

Course and Prognostic Factors for Neck Pain in Workers

Results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders

Linda J. Carroll, PhD,*† Sheilah Hogg-Johnson, PhD,‡§ Pierre Côté, DC, PhD,¶||**††
Gabrielle van der Velde, DC,‡¶||**†††† Lena W. Holm, DrMedSc,††
Eugene J. Carragee, MD, FACS,§¶¶¶ Eric L. Hurwitz, DC, PhD,||||
Paul M. Peloso, MD, MSc, FRCP(C),*** J. David Cassidy, DC, PhD, DrMedSc,¶||**
Jaime Guzman, MD, MSc, FRCP(C),†††††† Margareta Nordin, PT, DrMedSc,§§§¶¶¶¶
and Scott Haldeman, DC, MD, PhD|||||||*****

Study Design.

Best-evidence synthesis.

Objective. To perform a best evidence synthesis on the course and prognostic factors for neck pain and its associated disorders in workers.

Summary of Background Data. Knowledge of the course of neck pain in workers guides expectations for recovery. Identifying prognostic factors assists in planning effective workplace policies, formulating interventions and promoting lifestyle changes to decrease the frequency and burden of neck pain in the workplace.

Methods. The Bone and Joint Decade 2000–2010 Task Force on Neck Pain and its Associated Disorders (Neck Pain Task Force) conducted a critical review of the literature published between 1980 and 2006 to assemble the

best evidence on neck pain and its associated disorders. Studies meeting criteria for scientific validity were included in a best evidence synthesis.

Results. We found 226 articles related to course and prognostic factors in neck pain and its associated disorders. After a critical review, 70 (31%) were accepted on scientific merit; 14 of these studies related to course and prognostic factors in working populations. Between 60% and 80% of workers with neck pain reported neck pain 1 year later. Few workplace or physical job demands were identified as being linked to recovery from neck pain. However, workers with little influence on their own work situation had a slightly poorer prognosis, and white-collar workers had a better prognosis than blue-collar workers. General exercise was associated with better prognosis; prior neck pain and prior sick leave were associated with poorer prognosis.

Conclusion. The Neck Pain Task Force presents a report of current best evidence on course and prognosis for neck pain. Few modifiable prognostic factors were identified; however, having some influence over one's own job and being physically active seem to hold promise as prognostic factors.

Key words: neck pain, systematic review, epidemiology, prognosis. **Spine 2008;33:S93–S100**

From the *Department of Public Health Sciences and †the Alberta Centre for Injury Control and Research, School of Public Health, University of Alberta, Canada; ‡Institute for Work and Health, Toronto, Canada; §Department of Public Health Sciences, University of Toronto, Toronto, Canada; ¶Centre of Research Expertise in Improved Disability Outcomes (CREIDO), University Health Network Rehabilitation Solutions, Toronto Western Hospital, Canada; ||Departments of Public Health Sciences and Health Policy, Management and Evaluation, University of Toronto, Toronto, Canada; **Division of Health Care and Outcomes Research, Toronto Western Research Institute, Toronto, Canada; ††Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden; ‡‡Institute for Work & Health, Toronto, Canada; §§Department of Orthopedic Surgery, Stanford University School of Medicine, Stanford, CA; ¶¶Orthopedic Spine Center and Spinal Surgery Service, Stanford University Hospital and Clinics, Stanford, CA; ||||Department of Public Health Sciences, John A. Burns School of Medicine, University of Hawaii at Mānoa, Honolulu, HI; ***Endocrinology, Analgesia and Inflammation, Merck & Co. Rahway, NJ; †††Department of Medicine, University of British Columbia; ‡‡‡Occupational Health and Safety Agency for Healthcare in BC, British Columbia, Canada; §§§Departments of Orthopedics and Environmental Medicine and Program of Ergonomics and Biomechanics, School of Medicine and Graduate School of Arts and Science, New York University; ¶¶¶Occupational and Industrial Orthopedic Center (OIOC), New York University Medical Center; |||||Department of Neurology, University of California, Irvine, CA; *****Department of Epidemiology, School of Public Health, University of California, Los Angeles, CA; and ††††Department of Health Policy, Management and Evaluation, University of Toronto, Toronto, Canada.

The manuscript submitted does not contain information about medical device(s)/drug(s).

Corporate/Industry, Foundation, and Professional Organizational funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Address correspondence and reprint requests to Linda J. Carroll, 4075 RTF, University of Alberta, Edmonton, Alberta, Canada T6G 2E1; E-mail: lcarroll@ualberta.ca

Neck pain is common in workers and, as would be expected, the frequency of neck pain varies widely across different occupations, with the highest frequency seen among those working in hospitals and offices, and lowest frequency among workers in industrial/service and forestry sectors.¹

The question of whether workers experience resolution of their neck pain, and, if so, how long this takes, is of particular concern to workers themselves, to employers, and to health care providers. Knowledge about the course of neck pain in workers is useful for 2 reasons. First, this knowledge provides information that can be used to guide expectations. Second, it can help determine the effectiveness of neck pain interventions by establishing whether a particular intervention improves (or worsens) the usual course of recovery.

