J Rehabil Med 2005; 37: 365–371

PREDICTORS OF RETURN TO WORK IN PATIENTS SICK LISTED FOR SUB-ACUTE LOW BACK PAIN: A 12-MONTH FOLLOW-UP STUDY

Kjersti Storheim,[1] Jens Ivar Brox,[2] Inger Holm[2] and Kari Bø[1]

From the [1]Norwegian School of Sport Sciences, Department of Sport Medicine and [2]National Hospital, Oslo, Norway

Objective: **To investigate whether personal and work-related factors, physical performance and back-specific questionnaires predict return to work.**

Design: **A prospective study identifying prognostic factors for return to work.**

Subjects: **Ninety-three patients sick-listed for 8–12 weeks for non-specific sub-acute low back pain included in a randomized controlled trial.**

Methods: **Patients were examined with regard to demographic variables, a battery of back-specific questionnaires and physical tests before entering a randomized controlled trial. A stepwise backward Cox regression model was established to identify the most powerful predictors.**

Results: **During follow-up 78.5% of the patients have returned to full-time work. Fear-avoidance beliefs for work (relative risk (RR) for 1 SD change 0.49; 95% confidence interval (CI) 0.38–0.64), disability (RR 1.39, 95% CI 1.02–1.88) and cardiovascular fitness (RR 1.42, 95% CI 1.12–1.79) were identified as the best predictors for return to work. The prevalence of correct predictions was 69.3%.**

Conclusion: **The predictors identified in the present study may reflect personal risk factors in a patient who gets acute low back pain. On the other hand, they may support that fear of pain and injury may be more disabling than pain itself, and that deconditioning is a result of altered behaviour reflecting attitudes towards low back pain in society, and information and advice given in primary healthcare.**

Key words: low back pain, sub-acute, sick leave, return to work, long-term disability, prognostic factors.

J Rehabil Med 2005; 37: 365–371

Correspondence address: Kjersti Storheim, Norwegian School of Sport Sciences, Department of Sport Medicine, PB 4014 Ullevål Stadion, N-0806 Oslo, Norway. E-mail: Kjersti.Storheim@nih.no

Submitted June 24, 2004; accepted April 22, 2005

INTRODUCTION

The socio-economic costs of low back pain (LBP) in terms of absenteeism, disability and medical expenses are immense (1). LBP is the most frequent single cause of sick-listing, early retirement and disability pension in Norway (2). Cohort studies of the general working population have identified lower level of education and socio-economic position (3), perceived work as constantly physical demanding, health complaints other than back pain, and frequent feeling of being tired and worn out (4) as risk factors for disability pension within the Norwegian welfare system.

Patients sick-listed for LBP have an increased risk of developing long-term disability and permanent work incapacity (1). Previous studies have tried to identify characteristics predicting long-term disability or return to work (RTW) for patients sick-listed for LBP (5–9). Predictors can help to identify patients with a good prognosis and patients at risk for long-term disability. Hence, predictors may have clinical implications. Factors identified as positive predictors for RTW are good health and psychological status (5, 7), high job satisfaction (7), demographic and socio-economic variables such as being a breadwinner, being married, young age, and fewer job, personal, or family-related problems (7, 10, 11). Reporting less or intermittent pain (5, 7, 8) and less exhaustion for a physical fitness test were also positive factors for RTW (5). Factors identified as negative prognostic factors were lack of energy, low Internal Health Locus of Control Score, fear-avoidance, less favourable score on Minnesota Multiphasic Personality Inventory (MMPI), multiple positive Waddell non-organic signs, reduced subjective work ability, low expectations of returning to work (5, 6, 8, 12–16). In addition, negative factors were older age, more children, being less physically active (6, 8), working in the construction industry or in a position giving a constant load on the back (5, 8) and a history of back pain including factors such as reports of severe pain and/or disability, pain referred into the leg, lag time from injury to treatment, previous injuries or restricted lateral mobility (6, 8, 11, 12, 14, 17, 18). Length of time out of work (11, 13) and workers compensation/personal injury insurance status (14) were also found to influence RTW in subjects being sick-listed for LBP.

Studies of patients seeking medical help for acute or sub-acute LBP, but not yet sick-listed, have identified fear-avoidance beliefs for work (19), a fear-avoidance model including stress and personality variables (9), previous chronic LBP, initial great disability and poor job satisfaction (20) as risk factors for sick-listing.

