

REFRACTIVE ERRORS IN CHILDREN

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IAPB School Eye Health Guidelines

2024 edition

IAPB School Eye Health Work Group



School Health
Integrated Programming

Guidelines for School-based Eye Health Programs

Information for policy-makers and planners on conducting vision screening as a component of school-based eye health, as part of an integrated school health program



AMERICAN ACADEMY
OF OPHTHALMOLOGY*

Protecting Sight. Empowering Lives.*

Pediatric Eye Evaluations Preferred Practice Pattern®

- I. Vision Screening in the Primary Care and Community Setting
- II. Comprehensive Ophthalmic Examination

Importance of the topic:

- ❑ **High Prevalence:** Refractive errors are the most common visual disorders in children worldwide.
- ❑ **Early Onset:**
 - ❑ Hyperopia usually present at birth.
 - ❑ Myopia often begins in school-age years and may progress rapidly without intervention.
- ❑ **Undetected Burden**



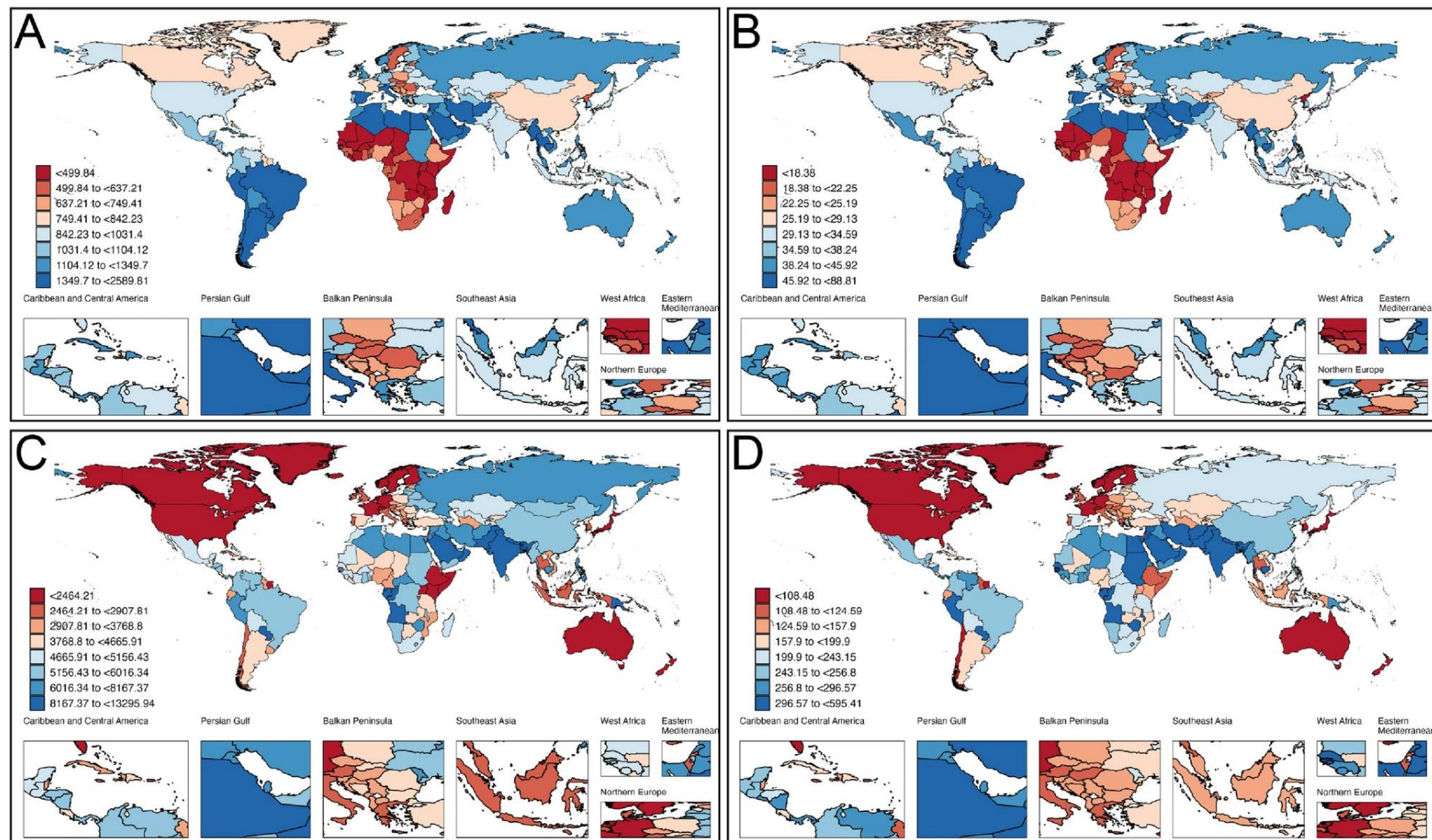
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- ❑ Impact on Development /Learning & Academic Performance
 - ❑ Social & Emotional Well-being
 - ❑ Motor Skills & Safety
 - ❑ Long-Term Consequences
 - ❑ Risk of Amblyopia
 - ❑ Progressive Myopia Associated with increased risk of retinal detachment, glaucoma, and macular degeneration in adulthood.



