INTRODUCTION to
BLINDNESS and LOW VISION

Purpose: The purpose of this module is to acquaint the Consultant with the major types of visual impairments and some of the implications those conditions have for employment in the Randolph-Sheppard program.

Learning Objectives
1. The consultant will be able to identify the characteristics of the major causes of vision loss in the United States.
2. The consultant will know what it means to be legally blind.
3. The consultant will be able to identify the major VR services assisting people with vision loss.

Vision
Vision is a combination of the eye translating light waves into electrical impulses sent to the brain, and the brain’s ability to interpret those signals into an image with color and movement. The brain brings understanding to what comes from the eye. Vision loss can occur anywhere along the way. Light enters the eye through the cornea (the clear outer layer), passes through the hole in the iris known as the pupil, and is focused by the lens of the eye to a point on the inner tissue of the eye known as the retina. The place that provides the most focus and understanding of color is known as the macula. Photoreceptors, known as rods and cones, then move the now electrical version of the light through the optic nerve to the brain where it is processed into what is seen.

Legal Blindness
To be eligible for the Randolph-Sheppard BEP, an individual has to be classified as legally blind, which is defined by the Social Security Administration as "central visual acuity 20/200 or less in the better eye with best correction or a visual field of 20 degrees or less." For the first part of the definition, it basically means that with glasses or contacts (best correction) using their better eye, the individual has a distance visual acuity of 20/200 or worse. We often say they can see at 20 feet what a person with normal vision sees at 200 feet. This is not entirely accurate because the measure has to do with the size of the letter on a chart, but it gives a general idea of how the person sees. However, a person can see 20/20 and still be legally blind, as stated in the second part of the definition which is related to the field of vision being 20 degrees or less. When looking straight ahead, a person with normal vision sees about 180-200 degrees to the sides, overhead, and below. A person with a reduced field of vision may trip and fall over chairs, curbs, stairs because they do not see them.

Levels of Vision Loss
Visual Acuity: There is a continuum of vision loss from normal vision to total blindness. Normal distance visual acuity is classified through measurement on a chart as 20/20 - seeing a certain size of print at 20 feet. The chart that is used to measure this vision is known as a Snellen chart and usually has a large E at the top. Many eye care
professionals use variations, including a projected chart. As you can see from the Snellen chart below, each line of the chart equates to a different visual acuity. If a person can read the big E (line 1) their vision is 20/200. Line 2 is 20/100. That is a big gap. What if the person’s vision is 20/150? If, with best correction, they cannot read line 2, but they can read line 1, then they are considered legally blind. This is one reason there is a lot of variation in vision between individuals with 20/200 visual acuity. Other reasons may include lighting, glare, fatigue, blind spots, cluttered environments, other sensory clues, familiarity, etc. Notice in the chart below, normal vision of 20/20 is measured on line 8.

![Snellen Chart with visual acuities](image)

A person can also have vision worse than 20/200 that might be measured as 20/400, 20/800 or 20/1200. At some point, the visual acuity will move to counting fingers at nine, six, or three feet or hand motion at a certain distance. The most severe classification of vision loss is light perception only (LPO) or no light perception (NLP).

If a person goes to a low vision clinic, vision is measured on a different type of chart, and you may find his/her vision is 20/150 in a Feinbloom chart. However, if on the Snellen chart or its equivalent, visual acuity is 20/200, they are still considered legally blind.

Field loss: If a person is legally blind because of a field loss to 20 degrees or less, they are missing objects in the environment. This makes locating small items or walking around very difficult. Most people with a field loss also have difficulty seeing in dark places or at night. The part of the eye that helps them see in these situations is the photoreceptor known as rods. If they are effected, then night blindness and loss of peripheral vision both are impacted.

**Adjusting to Vision Loss**
When an individual first begins to lose vision, he or she often go through a grieving process not unlike grieving the death of a loved one. This process can take years depending on the person’s personality, age, severity of vision loss, and stability of vision loss. Once they come to the place where they accept their vision loss, and receive
proper training, learn alternative strategies and the use of appropriate assistive
technologies, they are ready to explore employment options such as the BEP.