One of the most important predictive characteristics for RTW is the length of sick-leave (1, 11, 13, 21). The first 2 months appears to be a critical period in the natural history of LBP (9) and patients not returning to work during the sub-acute phase have an increased risk of long-term sick leave and chronic disability (1, 21). Except for the studies of Haldorsen et al. (6) and van der Giezen et al. (7), the above-mentioned studies

 ISSN 1650–1977
DOI 10.1080/16501970510040344

include subjects with a varied length of sick leave or both working and sick-listed subjects. Predictors have shown to change in strength parallel to increase in time out of work (11, 13). Additionally, studies often focus on demographic variables and to a lesser extent on instruments developed for studies of LBP patients. Hence, the aim of the present study was to identify predictors of RTW 1 year after inclusion, in patients with homogeneous sick-listing period included at a prognostic critical point for RTW by using back-specific instruments covering all recommended domains in back pain research.

MATERIAL AND METHODS

Subjects

In this 3-armed randomized controlled trial comparing physical exercise and cognitive intervention with a control group (22) patients were included on the basis of the following criteria: sick-listed from a permanent job and receiving between 50% and 100% compensation for non-specific LBP for 8–12 weeks, but with no sick-leave due to LBP during a period of 12 weeks before the current sick-listing period; aged between 20 and 60 years; able to read and write Norwegian.

Exclusion criteria were LBP caused by disc herniation with radiculopathy, spinal stenosis with neurological deficit, spondylolysis or spondylolisthesis over grade 2, spinal fracture, tumour or infection. Also excluded were patients with rheumatic diseases, previous back surgery, pregnancy, diseases that might interfere with participation (psychiatric or somatic), abuse of drugs or alcohol, and/or regularly physical exercise habits (more than 3 times per week for the last 6 months; essential for achieving physiological effect of the exercise intervention).

Patients were recruited from the local National Insurance Offices and from general practitioner's (GPs) in 2 counties with a total population of about 150,000 people near Oslo, Norway. The inclusion period was from March 1998 to April 2001. Interventions administered by the project were a standard investigation by a specialist in physical medicine and rehabilitation, followed by physical group training intervention or by cognitive intervention. The control group received usual care from their GP (22). All patients were informed about the study in writing and orally and gave their informed consent before inclusion. Approval was obtained from the Regional Committee of Medical Research Ethics and from the Data Inspectorate.

Variables tested for prediction value

Demographic variables were collected by questionnaire on the day of inclusion into the project. Variables covered were personal factors (age, gender, weight, height, body mass index, smoking/alcohol consumption, social participation at leisure time, level of leisure time physical activity, marital status, children and family responsibilities, social and family network/support, job-related factors (heaviness of workload, job satisfaction, support from colleagues and employer, job characteristics (physical, psychological, social, environments)), socio-economic status (formal education (3 levels: primary school, high school, college/ university), professional education (divided into 2 categories: ≤ 3 years, >3 years) and socio-economic position (occupation classified according to 6 socio-economic groups: unskilled workers, skilled workers, routine non-manual low, routine non-manual high, professionals low, professionals high), LBP history (duration of LBP, former sick-listing, former exploration and treatment for LBP) and co-morbidity (22–24).

International panels of experts have recommend the following instruments for LBP studies: pain symptoms (bothersomeness or severity and frequency of LBP and leg pain), back specific function, and generic health status (25). All recommended domains were covered, in addition to pain behaviour, life satisfaction and tests of physical performance.

Pain symptoms. LBP and leg pain were assessed by 2 separate horizontal visual analogue scales (VAS). Ohlund et al.'s pain drawing sheet was used for registration of pain distribution. Based on pain localization on the pain drawing, subjects were subcategorized; 1 = pain localized to the lower back, 2 = lower back pain with pain radiating to the leg, 3 = generalized pain. Consumption of painkillers was registered at a 4-point scale (1 = daily, 2 = weekly, 3 = less than every week, 4 = never) (see reference 22 for complete references).

Back specific function. Disability was evaluated by the Roland and Morris Questionnaire (22).

Generic health status. This was evaluated by the SF-36 Health Survey. The instrument covers physical health as well as mental health and is divided into 8 sub-scales (physical function, role physical, bodily pain, general health, vitality, social function, role emotional and mental health) in addition to a sub-scale for health transition (22).

Pain behaviour. Self-efficacy beliefs for pain were registered using the self-efficacy subscale for pain developed by Lorig et al. Self-efficacy beliefs for function were assessed by 8 questions regarding basic physical activities. Fear-avoidance beliefs for physical activity and work were evaluated using Waddell et al.'s back-specific Fear-Avoidance Belief Questionnaire (FABQ). Emotional distress was assessed by the short version of the Hopkins Symptom Checklist (HSCL-25) and by the Modified Somatic Pain Questionnaire (22).

