Accuracy of physical therapists' prognosis of low back pain from the clinical examination: a prospective cohort study

J. Haxby Abbott¹, Emma-Marie Kingan²

¹Centre for Musculoskeletal Outcomes Research, Orthopaedic Surgery Section, Department of Surgical Sciences, Dunedin School of Medicine, University of Otago, Dunedin, New Zealand, ²Central Lakes Physiotherapy, Wanaka, New Zealand

Objectives: To investigate, in patients with chronic or recurrent low back pain (LBP), the predictive validity of history items, demographic variables, outcome measure questionnaire scores, clinical examination items, and physical therapists' (PTs') summative estimation of prognosis on a four-point scale. Little is known about the ability of PTs to predict functional outcomes for patients with LBP.

Methods: This was a multi-centre prospective cohort study of 138 patients with LBP. We used backward stepwise linear regression modelling to estimate the predictive validity of the baseline variables. The endpoint outcome measure was the 18-item Roland-Morris Disability Questionnaire (RM18) at 1 year.

Results: Of 138 patients with LBP recruited, 89 (64%) completed follow-up at one year. Univariate analysis indicated that PTs' opinion of prognosis ($P=0.01$) and eleven other baseline variables were significantly associated with RM18 at 12 months. In the final multivariate model PTs' opinion of prognosis ($P=0.022$; $\beta=0.73$, CI 0.55, 0.95), an abnormality detected by passive physiological flexion testing ($P=0.043$, $\beta=1.61$, CI 1.02, 2.57), heavy work ($P=0.069$, $\beta=0.80$, CI 0.62, 1.01), and age ($P=0.079$, $\beta=1.01$, CI 0.99, 1.04) were independent prognostic factors for RM18 outcome, explaining 24% of the variance in the model.

Conclusions: Musculoskeletal PTs' summative clinical impression regarding prognosis, following a clinical examination, provides a valid predictive estimation of functional outcome at 1 year in patients with chronic or recurrent LBP.

Keywords: Patient examination, Physical therapist assessment, Prognosis, Low back pain, Spinal segmental mobility

Introduction

Approximately 50% of people with low back pain (LBP) still report disability after 3 months.¹ Early identification of those at risk may assist clinical decision-making that helps prevent persistent disability and thereby decrease the cost burden, estimated in 2008 to be between \$84.1 billion and \$624.8 billion per year in the United States.²

A variety of factors have been found to have a predictive association with the development of chronicity.³ Previous history of LBP,^{4,5} severity of LBP,⁶ baseline disability,⁷⁻⁹ age greater than 45 years,^{10,11} smoking,¹⁰ and positive neurological examination findings¹⁰ are known risk factors for chronic LBP. Psycho-social factors are also known to increase risk of developing chronic LBP.^{6,10,12} Baseline disability levels and depression have both been found to be predictors of treatment outcome,^{13,14} and pain distribution and

self-rated intensity have been shown to have some prognostic value.¹⁵ The usefulness of physical examination findings for prognosis in LBP have not been extensively investigated.^{3,16} Although some physical factors, such as range of motion, may also have prognostic value,¹⁵⁻¹⁷ none have shown consistent results across several trials.^{3,16} The predictive value of physical therapists' (PTs') prognosis has received little attention.

The specific objectives of this study were therefore:

1. to assess the predictive validity of PTs' summative opinion on the long-term functional outcome of patients with LBP, following a standardized clinical examination, and;
2. to assess the predictive validity of individual observations, tests, and measures obtained from the clinical examination for estimating functional outcome at 1 year.

