International Encyclopedia of Rehabilitation

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Low Vision

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Definitions

There are a wide variety of definitions and descriptions of low vision or persons with low vision which have been included in the literature. Definitions will vary from country to country and the reader should keep in mind that there is no one universally accepted definition of low vision. For example, Corn and Koenig (1996) define a person with low vision as "a person who has difficulty accomplishing visual tasks, even with prescribed corrective lenses, but who can enhance his or her ability to accomplish these tasks with the use of compensatory visual strategies, low vision and other devices, and environmental modifications." Lueck (2004) defines low vision as "a vision loss that is severe enough to impede an individual's ability to learn or perform usual tasks of daily life, given that individual's level of maturity and cultural environment, but still allows some functionally useful visual discrimination. Low vision cannot be corrected to normal by regular eyeglasses or contact lenses and covers a range from mild to severe vision loss, but excludes full loss of functional vision. The majority of persons who are legally blind are included within the category of low vision."

As discussed earlier, definitions of low vision will vary from country to country, and many of the attempts to define low vision are based on clinical measures, which, similar to the definition of legal blindness, do not give a complete picture of how much vision an individual has or how they function with their remaining vision. For example, Jose (1992) describes low vision as "a vision loss that is severe enough to interfere with the ability to perform everyday tasks, or activities and that cannot be corrected to normal by conventional eyeglasses or corrective lenses." The World Health Organization (WHO 1992) describes a person with low vision as "one who has an impairment of visual function, even after treatment and/or standard refractive correction, and has a visual acuity of less than 6/18 [the metric equivalent of 20/70] to light perception or a visual field of less than ten degrees from the point of fixation, but who uses, or is potentially able to use, vision for the planning and/or execution of a task." WHO maintains 5 levels of vision loss from low vision of 20/70 to no light perception (Whitcher 2008). While many definitions include clinical measures of acuity or visual field, Corn and Koenig (1996) describe these various definitions as arbitrary, given that there is no assurance that

a person with a specific clinical measure will or will not be able to complete specific tasks that do not require the recognition of letters or symbols at specified distances. Their expressed concern is what is often referred to as functional vision and may vary within the same individual based on factors such as lighting, fatigue or glare.

In industrial countries, we typically think of average or "normal" vision as 20/20 (read as "twenty over twenty" or "twenty-twenty") to 20/40 (Flax et al. 1993). In the late 19th century, a Dutch ophthalmologist named Snellen created a chart for measuring visual acuity that used letters of various sizes which lead to the use of the term 20/20. This term is often interpreted as meaning perfect vision, when, in fact, it means average vision. The first or top number in the fractional ratio indicates the distance of the eye from the eye chart. The standard distance is 20 feet, or 6 meters. The second or bottom number in the fractional ratio indicates the size of the symbol that was clearly seen. So the visual acuity 20/20 means that the eye could see at 20 feet a symbol (letter, number, or picture) the size that can be seen by the average eye at 20 feet. The measurement of 20/200 means that at a distance of 20 feet, the eye could see a symbol that could be seen by the average eye 200 feet away (Flax et al. 1993). According to Watt (2008) if a low vision patient sees 20/200, the smallest letter that they can see at 20 feet could be seen by a normal eye at 200 feet. This is referred to as the Snellen Acuity (English). In Metric Acuity, 20/20 equals 6/6. The conversion is that 20 feet equals approximately 6 meters (actually 6.096).

Metric	Snellen
6/4.5	20/15
6/6	20/20
6/7.5	20/25
6/9	20/30
6/12	20/40
6/15	20/50
6/30	20/100
6/60	20/200

