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a secondary cross-sectional analysis of 323 subjects

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Observational Studies

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Analgesic use in adolescents with patellofemoral pain or Osgood–Schlatter Disease: a secondary cross-sectional analysis of 323 subjects

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Abstract

Objectives: The prevalence of pain medication use for adolescent knee pain and factors associated with use are not well understood. This study aimed to determine the self-reported use of pain medication for knee pain and identify factors associated with use in adolescents (age 10–19) with longstanding knee symptoms.

Methods: In this exploratory cross-sectional study, we performed a secondary analysis of data previously collected in 323 adolescents with longstanding knee pain. Factors associated with pain medication use were assessed using multivariable logistic regressions. Analyses were repeated with stratification by age, sex, sport participation frequency, knee pain duration, and knee pain intensity.

Results: Among 323 adolescents (mean age 14.4 ± 2.5 , 73% female), 84% had patellofemoral pain, (peri- or retro-patellar pain during loaded bending of the knee) and 16% had Osgood–Schlatter Disease (apophysitis with swelling and localized pain at the tibial tuberosity). Twenty-one

percent (95% CI 16–25%) of adolescents reported pain medication use for their knee pain, with no difference in usage between those \leq vs. $>$ 15 years of age (21%, 95% CI 16–27% vs. 20%, 95% CI 13–29%). Adolescents with patellofemoral pain reported greater usage than their counterparts with Osgood–Schlatter Disease (22%, 95% CI 17–28% vs. 12%, 95% CI 4.5–24.3%). The most consistent factor associated with use was knee-related symptoms, observed in both the overall (OR 0.97, 95% CI 0.94–0.99) and stratified analyses (ORs ranged from 0.89 to 0.96).

Conclusions: Approximately one in five adolescents with longstanding knee pain reported pain medication use, particularly in adolescents with patellofemoral pain. Knee-related symptoms most consistently associated with the use of pain medications in this population. Future longitudinal studies with data collected at multiple time-points are needed to validate these findings.

Implications: Self-reported pain medication use is common in adolescents with longstanding knee pain, even though whether pharmacological therapy is the best pain management option at this young age is debatable. Reliance on pain medication at an early age could potentially hamper the development of healthy pain coping strategies and increase the risk of dependence and misuse later in life. Future studies should assess the safety, efficacy, and risks of long-term use of pain medications for adolescent knee pain.

Keywords: adolescent; analgesics; cross-sectional studies; knee joint; pain management; patellofemoral pain syndrome.

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Introduction

The use of pain medications in adolescents is a rising concern in Denmark, which has the highest rate of paracetamol use among the Nordic Countries. In Denmark, there has been a 30% increase in the use of paracetamol from 2000 to 2015 [1]. Pain medications are often the first-line treatment for musculoskeletal (MSK) pain, despite no clear

evidence regarding potential benefits or harms in adolescents [2–5]. Adolescents often turn to over-the-counter pain medications, such as paracetamol and NSAIDs, for short-term symptomatic relief without their parents' knowledge [6]. Our recent systematic review [7] found that pain medication use was prevalent among children and adolescents with MSK pain: ranging from 8 to 42% of those in school settings and up to 75% of those from pain clinics or participating in sports. This review also showed that adolescents with more severe pain complaints (e.g., longer pain duration, higher pain intensity and disability) and experiencing psychological distress were each more likely to use pain medications; and there were weaker, inconsistent associations of older age and female sex with use. These findings suggest certain subgroups of adolescents may be at an elevated risk for using pain medications to manage their symptoms. Notably, our review did not identify any study examining the use of pain medications in adolescents with chronic knee pain, one of the most common pain complaints in this age group.

