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Predicting Return to Work After Low Back Injury Using the Psychosocial Risk for Occupational Disability Instrument: A Validation Study

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Introduction*: This paper reports on the predictive validity of a Psychosocial Risk for Occupational Disability Scale in the workers' compensation environment using a paper and pencil version of a previously validated multimethod instrument on a new, subacute sample of workers with low back pain*. Methods*: A cohort longitudinal study design with a randomly selected cohort off work for 4–6 weeks was applied. The questionnaire was completed by 111 eligible workers at 4–6 weeks following injury. Return to work status data at three months was obtained from 100 workers. Sixty-four workers had returned to work (RTW) and 36 had not (NRTW)*. Results*: Stepwise backward elimination resulted in a model with these predictors: Expectations of Recovery, SF-36 Vitality, SF-36 Mental Health, and Waddell Symptoms. The correct classification of RTW/NRTW was 79%, with sensitivity (NRTW) of 61% and specificity (RTW) of 89%. The area under the ROC curve was 84%*. Conclusions. *New evidence for predictive validity for the Psychosocial Risk-for-Disability Instrument was provided*. Implications*: The instrument can be useful and practical for prediction of return to work outcomes in the subacute stage after low back injury in the workers' compensation context*.

KEY WORDS: return to work; low back; risk for disability; validity; psychosocial.

INTRODUCTION

The impetus to predict work disability after a low back injury is fuelled by the growing economic burden of low back occupational disability (1,2). While only 3–10%

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of persons with acute back pain have been estimated to develop chronic occupational disability (3), it is these cases that contribute most to the economic and social burden of illness and the individual's physical, psychological, and economic difficulties (4–6). A proliferation of lengthy lists of risk factors for chronic disability, including the so-called yellow, blue, and black flags (7–12) has occurred but the validation research on these lists, to date in primary or community care settings only, has been just emerging (13–15). Still, such lists as a whole often lack the requisite empirical validation for prediction of low back disability in workers' compensation and insurance settings and are not defensible in medicolegal environments, for which they have been originally developed.

The interest in prediction is predicated on the argument that early intervention after injury should increase the efficacy of treatment and decrease the cost and burden to the worker, insurance, and society by directing treatment toward those injured workers who need treatment most. Several attempts to develop screening prediction models have been undertaken (15–23).

These studies utilized samples which were drawn from diverse primary care, injured worker, and rehabilitation patient populations of varying degrees of representativeness and in various stages following the injury, and applied different outcomes (for example, return to work versus duration of disability) and different assessment approaches. Such methodological problems seriously limited ability to integrate and generalize their research evidence to other populations, outcomes, and contexts, and to develop unified models for identifying individuals at risk for disability early following the injury to provide appropriate intervention.

Despite the proliferation of studies involving modelling of occupational disability, only a few of them meet rigorous methodological criteria. Of the 2170 studies on predictors of pain disability, only 68 (4%) met the screening criteria for systematic review, and ultimately only 19 articles met the methodological standards of the review (22). Even fewer studies attempted to re-validate their original predictive models on new samples, despite frequently raised concerns about generalizability (14,20,24). The predictors identified in these studies cover the spectrum of the biopsychosocial model of disability including sociodemographic, medical, psychosocial, workplace organization, job demands and control, and ergonomic factors (22,25).

In general, a measuring instrument is valid if it measures what it is intended to measure. It is important to note, however, that one validates not an instrument per se, but rather some use to which the instrument is put. This distinction implies that it is quite possible for a measurement instrument to be relatively valid for measuring one kind of phenomenon and in one type of setting, but not entirely valid for assessing another (26). This issue does not appear to be fully recognized in studies on prediction of occupational disability and in emerging attempts to develop actuarial formulae for early identification of workers at high risk for disability. Yet, the economic, societal, and medicolegal implications of the use of poorly validated models and instruments in compensation and health care contexts are of serious concern.

This paper reports on re-establishing the predictive validity of a Psychosocial Risk for Occupational Disability Instrument using a paper and pencil self-report version of a previously validated assessment instrument on a new sample of injured workers with low back pain (27).

