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Public Insurance and Single-Guardian Households Are Associated with Diagnostic Delay in Slipped Capital Femoral Epiphysis

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Abstract

Background: Extensive literature documents the adverse sequelae of delayed diagnosis of slipped capital femoral epiphysis (SCFE), including worsening deformity and surgical complications. Less is known about predictors of delayed diagnosis of SCFE, particularly the effects of social determinants of health. The purpose of this study was to evaluate the impact of insurance type, family structure, and neighborhood-level socioeconomic vulnerability on the delay of SCFE diagnosis.

Methods: We reviewed medical records of patients who underwent surgical fixation for stable SCFE at a tertiary pediatric hospital from 2002 to 2021. We abstracted data on demographic characteristics, insurance status, family structure, home address, and symptom duration. We measured diagnostic delay in weeks from the date of symptom onset to diagnosis. We then geocoded patient addresses to determine their Census tract-level U.S. Centers for Disease Control and Prevention (CDC) and Agency for Toxic Substances and Disease Registry (ATSDR) Social Vulnerability Index (SVI), using U.S. Census and American Community Survey data. We performed 3 separate logistic regression models to examine the effects of (1) insurance status, (2) family structure, and (3) SVI on a delay of ≥12 weeks (reference, <12 weeks). We adjusted for age, sex, weight status, number of siblings, and calendar year.

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Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/XXXXXXX).

Appendix

Supporting material provided by the authors is posted with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/XXXXXXX).

Results: We identified 351 patients with SCFE; 37% (129) had a diagnostic delay of ≥12 weeks. In multivariable logistic regression models, patients with public insurance were more likely to have a delay of ≥12 weeks than patients with private insurance (adjusted odds ratio [OR], 1.83 [95% confidence interval (CI), 1.12 to 2.97]; p = 0.015) and patients from single-guardian households were more likely to have a delay of ≥12 weeks than patients from multiguardian households (adjusted OR, 1.95 [95% CI, 1.11 to 3.45]; p = 0.021). We did not observe a significant increase in the odds of delay among patients in the highest quartile of overall SVI compared with patients from the lower 3 quartiles, in both the U.S. comparison (adjusted OR, 1.43 [95% CI, 0.79 to 2.58]; p = 0.24) and the Massachusetts comparison (adjusted OR, 1.45 [95% CI, 0.79 to 2.66]; p = 0.23).

Conclusions: The delay in diagnosis of SCFE remains a concern, with 37% of patients with SCFE presenting with delay of ≥12 weeks. Public insurance and single-guardian households emerged as independent risk factors for diagnostic delay. Interventions to reduce delay may consider focusing on publicly insured patients and those from single-guardian households.

Level of Evidence: Prognostic Level III. See Instructions for Authors for a complete description of levels of evidence.

Slipped femoral capital epiphysis (SCFE) is a rotational displacement of the femoral head and the most common disease of the adolescent hip[1,2]. The stability of a slip often impacts the timeliness of its care; whereas “unstable” slips present acutely due to the inability to weight bear, “stable” slips typically have an atraumatic, gradual onset, which makes prompt diagnosis challenging[3,4]. Additionally, although many patients with SCFE present with typical unilateral pain in the hip, groin, or proximal thigh, a subset present with distal thigh or knee pain[5–8]. The delay in diagnosis has critical implications for both short-term and long-term patient morbidity. Longer delay is associated with increased slip severity, which, in turn, increases the risks of osteonecrosis, chondrolysis, and advanced hip arthritis[9–14].

Extensive literature documents delay in the diagnosis of SCFE and the complications of delay[4,15,16]. Much less is known about predictors of delayed diagnosis of SCFE, and even less is known about how the delay is affected by social determinants of health, such as family structure, the neighborhood and built environment, and insurance coverage and health-care access[17]. Whereas Medicaid status has been previously linked to the lack of timely orthopaedic care, including management for SCFE, more recent literature has not found an association between public insurance and SCFE symptom duration[7,18,19]. Therefore, additional research is needed to clarify the impact of insurance coverage on delayed diagnosis of SCFE. Moreover, the influence of family structure on diagnostic delays in SCFE is also understudied, despite well-established health-care utilization differences between single-guardian and multiguardian households[20]. Addressing these knowledge gaps will enhance our understanding of the complex interplay between social factors, health-care access, and timely SCFE diagnosis, guiding the development of targeted interventions to reduce delays and enhance patient outcomes.

