For men's opinions are accepted in the trains of ancient beliefs, by authority and on credit, as if they were religion and law. They accept by rote what is commonly held about it. They accept this truth, with all its structure of apparatus and arguments and proofs, as a firm and solid body, no longer shakable, no longer to be judged. On the contrary, everyone competes in plastering up and confirming this accepted belief with all the power of their reason, which is a supple tool, pliable, and adaptable to any form. Thus the world is soaked with twaddle and lies.

—Frame D. M., trans. Apology for Raymond Sebond. In: The Complete Works of Montaigne. Stanford, CA: Stanford University Press; 1957:403.

University of Alberta

Symptom Expectation and Attribution in Whiplash-Associated Disorders

by

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DEDICATION

Dedicated to all the workhorses, pack mules, sled dogs, slaves, and mischievous children who suffered a whip's lash, with no chance to litigate.

ABSTRACT

Introduction: Little is known about the effect of beliefs on whiplash-associated disorders.

Objective: To assess population beliefs regarding whiplash injury, to assess expectation as a predictor of recovery; to explore symptom attribution (Study III); and, assess the relationship between the Whiplash Disability Questionnaire (WDQ) and self-assessed recovery.

Materials and Methods: Canadian residents were surveyed about whiplash injury; a whiplash cohort was assessed for association between expectations of recovery and recovery; whiplash patients were examined to correlate auditory symptoms and cerumen occlusion; and, Whiplash patients were asked a global recovery question and results compared to the whiplash Disability Questionnaire (WDQ).

Results: Beliefs about whiplash injury were more negative. Expectations of recovery from injury increases the recovery rate. Cerumen explains auditory symptoms in whiplash patients. Patients responding 'yes' to the recovery question had a low WDQ score.

Conclusions: Population beliefs, expectations of recovery and symptom attribution are important in whiplash-associated disorders.

Key words: neck injury, whiplash injury, whiplash-associated disorders, traffic collisions, symptom expectation, recovery

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I would like to thank all of my co-authors and thesis supervisors from whom I have the great honour of learning.

I would like to thank in particular Dr. Anthony Science Russell, whose middle name really is Science, and who has mentored me for more years than either of us will admit.

I would like to thank my children for repeatedly expressing the belief that I know everything.

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LIST OF ABBREVIATIONS

BBQ	Back Beliefs Questionnaire
CES-D	Centre for Epidemiologic Studies Depression Scale
PDI	Pain Disability Index
WAD	Whiplash-Associated Disorders
WDQ	Whiplash Disability Questionnaire

INTRODUCTION

Whiplash-associated disorders are an important public health problem[1] as the diagnosis is made on the order of 100,000 times per year in Canada, resulting in over a billion dollars per year in treatment and disability costs. Studies in Canada indicate that 30-50% of whiplash patients will experience pain for at least 6 months after the collision, resulting in a significant impact on overall quality of life.[1] Additionally, patients will consume, on average, thousands of dollars of treatment and disability benefits.

The biopsychosocial model for whiplash has been proposed for some time[1], and does not exclude the possibility of pathology and pathophysiologic processes in chronic pain. It has been argued, for example, that there are injuries which do produce ongoing pathology and pain, such as injuries to the facet joints of the spine, and that, in addition, psychosocial factors modify the clinical presentation and recovery from these injuries.[2, 3] This argument does appear to be reproducible in select populations (i.e., tertiary care referral populations, with well-localized neck pain, few other symptoms, and low levels of psychological distress), but has been difficult to generalize to other clinical populations, where the whiplash-associated disorders include a multitude of other symptoms, widespread pain and high levels of, for example, depression. Studies of facet joint injections for neck pain in these latter populations have not confirmed the effectiveness of this approach.[4] Others have argued that the initial injury itself resolves, but that in some individuals nociception continues in the absence of a

peripheral stimulus, and chronic pain develops as a form of central sensitization of the nervous system, maintaining pain and other symptoms.[5] This approach again appears to have again arisen from studies of select populations (i.e., tertiary care physiotherapy referral populations, with well-localized neck pain, few other symptoms, and low levels of psychological distress), and remains challenged by the need to explain why these processes are not evident in other countries where the whiplash injury is common, but chronic pain as a complication of the injury is very uncommon, and why social or system interventions (i.e., legislative changes) can have so profound an effect on self-reported recovery.[6] There is some evidence that those with a more serious injury (i.e., WAD with radiculopathy - Grade III) have longer recovery than those without radiculopathy.[7] Also, whiplash victims with greater initial symptom severity and more initial symptoms have a longer and/or less complete recovery than those with fewer and less severe symptoms.[7] Whether more pain or more symptoms reflects pathology or not is unclear, because as yet there are no objective measures of the pathology that underlies most soft-tissue injuries. Pain and symptoms, as well, are likely influenced by emotional factors, and thus do not readily help to discern the effects of pathology on recovery.

It appears that whatever pathology or pathophysiological processes operate to produce symptoms in whiplash patients, this knowledge does not address the more complex social processes of perceptions of recovery and disability, and indeed, even pathophysiologic processes appear to be influenced

by social determinants.[8] For this reason, in recent years, psychological and social determinants of recovery have warranted further attention.

In fact, ten years ago it was commented that the concept of chronic whiplash as an injury was "an example of illness actually induced by society, in general, and by physicians in particular."[1] Subsequent data have shown it is an "injury" like no other, very much not in keeping with the effects of a localized disorder.[9] Secondly, the outcome of the acute injury depends where you live. That is, the acute whiplash injury, though not objectively demonstrable, appears to produce symptoms wherever there are cars and collisions, but when those with an acute whiplash injury develop chronic pain, that chronic pain is attributed to the collision event in some cultures and not in others. For example, in Lithuania, Germany, and Greece, victims of motor vehicle collisions appear to report recovery within weeks to months rather than years.[10,11] Engineers have shown that the prognosis of acute whiplash, when analyzed in the context of traumatic principles and crash severity, is independent of injury severity.[11] Culture, not crash, remains the best determinant of outcomes.[11] Finally, it has been speculated that the outcome of the acute injury may depend on what one expects. Expectations appear to be culturally determined. Expectations of naïve subjects (that is, those who have not experienced a whiplash injury) for the outcome of whiplash injury, have been shown to be very different in North America than they are in countries with reportedly low rates of chronic whiplash.[12-14] Perhaps because of expectations, social factors are important, and explain why doctors and rodeo cowboys are relatively immune.[15, 16]

These observations have many possible explanations, but also possibly have direct applications. Social interventions, such as changes in litigation and compensation schemes, have had verifiable effects on clinical outcomes, as shown in Saskatchewan, Canada, where outcomes were dramatically altered by a change to a no-fault (no payment for pain and suffering) system, these outcomes including correlates of clinical recovery.[17, 18] In addition, it was recently demonstrated in Australia that legislative change which removed financial compensation for "pain and suffering" for whiplash, was shown to improve self-reported health status of whiplash patients.[19] System-wide changes in the delivery of treatment for whiplash injury, creating protocols that direct treatment beyond individual practices, have also been shown to be useful,[20] though “overtreatment” through multidisciplinary approaches, for example, may not be helpful. That is, early treatment and evaluation may have benefit, but part of the problem contributing to the development of chronic pain may be the overmedicalization of whiplash-associated disorders.[19, 20]

Given that whiplash associated disorders (WAD) are common problems and that traditional approaches to treatment, which may include over-treatment, pose significant costs both to individuals with the condition and to society, more needs to be known about how to improve outcomes and what factors are prognostic. A recent review of the Task Force on Neck Pain and Associated Disorders supports the view that psychosocial and social factors are relevant to outcomes in whiplash-associated disorders.[21] Coping style, expectations, beliefs, post-collision anxiety, depression, fear of movement, feelings of

helplessness are all associated with delays in recovery, and it is not known to what extent these are influenced by social determinants. As well, there is evidence that more treatment and more health care utilization after injury is associated with delayed recovery, even when accounting for other prognostic factors.[22]. Thus, given the limited data concerning the effect of pathology on recovery, the increasing body of research examining psychosocial determinants of recovery and the observations that more therapy aimed at "healing an injury" is not itself associated with better outcomes, current research is increasingly focusing on further developing our understanding of the psychosocial component of the biopsychosocial model.

Regarding beliefs, especially, illness beliefs concerning neck pain and whiplash injury, symptom expectation (or expectations about recovery), and symptom attribution are considered important elements affecting recovery from whiplash injury. The studies conducted for this thesis focus on building on previous research regarding these specific aspects of whiplash-associated disorders. The studies deal with three areas: (1) population beliefs about neck pain, including whiplash injury, (2) whiplash injury recovery expectations, and (3) symptom attribution after whiplash injury.

Aims of the Thesis

The general aim of this thesis is to add to the knowledge regarding recovery in whiplash-associated disorders (WAD) after motor vehicle collisions, and in

particular to increase the knowledge and understanding of the influence of beliefs factors on recovery and the symptom experience after whiplash injury.

Specific aims are as follows:

1. To assess public beliefs of the Canadian population regarding WAD, neck pain from work injury, and upper extremity pain from work injury. (Study I)
2. To assess to whether early expectations of recovery in WAD predict actual subsequent recovery, and the role of "expectations" to predict recovery as determined by pain cessation and resolution of pain-related limitations in daily activities. (Study II)
3. To examine a simple example of symptom mis-attribution by considering the role of ear cerumen as a benign explanation for the symptoms of earache, fullness in the ears, diminished hearing, and tinnitus commonly associated with whiplash injury. (Study III)
4. To compare patient scores from the Whiplash Disability Questionnaire and the patient's response to: 'Do you feel you have recovered fully from your accident injuries?' (Study IV)

Study I: Population Beliefs on Neck Pain and Whiplash Injury

Fear-avoidant beliefs have been shown to predict recovery including future disability level in patients with neck and arm pain.[23, 24] Those subjects with more negative and fearful beliefs consistently experienced delayed recovery. Recent research has also shown that fear of movement is related to delays in returning to work in whiplash patients[25] and others have hypothesized a role for beliefs in recovery from whiplash injury.[26]

The specific mechanism whereby beliefs influence outcome from painful musculoskeletal conditions is unknown. Potentially, beliefs about pain and recovery held prior to the first episode of a painful condition influence an individual's initial reaction and subsequent management such as care seeking and disability behaviour. If pre-morbid beliefs influence initial management and disability behaviour, understanding population beliefs about pain or specific painful conditions may provide insight into the variability in outcomes observed within similar conditions. It may also provide insight into whether population-based strategies designed to change beliefs are needed, what the most appropriate messages might be and whether this approach is likely to be effective.[27]

Given the limited research that has been conducted on public beliefs about painful musculoskeletal disorders, we evaluated beliefs of the Canadian population regarding whiplash injury, neck pain from work injury, and upper extremity pain from work injury.

Study II: Recovery Expectation and Whiplash Injury

While the first study was designed to assess a wide range of beliefs that persons in the general population hold about neck pain, the second study was designed to assess the impact of one particular type of belief, expectations for recovery. It has long been acknowledged that beliefs, attitudes and fears about pain predict pain chronicity in low back pain populations.[28-32] A best evidence synthesis on the prognostic literature on neck pain has recently reported that psychosocial factors are also strongly associated with outcome for both non-specific neck pain in the general population and for whiplash-associated disorders (WAD).[13, 21, 33-36] One psychosocial factor of interest is expectation of particular health outcomes. This factor has been found to predict actual health outcomes in a wide range of health conditions. For example, positive expectations have been reported to predict a better health outcome in low back pain and myocardial infarction, and to predict success in weight loss programs.[36]

In fact, several studies have reported delayed return to work in injured workers expecting slower recovery.[37-39] Using a more direct measure of recovery in WAD, a recently published study reported that initial expectations to make a full recovery were associated with less self-perceived limitations in daily activities six months after the crash.[40]

Our study objective was to determine whether early expectations of recovery in WAD predict actual subsequent recovery. In accordance with the

above discussion, "recovery" was assessed in a number of different ways. Our primary recovery outcome was self-assessed global recovery. This is an important index of recovery because it does not require anyone external to the person with WAD to determine what constitutes "recovery" for him or her, and is consistent with the idea that "recovery" is person-specific and related to the individual's particular personal and social context. However, pain cessation and improvements in pain-related limitations are also important aspects of recovery in WAD. Therefore, we also studied the role of 'expectations' to predict recovery as determined by pain cessation and resolution of pain-related limitations in daily activities.