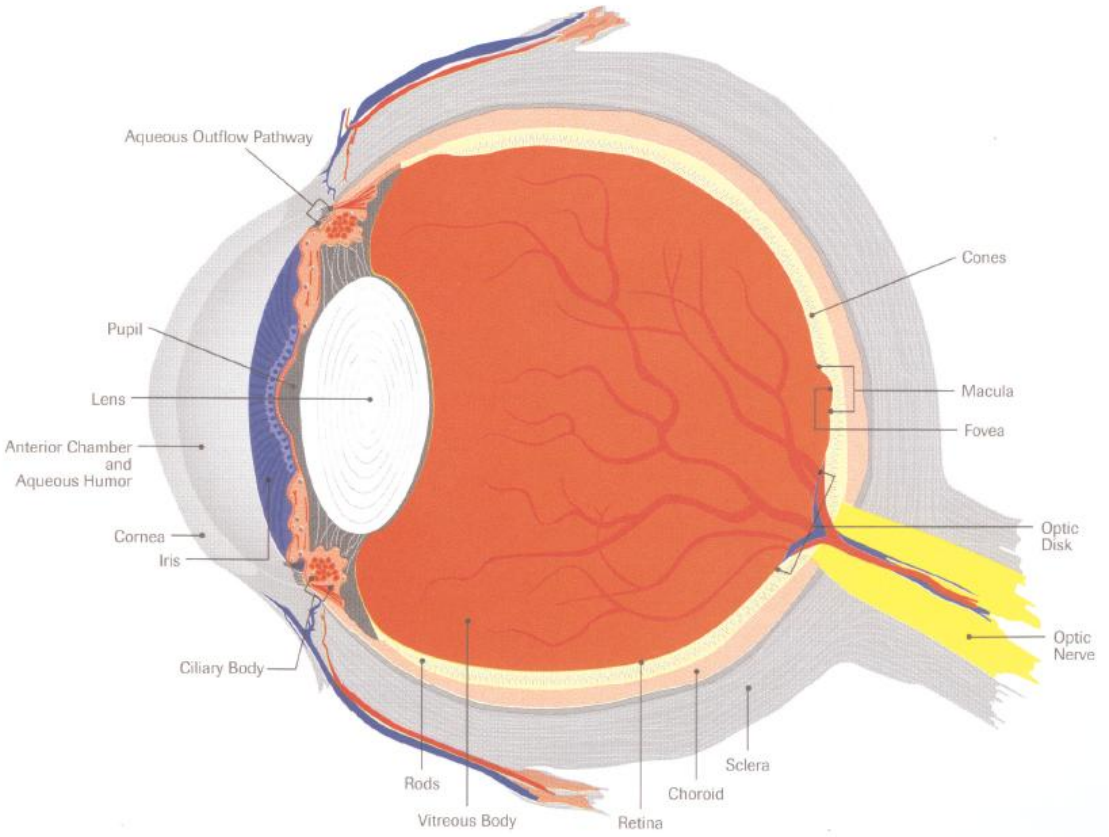
(Adapted from Watt 2008)

The Visual System

The visual system is made up of three basic parts: the eyes, the optic nerve, and the brain. Specific visual elements that assist in building a visual image include central visual acuity, peripheral (side) vision, binocular vision (which aids with depth perception), night vision, color vision and contrast sensitivity. The eye works very much like a camera, with light coming into the eye through the cornea and traveling through the lens of the eye with the iris functioning as an aperture to moderate the amount of light allowed to enter the eye. The light waves are bent by both the cornea and the lens so that they converge at a specific point on the retina, called the macula. If they do not converge exactly in the right place, the person may need glasses or contact lenses to assist them in seeing clearer. The retina is the tissue which holds the photoreceptor cells (like the film of a camera) and covers the inside of the rear chamber of the eye. The photoreceptor cells (rods and cones) and their attached network in the retinal pigment epithelium are where

the light rays are changed into neural-electric impulses that travel along the optic nerve to the occipital lobe of the brain. What an individual actual sees is composed of image, color, and movement, and is put together in the brain. Damage anywhere along the optic pathway from the cornea of the eye to the brain can cause vision impairment.

No matter the cause of vision loss, how an individual uses their remaining vision can vary tremendously from person to person or in different environments. Additional personal and environmental factors affecting the interpretation of vision include factors such as fatigue, personality, experience, novelty, complexity, lighting, contrast, and glare. These factors can enhance or complicate the individual's interpretation of what is seen (Corn 1983). For children with vision loss, learning to interpret their environment is one of the challenges of having low vision and often requires specialized instruction.



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Magnitude and Causes of Visual Impairment

According to the World Health Organization (WHO 2004), visual impairment is not distributed uniformly throughout the world. More than 90% of the world's visually impaired live in developing countries, and in every region of the world, females have a

significantly higher risk of being visually impaired than males (WHO 2004). In spite of sometimes crude methods of assessing vision loss, WHO also estimated worldwide prevalence of people who have a significant visual disability at approximately 135 million (Whitcher 2008). Except for the most industrial countries, cataract remains the leading cause of blindness in all regions of the world and when associated with aging, it is even more significant as a cause of low vision. Other major causes of low vision worldwide include glaucoma, age-related macular degeneration, trachoma, onchocerciasis (river blindness), Hanson's Disease (leprosy), malnourishment (vitamin A deficiencies), diabetic retinopathy, and other corneal opacities (WHO 2004).

