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ORIGINAL ARTICLE

Neck pain and disability due to neck pain: what is the relation?

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Abstract Pain and disability are interrelated, but the relationship between pain and disability is not straightforward. The objective of this study was to investigate the relationship between neck pain (NP) intensity, NP duration, and disability based on the population-based 'Funen Neck and Chest Pain' study. Pain intensity was measured using 11-box numerical rating scales, pain duration was measured using the Standardized Nordic Questionnaire, and disability was measured by the Copenhagen Neck Functional Disability Scale. Spearman rank correlation coefficients and logistic regression analyses were used to measure correlations and strength of associations between pain intensity, pain duration, and disability given domain specific characteristics (socioeconomic, health and physical, comorbidity, and variables related to consequences of NP). Neck pain was very common, but mainly mild and did not result in major disability. The correlations between NP intensity and disability were moderate but strongly associated, whereas weaker correlations and almost no associations were found between NP duration and disability. Pain duration is a poor indicator of disability. Given these variations, pain intensity and disability should be considered as two distinct dimensions and measured separately. These results have implications for future clinical and epidemiological studies.

Keywords Cross-sectional postal survey · Neck pain · Neck disability · Neck pain duration · Correlations

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Introduction

Neck pain (NP) is a common condition affecting as much as two-thirds or more of the general population at one point of time during their life [15]. Chronic NP is considered a multidimensional phenomenon, but the distinct dimensions and their interrelations are not fully understood. For example, pain and disability are considered to be interrelated [28] and Von Korff et al. [38] argue that in many situations it may be useful to regard pain intensity and disability as a unitary construct of global pain intensity. This may, however, not be entirely correct since studies investigating the relationship between pain intensity and disability for low back pain (a condition sharing many features with NP) demonstrate varying results: little or no correlation [17, 25, 39], fair correlation [35, 37], and highly significant correlation [9, 30, 40]. In studies on NP the reported relations between pain and disability are only fairly [41] or moderately correlated [6, 7, 16, 27, 41].

Therefore, the relationship between pain and disability is not straightforward as these are subjective measures and may therefore be influenced by physiological, psychosocial, and environmental factors [9]. Therefore, different therapeutic interventions may be required in order to affect both of these parameters [28, 39]. In addition, if pain and disability are considered identical dimensions there may be a risk of overlooking specific subgroups [24]. There is thus, a further need to investigate the relationship between pain

and disability in order to optimize the clinical interventions and enhance the epidemiological research in the future.

The overall objective of this study was therefore to investigate the relationship between NP intensity, NP duration, and disability due to NP. The specific aims of this study were to:

1. Report NP prevalence, NP intensity, NP duration, and disability due to NP in a large population based study;
2. Estimate the correlations for NP intensity and NP duration with disability due to NP in subgroups of NP sufferers, and;
3. Estimate the strength of the associations between NP intensity, NP duration, and disability due to NP in these subgroups.

Materials and methods

The Funen neck and chest pain study

A 7-page questionnaire was sent out in April 2003 to 7,000 non-institutionalised community residents aged 20–71 living in Funen County, Denmark. These were randomly selected via the Danish Civil Registration Office [34] to participate in the Funen Neck and Chest Pain study (FNCP) [13]. A letter of reminder including a new questionnaire was sent out to initial non-responders 1 month later. The internal validity of the FNCP study has been reported elsewhere [13]. In summary, 4,146 questionnaires (59.6%) out of 6,954 available were returned. A comprehensive non-response analysis showed that males, younger age groups, singles, divorced persons, and individuals with a primary or a lower secondary education were less likely to participate in the FNCP survey [13]. Only individuals reporting NP the past 2 weeks were included in the present study.

Definition of NP

The definition of NP was derived from the Standardised Nordic Questionnaire on musculoskeletal disorders (SNQ) [23] as 'pain, ache, or discomfort' in the area between the occiput and the third thoracic vertebra and between the medial borders of the scapulae. A diagram was included in the questionnaire with the anatomical area of interest clearly marked.

