Association between family history of surgically treated low back pain and adolescent low back pain

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Research Ethics Committee

The study protocol was approved by the Northern Ostrobothnia Hospital District Ethical Committee 108/2017 (15.1.2018).

Keywords

Low back pain; adolescent; Young Adult; surgery; Cross-Sectional Studies; Birth Cohort

Level of evidence: 4

Data Availability Statement

NFBC data are available from the University of Oulu, Infrastructure for Population Studies. Permission to use the data for research purposes can be applied for via an electronic material request portal. In the use of data, we followed the EU general data protection regulation (679/2016) and the Finnish Data Protection Act. The use of personal data was based on the cohort participants' written informed consent at their latest follow-up examination, which may cause limitations to its use. Please contact the NFBC project center (NFBCprojectcenter@oulu.fi) and visit the cohort website (www.oulu.fi/nfbc) for more information.

Conflicts of interest

None declared.

Key Points

- Having a family history of low back pain (LBP) and surgery was more common among adolescents with LBP.
- Adolescents who report a family history of LBP have higher odds of frequent LBP irrespectively of a family history of back surgery.
- No significant associations between a family history of back surgery and adolescent LBP were found among participants with a family history of LBP.

Abstract

Study Design: Cross-sectional.
Objective: To study the associations between a family history of surgically treated low back pain (LBP) and adolescent LBP.
Summary of Background Data: A family history of LBP is related to adolescent LBP, but whether a family history of back surgery is relevant to adolescent LBP is not known.
Methods: A subpopulation of the Northern Finland Birth Cohort 1986 was contacted when they were aged between 18 and 19 years. The postal questionnaire asked the participants to report their LBP and a relative's (mother, father, sibling) LBP and back surgery, and to provide data on potential covariates. The association between a family history of LBP ("no family history of LBP", "family history of LBP but no surgery", and "family history of LBP and surgery") and adolescent LBP (no LBP, occasional LBP, and frequent LBP) were evaluated using logistic regression analysis with odds ratios (ORs) and 95% confidence intervals (CIs), adjusted for sex, smoking, and psychological distress.
Results: Of the 1374 adolescents in the study, 33% reported occasional LBP and 9% frequent LBP. Both the "family history of LBP but no surgery" and "family history of LBP and surgery" categories were associated with frequent LBP (adjusted OR [aOR] 2.09, 95% CI 1.38–3.16; aOR 2.23, 95% CI 1.02–4.90, respectively). Occasional LBP was associated with the "family history of LBP and surgery" category. A subgroup analysis of adolescents with a family history of LBP found no statistically significant associations between family history of back surgery and adolescent LBP.
Conclusion: Our findings suggest that adolescents who report a family history of LBP have higher odds of frequent LBP irrespectively of a family history of back surgery.

Introduction

Children and adolescents with low back pain (LBP) globally show a relatively high incidence rate before turning 18 years[1]. Although in some cases, the pain relates to an injury or overuse due to certain sports, for example, a substantial part of those affected have non-specific LBP with no addressable underlying pathoanatomical cause[2-3]. Fortunately, LBP usually has a benign prognosis. However, for some, it persists or shows fluctuating symptoms in a long-term course from childhood to adulthood[4]. Several potential determinants of adolescent LBP exist, including sex[5], physical activity[6-7], body mass index (BMI)[8], smoking[9], and psychological distress[10].

Adolescence comprises the years during which critical development occurs under a high influence of family-related factors. As such, they, especially a family history of pain, have been scoped and highlighted in adolescent LBP[11-14]. Family history of pain might slow down recovery from LBP[15] and speed up earlier reoccurrence[16]. Adolescents are more likely to report LBP if both parents are affected, but a family history of pain itself seems to be of greater importance than which family member (mother, father, or sibling) has experienced pain[13].

In a meta-analysis[13], a history of family members' disabling pain or pain requiring treatment or use of healthcare services was associated with nearly two-fold odds of adolescent musculoskeletal (MS) pain, including LBP. However, the studies were of low quality and none of them accurately specified treatment. Hence, the characteristics of a family history of pain relevant to adolescent LBP are largely unknown, and further studies have been called for[13]. Among adults, individuals with LBP, in comparison to their pain-free counterparts, have shown to be more likely to have relatives who have undergone back surgery[17-18]. However, whether this is also the case among adolescents has not been specifically elucidated.

