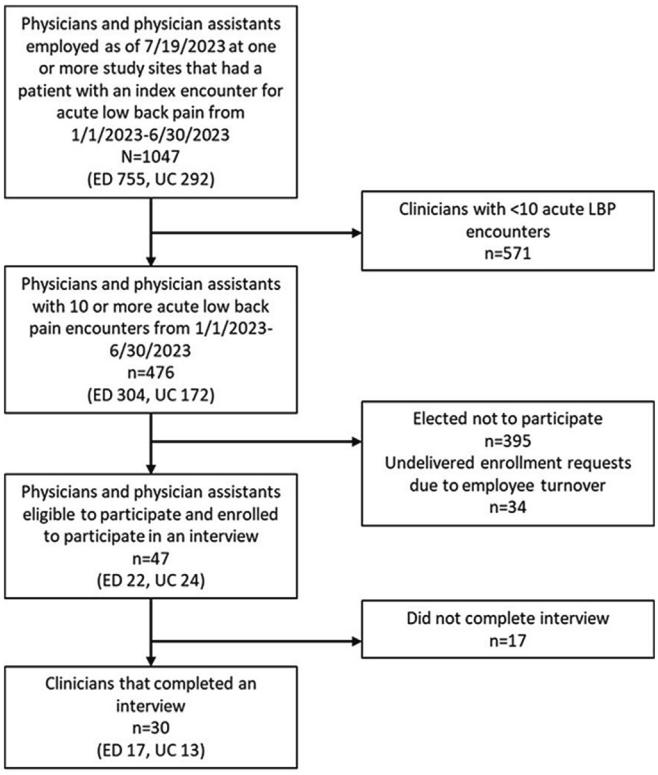

Fig. 2. Clinician consort diagram.

3.1.2. First-line treatment using PT

Primary determinants of physician and APP willingness to recommend PT as a first-line treatment option include: (1) knowledge regarding the purpose of PT, including its role as a first-line treatment option and its clinical benefits; and (2) perceptions of patient individual needs and circumstances as well. Knowledge regarding what PT is and what it is not varies by providers.

"People need to go to physical therapy in order to retrain their spinal stabilizers."

[(ED, ↑↓)]

"So yeah, so there may be some value and you know the stretching exercises and heat and cold and so forth and using physical therapy as a consult."

[(UC, ↑↓)]

"They can do massage, they can do electric stimulation, they can give you…exercises to strengthen your core, to prevent any future injury."

[(UC, ↓ ↓)]

"If they're pain is so severe that they can't even walk upright, then no, the physical therapy is not going to be very helpful for them."

[(ED, ↑↓)]

Not all physician and APPs see PT as a first-line treatment for acute LBP but work with other treatment modalities first before recommending PT.

"[If] they've had low back pain before they've tried basic stuff…and it's not working…that's the type of person. Let's step it up. Let's do formal physical therapy….

[(UC, ↓↑)]

"Let's do these medications and see if you have or have any better, and if not, let's go see physical therapy."

[(UC, ↓↓)]

Some providers lack knowledge as to when they should refer a patient for PT.

"Just to be honest, I don't know who to refer and who not to."

[(ED, ↑↓)]

"If I knew there was a modality…if I had…an immediate place where they could go and start to get help, then I wouldn't feel as obligated to do an MRI. I could probably just say…go to physical therapy first and they can help you from there."

[(ED, ↑↓)]

"I think a lot of the time I am reluctant to [refer to physical therapy] because I'm not sure if I'm giving them what they need… If I wrote three times a week for six weeks, is that all they'll ever get?"

[(ED, ↑↓)]

Table 4
Characteristic of clinician participants in key informant interviews (N = 30) from July 1, 2023 to September 30, 2023.

Characteristics	Emergency Department	Urgent Care	All Sites
N	17	13	30
Male, n (%)	11 (65)	11 (85)	22 (73)
Hispanic, n (%)	1 (6)	0 (0)	1 (3)
Race:			
White, n (%)	17 (100)	17 (100)	30 (100)
Role:			
MD/DO, n (%)	16 (94)	9 (69)	25 (83)
Emergency Medicine, n (%)	15 (88)	2 (15)	17 (57)
Family Medicine, n (%)	1 (6)	6 (46)	7 (23)
Sports Medicine, n (%)	0 (0)	1 (8)	1 (3)
PA-C, n (%)	1 (6)	4 (31)	5 (17)
Relationship:			
Employed	0 (0)	13 (100)	13
Affiliated	17 (100)	0 (0)	17
Count of sites clinician provided ALBP care:			
1–2, n (%)	10 (59)	9 (70)	19 (63)
3–4, n (%)	7 (41)	0 (0)	7 (23)
5–6, n (%)	0 (0)	2 (15)	2 (6)
7 or more, n (%)	0 (0)	2 (15)	2 (6)
Number of patients treated for acute LBP with no red flags during measurement period:			
Median (IQR)	9 (6,15)	19 (15, 30)	15 (8, 18)

Abbreviations: MD, medical doctor; DO, doctor of osteopathic medicine; PA-C, physician assistant; ICR, interquartile range; LBP, low back pain.

