The Course of Symptoms for Whiplash-Associated Disorders in Sweden: 6-Month Followup Study

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ABSTRACT. ***Objective.*** To describe symptom patterns and the course for recovery in persons with whiplash-associated disorders (WAD) over 6 months after a car collision, and to investigate associated gender differences.

Methods. The study population was based on insurance claimants, 18–74 years of age, who reported WAD after a collision, between January 2004 and January 2005. At baseline and again 6 months later they were asked to complete a questionnaire that included questions about presence and severity of pain and other possible WAD symptoms. It also included measurements of posttraumatic stress as well as anxiety and depression.

Results. A total of 1105 persons were studied. The most common symptoms at baseline after neck pain were reduced cervical range of motion (in 83.9% of men, 82.2% of women), headache (61.0% and 69.3%, respectively), and low back pain (35.9% and 36.1%). Some symptoms were already transient at baseline and symptoms such as neck pain, reduced cervical range of motion, headache, and low back pain decreased further over the 6 months. Baseline prevalence of depression was around 5% in both women and men, whereas posttraumatic stress and anxiety were more common in women (19.7% and 11.7%, respectively) compared to men (13.2% and 8.6%). The majority of all reported associated symptoms were mild at both baseline and followup.

Conclusion. Our findings support that the symptom pattern of WAD and the prevalence for many of the symptoms decreased over a 6-month period. (First Release May 15 2010; J Rheumatol 2010; 37:1527–33; doi:10.3899/jrheum.091321)

Key Indexing Terms:
WHIPLASH INJURIES NECK INJURIES PROGNOSIS COHORT STUDIES

Whiplash trauma is strain of the cervical spine occurring in an acceleration-deceleration movement of the head and spine, for instance in car crashes. The most common direction of impact is rear-end, but the injury also occurs after front and side collisions as well as rollover collisions[1,2]. The Quebec Task Force coined the term whiplash-associated disorders (WAD) in order to move away from the mechanism of the injury and instead describe the consequences of the injury[3]. The Quebec Task Force also suggested a numeric classification system for WAD (Grade 0–4), where grades 1–3 are considered to be symptomatic. Clinically, grades 1 and 2 are the most common, whereas grade 3, the most severe, constitutes only 2%–5% of all acute cases (grade 4 is spinal fracture, thus another diagnosis)[3]. Grade zero is not considered an injury but rather an exposure to the trauma mechanism[4,5]. Neck pain is the cardinal feature of WAD, but reduced range of motion, headache, and other associated pain problems are also reported.

WAD is the most common injury following car collision in many Western countries[6,7]. The annual incidence in Sweden in 1997 was 320 per 100,000 inhabitants[2]. There has been a decrease in the incidence of traffic injuries including WAD in Sweden over the past 5 years[8]. The reasons for this are not known, but the decrease is not due to a reduction in the number of traffic collisions.

Despite many years of research, little is known about objective (structural) damage to the cervical spine and its connective tissues from a whiplash mechanism. A systemic immune response was demonstrated in one study, but after 2 weeks it was normalized, indicating a transient inflammatory process[9]. In addition to these preliminary findings, most studies using diagnostic tests such as magnetic resonance images or radiographs have failed to distinguish WAD from neck pain of other etiology[10].

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Frequency and severity of physical signs and symptoms have been shown to be a predictor of recovery, along with psychological, social, and societal factors[11]. However, most studies describing the prevalence of various symptoms associated with WAD are based on patients from emergency departments or single healthcare providers, precluding the possibility of generalizing to populations outside these settings. A population-based Canadian study described the prevalence of various physical symptoms in addition to neck pain in persons who sustained WAD after a motor vehicle collision[12]. Information on initial whiplash-associated symptoms was collected at the time of filing a personal injury claim to the provincial insurance company, which was within a few days of the collision. The study showed neck pain was only one component of a group of diffuse symptoms after the collision. The male/female prevalence of the most common symptoms at baseline in addition to neck pain were headache (78.4% vs 86.1%), low back pain (61.9% vs 66.6%), dizziness (41.4% vs 48.3%), and numbness/tingling or pain in arms/hands (37.8% vs 46.4%). However, symptom duration was not ascertained, therefore no conclusions can be drawn about the symptom course (i.e., to what extent such symptoms are transient or long-lasting). Before we can draw firm conclusions about the prevalence and initial pattern of symptoms, there is also a need to confirm these findings in another population.

