

The Demographics and Epidemiology of Osteochondritis Dissecans of the Knee in Children and Adolescents

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Background: Osteochondritis dissecans (OCD) is a disorder of subchondral bone and articular cartilage whose incidence in children is not clearly known.

Purpose: The purpose of this study was to assess the demographics and epidemiology of OCD of the knee in children.

Study Design: Descriptive epidemiology study.

Methods: A retrospective chart review of an integrated health system was performed on patients with OCD of the knee aged 2 to 19 years from 2007 to 2011, with over 1 million patients in this cohort. Lesion location, laterality, and all patient demographics were recorded. The incidence of OCD was determined for the group as a whole and by sex and age group (2-5 years, 6-11 years, and 12-19 years). Patient differences based on age, sex, and ethnicity were analyzed, and using multivariable logistic regression models, associations between age, sex, ethnicity, and diagnosis of OCD of the knee were evaluated.

Results: One hundred ninety-two patients with 206 OCD lesions of the knee fit the inclusion criteria. No OCD lesion of the knee was found in 2- to 5-year-old children. One hundred thirty-one (63.6%) lesions were in the medial femoral condyle, 67 (32.5%) were in the lateral femoral condyle, 96 (50.0%) lesions were right sided, 82 (42.7%) were left sided, and 14 (7.3%) were bilateral. The incidence of patients with OCD of the knee aged 6 to 19 years was 9.5 per 100,000 overall and 15.4 and 3.3 per 100,000 for male and female patients, respectively. Those aged 12 to 19 years represented the vast majority of OCD, with an incidence of 11.2 per 100,000 versus 6.8 per 100,000 for those aged 6 to 11 years. For those aged 6 to 11 and 12 to 19 years, female patients had an incidence of 2.3 and 3.9 per 100,000, respectively, while male patients had an incidence of 11.1 and 18.1 per 100,000, respectively. Multivariable logistic regression analysis revealed a 3.3-fold increased risk of OCD of the knee in patients aged 12 to 19 years compared with those aged 6 to 11 years ($P < .001$; 95% confidence interval [CI], 2.37-4.48), and male patients had 3.8 times a greater risk of OCD of the knee than female patients ($P < .001$; 95% CI, 2.71-5.41). Based on race and ethnicity, blacks had the highest odds ratio of OCD of the knee compared with all other ethnic groups.

Conclusion: In this population-based cohort study of pediatric OCD of the knee, male patients had a much greater incidence of OCD and almost 4 times the risk of OCD compared with female patients. Also, patients aged 12 to 19 years had 3 times the risk of OCD of the knee as compared with 6- to 11-year-old children.

Keywords: osteochondritis dissecans; OCD; knee; epidemiology; incidence; pediatric; child

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Osteochondritis dissecans (OCD) is a focal, idiopathic alteration of subchondral bone with a risk of instability and disruption of adjacent articular cartilage that may result in premature osteoarthritis.⁸ König¹⁶ first described the condition in 1888. Although some authors have estimated the incidence of OCD of the knee,^{7,11,21} the only true incidence study in a self-contained population was performed by Linden¹⁹ of Malmo, Sweden. This study, however, assessed patients of all ages and included a relatively small population of 250,000 patients.

The American Academy of Orthopaedic Surgeons recently published an evidence-based clinical practice guideline for OCD of the knee.⁴ In this guideline, the importance of future research was emphasized, including the need for better epidemiology studies on this condition.

Given the limited size of this population and the dearth of knowledge regarding the demographics and epidemiology of OCD, the purpose of the present study was to evaluate the demographics and epidemiology of OCD of the knee in an extremely large population-based cohort of children and adolescents in Southern California.