Methods

This study examined a prospective cohort of consecutive patients who presented to physical therapy clinics with a new episode of chronic or recurrent

Correspondence to: J. Haxby Abbott, Orthopaedic Surgical Sciences, Dunedin School of Medicine, University of Otago, PO Box 913, Dunedin, New Zealand 9054. Email: haxby.abbott@otago.ac.nz

LBP. Patients aged between 20 and 59 years of age were invited to participate if they presented with an episode of recurrent or chronic LBP, defined as a minimum of one previous episode of LBP, the first episode of which was at least 3 months prior to the presenting episode. Patients were excluded if they: had received spinal surgery within the previous 6 months; had a history of traumatic fracture of the spine which resulted in permanent neurological deficit; had a history of serious neurological or psychiatric disease; were under 20 or over 59 years of age; or were pregnant. Approval for the project was granted by the Otago and Canterbury Regional Ethics Committees of the New Zealand Ministry of Health.

Patients were recruited from 17 PT clinics from three New Zealand urban centres. Participating PTs completed a standardized clinical examination. Briefly, it consisted of a relevant patient history and physical examination including observation of active sagittal range of motion, and palpation of the lumbar region including passive spinal sagittal segmental mobility testing.¹⁸ Physical therapists were permitted to add any further additional physical observations, tests, and measures deemed appropriate. At the conclusion of each clinical examination, the PTs were asked to give an opinion regarding the prognosis of a good outcome for each participant. The question asked was: "Based on all the information you have evaluated today, what is your prognosis for a good outcome, i.e. return to normal activity (e.g. work, sport) over the long term?" Long term was defined as 1–5 years. The PTs used a four-point Likert scale to record each response; the four responses were: (i) very good, very likely; (ii) good, moderately likely; (iii) poor, fairly unlikely; (iv) very poor, very unlikely.

Patients completed a history questionnaire form at baseline, as well as standardized outcome measures including: the 18-item modified Roland–Morris Disability Questionnaire (RM18);^{19,20} a pain drawing;^{14,21} and the Distress and Risk Assessment Method Questionnaire (DRAM)^{10,14,22} consisting of the modified Zung Self-rated Depression Scale (mZSDS),¹⁴ and the Modified Somatic Perceptions Questionnaire (MSPQ).²³ These were mailed to the researcher together with the clinical examination form. Follow-up questionnaires were sent to patients at 12 months after recruitment into the study.

The primary outcome measure (RM18) was a modified version of the Roland–Morris Disability Questionnaire.²⁰ This version is a shorter, 18-item questionnaire which excludes questions on sexual dysfunction and other components that are less sensitive to change for LBP.²⁰ The Roland–Morris Disability Questionnaire measures function, but has no psychological component.¹⁹ Previous studies have

found the Roland–Morris Disability Questionnaire to be predictive of outcome^{7–9} and to detect small changes in LBP subjects with low to moderate associated disability,^{19,20} with a minimal clinically important difference of 2–3 points.¹⁹

In this observational cohort study, we did not record or control for the treatment type, frequency, and number of treatments during the 12 months between baseline and follow-up.

Data analysis

Prior to data analysis we prospectively compiled a list of possible predictor variables from the research literature and/or biological rationale, restricted to those assessable in a single PT clinical examination. These are presented in Tables 1 and 2. We used linear regression for data analysis, with the dependent variable (RM18) treated as a continuous scale. Data were analyzed using Statistical Package for Social Sciences (SPSS) software version 11.

Data were cleaned by performing a frequency analysis to assess the validity of outlier values and input error. Histograms were then used to assess the distribution of data. Each predictor variable was plotted against the outcome variable on either a scatter plot (for continuous variables) or a box plot (for binary and ordinal variables). For ordinal data, a loess line was used to approximate the linearity of the relationship between the predictor variable and outcome variable. If the variables were not approximately linear, then they could not be used as a continuous variable in the multiple linear regression model, as this breaches statistical assumptions, and any such variable was treated as categorical. Categories that were not dissimilar were collapsed together.

Univariate analysis

The four scores for PTs' opinion of prognosis were box plotted against the outcome variable (Fig. 1). Each of the clinical examination and questionnaire variables at baseline were assessed by univariate analysis to estimate association with outcome.