Life satisfaction. This was estimated by Cantrils Ladder Scale, a 10-point vertical numerical rating scale where 1 = very dissatisfied and 10 = very satisfied (22).

Physical performance. Cardiovascular fitness was estimated by a sub-maximal bicycle ergometer test according to the method described by Åstrand & Rodahl (26). Trunk muscle performance was assessed by testing dynamic strength of the abdominal muscles (27) and isometric endurance of trunk extensors (28). Flexibility was tested both via forward bending (27) (fingertip-to-floor) and by specific tests of the hamstrings muscles (29), the hip flexor muscles (27) and lumbar ventral and lateral flexion (30).

Return to work

Data on return to work were collected from the local National Insurance Offices 12 months after inclusion to the study. Data used in the present study were number of days on sick-leave (continuous variable) and whether patients returned to full-time work (categorical variable) during the 1-year follow-up period.

Statistical analysis

Predictors for return to work were identified by 3 steps.

Step 1: cross-tabulations (for categorical data; chi-square and Fischer's exact test) and Mann-Whitney independent samples test (continuous variables) were used to select characteristics that differed between patients returning and patients not returning to full-time work during a period of 1 year after inclusion. Categorical data were collapsed if cells in the cross-tabulation contained less than 5 counts. The selection criterion for this first step was set to a *p*-value of 0.25. Hosmer & Lemeshow (31, p 86) indicate that a probability range of up to 0.25 should be used in such analyses because a more stringent cut-off such as the more traditional level $p<0.05$ frequently excludes important variables for the model developed. Characteristics were divided into 5 categories: (i) sociodemographic variables, (ii) job characteristics, (iii) pain, generic health and physical functioning, (iv) pain behaviour and (v) physical performance. All identified variables were thereafter tested against each other in a correlation analysis in order to identify variables covering similar aspects (defined as a correlation coefficient >0.70).

Step 2: within each category, backward stepwise Cox regression was performed. The dependent variable was working days lost until return to work, event was return to full-time work during the 1-year follow-up period, and a maximum of 4 variables (the 4 strongest) within each category were entered into the analysis.

The final step (Step 3) consisted of selection of the most significant correlate from each of the 5 categories, which subsequently was subjected to a final backward selection Cox regression analysis. Predictive values were expressed as Hazard rate ratios (HRR) with 95% confidence interval (CI).

To explore the predictive value of the model, the prognostic index (exponential term of Hazard function in the final Cox regression model) was calculated and its distribution was split at the median value. A 2×2 table crossing number of returners and non-returners with patients above and below this median was made, out of which we calculated sensitivity, specificity, positive predictive value, negative predictive value and the prevalence of correct predictions (32).

The software used for statistical analysis was SPSS 11 for Windows.

RESULTS

About 1950 persons in the target population were sick-listed for LBP for more than 8 weeks during the inclusion period. A total of 163 patients volunteered to participate and, of these, 93 fulfilled the criteria for inclusion.

Sick-listing data during the 1-year follow-up period were available for all participants. Background variables for participants returning and not returning to work are given in Table I. No background variables were significantly different between returners and non-returners. Seventy-three subjects (78.5%) returned to full-time work during the 1-year follow-up period (mean time before they returned was 18.5 weeks (SD 13.6)). Survival analysis of time until patients returned to full-time work is presented in Fig. 1.

The univariate analysis (Step 1 in the statistical analysis) identified several characteristics associated with RTW with a p-value < 0.25. Candidates for the Cox regression analysis were identified in all 5 categories (Table II). Only 3 variables were identified with p-value < 0.25 in the categories "pain behaviour" and "physical performance". Group allocation was not a significant variable ($p = 0.32$). No variables were rejected because a correlation coefficient > 0.70. Non-returners were less educated and reported more workload and more negative job characteristics. In addition, they were less active during leisure time (taking active part in organized groups and physical activity at leisure), and performed less on tests of physical performance. All back-specific questionnaires and scales recommended by international panels of experts differed significantly between returners and non-returners (Table II).

Step 2 reduced candidates for the final analysis (Table II). Table III gives descriptive statistics of variables identified in Step 2.

The final analysis, including the statistically strongest variable from each category (taking active part in organized groups at leisure, job characterized by strict routines, physical function at the SF-36 scale, FABQ-work and cardiovascular fitness (Table II)), identified 3 predictors for RTW in returners vs non-returners; FABQ-work, disability assessed by the sub-scale for physical function at the SF-36 scale, and cardiovascular fitness (Table IV).