In this birth cohort study of 18-year-old adolescents, we first studied whether having a) a family history of LBP and surgery and b) a family history of LBP but no surgery increases the odds of LBP among adolescents in comparison to having no family history of LBP. Secondly, we explored whether a family history of back surgery increases the odds of adolescent LBP among those with a family history of LBP. We hypothesized that a family history of LBP and surgery in particular would increase the odds of LBP, and that a family history of back surgery would be related to adolescent LBP.

Materials and methods

Study sample

Our study sample consisted of the Northern Finland Birth Cohort 1986 (NFBC1986) members who lived within 100 km of the city of Oulu in 2003–2004 (referred to as the Oulu Back Study [OBS]), with a mean age of 18 years. The OBS population is a subpopulation of the original NFBC1986 which includes all children whose expected date of birth was between July 1st, 1985 and June 30th, 1986, and whose families lived in the Northernmost provinces of Finland at that time (n=9432)[19]. The study design and the population of the NFBC1986 are described elsewhere in detail[20].

Of the 2969 eligible OBS participants, 2012 (68%) replied to a postal survey. The full postal survey can be found in the Northern Finland Cohort website in Finnish (https://www.oulu.fi/nfbc/back_study). Information on family history of LBP and back surgery was available for 1906 participants and on adolescent LBP for 1720 individuals, after excluding those with trauma-related LBP. A total of 1374 participants gave their written consent for their data to be used and answered all the relevant questions. The study protocol was approved by the Northern Ostrobothnia Hospital District Ethical Committee 108/2017 (15.1.2018).

Low back pain

The questionnaire asked the participants to report whether they had ever had LBP (excluding menstruation-related LBP). Those who answered "yes" to the questions were further asked to state the number of many days on which they had had LBP in the last year and whether their LBP was caused by a trauma. Then, those who did not have trauma-related LBP were grouped into three categories: no LBP, occasional LBP (=under 30 days), and frequent LBP (=30 days or more). The questions on LBP were accompanied by a drawn manikin to illustrate the lower back area for the respondents.

Family history of low back pain and surgery

In the present study, we focused on LBP among the participants' closest relatives, i.e., father, mother, and sibling(s). Data on family history of LBP were collected by eliciting whether some of the family members had had recurrent and chronic (lasting three months or more) LBP that had caused disability in daily activities. Back surgery information was elicited by asking whether any of the participants' family members had undergone back surgery. All the questions had three response options (no, I don't know, and yes) and were posed separately to each family member. The respondents who replied "yes" to the LBP question and the surgery question with respect to some or all family members were classified as "family history of LBP and surgery". Those who answered "yes" to the LBP question on some or all family members, and "no" or "I don't know" to the surgery question on all family members were classified as "family history of LBP but no surgery". Finally, the third category was formed from the respondents who responded “no” or “I don’t know” to the LBP question on all the family members and was called “no family history of LBP”. The third category was used as a reference.

Covariate candidates

Sex[5], physical activity[6-7], body mass index (BMI)[8], smoking[9], and psychological distress[10] were chosen as covariate candidates on the basis of the existing literature.

The level of brisk physical activity outside school or working hours was used to divide the participants into three categories: 1) inactive (under one hour per week), 2) moderately active (two to three hours per week), and 3) active (four or more hours per week). In the questionnaire, brisk activity was defined as physical activity causing at least some shortness of breath or sweating. BMI was calculated from reported weight and height (kg/m^2) and was considered a trichotomized variable: <25 kg/m^2 (normal weight), 25–29.9 kg/m^2 (overweight), and 30 or over kg/m^2 (obese). The participants were classified into non-smokers, non-regular smokers, and regular smokers (smoking at least once a week) on the basis of their current smoking behavior. Evaluation of psychological distress was based on a valid and generally used questionnaire, the General Health Questionnaire (GHQ-12)[21-22], which contains 12 items assessing an individual's psychological performance, for example, self-confidence, sleep disturbances, and depressive/anxious symptoms. In the GHQ-12, each item is rated on a four-point Likert scale, from which the total score ranging from 0 to 12 is calculated. We set the threshold at three points, according to the Finnish population-based recommendations[23] and classified the participants as follows: no significant psychological distress (0–3 points) and significant psychological distress (4–12 points).