Provider perceptions of a patient's individual needs and circumstances affect their willingness to recommend PT.

"If I think that I can't reliably give them information and make sure they understand it or just takes too much time [then I refer them to physical therapy]."

[(UC, ↓↓)]

"I always have the conversation with the patient…Physical therapy is a big time constraint for a lot of patients…If they're older and they're retired, we typically go straight to [physical therapy]. But if they're younger, which I see a lot of, physical therapy once a week or twice a week is really difficult.

[(UC, ↓↓)]

This can lead to deferring to the patient's preference in seeking PT.

"I'm sure there's some providers who give a lot more physical therapy referrals and I tend to do it more in a situation where I think it's going to be likely useful or really wanted by the patient.

[(UC, ↓↑)]

"If they're interested in physical therapy, absolutely [I will refer them]."

[(UC, ↑↓)]

3.2. Imaging and physical therapy intervention characteristics

Determinants to avoiding early imaging and first-line treatment using PT focus on the physician and APP's perception of the relative advantage of action.

3.2.1. Diagnostic imaging

Providers were mixed on their perceptions that they lack the necessary time to educate a patient on why imaging is not required, especially when a patient is persistent that imaging is needed.

"They come and they want things and it becomes a low utility thing to sit there and try to argue with them over and over again. And it's easier just to order the testing."

[(ED, ↑↑)]

"It adds some time, but really not much."

[(UC, ↓↑)]

"People come with their own expectations in mind, right? So it definitely takes a little bit more patient counseling in order to avoid imaging."

[(ED, ↓↑)]

"And if they're gonna be really upset… I will ultimately get an X-ray if that's a barrier."

[(UC, ↓↓)]

"Sometimes patients will express the desire for an X ray, but I'm usually I feel like I'm pretty successful in redirecting that concern…

[(UC, ↓↑)]

3.2.2. First line treatment using PT

Knowledge regarding evidence-based benefits of PT varied across providers, with personal experience as a patient influencing their perceptions of its benefit.

"Physical therapy does tend to speed up that recovery and also gives you strategies to prevent recurrence."

[(ED, ↓↑)]

"I mean literature is mixed in terms of…30-day outcomes. But I think… during the 30 days…for some people it's beneficial from a mental/emotional point to be…working towards something."

[(UC, ↓↑)]

"I'm just going by the data and…physical therapy definitely improves functional outcomes for patients with low back pain…I definitely have some patients who feel that it wasn't that helpful."

[(UC, ↓↓)]

"And having gone through this myself, I know that it works…"

[(ED, ↑↑)]

"I've had injuries and had physical therapy [and] that definitely colors my expectations of physical therapy…"

[(UC, ↓↑)]

This can come in part because ED and UC providers don't often have visibility to the results from referring past patients to PT, including whether they received care and the results of care.

"In urgent care we almost never get any follow up on our patients unlike primary care…So I'm kind of ambivalent on whether or not that would be useful on all patients."

[(UC, ↓↓)]

"it does feel a little bit like a black box that we're sending people too and just trusting that everything works out well."

[(ED, ↑↑)]

3.3. External environment characteristics

External factors such as insurance, legality, and current research influence how providers give care in relation to early imaging and PT referrals. The variability of health insurance coverage and payment requirements influence providers understanding of the total cost of treatment to the patient, affecting the path of care given.

"…insurance makes a big deal… [it's] expensive and I think that's sad because I actually think that physical therapy will not only help their acute pain but will prevent chronic problems…"

[(ED, ↑↓)]

"…[Physical Therapy] can be expensive because you pay each visit and so people that have high deductible plans… we're talking really expensive."

[(ED, ↑↑)]

The perception of potential future litigation risks, should they skip imaging and potentially fail to uncover more significant conditions, leads providers to opt into imaging.

"*I tend to like to get an X-ray because it covers my ***… if I miss a fracture that's been there…*"

[(UC, ↓↓)]

"*For example, if a patient comes in and we tell them that they have no red flags…if something does come back and shows that they had a lesion that require[s] surgery…they sue me, right?*"

[(ED, ↑↑)]

Physicians described a preference for the use of guidelines found in external resources over internal guidelines; lending the possibility that external research may not be aligned with current company policies.