Multivariate analysis

Backward stepwise multiple linear regression was used to establish the final model. Variables with *P*-values <0.2 from the univariate analysis were retained in a multivariate linear regression model. To avoid problems associated with over-fitting the statistical model, we planned *a priori* to limit the number of variables retained in the final multivariate model to one variable per ten patients in the sample.

Regression coefficient (beta), confidence intervals (CI) and *P*-values were calculated, as well as the adjusted *R*² statistic. We considered predictor variables with a *P*-value of <0.1 in the final multivariate model statistically significant. The *R*² statistic estimated the

Table 1 Description of patients at baseline: demographic, history, and questionnaire variables

Variables	n(%) or mean(SD)
<i>Sex (n=138)</i>	
Female	64 (46%)
Male	74 (54%)
<i>Age in years (n=134)</i>	39.8 (11.34)
<i>Work (n=132)</i>	
Sedentary	21 (16%)
Light	38 (29%)
Moderate	52 (39%)
Heavy	21 (16%)
<i>Exercise (n=135)</i>	
No exercise	16 (12%)
1–2 times per week	57 (42%)
Three or more times	62 (46%)
<i>Smoke (n=135)</i>	
Currently smoking	22 (16%)
Used to smoke	40 (30%)
Never smoked	73 (54%)
<i>LBP weeks (n=132)</i>	446 (459)
<i>LBP constant (n=134)</i>	
Intermittent	100 (75%)
Constant	34 (25%)
<i>LBP previously (n=132)</i>	
Yes	95 (72%)
No	37 (28%)
<i>Pain below the knee (133)</i>	
No	110 (83%)
Yes	23 (17%)
<i>VAS Pain (131)</i>	43 mm (25.4)
<i>Pain drawing multiple areas of pain (132)</i>	3.5 (3.6)
<i>RM18 at initial (133)</i>	7.1 (4.6)
<i>Zung Depressive Index initial (133)</i>	17.6 (9.6)
<i>Modified Somatic Pain Questionnaire initial (133)</i>	6.3 (5.2)
<i>DRAM score initial (133)</i>	
Normal	67 (50%)
At risk	48 (36%)
Distressed-depressive	7 (6%)
Distressed-somatic	11 (8%)
<i>PTs opinion of prognosis (132)</i>	
Very good, very likely	74 (56%)
Good, moderately likely	43 (32%)
Poor, fairly unlikely	10 (8%)
Very poor, very unlikely	5 (4%)

LBP=low back pain; VAS=Visual Analogue Scale; RM18=18-question modified Roland-Morris Disability Questionnaire; DRAM=Distress and Risk Assessment Method; PT=physical therapist.

amount of variance in the outcome variable that could be explained by the linear regression model.

Finally, we checked for potential bias by assessing for any differences between the patients lost to follow-up and those patients included in the final multivariate model, in a retained vs non-retained analysis.

Results

One hundred and thirty eight (138) patients were recruited into the study at baseline; 89 (64%) returned the questionnaires at the 12-month follow-up. The mean follow-up period from inception into the study was 13.3 months (SD 1.6). Tables 1 and 2 show the characteristics of patients at baseline. Twenty-seven PTs participated; their mean years (SD) of experience was 17 (7.1, minimum 6). All PTs had a postgraduate

Table 2 Description of patients at baseline: variables from the physical examination