We aimed to address this research gap and investigate factors associated with greater delay from time of symptom onset to definitive surgical treatment of SCFE. Timely presentation for care requires access to high-quality providers, and the resources and time required to

attend visits. Accordingly, we hypothesized that the delay would be greater in patients who are publicly insured, who reside in single-guardian households, and who reside in Census tracts with the highest social vulnerability.

Materials and Methods

In this retrospective cohort study, we reviewed electronic health records of patients who underwent surgical fixation for stable SCFE at a tertiary pediatric hospital from 2002 to 2021. We identified patients using the International Classification of Diseases, Tenth Revision (ICD-10) codes from a preexisting SCFE Registry developed from hospital administrative data. We excluded patients if there was no documentation of symptom presentation, there was no record of surgical fixation at our institution, or the patient had a prior femoral fracture in either the diseased hip or the contralateral hip. As time to diagnosis is typically much shorter in the second episode of SCFE (because patients and families are familiar with the diagnosis and heightened risk), only data from the initial slip were included if patients had a repeat or subsequent contralateral SCFE[4].

One author (L.M.S.) systematically reviewed both inpatient and outpatient records and abstracted select data elements into a REDCap (Research Electronic Data Capture Software) database. We defined the primary outcome measure, diagnostic delay, as weeks from the date of symptom onset, documented by clinician report, to the date of diagnosis. A clinical threshold for timely management of non-acute SCFE is ill-defined within the literature and there is no clear definition of clinically meaningful delay. Therefore, we chose to dichotomize delay based on the proportion of patients with a severe slip classification. In our study, only 2% of the patients with a delay of <12 weeks had a severe slip compared with 30% among those with a delay of ≥12 weeks; therefore, a delay of 12 weeks was determined as a clinically meaningful threshold.

The primary predictors abstracted were insurance status (public or private) and family structure (single-guardian or multiguardian household). We defined public insurance as any Medicaid plan or Medicaid Accountable Care Partnership plan abstracted from records on the date of the patient's surgical procedure. We defined a single-guardian household as one with only 1 adult guardian residing in the patient's primary residence, abstracted from records within a year prior to the date of the patient's surgical procedure.

We geocoded home addresses at the time of the surgical procedure using ArcGIS software (Esri) to identify the Census tract for each patient. We then linked each patient's Census tract with the U.S. Centers for Disease Control and Prevention (CDC) and Agency for Toxic Substances and Disease Registry (ATSDR) data to determine the Social Vulnerability Index (SVI) for each patient[21]. We selected the SVI due to its validation by the CDC, regular updates, open accessibility, and increasing recognition as a metric for identifying health-care disparities associated with neighborhood influences. We dichotomized SVI (≥0.75 compared with <0.75) to compare patients in the highest quartile of vulnerability with those in the 3 lower quartiles of vulnerability, consistent with prior literature[22,23]. We compared the Census tracts of our patient cohort with all U.S. tracts as well as tracts within Massachusetts (excluding out-of-state patients).

Due to collinearity in the 3 primary predictors, we used separate logistic regression models to examine the effects of insurance status, family structure, and SVI on a delay of ≥12 weeks (compared with <12 weeks). Effects were summarized using adjusted odds ratios (ORs) with 95% confidence intervals (CIs). In addition to each primary predictor, the models included age, sex, weight status (based on the age-specific percentile calculated from height and weight[24]), number of siblings, calendar year of symptom presentation. and physician specialty at the time of the initial presentation. As severity is thought to be a consequence of delay, the slip severity classification and Southwick angle measurement were not included as covariates in the models[4,5,9]. SCFE severity was assessed on anteroposterior and lateral radiographs by 2 authors (L.M.S. and M.E.) who measured the Southwick angle and categorized the slip as mild (<30°), moderate (30° to 60°), or severe (>60°). These authors were blinded to clinical and sociological data of the patients. Good reliability for both intraobserver and interobserver measurements of the slip angle on radiographs has been previously reported[25]. For this study, 10 random radiographs were selected and assessed by the 2 raters, yielding an intraclass correlation coefficient of 0.98, indicating excellent reliability.

Similarly, race or ethnicity and the number of interactions with the health-care system from symptom onset to diagnosis were not included in the model because they are likely to be on the causal pathway between the primary predictors and the outcome of diagnosis delay. In a sensitivity analysis, we reran the model with adjustment for race or ethnicity to determine whether the principal predictors influenced delay independent of race or ethnicity. This study was performed with institutional review board approval from our institution.