"But yeah, as far as trying to get more clarity with… what's the right image or what's the right physical therapy, we do definitely discuss it as colleagues and then use some outside resources like Up to Date"

[(UC, ↓↓)]

"I guess I would look that up and see if [Intermountain] has a care process model for low back pain…"

[(UC, ↓↑)]

3.4. Organizational context

The operations, needs, policies, and resources within a large-scale healthcare system held major influence over providers decision-making processes for both imaging and PT referrals. Clinicians provided commentary on the impact that resources from the individual clinic or site determines access to immediate imaging.

"…we work in a pretty resource rich setting, which probably makes it easier to order imaging even when maybe we don't have to."

[(ED, ↓↑)]

Additionally, the current bed space and other imaging needs at the site impacts providers decision to order images.

"I don't blame an emergency physician or APP [advanced practice provider] who just reflexively does that imaging because of the time pressures that we do have in the [emergency] department."

[(ED, ↑↑)]

"I have incentive… not to tie up imaging, not to tie up rooms in the department while we're trying to clear the waiting room…on a busy evening [it] could take 3 hours to get a CT scan back…"."

[(ED, ↓↑)]

The proximity of PT resources, and providers knowledge of or relationship with them within the system impacts the decision to refer a patient to PT treatments.

"I'll say, you know, it's 3:00 o'clock in the afternoon, walk down the hallway to our physical therapy group right here."

[(ED, ↑↓)]

"What I would love is to have resources for questions for people that don't know… people have their individual relationships, but it would be nice to have a system wide option."

[(UC, ↓↓)]

Practitioners stated frustrations with the time-consuming nature of a manual referral process, and perceived lack of a streamlined process within the Emergency Medicine electronic health record.

"So I do have some of the physical therapy offices that bring…a referral pad to us and it will say…just fill in the blanks, but that takes… between 2 to 4 minutes to do…and then it's not in the medical record. Unless I get it scanned in first, which takes another five minutes to do so…I'm not going to give handwritten anything."

[(ED, ↑↓)]

"Having to write out…a referral is just time consuming…"

[(UC, ↓↓)]

"I still have some questions about…what is the best way to refer…"

[(ED, ↑↑)]

"The ED referral system is terrible… there's some barriers that way that make referral difficult to physical therapy…"

[(ED, ↓↑)]

Disagreements appeared in the inclusion and role of a primary care physician in the referral process.

"Personally, I don't think they need …the primary care doctor [to] step in and say hey, they can go to physical therapy."

[(ED, ↑↓)]

"I feel like having that communication between… the treating physician and physical therapy is important and so I prefer if the primary care orders it so that they can follow it."

[(UC, ↓↓)]

One of the largest concerns of physicians and APPs refers to the lack of a feedback-loop for providers to understand the treatment and benefits the patient will receive in PT, along with little visibility as to the outcomes of referred patients.

"So if I just put it in the computer, it goes off into outer space and then disappears…because there will be no follow up from our office."

[(UC, ↓↓)]

"I don't get a lot of feedback from it, so I don't know. I assume it works great, but i don't know…"

[(ED, ↑↑)]

"It's like buying a present for someone but never getting to see them open it…I think it's an opportunity for emergency physicians if there was a way to close the loop and let us know how many future visits we avoided or … how happy or satisfied a patient was."

[(ED, ↑↑)]

4. Discussion

This mixed-methods study, including quantitative data on 8047 patients at 22 EDs and 27 UCs and qualitative data from 30 key informant interviews of factors across all sites, details determinants to concordance with acute LBP guidelines. This study generally corroborates the findings of previous research regarding barriers and facilitators to the use of imaging for acute LBP, extends our knowledge of the specific determinants that influence PT referral, and provides actionable insights for tailoring implementation strategies to increase adherence to these guideline components, as part of a larger hybrid effectiveness implementation trial we are conducting.

Physicians and APPs were generally familiar with guidelines and recommendations for the care of patients with acute LBP without red flags but there remained significant variability in the practice of ordering imaging and referring to PT. Some of this variability appears to relate to how individual providers weigh the benefits and risks of each: the cost to patients, the provider's time to implement, available resources, anticipated patient outcomes, medico-legal implications, and the impact on provider performance outcomes (e.g., patient satisfaction). Despite consistent recommendations across published guidelines and National Committee for Quality Assurance HEDIS quality measures,

the significant variability in imaging and therapy use in this study is consistent with prior research and highlights a continued need for strategies to reduce unwarranted variation in a value-based care environment [7,26-29,58].

