Table 1. Cohort / Case Control Studies of Incidence and Risk Factors for Neck Pain – General Population

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
Berglund et al., 2000; Cohort (Phase I) [1]	Swedish population covered by a large insurance company between 1987-1988 and followed in 1994 (n=1509)	Neck pain often or always in the past three months	Three month prevalence of neck pain at 7-year follow-up: Motor Vehicle Collision without reported WAD cases: 14.0% (8.1-19.8) controls: 11.1% (8.4-13.9) Motor Vehicle Collision with WAD cases: 39.6% (32.5-46.7) controls: 14.5% (11.9-17.1)	There is no increase of future neck or shoulder pain in drivers who did not report whiplash injury in connection with a rear-end collision seven years earlier (RR§=1.3 95%CI† 0.8-2.0+). In drivers with reported neck injury. the risk of neck /shoulder pain seven years after the collisions was increase nearly three-fold compared with that in the unexposed subjects (RR=2.7 95%CI (2.1-3.5)).
Björnstig et al., 1990; Cohort (Phase I)[2]	Patients with soft-tissue injury to the neck seen as in- or outpatient at the Regional Hospital in Umeå (Northern Sweden); April 1985-April 1986. Excludes penetrating injuries and contusions to the neck. Would also exclude a small number of patients seen at private clinics. (n=139)	Soft-tissue injury to the neck (whiplash) defined as neck injury without fracture, luxation or damage of neural elements, classified as AIS 1 #.	121 soft-tissue neck injuries/100,000 inhabitants overall. 3.74 soft-tissue neck injuries/100,000 inhabitants not due to traffic accidents.	Overall male/female ratio is 1:0.92, with the highest frequency in the 20-29 year age group.
Bot et al., 2006, Cohort (Phase I)[3]	Dutch population under the care of a random sample of Dutch GPs, 2001 (n=375,899).	Visit to GP with new complaint classified by GP using International Classification of Primary Care codes L01 (neck	Incidence of neck complaints in general practice overall was 15.5 per 1000 person-years 95%CI (15.1-15.9). For males, 11.6 per 1000 PY	Incidence of neck complaints increased with age, to a peak at 40-49 years of age, followed by declining rates after 49.

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
		symptoms/complaints) or L83 (syndrome of cervical spine e.g., syndromes with and without radiation of pain: cervical disc lesion; cervicobrachial syndrome; osteoarthritis; radicular syndrome of upper limbs; spondylosis; sprains and strains; torticollis; whiplash; cervicogenic headache).	95%CI (11.1-12.1) For females 19.3 per 1000 PY 95%CI (18.7-20.0) Incidence of cervical syndromes overall was 3.4 per 1000 person-years (95%CI (3.2-3.6). For males, 2.7 per 1000 PY 95%CI (2.5-3.0) For females 4.1 per 1000 PY 95%CI (3.8-4.4)	Incidence rates were higher for women than for men. Incidence rates were higher among those with public insurance than among those with private.
Bring et al., 1996 Cohort Study (Phase I)[4]	Adult (15-65) population of two cities in northern Sweden from July 1988 to June 1990 (n.133,800, 729 neck injury cases)	Patient seeking medical attention at hospital emergency room after minor or moderate (AIS # 2) neck injury, with or without concurrent head injuries.	Overall annual incidence rate of neck^ injury was 2.7 per thousand inhabitants per year (95% CI 2.5-2.9) Annual incidence rate of neck^ injury *not associated with vehicle* was 0.55 per thousand inhabitants per year (95% CI 0.47-0.64)	Incidence of neck injury was similar for men and women.
C⊥tϑ et al., 2004 Cohort Study (Phase I)[5]	Adult (20-69) population of Saskatchewan with valid health card in 1995, free of neck pain at time of initial questionnaire (n=513).		Age- and gender-standardized annual cumulative incidence of an episode of neck pain was 14.6% (95% CI 11.3-17.9). Most new episodes were mild, or Grade I (12.8% cumulative incidence (9.6-15.9). Less than one-percent of the population	The incidence of a new episode of neck pain was lower in older subjects than in younger ones (IRR** 0.60, 95%CI 0.38-0.93).

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
			developed disabling neck pain – grade III or IV – (0.6% (0-1.1))	
Croft et al., 2001; Cohort study (Phase II)[6]	Adults (18-75) registered with two family practices in the U.K. reporting no neck pain at baseline, 1992 (n=1708)	Neck pain in the area shown on a manikin lasting more than one day over the past 12 months, as self-reported via questionnaire	Cumulative 1 year incidence of neck pain was 17.9% (16.0-19.7%)	Incidence was: independent of age (ref 18-29 years old) 30-44 1.0 (0.7-1.4) 45-59 0.9 (0.6-1.3) 60+ 0.7 (0.5-1.1) and more common in women (RR = 1.2, 95% CI 0.9-1.5). Other risk factors, RR and 95% CI: Prior neck pain (ref No prior) 1.7 (1.2 - 2.5) # of children (ref None) One 1.2 (0.9-1.8) Two 1.2 (0.9-1.7) Three 1.5 (1.0-2.1) Four + 1.6 (1.1-2.4) Poor psychological status (ref GHQ 0-7) GHQ 8-12 1.1 (0.8-1.5) GHQ 13-17 1.6 (1.1-2.3) GHQ 18-36 1.5 (1.0-2.2) Low back pain (ref Absent) 1.7 (1.3-2.1).
Croft et al., 2003 Case-control study	Women registered with GP practices in the UK, 1967-68,	Neck pain lasting at least one day over the past	One-month prevalence of neck pain lasting at least one day	Neck pain was associated with health care visits for the following

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
(Phase III)[7]	enrolled in Oral Contraception study, followed 25 years later in 1994 (n=9723).	month.	was 18.9% (1835 / 9723)	diagnostic codes 25 years in the past (with OR‡): Mental Disorders: 1.3** Disease of Central Nervous System: 1.5** Acute respiratory infection: 1.2* Diseases of urinary system: 1.1* Diseases of breast, ovary, fallopian tube and parametrium: 1.2* Diseases of uterus and other female genital organs: 1.2** Arthritis and rheumatisms: 1.4*** Osteomyelitis and other MSK diseases: 1.3** *p<0.05; **p<0.01; ***p<0.001 Neck pain was not significantly associated with: Infective and parasitic diseases (OR‡ range 0.9-1.1) Neoplasms (OR‡ 0.9) Diseases of the digestive system: (OR‡ range 1.1-1.2)
Eriksen, 2004; Cohort study (Phase III)[8]	Norwegian nurses aides registered with the Norwegian Union of Health and Social Workers in 1999 (n=4744).	Absent from work because of neck pain for more than 14 consecutive days during the previous 12 months,.	N/A ‖	Exposure to environmental tobacco smoke during childhood was associated with an increased risk of sick leave attributed to neck pain. Compared to those not exposed, adjusted odds ratios for those sometimes exposed was 1.37 (1.03-1.84) and for those

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
				often exposed 1.32 (1.00-1.74).
Fejer et al., 2006; Twin Study[9] (in both cross-sectional and cohort tables)	Danish twins, age 20-71 years, registered in the Danish Twin Registry, surveyed in 2002 (n=33794).	Ever had neck trouble defined as ach, pain or discomfort, using the Standardized Nordic Questionnaire	N/A ‖	The overall heritibility of lifetime NP is 44% - nearly half of the variation with regard to NP in the young and middle-aged population is a result of genetic variation. Heritibility differs between men and women, highest for women (33% vs 51%). Environmental influence plays a larger role in men than in women. The non-shared environmental factor increased with age and the genetic component became negligible in the oldest age groups, especially among females in whom the liability to NP is almost entirely due to environmental factors (genetic effect estimated at 0%).
Hartvigsen et al., 2005; Twin Study[10]	Danish twins, age 75 years and older, registered in the Danish Twin Registry, time not reported (n=2108).	Pain or stiffness in the neck or neck/shoulder area during the past month.	N/A ‖	Additive genetic effects adjusted for age and significant environmental risk factors showed that additive genetic effects accounted for 0.05 (95%CI -0.21 to 0.31) of the occurrence of neck pain in men and 0.03 (95%CI -0.17 to 0.23) in women. Dominant genetic or common environmental effects were found not to affect the overall occurrence

