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Prevalence and Associated Factors of Refractive Error Among Schoolchildren in Brazil

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Abstract

Objective

To estimate the prevalence of refractive error and investigate associated sociodemographic, familial, and behavioral factors among public schoolchildren in Brazil.

Methods

This cross-sectional study was conducted in two public schools in Bauru, São Paulo, Brazil, between August and September 2025. Children aged 6–16 years underwent comprehensive ophthalmologic examination, including cycloplegic refraction. Refractive error was defined as myopia (spherical equivalent ≤ − 0.50 D), hyperopia (≥ + 2.00 D), or astigmatism (cylinder ≥ 0.75 D), based on the worse eye. Prevalence estimates with 95% confidence intervals (CI) were calculated using the exact method. Associations were assessed using Poisson regression with robust variance to estimate adjusted prevalence ratios (PR).

Results

A total of 672 students were evaluated. The overall prevalence of refractive error was 49.1% (95% CI: 45.3–53.0). Astigmatism was the most frequent type (19.8%), followed by myopia combined with astigmatism (12.5%). No statistically significant associations were observed for sex, age group, maternal education, outdoor activity, or screen time. A positive family history of spectacle use was independently associated with refractive error (PR = 1.72; 95% CI: 1.02–2.90).

Conclusion

Refractive error was highly prevalent among Brazilian schoolchildren, with astigmatism as the predominant type. Family history emerged as the main associated factor, highlighting the importance of school-based vision screening strategies for early detection and management.

Introduction

Refractive errors are among the leading causes of avoidable visual impairment in children and adolescents worldwide, with significant consequences for visual development, academic performance, and quality of life. Millions of children are affected by uncorrected refractive errors, which may lead to amblyopia and functional limitations if not detected and treated early.[1,2]

Over recent decades, epidemiological studies have documented a substantial increase in the prevalence of refractive errors, particularly myopia, across different regions. Meta-analyses indicate considerable

geographic variation in clinically significant refractive errors, depending on diagnostic criteria and study design, with especially high prevalence reported in school-aged populations.[3] In East Asia, myopia has reached epidemic levels, affecting more than 50% of adolescents, while European and Latin American countries report intermediate but rising prevalence rates.[4,5]

In Brazil, school-based vision screening initiatives exist, yet population-based data remain limited and regionally heterogeneous. Studies conducted in large urban centers have reported relevant prevalence of refractive errors among schoolchildren, underscoring the need for locally representative investigations that consider sociodemographic and behavioral characteristics.[6] The lack of consistent epidemiological data across different regions hinders public health planning for pediatric eye care.

Astigmatism is among the most frequent refractive errors in childhood and often coexists with myopia or hyperopia.[7] Myopia typically progresses during childhood and adolescence and is influenced by both genetic and environmental factors.[8,9] Parental myopia has been consistently associated with increased risk in offspring.[10,11] Environmental exposures—such as prolonged near work, increased screen time, and reduced outdoor activity—have been implicated as potential contributors.[12,13] Time spent outdoors has been described as a protective factor, possibly mediated by light exposure and retinal dopamine pathways.[14,9] However, associations with near work and screen time remain heterogeneous across studies.[12,15].

Despite growing international evidence, important gaps remain in the Brazilian context, particularly regarding standardized assessment of the prevalence of different refractive error types and their associated factors in school-based populations. Moreover, few national studies have examined isolated and combined myopia separately, potentially obscuring distinct epidemiological patterns.

Therefore, this study aimed to estimate the prevalence of refractive errors among public schoolchildren and to investigate associations with demographic characteristics, family history, and visual behaviors, with particular emphasis on myopia.

Methods

This was an observational, cross-sectional, analytical study conducted to estimate the prevalence of refractive errors and to investigate their association with sociodemographic, familial, and behavioral factors among schoolchildren.

The study was carried out in the municipality of Bauru, São Paulo State, Brazil, in public schools within the municipal education system offering elementary education (early and late grades). Schools were selected after authorization from the Municipal Department of Education and formal approval from school principals. Two municipal schools located in different geographic regions of the city (east and west zones) were included to represent distinct areas of the municipality. Data collection was conducted between August 4 and September 2, 2025, by a previously trained team.

The study population consisted of students aged 6 to 16 years who were regularly enrolled in the municipal public school system. All children from the selected classes were eligible if they met the age criteria and had written informed consent from parents or legal guardians. Participants were excluded if formal authorization was not provided, if they did not attend the ophthalmologic evaluation after recall attempts, or if they refused pupillary dilation required for cycloplegic refraction.