Source of Funding

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Results

There were 351 patients with stable SCFE included in the study; 44% presented with public insurance, 25% were from single-guardian households, and the mean SVI (and standard deviation) of the subjects' Census tracts, as compared with all U.S. Census tracts, was 0.41 ± 0.31. At the time of presentation, the mean age was 12 ± 1.6 years (range, 4 to 16 years), 60% were male, 61% were White, and 64% were obese (Table I).

The median symptom duration was 6 weeks (interquartile range, 3 to 16 weeks) and 37% (129) of the sample had a delay of ≥12 weeks. The patients' characteristics, categorized by the duration of symptoms, are presented in Supplementary Table 1. There was a significant association between slips categorized as severe and a delay of ≥12 weeks (89.5% of severe slips had a delay of ≥12 weeks, compared with 42.0% of moderate slips and 23.9% of mild slips; $p < 0.001$) (Table II). Additionally, individuals with younger age at the time of symptom presentation, individuals with obesity, a physician specialty of orthopaedic surgeon at the time of presentation, and individuals with a higher number of interactions with the health-care system prior to diagnosis more frequently had longer symptom duration (Table II).

In separate multivariable logistic regression models, patients with public insurance were more likely to have a delay of ≥12 weeks compared with patients with private insurance (adjusted OR, 1.83 [95% CI, 1.12 to 2.97]; p = 0.015) and patients from single-guardian households were more likely to have a delay of ≥12 weeks compared with patients from multiguardian households (adjusted OR, 1.95 [95% CI, 1.11 to 3.45]; p = 0.021). We did not observe a significant increase in the odds of delay among patients in the highest quartile of overall SVI compared with patients from the 3 lower quartiles, in both the U.S. comparison (adjusted OR, 1.43 [95% CI, 0.79 to 2.58]; p = 0.24) and the Massachusetts comparison (adjusted OR, 1.45 [95% CI, 0.79 to 2.66]; p = 0.23) (Table III).

Additional models that adjusted for race or ethnicity attenuated the adjusted ORs for the primary predictors. Specifically, the effect of insurance status was reduced from an adjusted OR of 1.83 (95% CI, 1.12 to 2.97) to 1.66 (95% CI, 1.00 to 2.76). Similarly, the effect of family structure was reduced from an adjusted OR of 1.95 (95% CI, 1.11 to 3.45) to 1.87 (95% CI, 1.03 to 3.39). The effect of SVI was largely eliminated with adjustment for race or ethnicity, from an adjusted OR of 1.43 (95% CI, 0.79 to 2.58) to 1.13 (95% CI, 0.59 to 2.17) (see Supplementary Table 2).

Discussion

In this study, we evaluated the relationships between diagnostic delay of SCFE and 3 primary predictor variables: public insurance, single-guardian households, and the SVI. Notably, patients with public insurance and those residing in single-guardian households were more likely to have a delayed diagnosis of SCFE. We did not observe a longer delay among patients living in a Census tract in the highest quartile of overall social vulnerability. Longer delay was also associated with increased slip severity, obesity, younger age at the time of symptom presentation, physician specialty of orthopaedic surgeon at the time of presentation, and ≥3 interactions with the health-care system prior to diagnosis.

Our study reinforces a known association between longer symptom duration and increased slip severity and confirms that, despite decades of research aimed at raising awareness regarding delay and reducing the delay, the delay of SCFE diagnosis persists[26].

One of the foci of this study was clarifying the role of public insurance in SCFE-specific diagnostic delay. Kocher et al. initially reported significant associations between longer delay in diagnosis of SCFE and Medicaid coverage compared with private insurance (median, 12.0 weeks compared with 7.0 weeks)[7]. On the contrary, Loder et al. retrospectively reviewed 142 patients with stable SCFE and did not find insurance to be associated with diagnostic delay[19]. Our study affirms the contribution of insurance status to the lack of timely orthopaedic care in SCFE. This is consistent with other reports relating Medicaid insurance to issues of access in pediatric orthopaedic care[18,27]. Prior nationwide studies have found that both primary care and orthopaedic offices limit or do not offer appointments to children with Medicaid. This is hypothesized to be driven by low physician reimbursement rates (Medicaid access increases as state-specific reimbursement rates increase), the higher proportion of Medicare patients in capitated plans compared with traditional fee-for-service plans, and administrative concerns with regard to Medicaid

paperwork[18,28]. Future study is needed to understand if SCFE-specific care is denied or delayed for those with less generous insurance or if insurance is a proxy for other factors or behaviors that lead to delay[29,30].