Kelsey et al., 1984; Case-control (Phase II)[11]	Patients from hospitals in New Haven and Hartford CT, and from neurosurgical and orthopaedic practices in 1979-1981, between 20-64 years. Cases: patients with prolapsed disc and symptoms that lasted at least 1 week and who had radiographs or myelograms. (n=88). Matched controls: patients admitted to same medical services for diagnoses not related to spine. (n=66) Radiographic controls: patients who were x rayed, but no prolapsed disc. (n=556).	1. Surgical: confirmed at surgery. (n=40). 2. Probable: pain and numbness distributed along a specific nerve root or extended as far down as the wrist, and at least one of following three signs: increased brachalgia with coughing sneezing, or straining at stool, or bicep/tricep reduced reflex). (n=20) 3. Possible: pain distributed along cervical nerve root to at least the elbow; or neck or shoulder pain without pain/numbness. (n=28)	N/A (case-control study)	Comparison to matched controls: Current smoking (OR‡ =2.1; 95% CI 0.9-5.0) Comparison to radiographic controls: Current smoking (OR‡=1.7; 95% CI 0.9-3.2) No association with lifting.
Kondo et al., 1981; Cohort (Phase I)[12]	Patients residing in Rochester MN (USA) for at least one year between 1950 and 1970; and diagnosed with disc protrusion or herniation that resulted in a radicular syndrome. (n=56)	One or more soft disc protrusions demonstrated by myelography or surgery.	Annual incidence = 5.5 per 100,000 (95%CI (4.2-7.0). Protrusions most common at C6 (59.25) Incidence/100,000 (95% CI): 20-34 years: 1.5 (0.5-3.5) 35-44 years: 16.2 (9.8-25.3). 45-54 years: 22.7 (14.4-34.0) ∃55 years: 5.1 (2.3-9.7)	IRR**=1.41 (95% CI 0.84-2.39) for males versus females.
MacGregor et al., 2004; Twin study[13] (in both cross-sectional and cohort tables)	Female registrants in the St. Thomas Hospital, UK Adult Twin Registry (age 45-79), timing not provided (n=1064).	Neck pain between the occiput and the third thoracic vertebra of at least one month duration associated with disability (impossible to do one or more of the following activities: look over	N/A	There was an excess concordance of neck pain in MZ twins when compared with DZ twins. Heritability for neck pain was estimated to be 48% (95% CI 29-67) for any pain ever and to be 35% (95%CI 9-61) for severe disabling pain.

		shoulder, reach up, drive, read for 15 minutes, turning over in bed, washing or brushing hair, working at a desk for 15 minutes, carrying heavy bags) sometime over lifetime		The strongest association was between General Health Questionnaire score and neck pain, but this association was mediated genetically.
Rekola et al., 1993; Cohort (Phase I)[14]	Population served by six health centres in central Finland, February, 1988 (N-93,000 inhabitants of whom 6526 made visit to health centre during study period)	Visiting health centre because of symptoms, mostly pain around the neck.	Of all musculoskeletal complaints, neck pain was the most frequently reported by women and the second most frequently reported by men. The incidence rate of visits for neck pain over the two week period was 2.6 per 1000 for males (2.1-3.0) and 3.5 per 1000 for females (3.0-4.0).	The incidence of neck pain visits rises with age, and peaks around 40-50 years of age, with slight drop after that.
Siivola et al., 2004; Cohort (Phase I)[15]	Young adults originally recruited as high school students from 5 high schools randomly selected from 11 high schools in Oulu, Finland, followed 7 years later in 1996 when 22-25 years old (n=547).	Occasional or weekly neck/shoulder pain over the past six months.	For those free of neck/shoulder pain in 1989, 59% reported occasional or weekly neck/shoulder pain during the six months prior to the 1996 survey.	Psychosomatic symptoms in adolescence were predictive of newly reported neck/shoulder symptoms in young adulthood (OR ‡ for psychosomatic score of 1.0 95%CI (1.0-1.1))
StΔhl et al., 2004; Cohort (Phase I)[16]	Students recruited from primary schools in a town in southern Finland and free of neck pain in 1995, followed one and four years later, 1995-1999 (n=366).	Neck pain at least once a month over the past three months.	At one year follow-up, the three-month prevalence of neck pain at least once a month was 21.3% (95%CI 17.2 – 25.9). For males 18.6% (13.6 – 25.0) For females 23.8% (18.3 – 30.4)	Neck pain was more prevalent in girls than in boys, and neck pain occurred more often with other MSK pains than as a single pain.

Versteegen et al., 1998; Cohort (Phase I)[17]	Catchment area of University Hospital at Groningen, the Netherlands (approx. 2 million persons). Included patients presenting to University Hospital between 1970 and 1994 with neck sprain or strain not due to car crash. Does not include those not presenting to hospital. (n=680)	ICD-9†† 847.0 sprain and stain of the neck.	The incidence of neck sprain/strain increased from 6.5/100,000 residents during 1970-74 to 28.5/100,000 residents in 1990-1994.

* Estimates directly from the publications or calculated from data provided in the publication
† CI is confidence interval
‡ OR is odds ratio
§ RR is Relative risk
** IRR is Incidence Rate Ratio
|| N/A no data given
\# AIS 1 is Abbreviated Injury Scale
† † ICD-9 is International Classification of Disease 9th Edition

Table 2. Cohort / Case Control Studies of Incidence and Risk Factors for Sport-Related Neck Pain

Author(s), Year, Design	Setting and Subjects Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
Bicycling - Recreational				
Rivara et al, 1997 [18] Cohort Phase I	Patients (n = 3390), injured while riding a bicycle, attending one of seven Seattle area hospitals 03/1992 through 08/1994	Neck injury - location and type	91 (2.4%) individuals sustained neck injuries of those, 76 (83.5%) had neck sprain	Neck sprain was not associated with helmet use (age adjusted OR = 0.9, 95% CI 0.6-1.5)
Ice Hockey - Varsity				
Benson, 1999 [19] Cohort, Phase III	Canadian University male ice hockey players during the 1997-1998 season, half of the team used full face shields and half used half face shiends (n=642)	1) Any injury received during organized practice or game during the season that required assessment or treatment by a team therapist or physician and resulted in at least one missed participation, or 2) any facial laceration, fracture, dental injury, eye injury, traumatic brain injury, or brachial plexus stretch	The neck injury rate for half shields was 0.34 per 1000 athlete-exposures (game or practice) (95%CI 0.18,0.60). For full shield it was 0.29 (95%CI 0.14,0.54).	The relative risk for wearing a half shield was 1.16(95% CI 0.43-3.16)
Stuart et al., 2002 [20] (reviewed by Meuwisse, 2002 [21]) Cohort	U.S. Junior A hockey players, timing not provided, during home games over a single season (n=282).	Neck injury occurring to a home-team player on the rink or players' bench requiring the medical attention of the athletic trainer.	There was one neck injury recorded over the season giving a rate of neck injury of 0.6 per 1000 player hours (95%CI 0.15, 2.26)	N/A||
LaPrade et al., 1995 [22] Cohort	National Collegiate Athletic Association Division I varsity ice hockey players on a single team over a four year period, timing not provided, U.S. (n=18,584 player-practice	Neck sprain occurring during a practice or a game that caused the player to miss the next practice or game, injury classified and recorded by athletic trainer using	The incidence rate of neck sprain pooled over practices and games was 0.20 per 1000 player-hours (95% CI 0.08,0.45)	N/A