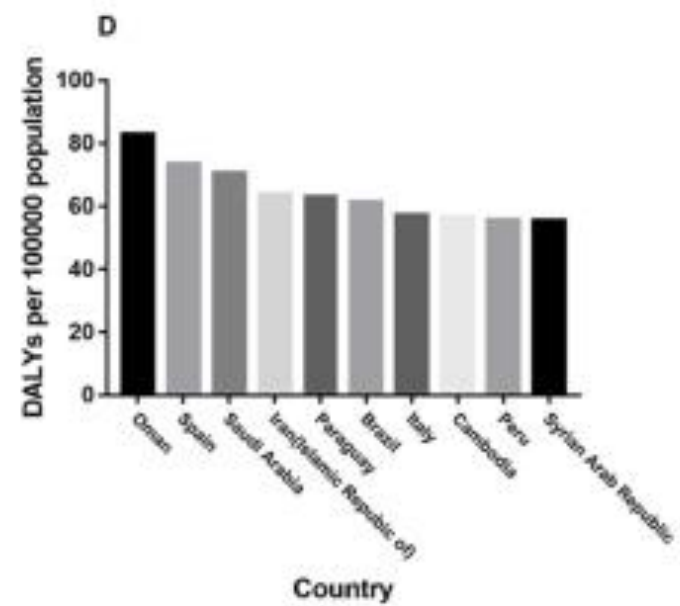
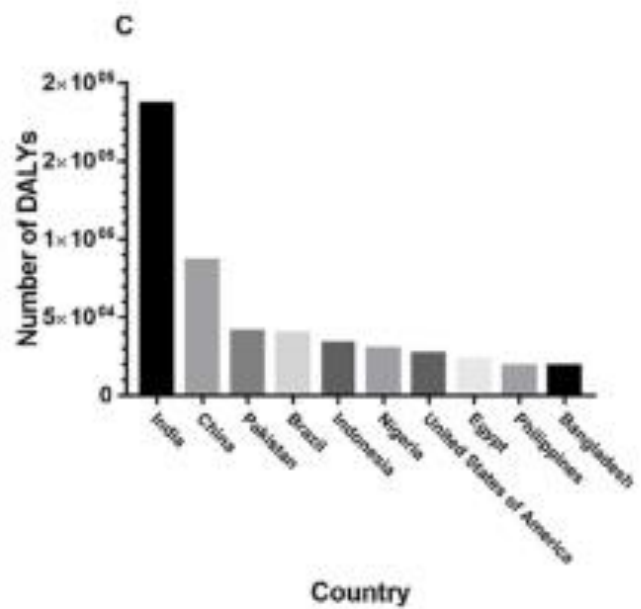