Knowing the determinants of neck pain course (*i.e.*, prognostic factors) is also important to those who wish to plan effective workplace policies, to formulate effective

tive workplace and nonworkplace interventions, and to help workers make effective lifestyle changes that will decrease the frequency and burden of neck pain. Identifying factors associated with poor prognosis also provides a target for intervention studies, both inside and outside of the workplace, and also indicates which workers are most likely to benefit from specific interventions.

It is important to consider study design in reviewing the literature on course and prognostic factors for neck pain. Cohort studies of prognostic factors necessarily involve *longitudinal* research designs that permit tracking of study participants over time. Studies of prognostic factors in workers must begin with workers who have neck pain at the onset of the study. These individuals are then tracked over time to identify any factors and characteristics that distinguish those who recover from those who do not. In other words, prognostic factors are those personal characteristics or circumstances which predict the course of recovery—or the failure to recover—from neck pain. Because cross-sectional studies provide a “snapshot” in time, factors found to be associated with neck pain in such studies could be risk factors, prognostic factors, or consequences of neck pain. Findings from cross-sectional studies on neck pain in workers are reported elsewhere.¹

In examining findings provided by longitudinal studies, the strength of the evidence produced by these studies should also be considered. One paradigm classifies cohort studies into a 3-level hierarchy of knowledge. This model has been used to interpret evidence obtained in prognostic studies of breast cancer, whiplash injuries, and mild traumatic brain injuries.^{2–5}

- Phase I studies are descriptive and hypothesis generating, exploring crude associations between potential prognostic factors and health outcomes.
- Phase II studies are also exploratory, but use stratified or multivariable analyses to identify sets of prognostic factors.
- A Phase III study is hypothesis driven and confirmatory. The goal is to confirm or refute the independence of any apparent relationship between a particular prognostic factor and the outcome of interest, after adjusting for confounding.⁶

In the current article, we have used this hierarchy to help us interpret findings from prognostic studies in workers. The course of neck pain and prognostic factors for recovery in the general population and in whiplash-associated disorders (WAD) are presented elsewhere.^{6,7} Although there may be many similarities across these populations, we believe this way of organizing our findings will be most useful to audiences. Within the working population, we further separated the tables reporting the course of neck pain from those reporting prognostic factors for recovery from neck pain.

■ Materials and Methods

Design and Data Collection

The literature search and critical review strategy are outlined in detail elsewhere.⁸ In brief, we systematically searched the electronic library database Medline for literature published from 1980 through 2005 on neck pain and its associated disorders; we also systematically checked the reference lists of relevant articles and updated the search to include key articles for 2006 and early 2007.⁸ We screened each citation for relevance to the Neck Pain Task Force mandate, using *a priori* inclusion and exclusion criteria. We made no attempt to assess the scientific quality of each study when establishing its relevance to the Neck Pain Task Force mandate. Studies were considered relevant if:

- they pertained to the assessment, incidence, prevalence, determinants or risk factors, prevention, course, prognosis, treatment and rehabilitation, and/or economic costs of neck pain;
- they contained data and findings specific to neck pain and/or disorders associated with neck pain, or described a systematic review of the literature on neck pain;
- they included at least 20 persons with neck pain or at risk for neck pain.

We excluded studies on neck pain that was associated with serious local pathology or systemic disease, such as neck pain from infections; fractures or dislocations (except where such studies inform differential diagnosis in neck pain); myelopathy; rheumatoid arthritis and other inflammatory joint diseases; or tumors.

Quality Assessment

Rotating pairs of Scientific Secretariat members performed independent, in-depth critical reviews of each article, identifying methodologic strengths and weaknesses. The criteria used in the methodologic appraisal of the studies can be seen online through Article Plus. Our methodologic appraisal focused on sources of potential selection bias, information bias, and confounding. We also considered whether or not these biases would likely result in erroneous or misleading conclusions. After discussions of each article, decisions were made about the article's scientific merit. Studies judged to have adequate internal validity and to be methodologically rigorous, such that the results could be accepted with reasonable confidence, were considered to be scientifically admissible and were summarized in evidence tables. These evidence tables were used to formulate the best evidence synthesis.