Knee pain is experienced in approximately one in every three adolescents [8, 9] and up to 40% will continue to experience pain even after 5 years post initial onset [10]. The two most commonly diagnosed chronic knee conditions during adolescence are patellofemoral pain (PFP), characterized by insidious onset of poorly defined peri- or retro-patellar pain during loaded bending of the knee [11] and Osgood–Schlatter Disease (OSD), which is an apophysitis of the tibial tuberosity, characterized by swelling and localized pain at the tibial tuberosity [12]. Little is known about the prevalence of pain medication use and factors associated with use in these adolescents with longstanding knee pain. Whether the strengths of association differ in subgroups of adolescents (e.g., male vs. female, older vs. younger, high vs. low sports participation) have not been examined. To fill these knowledge gaps, we will leverage baseline data previously collected in three different studies on knee pain in Danish adolescents: a prospective study of 151 adolescents

aged 10–14 with PFP [13], a randomised controlled trial of 121 adolescents aged 15–19 with PFP [14] and a prospective study of 51 adolescents aged 10–14 with OSD [12].

The primary aims of this cross-sectional study were to characterize the use of pain medication and identify factors associated with use among 10-to-19-year-old adolescents with longstanding knee pain. To explore effect modifications, we conducted secondary stratified analyses by factors that were previously identified as potentially affecting the use of pain medication, such as age, sex, sport participation frequency, knee pain duration and knee pain intensity. The potential association with other factors that were not investigated in previous studies, such as body mass index (BMI) and presence of pain in both knees was assessed as well.

Methods

Study design and setting

This is an exploratory cross-sectional secondary analysis of data collected in three previous studies on adolescent knee pain [12–14], including a total of 323 adolescents aged 10–19 (Figure 1). These studies were conducted in Denmark, where only individuals >15 years of age are allowed to purchase pain medication unsupervised [15]. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline [16].

Participants

Recruitments and inclusion/exclusion criteria were detailed in the original publications [12–14]. Briefly, adolescents were recruited from schools, social media and general practices in Denmark. Adolescents who reported knee pain on a questionnaire or who responded to a social media advertisement were considered potentially eligible and subsequently screened through a phone interview. Adolescents deemed eligible by the phone interview were invited for a clinical examination with two study physical therapists to confirm a diagnosis

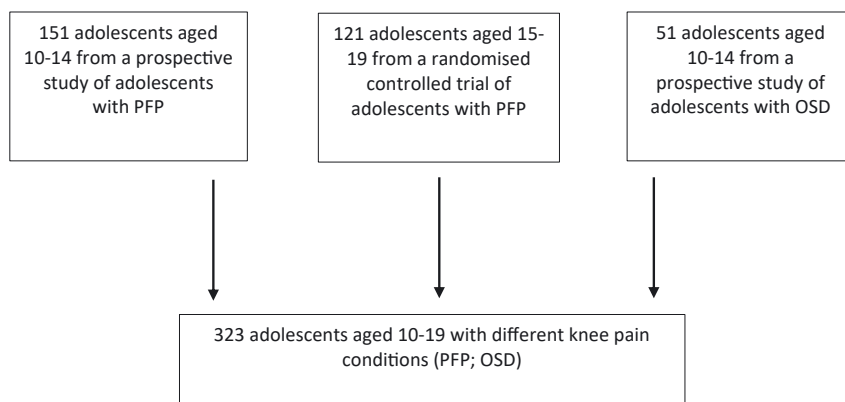


Figure 1: Description of the study sample.

for knee pain. Enrolled participants gave parental written informed consents.

Assessment of pain medication use (outcome variable)

Participants were asked to self-report their use of pain medication for knee pain by answering “yes” vs. “no” to the question “Do you use pain medication due to your knee pain?”.

Assessment of demographic and health-related factors (exposure variables)

Age, sex, and BMI: At the time of study enrolment, participants were asked to indicate their age and sex; body height and weight were measured using a scale and a stadiometer. BMI was computed as $\text{weight}/[\text{height}]^2$ in kg/m^2 .

Knee pain characteristics: Bilateral knee pain presence (yes vs. no) was assessed by asking participants whether they experienced knee pain in one or both knees. Knee pain duration was ascertained by the question “For how long have you experienced knee pain?”. Responses were subsequently calculated in years. Knee pain intensity was rated by worst pain during the previous week on a 0-to-100-mm visual analogue scale (VAS). In the presence of bilateral knee pain, participants were instructed to report duration and intensity of their most painful knee.