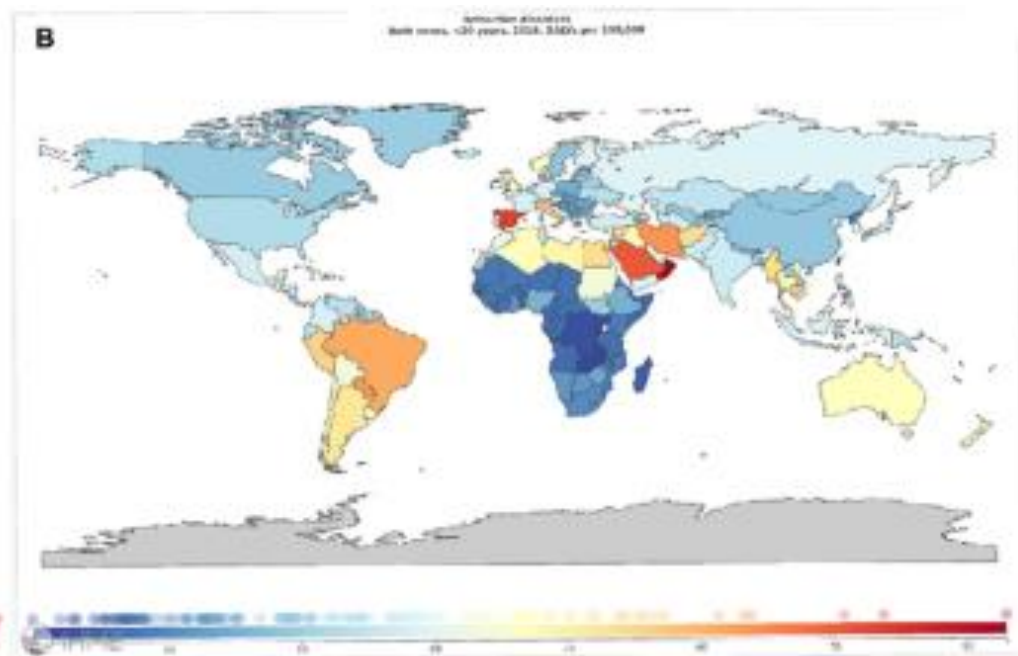
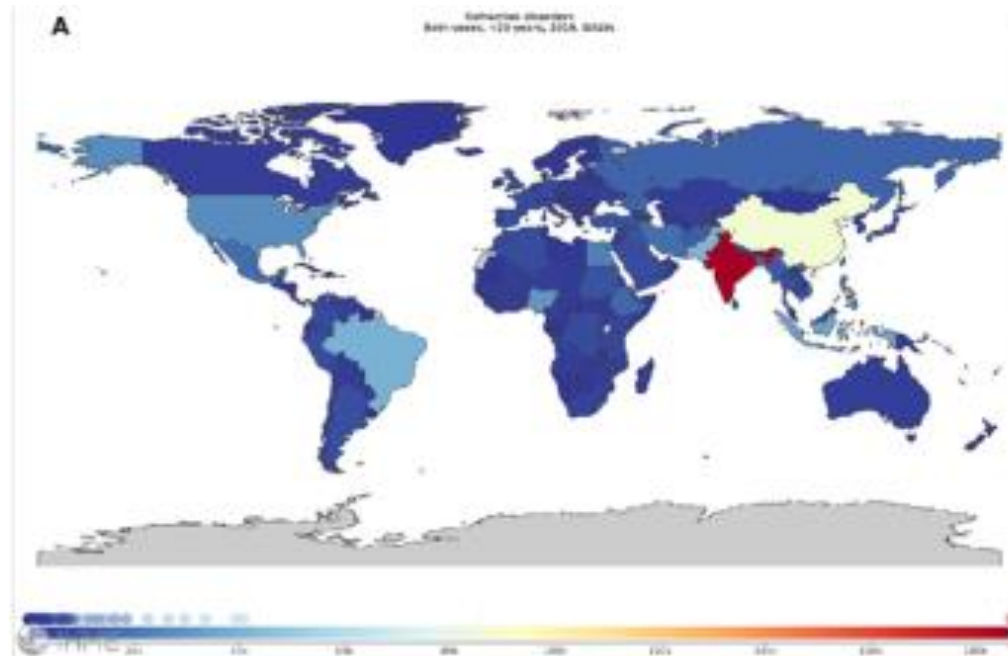
Global Burden

