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Risk factors for Hyperopia and Myopia in Preschool Children: *The Multi-Ethnic Pediatric Eye Disease and Baltimore Pediatric Eye Disease Studies*

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Abstract

Purpose—To describe the risk factors associated with hyperopia and myopia among children aged 6 to 72 months.

Design—Population-based cross-sectional study.

Participants—Population-based samples of 9970 children ages 6 to 72 months from Los Angeles County, California, and Baltimore, Maryland.

Methods—Participants were preschool African-American, Hispanic, and non-Hispanic white children (n=9770) from Los Angeles, California, and Baltimore, Maryland. Parental questionnaires and a comprehensive eye examination were administered.

Demographic, behavioral and clinical risk factors associated with hyperopia ($\geq +2.00$ diopters) and myopia (≤ -1.00 diopters) were determined.

Main Outcome Measures—Odds ratios (OR) for risk factors associated with myopia and hyperopia.

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*See Appendix 1 (available at <http://aaojournal.org>) for members/affiliations of the MEPEDS and BPEDS Groups.

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Results—Compared to non-Hispanic whites, African-American (OR: 6.0) and Hispanic (OR: 3.2) children were more likely to be myopic. Children aged 6–35 months were more likely to be myopic compared to those 60–72 months of age (OR: ≥ 1.7). Compared to African-American children, non-Hispanic white (OR: 1.63) and Hispanic (OR: 1.49) children were more likely to be hyperopic. Children whose parents had health insurance (OR: 1.5) and those with a history of maternal smoking during pregnancy (OR: 1.4) were more likely to have hyperopia. Astigmatism ≥ 1.5 diopters at any axis was associated with myopia (OR: 4.37) and hyperopia (OR: 1.43).

Conclusions—Children in specific racial/ethnic groups and age groups are at higher risk of having myopia and hyperopia. Cessation of maternal smoking during pregnancy may reduce the risk of hyperopia in these children. Given that both myopia and hyperopia are risk factors for the development of amblyopia and strabismus, these risk factors should be considered when developing guidelines for screening and intervention in preschool children.

Uncorrected refractive error is the leading cause of vision impairment in children.^{1–3} An estimated 12.8 million children age 5–15 years worldwide are affected.⁴ In addition, high ametropia is associated with strabismus and/or amblyopia.^{5–10} These, in turn, each affect more than 2% of preschool children.¹¹ The increased risk for strabismus or amblyopia associated with lower levels of ametropia has not been studied previously. However, the relationship between lower levels of refractive error and strabismus or amblyopia will be reported in companion papers.^{12, 13} Thus recognition of any refractive error in children would be a major step in preventing childhood vision loss, a significant public health problem. The prevention of refractive error by identifying avoidable or reversible biological or environmental risk factors for myopia or hyperopia could have even greater impact on preventing vision loss.

With automated methods of refraction increasingly available for screening of preschool children, identification of populations at risk for refractive error may increase the efficiency of vision screening programs. To date, no studies have evaluated risk factors for hyperopia and myopia in a population-based sample of children in the United States. The purpose of this paper is to identify demographic, behavioral, and clinical risk factors associated with myopia and hyperopia in Hispanic, non-Hispanic white, and African-American preschoolers from the population-based Multi-Ethnic Pediatric Eye Disease Study (MEPEDS) in California and Baltimore Pediatric Eye Disease Study (BPEDS) in Maryland.

Methods

The protocol and informed consent forms were reviewed and approved by the Institutional Review Board (IRB)/Ethics Committee of the Los Angeles County/University of Southern California Medical Center, the Committee on Human Subjects Research at the Johns Hopkins Bloomberg School of Public Health, the Battelle Centers for Public Health Research and Evaluation IRB, and the IRB of the Maryland Department of Health and Mental Hygiene, and complied with current Health Insurance Portability and Accountability Act regulations. A parent or guardian of each study participant gave written informed consent. An independent data monitoring and oversight committee provided study oversight.

Study Cohort

The study population, consisting of children aged 6 to 72 months, was identified by door-to-door screening of families within 74 census tracts in and around the cities of Inglewood, Riverside, and Glendale, California, for MEPEDS, and from 54 census tracts in and around the city of Baltimore, Maryland, for BPEDS. The details of the screening process have been reported elsewhere.^{11, 14} After written informed consent was obtained, an appointment was scheduled for a comprehensive eye examination in either the local study center or a bus

outfitted for mobile eye examinations. In Maryland, examinations were performed in the homes of families unable to travel to the study center.

