The Center for Health and Health Care in Schools
The George Washington University

Childhood Vision
What the research tells us

Overview

Vision problems are common among children.

While a nationwide study of vision problems in children has not been conducted in over 30 years, the most recent NHIS study shows vision problems are common in children, with an estimated 13.5 million children ages 0 – 17 affected.[1,2]

Many preschoolers have treatable vision problems.

Among preschool children, ages 0 – 4, vision problems affect approximately 2.4 million (10.5%) children, according to a 1983 government study.[3,4]

Rates of vision problems rise as children get older.

Among school-aged children ages 6 to 11 years old, an estimated 5.3 million (21.5%) have a vision problem. Rates continue to rise as children get older, with an estimated 24% of 12 – 17 year olds exhibiting some type of vision problem.[5,6]

Serious vision problems affect some children.

Approximately 453,600 children (less than 1%) 0 – 17 years old suffer from serious vision impairment, including blindness in one or both eyes, or other uncorrectable low vision problems.[7,8,9]

Early detection is important for some vision problems.

Optimum treatment for eye conditions such as lazy eye, crossed eyes or eyes that turn outward, require early detection, usually well before age 5, otherwise irreversible visual deficits, including blindness, may occur.[10,11]

Vision problems vary slightly between boys and girls.

Rates of eye conditions for preschool boys and girls are similar at 10.3% and 10.7%, respectively. However, as children get older, the rate of vision problems in boys is 3.5%

Common Eye Problems in Children

- **Amblyopia** (2–3% of children)—Known as "lazy eye." Reduced vision from lack of use in an otherwise normal eye
- **Astigmatism**—Irregular corneal shape that may result in blurred vision
- **Blepharitis**—Swollen eyelids
- **Cataract**—Cloudy lens that affects focusing
- **Conjunctivitis**—Known as "pink eye." Reddening of the white part of the eye usually caused by a viral, bacterial infection, or allergy
- **Corneal Abrasion**—Known as "scratched cornea"
- **Glaucoma**—Elevated eye pressure that can lead to blindness
- **Hyperopia**—Known as "farsightedness." Objects that are near are unclear
- **Myopia** (most common vision problem among school-age children)—Known as "nearsightedness." Objects that are far away are unclear
- **Pseudostrabismus**—Appearance of crossed eyes, yet the eyes are truly straight
- **Ptosis**—Known as "droopy eyelids." The eyelids do not open as they should
- **Strabismus** (4% of children)—Misaligned eye(s) that either turn inward ("crossed eyes") or outward.

American Academy of Pediatrics. Common vision and eye problems. 2000. Medical Library Online. Available at www.medem.com.

References:
Overview

1 Ganley JP and Roberts J. Eye conditions and related need for medical care among persons 1–74 years of age: United States, 1971–1972. Vital Health Stat 11(228). 1983. Page 21, Table 1.
2 America's Children 2003. Child population: Number of children under age 18 in the United States by age, selected years 1950–2000 and projected 2002 through 2020. Table POP1. U.S. Census Bureau 2001 estimates based on population projections for 2001–2020 that are unpublished. Available at http://www.childstats.gov.
3 Ganley JP, op.cit.
4 America's Children 2003, op. cit.
5 Ganley JP, op.cit.
6 America's Children 2003, op. cit.
7 National Center for Health Statistics. Current Estimates from the National Health Interview Survey: United States. Vital Health Stat 10(200). 1996. Table 57.
8 America's Children 2003, op. cit.
9 Centers for Disease Control and Prevention. National Center on Birth Defects and Developmental Disabilities. Vision Impairment: What is vision impairment? Available at http://www.cdc.gov/ncbddd/dd/ddvi.htm. Accessed April 22, 2004.
10 Cross AW. Health screening in schools. Part I. J Pediatr. 1985;107(4):487–494.
11 U.S. Preventive Task Force. Screening for visual impairment in children younger than ages 5 years: Recommendation statement. May 2004. Agency for Healthcare Research and Quality, Rockville, MD. Available at http://www.ahrq.gov/clinic/3rduspstf/visionscr/vishrs.htm.