Study III: Symptom Attribution and Whiplash-Associated Disorders

Studies I and II demonstrated that beliefs about recovery from whiplash injury are pessimistic and that expectations about recovery do in fact affect recovery. The range of symptoms in whiplash patients is wide and symptoms numerous.[9] A problem that may occur in the setting of pessimistic beliefs and expectations of non-recovery is mis-attribution of otherwise benign symptoms to whiplash injury, thus fostering further pessimistic beliefs and engendering a sense of non-recovery as symptoms arise. When a whiplash-injured patient experiences ongoing symptoms after injury, how do they know where their symptoms come from and if they are related to injury at all? We do not know the exact cause of

most neck and back pain associated with occupational activities, recreational activities, and daily life.

We know from numerous epidemiological studies that all of the symptoms of whiplash are common in the general population on a chronic and intermittent basis. In many cases, spontaneous neck or back pain may develop after a collision but be completely unrelated to the collision, because there is a certain incidence of these spontaneous symptoms in the general population. Obelieniene et al.[41] studied Lithuanian collision victims prospectively. They found that neck pain and headaches, besides being very frequent in the general population, occur spontaneously and fluctuate over short periods of time at the same rate and pattern of the Lithuanian collision victims. In other words, some neck pain would have occurred in any case had the individual remained a part of the non-collision general population.

Presumably, the collision victim may have been and will continue experiencing this background incidence of neck, back, and other symptoms. There is also a large body of literature that more specifically addresses the recognition of a high incidence of symptoms such as neck and back pain in association with many occupations.[42-47] Presumably, some portion of whiplash patients belong to these occupations. They are at risk for developing symptoms from their occupations in the future, yet again there may be a tendency instead to assume such symptoms arise from the collision.

In the setting of expectation of chronic pain, patients may assume that all symptoms of pain following a collision arise from the collision. Pre-collision

sources of pain thus become more noticeable in this setting of hypervigilance, and symptoms that patients previously viewed as benign and largely ignored are now registered.

This study took a very simple example of the potential for misattribution of symptoms, the ears, diminished hearing, or tinnitus. A population based survey of whiplash claimants indicated 20% of claimants will present with hearing disturbance or pain near the ear.[48] It is possible that in a significant number of these patients, these symptoms have a benign explanation that has no relationship to neck injury. Excessive cerumen (earwax) in the external auditory canal is, for example, known to be associated with symptoms of earache, fullness in the ears, and diminished hearing.[49] Earache, fullness in the ears, diminished hearing, and tinnitus are commonly associated with whiplash injury with attributions including temporomandibular injury.[50, 51] An objective of this thesis research, therefore, was to explore this simple example of attribution in whiplash associated disorder by demonstrating the role of cerumen as a benign explanation for these symptoms in whiplash patients.

Study IV: What is "Recovery" in Whiplash-Associated Disorders

Given the importance of beliefs, expectations and attributions in relation to recovery from whiplash-associated disorders, it is important that recovery be

measurable and defined both in clinical practice and future research studies. In order to inform the aforementioned research for this thesis, a cross-sectional validation study of a whiplash recovery questionnaire was conducted. Hoving et al.[52] conducted semi-structured interviews of 83 patients with whiplash associated disorders to identify any of the following problems and activity limitations: pain, anxiety, depression, anger, fatigue, limitation of personal care, role activities (work/study/housework), driving, sleeping, nonsport leisure activities, sport leisure activities, and social activity. Based on this work, Pinfold et al[53] proposed the Whiplash Disability Questionnaire (WDQ), a modified version of the Neck Disability Index[54] (NDI) with 13 items designed to evaluate whiplash related disability. Willis et al.[55] then continued the validation of a WDQ that was developed from the NDI using self reported disabilities in a group of participants experiencing whiplash associated disorders, demonstrating that the WDQ has excellent short and medium term reproducibility and responsiveness in a population seeking treatment for whiplash injury.

Rather than using questionnaires, primary care patients with whiplash injuries are usually asked how they are doing, or asked in a global way about their sense of overall recovery. For a disability questionnaire to be useful to physicians reporting on their patient's recovery, there should be good correlation between the disability scores and the patient's global sense of recovery. In order to determine if the WDQ is useful in this respect, we designed a simple head-to-head comparison of the responses of patients presenting to primary care clinics after a

motor vehicle collision on two measures: the patient's response to: 'Do you feel you have recovered fully from your accident injuries?' and their total scores on the WDQ.

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OVERVIEW OF MATERIALS AND METHODS

Study Participants

Study 1: This was a population-based, cross-sectional study using mailed surveys. Of the 5.58 million adult residents of Alberta and British Columbia, 2,000 were randomly sampled by an experienced polling company. Adult residents were randomly selected and stratified according to age group and gender. Non-residents of Alberta and British Columbia, individuals without a mailing address, and residents under the age of 18 were excluded.

Study 2: The study setting was the Canadian province of Saskatchewan, with approximately 1,000,000 residents. We included all residents aged 18 or older, who made an injury claim or were treated for a traffic related WAD between December 1, 1997 and November 30, 1999, and had made their claim within 42 days of the injury. Those reporting collision related neck pain were considered to be "WAD" cases. We excluded workers' compensation claims (since those persons are covered by a different insurance system), those unable to participate due to language barrier or serious unassociated illnesses, and those with serious injuries (hospitalized more than 2 days).

Study 3: Eighty-six consecutive adult WAD patients who attended a primary health care clinic were studied. None of the subjects wore hearing aids.

Study 4: This study took place through a group of walk-in primary care centres in Edmonton, Canada. Consecutive WAD patients who attended one of these clinics in the spring of 2005 were identified with the aim of contacting these patients approximately 3 months post injury.

Study Design, Measures and Procedures

Study 1: The study design was cross-sectional. Demographic data were collected including gender, age category, marital status, employment status, and residence (urban or rural). In addition, we inquired about a history of each condition (within four weeks, the past year, or ever). Beliefs for each condition were assessed via a modification of the Back Beliefs Questionnaire (BBQ) according to the condition of interest. Higher scores are interpreted as more positive or optimistic beliefs about the condition. An additional item was added inquiring about how quickly the condition settles and the likelihood of returning to activities such as work quickly.

Study 2: The study design was prospective inception cohort. All data were self-reported, and information from the insurance application formed our baseline data. This claim application was a paper-and-pencil questionnaire, which included items on pre-injury health, demographic and socioeconomic characteristics, post-collision pain intensity and location, post-injury symptoms, and depressive symptomatology. Consenting participants were then followed by structured telephone interviews, which included self-rated global recovery, at approximately

6 weeks, and 3, 6, 9, and 12 months post-collision. Of those who consented to participate in follow up, 16.2% dropped out prior to self-reported recovery. We assessed expectations for recovery by asking "Do you think that your injury will…" with response options "get better soon; get better slowly; never get better; don't know." Recovery was measured in 3 ways. Our main index of recovery was a global self-assessment using the question "How well do you feel you are recovering from your injuries?", with response options: (1) "all better (cured)," (2) "feeling quite a bit of improvement," (3) "feeling some improvement," (4) "feeling no improvement," (5) "getting a little worse," and (6) "getting much worse." We defined participants as recovered when they reported feeling "all better (cured)" or "feeling quite a bit of improvement" with no recurrence. This question was asked of participants at each follow up. A second index of recovery was self-rated neck pain intensity at follow up. Recovery was arbitrarily determined to be a rating of "0" or "1" on an 11-point numerical rating scale, where "0" means no pain at all, and a score of "10" refers to pain as bad as it could be. The neck pain intensity question was asked at baseline (the time of the injury claim) and repeated at each follow up. A third index of recovery was self-reported limitations in daily activities, as assessed by the Pain Disability Index (PDI). The PDI was administered at each follow up. Pain intensity (assessed at baseline and each follow up interview) was measured using an 11-point numerical rating scale for each region, and a pain drawing (administered only at baseline) was used to calculate the extent of body in pain. Pre-collision musculoskeletal complaints and other comorbid medical conditions were assessed at baseline

using a self-report measure of health problems. Depressive symptomatology was measured at baseline and at all follow up points using the Centre for Epidemiologic Studies Depression Scale (CES-D). Prior health and post-injury health were assessed at baseline using the following questions, respectively: "How was your health the month *before* the accident?" and "In general, would you say your health is *now* (that is, since the accident)" with the following response options for both questions: "excellent; very good; good; fair; poor."

Study 3: The study design was a prospective case series. All subjects underwent standardized clinical interviews regarding auditory symptoms and used of hearing aids. No hearing tests were conducted. Pre-existing hearing disorders and history of ear, nose and throat surgery were not specifically verified. Subjects' cerumen occlusion (impaired vision of the tympanic membrane) was measured according to a 4 point scale: grade 0 indicating little or no occlusion; grade 1, mild occlusion; grade 2, moderate occlusion; and grade 3, complete occlusion.

Study 4: The study design was cross-sectional. Through the International Classification of Diseases coding of the billing, motor vehicle collision victims were identified. Consecutive patient encounter billing codes on each day of billing in all clinics were examined until at least 250 potential subjects were identified. Those subjects were then contacted and interviewed by telephone survey. Prospective subjects were further assessed for inclusion and exclusion criteria at the time of interview. WAD grade 1 or 2 patients were included if they were

seated within the interior of a car, truck, sports/utility vehicle, or van in a collision (any of rear, frontal or side impact), had no or less than 5 minutes of loss of consciousness, were 18 years of age or over, and presented within 72 hours of their collision. Patients were excluded if they were told they had a fracture or neurological injury (i.e. grade 3 or grade 4 WAD), refused to give consent, had no fixed address or current contact information, were unable to communicate in English, had nontraumatic pain, were injured in a non-motor vehicle event, or were admitted to hospital. The primary outcome measure was the patient's response to the question: 'Do you feel you have recovered fully from your accident injuries?' Recovery was defined as answering 'yes' to the recovery question; other choices being 'no' and 'not sure'. The total score on the WDQ was also measured and correlated to recovery question responses to test the agreement between these two measures. The lowest score possible for the WDQ is 0 (indicating no disability) and the highest 130 (indicating maximum disability). Of the nearly 250 subjects identified from billing records, we found that many reported nontraumatic neck pain. It appears there was wide variance in diagnostic coding by physicians, with more than one in 3 potential subjects not reporting an injury, despite their code indicating one.

Analysis

Study 1: Descriptive statistics were used to describe the population in regard to important variables. One-way repeated measures ANOVAs with Bonferroni post-hoc tests were used to compare overall and factor-specific scores across

conditions. Effect size was calculated as a proportion of the group mean standard deviations around the grand mean and the common standard deviation for each group. The Friedman test was used to compare the ranked data on the added item (how quickly the condition settles and the likelihood of returning to activities such as work quickly) across conditions. Stratified analyses were performed for history of the condition, sex, and gender to determine whether these factors influenced belief scores. Significance was set at a = 0.05 for all tests. Data were analyzed with SPSS for Windows version 14.0 (SPSS Inc., Chicago, IL, USA).

