

Neck and shoulder pain in adolescents seldom occur alone: Results from the Norwegian Ungdata Survey

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Funding information

Oslo Metropolitan University funded this paper to Henriette Jahre, through a PhD position.

Abstract

Background: No previous studies have investigated the prevalence of co-occurring neck/shoulder pain, other musculoskeletal pain, headache and depressive symptoms in adolescents. This study aimed to describe the prevalence of isolated neck/shoulder pain and the co-occurrence of neck/shoulder pain with other musculoskeletal pain, headache and depressive symptoms in Norwegian adolescents.

Methods: This is a cross-sectional study using data from the Norwegian Ungdata survey (2017–2019). Adolescents from almost all municipalities in Norway answered a comprehensive questionnaire, including physical complaints. We investigated the prevalence of self-reported neck/shoulder pain in isolation and neck/shoulder pain in combination with other musculoskeletal pain, headache and depressive symptoms. The results were presented with per cent and stratified by school level and sex.

Results: In total, 253,968 adolescents (50% girls) participated in the study, of which 56.5% were from lower secondary school. The total prevalence of neck/shoulder pain was 24%, but only 5% reported isolated neck/shoulder pain. Among students reporting neck/shoulder pain, half of them also reported other musculoskeletal pain, and 50% of the boys and 70% of the girls reported co-occurring headache. Depressive symptoms were reported in 28% of the boys and 45% of the girls with neck/shoulder pain.

Conclusion: Neck/shoulder pain in adolescents is seldom isolated, but seems to co-occur with headache, other musculoskeletal pain and depressive symptoms. Researchers and clinicians should keep a broader health perspective in mind when approaching adolescents with neck/shoulder pain.

Significance: One in five adolescents reported neck/shoulder pain in this large population-based study of Norwegian adolescents. A majority of adolescents reported neck/shoulder pain in co-occurrence with other musculoskeletal pain, headache and depression. Researchers and clinicians should assess these comorbidities when assessing adolescents with neck/shoulder pain.

1 | INTRODUCTION

Musculoskeletal (MSK) pain is the number 1 cause of years lived with disabilities (YLD) globally and often with the first onset in adolescence (Batley et al., 2019; Hoftun et al., 2011; Rathleff et al., 2013). The consequences for the society and those affected include increased absence from school and leisure time activities, increased use of health care services and reduced quality of life (Hoftun et al., 2011; Stallknecht et al., 2017). Neck/shoulder pain is the most prevalent of the MSK pain conditions among adolescents (Auvinen et al., 2009; Batley et al., 2019; Stallknecht et al., 2017), and neck pain ranks as number 8 of all causes of YLD among 15- to 19-year-old adolescents globally (Hurwitz et al., 2018). It seems like MSK pain is more prevalent in girls than boys and that the prevalence increases with age (Auvinen et al., 2009).

In many cases, neck/shoulder pain is part of multisite MSK pain (pain in more than one MSK location) in adolescents (Hoftun et al., 2011). Numbers from the Young-HUNT3 Study (13–18 years of age) in Norway found that isolated neck/shoulder pain was reported by 3.2%, and neck/shoulder pain in combination with other pain conditions was reported by 17% (Hoftun et al., 2011). For instance, neck/shoulder pain often co-occur with headache, although most research exists on adults (Ashina et al., 2015; Calhoun et al., 2010; Plesh et al., 2012), and is sparsely investigated in adolescents. Besides co-occurring with other pain sites, neck/shoulder pain is also linked with depressive symptoms in adults (Kim et al., 2018) and adolescents (Diepenmaat et al., 2006; Prins et al., 2008). The high prevalence of multisite pain and combination with depressive symptoms is alarming as these combinations have important consequences, such as increased disability, reduced health-related quality of life and a higher risk of long-term sickness absence in adulthood than single-site pain (Eckhoff et al., 2017; Hoftun et al., 2011; Leino-Arjas et al., 2018). Still, there is a lack of large studies investigating co-occurrence in adolescents.

