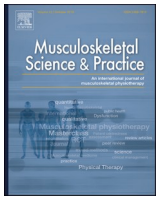
Musculoskeletal Science and Practice 78 (2025) 103365



Contents lists available at ScienceDirect

Musculoskeletal Science and Practice

journal homepage: www.elsevier.com/locate/msksp





Survey of rehabilitation practice for patients undergoing lumbar surgery in the United Kingdom

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ARTICLE INFO

Keywords:
Rehabilitation
Physiotherapy
Spinal surgery
Lumbar spine

ABSTRACT

Purpose: National guidelines recommend rehabilitation for patients undergoing elective lumbar surgery, yet current provision within the UK is unknown. The aim of this study was to determine Physiotherapy practice regarding prehabilitation, peri-operative, and post-operative rehabilitation, for patients undergoing lumbar discectomy, laminectomy, and single-level fusion, within the UK.

Methods: Physiotherapists working within the UK were invited to complete a cross-sectional, descriptive online survey. Open and closed-ended questions enquired about aims, content, format, and frequency of rehabilitation. Quantitative data were analysed descriptively, and open-ended responses were analysed narratively.

Results: 360 responses were received, revealing varied practices. Routine provision of prehabilitation was low (18 %) whereas peri-operative and post-operative rehabilitation was offered more frequently (>60 %). Rehabilitation was predominantly delivered in-person, on a one-to-one basis. Prehabilitation focused on educating patients and optimising psychological and physical health, peri-operative rehabilitation focused on safe mobility, and post-operative rehabilitation on improving function. Advice and education were the most common interventions across all rehabilitation phases. Exercise prescription was frequently used within peri-operative and post-operative rehabilitation. Post-operative restrictions were advised by 62 % of respondents. The most frequently provided activity restrictions were for lifting, driving, walking, sitting, and back movement, with timeframes varying considerably.

Conclusion: This study highlights considerable variation in access to and content of rehabilitation for patients undergoing lumbar surgery in the UK. While some variation may reflect personalised care, it also suggests uncertainty in the evidence base and inconsistent guideline use. Findings support the need for patient-centred pathways, updated UK-specific guidelines, and further research into implementation barriers, the impact of postoperative restrictions, and tailored rehabilitation interventions.

1. Introduction

Lumbar surgery is recommended for lumbo-sacral radicular pain or neurogenic claudication caused by nerve root compression, if symptoms fail to substantially improve after conservative treatment (National Institute for Health and Care Excellence, 2016). The three most common lumbar surgical procedures are microdiscectomy, laminectomy and single-level fusion (Getting It Right First Time, 2022) with over 40,000 being performed annually in the United Kingdom (UK) (NHS England Digital, 2023). However, around 40 % of patients continue to report ongoing pain and functional restriction (Weinstein et al., 2010). Prognostic factors for improvement include modifiable physical variables including pre- and post-operative walking capacity and performance, balance, and strength; and psychosocial variables including fear of movement, illness perceptions and expectations (McIlroy et al., 2025; Coronado et al., 2021; Canizares et al., 2020). Rehabilitation that is delivered from a biopsychosocial perspective, delivered pre-operatively (prehabilitation), peri-operatively, and/or post-operatively, may target

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https://doi.org/10.1016/j.msksp.2025.103365
Received 6 March 2025; Received in revised form 7 May 2025; Accepted 9 June 2025
Available online 16 June 2025
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these factors and has the potential to optimise patient outcomes and the experience of surgery and recovery.

UK spinal surgical pathways stipulate that peri-operative inpatient rehabilitation should be delivered to provide exercise prescription and to aid mobility, followed by an outpatient physiotherapy review at 2–3 weeks post-operatively (Getting It Right First Time, 2022). Pre-habilitation, is rehabilitation aimed at improving function to enhance post-operative recovery and maximise outcomes and typically includes exercise, psychological well-being and nutritional advice (Carli and Ferreira, 2018). Although prehabilitation is not explicitly referenced within the UK pathways, the recommendation to optimise patients for surgery is included, along with a best practice case study featuring a pre-operative education class for day-case discectomy patients. Pre-habilitation has been implemented in other surgical populations, including patients undergoing hip and knee replacement (Halloway et al., 2015) and those preparing for surgery for cancer (Support, 2019). Although the underlying conditions and surgical demands differ, pre-habilitation has the potential to be beneficial for patients undergoing lumbar spine surgery (Eubanks et al., 2023).

However, systematic reviews suggest that there is uncertainty about the effectiveness of pre- and post-operative rehabilitation for patients undergoing lumbar surgery largely due to the differing methodologies and low-quality studies (McGregor et al., 2014; Greenwood et al., 2016; Janssen et al., 2021; Rushton et al., 2012). Although, there is low-quality evidence that multimodal rehabilitation consisting of exercise and cognitive behavioural therapy improves pain and disability in the short-term after lumbar fusion surgery (Bogaert et al., 2022). To date, there are no published UK standards to guide physiotherapists regarding what rehabilitation should be provided, and current rehabilitation practice is largely unknown for the three most frequently undertaken lumbar surgical procedures (Rushton et al., 2014; Alsiaf et al., 2022; McGregor et al., 2006; Williamson et al., 2007).