MATERIALS AND METHODS

Institutional review board approval was obtained for this cross-sectional study. We assessed all patients aged 2 to 19 years from the entire database of patients enrolled as members of Kaiser Permanente Southern California from January 2007 until August 2011. Kaiser Permanente Southern California is an integrated health care system serving a large racially, ethnically, and socioeconomically diverse population of over 3.5 million patients. From this population, we retrospectively reviewed the electronic health records of inpatient, outpatient, and emergency department encounters for the first occurrence of an *International Classification of Diseases, 9th Revision* (ICD-9) code for OCD of the knee for each cohort member during the years of study enrollment. The ICD-9 codes used to identify patients with OCD included 732.5 and 732.7. Inclusion criteria included isolated OCD lesions of the knee in patients aged 2 to 19 years at the time of diagnosis during the study period. Exclusion criteria included osteochondral fractures and all other intra-articular cartilaginous, meniscal, ligamentous, or bony injuries that were not clearly OCD. After identifying patients with these ICD-9 codes, we then used a sophisticated natural language processing word search on all outpatient and inpatient records of these patients using the words “dissicans,” “osteochondritis,” “OCD,” “osteochondral,” and “dissecans” to further clarify which patients had any of these terms in any inpatient or outpatient progress notes, operative reports, or radiology dictations. After completing this, we reviewed the 961 patient records fulfilling these criteria to confirm which patients truly had OCD of the knee, including a review of radiographs to ensure patients actually had OCD and not variants of normal. Ultimately, 192 patients were found to fit the inclusion and exclusion criteria of having OCD of the knee.

We included age at diagnosis, sex, race and ethnicity, joint involvement, side involved, and specific location within the knee as variables. Specific locations included the medial femoral condyle, lateral femoral condyle, patella, trochlea, and the lateral or medial tibial plateau. The age for each patient was obtained from the electronic medical records and was categorized as 2 to 5, 6 to 11, or 12 to 19 years. These groupings were chosen to reflect pre-school, elementary school, and middle/high school groups per a prior study by Kessler et al¹² on the association of obesity and fracture risk. We categorized race/ethnicity as non-Hispanic white, Hispanic, non-Hispanic black, Asian or Pacific Islander, and other (which included unknown or combined races/ethnicities). A prior validation study compared race and ethnicity from health plan administrative records and birth certificates of 325,810

children and found that the positive predictive value (PPV) for Hispanic ethnicity was 95.6%.²⁹ The PPV for white, black, Asian/Pacific Islander, and other was 89.3%, 86.6%, 73.8%, and 1.2%, respectively.^{14,15}

Although all patients confirmed with a diagnosis of OCD of the knee from January 2007 to August 2011 were included in the analysis of OCD epidemiology and demographics, the incidence of OCD was only calculated for the year 2010. This was done because not all Southern California Kaiser Foundation Hospitals had transitioned to both a complete inpatient/outpatient electronic medical record and fully integrated, electronic Current Procedural Terminology (CPT) and ICD-9 coding until the end of 2009. In addition, only a portion of the year 2011 was used to identify patients. Thus, inclusion of the years 2007 to 2009 or 2011 would have provided inaccurate incidence data. For the year 2010, incidence was calculated for all patients with OCD of the knee, along with OCD incidence by age group, sex, and race/ethnicity.

The frequency of involvement of OCD of the knee and location within the knee joint was calculated by age group, sex, and ethnicity. Univariate logistic regression was used to determine risk factors for OCD of the knee and covariates that were significant at the .05 α level. Multivariable logistic regression analysis was used to estimate odds ratios and 95% confidence intervals (CIs) while controlling for potential confounders. The outcomes assessed were OCD of the knee and location of OCD within the knee, and the models included race (non-Hispanic white, Hispanic, black, Asian or Pacific Islander, other/unknown), age, and sex. Possible interactions between age, sex, and ethnicity were examined using likelihood ratio tests. An α level of .05 was used to determine statistical significance. SAS Enterprise Guide version 4.2 (SAS Institute, Cary, North Carolina) was used for all analyses.