Analysis

We classified the studies identifying prognostic factors into Phase I, II, or III studies (described earlier). We used this framework in our synthesis of the studies and in our development of summary statements of the evidence. Where the evidence from different studies varied, more emphasis was given to evidence from well-conducted Phase III studies, and secondarily, to well-conducted Phase II studies. The best evidence synthesis consists of a qualitative integration of the studies judged to be scientifically admissible, and links all summary statements and conclusions to the evidence tables, so that the evidence that formed the basis of any statements is made clear.^{9–11}

In accordance with our conceptual framework on the course and care of neck pain,¹² and similar to the organization of risk

factors for new onset (incidence) of neck pain,^{1,13,14} we further classified prognostic factors into the following categories:

- *Demographic and socioeconomic factors:* These are usually either nonmodifiable (e.g., age and gender) or not easily modifiable (e.g., socioeconomic status).
- *Health factors and pain history:* These can be classified as “impairments” according to the WHO’s ICF framework.¹⁵
- *Workplace factors:* These would include job tasks and ergonomic design of the workplace. Many workplace factors are potentially modifiable.
- *Psychological and social factors:* These would include depression, anxiety, and coping strategies, as well as interpersonal factors (e.g., relationships with friends). Again, many of these factors are potentially modifiable.
- *Societal factors:* This would include the prevailing compensation systems and laws. Such factors are potentially modifiable, although not on an individual basis.
- *Genetic factors:* These are potentially important prognostic factors, although not considered modifiable.
- *Health behaviors:* This would include health lifestyle factors such as physical exercise. Such factors are also potentially modifiable.

■ Results

This article reports our findings from the scientifically admissible articles on course and prognostic factors for recovery from neck pain in the working population. We identified 1203 articles; after critically appraising these studies, we judged 552 to be scientifically admissible for our best evidence synthesis. Seventy scientifically admissible studies pertained to course and prognostic factors for neck pain; of these, 14 studies pertained neck pain in workers. These 2 groups of studies are summarized in Tables 1 and 2 (available online through Article Plus), respectively.

The Course of Neck Pain

The preponderance of evidence indicates that, in workers with neck pain, over 50% will report neck pain 1 year later. However, because the course of neck pain was generally determined using reports of neck pain at discrete follow-up points, we were not able to distinguish whether this reflected persistent (continuous) or recurrent neck pain.

Our findings on course of neck pain are based on 10 studies (of 8 distinct cohorts) related to the course of neck pain in the working population (Table 1, available online through Article Plus). These studies examined the course of neck pain in:

- Swedish dentists with prevalent neck pain.¹⁶
- Finnish female bank tellers with prevalent neck pain.¹⁷
- Workers in nursing homes in The Netherlands with prevalent neck pain.^{18,19}
- Hospital, office, warehouse, or airport workers with prevalent neck pain who were covered by occupational medical departments in France.²⁰
- General population of workers with prevalent neck pain in France.²¹

- General population of workers Norway with “chronic neck pain,” defined by the authors as neck pain lasting for 6 months or longer, and accompanied by functional limitations.²²
- Workers in a Canadian province making claims for workers’ compensation benefits for neck pain (this consisted of new claims for neck pain, which may or may not reflect new neck pain episodes).^{23,24}
- American military personnel who underwent surgery for cervical disc herniation (no information was provided on pain presence, duration, or intensity).²⁵

Subjects in all cohorts (except the Canadian one) had prevalent neck pain at baseline. Measures of neck pain at baseline ranged from 3-month period prevalence (neck pain within the past 3 months) to 12-month period prevalence. The study of American military personnel provided information on medical fitness to return to duty, but did not provide information on the presence of neck pain at follow-up.

In the 6 distinct cohorts of workers with prevalent neck pain (*i.e.*, neck pain that lasted for some unspecified period of time), findings consistently indicated that more than 60% of subjects went on to report neck pain at follow-up. This is similar to findings of course of neck pain in the general population⁶ and in WAD (Grades I–III).⁷

In those with neck pain at an index point, the 3-month period prevalence of neck pain was 61% and 44% after 1 and 2 years, respectively¹⁸; 6-month period prevalence was 72.2% after 1 year²⁰; the 1-year period prevalence was 78% after 30 months,¹⁶ and was 80.8% at 4 years.²² Those subjects reporting more severe neck pain at baseline had less neck pain recovery,²⁰ and 62% of those with moderate or severe neck pain at baseline reported at least moderate neck pain 30 months later.¹⁶ A study that tracked changes in neck pain frequency among bank tellers reported that 9 months later, 23.7% had experienced a decrease in symptom frequency, with the remainder showing no change (59.5%), a fluctuating course (11.2%) or an increase in symptom frequency (5.6%).¹⁷

The Canadian workers’ compensation cohort studied new episodes of compensated work absence for neck pain (although this may not represent new episodes of neck pain). In this cohort of workers, the average work absence among claimants was 74.5 days. The study found that when compared with low back pain, neck pain resulted in similar levels of long-term work absence. In addition, neck pain claims were frequently recurrent, with 38.5% of claimants having at least 1 additional compensated work absence due to neck pain in the 3 years subsequent to the index claim.^{23,24}

In a study of workers with chronic pain at baseline (defined as long-standing pain with functional limitations), 64.8% of men and 53.2% of women had experienced some decrease in neck pain severity 5 years later and no longer met the case definition for chronic neck pain (using the same definition).²¹ However, the authors

of this study did not report on what degree of recovery was experienced. Finally, the study of US military personnel found that after surgical treatment for cervical disc herniation, 86% were considered medically fit for duty within 10 to 48 months.²⁵ Again, no information was provided about either the presence or severity of neck pain at follow-up.