Variables	n(%) or mean(SD)
<i>FBROM (132)</i>	
Hypermobility	0 (0%)
Full/normal ROM	58 (44%)
3/4	27 (20%)
1/2	29 (22%)
1/4	7 (5%)
Severely reduced	11 (9%)
<i>BBROM (134)</i>	
Hypermobility	7 (5%)
Full/normal ROM	34 (25%)
3/4	29 (22%)
1/2	32 (24%)
1/4	19 (14%)
Severely reduced	13 (10%)
<i>SBRROM (137)</i>	
Hypermobility	1 (1%)
Full/normal ROM	41%
3/4	37 (27%)
1/2	32 (23%)
1/4	7 (5%)
Severely reduced	4 (3%)
<i>SBLROM (133)</i>	
Hypermobility	3 (2%)
Full/normal ROM	55 (41%)
3/4	40 (30%)
1/2	20 (15%)
1/4	9 (7%)
Severely reduced	6 (5%)
<i>PA abnormal (135)</i>	
No	6 (4%)
Yes	129 (96%)
<i>PPF abnormal (132)</i>	
No	89 (67%)
Yes	43 (33%)
<i>PPE abnormal (124)</i>	
No	87 (70%)
Yes	37 (30%)

FBROM=Forward bending range of motion; BBROM=Backward bending range of motion; SBRROM=Side bending right range of motion; SBLROM=Side bending left range of motion; PA abnormal=Posterior anterior passive accessory glide tests detected an abnormality with at least one level of the lumbar spine; PPF abnormal=Passive physiological flexion tests detected an abnormality with at least one level of the lumbar spine. PPE abnormal=Passive physiological extension tests detected an abnormality with at least one level of the lumbar spine.

qualification in manual therapy; mean (SD) years since qualifying was 8.7 (5.1, minimum 2).

Physical therapists' opinions predicted that 88% of patients would have a 'very good' or 'good' outcome (56% and 32%, respectively). Although RM18 at baseline was normally distributed, the outcome variable, RM18 at 12 months, was positively skewed, so we log-transformed the data (logRM12) to correct this. A scatter plot depicting the association between therapists' prediction of prognosis and logRM12 demonstrated an approximately linear relationship, therefore we were able to consider prognosis as a continuous variable. Regression diagnostics showed equivalent variance over the range of the outcome variable. The distribution of data for all baseline explanatory variables including PTs overall opinion

Notes: rm1812=score on the Roland-Morris 18-point disability index at 12 month follow-up. Higher RM-18 score means greater disability, i.e. poorer outcome;; prog=physiotherapists' opinion of the long-term prognosis for good functional outcomes of patients with LBP on a 4-point Likert scale, where 0=Very good, very likely, 1=Good, moderately likely, 2=Poor, fairly unlikely, and 3=Very poor, very unlikely'.

Figure 1 Mean values of the outcome variable (RM-18 at 12 month follow-up) for each level of physiotherapists' opinion of the long-term functional outcomes of patients with LBP on a 4-point Likert scale.

of prognosis and baseline RM18 met the statistical assumptions for the use of linear regression.

Histograms of the categorical variables of work types and active range of motion tests showed a non-linear difference between categories, therefore we transformed these to dichotomous variables. Heavy work was compared to all other work types. Normal backward bending range of motion (BBROM) was compared to moderately and severely reduced range of motion, as biological rationale could be established and these categories were supported by the literature for range of motion as a predictor.²⁴

Univariate analysis

Physical therapists' opinion of the long-term functional outcomes of patients with LBP was positively associated with outcome ($P=0.01$) (Fig. 1).

From the univariate analysis, fourteen variables satisfied the criterion for consideration in the multivariate analysis having P -values less than 0.2 (Table 3). Excluded variables are listed in Table 4.

Multivariate analysis

Because the DRAM is derived from the MSPQ and ZDI, and therefore is not an independent factor, we decided to exclude DRAM from the multivariate model to avoid multicollinearity. Only one category of the DRAM (distressed-depressive category) was significantly associated with outcome, while both the MSPQ and ZDI data were found to be more statistically significant (Table 3). The final multivariate model, after nine steps of backward stepwise regression, retained four variables: age, heavy work, abnormal passive physiological flexion, and PTs' prognosis (Table 5). The adjusted R^2 showed that the final multivariate model explained 24% of the total variance in LogRM12.