The most recent survey, solely about Lumbar microdiscectomy, involved only neurosurgical centres, with 16 of 17 responses from England, limiting its generalisability (Alsiaf et al., 2022). There has not been a survey of UK physiotherapists regarding rehabilitation following laminectomy, however, a survey of spinal surgeons, identified 55 % do not routinely recommend post-operative physiotherapy. The survey was conducted 20-years ago, making the findings outdated (McGregor et al., 2006). Likewise, a survey of physiotherapy practice for patients undergoing lumbar fusion, conducted over a decade ago, requires updating (Rushton et al., 2014).

The aim of this study was to explore current UK physiotherapy rehabilitation practices for patients undergoing lumbar micro-discectomy, laminectomy and single-level fusion, and consider if provision aligns with current UK spinal surgical pathways.

2. Methods

2.1. Design

A cross-sectional, descriptive, online survey was conducted. The Checklist for Reporting of Survey Studies was used to inform design and reporting of the study (Sharma et al., 2021). The survey was created and distributed using Qualtrics (Qualtrics, Provo, UT).

2.2. Questionnaire development

The survey (supplemental material 1) was developed by a group comprising Physiotherapists, MSc pre-registration Physiotherapy students, and researchers following guidance on survey design (Stehr-Green, 2020). Previous literature reviews and surveys informed topic areas and questions (Rushton et al., 2014; Alsiaf et al., 2022). Questions were typically multiple choice with free text options. The survey contained 142 questions divided into four sections: respondents demographics; prehabilitation; perioperative (inpatient); and post-operative (outpatient) rehabilitation practices. Filter questions were employed to ensure that respondents answered only those questions pertaining to their specific area of work and the surgical procedures within their clinical experience. Questions explored rehabilitation aims, format, timing, location of rehabilitation, physiotherapy interventions, post-operative restrictions, and outcome measurement. The survey was piloted by 15 physiotherapists and one physiotherapy assistant after which minor refinements and formatting changes were made.

2.3. Participants and recruitment

Eligibility criteria for respondents included inpatient and outpatient physiotherapists and physiotherapy assistants working in NHS and non-NHS organisations in the UK that treat patients undergoing lumbar surgery, with experience in managing patients undergoing lumbar microdiscectomy, laminectomy, and/or fusion.

Recruitment took place between April and July 2023. The survey was distributed by email and social media platforms of professional networks (e.g., interactive Chartered Society of Physiotherapy Network), researcher networks, and advertising at professional meetings (e.g., National Spine Network). Potential participants were provided with a participant information sheet and participants were requested to explicitly provide consent prior to completing the survey. Internet Protocol addresses were not saved to maintain respondent anonymity. Participants could provide their contact details to enter an optional prize draw to win £100 shopping voucher on completion of the survey. Participant details could not be linked to the survey responses.

2.4. Data analysis

Data were transferred to Microsoft Excel and independently checked for integrity and validity by SMc and AMc. Responses not meeting the eligibility criteria or blank entries were removed. Descriptive statistics were used to summarise respondent characteristics and closed question responses. Free-text responses, including those provided under 'other' options, were grouped into categories according to the similarity of response and summarised using descriptive statistics. Percentages were calculated based on the number of potential eligible responses for the section (i.e., percentage of respondents that provide particular phase of rehabilitation). Percentages were not adjusted for missing data from partially completed surveys; item-level response rates were reported based on the number of responses relative to the number of potential respondents for each item. To prevent double counting of post-operative restrictions, if respondents answered about more than one phase of rehabilitation, their initial answer was included only. No sample size calculation was undertaken due to the exploratory nature of the study.

3. Results

The survey was accessed 630 times. 270 entries were removed (no data entered n = 134, not UK based or ineligible profession n = 134, spam entry n = 2) resulting in 360 responses from 113 different organisations. The mean completion rate was 83 %, with 62 % completing the whole survey. The median time taken to complete the survey was 13 min (interquartile range 6, 31). 255 (71 %) worked in England, 31 (9 %) in Scotland, 32 (9 %) in Wales and 42 (12 %) in Northern Ireland. Most respondents were in specialist or advanced physiotherapy roles (Agenda for Change band 7: 35 %; band 8: 28 %). Approximately 50 % reported receiving training on the management of lumbar surgical patients (Table 1).

The responses for the prehabilitation, peri-operative and post-operative rehabilitation are presented in Tables 2–4 respectively with additional results in supplementary material 2. There were few differences in rehabilitation provided between the different surgical procedures and therefore the results are reported together. 40 respondents

Table 1
Responder demographics.