Vocational Rehabilitation Services in each state provides the training and services
needed to get them ready for employment. Each person with vision loss is assigned to a
counselor who will guide them to the array of services necessary to help them achieve
independence. These services include:

- Low Vision Services – to find magnification aids that can improve functional
  vision
- Orientation & Mobility Services – to teach travel skills including the use of a white
cane
- Vision Rehabilitation Therapy or Rehabilitation Teaching Services – to teach
  independent living skills and communications skills like braille
  - Home-based
  - Center-based
- Assistive Technology Services (or Access Technology) – to evaluate and train on
  the use of various types of computer technology and other hand-held
  technologies.
- Counseling and Guidance – by the VR Counselor to evaluate the individual’s
  skills and assist in finding their best career choice.

Adjustment and function may vary based on severity and stability as well as age of
onset. Experience, comfort, self-stigma, and self-esteem may vary widely especially in
reference to persons who are congenitally visually impaired and those who acquired a
visual impairment as an adult. This is particularly true in relation to their work
experience and understanding of work.

Major Causes of Visual Impairment and Blindness in the United States

What follows is an overview of some of the major eye conditions impacting people in the
United States, the functional limitations and the implications for employment. The
leading four are macular degeneration, glaucoma, diabetic retinopathy and cataracts.
Although often age related, they can also occur in younger persons. All may benefit
from the VR Services mentioned above, but each person will need to be evaluated
individually.

Macular Degeneration

The macula is that part of the eye which is responsible for fine detailed vision and
colors. A person with age-related macular degeneration (ARMD) requires good light to
function optimally. It is one of the primary causes of permanent legal blindness in the
U.S. among persons over 65. Incidence increases with every decade over 50. It is
painless and progressive. ARMD is more common in women, Caucasians, those with a
family history of the disease, and people with a history of smoking. Diagnosis includes
the use of a dilated eye exam and Amsler grid to determine if there is a distortion in the
central vision. Symptoms include gradual or sudden loss of central vision, blurred vision and scotomas (blind spots) which cause:

- loss of central vision
- difficulty in recognizing faces
- faded colors and reduced contrast
- distortion

There are a broad spectrum of clinical and pathological findings, including Stargardt’s Disease and various types of macular dystrophies that impact younger persons.

Macular degeneration manifests into two types: dry (non-exudative) and wet (exudative). Both types are progressive and bilateral. The majority of persons who have ARMD have dry ARMD, and do not have significant vision loss. The more severe “wet” form accounts for 90% of all cases of legal blindness due to ARMD.

Dry: Most common variety, yet most people do not experience severe vision loss in the early stages of the dry form. It is characterized by variable degrees of atrophy and degeneration of the outer retina, retinal pigment epithelium, Bruch’s Membrane and choroid. Drusen, discrete yellow deposits thought to be waste products of cellular degeneration, calcify and increase in number. As the calcification increases areas of vision can be affected. There are three distinct stages of development: early, intermediate, and advanced dry ARMD. Advanced Dry ARMD may cause significant vision loss. The Age-Related Eye Disease Study (AREDS) of the National Eye Institute indicated that there is benefit of particular vitamins taken during the intermediate stage to minimize or slow progression of the disease in about a quarter of those taking them. Nutrition seems to be a factor and getting nutrients to the retina can be beneficial. Exercise, diet and vitamins are all seen as positive steps a patient can take to slow the progression of the disease.

Wet: Subretinal neovascularization causes fluid to build up and leak from behind the retina. Macular edema and leakage are the main characteristics. Treatment includes anti VEG-F (lantus or avastin) injections in the affected eye, and photodynamic therapy (injections of special photosensitive dye into the arm and following with cool laser therapy). Neither treatment is a cure, but may slow the advancement of the disease and some patients show improvement using the anti-VEG-F injections. Also there is experimentation with retinal transplants, health cell transplants into the macula, retinal relocation, anti-inflammatory treatments, and regulation of diet and vitamin therapy.

Implications for Employment: A person with macular degeneration will not lose all his/her vision, but will be missing that critically important central vision necessary for reading, recognizing faces, and seeing colors. This may cause difficulty with tasks like reading, writing, checking expiration dates, recognizing customers, keeping an area neat and clean, finding things and doing credit card transactions or operating a cash register. Activity of daily living skills, low vision services, orientation & mobility services
and assistive technology services may all be beneficial in assisting the individual to become productive and confident.

