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The association between psychological and social factors and spinal pain in adolescents

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Abstract

Spinal pain, back pain, and/or neck pain begins early in life and is strongly associated with spinal pain in adulthood. Understanding the relationship between psychological and social factors and adolescent spinal pain may be important in both the prevention and treatment of spinal pain in this age group. We aimed to determine if psychological and social factors were associated with spinal pain in a cross-sectional study of a school-based cohort of 1279 Danish adolescents aged 11–13, who were categorized into "any" and "substantial" spinal pain. "Substantial spinal pain" was defined as a lifetime frequency of "sometimes" or "often" and a pain intensity of at least two on the revised Faces Pain Scale. Logistic regression analyses, stratified by sex, were conducted for single and all variables together. Eighty-six percent of participants reported "any spinal pain" and 28% reported "substantial spinal pain". Frequency of psychological and social factors was significantly higher in those with spinal pain compared to those without. As the frequency of psychological and social factors increased, the odds of both "any spinal pain" and "substantial spinal pain" also increased.

Conclusion: Psychological and social factors may be important determinants in adolescent spinal pain.

What is Known:
• *Spinal pain begins early in life to reach adult levels by age 18. Spinal pain in adolescence is strongly associated with spinal pain in adulthood.*
• *In adults, psychological and social factors and spinal pain are strongly related; however, this relationship in adolescence is poorly understood.*
What is New:
• *Adolescents with spinal pain reported a significantly higher frequency of psychological factors and loneliness and lower levels of pupil acceptance.*
• *Adolescents reporting higher levels of loneliness, lower levels of pupil acceptance, and increased frequency of psychological factors had increased odds of reporting "substantial spinal pain".*

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Abbreviations

CI   Confidence interval
HBSC   Health Behaviour in School-Aged Children
OR   odds ratio
rFPS   Revised Faces Pain Scale
SP   spinal pain
YSQ   Young Spine Questionnaire
SES   Socioeconomic status

Introduction

Spinal pain (SP) is a major public health concern globally with low back pain and neck pain as leading causes of years lived with disability [30]. SP begins early in life and prevalence increases rapidly during adolescence to reach adult levels by age 18 [4, 8]. Thus, SP in adolescence is very common with some studies citing lifetime prevalence rates as high as 86% [1]. The majority of this SP is mild with few consequences; however, a smaller portion of adolescents have more persistent and recurring pain that impacts their daily lives and well-being [1]. Negative consequences of adolescent SP include absence from school, healthcare-seeking behavior, avoidance of sports and activities, as well as decreased quality of life [19, 20].

SP in adolescence is strongly associated with SP in adulthood [11, 14]. The literature on SP in adult populations illustrates that SP and psychological and social factors are strongly related [13, 22, 25]. A few studies have shown that psychological and social factors are also related to SP in adolescence [7, 24, 28, 31], but this is not as well established. Studies conducted on this age group have found that higher levels of stress, depression, negative behavior, emotional problems, poorer overall well-being, and higher levels of peer problems increase the odds of reporting SP [7, 24, 28, 31].

Therefore, the primary objective of this study was to determine if psychological and social factors are associated with SP in a cohort of Danish adolescents aged 11–13 years.

Methods

Study design

This study was cross sectional in nature and was a secondary analysis of baseline data collected in May and June of 2010 in connection with the School site, Play spot, Active transport, Club fitness, and Environment (SPACE) study [29].

Setting and data collection

The SPACE study was conducted at 14 schools in the Region of Southern Denmark. It was designed to test the effect of optimizing the physical environment around the schools to promote physical activity [29]. At baseline, the students completed an e-survey that included questions about SP as well as psychological and social factors. The survey was completed under supervision of the teacher during class time.

Participants

Students at the participating schools aged 11 to 13 years (*n* = 1348) were eligible for the study. Those who assented and responded to all of the SP-related questions were included in this study.

Ethics

For the SPACE study, a letter was sent to parents informing them of the study and that they could withdraw their child's participation at any time. For more details, see the SPACE protocol [29]. The Regional Ethics Committee for Southern Denmark was advised about the study and data collection. Under Danish law, no ethics approval was needed because the study did not include any invasive tests or interventions. Approval was obtained from the Danish Data Protection Agency (#2010-41-5147).

For the current study, Research Ethics Board approval was obtained from Canadian Memorial Chiropractic College (#172011).

Variables

Spinal pain (dependent variables)

The Young Spine Questionnaire (YSQ), embedded in the SPACE e-survey [29], was used to assess lifetime occurrence of SP. The YSQ was developed for 9–11-year olds and has satisfactory feasibility, content validity, and item agreement between questionnaire scores and interview findings [21].

The YSQ assesses the three spinal regions, neck, mid back, and low back, separately. For lifetime prevalence of pain, the participant was asked: "Have you ever had pain in your (specific region listed)?" with the response categories of "often", "sometimes", "once or twice", and "never". The participants who responded at least "once or twice" were asked to assess their worst pain ever using the revised Faces Pain Scale (rFPS). This scale is based on six faces that illustrate progressively worsening pain and can be scored from 0, representing no pain, to 5, representing worst imaginable pain. The rFPS has been found to be valid and appropriate for use in assessing pain intensity in children over the age of 4 [16].