Responses	All (n = 360)	England (n = 255)	Scotland (n = = 31)	Wales (n = = 32)	Northern Ireland (n = = 42)
Number of different organisations	105 + 8 prefer not to say	88 + 5 prefer not to say	7 + 1 prefer not to say	5 + 1 prefer not to say	5 + 1 prefer not to say
Organisation type					
NHS	298	207	25	29	37
Private/ independent with NHS contract	25	19	6	1	2
Other	2	2	0	0	0
Private/ independent	22	17	0	0	2
Social enterprise	13	10	0	2	1
Work setting					
Community Care	57	43	6	4	5
Interface service	20	14	2	4	4
Primary care	109	72	14	0	19
Secondary Care	138	97	6	23	12
Tertiary care (specialised spinal unit)	36	29	4	1	2
Organisation perform spinal surgery					
Yes	250	180	24	19	27
No	108	74	7	12	15
Missing	2	1	0	1	0
Surgery performed by					
Orthopaedic surgeons only	88	64	0	9	15
Neurosurgeons only	60	42	18	0	0
Both orthopaedic and neuro surgeons	97	70	6	9	12
Missing	5	4	0	1	0
Profession:					
Physiotherapist	343	244	29	31	39
Physiotherapy assistant	13	9	2	0	2
Rehabilitation assistant/ technician	4	2	0	1	1
NHS band (or equivalent)					
3	5	4	0	1	0
4	11	5	2	0	4
5	17	9	2	3	3
6	97	63	13	9	12
7	126	88	8	15	15
8	101	84	5	4	8
Other	3	2	1	0	0
Median years of experience working with spinal surgical patients, IQR, (range)	9.5 IQR 11 (0–32)	9 IQR 10 (0–32)	10 IQR 15 (1–30)	9.5 IQR 12.25 (0.5–30)	10 IQR 15 (0–30)
Received training on management of lumbar surgical patients					
Yes	186	138	18	10	20
No	59	38	6	8	7
Missing	115	79	7	14	15
Type of training received					
Inservice training	163	122	16	7	18
External course	19	215	0	0	4
Undergraduate training	59	41	5	6	7
Postgraduate training	19	15	2	1	1
Missing	2	2	0	0	0

were directly involved in the delivery of prehabilitation, 82 respondents with perioperative rehabilitation, and 171 were involved in the provision of post-operative rehabilitation. 104 respondents were not involved in the delivery of rehabilitation for patients undergoing lumbar surgery.

3.1. Access to rehabilitation

18 % of respondents reported that prehabilitation was routinely provided. Peri-operative rehabilitation was the most routinely provided (47 %). Additionally, peri-operative and post-operative rehabilitation were offered under specific circumstances. For example, if new neurological deficits or mobility difficulties were identified post operatively.

The timing and initiation of prehabilitation and post-operative rehabilitation varied. For example, for prehabilitation prior to microdiscectomy, 25 % (n = 8/32) reported patients were seen when listed for surgery, 13 % (n = 4/32) when they attended pre-assessment, and 16 % (n = 5/32) reported it was prior to the decision for surgery as part of their conservative care.

41 % (n = 184/480) of respondents stated that they commenced post-operative outpatient rehabilitation between 2 and 4 weeks after surgery, although it ranged from <2-weeks (11 %, n = 49/480) to >12 weeks post-operative (4 %, n = 18/480).

Inpatient physiotherapists referred patients for post-operative outpatient rehabilitation in >90 % (n = 130/141) of cases. Most referrals were to outpatient physiotherapy departments local to the patients' home (66 %, n = 93/141) whilst a third of respondents referred patients to out-patient departments at the surgical centre.

Prehabilitation and post-operative rehabilitation were predominantly provided in person (81 %, n = 412/542), on a one-to-one basis (76 %, n = 412/542). The number of sessions of prehabilitation varied, although almost all were seen ≤4 occasions. Peri-operatively most patients were seen on 1–2 occasions, post-operatively most patients were seen on 4 occasions (Fig. 1).

3.2. Aims and interventions used with rehabilitation

The aims of the prehabilitation included to (i) educate patients on care processes (25 %, n = 8/32), (ii) optimise psychological and physical health to aid post-operative recovery (25 %, n = 8/32) and (iii) enhance strength and function (25 %, n = 8/32). Almost all of respondents reported that peri-operative rehabilitation focused on educating patients about their condition and pain management and expediting safe discharge home. Of the respondents that provided post-operative rehabilitation, most respondents 79 % (354/446) reported the aim of post-operative rehabilitation included improving function; and approximately 50 % (214/446) of respondents reported the aim to be improvement in strength and conditioning (figure supplemental material 3).

Advice and education strategies were the most frequently reported rehabilitation interventions for all phases of rehabilitation. Gait re-education and progression of walking were also frequently reported within peri-operative and post-operative rehabilitation but not prehabilitation (Fig. 2).

Within prehabilitation, few respondents reported providing patients with specific pre-operative exercises (8 %, n = 8/96) and approximately half of respondents reported undertaking a physical examination (54 %, n = 52/96). Provision of exercises within peri-operative rehabilitation was reported by 65 % (n = 150/230) of respondents, these primarily focused on lumbar range of movement and core stability however, a third reported no exercises were provided in this phase (n = 75/230). Many types of exercises were provided within post-operative rehabilitation, including muscle endurance, abdominal-based, 'core stability' exercises and cardiovascular exercise.

Outcome measures were used within prehabilitation by approximately 27 % (n = 26/96) of respondents , and within post-operative rehabilitation by 68 % (n = 303/446) of respondents. Self-rated pain

Table 2
Summary of responses to questions on prehabilitation of patients undergoing lumbar surgery.

