Original research

Prospects of returning to work after lumbar spine surgery for patients considering disability pension: a nationwide study based on data from the Norwegian Registry for Spine Surgery

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► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/oemed-2023-108864).

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Received 8 February 2023
Accepted 14 June 2023
Published Online First 7 July 2023

To cite: Hammer L, Ingebrigtsen T, Gulati S, *et al*. *Occup Environ Med* 2023;**80**:447–454.

ABSTRACT

Objectives To assess the odds for not returning to work (non-RTW) 1 year after treatment among patients who had applied for or were planning to apply for disability pension (DP-applicant) prior to an operation for degenerative disorders of the lumbar spine.

Methods This population-based cohort study from the Norwegian Registry for Spine surgery included 26 688 cases operated for degenerative disorders of the lumbar spine from 2009 to 2020. The primary outcome was RTW (yes/no). Secondary patient-reported outcome measures (PROMs) were the Oswestry Disability Index, Numeric Rating Scales for back and leg pain, EuroQoL five-dimension and the Global Perceived Effect Scale. Logistic regression analysis was used to investigate associations between being a DP-applicant prior to surgery (exposure), possible confounders (modifiers) at baseline and RTW 12 months after surgery (outcome).

Results The RTW ratio for DP-applicants was 23.1% (having applied: 26.5%, planning to apply 21.1%), compared with 78.6% among non-applicants. All secondary PROMs were more favourable among non-applicants. After adjusting for all significant confounders (low expectations and pessimism related to working capability, not feeling wanted by the employer and physically demanding work), DP-applicants with under 12 months preoperative sick leave had 3.8 (95% CI 1.8 to 8.0) higher odds than non-applicants for non-RTW 12 months after surgery. The subgroup having applied for disability pension had the strongest impact on this association.

Conclusion Less than a quarter of the DP-applicants returned to work 12 months after surgery. This association remained strong, also when adjusted for the confounders as well as other covariates related RTW.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Many patients who are planning to apply or already have applied for disability pension (DP-applicants) are referred to lumbar spine surgery. They may, however, lack motivation and incentives to return to work (RTW).

WHAT THIS STUDY ADDS

⇒ Being a DP-applicant was strongly associated to non-RTW, despite surgical treatment, especially if they already had filed an application for DP prior to surgery.
⇒ DP-applicants also reported less health improvements after the surgery compared with non-applicants.
⇒ Psychosocial factors, such as not feeling wanted by the employer at the work place, work-related fear avoidance beliefs and pessimistic expectations regarding work participation, were also associated to non-RTW.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Most DP-applicants seem to have limited benefit of lumbar spine surgery, especially if the main treatment goal is RTW. This study indicates that many DP-applicants may lack incentives and motivation, signalling that an underlying RTW problem is not resolved by surgical treatment.

INTRODUCTION

In most countries, back pain is a major cause of disability, loss of quality-adjusted life-years and for receiving sickness benefits and disability pension (DP).[1] The negative socioeconomic consequences for patients, their families and society are significant.[2 3] Degenerative disorders, including lumbar disc herniation, spinal stenosis and spondylolisthesis, are common causes of back pain related disability. If conservative treatment fails, many patients with these conditions can be treated effectively with surgery and return to work (RTW).[4]

Sickness benefits compensates for the loss of income due to a medical condition. Longer sick leave prior to lumbar spine surgery is associated both with unfavourable patient-reported outcomes and decreased work participation after treatment.[5] Other known preoperative risk factors for non-RTW are longer duration symptoms, high back pain intensity, treatment pessimism and non-inclusive workplaces.[2 6–11] Interestingly, psychosocial factors such as anxiety, depression and fear-avoidance behaviour may be more important for non-RTW than severity of somatic symptoms.[12 13] Also,

problems at the workplace, especially in the relationship with a superior or colleagues, increase the risk of working disability and persisting pain.[10 13–15] Moreover, prolonged sick leave can lead to social isolation and secondary lifestyle and mindset changes, reducing patients' incentives to RTW.[3]

In Norway, such as in many European countries, all citizens have generous public social and health insurance schemes. To receive a DP from the Norwegian Labour and Welfare Administration, earning capacity must be permanently reduced by at least 50%. In addition, individual work ability assessment and appropriate medical examinations and treatments must have been tried out for at least 1 year.

As a consequence, many patients considering DP are referred to lumbar spine surgery and are often encouraged to undergo surgery by health professionals, social workers and family members.[16] However, patients with an unresolved DP issue may lack motivation and incentives to engage in work, and their odds for RTW after surgery are unknown. Unfortunately, patients considering DP status are often not unveiled and thus not considered in clinical decision-making prior to an operation. As a consequence, many surgeons may be overly optimistic about treatment outcomes.[17]

The aim of this study was to investigate the odds for non-RTW 1 year after surgery for degenerative disorders of the lumbar spine, for patients already considering DP prior to an operation.

METHODS

Study design

This is a population-based cohort study from the Norwegian registry for Spine Surgery (NORspine). It was conducted according to the methods proposed in the PROGnosis RESearch Strategy framework, and the results are reported according to the Strengthening the Reporting of Observational studies in Epidemiology guidelines.[18]

Participants and setting

We included all cases operated for degenerative disorders of the lumbar spine, registered in NORspine from September 2009 to September 2020 and followed them for 12 months. The patients were recruited consecutively from regular clinical practice at orthopaedic and neurosurgical departments at public and private hospitals in Norway. Patients under the age of 16, those precluded from consenting because of cognitive failure, and patients with spine tumours, primary spinal infections or fractures are not included in the NORspine.

