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VISUAL IMPAIRMENT ACROSS THE LIFE SPAN

Visual impairment is a broad term used to describe vision loss in individuals who are totally blind, functionally blind, or legally blind, or who have low vision. Like those who are totally blind, individuals with functional blindness will rely on the auditory and tactile senses for learning. *Legal blindness* is defined as central acuity of 20/200 or less with best correction, or less than 20 degrees of visual field remaining (normal visual field is about 160 degrees). Acuity measures such as 20/200 report the individual's distance vision as compared with the normal visual acuity of 20/20. Therefore, 20/200 means that what a person with normal vision could recognize at 200 feet would need to be viewed at 20 feet by an individual with legal blindness.

The term *low vision* is used to describe vision that is measured between 20/70 and 20/200. Low vision is used as the minimal criterion for services offered in schools through a teacher of the visually impaired (TVI), while legal blindness is generally the minimal criterion used to gain services through adult rehabilitation agencies, offered by rehabilitation teachers. Individuals who are born with a visual impairment are said to have a *congenital vision loss.* Those who acquire visual impairment later and have visual memories that enhance learning (usually acquired by the age of 5 years) are said to have an *adventitious vision loss.* Some visual conditions are stable (unchanging), and others are progressive (worsening).

PREVALENCE ACROSS THE LIFE SPAN

The prevalence of visual impairment is difficult to determine due to varying definitions and reporting procedures. About 9 million people have a significant visual impairment (Hardman, Drew, & Egan, 2002). The American Printing House for the Blind registered 57,148 legally blind children for fiscal year 2003 (American Printing House for the Blind, 2003). The *Twenty-Fourth Annual Report to Congress on the Implementation of the Individuals with Disabilities Act* (U.S. Department of Education, 2002) reported 25,927 children with visual impairment. This report cites data on children receiving special education services under 13 different disability categories, resulting in many children with visual impairment being reported under other categories, such as multiple disabilities or deafblind. Common additional disabilities include cognitive and neurological involvement, cerebral palsy, and hearing loss. Vision loss is also an age-related phenomenon, with nearly 50% of senior citizens (65 years and older) having a visual impairment (Hardman et al., 2002).

SYMPTOMS OF VISUAL IMPAIRMENT

Symptoms of visual impairment include swollen eyelids, protrusion of the eye, crusty rims or discharge, red eyes, twitching eyes, irregular eye movements, tilting of the head to see, eye rubbing, fluctuating blurriness, itchy or burning eyes, dry eyes, light sensitivity, eye discomfort, double vision, flashing lights or spots in the visual field, severe headaches, loss of ability to see shades of color, and double vision (Orr, 1998; Ward & Johnson, 1997). When such symptoms exist, it is appropriate to request a full evaluation by an ophthalmologist or optometrist.

COMMON EYE CONDITIONS

In Children

The leading causes of blindness in U.S. children ages 0–19 years are congenital cataracts, albinism, retinopathy of prematurity, and optic atrophy. The two leading causes among children without additional disabilities are albinism and optic nerve hypoplasia (Ward, 2000). Refractive errors and cortical visual impairment are also common causes of visual impairment.

A *cataract* is an opacity of the lens that prevents light from passing though to the retina. *Congenital cataracts* are apparent at birth and are removed, along with the lens, as soon as possible. The child will be provided with glasses or contact lenses to replace the eye's natural lens. Protection from bright lights is necessary due to photosensitivity that follows lens removal.

Albinism is genetically determined with two primary types, ocular albinism (involving only the eyes) and oculocutaneous albinism, which involves eyes, hair, and skin (Dorey, Neveu, Burton, Sloper, & Holder, 2003). The lack of skin or eye pigmentation is due to reduced or absent production of melanin. The

iris of the eye is often blue, but may be red or violet. The most common eye conditions associated with albinism are photosensitivity, nystagmus (rapid vertical or horizontal movement of the eye), strabismus (cross-eye or lazy eye), and refractive errors (Okulicz, Shah, Schwartz, & Janniger, 2003).

Retinopathy of prematurity (ROP) occurs when weak blood vessels spread and bleed into the retina. On rare occasion, the retina detaches. The causes of ROP are multifactorial, including low gestational age, increased number of blood transfusions, apnea, sepsis, and administration of oxygen to sustain premature life (Hartman, 2000, p. 226). Most cases of ROP resolve without treatment, though cryotherapy and surgery are sometimes necessary (Repka, 2002). Children with ROP often have refractive errors.