Ocular Examination and Interview

A priori, the MEPEDS and BPEDS shared identical, jointly designed core eye examination and clinical interview protocols for all primary outcome measures. The clinical interview consisted of a standardized questionnaire administered by trained interviewers; details have been described previously.^{11,14} The comprehensive eye examination was performed by optometrists or ophthalmologists, trained and certified using standardized protocols.^{11,14} To ensure consistency of implementation of protocols between sites, yearly reciprocal cross-site standardization visits were made to each of the clinics. In addition, all examiners at each site underwent annual certification by the investigators who conducted the standardization visits. Retinomax autorefractometry was performed on all children 30 to 60 minutes after cycloplegia with 1% cyclopentolate, two drops 5 minutes apart (0.5% for children ≤ 12 months of age). If drops were refused, non-cycloplegic retinoscopy was performed. If Retinomax readings had a confidence value < 8 after three attempts, cycloplegic retinoscopy was performed.

A parental questionnaire was administered on the day of the clinical examination to determine demographic characteristics, family history of eye diseases, and ocular and medical history of the participants. Similar questionnaires to determine the abovementioned risk factors were administered in California and Maryland. Additional questions limited to one or the other site were asked of the parents on other aspects (e.g.: quality of life) that are not the subject of this report.

Statistical Analysis

The analysis cohort consisted of all children in whom reliable cycloplegic refraction could be obtained. Spherical equivalent (SE) refractive errors from the right eye of each participant were used for purposes of this report. Myopia was defined as SE refractive error ≤ -1.00 diopter; hyperopia as SE refractive error $\geq +2.00$ diopters. Based on previously published reports and consensus of all the investigators, the lowest levels of ametropia considered to meet the definition of myopia or hyperopia in preschoolers are presented. Risk factors for these outcomes were explored using univariate analysis and multiple logistic regression analysis. Demographic and socioeconomic factors evaluated included study site (California or Maryland); age; sex; ethnic group (Hispanic white; non-Hispanic white; African-American; determined by parental report); household annual income ($< \$20,000$; $\geq \$20,000$); regular primary care (last checkup within past 2 years or not); self-reported difficulty accessing care (yes or no); health insurance (yes or no); vision insurance (yes or no); education of primary and secondary caregivers (completed or not completed high school) and preschool or daycare attendance (yes or no; MEPEDS only). Behavioral and clinical risk factors evaluated for both outcomes included maternal smoking during pregnancy (yes or no); pack-months of maternal smoking during pregnancy; maternal alcohol consumption during pregnancy (yes or no); maternal age at birth of child (< 35 years; ≥ 35 years); gestational age (< 33 weeks; ≥ 33 weeks); low birth weight for gestational age¹⁵ (yes or no); breastfeeding (yes or no); family history of strabismus or amblyopia in first degree relatives (yes or no); Down syndrome (yes or no); and cerebral palsy (yes or no). Finally, the association of astigmatism ≥ 1.50 diopters in any axis of the right eye with hyperopia or myopia was explored.

Univariate chi-square or, where appropriate, Fisher's exact tests were first performed for all of these demographic, behavioral, and clinical risk factors. Variables showing at least marginally significant associations ($P < 0.1$) in univariate analyses were considered candidates for subsequent forward stepwise multiple logistic regression, with the exception

of Down syndrome and cerebral palsy, which were excluded from multivariate models due to the very small numbers of children with these conditions. LOWESS plots (locally weighted polynomial regression) were created to examine the independent relationship between a given continuous risk factor and the prevalence of an outcome. Regression models were fitted conditioned on the continuous variable and adjusted for all other variables significantly associated with the outcome. The estimated prevalence of the outcome was plotted against the continuous variable. The LOWESS plot uses an iterative, locally weighted, least-squares method to plot the best-fit line (STATA). (Cleveland and Devlin 1988)¹⁶

Individuals with missing data were excluded from the univariate analysis for that variable; multivariate models were run first restricted to those with complete data for all variables entered into the model and re-run in the final analysis for all individuals with complete data for variables selected in the final step-wise regression. Formal tests of interaction were completed by including a product term in the multivariate model for maternal prenatal smoking with age, gender, and race/ethnicity. Odds ratios (OR) with 95% confidence intervals (CI) are reported for the significant independent risk factors included in the final model

Characteristics of participants were further evaluated, comparing those children in the analysis dataset to those who had been excluded because of missing data; Breslow-Day tests of homogeneity and product interaction terms were used to evaluate significant differences by exclusion status.