- **Over 2.2 billion** people globally have vision impairment or blindness.
- **At least 1 billion** cases are due to unaddressed refractive errors (WHO, 2021).
- Myopia is **rising** sharply, especially in East and Southeast Asia.



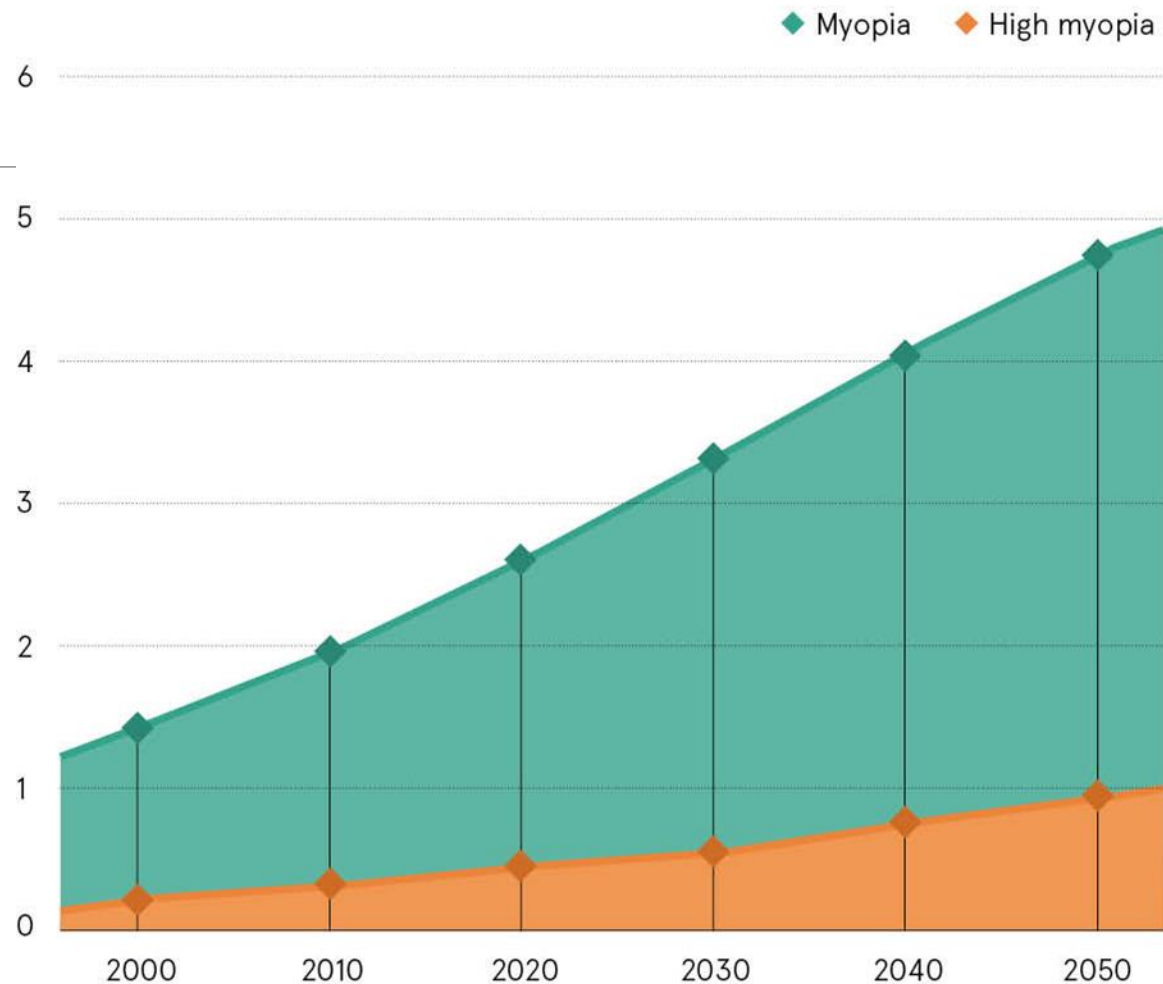


Geographic distribution of age-standardized prevalence rate (ASPR) and DALYs rate of RD in 204 countries and territories in 2021. ASPR (A) and AS-DALYs rate (B) in children and adolescents. ASPR (C) and AS-DALYs rate (D) in old adults. Abbreviations: RD, refraction disorders; ASPR, age-standardized prevalence rate; AS-DALYs, age-standardized disability-adjusted life years