The primary outcome was the presence of refractive error, determined through a complete ophthalmologic examination including cycloplegic refraction. For analytical purposes, the refractive status of the worse eye was considered, defined as the eye with the greatest absolute magnitude of refractive error (spherical equivalent or cylindrical component). Refractive errors were defined as follows: myopia (spherical equivalent ≤ − 0.50 diopters), hyperopia (spherical equivalent ≥ + 2.00 diopters), and astigmatism (cylinder ≥ 0.75 diopters). Children not meeting these criteria were classified as emmetropic. The outcome was operationalized both as a dichotomous variable (presence or absence of refractive error in the worse eye) and as a multinomial variable, considering specific types of refractive error and their combinations, excluding emmetropia.

Independent variables were selected based on prior evidence and grouped into three categories: sociodemographic (sex, age in complete years, later categorized, and family income); school and familial factors (parental education and family history of spectacle use); and behavioral variables (daily time spent in outdoor activities and daily screen time). All independent variables were analyzed categorically, with predefined reference categories for multivariable models.

Data collection included in-person ophthalmologic examination and a structured questionnaire administered to parents or legal guardians. Examinations were conducted at the participating schools in a designated area. Clinical assessment included visual acuity measurement using a Snellen chart or LEA symbols according to age and cooperation; cycloplegic refraction approximately 30 minutes after instillation of 1% cyclopentolate, performed using an autorefractor or manual retinoscopy; and fundoscopic examination to assess the posterior segment. All procedures followed a standardized protocol, and the team, composed of ophthalmologists and ophthalmic technicians, received prior training to ensure consistency and data quality.

Descriptive analysis was initially performed using absolute and relative frequencies. The prevalence of refractive error was estimated for the total sample and across subgroups, with 95% confidence intervals calculated using the exact Clopper–Pearson method.

Associations between explanatory factors and the presence of refractive error were assessed using Poisson regression with robust variance, estimating prevalence ratios (PR) and corresponding 95% confidence intervals. Adjusted estimates were obtained from log-linked models using the Huber–White robust variance estimator. Multinomial regression was used to evaluate factors associated with specific types of refractive error, excluding emmetropia, with results presented as relative risk ratios and 95% confidence intervals.

A significance level of 5% (α = 0.05) was adopted for all analyses. Statistical analyses were performed using R software (R Foundation for Statistical Computing), with appropriate packages for data management, modeling, and graphical visualization.[16]

Results

The distribution of sociodemographic and behavioral characteristics according to the presence of refractive error is presented in Table 1. No statistically significant differences were observed in the prevalence of refractive error according to age group (p = 0.224) or sex (p = 0.376).

Table 1
Distribution of refractive error according to sociodemographic characteristics, behavioral factors, and family history among schoolchildren

Refractive error							
	No		**Yes**		**Total**		
	N	**%**	**N**	**%**	**N**	**%**	
Age group							0.224
6–8 years	87	25.4	98	29.7	185	27.5	
9–12 years	159	46.5	154	46.7	313	46.6	
13–16 years	96	28.1	78	23.6	174	25.9	
Total	342	100.0	330	100.0	672	100.0	
Sex							0.376
Female	178	52	183	55.5	361	53.7	
Male	164	48	147	44.5	311	46.3	
Total	342	100	330	100	672	100	
Family income							0.261
Less than 1 minimum wage	29	8.5	30	9.1	59	8.8	
1–3 minimum wages	201	58.8	211	63.9	412	61.3	
3–5 minimum wages	90	26.3	77	23.3	167	24.9	
More than 5 minimum wages	22	6.4	12	3.6	34	5.1	
Paternal education							0.965
Primary education	177	54.6	167	54.8	344	54.7	
Secondary education	84	25.9	81	26.6	165	26.2	
Higher education	63	19.4	57	18.7	120	19.1	
Total	324	100	305	100	629	100	
Maternal education							0.529
Primary education	61	17.9	57	17.5	118	17.7	
Secondary education	193	56.8	174	53.4	367	55.1	
Higher education	86	25.3	95	29.1	181	27.2	
Note: Pearson’s chi-square test							

Refractive error							
	No		**Yes**		**Total**		
	N	**%**	**N**	**%**	**N**	**%**	
Total	340	100	326	100	666	100	
Outdoor activity							0.727
1–2 hours/day	162	47.4	169	51.2	331	49.3	
3–4 hours/day	73	21.3	68	20.6	141	21	
More than 4 hours/day	26	7.6	20	6.1	46	6.8	
Less than 1 hour/day	81	23.7	73	22.1	154	22.9	
Total	342	100	330	100	672	100	
Screen time							0.528
Less than 1 hour/day	18	5.3	25	7.6	43	6.4	
1–2 hours/day	130	38	129	39.1	259	38.5	
3–4 hours/day	121	35.4	104	31.5	225	33.5	
4 hours or more/day	73	21.3	72	21.8	145	21.6	
Total	342	100	330	100	672	100	
Family history of spectacle use							0.019
No	34	9.9	17	5.2	51	7.6	
Yes	308	90.1	313	94.8	621	92.4	
Total	342	100	330	100	672	100	
Note: Pearson’s chi-square test							

Similarly, family income, paternal education, and maternal education were not significantly associated with the presence of refractive error (all $p > 0.05$).