There was notable variation among interviewed physicians regarding what PT encompasses, how PT interventions are applied to help patients with LBP, and confusion around the technical aspects of making a referral. This has meaningful implications for implementation efforts around early access to PT for acute LBP, as many approaches do not address the lack of fundamental knowledge of PT among healthcare providers. PT is often referenced generically in research and in healthcare as though it is a singular treatment that is applied. Rather, PT is a broad and varied doctor-level discipline, and physical therapists work with patients across the lifespan and across neuromusculoskeletal conditions to improve movement, function, and quality of life [59]. Lentz et al. recently called for a common language standard in PT research to include a minimum set of characteristics like timing of care, mode of access, and order of treatment to better identify the specific mechanisms by which PT delivers value, which may reduce monolithic descriptions [60]. Future implementation efforts and advocacy work involving PT should not ignore the persistent variability in physician and APP understanding of the PT discipline.

Prior efforts to improve guideline concordance for both imaging rates and PT referral have had varied success with interventions including best-practice alerts and quality scorecards [7,28]. Al-hihi et al. found best practice alerts successful in reaching a goal of 90% adherence to HEDIS appropriate use of imaging standards. However, in the Delitto et al. TARGET Trial, while best practice alerts to identify high-risk patients using a stratified management approach for acute LBP were successful at doubling the PT referral rate for high-risk patients, nearly half of the patients did not receive an appropriate referral and the trial was unsuccessful at reducing the proportion of patients that transitioned to chronic LBP nor at improving self-report disability [7]. One reason may be due to “alert fatigue” with high override rates and desensitization to alerts that limit their potential impact [61]. This suggests that future implementation efforts should be multifactorial to address patient expectations, physician and APP behaviors and beliefs, and alignment of both financial and non-financial incentives for patients, providers, and health systems.

One implementation strategy that has been successful in oncology and chronic disease management is the use of clinical navigators to facilitate guideline concordance and alleviate the burden on physicians [62-64]. Use of navigation for LBP management, including PT-first components, is more novel but is currently being explored in several health systems and in research to steer patients towards high-value services early in the LBP episode [65-67]. Navigation for spine pain has the potential to address several of the barriers identified by emergency department/urgent care physicians and APPs in this study, including the desire for someone to follow-up with patients, difficulties with placing PT orders, need for systematic feedback loops, and lack of time to provide patient education. Intermountain Health is currently piloting a nurse navigation model for spine pain, which is the focus of a hybrid-effectiveness implementation trial that this mixed-methods analysis supports.

This study is not designed to establish causal relationships but is useful for guiding implementation. Our measurements of physician guideline concordance may have mis-estimated actual concordance behavior given the reliance on clinical documentation within the electronic health record. We did not examine implementation determinants at all sites, nor did we interview all frontline clinicians. Although we compiled a large sample of key informants, participants self-selected based upon willingness and availability though participants' patient characteristics were consistent with the overall patient study population. While responses appeared frank, we cannot rule out the fact that participant statements were influenced by the researchers' institutional alignment as health system employees. The use of PT referral as an element of guideline concordance is not an explicit component of most LBP guidelines but rather a proxy for several consistently recommended interventions including spinal manipulation, supervised exercise, and education [68-70]. PT referral is reliably captured in the electronic health record but does not guarantee receipt of the intended guideline components.

The study has several strengths, including the use of guideline concordance data to evaluate performance and guide sampling; qualitative methodological rigor; a large sample size with diverse viewpoints across locations and roles and geographies; and a theory-informed instrument to facilitate questioning. The results of this study suggest that future implementation strategies to achieve high concordance should (1) ensure clear definitions of what constitutes PT, (2) optimize workflows for placing PT referrals; and (3) implement a reliable and accessible measurement system. These results are actionable and will inform a hybrid implementation-effectiveness trial to measure the effect of these implementation strategies on concordance with acute LBP guidelines and on clinical outcomes.

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CRediT authorship contribution statement

Kate I. Minick: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ashley Krueger:** Writing – review & editing, Writing – original draft, Project administration, Formal analysis, Data curation. **Amelia Millward:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Kristy Veale:** Writing – review & editing, Writing – original draft, Resources, Investigation, Data curation. **Joseph Kamerath:** Writing – review & editing, Writing – original draft, Validation, Resources, Methodology, Conceptualization. **Devyn Woodfield:** Writing – review & editing, Writing – original draft, Visualization, Validation, Formal analysis. **Preston Cook:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Methodology, Conceptualization. **Timothy R. Fowles:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Methodology, Conceptualization. **Joseph Bledsoe:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Methodology, Conceptualization. **Adam Balls:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Data curation. **Raj Srivastava:** Writing – review & editing, Writing – original draft, Supervision, Resources, Methodology, Conceptualization. **Andrew J. Knighton:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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