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ORIGINAL ARTICLE

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Potential risk factors for prolonged recovery following whiplash injury

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Abstract A retrospective analysis of insurance data was made of 600 individuals claiming compensation for whiplash following motor vehicle accidents. Three hundred randomly selected claimants who had settled their injury claims within 9 months of the accident were compared with 300 who had settled more than 24 months after the accident. We compared the two groups to identify possible risk factors for prolonged recovery, for which settlement time greater than 24 months was a marker. Variables considered included demographic factors, type of collision, degree of vehicle damage, workers compensation, prior claim or neck disability, treatment and time to settlement. Consulting a solicitor was associated with a highly significant, four-fold increase of late settlement of the claim. A concurrent workers' compensation claim, prior neck disability and undergoing physiotherapy or chiropractic treatment were weakly associated with late settlement. The degree of damage to the vehicle (as indicated by cost of repairs) was not a significant predictor of late settlement. Late settlement may be the direct effect of legal intervention, independent of the severity of the injury. Whilst the financial benefit to the claimant of consulting a solicitor is apparent, the benefit of prolonged disability is not. It may be to the advantage of both insurers and claimants if those likely to proceed to late settlement could be recognised early and their claims settled expeditiously.

Keywords Whiplash · Neck injury · Motor vehicle accident · Compensation claim · Legal representation

Introduction

Whiplash is a common injury. In South Australia approximately 4,000 claims for whiplash, at a cost of the order of Australian $50 million, are made annually (for a population of 1.5 million). There is some evidence that the incidence of this condition has increased in recent decades, although it appears unrelated to increased seat belt use [11].

In an extensive review, the Quebec Task Force (QTF) on whiplash-associated disorders has noted that cases are usually self-limited, with a median time to recovery – measured by time to the end of disability compensation – of 31 days. However, a significant fraction exhibited prolonged disability: 10% of the cases studied in the Quebec cohort study were still unable to resume normal activity 200 days post-injury [8]. In a review of studies published since the QTF report, considerable variation has been found in the duration and extent of recovery. Important sources of variation have been the outcome measures used (e.g., settlement of claim, return to work, persistence of symptoms) and the type of insurance system (e.g., tort or no-fault) [3].

It is unclear if protracted disability from whiplash is related to the degree of trauma. In a 1996 review of whi-

plash, Stovner concluded that evidence for a causal link between trauma and chronic symptoms was sparse [9]. Two studies published since have shown predictive effects of some collision factors (e.g., collisions that are not rear-end) but have failed to show any association between crash severity and prognosis [5, 7].

Unexplained prolonged disability and lack of evidence on effective treatment have led to conflicting opinions on the role of psychological factors and litigation. Some studies in countries with differing insurance-payment systems have found evidence that psychosocial and legal issues may increase morbidity following whiplash injury [4, 6]. However, a randomised double-blinded study in Australia has shown a beneficial effect of radiofrequency neurotomy on chronic whiplash patients. This finding led the authors to propose that psychological effects are likely to be a consequence, rather than the cause, of chronic pain following whiplash and that the most likely cause of pain is post-traumatic dysfunction of the cervical zygapophyseal joints [12]. This study attempts to identify risk factors that may predispose to prolonged disability following whiplash injury.

Materials and methods

Records of whiplash claims filed over the period 1993–1996 were obtained with personal identifiers deleted. This data set was divided into two sub-files: (i) claims settled within 9 months of injury and (ii) claims settled more than 24 months after the injury. Subjects with radiological damage to the cervical spine, neurological deficit and/or significant associated injuries were excluded. Three hundred anonymous records were randomly selected from each sub-file.