Author(s), Year, Design	Setting and Subjects Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
	hours and 1008 player-game hours).			
Watson et al., 1996 [23] Cohort Phase I	Hockey players on one of three teams in the Ontario (Canada) Universities Athletic Association hockey league in seasons 1986/7 to 1991/2 inclusive (n=4218 player-games prior to rule change and n=3572 player-games after the rule change)	Neck injuries requiring attention from an athletic therapist and/or physician as result of incident during game, classified by the therapist.	Prior to implementation of rule change to penalize check-from-behind, the rate of neck injury was 2.37 per 1000 player games (95% CI 1.30, 4.05) After implementation of rule change, neck injury rate was 0.56 per 1000 player games (95% CI 0.17, 1.56)	Implementation of stiffer penalties for checking from behind appears associated with a reduction in neck injuries. Crude IRR = 0.24 and 95% CI (0.05-1.08).
Football – Varsity				
Hagel et al, 2003 [24] Meeuwisse et al, 2000 [25] Cohort Phase II	Varsity men's football players in the Canada West Universities Athletic Association 1993-1997 (981 players in total, but n defined as number of exposures: Total exposures = 99,781 (Practice = 89,556, Game = 10,225)	Acute neck injuries defined as any neck injury resulting in ≥ 1 complete or partial sessions of time loss, or any concussion or transient neck neurological injury. Severe injury{ classified as ≥ 7 session of time loss.	0.61 neck injuries per 1000 exposures for athletes reporting no past neck injury (95%CI 0.46,0.81) 3.56 neck injuries per 1000 exposures for athletes reported past neck injury (95%CI 2.7-4.6) Crude Incidence Rate: 11.1 neck injuries per 10,000 exposure (games only) Crude Injury Rate: 9.82 neck injuries per 10,000 athlete-exposures (games or practices) (95%CI 8.1,	In game situations, after controlling for year of participation, higher rate of neck injuries in players with prior neck pain vs. those without history of neck pain (Adjusted rate ratio = 5.04, 95% CI 3.1-8.2). Sensitivity analysis to examine effect of potential underreporting of neck injury among those with no past neck injury: if the 45 reported neck injuries in the group with no history represented only 20% of their neck injuries, then the risk ratio for past injury would be 1.16 and not significantly different from 1.0.

Author(s), Year, Design	Setting and Subjects Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
			11.9) (not severe 8.8; severe 1.0);	
Lacrosse – High School				
Hinton et al., 2005 [26] Cohort Phase I	High school lacrosse players in Virginia, U.S. during the 1999, 2000 and 2001 lacrosse seasons (n=212,850 athlete exposures for males and 146,190 athlete exposures for females where exposures is either a game or a practice)	Neck injury requiring medical attention by the athletic trainer and resulting in modification of participation for one or more days (recorded by thg athletic trainer using a standardized injury surveillance system).	The incidence rate of neck injury for boys was 0.08 per 1000 athlete exposures (95% CI 0.05-0.12) and for girls was 0.02 per 1000 athlete exposures (95%CI 0.007-0.05)	Boys were more likely to sustain neck injuries than girls. IRR 3.89 95%CI (1.13-20.73).
Luge - Olympic				
Cummings et al, 1997 [27] Cohort	Luge athletes (n=1043) training for the Olympics at 1 of 2 U.S. Olympic training centers, who completed 57,244 luge runs	Injuries, classified as minor (≤ 1 day missed training due to injury), moderate (2-7 missed days) and major (>7 missed days)	0.91 neck injuries per 1000 luge runs (95% CI† 0.68-1.2). 0.05 neck injuries per person per year. 45% of neck injuries were strains and 96% were mild.	N/A
Race Care Driving				
Minoyama et al., 2004 [28] Cohort	Professional race car drivers participating in the Fuji Speedway, Japan 1996-2000 (N=1,039 single seat cars and N=1,577 saloon cars)	Neck sprain due to in-race collision, documented at mandatory medical center visits.	For single seat cars; 16.5 per 1,000 competitors/race and for saloon cars; 21 per 1,000 competitors/race	N/A
Skiing - Recreational				
Hagel et al., 2005 [29] Case-Control	Skiers from 19 of the largest ski areas in Quebec, Canada during the 2001/2 season (1082 cases [131 / 1082 were	Neck injury (includes sprains, fractures etc.) identified by accident report form completed by ski patrol for a neck injury while skiing or snowboarding, as	N/A	The odds of sustaining a neck injury while wearing a helmet were 0.62 (0.33-1.19) as compared to not wearing a helmet.

Author(s), Year, Design	Setting and Subjects Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
Phase III	neck injuries] and 3295 controls).	indicated by the body region recorded.		
Taekwondo - National				
Pieter and Zemper, 1999 [30] Cohort	U.S. national Taekwondo athletes age 6-16 years 1989-1990 (n=4139) International Taekwondo athletes age 13-16 years, 1990 (n=119) Altogether, 7606 athlete exposures (athlete competing in bout).	Neck contusion, sprain or strain as diagnosed by attending physician.	For boys, there were 1.48 neck injuries per 1000 athlete exposures (95%CI 0.79-2.60) and for girls, there were 1.30 neck injuries per 1000 athlete exposures (95%CI 0.40-3.62)	N/A
Wrestlers - International				
Lorish et al.,1992 [7] Cohort, Phase I	International level male wrestlers aged 6-16 yrs participating in 2 tournaments in the United States, June 1987. (n=1742)	Any (neck) injury that occurred during a match that required medical attention. Moderate to severe injuries defined according to the following criteria: 1) wrestler physically unable to wrestle in next match; 2) wrestler would risk further injury if allowed to wrestle again; 3) wrestler had an injury that required further evaluation elsewhere (the emergency department at a nearby hospital); 4) time necessary for the physician to make an adequate decision regarding the ability to wrestle was longer than the time until the wrestler's next match.	4.6 neck injuries per 1000 matches (95%CI 3.3-6.3) 1.3 moderate to severe neck injuries per 1000 matches (95%CI 0.7-2.2) 1.89% (95% CI 1.3-2.7) experienced a cervical spine injury.	After controlling for weight, increasing age was associated with increased risk of injury.
General Participation – Multiple Sports				

Author(s), Year, Design	Setting and Subjects Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
Kelsey et al., 1984 [11] Case-control Phase II	Patients from hospitals in New Haven and Hartford CT, and from neurosurgical and orthopaedic practices in 1979-1981, between 20-64 years. Cases: patients with prolapsed disc and symptoms that lasted at least 1 week and who had radiographs or myelograms. (n=88). Matched controls: patients admitted to same medical services for diagnoses not related to spine. (n=66) Radiographic controls: patients who were x rayed, but no prolapsed disc. (n=556).	1. Surgical: confirmed at surgery. (n=40). 2. Probable: pain and numbness distributed along a specific nerve root or extended as far down as the wrist, and at least one of following three signs: increased brachalgia with coughing sneezing, or straining at stool, or bicep/tricep reduced reflex). (n=20) 3. Possible: pain distributed along cervical nerve root to at least the elbow; or neck or shoulder pain without pain/numbness. (n=28)	N/A (case-control study)	Comparison to matched controls: Diving > 25 times/2 years (OR‡=6.4, 95% CI§ 1.2-33.7). Comparison to radiographic controls: Diving > 25 times/2 years (OR=2.7, 95% CI 1.0-6.9). No association with golfing.
Mundt, 1993 [31] Case control Phase II	Adults (20-64) with disk herniations seen by 38 spine surgeons in Massachusetts, New Brunswick, New Jersey and New York. Controls were individually matched patients seen for reasons other than neck or back pain (n=63 for cervical disk)	Cervical disk herniation with radiographic or surgical confirmation	N/A	Practice any of the following at least 10 times in the 2 years previous to herniation: Any sport (RR=0.39; 95% CI 0.12-1.30) Lowest RR for golf (RR=0.59; 95% CI 0.21-1.62). Highest RR for bowling (RR=1.63; 95%CI 0.70-3.83) Free weights (RR=1.87; 95% CI 0.74-4.74) Weight lifting equipment (RR=0.75; 95% CI 0.31-1.78) No significant associations found

Author(s), Year, Design	Setting and Subjects Number (n) Enrolled	Case Definition	Incidence*	Risk Factors
Van den Heuvel et al., 2005 [32] Cohort Phase III	Workers, at job at least one year, working at least 24 hours per week, in the Netherlands in 1994 (n=1312).	Neck/shoulder pain in the past year, measured with Nordic questionnaire.	Three year cumulative prevalence of neck/shoulder symptoms was 39.8%. (37.4 – 42.2).	Neck/shoulder symptoms were reduced among those practicing a sport at least 10 months per year as compared to those practicing a sport 0 to 3 months per year (OR 0.82 (0.67-0.99).