The retained versus non-retained analysis showed that retained patients were significantly older (41 years versus 36 years, $P=0.006$) than the non-retained, and smokers were more likely to be lost to follow-up (Chi-Square, $P=0.023$). All other variables did not differ significantly between retained and non-retained patients.

We exponentiated the beta and CI for the variables retained in the model in order to interpret the findings with respect to the original units of RM18. The exponentiated regression coefficient ($\text{beta}10^x$) estimates the amount of change in the RM18 that is predicted by a one unit change in the explanatory variable. The data indicate that each level of PT

Table 3 Factors from the univariate analysis meeting the criterion for inclusion in the multivariate analysis ($P<0.2$)

Variable	P -value	R^2
Prognosis	0.010	0.066
Age	0.117	0.017
Work heavy vs sedentary	0.089	0.040
Work heavy vs all other work types	0.014	0.057
Smoke vs never smoked	0.032	0.035
LBP constant vs intermittent	0.184	0.009
Pain drawing with multiple areas of pain	0.049	0.034
RM18 at initial	0.037	0.039
DRAM score distressed-depressive vs normal	0.057	0.024
Zung depressive index initial	0.053	0.032
Modified somatic pain questionnaire initial	0.006	0.073
BBROM 3–5 (moderately-severely reduced) vs normal	0.047	0.034
PPF abnormal	0.019	0.054
PPE abnormal	0.061	0.031

LBP=low back pain; RM18=the 18-item Roland-Morris Disability Questionnaire; DRAM=the Distress and Risk Assessment Model; BBROM=Backward bending range of motion; PPF abnormal=Passive physiological flexion tests detected an abnormality with at least one level of the lumbar spine; PPE abnormal=Passive physiological extension tests detected an abnormality with at least one level of the lumbar spine.

Table 4 Potential predictor variables from the univariate analysis excluded from further analysis*

Variable	P-value	R ²
Sex	0.792	-0.11
Work moderate vs sedentary	0.881	0.040
Work light vs sedentary	0.740	0.040
Exercise >3 times per week vs no exercise	0.634	0.006
Exercise 1-2 times per week vs no exercise	0.199	0.006
Used to smoke vs never smoked	0.246	0.035
Number of weeks of LBP	0.687	-0.010
Previous LBP	0.467	-0.006
Pain below the knee	0.270	0.003
VAS Pain	0.472	-0.006
DRAM score at risk vs normal	0.246	0.024
DRAM score distressed-somatic vs normal	0.218	0.024
Psycho-social	0.273	0.003
FBROM hyper vs normal	0.704	-0.036
FBROM normal vs hypo=1 (normal)		
=2	0.366	-0.036
=3	0.824	-0.036
=4	0.510	-0.036
=5 (most hypo)	0.704	-0.36
BBROM hyper vs normal	0.993	0.001
BBROM normal vs hypo=1 (normal)		
=2	0.690	0.012
=3	0.131	0.012
=4	0.100	0.012
=5 (most hypo)	0.141	0.012
SBRROM hyper vs normal		
SBRROM normal vs hypo=1 (normal)		
=2	0.229	0.049
=3	0.111	0.049
=4	0.840	0.049
=5 (most hypo)	0.232	0.049
SBLROM hyper vs normal		
SBLROM normal vs hypo=1 (normal)		
=2	0.674	-0.023
=3	0.164	-0.023
=4	0.974	-0.023
=5 (most hypo)	0.949	-0.023
PA abnormal	0.587	-0.008

* Factors were excluded from further analysis if they had a *P*-value of greater than 0.2, or replicate a variable with a lower *P*-value which was included for further analysis. LBP=low back pain; VAS=visual analogue scale; RM18=the 18-item Roland-Morris Disability Questionnaire; DRAM=the Distress and Risk Assessment Model; FBROM=forward bending range of motion; BBROM=backward bending range of motion; SBRROM=side bending right range of motion; SBLROM=side bending left range of motion; PPF abnormal=Passive physiological flexion tests detected an abnormality with at least one level of the lumbar spine; PPE abnormal=Passive physiological extension tests detected an abnormality with at least one level of the lumbar spine; PA abnormal=Posterior anterior passive accessory glide tests detected an abnormality with at least one level of the lumbar spine.

