

# Chronic low back pain in individuals with chronic neck pain of traumatic and non-traumatic origin

## A population-based study

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Submitted 04-10-29. Accepted 05-06-13

**Background** It is unclear whether the prevalence of chronic low back pain is higher in chronic whiplash patients than in the general population. In a population-based study, we evaluated the prevalence of chronic low back pain in individuals with chronic neck pain of traumatic and non-traumatic origin, with special emphasis on whiplash injury.

**Subjects and methods** Additional questions concerning the patient's experience of neck and low back pain were added to the questionnaire of the MONICA health survey. 4,415 subjects aged 25–64 years were randomly selected from a geographically well-defined area in northern Sweden.

**Results** The prevalences of chronic low back pain and chronic neck pain were 16% and 17%, respectively. 51% of subjects had both back and neck pain. Of the patients with neck pain, one quarter had a history of neck injury, which was related to whiplash injury in almost one-half of the cases. The prevalence of chronic low back pain in individuals with chronic non-traumatic neck pain was 53%, and it was 48% in those with chronic neck pain and a history of neck trauma. There was no difference in the prevalence of chronic low back pain between whiplash injury and other types of neck trauma. Confounding factors such as sex, age, marital status, BMI, smoking status and level of education were not significantly different between traumatic and non-traumatic groups.

**Interpretation** Independently of traumatic or non-traumatic origin of the symptoms, the prevalence of chronic low back pain is 3 times higher in individuals with chronic neck pain than in the general popula-

tion. Causes other than a history of neck trauma, such as chronic musculoskeletal pain syndromes, may be important in evaluation of these cases. ■

Chronic low back pain is common in the general population (Heliovaara et al. 1991, Andersson 1993, 1999). Psychological and psychosocial factors are important in the development of chronic low back pain (Gamsa 1994, Vendrig et al. 1998, Turk and Okifuji 2002) and they are of more importance regarding the etiology than organic lesions (Andersson 1999, Ciaramella et al. 2004).

Whiplash injuries account for the majority of cases of cervical spine trauma, and the medical costs have increased substantially in recent years (SBU Report 1999). At the initial assessment after a whiplash injury, a history of low back pain has been reported in 10–50% of the cases and in follow-up studies low back pain is one of the most common complaints in addition to chronic neck pain (Gay and Abbot 1953, Hildingsson and Toolanen 1990, Heliovaara et al. 1991, Teasell 1992, Magnússon 1994, Berglund et al. 2001, Picavet et al. 2003). Recently, a retrospective study from Ireland showed an association between whiplash patients with persistent neck pain and chronic low back pain (Mulhall et al. 2003). The lack of a control group for assessment of the prevalence of low back pain in normal uninjured individuals makes the findings difficult to interpret. Thus, the

question remains as to whether the prevalence of chronic low back pain is higher in a population of neck-injured patients than in an uninjured population. This issue is also of medico-legal interest and finding answers might also contribute to our understanding of pain problems after whiplash injury.

We assessed the prevalence of chronic low back pain in individuals with chronic neck pain related to whiplash trauma, to other neck trauma, or not attributable to trauma.

## Subjects and methods

Together, the two northern-most counties in Sweden represent one of the 39 collaborating centers in the World Health Organisation (WHO) MONICA (MONItoring of trends and determinants in CARDiovascular disease) project. The main objective of this project is to assess risk factors in cardiovascular diseases. Up until 1999, four population surveys had been performed and as part of the last survey in 1999, additional questions about the patient's experience of neck and low back pain were added (Table 1). The MONICA questionnaire contains mainly cardiovascular risk factor data and socio-demographic data. The participants filled in the questionnaires and they also underwent a health examination including blood pressure measurements, weight, height and laboratory tests such as cholesterol and HDL.

The northern Sweden MONICA study covers a total population of 510,000 and a target population of 310,000 in the age range 25 through 79 years. Most of the inhabitants live in municipalities along the coastal area. According to the MONICA study protocol, the individuals under study were selected by stratified randomization for age and sex (MONICA Manual 1990).

In total, 8,356 subjects were invited to participate in the 1999 survey. 6,000 of them (72%) answered the self-administered questionnaire and underwent a physical examination. 14 participants did not respond to the questions concerning trauma, and were excluded.

