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Prognostic Factors for Chronicity in Lumbar and Cervical Spine Conditions Who are on Compensation

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Abstract

The lifetime prevalence of spinal pain has been reported as 54% to 80%. The costs of chronic disability to the injured worker, his or her family, employers, and society are enormous. Although there have been many epidemiological studies of risk factors for low back pain, there are few risk factors established in prospective.

Various demographic and risk factors and their significances are being discussed. Factors such as work environment, cigarette smoking, educational status, psychosocial factors, Pain interference, presence of chronic sciatic symptoms and duration of symptoms are consistently demonstrated predictors. The purpose of this study is to develop statistical models that accurately predict chronic work disability.

INTRODUCTION

Disability associated with injury-related back or neck disorder is a serious societal problem. Although most injured population return to work quickly, a substantial number do not. The costs of chronic disability to the injured person, his or her family, employers, and society are enormous. In a study of low back claims, 7% of claims for work-related disorders had disability greater than one year, and these accounted for 60% of the costs and 75% of the total disability days [1]. The identification of risk factors that predict chronic disability may also shed light on why some workers develop chronic disability.

In earlier reports, it was noted that lower age, higher education, working full-time and low fear avoidance beliefs each predicted a better outcome of chronic unilateral lumbar radiculopathy [2]. The demographic factor most commonly found to be associated with chronic disability was older age [3,4]. With respect to work-related factors, most studies have found occupation not to be associated significantly with chronic disability [4,5]. However, workplace offer of job accommodations/modifications has been found to be associated with shorter duration of disability [6,7].

Previous studies have also assessed many possible predictors associated with the prognosis of radiculopathy, such as clinical, demographic, psychosocial and radiological findings and treatment modalities [7,8]. Female gender, symptoms of depression and anxiety, psychosomatic symptoms, long-lasting leg pain, carrying heavy loads, and positive nerve stretch tests are among the numerous factors reported to be associated with a less favorable outcome.

Many recent studies that have examined predictors of disability in multivariate models warrant mention. In a recent study [9], psychosocial factors are key to the development of chronic disabling Low back pain in Japanese workers.

In summary, the reviews on predictor studies vary in the use of inclusion criteria and outcome measures, use unclear definitions of success criteria, and assessment been performed by multiple physicians. Identification of prognostic factors for persistent pain and disability are important for better understanding of the clinical course of chronic unilateral lumbar radiculopathy and to assist clinical decision-making. There is a lack of scientific evidence concerning prognostic factors. The aim of this study was to identify clinically relevant predictors in 1001 cases of chronic back/neck ache on Accident Compensation over six months, assessed by a single assessor (V. S. Pai) over the period of 4 years. We included a homogeneous patient sample selected with clear inclusion criteria in a specialized care setting, and clinically relevant outcome measures.

MATERIALS AND METHODS

The study population consisted of clients who file ACC (Accident compensation corporation) claims for their back/neck injuries in New Zealand. All clients were over 6 months on ACC benefit. Exclusion were back or neck related to infective

conditions or tumors. There is no time limit for compensation coverage. The independent medical adviser (IMA) was requested to give his opinion about injury related ongoing symptoms for further benefit entitlement.

The potential risk factors are socio-demographic, smoking, alcohol, medical care, clinical symptom and its intensity grading, psychosocial risk factors: blue, yellow orange and black flags as assessed by the Psychiatrist/ Psychologist/ Occupational physician/pain doctor and the type of treatment (Appendix 1). A complete clinical assessment with history taking including injury mechanism with a standard clinical examination was performed. The consultation also assessed pain, disability, treatment and work status. Claimants rate their average pain intensity in the past week on a 0-10 scale [10]. Pain interference with daily activities and ability to work were assessed using standard proforma [10-12].

In this study, all individuals had CT or MRI to identify any injury related changes for legal purposes. Clients were grouped using an Oswestry Scoring system as Poor, Fair and Good outcome [11] as stated under Appendix I.

Data was recorded on Excel for Mac Version 14.2.5 format and were analysed statistically using Chi Square and their relation to outcome results were defined. The frequency of each risk factor and its 95% confidence interval were calculated for the whole sample and for subgroups of patients.