Data collection

NORspine was established in 2007 for quality assessment and research. The NORspine has used similar questionnaires during the whole study period, but from 1 January 2019 some new variables were added. Consent to participate in the registry was voluntary and not required for having access to surgery. The national coverage rate for lumbar spine surgery was 100% at the institutional level and 81% at the individual level in 2021.[19]

At admission for surgery (baseline), patients completed self-administered forms, including questions about work status, sociodemographic and lifestyle issues, and patient-reported outcome measures (PROMs).[19] The surgeon recorded data about diagnosis, treatment, comorbidity, intraoperative complications, duration of surgery and length of hospital stay. Follow-up was conducted by the central registry unit without involvement of the treating hospital 12 months after surgery, when the patients

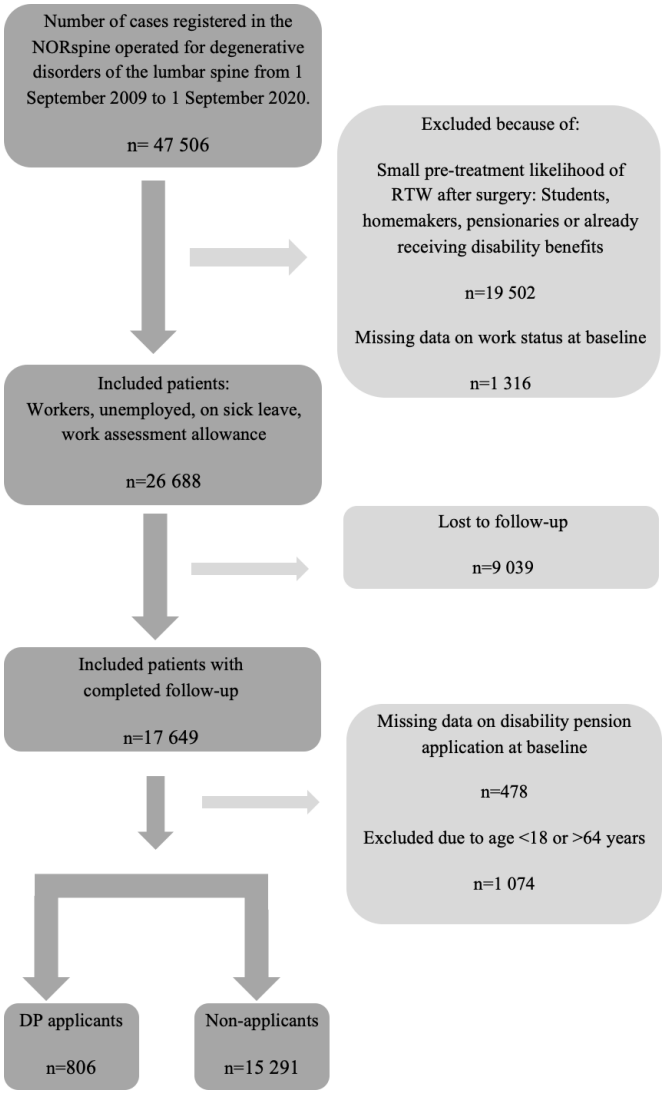

Figure 1 Flow chart showing the recruitment process to the study. DP, disability pension; NORspine, Norwegian registry for spine surgery; RTW, return to work.

responded to questionnaires similar to those completed at baseline. The forms included standardised questions about their current working and disability status. All questionnaires were sent and returned by mail. Participants not returning the questionnaire received one reminder.

Data source and variables

Cases

For the purpose of this study, we excluded cases already granted full or partial DP and those not working for other reasons (students, homemakers and retired pensionaries).[3] Cases with missing data on work status at baseline were also excluded (figure 1). We only included those aged 18–64 judged to have a fair pretreatment likelihood of RTW after surgery, that is, cases working full-time or part-time, involuntary unemployed, and those on full or partly sick leave, or on work assessment allowance (prolonged benefits for participation in treatment programmes or employment schemes) at baseline. In Norway, a person may be entitled to work assessment allowance when the sickness benefit period ends (after 1 year), if still ill and trying to get back into the labour market.

Exposure variable (DP-applicant)

At baseline, patients responded to the following specific questions about DP: 'Have you applied for DP?' (yes/no) and 'Are you planning to apply for DP?' (yes/no).

If they answered yes on one of these questions, we categorised them as DP-applicants (yes), and those who answered no on both as non-applicants (no).

Primary outcome

RTW was defined by cases not receiving any sickness or disability benefits 12 months after surgery; meaning that they reported to be working full time or part time. We defined those having been granted full or partial DP, full or partial sick leave or on work assessment allowance as non-RTW. Those who reported to be students, homemakers or involuntary unemployed at 12 months follow-up were also included in the RTW group as suggested by Floderus *et al*, who considered these categories to be closer to RTW than receiving sickness or disability benefits.[3]

Secondary outcomes

Secondary outcome measures were Oswestry Disability Index (ODI), Numeric Rating Scales (NRS) for back and leg pain, HRQoL measured by EuroQol five-dimension (EQ-5D) and the Global Perceived Effect scale (GPE).