The three spinal pain regions were collapsed into one category indicating SP in any region. A previous study on this population found that there was a high overlap of pain between the three spinal regions [1]. "Any SP" was defined as any frequency of SP above "never" regardless of intensity level. "Substantial SP" was defined as a frequency of "sometimes"

or "often" in at least one spinal region with a corresponding pain intensity of at least 2 on the rFPS. Stallknecht et al. previously used this method of defining SP from the YSQ [28].

Psychological and social factors (independent variables)

Data on psychological and social factors was collected using questions from the Health Behaviour in School-Aged Children: World Health Organization Collaboration Cross-National Survey (HBSC) [27] that was embedded in the SPACE e-survey [29]. The HBSC questions are subject to validation studies and piloting at national and international levels [27]. The four-item psychological subscale has been found to have good internal validity, convergent validity, and discriminant validity [10].

For each of the psychological variables, the questionnaire asks them: "In the past six months, how often have you been feeling low/bad mood/nervousness/difficulty sleeping?". The response categories were "every day", "more than once a week", "almost every week", "almost every month", and "rarely or never".

The social variables related to loneliness and pupil acceptance and the questions were: "Do you feel lonely?" with the response options: "no"/"sometimes"/"often"/"very often", and "Other pupils accept me as I am?" with the response options: "Strongly agree"/"agree"/"neither agree nor disagree"/"disagree"/"strongly disagree".

Other variables of interest

Age, socioeconomic status (SES), smoking, and alcohol were identified as covariates. Low SES has been shown to be associated with poorer overall health and there is high-quality evidence from a recent systematic review to suggest that low SES is a risk factor for developing musculoskeletal pain in adolescents [17]. Low SES is also associated with higher levels of mental health problems [26]. SES was based on the father's occupation at follow-up 2 years later and coded according to the Danish Occupational Social Class Measure [6]. SES was classified as high, middle, or low based on these ratings. Smoking has been shown to increase the odds of reporting LBP, and alcohol consumption has been found to be positively associated with current LBP in adolescents and young adults [12, 15, 23]. Smoking and alcohol consumption have also been identified as risk factors for mental health problems in adolescents [3, 5]. A participant was considered to smoke if they reported smoking at least once every week and to drink if they reported drinking alcohol at least once every month.

Data analysis

Descriptive statistics were used to present the study cohort in terms of psychological and social factors as well as SP. Results are presented as frequencies and percentages.

We constructed multiple logistic regression models to determine the association between the psychological and social variables and the two outcomes. The models were adjusted for age and SES, but due to rather small proportions of children smoking and drinking, these variables were not included ($n = 6$ and $n = 86$, respectively). We also checked if any interactions existed between the psychological and social variables. All regression analyses were stratified by sex. Adjusted odds ratios (OR) with 95% confidence intervals (CI) were reported.

To determine if there was an independent relationship between the psychological and social variables and the two outcomes, an exploratory factor analysis was first conducted for each of the constructs to determine if they would load onto the same factor, because a scoring system to estimate a combined score has not been created previously.

The psychological variables loaded onto the same factor; therefore, a scoring system was developed where a value of "0" to "4" was assigned to the response categories ("0" = never/rarely, "1" = almost every month, "2" = almost every week, 3 = more than once per week, and 4 = almost every day). The values were summed across the four variables to reach a composite psychological score that could range from "0" to "16". There was no linear relationship between the composite psychological score and the two outcomes, and we therefore categorized the score into three categories: (1) no psychological complaints (value of 0), (2) low composite psychological score (value of 1 to 4), and (3) high composite psychological score (value of 5 to 16). A one-factor solution for the social variables could not be found. The regression analyses described above were repeated for the composite psychological score.

Statistical significance was set at a p value of less than 0.05 ($p < 0.05$) for all analyses.

All statistical analyses were carried out in Stata 15.0 (StataCorp, College Station, Texas, USA).

Results

Participants

There were 1348 invited participants and 94.9% of the participants ($n = 1279$) were included in the study. There were 19 students who did not assent to the study, 12 students were 14 years and older at the time of data collection, and 38 students were absent on the day of data collection. The 69 participants who were not included were significantly older (mean = 13.0, SD = 0.79) than the study cohort, but with equal sex distribution.

The average age of the participants was 12.6 (SD = 0.61) and 51.6% ($n = 660$) were boys.

There were 378 participants with missing SES. These 378 participants were excluded from the adjusted multivariable analyses. At baseline, participants with missing SES data

had higher frequencies of low mood, nervousness, and loneliness and lower levels of pupil acceptance than the study cohort.

Please refer to Fig. 1 for flowchart of participants.