Growing prevalence of myopia worldwide

Number of people (bn)



'Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050', *Ophthalmology* 2016

Growing prevalence of myopia worldwide

28%

of the world's population suffered from myopia in 2010, equal to 1.95 billion people

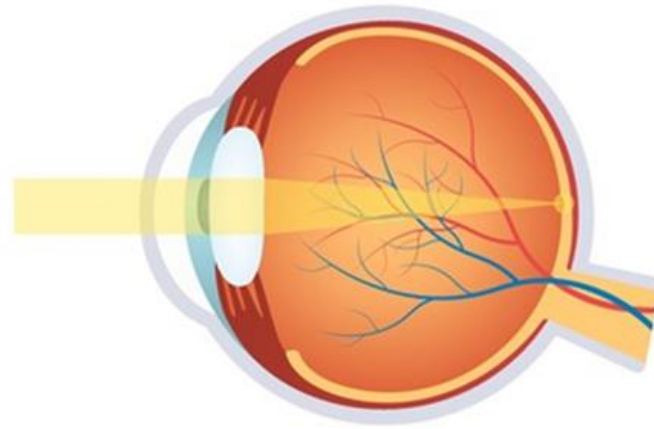
50%

are expected to be myopic by 2050, equal to 4.76 billion people

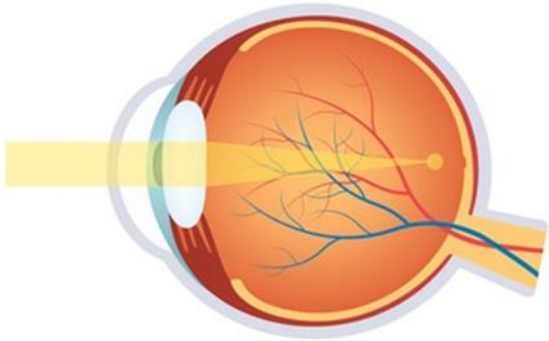
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people are predicted to suffer from high myopia by 2050, which puts them at risk of more serious eye conditions