Neck pain variables

Neck pain intensity during the past 2 weeks was measured by calculating the mean of three different 11-box numerical rating scales (NRS-11) ('average NP past 2 weeks, 'worst NP past 2 weeks', and 'NP right now') [14, 22]. Such a composite score maximizes the reliability and validity of pain assessment [12, 19–21] and thus, shows a greater stability which is especially important in clinical trials with relative small sample sizes or when monitoring changes over time [14, 20]. The composite NP score was categorised according to Fejer et al. [14]: mild NP = 1–4, moderate = 5–6, and severe NP = 7–10. In previous studies only Visual Analogue Scale has been used to calculate a composite score. However, the NRS-11 scale has been shown to be equally as good as other pain measurement scales [11, 18].

Neck pain duration within the past year was measured using the SNQ ("On how many days during the past year have you had NP?") [23].

Disability due to NP during the past 2 weeks was measured using the Copenhagen Neck Functional Disability Scale (CNFDS) [22]. The CNFDS has high test-retest reliability, high construct validity and has some advantages in terms of item non-response compared to the Neck Disability Index [14, 22]. The CNFDS consists of 15 questions related to normal daily activities (i.e. capable of lifting light objects, capable of sleeping without NP, etc.) which are all answered by either 'yes', 'occasionally', or 'no' and subsequently assigned a score of 0, 1, or 2 adding up to a score between 0 ('no disability due to NP') and 30 ('extremely disabled due to NP'). The CNFDS categorised as follows: minimal disability = 1–3, mild disability = 4–8, mild to moderate disability = 9–14, moderate disability = 15–20, moderate to severe disability = 21–26, and severe disability = 27–30 [22].

Variables related to subgroups

A series of different subgroups were classified into four domain characteristics defined by specific variables: socioeconomic, health and physical activity, comorbidity, and consequences of NP.

Socioeconomic variables (age, gender, personal income, and level of education) were obtained from the Danish Civil Registration Office [34] and Statistics Denmark [33]. Personal income was categorised into below or above the median income of the whole FNCP study sample [33]. The educational level was measured in years and categorised according to UNESCO's International Standard Classification of Education (ISCED-97) [29, 36]: Up to 10 years of schooling corresponds to 'primary education' and/or 'lower secondary education', from 10 to 12 years to 'upper secondary education' or 'post-secondary education', and more than 12 years corresponds to 'tertiary education'.

Health and physical activity variables were measured by three items: the level of physical activity at work ("How would you describe your work") was categorised into "mainly sitting", "sitting/standing, sometimes walking", "walking, sometimes heavy lifting", and "heavy physical work". The level of physical activity during leisure time ("How would you describe your leisure time?") was divided into "light physical <2 h per week", "light physical 2–4 h per week", "light physical >4 h per week", "strenuous 2–4 h per week", and "strenuous >4 h per week". A previous history of neck injury due to a traffic accident ("Have you ever injured your neck in a traffic accident?" yes/no) was included in the health related variables due to its impact on NP specifically and on health in general [2, 5, 10].

Comorbidity variables focused on thirteen different conditions/comorbidities ("Do you suffer from any of the following?"): (1) headache, (2) thoracic spine pain (past year), (3) low back pain (past year), (4) other muscle/joint problem(s), (5) cardiovascular problems, (6) respiratory diseases, (7) gastrointestinal problems, (8) urinary problems, (9) asthma/allergies, (10) neurological disorders, (11) mental health, (12) diabetes, and (13) cancer. The questions on thoracic spine and low back pain (past year) were obtained from the SNQ. All questions were answered with either 'yes' or 'no'. These thirteen conditions were divided into two groups; musculoskeletal (numbers 1–4) and non-musculoskeletal (numbers 4–12) comorbidities. The categorisation of these two groups was based on the individual's total number of comorbidities (i.e. 0, 1, 2, 3, and 4+).

