Prevalence of Facial Pain and Headache in Sweden

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Submitted December 13, 2019; accepted August 8, 2020.

Aims: To compare the prevalence of facial pain and headache across various regions in Sweden. **Methods:** This study involved a comparison of cross-sectional questionnaire studies over a period of 10 years including 128,193 individuals and assessed facial pain, pain on function, and headache. Participants included *(1)* all Public Dental Service patients aged 16 to 90 years in Västerbotten (n = 57,283) and Gävleborg (n = 60,900); and *(2)* random samples of residents in Kalmar (n = 3,560) and Skåne (n = 6,450). Facial pain and pain on function were assessed for all participants, and headache was also assessed for participants in Kalmar and Skåne. Descriptive statistics were used to estimate unadjusted prevalence estimates and demographic characteristics. Prevalence estimates were adjusted for age and sex using weighted distributions from the 2015 data in the Swedish population registry before comparisons across the regions. **Results:** Overall, the prevalence of facial pain and headache were significantly higher in female than in male participants ($P < .01$). The standardized prevalence of facial pain was 4.9% in Västerbotten, 1.4% in Gävleborg, 4.6% in Kalmar, and 7.6% in Skåne. For headache, the standardized prevalence was 18.9% in Kalmar and 21.3% in Skåne. In Skåne, individuals with facial pain had a 15-fold higher odds of headache than those without. **Conclusion:** In the present Swedish epidemiologic study, the prevalence of facial pain ranged from 1.4% in Gävleborg to 7.6% in Skåne. Besides different sampling frames and other population characteristics, the presence of a high number of immigrants in Skåne may account for some differences in pain prevalence across the Swedish regions. *J Oral Facial Pain Headache 2021;35:139–149. doi: 10.11607/ofph.2645*

Keywords: *facial pain, headache, prevalence, survey, temporomandibular disorders*

Orofacial pain and headache are debilitating musculoskeletal and neurologic disorders that impact quality of life and increase societal costs.[1] Depending on location, duration, and frequency, the prevalence of orofacial pain can range from as low as 1% for cheek pain to as high as 57% for current oral or facial pain.[2] While the most common orofacial pain conditions are dental-related, the second most common is temporomandibular disorders (TMDs). Reported prevalence estimates for TMDs range between 5% and 10% across different regions,[3–8] and this variation could be due to the use of different questions, sampling frames, and population characteristics.

Among the various Swedish regions that have been studied, prevalence estimates between 1.6%[9] and 39%[10] have been reported for facial pain symptoms and TMJ sounds. Differences in screening questions, age group, and geographical area probably explain this wide range. For example, in the central Sweden counties of Örebro and Östergötland, a cross-sectional questionnaire study in 50-year-old individuals found that about 10% of the study sample and 11% to 12% of the female participants reported pain in the temporomandibular joint (TMJ) region and difficulty in jaw opening.[9] Similarly, in the northern Sweden county of Västerbotten, a mailed questionnaire study on general and dental health that used the same facial pain questions as in the above study found that 24% of the 15- to 74-year-old participants experienced both facial pain and headache; 12% experienced pain and symptoms of dys-

function on maximum opening; and 3% experienced daily headaches.[10] Using the anamnestic section of the Helkimo index,[11] Yekkalam and Wänman explored the presence and severity of TMD in 35- to 75-year-old residents in Västerbotten. The researchers found that TMD symptoms ranged between 6.6% and 20.3%, with the prevalence of TMJ sounds at 19%, and that prevalence of headache was the highest among 35- and 50-year-old female participants at 25%.[12] In central Sweden, a series of cross-sectional studies in Jönköping between 1983 and 2003 also used the Helkimo index in individuals aged 20 to 70 years and found that 2% to 5% of the examined population reported facial pain symptoms. Female individuals in their 20s and 50s had a 2-fold higher odds of headache than male individuals.[13]

Besides community surveys, studies have also assessed the prevalence of facial pain from dental health records. For example, in central Sweden, a study in almost 30,000 adolescents aged 12 to 19 years in the county of Östergötland reported the presence of TMD pain in 6.0% of female and 2.7% of male adolescents. This study by Nilsson et al utilized two screening questions on facial pain that were introduced in all Public Dental Service (PDS) clinics in the county in the year 2000.[14] These screening questions were also introduced in the PDS clinics in the counties of Västerbotten and Gävleborg, in northern Sweden, in 2010. In the above epidemiologic studies, different sampling frames and dissimilar questions have been used to assess facial pain and headache prevalence, with no standardized population analyses with which to compare prevalence estimates across regions.

Furthermore, sociodemographic characteristics and certain health behaviors (eg, smoking and use of tobacco) can influence the prevalence of facial pain,[15,16] and the proportion of foreign-born individuals in Sweden—who in general have poorer health than those with a Swedish background—has risen.[17] Besides age, sex, and psychologic factors, a common risk factor associated with facial pain is comorbid pain, of which headaches are the most common.[18,19] Headaches, which have a prevalence of between 16% and 78% depending on type and definition,[20] also share risk factors with facial pain that are common to most chronic diseases.[4,5,21,22]

Thus, the first aim of the present study was to assess the standardized age- and sex-adjusted prevalence estimates of facial pain symptoms and headache using the same questions from two different sampling frames in Sweden; that is, from the PDS clinics and from the community surveys. The second aim was to assess the associations between facial pain symptoms and headache and population characteristics such as smoking, drinking, and use of snuff; employment; family status; place of residence; and immigrant status from the two south counties in Sweden that used community surveys.

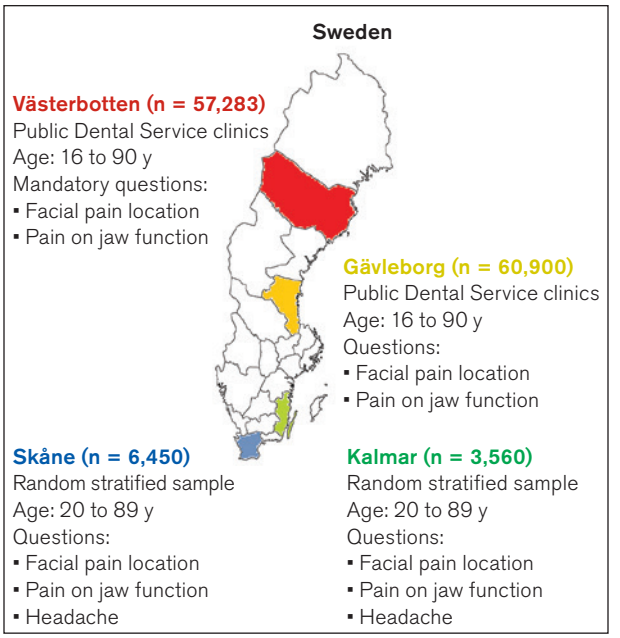

Fig 1 Map of Sweden. Shaded regions represent Swedish counties that collected data on facial pain and pain on function, and, in the case of the southern Swedish counties, data on headache.

Materials and Methods

Study Design, Setting, and Study Participants

The present study used cross-sectional data from four regional Swedish counties comprising two mostly rural counties—namely, Västerbotten (size = 55,186 km^2; inhabitants in 2015 = 263,378) and Gävleborg (size = 18,199 km^2; inhabitants in 2015 = 281,815) in northern Sweden—and one mostly rural county, Kalmar (size = 11,218 km^2; inhabitants in 2011 = 233,776), and one mostly urban county, Skåne (size = 11,303 km^2; inhabitants in 2006 = 1,184,500), in southern Sweden.

Data for the two northern Sweden counties were retrieved from the clinical record systems at the Public Dental Service (PDS) clinics for 2015. In Västerbotten, the digital health questionnaire required responses to the facial pain questions, and all 57,283 individuals aged 16 to 90 years who had had a first visit to any of the 33 PDS clinics were included. In Gävleborg, the digital health questions on facial pain were not mandatory, and after excluding individuals with missing responses to the facial pain questions, the sample included 97.9% (n = 60,900)

of the 62,190 patients aged 16 to 90 years who had had a visit to any of the 21 PDS clinics (Fig 1). In both counties, the questions on facial pain were made by interview at routine dental check-ups and entered into the digital health questionnaire.