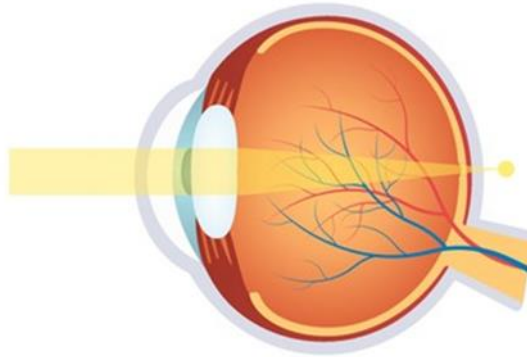




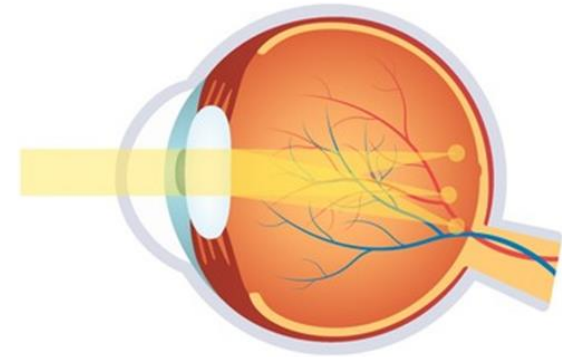
Normal vision



Myopia



Hyperopia



Astigmatism



TABLE 3 VISUALLY SIGNIFICANT CHILDHOOD OCULAR CONDITIONS

Condition	Frequency
Refractive errors	
Myopia (-0.75 D or more in eye with lesser refractive error)	0.7%–9.2% ^{16, 17, 18} (prevalence in children aged 5–17 years)
Myopia (more than -2.0 D)	0.2%–2% ¹⁹ (prevalence in children aged 3–5 years)
Hyperopia ($+3.0$ D or more in eye with lesser refractive error)	4%–9% ^{16, 17} (prevalence in children aged 5–17 years)
Hyperopia (more than $+3.25$ D)	6%–7% ¹⁹ (prevalence in children aged 3–5 years)
Astigmatism (worse eye cylinder power 3.0 D or more)	0.5%–3% ^{16, 20} (prevalence in children aged 5–17 years)
Astigmatism (cylinder power more than 1.5 D)	4%–11% ¹⁹ (prevalence in children aged 3–5 years)
Amblyopia	0.8%–3% ^{21–23} (prevalence in children aged 6–72 months)

Age-Based Screening Guidelines

Age Group

6 months

1–3 years

3–6 years

6+ years

Recommended Action

First eye exam (AAO)

Monitor emmetropization

Detect amblyopia, RE

School screening, myopia surveillance



Diagnosis

☐ Visual acuity screening

- Pinhole occluder

☐ Retinoscopy

- Manual
- Automated



Emmetropization

- The process whereby the refractive components and the axial length of the eye come into balance during postnatal development in order to induce emmetropia (no refractive error).