Question	Micro-discectomy	Micro-discectomy %	Laminectomy	Laminectomy %	Fusion	Fusion %
Patients routinely receive prehabilitation prior to undergoing lumbar surgery						
Yes	43	17	47	19	48	19
No	155	62	152	61	145	58
missing	52	21	51	20	56	22
Respondent directly involved in delivery of prehabilitation						
Yes	32	74	32	68	32	67
No	10	23	13	28	14	29
Missing	1	2	2	4	2	4
Format of prehabilitation						
In person	20	63	17	53	16	50
Virtually via telephone	4	13	5	16	4	13
Virtually via video call	2	6	1	3	1	3
Missing	6	19	9	28	11	34
Delivery of prehabilitation						
Group	7	22	8	25	7	22
Individual, one to one basis	19	59	15	47	14	44
Missing	6	19	9	28	11	34
Location of prehabilitation						
In physiotherapy clinic	13	41	11	34	7	22
In surgical outpatient clinic	3	9	2	6	3	9
In pre-assessment clinic	0	0	0	0	4	13
On a ward	0	0	2	6	1	3
Other	1	3	1	3	1	3
Missing	15	47	12	38	16	50
Timing prehabilitation typically provided						
When they attend pre-assessment	4	13	3	9	4	13
When the patient is listed for the procedure	8	25	9	28	9	28
When a specific appointment is arranged	4	13	4	13	4	13
Other	7	22	6	19	4	13
Missing	13	41	10	31	11	34

Table 3
Summary of responses to questions on peri-operative rehabilitation of patients undergoing lumbar surgery.

Question	All procedures	All procedures %	Discectomy	Discectomy %	Laminectomy	Laminectomy %	Fusion	Fusion %
Patients routinely receive peri-operative rehabilitation								
Yes	350	47	105	42	121	48	124	50
No	67	9	26	10	22	9	19	8
It depends on:	96	13	35	14	32	13	29	12
New neuro deficits	28	4	15	6	9	4	4	2
Mobility issues	24	3	10	4	9	4	5	2
Other reason	7	1	3	1	1	0	3	1
Missing	240	32	85	34	76	30	79	32
Respondent directly involved in delivery of peri-operative rehabilitation								
Yes	230		77		77		76	
No	225		75		74		76	
Criteria used to discharge patient from peri-op rehabilitation								
Yes	95	41	32	42	31	40	32	42
No	68	30	22	29	24	31	22	29
Missing	65	28	21	27	22	29	22	29
Discharge criteria used:								
Returned to baseline mobility (e.g. transfers/stairs)	79	83	26	62	26	65	27	64
Independent with post op exercises	12	13	3	7	4	10	5	12
Pain controlled	24	25	8	19	8	20	8	19
Recovery of physical function, able to sit, stand, walk and other basic gait stability activities	2	2	1	2	1	3	0	0
Wound healed	3	3	1	2	1	3	1	2
Stable vital signs/medically stable	6	6	2	5	2	5	2	5
Bladder/bowel control	6	6	2	5	2	5	2	5
No new symptoms of concern which would need medical review before D/C	3	3	1	2	1	3	1	2
Following discharge from the ward, is outpatient post-operative rehabilitation arranged for patients								
Yes	66	29	22	29	23	30	21	28
No	22	10	6	8	8	10	8	11
If required	75	33	26	34	24	31	25	33
Missing	67	29	23	30	22	29	22	29

(numerical rating scale) and back-related disability questionnaires were most frequently used (supplementary material 4). Outcome measures were infrequently reported within peri-operative rehabilitation (15 %, n = 35/230).

Approximately 40 % (n = 258/676) respondents had specific discharge criteria from peri-operative rehabilitation (return to baseline mobility and good pain control most frequently reported) and post-operative rehabilitation (achievement of patient specific goals most

Table 4
Summary of responses to questions on post-operative outpatient rehabilitation of patients undergoing lumbar surgery.

Question	All procedures	% all procedures	Discectomy	Discectomy %	Laminectomy	Laminectomy %	Fusion	Fusion %
Patients routinely receive post-operative rehabilitation								
Yes	480	44	175	49	161	45	144	40
No	90	8	25	7	28	8	37	10
In certain circumstances	197	18	69	19	67	19	61	17
Respondent directly involved in delivery of post-operative rehabilitation	446		164		154		128	
When does outpatient post-operative rehabilitation typically commence								
<2 weeks post-op	49	11	18	11	18	12	13	10
2–4 weeks post-op	184	41	73	45	65	42	46	36
4–6 weeks post-op	91	20	32	20	32	21	27	21
6–12 weeks post-op	61	14	21	13	18	12	22	17
>12 weeks post-op	18	4	4	2	4	3	10	8
Missing	43	10	16	10	17	11	10	8
Format of post-operative rehabilitation								
In person	385	86	137	84	133	86	115	90
Virtual-telephone	11	2	6	4	4	3	1	1
Virtual-video	9	2	4	2	2	1	3	2
Missing	41	9	17	10	15	10	9	7
Delivery of post-operative rehabilitation								
Individual, one to one basis	364	82	132	80	126	82	106	83
Group	21	5	5	3	7	5	9	7
Missing	61	14	27	16	21	14	13	10
Use of discharge criteria								
Nil	206	46	73	45	74	48	59	46
Yes	163	37	61	37	53	34	49	38
Missing	77	17	30	18	27	18	20	16
Discharge criteria:								
Achieved goals	56	13	23	14	17	11	16	13
Able to self-manage	28	6	12	7	8	5	8	6
Improved pain	46	10	20	12	14	9	12	9
Improved function	41	9	15	9	13	8	13	10
Safe	6	1	2	1	2	1	2	2
Surgical review	3	1	2	1	1	1	0	0
Outcome measure improvement	7	2	0	0	3	2	4	3