The objectives of our study were to describe the prevalence and course of commonly reported whiplash-related symptoms over a period of 6 months from the injury, and to describe the prevalence of self reported "poor" psychological health within 30 days of the collision; and to investigate if the prevalence of symptoms is different between the sexes.

The study was approved by the Regional Committee on Ethics at Karolinska Institutet, Stockholm.

MATERIALS AND METHODS

Our study was based on a prospective cohort of incident cases of personal injury claimants, age 18–74 years, who reported an injury to Trygg-Hansa or Aktsam, 2 traffic insurers in Sweden who had about 20% of the market share of traffic insurance in 2004. The inception time for the study was between January 15, 2004, and January 12, 2005. Car occupants who were injured in a motor vehicle collision were asked to answer a questionnaire at baseline and then again 6 months later, providing there was no fatal injury to any car occupant.

Persons included in the study were those who answered the questionnaire within 30 days of the collision and who reported WAD (as defined below). Persons with fractures, those who were hospitalized more than 2 days, and those who reported more than one injury claim to the insurers during the study period were excluded. In order to make comparisons between baseline and followup, we also excluded those who did not complete the followup questionnaire.

Information about new claimants was sent from the insurance companies to the research group at Karolinska Institutet on a weekly basis and a questionnaire was posted to the eligible claimants the following day. The questionnaire collected baseline data on demographic factors, preinjury health status, type of injury, presence and severity of symptoms after the collision, measurements of pain (intensity and location), and measurements to identify posttraumatic stress, anxiety and depressive symptoms.

Similar information was collected after 6 months. Those who reported a complete recovery at followup were considered to have no symptoms.

Definition of WAD. WAD was defined as an injury to the neck without fracture and was quantified as a response of "yes" to either of the 2 following questions: "Do you have or have you had pain/ache in the neck due to the accident?" or "Do you have or have you had reduced neck movement that you relate to the accident?".

Outcomes. The prevalence of 10 potential symptoms of WAD (neck pain, headache, low back pain, reduced cervical range of motion, numbness/tingling in hands/arms, numbness/tingling in feet/legs, ringing in the ears, memory problems, concentration problems, and dizziness) was measured with "yes/no" questions. Intensity of neck pain, headache, and low back pain was measured using numerical rating scales (0–10). The other 7 symptoms were measured with a 5-point Likert scale with response options ranging from "none" to "unbearable." We also assessed the prevalence of posttraumatic stress with the Impact of Event Scale[13] including the 2 domains of avoidance and intrusion. Anxiety and depressive symptoms were assessed with the Hospital Anxiety and Depression Scale (HADS)[14]. Baseline scores are reported for the 3 latter symptoms, whereas baseline and 6-month followup results are reported for the 10 other symptoms.

Statistical analysis. Results are presented as frequencies and proportions (percentages) and for continuous variables we calculated means and standard deviations. All statistical analyses were performed using SPSS version 17.0 (SPSS Inc., Chicago, IL, USA) and appear in chi-square test form for nominal and ordinal data and in one-way analysis of variance for scale-level data. Due to the risk of type II error from multiple testing, i.e., falsely rejecting the null hypothesis, we chose a more conservative p value of 0.01 for achieving statistical significance.

An attrition analysis was carried out by multivariable logistic regression to assess important differences between responders and nonresponders at baseline. In this analysis we included the information we had on all eligible subjects: age, sex, and whether they completed their claim or not. We considered both those who completed the baseline questionnaire and those who responded and reported they were uninjured to be responders.

RESULTS

Questionnaires were sent to 3927 persons who had reported an injury after a car collision. Of these 2496 (64%) returned the questionnaire; 436 of them were uninjured and 114 were outright refusals. Of the remaining 1946 who completed the questionnaire, 1571 reported WAD. Due to the other inclusion/exclusion criteria for the study we included 1005 in the analysis (Figure 1). The average number of days from the collision to completion of the baseline questionnaire was 18.2 (SD 6.6) and the number of days between collision and completion of the followup was 206.8 (SD 18.9).

Table 1 shows demographic and prior health factors by sex. Men represent 40.4% of the total sample and more often reported their health prior to collision to be excellent than women. Men also reported less frequent pretrauma neck pain and headache.