Statistical analysis

Associations between family history of LBP and surgery (an explanatory factor) and adolescent LBP (an outcome) were analyzed using multinomial logistic regression analysis, with odds ratios (ORs) and their 95% confidence intervals (CIs). The selection of the final covariates was also based on the statistically significant univariate association with the outcome in the logistic model. Physical activity and BMI were not related to the outcome, and therefore, the final models included sex, smoking, and psychological distress as covariates: 1) sex-adjusted and 2) fully adjusted. To further study the role of a family history of surgery in adolescent LBP, we conducted a sub-analysis among those with a family history of LBP. To describe the LBP categories more specifically, we presented the frequencies and percentages of all the other variables within the categories. We also compared these variables of the study sample and the rest of the OBS population to identify selection bias related to non-responders. In both analyses, we tested statistical significance using the Chi-square test. Analyses were performed using SPSS, version 27.0. Statistical significance was set at a p value of <0.05.

Results

Characteristics of the study sample

In this study of 1374 adolescents, 33% had occasional LBP and 9% frequent LBP (Table 1). A greater number of adolescents with frequent LBP were women and regular smokers, and recorded more significant psychological distress ($p<0.05$ for all) than those in the “occasional LBP” and “no LBP” categories. A family history of LBP with and without surgery were more common in the “occasional LBP” and “frequent LBP” categories than in the “no LBP” category ($p<0.05$).

Representativeness of the study sample

Table 2 presents the distribution of the studied variables within the study sample and the rest of the OBS population. A slightly higher number of participants were women (56% vs. 50%, p=0.006) and physically inactive (39% vs. 31%, p=0.012) than in the rest of the OBS population. There were no statistically significant differences in terms of smoking, BMI, psychological distress, LBP, and family history of LBP.

Associations between adolescent low back pain and family history of low back pain and surgery

Both "family history of LBP and surgery" and "family history of LBP but no surgery" categories associated significantly with frequent LBP in comparison to the "no family history of LBP" category (adjusted OR [aOR] 2.23, 95% CI 1.02–4.90; aOR 2.09, 95% CI 1.38–3.16, respectively; Table 3). In addition, adolescents with a family history of LBP and surgery had two times higher odds of reporting occasional LBP (aOR 1.81, 95% CI 1.11–3.00). A sub-analysis of those with a family history of LBP (Table 4) found no statistically significant associations between a family history of surgery and adolescent LBP.

Discussion

In this birth cohort study on 18-year-old adolescents, frequent LBP associated significantly with both "family history of LBP and surgery" and "family history of LBP but no surgery" categories when compared with counterparts with no family history of LBP. The associations were significant in both partly adjusted and fully adjusted models. However, family history of back surgery did not increase the odds of adolescent LBP among those with a family history of LBP.

Between 31% and 44% of adolescents with occasional or frequent LBP belonged to a family in which the father, mother, or sibling(s) had had chronic and disabling LBP. LBP was reported by 54% of participants with a positive family history of LBP and surgery, while the corresponding figure was 47% among those with a family history of LBP but no surgery, and 40% in the “no LBP” category. These likely reflect the aggregative nature of pain problems also within a Finnish family, but also emphasize the presence of a family history of back surgery in the adolescent LBP occurrence. In an Iranian study of 11- to 19-year-olds, 46% of participants with LBP and 22% of those without LBP had a family history of LBP[24]. Almost identical prevalence rates were also observed among Chinese adolescents aged 10 to 18 years[25]. Italian adolescents at the age of 14 to 19, in turn, reported higher levels of family history of LBP in both the LBP and no LBP groups (62% vs. 44%)[26]. Different definitions/operationalization of LBP and family history of LBP and cultural aspects may account for these differences, and direct comparisons to the prevalence of a family history of back surgery cannot be made due to unavailable information. In general, the prevalence rates of reported LBP were in line with previous literature[4,27].