Loder et al. additionally analyzed delay in SCFE diagnosis in relationship to the Area Deprivation Index (ADI), a neighborhood disadvantage metric composed of 17 socioeconomic variables[19]. Although the ADI lacks data on race or ethnicity, it is similar to the SVI in its use of Census tract data to assign relative disadvantage by region of interest[31]. Loder et al. did not find a correlation between deciles of increasing disadvantage and symptom duration[19]. Likewise, despite the wide distribution in our SVI and a trend toward higher odds of delay among individuals living in more vulnerable areas, our findings were not significant. We had hypothesized mechanistically that living in an area of disadvantage, relative to surrounding neighborhoods, would contribute to less individual health literacy and less individual trust in the health-care system, and, thus, less care-seeking behavior[32,33]. We grounded this hypothesis in the social determinants of health framework, which illustrates how an intersection of nonmedical factors can impact health in both positive and negative ways[17,34,35]. Our predictions were further influenced by prior studies that found associations between higher social vulnerability and higher risk of adverse long-term outcomes after injury, higher odds of undergoing an emergency surgical procedure compared with an elective surgical procedure, increased mortality from infectious disease, and, importantly, reduced access to care[23,36–38]. However, it is possible that our study was not sufficiently powered to detect differences between SVI categories, or that another method to assess vulnerability may be better suited to address the hypothesis[39]. Alternatively, there may be elements of care-seeking behavior (or health-care access) that are influenced primarily by employment or guardianship status.

To our knowledge, this is the first study to examine the role of family structure in the delay of SCFE diagnosis. Other studies have previously addressed the role of parenthood in health-care utilization and its influence on weight status; children residing in single-guardian households are less likely to receive preventative care and more likely to utilize care related to infections and injuries, to have unmet health-care needs, and to have obesity[40–44]. Although both single-guardian households[45] and SCFE[46] have independent associations with high childhood body mass, we controlled for weight status within each model and observed independent associations between single-guardian households and delay. Similarly, although the relationship between family structure and preventative care (compared with emergency care) could be offered as an explanation for the delay, our findings were not attenuated when physician specialty at the time of the initial presentation was added to the models in a sensitivity analysis.

Accordingly, we turn to alternate causal pathways in the delay of SCFE diagnosis in single-guardian households. A lack of economic resources and lower household income have been considered the primary mediators of health-related risks for single-parent family structures. Other proposed mechanisms include higher instability related to living transitions, higher time demands due to the lack of shared household responsibilities, and lower engagement in parent-child activities[20,44,45,47]. It is possible that the effect of limited guardian time and

resources is exacerbated by the ambiguous nature of symptom onset, the high potential for misdiagnosis, and the requirement for additional appointments to obtain specialty care.

Unexpectedly, longer delay was associated with the physician specialty of the orthopaedic surgeon at the time of presentation. We propose that it is more difficult to obtain an appointment with a specialist than with a primary care physician, thus contributing to a delayed initial presentation to orthopaedic care. There was also a noted trend in delayed diagnosis by an orthopaedic provider: we found that 47.1% had a delay of ≥12 weeks when diagnosed by orthopaedic surgeons (compared with 31.5% of patients when diagnosed by internal medicine physicians, family practice physicians, or pediatricians). Although this seems counterintuitive, given the orthopaedic nature of the disease, it is crucial to contextualize these findings with the number of interactions that patients had with the health-care system prior to the diagnosis. Notably, 72.5% of those seeing orthopaedic surgeons had at least 2 prior interactions compared with patients seeing general practitioners (26.9%). The delay in this case seems to be mediated by referral networks (under many major insurance networks, evaluation by a primary care physician is a common, intrinsic barrier to specialty care), as well as missed diagnoses in primary care settings. Our study joins the body of literature that suggests that more attention must be focused on orthopaedic education in the field of primary care.

When considering the role of race or ethnicity, we see that the modest attenuation of the effects of insurance status and family structure, and the considerable attenuation of the effect of SVI with adjustment for race or ethnicity, suggests that some of the burden of public insurance, single-guardianship, and social vulnerability is borne by non-White patients.