[12] Ganley JP, op.cit. Table 1.
[13] Kemper AR, Bruckman D, Freed GL. Prevalence and distribution of corrective lenses among school-age children. Optom Vis Sci. 2004;81:7–10.
[14] Kemper AR, Cohn LM, and Dombkowski KJ. Patterns of vision care among Medicaid-enrolled children. Pediatr. 2004;113(3):e190–196.
[15] American Academy of Pediatrics. American Academy of Ophthalmology. Policy Statement: Protective eyewear for young athletes. Pediatr. 2004;113(3):619–621.
[16] National Injury Information Clearinghouse. U.S. Consumer Product Safety Commission/ Directorate for Epidemiology. Product Summary Report from the National Electronic Injury Surveillance System (NEISS). All products eye injuries CY 2002. Report generated April 30, 2004.

References:
Vision Screenings and Exams

[1] American Academy of Ophthalmology. State affairs secretariat. Eye screening state status. 2002.
[2] Zaba J, Johnson RA, Reynolds WT. Vision examinations for all children entering public school—the new Kentucky law. Optometry. 2003;74(3):149–158.
[3] American Optometric Association. Optometric clinical practice guideline: Pediatric eye and vision examination. St. Louis: American Optometric Association, 2002.
[4] American Public Health Association. Policy statement 2001–1: Improving early childhood eyecare. Available at www.apha.org/legislative/policy/01_policy.pdf.
[5] American Academy of Ophthalmology. Policy statement: Vision screening for infants and children. Available at www.aao.org.
[6] American Academy of Pediatrics. Policy statement: Eye examinations in infants, children, and young adults. Pediatr. 2003;111:902–907.

higher (23.2%) than for girls (19.7%) for the 6 – 11 age group. The difference continues into the 12 – 17 age group with rates for boys at 26.1% and girls at 22.5%.[12]

Income may make a difference in correcting identified vision problems.

According to several studies, income may make a difference in correcting vision problems. Children in families with incomes greater than 200% of the federal poverty level were more likely to have corrective lenses (29.9%) than those with incomes less than 200% of the federal poverty level (19.3%).[13,14]

Sports and toys are leading causes of eye injuries in children according to hospital reports.

In 2000, an estimated 18,060 sports and recreation-related eye injuries to children under 14 were reported.[15] The five most commonly reported sports activities associated with eye injuries included baseball, basketball, swimming, bicycling, and football. Playing with toys caused another 9,000 eye injuries to children under 14. Among the most common toys cited as causing eye injuries were toy weapons, bicycles, and balloons.[16]

Vision Problem Warning Signs

- Eyes turning inward (crossing) or outward
- Squinting
- Headaches
- Not doing as well in schoolwork as before
- Blurred or double vision
- Losing place while reading
- Avoiding close work
- Holding reading material closer than normal
- Tending to rub eyes
- Eyes tiring when reading or doing schoolwork
- Turning or tilting head to use one eye only
- Making frequent reversals when reading or writing
- Using finger to maintain place when reading
- Consistently performs below potential

US Dept of Health and Human Services. AHRQ. Put Prevention into Practice: Child Health Guide. Publication No. APPIP 98–0026. Current as of January 2003.

Harris P. Learning related visual problems in Baltimore City: A long-term program. JOVD. 2002;33:75–115.

American Optometric Association. Children's vision: school-age vision. Available at www.aoa.org.

Vision Screenings and Exams

A majority of states require or recommend vision screenings or exams for school children.

As of 2002, 30 states plus the District of Columbia *required* vision screening in elementary schools or for all school-aged children. Eleven states *recommended* vision screenings.[1] Grades at which students should receive vision screenings vary by state with the majority requiring testing before kindergarten or first grade. Even with these recommendations and requirement, only a small percentage of preschool and school age children actually receive the recommended or required tests. In 2000, Kentucky was the first state to *mandate comprehensive vision exams* for all students entering kindergarten or first grade.[2]

Health professionals differ on the best strategies for detecting vision problems among large groups of children.

To identify children with vision problems, the American Optometric Association[3] and the American Public Health Association[4] recommend *comprehensive vision examinations* for all children starting at 6 months of age and at regular intervals thereafter, while the American Academy of Ophthalmology[5] and the American Academy of Pediatricians[6] support *vision screenings* for all children by age 3 and at regular intervals thereafter.