In the southern Sweden counties, data were obtained from surveys mailed to representative, randomized samples in Kalmar and Skåne. Questions on facial pain and headache were included in county surveys, which were designed to collect information about characteristics relevant to the oral health of the adult population. In Kalmar County, the survey was mailed to 7,200 randomly selected 20- to 89-year-old individuals who were publicly registered as residing in the county in 2011. A random, stratified sampling procedure selected a minimum of 600 individuals from each of the 12 municipalities; about half (n = 3,806; 52.9%) responded. Similarly, in Skåne, surveys were mailed to 10,626 randomly selected 20- to 89-year-old residents listed in the Swedish Population Address Register (SPAR) in 2006; 6,743 (63.5%) individuals responded to the questionnaire. After excluding questionnaires with missing responses to age, sex, and facial pain and headache questions, the sample included 3,560 (49.4%) individuals in Kalmar and 6,450 (60.7%) in Skåne.

Facial Pain and Headache

The facial pain questions assessed location and frequency (presence of pain in the temple, face, jaw, or jaw joint once a week or more) and pain on function (presence of pain once a week or more on jaw opening or chewing). All four health questionnaires included these two facial pain questions. The question on headache assessed the presence of headache once a week or more in the past 6 months and was included in the health questionnaires for Kalmar and Skåne.

In Västerbotten and Gävleborg, the response options for the two facial pain of once a week or more questions were binary, with "yes" and "no" answers. In Kalmar and Skåne, the response options were "no," "monthly," "once a week," and "several times a week"; these responses were merged into "no or less than once a week" and "once a week or more." Ethical approval for the studies at the counties of Skåne and Kalmar were obtained from the Ethical Board at the University of Lund, Sweden, and for the counties of Västerbotten and Gävleborg were obtained from the Regional Ethical Board at Umeå University, Sweden.

Demographic Variables

In Kalmar and Skåne, relevant demographic variables were selected from the oral health questionnaire for descriptive purposes. Variables included age, sex, smoking (current, past, never); use of snuff (current, past, never); drinking (once a week or more, less than once a week, never); employment (working, studying, retired, on sick leave, other, and combinations of any of the above); family status (living alone, cohabitating). Variables on birthplace, parental place of birth (Sweden, Nordic, other country), and immigrant status (Swedish, first- and second-generation immigrant) were also included. For Kalmar, residence was categorized into large urban area, smaller urban area, and countryside; and for Skåne, into southwest, northwest, southeast, and northeast regions. This observational study conforms with STROBE guidelines.[23]

Statistical Methods

To compare representativeness of the present study samples to the respective counties' census data, the ratio of the study sample percentage relative to the census percentage was used as an indicator of the degree to which participants in this study were representative of the same age range and sex groups in the respective counties. Ratios of $\geq$ 1.5 and $\leq$ 0.7 were used as thresholds to signify marked departure from representativeness. Descriptive statistics were used to describe unadjusted prevalence estimates for each pain symptom (pain in the facial region, pain on function, and headache). Chi-square statistics were used to assess differences among the unadjusted prevalence estimates for the three pain symptoms. For each pain symptom, differences by sex were assessed using chi-square tests and differences by median (interquartile range [IQR]) age by Mann-Whitney tests, each at an alpha level of .05. Standardized prevalence estimates were computed by applying weighted age distributions from the 2015 Swedish population registry data for each sex group,[24] and chi-square statistics were used to estimate differences in prevalence between the two north counties and between the two south counties for each pain symptom (α level = .05). The sample size calculations revealed more than 80% power at an alpha of .05 to detect a minimal difference of 1% between the north counties and of 2% between the south counties for prevalence of pain symptoms, given the estimated prevalence of approximately 5%[7] at the time of initiating the study.

Associations between population characteristics and the three pain symptoms were assessed by computing odds ratios (ORs) and 95% CI at an alpha level of .05 using logistic regression models that were adjusted for age, sex, and region because of their associations with the pain outcomes. Given multiple testing with 11 population characteristics, a Bonferroni correction would yield a critical *P* value of .0004; however, conclusions about statistically significant associations should be approached with caution, even with multiple

Table 1 A Comparison of Age and Sex Distributions in the Study Sample and the Census Data in Each County

Counties	Kalmar (2011)			Skåne (2006)			Gävleborg (2015)			Västerbotten (2015)		
Data	Census	Study sample	Ratio	Census	Study sample	Ratio	Census	Study sample	Ratio	Census	Study sample	Ratio
Age groups, y												
16–19	NA	NA	NA	NA	NA	NA	7.6	11.5 (11.2, 11.7)	1.5	7.5	13.0 (12.8, 13.3)	1.7
20–29	15.1	8.5 (7.5, 9.4)	0.5	16.7	14.2 (13.4, 15.1)	0.9	14.8	19.6 (19.3, 19.9)	1.3	18.2	20.9 (20.5, 21.2)	1.2
30–39	13.4	10.7 (9.7, 11.7)	0.8	18.0	16.3 (15.4, 17.2)	0.9	12.3	11.8 (11.6, 12.1)	1.0	14.2	14.9 (14.6, 15.1)	1.1
40–49	16.9	15.1 (14, 16.3)	0.9	17.6	17.9 (17, 18.8)	1.0	15.4	15.2 (14.9, 15.4)	1.0	14.6	13.7 (13.4, 14)	0.9
50–59	16.8	19 (17.7, 20.3)	1.1	16.9	19.1 (18.2, 20.1)	1.1	15.5	15.2 (15, 15.5)	1.0	14.5	12.8 (12.5, 13.1)	0.9
60–69	18.6	25.3 (23.9, 26.7)	1.4	15.0	17.2 (16.3, 18.1)	1.1	16.1	13.7 (13.5, 14)	0.9	14.6	11.9 (11.6, 12.1)	0.8
70–79	11.9	14.6 (13.4, 15.8)	1.2	9.6	10.4 (9.7, 11.2)	1.1	12.3	8.9 (8.6, 9.1)	0.7	10.8	8.6 (8.3, 8.8)	0.8
80–90	7.3	6.9 (6, 7.7)	0.9	6.1	4.9 (4.3, 5.4)	0.8	6.2	4.1 (4, 4.3)	0.7	5.7	4.3 (4.2, 4.5)	0.8
Sex												
Females	50.2	54.6 (52.9, 56.2)	1.1	50.9	56.0 (54.8, 57.2)	1.1	49.8	51.1 (50.7, 51.5)	1.0	49.5	50.2 (49.8, 50.6)	1.0
Males	49.8	45.4 (43.8, 47.1)	0.9	49.1	44.0 (42.8, 45.2)	0.9	50.2	48.9 (48.5, 49.3)	1.0	50.5	49.8 (49.4, 50.2)	1.0

NA = not available. Data are reported as % (95% CI).

testing, as this study reports only unadjusted and demographically adjusted results.

A sensitivity analysis evaluated potential bias associated with mandatory responses in Västerbotten vs nonmandatory responses in Gävleborg. For this sensitivity analysis, 1,290 individuals with missing responses to either of the facial pain symptom questions in Gävleborg were added back into the analytical sample of 60,900 individuals, and missing responses were coded as "yes." Standardized prevalence estimates were calculated as described above for location of pain and pain on function. All statistics were done in SAS version 9.4.

Results

In Skåne, age distributions were generally similar for the present sample and the census data (percentage ratio = 0.8 to 1.1), whereas in Kalmar, participants in the sample were likely to be older (60 to 69 years; percentage ratio = 1.4). In contrast, compared to the census data, the age distribution of participants who visited the PDS clinics in Västerbotten and Gävleborg in the sample was younger (16 to 19 years; percentage ratio ≥ 1.5). The percentage of male and female participants did not differ markedly between the sample and census data (Table 1).