* Estimates directly from the publications or calculated from data provided in the publication
† CI is confidence interval
‡ OR is odds ratio
§ RR is Relative risk
‖ N/A no data given

Table 3. Cross-sectional Studies of the Prevalence of Neck Pain and Its Associated Factors – General population – all ages and adults

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Al-Awadhi et al., 2004 [33] ‖	Adult Kuwaiti nationals 15+ years old living in any of the five governorates of Kuwait (n=7670).	COPCORD Study - Self-reported musculoskeletal pain in the neck, location indicated on mannequin, over the previous 7 days or prior to 7 days ago.	Seven-day prevalence for neck symptoms of 5.6% 95%CI (5.1 - 6.2).	N/A
Andersson et al., 1993 [34] Andersson et al, 1998 [35] Andersson 1994 [36]	Random sample of the 25-74 year old population in two defined areas in south of Sweden, 1988, age 25-74 years, (n=1,609)	Persistent or recurrent pain from neck-back of head with a duration of >3 months. Assessed with questionnaires. Chronic neck and/or shoulder pain duration > 6 months, with or without pain in the arms.	Prevalence of persistent or recurrent pain of > 3 months: Men: 14.5% (95% CI 12.1-16.9) Women: 19.1% (95% CI 16.4-21.8)	Chronic neck/shoulder pain of > 6 months was associated with middle age (45-64 years), living with a partner and sleep disturbances during the past three months. No association with smoking was found.
Andersson 1999 [37]		Visit to primary health care centre with ICD-8 diagnostic code of 7280 or 7282 or an ICD-9 diagnostic code of 723.	For one of the areas, Brom Īla, alone, the prevalence of persistent or recurrent pain of > 3 months was 10.5% overall. During the same time period, there were 16 visits per 1000 population per year to the primary health care centre with associated diagnostic code for neck pain. Ratio of attendance proportion to prevalence is 0.15.	Health care visits identified with neck pain decreased over time with annual visits per 1000 population of 11.9 in 1987, 11.0 in 1990, 9.3 in 1993, 8.8 in 1996.
Andrianakos et al., 2003 [38]	Residents living in 9 areas of mainland Greece (urban, suburban and rural) age 19 years and	Neck pain localized in the neck either radiating or not along an upper extremity, present at the time of interview or anytime in the past	Age and sex adjusted lifetime prevalence of recurrent neck pain was 4.8% (95% CI 4.4-5.2).	N/A

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
	older, 1996-1999 (n=8740).	provided it was recurrent and associated with spinal OA, intervertebral disc herniation, spondylolisthesis or any other chronic cause.		
Badley et al. 1992 [39]	Residents living in a household in Calderdale, West Yorkshire (United Kingdom) in 1986; aged > 15 years. (n = 42,826).	Pain, swelling, and stiffness in the neck defined by postal questionnaire.	Prevalence (pooled across age groups): 5.9% (95% CI 5.7-6.1). Age-specific prevalence (95% CI): 16-24 = 0.4% (0.3-0.5); 25-34 = 1.7% (1.4, 2.0); 35-44 = 5.0% (4.5-5.5); 45-54 = 7.2% (6.6- 7.8); 55-64 = 11.4% (10.6-12.2); 65-74 = 10.3% (9.5-11.1); 75-84 = 10.0% (8.9- 11.1); 85+ = 9.3% (6.9-11.7)	N/A
Bassols et al., 1999 [40]	Random sample of adult (18+) population of Catalonia, Spain in 1994 (n=1964).	Neck pain as the only, or the most troubling source of pain in the last six months.	Six-month prevalence of neck pain was 31.8% (95%CI 29.7-33.9) Six-month prevalence of neck pain as the most troubling pain was 6.9% (95% CI 5.8-8.1) That is, of those reporting neck pain over the past six months, 21.8% thought it was the most troubling pain.	Six-month prevalence of neck pain as the most troubling pain increases with age, peaking at ages 51-70, and then declines in the oldest age group.
Borge & Nordhagen, 2000 [41]	Mothers and fathers of children aged 13-15 from a rural municipality, Norway, 1996. (n=229)	Neck-shoulder pain experienced often/weekly or nearly always during the past two months. Assessed with questionnaires.	Fathers: 27% (95% CI 21-34); Mothers: 40% (95% CI 33-46).	N/A

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Bovim et al., 1994 [42]	Random sample of the population of Norway, date not given, age 18-67 years, (n= 7,648).	Neck pain assessed by postal questionnaires and defined as having troublesome neck pain within the last year. Duration of neck pain was classified into 4 categories; < 1 month, 1-3 months, 4-6 months and >6 months)	Twelve-months overall prevalence of troublesome neck pain was 34.4% (95%CI 33%-35%), (9% lasted for <1 month, 8% lasted 1-3 months, 4% lasted 3-6 months and 14% lasted >6 months). The prevalence of complaints lasting one month or more was higher in women (31%) than in men (19%).	N/A
Chaiamnuay et al., 1998 [43]	All adults living in one of three villages in the Khao Changoke Community, Nakornayok Province, in rural Thailand, timing not provided (n=2455)	COPCORD Study - Self-reported musculoskeletal pain in the neck over the previous 7 days, verified by clinical examination.	Seven-day prevalence for neck symptoms of 3.4% (95% CI 2.7 - 4.2), 3.0% for males (2.1 - 4.2) and 3.7% for females (2.8 - 4.9).	N/A
Chiu et al., 2005 [44] (cohort study, analysed as cross-section)	Outpatients from physiotherapy departments in Hong Kong, 2001-2002 (n=218)	More than three months of on-and-off neck pain.	N/A	Neck pain correlation with disability scores were 0.37 at recruitment, 0.55 at six weeks and 0.63 at six months. Correlations at all three time points between neck pain and each of ROM and strength were more modest with magnitudes between 0.20 and 0.30.
Chiu et al., 2006 [45]	Cantonese speaking residents of Hong Kong aged 15 years or older, timing not provided (n=664).	Ever had neck pain up to present time. Neck pain at least once in the past 12 months.	Lifetime prevalence of neck pain 65.4% (95%CI 61.8-69.0). Twelve-month prevalence of neck pain 53.6% (95%CI 49.8-57.4). Of	Neck pain in the previous twelve months was associated with female gender and with occupation, where those in managerial, administrative and professional occupations had the