RESULTS

During the study period, no patient under 6 years of age was found to have OCD of the knee. Thus, we analyzed 2 age groups: 6 to 11 years and 12 to 19 years (Table 1). A total of 192 patients were found to have OCD of the knee, with 206 joints involved because of 14 patients with bilateral OCD of the knee. There were 151 (79%) male and 41 (21%) female patients, with a male:female ratio of 3.7:1. For the group as a whole, 96 (50.0%) lesions were right sided, 82 (42.7%) were left sided, and 14 (7.3%) were bilateral (Table 2). Female patients had only 1 case of bilateral disease (2.4% of the total) and an equal distribution of right- and left-sided lesions compared with male patients. The side of joint involvement also did not differ significantly by age group. There were 2.6 times as many OCD lesions in the 12- to 19-year-old group as in the 6- to 11-year-old group, with 139 and 53 lesions, respectively. The male:female ratio did not differ significantly between the age groups, with 79.2% and 78.4% with OCD of the knee in male patients in the older and younger age groups, respectively. The mean and median age of disease onset for the entire group was 13.2 ± 2.81 years and 13.0 years,

TABLE 1
Demographics of Patients Included in OCD Modeling of the Knee^a

	No OCD (n = 1,068,023)	OCD (n = 192)	Total (N = 1,068,215)	P Value
Ethnicity, n (%)				<.0001
Non-Hispanic white	234,703 (22.0)	68 (35.4)	234,771 (22.0)	
Black	91,585 (8.6)	53 (27.6)	91,638 (8.6)	
Hispanic	492,547 (46.1)	51 (26.6)	492,598 (46.1)	
Asian/Pacific Islander	70,014 (6.6)	9 (4.7)	70,023 (6.6)	
Other	179,174 (16.8)	11 (5.7)	179,185 (16.8)	
Age, y				<.0001
Mean ± standard deviation	11.0 ± 3.85	13.2 ± 2.81	11.0 ± 3.85	
Median	11.0	13.0	11.0	
Q1, Q3	7.0, 14.0	11.0, 15.0	7.0, 14.0	
Range	6.0-18.0	6.0-19.0	6.0-19.0	
Age group, n (%)				<.0001
6-11 y	593,101 (55.5)	53 (27.6)	593,154 (55.5)	
12-19 y	474,922 (44.5)	139 (72.4)	475,061 (44.5)	
Sex, n (%)				<.0001
Missing	22 (0.0)	0 (0.0)	22 (0.0)	
Female	533,702 (50.0)	41 (21.4)	533,743 (50.0)	
Male	534,299 (50.0)	151 (78.6)	534,450 (50.0)	
Age and sex combined, n (%)				<.0001
Missing	22 (0.0)	0 (0.0)	22 (0.0)	
Female: 6-11 y	290,504 (27.2)	11 (5.7)	290,515 (27.2)	
Female: 12-19 y	243,198 (22.8)	30 (15.6)	243,228 (22.8)	
Male: 6-11 y	302,589 (28.3)	42 (21.9)	302,631 (28.3)	
Male: 12-19 y	231,710 (21.7)	109 (56.8)	231,819 (21.7)	

^aThe *P* value or *t* test for continuous variables and the Mantel-Haenszel χ^2 test for categorical variables. OCD, osteochondritis dissecans; Q1, 25th percentile; Q3, 75th percentile.

respectively, with no significant difference between male and female patients. The distribution of specific joint locations revealed that the majority of knee lesions involved the medial femoral condyle (n = 131; 63.6%), with most of the remainder involving the lateral femoral condyle (n = 67; 32.5%) (Table 3).

In the incidence analysis, from the pool of all Kaiser Permanente Southern California patients in the year 2010, there were a total of 837,025 patients aged 2 to 19 years. The 159,775 patients in the 2- to 5-year-old age group were excluded from incidence analysis because there was no patient found with OCD of the knee in this age group. Based on the year 2010, the incidence of OCD of the knee for patients aged 6 to 19 years (n = 677,250) was 9.5 per 100,000 for all patients and 15.4 and 3.3 per 100,000 for male and female patients, respectively (Table 4). The group of 12- to 19-year-old patients represented the vast majority of OCD, with an incidence of 11.2 per 100,000 versus 6.8 in 6- to 11-year-old children. Older male patients had the highest incidence of disease, with a nearly 8-fold greater incidence of OCD versus younger female patients at 18.1 per 100,000 as compared with 2.3 per 100,000, respectively. Older female patients (12-19 years old) had an incidence of 3.9 per 100,000. Even in the younger age group, the male predilection was obvious, with a nearly 5-fold greater incidence of OCD in younger male patients (11.1 per 100,000) as compared with younger female patients (2.3 per 100,000).