Adolescents with a family history of surgically treated LBP had over two-fold odds of frequent LBP, compared with “no family history of LBP”. However, similar odds of having frequent LBP were also detected among the participants with a family history of LBP but no back surgery. Moreover, in the sub-analysis of participants with a family history of LBP, relative’s history of back surgery was not associated with adolescent LBP. In general, these results rather support the existing knowledge of the role of a family history of LBP in adolescent LBP than emphasize the presence of a history of back surgery. Still, we believe that a family history of back surgery is an element that requires further study among adolescents. Although our data did not show a consistent association between a family history of back surgery and adolescent LBP, ORs in the sub-analysis were of borderline significance.

In their study, Matsui et al.[17] compared 24 adult pain patients who were immediate relatives of patients who had undergone back surgery to controls without a family history of back surgery. They found that the patients had a more severe grade of disc degeneration and a higher prevalence of disc herniations in magnetic resonance imaging than the controls. In their questionnaire-based study, Postacchini et al.[18] in turn noticed that individuals with LBP had more first-degree relatives who had undergone back surgery than their counterparts without LBP. Although these studies were conducted among adult populations, they emphasize the need of additional studies. A recent review[11] found that 15 of 19 studies reported a positive association between family history of pain and adolescent back pain, and a meta-analysis of longitudinal studies found that children and adolescents with a family history of pain had 58% higher odds of MS pain[13]. Even though Dario et al.[13] elucidated MS pain rather than specifically LBP and none of the studies in the meta-analysis evaluated the influence of a family history of LBP and surgery on adolescent pain[28-32], our estimates are of similar magnitude to those of their study.

On a speculative note, adolescents might have a higher grade of disc degeneration, predisposed by genetics[33], that may explain the observations at some level at least. Another potential explanation is that heritable back disorders are concentrated among adolescents with a family history of LBP. For instance, Lumbar Scheuermann's disorder is found to be inheritable and related to LBP in adolescent populations[34-35]. Parents whose offspring suffer pain often report higher levels of somatization and protective behaviour[36] which may also contribute to the occurrence of adolescent LBP. Moreover, it may be that beliefs about pain, such as fear-avoidance, are prone to develop within a "pain-rich" family environment[37], and create elevated pain reports. Health-related behaviors shared by family members[6] and socioeconomic environment in general[5] may also potentially explain the aggregation of pain symptoms within families.

Strengths and limitations

According to the best of our knowledge, to date, no study has specifically examined the association between family history of LBP and surgery and adolescent LBP. In this sense, the present study is among the first in the field. As there were only minor differences between the health behaviors and sex-distribution in the study sample and in the rest of the OBS population (Table 2), the study sample can be regarded as representative of the OBS target population, which in turn is representative of the original NFBC1986 cohort[38]. Moreover, we were able to exclude trauma- and menstruation-related LBP from the analyses and clarify the potential influence of back surgery on adolescent LBP irrespective of psychological symptoms and health behaviors. Self-reported data with dropouts and recall bias are the main limitations of our study. The data on LBP and back surgery were also self-reported and thus susceptible to inaccuracies and bias. On the other hand, offspring-reported parental pain is believed to have high sensitivity and modest specificity[39]. The number of participants in certain groups was low, which needs to be considered when interpreting the findings. Unfortunately, we had no information on living conditions, i.e., whether adolescents lived or had lived with their parent(s)/sibling(s), which can be also listed as a limitation of this study. An additional limitation may be the cross-sectional design, which restricts the evaluation of causality.

Conclusions

Our findings show that adolescents with a family history of LBP have higher odds of LBP and in particular frequent LBP, regardless of a history of back surgery. In addition, family history of back surgery was not associated with adolescent LBP among those with a family history of

LBP. These findings highlight the relevance of a family history of LBP in adolescent LBP and encourage exploring the benefits of using a family history of LBP as a screening tool[13]. Still, we believe that a family history of back surgery is an element that requires further study among adolescents in more detail in other populations and prospective designs.

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Table 1. Characteristics of study sample, stratified by low back pain (LBP) frequency during preceding year, % (n).