Northern Sweden Counties

In Västerbotten, the prevalence of facial pain (5.0%; 95% CI = 4.8, 5.2) was more than double ($P < .01$) the prevalence of pain on function (2.3%; 95% CI = 2.2, 2.4; Fig 2). The prevalence of facial pain only (3.4%) was almost 5 times as high as prevalence of pain on function only (0.7%), and twice as high as prevalence of facial pain and pain on function combined (1.6%). In contrast, in Gävleborg, the prevalence of facial pain (1.4%; 95% CI = 1.3, 1.5) was lower than pain on function (1.8%; 95% CI = 1.7, 1.9; $P < .01$; Fig 2).

Individuals in Gävleborg were significantly older (median age = 44.0; IQR = 34.0) than individuals in Västerbotten (40.0 [34.0]; $P < .01$). Individuals with facial pain in Gävleborg were significantly older (40.0 [29.0]) than in Västerbotten (36.0 [26.0]; $P < .01$), but not for pain on function. The proportion of females was significantly higher than males in Gävleborg (females = 51.1%, males = 48.9%; $P < .01$), but not in Västerbotten (females = 50.2%, males = 49.8%; $P = 0.3$). In each of the two counties, compared to individuals with no facial pain, individuals with facial pain were younger (both $P < .01$) and more likely to be female (both $P < .01$), with 3 times as many female as male participants across age groups 20 to 79 years ($P < .01$). A similar pattern occurred for pain on function in each county (Fig 3).

Standardized prevalence estimates (95% CI) for facial pain and pain on function across the two counties were higher in Västerbotten (facial pain = 4.9% [4.7, 5.0]; pain on function = 2.3% [2.1, 2.4]) than in Gävleborg ($P < .01$; Table 2).

Southern Sweden Counties

In each southern county, facial pain was significantly more prevalent than pain on function (all $P < .01$; Fig 2). The prevalence of headache ranged between

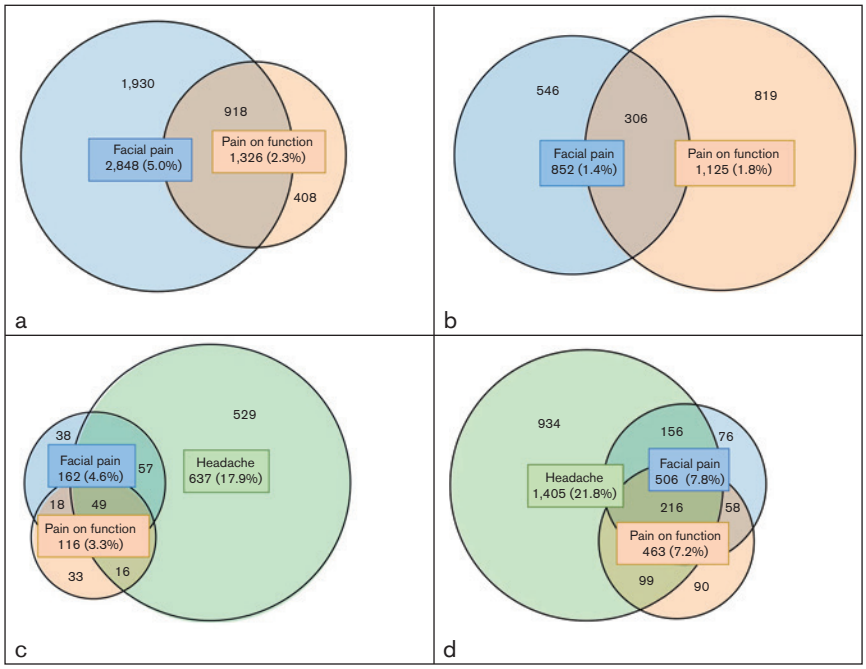

Fig 2 Venn diagrams for each county for the following three pain symptoms: *(1)* pain in the temple, face, jaw, or jaw joint region once a week or more; *(2)* pain during jaw opening or chewing once a week or more; and *(3)* headache once a week or more reported in the past 6 months. Each circle represents one pain symptom. Numbers and percentages are for affirmative responses. **(a)** Västerbotten (n = 57,283). **(b)** Gävleborg (n = 60,900). **(c)** Kalmar (n = 3,560). **(d)** Skåne (n = 6,450).

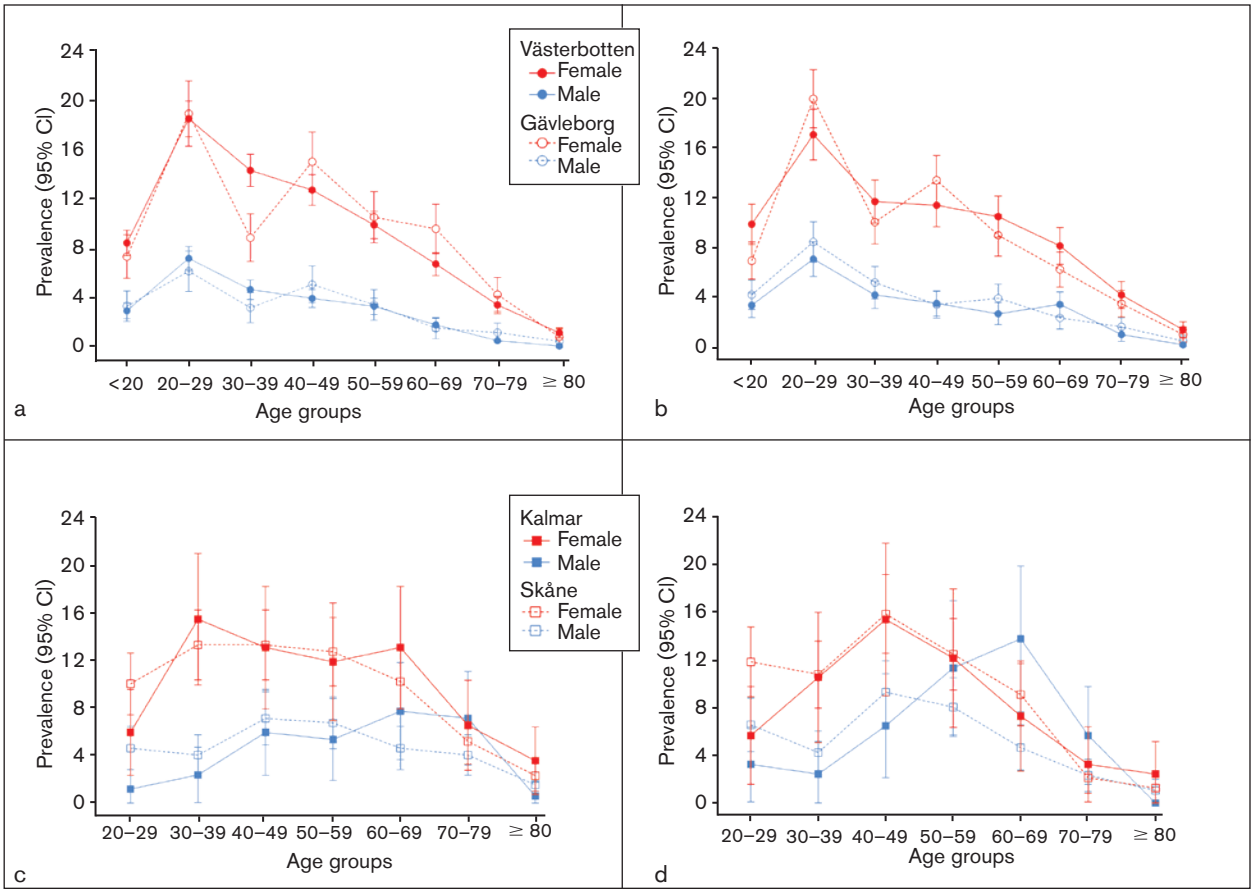

Fig 3 Age-stratified percent prevalence and 95% CI for male and female participants with pain in the temple, face, jaw, or jaw joint region once a week or more and with pain during jaw opening or chewing once a week or more. Prevalence estimates are calculated based on the total number of individuals who responded to the question for the specific county. **(a)** Facial pain in Västerbotten (n = 2,848) and Gävleborg (n = 852). **(b)** Pain on function in Västerbotten (n = 1,326) and Gävleborg (n = 1,125). **(c)** Facial pain in Kalmar (n = 162) and Skåne (n = 506). **(d)** Pain on function in Kalmar (n = 116) and Skåne (n = 463).