A series of univariate analyses was conducted for the relationship between late (>24 months) settlement and the following potential predictors: age, sex, occupation, position in the vehicle, type of collision, prior or concurrent workers' compensation claim, prior neck disability, cost of vehicle repair, whether a solicitor was consulted and cost of treatment. The 600 claims were classified into those with and without the potential risk factor, and the relationship between the risk factors and late settlement was estimated as a risk ratio as follows:

Risk ratio=proportion of subjects with risk factor whose claim was settled after 24 months, divided by the proportion of subjects without the risk factor whose claim was settled after 24 months.

Since one-half of the subjects were selected from the "late settlement" category, the expected proportion of subjects with any risk factor who had a late settlement, in the absence of any association between the factor and late settlement, would be one-half, and the risk ratio equal to one. A risk ratio significantly greater than one would therefore suggest that the risk factor increased the risk of late settlement. The statistical significance of the risk ratio was estimated using a chi-square test. In cases where there were more than two categories of predictor variable (e.g., occupation, mode of injury), a chi-square test for homogeneity was applied to determine whether the distribution differed significantly from the expected value.

A comparison was also made of the distribution of certain variables in the groups in the "early settlement" and "late settlement" categories, using non-parametric analyses. Variables found in the univariate analyses to be significantly related to late settlement were entered into a log binomial model to estimate the role of the variables after adjustment for mutual confounding.

Results

Gender

Of the 600 claimants, 63.5% (381) were female, significantly greater than the proportion of males. Fifty-three percent of the women settled their claims after 24 months, compared with 46% of the men. However, the excess of women with late settlement was not statistically significant (risk ratio=1.15, Table 1).

Age

The proportion of claims settled early for each age stratum is shown in Table 2. In most age strata the proportion of subjects whose settlement was late was close to the expected value of 50%. The exception was subjects aged 65 years and over, of whom only 28% settled late. The latter accounts for the χ^2 value for homogeneity of 13.0, *df* (degrees of freedom)=4, p=0.01. There is no obvious trend away from late settlement for age, and non-parametric testing confirmed that age was not a significant predictor for prolonged settlement.

Occupation

The proportion of late claims by occupation is shown in Table 3. There was no significant association with late settlement in any occupational category (p=0.62).

Type of collision

There was significant variation in the proportion of claims settled late between different types of accident (χ^2=17.3,

Table 1 Settlement time by gender

Sex	Early settlement (<9 months)	Late settlement (>24 months)	Total
Male	119	100	219
Female	181	200	381

Risk ratio for late settlement (F/M)=1.15, NS

Table 2 Settlement time by age

Age range (years)	Early settlement (<9 months)	Late settlement (>24 months)	% with late settlement
0–24	70	61	47
25–44	151	147	49
45–54	36	61	63
55–64	22	23	51
65+	21	8	28

Table 3 Settlement time by occupation

Occupation	Early settlement (<9 months)	Late settlement (>24 months)	% with late settlement
Blue collar	79	70	47
White collar	112	126	53
HD	43	37	46
Unemployed	23	21	48
Pensioner	28	24	46
Student	15	22	59

χ^2=0.62, NS.

Table 4 Settlement time by type of collision

Mode of injury	Early settlement (<9 months)	Late settlement (>24 months)	% with late settlement
Rear hit	146	152	51
Front hit	7	28	80
Rear and front hit	43	39	48
Side hit	92	76	45
Rollover	12	5	29

df=4, *p*=0.002). Eighty percent of subjects who had experienced a front-end collision had a late settlement. Only 29% of rollovers had a late settlement, although the number of accidents in this category was small. For rear-end, side-impact and chain collisions the proportion of late settlements was close to the expected value of 50% (Table 4).

Position in vehicle

Of the claimants, 423 were drivers, and 177 were passengers, of whom 145 were in the front seat. None of the positions in the vehicle was predictive of early or late settlement of claim.