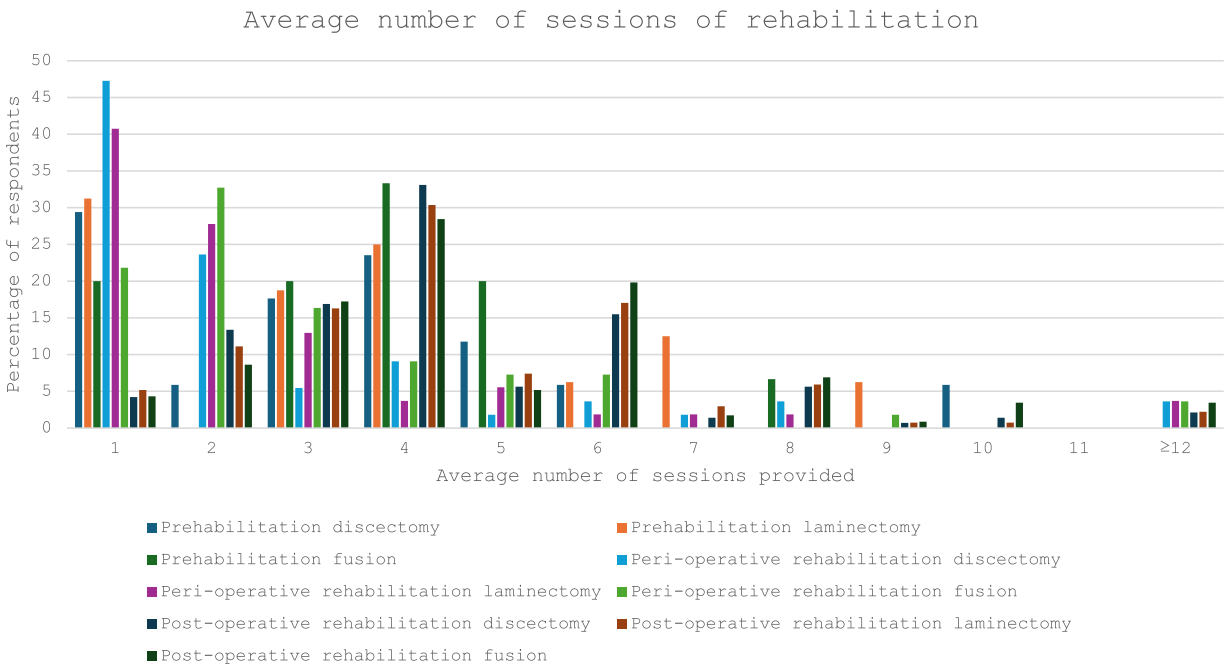


Fig. 1. Bar chart illustrating typical number of sessions of rehabilitation provided to patients undergoing lumbar surgery.

frequently reported criteria).

3.3. Restrictions following surgery

Fig. 3 illustrates the diverse restrictions advised following lumbar surgery. 12 % (39/330) reported advising no restrictions post-surgery (further detail in supplemental material 5). Avoidance of lifting for 12 weeks was the most frequent restriction. Restrictions on lumbar flexion, return to work, walking and driving were also common. Timeframes varied widely: lifting restrictions ranged from 0 to 6 months; movement