	No low back pain (n=791)	Occasional LBP (n=457)	Frequent LBP (n=126)	P value (chi-square test)
Sex				0.003
Women	53 (419)	59 (270)	68 (85)	
Men	47 (372)	41 (187)	33 (41)	
Smoking				<0.001
Non-smoker	60 (477)	55 (253)	41 (51)	
Non-regular smoker	14 (110)	17 (79)	17 (21)	
Regular smoker	26 (204)	27 (125)	43 (54)	
Physical activity*				0.781
Active	32 (252)	36 (161)	33 (41)	
Moderately active	29 (230)	27 (124)	28 (35)	
Inactive	39 (308)	37 (169)	40 (50)	
Body mass index*				0.071
<25 kg/m^2	89 (683)	85 (383)	82 (102)	
25–29.9 kg/m^2	9 (70)	13 (57)	13 (16)	
30 kg/m^2 or over	2 (16)	2 (9)	5 (6)	
Psychological distress				0.004
Not significant	81 (637)	75 (342)	69 (87)	
Significant	20 (154)	25 (115)	31 (39)	
Family history of LBP				0.001
No family history of LBP	73 (580)	69 (315)	56 (71)	
Family history of LBP but no surgery	22 (175)	24 (108)	37 (46)	
Family history of LBP and surgery	5 (36)	7 (34)	7 (9)	

*N varies due to missing data.
Occasional LBP=under 30 days of LBP per year
Frequent LBP=30 days or more of LBP per year

Table 2. Representativeness of study sample, % (n).

	Study sample (n=1374)	Rest of the OBS population	P value (chi-square test)
Sex			0.006
Women	56 (774)	50 (291)	
Men	44 (600)	50 (296)	
Smoking			0.238
Non-smoker	57 (781)	52 (164)	
Non-regular smoker	15 (210)	16 (49)	
Regular smoker	28 (383)	32 (102)	
Physical activity*			0.012
Active	33 (454)	41 (133)	
Moderately active	28 (389)	28 (90)	
Inactive	39 (527)	31 (100)	
Body mass index*			0.745
<25 kg/m^2	87 (1168)	86 (267)	
25–29.9 kg/m^2	11 (143)	12 (36)	
30 kg/m^2 or over	2 (31)	3 (9)	
Psychological distress			0.809
Not significant	78 (1066)	77 (410)	
Significant	22 (308)	23 (122)	
Low back pain (LBP)			0.754
No LBP	58 (791)	58 (199)	
Occasional LBP	33 (457)	32 (111)	
Frequent LBP	9 (126)	10 (36)	
Family history of LBP			0.133
No family history of LBP	70 (966)	66 (353)	
Family history of LBP but no surgery	24 (329)	28 (151)	
Family history of LBP and surgery	6 (79)	5 (28)	

*N varies in study sample category due to missing data.
OBS=Oulu Back Study
Occasional LBP=under 30 days of LBP per year
Frequent LBP=30 days or more of LBP per year

Table 3. Odds ratios and 95% confidence intervals for associations between adolescent low back pain (LBP) and family history of LBP and surgery (n=1374).

	Sex-adjusted			*Fully adjusted**		
	Frequent LBP	Occasional LBP	No LBP	Frequent LBP	Occasional LBP	No LBP
Family history of LBP and surgery	2.12 (0.98–4.60)	**1.77** (1.08–2.88)	Ref.	**2.23** (1.02–4.90)	**1.81** (1.11–3.00)	Ref.
Family history of LBP but no surgery	**2.12** (1.41–3.19)	1.13 (0.86–1.49)	Ref.	**2.09** (1.38–3.16)	1.12 (0.85–1.48)	Ref.
No family history of LBP		Ref.			Ref.	

*Adjusted for sex, smoking, and psychological distress.

Table 4. Sub-analysis of associations between adolescent low back pain (LBP) and family history of back surgery among adolescents with family history of LBP (n=408). Odds ratios and their 95% confidence intervals.

	Sex-adjusted			*Fully adjusted**		
	Frequent LBP	Occasional LBP	No LBP	Frequent LBP	Occasional LBP	No LBP
Family history of back surgery	1.03 (0.46–2.30)	1.57 (0.93–2.67)	Ref.	1.09 (0.48–2.45)	1.61 (0.94–2.74)	Ref.
No family history of back surgery		Ref.			Ref.	

*Adjusted for sex, smoking, and psychological distress.