Childhood Vision
What the research tells us

7 Ehrlich M, Reinecke R, Simons K. Preschool vision screening for amblyopia and strabismus: programs, methods, guidelines. Surv Ophthalmol. 1983;23:145–163. See page 159 conclusion and addendum.

8 Kushner B. Pediatric ophthalmology in the new millennium. Arch Ophthalmol. 2000;118:1277–80.

9 Ciner EB, Schmidt P, Orel-Bixler D, et al. Vision screening of preschool children: evaluating the past, looking toward the future. Optom Vis Sci. 1998:75(8):571–84.

10 Vision in Preschoolers Study Group. Comparison of preschool vision screening tests as administered by licensed eye care professionals in the vision in preschoolers study. Ophthalmol. 2004;111:(4)637–650

11 Donohue SP, Johnson TM, Leonard-Martin TC. Screening for amblyogenic factors using a volunteer lay network and the MTI photoscreener. Ophthalmol. 2000;107:1637–44.

12 Preslan MW and Novak A. Baltimore vision screening project. Phase 2. Ophthalmol. 1998;105(1):151–153.

13 Yawn BP, Lydick EG, Epstein R, Jacobsen SJ. Is school vision screening effective? J Sch Health. 1996;66(5):171–175.

14 Department of Health and Human Services. Office of Inspector General. Medicaid managed care and EPSDT. May 1997. OEI–05–93–00290.

15 Centers for Medicare and Medicaid Services. State medicaid manual. Part 5:5010–5360. Available at www.cms.hhs.gov/manuals/pub45pdf/smmtoc.asp.

16 U.S. Department of Labor, Bureau of Labor Statistics. National compensation survey: employee benefits in private industry in the United States. Summary 04–02. April 2004. Page 3, Table 1.

17 U.S. Department of Labor, Bureau of Labor Statistics. National Compensation Survey: Employee benefits in private industry in the United States, 2000. Bulletin 2555: January 2003. Page 53. Table 59.

Although early detection of problems is key to protecting children's vision, vision screening and eye exam rates are low among pre-school children.

It is estimated that up to 21% of preschool children are screened for vision problems and that only 5% – 14% of children receive an eye exam by an eye care practitioner before entering school.[7,8,9]

Sensitivity of screening exams varies.

According to a recent study, the four most effective vision screening methods, when performed by an optometrist or pediatric ophthalmologist, detect just two in three children with a vision problem but nearly 90 percent of children with the most important conditions. The effectiveness of vision screenings performed by nurses or volunteers may very and will be assessed in a future study.[10]

Among children screened for vision problems, rates for follow-up care are low and often delayed.

According to two studies, nearly 40% of the 7 – 17% of children who were screened and referred for additional testing did not receive the recommended follow-up care.[11,12] Another study noted that when a 5 or 6 year old failed a vision screening, the average delay before evaluation by an eye care professional was 4 years.[13]

Medicaid enrollment does not assure that beneficiaries receive vision-screening services.

Although Medicaid EPSDT covers vision screenings for children along with other screening services, a 1997 study found that only 28% of enrolled children received screenings.[14] Independent of the EPSDT screening, Medicaid may cover a complete vision exam if it falls within state periodicity schedules.[15] Policies vary from state to state.

One-quarter of all workers in private industry have access to insurance coverage for vision services.

Although children as a group are not identified, 25% of all workers have access to insurance coverage for vision care services,[16] with 99% covering eye exams. Vision care is defined as "coverage for eyeglasses, and with few exceptions, eye exams and contact lenses."[17]

How do exams and screenings compare?

Vision exams

- Conducted by ophthalmologist or optometrist
- Ocular history
- Medical history
- Family ocular and medical history
- Unaided acuity test
- Best-corrected acuity test
- External ocular examination
- Internal ocular examination
- Pupillary responses
- Binocular function
- Accommodation and convergence
- Color vision
- Diagnosis
- Recommendations

Zaba J et al. Vision examinations for all children entering public school — the new Kentucky law. Optometry. 2003;74(3):149–158.