The ODI is a disease-specific measure of back pain-related disability in 10 activities of daily living. The scale ranges from 0 to 100 (no—maximal disability). To define a Patient Acceptable Symptom State (PASS) at 12 months follow-up, we used a cut-off suggested by van Hooff *et al*, that is, an ODI raw score ≤22.[20]

The NRS for back and leg pain assesses pain intensity on a scale ranging from 0 to 10 (0 equals no pain, 10 means worst pain imaginable; minimal clinically important change 1.0 points).[21]

EQ-5D is a generic measure of health-related quality of life, comprising 5D concerning mobility, self-care, daily activities, pain/discomfort and anxiety/depression. Health state index scores range from −0.60 to 1, where 1 corresponds to perfect health and 0 to death.[22]

GPE is a balanced 7-point Likert scale, that is, the patients' response to one question: 'To what degree did you benefit from the operation?'' The response alternatives are 'completely recovered', 'much improved', 'slightly improved', 'unchanged', 'slightly worsened', 'much worsened' and 'worse than ever'.[23]

Covariates

Based on previous literature, the study group evaluated all baseline covariates to identify possible confounding factors clinically relevant and related both to the exposure and outcome.[24–26] The following continuous variables were selected; age (years), body mass index (BMI) (kg/m^2), NRS for leg pain (0–10), NRS for back pain (0–10), ODI (0–100) and EQ-5D (-0.60–1). In 2019, a new baseline question concerning physical strain at work was included in the NORspine and our analysis: 'Do you have physically heavy work?' (1–10 (not heavy – very heavy)). Also, four questions from the Örebro Musculoskeletal Pain Questionnaire (ÖMPQ) which can be used to identify patients at risk for persistent pain and disability were added.[27 28] We used ÖMPQ items number 15, 16, 19 and 20.[29] For each item, the patients responded on a Numerical Rating Scale ranging from 0 to 10. Item 15, pain-expectancy: 'In your view, how large is the risk that your current pain may become persistent?' (no risk—very high risk). Item 16, work-expectancy: 'In your estimation, what are the chances you will be working your normal duties in 6 months' (no chance—very large chance). Item 19, pain related fear avoidance beliefs: 'An increase in pain is an indication that I should stop what I am doing until the pain decreases' (completely disagree—completely agree). Item 20, work related fear avoidance beliefs: 'I should not do my normal work with my present pain' ('completely disagree—completely agree').[30] Categorical variables included were gender, smoking, college or university education, native Norwegian speaker, duration of back pain >12 months, duration of leg pain >12 months, use of painkillers, comorbidity, 'American Society of Anesthesiologists' (ASA grade)[31] classification >2, moderate to severe anxiety/depression (EQ-5D, fifth item) and reading/writing difficulties (1=yes/0= no). One question concerning the employer–employee relation was added in 2019; 'Do you feel that your employer wants you back to work?' (1=yes/2=uncertain/3=no).

Statistical methods

All analyses were performed with IBM Statistical Package for the Social Sciences (SPSS; V.27th (IBM)). Descriptive data are presented as means with 95% CI's for continuous variables and counts with percentages for category variables. Mean differences between two groups were examined with one-way analysis of variance (ANOVA) for continuous variables and Pearson's χ^2 test for category variables. The level of significance was set to 0.05.

We used binary logistic regression to assess the associations between possible confounders, the exposition and the outcome (RTW, yes/no). We defined a variable as a significant confounder if the covariate changed the beta of the exposition variable (univariate analysis (online supplemental table 1)) with more than 10% when added in bivariate analyses. The exposition variable (reference: DP-applicant (no)) and confounders were then checked for collinearity and interactions. We considered a Pearson's correlation coefficient of ≥0.6 between covariates as significant collinearity.[32] We then assessed the exposition variable, first along with the significant confounders and then along with all baseline variables judged to be potential predictors for non-RTW, to evaluate the independence of the associations.

Sensitivity analyses

To further evaluate the robustness of the main findings, we repeated the multivariate analyses after excluding patients working fulltime prior to surgery, since they anyways would be more likely to RTW.

We also stratified DP-applicants into two subgroups at baseline ('planning to apply' and 'having applied'), expecting that those already 'having applied' would be at higher risk for non-RTW.

Bias

We assessed missing data by comparing baseline characteristics of patients responding at 12 months and cases lost to follow-up to identify possible selection bias (online supplemental table 2). No imputation was performed.[33] To decrease confounding bias, we assessed all possible predictors for outcome present at baseline for confounding.

RESULTS

Participants

Figure 1 shows the study flow chart. Of 47 506 cases who were operated for degenerative disorders of the lumbar

spine and registered in NORspine during the study period, we excluded 20 818 cases because they were highly unlikely to engage in income-generating work after surgery (students, homemakers, retired pensionaries and those already receiving a DP) or had missing data on work status at baseline. Hence, we included 26 688 cases. Of these, 9039 (33.7%) were lost to follow-up at 12 months. Data on DP application status at baseline were missing in 478 (1.8%) cases. We also excluded 1074 cases (4.0%) over or under the age of 18–64. Thus, 16 097 (60.3%) cases were available for the comparative analyses between DP-applicants (n=806, 5.0 %) and non-applicants (n=15 291, 95.0 %).