Four additional variables related to personal *consequences of NP* were obtained from the SNQ: (1) "Are you currently under disablement rehabilitation because of NP?" (disablement rehabilitation), (2) "Have you been less physically active because of NP during the past year?" (less active), (3) "Have you changed job because of NP during the past year?" (change of job), and (4) "Have you been examined or treated by a medical doctor, a physiotherapist or a chiropractor because of NP during the past year?" (healthcare seeking). Possible answers to these questions were yes or no.

Statistical analyses

Neck pain prevalence, NP intensity, NP duration, and disability due to NP during the past 2 weeks were tabulated for each of the subgroups, and the categories within each subgroup were tested for statistically significant differences using Chi square and Fisher's exact test. The whole study population was used to calculate the prevalence estimates. The rest of the analyses were performed using only the individuals having reported NP in the past 2 weeks.

Gender-stratified Spearman rank correlation coefficients were used to measure the correlation between NP intensity/duration and disability due to NP. Further, the correlations between NP intensity/duration and disability were calculated for each of the subgroups to determine possible variations in correlation coefficient across subgroups. The correlation coefficients were interpreted according to the guidelines by Colton [8]: 0.00–0.25 = little/no relationship, 0.25–0.50 = fair degree of relationship, 0.50–0.75 = moderate/good relationship, and 0.75–1.00 = good/excellent correlation.

To assess the strength of the associations between NP intensity/duration and disability, gender-stratified logistic regression models including either NP intensity or NP duration and disability were constructed. Each subgroup was subsequently included in the model one at a time to measure the strength of the association in that specific subgroup. In all regression analyses, the robust standard errors were estimated using the Huber/White sandwich variance estimator.

Adjustments were only made for logical errors (logical imputation) [13], hence, all analyses were based on the largest complete set of data across groups. For all statistical analyses the level of significance was set to 5% ($P < 0.05$). All statistical analyses were conducted using the Stata Statistical Software Package (version 8.2) [32].

Results

Neck pain prevalence, intensity, duration, and disability

In total, 1,293 participants (31%, 95% CI 30–33) had experienced NP during the past 2 weeks and formed the basis for this analysis.

Table 1 shows the prevalence, intensity, duration, and disability due to NP during the past 2 weeks for all the domain specific characteristics. About one in three individuals reported NP during the past 2 weeks. The highest 2-week prevalence estimates were seen in the variables related to consequences of NP and the lowest NP prevalence was found in individuals with no other musculoskeletal comorbidities. Overall, only mild pain was reported. Moderate NP was reported in individuals with multiple comorbidities, traffic related neck injuries and in variables related to consequences of NP. The median number of days with NP during the past year was 40 days. The highest median number of days were found in the consequences of NP variables and the lowest were seen in individuals with no additional musculoskeletal comorbidity. Generally, only mild disability was reported across most of the subgroups. The disability scores were lower if no comorbidity was present.

Table 1 Age and gender standardised 2-week NP prevalence, mean NP intensity past 2 weeks, median pain duration past year, and mean disability due to NP past 2 weeks, for socioeconomic and health related variables, and variables related to consequences of NP