Study 2: We built Cox proportional hazard models to determine the association between expectation for recovery and each index of recovery. We examined the proportionality assumption of our models graphically by plotting the log-log of the survival functions. Subjects were followed until they met our criteria for recovery, to the end of the study, or until they withdrew from the study. Assuming that attrition occurred randomly between each follow up period, those who withdrew from the study prior to having recovered were censored half way between the last participation point and the next scheduled interview. For each of the 3 models (one for each index of recovery), we followed the same analysis strategy. We first built a univariate Cox model with expectation for recovery (our exposure variable) as the only independent variable. To identify confounders, we then built a series of bivariate models that tested whether the inclusion of each potential confounder (the variables described above) produced a 10% or greater change in the regression coefficient of the crude association between expectations

and recovery. We adjusted for those confounding factors in the final models. Our findings are reported as hazard rate ratios, which measure relative risks. All analyses were completed using SPSS for Windows, version 16.0 and STATA/SE, version 9.

Study 3: We performed descriptive statistics. The proportion of subjects having auditory symptoms was calculated and the proportion of subjects with symptoms who had an ear occlusion score of grade 3 or more was compared to the proportion of asymptomatic subjects with occlusion scores of grade 3 or more. The proportion of subjects whose auditory symptoms resolved after cerumen removal was also calculated.

Study 4: The total score on the WDQ was correlated to the recovery question responses to test the agreement between these two measures. Internal consistency was assessed by calculating Cronbach's alpha.

OVERVIEW OF KEY RESULTS

Study 1: Three hundred (15%) surveys were returned. Overall belief scores were different across conditions ($p < 0.001$). Post-hoc tests revealed beliefs about whiplash injury were more negative compared to the other conditions ($p < 0.017$). There were moderate levels of uncertainty in the responses, especially in regard to whiplash injury. For items related to active coping, over 55% of respondents

agreed that remaining active and exercising was important. The sample was pessimistic in regard to recovery and resuming usual activities for all conditions, but more so in the case of WAD.

Study 2: After adjusting for the effect of sociodemographic characteristics, post crash symptoms and pain, prior health status and collision-related factors, those who expected to get better soon recovered over 3 times as quickly (hazard rate ratio = 3.62, 95% confidence interval 2.55-5.13) as those who expected that they would never get better. Findings were similar for resolution of pain-related limitations and resolution of neck pain intensity, although the effect sizes for the latter outcome were smaller.

Study 3: All of the 86 subjects reported neck pain. Of 71 subjects reporting no auditory symptoms, the greatest occlusion in either ear was grade 0 in 62 subjects, grade 1 in seven, and grade 2 in two. Fifteen subjects reported at least one of acute onset earache, fullness in the ears, diminished hearing, and tinnitus. Of the seven subjects reporting tinnitus only, none had grade 3 cerumen occlusion in either ear. Of eight subjects reporting one or more auditory symptoms, seven had grade 3 cerumen occlusion in the affected ear. One subject had bilateral grade 3 occlusion, with auditory symptoms present in one ear only. Patients with occlusion and auditory symptoms were advised to visit their family doctor for cerumen removal. These patients were followed as part of routine care and in 3–4 weeks were found to be asymptomatic of auditory symptoms following cerumen

removal.

Study 4:

A total of 147 subjects were interviewed by telephone. After initial questioning, 16 chose not to participate (89% participation rate). The mean age of participating subjects was 35.9 (SD=10.9, range 18–71 years, 68 of 131 subjects [52%] were female). Of these subjects, 52 (39.7%) reported that they felt they had recovered from their injuries. For the cohort as a whole, the mean WDQ score was 19.2 (SD 17.4, range 0–82). Those who reported complete recovery had a mean WDQ score of 2.5 (SD=3.6, range 0–12) and those who reported they had not recovered had a mean WDQ score of 29.9 (SD=13.9, range 13–82). All subjects who responded 'yes' to the recovery question had a WDQ score below 13, while all those responding 'no' to the recovery question had a WDQ score of 13 or over. We also found a high internal consistency, with Cronbach's alpha = 0.95.

OVERVIEW OF CONCLUSIONS

Study 1: Population beliefs related to neck pain, arm pain, and WAD in the two Canadian provinces sampled were consistent with the literature in regard to remaining active, but appeared misinformed relating to the prognosis of these conditions. Strategies for reeducating the public are indicated.

Study 2: Patients' early expectations for recovery are an important prognostic factor in recovery after whiplash injury, and are potentially modifiable. Clinicians

should assess these expectations in order to identify those patients at risk of chronic whiplash, and future studies should focus on the effect of changing these early expectations.

Study 3: The findings suggest high grade cerumen occlusion frequently occurs in the ear affected by acute auditory symptoms. However, tinnitus alone has no apparent association with cerumen occlusion. It is possible that a significant number of acute onset auditory symptoms reported in whiplash patients have a benign cause.

Study 4: The results of this study suggest that the global recover y question correlates well with a WDQ score below 13. As the maximum score on the WDQ is 130 (maximum disability), a score of 13 or less is expected to be associated with a high level of functioning. Conversely, the WDQ captures the patient's global sense of recovery well. The WDQ is thus useful in detecting recovery, and in those not recovered it identifies specific areas of concern for the patient. This study indicates that the WDQ may be a useful outcome measure in clinical practice.

The full versions of these published studies follow.

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A population-based survey of beliefs about neck pain from whiplash injury, work-related neck pain, and work-related upper extremity pain

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ABSTRACT

Background: Beliefs about pain conditions appear to influence recovery in a variety of musculoskeletal conditions. Little is known about population beliefs about neck and arm pain.
Aims: To evaluate population beliefs of three common musculoskeletal conditions: work-related neck and arm pain and whiplash injury (WAD).
Methods: Mail-out surveys were delivered to 2000 adult residents of two Canadian provinces cross-sectionally. To evaluate beliefs about the three conditions, the back beliefs questionnaire was modified yielding three comparable 10-item measures. In addition, we inquired about the belief about how quickly the condition settles. Respondents indicated their level of agreement on a 5-point Likert scale with lower scores interpreted as negative or pessimistic. Overall and item specific descriptive statistics are reported. A one-way repeated measures ANOVA was performed to compare beliefs across conditions.
Results: Three hundred (15%) surveys were returned. Overall belief scores were different across conditions ($p < 0.001$). Post-hoc tests revealed beliefs about whiplash injury were more negative compared to the other conditions ($p < 0.017$). There were moderate levels of uncertainty in the responses, especially in regard to whiplash injury. For items related to active coping, over 55% of respondents agreed that remaining active and exercising was important. The sample was pessimistic in regard to recovery and resuming usual activities for all conditions, but more so in the case of WAD.
Conclusions: Population beliefs related to neck pain, arm pain, and WAD in the two Canadian provinces sampled were consistent with the literature in regard to remaining active, but appeared misinformed relating to the prognosis of these conditions. Strategies for reeducating the public are indicated.

1. Introduction

Regional neck and arm pain and whiplash associated disorders (WAD) are common problems. WAD in particular poses significant costs both to individuals with the condition and to society. Little is known, however, about methods of improving outcomes or prognostic factors in people with these conditions. Recently, fear-avoidant beliefs have been implicated as being associated with recovery including future disability level in patients with neck and arm pain (Lee et al., 2007; Ryall et al., 2007; Landers et al., 2007). Although the literature is not consistent, it is suggestive of a trend where subjects with more negative and fearful beliefs experience delayed recovery. In keeping with the hypothesized role for beliefs in recovery from WAD (Vangronsveld et al., 2007), recent research has shown that baseline pain catastrophizing and fear of movement may be factors related to delays in returning to work in WAD patients (Adams et al., 2007).

The specific mechanism whereby beliefs influence outcome from painful musculoskeletal conditions is unknown. Potentially, beliefs about pain and recovery held prior to the first episode of a painful condition influence an individual's initial reaction and subsequent management such as care seeking and disability behaviour. If pre-morbid beliefs influence initial management

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and disability behaviour, understanding population beliefs about pain or specific painful conditions may provide insight into the variability in outcomes observed within similar conditions. It may also provide insight into whether population-based strategies designed to change beliefs are needed, what the most appropriate messages might be and whether this approach is likely to be effective (Buchbinder et al., 2008). As an illustration, studies from multiple countries have demonstrated widespread pessimism about recovery from back pain despite consistent evidence to the contrary (Buer and Linton, 2002; Goubert et al., 2004; Gross et al., 2006; Klenerman et al., 1995; Vlaeyen and Linton, 2000). Mass media campaigns undertaken in Australia and Scotland aimed at changing population beliefs about low back pain positively altered general public beliefs about the condition and appeared to reduce subsequent disability behaviours in Australia (Buchbinder et al., 2001; Waddell et al., 2007). General public beliefs about other painful conditions, including neck and arm pain have not been as thoroughly studied.

Specific to WAD there is some evidence regarding beliefs about WAD in non-clinical samples. Beliefs about potential symptoms experienced following a motor vehicle collision as well as the duration of these symptoms have been compared between Canadian and Lithuanian (Ferrari et al., 2002), Greek (Ferrari et al., 2003), and German (Ferrari and Lang, 2005) samples. These studies suggest the possibility that beliefs about WAD outcome may differ across societies, with the Canadian samples holding more negative beliefs. However, these studies were not population-based and lacked a valid measurement tool for measuring beliefs therefore limiting their application. In line with this research, clinical observations also suggest a social negativity related to WAD that may lead to a unique set of beliefs related to WAD.

Given the limited research that has been conducted on public beliefs about painful musculoskeletal disorders, we evaluated beliefs of the Canadian population regarding WAD, neck pain from work injury, and upper extremity pain from work injury. We hypothesized that beliefs about WAD would be more negative than those regarding neck pain or upper extremity pain.

2. Methods

2.1. Study design and participants

A population-based, cross-sectional study using mailed surveys was performed from January 15th to March 15th, 2007. Of the 5.58 million adult residents of Alberta and British Columbia, 2000 were randomly sampled by an experienced polling company. The sample was identified through the most recent mail lists with the primary sources being phone books and the federal postal service. Adult residents were randomly selected and stratified according to age group and gender. Non-residents of Alberta and British Columbia, individuals without a mailing address, and residents under the age of 18 were excluded. Introductory postcards were sent and potential participants were mailed the questionnaire related to beliefs about three musculoskeletal conditions: neck pain from work injury, upper extremity pain from work injury, and WAD.

2.2. Survey instrument

Demographic data were collected including gender, age category, marital status, employment status, and residence (urban or rural). In addition, we inquired about a history of each condition (within four weeks, the past year, or ever).

Beliefs for each condition were assessed via a modification of the Back Beliefs Questionnaire (BBQ) according to the condition of interest. For example, neck pain from work injury, shoulder/arm pain from work injury, or neck pain from whiplash injury was substituted for back pain. Each condition was defined to the respondent both in writing and pictorially demonstrating the location of the pain. The BBQ is a 14-item instrument, where participants are asked to state their agreement on each item using a 5-point Likert scale ranging from completely disagree to completely agree, with the middle score indicating uncertainty. The BBQ has demonstrated adequate levels of reliability in low back pain samples (Cronbach's $\alpha = 0.70$, test–re-test ICC = 0.87) (Symonds et al., 1996). Although a previously modified version of the BBQ for WAD found a single factor structure (McClune et al., 2003), factor analysis of the data in this study revealed that four unique factors exist within 10 common items in each questionnaire. Results of the factor analysis required that four items be omitted: two due to non-interpretable factor loadings and two due to factor complexity and low communality (Bostick et al., 2008) (Table 1). The four factors are labeled recovery pessimism, beliefs about active coping, beliefs about passive coping, and treatment pessimism. Given this factor structure, overall and factor specific scores were evaluated. All items are reversed with the exception of items 4 and 6 providing a minimum total score of 10 and a maximum total score of 50. Factor specific scores range from 3 to 15 (factors 1 and 2) and 2 to 10 (factors 3 and 4). Higher scores are interpreted as more positive or optimistic beliefs about the condition. An additional item was added inquiring about how quickly the condition settles and the likelihood of returning to activities such as work quickly (Table 1). The primary dependent variable included overall and factor specific beliefs scores yielding continuous data. In order to test the validity of comparing beliefs across the three conditions, a χ^2 test evaluating the homogeneity of the correlation matrices for each questionnaire was performed and found to be not different ($\chi^2 = 89.41$, $p = 0.50$). Failure to reject the null hypothesis indicates the matrices are similar (Jennrich, 1970), therefore permitting valid comparisons across questionnaires.