As indicated by clinical practice guidelines (Blanpied et al., 2017), neck pain is often treated as an isolated diagnosis, and most interventions for neck pain show low-to-moderate effect (Coulter et al., 2019; Fredin & Lorås, 2017). One reason might be that neck pain is treated as an isolated diagnosis, ignoring the co-occurrence of other symptoms. Large-scale studies are needed to investigate neck/shoulder pain prevalence in isolation and co-occurrence with other symptoms. Some studies on this topic already exist but were published more than a decade ago (Auvinen et al., 2009; Hoftun et al., 2011). A lot has changed in our society regarding adolescents lifestyle habits (more sedentary behaviour and more screen time) (Yang et al., 2019), so updated knowledge is necessary. Further, it would be essential to investigate the prevalence in separate age cohorts as adolescence includes

rapid biological and social changes (Patton & Viner, 2007). This knowledge may help us better understand neck/shoulder pain as a phenomenon; for instance, by giving opportunities for identification of subgroups of patients and indicate when preventive actions should be implemented.

The aim of this study was to describe the prevalence of isolated neck/shoulder pain and the co-occurrence of neck/shoulder pain with other MSK pain, headache and depressive symptoms, stratified by school levels and sex in a large population-based study of Norwegian adolescents.

2 | METHODS

2.1 | Study design and setting

In this cross-sectional study, we used data from the Ungdata Survey in Norway collected between 2017 and 2019. Ungdata is a repeated cross-sectional local survey of adolescents' health and well-being, administered across almost all municipalities in Norway. The survey is conducted by Norwegian Social Research (NOVA) in cooperation with regional centres for drug rehabilitation (KoRus). The municipalities are encouraged to repeat the survey every third year. The survey consists of a comprehensive electronic questionnaire that students answer during a school class administered by the teacher. The questionnaire used in this study consisted of approximately 150 questions that were similar across all municipalities, and additionally, the municipalities could select between some predefined supplemental questionnaires. The reporting of this study is following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Table S1).

2.2 | Study population

During 2017–2019, students from lower (13–15 years of age) and upper secondary school (16–19 years of age) from 412 (98%) municipalities in Norway participated, and 260,616 adolescents answered the questionnaire. The 16 nonparticipating municipalities chose themselves not to participate because the number of adolescents living there were too small to get meaningful results from a quantitative youth survey, usually below 30.

The response rate was high; in lower secondary school, 87% participated and 73% in upper secondary school (Bakken, 2019). We excluded 34,064 (13%) participants because of missing data on sex, neck/shoulder pain, headache, other MSK pain or depressive symptoms. A higher proportion of excluded participants were boys (58% vs. 47% of the included) and students from upper secondary school (47% vs. 43% of the included).

2.3 | Ethical consideration

Participation was voluntary. The data collection at lower secondary schools was conducted anonymously and did not need approval by data protection agencies. The collection of data from upper secondary schools was approved by the Norwegian Centre for Research Data. Minor students' parents were informed about the survey at least 2 weeks before inclusion and could contact the school if they wanted to reserve their child from participation.

2.4 | Pain variables

The survey included multiple items regarding physical health complaints: 'Have you had any of these health issues during the past month?' The alternatives were as follows: 'neck and shoulder pain', 'other joint and muscle pain', 'headache', 'abdominal pain', 'nausea' and 'heart palpitations'. We used the categories 'neck and shoulder pain', 'other joint and muscle pain' and 'headache', as these categories are closely linked to MSK pain. The category 'other joint and muscle pain' is called 'other MSK pain' in this paper. The response alternatives were 'never', 'a few times', 'many times' and 'daily'. The response alternatives 'many times' and 'daily' were combined and coded as yes. 'Never' and 'a few times' were combined and coded as *no/seldom pain*. This pain questionnaire is used in several waves of the Ungdata survey (Frøyland, 2015), but is not formally validated or reliability tested.

2.5 | Neck/shoulder pain combinations

We categorized neck/shoulder pain according to its co-occurrence with pain in other sites and symptoms of depression. The prevalence of neck/shoulder pain is presented as the total prevalence (all participants with neck/shoulder pain), isolated neck/shoulder pain (neck/shoulder pain is the only pain site) or in different combinations: (1) neck/shoulder pain and other MSK pain; (2) neck/shoulder pain and headache; (3) neck/shoulder pain, other MSK pain and headache; (4) neck/shoulder pain and depressive symptoms and (5) neck/shoulder pain, other MSK pain, headache and depressive symptoms. The different pain combinations are not mutually exclusive as we wanted to describe the actual prevalence of these combinations.