	Two week prevalence (n = 4,146)		Mean pain intensity past 2 weeks (n = 1,257)		Median pain duration past year (n = 1,202)		Mean disability score past 2 weeks (n = 1,293)	
	%	(95% CI)	Score	(95% CI)	Days	(Interquartile range)	Score	(95% CI)
Two week NP	31.2	(29.8–32.6)	3.3	(3.1–3.4)	40	(14–180)	6.9	(6.6–7.2)
Socioeconomic variables								
Gender								
Men	26.1	(24.2–28.1)	3.2	(3.0–3.4)	30	(10–120)	6.6	(6.1–7.1)$^{n.s.}$
Women	35.5	(33.6–37.5)	3.4	(3.2–3.5)	50	(15–200)	7.1	(6.7–7.5)
Age								
Younger (21–49 years)	34.6	(32.6–36.5)	3.1	(2.9–3.2)**	40	(14–225)	6.6	(6.2–7.0)*
Older (50–71 years)	27.3	(25.3–29.3)	3.6	(3.4–3.8)	50	(14–145)	7.4	(6.8–7.9)
Education								
<10 years (primary education)	33.2	(30.5–35.9)$^{n.s.}$	3.6	(3.3–3.8)	50	(14–200)$^{n.s.}$	8.0	(7.4–8.6)
10–12 years (sec. education)	32.0	(30.0–34.0)	3.3	(3.1–3.5)	40	(14–180)	6.6	(6.2–7.0)
>12 years (tertiary education)	25.7	(22.9–28.4)	2.8	(2.5–3.1)	36	(14–100)	5.8	(5.2–6.5)
Income								
Below median	32.2	(30.0–34.4)$^{n.s.}$	3.5	(3.3–3.7)	50	(14–200)	7.7	(7.3–8.2)
Above median	31.1	(29.1–33.0)	3.1	(2.9–3.3)	36	(14–150)	6.1	(5.8–6.5)
Health and physical activity								
Physical activity at work								
Mainly sitting	33.5	(30.4–36.6)*	2.8	(2.6–3.1)*	30	(14–150)$^{n.s.}$	5.9	(5.3–6.4)*
Sitting/walking	30.9	(28.6–33.2)	3.5	(3.3–3.7)	60	(15–200)	7.3	(6.7–7.9)
Walking/some heavy lifting	29.1	(26.7–31.5)	3.3	(3.1–3.6)	49	(14–200)	7.1	(6.6–7.6)
Heavy physical	35.3	(31.8–38.9)	3.5	(3.1–3.8)	30	(14–100)	6.9	(6.2–7.6)
Physical activity in leisure time								
Light physical (<2 h/week)	32.0	(28.7–35.3)$^{n.s.}$	3.6	(3.2–3.9)$^{n.s.}$	70	(15–210)$^{n.s.}$	7.3	(6.4–8.2)$^{n.s.}$
Light physical (2–4 h/week)	31.0	(28.1–34.0)	2.9	(2.6–3.2)	40	(14–145)	6.8	(6.1–7.4)
Light physical (>4 h/week)	33.4	(31.1–35.6)	3.5	(3.3–3.7)	40	(14–200)	6.9	(6.5–7.4)
Strenuous (2–4 h/week)	26.5	(23.1–30.0)	3.0	(2.6–3.4)	30	(15–100)	6.3	(5.5–7.1)
Strenuous (>4 h/week)	28.0	(24.3–31.7)	3.3	(2.8–3.8)	30	(10–175)	6.7	(5.6–7.8)
Musculoskeletal comorbidities								
None	10.1	(8.3–11.9)	2.2	(1.8–2.6)	15	(3–30)	4.5	(3.7–5.3)
One	35.5	(33.8–37.2)	2.9	(2.6–3.1)	50	(14–200)	5.6	(5.0–6.1)
Two	27.6	(26.0–29.1)	3.1	(2.9–3.4)	45	(14–200)	6.6	(6.1–7.1)
Three	26.9	(25.4–28.3)	3.8	(3.5–4.1)	30	(14–150)	7.6	(7.0–8.2)
Four or more	29.2	(27.9–30.6)	4.1	(3.7–4.5)	30	(14–150)	10.7	(9.5–11.8)
Non-musculoskeletal comorbidities								
None	25.9	(24.0–27.8)	3.0	(2.8–3.2)	30	(14–120)	5.8	(5.4–6.2)
One	32.6	(30.1–35.1)	3.2	(3.0–3.4)	43	(14–180)	6.5	(6.0–6.9)
Two	36.9	(33.3–40.6)	3.5	(3.1–3.8)	50	(14–200)	8.2	(7.3–9.0)
Three	39.2	(35.6–42.8)	4.0	(3.4–4.6)	90	(15–360)	9.1	(7.6–10.5)
Four or more	52.8	(33.8–38.3)	4.8	(4.2–5.4)	110	(20–365)	12.7	(10.6–14.8)
Traffic related neck injury								
Yes	55.0	(50.8–59.1)	4.1	(3.7–4.5)	100	(20–300)	10.0	(9.0–11.1)
No	23.9	(22.0–25.9)	3.2	(3.0–3.3)	40	(14–150)	6.4	(6.1–6.7)