Knee injury and Osteoarthritis Outcome Score (KOOS): The KOOS is a self-administered instrument consisting of 42 items in five subscales of Pain (pain frequency and pain severity), Symptoms (other symptoms, such as swelling, restricted range of motion, and mechanical symptoms), ADL (difficulties in function in daily living activities), Sport/Rec (difficulties in function in sport and recreation, and QOL (knee-related quality of life) [17]. Each item was scored on a 0-to-4 Likert scale, where 0=no problems and 4=extreme problems. Scores were transformed to a scale ranging from 0 (extreme knee problems) to 100 (no knee problems) [17].

Sport participation: Participants were asked to indicate whether they participated in leisure time sports (Yes vs. No) and the type, duration, and frequency (times per week) of participation.

EuroQol 5-dimensions – youth version (EQ-5D-Y): Participants’ health-related quality of life was assessed using the youth version of the European Quality of Life-5 Dimensions (EQ-5D-Y) [18, 19]. The five dimensions included mobility (walking about), self-care (looking after oneself), usual activities (doing usual activities), pain/discomfort (having pain or discomfort), and anxiety/depression (feeling worried, sad or unhappy). Participants also rated the overall health on a vertical visual analogue scale (EQ-5D-Y VAS) [18, 19]. The five items can be converted into an index score, which ranges from -0.59 to 1.00 (higher scores indicate better quality of life).

Statistical analysis

Descriptive analysis was performed, and data were inspected for normality both visually and quantitatively using the Shapiro–Wilk

test for normality. Data were reported as means and standard deviations (SD), medians and inter-quartile ranges (IQR) or as counts (%) where appropriate. Univariable logistic regressions assessed the association of each of the exposure variables, including age, sex, BMI, sport participation, presence of bilateral knee pain, knee pain duration, pain intensity, each of the five KOOS subscale score, each of the six EQ-5D-Y score, the total EQ-5D-Y index score, with the use of pain medication (binary outcome). Following the purposeful selection of variables method [20], backward selection (removing variables with $p \geq 0.15$ in the univariable models) was used to develop the final multivariable logistic regression analysis. We summarized the results as adjusted odds ratios and 95% confidence intervals (CIs) for associations between each exposure variable and pain medication use. Exploratory multivariable stratified analysis was performed to identify potential effect modification by age (≤ 15 vs. > 15 years of age), sex (males vs. females), sport participation frequency (0 vs. 1–3 vs. > 3 times/week), knee pain duration (< 2 vs. ≥ 2 years) and knee pain intensity (score at ≤ 35 vs. 36–54 vs. 55–70 vs. > 70). We chose 15 years of age as a cutpoint, based on the Danish regulation that only individuals older than 15 years of age are allowed to purchase pain medication unsupervised [6, 15]. For the other variables, the cutpoints were selected to ensure similar numbers of adolescents in each subgroup. All statistical analyses were conducted using STATA 14.

Results

Pain medication use

One in every five adolescents (20.6%, 95% CI 16.3–25.4%) reported using pain medication for knee pain. The use of pain medication was more frequent among adolescents with PFP (22.2%, 95% CI 17.4–27.7%) compared to OSD (12.0%, 95% CI 4.5–24.3%). The use of pain medication was similar between adolescents \leq and > 15 years of age (20.9%, 95% CI 15.6–27.2% vs. 20.0%, 95% CI 13.1–28.5%) (Table 1). The prevalence of pain medication use was slightly higher among females (21.9%, 95% CI 16.8–27.8%) than males (16.8, 95% CI 9.5–26.7%).