Descriptive data

Table 1 shows baseline characteristics of DP-applicants and non-applicants. A larger proportion of DP applicants than non-applicants were females, smokers, had lower education, moderate to severe anxiety or depression, a higher ASA score, more comorbidity, more than 12 months duration of pain, undergone previous operations, were not native Norwegian speakers and used more painkillers. The DP-applicants also were older, had higher mean BMI, ODI and NRS scores for both radiating pain and back pain, and lower mean EQ-5D score. They had heavier physical work and more fear avoidance and pessimism about RTW.

Online supplemental table 2 compares baseline characteristics for the 17 649 cases who completed 12 months follow-up (respondents) and the 9039 cases who were lost to follow-up (non- respondents). A larger proportion of the non-respondents were male, smokers, had low education, depression and had undergone previous operations. Non-respondents were also younger, had higher ODI and lower EQ-5D scores and were more likely to believe they should not work with their present pain.

Main results

The proportions categorised as RTW was higher among non-applicants 12 019/15 291 (78.6%) compared with DP-applicants 186/806 (23.1%), (p<0.001) (table 2), that is, 78/294 (26.5%) for those 'having applied' and 108/512 (21.1%) for those planning to apply for DP.

The proportions reporting improvement on the GPE (slightly better—completely recovered) (13 379/15 291 (87.5 %) vs 556/806 (69.0 %)) (p <0.001), and reaching PASS, (10 794/15 291 (70.6 %) vs 245/806 (30.4 %)) (p <0.001) were higher also among non-applicants. All PROMs mean scores at 12 months follow-up, as well as the mean change scores, were more favourable for the non-applicants (table 2).

The odds for non-RTW were 12.2 (95% CI 10.4 to 14.5) for DP-applicants compared with non-applicants in an unadjusted, univariate analysis. The results from the bivariate analyses of all possible confounders are presented in online supplemental table 1, showing how much the beta (association) for the exposition changed when each of the possible confounders were included in the analysis.

Five variables were identified as significant confounders; duration of preoperative sick leave, heavy physical work, pessimistic expectations about RTW (ÖMPQ, item 16), fear avoidance beliefs related to work (ÖMPQ, item 20), and beliefs that their employer did not want them back to work. No significant collinearity was found. There was a significant interaction between the duration of sick leave and being a DP-applicant or not. Due to this interaction we stratified a multivariable model

Table 1 Baseline characteristics of disability pension (DP) applicants and non-applicants and type of surgery performed

	DP-applicants	Non-applicants	P value
Age,* mean (95% CI)	50.0 (49.3 to 50.7)	47.5 (47.3 to 47.6)	<0.001
Missing, n (%)	0	0	
Female gender,* n (%)	423 (52.5)	6341 (41.5)	<0.001
Missing	0	0	
Smokers,* n (%)	262 (32.5)	3111 (20.3)	<0.001
Missing	8 (1.0)	131 (0.9)	
College or university education,* n (%)	206 (25.6)	6600 (43.2)	<0.001
Missing	9 (1.1)	70 (0.5)	
Native Norwegian speaker,* n (%)	692 (85.9)	14 125 (92.4)	<0.001
Missing	4 (0.5)	42 (0.3)	
Body mass index,* mean (95% CI)	28.2 (27.9 to 28.6)	27.2 (27.1 to 27.2)	<0.001
Missing	29 (3.6)	372 (2.4)	
Numeric Rating Scale for back pain,* mean (95% CI)	7.2 (7.0 to 7.3)	6.2 (6.1 to 6.2)	<0.001
Missing, n (%)	14 (1.7)	363 (2.4)	
Numeric Rating Scale for leg pain,* mean (95% CI)	6.9 (6.8 to 7.1)	6.5 (6.5 to 6.5)	<0.001
Missing, n (%)	21 (2.6)	373 (2.4)	
Oswestry Disability Index,* mean (95% CI)	48.6 (47.4 to 49.8)	42.0 (41.7 to 42.3)	<0.001
Missing, n (%)	3 (0.4)	82 (0.5)	
EuroQoL 5 Dimensions 3 Level,* mean (95% CI)	0.22 (0.19 to 0.25)	0.33 (0.32 to 0.34)	<0.001
Missing, n (%)	155 (19.2)	2863 (18.7)	
Duration of back pain,* n (%)			<0.001
No symptoms	9 (1.1)	311 (2.0)	
Less than 3 months	47 (5.8)	1994 (13.0)	
3–12 months	164 (20.3)	5660 (37.0)	
12–24 months	141 (17.5)	2381 (15.6)	
More than 24 months	426 (52.9)	4681 (30.6)	
Missing	19 (2.4)	264 (1.7)	
Duration of radiating pain,* n (%)			<0.001
No symptoms	19 (2.4)	440 (2.9)	
Less than 3 months	73 (9.1)	2871 (18.8)	
3–12 months	215 (26.7)	6379 (41.1)	
12–24 months	167 (20.7)	2334 (15.3)	
More than 24 months	299 (37.1)	2860 (18.7)	
Missing	33 (4.1)	407 (2.7)	
Using painkillers,* n (%)	732 (90.8)	12 569 (82.2)	<0.001
Missing	6 (0.7)	109 (0.7)	
Previously operated in the lumbar spine,* n (%)	319 (39.6)	3409 (22.3)	<0.001
Missing	3 (0.4)	104 (0.7)	
Surgeon reported comorbidity,* n (%)	400 (49.6)	4415 (28.9)	<0.001
Missing	68 (8.4)	1183 (7.7)	
American Society of Anesthesiologists' classification,* n (%)			<0.001
I and II	732 (90.8)	14 602 (95.5)	
III and IV	65 (8.1)	523 (3.4)	
Missing	9 (1.1)	166 (1.1)	
Moderate to severe anxiety/depression,*‡ n (%)	418 (61.1)	4836 (37.5)	<0.001
Missing	16 (2.3)	239 (1.9)	
Duration of sick leave,* n (%)			<0.001
Less than 3 months	50 (6.2)	3866 (25.3)	
3–12 months	24 (3.0)	1235 (8.1)	
12–24 months	81 (10.0)	1013 (6.6)	
More than 24 months	160 (19.9)	632 (4.1)	
Not answered (/not receiving SB)	491 (60.9)	8545 (55.9)	
Reading/writing difficulties,† n (%)	27 (22.1)	218 (9.0)	<0.001
Missing	6 (4.9)	86 (3.6)	