2.3. Sample size

Power analysis revealed that with 300 study participants, $\alpha = 0.05$ and $\beta = 0.20$, the study was powered to detect a small difference across the three conditions using a one-way repeated measures ANOVA (where effect size, $f = 0.10$ for small effect, 0.25 for medium effect, and 0.40 for large) (Portney and Watkins, 2000).

2.4. Analysis

Descriptive statistics were used to describe the population in regard to important variables. One-way repeated measures

Table 1
Questionnaire used to compare beliefs across the three conditions: neck injury from work, upper extremity injury from work, and whiplash injury

Factor 1: recovery pessimism
1. *Condition* will eventually stop you from working
2. *Condition* makes everything in life worse
3. *Condition* means long periods of time off of work
Factor 2: beliefs about active coping
4. A bad *neck/upper extremity* should be exercised
5. If you have *condition* you should rest until it gets better
6. If you have *condition* you should try to stay active
Factor 3: beliefs about passive coping
7. Medication is the only way of relieving *condition*
8. Simple pain killers are usually enough to control most *condition*
Factor 4: treatment pessimism
9. There is no real treatment for *condition*
10. Doctors cannot do anything for *condition*

Added item: most (condition) settles quickly and you get on with usual activities such as getting back to work (not included in overall score).

ANOVAs with Bonferroni post-hoc tests were used to compare overall and factor-specific scores across conditions. Effect size was calculated as a proportion of the group mean standard deviations around the grand mean and the common standard deviation for each group (Portney and Watkins, 2000). Magnitude of an effect is judged as small when $f = 0.1–0.25$, medium when $f = 0.25–0.4$, and large when $f > 0.4$. The Friedman test was used to compare the ranked data on the added item (how quickly the condition settles and the likelihood of returning to activities such as work quickly) across conditions. Stratified analyses were performed for history of the condition, sex, and gender to determine whether these factors influenced belief scores. Significance was set at $\alpha = 0.05$ for all tests. Data were analyzed with SPSS for Windows version 14.0 (SPSS Inc., Chicago, IL, USA).

3. Results

Of the 2000 questionnaires that were mailed, 300 were returned (15% response rate). Response rate increased with older age (18–24-year-old: 2%, 25–34: 7%, 35–49: 10%, 50–65: 23% and age over 65: 27%). Characteristics of the sample, along with a comparison with census data, can be found in Table 2. In comparison with 2006 Alberta and British Columbia census data, this sample is older and a higher proportion of participants are married (Statistics Canada, 2006). The proportion of respondents with a history of work-related neck pain, work-related upper extremity pain, and WAD in the past year was 48%, 55%, and 4% respectively. Eighty-nine percent of respondents had complete data on the work-related upper extremity and neck pain questionnaires and 92% for the WAD questionnaire. No statistically significant differences were observed between those with and without missing data on the factors age, sex, geographic location of residents (urban versus rural) and history of the condition.

3.1. Overall questionnaire scores

Overall beliefs scores ranged from a mean of 32.8/50 (±0.5) for WAD to 34.5/50 (±0.6) for neck pain and 35.3/50 (±0.6) for upper extremity pain (Table 3). Means were statistically different across conditions ($p < 0.05$). Post-hoc tests (with Bonferroni correction $\alpha = 0.017$) revealed that beliefs scores about WAD were significantly lower when compared to neck pain (mean difference: −1.85 (−2.25, −1.44), $p < 0.017$) and upper extremity pain (mean difference: −2.47 (−2.90, −2.03), $p < 0.017$) indicating more negative or pessimistic beliefs. The effect size for the difference among conditions was small to medium ($f = 0.24$). Neck and upper extremity injury from work were not found to be different from one another. There was a moderate level of uncertainty when answering individual items in the case of WAD as 21–38% of the responses for each item were rated as "don't know". The proportion of uncertainty for work-related neck pain and upper extremity pain ranged from 10% to 32% and 9% to 28%, respectively. This level of uncertainty was greater in nearly every item for WAD compared to the other two conditions.

Table 2
Comparison of study sample characteristics with Alberta (AB) and British Columbia (BC) census data

Variable	Sample proportion (%)	AB/BC 2006 Census data proportion (%)[a]
Gender ($n = 295$)		
Female	47.8	51.0
Age category ($n = 296$)		
18–24	1.4	9.3
25–34	7.8	17.5
35–49	21.6	31.1
50–65	38.2	24.9
65+	31.1	17.2
Residence ($n = 295$)		
Urban	80.3	79.9[b]
Marital status ($n = 294$)		
Married	72.4	50.5
Employment status ($n = 291$)		
Not employed	2.5	2.9

[a] Age categories proportions are based on Canadian population age 20 and older.
[b] 2001 Canadian population data.

Table 3
Comparison of beliefs across neck pain, upper extremity pain and whiplash associated disorders ($n = 240$)

	Mean score (95% CI)	*F*-statistic	*p*-value
Overall scores (range 10–50)			
Beliefs about neck pain from work injury (Q1)	34.5 (33.9, 35.0)		
Beliefs about upper extremity pain from work injury (Q2)	35.3 (34.7, 35.9)	79.08	$p < 0.001$
Beliefs about WAD (Q3)	32.8 (32.3, 33.3)		
Factor specific sub-scores			
Factor 1: recovery pessimism (range 3–15)			
Work-related neck pain	9.1 (8.8, 9.4)		
Work-related arm pain	9.5 (9.2, 9.8)	2.00	$p = 0.16$
WAD	9.3 (9.1, 9.4)		
Factor 2: active coping beliefs (range 3–15)			
Work-related neck pain	10.6 (10.4, 10.9)		
Work-related arm pain	10.8 (10.6, 11.0)	17.71	$p < 0.001$
WAD	10.3 (10.1, 10.5)		
Factor 3: passive coping beliefs (range 2–10)			
Work-related neck pain	7.2 (7.0, 7.4)		
Work-related arm pain	7.1 (7.0, 7.3)	1.10	$p = 0.296$
WAD	7.2 (7.0, 7.3)		
Factor 4: treatment pessimism (range 2–10)			
Work-related neck pain	7.6 (7.4, 7.8)		
Work-related arm pain	7.9 (7.7, 8.0)	24.36	$p < 0.001$
WAD	7.3 (7.1, 7.5)		

3.2. Factor-specific questionnaire scores

Factors two and four (beliefs about active coping and treatment pessimism) were also found to be significantly different across conditions with post-hoc tests revealing that only belief scores about WAD were lower compared to work-related neck and upper extremity pain (Table 3). The effect size for this difference was small for both beliefs about passive coping and treatment pessimism ($f = 0.12$ and 0.14, respectively). Factors one and three (recovery pessimism and beliefs about passive coping) were not different across conditions.

When evaluating responses to specific items, the population appeared to have positive beliefs in regard to active and passive coping. More than 55% agreed with the statements "a bad *condition* should be exercised" and "you should try to stay active". In addition, the majority of participants in the cases of work-related neck and upper extremity pain (>55%) also disagreed with the statement "you should rest until it gets better", while 41% disagreed in the case of WAD. The majority of participants (>72%) disagreed that "medication is the only way of relieving *condition*". In most of these cases the proportion of participants responding positively was lower in the case of WAD.

In regard to items relating to recovery prognosis, the population appeared to hold pessimistic beliefs. Approximately 50% of the

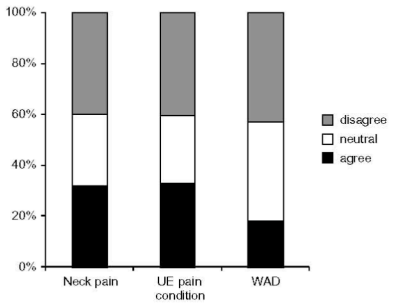

Fig. 1. Comparison of beliefs across conditions on the tailored item: "most (condition) settles quickly and you get on with usual activities such as going back to work".

sample agreed with the statement "*condition* makes everything in life worse". Although about half of the respondents either agreed or were uncertain about the statement "*condition* means long periods of time off of work" in regard to work-related neck and upper extremity pain, more than 60% agreed or were uncertain in the case of WAD. Similarly, more people either agreed or were uncertain if these conditions would lead to eventually having to stop working. A similar pattern of negativity was found with the item "most *condition* settles quickly, and you get on with normal activities such as going to work". Only 32%, 33%, and 18% of participants agreed with this statement with regard to neck pain from work injury, upper extremity pain from work injury, and WAD respectively ($\chi^2 = 10.35$, $p = 0.006$) (Fig. 1).

3.3. Stratified analyses

There was no relationship discovered between overall beliefs scores and history of the condition, age, and gender indicating these factors did not confound the findings.

4. Discussion

Population beliefs regarding the three painful musculoskeletal conditions were generally in agreement with the literature in terms of management strategies (i.e. most respondents agreed that staying active was more important than rest). However, they also reported a high level of pessimism regarding likelihood of recovery. For example, a minority of subjects agreed with the statement "most *condition* settles quickly and you get on with usual activities such as getting back to work", and were similarly pessimistic regarding these conditions meaning long periods of time off work and eventually causing them to stop working. A recent systematic review indicated that approximately 50% of patients with neck pain still have symptoms after one year (Carroll et al., 2008), suggesting that the sample may be appropriately informed about neck pain prognosis. However, because psychosocial factors such as negative recovery expectations, fear of movement and catastrophizing appear to contribute to the development of prolonged disability (Cole et al., 2002; Carroll et al., 2008) recovery pessimism could be considered a maladaptive belief. Further, given recent prognostic evidence identifying a link between negative beliefs and delayed recovery in neck and arm pain (Lee et al., 2007; Ryall et al., 2007; Landers et al., 2007; Adams et al., 2007), the widespread pessimism observed in the general public even in those without a history of the condition is of concern.

Results of the current study are consistent with the negative population beliefs that have been previously observed for low back pain (Buchbinder et al., 2001; Gross et al., 2006; Waddell et al., 2007; Werner et al., 2005). As mass media education campaigns have been effective in changing back pain beliefs (Buchbinder et al., 2001; Waddell et al., 2007), and in some settings, reducing work-related disability and health care utilization (Buchbinder et al., 2001), similar programs may be effective for WAD and related conditions. Data from this study could inform future public education programs related to these painful musculoskeletal conditions. For example, as opposed to highlighting the importance of staying active, future campaign messaging should focus on the unlikely scenario of persistent disability to reduce fear-avoidance beliefs.