![Figure 2: Vision with Macular Degeneration](image)

**Glaucoma**

With glaucoma, the major and most common characteristic is an increased intraocular pressure (IOP) that causes a cupping of the optic disk. Glaucoma itself is actually the cupping of the disk – and some people can have increased IOP, with no cupping or normal pressure (low-tension glaucoma) with cupping. There are two main types: open angle and closed angle glaucoma. The primary pathology of open angle glaucoma is a degenerative process in the trabecular meshwork. The most common symptom is increased IOP, but the real measure is in the cupping of the optic nerve head as that is where vision loss begins. It is often hereditary, and causes slow, sometimes unnoticed loss of peripheral vision and loss in central vision with blind spots and blurring. It can be congenital or adventitious. Glaucoma occurs when there is damage to the optical nerve. The main treatment options are in the form of eye drops to alter the production and flow of the intraocular fluids. Some current research indicates that there may be some possibilities of restoring damaged optic disk tissue, but treatment options for disk replacement are still in clinical trials. More common after the age of 40, and is the leading cause of blindness in Afro-Americans, but after age 60 is equally found among racial groups, especially among Hispanic populations.

There are five main types of glaucoma:

Angle closure or closed angle glaucoma: sudden onset of vision loss with intense pain and nausea, redness of the eye and blurred vision because the flow of fluid from the eye is blocked. Treatment is usually immediate laser surgery to open a passageway through the trabecular meshwork for fluid to exit the eye or to allow flow of fluid through
the iris. This type is considered a medical emergency as irreversible blindness can occur within a few days.

Open angle: can cause night blindness, loss of peripheral vision, and blind spots. Although treatment cannot restore vision, it can usually prevent progression of the disease. Without treatment, blindness is usually inevitable. Compliance with topical medical treatment is often a problem as drops cause discomfort and redness and temporary blurring of the vision, and some people have difficulty applying them.

Congenital Glaucoma: children are born with a defect in the structure of the eye which slows the normal drainage of fluid in the eye. Symptoms are cloudiness in the eye, excessive tearing and light sensitivity. Treatment is usually surgical intervention as the use of eye drops is difficult in infants. In earlier days, some surgical interventions included holes or wedges cut from the iris which cause increased photophobia.

Secondary Glaucoma: secondary glaucoma occurs most often as the result of eye surgery, eye injury or infection, or from certain other eye conditions such as aniridia or severe cataracts. There is also a form that is linked to diabetes.

Low-Tension Glaucoma: occurs when the individual has intraocular pressure less than 21 Hg, but still have changes in the optic disk or visual field. In some cases, intraocular pressure as low as single digits is recommended.

There are three basic treatments of glaucoma: laser trabeculoplasty, conventional surgery and the use of certain eye medications. Laser trabeculoplasty involves the use of a laser to open the trabecular meshwork and allow drainage of the fluid of the eye. Conventional surgery makes a new opening for the fluid to leave the eye covered by a flap known as a blep. Medical treatment of glaucoma includes the use of different eye drops or medications which must be taken regularly and continuously, to either slow production of the fluid of the eye or to increase the flow by thinning the fluid. Side effects can complicate patient compliance and include stinging, blurring of vision, redness of the eye, heart palpitations and depression.

Implications for Employment: Changes in vision may take adjustment time and a person, even with medical compliance may have changes in vision that will need accommodation. If they have remaining vision, they may have difficulty with dark places, dealing with clutter, and visual awareness of their environment. If they have no vision, they will rely heavily on other sensory input to function. Orientation and mobility is important. Again, with proper training and assistive technology and adaptive equipment, they can function well in the BEP.
Diabetic Retinopathy

Diabetic retinopathy is a group of eye problems that persons with diabetes may acquire as a complication of diabetes. Diabetic eye disease includes cataract, glaucoma, and diabetic retinopathy. Diabetic retinopathy is the leading cause of blindness in persons under age 45. It is caused by changes in the blood vessels of the retina. It manifests as either the retinal blood vessels swelling and leaking fluid or by the development of abnormal new blood vessels (neo-vascularization). Diabetic retinopathy is more frequent and with less time between diagnosis and onset of visual loss in young people with insulin-dependent diabetes (type I) than those with age related (type II) diabetes.