Univariate results are reported using the same dataset as the final model (excluding participants with missing values for any of the variables included in the final multivariate model). Subgroup analysis stratified by site was performed. All analyses were conducted using SAS software 9.1 (SAS Institute, Cary, NC) and a significance level of $P < 0.05$.

Results

Eighty percent of eligible MEPEDS children and 62% of eligible BPEDS children were examined. Comparison of participants and nonparticipants is published elsewhere.^{14,17} Refractive error was determined with cycloplegia in nearly all participants. As previously reported, only 4.7% of BPEDS participants and 4.1% of MEPEDS participants underwent non-cycloplegic retinoscopy due to parental refusal of eyedrops.¹⁸ Spherical equivalent refractive error of the right eye could not be determined in 77 of the 9869 children who met race/ethnicity inclusion criteria (Fig 1). Testability of refractive error using the retinomax auto-refractor as a function of age has been previously reported.¹⁹

3.8% of preschool children (1.0% of non-Hispanic Whites; 3.3% of Hispanics; 5.8% of African-Americans) are affected by myopia $\geq -1.00D$, and 20.8% (25.1% of non-Hispanic Whites; 22.8% of Hispanics; 17.0% of African-Americans) are affected by hyperopia $\geq +2.00D$. This is consistent with an earlier report.²⁰

Significant associations, by univariate analyses, between demographic, behavioral, and clinical risk factors for hyperopia and myopia are highlighted in Table 1. Although significantly associated with myopia and/or hyperopia in the univariate analysis, cerebral palsy and Down syndrome were not included in the multivariate model because few subjects with these conditions were identified in our sample.

Multivariate logistic regression identified presence of astigmatism, young age (<36 months), African-American or Hispanic ethnicity (compared to non-Hispanic whites), and testing location (Baltimore) as independent factors of a greater risk for myopia (Table 2). These risk

factors were unchanged if myopia was redefined as ≤ -0.5 diopter. When myopia was defined as ≤ -2.00 diopters, age group lost significance, but limited access to health care became an independent risk factor.

Hyperopia, on the other hand, is independently associated with astigmatism, and with Hispanic and non-Hispanic white race/ethnicity (compared to African Americans), but does not diminish with age (Table 3). It is, in fact, less prevalent in 1- to 3-year-olds, than in 6-year-old children. Hyperopia is also associated with having health insurance and maternal smoking during pregnancy. Astigmatism was not associated with hyperopia in those subjects who were excluded from analysis for missing data. This was the only significant difference in characteristics of children included in the data analysis compared to those excluded for missing data.

Subgroup analysis showed that maternal smoking during pregnancy was a significant independent risk factor for hyperopia only in the BPEDS cohort (OR= 1.70, 95% CI 1.33–2.18). The prevalence of maternal smoking during pregnancy in California was significantly lower than in Maryland (5.3% vs. 20.5%), but maternal smoking during pregnancy remained associated with hyperopia after adjusting for site (O.R. 1.43; 95% CI 1.20–1.70) and after adjusting for site and race/ethnicity (O.R. 1.41; 1.18–1.69). The prevalence of missing maternal smoking data was similar for the two locations (19% for California vs. 20% for Maryland). Maternal smoking remained a significant risk factor for higher threshold levels of hyperopia - hyperopia $\geq +3.00D$ (O.R. 1.45; 95% CI 1.14–1.84) and hyperopia $\geq +3.50D$ (O.R. 1.39; 95% CI 1.02–1.90) for the entire cohort. There were no interactions of maternal smoking with any other significant variable for hyperopia identified from the multivariate model. There was no association of prenatal smoking with any level of myopia in both univariate and multivariate analyses.

The association of hyperopia with pack-months of maternal smoking during pregnancy exposure was also explored after adjusting for other significant risk factors determined by the multivariate model. The relationship appears to be linear and dose-dependent, with a 6% higher prevalence of hyperopia for every increase of 10 pack-months of maternal smoking during pregnancy (Fig 2).