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
			the 356 reporting neck pain in the past twelve months: 15% had moderate to severe pain; 4.5% had to limit their social activities; 3.1% had to limit their work.	highest prevalence of neck pain.
		Neck pain within the past seven days.	Point prevalence (pain over past seven days) was 12.0% (95% CI 9.7 – 14.8)	
Chopra et al., 2002 [46] Chopra et al., 2001 [47]	All adults listed on the electoral list as residing in a rural Indian village, Bhigwan, in western India in 1996. (n=4,092)	COPCORD Study - Self-reported pain, swelling, stiffness or tenderness in the neck during previous 7 days, by marking on a manikin.	Seven-day prevalence for neck symptoms of 6% (95% CI 5.3 - 6.7), trapezius/scapular symptoms 3.15% (95% CI 2.6 -3.7), and shoulder symptoms 7.4% (95% CI 6.6 - 8.2).	Prevalence in females was twice that in males.
Ciancaglini et al, 1999 [48]	Random sample of adult population of Segrate municipality in northern Italy, 1995. (n=483)	Neck pain defined as troublesome pain experienced within the last year in the neck area between the occipital bone and the spinous process of the seventh cervical vertebra.	Twelve-month prevalence of 38.9% (95%CI 34.6-43.4). (for females, 41.7% and for males 34.4%).	Neck pain associated with female sex, and presence of temporomandibular dysfunction (TMD), and the likelihood of neck pain increases with increasing TMD symptomatology.
Côté et al., 1998 [49] Côté et al., 2000A [50] Côté et al., 2000B [51]	Age stratified random sample of non-institutionalized residents of Saskatchewan, Canada as of 1995; covered by universal health care (over 99% of the	Neck pain location defined by a diagram. Severity of six-month period prevalence of pain was measured with the Chronic Pain Questionnaire (von Korff et al., 1992)	Age-standardized prevalence: Lifetime prevalence = 66.7% (95% CI 63.8-69.5). Point prevalence = 22.2% (95% CI 19.7-24.7). Six-month period prevalence of any neck pain = 51.9% (95% CI 49.0-54.8). Six-month prevalence	All grades of 6-month period neck pain were more common in women than in men. Age and gender adjusted associated factors: All severities of neck pain: Headache, low back pain and history of neck injury in a motor vehicle collision.

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
	population); aged 20-69. (n=1,131.)		by severity: low intensity/low disability neck pain = 39.7% (95% CI 36.7-42.7), high intensity/low disability neck pain = 10.1% (95% CI 8.2-11.9), high intensity/ significant disability neck pain = 4.6% (95% CI 3.3-5.8)	Low intensity/low disability neck pain: higher education. High intensity/low disability neck pain: Current smoker. High intensity/significant disability neck pain: Digestive problems and cardiovascular problems.
Ektor-Andersen et al., 1999 [52]	Residents of Malmö Sweden, born 1926 to 1945, living in Malmö in 1990 (n=8116)	Presence of neck/shoulder ache, pain or discomfort during the past 12 months (Nordic Questionnaire), characterized as: Chronic intermittent ('yes once or twice' or 'yes sometimes'); Chronic continuous ('yes often' or 'yes all the time')	Crude twelve-month period prevalence of neck pain (95%CI): Chronic intermittent: Males 46.7% (44.8-48.6) Females 51.9% (50.0-53.8) Chronic continuous: Males 17.6% (16.1-19.1) Females 26.5% (24.8-28.2) Any (intermittent and continuous combined): Males 64.2% (62.3-66.0) Females 78.6% (77.0-80.2)	Total body pain higher with increasing neck-shoulder pain, being out of full-time work and among women. Independent of working status, self-experienced health decreased with both total body pain and increasing shoulder-neck pain (relationship with shoulder-neck pain more pronounced). Mental distress increases with increasing total body pain and increasing shoulder-neck pain. Women working full time showed higher of mental distress and more distress in relation to the degree of shoulder-neck pain than men. Degree of shoulder-neck pain, is highly dependent on the total burden of painful areas. The relationship is more pronounced in women than men. 72% of those reporting shoulder-neck pain had more than one painful body location.

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Fejer et al., 2006 [9] Twin Study	Danish twins, age 20-71 years, registered in the Danish Twin Registry, surveyed in 2002 (n=33794).	Ever had neck trouble defined as ach, pain or discomfort, using the Standardized Nordic Questionnaire	Lifetime prevalence of neck pain was 44% (95% CI 43.8-44.9).	NP reported more often by women (50% (95%CI 48-51)) than men (36% (95%CI 34-37)) The reported lifetime prevalence of NP increased until about 35 years of age, and then stagnated with a slight decrease from approximately 50 years of age.
Gordon et al., 2002 [53]	Population of the fishing community of Port Lincoln, Australia, age 18 or over, date not provided (n=812)	Waking due to cervical pain or cervical stiffness during a usual week and during the last week.	One-week prevalence of waking due to cervical pain 19.8% (95%CI 17.1-22.7) One-week prevalence of waking due to cervical stiffness 16.1% (95% CI 13.7-18.9%)	For women, the prevalence of waking cervical symptoms decreased with increasing age. For men, the prevalence of waking cervical symptoms was highest in the middle age category (40-59 years).
Guez et al., 2002 [54] Guez et al., 2003 [55]	Adult residents, age 25-74, of the two northernmost counties in Sweden in 1999, (n=6000) Those aged 25-64 studied separately (n=4392)	Neck pain (no time, no frequency stipulated) Neck pain with a duration exceeding 6 months. Chronic neck pain defined as continuous pain more than 6 months' duration.	Point prevalence of neck pain 43% (95%CI 41-44). Chronic neck pain reported by 19% (95%CI 18-10) – and by gender, 22% (20-23) of women and 16% (14-17) of men.	Chronic neck pain was associated with smaller community size (< 15,000 inhabitants) – adjusted for age and gender. For those with chronic neck pain, a history of trauma is associated with male gender, younger age, sick-leave and "okay" or "bad/very bad" self-perceived health.
Hagen et al., 1997 [56]	Random sample of the counties Oslo and Nordland, Norway, date not given, age 20-79 years, (n= 11,780).	Neck – shoulder pain during the past month and not related to rheumatic diagnosis. Assessed with questionnaires.	Overall: 15.4% (95% CI 14.7-16.1); men: 12.9 % (95% CI 12.0-13.8); women: 18.4% (95%CI 17.4-19.4)	Neck/shoulder pain associated with younger age (20-49), female sex, less education, married or divorced/widowed

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Hagen et al., 2002 [57] Zwart et al., 2004 [58]	Inhabitants of the county of Nord-Trρndelag, Norway between 1995 and 1997, age 20 years or older (n=51,050).	Neck pain defined as pain/stiffness in the neck continuously for at least three months over the past year using the Standardized Nordic Questionnaire. (excludes those with widespread symptoms)	Twelve-month prevalence of neck pain 4.8% (95%CI 4.6-4.9)	Individuals with neck pain were more likely to suffer from headache as compared with those with musculoskeletal symptoms in other restricted areas. Chronic neck pain is associated with analgesic overuse.
Hartvigsen et al., 2004 [59]	Danish twins 70 years of age or older, registered in the Danish twin registry, 1995-2001 (n=4486)	Pain or stiffness in the neck or shoulders over the past month.	One-month prevalence of neck pain alone was 11% (95%CI 10-12) and one-month prevalence for concurrent back and neck pain was 11% (95%CI 10-12). Therefore, one-month prevalence of neck pain was 22.1% (95%CI 20.3-23.9).	Neck pain was associated with poorer self-rated health.
Hasvold & Johnsen, 1993 [60], Hasvold et al., 1996 [61],	All inhabitants aged 20-56 in the municipality of Tromsρ, Norway in 1986. n= 17650 provided usable answers regarding neck and shoulder pain.	Those who answered weekly or daily to the following question: How often do you have neck or shoulder pain?	Crude prevalence for weekly or daily complaints overall was 15.4% for males and 24.9% for females. Overall age-adjusted prevalence for weekly complaints was 7.6% (7.0-8.2) for males and 12.4% (11.7-13.2) for females. Daily prevalence was 7.8% (7.2-8.4) for males and 12.5% (11.8-13.2) for females. Weekly or daily complaints for women: ages 20-29 = 19%; 30-39 = 21.5%; 40-49 = 30.9%; 50-56 = 36.3% For men:	Prevalence of neck shoulder pain increased with age and was higher in women.