Prevalence

Psychological factors

The prevalence of participants that reported "almost every week" they were feeling low was 17.7% (95% CI: 15.7–19.9), feeling irritable/bad mood was 25.2% (95% CI: 22.8–27.6), feeling nervous was 18.4% (95% CI: 16.3–20.6), or had difficulties sleeping was 34.3% (95% CI: 31.7–36.9). The prevalence of participants that reported they had ever been feeling low was 39.5% (95% CI: 36.8–42.2), feeling irritable/bad mood was 54.7% (95% CI: 51.9–57.4), feeling nervous was 45.6% (95% CI: 42.8–48.3), or had difficulties sleeping was 54.1% (51.4–56.8). Girls consistently reported a higher prevalence of these psychological factors and this was statistically significant for all four psychological variables.

Due to small cell sizes, the response categories for psychological factors were collapsed for the descriptive analysis. Participants with "any SP" or "substantial SP" reported a significantly higher frequency of all the psychological variables compared to those with no SP (Table 1).

Social factors

The prevalence of participants that reported feeling lonely at least "sometimes" was 26.3% (95% CI: 23.9–28.8). Only 2.9% (95% CI: 2.1–4.0) and 1.5% (95% CI: 0.9–2.3) reported feeling lonely "often" or "very often", respectively. When asked "Other pupils accept me as I am?", 82.5% (95% CI: 80.3–84.5) of participants either "agreed" or "strongly agreed" that other pupils were accepting of them. Only 3.8% (95% CI: 2.8–4.9) "disagreed" or "strongly disagreed" that other pupils were accepting of them. Similarly to psychological factors, girls consistently reported a higher prevalence of loneliness and lower levels of pupil acceptance. However, none of these differences were statistically significant.

Due to small cell sizes, the response categories for social factors were collapsed for the descriptive analysis. Participants with "any SP" or "substantial SP" reported a significantly higher frequency of loneliness and lower levels of pupil acceptance compared to those with no lifetime SP (Table 1).

Spinal pain

The lifetime prevalence of "any SP" was 86.2% (95% CI: 84.2–88.0) and "substantial SP" was 28.3% (95% CI: 25.9–30.8). Girls reported a significantly higher prevalence of both types of SP. Neck pain was the most prevalent, followed by

Fig. 1 Participant flowchart
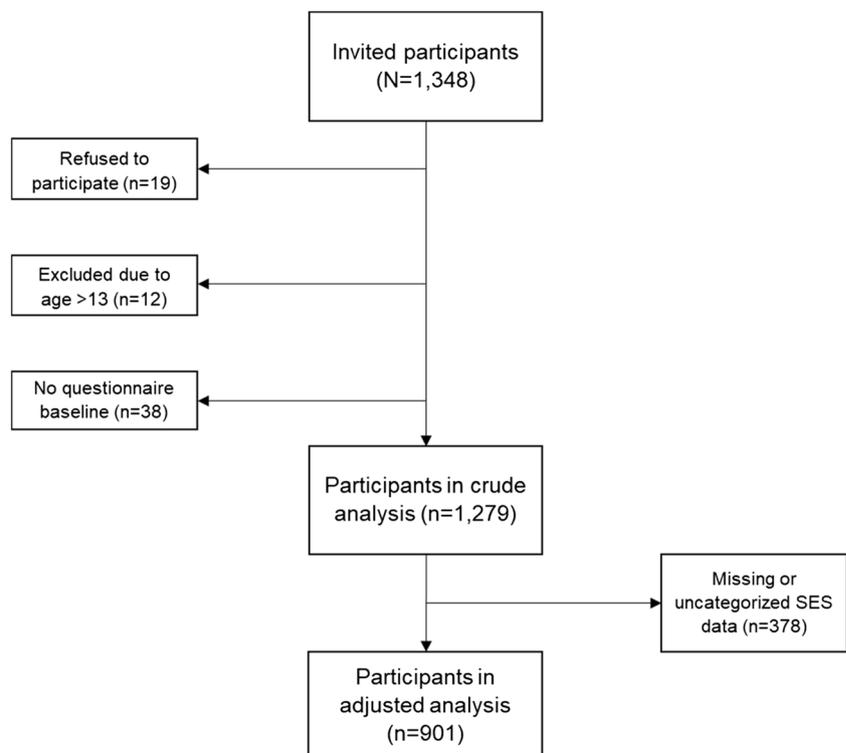
mid back pain and low back pain in both boys and girls (Fig. 2a, b).

The mean intensity of "any" pain was highest in the neck (1.5, 95% CI: 1.5–1.6), followed by the mid back (1.5, 95% CI: 1.4–1.6) and low back (1.3, 95% CI: 1.2–1.4). The mean intensity of "substantial" pain was highest in the low back (3.2, 95%CI: 3.0–3.4), followed by the mid back (2.9, 95% CI: 2.8–3.1) and the neck (2.9, 95% CI: 2.8–3.1) (Fig. 3a, b).