Table 2 describes the collision-related characteristics, initial healthcare provider, postcollision pain intensity, posttraumatic stress, and anxiety and depressive symptoms. The only significant difference between sexes in terms of collision characteristics was location in the car at the time of the collision; the front seat passenger was more often a woman,

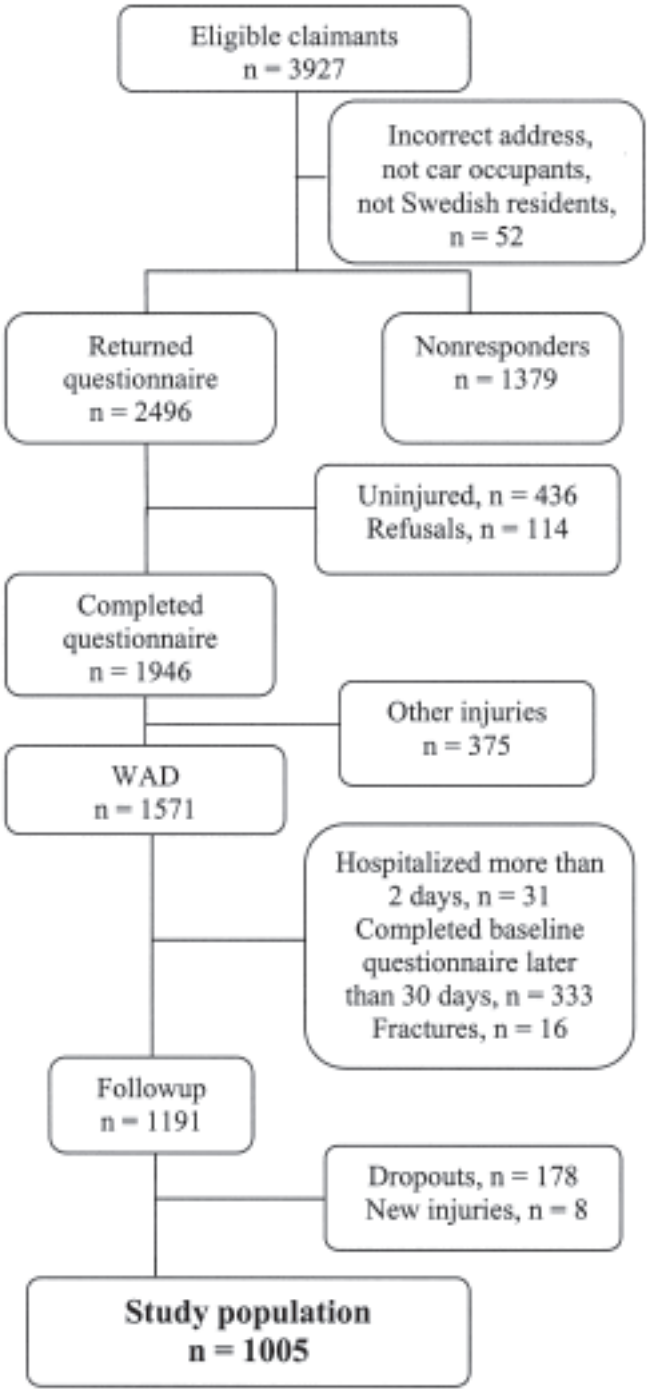

Figure 1. Selection of subjects for the study.

and the driver more often a man. Slightly less than half the participants had sought initial care at an emergency ward. These persons had more symptoms in all categories at baseline and were also less likely to have recovered at the time of followup (all statistically significant at the p = 0.01 level; data not shown). There were no sex differences for levels of current neck or low back pain intensity or in the prevalence

Table 1. Subjects' baseline characteristics (n = 1005). Values are n (%) unless specified.

Variables	Men*, 406 (40.4)	Women*, 599 (59.9)	p
Demographic factors			
Age, yrs			
18–29	97 (23.9)	150 (25.0)	NS
30–39	122 (37.7)	202 (33.7)	
40–49	93 (22.9)	130 (21.7)	
50 and over	94 (23.2)	117 (19.5)	
Education			
Less than high school	60 (14.8)	73 (12.2)	NS
High school	223 (55.1)	283 (47.4)	
University	122 (30.1)	241 (40.4)	
Prior health factors			
General health the month before motor vehicle collision			
Excellent	218 (54.0)	237 (39.6)	0.000
Very good	105 (26.0)	202 (33.8)	
Good	58 (14.4)	123 (20.6)	
Fair	14 (3.5)	28 (4.7)	
Poor	9 (2.2)	8 (1.3)	
Neck pain the month before motor vehicle collision			
Never	313 (77.1)	358 (59.8)	0.000
Sometimes	84 (20.7)	213 (35.6)	
Very often	2 (0.5)	18 (3.0)	
Every day	7 (1.7)	10 (1.7)	
Headache the month before motor vehicle collision			
Never	284 (70.0)	339 (56.6)	0.000
Sometimes	119 (29.3)	242 (40.4)	
Very often	2 (0.5)	15 (2.5)	
Every day	1 (0.2)	3 (0.5)	

* Total number differs due to missing data.

of depressive symptoms. However, significant differences in intensity of headache as well as posttraumatic stress and anxiety were found, with higher levels in women.