Sample characteristics

Table 1 summarizes study participant characteristics ($n=323$; 73% female; 84% had PFP and 16% OSD). The mean (standard deviation, SD) age was 14.4 (2.5) years. Most adolescents (62%) reported active participation in sport (median frequency: 2 times/week; Interquartile range, IQR=0–7). Many adolescents had bilateral knee pain (74%). The median knee pain duration was 2 years (IQR=0.2–7.3) and the median pain intensity score was 54.5 (IQR=0–97). Median (IQR) scores for the KOOS subscales were: 69 (61–78) for KOOS pain, 71 (61–82) for KOOS symptom, 79 (69–87) for KOOS ADL. The mean (SD) score

Table 1: Baseline sample characteristics.

Variable	Mean \pm SD, (range)	N	Missing, %
Age	14.4 \pm 2.5 (10–19)	323	0 (0%)
Sex	Female	237 (73.4%)	0 (0%)
	Male	86 (26.6%)	
BMI	20.3 \pm 3.1 (14.1–32.8)	323	0 (0%)
Knee pain type	PFP	272	0 (0%)
	OSD	51	0 (0%)
Bilateral pain	Yes	241 (74.8%)	1 (0.3%)
	No	81 (25.2%)	
Sport active	Yes	202 (62.9%)	2 (0.6%)
	No	119 (37.1%)	
KOOS sport recreational	55 \pm 21 (5–100)	316	7 (2.2%)
KOOS quality of life	51 \pm 18 (0–100)	316	7 (2.2%)
Variable	Median (interquartile range)	N	Missing (%)
KOOS pain	69 (61–78)	316	7 (2.2%)
KOOS symptom	71 (61–82)	316	7 (2.2%)
KOOS adl	79 (69–87)	316	7 (2.2%)
Sport time/week	2.0 (0–7)	323	0 (0%)
Knee pain duration, years	2.0 (0.2–7.3)	322	1 (0.3%)
Pain intensity	54.5 (0–97)	300	23 (7.1%)
Variable	Prevalence (95% CI)	N	Missing (%)
Pain medication use			
Total sample	20.6 (16.3–25.4)	66 (Yes) 254 (No)	3 (0.9%)
Adolescents with PFP	22.2 (17.4–27.7)	60 (Yes) 210 (No)	
Adolescents with OSD	12.0 (4.5–24.3)	6 (Yes) 44 (No)	
Age \leq 15	20.9 (15.6–27.2)	43 (Yes)	
Age $>$ 15	20.0 (13.1–28.5)	162 (No) 23 (Yes) 92 (No)	
Females	21.9 (16.8–27.8)	52 (Yes) 185 (No)	
Males	16.8 (9.5–26.7)	14 (Yes) 69 (No)	
Variable	Category	N	Missing (%)
EQ-5D-Y mobility	No problems	163 (51.6%)	7 (2.2%)
	Some problems	145 (45.9%)	
	Extreme problems	8 (2.5%)	
EQ-5D-Y self-care	No problems	293 (92.7%)	7 (2.2%)
	Some problems	23 (7.3%)	
	Extreme problems	0 (0%)	
EQ-5D-Y usual activities	No problems	66 (20.9%)	7 (2.2%)
	Some problems	217 (68.7%)	
	Extreme problems	33 (10.4%)	
EQ-5D-Y discomfort	No problems	19 (6.0%)	7 (2.2%)
	Some problems	243 (76.9%)	
	Extreme problems	54 (17.1%)	
EQ-5D-Y anxiety/depression	No problems	261 (82.6%)	7 (2.2%)
	Some problems	49 (15.5%)	
	Extreme problems	6 (1.9%)	
EQ-5D-Y VAS	70.7 \pm 19.1 (10–100)	316	7 (2.2%)
EQ-5D-Y score	0.60 \pm 0.28 (–0.32 to 1)	316	7 (2.2%)

for KOOS function in sport and recreation was 56 (21), and 51 (18) for KOOS quality of life. Regarding the EQ-5D items, most adolescents reported no problems with self-care (92%) and anxiety/depression (83%) and “some problems” with mobility (46%), with performing usual activities (69%) and with discomfort (77%). The mean (SD) EQ-5D index score was 0.60 (0.28).