Many of the limitations of our study emanate from the retrospective nature of the work. First, the quantification of delay relied on 3 imperfect measures: (1) accurate parent and patient recall of symptom onset, (2) accurate provider documentation in the electronic health record, and (3) appropriate operationalization of time intervals at the time of data collection. The data with regard to the number of adult guardians living in the patient's primary address was abstracted from a standardized nursing admission note to the hospital. Specifically, information was taken from a uniform chart that lists the names of fellow residents of the patient's household, designates the respective relationships, and often lists the ages of the patient's siblings. Although these data are as reliable as other information routinely taken from patients and patients' families and uploaded by a health professional into an electronic health record, approximately 10% of these data are missing, which was a limitation of the study. Consequently, the length of time from symptom onset to diagnosis may—in many cases—have been subject to patient, provider, or data abstraction bias. It is unclear whether these potential biases would have lengthened or shortened delay. Second, we did not and could not capture crucial differences across families such as individual household income, immigrant status, parental educational attainment, or health literacy. Furthermore, our dichotomized variable of guardianship could not capture the complexity of family structures or diverse networks of support. We have attempted to offset the effects of ecological fallacy by studying multiple levels of social identity. Yet, use of aggregate measures and dichotomized variables to describe nuanced patient realities may have created misclassification. We chose to compare Census tracts at a fixed time because the distribution

of SVI across Eastern Massachusetts counties (the principal source of subjects) was stable in our study period[48]. However, we recognize that subtle shifts may have occurred in neighborhoods across the time span of our study, and this should be considered when interpreting our findings. This sensitivity analysis should be interpreted cautiously because of the associations between area-level SVI and individual-level race and ethnicity.

However, at 351 patients, our study is one of the largest in this relatively rare disease. Another advantage of this study is its consideration of family structure in the causal pathway of delay, a variable that has been anecdotally contemplated and now formally documented as influencing time to diagnosis.

This study solidifies the role of public insurance in delay and adds to the literature the finding that single guardianship may also contribute to the diagnostic delay of SCFE. Over the decades, the delay in diagnosing SCFE has remained unchanged and the propensity for misdiagnosis in pre-orthopaedic settings remains high. Thus, the need for orthopaedic providers to engage with their referring colleagues with regard to these particular risk factors cannot be overstated; the onus of educating referring clinicians about identifying unusual, disabling conditions such as SCFE must lie within the orthopaedic community. Our study supports expanding the illness narrative of SCFE to include the social factors of single guardianship and public insurance. Reducing delay in the diagnosis of SCFE calls for personal, intentional orthopaedic leadership in their local medical communities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE I

Patient Characteristics by Primary Predictors *

	All† (N = 351)	Insurance Status			Family Structure			SVI		
		Private† (N = 186)	Public† (N = 149)	P Value	Single-Guardian Household† (N = 78)	Multiguardian Household† (N = 237)	P Value	<0.75† (N = 251)	≥0.75† (N = 68)	P Value
Age at symptom presentation				0.24			0.61			0.75
<11 years	95 (27%)	45 (24%)	46 (31%)		19 (24%)	68 (29%)		69 (27%)	17 (25%)	
11 years	85 (24%)	46 (25%)	32 (21%)		21 (27%)	54 (23%)		60 (24%)	15 (22%)	
12 years	79 (23%)	39 (21%)	37 (25%)		17 (22%)	57 (24%)		51 (20%)	18 (26%)	
≥13 years	92 (26%)	56 (30%)	34 (23%)		21 (27%)	58 (24%)		71 (28%)	18 (26%)	
Sex				0.48			0.74			0.28
Female	139 (40%)	69 (37%)	62 (42%)		28 (36%)	96 (41%)		103 (41%)	23 (34%)	
Male	212 (60%)	117 (63%)	87 (58%)		50 (64%)	141 (59%)		148 (59%)	45 (66%)	
Race or ethnicity				<0.001			<0.001			<0.001
White	187 (61%)	120 (74%)	61 (46%)		27 (39%)	147 (70%)		164 (74%)	9 (15%)	
Black	75 (24%)	27 (17%)	45 (34%)		33 (47%)	36 (17%)		37 (17%)	32 (54%)	
Hispanic‡	31 (10%)	9 (6%)	21 (16%)		9 (13%)	16 (8%)		11 (5%)	15 (25%)	
Asian	8 (3%)	6 (4%)	1 (1%)		0 (0%)	7 (3%)		5 (2%)	2 (3%)	
Other	6 (2%)	1 (1%)	5 (4%)		1 (1%)	5 (2%)		4 (2%)	1 (2%)	
Not recorded	44	23	16		8	26		30	9	
Weight status				0.28			0.40			0.14
Underweight or normal (<85th percentile)	57 (17%)	35 (19%)	21 (14%)		12 (16%)	40 (17%)		46 (18%)	8 (13%)	
Overweight (85th to 94th percentile)	65 (19%)	40 (22%)	25 (17%)		10 (13%)	52 (22%)		55 (22%)	8 (13%)	
Obese (≥95th percentile)	217 (64%)	108 (59%)	99 (68%)		54 (71%)	140 (60%)		148 (59%)	48 (75%)	
Not recorded	12	3	4		2	5		2	4	
Slip severity classification				0.17			0.24			0.68
Mild	197 (62%)	108 (66%)	80 (59%)		40 (55%)	138 (65%)		147 (64%)	35 (58%)	