TABLE 2
Demographics for Patients With OCD of the Knee^a

	Male	Female	Total
Age, y			
No. of patients	151	41	192
Mean ± standard deviation	13.2 ± 2.78	13.0 ± 2.92	13.2 ± 2.81
Median	13.0	13.0	13.0
Q1, Q3	11.0, 15.0	11.0, 16.0	11.0, 15.0
Range	6.0-19.0	6.0-17.0	6.0-19.0
Side, n (%)			
Right only	76 (50.3)	20 (48.8)	96 (50.0)
Left only	62 (41.1)	20 (48.8)	82 (42.7)
Bilateral	13 (8.6)	1 (2.4)	14 (7.3)

^aOCD, osteochondritis dissecans; Q1, 25th percentile; Q3, 75th percentile.

The results of the multivariable logistic regression analysis further supported the univariate results previously mentioned. The odds ratio of having OCD of the knee was 3.3 times greater for patients aged 12 to 19 years than for those aged 6 to 11 years (*P* < .0001; 95% confidence interval [CI], 2.37-4.48) (Table 5). In addition, the odds ratio of a male patient having OCD of the knee was 3.8 times greater than that of female patients (*P* < .0001; 95% CI, 2.71-5.41). The increased risk of disease in male patients

TABLE 3
Location of OCD of the Knee by Sex and Age Group^a

Location	Sex, n (%)		Age Group, n (%)		Total (N = 206), n (%)
	Male (n = 164)	Female (n = 42)	6-11 y (n = 59)	12-19 y (n = 147)	
Medial femoral condyle	104 (63.4)	27 (64.3)	37 (62.7)	94 (63.9)	131 (63.6)
Lateral femoral condyle	53 (32.3)	14 (33.3)	22 (37.3)	45 (30.6)	67 (32.5)
Central femoral trochlea	1 (0.6)	0 (0.0)	0 (0.0)	1 (0.7)	1 (0.5)
Patella	3 (1.8)	0 (0.0)	0 (0.0)	3 (2.0)	3 (1.5)
Lateral femoral trochlea	2 (1.2)	1 (2.4)	0 (0.0)	3 (2.0)	3 (1.5)
Lateral tibial plateau	1 (0.6)	0 (0.0)	0 (0.0)	1 (0.7)	1 (0.5)

^aOCD, osteochondritis dissecans.

TABLE 4
Incidence Rates for OCD of the Knee by Age for the Year 2010^a

Age Group	Incidence Population (n = 677,250)			Incidence Rate (per 100,000)		
	Female	Male	Total	Female	Male	Total
6-11 y	129,175	135,611	264,786	2.3	11.1	6.8
12-19 y	203,038	209,427	412,465	3.9	18.1	11.2
6-19 y	332,213	345,038	677,250	3.3	15.4	9.5

^aOCD, osteochondritis dissecans.

TABLE 5
Multiple Logistic Regression Models for OCD of the Knee^a

	Odds Ratio (95% CI)	P Value
White vs Asian	2.07 (1.04-4.16)	.04
White vs black	0.49 (0.34-0.71)	.0001
White vs Hispanic	2.57 (1.79-3.70)	<.0001
White vs other	5.01 (2.65-9.48)	<.0001
Black vs Hispanic	5.21 (3.54-7.65)	<.0001
Black vs Asian	4.20 (2.07-8.52)	<.0001
Asian vs Hispanic	1.24 (0.61-2.52)	.55
12-19 y (male) vs 6-11 y (male)	3.30 (2.31-4.72)	<.0001
12-19 y (male) vs 6-11 y (female)	12.04 (6.48-22.40)	<.0001
12-19 y (male) vs 12-19 y (female)	3.90 (2.60-5.84)	<.0001
6-11 y (male) vs 6-11 y (female)	3.64 (1.88-7.08)	.0001
12-19 y vs 6-11 y	3.26 (2.37-4.48)	<.0001
Male vs female	3.83 (2.71-5.41)	<.0001