Regarding behavioral variables, no association was identified between daily time spent in outdoor activities and refractive error ($p = 0.727$), nor between screen time and the presence of the outcome ($p = 0.528$).

In contrast, a statistically significant association was observed between family history of spectacle use and refractive error ($p = 0.019$), with a higher proportion of refractive error among children with a positive family history.

The overall prevalence of refractive error in the worse eye was 49.1% (95% CI: 45.3–53.0). Prevalence was similar between males (47.3%; 95% CI: 41.6–53.0) and females (50.7%; 95% CI: 45.4–56.0) (Fig. 1 and table supplementary 1).

Across age groups, prevalence ranged from 44.8% (95% CI: 37.3–52.5) among adolescents aged 13–16 years to 53.0% (95% CI: 45.5–60.3) among children aged 6–8 years. Children aged 9–12 years showed a prevalence of 49.2% (95% CI: 43.5–54.9). No clear gradient was observed across age categories.

Prevalence varied modestly according to family income, ranging from 35.3% (95% CI: 19.7–53.5) among children from families earning more than five minimum wages to 51.2% (95% CI: 46.3–56.1) among those in the one to three minimum wage category. Similar patterns were observed across maternal education levels, with prevalence estimates between 47% and 53%.

Regarding behavioral factors, prevalence was relatively homogeneous across categories of outdoor activity, ranging from 43.5% (95% CI: 28.9–58.9) among those reporting more than four hours per day to 51.1% (95% CI: 45.5–56.6) among those reporting one to two hours daily. Screen time showed no consistent dose–response pattern, with prevalence estimates between 46% and 58% across categories.

In contrast, a marked difference was observed according to family history of spectacle use. Children with a positive family history had a substantially higher prevalence of refractive error (50.6%; 95% CI: 46.4–54.4) compared with those without such history (30.6%; 95% CI: 20.8–47.9).

When analyzing refractive error types in the worse eye, astigmatism was the most frequent condition, with a prevalence of 19.8% (95% CI: 16.8–23.0). This was followed by myopia combined with astigmatism (12.5%; 95% CI: 10.1–15.2). Isolated hyperopia (5.8%; 95% CI: 4.2–7.8), isolated myopia (5.7%; 95% CI: 4.0–7.7), and hyperopia combined with astigmatism (5.4%; 95% CI: 3.8–7.3) were less frequent (Table 2).

Stratified analyses by sex showed a similar distribution pattern, with astigmatism remaining the most prevalent refractive error in both females (21.1%; 95% CI: 17.0–25.6) and males (18.3%; 95% CI: 14.2–23.1), without substantial differences in the relative distribution of specific error types.

Clear differences emerged according to spectacle use. Among children not wearing spectacles, astigmatism was the predominant refractive error (20.6%; 95% CI: 17.3–24.2), whereas combined errors were less frequent. In contrast, among spectacle wearers, combined myopia and astigmatism predominated (50.0%; 95% CI: 40.7–59.3), followed by isolated astigmatism (16.1%; 95% CI: 10.0–24.0) and isolated myopia (13.6%; 95% CI: 8.0–21.1).

A similar pattern was observed when stratifying by previous spectacle prescription. Among children without prior prescription, astigmatism was the most frequent refractive error, whereas among those with prior prescription, combined myopia and astigmatism was the predominant type (46.1%; 95% CI: 37.2–55.1).

Analysis according to current spectacle prescription showed that, among children without current prescription, astigmatism remained the most frequent type. Conversely, among those with a current prescription, combined myopia and astigmatism (34.0%; 95% CI: 28.1–40.3) and isolated astigmatism (25.4%; 95% CI: 20.1–31.4) were the most prevalent categories.

Figures 2A and 2B illustrate the proportional distribution of refractive error types according to daily screen time and time spent in outdoor activities.

Regarding outdoor activity, astigmatism was the most frequent refractive error across all exposure categories, accounting for approximately 38% to 50% of cases. Among children reporting more than four hours per day outdoors, astigmatism represented half of all refractive errors, followed by hyperopia and combined myopia/astigmatism. In contrast, among those reporting less than one hour per day outdoors, combined myopia/astigmatism accounted for a relatively larger proportion of cases, although astigmatism remained the predominant type. Isolated myopia and hyperopia showed lower and relatively stable proportions across outdoor activity categories (Fig. 2A).

Regarding daily screen time, astigmatism remained the most prevalent refractive error across all exposure categories, accounting for approximately 29% to 52% of cases. Among children reporting less than one hour of screen time per day, astigmatism represented the majority of refractive errors, followed by combined myopia and astigmatism.