opinion of better prognosis on the Likert scale predicts that, on average, RM18 will be 0.73 times lower than therapist-predicted poorer prognosis. From an average RM18 of 9.5 for patients whom therapists

predicted would have a 'very poor' outcome, the results of the multivariate analysis indicate that patients predicted by the therapist to have a 'poor' outcome will have an average RM18 of approximately ($9.5 \times 0.73 =$) 6.9, patients predicted to have a 'good' outcome will have an average RM18 of approximately ($9.5 \times 0.73 \times 0.73 =$) 5.1, and patients predicted to have a 'very good' outcome will have an average RM18 of approximately ($9.5 \times 0.73 \times 0.73 \times 0.73 =$) 3.7. The predictions of the regression analysis are consistent with the raw data (Fig. 1).

An abnormality detected by manual passive physiological intervertebral flexion testing was associated with an RM18 at 12 months an average of 1.61 times higher than the mean RM18 of patients with no abnormality detected.

Discussion

These results show that, on average, PTs can predict with moderate accuracy which patients will have higher self reported disability at 12 months. The magnitude of difference in outcome predicted by a PTs' prognosis was more than two points on the RM18 worse than 'very good' (i.e. 'poor' or 'very poor') which is considered to be clinically significant.^{19,20} These predicted levels of RM18 at outcome are consistent with chronic LBP.⁸

The predictive validity of health professionals' summative prognosis from an initial clinical examination has received little attention in the literature. Previous research has investigated the ability of general practitioners (GPs)^{6,25} and PTs²⁶ to predict the prognosis of LBP patients. These found a significant association between the GPs' or PTs' opinion of prognosis, based on their summative clinical impression, and the patient's outcome. Like Hancock *et al.*,²⁶ we found that the PTs' summative prediction was retained in the final predictive model, indicating that their predictions were based on information other than that provided by the other variables retained in the model. Like Jellema *et al.*,²⁵ we found the summative prediction made by the examining health professional to be a predictor of outcome; however, our final model including age, heavy work and manual spinal assessment findings explained more variability in outcome than PTs' summative prediction alone for this purpose. What factors the PTs took into account in making the prognosis is unknown.

Table 5 Variables retained in the final regression model

Variable	beta	CI 95%	beta 10 ^x	CI 10 ^x	P-value	R ²
Prognosis	-0.137	(-0.253, -0.020)	0.73	(0.55, 0.95)	0.022	0.242
PPF abnormal	0.208	(0.007, 0.410)	1.61	(1.02, 2.57)	0.043	
Heavy work	-0.098	(-0.204, 0.008)	0.80	(0.62, 1.01)	0.069	
Age	0.008	(-0.001, 0.018)	1.01	(0.99, 1.04)	0.079	

PPF abnormal=passive physiological flexion tests detected an abnormality with at least one level of the lumbar spine.

This study is the first to test and find abnormal passive physiological spinal motion to be a significant predictor of functional outcome at 12 months for chronic or recurrent LBP. Although only one of three manual spinal assessment tests (passive physiological flexion) was significantly associated with outcome, abnormal passive physiological extension and moderately to severely reduced BBROM also demonstrated association with outcome in the univariate analyses, and qualified for entry into the multivariate model. Previous research has shown manual assessment of spinal segmental motion by PTs to possess both criterion-related validity^{18,27,28} and predictive validity,^{29–32} and manual PTs use them to make treatment decisions.³³ Hancock *et al.*²⁶ found that the presence of one or more hypomobile segments was not predictive of outcome, however the methods of assessment were not described. Our data suggest that passive physiological flexion has predictive validity contributing to PTs ability to assess patients for elevated risk of disability. Nevertheless, the strength of association was weak so it should be considered in conjunction with other identified risk factors and verified in subsequent research before using it confidently in clinical practice. It may be that patients with abnormal passive physiological flexion require more comprehensive intervention, given their risk of higher levels of disability at 1 year. Researchers should incorporate manual therapy assessment, performed by PTs with demonstrated competence in the procedures, in future studies of prognosis.