Workers' compensation

Only 58 of the 600 claims were subject to workers' compensation, of which 46 (79%) had a late settlement, compared with 52% for non-workers' compensation cases. Thus workers' compensation cases were significantly more likely to have a late settlement (risk ratio=1.5, *p*=0.001). Thirty-five claimants had had a prior workers' compensation claim, but there was no significant association with a history of a prior workers' compensation claim (54% late settlement for those with a previous claim vs 50% with no previous claim). Of employed subjects, the median time off work for those who settled within 9 months was 5 days, compared with 4 days for those who settled late (Kruskal-Wallis χ^2 =0.02, NS).

Table 5 Settlement time by cost of repairs

Cost of repairs	Early settlement (<9 months)	Late settlement (>24 months)	% with late settlement
<$1000	64	54	46
$1000–2500	85	82	49
>$2,500	86	92	52
Written off	65	72	53

Prior neck disability

Of the131 subjects who had a history of neck disability, 58% settled late, compared with 48% for those with no prior neck disability. A history of neck disability was thus predictive of late settlement (risk ratio=1.2, χ^2=4.3, *p*=0.04).

Damage to vehicle

The cost of repairs as an index of vehicle damage was not a predictor of late settlement. As shown in Table 5, there was no trend towards late settlement with increasing cost of repairs, nor was having the vehicle written off associated with late settlement. Whether the vehicle was driveable after the accident was not a significant predictor of late settlement.

Seeking medical attention on the day of accident

Of the 155 subjects attending a hospital on the day of the accident, 58% settled late compared with 47% of the other subjects. Thus, attending hospital on the day of the accident is a weak but statistically significant predictor of late settlement (risk ratio=1.23, χ^2=5.4, *p*=0.02). However, a non-hospital medical consultation on the day of the accident had an opposite association. Of the 144 subjects who saw a doctor other than in a hospital on the day of the accident, 41% settled late, compared with 50% of subjects who were not seen at all on the day of the accident, although the effect was not statistically significant (risk ratio=0.69, χ^2=3.3, *p*=0.07). Overall, attendance at either a hospital or a medical practitioner's rooms on the day of the accident had no association with late settlement (50% late settlement irrespective of attendance).

Attending a physiotherapist or chiropractor

Four hundred seventy subjects attended a physiotherapist some time between the accident and settlement. Those who attended were more likely to settle late (54% vs 32%, risk ratio=1.7, χ^2=20.8, *p*=0.001); but for these subjects, a risk of late settlement was not associated with the length of time between the accident and first consultation. The median time until the physiotherapist was seen was one

week for both those who settled early and those who settled late. At some time between the accident and settlement, 102 subjects attended a chiropractor. Those who attended were more were likely to settle late (63% vs 47%, risk ratio=1.3, χ^2=8.0, p=0.005). Of the subjects who attended a chiropractor, there was a greater time before the first consultation in those who settled late. The median time until the chiropractor was seen was 1 week in those who settled early and 8 weeks in those who settled late.

Consulting a solicitor

Of the 344 subjects settling their claim through a solicitor, 75% settled late, compared with only 17% of those who settled directly with the insurer. Thus there was a highly significant association between consulting a solicitor and likelihood of a late settlement (risk ratio=14.6, χ^2=197, p=0.001).

Total cost

The median total claim cost for the 300 subjects who settled early was Australian $3,907, and for the 300 who settled late the median cost was $19,457. The difference was significant (p=0.001).

Multivariate analysis

The following variables were entered into a log binomial model: nature of collision (front end, rear end, etc.), making workers' compensation claim, prior neck disability, attending a physiotherapist, attending a chiropractor and consulting a solicitor. As shown in Table 6, there was an elevated risk of late settlement associated with making a worker's compensation claim and prior neck disability. However, the elevation was small in each case (1.15 and 1.14, respectively) and of only marginal statistical significance. Attending either a chiropractor or physiotherapist also accounted for increased risk of late settlement. The increases were small (1.16 and 1.30, respectively) but statistically significant. On the other hand, consulting a solicitor was associated with over a 4-fold increase in risk of late settlement, an increase which was highly significant.