2.6 | Symptoms of depression

Symptoms of depression were measured with the Depressive Mood Inventory, derived from the Hopkins Symptom

Checklist (HSCL) (Derogatis et al., 1974). This six-item scale is validated in adolescents (Kandel & Davies, 1982) and has proven good reliability (Kleppang et al., 2018). The adolescents answered how often the previous week they: 'felt that everything was a struggle', 'had sleep problems', 'felt unhappy, sad or depressed', 'felt hopelessness about the future', 'felt stiff or tense' and 'worried too much about things'. These questions were answered on a 4-point Likert scale ranging from 'not at all' to 'a great deal'. A mean score was calculated, and a higher score indicated more depressive symptoms. This variable was treated as a binary variable in the analyses. To identify more severe symptoms of depression, a cut-off score of ≥ 3.0 was used to distinguish adolescents with symptoms of depression. This cut-off is used in other studies and seems to capture the range of prevalence rates of depressive disorders commonly reported in Norwegian adolescents (Abebe et al., 2015; Sund et al., 2011).

2.7 | Statistical analyses

The prevalence of total neck/shoulder pain, isolated neck/shoulder pain and the different pain combinations were presented in per cent with 95% confidence intervals (CIs). The confidence intervals were estimated using the Clopper-Pearson method (Upton & Cook, 2008). Pain combinations were analysed for the whole sample and separately for the participants reporting neck/shoulder pain. The analyses were stratified for school level and sex. The chi-square test was used to investigate possible differences in school levels and sex; *p*-values of ≤ 0.05 were considered significant. Participants with missing values on sex, neck/shoulder pain, other MSK pain, headache or depressive variables were excluded from the analyses. All analyses were conducted in SPSS, version 25.

3 | RESULTS

The study sample consisted of 226,552 adolescents; 56.9% were from lower secondary schools. The distribution of boys and girls was approximately equal in both lower (boys 49.3%, girls 50.7%) and upper secondary school (boys 48.3%, girls 51.7%). The total prevalence of neck/shoulder pain was 24% (16% in boys and 33% in girls).

3.1 | Prevalence of isolated neck/shoulder pain and co-occurrences in the total sample

Isolated neck/shoulder pain was reported by 4.6% in the total sample (5% of the girls and 4.2% of the boys). Headache and neck/shoulder pain was the most prevalent pain combination (15.5%) followed by neck/shoulder pain and other

TABLE 1 Prevalence of co-occurring neck/shoulder pain, other MSK pain, headache and depressive symptoms ($n = 226,552$)

Symptoms	Lower secondary school students % (95% CI)			Upper secondary school students % (95% CI)			All participants % (95% CI)		
	Boys ($n = 63,627$)	Girls ($n = 65,325$)	Total ($n = 128,952$)	Boys ($n = 47,111$)	Girls ($n = 50,489$)	Total ($n = 97,600$)	Boys ($n = 110,738$)	Girls ($n = 115,814$)	Total ($n = 226,552$)
Isolated NS pain									
Yes	4.3 (4.1–4.4)	5.0 (4.8–5.2)	4.6 (4.5–4.8)	4.0 (3.9–4.2)	5.0 (4.8–5.2)	4.6 (4.4–4.7)	4.2 (4.0–4.3)	5.0 (4.9–5.0)	4.6 (4.5–4.7)
NS pain and other MSK pain, n (%)									
Yes	7.5 (7.3–7.7)	13.6 (13.4–13.9)	10.6 (10.4–10.8)	7.8 (7.5–8.0)	17.5 (17.2–17.9)	12.8 (12.6–13.0)	7.6 (7.5–7.8)	15.3 (15.1–15.5)	11.6 (11.4–11.7)
NS pain and headache									
Yes	7.3 (7.1–7.5)	19.3 (19.0–19.6)	13.4 (13.2–13.6)	8.2 (8.0–8.5)	27.5 (27.1–27.9)	18.2 (17.9–18.4)	7.7 (7.6–7.9)	22.9 (22.6–23.1)	15.5 (15.3–15.6)
NS pain, other MSK pain and headache									
Yes	4.3 (4.2–4.5)	10.3 (10.1–10.5)	7.3 (7.2–7.5)	4.7 (4.5–4.9)	14.2 (13.9–14.5)	9.6 (9.4–9.8)	4.5 (4.4–4.6)	12.0 (11.8–12.2)	8.3 (8.2–8.4)
NS pain and depressive symptoms									
Yes	3.4 (3.2–3.5)	12.3 (12.1–12.6)	7.9 (7.8–8.0)	4.9 (4.7–5.1)	18.4 (18.1–18.8)	11.9 (11.7–12.1)	4.0 (3.9–4.1)	15.0 (14.8–15.2)	9.6 (9.5–9.7)
NS pain, other MSK pain, headache and depressive symptoms									
Yes	1.7 (1.6–1.8)	6.2 (6.0–6.4)	4.0 (3.9–4.1)	2.3 (2.2–2.5)	9.0 (8.8–9.3)	5.8 (5.6–5.9)	2.0 (1.9–2.1)	7.4 (7.3–7.6)	4.8 (4.7–4.9)