Univariable analysis

As shown in Table 2, longer duration of knee pain and more problems with anxiety/depression were each statistically significantly associated with increased odds of pain medication use. Among the KOOS subscales, higher scores (indicating better status) in Pain, Symptoms, ADL, QOL were each statistically significantly associated with reduced odds of pain medication use. Knee pain intensity, knee-related difficulties in sport and recreation (KOOS Sport/Rec), mobility (EQ-5D-Y Mobility) and self-rated overall health (EQ-5D-Y VAS) were not statistically significantly associated with pain medication use. However, they had a p value <0.15 and were therefore included in the final multivariable analysis.

Table 2: Results of univariable logistic regression of the factors associated with the use of pain medication.

Variable	Odds ratio	95% CI	p-Value
Age (n=320)	0.96	0.86–1.07	0.472
Sex (n=320)	0.72	0.38–1.39	0.327
BMI (n=320)	1.03	0.94–1.12	0.509
Bilateral pain (n=319)	0.65	0.36–1.18	0.158
Sport active (n=318)	1.07	0.60–1.88	0.828
Sport time/week (n=320)	0.92	0.79–1.06	0.251
Knee pain duration (n=319)	1.23	1.06–1.42	0.007 ^a
Pain intensity (n=297)	1.01	0.99–1.02	0.137
KOOS pain (n=313)	0.97	0.95–0.99	0.001 ^a
KOOS symptom (n=313)	0.97	0.95–0.99	$<0.001^a$
KOOS function in daily living (n=313)	0.98	0.96–0.99	0.011 ^a
KOOS sport and recreation (n=313)	0.99	0.98–1.00	0.146
KOOS quality of life (n=313)	0.98	0.97–0.99	0.028 ^a
EQ-5D-Y mobility (n=313)	1.62	0.99–2.64	0.056
EQ-5D-Y self-care (n=313)	1.06	0.38–2.98	0.905
EQ-5D-Y usual activities (n=313)	0.83	0.51–1.38	0.480
EQ-5D-Y pain discomfort (n=313)	1.25	0.70–2.23	0.450
EQ-5D-Y anxiety/depression (n=313)	2.20	1.28–3.79	0.005 ^a
EQ-5D-Y VAS (n=313)	0.99	0.97–1.00	0.051
EQ-5D-Y score (n=313)	0.53	0.21–1.33	0.178

^a p value <0.05 .

Multivariable analysis

As shown in Table 3, only KOOS Symptoms subscale was significantly associated with pain medication use. For every one-unit decrease in KOOS Symptoms score, there was 3% reduced odds of use (OR 0.97, 95% CI 0.94–0.99%). Results of the stratified multivariable analysis varied (Supplementary Tables 1–4). Among adolescents ≤ 15 years of age, higher pain intensity and better KOOS Symptoms subscale score were each associated with reduced odds of pain medication use, while more problems with anxiety/depression with increased odds. Among adolescents >15 years of age, no factor was associated with use. When stratified by knee pain duration, having more problems with anxiety/depression was associated with increased odds for pain medication use among adolescents who reported having knee pain for <2 years. In the analysis stratified by pain intensity, having better KOOS Symptoms subscale score was associated with decreased odds of pain medication use among those with a score ≤ 54 . Non-sport-participating adolescents (0 times/week) with better KOOS Symptoms subscale had lower odds of pain medication use. No other variables were statistically significantly associated with the use of pain medication in the remaining stratified analyses.

Discussion

One in every five adolescents with either PFP or OSD use pain medication for knee symptom relief. The use of pain medication among adolescents with PFP was twice as high compared to those with OSD (22 vs. 12%), although there was large imprecision in the estimates. The pattern of pain medication use was similar between adolescents ≤ 15 years of age (21%) and those >15 years old (20%). The most

Table 3: Results of multivariable logistic regression of the factors associated with the use of pain medication.