Course of symptoms. Significant differences between men and women were noted for headache, numbness/tingling in arm/hand, dizziness, and memory and concentration problems at baseline, with women reporting these problems more than men (Table 3). Nearly all reported to have or to have had neck pain after the accident (98.3% in men and 99.3% in women), but when they completed the baseline questionnaire the prevalence had decreased to 81.4% and 84.7%, respectively (with 44% and 45% reporting any neck pain at followup). Headache and reduced cervical range of motion of the neck had a similar course of recovery.

The difference between frequency of each of the symptoms at baseline and at followup was significant for neck pain, headache, low back pain, and reduced cervical range of motion in men and women. In men there was a significant increase in frequency of memory problems, from 6.7% to 12.6% (Table 3). However, the frequencies of other associated symptoms remained similar to baseline measures. Additional stratified analysis showed that around 50% of subjects who had any of numbness in the arms or legs, ring-

Table 2. Baseline collision and injury related characteristics (n = 1005). Values are n (%) unless specified.

Variables	Men*, 406 (40.4)	Women*, 599 (59.9)	p
Location in vehicle			0.000
Driver	363 (89.4)	451 (75.3)	
Front seat passenger	31 (7.6)	106 (17.7)	
Back seat passenger	11 (2.7)	42 (7.0)	
Do not know	1 (0.3)	0	
Direction of impact			NS
Front	85 (20.9)	162 (27.0)	
Rear	233 (57.4)	326 (54.4)	
Driver's side	42 (10.3)	47 (7.8)	
Passenger's side	19 (4.7)	24 (4.0)	
Rollover	25 (6.2)	39 (6.6)	
Do not know	2 (0.5)	1 (0.2)	
Head position			NS
Straight ahead	239 (58.9)	363 (60.3)	
Turned to the side	118 (29.1)	148 (24.7)	
Do not know	49 (12.1)	87 (14.5)	
Injury-related characteristics			
Initial healthcare provider			NS
None	57 (14.1)	57 (9.5)	
Emergency ward	187 (46.3)	297 (48.6)	
Other medical doctor	149 (36.8)	243 (40.6)	
Physiotherapist	2 (0.5)	1 (0.2)	
Chiropractor	1 (0.2)	0 (0)	
Naprapath	5 (1.2)	3 (0.5)	
Osteopath	1 (0.2)	0 (0)	
Massage therapist	2 (0.5)	1 (0.2)	
Other (health service online, etc.)	1 (0.2)	3 (0.4)	
Pain intensity (NRS) at baseline, mean (SD)			
Neck pain	2.89 (2.40)	3.15 (2.43)	NS
Headache	1.65 (2.42)	2.06 (2.56)	0.012
Low back pain	1.21 (2.24)	1.23 (2.25)	NS
Posttraumatic stress (IES)			0.005
No (IES < 26)	348 (86.8)	447 (80.3)	
Yes (IES ≥ 26)	53 (13.2)	117 (19.7)	
Anxiety (HADS-A)			0.006
No anxiety < 8	337 (83.0)	447 (74.6)	
Borderline 8–10	34 (8.4)	82 (13.7)	
Anxiety ≥ 11	35 (8.6)	70 (11.7)	
Depressive symptoms (HADS)			NS
No depression < 8	350 (86.8)	518 (87.5)	
Borderline 8–10	31 (7.7)	49 (8.3)	
Depression ≥ 11	22 (5.5)	25 (4.2)	

* Total number differs due to missing data. NRS: Numerical Rating Scale 0–10; IES: Impact of Event Scale; HADS: Hospital Anxiety Depression Scale.

ing in the ears, dizziness, or concentration or memory problems when completing the baseline questionnaire also reported those symptoms at followup.

Figures 2 and 3 illustrate the frequency and severity of the different symptoms at baseline (Figure 2) and at followup (Figure 3). Reduced cervical range of motion was reported more commonly than other symptoms. When symptoms were reported they were more often of mild or moderate severity, independent of the type of symptom and independent of whether it was measured at baseline or at followup.