Most of the differences in findings could be explained by study design issues. Studies with (a) shorter follow-up periods, (b) longer period prevalence measures (*e.g.*, pain in the past 12 months *vs.* pain in the past 3 months), and/or (c) a less restrictive case definition for pain (*e.g.*, any pain *vs.* pain accompanied by limitations or pain requiring time off work) reported a higher prevalence of pain at follow-up.

Prognostic Factors for Neck Pain

Our best evidence synthesis includes 8 studies reporting prognostic factors for neck pain in workers (Table 2, available online through Article Plus). Four of these studies also reported information on course of neck pain (above). Working populations in the studies of prognostic factors included:

- male construction workers,²⁶
- workers in nursing homes in The Netherlands,¹⁸
- female sewing machine operators in Denmark,²⁷
- female electronics assembly workers in Sweden,²⁸
- forest industry workers in Finland with a new episodes of neck pain,²⁹
- military personnel in the United States who had undergone surgical intervention for cervical disc herniation,²⁵
- general populations of working persons (work type unspecified) in France,²¹
- general populations of working persons (work type unspecified) in Norway.²²

All studies (except the 1 involving forest industry workers) consisted of workers with prevalent neck pain of unknown duration at baseline. The heterogeneity of the study populations, prognostic factors studied, follow-up periods, outcomes and analyses did not support statistical pooling of results. Therefore, individual study results are presented in evidence tables, which form the framework for our summary and conclusions. These tables provide extensive information about the size of the estimated associations, and the precision of these estimates where these were provided. We refer the reader to these tables for this specific information.

Demographic and Socioeconomic Factors

Gender. Evidence varies in the 4 studies (all Phase II) assessing gender as a prognosis factor in workers' neck pain. Where a study did find a positive gender association, the size of the effect was modest. In the 2 general (occupation unspecified) working populations, women were slightly more likely to have persistent or recurrent pain [odds ratios (OR) < 2].^{21,22} However, gender did

not predict recurrent pain in nursing home workers or length of sick leave in forest workers with new episodes of neck pain.^{18,29}

Age. The evidence indicates that age is not a prognostic factor for outcome in workers with neck pain: 6 of the 7 studies assessing age in the prognosis of neck pain reported no association.^{18,22,25–27,29} Of these, 1 was Phase I study and 5 were Phase II studies. One Phase II study did find an association between age and prognosis among female workers in France with chronic neck pain at the index point. The case definition in this study was longstanding pain, with functional limitations. The study found that workers under age 50 years were less likely to continue to meet the case definition for chronic neck pain 5 years later, compared with workers over age 55. The effect of age was modest (OR = 0.6; for measures of precision for this and other estimates, see Table 2, available online through Article Plus).²¹ This study demonstrated no age effect for recovery in male workers with chronic neck pain after adjusting for other factors.

Prior Health, Prior Pain, and Comorbidities. We accepted 5 studies (all Phase II), all of which presented evidence that prior pain (self-reported) and/or prior sick leave predicted a less favorable outcome in workers with neck pain. Prior musculoskeletal pain was a moderately strong predictor (OR = 1.7–2.6) of persistent and/or recurrent pain.^{18,21,22} One study found that severe current neck pain combined with a history of sick leave for a prior episode of neck pain was a strong predictor (OR > 5) of longer sick leave for current neck pain.²⁹ In addition, prior sick leave for reasons other than neck pain predicted worsening of cervicobrachial symptoms over a 1-year period.²⁸ However, general health status was not associated with neck pain recurrence.¹⁸

We found no scientifically admissible study or studies that assessed the role of degenerative changes in prognosis for neck pain among workers.

Occupation Type and Physical/Ergonomic Job Characteristics

Eight studies addressed the prognostic role of occupation type/classification and physical job demands/ergonomic factors^{18,21,22,25–29}; all except 1²⁵ were Phase II studies (with multivariable analyses to explore sets of predictors).

Occupation Type and Classification. All the studies investigating this issue (1 Phase I study and 4 Phase II studies) found evidence that job type/classification had an influence on prognosis.