Variable (n=297)	Odds ratio	95% CI	p-Value
Knee pain duration	1.16	0.98–1.37	0.081
Pain intensity	0.99	0.98–1.01	0.551
KOOS pain	0.97	0.93–1.00	0.068
KOOS symptom	0.97	0.94–0.99	0.016 ^a
KOOS function in daily living	1.03	0.98–1.06	0.236
KOOS sport and recreation	1.01	0.99–1.03	0.499
KOOS quality of life	0.99	0.97–1.02	0.910
EQ-5D-Y mobility	1.06	0.54–2.06	0.870
EQ-5D-Y anxiety/depression	1.71	0.91–3.20	0.096
EQ-5D-Y VAS	0.99	0.98–1.01	0.608

^a p value <0.05 .

consistent factor associated with pain medication use was having other knee-related symptoms (i.e., KOOS Symptoms) both in the overall and stratified analyses. Lower pain intensity was associated with the use of pain medication only in adolescents ≤ 15 years of age. Having more problems with anxiety/depression was associated with increased use of pain medication among adolescents ≤ 15 years of age and those with knee pain for < 2 years respectively.

Prevalence of pain medication use – comparison with previous studies and explanation of findings

A direct comparison of the present study's results with previous literature is limited due to the scarcity of studies on the use of pain medication specifically for adolescent knee pain [21]. A recent systematic review found that 8–42% of adolescents in school settings used pain medication for MSK pain [7]. Our findings of 21% are well within this range, since a large proportion of adolescents in our study were recruited from schools. Previous studies of participants with various health conditions [6, 22] have observed increased medication use among older adolescents and females. Surprisingly, usage rate was comparable between those \leq vs. > 15 years of age in the present study (additional data for each age year group are provided in Supplementary Table 5). This might be explained by the increased tendency for pain medication use in Denmark across all age spectrum; habits of resorting to pain medication for symptom relief may have formed at a younger age [1, 23]. Consistent with previous literature, females tended to use more pain medication than male, although the estimates had wide confidence intervals.

Factors associated with pain medication use – comparison with previous studies and explanation of findings

Pain characteristics (pain duration, severity, intensity, and disability levels) and psychological factors (being bullied, low self-esteem, presence of one or more mental health conditions) were each associated with an increased risk of using pain medication in previous studies of participants with diverse health conditions [6, 22]. In contrast, our analysis indicated that having other knee-related symptoms (KOOS Symptoms), but not the knee pain (KOOS Pain) ($OR=0.97$, 95% $CI=0.93-1.00$, $p=0.07$), was associated with pain medication use.

Our stratified analysis showed that having worse KOOS Symptoms, lower pain intensity, and more problems with anxiety/depression were each associated with increased use of pain medication among adolescents ≤ 15 years of age. Younger adolescents with less mature coping strategies and poor emotional well-being may be more inclined to manage symptoms with medication. Considering that younger adolescents have restricted access to medications in Denmark, it is plausible that parents or general practitioners may be quick to shield younger adolescents from disease-related symptoms and distress by recommending and providing pain medications [6]. We are surprised by the paradoxical finding that lower pain intensity was associated with greater use of pain medication. The relationship between pain and medication use may not be linear and likely mirrors the U-shape relationship between physical activity levels and pain [24]. In other words, those with the lowest and highest physical activity levels may be more likely to use pain medication. This is supported by our data (available on request), which showed greater use of pain medication among those who participated in athletic activity 0–2 times/week (24–26%) or > 6 times/week (40%), compared to 3–6 times/week (13%). Anxiety/depression was also associated with increased odds for pain medication use among adolescents whose knee pain lasted less than 2 years (though the estimate showed a wide 95% CI). This is in agreement with previous findings documenting an association between psychological factors and the use of pain medication [6, 22]. A potential explanation for the lack of association among those experiencing knee pain ≥ 2 years could be the acceptance of a chronic pain condition, coupled with the development of a healthier attitude toward pain over time (e.g. less psychological concern and fewer pain medications) [25–27]. Contrary to previous research [6, 28, 29], the use of pain medication was not associated with participating in sports or with a higher frequency of sport participation. This might be due to the low frequency of sport participation in our study cohort (50% participated in sport 2 times/week or less), which is not comparable to the physical activity levels of elite athletes.