As daily screen time increased, a more balanced distribution between isolated astigmatism and combined myopia/astigmatism was observed, particularly among those reporting one to two hours and three to four hours per day. Isolated myopia and hyperopia accounted for smaller proportions across all screen time categories, without marked variation between exposure levels (Fig. 2B)

To investigate factors associated with refractive error in the worse eye, Poisson regression with robust variance was performed to estimate adjusted prevalence ratios (PR) and 95% confidence intervals. The multivariable model included predefined sociodemographic, behavioral, and familial variables (Fig. 3).

After adjustment, no statistically significant association was observed between sex and refractive error (PR = 1.08; 95% CI: 0.88–1.33; p = 0.447). Similarly, compared with children aged 6–8 years, those aged 9–12 years (PR = 0.75; 95% CI: 0.51–1.11; p = 0.148) and 13–16 years (PR = 0.81; 95% CI: 0.63–1.05; p = 0.108) showed lower prevalence ratios, although these differences were not statistically significant.

Maternal education was not significantly associated with refractive error. Compared with children whose mothers had primary education, those whose mothers had secondary (PR = 0.82; 95% CI: 0.63–1.06; p = 0.130) or higher education (PR = 0.85; 95% CI: 0.61–1.18; p = 0.339) showed lower, but non-significant, prevalence ratios.

In contrast, family history of spectacle use was significantly associated with refractive error. Children with a positive family history had a 72% higher prevalence of refractive error compared with those without such history (PR = 1.72; 95% CI: 1.02–2.90; p = 0.042).

No statistically significant associations were observed between time spent in outdoor activities and refractive error. Although children reporting more than four hours per day outdoors showed a lower prevalence ratio (PR = 0.77; 95% CI: 0.43–1.37; p = 0.376) compared with those reporting less than one hour per day, confidence intervals were wide and included the null value.

Discussion

The overall prevalence of refractive error observed in this study (49.1%) was high compared with recent estimates from different regions worldwide. A recent European meta-analysis reported a prevalence of clinically significant refractive error of 17.9% among children and adolescents.[3] Population-based studies conducted in China have reported prevalence ranging from 32.9% to 56.5%, depending on age group and diagnostic criteria.[4] In Brazil, school-based screening programs conducted in São Paulo identified refractive error in approximately 45% of children,[6] a value close to that observed in the present investigation.

Differences across studies may be explained by variations in diagnostic criteria, use of cycloplegia, measurement methods, and population characteristics.[3,5] In the present study, the use of cycloplegic refraction increases diagnostic accuracy and reduces the risk of myopia overestimation.[23]

No statistically significant associations were observed between refractive error and sex, age group, family income, or maternal education after multivariable adjustment. The absence of sex differences is consistent with recent meta-analyses that did not identify consistent patterns for aggregated refractive error outcomes.[3] Although previous studies have suggested associations between socioeconomic status, parental education, and childhood myopia, these relationships are often mediated by complex contextual factors, including educational intensity and access to healthcare services.[17,18]

Astigmatism was the most frequent refractive error in the sample, followed by combined myopia and astigmatism, a pattern consistent with international evidence.[3] Astigmatism commonly coexists with other refractive errors and may remain relatively stable throughout childhood.[7] Its high frequency has important clinical implications, as uncorrected astigmatism is associated with amblyopia, visual discomfort, and impaired academic performance.[2]

The statistically significant association between family history of spectacle use and refractive error represents one of the most robust findings of this study. Children with a positive family history had a 72% higher prevalence of refractive error after multivariable adjustment. This result reinforces the well-established hereditary contribution to refractive error development,[10,11] although gene–environment interactions are recognized as complex.[19,20]

No statistically significant associations were observed between refractive error and time spent in outdoor activities or daily screen time. Nevertheless, a trend toward lower prevalence among children reporting greater outdoor exposure was observed. Robust evidence supports the protective role of natural light exposure in myopia prevention.[14,16,13] The lack of statistical significance in the present study

may reflect limitations related to self-reported exposure measurement, sample size, or behavioral variability within the study population.

These findings have relevant implications for public health policies targeting pediatric eye care. The high prevalence of refractive error underscores the need for structured school-based vision screening programs, in line with international recommendations.[2,21] Evidence indicates that school screening and timely provision of spectacles significantly improve academic performance and quality of life.[22]

This study has limitations inherent to its cross-sectional design, which precludes causal inference and temporal assessment between exposures and outcome. Behavioral variables were measured through questionnaires and may be subject to recall bias and misclassification. However, a major strength of the study is the use of cycloplegic refraction, the gold standard for refractive assessment in children, as well as multivariable adjustment for relevant potential confounders.

In summary, the high prevalence of refractive error observed, together with the significant association with family history, reinforces the importance of early screening and intervention strategies in school-aged populations, particularly in urban settings of middle-income countries.