The sensitivity, specificity, positive predictive value, negative predictive value, and the prevalence of correct predictions were 100%, 62.0%, 38.6%, 100% and 69.3%, respectively.

Table I. *Baseline demographic data of patients returning to full-time work (Pat. RTW) and patients not returning to full-time work (Pat. not RTW) with low back pain (LBP)*

Variable	Pat. RTW ($n = 73$) Mean (SD)	Pat. not RTW ($n = 20$) Mean (SD)
Age (years)	40.5 (9.8)	42.3 (11.7)
Height (cm)	175.0 (8.5)	170.9 (7.8)
Weight (kg)	78.1 (15.1)	80.0 (19.9)
Body mass index (kg/m^2)	25.4 (4.0)	27.7 (6.4)
Gender (% men)	52.1	35.0
Smokers (%)	46.6	55.0
Married (%)	72.6	85.0
Number of children	2.0 (0.7)	1.9 (1.0)
Time since first LBP episode (years)	11.8 (10.3)	11.1 (11.4)
LBP at present (VAS; 0–100 mm)*	53.5 (22.1)	63.9 (15.9)
RMDQ (0–24)*	8.4 (3.4)	10.1 (3.5)
MSPQ (0–39)*	6.6 (4.7)	7.2 (4.8)
Highest education (%)		
Primary school (9 years)	13.7	30.0
High school (12 years)	63.0	55.0
College/university	23.3	15.0
Work status (%)		
Full-time	76.7	75.0
Part-time	23.3	25.0
Heaviness of workload (%)		
Office working/sedentary	42.5	20.0
Light manual handling	28.8	50.0
Heavy manual handling	28.8	30.0
Randomized group (%)		
Cognitive intervention	38.4	30.0
Physical exercise	34.2	25.0
Control (usual care)	27.4	45.0
Length of sick listing at inclusion (weeks)	11.4 (2.0)	11.2 (2.3)
Previous sick-listed for LBP (% yes)	65.8	65.0
Previous long-term sick-listed for LBP (% yes)	28.8	25.0
Number of previous LBP sick-listing periods	3.0 (7.5)	1.7 (1.9)
Co-morbidity (chronic pain diagnosis, % yes)	26.0	25.0
Consumption of pain killers (% daily users)	11.0	20.0
Job satisfaction (% satisfied)	83.6	90.0

* For all scales; 0 = best score (indicating no pain /disability/somatization).
RMDQ = Roland Morris Disability Questionnaire; MSPQ = Modified Somatic Pain Questionnaire.

DISCUSSION

The best predictors for RTW in the present study including patients with LBP sick-listed for 8–12 weeks were fear-avoidance beliefs for work, disability and cardiovascular fitness. The prevalence of correct predictions was 69.3%, which resembles other studies published within the same field (6, 8, 33). In accordance with previous studies, the present study indicates that several factors are involved in the transition from sub-acute to chronic disabling LBP. Identified predictors may reflect personal risk factors in a patient who gets acute LBP. On the other hand, they may support that fear of pain and injury may be more disabling than pain itself, and that deconditioning may be a result of altered behaviour (1). In addition, identified predictors may reflect an interaction between attitudes towards LBP in society, and the information and advice given in primary healthcare.

Creating predictive models out of a large number of variables and relatively small sample sizes in the final groups of returners and non-returners is difficult (31). We followed a mathematical strategy when building our model. Emphasis was put on

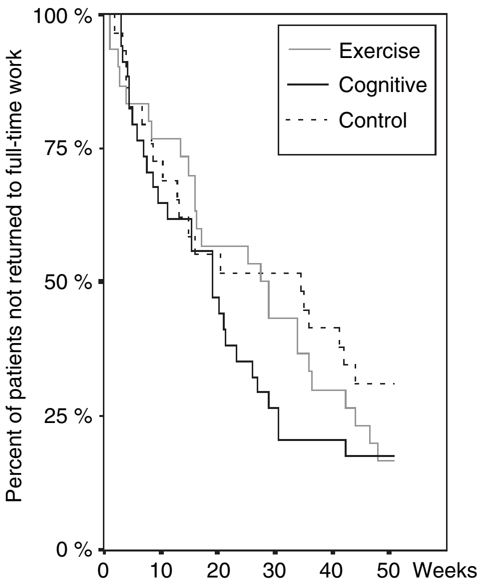

Fig. 1. Sick leave in all intervention groups expressed as survival analysis and visualized by Kaplan–Meier curves. Survival is defined as not returned to full-time work 52 weeks after inclusion.