The primary limitation of this study is the low response rate resulting in a sample that was older than the general population. The small number of respondents in the younger age categories prevented the use of weighting procedures to better represent the sample. Therefore, the findings are likely not generalizable beyond the characteristics of this sample. The low response rate occurred despite strategies to maximize response such as introductory postcards and constructing a seemingly salient and relatively short survey. Response rates for general population surveys are often poor (McColl et al., 2001) and there appears to be a trend towards reduced response rates for population surveys (de Leeuw and de Heer, 2002). Reasons for this trend are not entirely clear (de Leeuw and de Heer, 2002; Keeter et al., 2000). In the absence of non-responder data the effect of response bias cannot be clearly elucidated. Future surveys of the general population might include repeat mail-outs and incentives to increase response rates. Additionally, given the lower response in the younger age groups, subsequent surveys might include a mixed method approach where younger people are provided an electronic version of the survey. The proportions of individuals with a one-year history of the conditions are similar to Canadian prevalence data for neck pain in the general population (53%) (Cote et al., 1998) and upper extremity pain in the working population (55%) (Leroux et al., 2005). No known comparable population prevalence data exists for WAD, however it is likely to be similar given available incidence data (Cassidy et al., 2000) and the high proportion of cases of delayed recovery after WAD (Cassidy et al., 2000). Although the data is over-represented by older adults, some literature suggests that older age is a poor prognostic indicator for delayed recovery after WAD (Cote et al., 2001), in which case the findings from this study provide important information about a potentially at-risk population.

Another limitation of the study is the cross-sectional nature of the design. This does not permit a determination of causal relationships between observed beliefs and health outcomes such as delayed recovery or health care utilization. Furthermore, what constitutes a clinically meaningful difference in beliefs on the survey instrument used is currently unknown. The magnitude of the difference in beliefs across conditions though modest, is supportive of clinical observations regarding the unique beliefs about WAD.

4.1. Conclusion

The majority of population beliefs related to neck pain, arm pain, and WAD in the two Canadian provinces sampled are consistent with evidence in terms of the importance of staying active despite the condition. However, in regard to recovery prognosis the population beliefs appear to be maladaptive. Widespread pessimism related to recovery was observed even in those without a history of the condition. Given the prevalent pessimism regarding recovery, and the high proportion of uncertainty in responding to these items, strategies for reeducating the public are indicated.

Reeducation strategies may potentially reduce health care utilization and disability.

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Recovery in Whiplash-Associated Disorders: Do You Get What You Expect?

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ABSTRACT. ***Objective.*** Positive expectations predict better outcome in a number of health conditions, but the role of expectations in predicting health recovery after injury is not well understood. We investigated whether early expectations of recovery in whiplash associated disorders (WAD) predict subsequent recovery, and studied the role of "expectations" to predict recovery as determined by pain cessation and resolution of pain-related limitations in daily activities.

Methods. A cohort of 6,015 adults with traffic-related whiplash injuries was assessed, using multivariable Cox proportional hazards analysis, for association between these expectations and self-perceived recovery over a 1-year period following the injury. Recovery was assessed using 3 indices: self-perceived global recovery (primary outcome); resolution of neck pain severity; and resolution of pain-related limitations in daily activities.

Results. After adjusting for the effect of sociodemographic characteristics, post-crash symptoms and pain, prior health status and collision-related factors, those who expected to get better soon recovered over 3 times as quickly (hazard rate ratio = 3.62, 95% confidence interval 2.55-5.13) as those who expected that they would never get better. Findings were similar for resolution of pain-related limitations and resolution of neck pain intensity, although the effect sizes for the latter outcome were smaller.

Conclusion. Patients' early expectations for recovery are an important prognostic factor in recovery after whiplash injury, and are potentially modifiable. Clinicians should assess these expectations in order to identify those patients at risk of chronic whiplash, and future studies should focus on the effect of changing these early expectations. (First Release Feb 15 2009; J Rheumatol 2009;36:1063–70; doi:10.3899/jrheum.080680)

Key Indexing Terms:
EXPECTATION WHIPLASH RECOVERY

It has long been acknowledged that beliefs, attitudes and fears about pain predict pain chronicity in low back pain populations[1-5]. A best evidence synthesis on the prognostic literature on neck pain has recently reported that psychosocial factors are also strongly associated with outcome for both nonspecific neck pain in the general population and for whiplash-associated disorders (WAD)[6-10]. One psychosocial factor of interest is expectation of particular health outcomes. This factor has been found to predict actual health outcomes in a wide range of health conditions. For example, positive expectations have been reported to predict a better health outcome in low back pain and myocardial infarction, and to predict success in weight loss programs[11].

Janzen, *et al* have proposed a pragmatic conceptual model describing the possible role of health expectations in Alzheimer disease[12], and there are theoretical reasons to believe that expectations are also important in health outcomes after a musculoskeletal injury[6,9,10,13]. In fact, several studies have reported delayed return to work in injured workers expecting slower recovery[12,14,15]. Return to work,

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however, is not synonymous with health recovery, since many factors other than health status determine whether and how quickly an injured worker returns to work. Using a more direct measure of recovery in WAD, a recent study reported that initial expectations to make a full recovery were associated with less self-perceived limitations in daily activities 6 months after the crash[16].

Health and health outcome expectations are socially and culturally contingent, that is, they are created by the individual's understanding of the world, and formed in relationship to the social and cultural contexts within which he or she is situated. This process is both longitudinal and cyclical[12]. Yet the term "expectation" is not used uniformly in the current literature, and is sometimes used interchangeably with "self-efficacy," as termed by Bandura[17]. However, Maddux (1999) describes the 2 concepts as different in subtle but important ways: "Self-efficacy" relates to beliefs about the ability to achieve a goal under specific circumstances; whereas an "outcome expectation" refers to the belief that a particular outcome will be achieved[18]. An example is returning to work after a work injury. In this case, "self-efficacy" is the individual's belief that he/she will be able to perform the individual tasks that are the components of the job. "Outcome expectancy" is the individual's global belief in achieving the outcome of "return to work." It should be noted that people may not believe that they will be able to perform all the individual work-related tasks of their job, but may still expect that the overall outcome (return to work) will be achieved.

When the outcome of interest is "recovery," outcome expectancies cannot rely on understanding "health recovery" in the context of musculoskeletal pain and injuries. Individuals appear to ascribe different meanings to the concept of "recovery," as demonstrated by Beaton, *et al*'s studies of workers[19]. Their findings suggest that workers with musculoskeletal injuries variously conceive of "recovery" as (1) involving a pain-free state (which Beaton, *et al* termed "resolution"); (2) a state in which pain and symptoms are present but the person has adjusted his or her life to accommodate and minimize these symptoms (termed "readjustment"); or (3) a state in which the pain and symptoms are "redefined," that is, the person has adapted to living with the disorder ("redefinition"). Consistent with this view, Ottosson, *et al* reported that although improvements in pain and physical functioning (measured by the Medical Outcomes Study Short Form-36) were highly associated with an answer of "yes" to the question of "Do you feel recovered?", persons with WAD did not necessarily require their health or pain level to return to baseline measures before considering themselves to have "recovered"[20]. Thus the term "recovery" has a variety of different meanings that go beyond a simplistic view of pain/symptom cessation and/or return to usual functioning. This has important implications for research whose goal is to examine recovery as an outcome in musculoskeletal disorders.

Our study objective was to determine whether early expectations of recovery in WAD predict actual subsequent recovery. In accordance with the above discussion, "recovery" was assessed in a number of different ways. Our primary recovery outcome was self-assessed global recovery. This is an important index of recovery because it does not require anyone external to the person with WAD to determine what constitutes "recovery" for him or her, and is consistent with the idea that "recovery" is person-specific and related to the individual's particular personal and social context. However, pain cessation and improvements in pain-related limitations are also important aspects of recovery in WAD. Therefore, we also studied the role of "expectations" to predict recovery as determined by pain cessation and resolution of pain-related limitations in daily activities.

MATERIALS AND METHODS

Design and study population. Our study setting was the Canadian province of Saskatchewan, with approximately 1,000,000 residents, universal healthcare coverage and a single motor-vehicle insurer. We included all residents aged 18 or older, who made an injury claim or were treated for a traffic-related WAD between December 1, 1997 and November 30, 1999, and had made their claim within 42 days of the injury. Those reporting collision-related neck pain were considered to be "WAD" cases. We excluded workers' compensation claims (since those persons are covered by a different insurance system), those unable to participate due to language barrier or serious unassociated illnesses, and those with serious injuries (hospitalized more than 2 days).

Sources of data and followup. All data were self-reported, and information from the insurance application formed our baseline data. This claim application was a paper-and-pencil questionnaire, which included items on pre-injury health, demographic and socioeconomic characteristics, post-collision pain intensity and location, post-injury symptoms, and depressive symptomatology. Consenting participants were then followed by structured telephone interviews, which included self-rated global recovery, at approximately 6 weeks, and 3, 6, 9, and 12 months post-collision. Of those who consented to participate in followup, 16.2% dropped out prior to self-reported recovery[21]. Research ethics boards of the University of Saskatchewan and the University of Alberta approved the study.

Measures. We assessed expectations for recovery by asking "Do you think that your injury will…" with response options "get better soon; get better slowly; never get better; don't know." The use of a single question to assess expectation for recovery arises from qualitative studies on expectancies[22] and has been used to assess expectations in previous studies[16,23].

Recovery was measured in 3 ways. Our main index of recovery was a global self-assessment using the question "How well do you feel you are recovering from your injuries?", with response options: (1) "all better (cured)," (2) "feeling quite a bit of improvement," (3) "feeling some improvement," (4) "feeling no improvement," (5) "getting a little worse," and (6) "getting much worse." We defined participants as recovered when they reported feeling "all better (cured)" or "feeling quite a bit of improvement" with no recurrence. This global self-assessment of recovery is consistent with research emphasizing the importance of using patient-centered perspectives in assessing "recovery" in injuries[19]. This question was asked of participants at each followup.

A second index of recovery was self-rated neck pain intensity at followup. Recovery was arbitrarily determined to be a rating of "0" or "1" on an 11-point numerical rating scale, where "0" means no pain at all, and a score of "10" refers to pain as bad as it could be. Although pain ratings of

"0" to "3" on this type of scale are generally considered to be "mild" in nature[24], we chose the scores of "0" or "1" to provide a more conservative measure of recovery. The neck pain intensity question was asked at baseline (the time of the injury claim) and repeated at each followup.

A third index of recovery was self-reported limitations in daily activities, as assessed by the Pain Disability Index (PDI)[25-27]. This is a 7-item questionnaire that assesses pain-related limitations or disruptions in activities of daily living such as home responsibilities, occupation, recreation, and social activities. Scores are summed over the 7 questions and possible scores range from 0 to 70, with 0 indicating no disability in any of the assessed areas and 70 indicating that all the activities which they would normally do have been completely disrupted or prevented by the pain. We arbitrarily chose a score of 0 to indicate recovery, again choosing to be extremely conservative in our choice of cutpoints. The PDI was administered at each followup.

Potential confounders. Potential confounders were measured at baseline on the claim form and included age; sex; marital status; education; family income; employment status; prior neck or back injuries; pre-injury musculoskeletal complaints; overall health the month prior to the injury; comorbid diseases; direction of impact to the vehicle; post-injury neck, low back, and headache pain intensity; extent of body in pain; post-injury symptoms (presence and number); baseline self-perceived disability (see description below); presence of crash-related fractures; self-reported head injuries; need for hospitalization after the injury; health care received after the injury; and self-rated global post-injury health.

Pain intensity (assessed at baseline and each followup interview) was measured using an 11-point numerical rating scale for each region, and a pain drawing (administered only at baseline) was used to calculate the extent of body in pain[28,29]. Pre-collision musculoskeletal complaints and other comorbid medical conditions were assessed at baseline using a self-report measure of health problems[30]. Depressive symptomatology was measured at baseline and at all followup points using the Centre for Epidemiologic Studies Depression Scale (CES-D)[31]. Prior health and post-injury health were assessed at baseline using the following questions, respectively: "How was your health the month *before* the accident?" and "In general, would you say your health is *now* (that is, since the accident)" with the following response options for both questions: "excellent; very good; good; fair; poor." The PDI was administered only at followup interviews, but the initial (baseline) questionnaire included 4 questions about self-perceived disability. These were: "Have the injuries resulting from the accident prevented you from carrying out any of the following activities? (check all that apply): Daily home activities; Employment; Education; Other."