Metal workers were twice as likely as welders to have neck-pain related sick leave of more than 3 days,²⁶ and blue-collar workers were at least 6 times more likely to have taken longer sick leave (>3 days) compared with white-collar workers.²⁹ However, length of sick leave does not necessarily reflect pain duration, and the course of neck pain in these groups was not reported. A Phase I study of military service personnel who had undergone

cervical disc herniation surgery found that enlisted personnel were almost 3 times more likely than officers to be judged as medically unfit for duty after surgery.²⁵

A study of sewing machine operators in Denmark found that those who changed employment were over 4 times more likely to recover from long-lasting pain than those who stayed in the same job.²⁷ Another study also found that changing employment predicted improvement of cervicobrachial symptoms in female electronics assembly workers; previous heavy work and high productivity were prognostic of worsening symptoms, although no information is provided in this study about the strength of these associations.²⁸

Physical, Ergonomic, and Job Demand Factors. The evidence from 6 studies (1 Phase I study and 5 Phase II studies) indicates that these factors do not predict outcome of neck pain in workers. In sewing machine operators with neck pain, the type of machine operated, the workload and pace of tasks, and the presence of ergonomic adjustments in the workplace were not associated with workers' pain status 6 years later.²⁷ In women with neck pain who worked in the electronic manufacturing industry, work type within the assembly line, duration of employment, working hours, strenuous work operations and work posture did not predict symptom changes.²⁸ Moreover, in a general (occupation unspecified) working population, job characteristics such as hours at work, heavy lifting, overhead work, posture and pace of work did not predict persistent or recurrent pain.²² Duration of employment or work-related physical loads were not prognostic factors for recurrence of neck pain in a study involving nursing home workers.¹⁸

The 2 exceptions to these negative findings about physical, ergonomic, and job demand factors were in different samples of persons with neck pain. One was a study of US military personnel who had undergone surgery for cervical disc herniation. It found that a shorter duration of service was associated with greater likelihood of being judged medically unfit for duty after cervical surgery, although this increase in odds was less than 20%.²⁵ The other was a study of workers (unspecified occupations) who had *chronic* neck pain at baseline. It found that high job demands (defined in the study as having to hurry, to performing several tasks at the same time, or being interrupted often) predicted continued chronic pain at 5 years, as did repetitive work (but only in women). Again, the associations for these prognostic factors were modest (<30% increased odds of a poor outcome).²¹

We found no scientifically admissible study or studies examining the impact of vibration or long hours of driving on prognosis of neck pain.

Psychological and Social Factors (Work and Nonwork-Related)

The evidence from 4 Phase II studies examining this issue indicates that most of the psychosocial factors studied did not predict the course of neck pain in workers. Psy-

chosocial factors under scrutiny were: perceived psychological and work stress, job satisfaction, depressive symptoms, psychological load, satisfaction with colleagues, and social support.^{18,21,22,28} However, 1 of these studies did find that workers with neck pain who perceived themselves as having little influence over their work were more likely to again report neck pain 4 years later. This association was of moderate strength (OR = 2.54).²²

We found no scientifically admissible study or studies that looked at coping strategies, anger and frustration in workers as prognostic factors in neck pain. We believe these factors deserve to be evaluated, because they were prognostic of outcome in the general population and in persons with WAD.^{6,7}

Compensation, Legal, and Societal Factors

Only 1 Phase I study examined compensation factors as predictors of outcome in a specialized group of workers (US military personnel who had undergone surgical treatment for cervical disc herniation). In this study, compensation factors did not predict whether these personnel were rated as medically unfit for duty after surgical treatment.²⁵

We found no scientifically admissible study or studies looking at prognostic factors for recovery in workers' compensation claimants.

Health Behaviors

Evidence is consistent in the 2 studies on this topic (both Phase II) that workers who exercised had a better prognosis for neck pain. After adjustment for a variety of work-related factors and job changes, physical training outside of work predicted improvement in cervicobrachial symptoms among Swedish female electronics assembly workers (no effect sizes reported).²⁸ Men in the general working population in France who engaged in sporting activities were 50% more likely to experience an improvement in chronic neck pain²¹ compared with male workers who did not take part in sports.

We found no scientifically admissible study or studies that examined the potential prognostic role of body mass index, smoking, or other health-related lifestyle factors.

Genetic Factors

We found no scientifically admissible study or studies that examined the effect of genetic factors on the prognosis of neck pain in workers.

Cultural Factors

We found no scientifically admissible study or studies that explored the prognostic role of cultural factors among workers with neck pain.

Other Factors

Two factors—prior treatment for 2 disc levels, and requiring additional surgery—were both predictive of prognosis in a group of military service personnel who had undergone cervical disc herniation surgery. Those with a history of prior treatment and who needed more

surgery were more likely to be assessed as medically unfit for duty later on.²⁵

■ Discussion

The available evidence indicates that the course of neck pain in workers is persistent or recurrent in the majority of cases,^{16–18,20,22–24} and that more than 60% of workers with neck pain reported having neck pain 1 year later. These findings are consistent with findings about the course of neck pain in the general population and the course of recovery in WAD.^{6,7} However, 2 studies of workers with severe neck pain problems suggest that these groups showed some degree of improvement over time: more than half of workers (unspecified occupations) with long-standing, limiting pain improved to some degree over a 5-year period²¹; and military personnel had a good prognosis for return to work after cervical disc herniation surgery.²⁵ No information was provided on either the presence or severity of neck pain at follow-up in these studies, so no inferences can be made regarding recovery from pain.