Table 2 Standardized Prevalence Estimates (95% CI) for Facial Pain, Pain on Function, and Headache in the North and South Swedish Counties

	Facial pain	*P* value	Pain on function	*P* value	Headache	*P* value
Northern counties						
Västerbotten (n = 57,283)	4.85 (4.68, 5.03)	< .01	2.26 (2.13, 2.38)	< .01	NA	NA
Gävleborg (n = 60,900)	1.35 (1.26, 1.44)		1.78 (1.68, 1.89)		NA	NA
Southern counties						
Kalmar (n = 3,560)	4.56 (3.86, 5.27)	< .01	3.37 (2.75, 3.98)	< .01	18.93 (17.46, 20.40)	< .01
Skåne (n = 6,450)	7.60 (6.94, 8.26)		7.03 (6.39, 7.67)		21.32 (20.21, 22.44)	

P values from chi-square tests evaluating significant differences within the north and south counties for each pain symptom.
NA = not available.

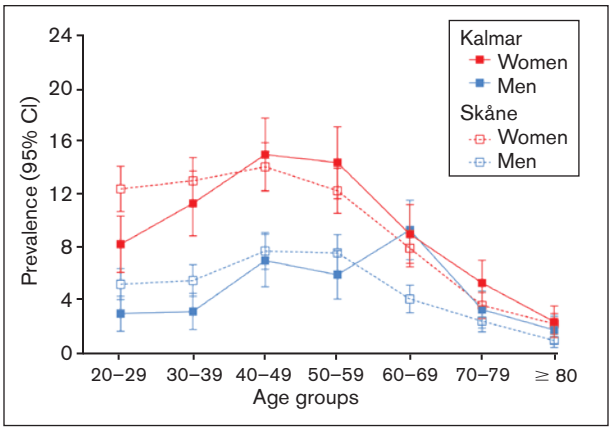

Fig 4 Age-stratified percent prevalence and 95% CI for male and female participants with headache once a week or more reported in the past 6 months in Kalmar (n = 637) and Skåne (n = 1,405).

17.9% and 21.8% for the two sampling areas and was more than twice the prevalence of facial pain or pain on function (all $P < .01$). Across Kalmar and Skåne, the proportion of individuals with headache only (range = 14.5% to 14.9%) was higher than those with facial pain only (range = 1.1% to 1.2%) or pain on function only (range = 0.9% to 1.4%). The proportion of individuals with both facial pain and headache ranged between 1.6% and 2.4%, and with all three pain symptoms (facial pain, pain on function, and headache) between 1.4% and 3.3% across the two sampling areas (Fig 2).

In Kalmar, individuals were significantly older (median [IQR] age = 58.0 [24.5]) than in Skåne (51.0 [27.0]; $P < .01$). The median (IQR) ages for pain on function (51.0 [23.0]) and headache (50.0 [23.0]) in Kalmar were both significantly higher ($P < .01$) than the median age (IQR) for pain on function (45.0 [21.0]) and headache (45.0 [23.0]) in Skåne. The proportion of female participants was significantly higher than male participants in both Kalmar (females = 54.6%, males = 45.4%) and Skåne (females = 56.0%, males = 44.0%; both $P < .01$). In both male and female participants, a high prevalence of facial pain was noted between ages 60 and 69 years in Kalmar and between ages 30 and 59 years in Skåne (Fig 3). Except for male participants in Kalmar, at each of the southern counties, the highest prevalence was found between ages 40 and 49 years for pain on function and between 40 and 59 years for headache (Figs 3 and 4).

Between the two southern counties, the standardized prevalence estimates (95% CI) were significantly higher in Skåne (facial pain = 7.6% [6.9, 8.3]; pain on function = 7.0% [6.4, 7.7]; headache = 21.3% [20.2, 22.4]) than in Kalmar (all $P < .01$; Table 2).

In Kalmar, individuals with headache were more likely to be female, current or past smokers, unemployed or on sick leave, be foreign-born, have a foreign-born parent, be either first- or second- generation immigrants, and were less likely to drink alcohol (all $P < .05$; Appendix 1; see all appendices in the online version of this article at www.quintpub.com/journals). Adjusted regression analyses showed that the magnitude of associations between headache and each of the above population characteristics were similar to those described for Skåne for each of the three pain symptoms. Furthermore, facial pain and pain on function were each significantly associated with a fewer number of population characteristics than headache (Appendix 1).

In contrast, in Skåne, relative to individuals without pain symptoms, individuals with facial pain, pain on function, and headache combined were more likely to be female, current or past smokers, drink alcohol less than once a week or never, be studying or retired, be foreign-born, have foreign-born parents, and be either first- or second-generation immigrants (all $P < .05$; Appendix 2). Also, individuals with facial pain and pain on function were more likely to be living alone (both $P = .01$; Appendix 2). Adjusted regression analyses showed that, in Skåne, the odds for each pain symptom were almost twice as high in female as in male participants. Relative to individuals who never smoked, past smokers showed a 30% to 60% significant increase in the three pain symptoms. For current smokers relative to individuals who nev-

Table 3 Association Between Facial Pain and Headache

	Headache during the last 6 mo		Odds ratio (95% CI)	
Facial pain	No pain or less than once a week (n = 5,045), n (%)	Once a week or more (n = 1,405), n (%)	Unadjusted	Adjusted[a]
Skåne				
None or less than once a week	4,911 (97.34)	1,033 (73.52)	1.0	1.0
Once a week or more	134 (2.66)	372 (26.48)	13.20 (10.71, 16.26)	12.99 (10.47, 16.11)
Kalmar				
None or less than once a week	2,867 (98.08)	531 (83.36)	1.0	1.0
Once a week or more	56 (1.92)	106 (16.64)	10.22 (7.30, 14.31)	9.71 (6.86, 13.76)

[a]Logistic models adjusted for age, sex, and region.

er smoked, a 2-fold higher odds for facial pain and headache and more than a 2-fold higher odds for pain on function were seen. On the contrary, compared to no alcohol consumption, alcohol consumption was significantly associated with about half the odds of each of the three pain symptoms (Appendix 2). Being retired was associated with greater odds of facial pain, pain on function, and headache each compared to working individuals. Furthermore, in Skåne, compared to individuals born in Sweden, individuals born in other Nordic countries had a 50% significant increase in pain on function, whereas individuals born in non-Nordic countries had an approximate 2-fold significant increase for each of the three pain symptoms. As for parental birth place, relative to individuals with native-born mothers, individuals with Nordic-born mothers were associated with a 40% significant increase in headache only, but non-Nordic born mothers were associated with a 50% or more significant increase in each of the three pain symptoms. In addition, relative to individuals with native-born fathers, individuals with Nordic-born fathers had an 80% significant increase in pain on function only, and individuals with non-Nordic born fathers had a 30% to 90% significant increase in each of the three pain symptoms (Appendix 2). With regard to immigrant status, in Skåne, relative to native Swedes, first- and second-generation immigrants had significantly higher odds of each of the three pain symptoms (Appendix 2).

Headache and Orofacial Pain Association

After adjusting for age, sex, and region, compared to those without facial pain, in Skåne, the odds of frequent headache were 13-fold higher for individuals with facial pain, and in Kalmar, the odds of frequent headache were 10-fold higher for individuals with facial pain (Table 3).