Table II. *Variables identified as potential predictors for return to work 1 year after inclusion at step 1 and 2 in the statistical analysis*

Variable	Step 1 *p*	Step 2* *p*
Sociodemographic variables#		
Taking active part in organized groups at leisure	0.029	**0.005**
Professional education	0.052	
Basic education	0.090	
Probability of receiving support during sickness	0.116	
Contact/social intercourse with neighbours	0.127	
Gender	0.136	
Received help from neighbours during current sick leave period	0.143	
Socio-economic status	0.145	
Job characteristics#		
Physical demanding/exhausting job	0.015	0.004
Job characterized by strict routines	0.047	**0.001**
Irregular working time/shift work	0.069	0.039
Psychological exhausting job	0.111	0.064
Heaviness of workload	0.120	
Being controlled at work	0.121	
How easy it is to report things to complain of at work	0.142	
Pain, generic health and physical functioning#		
Physical function at SF-36	0.000	**0.003**
Bodily pain at SF-36	0.006	0.009
Physical activity at leisure	0.010	
Pain localization	0.016	
Pain intensity registered at VAS	0.058	
Pain drawing	0.061	
Roland and Morris Disability Questionnaire	0.067	
General health at SF-36	0.113	
Pain behaviour		
Fear-avoidance beliefs for work	0.001	**0.000**
Self efficacy for pain	0.023	0.001
Self efficacy for function	0.041	
Physical performance		
Cardiovascular fitness	0.004	**0.002**
Number of sit-ups to exhaustion	0.013	
Isometric endurance of trunk extensors	0.021	0.083

* Descriptive statistics of variables identified is reported in Table III. Bold = variables included in the final analysis. # Report of variables in the table is limited to $p = 0.015$ because multiple variables were identified with a p-value < 0.25 and only the 4 strongest were entered into the logistic regression analysis.

achieving a reasonable statistical power in each stepwise regression procedure, not keeping more than maximal 4 variables within each category of candidates. A complete backward stepwise regression was not possible because of the limited size of the study, in particular the small number of patients not returning to work (only 20 subjects did not return to full-time work).

In recent years, much attention has been paid to the role of psychological factors in the development and maintenance of chronic LBP and disability, in particular fear-avoidance beliefs and distress (34). The fear-avoidance model embraces a variety of personal beliefs and efficacy systems and a cognitive-behavioural framework is provided to understand why some patients with LBP develop persistent disability (35). Fear avoidance beliefs for work is identified as a predictor for future sick-listing or disability in patients with acute and sub-acute LBP (16, 19) and in chronic LBP (15). In the present study, a high degree of fear-avoidance beliefs for work, measured by Waddell's back-specific fear-avoidance beliefs scale, was the strongest predictor for not-RTW. Reducing the score by 1 SD reduced the probability of not returning to work during the 1-year follow-up period by about 50%. To our knowledge, the present study is the first study using the FABQ-scale in patients sick-listed 8–12 weeks for LBP. The sub-scale for work consists of 7 questions about patient's attitude towards work and is strongly related to work absence caused by LBP (36). In Norway, sub-acute patients at 8 weeks of sick leave must be reconsidered by their GP to be eligible for further sickness benefit. Hence, the FABQ-work scale may be a useful tool for GPs to identify obstacles for RTW when reconsidering patients' status. The FABQ is a simple questionnaire both to complete and to score (36).

In the present study, patients not returning to work reported that they were more disabled, as measured by the SF-36 subscale for physical function. This corresponds with a previous study in patients with acute non-specific LBP identifying high degree of self-reported disability as a negative prognostic factor for prolonged sick listing (20). Disability also predicted RTW in studies of sick-listed workers where the majority of subjects were included in an early sub-acute phase (12, 14), but not with the study of van der Giezen et al. where all patients were included at the same stage as in the present study (7). Disability may be evaluated by simple standardized questionnaires such as the Roland Morris Disability Questionnaire (37) or the Oswestry low back pain disability questionnaire (38).