Statistical analysis. We built Cox proportional hazard models to determine the association between expectation for recovery and each index of recovery. We examined the proportionality assumption of our models graphically by plotting the log-log of the survival functions. Subjects were followed until they met our criteria for recovery, to the end of the study, or until they withdrew from the study. Assuming that attrition occurred randomly between each followup period, those who withdrew from the study prior to having recovered were censored half way between the last participation point and the next scheduled interview. For each of the 3 models (one for each index of recovery), we followed the same analysis strategy. We first built a univariate Cox model with expectation for recovery (our exposure variable) as the only independent variable. To identify confounders, we then built a series of bivariate models that tested whether the inclusion of each potential confounder (the variables described above) produced a 10% or greater change in the regression coefficient of the crude association between expectations and recovery[32]. We adjusted for those confounding factors in the final models. Our findings are reported as hazard rate ratios, which measure relative risks. All analyses were completed using SPSS for Windows, version 16.0 and STATA/SE, version 9.1[33,34].

RESULTS

Of the 8,634 claimants during the 2-year inception period, 6,749 met the criteria for WAD, and 6,021 made their claim within 42 days of the injury. Of these, 6 did not answer the expectation question, leaving a study sample of 6,015. Median time between the crash and completion of claim form was 11 days. Characteristics of the study sample, stratified by their expectations to recover, are reported in Table 1. Most (41.9%) expected to get better slowly, 24.4% expected to get better soon, 1.9% expected to never get better, and 31.8% did not know. There was no association between time to complete the claim form and how well individuals expected to recover. Average time to recovery for each measure of recovery was fastest in those who expected to get better soon, followed by those who expected to get better slowly, and slowest in those who expected to never get better (Table 1). At baseline, those with more positive expectations for their recovery had lower pain scores, less depressed mood, better prior health, higher education, and higher family income.

For our first model, which assessed the association between expectations to recover and global self-assessed recovery, 4 factors met our criteria for confounding. These were depressive symptomatology, post-crash self-reported health, initial post-crash neck pain intensity, and initial post-crash low back pain intensity. After adjusting for these confounders, and in comparison with those who expected that they would never get better (our reference category), those who expected to get better soon recovered over 3 and a half times as quickly; those who expected to get better slowly recovered over 2 and a half times as quickly; and those who did not know recovered almost twice as quickly (Table 2). As a sensitivity check, we also built a model that included all possible confounders (listed in Materials and Methods), but this did not appreciably change the above estimates.

We performed the same analyses for the remaining outcomes. For the outcome of recovery of neck pain intensity (that is, achieving a neck pain score of 0 or 1), the following factors were identified as confounders and were adjusted for in the final model: initial post-injury neck pain intensity, initial post-injury headache intensity, and initial post-injury self-assessed health. After adjusting for these confounders, those who expected to get better soon experienced pain recovery 80% more quickly than those who believed they would never recover, those who expected to get better slowly recovered approximately 50% more quickly, and those who didn't know recovered at approximately the same rate as those who expected never to recover (Table 3).

For the outcome of resolution of pain-related limitations (as identified as a PDI score of 0), the following factors confounded the relationship between expectations and recovery, and were adjusted for in the final model: initial post-injury neck, back, and headache pain intensity; initial post-injury percentage of body in pain; sleep disturbances; initial post-injury self-assessed global health; initial post-injury depressive symptomatology; and initial post-injury limitations in

Table 1. Demographic description of the study population and days to self-rated recovery (n = 6,015).

Variables	Get better soon (n = 1470)	Get better slowly (n = 2519)	Do not know (n = 1914)	Never get better (n = 112)
Demographic and socioeconomic factors				
Sex: % (n)				
Men	33.1 (486)	32.5 (818)	36.3 (695)	37.5 (42)
Women	66.9 (984)	67.5 (1,701)	63.7 (1,219)	62.5 (70)
Age: Mean (SD)	39.0 (14.2)	38.3 (15.5)	39.5 (16.0)	36.8 (14.8)
Marital status: % (n)				
Single	30.1 (442)	34.4 (867)	32.8 (628)	48.2 (54)
Married/common law	58.0 (853)	53.5 (1,347)	52.3 (1,000)	31.3 (35)
Widowed	2.9 (42)	2.6 (65)	3.8 (72)	3.6 (4)
Separated/divorced	9.0 (133)	9.5 (239)	11.1 (213)	17.0 (19)
Highest educational level: % (n)				
Less than high school	15.3 (224)	22.1 (557)	28.0 (534)	31.2 (35)
High school	23.5 (345)	23.7 (596)	26.4 (503)	16.1 (18)
Post secondary education/some university	27.9 (410)	26.0 (655)	23.3 (444)	34 (30.4)
Technical school graduate	16.5 (242)	15.0 (378)	13.3 (254)	13.4 (15)
University graduate	16.8 (247)	13.1 (330)	9.0 (172)	8.9 (10)
Annual family income, CAD, % (n)				
$ 0–$20,000	24.5 (352)	32.2 (792)	35.1 (648)	45.4 (49)
$20,001–$40,000	28.3 (406)	31.3 (770)	33.3 (615)	33.3 (36)
$40,001–$60,000	26.3 (378)	19.7 (484)	18.1 (334)	11.1 (12)
Above $60,000	20.8 (299)	16.7 (411)	13.4 (248)	10.2 (11)
Pre collision health				
Health before MVC $: % (n)				
Excellent	34.0 (500)	33.1 (833)	33.6 (643)	21.6 (24)
Very good	41.0 (603)	39.2 (988)	33.1 (634)	33.3 (37)
Good	20.1 (295)	22.4 (564)	24.2 (464)	27.0 (30)
Fair or poor	4.9 (72)	5.3 (134)	9.1 (173)	18 (20)
Post collision health				
Current health: % (n)				
Excellent	7.3 (107)	1.8 (46)	1.6 (30)	0
Very good	21.2 (311)	8.9 (224)	5.7 (108)	2.7 (3)
Good	39.9 (585)	30.0 (756)	18.3 (350)	18.9 (21)
Fair or poor	31.6 (464)	59.2 (1,493)	74.4 (1,423)	78.3 (87)
Neck/shoulder pain: mean (SD)*	5.5 (2.1)	6.5 (1.9)	7.0 (2.0)	7.6 (2.0)
Headache: mean (SD)*	4.1 (3.2)	5.2 (3.3)	5.8 (3.3)	6.1 (3.4)
Low back pain: mean (SD)*	2.6 (3.0)	3.8 (3.5)	4.5 (3.6)	5.6 (3.6)
Depression score: mean (SD)†	11.1 (9.7)	16.5 (11.6)	19.5 (13.0)	23.0 (12.9)
Days from crash to self-rated global recovery: mean (95% CI)	130 (124–136)	195 (188–202)	249 (242–257)	318 (290–347)
Days from crash to resolution of neck pain: mean (95% CI)	157 (140–163)	206 (200–212)	238 (232–245)	264 (236–291)
Days from crash to resolution of pain-related limitations: mean (95% CI)	171 (164–179)	238 (230–247)	283 (275–291)	331 (301–360)

* Pain at baseline, measured on a numerical rating scale (0-10). † Post-collision depression was measured by the Center for Epidemiological Studies—Depression Scale (CES-D). SD: standard deviation; CAD: Canadian dollars; MVC: motor vehicle collision; CI: confidence interval.

ability to carry out daily home activities. After adjusting for these confounders, those who expected to get better soon experienced complete resolution of pain-related limitations 3 times as quickly; those who expected to get better slowly recovered more than twice as quickly; and those who did not know recovered almost twice as quickly as those who expected that they would never recover (Table 4).

DISCUSSION

Recovery from whiplash injuries is a prolonged process for many[21,35-44]. This underscores the importance of identifying key prognostic factors, especially those prognostic factors that are potentially modifiable and thus might serve as targets of interventions. A number of psychological factors such as coping, depression, and anxiety are important in

Table 2. Association between expectations for recovery and self-reported global recovery. Crude and adjusted hazard rate ratios (HRR) and 95% confidence intervals (CI).

Expectation at Baseline	Unadjusted HRR (95% CI)	Adjusted HRR (95% CI)*
Will never get better	1.00	1.00
Will get better soon	5.26 (3.76–7.37)	3.62 (2.55–5.13)
Will get better slowly	3.18 (2.27–4.44)	2.66 (1.88–3.75)
Don't know	2.05 (1.47–2.87)	1.95 (1.38–2.76)

* Adjusted for the following baseline confounders: post-injury depressive symptomatology (CES-D), post-injury self-reported health, post-injury neck pain intensity, and back pain intensity.

Table 3. Association between expectations for recovery and resolution of neck pain. Crude and adjusted hazard rate ratios (HRR) and 95% confidence intervals (CI).*

Expectation at Baseline	Unadjusted HRR (95% CI)	Adjusted HRR (95% CI)*
Will never get better	1.00	1.00
Will get better soon	2.62 (1.94–3.53)	1.81 (1.34–2.44)
Will get better slowly	1.74 (1.30–2.34)	1.49 (1.11–2.01)
Don't know	1.30 (0.96–1.75)	1.27 (0.94–1.71)

* Resolution of neck pain refers to a score of 0 or 1 on an 11-point numerical rating scale of neck pain intensity. Adjusted HRR are adjusted for the following baseline confounders: post-injury self-reported health, post-injury neck pain intensity, post injury headache.

Table 4. Association between expectations for recovery and resolution of pain-related limitations. Crude and adjusted hazard rate ratios (HRR) and 95% confidence intervals (CI).*

Expectation at Baseline	Unadjusted HRR (95% CI)	Adjusted HRR (95% CI)
Will never get better	1.00	1.00
Will get better soon	4.49 (3.10–6.50)	3.01 (2.05–4.43)
Will get better slowly	2.65 (1.84–3.83)	2.38 (1.62–3.48)
Don't know	1.86 (1.28–2.69)	1.93 (1.32–2.84)

* Resolution of pain-related limitations refers to a score of 0 on the Pain Disability Index. Adjusted HRR are adjusted for the following baseline confounders: percentage of body in pain after the injury, post-injury neck pain intensity, post-injury back pain intensity; post-injury headache intensity, sleep disturbance, post-injury self-rated health, post-injury depressive symptomatology, and initial self-reported limitations in daily home activities.

recovery from whiplash injuries[41-45]. Our study shows that expectation for recovery is another important prognostic factor. Self-rated global recovery took from an average of 4 months for those believing they would recover quickly to an average of almost 11 months for those believing they would never recover. Pain recovery and resolution of pain-related limitations showed a similar pattern. Regardless of demographic or socioeconomic factors, prior health, initial pain intensity, post-crash symptoms, or psychological status, those anticipating a quick recovery actually did recover most quickly. Almost one-third of the participants could not predict how quickly they would recover – interestingly, these persons actually recovered at a rate approximately midway between those anticipating a slow recovery and those anticipating that they would never recover. This pattern was observed regardless of which index of recovery was considered.