Sensitivity Analysis

The assessments of potential bias due to mandatory reports in Västerbotten vs nonmandatory reports in Gävleborg yielded, after coding missing responses as "yes," a standardized prevalence of 3.34% (95% CI = 3.19, 3.48) for facial pain and 3.78% (95% CI = 3.63, 3.93) for pain on function in Gävleborg.

Discussion

This epidemiologic survey examined the prevalence of facial pain symptoms and headache in northern and southern counties of Sweden during a period of about 10 years (2006 to 2015) and found that, across all regions, the prevalence of facial pain symptoms and headache was higher in female than in male participants. In northern Sweden, the prevalence of facial pain symptoms was highest in female individuals aged 20 to 29 years old, and in southern Sweden, in female individuals between 30 and 49 years old. Age- and sex-adjusted prevalence estimates of facial pain, pain on function, and headache were highest in Skåne and lowest in Gävleborg. Unique to Skåne and relative to native-born Swedes, being foreign-born or an immigrant was significantly associated with all three pain symptoms.

In the present samples, the prevalence estimates of facial pain, pain on function, and headache were estimated using self-report survey questionnaires from randomized samples in Kalmar and Skåne in southern Sweden, and from digital health questionnaires at the Västerbotten and Gävleborg PDS clinics in northern Sweden. The unadjusted prevalence estimates are in line with prevalence rates in Västerbotten (2010)[25] and Sörmland (2012),[26] but lower than the prevalence estimates reported by Gillborg et al for Skåne (2006).[27] The Gillborg et al study estimated a prevalence of TMD pain based on positive responses to either of the two facial pain questions, whereas the present study reported prevalence estimates separately for each of the three pain outcomes. The estimated prevalence of facial pain in the present study falls within the broad range of 1.8% to 25.8% of the estimated prevalence of facial pain in different countries.[28] While this broad range can be attributed to the different demographic characteristics, sampling locations, and use of different sign and symptom reporting, another important difference

to consider is the use of a time frame vs the use of frequency in the questions. For example, in the US National Health Interview Survey (NHIS), the facial pain question asks ''During the past 3 months, did you have facial ache or pain in the jaw muscles or the joint in front of the ear?" vs the question in the present study, which asks "Do you have pain in your face, jaw, temples, in front of the ear, or in the ear, once a week or more?"

In the present study, which used the same questions across northern and southern Sweden but had different sampling methods, other potential factors that could account for differences in prevalence estimates were demographic characteristics and participant behavior. Variations in demographic characteristics were assessed by comparing age and sex distributions in the PDS clinic samples to the county population, and it was found that individuals who visited the PDS clinics were younger. As for participant behavior, social insurance reports indicate that approximately 70% of the Västerbotten county population visit dentists at least once during a 3-year period, whereas the remaining 30% do not. Of the 70% who do visit dentists, 20% visit private clinics and the remaining 50% visit PDS clinics.[29] The above two issues raise concerns about potential selection bias and therefore the possible underestimation of the prevalence of facial pain symptoms from PDS clinics.

Differences in prevalence estimates across the two northern counties, which were likely due to variations in data acquisition methods, were also considered. The above concern regarding different data acquisition methods in the two northern Sweden samples—that is, mandatory responses in Västerbotten vs nonmandatory responses in Gävleborg—was addressed in a sensitivity analysis. This analysis showed that when missing responses for facial pain in Gävleborg were coded as "yes," the standardized prevalence estimates were closer to prevalence estimates in the Västerbotten sample. This suggests that under-reporting of pain symptoms due to the structure of the setting or participant behaviors might have affected the reported findings in Gävleborg.

Prevalence estimates between the two southern counties also differed. In contrast to the northern counties, variations in standardized prevalence estimates among the samples in southern Sweden could be due to between-county differences in nonresponse rates or population characteristics. Based on prior latency analysis from the Kalmar study, 50 nonresponders were randomly selected for a telephone interview to assess reasons for nonresponses using eight questions. Findings showed that nonresponders differed from responders with respect to having lower self-assessed need for dental treatment, living in smaller urban areas, were younger with a mean age of 50 years, and were more likely to be male. Given that nonresponders in Kalmar had a lower self-assessed need for dental treatment than responders, it is possible that nonresponders in Kalmar were also less likely to report pain symptoms. In addition, population characteristics such as age, smoking status, and immigrant status, which are known to be associated with pain symptoms, differed between Kalmar and Skåne. For example, in Skåne, there was a higher proportion of individuals who were younger (< 30 years old), current smokers, foreign-born, had foreign-born parents, and were either first- or second-generation immigrants than in Kalmar.

The present findings with regard to the association of facial pain and headache with risk factors such as sex, smoking, and employment are consistent with findings from a Finnish survey study,[30] the UK Biobank study,[15] and the OPPERA study conducted in the US population.[19,31] However, associations between alcohol consumption and facial pain and headache in this study were in the opposite direction of the associations reported by the Finnish survey study.[30] Miettinen et al found alcohol consumption once a week or more was associated with a 30% increase in odds of facial pain and of pain on function in garrisons of the Finnish Defense Forces,[30] whereas in Skåne, the present study found more than a 30% decrease in odds of facial pain and of headache and no significant associations in Kalmar. Besides the different sampling populations, potential confounding from education and social economic status could explain the contrasting findings.[32] Similar reasons could be attributed to the present findings on use of snuff, which were in the opposite direction of findings reported by Miettinen et al.[30] Relative to working individuals, being unemployed or on sick leave was strongly associated with all three pain symptoms in Kalmar, and being retired was strongly associated with all three pain symptoms in Skåne. However, retirement could be early or due to any age or sickness and was therefore difficult to interpret. No other literature on retirement with TMD pain could be identified, suggesting this area for future research. Results of previous studies on facial pain, culture, and immigrants are varied. Al-Harthy et al found cultural differences between pain threshold and tolerance and lower pain sensitivity among female non-Swedes than Swedes,[33] whereas Diercke et al found differences between Turkish immigrants, re-settlers, and German individuals that were significant for metric measurement for jaw opening but not for facial muscle pain on palpation or muscle and TMJ pain during opening.[34] Prior studies on immigrant populations and musculoskeletal pain have reported higher odds of chronic widespread pain, higher pain-associated psychosocial dysfunction, and

higher rates of disability in southern European and Middle Eastern immigrants in Sweden compared to native-born Swedes.[35–38] Similarly, the odds of South Asian immigrants in the United Kingdom reporting widespread musculoskeletal pain was nearly 4-fold higher than in native-born British residents.[39] On the contrary, in the OPPERA baseline case-control study, compared to US-born individuals, foreign-born individuals were not significantly associated with chronic TMD case status,[31] suggesting that US immigrants probably differ from immigrants in other countries on lifestyle characteristics. In the present study, Skåne had a higher proportion of first- and second-generation immigrants with each of the three pain symptoms than Kalmar. After adjusting for age, sex, and region, in Skåne, second-generation immigrants were significantly associated with nearly twice the odds of facial pain, pain on function, and headache. Taken together, these findings point to the influence of demographic characteristics, lifestyle, immigration status, and culture on facial pain and headache symptom reporting.

The present study also found a significant overlap in facial pain and headache reports. After adjustments for age and sex, headache was associated with a 13-fold higher odds of facial pain in Skåne. These findings agree with other studies that have also reported strong associations between facial pain and headache: among others, the UK Biobank study found a relative risk (RR) of 6.01 (95% CI = 5.76, 6.27),[15] and the OPPERA study, an odds ratio (OR) of 8.8 (95% CI = 3.8, 20.1).[19] Potential overlap between facial pain and headache can be due to shared pathophysiologic mechanisms, such as similarities in the sensitization of the nociceptive pathway or dysfunction of the endogenous pain modulatory systems.[40,41] Besides similar sign and symptomatic presentations between facial pain and headache,[21,42] evidence also suggests that either of these conditions may be a risk factor for the other.[43–46] It is possible that facial pain, such as TMDs, predisposes some individuals to pain in other areas by creating a pro-nociceptive environment.[47] Conversely, it could be that headache increases the propensity for TMDs in some individuals by activating the second and third divisions of the trigeminal nerve.[48] However, in this study, the strong association could also be due to the headache question not clearly distinguishing headache from facial pain in the temple region.