SUMMARY

Most of the costs linked to the treatment of back pain apply to a small proportion of sufferers experiencing chronic pain symptoms leading to disability [13]. Chronic pain syndrome[7] should be the diagnosis when there is association of psychological, emotional, and social components in chronic pain.

Various factors have been investigated for chronic low back/ neck pain in epidemiologic studies. They have been reported occupational, non-occupational, and psychosocial factors [14,15]. Risk factors in development of chronic backache are: Advanced age/ Males [16], socio-economic group [17], body mass index [18], Blue collar job [16], history of compensation [19,20], initial clinical presentation [21], retaining a lawyer [16], psychosocial [22-24], heavy nature of work and Smoking [18]. Cohen [15] concluded that the risk factors for chronic back pain are predominantly psychosocial and occupational rehabilitation.

Age

The demographic factor most commonly found to be associated with chronic disability is advancing age [24,25]. Back pain has an annual prevalence of 15–30% and rises with increasing age up to 65 years [26]; Age has also been found to have a negative effect on recovery [2,3].

We did not find strong evidence to support an association with age and chronicity of back or neck aches (Table 1), but there was a trend that population over 60 years had more fair to poor outcome. This could be due to underlying pathology of spondylosis than related to injury level. A workplace offer of job accommodations/modifications has been found to be associated with shorter duration of disability [6,7].

Table 1: Age chart [p Value > 0.05].

	Total	Male	Female
<20 years	9	4	5
20-30	122	77	45
30-40	168	112	56
40-50	286	171	115
50-60	266	177	89
60-70	140	85	55
>70	10	10	0
We did not find strong evidence to support an association of chronicity of back/neck and the age group,			

Gender

Female gender, symptoms of depression and anxiety, psychosomatic symptoms reported to be associated with a less favorable outcome [7,8]. The objective was to investigate the influence of sex on the outcome of chronic back/neck pain. Our data analysis (Table 2) suggested that gender was not a risk factor in population of chronic backaches who were on accident compensation.

Ethnical

Chronic back/neck ache are more common among Caucasian population 68·7 per 1000 people than non Caucasian population 38·7 per 1000 people [27]. In our study, there was no statistically significant difference between any groups (Caucasians, Maoris, Asians and Indians) with regards to the chronicity of backache. It appeared from the (Table 3) that there was increased back/neck ache amongst Indians. This was due to the fact that the author was referred with Indian clients, as he could communicate in their local languages.

Relationship status

Living alone has been blamed for the poor outcome [20]. There was no statistically significant difference between different groups "relationship status" with regards to the outcome (Table 4) in chronic backaches on accident compensation. Although chronic aches may be an important reason for family break up, we did not find a statistical significance between living alone and outcome of chronic back/neck ache.

Educational status (Social Class)

It has been suggested [17,25] that individuals from more deprived backgrounds were more likely to develop chronic back/neck pain. Associations between chronic back/neck and social class, low levels of educational and low income have been reported as being present.

Our results of the CHITEST suggested existence of difference between groups of educational status of statistical significance (Table 5). However, postgraduate group was too small to be of statistical significance. From the data analysis it was obvious that patients with secondary education were less likely to have a positive outcome as compared to patients with Tertiary Education. The type of Tertiary Education did not seem to matter substantially.

Table 2: Gender vs Outcome [p Value > 0.05].					
Sex	**Not Known**	**Poor**	**Fair**	**Good**	**Sum**
Male	27	131	134	344	636
Female	15	67	79	204	365
					1001
There was no evidence that the influence of sex on the outcome of back/neck ache.					

Table 3: Ethnic vs Backache [p Value > 0.05].		
Ethnic	**Normal/1000**	**Chronic back ache/1001**
Caucasians	650	704
Maoris	180	180
Chinese	80	17
Indian	40	75
Islander	40	17
Rest	10	8
There was no statistically significant difference between any two race groups with regards to the outcome of back/neck ache.		

Table 4: Relationship Status vs Outcome [p Value > 0.05].					
Status	**UnKnown**	**Poor**	**Fair**	**Good**	**Sum**
Widow	1	4	3	8	16
Single	13	68	66	158	305
Partner	9	22	31	79	141
Married	19	104	113	303	539
					1001
Our study supported that there was no statistically significance in different groups of relationship with regards to the outcome.					