^aThe P value indicates the significance of the effect in predicting OCD of the knee. OCD, osteochondritis dissecans.

was consistent across the age groups, with 12- to 19-year-old male patients having a 3.9-fold increased risk of OCD of the knee as compared with 12- to 19-year-old female patients ($P < .0001$; 95% CI, 2.60-5.84) and 6- to 11-year-old male patients having a 3.6-fold increased risk versus female patients in the same age group ($P = .0001$; 95% CI, 1.88-7.08). Twelve- to 19-year-old male patients had the highest risk of disease, with 12 times the increased risk of OCD of the knee as compared with 6- to 11-year-old female patients ($P < .0001$; 95% CI, 6.48-22.40). Based on the multivariable logistic regression analysis, the location within the knee did not differ significantly by sex or age group (Table 6).

In terms of ethnicity and race, the study population aged 6 to 19 years of just over 1 million patients during the 4.5-year period was quite diverse, with the largest ethnic group (46.1%) self-identifying as Hispanic. However, among those with OCD of the knee, non-Hispanic whites and blacks were overrepresented, with 35.4% and 27.6% of patients with OCD of the knee in the 2 age groups, respectively, compared with only 22.0% non-Hispanic whites and 8.6% blacks in the general 2- to 19-year-old population (Table 1). In the multivariable logistic regression analysis conducted by race and ethnicity, the risk of OCD of the knee was greatest for blacks, who had double the risk of OCD as compared with non-Hispanic whites ($P < .0001$; 95% CI, 1.4-2.9). Whites, however, had 2.6 times a greater risk of OCD than Hispanics ($P < .0001$; 95% CI, 1.8-3.7), 2.1 times a greater risk than Asians/Pacific Islanders ($P = .04$; 95% CI, 1.0-4.2), and 5 times a greater risk of disease than those of mixed race/unknown ethnicity ($P < .0001$; 95% CI, 2.7-9.5). The incidence analysis demonstrated an incidence rate ranging from as high as 31.6 per 100,000 in non-Hispanic blacks (and 45.5 in male patients) down to a low of 4.7 and 4.8 per 100,000, respectively, in Asians and those of mixed race/other (Table 7). Of note, the incidence of OCD of the knee in the non-Hispanic white teenage group was 2.3 and 20.5 in female and male patients, respectively, which are somewhat lower than those of Linden's¹⁹ predominantly white teenage group.

DISCUSSION

Lefort et al¹⁸ and Hefti et al¹⁰ have provided the largest studies on OCD of the knee, reporting on multicenter

TABLE 6
Logistic Regression Analysis of Location Within the Medial and Lateral Femoral Condyles by Age and Sex^a

	Medial Femoral Condyle		Lateral Femoral Condyle	
	Odds Ratio (95% CI)	P Value	Odds Ratio (95% CI)	P Value
12-19 y (male) vs 6-11 y (male)	1.19 (0.57-2.46)	.64	0.62 (0.30-1.29)	.20
12-19 y (male) vs 6-11 y (female)	0.49 (0.12-2.03)	.33	1.49 (0.36-6.08)	.58
12-19 y (male) vs 12-19 y (female)	1.33 (0.57-3.10)	.52	0.68 (0.29-1.60)	.38
6-11 y (male) vs 6-11 y (female)	0.42 (0.09-1.82)	.24	2.40 (0.55-10.44)	.24
12-19 y vs 6-11 y	0.95 (0.49-1.84)	.89	0.79 (0.41-1.53)	.48
Male vs female	0.97 (0.47-2.01)	.93	0.97 (0.46-2.03)	.93

^aThe P value indicates the significance of the effect in predicting osteochondritis dissecans in the medial/lateral femoral condyle.