Associations between individual psychological factors and spinal pain

Increasing ORs for reporting SP were seen with an increased frequency for each of the four psychological factors. Sleeping difficulties were statistically significantly related to "any SP" in girls whereas the same was true for bad mood, nervousness, and sleeping difficulties in boys. In the analysis for "substantial SP", the ORs were statistically significant for all psychological factors in both girls and boys (Figs. 4a and 5a).

Associations between individual social factors and spinal pain

Increasing OR were seen for loneliness and pupil acceptance in those with "any SP" and these OR were not significant except for loneliness "sometimes" in both sexes. The same pattern was seen with "substantial SP" but the ORs were significant for both girls and boys (Figs. 4b and 5b).

Table 1 Baseline characteristics of included participants ($n = 1279$)

		Total ($n = 1279$) n (%)	No SP[a] ($n = 176$) n (%)	Any SP ($n = 1103$) n (%)	Substantial SP ($n = 362$) n (%)
Age	11	276 (21.6)	30 (17.1)	246 (22.3)	64 (17.7)
	12	654 (51.1)	86 (48.9)	568 (51.5)	286 (51.4)
	13	349 (27.3)	60 (34.1)	289 (26.2)	112 (30.9)
Sex[*], [**]	Girls	619 (48.4)	71 (40.3)	548 (49.7)	194 (53.6)
	Boys	660 (51.6)	105 (59.7)	555 (50.3)	168 (46.4)
Social class (of father)	High	187 (14.6)	27 (15.3)	160 (14.5)	60 (16.6)
	Middle	443 (34.6)	64 (36.4)	379 (34.6)	113 (31.2)
	Low	271 (21.2)	42 (23.9)	229 (20.8)	77 (21.3)
	Unclassified	136 (10.6)	19 (10.8)	117 (10.6)	34 (9.4)
	Missing	242 (18.9)	24 (13.6)	218 (19.8)	78 (21.6)
Low mood[*], [**]	Never/rarely	774 (60.5)	132 (75.0)	642 (58.2)	164 (45.3)
	Almost every month/every week	393 (30.7)	38 (21.6)	355 (32.2)	131 (36.2)
	More than once per week/almost every day	112 (8.8)	6 (3.4)	106 (9.6)	67 (18.5)
Bad mood[*], [**]	Never/rarely	580 (45.3)	113 (64.2)	467 (42.3)	109 (30.1)
	Almost every month/every week	561 (43.9)	56 (31.8)	505 (45.8)	172 (47.5)
	More than once per week/almost every day	138 (10.8)	7 (4.0)	131 (11.9)	81 (22.4)
Nervousness[*], [**], °	Never/rarely	696 (54.4)	125 (71.0)	571 (51.8)	152 (42.0)
	Almost every month/every week	477 (37.3)	47 (26.7)	430 (39.0)	155 (42.8)
	More than once per week/almost every day	106 (8.3)	4 (2.3)	102 (9.2)	55 (15.2)
Difficulty sleeping[*], [**]	Never/rarely	587 (45.9)	114 (64.8)	473 (42.9)	119 (32.9)
	Almost every month/every week	408 (31.9)	45 (25.6)	363 (32.9)	102 (28.2)
	More than once per week/almost every day	284 (22.2)	17 (9.6)	267 (24.2)	141 (38.9)
Loneliness[*], [**]	Never	943 (73.7)	158 (89.8)	785 (71.2)	215 (59.4)
	Sometimes	280 (21.9)	15 (8.5)	265 (24.0)	117 (32.3)
	Often or very often	56 (4.4)	3 (1.7)	53 (4.8)	30 (8.3)
Pupils accept me as I am[*], [**]	Strongly agree or agree	1055 (82.5)	157 (89.2)	898 (81.4)	269 (74.3)
	Neither agree not disagree, disagree or strongly disagree	224 (17.5)	19 (10.8)	205 (18.6)	93 (25.7)

SP spinal pain

[a] Individuals reporting SP "never" in all three spinal regions

*Statistically significant between "any SP" and "no SP" ($p < 0.05$)

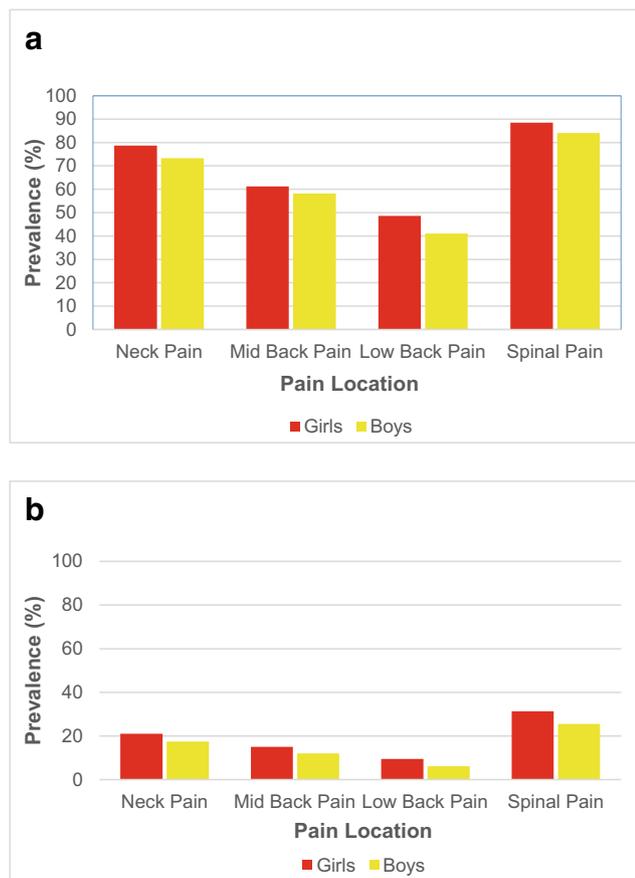** Statistically significant between "substantial SP" and "no SP" ($p < 0.05$)