Strengths and limitations

A strength of this study is the use of suitable validated measures for the collection of data such as the KOOS [17], the EQ-5D youth version [18, 19], and the VAS scale for the assessment of knee pain intensity [30, 31]. In addition, we followed the purposeful selection of variables in logistic regression method [20] for the inclusion of variables in the

multivariable analysis. Another strength is that stratified analysis was performed to identify subgroups within the population that may be at increased risk of use of pain medication. This study also has some limitations. The cross-sectional design precludes us from determining the temporal sequence between exposure and outcome and therefore limits the inference of causality [32]. In addition, this study was a secondary data analysis of three trials not specifically designed for exploring the use of pain medication for knee pain; thus the patterns and features of pain medication use was not delineated in further depth. Additional questions inquiring about the duration of use, type of pain medication, dosage, side-effects associated with use, socioeconomic status, knowledge and attitudes toward use, and parental attitudes toward and use of pain medication would have provided broader and deeper insights. Future longitudinal studies that comprehensively characterize pain medication use at multiple follow-up time points would enable identifying trajectories of pain medication use and examining the temporal relations among these factors in adolescents with longstanding knee pain.

Implications

Self-reported pain medication use is common in adolescents with longstanding knee pain. A similar usage pattern observed in younger group (10–15 years of age) is particularly concerning. Although there is some evidence for the effectiveness and safety of pain medication use for knee conditions in adults [33, 34], it is still unclear whether pain medication is effective or harmful in children and adolescents [2–5]. Reliance on pain medication at an early age could potentially hamper the development of healthy pain coping strategies and increase the risk of dependence and misuse later in life. This raises the questions: why the use is common at such a young age and whether pharmacological therapy is the optimal pain management strategy for this age group, especially in the long-term. Knee related symptoms were consistently associated with pain medication use in our cohort. In addition to pain relief, interventional programs should address swelling, joint instability/crepitus, and range of motion to mitigate reliance on pain medication.

The current study documents that adolescents with PFP are more likely to use pain medication compared to those with OSD. This should be considered by the general practitioner, who is usually the first point of contact for the management of adolescent knee pain [35], when treating an adolescent with knee pain and deciding on the long-term pain management strategy. A multi-modal treatment

strategy for pain in adolescents which includes also a non-pharmacological approach might be considered [36–38]. In addition, the use of pain medication might be affected by cultural factors influencing both the experience of pain [39, 40] and the attitudes towards the use of pain medication [40, 41]. The use of pain medication is also influenced by socioeconomic factors (e.g. parental income, being an immigrant) [42–45] and by the structure of the healthcare system (accessibility to and reimbursements for prescription of pain medication) [1, 46]. Therefore, further replication studies performed in different countries, and within different socioeconomic and/or ethnic groups are needed. Adolescents have a low knowledge of pain medication and often misuse them [6]. Therefore, future studies that assess the knowledge about pain and pain medication literacy [47] would enable to obtain a more complete picture on the adolescents' attitudes and reasons towards the use of pain medication as a pain management strategy.

Conclusions

Among adolescents with longstanding knee pain, 21% reported pain medication use, and the use was already common in adolescents aged 10–15 years. The most consistent factor associated with use was self-reported knee-related symptoms. Future longitudinal studies with multiple follow-up time points and more comprehensive data on patterns and features of pain medication use are needed to expand and enrich our understanding of pain medication use in adolescents.

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Informed consent: Informed consent has been obtained from all individuals included in this study.

Ethical approval: The research was performed in accordance with the tenets of the Helsinki Declaration. Ethical approval for the studies from which the data for this study originated was obtained from the Scientific Ethical Committee of the North Denmark Region (N-2014-0100 and N-2011-0020).

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