continued

Table 1 continued

	DP-applicants	Non-applicants	P value
Wanted back to work by employer,†§ n (%)			<0.001
Yes	51 (41.8)	2004 (83.1)	
Uncertain	33 (27.0)	155 (6.4)	
No	21 (17.2)	71 (2.9)	
Missing	17 (13.9)	182 (7.5)	
Heavy physical work† (0–10), mean (95% CI)	5.9 (5.2 to 6.5)	4.4 (4.2 to 4.5)	<0.001
Missing, n (%)	26 (21.3)	132 (5.5)	
Örebro Musculoskeletal Pain Questionnaire (ÖMPQ)			
ÖMPQ item no 15†¶ (0–10), mean (95% CI)	6.9 (6.4 to 7.4)	5.6 (5.5 to 5.7)	0.022
Missing, n (%)	12 (9.8)	162 (6.7)	
ÖMPQ item no 16†** (0–10), mean (95% CI)	3.6 (3.0 to 4.2)	7.8 (7.7 to 8.0)	<0.001
Missing, n (%)	11 (9.0)	114 (4.7)	
ÖMPQ item no 19† ††(0–10), mean (95% CI)	7.7 (7.2 to 8.2)	7.2 (7.1 to 7.3)	0.164
Missing, n (%)	12 (9.8)	119 (4.9)	
ÖMPQ item no 20†‡‡ (0–10), mean (95% CI)	8.4 (7.9 to 8.9)	6.9 (6.7 to 7.0)	<0.001
Missing, n (%)	18 (14.8)	129 (5.3)	
Type of surgery performed n (%)			
Lumbar disc surgery	320 (39.7)	9251 (60.5)	<0.001
Microdecompression	229 (28.4)	3575 (23.4)	
Laminectomy	26 (3.2)	285 (1.9)	
Fusion surgery	185 (23.0)	1808 (11.8)	
Disc prosthesis	20 (2.5)	224 (1.5)	
Other types of surgery	26 (3.2)	148 (1.0)	
Missing	0 (0.0)	0 (0.0)	

*Variables from 2009–2020: n=806 DP-applicants, n=15291 non-applicants.
†Variables available from 2019–2020 only: n=122 DP-applicants, n=2412 non-applicants.
‡EQ-5D fifth item.
§'Do you feel that your employer wants you back to work?'.
¶ 'In your view, how large is the risk that your current pain may become persistent?' (no risk-very large risk).
**'In your estimation, what are the chances you will be working your normal duties in 6 months' (no change-very large chance).
††'An increase in pain is an indication that I should stop what I'm doing until the pain decreases' (completely disagree-completely agree).
‡‡'I should not do my normal work with my present pain' (completely disagree-completely agree).
EQ-5D, EuroQol 5 Dimensions.

Table 2 Clinical outcomes 12 months after surgery among disability pension (DP) applicants and non-applicants

	DP-applicants n=806 (5.0%)	Non-applicants n=15291 (95.0%)	P value
Returned to work, n (%)			<0.001
Yes	186 (23.1)	12 019 (78.6)	
No	620 (76.9)	3272 (21.4)	
Missing	0	0	
Benefit of operation, (GPE-scale), n (%)			<0.001
Completely recovered	54 (6.7)	3538 (23.1)	
Much better	261 (32.4)	7212 (47.2)	
Slightly better	241 (29.9)	2629 (17.2)	
Unchanged	98 (12.2)	821 (5.4)	
A little worse	67 (8.3)	532 (3.5)	
Much worse	49 (6.1)	327 (2.1)	
Worse than ever	30 (3.7)	132 (0.9)	
Missing	6 (0.7)	100 (0.7)	
Achieved PASS,* n (%)	245 (30.4)	10 794 (70.6)	<0.001
Missing	4 (0.5)	55 (0.4)	
Numeric Rating Scale (NRS) score for back pain,† mean (95% CI)	5.1 (4.9 to 5.4)	3.1 (3.0 to 3.1)	<0.001
Missing, n (%)	4 (0.5)	78 (0.5)	
NRS score for leg pain,† mean (95% CI)	4.4 (4.2 to 4.6)	2.5 (2.4 to 2.5)	<0.001
Missing, n (%)	5 (0.6)	116 (0.8)	
Oswstry Disability Index (ODI),† mean (95% CI)	33.4 (32.1 to 34.7)	17.0 (16.8 to 17.3)	<0.001
Missing, n (%)	4 (0.5)	55 (0.4)	
EuroQoL 5 Dimensions 3 Level (EQ-5D),† mean (95% CI)	0.47 (0.45 to 0.50)	0.72 (0.71 to 0.72)	<0.001
Missing, n (%)	65 (9.5)	922 (7.2)	
NRS change score for back pain,‡ mean (95% CI)	2.1 (1.9 to 2.3)	3.1 (3.0 to 3.1)	<0.001
Missing, n (%)	18 (2.2)	435 (2.8)	
NRS change score for leg pain,§ mean (95% CI)	2.5 (2.3 to 2.8)	4.0 (4.0 to 4.1)	<0.001
Missing, n (%)	26 (3.2)	376 (3.1)	
ODI change score,§ mean (95% CI)	15.2 (13.7 to 16.7)	25.0 (24.6 to 25.3)	<0.001
Missing, n (%)	7 (0.9)	135 (0.9)	
EQ-5D 3 level change score,§ mean (95% CI)	0.26 (0.23 to 0.30)	0.39 (0.38 to 0.40)	<0.001
Missing, n (%)	93 (13.6)	1329 (10.3)	