BACKGROUND

A theoretically derived biopsychosocial predictive model of occupational low back disability was constructed and its psychometric properties were empirically tested (27). The biopsychosocial model included five groups of variables: 1) sociodemographic, 2) medical history and physical examination, 3) psychosocial, 4) pain behavior, and 5) workplace factors, including safety environment, disability management, work accommodation, demand and control job variables, and perception of job being threatened by injury. Two groups of workers, those with subacute low back injuries (4–6 weeks postinjury) and those with chronic low back pain (6–12 months postinjury) were assessed at baseline, 3 days later (to test reliability), and 3 months after the initial assessment (to test predictive validity) at which time the return to work outcome was determined. The retained predictors in the final logistic regression model covered the biopsychosocial spectrum and included: 1) physical/medical factors such as sciatica and time to complete walk, 2) psychosocial factors such as perception of severity of disability and expectations of recovery, 3) pain behavior-guarding, and 4) a workplace-related factor, namely, the belief that the worker's job is threatened due to injury. These factors were derived from three methods: 1) self-report using a paper and pencil questionnaire, 2) physical examination, and 3) behavioral pain observation. As the physical examination and pain behavior observation require a physician, an independent observer, and about 1 h of time, and are therefore impractical for mass applications, the paper and pencil self-report measured predictors identified in the original study formed the starting point for the development and testing of a Risk for Disability instrument. The significant factors in the "paper and pencil" model in the original testing included sensory pain, perception of general health, vitality, perceived health change, perceived coworkers' support, expectations of recovery, and perception that the job is threatened due to injury. We also augmented the model with significant predictors arising from other models tested, including those that had duration of disability and total cost as outcomes. Moreover, it was important that we covered much the spectrum of key critical categories, particularly workplace-related factors, with the exception of ergonomic factors. The initial core empirical model also included workplace and medically oriented questions. The self-report-based "paper and pencil" variables and instruments that were selected for validation of the Psychosocial Risk for Disability instrument included the following measures/variables: Expectations of Recovery, Workers' Compensation/Employer Response to Claim, Time with Employer, SF-36 Health Survey, Perceptions of Injury Severity, Waddell Symptoms, Distress Scale, and Karasek Job Content Questionnaire.

STUDY DESIGN

A cohort longitudinal study design with a randomly selected cohort of compensated low back injured workers, who had remained off work 4–6 weeks after their original injury, was used. To qualify for the study, participants had to be off work due to subacute low back injury, have a low back injury claim with the Workers' Compensation Board of British Columbia (WCB), be on active wage loss, be receiving WCB benefits, be between 18 and 60 years of age, be able to read English, have no history of back surgery, and not be pregnant. Each week appropriate workers were identified from the WCB-BC computerized

claim registry and those who met the inclusion criteria were invited to join the study via a mailed Risk for Disability Questionnaire.

The study received ethics approval from the University of British Columbia. Informed consent was obtained and participants were assured that their study responses would not be available to any workers' compensation staff.

MEASURES

Predictive variables included in the study were demographically, clinically, and occupationally related. The *demographic variables* included gender, marital status, education, age, employment status, number of children, number of people dependent on family income, percent of total income provided. In addition, the variables, union membership, number of full-time jobs held in past 5 years, total years current job held, and total years of employment with current employer were selected to cover factors related to the worker's occupational stability.

An *Expectations of Recovery* scale was based on the work of Sandström and Esbjörnsson (28) and the Institute of Work & Health (29). It comprised seven questions, related to the worker's own assessment and prediction as to whether or not he/she would get better soon, return to usual activities, return to work within the next month, and return to the preinjury job. Three of the seven questions asked the workers to consider what they had been told about their injury and what those closest to them advised.

For the *Workers' Compensation Board (WCB)/Employer Response to Claim* scale, six questions were developed to assess the workers' perception regarding WCB and employer response to their low back injury claim. A yes/no response was requested to those questions which pertain to being treated fairly by WCB and by the worker's employer, and whether filing a claim resulted in a negative reaction from the employer. Finally, the workers were asked whether or not their jobs were threatened in any way due to injury.