Optic nerve atrophy (ONA) occurs when damage is sustained to the optic nerve, which is composed of over a million axons (small nerve fibers). When a sufficient number of axons deteriorate, insufficient information is sent to the brain, resulting in a blurred image. ONA may be caused by tumors, insufficient blood or oxygen supply in utero or during birth, and genetic conditions. The impact of ONA includes reduced central acuity, reduced color vision, and visual field loss.

Optic nerve hypoplasia (ONH*)* occurs when the optic nerve is underdeveloped due to too many optic nerve fibers dying off in utero. Visual impairment from ONH ranges from mild to blindness, with reduced central acuity, peripheral field loss, and nystagmus being common.

The origin of *cortical visual impairment* (CVI) is in the brain, not the eye. Major causes of CVI include asphyxia, hypoxia, ischemia, neurological insult, hydrocephalus, and infections of the central nervous system such as meningitis and encephalitis. Vision fluctuates, and the use of peripheral vision may be superior to central vision. Photosensitivity appears in one third of the children with CVI, and poor depth perception is common. Children with CVI often have more difficulty with specific types of visual stimuli, such as recognizing faces (Morse, 1999). Movement of the child or the visual stimuli may enhance vision (Blind Babies Foundation, n.d.). Many children with CVI have additional disabilities.

In Children and Adults

There are three types of refractive errors that occur in children and adults. *Myopia,* also known as nearsightedness, occurs when the eyeball is too long, causing light rays to focus in front of the retina. This results in the ability to see well up close, but not as well at a distance. A concave lens is used to correct for myopia, because it causes light to diverge. *Hyperopia,* also known as farsightedness, occurs when the eyeball is too short and light rays converge behind the retina. A convex lens is used to correct for hyperopia, because it converges the light. A third refractive error is *astigmatism,* caused by unequal curvature of the cornea, resulting in difficulty seeing in both near space and at a distance. A cylindrical lens is used for correction (Ward, 2000).

In Adults

The most common effects of aging on the eye are reduced acuity, need for increased illumination (due to reduction in pupil size), need for greater contrast (due to loss of fine detail vision), floaters, dry eyes, difficulty adapting to changes in lighting, difficulty with glare, and reduced depth perception (Orr, 1998). In addition, the following conditions are leading causes of visual impairment in adults: macular degeneration, glaucoma, diabetic retinopathy, and cataracts (Ward & Johnson, 1997).

Macular degeneration occurs because the aging process tends to destroy some of the cells within the macula, the portion of the retina responsible for the highest level of visual acuity. This results in loss of fine detail vision, central acuity, and color perception.

Glaucoma is a leading cause of blindness in adults over 45 years of age, with African Americans and adults with diabetes being at highest risk. Glaucoma occurs when drainage of aqueous humor is partially or fully blocked, creating increased intraocular pressure. Glaucoma is treated with drug therapy and surgery.

While the congenital form of *cataracts* affects infants, more than 50% of the U.S. population over the age of 65 develop them as part of the aging process (National Eye Institute, 2003). Treatment is surgical removal of the lens, followed by wearing strong eyeglasses or contact lenses.

Diabetic retinopathy usually appears in people who have had diabetes for at least 15 years. Neovascularization occurs when newly formed blood vessels are weak and break, bleeding into the retina or vitreous fluid. Diabetes may also affect on retinal function by reducing blood supply to the retina. The best prevention is to maintain appropriate insulin

levels and to monitor for any signs of vision loss. Treatment may include laser therapy and surgery. Diabetes also increases the risk for cataracts and glaucoma.

IMPACT OF VISUAL IMPAIRMENT

The impact of visual impairment is dependent on the severity of the vision loss, age of onset, the individual's visual efficiency (how well remaining vision is used), presence of additional disabilities, functional use of other senses, and the quality of intervention services.

Congenital Blindness

Children who are born with severe visual impairment miss many opportunities to access information with ease. Sighted individuals learn primarily through a *whole-to-parts approach* (a broad view is instantly accessed, and then the individual focuses on details of interest). Individuals with severe visual impairment experience the world through a *parts-to-whole approach.* One part of an experience is accessed at a time, through limited vision or touch. The process of organizing these "parts" into a meaningful whole is cognitively demanding. In addition, there are many things that cannot be touched in their entirety or viewed with limited vision. Experiential learning, coupled with rich verbal descriptions, provides the foundation for conceptual development.

Adventitious Loss

Children or adults who acquire vision loss have the advantage of visual memories to support learning. However, they experience emotional loss not felt by those born with vision loss. Adventitious blindness affects many areas of life and will require the individual to make significant and often unwelcome changes. New ways of performing everyday tasks (such as reading, writing, and cooking) must be learned. The loss of driving privileges may be particularly traumatic. New techniques must be learned to meet the current job demands of most individuals, while a few persons will need to develop new career goals.