Vision screenings

- Conducted by wide-range of health professionals from public health nurses and non-professional volunteers to ophthalmic technicians.
- May include anything short of a complete eye exam
- Components can vary greatly
- Visual acuity
- Ocular alignment
- Refractive Errors

U.S. Preventive Services Task Force. Guide to Clinical Preventive Services, 2nd Edition. Washington, DC: U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 1996.

Vision in Preschoolers Study Group. Comparison of Preschool Vision Screening Tests as Administered by Licensed Eye Care Professionals in the Vision in Preschoolers Study. Ophthalmol. 2004;111(4):637–650.

Diagnostic Results

Age	Lazy Eye (Amblyopia)	Eyes turned in or out (Strabismus)	Lenses (Refractive Errors)
3	9 (1.31%)	13 (1.90%)	65 (9.48%)
4	31 (2.93%)	26 (2.46%)	127 (11.99%)
5	21 (1.97%)	17 (1.59%)	135 (12.66%)
6	4 (3.85%)	2 (1.90%)	16 (15.24%
Total	65 (2.23%)	58 (1.99%)	343 (11.76%)

In 2002, under the Kentucky Eye Exam law, 2,916 children ages 3–6 years of age were examined. Mozlin R, Zaba JN, and Reynolds WT. Vision examinations versus vision screenings: Lessons learned in Kentucky. J Behavioral Optometry. 2003;14(5):123–126.

References:
What Schools, Parents and the Communities Can Do

1 Yawn BP, Lydick EG, Epstein R, Jacobsen SJ. Is school vision screening effective? J of Sch Health. 1996;66(5):171–175.
2 Orfield A. Vision problems of children in poverty in an urban school clinic: Their epidemic numbers, impact on learning, and approaches to remediation. JOVD. 2001;32:114–141.
3 Appelboom TM. A history of vision screening. J of Sch Health. 1985;55(4):138–141.
4 Wasserman RC, Crost CA, Brotherton SE. Preschool vision screening in pediatric practice: A study from the pediatric research in office settings (PROS) network. Pediatr. 1992;89(5):834–838.
5 National Injury Information Clearinghouse. U.S. Consumer Product Safety Commission/ Directorate for Epidemiology. Product summary report from the national electronic injury surveillance system (NEISS). All products eye injuries CY 2002.
6 National Library of Medicine. (1/18/2003) MedlinePlus Medical Encyclopedia: Vitamin A. Available at http://www.nlm.nih.gov/medlineplus/ency/article/002400.htm.

What Schools, Parents and Communities Can Do

Schools

Healthy Vision is important for school success.

The first indication of abnormal visual acuity may be identified during school-based vision screening program.[1] School personnel should encourage all students to receive a vision screening or eye exam by the appropriate eye care professional.

Size of print can make a difference.

Choosing books with larger print and teaching reading with larger letter on the wall instead of down on a desk which may be too high for proper distance from eye to book, may help some students.[2]

Teachers can help identify children with vision problems.

Because teachers are with students 6 – 7 hours a day, teachers are in a unique position to observe and to detect the first signs of vision problems, such as eyestrain or visual dysfunction.[3] Parents should be notified of problems and a referral to the appropriate eye care professional should be provided.

Vision Skills Needed in School

- Near vision. The ability to see clearly and comfortably at 10–13 inches.
- Distance vision. The ability to see clearly and comfortably beyond arm's reach.
- Binocular coordination. The ability to use both eyes together.
- Eye movement skills. The ability to aim the eyes accurately, move them smoothly across a page and shift them quickly and accurately from one object to another.
- Focusing skills. The ability to keep both eyes accurately focused at the proper distance to see clearly and to change focus quickly.
- Peripheral awareness. The ability to be aware of things located to the side while looking straight ahead.
- Eye/hand coordination. The ability to use the eyes and hands together.

American Optometric Association. Children's vision: school-age vision. Available at http://www.aoa.org.

Parents

Healthy vision begins early.

The American Academy of Pediatrics recommends all preschool children be screened by age 4 as part of a regular preventive exam.[4] The American Optometric Association and the American Public Health Association also recommend children receive eye exams at early and regular intervals.