The *SF-36, short form of the Health Status measure* (30) provided a standardized comprehensive multidimensional measurement of health status concepts. The scales included a Physical Functioning Scale, two scales that distinguished between Role Limitations because of "physical health" or "mental health," a Social Functioning Scale that assessed health-related effects on social activation; a Mental Health Scale; a measure of Vitality and General Health Perception Scale.

The *Perception of Injury Severity Scale* was developed to measure study participants' self-concept with respect to their degree of impairment. Five yes/no questions were developed to explore the patients' levels of perceived disability. Each "yes" response was given a score of 1 and was totalled to give a cumulative score.

Waddell Symptoms were assessed. These pertained to self-reported complaints made by the patient which are not based on normal physiology, anatomy, or pathological processes in conditions associated with nonspecific low back pain. The questions tapped into the use of mobility aids, hospital emergency admissions for back pain, and into having been informed about serious and potentially anxiety-producing pathology related to this pain.

The *Distress Scale* comprised 11 items intended as a gross screen for indications of current psychological distress. Questions ask about unexpected weight loss or weight gain, changes in appetite, sleep difficulties, psychological distress (anxiety and depression), and receiving psychological/mental health treatment.

The *Job Content Questionnaire* (31) was designed to measure the content of work tasks. The questionnaire focused on the psychosocial structure and characteristics of the work situation and was derived from a demand-control model of occupational stress (32). Factors relevant to work demands, control over work, decision-making opportunities, work relationships, and physical aspects of work were included.

The instrument was time- and labor-efficient in administration. It took between 20 and 30 min and was completed by the workers at home.

SAMPLING FRAME

One hundred and eleven (111) eligible workers returned the Risk for Disability questionnaire at the initial mail-out at 4–6 weeks postinjury. The Return to Work (RTW) status at 3 months follow-up (4–4.5 months postinjury) could not be determined for five workers; six were not working for reasons other than injury (e.g., laid off). These cases were excluded, leaving a total of 100 cases for analysis (90.9%). Sixty-four (64) workers had returned to work (RTW) and 36 had not returned to work (NRTW).

RESULTS

Demographics

The sample consisted of 62% males and 38% females (Table I). The mean age was 40.7 years (SD = 11.3). Two-thirds (66%) were married or living common-law. One-quarter (27%) had no children, 45% had one or two children, 26% had three or more children. Just under one-half (49%) had one or two people dependent on family income. One-half of the respondents (48%) provided more than 75% of the total family income.

One-half (51%) of the workers had some college, university, or technical school education; only 4% had less than grade 9 education. Most of the respondents (89%) were working full-time (at least 20 h per week); 61% were union members. Two-thirds (65%) of the workers held only one full-time job in the past 5 years and 16% held two jobs. The mean total number of years holding their current job was 7.7 years. The mean total number of years employed by their current employer was 7.6 years (see Table I).

Return to Work

At 3 months after the injury, nearly two-thirds (64%) of respondents had returned to work. Of these, 83% were back full-time and 80% were back to their former job. Only 6% had different jobs, 6% had similar jobs, and the remaining 8% had a modified former job. Almost all of those who had returned to work (92%) were with the same employer as at the time of injury. Of those who had not returned to work, one-third (33%, 12 of 36) had made an attempt to return to work. Job accommodations were not made or were not necessary in 69% of all cases; graduated return to work and light duties were the most common accommodations when accommodations were made.

Table I. Demographic Information of Workers ($N = 100$)

Sex (% male/female)	62/38
Age (yr)	40.7 ± 11.3
Current employment (mean)	
Years in job	7.7 ± 7.6
Years with employer	7.6 ± 7.1
Highest education (%)	
Grade school (0–8 years)	4
High school (9–12 years)	45
College/University/Technical school	51
Employment status	
Part-time (<20 h/week)	11
Full-time (>20 h/week)	89
Marital status (%)	
Married/Common law	66
Single (never married)	18
Widowed/Separated/Divorced	16
Number of children	
None	27
One or two	45
Three or more	26
Number of people dependent on income	
One or two	49
Three or four	40
Five or more	11
Percent total income worker provided	
More than 75%	48
50–75%	32
25–50%	16
0–25%	4
Union membership (%)	
Union	61
Nonunion	39

Prediction of Return to Work (RTW)

Comparisons of Return to Work by Demographic Variables

There was no significant association between return to work status (Yes/No) and sex, age, marital status, number of children, number of people dependent on family income, percent of total income provided by worker, highest education level, employment status, number of full-time jobs held in the past 5 years, total years held current job, and total years employed by this employer (Table I).