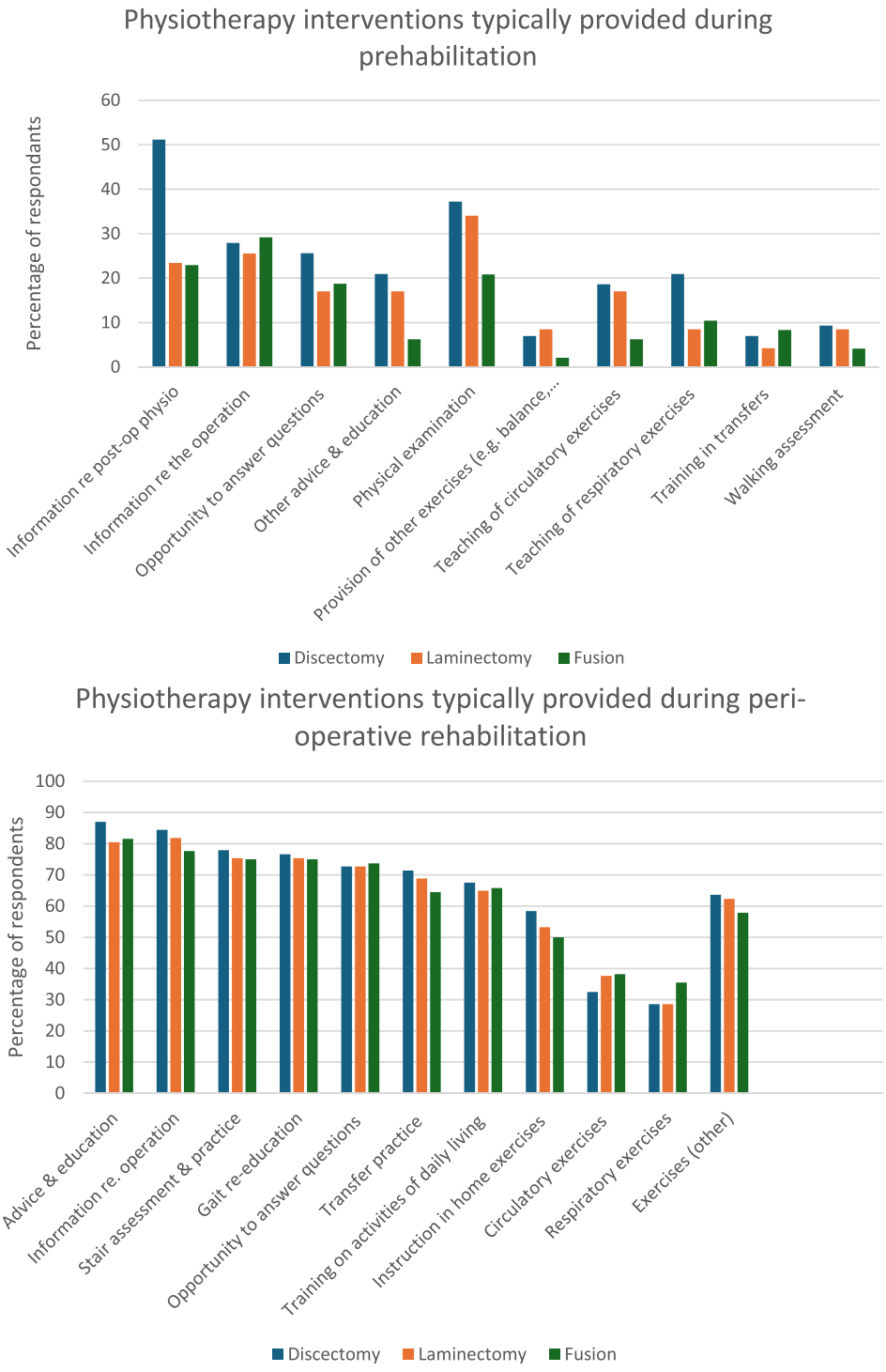


Fig. 2. Interventions used within rehabilitation for patients undergoing lumbar surgery
Fig. 2a Interventions used within prehabilitation
Fig. 2b Interventions used within peri-operative rehabilitation
Fig. 2c Interventions used within post-operative outpatient rehabilitation

restrictions from 'move as tolerated' to no bending and twisting for 12 weeks; driving restrictions from 2 to 8 weeks, or ambiguously 'when safe'. Restrictions were based on surgeon preference (67 %, n = 195/291), tissue healing (35 %, n = 102/291), and research findings (25 %, n = 73/291). 65 % (n = 216/330) of respondents reported providing written instructions regarding restrictions.

4. Discussion

This study described current UK prehabilitation, peri-operative, and post-operative physiotherapy practices for patients undergoing lumbar microdiscectomy, laminectomy, and single-level fusion. It revealed variable physiotherapy rehabilitation practices, that frequently did not align with current UK spinal surgical pathways (Getting It Right First

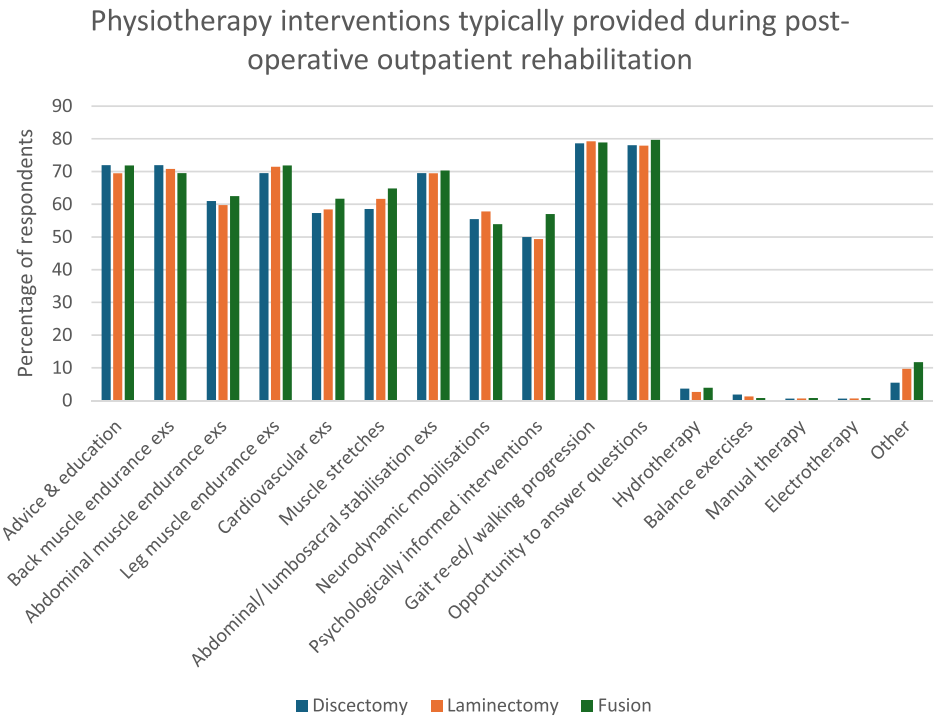


Fig. 2. (*continued*).