Our study confirms that there is a robust association between expectations for recovery and actual WAD recovery as assessed by several relevant types of measures. These findings have direct and important clinical interventions. Expectations for type, intensity, and duration of whiplash-associated symptoms exist prior to such an injury. Janzen, *et al*'s[12] model of health expectations posits that such expectations are not only a function of previous experiences with similar events, but of knowledge and beliefs (that may or may not be accurate) about the particular health state. WAD is seen by the general public (those who have never experienced them) as often having a poor prognosis, frequently leading to chronic symptoms[10]. It seems likely that these prior beliefs are influential in the expectations individuals form for their own recovery after an actual injury, and that these expectations for recovery are modified by the immediate injury experience (for example initial pain intensity and extent), as well as by early experiences with healthcare professionals, and the insurance and legal system.

Our findings suggest that it is worthwhile for practitioners to assess expectations for recovery as a means of identifying those injured patients at risk for poor recovery. At particular risk are those who either anticipate never getting better, or who appear unsure of what to expect. However, those who are unsure of what to expect for their own recovery may be especially amenable to interventions that address expectations.

These findings are in harmony with trials showing that early educational interventions (administered using a videotape) that include reassurance and education are beneficial for patients with WAD[45], and it is likely that this strategy works by modifying patient expectations. However, it should be noted that simply handing a patient an evidence-based information pamphlet on the positive prognosis for WAD has not been shown to be effective[46]. This may be because reassurance has to be coupled with advice about exercise (as was done in the previously mentioned videotape), or perhaps because modifying patient expectations requires a more active approach than simply providing a pamphlet. Future research is needed to identify the most effective strategy and timing for intervening in patient expectations for recovery from WAD, and to clarify the best way to deliver these interventions to those who can benefit the most (that is, those with negative expectations or those who are unsure of what to expect).

However, even if modifying persons' expectations for

recovery actually improves their outcome, the mechanism by which expectations affect recovery remains unclear. There may be several possible mechanisms, but one likely hypothesis is that changes in outcome expectations are mediated by self-efficacy beliefs, since outcome expectancy is thought to be at least partially composed of self-efficacy expectations (an expectation for successful completion of a behavioral response, nested within an overall outcome expectation)[12,18]. These self-efficacy expectations and behaviors are thought to be important mediators between behavioral responses and actual attainment of the desired outcome[47]. In turn, self-efficacy can be influenced by performance accomplishments, vicarious experience, verbal persuasion and emotional arousal[17]. What is critical is that each of these mechanisms can induce a cognitive process that provides the individual with feedback in order to evaluate and acquire new patterns of behavior to serve as stored associations for future events or consequences. This, in turn, provides necessary prior understanding for future situations that would guide subsequent expectancy formulation, enabling a cyclical and longitudinal blueprint for future situations. Interventions aimed at modifying expectancies could focus on initially uncovering what associations individuals currently have, since these associations would be unique to the situation and context; and then demonstrating how those associations may be reexamined in order to improve self-efficacy behaviors, thereby potentially altering outcomes.

Our study has several important strengths. It is a population-based inception cohort study, with complete ascertainment of all eligible WAD claimants. Although some WAD studies exclude those with other non-neck complaints, ours did not because the vast majority of persons with WAD have numerous and widespread complaints[48], and exclusion of such individuals would seriously limit the external validity of findings. Instead, we included those with other injuries and adjusted for these factors in our analysis. This makes our sample much more representative of those who make injury claims and present to health providers for care.

Also, we had extensive baseline measures so were able to consider the potential confounding effect of a wide range of demographic, socioeconomic, crash-related, and health-related factors. We had baseline measures on everyone (through the administrative claim form, which formed our baseline data). Although we experienced some attrition, our followup rate was over 80%, thus minimizing the potential effect of bias through differential attrition. Very importantly, we had several different ways of assessing recovery available to us. We believe that self-rated global recovery was the strongest measure of recovery because it does not involve an external source determining what constitutes recovery for any of our participants. However, to the researcher or clinician, it constitutes a kind of "black box" in that we do not know what considerations have gone into that self-assessment. The fact that expectations to recover are also associated with neck pain recovery and resolution of pain-related limitations in activities lends confidence to these findings. In addition, the study design respected the temporality of the exposure-outcome relationship and the dose-response relationship demonstrated in the hazard rate ratios is often used as an indication of causality.

Our study also has several limitations. Outcome information was ascertained at pre-specified timepoints rather than assessed on a continuous basis. This means that we cannot identify the precise time at which these indices of recovery were reached. Much more frequent assessment of outcome would lead to richer and more precise information about time to recover; it would also incur an unreasonable burden on participants, and would be impractically costly in such a large study. It is likely that the effect of this bias would be to artificially decrease the effect size, and that our estimates are a conservative measure of the true association.

We chose the conservative outcome of "0" or "1" for neck pain recovery and of "0" for recovery in pain-related limitations in activities. It should be recognized that these endpoints may not reflect pre-crash health, since non-WAD related neck pain is common in the general public and working population[49]. An ideal alternative would have been to compare neck pain and pain-related activity limitations at followup with actual pre-crash values, although it is seldom possible to get this information. It is common to use self-report after the crash to ascertain information about pre-crash pain conditions; however, these data may be systematically biased in favor of exaggerated estimates of prior health and minimization of prior pain problems[50]. However, it is unclear how much bias there might be in jurisdictions with no-fault insurance systems.

One way of addressing this issue indirectly is to assess the similarities and differences between this cohort of WAD claimants and the general, non-injured population. Several years ago, we studied the health of a random sample of the general adult population in the same province, and can draw some comparisons[51-53]. In the current cohort of WAD claimants, almost 64% of participants reported having had very good or excellent pre-crash general health. In the earlier random sample survey, only 54% of the sample reported having very good or excellent health. Although this might suggest overreporting of positive health status by WAD claimants, another possible explanation is the younger age of the participants in the WAD cohort. One-third of the sample in the earlier health survey study was aged 50 or older, whereas only one-quarter of the WAD claimants was in that age range. We would expect better overall health in younger individuals. On average, we would also expect better health in those driving vehicles than in the general population.

As well, there is good evidence that a past history of WAD is a risk factor for prevalent neck pain and other health complaints[37,54,55]. In examining the self-reported health of

that subgroup of persons in the earlier general population sample who reported no history of neck injuries (who might be considered similar to WAD claimants prior to the crash), almost 60% (similar to our study) report having very good or excellent general health. This suggests less bias in these measures than might have been expected. Other demographic differences in the 2 cohorts (data not shown) was a higher educational attainment in the WAD group than in the general population sample (which might be related to the younger age of the participants); a preponderance of women in the WAD cohort; and, despite the higher educational attainment, lower income (which may be a result of the higher proportion of women in this group, who had lower income).

Expectations for recovery, measured in the first 6 weeks after a traffic-related WAD, predict actual recovery, as assessed using a global self-assessed recovery question, a pain intensity questionnaire and a questionnaire measuring pain-related limitations in daily activities. These findings were robust after adjusting for a large number of demographic, socioeconomic factors, health, crash-related factors, and post-crash symptoms and pain.

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Auditory symptoms in whiplash patients

Could earwax occlusion be a benign cause?

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BACKGROUND
Excess cerumen (earwax) in the external auditory canal is associated with symptoms of earache, fullness in the ears, and diminished hearing. These symptoms, and tinnitus, are commonly associated with whiplash injury.

METHODS
Eighty-six whiplash patients were examined to determine if there was a correlation between symptoms of earache, fullness in the ear, diminished hearing, and tinnitus, and the degree of cerumen occlusion. Cerumen occlusion was measured by visualisation of the tympanic membrane and graded according to a 4 point scale.

RESULTS
Of 71 subjects reporting no acute onset (within 7 days of the collision that caused their whiplash) earache, fullness in the ears, hearing loss, or tinnitus, 62 had little or no cerenum occlusion. Of seven subjects reporting tinnitus but no other auditory symptoms, none had greater than moderate cerenum occlusion. Of eight subjects reporting one or more of acute onset earache, fullness in the ears, diminished hearing, and tinnitus, seven had complete cerenum occlusion in the affected ear.

DISCUSSION
The findings suggest high grade cerumen occlusion frequently occurs in the ear affected by acute auditory symptoms. However, tinnitus alone has no apparent association with cerumen occlusion. It is possible that a significant number of acute onset auditory symptoms reported in whiplash patients have a benign cause.

Excessive cerumen (earwax) in the external auditory canal is associated with symptoms of earache, fullness in the ears, and diminished hearing.[1] Earache, fullness in the ears, diminished hearing, and tinnitus are commonly associated with whiplash injury with attributions including temporomandibular injury.[2,3] The objective of this study was to assess the role of cerumen as a benign explanation for these symptoms in whiplash patients. Consecutive acute whiplash patients were examined to determine if there was a correlation between symptoms of acute onset (within 7 days of the collision that caused their whiplash) earache, fullness in the ears, diminished hearing, and tinnitus, and the amount of cerumen occlusion.

Ethics approval for this study was obtained from the University of Alberta Health Ethics Research Board.

Methods

Over a period of 12 weeks, 86 whiplash patients were studied. One patient was diagnosed with grade 3 whiplash associated disorder (WAD) according to the Quebec Task Force Classification of WADs[4] and 85 were diagnosed with grade 2 WAD. None of the subjects wore hearing aids. No hearing tests were conducted. Pre-existing hearing disorders and history of ear, nose and throat (ENT) surgery were not specifically verified. The mean age of the subjects was 32 years (range 17–81); 64% were women. Subjects' cerumen occlusion (impaired vision of the tympanic membrane) was measured according to a 4 point scale:[5] grade 0 indicating little or no occlusion; grade 1, mild occlusion; grade 2, moderate occlusion; and grade 3, complete occlusion.

Results

All of the 86 subjects reported neck pain. Of 71 subjects reporting no auditory symptoms, the greatest occlusion in either ear was grade 0 in 62 subjects, grade 1 in seven, and grade 2 in two.

Fifteen subjects reported at least one of acute onset earache, fullness in the ears, diminished hearing, and tinnitus. Reported symptoms and grades of cerumen occlusion for these subjects are shown in *Table 1*. Of the seven subjects reporting tinnitus only, none had

Table 1. Cerumen occlusion* in whiplash patients with at least one of: acute onset earache, fullness in the ears, diminished hearing, tinnitus

Subject	Symptoms	Occlusion right ear	Occlusion left ear
1	Bilateral tinnitus	0	2
2	Left earache, left ear fullness, bilateral tinnitus	1	3
3	Right earache	3	2
4	Right ear tinnitus	1	2
5	Bilateral tinnitus	1	0
6	Bilateral earache, bilateral diminished hearing, bilateral tinnitus	3	3
7	Bilateral tinnitus	1	0
8	Left ear fullness, 'noises'	2	3
9	Right ear tinnitus	0	0
10	Bilateral tinnitus	0	1
11	Bilateral ear fullness	3	3
12	Bilateral tinnitus	0	0
13	Left earache	2	3
14	Left ear diminished hearing	2	3
15	Right ear diminished hearing, right ear fullness	3	3

* 0 = little or no occlusion, 1 = mild occlusion, 2 = moderate occlusion, 3 = complete occlusion

grade 3 cerenum occlusion in either ear. Of eight subjects reporting one or more auditory symptom, seven had grade 3 cerenum occlusion in the affected ear. One subject had bilateral grade 3 occlusion, with auditory symptoms present in one ear only.

Patients with occlusion and auditory symptoms were advised to visit their family doctor for cerumen removal. These patients were followed as part of routine care and in 3–4 weeks were found to be asymptomatic of auditory symptoms following cerumen removal.

Discussion

The findings suggest high grade cerumen occlusion occurs in the ear affected by acute auditory symptoms. However, tinnitus alone has no apparent association with cerumen occlusion. There is cause for conducting an external auditory examination in patients presenting with symptoms of earache, fullness in the ears, diminished hearing, or tinnitus.