Attrition analysis. The most important factor associated with being a nonresponder was having a noncompleted insurance claim. This implies that there was either no injury or that the injury was transient, with the claimant not seeking any healthcare. Other factors associated with nonresponse were being male and being < 40 years of age.

DISCUSSION

Our findings indicate that there is a common pattern of symptoms beyond neck pain in persons with WAD. This was suggested more than a decade ago by the Quebec Task Force, when they introduced the term whiplash-associated disorders, but the magnitude of symptoms other than neck pain was not shown until recently in a Canadian study[12]. The findings from our study showed a pattern similar to the Canadian findings, but the prevalence of many of the symptoms besides neck pain was lower in our study population compared to the study by Ferrari, *et al*[12]. For instance, the prevalence of low back pain in the Canadian study was around twice as high as in our study, as were numbness/tingling in legs and dizziness. The prevalence of other symptoms, such as concentration and memory problems, was more similar to the results in the Canadian study, and for both studies the most common symptoms other than neck pain were headache, low back pain, numbness/tingling in arm/hand, concentration problems, and dizziness. However, after an average of 18 days following the collision (the average time to completion of the first questionnaire), a decrease in symptoms was reported in our study. To what extent similar associated symptoms are also present in other types of traffic injuries remains to be assessed.

While many symptoms were transient, numbness/tingling in either arm/hand or leg/foot, ringing in the ears, and memory and concentration problems did not decrease as much during the followup time as other symptoms. It is possible that such symptoms are more common in severe cases, which are less likely to experience recovery within 6 months.

There was a significant difference between women and men for some symptoms. We found that women reported more headache, numbness/tingling in arm/hand, dizziness, and memory and concentration problems at baseline. However, the only statistically significant symptom difference between sexes was dizziness (more prevalent in women) at followup. The reason for this is not clear. It may be due to differences in reporting behavior or in deciding whether to participate in a study or not. In our study, men were more likely not to participate compared to women. Those who did participate might have been less likely to recover, whereas such a selection bias would be smaller in women. The potential gender differences in the course of recovery should be assessed in future studies with use of multivariable techniques.

Table 3. Frequency of symptoms after the collision at baseline and at followup (men = 406, women = 599). Data in bold type denote that differences in frequency between having current symptoms at baseline and symptoms at followup are significant ($p < 0.01$).

Symptoms After the Collision	Baseline* Have/Had Symptoms (yes/no), n (%)			Baseline* Currently Have Symptoms (yes/no), n (%)			Followup* Have Symptoms (yes/no), n (%)		
	Men	Women	p	Men	Women	p	Men	Women	p
Neck pain	399 (98.3)	595 (99.3)	NS	329 (81.4)	505 (84.7)	NS	**178 (44.0)**	**269 (45.0)**	NS
Headache	247 (61.0)	414 (69.3)	NS	180 (44.6)	320 (53.6)	0.006	**107 (26.5)**	**171 (28.6)**	NS
Low back pain	145 (35.9)	216 (36.1)	NS	129 (31.9)	183 (30.7)	NS	**82 (20.2)**	**108 (18.2)**	NS
Reduced cervical range of motion	338 (83.9)	513 (86.2)	NS	287 (71.2)	437 (73.2)	NS	**155 (38.2)**	**244 (40.8)**	NS
Numbness/tingling in arm/hand	88 (21.9)	202 (33.9)	0.000	72 (17.9)	163 (27.3)	0.001	85 (21.0)	143 (24.0)	NS
Numbness/tingling in leg/foot	24 (6.0)	42 (7.0)	NS	21 (5.2)	38 (6.4)	NS	38 (9.4)	43 (7.2)	NS
Ringing in ears	48 (11.9)	83 (13.9)	NS	42 (10.4)	62 (10.4)	NS	54 (13.3)	71 (11.9)	NS
Memory problems	30 (7.5)	84 (14.1)	0.001	27 (6.7)	72 (12.1)	0.005	**51 (12.6)**	82 (13.8)	NS
Concentration problems	77 (19.2)	156 (26.3)	0.009	59 (14.6)	129 (21.6)	0.006	72 (17.8)	110 (18.5)	NS
Dizziness	70 (17.4)	177 (29.7)	0.000	55 (13.6)	133 (22.3)	0.001	53 (13.1)	118 (19.9)	0.006

* Total number differs due to missing data.