*PASS, defined as ODI≤22 at 12 months after surgery.
†Higher score more favourable: 0=death, 1=perfect health.
‡Higher change score between baseline and 12 months follow-up indicates more improvement.
§0–100 (no-maximum back pain related disability).
GPE, Global Perceived Effect; PASS, Patient Acceptable Symptom State.

by cases with a duration of sick leave <12 months (table 3) and ≥12 months (online supplemental table 3) at baseline. Since the right to receive sick leave benefits normally ends after 12 months (except for those on work assessment allowance), only multivariate analyses of cases with sick leave <12 months are presented in tables 3 and 4. For cases with preoperative sick leave ≥12 months, being a DP-applicants did not reach statistically significance (OR 1.9, 95% CI 0.7 to 5.3) (p = 0.22) (online supplemental table 3).

When adjusted for all confounding factors, being a DP-applicants remained a statistically significant (p<0.001) and independent risk factor for non-RTW (OR 3.8, 95% CI 1.8 to 8.0) among cases with a preoperative sick leave <12 months (table 3, left side).

Sensitivity analyses

Online supplemental table 4 shows that the DP applicants had similar odds for non-RTW (OR 3.8, 95% CI 1.8 to 8.3) when cases working at baseline were excluded from the analyses.

Among cases on sick leave less than 12 months prior to surgery, both subgroups of DP-applicants showed a significant association with non-RTW in univariate analyses ('planning to apply': OR 12.3, 95% CI 7.7 to 19.5, p <0.001 and 'having applied': OR 6.3, 95% CI 3.8 to 10.4, p <0.001) (online supplemental table 5). When adjusted for the confounders in the multivariate analyses 'having applied for DP' showed a strong association to non-RTW (OR 7.0, 95% CI 2.5 to 19.3, p<0.001), whereas 'planning to apply for DP' did not (OR 1.8, 95% CI 0.6 to 5.3, p= 0.274) (table 3, right side). When adjusting for all baseline covariates, judged to be possible predictors for non-RTW, we found similar results concerning the exposition (OR 5.9, 95% CI 1.7 to 20.7, p=0.006) and the confounders (table 4). In addition, female gender, low educational level, and more severe and longer duration of back pain at baseline also were also independently associated to non-RTW independently. Interestingly, comorbidity, previous and type of spine surgery performed (fusion surgery (yes/no) and baseline disability (ODI) were not.

Table 3 Multivariate analyses of the association (OR) between the exposition variable (disability pension (DP) applicants) and its subgroups (planning to apply and having applied (reference subgroup 'has not applied'), the significant confounders, and return to work 12 months after surgery (dependent variable)

	Preoperative sick leave <12 months					
				Subgroup analyses§		
	OR	95% CI	P value	OR	95% CI	P value
DP-applicants (yes)	3.8	1.8 to 8.0	<0.001	–	–	–
Planning to apply	–	–	–	1.8	0.6 to 5.3	0.274
Having applied	–	–	–	7.0	2.5 to 19.3	<0.001
ÖMPQ item no 16* (0–10)	0.9	0.9 to 0.9	<0.001	0.9	0.9 to 0.9	<0.001
ÖMPQ item no 20† (0–10)	1.1	1.1 to 1.2	<0.001	1.1	1.1 to 1.2	<0.001
Wanted back to work by employer‡ (1–3) (yes/uncertain/no)	1.7	1.3 to 2.2	<0.001	1.7	1.3 to 2.2	<0.001
Heavy physical work (0–10)	1.1	1.1 to 1.1	<0.001	1.1	1.1 to 1.1	<0.001

All variables from 2019 to 2020: n=122 DP-applicants, n=2412 non-applicants.
Only patients with preoperative sick leave less than 12 months are included.
*ÖMPQ: 'In your estimation, what are the chances you will be working your normal duties in 6 months' (no change-very large chance).
†ÖMPQ: 'I should not do my normal work with my present pain' (completely disagree-completely agree).
‡'Do you feel that your employer wants you back to work?'.
§DP-applicants divided in 'have applied' and 'planning to apply', with 'has not applied' as reference group.
ÖMPQ, Örebro Musculoskeletal Pain Questionnaire.