Discussion

Although major risk factors for myopia in school-age children are known to include family history,^{21,22} environment,²³ and ethnicity,²⁴ less is known about the risk factors for hyperopia. No previous population-based studies have addressed this issue in preschool-aged children. Using multivariate analysis in a population-based, multi-ethnic sample of children, this study has identified risk factors associated with hyperopia and myopia in children aged 6 to 72 months.

Notwithstanding the limitations of a cross-sectional study, the data presented here do not support the notion of emmetropization in young children with hyperopia as the only significant drop in the prevalence of hyperopia is at 1 year of age ($p=0.0001$); and hyperopia is less prevalent in 1- to 3-year-olds than in 6-year-olds ($p=0.001$). Conversely, the prevalence of myopia is lower in children aged 4–6 years compared to those 3 years of age and younger ($p<0.0001$). Previous papers by the BPEDS and MEPEDS groups also showed minimal differences in the distribution of refractive errors by age in preschoolers.^{18, 20} This again is in contradistinction to the higher prevalence of myopia and lower prevalence of hyperopia noted in older school age children compared to younger school aged children.^{25, 26} As this is not an incidence study, we cannot determine if subsets of the ametropic children are shifting toward or away from emmetropia. Nonetheless, the

increasing axial length associated with age during the first 5 years of life does not lead to age-related shifts toward myopia in preschool children.²⁷ Concomitant biometric changes in the cornea or lens of young children would not be expected to be entirely spherical and might explain independent association of astigmatism ≥ 1.50 diopters with both myopia and hyperopia.

The results of this study cannot be directly applied to designing screening strategies in preschoolers except to suggest that strategies based on detection of abnormal refractive errors may be less age-dependent than previously thought. Since hyperopia $\geq +2.00$ D is associated with strabismus,¹² yet is stable beyond 1 year of age, screening for hyperopia may be initiated at any time beyond 1 year of age. This stability is similar to that previously reported for spherical equivalent anisometropia ≥ 1.0 D beyond one year of age, which is also associated with increased risk for amblyopia.^{13, 28} Thus, the age at which amblyopia or strabismus develops as a result of ametropia or anisometropia may be an important consideration in the timing of preschool screening programs that are based on refractive errors. While our data provide some insights into the relationship between age, ethnicity, refractive error and amblyopia and strabismus, caution must be exercised in interpreting our data as they are cross sectional by design. Validation of these risk associations will require further prospective research.

Race has a significant independent role in the risk of myopia and hyperopia, with African-American and Hispanic children at significantly greater risk for myopia than non-Hispanic whites and with African Americans at significantly less risk for hyperopia than Hispanics or non-Hispanic whites. A previous population-based study of school-aged children also noted that non-Hispanic whites were at significantly higher risk for hyperopia $\geq +2.00$ D than Asians or children of Middle Eastern descent.²⁵ However, our study is the first comparing risk factors for refractive error in non-Hispanic whites, Hispanics and African Americans. Knowledge of age- and race-related relative risks for different refractive errors may impact the screening strategies chosen for use in preschool children.

Maternal smoking during pregnancy is a significant independent and avoidable risk factor for hyperopia in preschool age children, even after adjusting for the expected co-variables of race, income, and education. This was similarly found to be the case in a population-based study in Australia, though the association was found in 6-year-olds and was only borderline in 12-year-olds.²⁵ Another clinical study of parental smoking and refractive error in children found parental smoking (one or both parents) was associated with a decreased risk of myopia and an increased risk of hyperopia compared with children whose parents did not smoke.²⁹ In the same study, smoking by either parent during the pregnancy was associated with decreased risk of myopia after adjusting for the child's age, body mass index, near work, myopia status of parents, and parents' education level. On the other hand, no association between parental smoking and childhood myopia was found in a separate study of children in Singapore.³⁰

The strong association of maternal smoking with childhood hyperopia supports the notion that nicotinic acetylcholine receptors may regulate eye growth in a manner antagonistic to the muscarinic acetylcholine receptors that promote axial elongation of the eye.²⁹ However, nicotinic antagonists actually inhibit experimental myopia in chicks, making it unlikely that nicotinic agonists found in tobacco do the same.³¹ Thus, the biological explanation for the relationship of childhood hyperopia with smoking exposure remains speculative.

The independent association between being hyperopia and having health insurance status is unlikely to be directly related. However, having health insurance may be a surrogate

measure for unknown risk factors such as diet or type of prenatal care that were not collected in our study.