The recruitment process was very similar in our study and that by Ferrari, *et al*[12], except that the questionnaire in the Canadian study was completed in addition to the insurance injury form, whereas our questionnaires were strictly separated from the claims process and were sent by mail to the claimants within a week of their claim receipt by the insurer. The influence of this is likely to be significant, but difficult to evaluate. It is possible that the Canadian claimants could have reported exaggerated symptom prevalence and symptom intensity because they were reporting it directly to their insurance company, compared to the Swedish claimant's report given to researchers with anonymity. On the other hand, the Swedish claimants might have been more eager to report minor and transient injuries compared to Canadian claimants. However, the injury/collision rate was approximately 17 in 100 collisions in 1994 and decreased to just below 12/100 in 1995 after the change in insurance legislation in Saskatchewan (Saskatchewan

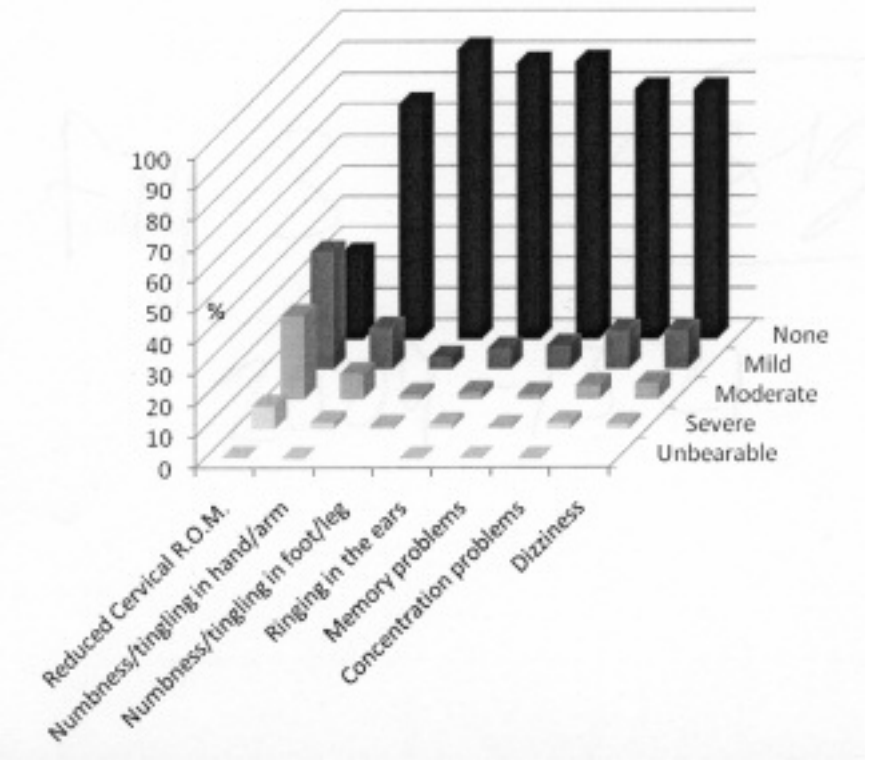

Figure 2. Frequencies and severity of symptoms at baseline, measured with a 5-grade Likert scale (n = 1005). ROM: range of motion.