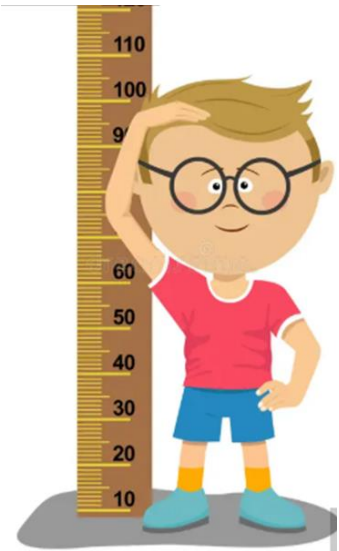
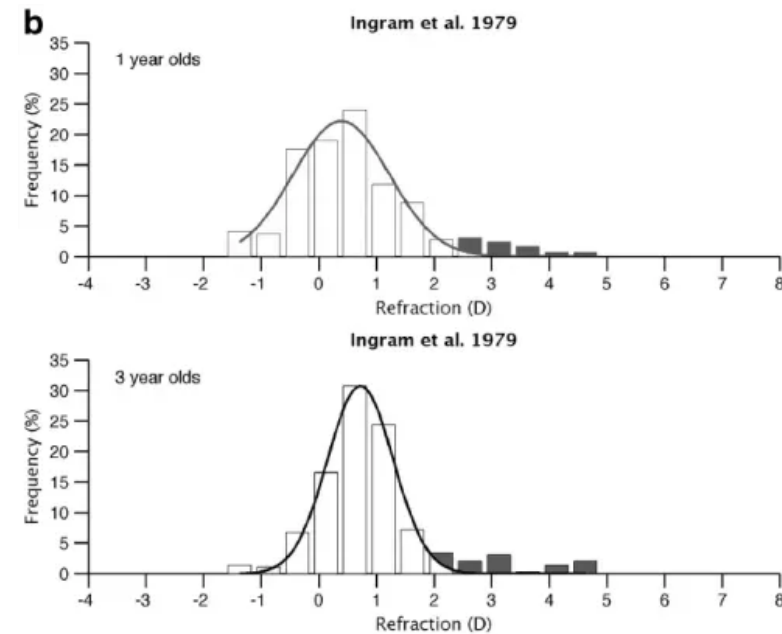
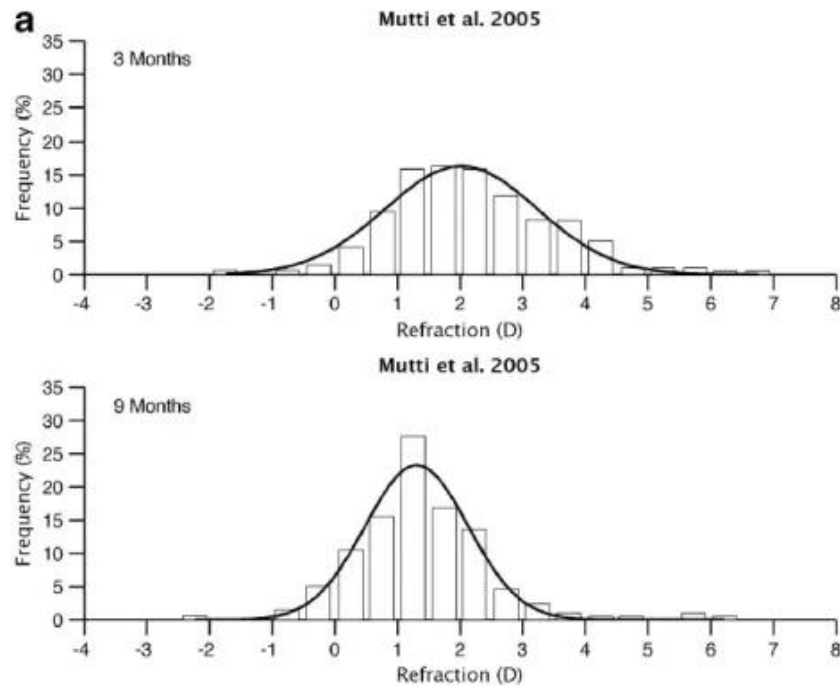


TABLE 2 GUIDELINES FOR REFRACTIVE CORRECTION IN INFANTS AND YOUNG CHILDREN

Condition	Refractive Errors (diopters)			
	Age <1 year	Age 1 to <2 years	Age 2 to <3 years	Age 3 to <4 years
Isoametropia (similar refractive error in both eyes)				
Myopia	5.00 or more	4.00 or more	3.00 or more	2.50 or more
Hyperopia (no manifest deviation)	6.00 or more	5.00 or more	4.50 or more	3.50 or more
Hyperopia with esotropia	1.50 or more	1.00 or more	1.00 or more	1.00 or more
Astigmatism	3.00 or more	2.50 or more	2.00 or more	1.50 or more
Anisometropia (without strabismus)*				
Myopia	4.00 or more	3.00 or more	3.00 or more	2.50 or more
Hyperopia	2.50 or more	2.00 or more	1.50 or more	1.50 or more
Astigmatism	2.50 or more	2.00 or more	2.00 or more	1.50 or more

NOTE: These values were generated by consensus and are based solely on professional experience and clinical impressions because there are no scientifically rigorous published data for guidance. The exact values are unknown and may differ among age groups; they are presented as general guidelines that should be tailored to the individual child. Specific guidelines for older children are not provided because refractive correction is determined by the severity of the refractive error, visual acuity, and visual symptoms.