There was a marginally significant difference with respect to union membership ($P = .091$); of those who returned to work, 67% were union members, compared with 50% of non-RTW.

Comparisons of Return to Work by Clinical and Occupational Scales

RTW and non-RTW groups were significantly different with respect to mean scores on Expectations of Recovery ($P < .001$) and WCB/Employer Response to Claim questions ($P = .018$) (Table II). Not surprisingly, workers who had returned to work had more positive

Table II. Two-Sample *t*-Tests of Clinical and Occupational Measures by RTW

Variable	NRTW ($N = 36$)	RTW ($N = 64$)	*P* value	Effect size
Expectations of recovery	17.00 ± 2.61	14.23 ± 3.43	<.001	0.88
WCB/Employer response	2.50 ± 1.21	3.09 ± 1.17	.018	0.50
SF-36 subscales				
Physical functioning	34.17 ± 19.84	52.27 ± 19.58	<.001	0.92
Role-physical	1.39 ± 8.33	4.69 ± 16.59	NS[a]	0.25
Bodily pain	27.75 ± 14.58	38.56 ± 14.25	<.001	0.75
General health	68.61 ± 17.01	75.02 ± 17.31	NS	0.37
Vitality	33.89 ± 19.93	49.30 ± 17.25	<.001	0.84
Social functioning	40.28 ± 22.58	52.15 ± 22.44	.013	0.53
Role-emotional	25.71 ± 33.42	44.27 ± 38.52	.018	0.50
Mental health	56.44 ± 16.31	68.81 ± 15.73	<.001	0.78
Health transition	3.11 ± 0.62	2.55 ± 0.87	.001	0.71
Physical component scale	29.72 ± 4.35	33.87 ± 5.06	<.001	0.86
Mental component scale	40.59 ± 9.25	46.51 ± 8.26	.002	0.68
Medical history scales				
Perceptions of injury severity	2.75 ± 1.03	1.98 ± 0.93	<.001	0.80
Waddell symptoms	3.22 ± 1.51	1.88 ± 1.34	<.001	0.96
Distress scale	2.84 ± 0.45	2.58 ± 0.41	.004	0.61
Karasek workplace scales				
Skill discretion	10.64 ± 2.99	10.59 ± 3.13	NS	0.02
Decision authority	5.06 ± 2.35	5.30 ± 2.07	NS	0.11
Job security	1.97 ± 0.91	1.98 ± 0.63	NS	0.01
Coworker support	6.11 ± 1.26	5.90 ± 1.32	NS	0.16
Supervisory support	5.39 ± 2.20	5.49 ± 1.80	NS	0.05
Overall control	20.75 ± 6.21	21.19 ± 6.32	NS	0.07
Overall work support	11.50 ± 2.98	11.22 ± 2.71	NS	0.10
Overall resources	34.22 ± 8.23	34.39 ± 7.03	NS	0.02

[a]Not significant.

expectations of recovery (lower scores on the scale) and more positive WCB/employer response to claim (high scores on the scale). Overall, most of the workers (63%) felt the employer's reaction was supportive and helpful, and 20% felt that employers were eager for the workers' return to work. Only 3% felt the reaction was one of anger or blame.

RTW and non-RTW groups were also significantly different with respect to almost all the subscales (except Role-Physical) of the SF-36. The RTW group had significantly better physical functioning, general health, vitality, social functioning, mental health, better role-emotional, and less bodily pain. The overall physical and mental component summary measures also showed more positive mean scores for the RTW group.

With respect to medical history scales, the RTW group had significantly lower perceptions of severity of injury, fewer Waddell symptoms, and better psychological health. The subscales of the Karasek Job Content Questionnaire showed no significant differences between the RTW and non-RTW groups.