A population based survey of whiplash claimants indicated 20% of claimants will present with hearing disturbance or pain near the ear.[6] It is possible that in a significant number of these patients, these symptoms have a benign explanation. Provision of patient information and the simple procedure of cerumen removal may be more beneficial than referral to a ENT or other specialist, which could lead to overtreatment of a benign disorder. If and when excess cerumen is ruled out as a cause of acute auditory symptoms, a number of other (often benign) causes can be investigated.[7]

Conflict of interest: none declared.

Implications for general practice

What we already know:

- Excess cerumen in the external auditory canal is associated with symptoms of earache, fullness in the ears, and diminished hearing.
- These symptoms, and tinnitus, are commonly associated with whiplash injury.

What this study found:

- Significant cerumen occlusion frequently occurs in whiplash patients where the ear is affected by acute onset earache, fullness in the ears, or diminished hearing.
- Tinnitus alone has no apparent association with cerumen occlusion.
- A significant number of acute onset auditory symptoms reported in whiplash patients may have a benign cause.

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RESEARCH

Assessing whiplash recovery

The Whiplash Disability Questionnaire

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BACKGROUND
General practitioners often need to track outcomes of whiplash patients, and a disability questionnaire may be useful.

METHODS
Whiplash patients who attended primary care clinics in Edmonton, Canada were interviewed 3 months postcollision. Subjects were asked a global recovery question: 'Do you feel you have recovered fully from your accident injuries?' Subjects then completed the Whiplash Disability Questionnaire (WDQ).

RESULTS
A total of 131 subjects participated. Of these, 52 (39.7%) reported that they felt they had recovered. Those who reported complete recovery had a mean WDQ score of 2.5 and those who reported they had not recovered had a mean WDQ score of 29.9. All who responded 'yes' to the recovery question had a WDQ score below 13, while all those responding 'no' to the recovery question had a WDQ score of 13 or more.

DISCUSSION
The WDQ as an outcome measure may be useful in clinical practice.

General practitioners often encounter and manage whiplash patients. They are also often asked to provide insurance and other medicolegal reports on patient outcomes. Disability questionnaires can assist as they focus on global functioning rather than just symptoms. Hoving et al[1] conducted semi-structured interviews of 83 patients with whiplash associated disorders (WAD) to identify any of the following problems and activity limitations: pain, anxiety, depression, anger, fatigue, limitation of personal care, role activities (work/study/housework), driving, sleeping, nonsport leisure activities, sport leisure activities, and social activity. Based on this work, Pinfold et al[2] proposed the Whiplash Disability Questionnaire (WDQ), a modified version of the Neck Disability Index[3] (NDI) with 13 items designed to evaluate whiplash related disability. Willis et al[4] then continued the validation of a WDQ that was developed from the NDI using self reported disabilities in a group of participants experiencing whiplash associated disorders, demonstrating that the WDQ has excellent short and medium term reproducibility and responsiveness in a population seeking treatment for WAD.

Rather than using questionnaires, primary care patients with whiplash injuries are usually asked how they are doing, or asked in a global way about their sense of overall recovery. For a disability questionnaire to be useful to GPs reporting on their patient's recovery, there should be good correlation between the disability scores and the patient's global sense of recovery. In order to determine if the WDQ is useful in this respect, we designed a simple head-to-head comparison of the responses of patients presenting to primary care clinics after a motor vehicle collision on two measures: the patient's response to: 'Do you feel you have recovered fully from your accident injuries?' and their total scores on the WDQ.

Methods

This study was a telephone based interview study comparing two outcome measures, with approval from the Research Ethics Board of the University of Alberta, Canada. It took place through a group of walk-in primary care centres owned and operated by one company in Edmonton, Canada. These clinics serve a catchment area of 1 million people. There are 15 such clinics in Edmonton spread throughout the city. They serve a

wide demographic and are among the most common primary care centres to receive whiplash patients.

Patients who attended one of these clinics in the spring of 2005 were identified through the daily diagnostic codings of consenting physicians, with the aim of contacting these patients approximately 3 months postinjury. Through the International Classification of Diseases coding of the billing, motor vehicle collision victims were identified. Consecutive patient encounter billing codes on each day of billing in all clinics were examined until at least 250 potential subjects were identified. Those subjects were then contacted and interviewed by telephone survey. Prospective subjects were further assessed for inclusion and exclusion criteria at the time of interview. WAD grade 1 or 2 patients were included if they were seated within the interior of a car, truck, sports/utility vehicle, or van in a collision (any of rear, frontal or side impact), had no or less than 5 minutes of loss of consciousness, were 18 years of age or over, and presented within 72 hours of their collision. Patients were excluded if they were told they had a fracture or neurological injury (ie. grade 3 or grade 4 WAD), refused to give consent, had no fixed address or current contact information, were unable to communicate in English, had nontraumatic pain, were injured in a nonmotor vehicle event, or were admitted to hospital.

The primary outcome measure was the patient's response to the question: 'Do you feel you have recovered fully from your accident injuries?' Recovery was defined as answering 'yes' to the recovery question; other choices being 'no' and 'not sure'. The total score on the WDQ was also measured and correlated to recovery question responses to test the agreement between these two measures. The lowest score possible for the WDQ is 0 (indicating no disability) and the highest 130 (indicating maximum disability).

Of the nearly 250 subjects identified from billing records, we found that many reported nontraumatic neck pain. It appears there was wide variance in diagnostic coding by physicians, with more than one in 3 potential subjects not reporting an injury, despite their code indicating one.

Results

A total of 147 subjects remained eligible, and were interviewed by telephone. After initial questioning, 16 chose not to participate (89% participation rate). The mean age of participating subjects was 35.9 (SD=10.9, range 18–71 years, 68 of 131 subjects [52%] were female). Of these subjects, 52 (39.7%) reported that they felt they had recovered from their injuries. For the cohort as a whole, the mean WDQ score was 19.2 (SD 17.4, range 0–82). Those who reported complete recovery had a mean WDQ score of 2.5 (SD=3.6, range 0–12) and those who reported they had not recovered had a mean WDQ score of 29.9 (SD=13.9, range 13–82). All subjects who responded 'yes' to the recovery question had a WDQ score below 13, while all those responding 'no' to the recovery question had a WDQ score of 13 or over. Like Pinfold et al[2] we also found a high internal consistency, with Cronbach's alpha = 0.95.

Discussion

The results of this study suggest that the global recovery question correlates well with a WDQ score below 13. As the maximum score on the WDQ is 130 (maximum disability), a score of 13 or less is expected to be associated with a high level of functioning. Conversely, the WDQ captures the patient's global sense of recovery well. The WDQ is thus useful in detecting recovery, and in those not recovered it identifies specific areas of concern for the patient (ie. their sense of a lack of recovery may be related not so much to pain itself but to, for instance, a limitation in returning to their normal leisure activities). We suggest that the WDQ may be a useful outcome measure for GPs following whiplash patients and reporting their recovery to others.

Conflict of interest: none declared.

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GENERAL DISCUSSION AND CONCLUSIONS

The above research contributes to our understanding of population-held beliefs about recovery from whiplash injury, to our understanding of the effects of expectation of recovery on rates of recovery after whiplash injury, and to our understanding of the problem of symptom attribution in whiplash patients.

The research found a high level of pessimism regarding likelihood of recovery from neck pain and especially from whiplash injury. For example, a minority of subjects agreed with the statement "most *condition* settles quickly and you get on with usual activities such as getting back to work", and most also believed that these conditions mean long periods of time off work and are likely to eventually cause them to stop working. Because psychosocial factors such as negative recovery expectations, fear of movement and catastrophizing contribute to the development of prolonged disability recovery pessimism could be considered a maladaptive belief. The widespread pessimism observed in the general public even in those without a history of the condition is of concern. As mass media education campaigns have been effective in changing back pain beliefs, and in some settings, reducing work related disability and health care utilization[1], similar programs may be effective for WAD and related conditions. Data from this study could inform future public education programs related to whiplash injury. For example, as opposed to highlighting the importance of staying active, future campaign messaging could focus on the unlikely scenario of persistent disability to reduce fear-avoidance beliefs.

This MSc thesis research also found that there is a robust association between expectations for recovery and actual whiplash recovery. These findings have direct and important clinical interventions. Expectations for type, intensity and duration of whiplash-associated symptoms exist prior to such an injury. It seems likely that these prior beliefs are influential in the expectations individuals form for their own recovery after an actual injury; and that these expectations for recovery are modified by the immediate injury experience (for example initial pain intensity and extent), as well as by early experiences with health care professionals.

Our findings suggest that it is worthwhile for practitioners to assess expectations for recovery as a means of identifying those injured patients at risk for poor recovery. At particular risk are those who either anticipate never getting better, or who appear unsure of what to expect. However, those who are unsure of what to expect for their own recovery may be especially amenable to interventions that address expectations. These findings are in harmony with trials showing that early educational interventions (administered using a videotape) that include reassurance and education are beneficial for WAD patients,[2] and it is likely that this strategy works by modifying patient expectations. However, it should be noted that, after performing a randomized controlled trial, Ferrari et al. concluded that simply handing a patient an evidence-based information pamphlet on the positive prognosis for WAD was not effective[3], even though the information pamphlet was based on a previously validated source, focused on a set of clear messages, and provided simple and ‘‘common sense’’ advice. Within

the power limits of the sample size, any major impact was unlikely to have been missed. Furthermore, the estimate of the observed effect did not remotely approximate the authors' a priori established minimal clinically important difference. This may be because reassurance has to be coupled with advice about exercise (as was done in the previously mentioned videotape), or perhaps because modifying patient expectations requires a more active approach than simply providing a pamphlet. Equally, expectations may not be the only risk factors for chronic pain.

Some recent evidence suggests that the development of disabling neck/low back pain is strongly associated with an increased use of passive coping strategies (e.g., reliance on medications for symptom relief), regardless of levels of active coping.[4] That is, even if an injured person remains active and engages in physical exercise, the concomitant tendency to hold passive strategies such as relying heavily on pain medications, frequently focusing on and discussing their pain with others, and canceling social activities negates the beneficial effects of the active coping.[4] Another limitation to educational literature interventions is that it is difficult to verify compliance. Even with practitioner-led educational interventions, compliance with advice is an issue. Finally, it may be that the intervention is not sufficiently robust to counter the effects of other factors such as those that may exist in a litigation system. It has been shown that the characteristics of the prevailing litigation system may significantly reduce recovery rates from whiplash- related injuries.[5]

There may still be a role for educational interventions in modifying expectations, but it is likely that these efforts will have to be informed with further research examining the social context in which educational interventions take place, and the independent (if there is one) effect of coping styles on outcomes. Interventions aimed at modifying expectations could focus on initially uncovering what associations individuals currently have, since these associations would be unique to the situation and context; and then demonstrating how those associations may be re-examined in order to improve self-efficacy behaviors, thereby potentially altering outcomes.

Finally, it has been demonstrated that a significant proportion of whiplash patients are at risk for mis-attributing some types of symptoms to injury rather than the more benign and clinically common sources unrelated to injury. This is exampled by the finding that excessive ear wax is the most likely explanation and correlates highly with auditory symptoms in whiplash patients.

Combined, these studies fit together in beginning to unravel what illness beliefs are by the general population concerning whiplash injury, what expectations for recovery are held by whiplash victims, and how illness beliefs and expectations may combine or cooperate to create problems of symptom misattribution. That is, as has been discussed elsewhere[6], in the setting of expectation of chronic pain, patients may assume that numerous, unrelated symptoms arise from the collision. Pre-collision and co-incidental sources of symptoms become more noticeable in this setting of hypervigilance created by symptom expectation, and symptoms that patients previously viewed as benign

and largely ignored are now registered. These studies thus build on work pre-dating the MSc thesis and ongoing efforts to unravel these concepts.

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