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
			ages 20-29 = 10.8%; 30-39 = 13.1%; 40-49 = 17%; 50-56 = 26.9%.	
Isacsson et al., 1995 [62]	Men born in even months in 1914 and living in the City of Malmö, Sweden in 1982-1983, (n=500).	Neck pain was assessed by questionnaire and defined as daily aches, pain or discomfort during the last 12 months.	Twelve-month prevalence of daily neck pain was 5.2% (95%CI; 3.4-7.5). Of those with daily neck or low back pain, 33.3% had neck pain and 23.1% had symptoms from both neck and low back.	N/A
Jacobsson et al., 1989 [63]	An age stratified random sample of residents of Malmö City, Sweden, 1985; included in a postal health survey in 1984, aged 50-70, (n=445).	Neck pain was defined as pain located within the triangle between the occipital process, the medial corner of scapula and the acromion. It had to be continuous or intermittent for more than 6 weeks duration during the preceding 12 months.	Twelve-month prevalence of neck pain was 3.0% (95% CI 1.2-6.2) for men and 10.2% (95% CI 6.5-15.1) for women.	N/A
Kim et al., 2001 [64]	General adult population of Japan, aged 20 years or older in 1997, (n=3030).	Stiff neck/shoulder in the previous month.	One-month prevalence of stiff neck/shoulder overall was 45.3% (95%CI 43.5-47.1)	Stiff neck/shoulder showed no independent association with insomnia once age, sex, education, marital status, occupation and other somatic complaints had been accounted for.
Lahz and Bryant, 1996 [65]	All patients from a brain injury clinic in New South Wales, Australia, timing not provided (n=132).	Frequent pain in the neck/shoulders for at least 6 months.	The point-prevalence of chronic neck/shoulder pain among patients with mild traumatic brain injury was 28% and among patients with moderate/severe traumatic brain injury was 24%.	N/A

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Lau et al., 1996 [66]	Residents, aged 30 years or older, of one of two housing blocks in Hong Kong, timing not provided (n=800).	Neck pain lasting for a day or more located within a defined area on a body diagram, ever (lifetime prevalence) or occurring during the preceding year (12 month prevalence). Lifetime prevalence characterized by certain features:	Lifetime prevalence of neck pain Men: 31% (25.7-36.5) Women: 27% (23.2-31.2) Twelve month prevalence Men: 15% (11.1-19.5) Women: 17% (13.8-20.6)	Lifetime prevalence of neck pain was associated with living in private housing (as compared to public housing), history of being hospitalized for an accident involving the neck; being in managerial or professional occupations (as compared to secretarial/clerk, light factory or heavy industry/construction)
		Lasting for a month or more with pain on most days;	Men: 7% (4.4-10.5) Women: 12% (9.3-15.2)	
		Radiating to fingers;	Men: 7% (4.4-10.5) Women: 12% (9.3-15.2)	
		Interfering with sleep;	Men: 10% (6.8-13.9) Women: 16% (12.9-19.6)	
		Necessitating a medical consultation;	Men: 16% (12.0-20.6) Women: 16% (12.9-19.6)	
		Necessitating an operation.	Men: 0.7% (0.08-2.4) Women 0.2% (0.01-1.1)	
Lee et al, 2005 [67]	Students over 18 years of age at a college of rehabilitation science in South Korea (n=81)	Low level neck pain or discomfort from once a month to three times a month (monthly pain) Neck pain or discomfort from at least once per week to daily (weekly	N/A	Those with more frequent neck pain were better able to discriminate the amount of rotation of the neck. Those with less frequent or no pain were able to improve ROM on second

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
		pain). Compared to no/infrequent pain (no pain, or pain up to 6 times year)		testing, whereas those with more frequent pain were not. Neck muscle endurance was greater for those with no or infrequent neck pain as compared to those with monthly or weekly neck pain. Neck pain score and disability scores were higher for those reporting monthly or weekly pain as compared to those reporting no or infrequent pain.
Luo et al., 2004 [68]	Patients consulting a university-based spine clinic, U.S., 2000 (n=537).	Consulting the spine clinic and having neck pain.	N/A	Higher scores on the Neck Disability Index were associated with higher levels of neck pain, not working, higher levels of back pain, lower levels of education, higher levels of stress, experiencing arm or shoulder pain, depression, smoking and anxiety.
MacGregor et al., 2004 [13] Twin study	Female registrants in the St. Thomas Hospital, UK Adult Twin Registry (age 45-79), timing not provided (n=1064).	Neck pain between the occiput and the third thoracic vertebra of at least one month duration associated with disability (impossible to do one or more of the following activities: look over shoulder, reach up, drive, read for 15 minutes, turning over in bed, washing or brushing hair, working at a desk for 15 minutes, carrying heavy bags) sometime over lifetime	Lifetime prevalence of neck pain was 52% (95%CI 48.9-55.0) Lifetime prevalence of neck pain of at least one month duration which was disabling was 12% (95%CI 10.1-14.1)	N/A'

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Mäkelä et al. 1991 [69]	Finnish general population between 1977 and 1980; > 29 years of age; included on population register (n = 7217).	Chronic neck syndrome defined as convincing history of severe, longstanding neck pain that had manifested symptoms during the previous month, documented history of diagnosed neck syndrome with convincing observable signs on physical examination, mild or moderate neck pain with observable physical signs at the time of examination.	Lifetime prevalence of experiencing of neck pain was 71% (95% CI 70.0-72.0). One-month prevalence of neck pain was 41.1% (95% CI 40.0-42.2). Point prevalence of chronic neck syndrome was 9.5% (95% CI 8.5-10.6) in men and 13.5% (95% CI 12.5-14.6) in women.	Age and sex adjusted factors related to chronic neck syndrome: Individuals aged 30-64 years: Previous injury to the back, neck, or shoulder, smoking, BMI[§], parity, mental and physical stress at work. Reduced work capacity, domestic chores, and leisure activities, physician contacts in past 12 months, use of analgesics. Individuals aged > 64 years: Previous injury to the back, neck, or shoulder, BMI, parity, mental and physical stress at work. Reduced work capacity, domestic chores, and leisure activities, physician contacts in past 12 months, use of analgesics. Chronic neck syndrome associated with low back, shoulder and non-specific generalized musculoskeletal pain, osteoarthritis, mental disorders, and cardiovascular disease.
Minaur et al., 2004 [70]	All residents of Yarrabah in North Queensland, Australia, aged 15 years and over, Yarrabah predominantly Aboriginal (n=847).	COPCORD Study - Self-reported pain, tenderness, swelling or stiffness in the neck, location indicated on body diagram – experienced either over the previous 7 days, or prior to 7 days ago .	Seven-day prevalence for neck symptoms of 3% (95% CI 2-5).	N/A
Nilsson 1995	Population of Odense	Cervicogenic headache, five or more	One-month prevalence of	N/A

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
[71]	municipality in Denmark, aged 20-59 years in 1993 (n=315)	headache days in the previous month, headache in the occipital area, precipitated by neck movements/positions, with decreased cervical range of motion or increased cervical muscle tenderness.	cervicogenic headache among general population 2.5% (95% CI 1.1-4.9) (Among those with frequent headaches, cervicogenic headaches comprise 17.8% (95% CI 8.0-32.0)	
Palmer et al., 2003 [72]	Adults (age 16-64) registered as patients with one of 34 general practices in the UK and serving members of the British armed services in 1997-98. (n=12,907)	Neck pain lasting a day or longer in the past 12 months and neck pain lasting a day or longer in the past 12 months that prevented normal activities.	Twelve-month prevalence of neck pain 35.3% (95% CI 34.4-36.1). Twelve-month prevalence of neck pain preventing activity 11.5% (95% CI 10.9-12.1)	Neck pain associated with former smoking and current smoking. Neck pain preventing activity associated with former smoking and current smoking.
Peterson et al., 2003 [73]	Patients presenting of a chiropractic outpatient clinic referred for radiography, U.K., timing not provided (n=182).	Average neck pain over the preceding week. Disability as measured by the Neck Disability Index.	N/A	There was no association between either pain intensity or disability and radiographic evidence of degeneration in the cervical spine.
Picavet & Schouten 2003 [74]	Age and sex stratified random sample of the adult (25 years and over) Dutch population (n=3664)	Neck pain over one or more pain periods during the last 12 months Current neck pain Current neck pain lasting more than three months.	Twelve-month prevalence 31.4% (95% CI 29.9-32.9) Point prevalence of neck pain 20.6% (95% CI 19.3-21.9) Chronic neck pain 14.3% (95% CI 13.2-15.4)	Neck pain more prevalent in women than in men. Prevalence was highest in the middle age group (45-64 years)
Rajala et al., 1995 [75]	Residents born in 1935 and living in the city of	Neck pain was assessed via interview using the Standardized	Twelve-month prevalence (and 95%CI) was 56.5% (34.5-76.8) in	In women there was a crude association between neck pain and