Table III. *Descriptive statistic of variables identified in step 2 in the statistical analysis for patients returning to full-time work (Pat. RTW) and patients not returning to full-time work (Pat. not RTW)*

Variable	Pat. RTW ($n = 73$)	Pat. not RTW ($n = 20$)
Sociodemographic variables		
Taking active part in organized groups at leisure (% with high degree of engagement)	67	40
Job characteristics		
Physical demanding/exhausting job (% with demanding/exhausting job)	61	90
Job characterized by strict routines (% with such job-characteristic)	83	95
Irregular working time/shift work (% having irregular working time/shift work)	43	65
Psychological exhausting job (% having psychological exhausting job)	71	53
Pain, generic health and physical functioning		
Physical function at SF-36 (scale from 0–100, high score indicate good health)*	66.2 (16.0)	50.0 (16.4)
Bodily pain at SF-36 (scale from 0–100, high score indicate good health)*	30.2 (12.3)	22.8 (11.1)
Pain behaviour		
Fear-avoidance beliefs for work (0–42, high score indicate high fear-avoidance)*	25.5 (9.0)	33.6 (5.8)
Self efficacy for pain (scale from 1–7, high score indicate good self efficacy)*	4.4 (1.2)	3.6 (1.2)
Physical performance		
Cardiovascular fitness (ml O_2/kg/min)*	33.0 (6.6)	28.3 (5.8)
Isometric endurance of trunk extensors (seconds)*	78.6 (40.5)	54.9 (40.6)

* Values are given in mean with standard deviation (SD).

Waddell suggests (1) that fear of pain and injury may be more disabling than pain itself, and that deconditioning may be a result of altered behaviour. Cardiovascular fitness was the best predictor of tests of physical performance. The more specific back muscle endurance test was associated with RTW in the first steps of the statistical analysis, but was not among the predictor candidates included in the final analysis. Association between cardiovascular fitness and RTW is in agreement with another Norwegian population with LBP sick-listed up to 6 months, where less self-reported exhaustion on a physical fitness test was identified as a positive factor for RTW (5). However, in another study of patients sick-listed for at least 8 weeks, cardiovascular fitness did not predict RTW (39). Cardiovascular fitness and its role as a risk factor for LBP received great enthusiasm after Cady et al. (40) concluded that physical fitness and conditioning were preventive for back injuries. This was not confirmed in the study of Battie et al. (41). Subjects developing chronic disabling back pain were found to have significantly lower fitness compared with unaffected age- and sex-matched controls, and Battie et al. hypothesized that level of cardiovascular fitness may affect the response to LBP problems and recovery (41). Although cardiovascular fitness depends on age, gender and heredity (26), the result of the present study may speak in favour of evaluating cardiovascular fitness at an early stage in patients sick listed for LBP. The present study used a bicycle ergometer test requiring equipment, expertise and time. A current study suggests that a 50-feet or 5-minute walking test gives valid estimates of aerobic capacity in subjects with LBP (42). These methods may be more feasible for use in clinical practice.

The variables identified as prognostic factors for RTW in the present study may correspond with the prognostic factors identified in 3 other Norwegian sick-listed populations with LBP (5, 6, 39) and with factors predicting disability pension in the general working population (3, 4). Less exhaustion on test of cardiovascular fitness was found to be a predictor for RTW in patients sick-listed up to 6 months (5). Additionally, Haldorsen et al.'s study of patients sick-listed for sub-acute LBP found self-reported reduced work ability and low Health Locus of Control to be negatively associated with RTW (6). Differences in patient selection, measures and instruments, treatment, statistical models and point of time when the studies were conducted may limit comparisons between the present study and the studies of Haldorsen et al. (39). However, the results of these studies may give important information on which factors warrants attention in patients sick-listed for more than 8 weeks within the Norwegian welfare system.

The present study covered a broad spectrum of variables, including back-specific instruments and tests of physical performance. Covering all significant domains and variables decrease the risk of identifying surrogate measures for more

Table IV. *Variables found to differentiate between returners and non-returners in the final backward Cox regression model*

Variable	β-coefficient	Return rate ratios for 1 SD change	95% CI	*p*-value
FABQ-work	−0.079	0.49	0.38–0.64	0.000
SF-36 physical function	0.019	1.39	1.02–1.88	0.036
Cardiovascular fitness	0.052	1.42	1.12–1.79	0.004

SD = standard deviation; CI = confidence interval; FABQ = fear avoidance beliefs questionnaire.

general features as predictors (31). Additionally, we have complete baseline data and follow-up data (sick-listing/dependent variable) of all included patients. Our strategy for building up the final model was mainly mathematical and statistical. Several approaches could have been used (31), but based on assumed clinical importance, previous studies and statistical methods we suggest that the final model contains essential variables.

The present study included patients according to strict inclusion- and exclusion criteria at an instant in the sick-listing history viewed as critical for success or failure regarding RTW (9). Thus, this may be a more homogeneous group of patients than presented in other studies. On the other hand, only about 5% of the target population participated in the study. It is therefore possible that the participants of the study are a selection with respect to predictors of RTW compared with all patients sick-listed in the target population and that the external validity of the study is low. However, the results are in accordance with results of a recent study where 75% of patients were included in the sub-acute phase (12). The sample size may also be a limitation of the study, although the sample size resembles previous prognostic studies of LBP patients (10, 15–17, 20, 39).