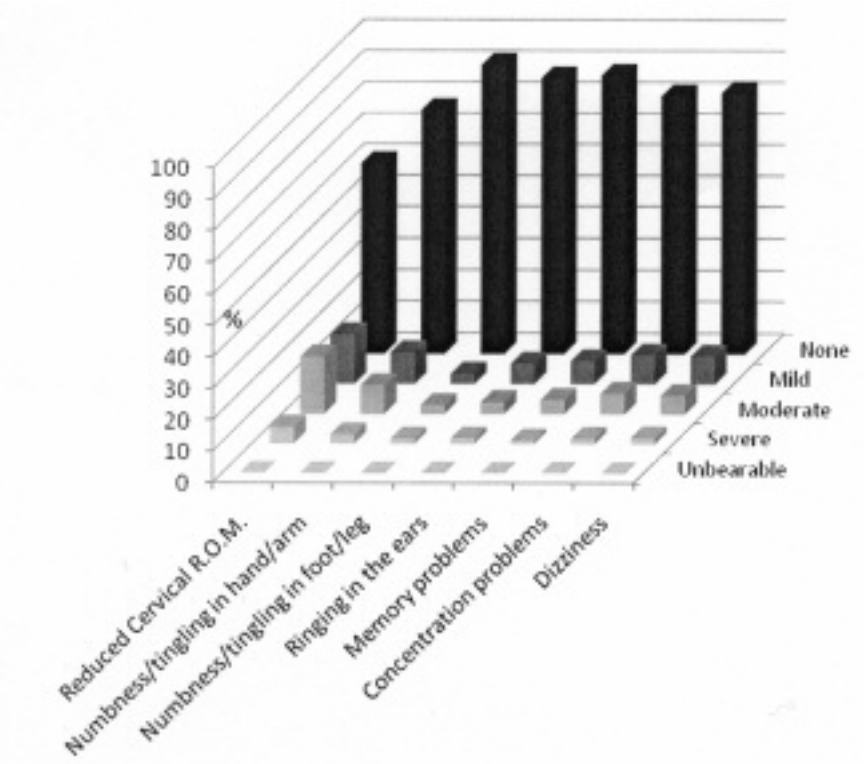

Figure 3. Frequencies and severity of symptoms at 6 months, measured with a 5-grade Likert scale (n = 1005). ROM: range of motion.

Government Insurance 2007; personal communication), similar to the rate for all Swedish traffic insurers (11.6 per 100 collisions in 2004)[8].

In the case of traffic injuries, the Swedish compensation system differs from the North American compensation system in that it is a mix of a no-fault system (all passengers and drivers are entitled to compensation independent of fault) and a tort system (where only persons not at fault are entitled to compensation and non-economic benefits such as for pain and suffering and disfigurement can be paid). However, the Swedish compensation system has a strict practice for benefits such as pain and suffering, and the amounts are substantially lower than under the North America systems (i.e., a WAD injury payment normally falls between US $100 and $600). In addition, medical expenses and payment for income replacement are paid out, and in the case of longterm incapacity and pain compensation, payment amounts for medical impairment depend on the age of the injured person and the degree of medical impairment. The latter is also strictly regulated according to practice.

The prevalence of depression and depressive symptoms in our study is in keeping with the prevalence of all types of depressions in the Swedish population (the PART study, where the one-month prevalence was found to be 9.8%)[15]. Our study could not confirm the finding from a previous cohort study of WAD claimants in Canada that 42.3% of claimants reported depressive symptoms within 6 weeks of the injury[16]; our results showed a 4.7% prevalence of depression across sexes and another 8.0% who were classified as borderline cases for depression. In the Canadian study the initial questionnaire was completed a median of 11 days postinjury, which is very similar to our 18 days. Depression scores at baseline were not associated with the time between the injury and completion of the questionnaire in either study. Both studies recruited study participants from injury claims, and although the measurements of depressive symptoms were slightly different (Centre for Epidemiological Studies–Depression Scale in the study by Carroll, *et al*[16] and HADS-D in our study), this cannot explain the large difference in the prevalence rate. It is possible that Canadian claimants perceive more psychological stressors in communication with insurers and healthcare providers than those in Sweden. There are also possible cultural differences in the way information and reassurance of the recovery process is mediated in these communications.

The strengths of our study are that it is population-based and was designed in a way that makes it comparable to the Canadian study. We excluded persons with fractures because the risk of symptoms due to fractures would interfere with symptoms due to WAD. We measured the post-injury prevalence of symptoms as well as subjects' current symptoms when responding to the baseline questionnaire, which indicated whether the symptom was transient at an early stage.

One limitation of this study is that the overall response rate was 64%, making it somewhat difficult to generalize

descriptive findings beyond the study group. In the nonresponder analysis we found that those who did not participate were more likely not to have completed the injury claim. This supports the hypothesis that nonresponders had a transient injury or no injury to a larger extent. In this case, our results are likely to be overestimated. The dropout rate for the followup was 15%, which may be a potential source of selection bias in the study. We examined the baseline distribution and intensity of symptoms for all 1191 claimants who responded to the baseline questionnaire and compared these with the study sample of 1005 who responded to both questionnaires. This additional sensitivity check showed that there were no differences in the prevalence of any of the symptoms at baseline. However, there might still be a difference in the course of symptom recovery between those who dropped out and the responders. Another weakness of the study is that we did not have accurate information about precollision health conditions. It has been suggested that study subjects, for instance, underestimate the presence of previous neck pain when they have new onset of neck pain after a collision[17]. Recurrent neck pain prior to a collision may be a risk factor for the onset of WAD[18], but also a prognostic factor for prolonged symptoms after WAD (although this evidence is not consistent)[2,11,19]. In studies on the course of neck pain in the general and working populations, most analyses confirm that over 50% of persons with neck pain will report neck pain up to one year later[20,21]. The design of our study did not allow conclusions about the cause of symptoms.