Abbreviations: NS, neck/shoulder; MSK, musculoskeletal.

musculoskeletal pain (11.6%) (Table 1). The prevalence of all pain combinations and combinations with depressive symptoms was significantly higher among girls than boys and were significantly higher among upper secondary school students compared to lower secondary school students except for the combination of neck/shoulder and other MSK pain in boys (Table 1). For more details, see Table S2.

3.2 | Prevalence of co-occurrences in participants with neck/shoulder pain

Among adolescents who reported neck/shoulder pain ($n = 55,291$), 18.9% had isolated neck/shoulder pain (15% of the girls and 27% of the boys), 48% reported other MSK (47% in girls and 49% in boys), 63% reported headache (70% in girls and 50% in boys) and 39% reported depressive symptoms (46% in girls and 26% in boys) (Figure 1). The combination of neck/shoulder pain and other MSK pain was not statistically different in lower and upper secondary school students. The combination of other MSK pain and headache had a higher prevalence in upper secondary school girls compared to lower secondary school girls (37% vs. 35%) with neck/shoulder pain, but not in boys (29% vs. 28%) with neck/shoulder pain. The co-occurrence of other MSK pain, headache and depressive symptoms among adolescents with neck/shoulder pain was significantly higher in upper secondary school students than lower secondary school students (Figure 1).

4 | DISCUSSION

This large population-based study of Norwegian adolescents showed that combinations of neck/shoulder pain, other MSK pain, headache and depressive symptoms were common among the adolescents, and even more common among girls than boys. The total prevalence of neck/shoulder pain was 24%, and only 5% reported isolated neck/shoulder pain. This indicated that most of the adolescents with neck/shoulder pain had co-occurring headache, other MSK pain and/or depressive symptoms.

Of the adolescents with neck/shoulder pain, about half reported to have other MSK pain, and headache was seen in 50% and 70% of these boys and girls, respectively (Figure 1). Furthermore, depressive symptoms co-occurred with neck/shoulder pain in 28% of the boys and were higher among boys in upper secondary school than lower secondary school. In contrast, 45% of the girls with neck/shoulder pain reported co-occurring depressive symptoms. Girls reported, in general, more pain and depressive symptoms than boys, and the prevalence of pain was higher among girls in upper secondary school than girls in lower secondary school.

The low prevalence of isolated neck/shoulder pain and the high prevalence of co-occurrence with other MSK pain correspond to previous studies. A cohort study of Finish adolescents found a prevalence of 3% for isolated neck pain and a prevalence of 15% when neck pain was combined with shoulder, low back and peripheral (extremities) pain (Auvinen et al., 2009). A Norwegian study of the general adult