There are two types of diabetic retinopathy: proliferative and non-proliferative diabetic retinopathy. The prevalence of proliferative retinopathy in type I diabetics with 15 years of systemic disease is 50%, while it is much less in those with type II. According to the National Eye Institute, between 40-45% of those diagnosed with diabetes have some degree of diabetic retinopathy. Symptoms are sometimes very difficult to detect because until the macula is effected there may be no obvious indication to the individual. This is one reason that regular eye exams are so important for persons who have diabetes. Eye care professionals can diagnose it very quickly. Once there is some impact on the macula, blurred vision occurs.

Research has shown that the major factor in preventing diabetic retinopathy and its advancement is management of the systemic disease and good blood sugar control of around 80-120. When a person has diabetic retinopathy it is not unusual to also have other complications from diabetes which may affect the heart, kidneys, or extremities. There are four levels of severity of diabetic retinopathy and it is progressive. Secondary visual concerns include glaucoma, detached retinas, cataracts, and blurry vision. The biggest challenge will be related to managing their diabetes and blood sugar levels during the work day, and it is important that the individual have a stable glucose management program that is fully accessible. Blood sugar levels can fluctuate

Figure 3: Simulation of vision with glaucoma
depending on stress, physical activity, and food intake. When they become too high or too low, the individual can show symptoms of illness and sometimes confusion.

Implications for Employment: Diabetic retinopathy is spotty at times and the person’s functional vision can swing from 20/200 to totally blind. Good diabetic management can reduce these variances. Keeping stress levels reduced, having meals on a schedule and time to manage the diabetes will be important. Adjustments for functional vision through a low vision clinic that include variations in vision are important. Depending on where the blind areas are in the central vision and how severe the vision loss is, the individual may have difficulty making eye contact with customers, using a cash register, reading numbers on a credit card, reading expiration dates on merchandise, keeping the area clean and pleasant looking, and organizing and completing paperwork. They may also have difficulty recognizing faces, discriminating certain colors and dealing with glare. All of these areas can be corrected with training, low vision devices and strategies, environmental modifications, and assistive technology. If necessary O&M and ADL skills will also be important parts of the overall rehabilitation program. Assistive technology and accessible equipment are also necessary.

**Cataract**

A cataract is a lens opacity caused by either clumps of protein in the lens or a gradual discoloration of the fluid in the lens. The disease is progressive with the intensity of the cataract varying markedly. The development of cataracts is age related. Cataract affect about 10% of all Americans, 50% of those between 65 and 75 years of age and about 70% of those over 75. Most are bilateral. Most are not visible by a casual observer until they become mature or dense enough to cause severe vision impairment or blindness. Persons at risk include persons who have diabetes, or smokers, persons who are chronically dehydrated, those who abuse alcohol and those with prolonged exposure to ultraviolet light. Symptoms include hazy, cloudy central vision becoming more progressively dense, glare, poor night vision, and halos around lights at night, double vision or multiple vision in one eye. There are several types of cataracts including
secondary cataract in persons who have had eye surgery or glaucoma, traumatic cataract from a blow to the eye, congenital cataract, and radiation cataract. The only treatment is lens extraction with either intraocular lens (IOL) implant or the use of contacts or glasses.

Cataracts are usually removed and replaced with an IOL or glasses, but in extreme cases where one eye has not responded well to surgery, surgery on the remaining eye may be delayed or not deemed appropriate. In the BEP, a person who has operable cataracts will likely not become candidates for a facility as they would not be legally blind after surgery.

Implications for Employment: Need for improved lighting, increased contrast and avoidance of glare. Colors are sometimes difficult to discern. The person may need a low vision examination or some assistive technology to assist with reading tasks such as completing paperwork requirements, reading expiration dates, or reading overhead signage. They may have difficulty recognizing faces as well.

Retinitis Pigmentosa (RP)

Retinitis pigmentosa (RP) is the name given to a group of inherited eye diseases that affect the retina. Retinitis pigmentosa causes the degeneration of photoreceptor cells in the retina, most often starting with the rods. As these cells degenerate and die, patients experience progressive vision loss.