Our study included all 4,415 individuals below the age of 65 years. By definition, only individuals seeking a physician after a neck injury were considered to have a history of trauma. Chronic

Table 1. Questions on neck and low back complaints

1. Have you visited a doctor because of a neck or head injury?
  - Yes, due to whiplash injury
  - Yes, other neck injury
  - Yes, head injury
  - No
2. If you suffer from neck pain, for how long have you had the symptoms?
  - In the past week
  - For the past 6 months
  - For more than 6 months
3. If you suffer from neck pain, how often do you have the symptoms?
  - All the time
  - A few times a month
  - A few times a year
4. If you suffer from low back pain and/or ache, stiffness, for how long have you had symptoms?
  - In the past week
  - For the past 6 months
  - For more than 6 months.
5. If you suffer from low back pain and/or ache, stiffness, how often do you have symptoms?
  - All the time
  - A few times a month
  - A few times a year

low back pain was defined as continuous pain lasting more than 6 months. The alternatives in the questionnaire were whiplash, other neck or head injury, or no injury. Each person could report more than one alternative. Using a separate question, we identified individuals with both head injury and combined head and neck injury, and these were excluded from the study.

There were 828 individuals below 65 years of age who suffered from chronic neck pain. 752 individuals for whom there was complete data on items concerning neck trauma and low back pain were included. For the individuals who failed to respond, the information was collected by telephone interviews or questionnaires. Basic information was obtained for 50% of the non-participants.

## Statistics

Confidence intervals for prevalence rates and proportions were calculated by applying normal approximation to the binomial distribution. We used univariate logistic regression to analyze the association between type of neck trauma as predictor and chronic low back pain as outcome, where only individuals with chronic neck pain were

Table 2. Prevalence of chronic low back pain according to age group and sex, in the entire survey population and in individuals with chronic neck pain

| Age group | Sex | Chronic low back pain <sup>a</sup>  |                                                           |
|-----------|-----|-------------------------------------|-----------------------------------------------------------|
|           |     | within the entire survey population | within the subgroup of individuals with chronic neck pain |
| 25–34     | M   | 7 (16 / 221)                        | 47 (7 / 15)                                               |
|           | F   | 13 (31 / 246)                       | 55 (23 / 42)                                              |
| 35–44     | M   | 11 (54 / 504)                       | 48 (30 / 62)                                              |
|           | F   | 11 (62 / 585)                       | 43 (41 / 96)                                              |
| 45–54     | M   | 13 (92 / 709)                       | 51 (52 / 102)                                             |
|           | F   | 17 (119 / 705)                      | 51 (81 / 160)                                             |
| 55–64     | M   | 18 (128 / 698)                      | 51 (72 / 141)                                             |
|           | F   | 24 (181 / 747)                      | 58 (121 / 210)                                            |
| Total     | M   | 14 (290 / 2132)                     | 50 (161 / 320)                                            |
|           | F   | 17 (393 / 2283)                     | 52 (266 / 508)                                            |

<sup>a</sup> percentage and (number with chronic low back pain / number in the population)

included in the analysis. Some possible confounders such as sex, age, level of education, BMI and smoking habits were tested one at a time as predictors of chronic low back pain in a logistic regression model. We used multiple logistic regression to explore the association in greater depth, adjusting for factors that turned out to be statistically significant in the univariate models. Odds ratios with corresponding 95% confidence intervals (CI) were calculated by logistic regression. The statistics package SPSS, version 11.5, was used for all calculations.

## Results

The prevalence of chronic low back pain was 16% (CI: 14–17) in the study population, 17% (95% CI: 16–19) for women and 13.6% (95% CI: 12–15) for men. It was more common in women and increased with age (Table 2). The corresponding age-adjusted odds ratio for women compared to men was 1.3 (95% CI: 1.2–1.6).

752 patients had chronic neck pain. 186 of them had a history of neck injury, and 81 of these had sustained a whiplash injury.

The prevalence of chronic low back pain in individuals with chronic non-traumatic neck pain was 53% (95% CI: 49–57), and 48% in those with chronic neck pain with a history of neck trauma

Table 3. The prevalence (%) of chronic low-back pain

| Subgroup                                  | N     | n   | %    | (95% CI)    |
|-------------------------------------------|-------|-----|------|-------------|
| The study population                      | 4415  | 683 | 15.7 | (14.4–16.6) |
| Individuals with chronic neck pain and    |       |     |      |             |
| no history of neck trauma                 | 566   | 301 | 53   | (49–57)     |
| a history of neck trauma                  | 186   | 90  | 48   | (41–56)     |
| whiplash trauma                           | 81    | 41  | 51   | (40–62)     |
| other neck trauma                         | 105   | 49  | 47   | (37–56)     |
| Individuals without chronic neck pain and |       |     |      |             |
| no trauma                                 | 3,176 | 214 | 6.7  | (5.9–7.7)   |
| whiplash trauma                           | 73    | 7   | 10   | (5–19)      |
| other neck trauma                         | 105   | 9   | 9    | (5–16)      |