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
	Oulo, Finland on October 1, 1990, (n=780).	Nordic Questionnaire, (ref Kuorinka, 1987) and defined as neck pain often or almost continuously during the past 12 months.	depressed men, 35.2% (30.0-40.7) in non-depressed men, 65.4% (50.9-78.0) in depressed women and 45.5% (40.4-50.7) in non-depressed women.	prevalent depression. In men, the association was shown only between neck pain with marked effect on daily activities and prevalent depression.
Salemi et al., 1996 [76]	The residents of the Municipality of Terrasini, Palermo, Italy, as of November 1, 1987, (n=7,653).	Cervical spondylotic radiculopathy (CSR) was assessed by an interview questionnaire and confirmed by clinical examination. CSR was defined as bouts of pain in the neck, radiation down on one or both arms.	Six-month prevalence per 1000 (and 95% CI) was 5.8 (3.6-8.8) in women and 1.3 (0.4-3.0) in men. There was a peak prevalence in the ages of 50-59 (35.4 in women and 8.3 in men).	N/A
Schytt et al., 2005 [77]	Swedish childbearing women who gave birth during 1999/2000 (n=	Minor or major problem with neck and shoulder pain over the past four weeks at 8 weeks post-delivery, and at 12 months post delivery.	At eight weeks post-delivery, 29.4% of women reported minor or major neck and shoulder pain. At one year after childbirth, 35.5% of women reported minor or major neck and shoulder pain.	N/A
Thomas et al., 2004 [78]	Adults aged 50 years and over enrolled in three primary care general practices from North Staffordshire, UK, timing not provided, (n=7878).	Neck pain defined as pain in the past 4 weeks lasting for one day or longer, with location of pain indicated by markings on manikin.	Four-week prevalence of neck pain Overall: 20.5% (95%CI 19.7-21.4) By age group age 50-59 : 22.8% age 60-69 : 22.9% age 70-79 : 17.7% age 80-89 : 14.9% Of those reporting neck pain, those reporting interference with	N/A

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
			everyday life by age group: age 50-59 : 64.1% age 60-69 : 70.5% age 70-79 : 74.4% age 80-89 : 86.2% Overall prevalence of neck pain interfering with everyday life: 14.5% (95%CI 13.7-15.3)	
Urwin et al, 1998 [79]	Adults (16 and older) enrolled in three general medical practices in Greater Manchester, UK, sampled by age and gender strata – timing not provided. (n=5752).	Answered yes to question: Have you experienced pain in any of the following areas for more than one week in the past month? Asked for neck, shoulder, back, etc.	Overall one-month age-adjusted prevalence percentages were 17% (15-19) for women and 11% (9-13) for men. Crude one-month prevalence for women: Ages 16-44 = 12%; 45-64 = 19%; 65-74 = 23%; 75+ = 21. Crude one-month prevalence for men: Ages 16-44 = 7%; 45-64 = 15%; 65-74 = 17%; 75+ = 18%.	Some increased prevalence in pain among those subjects living in socially deprived neighborhoods, although the relation was not as clear in neck pain. Prevalence higher in women and increased with age.
van der Donk et al., 1991 [80]	Residents of urban/rural districts of Zoetermeer, Netherlands, 1975-1978; age 20-65 years. (n = 5440)	Neck pain defined by postal questionnaire. Respondents asked whether they were currently suffering from neck pain.	Point prevalence: in all respondents was 13.8% (95% CI 12.9-14.7).	Prevalence of neck pain increased with age in both sexes, peaking around 50-55 years, but a steeper increase was observed for women between 35-50 years. Female to Male ratio for neck pain was 1.8:1
Webb et al., 2003 [81]	Age- and sex-stratified random sample of adults drawn from three general practices in the	Neck pain lasting for more than 1 week over the last month. -intense if of moderate or worse intensity	One-month prevalence of neck pain (95% CI) overall 13.8% (12.5-15.1) women 16.5% (14.6-18.3)	Neck pain with disability associated with female gender and not being a house owner

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
	predominantly urban area of West Penine, UK (n=4515)	-chronic is first occurred 5 or more years ago -disabling if Oswestry score 25 or greater	men 10.7% (9.0-12.4) intense 7.8% (6.2-9.4) disabling 7.5% (5.9-9.1) chronic 5.9% (4.7-7.2)	
Westerling and Jonsson, 1980 [82]	A random sample of residents in the county of Stockholm 3969-1973, aged 18-65. (n= 2,537)	Neck problems were defined by questionnaire and expressed as any neck"trouble"i.e., pain, tenderness and/or stiffness in the past 12 months.	Twelve-month prevalence was 12.1% (95% CI 10.8-13.4)	NA
Wigley et al., 1991 [83]	Adults 15+ years old living in a rural Philippine village, timing not provided (n=915).	COPCORD Study - Self-reported musculoskeletal pain in the neck	Point prevalence for neck symptoms of 7.3% (95% CI 5.7 – 9.2)	N/A
Zapletal et al., 1996 [84]	Outpatients age at least 17 years, referred for CT scan of brain or sinuses not related to generalized arthropathy or because of suboccipital pain, at a department of radiology in the Netherlands, timing not provided (n=210).	Experienced pain in the suboccipital region.	N/A	Suboccipital pain associated with grade of atlanto-odontoid (AO) osteoarthritis

* Estimates directly from the publications or calculated from data provided in the publication
† N/A no data given
‡ CI is confidence interval
|| COPCORD study

+++ Estimate calculated from data provided in the publication
' Results related to genetics appear in table 1
CT is Computerized Tomography
MRI is Magnetic Resonance Imaging
BMI is Body Mass Index

Table 4. Cross-sectional Studies of the Prevalence of Neck Pain and Its Associated Factors – General population – children and adolescents

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Borge & Nordhagen, 2000 [41]	All children (aged 13-15 years) from a rural municipality, Norway, 1996. (n=229)	Neck-shoulder pain experienced often/weekly or nearly always during the past two months. Assessed with questionnaires.	Boys: 5% (95% CI 1-10); Girls: 11% (95% CI 5-17);	Neck pain in children had crude association with the presence of neck pain in fathers or in mothers
Ehrmann Feldman et al., 2002 [85] Cohort (associations analysed cross-sectionally)	High school students in Montreal, Canada followed for one year from fall 1997 to faln 1996 (kncluded if pain free at previous time point) (n=502)	Neck pain occurring at least once a week within tje preceding 6 months as assessed by self-report questionnaire.	Cumulative 6 month incidence of neck pain was approximately 10% over the first six months, and then approximately 7.5% over the second six months	Neck pain was associated with working at a job and with mental health (SF-36 mental health scale).
Haavet et al., 2004 [86]	Fifteen year old students in 10th grade of lower secondary school in Oslo, Norway, 2000-2001 (n=7329)	Neck/shoulder pain over the last 12 months	Twelve-month prevalence of neck/shoulder pain was 42% in girls and 27% in boys (overall pooled estimate 36%)	Prevalence of neck pain was higher in girls than in boys. In boys, neck/shoulder pain was associated with feeling a high pressure to succeed, being exposed to violence, being exposed to bullying at school and experiencing a sexual violation. In girls, neck/shoulder pain was associated with feeling a high pressure to succeed, lower economic status of family, parents not living together, having someone close die,