In most industrial countries, uncorrectable low vision is usually caused by damage to the nerve layer inside the eyes known as the retina (Flax et al. 1993). Until recently, very little could be done medically to improve vision once damage occurred in the nerve layer. In developing countries, the causes of vision loss are much different, in that most vision is correctible and/or preventable. The current leading cause of visual impairment among children in industrialized countries is cortical visual impairment (also known as cerebral visual impairment) in which visual dysfunction is caused by damage or injury to the brain (Roman-Lantzy 2007). Age-related macular degeneration is a leading cause of visual impairment in older adults in industrialized countries (Roodhooft 2000) and presents a wide range of functional implications to older adults with low vision (Fischer 2000).

Over 50% of the world's vision loss is caused by cataracts, a clouding of the lens of the eye associated with aging which is complicated by dehydration, exposure to sunlight and heat (Whitcher 2008). Many other conditions are related to the aging process and public health factors such as clean water; for a more detailed discussion of aging and vision loss, see Watson (1996) and Houde (2007). International efforts are underway to eradicate preventable and correctable blindness by the year 2020. (See http://www.v2020.org/ for more information on this effort). For a more detailed glossary of terms/eye conditions, see:

- Vision Problems in the United States
  http://www.preventblindness.org/vpus/glossary.pdf
- Glossary of Eye conditions
  http://www.afb.org/Section.asp?SectionID=40&DocumentID=2139
- Royal National Institute of Blind People
  http://www.rnib.org.uk
- CNIB
  http://www.cnib.ca
- World Health Organization
  http://www.who.int/mediacentre/factsheets/fs282/en/
- Social Security Online/Disability Programs
  http://www.ssa.gov/disability/professionals/bluebook/2.00-SpecialSensesandSpeech-Adult.htm

Employment Considerations

It is widely agreed that unemployment and underemployment are major problems for men and women who have low vision (Moore and Wolffe 1996). Because approximately 90% of people with visual impairments have some useful vision, low vision devices and rehabilitation services offer opportunities to enhance their visual and functional capacities (Watson 1996). In developing countries, there are special challenges to low vision service delivery. Many of these challenges and potential solutions are outlined in a compilation of papers in the volume *Vision Rehabilitation (Assessment, Intervention and Outcomes)* published in 2000, and edited by Cynthia Stuen of Lighthouse International. Generally, special programs to enhance employment options in developing countries focus on 1) improving educational opportunities for those who have low vision, (Chen and Tilp 2000), 2) developing relationships that will yield cooperative service delivery with local non-governmental agencies, governmental agencies and hospitals (Khan 2004; Stuen 2000), and 3) the development of cottage businesses opportunities such as rug making or agricultural opportunities (Stuen 2000).

In industrial countries, researchers and rehabilitation professionals have considered the underlying reasons for the high rates of unemployment and underemployment of persons with low vision and have suggested a number of causes, including the following:

- negative attitudes of employers toward people with visual impairments
- lack of employment and employment-related skills
- government-generated work disincentives, such as entitlement programs that provide welfare or disability benefits
- lack of housing and family supports
- lack of transportation
- lack of access to information (Moore and Wolffe 1996).

It is important for rehabilitation professionals to have a good understanding of the difficulties faced by persons with low vision who have never worked, as well as of those who need to find ways to keep their jobs or find new ones. With this information, rehabilitation personnel are better able to help persons with low vision decide where and how they wish to be employed. Support should be offered in the framework of a counseling relationship that is focused on meeting the challenges of public attitudes, altering self-concepts, increasing employers' knowledge of visual impairment, and undergoing career planning and vocational preparation (Moore and Wolffe 1996).

For those who want to learn more about the range and diversity of jobs performed by adults with low vision, they should consult:

- Career Connect website maintained by the American Foundation for the Blind http://www.afb.org
- the jobs website maintained by the Royal National Institute for the Blind http://www.rnib.org.uk
- Lighthouse International http://www.lighthouse.org
- Royal New Zealand Foundation of the Blind http://www.rnzfb.org.nz
- Vision Australia http://www.visionaustralia.org.au
- Organizacion Nacional de Ciegos Espanoles http://www.once.es

Other national and international organizations that promote employment opportunities for individuals with low vision include:

- Rehabilitation Research and Training Center (RRTC) on Blindness and Low Vision at Mississippi State University http://www.blind.msstate.edu
- World Blind Union http://www.worldblindunion.org
- International Society for Low Vision Research and Rehabilitation http://www.islrr.org

For additional information and resources on employment issues affecting persons with low vision in developing countries, the reader should consult:

- BlindnessInternational http://www.blindnessinternational.org/programs/index.htm
- Indian NGOs http://www.indianngos.com/issue/disability/blind/resources/articledigitaldivide.htm
- Barriers in New Zealand http://www.msd.govt.nz/documents/events/strategic-social-policy/conference-04/74.doc

For a more detailed discussion of vision rehabilitation services in the Americas, see Overbury and Collin (2000); for vision rehabilitation services in Asia, the Pacific and the Middle East, see Johnston and Goodrich (2000); for vision rehabilitation services in Europe and Africa, see Backman (2000); and for a broad glance at worldwide employment of people with visual impairments, see Wolffe and Spungin (2002).

Low Vision Devices

Many people with low vision can benefit from either changes in the environment (lighting, adding contrast, or reducing clutter and glare) or the use of low vision devices. People with low vision vary dramatically in their ability to successfully use magnification devices for near and distance vision tasks. Their ability will vary based on age, visual condition/eye disease, amount or ability to use their residual vision, etc. Low vision devices are frequently categorized as optical (near & distance magnification) and non-optical devices.

Many countries, both developing and industrial countries, are developing low vision service programs to assess and implement the use of optical and non-optical low vision devices. Low Vision clinicians can be ophthalmologists, optometrists, occupational therapists, teachers of the visually impaired, or low vision therapists, and specialize in helping persons with low vision maximize their visual efficiency. Learning techniques in eccentric viewing, and sensory integration can assist people with low vision to use their residual vision more effectively. Proper selection and training in the use of different optical and non-optical aids can also enhance the use of low vision so that an individual can use their remaining vision more effectively.

Overview of Low Vision Devices			
Type of Low Vision Device	**Description**	**Primary Use**	**Examples of Devices**
Near-vision magnification	Any optical device that magnifies the image for viewing tasks within 18 inches. These devices incorporate the use of specific lenses, generally convex or plus lenses.	Used primarily for near tasks within arm's reach, such as reading, writing, sewing, playing board games, and crafts.	Handheld magnifier Stand magnifier Spectacle lenses Mirror magnifier Telemicroscope
Distance-Vision magnification	Any optical system that magnifies the size of an image for viewing tasks from 12 inches to infinity. These devices incorporate the use of both convex and concave lenses.	Used primarily for distance tasks beyond arm's reach, such as spotting street signs, viewing sporting events, or watching television.	Handheld telescope Spectacle-mounted telescope Behind-the-lens telescope
Nonoptical device	A device that does not involve the use of corrective lenses (convex or concave). Many nonoptical devices do not involve magnification.	Used in near and distance tasks to enhance environmental features, such as illumination and contrast, to sustain visual functioning and to control visual fatigue.	Lighting Color filter Large-print material Reading stands
Electronic magnification	A device that magnifies the size of an image through the use of lenses and electronic enhancement. The size of the image is increased as it is projected.	Used primarily for near and distance tasks that require greater magnification and flexibility in adjusting contrast and illumination.	Microcomputer screen Closed-circuit television Low Vision Enhancement System

Adapted with permission of the publisher, from G.J. Zimmerman (in press). Optics and Low Vision Devices. In A.L. Corn & J.N. Erin (Eds.). Foundations of Low Vision: Clinical and Functional Perspectives, 2nd edition. New York: AFB Press

There are a wide variety of resources available to people with low vision. Examples include the Low Vision Gateway to the Internet (http://www.lowvision.org), the American Foundation for the blind (http://www.afb.org) which provides a broad overview of assistive technology, and the National Rehabilitation Information Center (http://www.naric.com) which provides a broad search capability related to low vision. For additional information in accommodating employees with low vision, the reader should consult the Job Accommodation Network (JAN) at West Virginia University (http://www.jan.wvu.edu/media/Sight.html).

Summary

This brief introduction to low vision is designed to expose the reader to the visual system and provide resources or leads on where to go for additional information. Understanding the task-specific visual difficulties that persons with low vision may face can be difficult and confusing. Knowing how to resolve those difficulties can likewise require a vast array of knowledge and experts in a variety of areas. It is hoped that this chapter can serve as a valuable resource and help improve one's understanding of low vision and how it can impact the individual.

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