Table 5: Education vs Outcome [p Value <0.05].					
Education	**Unknown**	**Poor**	**Fair**	**Good**	**Total**
Secondary	36	175	178	426	815
Diploma	4	2	14	30	50
Bachelor	2	21	20	84	127
Post grad	0	1	1	8	9
From the data analysis it was obvious that patients with Secondary Education were less likely to have a positive outcome of chronic back/neck ache as compared to those with Tertiary Education [Diploma, Bachelor or Post graduate]					

Urban or rural

Lower rates of health care utilization are reported by rural residents [28]. In NZ (Census of 2001), over 80% of the population lived in urban areas.

Our study interpretation is difficult for various reasons (Table 6)

1. Many chronic back patients get surgically operated in the main centers and therefore outcome is not the real reflection of an urban or rural setting.
2. In rural areas, the job market is limited and it is harder for individuals with chronic back/neck symptoms to return to alternative work.
3. Many individuals with chronic pain prefer to be on ACC related benefits than making an attempt to return to work as returning to alternative work would substantially reduce their earning potential.
4. There is also a barrier for chronic back/neck population to attend multi-disciplinary pain clinics, as this facility is only available in big centres.
5. It is more likely for some individuals with chronic backache to live in sunnier places like Hawkes Bay and Tauranga for life style purposes and they generally do not prefer to move to places where alternative work is available. For these reasons, chronic back/neck ache in relation to Urban/rural in this study was not accurate.

Body mass index has been linked to low back pain with obese people in particular at increased risk of backache [18, 25]. We could not statistically confirm in our findings that there was higher risk of development of chronicity of symptoms in obese population who were on compensation.

Occupation

Andersson [29] reported that patients with a sedentary/sitting occupation had a higher risk to persistent chronic pain. In our study the p-value for all groups of occupations yielded poor evidence against the null hypothesis thus suggesting that there is no difference between clinical outcomes and job types of heavy, medium or light work (Table 7). Therefore factors other than biomechanical issues were the cause for poor and fair results [30]. In our study the p-value for all comparisons with the "not working patients" yielded strong evidence against the null hypothesis. This meant that individuals with "no jobs" were more likely to have a poor outcome.

In our study it was clear that job satisfaction, ability to modify work, social support, financial incentive for alternative work and fears of re-injury were main determinants of disability after chronic back or neck aches at the workplace setting. The lack of exercise, unemployment and the presence of depression were also influencing the recovery process.

Table 6: Urban or Rural vs Outcome [p Value > 0.05].					
Place	**Unknown**	**Poor**	**Fair**	**Good**	**Sum**
Auckland	18	54	73	191	336
Hamilton	5	6	20	41	72
HB	6	14	23	77	120
Hastings	1	4	13	17	35
Tauranga	1	38	11	31	81
Napier	1	10	16	35	62
Gisborne	6	8	23	87	124
Other	3	65	34	69	171
					1001
Interpretation was difficult. Due consideration should be given in interpreting this table as discussed under summary.					

Table 7: Type of work vs outcome [p Value > 0.05].

Job	Unknown	Poor	Fair	Good	Total
Heavy	6	6	13	26	51
Medium	28	105	144	375	652
Light	8	30	41	137	216
None	0	57	15	10	82
					1001

There was no statistically significant difference between groups of Heavy, medium or light work with regards to the outcome of back/neck ache.

Duration of symptoms vs outcome

One study [31] noted that if a worker had not returned to work by 3 months, there was a 50% chance that he or she would not return to work. One could argue that the severity of initial low back injury and physical demands of the job to which one had to return-might have been influencing return to work after 1 year. In a study [30], the data revealed no significant differences between return-to-work and non-return-to-work in individuals on the light versus heavy job categories.

Workplace offer of job accommodations/ modifications has been found to be associated with shorter duration of disability [23,32]. Currently, it is not possible to predict accurately which workers with recent injuries will go on to develop chronic disability [4,26].