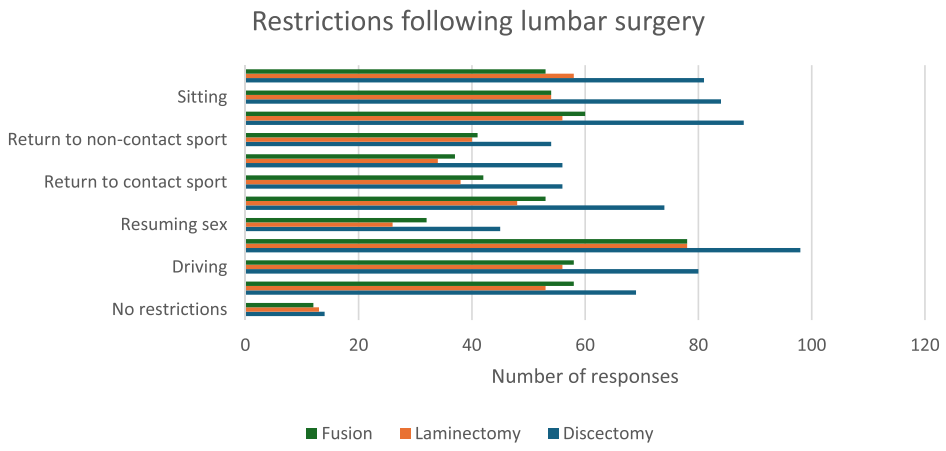


Fig. 3. Restrictions following lumbar surgery.

Time, 2022).

Patients undergoing lumbar surgery report feeling underprepared for their post-operative period, this has been associated with anxiety, fear of doing something wrong, and dissatisfaction with their care (Rushton et al., 2022; McIlroy et al., 2024). If patients are not seen pre-operatively or whilst as an inpatient, health care professionals need to find methods to equip patients with the knowledge and skills to manage their recovery independently, especially as access to post-operative rehabilitation is also inconsistent. Qualitative studies of patients receiving rehabilitation following lumbar spine surgery including discectomy (Rushton et al., 2017), laminectomy (McIlroy et al., 2024) and fusion (Rushton et al., 2022) suggest that rehabilitation can enhance post-operative confidence and support patients through the challenging recovery period. Patients report particularly valuing the management of expectations and holistic, personalised care. However, some prefer to self-manage their recovery when provided with a comprehensive information, while others experience immediate post-operative improvement and perceive rehabilitation as unnecessary (Rushton et al., 2020). These findings have led to recommendations for a stepped-care approach to rehabilitation (Rushton et al., 2017), and highlights the limitations of 'one size fits all' patient pathways and underscores the importance of embedding patient experience and co-production into service design.

Our results demonstrated lower routine provision of prehabilitation compared to previous surveys which reported approximately a third of services provided prehabilitation (Rushton et al., 2014; Alsiaf et al., 2022). Methodological differences, including eligibility criteria, and our definition of prehabilitation versus pre-operative, conservative care may explain the discrepancy. Provision of education was the most frequently provided physiotherapy intervention in our survey, similar to previous surveys (Rushton et al., 2014). Prehabilitation, aims to minimise surgical stress, prevent deconditioning, and accelerate functional recovery. Furthermore, it may reduce length of post-operative stay (Nielsen et al., 2010) and improve post-operative physical function (Fors et al., 2019). Education may form an effective part of prehabilitation (Burgess et al., 2019) however, it is more effective when combined with exercise, nutrition, and emotional well-being (Carli and Ferreira, 2018) yet this

was not typically reflected in our results. Therefore, a more comprehensive and holistic approach to prehabilitation, rather than a one off education session, may be required to optimise its impact. The UK guidelines omit prehabilitation from the surgical pathways (Getting It Right First Time, 2022). While prehabilitation is effective in other surgical conditions, such as hip and knee replacement (Halloway et al., 2015), it may also be a useful adjunct for spinal surgery. This is especially important for older patients or where prolonged pain and disability prior to surgery leads to deconditioning. The role of prehabilitation in these cases requires further definition within the pathways.

Adherence to national standards and clinical guidelines is associated with improved patient outcomes (Farrow et al., 2018) yet uptake of clinical guidelines across healthcare has been reported to be between 50 and 60 % (Wang et al., 2023; Runnacles et al., 2018). Our findings demonstrate that access to rehabilitation for patients undergoing lumbar surgery is similar to the provision 10–20 years ago (Rushton et al., 2014; Williamson et al., 2007). Barriers to uptake of new guidance and adherence include awareness and attitude towards guidelines, insufficient resources, and organisational constraints (Wang et al., 2023; Runnacles et al., 2018). Our results indicate that despite most respondents being highly experienced clinicians, only half had received training on managing lumbar surgical patients. The lack of formal training may contribute to the variation in UK physiotherapy practice. Furthermore, it is the inpatient physiotherapist's responsibility to refer a patient for outpatient rehabilitation. Since not all patients are seen in this setting, it is unsurprising that not all receive post-operative outpatient rehabilitation. This indicates a need for training and changes in referral processes and patient-centred pathways of care. Future research should explicitly explore the barriers to implementation of evidence-based rehabilitation for patients undergoing spinal surgery.