Table II also presents effect sizes for each of the clinical and occupational scales. These were computed as the difference between means of RTW and non-RTW groups divided by the pooled standard deviation. Effect sizes of 0.80, 0.50, and 0.30 are considered "large," "medium," and "small," respectively. Variables with large effect sizes were: Expectations of Recovery, SF-36 subscales of Physical Functioning, Bodily Pain, Vitality, Mental Health, and Health Transition, and the Medical History Scales of Perceptions of Injury Severity and Waddell Symptoms. Medium effect sizes were seen for WCB/Employer Response, SF-36 subscales of Social Functioning, Role- Emotional, and the Medical History Distress Scale.

Table III. Final Combined Logistic Regression Model Using All Significant Predictors

Variable	*B*	SE	SIG	Odds ratio
Expectations of recovery	−0.194	0.092	.036	0.82
SF-36: Vitality	0.029	0.017	.083	1.03
SF-36: Mental health	0.032	0.018	.076	1.03
Waddell symptoms	−0.526	0.197	.008	0.59
Constant	1.743	1.744	.32	

Logistic Regression Models of Return to Work

Logistic regression models were fitted to assess the combined ability of the various variables to predict return to work. Given the large number of potential predictors, models were built with variables entered in blocks, using stepwise methods.

Using demographic variables only, union membership was the only marginally significant predictor (confirming the earlier bivariate analysis). However, the correct classification rate did not differ from the baseline classification rate of 64% that would be achieved simply by predicting return to work for all workers. That is, using union membership did not improve on the ability to classify a worker as returning to work.

Using Expectations of Recovery and WCB/Employer Response scales, the stepwise procedure retained only Expectations of Recovery, leading to a correct classification rate of 72%.

Both the Physical and Mental Components of the SF-36 were significant predictors, separately and together, with the combination having a correct classification rate of 71%. Of the subscales of the SF-36, Physical Functioning, Vitality, Mental Health, and Health Transition were significant predictors, and gave a correct classification rate of 76%.

Using the medical history scales, Waddell Symptoms was a significant predictor and Perception of Injury Severity was marginally significant. The model with these two predictors had a correct classification rate of only 69%. A stepwise logistic regression model with the Karasek Job Content Questionnaire subscales retained none of the variables as predictors.

A final combined model was developed by using the significant predictors from each of the previous models. The variables considered for this final model were: Union membership; Expectations of Recovery; WCB/Employer Response; Physical Functioning, Vitality, Mental Health, and Health Transition, all from the SF-36; and Perception of Injury Severity and Waddell Symptoms from Medical History.

With these variables in the model the correct classification rate was 80%. Stepwise backward elimination resuletd in the final combined model containing as predictors: Expectations of Recovery, SF-36 Vitality, SF-36 Mental Health, and Waddell Symptoms. The overall correct classification (accuracy) rate was 79%, with 61% non-RTW status (sensitivity) and 89% of RTW status correctly classified (specificity) (see Table III).

These analyses have demonstrated the validity of an original model of disability prediction (27) using a newly developed Risk for Disability Instrument with a WCB population of low back injured workers. From this model, a ROC curve was constructed using the sensitivities and specificities generated by the model. The area under the curve was 84% indicating that the instrument can be considered to be a useful predictor of outcome. (Notably, an area under the curve of 50% indicates an instrument no better than chance.)

DISCUSSION

A recent empirically-supported biopsychosocial model of occupational disability following low back injury in the workers' compensation context (27), using a multimethod approach, demonstrated return to work prediction accuracy of 80.5% for those workers who returned to work 3 months following the initial examination (specificity) and 74.4% prediction accuracy for those workers who failed to return to work (sensitivity). To develop the self-report based Psychosocial Risk for Disability instrument, further validity testing of the original predictive model (27,33) was completed on a new worker sample using paper and pencil–derived variables from that model. It produced a similar overall classification rate of 80%, but more significant discrepancy between sensitivity (61%) and specificity (89%) than in the original sample. The review of demographic characteristics of both samples indicated that the educational levels of current worker sample were somewhat higher (51% of college/university/technical school education compared to 40% on the original sample), which might have contributed to the discrepancy. Moreover, the reduction of sensitivity can be attributable to the transition from the multimethod approach, which is psychometrically preferable (34) but labor-intensive and of problematic feasibility in large-scale applications, to simple paper and pencil approach.