In this study, it was clear that with increased duration of symptoms or inability to work was associated with less favourable outcome with respect to return to work (Table 8). If the symptom duration is greater than a year but less than 3 years the chance of returning to original or alternative work was 50%. However, with persistence of pain and inability to work for more than three years, there was less than 5% chance to return to work.

Symptoms: leg or back symptoms and interference

One study [21] has demonstrated that sciatic pain is a significant predictor of no return to work. With persisting sciatic pain, individuals are less likely to return to work. In our study there was strong evidence that individuals with symptoms of back pain with objective radiculopathy had a much poorer recovery rate than individuals with back pain alone (Table 9).

There is a trend among the medical community in New Zealand to treat Group Ia (back ache with subjective sciatica) by certifying individuals with time off work for a year to 18 months for symptoms and presence of an annular tear on an MRI. In our study this group quite often developed psychosocial issues resulting in long-term back/neck syndrome. We strongly recommend that early core strengthening exercises and return to alternative work program is more beneficial than resting for a better outcome. These are specific exercises to strengthen paraxial musculature of the spine and deeper abdominal muscles [33]. We recommend appropriate physiotherapist intervention to understand type of exercises.

Interference

Symptoms were grouped under four grades: Grade I Low pain interference; Grade II High pain intensity with low interference; Grade III High pain intensity with high pain interference; Grade IV Total incapacity.

In this study, there was very strong evidence that individuals displaying interference Grade I had better recovery rate upon comparison with any other interference groups (Table 10). There was very strong evidence that individuals displaying high pain intensity and relying on multiple medications such as Oxynorm, Oxycontin, tramadol or Endone or any other narcotics did poorly.

Influence of injury grade

There have been many epidemiological studies of risk factors for low back pain, there are few risk factors established in prospective studies; and our understanding of them remains relatively crude. Individuals in jobs requiring manual materials handling, particularly repeated heavy lifting and lifting while twisting, are at increased risk of back pain leading to work absence. In addition, exposure to whole-body vibration and job requirements for static postures are associated with back pain [18,34].

In our series 701 of 1001 back pain symptoms were related to either a spontaneous onset or a low velocity injury event. When outcome results were analyzed with the injury grade, the P-value was close to 1 and there was no evidence against the null hypothesis. This suggested that there was no difference for outcome between any given groups with regards the injury grade (Table 11).

Smoking

Leboeuf-Yde [18] conducted a systematic review of

Table 8: Duration of symptoms vs Outcome [p Value < 0.05].

Symptoms duration	Unknown	Poor	Fair	Good	Sum
>6M	27	22	54	345	448
>1Y	6	25	54	84	169
>3Y	3	40	33	43	119
>6Y	6	111	72	76	265
					1001

Initial observation of results of the Chi test suggested that there existed difference between groups of statistical significance. There was very strong evidence that patients with symptom duration less than a year had the best recovery rate.

Table 9: Type of Symptoms vs Outcome [p Value < 0.05].

Symptoms	Unknown	Poor	Fair	Good	Sum
Back/neck ache [B/NA]	28	110	132	399	669
B/NA + Subjective sciatica	4	26	33	72	135
B/NA + Objective Sciatica	10	60	46	71	187
Cauda Equina	0	2	2	6	10

There was strong evidence that patients with symptoms in "Back/neck pain with objective radiculopathy" had a much poorer recovery rate than patients with "Back/neck ache" only group.

Table 10: Interference [p Value < 0.05].

Grade	NA	Poor	Fair	Good	Total
I	18	108	133	401	660
II	20	68	67	140	295
III&IV	4	22	13	7	46

[Grade I Low pain interference; II High pain intensity with low interference; III High pain intensity with high pain interference; IV Total incapacity]

There was very strong evidence that patients displaying Grade I interference had the best recovery rate upon comparison with any other grades of interference.

Table 11: Influence of injury grade Vs the outcome of back pain [p Value > 0.05].