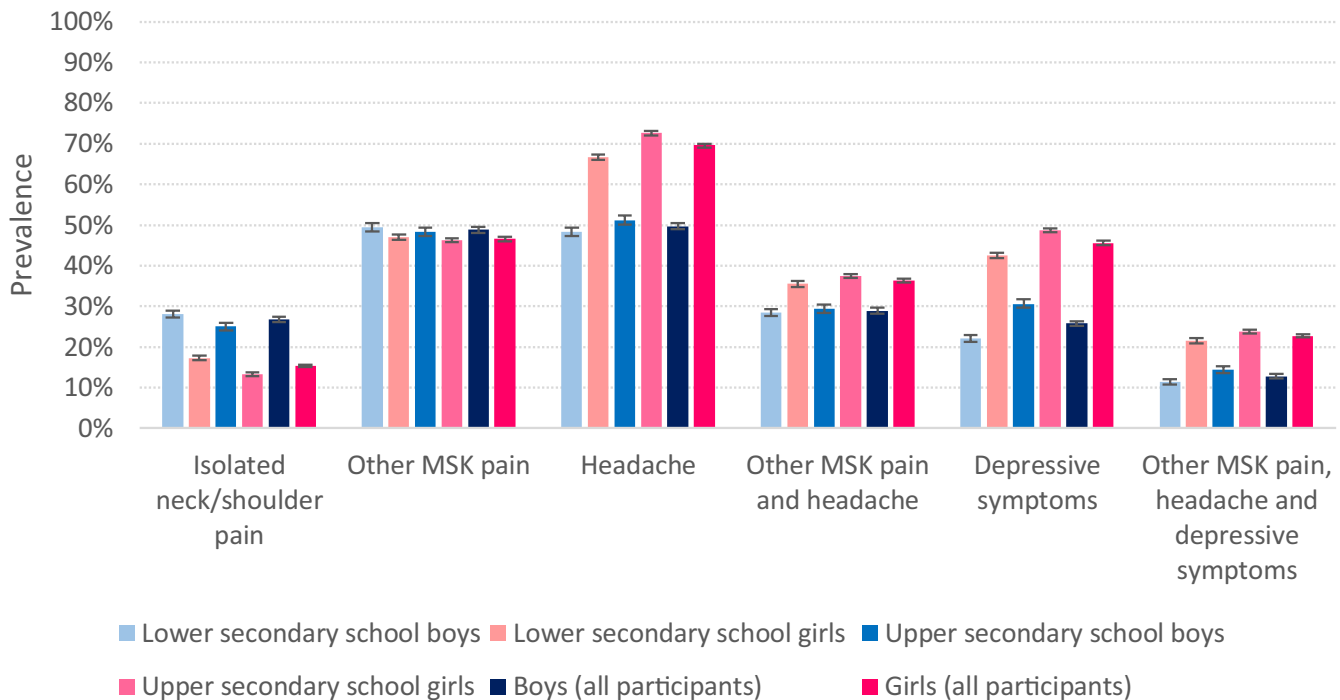


FIGURE 1 Prevalence of other musculoskeletal (MSK) pain, headache and depressive symptoms among adolescents who report neck/shoulder pain in the last month ($n = 55,291$)

population found a prevalence of isolated neck pain of 1.4% and a prevalence of 15.9% when neck pain was combined with at least one of the regions of head, shoulder or upper back. They also found a prevalence of 14.8% when neck pain was part of widespread pain (neck pain with four or more of nine possible sites) (Natvig et al., 2010). A community study among adults attending general practices in England found less than 1% reporting isolated neck pain (Carnes et al., 2007). These estimates from previous studies are lower than our estimates, but these disparities are probably due to different assessment of neck pain, as we combined neck and shoulder pain. Still, these findings indicate that neck pain and neck/shoulder pain are part of multisite MSK pain in both adults and adolescents.

The co-occurrence of headache and neck/shoulder pain among adolescents was also high (48%–72%). This is in line with a previous study of adolescents with migraine and tension-type headache, reporting that 63% of the adolescents with headache also reported neck/shoulder pain (Blaschek et al., 2012). In adults with primary headache, the prevalence of neck pain is shown to be as high as 85.7% (Ashina et al., 2015). It is not known why neck/shoulder pain often co-occurs with other pain sites such as other MSK pain and headache. Possible explanations are that pain-associated changes occurring in one body site have implications for other body sites and that different body parts share similar mechanisms, such as neurophysiological changes implicated in central sensitization (Bendtsen, 2000). This explanation might, however, be more relevant in long-lasting pain conditions. Another possible explanation is that different body parts share similar risk factors, both physical and psychological (Coggon et al., 2013). Further, multiple pain sites may reflect the adolescents' general health status as previous studies have shown stronger associations between different lifestyle (smoking, high BMI and sedentary behaviour) and psychological variables (symptoms of anxiety and depression) and multiple MSK pain than single-site pain (Heikkala et al., 2019; Puroila et al., 2015).

In accordance with previous literature, we found a high co-occurrence of neck/shoulder pain and depressive symptoms (Diepenmaat et al., 2006; Myrtveit et al., 2014). A Dutch study showed a prevalence of neck/shoulder pain of 22% among adolescents who reported symptoms of depression, with an OR of 1.9 (95% CI 1.5–2.5) adjusted for sex, family structure and stress (Diepenmaat et al., 2006), indicating that the odds of neck pain increased if you had symptoms of depression. The high prevalence is a public health concern since studies have shown worse prognosis, higher disability and poorer quality of life in adolescents with depressive symptoms in co-occurrence with MSK pain (Holley et al., 2017; Leino-Arjas et al., 2018). Proposed mechanisms for the relationship between pain and depression are shared structural regions in the brain, similarities in the neurobiological level,

genetic influence and cognitive and behavioural factors, such as sleep and fear avoidance (Goesling et al., 2013). The relationship may be reciprocal, as depression might lead to changes that increase the vulnerability to pain, while nociceptive input might induce or aggravate depressive states (Kroenke et al., 2011).