Our findings support the complex symptom pattern of WAD. Most symptoms decreased over a 6-month study period, but the most common symptom, neck pain, was still reported in 43%–45% of the study population at 6 months after the collision. WAD symptoms were more commonly reported in women at baseline, but no gender differences were seen at followup, with the exception of dizziness, which was more prevalent in women. Most symptoms were reported to be mild or moderate at baseline as well as at followup.

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REFERENCES

1. Holm LW, Carroll LJ, Cassidy JD, Ahlbom A. Factors influencing neck pain intensity in whiplash-associated disorders in Sweden. Clin J Pain 2007;23:591-7.
2. Sterner Y, Toolanen G, Gerdle B, Hildingsson C. The incidence of whiplash trauma and the effect of different factors on recovery. J Spinal Disord Tech 2003;16:195-9.
3. Spitzer W, Skovron M, Salmi L, Cassidy J, Duranceau J, Suissa S, et al. Scientific monograph of the Quebec Task Force on whiplash-associated disorders: redefining "whiplash" and its management. Spine 1995;15 Suppl:1S-73S.
4. Hartling L, Brison RJ, Ardern C, Pickett W. Prognostic value of the Quebec Classification of Whiplash-Associated Disorders. Spine 2001;26:36-41.
5. Suissa S, Harder S, Veilleux M. The relation between initial symptoms and signs and the prognosis of whiplash. Eur Spine J 2001;10:44-9.
6. Cassidy JD, Carroll LJ, Cote P, Lemstra M, Berglund A, Nygren A. Effect of eliminating compensation for pain and suffering on the outcome of insurance claims for whiplash injury. N Engl J Med 2000;342:1179-86.
7. Berglund A, Alfredsson L, Jensen I, Bodin L, Nygren Å. Occupant- and crash-related factors associated with the risk of whiplash injury. Ann Epidemiol 2003;13:66-72.
8. Personal injury claims statistics 2008. Stockholm: Swedish Insurance Association [Svensk försäkring i siffror]. [Internet. Accessed April 8, 2010.] Available from: http://www.forsakringsforbundet.com/upload/pdf-filer/statistikfolder/svfolder_08.pdf
9. Kivioja J, Özenci V, Rinaldi L, Kouwenhoven M, Lindgren U. Systemic immune response in whiplash injury and ankle sprain: elevated IL-6 and IL-10. Clin Immunol 2001;101:106-12.
10. Nordin M, Carragee EJ, Hogg-Johnson S, Weiner SS, Hurwitz EL, Peloso PM, et al. Assessment of neck pain and its associated disorders: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine 2008;33 Suppl:S101-22.
11. Carroll LJ, Holm LW, Hogg-Johnson S, Cote P, Cassidy JD, Haldeman S, et al. Course and prognostic factors for neck pain in whiplash-associated disorders (WAD): results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine 2008;33 Suppl:S83-92.
12. Ferrari R, Russell AS, Carroll LJ, Cassidy JD. A re-examination of the whiplash-associated disorders (WAD) as a systemic illness. Ann Rheum Dis 2005;64:1337-42.
13. Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: a measure of subjective stress. Psychosom Med 1979;41:209-18.
14. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. Acta Psychiatr Scand 1983;67:361-70.
15. The Swedish Council on Technology Assessment in Health Care. Report 166. Treatment of depression. A systematic literature review, Vol. 1, 2004. Stockholm: Swedish Council on Technology Assessment in Health Care.
16. Carroll LJ, Cassidy JD, Cote P. Frequency, timing, and course of depressive symptomatology after whiplash. Spine 2006;31:E551-6.
17. Don AS, Carragee EJ. Is the self-reported history accurate in patients with persistent axial pain after a motor vehicle accident? Spine J 2009;9:4-12.
18. Wiles NJ, Jones GT, Silman AJ, Macfarlane GJ. Onset of neck pain after a motor vehicle accident: a case-control study. J Rheumatol 2005;32:1576-83.
19. Kivioja J, Jensen I, Lindgren U. Early coping strategies do not influence the prognosis after whiplash injuries. Injury 2005;36:935-40.
20. Carroll LJ, Hogg-Johnson S, Cote P, van der Velde G, Holm LW, Carragee EJ, et al. Course and prognostic factors for neck pain in workers: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine 2008;33 Suppl:S93-100.
21. Carroll LJ, Hogg-Johnson S, van der Velde G, Haldeman S, Holm LW, Carragee EJ, et al. Course and prognostic factors for neck pain in the general population: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine 2008;33 Suppl:S75-82.