Declarations

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Author Contributions

J.E.M.F. contributed to conceptualization, formal analysis, investigation, methodology, project administration, resources, supervision, validation, visualization, writing – original draft, and writing – review and editing. M.N.N. contributed to data curation, validation, and visualization. F.A.V. contributed to conceptualization, data curation, formal analysis, methodology, validation, visualization, and writing – original draft. R.A.-F. contributed to methodology, validation, visualization, writing – original draft, and writing – review and editing. C.S. contributed to conceptualization, formal analysis, investigation, methodology, project administration, supervision, validation, visualization, and writing – review and editing. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Data availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request for non-commercial research purposes.

Consent to publish
Not applicable.

Competing interests
The authors declare no competing interests.

Ethics Approval and Consent to Participate

This study was approved by the Research Ethics Committee of the Faculty of Medicine of Bauru, University of São Paulo, under CAAE number 81736624.0.0000.5441. The study adhered to the principles of the Declaration of Helsinki. Written informed consent was obtained from parents or legal guardians, and assent was obtained from participating children when applicable.

References

1. Morgan IG, Ohno-Matsui K, Saw SM. Myopia Lancet. 2012;379(9827):1739–48.
2. Hutchinson AK, Morse CL, Hercinovic A, et al. Pediatric eye evaluations preferred practice pattern. Ophthalmology. 2023;130(1):1–43.
3. Doyle M, O'Donnell A, Harrington S, O'Dwyer V, Moore M. Prevalence of clinically significant refractive error in children in Europe: systematic review and meta-analysis. PLoS ONE. 2025;20(3).
4. Mingming C, Zhou Y, Shaoli L, et al. Prevalence and associated factors of myopia and axial length-related visual impairment in children and adolescents aged 4–18 years. Sci Rep. 2025;15(1):35277. 10.1038/s41598-025-18400-4.
5. Guillon-Rolf R, Grammatico-Guillon L, Leveziel N et al. Refractive errors in a large dataset of French children: the ANJO Study. Sci Rep. 2022;12.
6. Costa DRD, Debert I, Susanna FN, et al. Vision for the Future Project: screening impact on the prevention and treatment of visual impairments in public school children in São Paulo city, Brazil. Clin (Sao Paulo). 2021;76:e2662.
7. Kam KW, Shing E, Zhang Y, et al. Prevalence and severity of astigmatism in children after COVID-19. JAMA Ophthalmol. 2025;143(2):155–62.
8. Tricard D, Marillet S, Ingrand P, et al. Progression of myopia in children and teenagers: a nationwide longitudinal study. Br J Ophthalmol. 2022;106(8):1104–10.
9. Jonas JB, Ang M, Cho P, et al. IMI prevention of myopia and its progression. Invest Ophthalmol Vis Sci. 2021;62(5):6.
10. Tang SM, Kam KW, French AN, et al. Independent influence of parental myopia on childhood myopia in a dose-related manner in 2,055 trios: the Hong Kong Children Eye Study. Am J Ophthalmol. 2020;218:45–54.

11. Jiang X, Tarczyn-Hornoch K, Cotter SA, et al. Association of parental myopia with higher risk of myopia among multiethnic children before school age. JAMA Ophthalmol. 2020;138(5):501–9.
12. Ha A, Lee YJ, Lee M, et al. Digital screen time and myopia: a systematic review and dose-response meta-analysis. JAMA Netw Open. 2025;8(2):e2460026. 10.1001/jamanetworkopen.2024.60026.
13. Ding H, Jiang L, Lin X, Ye C, Chun B. Association of physical activity, sedentary behaviour, sleep and myopia in children and adolescents. BMC Public Health. 2025;25:Article number pending.
14. Kido A, Miyake M, Watanabe N. Interventions to increase time spent outdoors for preventing incidence and progression of myopia in children. Cochrane Database Syst Rev. 2024;3:CDXXXXXX.
15. Xie X, Ma J, Chen Q et al. Evaluation of myopia status and eye use behavior in school-age and preschool children. PLoS ONE. 2024;19(1).
16. He X, Sankaridurg P, Wang J, et al. Time outdoors in reducing myopia: a school-based cluster randomized trial. Ophthalmology. 2022;129(3):285–95.
17. He X, Sankaridurg P, Xiong S, et al. Prevalence of myopia and high myopia, and the association with education: Shanghai Child and Adolescent Large-Scale Eye Study (SCALE). BMJ Open. 2021;11:e043722.
18. Clark R, Kneepkens SCM, Plotnikov D et al. Time spent outdoors partly accounts for the effect of education on myopia. Invest Ophthalmol Vis Sci. 2023;64(4):Article number pending.
19. Yu M, Hu Y, Han M et al. Global risk factor analysis of myopia onset in children: a systematic review and meta-analysis. PLoS ONE. 2023;18(2).
20. Modjtahedi BS, Abbott RL, Fong DS, et al. Reducing the global burden of myopia by delaying the onset of myopia and reducing myopic progression in children: the Academy's Task Force on Myopia. Ophthalmology. 2021;128(6):816–26.
21. Little JA, Chan VF, Saw SM, et al. Current status of school vision screening: rationale, models, impact and challenges. Br J Ophthalmol. 2025;109(4):455–63.
22. Neitzel AJ, Wolf B, Guo X, et al. Effect of a randomized interventional school-based vision program on academic performance. JAMA Ophthalmol. 2021;139(2):125–32.