Table 1 continued

	Two week prevalence (n = 4,146)		Mean pain intensity past 2 weeks (n = 1,257)		Median pain duration past year (n = 1,202)		Mean disability score past 2 weeks (n = 1,293)	
	%	(95% CI)	Score	(95% CI)	Days	(Interquartile range)	Score	(95% CI)
Consequences of NP								
Less active								
Yes	73.3	(70.4–76.2)	4.4	(4.2–4.7)	100	(30–300)	10.4	(9.9–11.0)
No	18.8	(16.9–20.7)	2.6	(2.5–2.8)	30	(10–100)	4.8	(4.6–5.1)
Healthcare seeking								
Yes	70.9	(67.9–73.9)	4.0	(3.8–4.3)	90	(30–300)	8.4	(7.9–8.9)
No	22.2	(20.7–23.6)	2.7	(2.5–2.8)	30	(10–100)	5.6	(5.2–5.9)
Change of job								
Yes	74.0	(71.2–76.7)	4.8	(4.5–5.2)	176	(40–350)	11.8	(10.8–12.7)
No	28.4	(27.0–29.9)	3.0	(2.8–3.1)	30	(14–120)	5.8	(5.6–6.1)
Disablement rehabilitation								
Yes	52.2	(49.9–54.6)	6.0	(5.5–6.6)	360	(160–365)	16.2	(14.7–17.7)
No	30.5	(29.1–31.9)	3.1	(3.0–3.2)	38	(14–150)	6.6	(5.9–6.4)

The gender variable was only age standardised and the age variable was only gender standardised

Fisher's exact test for test of differences between the categories in each variable: $P < 0.001$ for all variables, except for: $^{*}P < 0.05$, $^{**}P < 0.01$

n.s. Not significant

Correlations between disability, intensity, and duration

The Spearman rank correlation coefficients between NP intensity/duration and disability due to NP generally showed moderate to good correlations (Table 2). However, subgroups with less than 100 individuals were only poorly or negatively correlated ($r < 0.25$). Few trends were noted: (1) age and gender differences were small, (2) the more musculoskeletal or non-musculoskeletal comorbidities the higher the correlation coefficients, and (3) individuals who did not seek healthcare, who were not less physically active, had not changed job, or were not under disablement rehabilitation only demonstrated fair correlation coefficients.

Associations between disability, intensity, and duration

The logistic regression analyses between NP intensity and disability showed inconsistent patterns within each subgroup; the strongest associations were found in physical activity and comorbidities (Table 3). Pain duration was only weakly associated with disability and in most cases they were statistically non-significant.

Discussion

The 2-week NP prevalence (31%) in the present study is similar to prevalence estimates in other Scandinavian countries [15]. It is, however, somewhat higher than previously reported prevalence estimates in Denmark. The 2-week NP prevalence in 1986–1987 was 29% in women and 18% in men [4], whereas in the present study the 2-week NP prevalence was 35.5 and 26.1%, respectively. This difference may reflect a real increase in NP in the general population or could simply be due to the variation in such estimates—including the willingness to participate in the study. Despite the frequent NP reporting only mild pain and mild disability was reported. Thus, generally, NP does not result in severe pain or major disability during people's daily life. Older individuals suffered less frequently from NP, but nevertheless reported higher scores of pain intensity and were more disabled due to NP compared to the younger individuals.

Moderate correlations between NP intensity and disability were seen in all socioeconomic and most of the other variables in the present study. There was a marked decrease in correlation coefficients when numerous musculoskeletal and non-musculoskeletal problems and 'consequence of NP' related factors were present in individuals with NP. In nearly all correlation coefficients between NP duration and disability only a fair degree of relationship was found ($r < 0.50$). This indicates a more widespread scatter in the pain duration measurement in relation to disability. However, in all the correlation coefficients below 0.25 the sample sizes were very small ($n < 100$) and they should probably be disregarded.