Table 6 Results of multivariate analysis (log binomial model) of possible determinants of late settlement

	Relative risk estimate	95% confidence interval	p-value (χ^2)
Mode of injury	0.98	0.94–1.02	0.33
Workers comp claim	1.15	0.99–1.34	0.08
Prior neck disability	1.14	1.00–1.29	0.06
Attended chiropractor	1.16	1.03–1.29	0.01
Attended physiotherapist	1.30	1.05–1.63	0.02
Consulted solicitor	4.13	3.11–5.48	<0.0001

Discussion

Factors identified as presenting a risk of late settlement were front-end collisions, claims involving workers' compensation, history of prior neck disability, undergoing physiotherapy or chiropractic treatment and consulting a solicitor. By far the strongest association was consultation with a solicitor. The degree of damage to the vehicle (as indicated by cost of repairs) was not a significant predictor. Other factors not predictive of prolonged settlement were a history of prior workers' compensation claim, the period off work, occupational category, whether the subject was the driver or a passenger, and early presentation for medical attention.

The association of front-end collision and late settlement is similar to findings of a recent study of Quebec motor vehicle crashes, in which front and side collisions were found to predict delayed recovery [10]. The Quebec Task Force excludes front-end impact from its definition of whiplash [8]. It is plausible that the distinct dynamics of front-end collisions will yield prognostic markers that differ from those of whiplash injury. However, our multivariate analysis eliminated the nature of the collision as a significant predictor of late settlement: correlation analysis showed that this was not due to collinearity between the type of collision and the other variables.

The association of prior neck disability with late settlement is plausible and consistent with findings from other studies [2]. However, multivariate analysis showed this factor to be only weakly predictive of late settlement. Injury subject to a workers' compensation claim was similarly identified in the initial analysis as predictive of late settlement but found in the multivariate analysis to be only weakly predictive. Correlation analysis showed that this was not due to collinearity with consulting a solicitor (i.e., there was no association between having a work-related motor vehicle injury and consulting a solicitor).

A critical question is whether the duration of disability from whiplash injury is related to the severity of injury. The available data did not provide a direct measure of injury severity. The only available index was the cost of vehicle repair. Since the degree of damage to the vehicle and severity of injury are both related to the amount of energy transfer, some correlation is to be expected. Similarly, a delay in settlement beyond 2 years – the outcome variable used in this study – is not necessarily synonymous with prolonged disability. However, a correlation is likely. Cassidy et al. have reported a strong association between intensity of neck pain and level of physical functioning, on the one hand, and time to closure of the claim for whiplash injury, on the other [1]. Our finding of a lack of as-

sociation between crash severity and prognosis is supported by other recently published studies [5, 7]. On the basis of the indirect measures of both injury severity and duration of disability, these results fail to show any relationship between severity of injury and recovery time.

The strong association between consulting a solicitor and late settlement may be interpreted in two ways: (1) the more severe injury cases may consult a solicitor, with the late settlement resulting from prolonged disability due in turn to the severity of injury; or (2) consultation with the solicitor may be a direct cause of prolonged settlement, independent of the severity of injury. Since our findings, albeit based on indirect measures, showed no association between injury severity and duration of disability, we suggest that the late settlement and increased cost of the claim may be the direct effect of legal intervention and independent of the severity of the injury. Whilst the financial benefit to the claimant of consulting a solicitor is apparent, the benefit of prolonged disability is not. It may be to the advantage of both insurers and claimants if those likely to proceed to late settlement could be recognised early and their claims settled expeditiously.

As factors indicative of greater trauma were not predictive of prolonged settlement, we hypothesise that psychosocial factors are more important determinants of outcome. Accordingly, we are now undertaking a prospective study of whiplash injuries, to measure the influence of psychological, social, physical and emotional well-being on the duration of disability.

As discussed above, there are other dimensions of recovery in addition to settlement of injury claim. These include the return to work, need for continuing treatment and ability to perform activities of daily living. Our prospective study employs a variety of such measures of outcome.

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