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	All† (N = 351)	Insurance Status			Family Structure			SVI		
		Private† (N = 186)	Public† (N = 149)	P Value	Single-Guardian Household† (N = 78)	Multiguardian Household† (N = 237)	P Value	<0.75† (N = 251)	≥0.75† (N = 68)	P Value
Moderate	81 (26%)	42 (26%)	33 (24%)		20 (27%)	50 (24%)		55 (24%)	17 (28%)	
Severe	38 (12%)	14 (9%)	23 (17%)		13 (18%)	23 (11%)		26 (11%)	8 (13%)	
Not recorded	35	22	13		5	26		23	8	

*Of the patients who did not have data recorded, 16 did not have insurance status recorded, 36 did not have family structure recorded, and 32 did not have SVI (based on U.S. percentiles) recorded.

†The values are given as the number of patients, with or without the percentage in parentheses.

‡Hispanic ethnicity was not reported independently from race in the medical record during the time frame of this study.

TABLE II

Bivariate Association Between Duration of Symptoms and Patient Characteristics*

	Duration of Symptoms		
	No. of Patients	**Delay ≥12 Weeks**	**P Value**
Insurance status			0.014
Private insurance	186	31.2%	
Public insurance	149	44.3%	
Family structure			0.03
Single-guardian household	78	47.4%	
Multiguardian household	237	33.8%	
SVI (U.S.)			0.22
<0.75	251	34.7%	
≥0.75	68	42.6%	
SVI (Massachusetts)			0.36
<0.75	210	33.8%	
≥0.75	81	39.5%	
Age at symptom presentation			0.013
<11 years	95	50.5%	
11 years	85	32.9%	
12 years	79	30.4%	
≥13 years	92	31.5%	
Sex			0.64
Female	139	35.3%	
Male	212	37.7%	
Race			0.24
White	187	33.2%	
Black	75	41.3%	
Hispanic†	31	51.6%	
Asian	8	50.0%	
Other	6	50.0%	
Weight status			0.012
Underweight and normal (<85th percentile)	57	26.3%	
Overweight (85th to 94th percentile)	65	26.2%	
Obese (≥95th percentile)	217	42.4%	
Calendar year of symptom presentation			0.43
2002–2009	137	38.0%	
2010–2015	127	39.4%	
2016–2021	87	31.0%	
Slip severity classification			<0.001

	Duration of Symptoms		
	No. of Patients	**Delay ≥12 Weeks**	**P Value**
Mild	197	23.9%	
Moderate	81	42.0%	
Severe	38	89.5%	
No. of siblings (not including patient)			0.48
0	31	38.7%	
1	127	37.8%	
2	69	46.4%	
≥3	35	31.4%	
Physician specialty at time of initial presentation			0.004
Internal medicine, family medicine, or pediatrician	207	37.7%	
Emergency department physician	72	29.2%	
Orthopaedic surgeon	59	42.4%	
Other	5	0%	
Physician specialty at time of diagnosis			0.14
Internal medicine, family medicine, or pediatrician	108	31.5%	
Emergency department physician	73	24.7%	
Orthopaedic surgeon	157	47.1%	
Other	11	27.3%	
No. of interactions with health care: symptom onset to diagnosis (diagnostic visit included)			<0.001
1	177	22.6%	
2	124	43.5%	
≥3	40	70%	

*Of the patients who did not have data recorded, 16 did not have insurance status recorded, 36 did not have family structure recorded, and 32 did not have SVI (based on U.S. percentiles) recorded.