A strength of this study is that large samples were assembled using dental record databases from PDS clinics in northern Sweden and data from surveys from randomized samples in southern Sweden. In comparing pain prevalence estimates using dental records vs surveys, it is possible that other competing oral health conditions, such as periodontal conditions, which practitioners are more likely to register and that require continuous treatment, might affect the recording of pain symptoms and conditions. Another possibility is that some individuals avoid visiting a health care facility until their pain condition is severe and debilitating. The above limitations are potential reasons for the lower prevalence estimates of pain conditions when using dental health records.[49,50] Though the questions on facial pain from the Västerbotten PDS clinic in the present study were mandatory and are unlikely to be affected by under-recording, it is difficult to estimate how much variability in the two sampling frames can be attributed to other factors.

In general, pain prevalence can be heterogenous across settings, and most of this variability is due to varied case definitions. In contrast, the present study used the same case definition and the same survey questions to assess prevalence of facial pain and headache across the four sampling areas, albeit with some limitations, as the headache prevalence could only be assessed in two of the sampling areas. Furthermore, given that chronic facial pain is often considered to represent TMD pain[51,52]—perhaps because painful TMDs are the most prevalent of the chronic facial pains—Lövgren et al[53] assessed the validity of the facial pain questions as screening questions for TMDs and found a sensitivity of 0.78 for painful TMDs.[53] These findings indicate that the questions in the present study have acceptable sensitivity for identifying potential painful TMD cases; yet, while these questions have adequate criterion validity,[54] screener performance could be improved based on other published screeners for TMD pain.[55,56] Besides validity (sensitivity, specificity), another parameter to consider is utility. Given that half the individuals who screen positive for TMDs receive treatment,[57] these questions serve the public health purpose of identifying patients with possible TMDs who have not yet had a clinical dental assessment.

Conclusions

The standardized population prevalence of facial pain and of pain on function was lowest in the northern Sweden county of Gävleborg and highest in the southern Sweden county of Skåne. Further research is needed to explore whether possible differing population characteristics—such as immigration, culture, and behaviors around seeking health care—may contribute to these variations in the standardized prevalence estimates for facial pain symptoms and headache among the Swedish regions.

Highlights

Public health relevance:

- This epidemiologic survey examining the prevalence of facial pain and headache symptoms in northern and southern Sweden observed a prevalence of facial pain ranging from 1.4% to 7.6%.
- The standardized population prevalence of facial pain and of pain on function was found to be lowest in the PDS clinics of Gävleborg, and highest from community surveys in Skåne. Skåne also had the highest prevalence of headache.
- Different data acquisition methods, immigration, and culture may contribute to differences in the age- and sex-adjusted prevalence estimates for facial pain and headache across Sweden.

Acknowledgments

S.S.: data cleaning, design, analysis, and interpretation; drafting and critical revision of the manuscript; A.L., S.Å., and B.A.: data acquisition and revision of the manuscript; T.L., B.H.H.: study concept and revision of the manuscript; P.N.: critical revision of the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work. The authors would like to acknowledge P-O. Östergren for help with conceptualization and interpretation of analysis and S. Soltani for data cleaning.

This study was supported by a postdoctoral fellowship from the Faculty of Odontology, Malmö University, and partially funded by a grant from Region Skåne, Sweden (OFRS). This study was performed in collaboration with the Regional Board of Dental Public Health in Skåne and Kalmar, Sweden. The authors have nothing else to disclose and no conflicts of interest.

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Appendices

Appendix 1 Association Between Characteristics and Pain Outcomes in Kalmar (n = 3,560)

	Facial pain				Pain on function			
	No (n = 3,398)	Yes (n = 162)		OR[a]	No (n = 3,444)	Yes (n = 116)		OR[a]
	n (%)	n (%)	*P*	(95% CI)	n (%)	n (%)	*P*	(95% CI)
Sex								
Male (ref)	1,570 (46.2)	47 (29.0)	< .01	1.0	1,569 (45.6)	48 (41.4)	.37	1.0
Female	1,828 (53.8)	115 (71.0)		2.1 (1.5, 3.0)	1,875 (54.4)	68 (58.6)		1.1 (0.8, 1.6)
Smoking								
Never (ref)	1,926 (56.8)	75 (47.2)	.05	1.0	1,946 (56.7)	55 (47.8)	.12	1.0
Past	971 (28.7)	57 (35.9)		1.8 (1.2, 2.5)	991 (28.9)	37 (32.2)		1.6 (1.0, 2.5)
Current	492 (14.5)	27 (17.0)		1.3 (0.8, 2.1)	496 (14.5)	23 (20)		1.7 (1.0, 2.7)
Snuff								
Never (ref)	2,765 (82.1)	134 (83.8)	.83	1.0	2,802 (82.1)	97 (84.4)	.80	1.0
Past	213 (6.3)	10 (6.3)		1.4 (0.7, 2.8)	216 (6.3)	7 (6.1)		0.9 (0.4, 2.1)
Current	389 (11.6)	16 (10.0)		1.2 (0.7, 2.1)	394 (11.6)	11 (9.6)		0.7 (0.4, 1.5)
Alcohol consumption								
Never (ref)	1,061 (31.4)	55 (34.0)	.55	1.0	1,075 (31.3)	41 (35.3)	.59	1.0
Less than once a week	924 (27.3)	47 (29.0)		1.0 (0.6, 1.4)	939 (27.4)	32 (27.6)		0.7 (0.4, 1.2)
Once a week or more	1,399 (41.3)	60 (37.0)		0.9 (0.6, 1.4)	1,416 (41.3)	43 (37.1)		0.8 (0.5, 1.3)
Employment								
Working (ref)	1,737 (51.2)	68 (42)	< .01	1.0	1,753 (51)	52 (44.8)	< .01	1.0
Studying	81 (2.4)	4 (2.5)		0.7 (0.3, 2.1)	80 (2.3)	5 (4.3)		1.4 (0.5, 3.9)
Unemployed	75 (2.2)	8 (4.9)		2.4 (1.1, 5.2)	76 (2.2)	7 (6)		2.8 (1.2, 6.6)
Retired (age, early, or sick)	1,261 (37.2)	60 (37.0)		2.2 (1.4, 5.2)	1,283 (37.3)	38 (32.8)		2.0 (1.1, 3.6)
Sick leave	36 (1.1)	6 (3.7)		3.3 (1.3, 8.8)	35 (1)	7 (6)		6.3 (2.5, 15.9)
Other	95 (2.8)	7 (4.3)		1.4 (0.6, 3.1)	99 (2.9)	3 (2.6)		1.0 (0.3, 2.8)
Combination	105 (3.1)	9 (5.6)		2.3 (1.1, 4.7)	110 (3.2)	4 (3.5)		1.4 (0.5, 3.9)
Family situation								
Cohabitating (ref)	2,617 (77.4)	115 (71.4)	.08	1.0	2,646 (77.2)	86 (74.8)	.57	1.0
Living alone	766 (22.6)	46 (28.6)		1.4 (1.0, 2.0)	783 (22.8)	29 (25.2)		1.2 (0.7, 1.9)
Residence								
Countryside (ref)	1,346 (40)	69 (43.1)	.19	1.0	1,357 (39.8)	58 (51.3)	.04	1.0
Smaller urban area	1,670 (49.6)	69 (43.1)		0.8 (0.6, 1.2)	1,695 (49.7)	44 (38.9)		0.6 (0.4, 0.9)
Large urban area	348 (10.3)	22 (13.8)		1.3 (0.8, 2.1)	359 (10.5)	11 (9.7)		0.7 (0.4, 1.4)
Place of birth								
Sweden (ref)	3,147 (92.8)	145 (89.5)	.07	1.0	3,193 (92.9)	99 (85.3)	< .01	1.0
Nordic country	50 (1.5)	6 (3.7)		3.2 (1.3, 7.7)	51 (1.5)	5 (4.3)		3.7 (1.4, 9.7)
Other country	193 (5.7)	11 (6.8)		1.0 (0.5, 2.0)	192 (5.6)	12 (10.3)		1.6 (0.8, 3.1)
Maternal birth place								
Sweden (ref)	3,023 (91.3)	134 (86.5)	.02	1.0	3,065 (91.4)	92 (82.9)	< .01	1.0
Nordic country	78 (2.4)	9 (5.8)		2.9 (1.4, 5.9)	79 (2.4)	8 (7.2)		3.5 (1.7, 7.6)
Other country	210 (6.3)	12 (7.7)		1.1 (0.6, 2.0)	211 (6.3)	11 (9.9)		1.3 (0.6, 2.6)
Paternal birth place								
Sweden (ref)	2,993 (90.8)	135 (87.7)	.28	1.0	3,033 (90.8)	95 (85.6)	.11	1.0
Nordic country	86 (2.6)	7 (4.6)		1.8 (0.8, 4.0)	87 (2.6)	6 (5.4)		2.2 (0.9, 5.3)
Other country	217 (6.6)	12 (7.8)		1.1 (0.6, 2.1)	219 (6.6)	10 (9)		1.2 (0.6, 2.5)
Immigrant status								
Swedish (ref)	2,936 (88.3)	129 (82.2)	.07	1.0	2,976 (88.3)	89 (79.5)	.01	1.0
First generation	159 (4.8)	12 (7.6)		1.4 (0.8, 2.7)	163 (4.8)	8 (7.1)		1.3 (0.6, 2.9)
Second generation	231 (7)	16 (10.2)		1.4 (0.8, 2.5)	232 (6.9)	15 (13.4)		1.8 (1.0, 3.4)