Table 2 Spearman correlation coefficients between NP disability and NP intensity or NP duration for socioeconomic and health related variables, and variables related to consequences of NP

	Pain intensity *r*		Pain duration *r*	
	Men	Women	Men	Women
Socioeconomic variables				
Gender	0.52	0.55	0.38	0.38
Age				
Younger (21–49 years)	0.52	0.55	0.35	0.38
Older (50–71 years)	0.52	0.56	0.39	0.39
Education				
<10 years (primary education)	0.57	0.57	0.52	0.31
10–12 years (secondary education)	0.53	0.57	0.35	0.43
>12 years (tertiary education)	0.23	0.48	0.18	0.41
Income				
Below median	0.55	0.61	0.48	0.40
Above median	0.49	0.48	0.30	0.36
Health and physical activity				
Physical activity at work				
Mainly sitting	0.52	0.49	0.23	0.34
Sitting/walking	0.45	0.61	0.33	0.46
Walking/some heavy lifting	0.59	0.56	0.49	0.37
Heavy physical	0.54	0.39	0.35	0.12
Physical activity in leisure time				
Light physical (<2 h/week)	0.57	0.54	0.43	0.34
Light physical (2–4 h/week)	0.43	0.54	0.26	0.41
Light physical (>4 h/week)	0.50	0.63	0.40	0.43
Strenuous (2–4 h/week)	0.55	0.45	0.24	0.20
Strenuous (>4 h/week)	0.60	0.50	0.42	0.31
Musculoskeletal comorbidities				
None	0.32	0.50	0.05	0.34
One	0.42	0.48	0.35	0.17
Two	0.52	0.53	0.33	0.35
Three	0.60	0.56	0.42	0.42
Four or more	0.53	0.59	0.40	0.24
Non-musculoskeletal comorbidities				
None	0.47	0.54	0.35	0.41
One	0.50	0.48	0.33	0.34
Two	0.56	0.56	0.41	0.32
Three	0.58	0.68	0.65	0.50
Four or more	0.66	0.83	0.20	0.26
Traffic related neck injury				
Yes	0.76	0.64	0.53	0.43
No	0.47	0.53	0.34	0.35
Consequences of NP				
Less active				
Yes	0.52	0.60	0.35	0.32
No	0.36	0.41	0.26	0.25
Seeking treatment				
Yes	0.52	0.54	0.29	0.34
No	0.48	0.49	0.39	0.27
Change of job				
Yes	0.61	0.67	0.45	0.50
No	0.46	0.48	0.33	0.26
Disablement rehabilitation				
Yes	–0.15	0.73	–0.32	0.45
No	0.48	0.51	0.33	0.32

The moderate correlation coefficients between pain intensity and disability found in the present study were similar to what others have reported. Marchiori and Henderson [27] collected data on 700 consecutive patients referred to clinical radiology for cervical radiographs. They reported a moderate correlation ($r = 0.65$) between pain intensity (measured on a visual analogue scale—VAS) and the Neck Disability Index (NDI). Hermann and Reese [16] also reported a moderate correlation ($r = 0.65$) between VAS and NDI in a small patient sample ($n = 80$) referred to a hospital-based physiotherapy clinic. Chiu et al. [6] likewise demonstrated moderate correlations ($r = 0.55$ and 0.63) using VAS and Northwick Park Neck Pain Questionnaire (NPQ) in 218 patients with chronic NP recruited from two physiotherapy departments. A study by Clair et al. demonstrated a moderate correlation between VAS and the Neck Pain and Disability Scale (NPDS) in 71 patients with non-acute NP referred to a hospital based physiotherapy department. Finally, Wlodyka-Demaille et al. [41] correlated VAS with three different functional disability measures and reported fair to moderate correlations (NDI: $r = 0.46$, NPDS: $r = 0.47$, NPQ: $r = 0.55$) in 71 patients with neck disorders of at least 15 days duration. The small differences between previous studies and the present study are most likely due to the use of different disability scales and the use of different study populations. The latter explanation is indicated in the present study, as variations in correlations coefficients were found across the different subgroups.