Table 2

Table 2 is available in the Supplementary Files section.

Figures

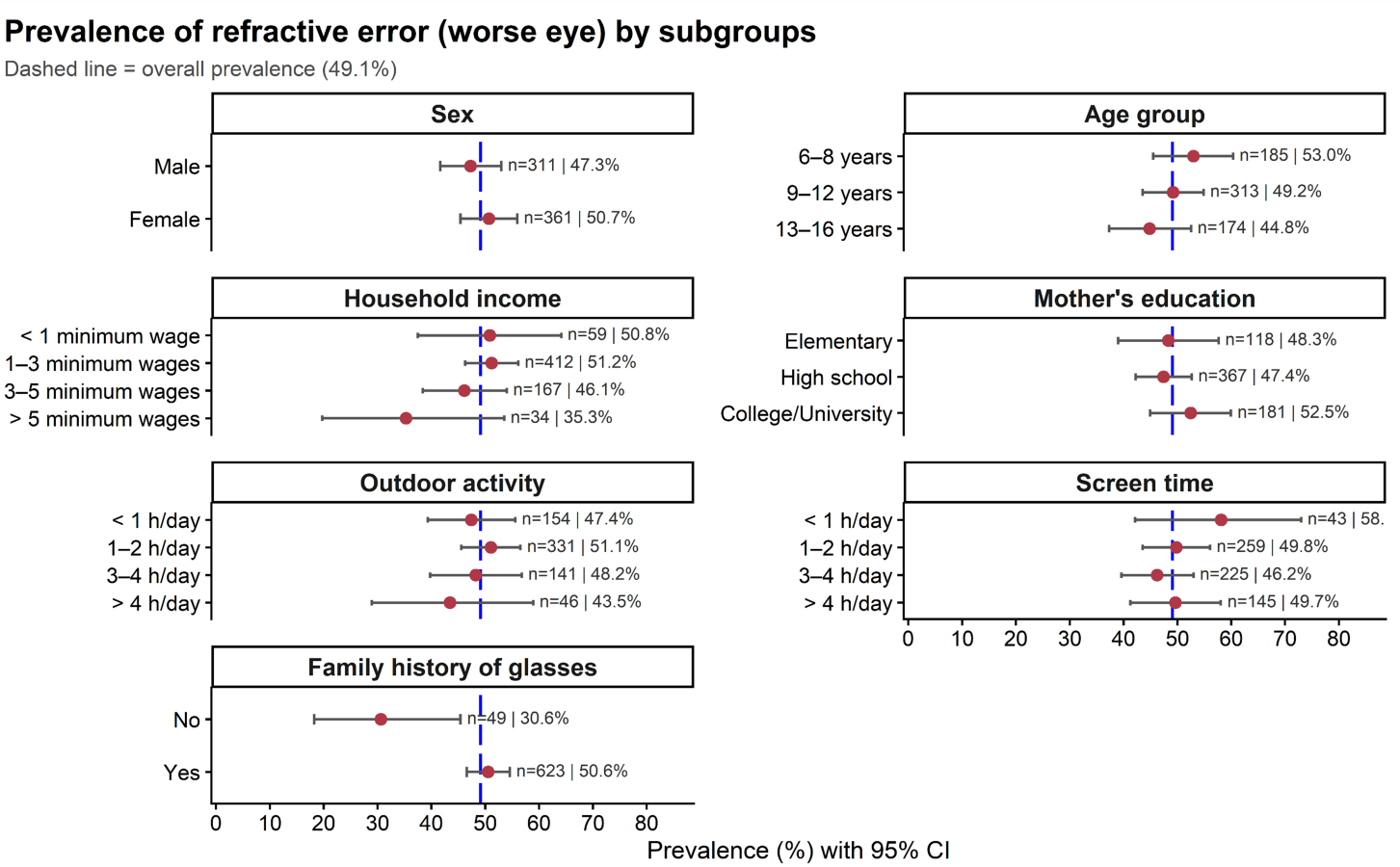
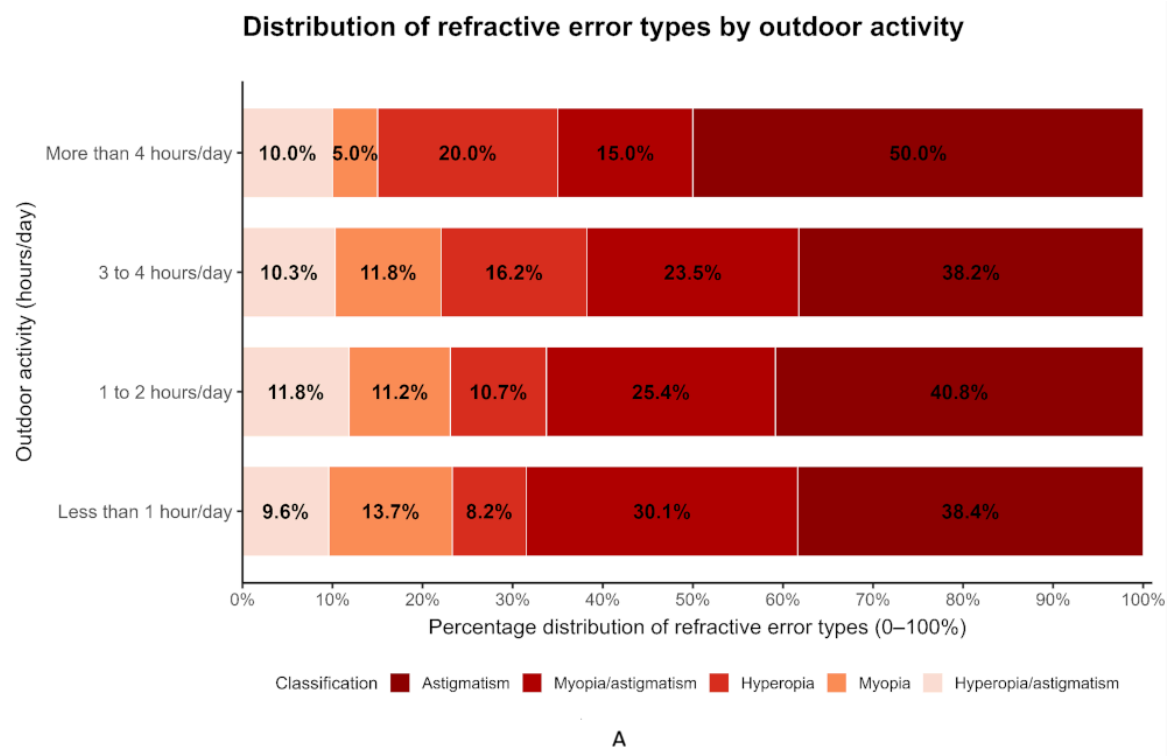