Similar to findings from other studies, girls reported a higher prevalence of all pain conditions and depressive symptoms than boys, both as single conditions and in combinations (Hoftun et al., 2011; Rathleff et al., 2013). Explanations for sex differences in the reporting of pain might be that girls have a higher pain sensitivity, the influence of sex hormones, differences in genotypes, different coping strategies and that girls and boys often have different pain expressions (Bartley & Fillingim, 2013). It is more socially acceptable to report pain among girls, which may lead to biased reporting of pain (Keogh & Eccleston, 2006). Upper secondary school girls had a higher pain prevalence than girls in lower secondary school, especially the prevalence of neck/shoulder pain, which is in line with other studies (Paananen et al., 2010; Picavet et al., 2016; Wurm et al., 2018). Similar results were found in boys, except for the combination of neck/shoulder and other MSK pain.

4.1 | Strengths and limitations

A strength of this study is that it is based on a large population-based sample of Norwegian youths from almost all municipalities and lower and upper secondary schools in Norway. In addition, the Ungdata survey had a high response rate, reducing the possibility of selection bias. This study also has some limitations. We do not have data on pain severity, such as pain-related disability or pain intensity, which might have led to an overestimation of the prevalence of pain. Further, we have no data on pain duration, which means that reported pain may include both short-term and long-term pain. Additionally, we do not have information on the adolescents' main problem (neck/shoulder, other MSK, headache or depression).

4.2 | Implications

This study showed a high prevalence of co-occurring neck/shoulder pain, other MSK pain, headache and depressive symptoms in adolescents, suggesting that these complaints should be considered when assessing and designing interventions targeting adolescents with these conditions. For clinicians consulting and treating adolescents with neck/shoulder pain, other MSK pain, headache and/or depressive symptoms, these results highlight the importance of a broad examination and the awareness of the complexity of these problems. The

combination of pain and depressive symptoms is especially important to address, as these people often have a worse prognosis (Holley et al., 2017; Leino-Arjas et al., 2018). For researchers, this highlights the need for investigating more complex preventive and treatment modalities including co-occurring symptoms and not only neck/shoulder in isolation. Future large-scale studies should use validated pain questionnaires including pain intensity and duration to improve the knowledge regarding pain conditions in adolescents. Further, the high prevalence of pain and depressive symptoms in upper secondary school students compared to lower secondary school students, especially among girls, highlights the importance of targeting younger children for prevention.

5 | CONCLUSION

The prevalence of neck/shoulder pain in combination with other MSK pain, headache and depressive symptoms was high in adolescents. Other MSK pain and headache were seen in more than half of the adolescents with neck/shoulder pain, and symptoms of depression were seen in about one-fourth of the boys and almost half of the girls. Neck/shoulder pain seems to co-occur with other health conditions, including other MSK pain, headache and depressive symptoms. According to this knowledge, researchers and clinicians should approach adolescents with neck/shoulder pain with a broad health perspective.

ACKNOWLEDGEMENTS

We want to thank the adolescents participating in this study, NOVA and KoRus for giving us access to the data and the Norwegian Directorate of Health for funding the survey. We would also thank Oslo Metropolitan University for funding Henriette Jahres' PhD. The dataset used in this study was given from the Norwegian Centre for Research Data (NSD) with the terms of not sharing the dataset, so this is not available for publicity. The dataset generated and analysed during this present study is only available from NOVA under a reasonable request. NOVA is not responsible for the data analyses or the interpretation of the results of this study. The authors have no conflict of interest to declare.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

HJ originated the idea, analysed the data, interpreted the result and wrote the first and the subsequent drafts of the manuscripts. AB contributed by acquisition of the data. AB, MG, KS, KRR and BEØ substantially contributed to the conception and design of the study, interpretation of data and revised the drafting of the article critically for intellectual content. All the authors approved the final version to be published.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Jahre H, Grotle M, Smedbråten K, Richardsen KR, Bakken A, Øiestad BE. Neck and shoulder pain in adolescents seldom occur alone: Results from the Norwegian Ungdata Survey. *Eur J Pain*. 2021;25:1751–1759. <https://doi.org/10.1002/ejp.1785>