†Hispanic ethnicity was not reported independently from race in the medical record during the time frame of this study.

TABLE III

Logistic Regression Models of the Effect of Primary Predictors on Delay ≥12 Weeks

	Primary Predictor							
	Insurance Status*		Family Structure†		SVI‡ (U.S.)		SVI‡ (Massachusetts)	
	Adjusted OR§	P Value	Adjusted OR§	P Value	Adjusted OR§	P Value	Adjusted OR§	P Value
Primary predictor	1.83 (1.12 to 2.97)	0.015	1.95 (1.11 to 3.45)	0.021	1.43 (0.79 to 2.58)	0.24	1.45 (0.79 to 2.66)	0.23
Age at symptom presentation								
<11 years	Reference		Reference		Reference		Reference	
11 years	0.52 (0.27 to 1.00)	0.050	0.46 (0.24 to 0.90)	0.022	0.49 (0.26 to 0.94)	0.031	0.49 (0.26 to 0.94)	0.032
12 years	0.39 (0.19 to 0.79)	0.009	0.37 (0.18 to 0.76)	0.007	0.37 (0.18 to 0.76)	0.006	0.37 (0.18 to 0.76)	0.006
≥13 years	0.45 (0.21 to 0.93)	0.031	0.40 (0.19 to 0.84)	0.016	0.43 (0.21 to 0.90)	0.026	0.44 (0.21 to 0.92)	0.028
Sex								
Female	Reference		Reference		Reference		Reference	
Male	1.48 (0.85 to 2.57)	0.17	1.47 (0.84 to 2.57)	0.17	1.44 (0.83 to 2.50)	0.20	1.46 (0.84 to 2.54)	0.18
Weight status								
Underweight or normal	Reference		Reference		Reference		Reference	
Overweight	0.94 (0.40 to 2.17)	0.88	0.97 (0.42 to 2.26)	0.95	0.95 (0.41 to 2.20)	0.90	0.95 (0.41 to 2.20)	0.91
Obese	1.51 (0.75 to 3.05)	0.25	1.49 (0.74 to 3.02)	0.26	1.52 (0.75 to 3.06)	0.25	1.50 (0.74 to 3.03)	0.26
Calendar year of symptom presentation								
2002–2009	1.72 (0.90 to 3.25)	0.098	1.51 (0.80 to 2.86)	0.20	1.49 (0.79 to 2.80)	0.22	1.49 (0.80 to 2.79)	0.21
2010–2015	1.55 (0.84 to 2.86)	0.16	1.45 (0.79 to 2.66)	0.23	1.45 (0.79 to 2.65)	0.23	1.41 (0.77 to 2.58)	0.27
2016–2021	Reference		Reference		Reference		Reference	
No. of siblings (excluding patient)								
0	Reference		Reference		Reference		Reference	
1	1.01 (0.42 to 2.40)	0.99	1.21 (0.50 to 2.91)	0.68	1.02 (0.43 to 2.39)	0.97	1.02 (0.43 to 2.40)	0.97
≥2	1.11 (0.46 to 2.68)	0.81	1.41 (0.58 to 3.43)	0.45	1.21 (0.51 to 2.86)	0.67	1.23 (0.52 to 2.91)	0.64
Physician specialty at time of symptom presentation								
Internal medicine, family medicine, or pediatrician	Reference		Reference		Reference		Reference	
Emergency department	0.63 (0.34 to 1.17)	0.14	0.64 (0.34 to 1.19)	0.16	0.67 (0.36 to 1.24)	0.21	0.68 (0.37 to 1.26)	0.22

	Primary Predictor							
	Insurance Status*		Family Structure†		SVI‡ (U.S.)		SVI‡ (Massachusetts)	
	Adjusted OR§	P Value	Adjusted OR§	P Value	Adjusted OR§	P Value	Adjusted OR§	P Value
Orthopaedic surgeon	1.26 (0.67 to 2.38)	0.47	1.23 (0.65 to 2.30)	0.52	1.21 (0.64 to 2.27)	0.56	1.21 (0.65 to 2.27)	0.55

*Reference: private insurance.

†Reference: multiguardian households.

‡Reference: <75th percentile.

§The values are given as the adjusted OR, with the 95% CI in parentheses.