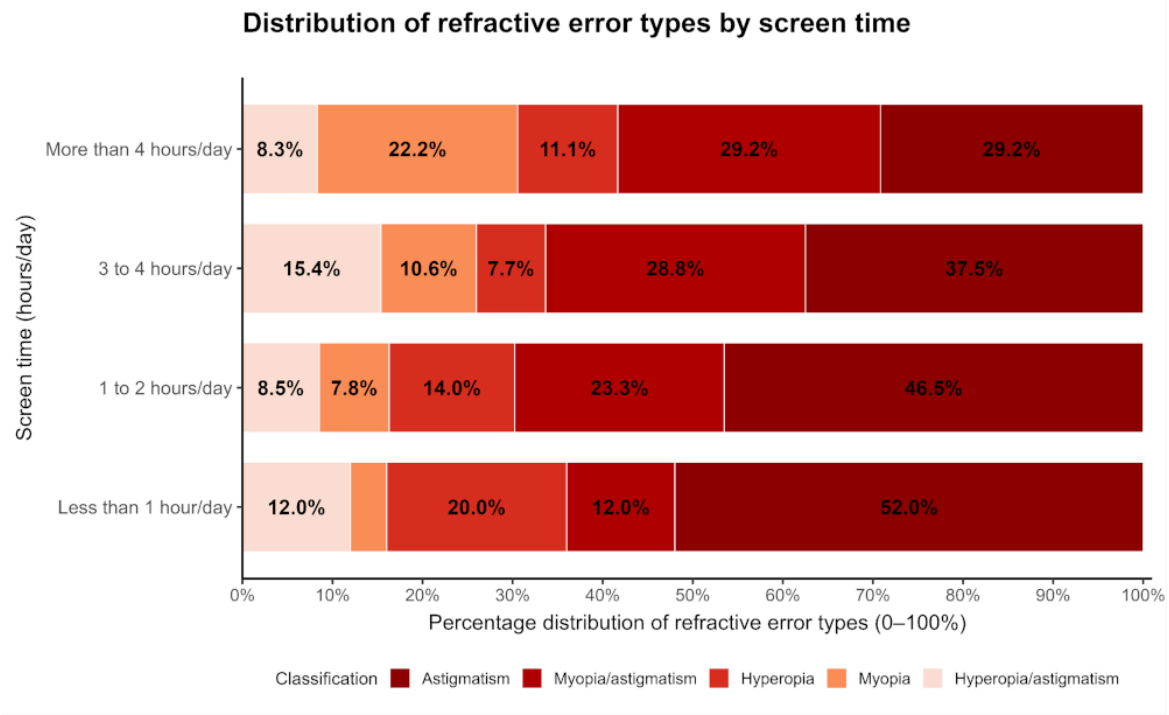


Figure 1

Prevalence of refractive error (worse eye) according to sociodemographic characteristics, behavioral factors, and family history.