The most common feature of all forms of retinitis pigmentosa is a gradual degeneration of photoreceptor cells called rods and cones. Most forms of RP first cause the degeneration of rods. These forms of RP sometimes called rod-cone dystrophy, usually begin with night blindness. Night blindness is somewhat like the experience normally sighted individuals encounter when entering a dark movie theatre on a bright, sunny day. However, patients with RP cannot adjust well to dark and dimly lit environments. As the disease progresses and more rod cells degenerate, persons lose their peripheral vision. Persons with RP often experience a ring of vision loss in their mid-periphery with small islands of vision in their very far periphery. Others report the sensation of tunnel
vision, as though they see the world through a straw. Many patients with retinitis pigmentosa retain a small degree of central vision throughout their life.

Initial symptoms include night blindness, tunnel vision, blind spots, difficulty adjusting to different lighting conditions and photosensitivity. Onset of symptoms usually occurs in persons between 18 and 30. Diagnosis by electroretinalgram (ERG) can be done at any age. There is no treatment or cure and loss of vision varies in individuals, although recent clinical studies are holding out some hope in the use of stem cell implantations.

Usher’s Syndrome is a syndrome which includes the loss of hearing and RP. Researchers believe that the hearing loss in Usher’s Syndrome is due to a problem with the sensory (nerve) cells in the cochlea, a structure within the inner ear that is necessary for transmission of sound to the brain. Extensive research is being conducted on a cure for Usher’s Syndrome. While not a cure, a specified dose of vitamin A has been found to slow the progression of RP in some individuals with typical RP and Usher’s Syndrome type II.

There are 3 types of Usher Syndrome:
- Type I: congenitally profoundly deaf, with balance problems and RP.
- Type II: congenitally hard of hearing with a moderate to severe loss but the hearing loss is stable and RP develops in adolescence. Usually there are no balance problems.
- Type III: congenitally hard of hearing with progressive hearing loss and balance problems and combined with onset of RP.

Implications for Employment: Retinitis Pigmentosa can lead to total blindness in some people, and it is not unusual for persons with RP to have an unexpected significant change in vision. Since mobility is a challenge, often individuals with RP may have a guide dog or require the use of a white cane. If accompanied by deafness and balance issues, communications and safety considerations will need to be made. Proper training and assistive technology can make it possible for blind or deafblind persons with RP to be effective blind entrepreneurs.

Figure 6: Vision with RP
Other Eye Conditions

There are a number of other eye congenital (from birth) and adventitious (adult onset) eye conditions. Other relatively common conditions include the following:

- **Nystagmus** – in children who are born with visual impairment it is not unusual for the eye to move involuntarily in a rotary or pendular fashion or a combination of similar movements, etc.

- **Retinoblastoma** – cancer of the eye. Often leading to removal of one or both eyes. May lead to partial vision or total blindness. Peter Falk who played Columbo on television had one eye removed at age 3 from retinoblastoma. If the cancer also impacts the orbit around the eye, there may be additional facial scarring.

- **Albinism** – lack of pigment in the skin, retina and hair. Often leads to legal blindness, super-sensitivity to light and nystagmus.

- **Retinopathy of Prematurity** – Retinopathy of prematurity (ROP) is a potentially blinding eye disorder that primarily affects premature infants weighing about 2½ pounds or less that are born before 31 weeks of gestation. The smaller a baby is at birth, the more likely that baby is to develop ROP. This disorder—which usually develops in both eyes—is one of the most common causes of vision loss in childhood and can lead to lifelong vision impairment and blindness. ROP is the cause of blindness in singer Stevie Wonder.

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“Just because a man lacks the use of his eyes doesn't mean he lacks vision.”

Stevie Wonder

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Overall Implications of Vision Loss

- Difficulty observing the environment so things may be overlooked.
- Difficulty in accessing printed materials unless a magnifier or assistive technology is used.
- Challenges with mobility, orientation, and transportation.
- Challenges with confidence and self-esteem.
• May need training in activities of daily living, use of visual aids, orientation and mobility, as well as more soft skills such as social skills.

**Doing the right thing for the blind entrepreneur**

• Read your consumer’s eye report.

• Ask the person directly about their vision and challenges they may experience.

• Encourage them to report changes in vision.

• If the person has difficulty doing a task, explore options with the VR counselor or the rehabilitation teacher or orientation & mobility specialist in your area.

**Resources**

Resources for more information on specific eye conditions:

• National Eye Institute [https://www.nei.nih.gov/health](https://www.nei.nih.gov/health)


**References**