TABLE 7
Incidence Rates for OCD of the Knee by Ethnicity for the Year 2010^a

Ethnicity	Incidence			Incidence Population			Incidence Rate (per 100,000)		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Non-Hispanic white	2	12	14	66,183	69,175	135,358	3.0	17.3	10.3
Non-Hispanic black	5	13	18	28,417	28,581	56,998	17.6	45.5	31.6
Hispanic	4	21	25	143,608	147,194	290,802	2.8	14.3	8.6
Asian	0	2	2	20,758	22,069	42,827	0.0	9.1	4.7
Other	0	5	5	49,970	54,577	104,547	0.0	9.2	4.8

^aThe total population for the ethnicity incidence analysis was less than the total population used for the age group incidence analysis (Table 4) due to a portion of the subjects not having a recorded ethnicity. OCD, osteochondritis dissecans.

studies of 892 and 452 patients, respectively. While these and other large-scale studies^{11,19,20} provide insight into the demographics of OCD, none of these are studies of self-contained populations, and none assesses the incidence of disease. Marsden and Wiernik²¹ reviewed 18,405 radiographs of multiple joints in male patients in 1 military hospital and found an incidence of OCD of 2.3% in “the total number of men reporting sick” and an incidence of 4% OCD in all knee radiographs reviewed. Linden’s¹⁹ assessment of the incidence of OCD of the “condyles of the femur” is the only true incidence study previously performed regarding OCD of the knee. The author found an incidence of 6 to 7 per 100,000 female patients and 9 to 15 per 100,000 in male patients of all ages, with a maximum OCD incidence between the ages of 10 and 20 years of 19 per 100,000 in female patients and 29 per 100,000 in male patients.¹⁹ This study, however, included only 250,000 patients of all ages and, of course, a much smaller number of pediatric and adolescent patients.

The present study found a lower incidence of OCD of the knee in the teenage group as compared with that in the study of Linden¹⁹ at 18.1 per 100,000 male patients and 3.9 per 100,000 female patients. This lower incidence in our study is likely explained by a number of factors. First of all, as opposed to the almost completely white population in Linden’s study,¹⁹ our population in Southern California was extremely ethnically and racially diverse, with 45.6% Hispanics, 6.4% Asians/Pacific Islanders, 17.7% those of mixed race/other, and only 21.7% non-Hispanic whites.

Thus, 69.7% of the pediatric population in this patient cohort was Hispanic, Asian, or mixed race/other, all groups that had less than half the risk of disease of non-Hispanic whites based on logistic regression analysis. Secondly, in the non-Hispanic whites, the group most comparable with Linden’s population,¹⁹ the incidence of OCD in older children and adolescents was lower than Linden’s 10- to 20-year-old group. This difference is explained by the fact that, more than likely, our non-Hispanic white population was composed of only a minority of patients of Scandinavian descent.

Prior smaller scale studies on the laterality of OCD of the knee have demonstrated a typical range of 14% to 30% of patients presenting with bilateral knee involvement.^{9,11,13,22,23} However, some of the largest studies conducted on OCD of the knee by Marsden and Wiernik²¹ (300 patients) and Hefti et al¹⁰ (452 patients with 509 affected knees) found a much lower frequency of bilateral involvement of 2.7% and 12.6%, respectively. One limitation of our data set is the fact that a series of bilateral knee radiographs were not routinely obtained. If bilateral radiographs had been obtained, the percentage of cases with bilateral OCD may have been different. Similar to these 2 large-scale studies, we found a lower incidence of bilateral disease (7.5%) than is typically noted in the aforementioned smaller studies and OCD literature review articles.^{3,7,30} In addition, prior studies have shown a fairly similar proportion of right- and left-sided involvement, with some noting slightly greater right-sided

involvement^{19,21} and others noting slightly greater left-sided involvement.^{10,11} Our study supports this fairly similar proportion of right- and left-sided involvement, with slightly greater right-sided involvement.