(95% CI: 41–56). Within the group of all individuals with chronic neck pain secondary to trauma, there was no major difference in the prevalence of chronic low back pain between the whiplash group (51%) and the other neck trauma group (47%) (Table 3). Crude odds ratio for prevalence of chronic low back pain in the whiplash group compared to the non-traumatic group was 0.9 (95% CI: 0.6–1.4). The prevalence of chronic low back pain in individuals with chronic neck pain, irrespective of origin, varied only slightly between different age groups (Table 1). Factors such as sex, age, BMI, marital status, and smoking habits were not statistically significant when tested as predictors of the prevalence of chronic low back pain, so we did not have to control for these factors. The only factor that seemed to be a possible confounder was the level of education (Table 4). After adjusting for education in a multiple model, there were no significant changes in risk regarding low back pain. Considering the population without chronic neck pain, the prevalence of chronic low back pain was at the same level in those with and without a history of neck trauma. The prevalence was 7% in those without neck trauma and 10% in the whiplash group, with overlapping confidence intervals (Table 3).

The drop-out analysis showed that a smaller proportion of the non-responders were married or cohabitants. The non-responders also more often regular smokers and had a somewhat lower BMI than the participants. Furthermore, fewer of these individuals had been informed about high blood pressure. There were no substantial differences in

**Table 4.** Prevalence of chronic low back pain in individuals with chronic neck pain. Statistical analysis of some possible risk factors

|                        | Chronic low back pain  |                         | OR   | (95% CI)   | P-value |
|------------------------|------------------------|-------------------------|------|------------|---------|
|                        | No<br>(n = 396)<br>(%) | Yes<br>(n = 421)<br>(%) |      |            |         |
| History of neck trauma |                        |                         |      |            |         |
| no trauma (n = 566)    | 47                     | 53                      | ref. |            |         |
| whiplash (n = 81)      | 49                     | 51                      | 0.90 | (0.57–1.4) | 0.7     |
| other neck (n = 105)   | 53                     | 47                      | 0.77 | (0.51–1.2) | 0.2     |
| Gender                 |                        |                         |      |            |         |
| women                  | 48                     | 52                      | ref. |            |         |
| men                    | 50                     | 50                      | 0.92 | (0.70–1.2) | 0.6     |
| Age                    |                        |                         |      |            |         |
| 25–34                  | 47                     | 53                      | ref. |            |         |
| 35–44                  | 55                     | 45                      | 0.73 | (0.40–1.4) | 0.3     |
| 45–54                  | 49                     | 51                      | 0.93 | (0.52–1.7) | 0.8     |
| 55–64                  | 45                     | 55                      | 1.1  | (0.63–1.9) | 0.7     |
| Married/cohabitant     |                        |                         |      |            |         |
| no                     | 44                     | 56                      | ref. |            |         |
| yes                    | 50                     | 50                      | 0.78 | (0.47–1.3) | 0.3     |
| Education              |                        |                         |      |            |         |
| university             | 59                     | 41                      | ref. |            |         |
| primary                | 44                     | 56                      | 1.86 | (1.2–2.9)  | 0.00    |
| secondary              | 48                     | 52                      | 1.53 | (1.0–2.3)  | 0.04    |
| BMI                    |                        |                         |      |            |         |
| ≤ 25                   | 52                     | 48                      | ref. |            |         |
| > 25                   | 47                     | 53                      | 1.21 | (0.91–1.6) | 0.2     |
| Smoking                |                        |                         |      |            |         |
| non-smokers            | 49                     | 51                      | ref. |            |         |
| smokers                | 46                     | 54                      | 1.11 | (0.80–1.5) | 0.5     |

level of education. Details of the drop-out analysis and quality assessments in the MONICA project have been published by Eriksson et al. (2003).