The variation in physiotherapy practice may reflect the delivery of individualised, multi-modal rehabilitation tailored to each patient's needs, goals, and context, including biopsychosocial factors by autonomous physiotherapists. However, it may also reflect the limited evidence available to guide practice (McGregor et al., 2014; Bogaert et al., 2022; Yu et al., 2024; Pester et al., 2023). For post-operative rehabilitation there were no apparent differences in exercise prescription, or timing of rehabilitation initiation between the different operations. This was surprising, as the rehabilitation needs of patients undergoing the different procedures may differ (Rushton et al., 2020). Rehabilitation, including intensive exercise, within four weeks of microdiscectomy or decompression is safe and improves pain and function compared to no rehabilitation or less intense exercise (Snowdon and Peiris, 2016). Therefore, early access to rehabilitation and particularly exercises to restore function and reduce pain catastrophisation and kinesiophobia (Wood et al., 2023) is indicated. There is uncertainty around the optimum time to initiate rehabilitation following lumbar fusion. One trial demonstrated group-based rehabilitation at 6-weeks post lumbar fusion resulted in greater pain and disability at 1-year following surgery compared to the same rehabilitation started at 12-weeks although there was no differences in functional performance (Oestergaard et al., 2012, 2013). In contrast, another trial concluded initiation of psychomotor therapy (cognitive behavioural approach and graded motor relearning approach to lumbopelvic stabilisation training) at 6-weeks vs exercise therapy at 12-weeks was safe and resulted in improved disability 1-year after surgery (Abbott et al., 2010). The uncertainty of evidence may fuel the variation in initiation of rehabilitation and restrictions following surgery.

The most common restriction was lifting no more than a kettle for 12 weeks "to protect the spine from damage". Similarly, lumbar flexion and sitting were frequently restricted. These positions increase intradiscal pressure (Roman-Liu et al., 2023), theoretically raising the risk of disc prolapse recurrence. However, in a case series of 150 patients, removal of restrictions following microdiscectomy had no adverse effects (Carragee et al., 1999). The lack of an empirical basis for restrictions might explain the inconsistency observed within this survey. Inconsistent advice can increase patient anxiety (McIlroy et al., 2024) and fear-avoidance behaviour, raising the risk of poor surgical outcomes (Archer et al., 2014). Further research on the impact of restrictions and clear guidance is required to promote consistency in advice and improve patient care.

The UK spinal pathways (Getting It Right First Time, 2022) provide important direction to reduce variation in surgical care. However, they place limited emphasis on personalised care and the nuances of social and environmental factors, and have not been evaluated from either a clinician or patient perspective. France (Dupeyron et al., 2021), Belgium and the Netherlands (Bogaert et al., 2023) have recently produced guidance, using Modified Delphi studies, for pre-, peri-, and post-operative rehabilitation for lumbar discectomy and fusion surgery, but not for laminectomy. The guidance has outlined recommended core content and considered post-operative restrictions. A prospective non-randomised trial evaluated the impact of a rehabilitation pathway in 72 patients in Belgium, receiving one or two level lumbar fusion compared to usual care. It demonstrated that the rehabilitation pathway was associated with greater improvements in disability, back pain, and return-to-work rate, and was cost-effective compared with usual care (Bogaert, 2025a,b). We recommend this work is developed and extended to include laminectomy, and to establish a core outcome set applicable to all stages of rehabilitation, tailored to the UK public healthcare system to optimise implementation.

4.1. *Strengths and limitations*

The comprehensive survey had 360 responses, with respondents from all UK countries and encompasses the entire rehabilitation pathway. The respondents were self-selecting and therefore those that do not offer rehabilitation may be less likely to respond, therefore provision could be lower than we reported. We included three types of surgery within the survey. Although aggregating the results may have reduced specificity, data for each procedure are provided in the tables. The length of the survey may have affected the completion rate, resulting in missing data from incomplete responses. Consequently, some results should be interpreted with caution and considered as hypothesis-generating (Jakobsen et al., 2017). However, the variability in responses suggests findings and conclusions are unlikely to change. A potential limitation of the survey approach is that it may not fully capture the nuances of patient-centred care, and these aspects might therefore be underrepresented in the findings. We could not determine whether variables like experience or work setting influenced clinical practice. Future research, potentially using qualitative methodologies, could explore these factors in more depth, examining the influence of contextual and individual-level variables on evidence-based practice, as well as identify potential barriers to implementation. Additionally, exploring areas where there is clinical equipoise in rehabilitation could help inform targeted interventions and further guideline development.

5. Conclusion

This study provides a comprehensive overview of current UK physiotherapy practices across the prehabilitation, peri-operative, and post-operative pathways for patients undergoing lumbar microdiscectomy, laminectomy, and fusion. The findings highlight significant variability in both access to and the content of rehabilitation. While this may reflect efforts to deliver individualised, biopsychosocially-informed care, it also points to uncertainty in the evidence base and inconsistencies in guideline implementation.

These results support the need for greater emphasis on patient-centred pathways, and updated, context-appropriate UK rehabilitation guidelines. Future research should explore barriers to guideline implementation, the impact of postoperative restrictions, and the development of tailored rehabilitation interventions to ensure equitable and

effective care.

CRediT authorship contribution statement

Suzanne McIlroy: Writing – original draft, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Michael Reddington:** Writing – review & editing, Supervision, Conceptualization. **Lindsay Bearne:** Writing – review & editing, Supervision, Methodology. **Dominic Thurgood:** Writing – review & editing, Data curation. **Andrew McCarter:** Writing – review & editing, Methodology, Formal analysis, Conceptualization.

Ethics approval

The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments. Informed consent was obtained from all individual participants within the study. Ethical approval was obtained from King's College London (MRSP-22/23-34437).

Funding

This work was part supported by a research training fellowship awarded to Suzanne McIlroy, provided by The Dunhill Medical Trust. Grant: RTF2006\14.

Declaration of competing interest

The authors have no relevant financial or non-financial interests or competing interests to disclose.

Acknowledgements

Thank you to Sade Bailey Macdonald and Rachael Robinson for developing and piloting the survey used within this project.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.msksp.2025.103365.

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