Injury Grade	Unknown	Poor	Fair	Good	Sum
Spontaneous	0	15	17	31	63
High Velocity	0	3	8	8	19
Low Velocity	24	99	119	286	528
Medium Velocity	17	78	67	216	378
Multiple	1	3	2	7	13

There was no difference between any given groups of statistical significance. Therefore velocity of injury at the onset did not help in predicting final outcome.

epidemiologic literature on smoking and low back pain in 47 epidemiologic studies. She reported that statistically significant positive association between smoking and low back pain was noted in 51%. Smoking has been associated with alterations of the levels of neuropeptides that play a role in chronic pain states.

Our results showed that there was a definite link between smoking and outcome of chronic back/neck ache (Table 12).

Alcohol/Drugs

Alcohol/Drugs intake did not appear to affect the outcome. There was no evidence against the null hypothesis (p value>0.05) indicating there was no difference in outcome between any given groups and are not risk factors (Table 13).

Reported Marijuana use might have been under reported and was document in 48 clients. With available information, it's use did not cause significant difference.

Psychological factors

Pincus [35] and Mallen [36] conducting a thorough evaluation of number of important psychosocial variables strongly supported the concept that chronic low back pain disability represents more than just a pure physical disorder. There was a significant and seemingly predominant, psychosocial component that produced the prolonged disability [30]. The MMPI had been evaluated extensively as an assessment device of nonorganic factors influencing the severity of disability and predicting the outcome for chronicity of back ache of various psychological and medical treatments.

Our study (Table 14) was favoring the view that the development of chronic pain and disability depended more on psychosocial factors (black, red and yellow flags) than on physical structural changes as suggested previously [22, 30,34,37]. Although it was not always possible to predict these flags early in the clinical course, an attempt should be made with MMMPI assessment prior to surgical intervention to identify early and modify psychosocial factors. It had been reported that early identification of these factors had an important role in the transition from acute to chronic low backache [24]. Maladaptive attitudes and beliefs concerning back/neck pain, particularly fear-avoidance beliefs, pain-coping strategies, reinforcement of pain behaviors by family members, and job dissatisfaction were important issues to be considered when treating individuals with back/neck pain [25].

The available evidence [38] provides a consistent picture that yellow flags are prominent in the development of disability due to musculoskeletal pain. A systematic review of 45 studies [36] showed that higher pain severity at baseline, longer pain duration, multiple-site pain, previous pain episodes, anxiety or depression, higher somatic perceptions or distress, adverse coping strategies, low social support, older age, higher baseline disability, and greater movement restriction were significant prognostic indicators for poor outcomes. A maladaptive coping strategy was the tendency to nonverbal/motoric expressive

Table 12: Smoking vs Outcome [p Value < 0.05].

	Unknown	Poor	Fair	Good
Ex Smoker	0%	29%	42%	29%
Heavy	0%	28%	26%	46%
Moderate	2%	7%	28%	63%
Light	0%	27%	23%	50%
No	6%	19%	18%	57%

The p value was much lower than 0.05, which meant that there was strong evidence suggesting that there was a difference in outcome between Heavy and Non Heavy Smokers.

Table 13: Impact of drinking Vs Outcome of back pain [p Value > 0.05].

Drinking	Unknown	Poor	Fair	Good	Sum
No	21	65	76	185	347
Light	13	78	63	187	341
Moderate	7	35	52	140	234
Heavy	1	20	22	36	79

There was no difference between any given groups.

Table 14: Effect of psychosocial [p Value < 0.05].

Flags	Definition	Present	Absent
Black flag	Legal, no light work	286	715
Blue flag	Strong belief, Conflict with superior, Belief that work is too onerous	446w	555
Orange flag	Depression, Maniac	182	819
Yellow flag	Waddle signs, Pain behavior, fear avoidance	440	561

The difference in outcome between population with various flags and those without flags was a legitimate pattern and it did suggest significant association of psychosocial factors and poor outcome.

Table 15: Effect of treatment Vs outcome [p Value < 0.05].

Treatment Groups	Unknown	Poor	Fair	Good
I Lumbar discectomy or decompression or fusion	1	18	8	24
II Cervical discectomy or decompression or fusion	8	31	21	32
III Multiple surgeries [42 lumbar ; 4 cervical]	0	35	7	4
IV Non-operative treatment	33	114	174	491
From this data analysis it could be seen that Group 4 [non-operative treatment] produces the most positive result of statistical significance. Group 3 produces overwhelmingly negative results.				

behavior such a groans, twisting of faces, rubbing the painful areas during pain and were more likely to complain of persistent pain at the short- and long-term follow-up [39].