The regression analyses showed that pain intensity is associated with disability for all subgroups. In contrast, the weak association between pain duration and disability indicates that pain duration is a poor indicator of the level of disability.

Table 3 Logistic regression analysis for association between NP disability and NP intensity or NP duration for each of the socioeconomic and health related variables, and variables related to consequences of NP (adjusted for age)

	Pain intensity		Pain duration	
	Men OR (95% CI)	Women OR (95% CI)	Men OR (95% CI)	Women OR (95% CI)
NP disability	2.0 (1.6–2.6)	2.4 (1.9–3.1)	1.0 (1.0–1.0)*	1.0 (1.0–1.0)**
Socioeconomic				
Age	2.0 (1.6–2.6)	2.4 (1.9–3.1)	1.0 (1.0–1.0)*	1.0 (1.0–1.0)**
Education				
<10 years (primary edu.)	1.7 (1.2–2.6)**	2.0 (1.2–3.1)**	1.0 (1.0–1.0)*	1.0 (1.0–1.0)$^{n.s.}$
10–12 years (secondary edu.)	2.6 (1.8–3.6)	2.9 (2.0–4.4)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)**
>12 years (tertiary edu.)	1.5 (1.0–2.4)$^{n.s.}$	2.1 (1.4–3.3)**	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Income				
Below median	2.1 (1.3–3.5)*	3.3 (2.0–5.3)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)**
Above median	2.0 (1.5–2.6)	2.1 (1.6–2.9)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Health and physical activity				
Physical activity at work				
Mainly sitting	3.2 (1.9–5.4)	2.1 (1.2–3.5)**	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Sitting/walking	1.7 (1.2–2.4)**	2.2 (1.5–3.1)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Walking/some heavy lifting	1.7 (1.2–2.4)**	2.7 (1.6–4.5)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)
Heavy physical	2.8 (1.6–4.7)	4.6 (2.1–10.3)	1.0 (1.0–1.0)$^{n.s.}$	1.1 (1.0–1.2)**
Physical activity in leisure time				
Light physical (<2 h/week)	1.7 (1.1–2.7)*	2.2 (1.3–4.0)*	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Light physical (2–4 h/week)	2.6 (1.4–4.8)**	1.8 (1.2–2.8)*	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Light physical (>4 h/week)	1.9 (1.3–2.8)*	2.8 (1.8–4.2)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.1)$^{n.s.}$
Strenuous (2–4 h/week)	2.5 (0.8–7.5)$^{n.s.}$	3.2 (0.8–12.5)$^{n.s.}$	1.1 (1.0–1.1)$^{n.s.}$	1.0 (1.0–1.0)*
Strenuous (>4 h/week)	2.5 (1.5–4.1)	2.3 (1.0–5.4)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Musculoskeletal comorbidities				
None	1.6 (0.7–3.2)$^{n.s.}$	2.1 (1.2–3.7)*	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
One	1.8 (1.3–2.5)	1.8 (1.4–2.5)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)**
Two	2.0 (1.3–2.9)**	3.2 (1.6–6.3)**	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Three	3.9 (1.3–11.5)*	2.6 (1.8–3.7)	1.0 (1.0–1.0)$^{n.s.}$	1.1 (1.0–1.1)*
Four or more	1.0 (0.9–1.1)$^{n.s.}$	–	1.1 (1.0–1.2)**	–
Non-musculoskeletal comorb.				
None	1.8 (1.3–2.5)	2.0 (1.5–2.8)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)*
One	2.1 (1.4–3.3)**	3.4 (1.8–6.4)	1.0 (1.0–1.0)$^{n.s.}$	1.1 (1.0–1.1)**
Two	2.0 (1.3–3.1)**	2.5 (1.2–4.9)*	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
Three	16.3 (2.3–113.3)*	1.0 (1.0–1.1)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$	1.1 (1.0–1.1)**
Four or more	–	–	–	1.2 (1.1–1.3)
Traffic related neck injury				
Yes	7.4 (1.1–52.5)*	7.7 (1.9–30.3)*	1.1 (1.0–1.1)**	1.0 (1.0–1.0)*
No	2.0 (1.6–2.5)	2.3 (1.8–3.0)	1.0 (1.0–1.0)*	1.0 (1.0–1.0)**
Consequences of NP				
Less active				
Yes	3.6 (1.7–7.8)**	3.2 (2.0–5.2)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)*
No	1.8 (1.4–2.3)	2.2 (1.6–3.0)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)*
Healthcare seeking				
Yes	2.3 (1.3–3.9)**	3.2 (1.9–5.2)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)$^{n.s.}$
No	1.8 (1.4–2.4)	2.1 (1.5–2.8)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)*
Change of job				
Yes	–	–	–	–
No	2.0 (1.5–2.5)	2.4 (1.8–3.2)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)*
Disablement rehabilitation				
Yes	–	1.7 (0.5–6.0)$^{n.s.}$	–	–
No	2.0 (1.6–2.5)	2.6 (2.0–3.3)	1.0 (1.0–1.0)$^{n.s.}$	1.0 (1.0–1.0)**