A



B

Figure 2

A. Distribution of refractive error types according to time spent in outdoor activities

B. Distribution of refractive error types according to daily screen time

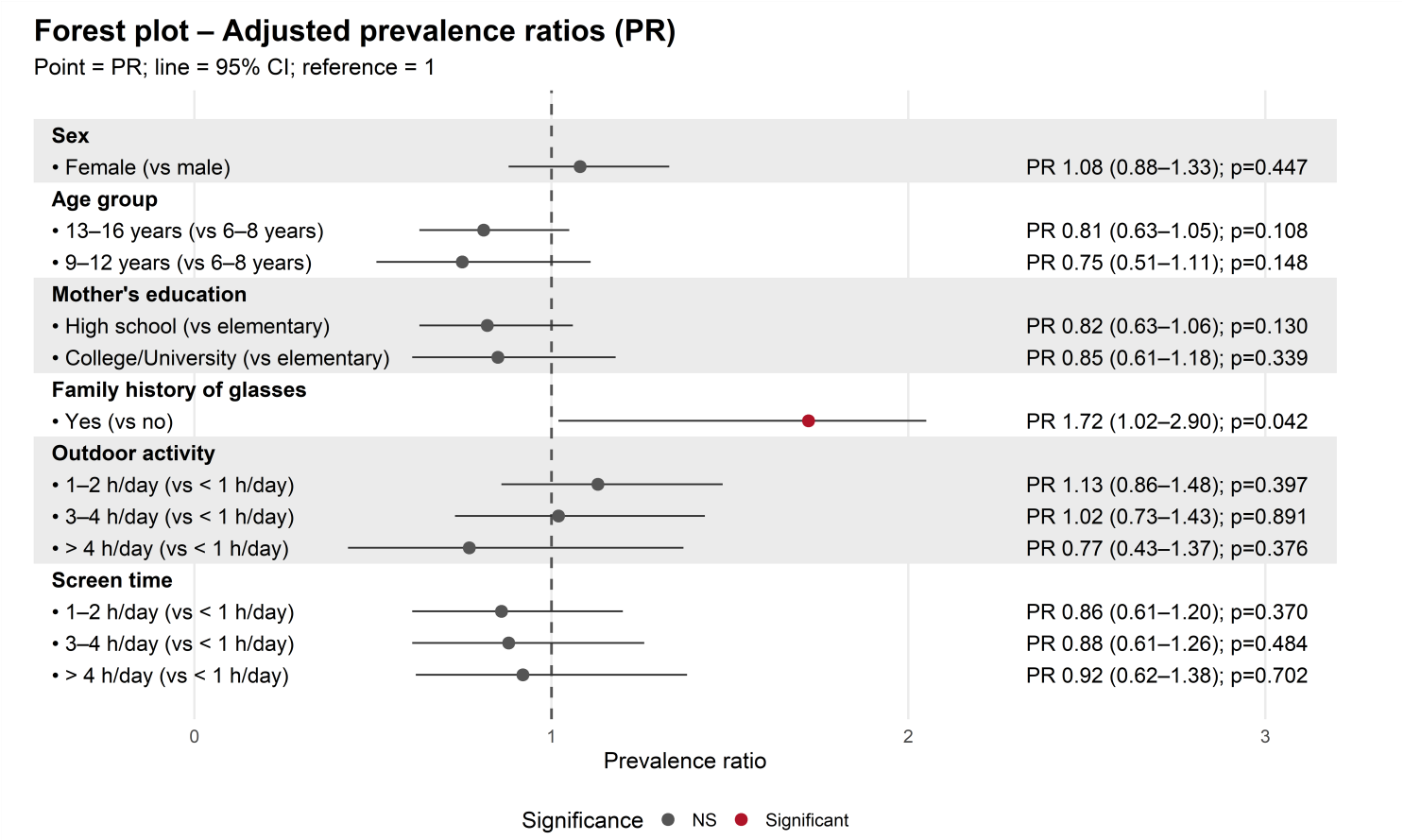


Figure 3

Adjusted prevalence ratios for refractive error in the worse eye according to sociodemographic, behavioral, and familial factors.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryTable1.docx
- Table2.docx