Treatment

It is unclear from literature as to which individuals are the best candidates for fusion versus conservative management when experiencing chronic back or neck pain without significant neurological impairment [40]. Nonsmokers may be more likely to have a favorable surgical fusion outcome in chronic low back pain patients. Presently, the main stay of nonoperative treatment is core strengthening for the low back ache and core stability exercises for chronic neck pain. It can be assumed that the extreme tendency to the avoidance of physical activities leads to a decreased physical fitness and in the long run contributes to a de conditioning syndrome with a poor condition of the trunk muscles, which then causes back/neck pain under normally physiological strain or stress [33, 41]. Norwegian study by Brox [42] suggested no substantial difference in disability when fusion was compared with intensive cognitive intervention and exercise rehabilitation. A British study [43] of LBP (low back pain) treatment found that the pooled mean difference in ODI between the surgical and nonsurgical groups was in favor of surgery, but cautioned about the risk of complications with surgery.

From our data analysis it could be seen that the non-operative group produced the most positive result of statistical significance (Table 15). Surgically treated group produces overwhelmingly negative results. However, this poor outcome in this study should not be interpreted that surgery should not be performed for chronic back/neck ache as the study was based on assessment of individuals who were having persisting pain with or without surgery. Patients with good surgical outcome were not referred to us. It was clear that surgical outcome was not always predictable and when the results following surgery were poor, symptoms following surgery appeared to be worse than those who had been treated non-operatively. A good informed consent, appropriate case selection for surgery and in some situation preoperative MMPI or BDI [44,45] to assess psychological profiles are essential to optimise surgical outcome. Fransen's [23] study showed that 3 months after the initial assessment, 24% still were receiving compensation payments. The natural history of back pain in the population without compensation was however favorable since overall studies showed that 30-60% of patients recover in 1 week, 60-90% recover in 6 weeks and 95% recover in 12 weeks. However, when compensation was present, 20% of the claimants were unable to resume work at 3 months follow-up [21]. Our cohort consisted of all individuals who claim a social insurance benefit and the results must be interpreted within the context of a compulsory ACC scheme and might explain high rate of no return to work.

There are several drawbacks introduced by the study design and method. First, the information given by the patients was an important source of knowledge for the medical adviser and thus it is possible that some patients would respond in a way to mislead the medical adviser. Second, the information in the medical documents obtained from the treating physicians and doctors might have led to biased responses. Finally, our sample is drawn from an ACC compensation population, and hence generalizing our findings to the Non ACC related back aches must be done with caution.

The strength of this study was its prospective design and size of the study assessed by a single independent medical assessor with no conflict of interest, using standardized method. Availability of MRI/CT in all clients and documents of psychological, psychiatric or occupational reports made this study meaningful. Our ability to examine the relevant importance of risk factors influencing "return to work" using statistical analysis was also complementary. In conclusion, our results shed light on the interrelation and contribution of previously identified risk factors for chronic back and neck pain. We suggest that a "psychosocial factor" is the most important risk factor for chronic back/neck ache in countries where compensation covers injury related issues. Among other factors, educational level, patients' job satisfaction and unavailability of light duty work also contribute and must be considered in prospective studies.

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APPENDIX 1

a. Psychosocial factors:

Black flag	Legal, no light work
Blue flag	Strong belief, Conflict with superior, belief that work is too onerous
Orange flag	Depression, Maniac
Yellow flag	Waddle signs, Pain behavior, fear avoidance

b. Interference

Grade I	Low pain interference
Grade II	High pain intensity with low interference
Grade III	High pain intensity with high pain interference
Grade IV	Total incapacity

c. Clinical symptoms were further grouped under:

Type I	Only back or neck ache
Type IA	Subjective radicular symptoms but no objective signs
Type II	With objective radiculopathy
Type III	With cauda equine signs.

d. Clinical Outcome (Oswestry Scoring system)

Good	21-40
Fair	41-60
Poor	61-80

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