Other results of this study support previous findings in the literature. Age^{10,11} and heavy work^{5,11} already have been identified as predictors of LBP chronicity. Older age may be a higher risk factor due to age-associated degenerative changes of the spine hindering recovery from acute damage. Furthermore, age is associated with a greater lifetime frequency of episodes of LBP, a factor associated with increased chronicity.³⁴ Heavy work imposes greater load on the spine, which may pose risk of recurrence or chronicity, but has not consistently shown to be associated with these outcomes.^{3,34,35}

Strengths of the study were that the methodology was pragmatic, with a large number of therapists participating in the study representing a range of background and training. This increases the external validity of our results. These results could therefore be generalizable to patients typically seeking PT for recurrent or chronic LBP, but may not be generalizable to people with acute LBP. The follow-up period of 12 months conforms with recommendations for prognostic studies on the course of LBP assessing predictive factors,^{11,15,36} due to the high recurrence rate for LBP and natural history of LBP.¹ The sample size was sufficient to obtain significant

associations in the final model, however we cannot rule out the possibility that potentially significant variables may have been excluded due to type 2 error.

Our retention rate (64%) presents a potential limitation. However we found negligible differences between the retained and non-retained groups with regard to most variables, including baseline RM18. Small differences were found between the retained and non-retained group in only two variables: age and smoking status. Younger patients were more likely to be lost to follow-up, which could affect results since age was one of the final four variables in the model. However the five-year difference for age (41 years versus 36 years, respectively) is probably not clinically significant. A higher proportion of smokers dropped out of our study, which could have biased the results towards non-significance. Previous studies have found that smokers are three times more likely to develop chronic LBP,¹⁰ so it is possible that loss to follow-up of a higher proportion of smokers in our study may have resulted in failure to detect a stronger association. If there had been no loss to follow-up, the results could have been more significant in age and smoking, which may have affected the final model.

Potential limitations of this study were that the 'very poor' prognosis group was only represented by two individuals at follow-up, compared to five at baseline, making our prediction of RM18 less accurate for that level of prognosis. The distribution of RM18 scores at follow-up, however, is consistent with PTs' prediction of prognosis at baseline.

As a result of the observational nature of this study, type, frequency, or duration of any treatment received by patients during the 1 year of follow-up was not controlled. These factors may have affected the association between PT opinion of prognosis and the outcome of the patients. For instance, it is possible that treatments received by patients in the various categories predicted by the PT were different such that, if more treatment was provided to patients predicted to have a poor prognostic risk, the magnitude of our findings may have diminished. Future studies might consider controlling for dose or type of treatment received by patients.

The four variables in the final model explained 24% of the variance. Although this leaves 76% unexplained, it is a relatively strong finding in the context of estimating the future course of this heterogeneous disorder from only clinical observations. These factors by themselves are not strong enough to predict outcome with any level of certainty, due to other unknown variables affecting prognosis. However they do provide valuable research-informed guidance for the clinician. Incorporation of data from other sources, such as the Fear Avoidance Belief Questionnaire, may

warrant further consideration, as research has identified it as a predictor for chronic LBP.³⁷

Conclusions

This study found PTs' summative estimate of prognosis, and manual passive physiological flexion test results, to be significantly associated with a poorer outcome for recurrent or chronic LBP at 12 months. Age and heavy work, which have previously been found as predictors in the literature, were also retained in the final model. The strength of the associations found was weak; therefore we recommend the information be considered in conjunction with other identified risk factors. We also recommend these results be verified in subsequent research before using them confidently in clinical practice.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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