Fig. 2 **a** Prevalence of any pain by location. **b** Prevalence of substantial pain by location

Fig. 3 **a** Intensity of any pain by location. **b** Intensity of substantial pain by location

Association between composite psychological score and spinal pain

In the logistic regression with the composite psychological score, the OR of reporting SP increased with an increase in the composite psychological score for both "any SP" and "substantial SP". All OR were significant except for girls with "substantial SP" with a composite psychological score of 1–4 (Table 2).

Combined analysis of social factors and spinal pain

In the logistic regression with both social variables and SP, the OR for loneliness and pupil acceptance remained significant in girls with "substantial SP". The OR for reporting loneliness "sometimes" was significant for both "any SP" and "substantial SP" in both sexes as well as for loneliness "often/very often" in girls with "substantial SP". The estimates were slightly decreased for both loneliness and pupil acceptance in this analysis compared to the analyses of the individual items (Table 3).
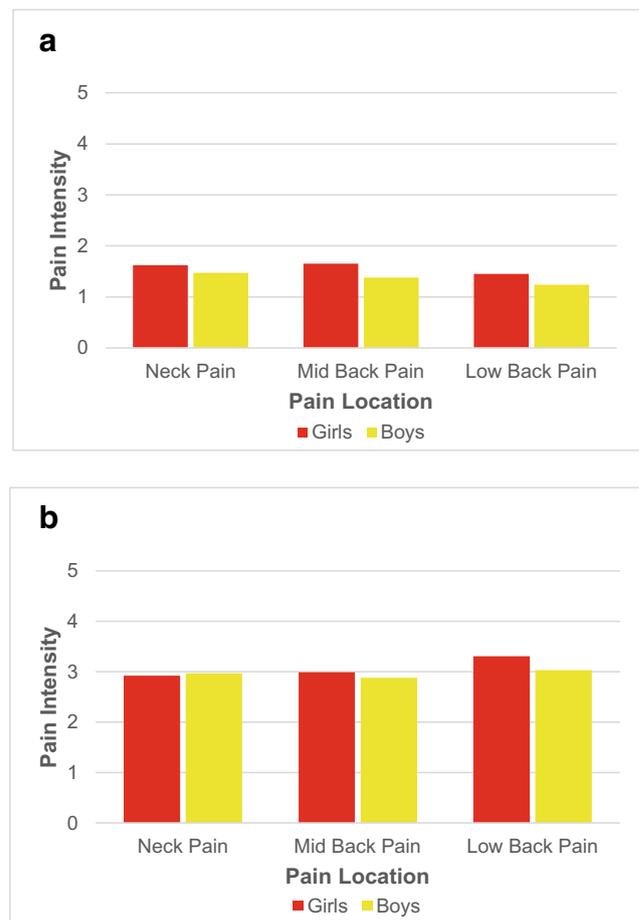
Combined analysis of the composite psychological score and social factors and spinal pain
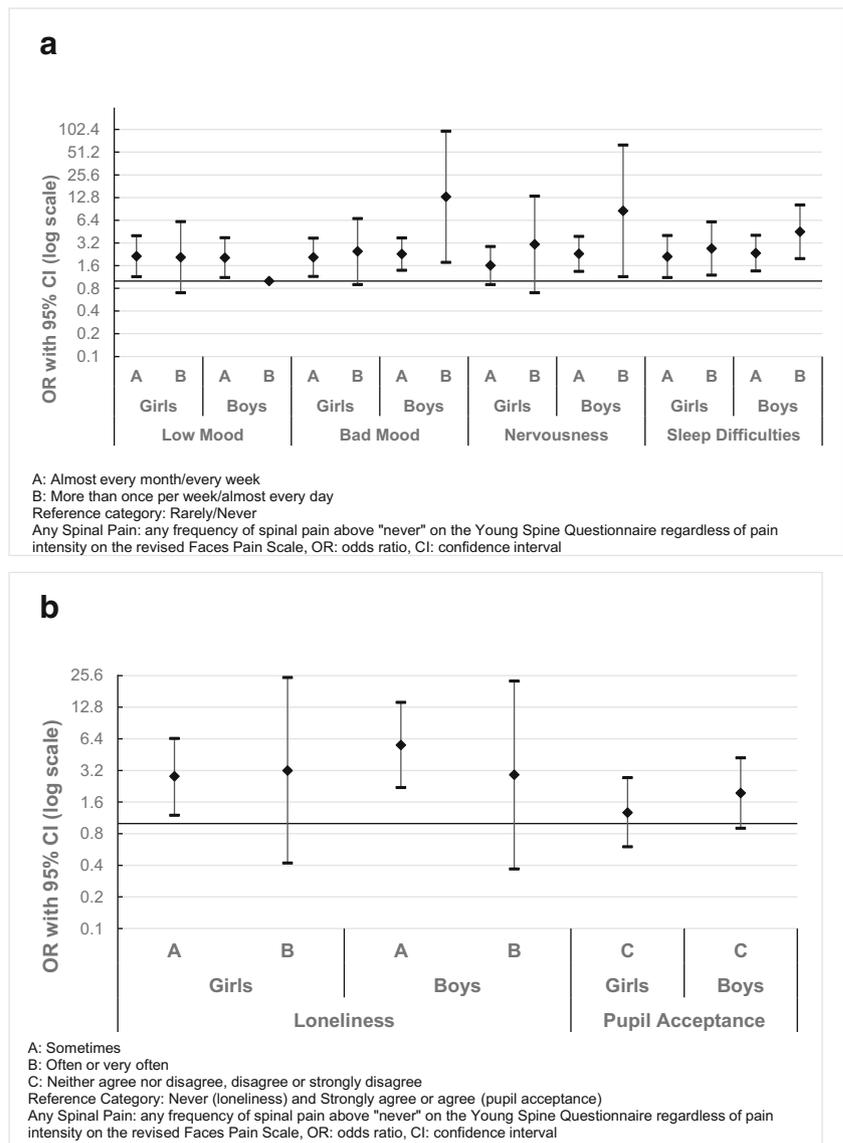
No significant interactions were found between the composite psychological score and the social variables in the multivariable logistic regression analysis. Therefore, none of the interaction terms were included in the multivariable logistic regression analysis.