Chi-square test was used to evaluate the overall association between population characteristics and pain symptom status.
[a]Adjusted effects were computed in logistic regression models that adjusted for age, gender, and regions within the county.
OR = odds ratio; ref = reference.

Appendix 1 Association Between Characteristics and Pain Outcomes in Kalmar (n = 3,560) *(continued)*

	Headache			
	No (n = 2,923)	Yes (n = 637)		OR[a]
	n (%)	n (%)	*P*	(95% CI)
Sex				
Male (ref)	1,403 (48)	214 (33.6)	< .01	1.0
Female	1,520 (52)	423 (66.4)		1.8 (1.5, 2.1)
Smoking				
Never (ref)	1,677 (57.6)	324 (50.9)	< .01	1.0
Past	839 (28.8)	189 (29.7)		1.5 (1.2, 1.8)
Current	396 (13.6)	123 (19.3)		1.6 (1.3, 2.0)
Snuff				
Never (ref)	2,360 (81.6)	539 (84.9)	.13	1.0
Past	191 (6.6)	32 (5)		0.9 (0.6, 1.4)
Current	341 (11.8)	64 (10.1)		0.9 (0.7, 1.3)
Alcohol consumption				
Never (ref)	894 (30.7)	222 (35)	.01	1.0
Less than once a week	788 (27.1)	183 (28.9)		0.8 (0.7, 1.0)
Once a week or more	1,230 (42.2)	229 (36.1)		0.8 (0.7, 1.0)
Employment				
Working (ref)	1,458 (50)	347 (54.5)	< .01	1.0
Studying	61 (2.1)	24 (3.8)		1.0 (0.6, 1.7)
Unemployed	59 (2)	24 (3.8)		1.5 (0.9, 2.5)
Retired (age, early, or sick)	1,145 (39.3)	176 (27.6)		1.1 (0.9, 1.5)
Sick leave	25 (0.9)	17 (2.7)		2.6 (1.3, 4.9)
Other	79 (2.7)	23 (3.6)		0.9 (0.6, 1.5)
Combination	88 (3)	26 (4.1)		1.4 (0.8, 2.2)
Family situation				
Cohabitating (ref)	2,247 (77.3)	485 (76.3)	.60	1.0
Living alone	661 (22.7)	151 (23.7)		1.1 (0.9, 1.4)
Residence				
Countryside (ref)	1,148 (39.7)	267 (42.3)	.47	1.0
Smaller urban area	1,436 (49.7)	303 (47.9)		0.9 (0.8, 1.1)
Large urban area	308 (10.7)	62 (9.8)		0.9 (0.6, 1.2)
Place of birth				
Sweden (ref)	2,718 (93.2)	574 (90.3)	.03	1.0 (0, 0)
Nordic country	42 (1.4)	14 (2.2)		2.1 (1.1, 3.8)
Other country	156 (5.4)	48 (7.6)		1.3 (0.9, 1.8)
Maternal birth place				
Sweden (ref)	2,617 (92)	540 (87)	< .01	1.0
Nordic country	65 (2.3)	22 (3.5)		1.9 (1.1, 3.1)
Other country	163 (5.7)	59 (9.5)		1.5 (1.1, 2.1)
Paternal birth place				
Sweden (ref)	2,595 (91.4)	533 (87.1)	< .01	1.0
Nordic country	70 (2.5)	23 (3.8)		1.6 (1.0, 2.6)
Other country	173 (6.1)	56 (9.2)		1.4 (1.0, 1.9)
Immigrant status				
Swedish (ref)	2,550 (89.2)	515 (82.5)	< .01	1.0
First generation	122 (4.3)	49 (7.9)		1.7 (1.2, 2.5)
Second generation	187 (6.5)	60 (9.6)		1.5 (1.1, 2.1)

Chi-square test was used to evaluate the overall association between population characteristics and pain symptom status.

[a]Adjusted effects were computed in logistic regression models that adjusted for age, gender, and regions within the county.

OR = odds ratio; ref = reference.

Appendix 2 Association Between Characteristics and Pain Outcomes in Skåne (n = 6,450)