* The values represent the minimum difference in the magnitude of refractive error between eyes that would prompt refractive correction in the absence of other abnormalities. Thresholds for correction of anisometropia should be lower if the child has strabismus or amblyopia.

When not to wait for emmetropization:

- ❑ High Refractive Error
 - Hyperopia > +5.00 D
 - Myopia > -3.00 D
 - Astigmatism > 2.00 D
- ❑ Anisometropia
 - >1.00 D hyperopic difference
 - >3.00 D myopic difference
- ❑ Strabismus or Risk of Esotropia
- ❑ Amblyopia Risk or Diagnosis
- ❑ Developmental Delay or Visual Behavior Concerns
- ❑ Family History of Severe Refractive Error or Amblyopia



Management

- ☐ Spectacles (eyeglasses)

- ☐ Contact lenses

- ☐ Surgery

 - ☐ Keratorefractive

 - ☐ Phakic IOLs

 - ☐ Lens extraction + Intraocular lenses

 - ☐ Bioptics



Correction for myopia is indicated if :

- ❑ Minus powered lenses improve vision by 2 or more log MAR VA lines (or 2 or more Snellen VA lines) in one or both eyes.



Correction for hypermetropia is indicated if:

- ☐ Plus powered lenses improve vision by 2 or more log MAR VA lines (or 2 or more Snellen VA lines) in one or both eyes and/or noticeably improve comfort;
- ☐ There is amblyopia and:
 - ☐ The child's age, usually 8 years or below, suggests the amblyopia is potentially treatable), or
 - ☐ Esotropia or
 - ☐ Large esophoria (and the child has some potential for normal binocular vision).



Correction of astigmatism is indicated if:

- ❑ Cylindrical lenses improve vision by 2 or more log MAR VA lines (or 2 or more Snellen VA lines) in one or both eyes and/or noticeably improve comfort,
- ❑ There is a suggestion of amblyopia (and the Child's age suggests the amblyopia is potentially treatable).



Correction for anisometropia is indicated if:

- ❑ Significant anisometropia PLUS one or more of the following:
 - ❑ Correctly balanced lenses improve vision of the worse eye by 2 or more logMAR VA lines (or 2 or more Snellen VA lines), and/or noticeably improve comfort,
 - ❑ There is a suggestion of amblyopia (and the child's age suggests the amblyopia is potentially treatable).



Referral to the local eye care provider should be made for:

- Any child presenting visual acuity is less than 6/60 in either eye, even if due to a correctable RE;
- Any child presenting a strabismus
- All children whose visual acuity does not improve to normal (6/9) in both eyes with refraction
- Any child requiring cycloplegic refraction (if not done on site)
- Any child presenting an ocular health problem in one or both eyes
- Cornea is not transparent
- Pupil is not round and black
- Eyes are red with discharge (conjunctivitis or allergy) , White patch on the conjunctiva (Bitot's spot) , Conjunctival growths

No child with severe vision impairment (VA <6/60; 1.0) or who is blind (VA <3/60; 1.3) should be referred directly to low vision services, special education or rehabilitation without first being assessed by an primary or secondary eye care professional.



Cycloplegia indications:

- ❑ Children uncooperative or difficult to refract
 - ❑ VA that doesn't improve at refraction
 - ❑ Media opacities or irregular corneas,
 - ❑ Presence of strabismus or suspected amblyopia
 - ❑ Significant progression in myopia or suspected latent hyperopia (fails +2.00 test)
-
- In children over the age of 5 years, 2 drops of cyclopentolate 1% should be administered per eye with 5 minutes separation between instillations.
 - Parental consent is mandatory.
 - Children, parents and teachers should be aware of side effects (blurriness, dilated pupils, sensitivity to light, dizziness etc.)



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