The OR for the composite psychological score remained significant, except for girls with "substantial SP" and a composite psychological score of 1–4. Loneliness and pupil acceptance were not significantly associated with SP in this model, with the exception of loneliness "sometimes" in girls with "substantial SP" and boys with "any SP" (Table 4).

Discussion

In this sample of Danish adolescents, the odds of reporting "any SP" or "substantial SP" were greatly increased with higher frequencies of psychological factors with ORs ranging from 2 to 13. Participants reporting "any SP" or "substantial

Fig. 4 **a** Logistic regression of individual psychological factors with any spinal pain. **b** Logistic regression of individual social factors with any spinal pain

a

A: Almost every month/every week
B: More than once per week/almost every day
Reference category: Rarely/Never
Any Spinal Pain: any frequency of spinal pain above "never" on the Young Spine Questionnaire regardless of pain intensity on the revised Faces Pain Scale, OR: odds ratio, CI: confidence interval

b

A: Sometimes
B: Often or very often
C: Neither agree nor disagree, disagree or strongly disagree
Reference Category: Never (loneliness) and Strongly agree or agree (pupil acceptance)
Any Spinal Pain: any frequency of spinal pain above "never" on the Young Spine Questionnaire regardless of pain intensity on the revised Faces Pain Scale, OR: odds ratio, CI: confidence interval

SP" reported significantly higher frequencies of all four psychological factors than those without SP. Furthermore, reporting multiple psychological factors with higher frequencies, indicated by a higher composite psychological score, resulted in an increased OR of reporting SP.

Recently, Stallknecht et al. found that Danish adolescents aged 10–14 reporting medium and high values of stress had an increased OR of reporting SP compared to those reporting no stress [28]. Adolescents who reported poorer general well-being also had increased odds for reporting SP compared to those who reported better well-being [28]. Similarly, in Dutch adolescents aged 12–16, stress and depressive symptoms were found to be associated with neck pain/shoulder pain and low back pain [7]. Two British studies assessed emotional factors in British adolescents aged 11–14 using the Strengths and Difficulties Questionnaire and both found that participants reporting high levels of "negative" behavior were significantly

more likely to report low back pain [24, 31]. Another British study found that children aged 11–14 who reported higher levels of psychosocial difficulties were more likely to develop LBP compared to their peers [18].

Previous studies have shown inconsistent evidence for the effect of sleep quantity on back pain onset in adolescents [2]. There is moderate evidence of no higher risk of poor sleep quality with back pain onset [2]. There is moderate quality evidence that boys with daytime tiredness are not at higher risk of back pain, but this evidence is inconsistent in girls [2]. Recent reviews have shown that there is a reciprocal relationship between sleep and pain and that sleep impairments are a stronger predictor of pain than pain is of sleep impairments [9].