Women in the general working population (occupations unspecified) were slightly more likely to report persistent or recurrent neck pain compared with men.^{21,22} This is consistent with 2 studies reporting gender differences in prognosis in general population samples.⁶ However, gender was not a prognostic factor for outcome in 2 specific occupational groups: nursing home workers, and persons working in the forest industry.^{18,29} As for age, there is evidence for an increased risk of new neck pain episodes in older workers.¹ However, older age does not seem to be an important predictor of recovery in workers with neck pain.^{18,22,25–27,29}

Most of the physical job-demand characteristics and ergonomic factors studied had little or no prognostic value. For example, there was no relationship between the following factors and recurrent/persistent neck pain among workers on an assembly line: the type of sewing machine used, workload, pace, ergonomic adjustments, work type (within the assembly line), employment duration, hours at work, strenuousness of work operations, work posture, physical load, heavy lifting, and overhead work.^{18,22,27,28} Only small associations were observed between high job demands and recurrent/persistent neck pain at follow-up; among women, repetitive work was linked to this outcome, but again, the association was modest.²¹ It should be noted that most of the physical job-demand characteristics were assessed through self-report, which may not accurately reflect the reality of the job situation.

As for psychological factors in workers, most were not prognostic of recovery.^{18,21,22,28} Interestingly, 1 study reported that while depression increased the risk of developing chronic neck and shoulder pain, it did not predict outcome for those with chronic neck/shoulder pain at baseline.²¹ However, we found no study or studies involving workers that looked at the impact of coping style, anger or frustration in predicting outcome. These

were among the most important of the psychosocial factors in the *general population* studies.

Some factors that *were* prognostic of poorer outcome of neck pain in the working population were prior musculoskeletal pain, prior sick leave,^{18,21,22,28,29} and occupational type (blue-collar *vs.* white-collar/metal workers *vs.* welders/enlisted *vs.* being an officer).^{25,26,29} For some occupations (specifically, sewing machine operators), changing jobs was strongly associated with more positive outcomes.²⁷

Having little (self-perceived) influence over one's own work situation was the only psychosocial factor studied which had clear prognostic value; however, the effect of this factor was modest.²² Finally, the 2 studies of the prognostic role of exercise (again, self-reported) reported that this factor did predict better outcome.^{21,28} This is consistent with evidence that exercise is an effective intervention,³⁰ although the finding is discrepant with those from *general population* samples,⁶ where exercise did not predict recovery.

We recognized some important gaps in the literature. For example, no scientifically admissible studies considered the prognostic factors for recovery in workers' compensation claimants (although it is likely that many subjects in accepted studies were receiving workers compensation benefits). We also noted a lack of studies considering the prognostic role of degenerative disc disease in recovery from neck pain. Few health-related lifestyle factors were studied, despite the fact that these are potentially modifiable—for example, we found no studies examining the prognostic roles of body mass index or smoking. No scientifically admissible studies considered the prognostic role of work-related vibration (*e.g.*, in workers using jackhammers) or work-related driving (*e.g.*, in truck drivers or bus drivers). Other gaps in the prognostic literature include the roles of coping, anger, or frustration, the role of cultural factors, and prognosis for neck pain among workers who live in developing countries.

The evidence clearly suggests that prognosis for neck pain in workers is determined by a combination of factors. Unfortunately, few of the factors identified as prognostic are easily modifiable; others that may potentially be modifiable (like having to hurry and engaging in repetitive work) were shown to have limited effects on prognosis (small effect sizes).²¹

Furthermore, within professions or type of work, few factors other than changing work status or reallocation of job appeared to predict recovery from neck pain. This is true despite other research which demonstrates that job-related factors are very important in differentiating risk of onset for neck pain among workers.¹

Exercise is a promising prognostic factor: it is potentially modifiable (*i.e.*, sedentary workers can be encouraged to become more active), and there is evidence from other studies that it is an effective intervention strategy for neck pain.³⁰ However, we advise caution here, because evidence from general population studies shows no

prognostic effect for general exercise, and evidence suggests bicycling had a negative effect on recovery from neck pain.⁶