Myopia was more likely in BPEDS participants than in MEPEDS participants in our multivariate analysis, indicating an effect independent of race or ethnicity. This could reflect genetic differences between similar racial populations in different geographical locations or demographic or environmental differences that are not captured in the present analysis. Since similarly small proportions of children were refracted without cycloplegia at the two sites, the association with study site is unlikely to be an artifact of misclassification with regard to refractive error.

The definitions of hyperopia (≥ 2 diopters) and myopia (≥ 1 diopter) could be questioned since subjects with less severe refractive errors may still be considered to have the condition and thus lead to misidentification of risk factors. When subjects with borderline refractive error (hyperopia between 1 and 2 diopters or myopia between 0 and 1 diopter) were excluded from the analyses, there was no change in the independent risk factors that were identified.

Several limitations to this study are related to the cross-sectional study design. For example, although the association of refractive error with age suggests loss of early myopia as children age, longitudinal study is needed to confirm whether such a process of emmetropization occurs. Since gestational exposure to maternal smoking was determined retrospectively by parental report, there is the potential for recall bias, with parents of children with refractive error being more likely to report such exposure. However, we believe that such bias would be limited by the fact that refractive error was not measured and communicated to parents until after completion of the parental interview.

Missing data may be another limitation of the study. We excluded 77 individuals because of missing data from the myopia analysis and 1401 individuals from the hyperopia analysis; however, we did not find significance differences in characteristics of participants included in the analysis versus those who were excluded with the exception that a higher proportion of those with astigmatism and hyperopia were included in the analysis.

The size and population-based design of this study are its major strengths. We believe our results may be generalized to other similar populations and are less likely to be impacted by referral or selection biases than findings from clinic-based studies. The use of identical protocols in two sites has allowed us to pool MEPEDS and BPEDS data with resulting gains in power and precision of our estimates of the strength of reported associations.

In conclusion, we have explored various demographic, behavioral and clinical associations with myopia and hyperopia in a population-based study of preschool children. Both hyperopia and myopia are associated with astigmatism. Independent associations with myopia are young age and African-American ethnicity, while hyperopia is associated with whites and exposure to maternal smoking during pregnancy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Participant flowchart highlighting those children who were included and excluded from the final analysis sample for both outcomes – myopia and hyperopia in both the Multi-Ethnic Pediatric Eye Disease Study and the Baltimore Pediatric Eye Disease Study.

Figure 2.

Locally weighted regression line illustrating the independent association of the amount of maternal smoking during pregnancy and the estimated prevalence of hyperopia in both the Multi-Ethnic Pediatric Eye Disease Study and the Baltimore Pediatric Eye Disease Study. The estimated prevalence of hyperopia was obtained using a stepwise logistic regression procedure that adjusts for other potential risk factors.

Frequency Distributions Of Demographic, Behavioral, Clinical, and Ocular Risk Factors in Children With and Without Myopia and Hyperopia in the Multi-Ethnic Pediatric Eye Disease Study and the Baltimore Pediatric Eye Disease Study

Table 1

Potential Risk Factors	Myopia (≤-1D) N=9893		Hyperopia (≥+2D) N=8569		P-value
	Yes N=378 n (%)	No N=9515 n (%)	Yes N=1788 n (%)	No N=6781 n (%)	
Site					0.52
California	269 (4)	7256 (96)	1359 (21)	5203 (79)	
Maryland	109 (5)	2259 (95)	429 (21)	1578 (79)	
Age					<.0001
6–11 months	56 (6)	815 (94)	210 (26)	593 (73)	
12–23 Months	94 (6)	1596 (94)	289 (19)	1213 (80)	
24–35 Months	81 (4)	1733 (96)	277 (18)	1294 (82)	
36–47 Months	51 (3)	1774 (97)	337 (22)	1209 (78)	
48–59 Months	47 (3)	1796 (97)	322 (20)	1256 (80)	
60–72 Months	49 (3)	1801 (97)	353 (23)	1216 (77)	
Race					<.0001
Non-Hispanic White	25 (1)	2403 (99)	474 (25)	1413 (75)	
Hispanic White	104 (3)	3076 (97)	693 (23)	2342 (77)	
African-American	249 (6)	4036 (94)	621 (17)	3026 (83)	
Maternal age ≥35 years	43 (4)	1082 (96)	222 (21)	853 (79)	0.83
Breastfed	217 (4)	5636 (96)	1192 (21)	4551 (79)	0.74
Alcohol during pregnancy	13 (5)	251 (95)	66 (25)	194 (75)	0.07
Smoking during pregnancy	31 (4)	730 (96)	202 (27)	558 (73)	<.0001
Gestational age < 33 weeks	7 (3)	259 (97)	56 (23)	192 (77)	0.50
Gestational age					0.20
20 to <33 weeks	7 (3)	259 (97)	56 (23)	192 (77)	
33 to < 37 weeks	26 (5)	547 (95)	111 (20)	438 (80)	
37 to <42 weeks	297 (4)	7278 (96)	1517 (21)	5827 (79)	
≥ 42 weeks	14 (4)	353 (96)	89 (25)	265 (75)	
Low birth weight for gestation	62 (4)	1589 (96)	294 (19)	1286 (81)	0.02