Vision loss in senior citizens is often a secondary condition, making it important to consider health characteristics when planning intervention (Crews & Campbell, 2001). Senior citizens with deteriorating vision often feel a loss of control over self and environment (Orr, 1998). They also report reduced life satisfaction and a more pessimistic view of the future (Heyl & Wahl, 2001). The impact of such psychosocial effects should not be underestimated.

SKILLS OF BLINDNESS

All individuals who are blind will need to learn specialized skills, often called the *skills of blindness* or the *expanded core curriculum.*

Orientation and Mobility

Orientation and mobility involve knowing where you are in space (orientation) and physically moving through space safely (mobility). These skills begin to develop in infancy by supporting the child to achieve gross-motor milestones. Vision provides access to interesting stimuli at a distance and thus is a great motivator for movement. Therefore, children who are blind need adults to create invitations to explore. Special skills such as sighted guides, search patterns, protective techniques, cane techniques, use of public transportation, reading of tactile maps, and ways to ask for travel assistance are taught. Instruction includes the use of low vision aids when appropriate. Technologies such as the Mowat Sensor, Sonicguide, or Sonic Pathfinder use ultrasound to gain access to information about objects that is translated into tactile (vibratory) or audible input. The laser cane translates information accessed by infrared light into audible or tactile input. Dog guides are used by a small segment of the population as one form of travel support. The goal of any orientation and mobility program is to support the individual to maximize independent travel.

Literacy

Individuals with visual impairment access reading materials in primarily four ways: Braille, enlarged print, human readers, and auditory recordings. Most use more than one form of literacy, according to the demands of each situation. A *learning media assessment* defines the most appropriate literacy medium for each purpose.

Braille was developed by Louis Braille when he was 15. It is a system of embossed characters that appear in different combinations organized within a cell that is two dots wide by three dots high. There are 720 possible dot combinations to express letters,

numbers, contracted forms, punctuation, and musical and scientific notations (Luxton-Gourgey, 2000). Braille may be produced with a braillewriter, slate and stylus, or electronic note taker. Braille takes up 2 ½ times more space than print, so contracted forms are used to abbreviate document length.

Braille mastery is a significant achievement, because it provides the learner with a tactual approach that will answer both writing and reading needs. Federal law requires that braille instruction be discussed for all children with visual impairment as part of the individualized education plan that is developed yearly. The National Library Service for the Blind and Physically Handicapped maintains a collection of braille books for loan.

Technology plays an important role in the achievement and expression of literacy. The *assistive technology assessment* determines the most appropriate applications of technology and is the basis of recommendations for access devices such as screen enlargers and braille display that provide timely access to the printed word. Due to their small size, note takers are a convenient way to write in braille. A computer can be connected to the note taker to produce either braille or speech output. The closed-circuit television (CCTV) uses a zoom lens to enlarge materials up to 60 times, a useful device for print readers with low vision. Screen reading software reads the printed word and converts it to speech, as does the Kurzweil Reader. Books on tape and computer disk are available through Recordings for the Blind and Dyslexic.

Special Techniques of Daily Living

All individuals with visual impairment will need to learn specialized techniques to accomplish personal care tasks (such as hair care and shaving) and daily living skills (such as cooking and shopping). The emphasis of this instruction is on learning the most efficient means to accomplish the task.

SOCIALIZATION

Socialization can be affected by either congenital or adventitious blindness. Congenital blindness limits access to messages sent through body language and facial expression. Teachers and parents must provide this information to the developing child, while also teaching the child to listen for clues to the emotional reactions of others. Adventitious blindness may temporarily result in increased isolation, in part due to the loss of independent travel. Blindness organizations, such as the National Federation of the Blind, are critical to supporting individuals in becoming self-advocates, an important part of socialization.

EMPLOYMENT

Unemployment is a serious problem for adults with visual impairment, with 69% of the blind and 56% of working age adults with low vision unemployed. Reasonable job accommodations support the employment of individuals with visual impairment. Such accommodations may include modification of equipment and materials, task restructuring, providing drivers or readers, and creating accessible work environments (Wolffe & Candela, 2002).

PARTICIPATION IN ALL COMMUNITIES

Universal design promotes the development of accommodations and adaptations that serve the needs of all individuals. Usage features are communicated in ways that are perceptible to all. Universally designed environments and materials provide for equitable and flexible use by individuals with every type of physical difference, including individuals with visual impairment (Lang, 2000, pp. 665–666). Universal design offers the promise of more active participation for all individuals across the life span.

—Susan M. Bruce

See also Visual Impairment, Late Life Adjustment and Rehabilitation

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