State of the Literature and Limitations

Our findings and conclusions are limited by both limitations in the current literature and limitations in our methodology. These are discussed in more detail elsewhere.^{8,31} Briefly, the limitations in the current literature include imprecise and/or nonuniform case definitions of neck pain, with little information about clinical factors that may be important (*e.g.*, most studies did not report on the presence or absence of radiculopathy or use samples in which neck pathology was clearly ruled out). This may lead to significant (but unrecognized) heterogeneity within study samples, and this may mask or inflate estimates of the associations reported. In addition, our conclusions about prognostic factors are based on only 8 studies. Although these studies were included in the best evidence synthesis because they were judged as scientifically admissible, the quality and methodology of the studies still varied considerably. In particular, the adequacy of control of confounders varied widely among studies. We attempted to address this potential source of bias by classifying studies into Phase I, II, and III and by giving greater scientific weight to studies that explicitly controlled for confounders (*i.e.*, Phase III studies). Most of the studies examining prognostic factors were Phase II, and there were no Phase III studies. Still, even with extensive control of confounding, it is not possible to rule out the possibility that an unmeasured factor (*e.g.*, comorbid health conditions) had an important impact on the strength of the relationship between prognostic factors and outcome in neck pain.


The methodology used in the synthesis of the best evidence also has some limitations (outlined in more detail elsewhere).⁸ In particular, although there is a large overlap among journals indexed in Medline and in other electronic health databases, it is possible that using only Medline resulted in missing studies that may have informed this best evidence synthesis. There is also controversy about whether systematic literature reviews should report findings from all relevant studies or use a best evidence synthesis, as we did. We believe that using a best evidence synthesis approach, that is, reporting evidence only from those studies we judged to have adequate validity, increases the validity of the conclusions.

In conclusion, neck pain is an important health issue among working people. But to date, few methodologically rigorous studies have examined factors that might differentiate those who recover well from those who do not. Most of research articles accepted for our best evidence synthesis were Phase II studies whose findings require confirmation. Phase III studies must be done to verify or discount the independent role of demographic, health-related, psychosocial, lifestyle (health behaviors)

compensation, and societal factors on prognosis for neck pain in this population.

Key Points

- Of the 226 articles relating to course and prognostic factors, 70 articles (31%) were deemed scientifically admissible and were accepted for our review. Fourteen of these studies related to the course and prognostic factors for neck pain in working populations.
- In the working population, neck pain follows a persistent or recurrent course; and between 60% and 80% of workers who reported having neck pain at some initial point in time reported neck pain 1 year later.
- Evidence is mixed regarding the role of gender in recovery from neck pain.
- The preponderance of evidence indicates that age had little prognostic value in predicting recovery from neck pain in workers.
- The preponderance of evidence indicates that specific workplace or physical job demands were unassociated with recovery from neck pain; in studies demonstrating an association, these associations were weak. However, there is preliminary evidence that broad occupation type was important: white-collar workers had shorter sick leave than blue-collar workers; officers had better return to work after cervical disc surgery than individuals in the enlisted ranks; and for sewing machine operators and female factory assembly workers, neck pain recovery was better for those who subsequently changed occupations.
- There is preliminary evidence that workers who engaged in general exercise and sporting activities were more likely to experience improvement in neck pain.
- Prior neck pain and/or prior sick leave were identified as prognostic for poor recovery.

 tables

Tables available online through Article Plus.

Acknowledgments

We are indebted to Ms. Oksana Colson and Ms. Leah Phillips (MA) for their administrative assistance and to Mr. Stephen Greenhalgh (MA, MLIS), Ms. C. Sam Cheng (MLIS), and Ms. Lori Giles-Smith (MLIS), research librarians, for their assistance in the work of the Neck Pain Task Force.

The Bone and Joint Decade 2000–2010 Task Force on Neck Pain and its Associated Disorders is supported by a grant to the University of Alberta from: the National Chiropractic Mutual Insurance Company and the Canadian Chiropractic Protective Association; Jalan Pacific Inc.; Länsförsäkringar; and the Insurance Bureau of Can-

ada; and by a grant to Karolinska Institute in Stockholm, Sweden from the Swedish Whiplash Commission. Supported by the Canadian Institutes of Health Research through a New Investigator Award and by the Institute for Work and Health through the Workplace Safety and Insurance Board of Ontario (to P.C.); the Canadian Institutes of Health Research through a Fellowship Award (to G.v.d.V.); Health Scholar Award from the Alberta Heritage Foundation for Medical Research (to L.J.C.); and by an endowed research chair from the University Health Network (to J.D.C.).