	Facial pain				Pain on function			
	No (n = 5,944)	Yes (n = 506)		OR[a]	No (n = 5,987)	Yes (n = 463)		OR[a]
	n (%)	n (%)	*P*	(95% CI)	n (%)	n (%)	*P*	(95% CI)
Sex								
Male (ref)	2,670 (44.9)	168 (33.2)	< .01	1.0	2,669 (44.6)	169 (36.5)	< .01	1.0
Female	3,274 (55.1)	338 (66.8)		1.6 (1.3, 2)	3,318 (55.4)	294 (63.5)		1.4 (1.1, 1.7)
Smoking								
Never (ref)	3,169 (54.2)	218 (43.7)	< .01	1.0	3,206 (54.4)	181 (40.1)	< .01	1.0
Past	1,543 (26.4)	136 (27.3)		1.4 (1.1, 1.7)	1,566 (26.6)	113 (25.1)		1.6 (1.1, 1.9)
Current	1,138 (19.5)	145 (29.1)		1.9 (1.5, 2.3)	1,126 (19.1)	157 (34.8)		2.5 (2.0, 3.1)
Snuff								
Never (ref)	4,769 (84.7)	423 (87.6)	.22	1.0	4,823 (84.9)	369 (84.8)	.98	1.0
Past	271 (4.8)	20 (4.1)		0.9 (0.6, 1.5)	271 (4.8)	20 (4.6)		1.0 (0.6, 1.7)
Current	593 (10.5)	40 (8.3)		0.9 (0.7, 1.3)	587 (10.3)	46 (10.6)		1.1 (0.8, 1.5)
Alcohol consumption								
Occasionally or never (ref)	865 (14.7)	125 (25.0)	< .01	1.0	867 (14.6)	123 (26.9)	< .01	1.0
Less than once a week	2,241 (38.1)	219 (43.7)		0.7 (0.5, 0.9)	2,283 (38.5)	177 (38.7)		0.5 (0.4, 0.7)
Once a week or more	2,780 (47.2)	157 (31.3)		0.4 (0.3, 0.6)	2,779 (46.9)	158 (34.5)		0.4 (0.3, 0.5)
Employment								
Working (ref)	3,061 (57.7)	217 (48.4)	< .01	1.0	3,063 (57.5)	215 (51.1)	< .01	1.0
Studying	328 (6.2)	34 (7.6)		1.4 (0.9, 2.0)	326 (6.1)	36 (8.6)		1.3 (0.9, 2.0)
Unemployed	1,164 (22)	77 (17.2)		1.0 (0.7, 1.4)	1,199 (22.5)	42 (10)		0.6 (0.4, 1.0)
Retired (age, early, or sick)	748 (14.1)	120 (26.8)		2.2 (1.7, 2.8)	740 (13.9)	128 (30.4)		2.4 (2.0, 3.1)
Family situation								
Cohabitating (ref)	4,143 (70.8)	318 (64.4)	.01	1.0	4,168 (70.8)	293 (64.3)	.01	1.0
Living alone	1,355 (23.2)	141 (28.5)		1.4 (1.1, 1.7)	1,366 (23.2)	130 (28.5)		1.3 (1.1, 1.7)
Other	350 (6)	35 (7.1)		1.2 (0.8, 1.7)	352 (6)	33 (7.2)		1.0 (0.7, 1.5)
Residence								
Southwest (ref)	2,935 (50.7)	240 (48.8)	.76	1.0	2,942 (50.5)	233 (51.4)	.09	1.0
Northwest	1,441 (24.9)	127 (25.8)		1.1 (0.9, 1.4)	1,439 (24.7)	129 (28.5)		1.2 (0.9, 1.5)
Northeast	917 (15.8)	85 (17.3)		1.2 (0.9, 1.5)	941 (16.2)	61 (13.5)		0.9 (0.6, 1.1)
Southeast	496 (8.6)	40 (8.1)		1.0 (0.7, 1.4)	506 (8.7)	30 (6.6)		0.8 (0.5, 1.2)
Place of birth								
Sweden (ref)	5,154 (87.3)	411 (81.6)	< .01	1.0	5,211 (87.6)	354 (77)	< .01	1.0
Nordic country	166 (2.8)	15 (3)		1.1 (0.6, 1.9)	164 (2.8)	17 (3.7)		1.5 (0.9, 2.5)
Other country	587 (9.9)	78 (15.5)		1.7 (1.3, 2.2)	576 (9.7)	89 (19.4)		2.1 (1.6, 2.7)
Maternal birth place								
Sweden (ref)	4,867 (84.3)	388 (78.9)	< .01	1.0	4,922 (84.7)	333 (73.4)	< .01	1.0
Nordic country	124 (2.2)	11 (2.2)		1.1 (0.6, 2.1)	122 (2.1)	13 (2.9)		1.5 (0.8, 2.7)
Other country	780 (13.5)	93 (18.9)		1.5 (1.2, 1.9)	765 (13.2)	108 (23.8)		1.9 (1.5, 2.4)
Paternal birth place								
Sweden (ref)	4,876 (84.5)	386 (78.5)	< .01	1.0	4,931 (84.9)	331 (72.9)	< .01	1.0
Nordic country	127 (2.2)	12 (2.4)		1.1 (0.6, 2.1)	123 (2.1)	16 (3.5)		1.8 (1.0, 3.1)
Other country	770 (13.3)	94 (19.1)		1.5 (1.2, 2.0)	757 (13)	107 (23.6)		1.9 (1.5, 2.5)
Immigrant status								
Swedish (ref)	4,685 (82.2)	365 (75.6)	< .01	1.0	4,742 (82.7)	308 (69.2)	< .01	1.0
First generation	304 (5.3)	33 (6.8)		1.3 (0.9, 1.9)	299 (5.2)	38 (8.5)		1.6 (1.1, 2.4)
Second generation	710 (12.5)	85 (17.6)		1.5 (1.2, 2.0)	696 (12.1)	99 (22.3)		2.1 (1.6, 2.7)

Chi-square test was used to evaluate the overall association between population characteristics and pain symptom status.
[a]Adjusted effects were computed in logistic regression models that adjusted for age, gender, and regions within the county.
OR = odds ratio; ref = reference.

Appendix 2 Association Between Characteristics and Pain Outcomes in Skåne (n = 6,450) *(continued)*

	Headache			
	No (n = 2,196)	Yes (n= 1,405)		OR[a]
	n (%)	n (%)	*P*	(95% CI)
Sex				
Men (ref)	2,355 (46.7)	483 (34.4)	< .01	1.0
Women	2,690 (53.3)	922 (65.6)		1.7 (1.5, 1.9)
Smoking				
Never (ref)	2,726 (54.9)	661 (47.8)	< .01	1.0
Past	1,328 (26.7)	351 (25.4)		1.3 (1.1, 1.5)
Current	913 (18.4)	370 (26.8)		1.7 (1.4, 1.9)
Snuff				
Never (ref)	4,043 (84.6)	1,149 (86.1)	.20	1.0
Past	239 (5)	52 (3.9)		0.8 (0.6, 1.2)
Current	500 (10.5)	133 (10)		1.1 (0.9, 1.3)
Alcohol consumption				
Occasionally or never (ref)	701 (14)	289 (20.8)	< .01	1.0
Less than once a week	1,878 (37.6)	582 (41.9)		0.7 (0.6, 0.8)
Once a week or more	2,418 (48.4)	519 (37.3)		0.6 (0.5, 0.7)
Employment				
Working (ref)	2,599 (57.5)	679 (55.2)	< .01	1.0
Studying	255 (5.6)	107 (8.7)		1.2 (0.9, 1.6)
Unemployed	1,087 (24.1)	154 (12.5)		0.8 (0.6, 1.1)
Retired (age, early, or sick)	577 (12.8)	291 (23.6)		2.0 (1.6, 2.2)
Family situation				
Cohabitating (ref)	3,510 (70.7)	951 (69.1)	.17	1.0
Living alone	1,169 (23.5)	327 (23.8)		1.0 (0.9, 1.2)
Other	287 (5.8)	98 (7.1)		0.9 (0.7, 1.2)
Residence				
South-west (ref)	2,485 (50.6)	690 (50.2)	.77	1.0
North-west	1,213 (24.7)	355 (25.8)		1.1 (1.0, 1.3)
North-east	783 (16)	219 (15.9)		1.1 (0.9, 1.3)
South-east	426 (8.7)	110 (8)		1.0 (0.8, 1.2)
Place of birth				
Sweden (ref)	4,419 (88.1)	1,146 (82.2)	< .01	1.0
Nordic country	146 (2.9)	35 (2.5)		0.9 (0.6, 1.3)
Other country	452 (9)	213 (15.3)		1.7 (1.4, 2.0)
Maternal birth place				
Sweden (ref)	4,175 (85.4)	1,080 (78.5)	< .01	1.0
Nordic country	98 (2)	37 (2.7)		1.4 (1.0, 2.1)
Other country	614 (12.6)	259 (18.8)		1.5 (1.3, 1.8)
Paternal birth place				
Sweden (ref)	4,179 (85.5)	1,083 (78.7)	< .01	1.0
Nordic country	105 (2.2)	34 (2.5)		1.1 (0.8, 1.5)
Other country	604 (12.4)	260 (18.9)		1.3 (1.1, 1.5)
Immigrant status				
Swedish (ref)	4,030 (83.4)	1,020 (75.4)	< .01	1.0
First generation	238 (4.9)	99 (7.3)		1.3 (1.0, 1.7)
Second generation	562 (11.6)	233 (17.2)		1.5 (1.3, 1.8)

Chi-square test was used to evaluate the overall association between population characteristics and pain symptom status.

[a]Adjusted effects were computed in logistic regression models that adjusted for age, gender, and regions within the county.

OR = odds ratio; ref = reference.