The literature has consistently shown that 70% to 85% of OCD lesions of the knee tend to involve the medial femoral condyle, with the majority involving the classic location in the posterolateral aspect of the medial femoral condyle and most of the rest being in the lateral femoral condyle.^{1,5,6,9-11,17-21,25,26} Our epidemiological study supports the prior literature on the predominance of medial condylar lesions, although the 64% incidence of medial lesions is on the lower end of that typically listed in the literature. However, almost all of these studies have combined adults and children, and the largest study ever conducted on OCD of the knee demonstrated a frequency of medial involvement very close to ours at 70%.¹⁸

In terms of sex, prior studies on OCD of the knee in children and adults have confirmed a predominance in male patients, with a male:female ratio ranging from 1.5:1 up to 13:1.^{2,7,9-11,18-20,22,24,27} In a literature review, Schenck and Goodnight²⁸ reported the male:female ratio to be from 2:1 to 3:1. However, some authors have suggested an increasing incidence of OCD in girls recently because of increased female sports participation.^{3,11,13} The present study clearly confirms the male predilection and shows that boys have a risk of nearly 4 times that of girls based on logistic regression analysis in this extremely large self-contained population. In terms of age of presentation, most studies have suggested an initial presentation in children primarily during the second decade of life.^{2,7,19,20} Other studies,^{9,26} however, have suggested the greatest percentage in the first decade of life, with Cahill³ noting a decrease in average OCD onset from 12.9 years of age in 1983 to 11.3 in 1992 because of children being “introduced to organized sports at younger and younger ages.” However, the present study unequivocally shows that older children have the highest frequency of disease, with more than 3 times the increased risk of OCD of the knee in older children. In fact, the risk of a 12- to 19-year-old male patient having OCD of the knee was 12 times higher than that of a 6- to 11-year-old female patient based on multivariable logistic regression.

Historically, little has been known about the association between race/ethnicity and OCD. The present study sheds the first light on this topic. The logistic regression analysis demonstrates that, at least for OCD of the knee, blacks have a markedly increased risk of disease compared with all other races/ethnicities. Non-Hispanic whites, although having less than half the risk of disease of blacks, also have a very significantly increased risk of disease compared with all other groups, even when controlling for all variables other than education and household income. In the incidence analysis, all but black teenagers had a lower incidence of OCD of the knee as compared with Linden's¹⁹ fairly homogeneous Scandinavian white population of 10- to 20-year-old patients.

Our study has a number of weaknesses. First and foremost, the incidence data were obtained only from 2010, while the demographic and epidemiological data were

gleaned from a 4.5-year period from January 2007 until August 2011. As mentioned previously, the incidence data were gathered only for 2010 because not every single Kaiser Permanente Southern California hospital and clinic had transitioned to both outpatient and inpatient electronic medical records and ICD-9 and CPT coding until the end of 2009. We did not want to underestimate the true incidence of disease by including the 2007 to 2009 and the partial 2011 data. We included all patients in the demographic analysis because of the assumption that the missing patients during the period of interest would be missed equally between all ages, sexes, and races/ethnicities. Other study weaknesses include the retrospective nature of the study along with the fact that asymptomatic OCD may have been missed in some patients, thus potentially decreasing the measured OCD incidence. However, some asymptomatic lesions may have been also identified incidentally on radiographs taken for other reasons. Last of all, in multivariable logistic regression modeling of the analysis of risk of OCD by ethnicity/race, no measures of socioeconomic status were assessed as potential confounders.

In summary, the present study represents the first true incidence study of OCD of the knee in the United States in patients aged 19 years and younger. The population of this study was more than 12 times larger than that in the only prior incidence study on OCD of the knee by Linden.¹⁹ This study clearly demonstrates the greater predilection of OCD in male patients and teenagers. In addition, it demonstrates that blacks have the highest risk of OCD of the knee, with twice the incidence of non-Hispanic whites and at least 4 times the risk of disease as compared with all other races/ethnicities. Thus, the epidemiology and demographics of pediatric OCD must be understood not just based on age and sex but also on race and ethnicity. It seems clear that as orthopaedic surgeons, we must have a higher index of suspicion for OCD of the knee in male patients, older teenagers, and blacks and potentially target our treatment efforts toward these groups of patients.

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