## Discussion

We found that chronic neck pain per se, irrespective of origin, is accompanied by a high rate of chronic low back pain. Thus, patients with chronic neck pain after different types of injury to the cervical spine had the same rate of chronic low back pain as uninjured cases. It has been discussed if the high rate of low back pain after whiplash injuries in patients with seat-belts is caused by a distortion of the lumbar spine simultaneously with the neck trauma (Mulhall et al. 2003). This seems unlikely, since we found that other types of trauma to the cervical spine had equal frequency of chronic low back pain. This is further supported by the fact that individuals with chronic neck pain after

whiplash injury had the same prevalence of chronic low back pain as those without a neck injury. Chronic musculoskeletal pain, common in the general population, is characterized by pain appearing at different sites of the body (Elliott et al. 1999, Huppe et al. 2004). These symptoms are probably due to several factors such as those of a psychosocial and socio-demographic nature, the nature of compensation systems, and cultural background (Croft et al. 2003, Rahman et al. 2004). Individuals with persistent regional pain are more prone to report persistent pain elsewhere, as well as several other symptoms (Croft 1996, Papa-georgiou et al. 1996, Bergman et al. 2001). Thus, the theory that chronic muscular pain at one site of the body may induce pain at other sites seems applicable in these cases, and may explain our findings. Also, it is possible that our patients with chronic neck pain and low back pain also had pain in other parts of the body, but the questionnaire did not include

any part outside the spine.

We have no information regarding when the symptoms appeared in relation to the trauma to the cervical spine, and some of the symptoms may have appeared spontaneously even if the patient has a history of trauma. Minor injuries to the cervical spine were excluded by the fact that the patient had to seek a doctor after the injury to be classified as a trauma case.

We do not know whether our cases experienced trauma to other parts of the body with subsequent neck or low back pain. However, soft-tissue injuries of the neck after high-energy road traffic accidents seem rare (Malik and Lovell 2004). The diagnosis “chronic low back pain” is usually based on the clinical symptoms, and as we did not perform a clinical or radiographical examination there may have been cases with organic lesions. In a recent study, psychological factors were found to be more relevant than collision severity in predicting the duration and severity of symptoms in collision vic-

tims (Richter et al. 2004). Psychological and psychosocial factors, which are known to influence the development of chronic lumbar pain (Polatin et al. 1992, Vendrig et al. 1998, Andersson 1999), were not compared between those with cervical spine injury and chronic low back pain, and those with chronic low back pain without a neck trauma. The similar distribution of age and sex in both groups makes it unlikely that the above factors would have a significant influence on our findings. This is also supported by the fact that level of education (possibly reflecting the working conditions) was equal in both groups, as were BMI and smoking habits.

The drop-out analysis of the MONICA study did not reveal any differences that would influence the results of our study (Eriksson et al. 2003).

We defined chronic symptoms as persistent daily symptoms lasting more than 6 months, a definition that is commonly used (SBU report 145/2 1999). The prevalence of chronic neck pain in our study is equivalent to that reported in earlier Scandinavian studies (Mäkelä et al. 1991). Half of our cases with whiplash injury had chronic neck pain, which is a higher figure than usually reported. This was probably due to the cumulative effect of the study design, which may also explain the higher mean age in our whiplash group. Moreover, it has been reported recently that the prevalence of chronic neck pain is higher in small communities (Guez et al. 2002), and a substantial proportion of our patients came from a rural area with a high unemployment rate and few opportunities to change work. The patients may therefore be more prone to withhold their symptoms. The overall prevalence of chronic low back pain in the general population in the present study is similar to that in other studies from the same region (Heliövaara et al. 1991, Andersson 1999, Evans et al. 2001).

The word “whiplash” was not defined in our questionnaire, but we are convinced that people in general are aware of this condition. We have no validated diagnosis, but the fact that all patients had been examined by a doctor increases the accuracy of the diagnosis reported by the patient. In an epidemiological study of moderate and minor non-contact neck injuries (AIS 2) from the same region, car accidents accounted for 85% of the neck injuries (Bring et al. 1996). Thus, it is reasonable to assume that most of our whiplash cases had

sustained an injury in car accident and that the low rate of other trauma mechanisms did not influence the results.

In conclusion, the prevalence of chronic low back pain is 3 times higher in individuals with chronic neck pain—irrespective of whether it is of traumatic or non-traumatic origin—than in the general population. Mechanisms other than a history of trauma, such as chronic musculoskeletal pain syndromes, may be important to consider when evaluating these cases.

#### Author contributions

MG suggested the research questions and designed the questionnaire together with CH and GT. SN was responsible for the MONICA database and statistical work. The manuscript was written by MG and revised by CH and GT.

We thank the Swedish Research Council (grant no. 345-2003-2461) and the County Council of Norrbotten and Västerbotten of the northern Sweden MONICA project. Financial support was also provided by the foundation “Länsförsäkringsbolagens Forskningsfond”, the Swedish Association for Persons Disabled by Traffic Accidents or Cancer, and by the University of Umeå, Sweden.

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