The studied population consisted of 3 randomized groups of patients. Haldorsen et al. (5) found that prognostic value of variables differed with treatment given. On the other hand, Fritz et al. (16) concluded that there was no significant interaction between treatment and prognostic factors identified, and that adding treatment group to the model even improved model fit. The interventions of the present study reduced FABQ-work and disability in the cognitive group (22) and cardiovascular fitness was most improved in patients adhering to the exercise protocol[1], but interventions had no statistically significant effect on sick-listing (dependent variable) (22). Additionally, group allocation was not a significant variable in step 1 of the statistical analysis. It may also be suggested that drop-out and co-interventions in the intervention groups (22) diminish a possible effect of randomization. The limited size of the study, in particular the fact that 78.5% of patients returned to work, set limitations for statistical analysis of interaction between treatment and the best predictors. To confirm the validity of our results, further studies are warranted.

ACKNOWLEDGEMENTS

The authors thank The Norwegian Foundation for Health and Rehabilitation, The Norwegian Fund for Postgraduate Education in Physiotherapy and The Norwegian Back Pain Network, research unit, for economical support and realization of this project. We are also grateful to Professor Ingar Holme for statistical advice.

[1]Storheim K, Holm I, Brox JI, Finckenhagen HB, Braaen BA, Bo K. Does group training improve physical performance, disability and return to work in patients sick listed for sub-acute low back pain? A single blind randomized controlled trial with 1-year follow-up. Unpublished.

REFERENCES

1. Waddell G. The Back Pain Revolution. First edn. London: Churchill Livingstone; 1998.
2. Norwegian National Insurance Scheme. Trygdestatistisk årbok 2001. Oslo: Norwegian National Insurance Scheme; 2001.
3. Hagen KB, Holte HH, Tambs K, Bjerkedal T. Socioeconomic factors and disability retirement from back pain: a 1983–1993 population-based prospective study in Norway. Spine 2000; 25: 2480–2487.
4. Hagen KB, Tambs K, Bjerkedal T. A prospective cohort study of risk factors for disability retirement because of back pain in the general working population. Spine 2002; 27: 1790–1796.
5. Haldorsen EM, Kronholm K, Skouen JS, Ursin H. Predictors for outcome of a multi-modal cognitive behavioural treatment program for low back pain patients-a 12-month follow-up study. Eur J Pain 1998; 2: 293–307.
6. Haldorsen EM, Indahl A, Ursin H. Patients with low back pain not returning to work. A 12-month follow-up study. Spine 1998; 23: 1202–1207.
7. van der Giezen AM, Bouter LM, Nijhuis FJ. Prediction of return-to-work of low back pain patients sicklisted for 3–4 months. Pain 2000; 87: 285–294.
8. McIntosh G, Frank J, Hogg-Johnson S, Bombardier C, Hall H. Prognostic factors for time receiving workers' compensation benefits in a cohort of patients with low back pain. Spine 2000; 25: 147–157.
9. Klenerman L, Slade PD, Stanley IM, Pennie B, Reilly JP, Atchison LE, et al. The prediction of chronicity in patients with an acute attack of low back pain in a general practice setting. Spine 1995; 20: 478–484.
10. Lehmann TR, Spratt KF, Lehmann KK. Predicting long-term disability in low back injured workers presenting to a spine consultant. Spine 1993; 18: 1103–1112.
11. Lancourt J, Kettelhut M. Predicting return to work for lower back pain patients receiving worker's compensation. Spine 1992; 17: 629–640.
12. Schultz IZ, Crook JM, Berkowitz J, Meloche GR, Milner R, Zuberbier OA, et al. Biopsychosocial multivariate predictive model of occupational low back disability. Spine 2002; 27: 2720–2725.
13. Gallagher RM, Rauh V, Haugh LD, Milhous R, Callas PW, Langelier R, et al. Determinants of return-to-work among low back pain patients. Pain 1989; 39: 55–67.
14. Gatchel RJ, Polatin PB, Mayer TG. The dominant role of psychosocial risk factors in the development of chronic low back pain disability. Spine 1995; 20: 2702–2709.
15. Crombez G, Vlaeyen JW, Heuts PH, Lysens R. Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. Pain 1999; 80: 329–339.
16. Fritz JM, George SZ, Delitto A. The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status. Pain 2001; 94: 7–15.
17. Kool JP, Oesch PR, de Bie RA. Predictive tests for non-return to work in patients with chronic low back pain. Eur Spine J 2002; 11: 258–266.
18. Anema JR, van der Giezen AM, Buijs PC, van Mechelen W. Ineffective disability management by doctors is an obstacle for return-to-work: a cohort study on low back pain patients sicklisted for 3–4 months. Occup Environ Med 2002; 59: 729–733.
19. Linton SJ, Hallden K. Can we screen for problematic back pain? A screening questionnaire for predicting outcome in acute and sub-acute back pain. Clin J Pain 1998; 14: 209–215.
20. Coste J, Delecoeuillerie G, Cohen dL, Le PJ, Paolaggi JB. Clinical course and prognostic factors in acute low back pain: an inception cohort study in primary care practice. BMJ 1994; 308: 577–580.
21. Hagen KB, Thune O. Work incapacity from low back pain in the general population. Spine 1998; 23: 2091–2095.
22. Storheim K, Brox JI, Holm I, Koller AK, Bø K. Intensive group training versus cognitive intervention in sub-acute low back pain: short-term results of a single-blind randomized controlled trial. J Rehabil Med 2003; 35: 132–140.
23. Dalgard OS, Lund HL. Psychosocial risk factors and mortality: a prospective study with special focus on social support, social participation, and locus of control in Norway. J Epidemiol Community Health 1998; 52: 476–481.