DISCUSSION

Key results

This nationwide registry study showed that having applied or planning to apply for DP prior to lumbar spine surgery was strongly associated to non-RTW 12 months after surgery, especially among patients with sick leave less than 12 months before the operation. Those having applied for DP prior to surgery were less likely to RTW than those planning to apply. After adjustment for confounders this association remained strong and showed independence from all the other covariates evaluated. Also, DP-applicants consistently reported considerably less favourable outcomes than non-applicants on all secondary outcome measures. Despite surgical treatment, only 23% of DP-applicants returned to work, compared with 79% of the non-applicants. This is in line with a retrospective study by Anderson *et al* from Ohio (USA) of 686 workers' compensation claimers operated with spinal fusion.[34]

We found that duration of preoperative sick leave was the strongest confounding factor, as shown previously.[6 7] Being a DP-applicant was still a significant risk factor for non-RTW for cases with a preoperative sick leave under 12 months. Since the right to receive sickness benefits in Norway ends after 12 months, it is not surprising that the effects of the exposition and confounders were weaker for cases with a longer preoperative

Table 4 Multivariate analyses of the effects (OR) of the exposition variable (disability pension (DP) applicant) and other variables on return to work 12 months after surgery

	Univariate analyses			Multivariate analyses		
	OR	95% CI OR	P value	OR	95% CI OR	P value
Planning to apply for DP (yes)	12.3	7.7 to 19.5	<0.001	2.4	0.7 to 8.3	0.183
Have applied for DP (yes)	6.3	3.8 to 10.4	<0.001	5.9	1.7 to 20.7	0.006
Age*	1.0	1.0 to 1.0	0.005	1.0	1.0 to 1.0	0.308
Female gender*	1.9	1.7 to 2.1	<0.001	2.5	1.8 to 3.4	<0.001
Smoking* (yes/no)	1.9	1.6 to 2.2	<0.001	0.9	0.6 to 1.4	0.683
College or university education* (yes/no)	0.5	0.4 to 0.5	<0.001	0.7	0.5 to 0.9	0.020
Native Norwegian speaker* (yes/no)	1.6	1.3 to 2.0	<0.001	1.5	0.9 to 2.4	0.142
Body mass index*	1.0	1.0 to 1.0	0.002	1.0	1.0 to 1.0	0.927
Numeric Rating Scale score for back pain* (0–10)	1.2	1.1 to 1.2	<0.001	1.1	1.0 to 1.2	0.004
Numeric Rating Scale score for radiating pain* (0–10)	1.0	1.0 to 1.0	0.083	0.9	0.9 to 1.0	0.105
Oswestry Disability Index* (0–100)	1.0	1.0 to 1.0	<0.001	1.0	1.0 to 1.0	0.443
Longer than 12 months duration of back pain* (yes/no)	1.8	1.6 to 2.0	<0.001	1.6	1.0 to 2.4	0.050
Fusion surgery (yes/no)	2.1	1.5 to 2.9	<0.001	1.5	0.9 to 2.3	0.102
Use of painkillers* (yes/no)	1.7	1.4 to 2.0	<0.001	1.3	0.8 to 2.0	0.299
Previous lumbar spine surgery*	0.8	0.6 to 1.1	0.111	0.8	0.5 to 1.1	0.149
Any comorbidity* (yes/no)	1.7	1.5 to 2.0	<0.001	1.3	0.9 to 1.9	0.101
American Society of Anaesthesiologists' classification* >2 (yes/no)	1.6	1.2 to 2.2	0.004	1.2	0.6 to 2.3	0.544
Moderate to severe anxiety and/or depression*‡ (yes/no)	1.0	0.9 to 1.2	0.677	0.9	0.7 to 1.3	0.604
Reading/writing difficulties† (yes/no)	1.5	1.1 to 2.1	0.004	1.1	0.8 to 1.7	0.556
Wanted back to work by employer†§ (1–3) (yes/uncertain/no)	2.5	2.0 to 3.2	<0.001	1.9	1.4 to 2.6	<0.001
Heavy physical work† (0–10)	1.2	1.1 to 1.2	<0.001	1.1	1.0 to 1.1	0.003
ÖMPQ item no 15†¶ (0–10)	1.0	1.0 to 1.1	0.128	1.0	0.9 to 1.0	0.456
ÖMPQ item no 16†** (0–10)	0.8	0.8 to 0.9	<0.001	0.9	0.9 to 1.0	<0.001
ÖMPQ item no 19†, †† (0–10)	1.0	1.0 to 1.1	0.033	1.0	0.9 to 1.0	0.186
ÖMPQ item no 20†‡‡ (0–10)	1.2	1.2 to 1.2	<0.001	1.2	1.1 to 1.3	<0.001

Patients with a preoperative sick leave less than 12 months are included.
*Variables from 2009-2020: n=806 DP-applicants, n=15291 non-applicants.
†Variables from 2019 to 2020 only: n=122 DP-applicants, n=2412 non-applicants.
‡EQ-5D fifth item.
§'Do you feel that your employer wants you back to work?'.
¶ 'In your view, how large is the risk that your current pain may become persistent?' (no risk -very large risk).
**'In your estimation, what are the chances you will be working your normal duties in 6 months' (no change-very large chance).
††'An increase in pain is an indication that I should stop what I'm doing until the pain decreases' (completely disagree-completely agree).
‡‡'I should not do my normal work with my present pain' (completely disagree-completely agree).
EQ-5D, EuroQol five-dimension; ÖMPQ, Örebro Musculoskeletal Pain Questionnaire.

sick leave. This means that patients with persisting working disability beyond 12 months will soon have to settle with a DP or work assessment allowance, and that the prospect of RTW is very low.