In our study, those reporting "any SP" or "substantial SP" reported significantly higher levels of loneliness and lower levels of pupil acceptance than those without SP. When the social variables were both included in an analysis together

Fig. 5 a Logistic regression of individual psychological factors with substantial spinal pain. **b** Logistic regression of individual social factors with substantial spinal pain
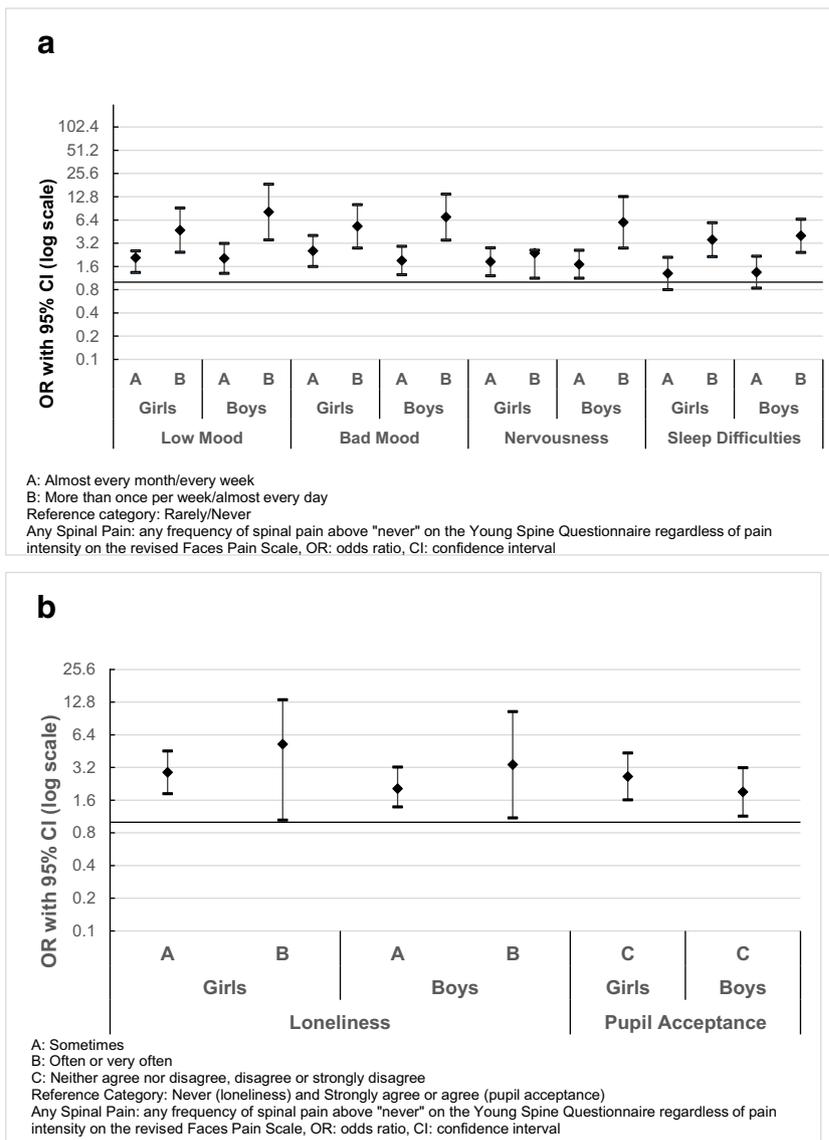
with SP, associations were still positive, but the estimates were lower and most of them not statistically significant. These findings are similar to a study by Watson et al. where participants reporting high levels of pupil problems had a small but significant OR for reporting LBP compared to those reporting low levels of pupil problems [31].

Table 2 Association between composite psychological score and spinal pain

	Any SP		Substantial SP	
	Girls	Boys	Girls	Boys
Psychological Composite Score[b]	Adjusted[a] OR (95% CI)	Adjusted[a] OR (95% CI)	Adjusted[a] OR (95% CI)	Adjusted[a] OR (95% CI)
0	1.0	1.0	1.0	1.0
1–4	2.58 (1.36, 4.93)	2.88 (1.75, 4.74)	1.83 (0.90, 3.71)	1.88 (1.06, 3.36)
5–16	4.62 (2.06, 10.35)	8.69 (3.92, 19.23)	5.85 (1.86, 11.97)	5.82 (3.23, 10.51)

SP spinal pain, *OR* odds ratio, *CI* confidence intervals

[a] Adjusted for socioeconomic status (SES) and age

[b] Composite psychological score: a score created by combining the reported frequencies of all four psychological variables to create a composite psychological score out of a total of 16