Potential Risk Factors	Myopia ($\leq -1D$) N=9893		Hyperopia ($\geq +2D$) N=8569		P-value
	Yes N=378 n (%)	No N=9515 n (%)	Yes N=1788 n (%)	No N=6781 n (%)	
Cerebral palsy	2 (15)	11 (85)	2 (17)	10 (83)	0.72
Down syndrome	3 (14)	18 (86)	9 (56)	7 (44)	0.01
Family history of strabismus	17 (3)	540 (97)	125 (24)	388 (76)	0.04
Family history of amblyopia	2 (2)	122 (98)	35 (29)	86 (71)	0.03
Household income $< \$20,000/\text{year}$	178 (4)	4361 (96)	875 (21)	3348 (79)	0.52
Health insurance	354 (4)	8644 (96)	1734 (21)	6493 (79)	0.02
Vision insurance	180 (4)	4320 (96)	843 (21)	3254 (79)	0.57
Last health exam < 2 years ago	359 (4)	8831 (96)	1755 (21)	6655 (79)	0.06
Limited access to healthcare-yes	15 (6)	221 (94)	44 (22)	160 (78)	0.80
Primary caregiver education $< \text{high school}$	92 (4)	2516 (96)	548 (23)	1877 (77)	0.01
Secondary caregiver education $< \text{high school}$	46 (4)	1060 (96)	237 (23)	773 (77)	0.28
Astigmatism ($\geq 1.5D$)	118 (12)	848 (88)	234 (27)	623 (73)	<0.0001

D: Diopters

Table 2

Multivariable Logistic Regression Analysis of Risk Factors for Myopia ($\leq -1D$) in the Multi-Ethnic Pediatric Eye Disease Study and the Baltimore Pediatric Eye Disease Study

	Order of Entry into Model	OR	95% CI	
Astigmatism $\geq 1.5D$	1	4.37	3.45	5.54
Race	2			
African American vs. NHW		6.01	3.95	9.14
Hispanic vs. NHW		3.23	2.03	5.11
Age	3			
6–11 Months vs. 60–72 Months		2.04	1.37	3.06
12–23 Months vs. 60–72 Months		2.16	1.51	3.09
24–35 Months vs. 60–72 Months		1.71	1.19	2.47
36–47 Months vs. 60–72 Months		1.11	0.74	1.66
48–59 Months vs. 60–72 Months		0.96	0.64	1.45
Site	4			
Baltimore vs. California		1.50	1.17	1.93

D: diopters, OR: odds ratio, CI: confidence interval

Table 3

Multivariable Logistic Regression Analysis of Risk Factors for Hyperopia ($\geq +2D$) in the Multi-Ethnic Pediatric Eye Disease Study and the Baltimore Pediatric Eye Disease Study

	Order of Entry into Model	OR	95% CI	
Race	1			
Non-Hispanic White vs. African-American		1.63	1.43	1.87
Hispanic White vs. African-American		1.49	1.32	1.68
Astigmatism $\geq 1.5D$	2	1.43	1.21	1.69
Smoking during pregnancy	3			
Yes vs. No		1.44	1.21	1.72
Age	4			
6–11 Months vs. 60–72 Months		1.44	0.94	1.40
12–23 Months vs. 60–72 Months		0.81	0.68	0.97
24–35 Months vs. 60–72 Months		0.74	0.62	0.88
36–47 Months vs. 60–72 Months		0.95	0.80	1.13
48–59 Months vs. 60–72 Months		0.89	0.75	1.05
Having Health insurance	5			
vs. no health insurance		1.51	1.12	1.69

D: Diopters, OR: odds ratio, CI: confidence interval