Recent systematic analysis indicated that the application of evidence-based demographic and psychosocial predictors produces sensitivities and specificities of risk for disability screening measures in community or rehabilitation settings ranging from 70 to 80% (15). In the current study, even though the analysis of the ROC curve, using the sensitivities and specificities generated by the model demonstrated that the area under the curve was 84%, indicative of good outcome prediction, the discrepancy between these two dimensions of predictive validity needs to be considered in future applications. If applied in the workers' compensation environment for identification of injured workers at risk for disability, the instrument would likely fairly correctly identify those who are *not* at risk for work disability, but it is unlikely to be, in isolation from other data, sufficiently accurate in detecting all those who are at high risk for failure to return to work. Elevated rates of false negatives and low rates of false positives are therefore likely to result in underidentifying individuals at risk of disability but in good ability to rule out those workers who are returning to work (35).

Notably, most other studies focusing on screening for pain-related work disability, either used primary-care samples (14,17,20,36), or a chronic pain (rather than subacute) population (37), or, if developed for workers' compensation population, it had inherent limitations in study design (38). However, a recent validation study of the Örebro Musculoskeletal Pain Questionnaire, an instrument designed to identify patients at risk for development of persistent back problems in primary health care setting, indicated, with a cutoff score of 90 points, a significant discrepancy between sensitivity of 89% and specificity of 65% for absenteeism due to sickness (14). This discrepancy would likely produce elevated levels of false positives and low levels of false negatives (35).

Overall, the types and combinations of predictors identified in our final combined logistic regression model, all of them cognitive-behavioral, are consistent with the literature (22,27). Specifically, expectations of recovery and perception of vitality were evident in the initial model of work disability (27). Interestingly, in this validation study utilizing a paper and pencil, self-report-derived predictive measures, variables related to mental health and Waddell symptoms replaced pain-behavior and physical examination variables from

the original multimethod predictive model. The contribution of mental health variables is consistent with studies demonstrating that psychological distress is predictive of disability (22,39–42). Also, the notion that patients at risk for disability endorse symptoms which are not based on normal physiology or anatomy in conditions associated with nonspecific low back pain, was also previously raised in the literature, but has not been consistently validated to date.

In our validation study, these worker complaints were measured by the Waddell *symptoms* (and *not* with more commonly known Waddell *signs*) and identified as one of the four key self-reported predictors of disability. Like Waddell signs, Waddell symptoms continue to be difficult to interpret at a conceptual and clinical level.

The Psychosocial Risk for Disability Instrument was intended for screening of subacute low back injured workers in the workers' compensation setting. Therefore, a specific definition or "cutoff value" of elevated risk, had to be developed. For example, for workers' compensation screening applications, elevated risk workers could be defined as those with an estimated probability of return to work less than or equal to 0.33. This threshold allows for identification of 20% of workers as being at elevated risk for work disability. Further, it includes less than 5% of those workers who did return to work and half of those who did not return to work.

The generalizability of predictive validity data for the Risk for Disability instrument is limited to the English-speaking workers' compensation population and to workers with subacute low back injuries. Specific sociodemographic characteristics of the geographic region of British Columbia, from which the sample was drawn, with high rates of unionization and prevalence of small employers, should also be considered. The validation sample size was also small which limits generalizability. Prior to application in secondary prevention, the utility of the instrument requires further investigation with a larger study sample. Also, ergonomic factors, a potentially important group of predictors, (25) were not included in the study due to feasibility issues.

Further research on predictive validity, using continuous outcomes such as duration and costs of disability, on the specificity–sensitivity discrepancy identified in the study, and on the effects of different statistical definitions of "at risk" status, are warranted. Also, investigations of concurrent, convergent, and discriminant validity have not yet been completed.

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