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Lien et al., 2005 [87]	Excluding pupils from Latin America (n=7183)			being exposed to violence, being exposed to bullying. Neck/shoulder pain was associated with mental distress.
Hakala et al., 2002 [88]	Inclusion setting 1: Birth cohort; ages 12, 14, 16 and 18. A Nation wide Health and Lifestyle survey, administered in 1991, 1999 and 2001. (n=62,398) Inclusion setting 2: All students aged 14-16, in secondary schools; surveyed in 1996, 1998 and 2000 from the regions Helsinki, southwestern Finland, eastern Finland, central Finland and Lapland; and 1997, 1999 and 2001 from western Finland. 88% of schools participated. (n=127,217)	Neck pain defined as pain in the neck or shoulder at least weekly during the past 6 months using the Standardized Nordic Questionnaire (Ref. Kuorinka, 1987)	Six-month prevalence of neck or shoulder pain increased during the study period. In girls the odds ratkos varigd from 1.23 to 1.72 compared to 1991. In boys the corresponding odds ratios were 1.23 – 1.70. Kn 2001 rain in the neck and shoulder affected 14% of girls and 6% of boys in 12 year olds, 24% of girls and 12% of boys in 14 year olds, 38% of girls and 16% of boys in 16 year olds and 45% of girls and 19% of boys in 18 year olds.	N/A†
H≅rm≅ et al., 2002, [89]	Secondary school students from two regions of Finland in 1997 (n=15,965).	Neck/shoulder pain occurring once a week/daily/almost daily during the past six months.	N/A	Neck/shoulder pain associated with depression.
Lingaas Holman et al, 2000 [90]	Population of Trρndelag County, Norway, in 1995-1997, aged 13-18 years, (n=8771).	Neck shoulder pain sometimes or often in the past twelve months	Twelve-month prevalence of neck pain was 15.9% in boys (95%CI 14.4-17.5) and 28.6% in girls (95%CI 26.7-30.6)	Neck/shoulder pain associated with daily smoking in both boys and girls.

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
Mikkelsson et al., 1997 [91] Cross-sectional analysis in a Cohort study	Pre-adolescents in 19 of 21 primary schools, third to fifth grade, in Lathi, Finland, 1995, (n= 1,756 and 1,628 at one year follow up).	Neck pain was assessed by validated questionnaires completed at school. Neck pain was defined as pain or ache in the neck during the last three months.	Three-month prevalence of neck pain was about 16% for girls and 14% for boys. Of those that had neck pain 40% had it as a single complaint and 60% combined with other musculoskeletal complaints. Of those that had neck pain 3.4% had injured their neck. Persistent pain was common; 57.7% of the girls and 36.5% of the boys had persistent neck pain at one year follow up.	N/A
Mikkelsson et al., 1997 #739	(n=239 NP and controls)	Neck pain or aches at least once a week over the past three months, not attributable to an injury.	Three-month prevalence of neck pain at least once a week, not attributable to injury was 6.5% (114/1756)	Neck pain was associated with depression, sleep problems and behavioural problems (somatic, anxiety/depression, attention, delinquency, aggression)
Niemi et al., 1996 [92] Niemi et al., 1997 [93] Siivola et al., 2004 [15]	High School students from 5 high schools randomly selected from 11 high schools in Oulu, Finland, (n=714) Followed 7 years later in 1996 when 22-25 years old (n=547)	Neck pain was assessed by the Standardized Nordic Questionnaire (ref Kuorinka, 1987) and defined as occasional pain; 1-2 times or less per month and frequent or disturbing pain; 1 time or more per week over the past 12 months.	Twelve-month prevalence of occasional neck pain was 78.6% (95%CI 74.2-82.5) in girls and 63.5% (95%CI 57.5-69.3) in boys. Twelve-month prevalence of frequent/disturbing neck pain was 21.4% (95% CI 17.5-25.8) in girls and 10.0% (95%CI 6.7-14.3) in boys. At seven year follow-up, the twelve-month prevalence of frequent/disturbing neck pain was: Men: 19% (95%CI 13-25) Women: 34% (95%CI 29-39)	Girls participating in sports involving dynamic use of the upper extremities had fewer symptoms than those having hobbies involving static posture of the upper limbs or those practicing other types of physical activity.

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
SmedbrΔten et al., 1998 [94]	School children from the municipality of Ullensaker, Norway, ages 10, 13 and 15 years old in 1993 (n=569).	Neck pain identified as those who answered yes to "Do you usually feel pain somewhere in the body?" and then indicated the neck on a map of the body.	Prevalence of pain was 12% in boys (95%CI 8.5-16.4) and 23% in girls (95%CI 18.2-28.3)	Prevalence of pain higher in girls than in boys.
Van Gent et al., 2003 [95]	Students in the first and second class of secondary school (ages 12-14) in the areas of the Regional Health Centers of Regio Arnhem and Regio Achterhock in the Netherlands, 1998 (n=745).	Neck/shoulder complaints in the previous 3 months. Severe neck complaints in the previous 3 months – severe if bothered children daily, if led to medical consumption or if hampered normal functioning.	Three-month prevalence of neck/shoulder complaints 43.6% (34.2% of boys and 53.3% of girls) Three-month prevalence of severe neck/shoulder complaints was 5.0% in boys and 6.5% in girls.	Neck/shoulder complaints and severe neck shoulder complaints more prevalent in girls than in boys, and also associated with lower age and psychosomatic factors. The relative weight, type and way of carrying the schoolbag were not associated with the presence of neck/shoulder complaints
Vikat et al., 2000 [96]	Adolescents living in Finland, age 12, 14, 16 and 18 in 1991 (n=11,095)	Neck or shoulder pain during the past half year at least weekly (main case definition, although following categories available – seldom or not at all; about once a month; about once a week; almost daily.)	Six-month prevalence of neck/shoulder pain at least weekly was 15% overall (no estimate of precision available for this age-standardized prevalence). For boys, age-specific six-month prevalence was: for 12 year olds, 5%; for 14 year olds; 7%; for 16 year olds, 8%; for 18 year olds, 15%. For girls, age-specific six-month prevalence was: for 12 year olds, 7%; for 14 year olds; 14%; for 16 year olds, 26%; for 18 year olds, 36%.	Neck/shoulder pain during the past six months at least weekly was associated with: Sex Age # psychosomatic symptoms low back pain at least weekly long term illness 3 or more colds in past 6 months wearing corrective lenses
Wedderkopp et al/. 2001 [97]	Children aged 8-10 years and adolescents aged 14-16 years	Neck pain within the past month.	One-month prevalence of neck pain (95% CI)	N/A

Author(s), Year, Study Design	Setting and Subjects, Number (n) Enrolled	Case Definition	Prevalence*	Associated Factors
	living in Odense, Denmark in 1997-1998 (n=806).		In 8-10 yr old boys 6% (3-10) In 14-16 yr old boys 3% (1-7) In 8-10 yr old girls 11% (7-15) In 14-16 yr old girls 6% (3-11)	
Wedderkopp et al., 2005 [98]				Neck pain does not appear associated with pubertal stage among girls.
Whittfield et al., 2005 [99]	Third and sixth form students (around 13 years and 17 years old) from co-educational secondary schools in Auckland, New Zealand, timing not provided (n=140)	Neck ache, pain, discomfort, or numbness that may be result of school bag at any time in the last seven days (standardized Nordic questionnaire)	Seven day prevalence of neck symptoms was 51.4% for 3rd from girls, 51.4% for 6th form girls, 37.1% for 3rd form boys and 37.1% for 6th form boys.	No relationship was found between weight of schoolbag and the prevalence of neck symptoms.

* Estimates directly from the publications or calculated from data provided in the publication
† N/A no data given
‡ CI is confidence interval
+++ Estimate calculated from data provided in the publication
CT is Computerized Tomography
MRI is Magnetic Resonance Imaging
BMI is Body Mass Index

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