References

- Côté P, van der Velde G, Cassidy JD, et al. The burden and determinants of neck pain in workers. Results of the Bone and Joint 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008;33(Suppl):S60–S74.
- Altman DG, Lyman GH. Methodological challenges in the evaluation of prognostic factors in breast cancer. *Breast Cancer Res Treat* 1998;52:289–303.
- Carroll LJ, Cassidy JD, Côté P. Depression as a risk factor for onset of an episode of troublesome neck and low back pain. *Pain* 2004;107:134–9.
- Carroll LJ, Cassidy JD, Peloso PM, et al. Prognosis for mild traumatic brain injury: results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. *J Rehabil Med* 2004;43:84–105.
- Côté P, Cassidy JD, Carroll L, et al. A systematic review of the prognosis of acute whiplash and a new conceptual framework to synthesize the literature. *Spine* 2001;26:E445–E458.
- Carroll LJ, Hogg-Johnson S, van der Velde G, et al. Course and prognostic factors for neck pain in the general population. Results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008;33(Suppl):S75–S82.
- Carroll LJ, Holm LW, Hogg-Johnson S, et al. Course and prognostic factors for neck pain in whiplash-associated disorders (WAD). Results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008;33(Suppl):S83–S92.
- Carroll LJ, Cassidy JD, Peloso PM, et al. Methods for the best evidence synthesis on neck pain and its associated disorders. The Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2007. 2008;33(Suppl):S33–S38.
- Slavin RE. Best evidence synthesis: an alternative to meta-analytic and traditional reviews. *Educ Researcher* 1986;15:5–11.
- Slavin RE. Best evidence synthesis: an intelligent alternative to meta-analysis. *J Clin Epidemiol* 1995;48:9–18.
- van der Velde G, van Tulder M, Côté P, et al. The sensitivity of review results to methods used to appraise and incorporate trial quality into data synthesis. *Spine* 2007;32:796–806.
- Guzman J, Hurwitz EL, Carroll LJ, et al. A conceptual model for the course and care of neck pain. Results of The Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008; 33(Suppl):S14–S23.
- Hogg-Johnson S, van der Velde G, Carroll LJ, et al. The burden and determinants of neck pain in the general population: Results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008;33(Suppl):S39–S51.
- Holm LW, Carroll LJ, Cassidy JD, et al. The burden and determinants of neck pain in whiplash-associated disorders after traffic collisions: Results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008;33(Suppl):S52–S59.
- World Health Organization. International Classification of Function, Disability and Health: ICF. Geneva: WHO, 2001.
- Runderantz BL, Johnsson B, Moritz U. Pain and discomfort in the musculoskeletal system among dentists. A prospective study. *Swed Dent J* 1991;15: 219–28.
- Takala EP, Viikari-Juntura E, Moneta GB, et al. Seasonal variation in neck and shoulder symptoms. *Scand J Work Environ Health* 1992;18:257–61.
- Luime JJ, Kuiper JJ, Koes BW, et al. Work-related risk factors for the incidence and recurrence of shoulder and neck complaints among nursing-home and elderly-care workers. *Scand J Work Environ Health* 2004;30:279–86.
- Luime JJ, Koes BW, Miedema HS, et al. High incidence and recurrence of shoulder and neck pain in nursing home employees was demonstrated during a 2-year follow-up. *J Clin Epidemiol* 2005;58:407–13.
- Leclerc A, Niedhammer I, Landre MF, et al. One-year predictive factors for various aspects of neck disorders. *Spine* 1999;24:1455–62.
- Cassou B, Derriennic F, Monfort C, et al. Chronic neck and shoulder pain, age, and working conditions: longitudinal results from a large random sample in France. *Occup Environ Med* 2002;59:537–44.
- Eriksen W, Natvig B, Knardahl S, et al. Job characteristics as predictors of neck pain. A 4-year prospective study. *J Occup Environ Med* 1999;41:893–902.
- Abenhaim L, Suissa S, Rossignol M. Risk of recurrence of occupational back pain over three year follow up. *Br J Ind Med* 1988;45:829–33.
- Rossignol M, Suissa S, Abenhaim L. Working disability due to occupational back pain: three-year follow-up of 2,300 compensated workers in Quebec. *J Occup Med* 1988;30:502–5.
- Kaptain GJ, Shaffrey CI, Alden TD, et al. Secondary gain influences the outcome of lumbar but not cervical disc surgery. *Surg Neurol* 1999;52:217–23.
- Burdorf A, Naaktgeboren B, Post W. Prognostic factors for musculoskeletal sickness absence and return to work among welders and metal workers. *Occup Environ Med* 1998;55:490–5.
- Schibye B, Skov T, Ekner D, et al. Musculoskeletal symptoms among sewing machine operators. *Scand J Work Environ Health* 1995;21:427–34.
- Jonsson BG, Persson J, Kilbom A. Disorders of the cervicobrachial region among female workers in the electronics industry: a two-year follow up. *Int J Ind Ergon* 1988;3:1–12.
- Viikari-Juntura E, Takala E, Riihimäki H, et al. Predictive validity of symptoms and signs in the neck and shoulders. *J Clin Epidemiol* 2000;53:800–8.
- Hurwitz EL, Carragee EJ, van der Velde G, et al. Treatment of neck pain: non-invasive interventions. Results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008; 33(Suppl):S123–S152.
- Carroll LJ, Hurwitz EL, Côté P, et al. Research priorities and methodological implications. Results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders. *Spine* 2008;33(Suppl):S213–S219.