Protection of eyes during sports activity is important.

With over 42,000 eye injuries reported to hospitals in a one-year period, parents should provide protective eyewear for children when they are engaged in sports.[5]

Vitamin A is important for healthy vision.

Vitamin A comes from animal sources, such as eggs, meat, milk, cheese, cream, liver, kidney, cod and halibut fish oil. The precursor form, beta-carotene, is found in plants. Sources of beta-carotene are carrots, pumpkin, sweet potatoes, winter squashes, cantaloupe, pink grapefruit, apricots, broccoli, spinach, and most dark green, leafy vegetables. These vegetable sources of beta-carotene, unlike most animal sources, are free of fat and cholesterol. A well-balanced diet can provide the necessary nutrients for good eye health.[6]

Community

Need for current research is clear.

The most recent national data available on the prevalence of vision problems in children available, the NHIS study, was published in 1983 using 1971–72 data.[7] While small-scale studies are being undertaken, the need for a national large-scale study is apparent.

"Remediation for poor visual skills is as important as remediation for learning failure, because lack of many of these vision skills correlate with learning problems."

Orfield A. Vision problems of children in poverty inan urban school clinic. Their epidemic numbers impact on learning, and approaches to remediation. JOVD. 2001:32:114–141

Glossary of Vision Terms**

Ophthalmology—a branch of medicine specializing in the anatomy, function and diseases of the eye.

Ophthalmologist—a medical doctor who specializes in eye and vision care. Ophthalmologists are specially trained to provide the full spectrum of eye care, from prescribing glasses and contact lenses to complex and delicate eye surgery. In addition to medical school and a one-year internship, all ophthalmologists spend at least three years of residency in a hospital. Some ophthalmologists may sub-specialize in a specific area of eye care.

Optometry—a health care field that specializes in examining, diagnosing, treating and managing some diseases and disorders of the visual system, the eye and associated structures as well as diagnose related systemic conditions.

Optometrist—a health care professional that examines the internal and external structure of the eyes to diagnose eye diseases, systemic diseases, and vision conditions. Optometrists complete pre-professional undergraduate education in a college or university and four years of professional education at a college of optometry. Some optometrists complete a residency.

Pediatric Ophthalmology—branch of ophthalmology that involves the medical and surgical management of strabismus, amblyopia, genetic and developmental abnormalities and a wide range of inflammatory, traumatic and neoplastic conditions occurring in the first two decades of life. This subspecialty also deals with the ocular manifestations of certain systemic disorders.

Refractive Error—a category of vision problems that refers to a loss of visual acuity. The loss of acuity is due to improper light refraction as a result of the shape of the eye. The result is a blurred image. These types of errors are eye disorders.

Vision problems or abnormalities—general term used to describe a broad range of vision related abnormalities that may include correctable conditions such as near and farsightedness, disorders, diseases, impairment, and blindness.

Vision impairment—the measured visual acuity of 20/70 or worse, with correction, in the better eye. Vision impairment means that a person's eyesight cannot be corrected to a "normal" level. It is a loss of vision that makes it hard or impossible to do daily tasks without specialized adaptations. Vision impairment may be caused by a loss of visual acuity, where the eye does not see objects as clearly as usual. It may also be caused by a loss of visual field, where the eye cannot see as wide an area as usual without moving the eyes or turning the head.

Visual acuity—clarity of sight, generally referring to the ability to see things clearly from a specific distance.

** *The majority of definitions are from the American Academy of Ophthalmology, American Optometrists Association, National Library of Medicine/Medline Plus, and Centers for Disease Control and Prevention.*

[7] Ganley JP and Roberts J. Eye conditions and related need for medical care among persons 1–74 year of age, United States, 1971–1972. Vital Health Stat 11(228). 1983.

The Center for
Health and Health Care in Schools
School of Public Health and Health Services
Graduate School of Education and Human Development
The George Washington University

1350 Connecticut Avenue, NW, Suite 505
Washington, DC 20036
202–466–3396 fax: 202–466–3467

June 2004

Check Yearly. See Clearly.®
www.checkyearly.com

This project was supported with funding from the Vision Council of America.