24. Statistics Norway. Standard classification of socio economic status. Statistisk Sentralbyrå, Oslo, 1984.
25. Deyo RA, Battie M, Beurskens AJ, Bombardier C, Croft P, Koes B, et al. Outcome measures for low back pain research. A proposal for standardized use. Spine 1998; 23: 2003–2013.
26. Åstrand P-O, Rodahl K. Textbook of work physiology. 3rd edn. New York: McGraw-Hill; 1986.
27. Hyytiainen K, Salminen JJ, Suvitie T, Wickstrom G, Pentti J. Reproducibility of nine tests to measure spinal mobility and trunk muscle strength. Scand J Rehabil Med 1991; 23: 3–10.
28. Biering-Sorensen F. Physical measurements as risk indicators for low-back trouble over a one-year period. Spine 1984; 9: 106–119.
29. Fredriksen H, Dagfinrud H, Jacobsen V, Maehlum S. Passive knee extension test to measure hamstring muscle tightness. Scand J Med Sci Sports 1997; 7: 279–282.
30. Bo K, Hilde G, Storheim K. Intra- and interobserver reproducibility of Cybex EDI 320 measuring spinal mobility. Scand J Med Sci Sports 1997; 7: 140–143.
31. Hosmer DW, Lemeshow S. Applied logistic regression. New York: John Wiley & Sons; 1989.
32. Altman DG. Practical statistics for medical research. 1st edn. London: Chapman & Hall; 1991.
33. Stevenson JM, Weber CL, Smith JT, Dumas GA, Albert WJ. A longitudinal study of the development of low back pain in an industrial population. Spine 2001; 26: 1370–1377.
34. Grotle M, Vollestad NK, Veierod MB, Brox JI. Fear-avoidance beliefs and distress in relation to disability in acute and chronic low back pain. Pain 2004; 112: 343–352.
35. Vlaeyen JW, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain 2000; 85: 317–332.
36. Waddell G, Newton M, Henderson I, Somerville D, Main CJ. A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. Pain 1993; 52: 157–168.
37. Roland M, Morris R. A study of the natural history of back pain. Part I: development of a reliable and sensitive measure of disability in low-back pain. Spine 1983; 8: 141–144.
38. Fairbank JC, Couper J, Davies JB, O'Brien JP. The Oswestry low back pain disability questionnaire. Physiotherapy 1980; 66: 271–273.
39. Haldorsen EH, Wormgoor ME, Bjorholt PG, Ursin H. Predictors for outcome of a functional restoration program for low back pain patients: a 12-months follow-up study. Eur J Phys Med Rehabil 1998; 8: 103–109.
40. Cady LD, Bischoff DP, O'Connell ER, Thomas PC, Allan JH. Strength and fitness and subsequent back injuries in firefighters. J Occup Med 1979; 21: 269–272.
41. Battie MC, Bigos SJ, Fisher LD, Hansson TH, Nachemson AL, Spengler DM, et al. A prospective study of the role of cardiovascular risk factors and fitness in industrial back pain complaints. Spine 1989; 14: 141–147.
42. Cunha IT, Simmonds MJ, Protas EJ, Jones S. Back pain, physical function, and estimates of aerobic capacity: what are the relationships among methods and measures? Am J Phys Med Rehabil 2002; 81: 913–920.