Table 3 Combined analysis of social factors and spinal pain

	Frequency	Any SP		Substantial SP	
		Girls Adjusted[a] OR (95% CI)	Boys Adjusted[a] OR (95% CI)	Girls Adjusted[a] OR (95% CI)	Boys Adjusted[a] OR (95% CI)
Loneliness	Never (ref)	1.0	1.0	1.0	1.0
	Sometimes	3.02 (1.26, 7.21)	5.35 (2.10, 13.64)	2.47 (1.53, 3.99)	1.94 (1.22, 3.08)
	Often or very often	3.49 (0.44, 27.66)	2.45 (0.31, 19.61)	4.36 (1.65, 11.51)	2.77 (0.88, 8.76)
Pupils accept me as I am	Strongly agree or agree (ref)	1.0	1.0	1.0	1.0
	Neither agree nor disagree, disagree or strongly disagree	0.81 (0.36, 1.84)	1.59 (0.72, 3.53)	1.74 (1.01, 3.01)	1.61 (0.95, 2.75)

SP spinal pain, *OR* odds ratio, *CI* confidence intervals

[a] Adjusted for socioeconomic status (SES) and age

When the composite psychological score and social variables were included in the same analysis, all the estimates were reduced. This indicates that loneliness and psychological scores are likely interdependent and thus lower the effect of one another when included in the same model.

There are several strengths in this study including the high participation rate (95%). The sample is also representative of the Danish population, increasing the generalizability of the study. The HBSC questionnaire is subjected to validation and piloting at national and international level [27] and the YSQ was developed and tested for this age group [21]. This study also provides information on two definitions of SP, which allows us to comment on the association between the frequency of psychological and social factors and the severity of reported SP.

However, this study also has some limitations. Due to the cross-sectional nature, neither causation nor direction of

association can be determined. The 95% CI for some associations are quite wide, and thus, results should be interpreted with caution. Due to missing SES data, a substantial number of participants were excluded from the adjusted analyses. These participants reported significantly higher frequencies of low mood, nervousness, loneliness, and pupil acceptance. Thus, their exclusion from the adjusted analyses have likely resulted in an underestimation of the reported ORs. Finally, the composite psychological scoring has not undergone a validation process.

There was a high prevalence of psychological and social factors among adolescents in this study cohort. Previous studies have shown that depression, stress, anxiety, sleeping difficulties, and loneliness can all result in negative health-related consequences, including SP. With SP causing such a high level of disability in the population, and SP beginning early in life, it is important to understand the factors associated with

Table 4 Combined analysis of the composite psychological score and social factors and spinal pain

	Frequency	Any SP		Substantial SP	
		Girls Adjusted[a] OR (95% CI)	Boys Adjusted[a] OR (95% CI)	Girls Adjusted[a] OR (95% CI)	Boys Adjusted[a] OR (95% CI)
Composite[b] psychological score	0 (ref)	1.0	1.0	1.0	1.0
	1–4	2.48 (1.29, 4.74)	2.67 (1.62, 4.42)	1.71 (0.83, 3.48)	1.82 (1.02, 3.26)
	5–16	3.46 (1.46, 8.18)	6.42 (2.81, 14.68)	4.10 (1.94, 8.67)	5.01 (2.70, 9.29)
Loneliness	Never (ref)	1.0	1.0	1.0	1.0
	Sometimes	2.31 (0.93, 5.78)	3.70 (1.42, 9.64)	1.70 (1.02, 2.86)	1.34 (0.82, 2.20)
	Often or very often	2.33 (0.28, 19.35)	1.44 (0.17, 12.51)	2.61 (0.95, 7.14)	1.64 (0.50, 5.39)
Pupils accept me as I am	Strongly agree or agree (ref)	1.0	1.0	1.0	1.0
	Neither agree nor disagree, disagree or strongly disagree	0.77 (0.34, 1.79)	1.17 (0.51, 2.68)	1.64 (0.94, 2.87)	1.25 (0.71, 2.17)

SP spinal pain, *OR* odds ratio, *CI* confidence intervals

[a] Adjusted for socioeconomic status (SES) and age

[b] Composite psychological score: a score created by combining the reported frequencies of all four psychological variables to create a composite psychological score out of a total of 16

the development and perpetuation of SP in adolescents. A better understanding of these factors is likely to lead to better preventative measures as well as more comprehensive intervention strategies in adolescents with SP.

Conclusion

This study indicated that psychological and social factors are associated with SP in adolescents with a higher frequency of these reported factors resulting in higher odds of reporting SP, especially "substantial SP". Psychological factors appear to be more strongly related to SP than the social variables. Together, this reinforces the importance of understanding psychological and social factors in adolescents reporting SP.

Compliance with ethical standards

Ethics For the SPACE study, a letter was sent to parents informing them of the study and that they could withdraw their child's participation at any time. For more details, see the SPACE protocol [29]. The Regional Ethics Committee for Southern Denmark was advised about the study and data collection. Under Danish law, no ethics approval was needed because the study did not include any invasive tests or interventions. Approval was obtained from the Danish Data Protection Agency (#2010-41-5147).

For the current study, Research Ethics Board approval was obtained from Canadian Memorial Chiropractic College (#172011).

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval Approval was obtained from the Danish Data Protection Agency (#2010-41-5147). Research Ethics Board approval was obtained from Canadian Memorial Chiropractic College (#172011).

Informed consent For the SPACE study, a letter was sent to parents informing them of the study and that they could withdraw their child's participation at any time.

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