Almost 70% of the DP-applicants in our study did not achieve PASS 12 months after surgery. This finding was consistent across all secondary outcome measures, including the GPE scale, where 30% of DP-applicants compared with 12% of non-applicants reported to be unchanged or worse after surgery. These findings are in line with previous literature.[12 34]

Compared with non-applicants, DP-applicants were older, more often smokers, had lower education, more comorbidity, longer duration of symptoms and fewer were native Norwegian speakers, and they reported more reading and writing difficulties. This is also in accordance with previous studies,[2 35] and many of these characteristics have been linked to lower social class.[36] The DP-applicants also had more disability and pain according to the baseline PROMs. Surprisingly, none of these factors, including the severity of baseline disability and pain problems, did confound the effect of being a DP-applicant.

We included four questions from ÖMPQ that have been recommended as a screening tool for psychosocial issues ('yellow flags') and for the prediction of long-term disability and failure to RTW.[29] According to Opsommer *et al*,[26] two of these items (15 and 16) concerned with expectations have shown similar predictive value for RTW as the short and full original versions of ÖMPQ. Interestingly, we found that pessimistic expectations and fear avoidance beliefs regarding work participation (items 16 and 20) were associated with non-RTW, whereas pessimistic expectations and fear avoidance beliefs regarding pain (item 15 and 19) were not. Moreover, having physically demanding work before surgery and beliefs about not being wanted at the workplace by the employer were also associated with non-RTW. This is in line with existing literature.[14 37] Our results lend support to previous studies indicating that work expectancy and fear avoidance beliefs could be more important prognostic factors for RTW than severity of somatic symptoms.[12 13]

Implications

Clinicians, and particularly spine surgeons, should consider the poor prospects of DP-applicants to RTW in the clinical decision-making process prior to an operation, especially if RTW is the main treatment goal. Our findings concerning the workplace relations, fear avoidance beliefs and work expectancy, indicates that many DP-applicants may lack incentives and motivation,[16] which may signal an underlying RTW problem. One strategy to try to improve RTW could be to reduce waiting time for surgery,[6] to prevent chronification of pain and working disability. If alternative conservative treatments may be more effective for RTW, and whether risk factors at the workplace, negative expectations and fear avoidance beliefs are modifiable factors is uncertain. However, additional multidisciplinary counselling from health professionals and social workers could have a potential to improve RTW.[38]

Strengths and limitations

The NORspine has high national coverage and completeness, and the psychometric properties of the PROMs are well documented. The patient population was relatively homogenous, that is, all were treated surgically for similar conditions. Hence, the internal validity of our study should be acceptable. Still, there are several weaknesses. In this observational study, we had no control group. Therefore, we cannot draw any conclusions about casual relations or the relative impact of surgery, no treatment or other interventions on RTW. Lost to follow-up was 33.7% at 12 months after surgery. This could represent an attrition bias but drop-out analysis showed small differences in baseline characteristics between respondents and the non-respondents. Moreover, in two previous studies, we found no statistically significant differences in outcomes between respondents and non-respondents and concluded that loss to follow-up in the registry would not bias the assessment of treatment outcomes.[33 39] Similar results were found in a study from the Danish spine registry (DANEspine).[40]

Due to the large number of cases, even minor and clinically irrelevant PROM changes may reach statistical significance. We, therefore, used a clinically meaningful cut-off on the ODI scale as a secondary outcome, that is, percentage of patients reaching the PASS. Risk factors may reach statistical significance by chance (type 1 error), but we only included covariates previously reported as relevant. Still, our study could be subject to unobserved confounding. For instance, we did not have data on patients' income which likely does influence RTW. Moreover, we have no data on duration of postoperative sick leave to assess the sustainability of RTW, only data on the patients' current work and disability status at 12 months follow-up.

Generalisability

NORspine is a comprehensive population-based clinical registry collecting data from routine clinical practice. This ensures a high external validity and generalisability of our findings. They may, however, be less relevant in countries with different labour and welfare systems, especially outside Scandinavia and Europe, offering less generous sick leave pay and disability compensation. Still, our main findings coincide with reports from other countries.[35]

CONCLUSION

DP-applicants had 3.8 times higher odds for non-RTW 12 months after lumbar spine surgery, and they reported worse clinical outcomes than non-applicants. Other independent risk factors (modifiers) at baseline were not being wanted at the workplace by the employer, fear avoidance beliefs about work, low expectancy about working capability, longer duration of sick leave and having physically demanding work.

Contributors LH, TS and TI have done most of the planning, conduct and reporting. TS is acting as guarantor. SG, SH, ØN and KWH have all been helpful in the report, and provided useful input.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval All participants had provided written informed consent when included in the NORspine. The Regional Committee for Medical Research Ethics in Central Norway approved the study (2016/840), and all participants provided written informed consent.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available.

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