Except for the age variable

$P < 0.001$ for all ORs, except: $*P < 0.05$, $**P < 0.01$

n.s. Not significant, – not applicable

A post hoc analysis was conducted to examine whether the inclusion of both NP intensity and NP duration in the same logistic regression model would influence the strength of associations in each of the two outcome measures. The associations for the intensity-disability and duration-disability relationships both weakened, but, the duration-disability association became non-significant. Thus, NP duration is probably not a relevant predictor for disability.

The difference between correlation coefficients and regression models need to be emphasised. The correlation coefficients measure the scatter of the points around an underlying linear trend: the smaller the spread the greater the correlation [1]. Thus, pain duration was gathered closely around the underlying linear trend with regard to disability. Regression analyses, however, describe the strength of the association between pain duration and disability: the higher the odds ratio the better the duration may "predict" the level of disability. Therefore, despite the significant association between pain duration and disability, the duration itself may not predict the level of disability per se (i.e. the variation of the disability score is more or less the same regardless of NP duration). Likewise, Clair et al. found that symptom duration did not significantly correlate with pain intensity or disability [7].

The risk of bias in recall of pain is a threat to the validity of any retrospective study [26]. Any answer is based on each individual's own recollection and interpretation, and the presence of NP may influence the answers. These self reported variables may thus be subject to bias. However, in this study such bias may not be a major concern as the subjects needed only remember 2 weeks back in most of the items [3]. The reporting of number of days with NP during the past year should, however, be interpreted with caution. However, since this study only included subjects with NP, we hypothesise that any information bias is non-systematic and may therefore at worst underestimate the effects (i.e. non-differential misclassification) [31].

We have demonstrated that pain and disability were less well correlated when the NP symptoms were relatively mild and if no or only few comorbidities were present, whereas moderate correlations were seen when the NP symptoms were more severe (i.e. with increased number of comorbidities, traffic related neck injury, etc.). Thus, the strongest correlations between pain and disability would be found in patient populations and weaker correlations would be found in the general non-patient dominated population. Strong associations were found between NP intensity and disability, but increased musculoskeletal comorbidities weakened this association. Given these subgroup differences NP intensity and disability due to NP should be considered as two separate measures, and hence, two dimensions. The weak correlations and associations between duration and disability indicate that duration is an inappropriate measure of disability. These results have implications for future clinical and epidemiological studies as different therapeutic strategies may be required for these two dimensions.

Conclusions

Neck pain is very common in Denmark, but at least for the younger population it does not result in intense pain or major disability during daily life. The correlations between pain and disability were moderate and increased with an increasing number of pain sites and factors related to consequences of NP. Pain intensity was associated with disability in all subgroups; whereas the duration of NP was only weakly associated with disability indicating that duration is a poor indicator of disability. Future studies should measure and interpret pain and disability as two distinct dimensions.

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