Learning objectives

1. To briefly review normal eye anatomy
2. To be able to define and appreciate the magnitude of visual impairment
3. To understand why visual impairment is an important global health issue
4. To be able to describe the major causes of visual impairment worldwide, including background, epidemiology, and management
5. To present some of the public health efforts to improve eye health worldwide
Normal eye anatomy

• Before we begin a discussion of visual impairment and its causes, let’s take a moment to review the normal structures of the eye (seen here in cross-section).
Normal eye anatomy

- **Cornea**: the transparent front “window” of the eye, the cornea serves as an important refractive surface.
- **Iris**: the colored part of the eye which helps to screen out and focus incoming light.
- **Pupil**: the circular opening in the center of the iris.
- **Lens**: a transparent, biconvex structure behind the pupil and iris that aids in focusing of images.
- **Retina**: the neural tissue which lines the back of the eye, it converts light energy to impulses that travel to the brain via the optic nerve.
- **Macula/Fovea**: the area of the retina responsible for fine, central vision.
What is visual impairment?

- Includes both **low vision** and **blindness**, as clinically defined by the World Health Organization (WHO):
  - **Low vision** is the inability, even with corrective lenses, to clearly see at a distance of 6 meters (20 feet) what individuals with normal vision can clearly see at a distance of 18 meters (60 feet).
  - **Blindness** is the inability to read the largest letter on a vision chart at a distance of 3 meters (10 feet).

The magnitude of visual impairment

- According to WHO, in 2002 more than 161 million people were visually impaired. Of those individuals, an estimated 37 million were blind.
- Uncorrected refractive error (near-sightedness, far-sightedness, and astigmatism) may account for an additional 82 to 117 million cases of visual impairment.
- Over 90% of all blind people live in developing countries.

Why is this an important global health issue?

- Blindness and low vision are important global health issues because they confer increased morbidity and mortality, decreased quality of life, and substantial economic productivity loss.
- Without additional intervention, the total number of blind people worldwide has been predicted to increase to **76 million** by 2020.
- Remarkably, at least **75%** of world blindness is believed to be entirely treatable or preventable. Let’s discuss the leading causes.

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Causes of visual impairment

- Cataract, 47.8%
- Others, 13%
- Glaucoma, 12.3%
- Age-Related Macular Degeneration, 8.7%
- Diabetic Retinopathy, 4.8%
- Corneal Opacity, 5.1%
- Childhood Blindness, 3.9%
- Trachoma, 3.6%
- Onchocerciasis, 0.8%
- Others, 13%

Causes of visual impairment: Cataract

• Background

  – An opacity in the lens of the eye
  – Most often age-related, but can also be genetic, congenital, or the result of disease, trauma or medication use

A mature age-related cataract. (Image: National Eye Institute, National Institutes of Health)
Causes of visual impairment: Cataract

- Epidemiology
  - The most common cause of world blindness, accounting for almost 50% of cases (18 million people)
  - Risk factors: cigarette smoking, UV-B light exposure, diabetes mellitus, and corticosteroid use; possibly dehydration (e.g. from severe diarrhea), malnutrition, and heavy alcohol use
Causes of visual impairment: Cataract

- Management
  - Surgical removal of the lens, typically followed by implantation of a synthetic intraocular lens, is curative and cost-effective
  - Small-incision cataract surgery (SICS) is a fast and inexpensive method used in some developing countries that has been shown to have excellent visual outcomes

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Causes of visual impairment: Glaucoma

• Background

  – A group of diseases characterized by optic nerve cupping and irreversible vision loss, usually associated with elevated intraocular pressure (IOP)
  – Two most common forms are primary open-angle glaucoma (POAG) and angle-closure glaucoma (ACG)
Causes of visual impairment: Glaucoma

- Epidemiology
  - The 2\textsuperscript{nd} most common cause of world blindness, accounting for \textbf{12.3\%} of cases (4.4 million people)
  - Risk factors: increasing age, African ethnicity (POAG), Asian ethnicity (ACG), increasing IOP, and genetic predisposition; possibly diabetes mellitus
Causes of visual impairment: Glaucoma

• Management
  – Goal is to maintain normal IOP through the use of a variety of pharmacologic therapies
  – Refractory cases may be treated with laser therapy or surgically
  – Regular eye examinations assessing IOP, visual fields, and changes in the appearance of the optic nerve are essential
Causes of visual impairment: Age-related macular degeneration

- Background
  - A chronic, degenerative condition common in older individuals that affects the part of the eye responsible for central vision
  - Classified into two types, **dry** and **wet**:
    - Dry form accounts for 80% of all AMD
    - Wet form involves proliferation of blood vessels (neovascularization) and accounts for the nearly 80% of blindness caused by AMD
Causes of visual impairment: Age-related macular degeneration

A. Dry age-related macular degeneration. The multiple small, yellow deposits in the macula are called *drusen*. B. Wet age-related macular degeneration demonstrating neovascular changes and hemorrhage. (Images: National Eye Institute, National Institutes of Health)
Causes of visual impairment: Age-related macular degeneration

- Epidemiology
  - The third leading cause of blindness worldwide, accounting for 8.7% of cases (3.2 million people), and the primary cause of blindness in developed countries, particularly in elderly individuals
  - Risk factors: increasing age, cigarette smoking, family history, low dietary intake of antioxidants and zinc, white ethnicity, and hypertension; possibly female gender, cardiovascular disease, and cataract surgery
Causes of visual impairment: Age-related macular degeneration

• Management
  
  – Studies have shown a possible benefit from antioxidants such as vitamins C and E, beta-carotene, and zinc
  – Laser therapy, intravitreally injected medications, and photodynamic therapy are options for treatment of the wet form

Causes of visual impairment: Corneal opacity

- Background
  - Caused by corneal disease or trauma with subsequent scarring and possibly monocular or bilateral blindness
  - Specific causes include trauma, corneal infection, vitamin A deficiency, measles, trachoma, onchocerciasis, leprosy, and harmful traditional practices

A child with corneal scarring at an outreach clinic in Nepal. Photo courtesy of The Tilganga Eye Centre.
Causes of visual impairment: Corneal opacity

• Epidemiology
  – The 4th most common cause of blindness worldwide, accounting for 5.1% of cases in 2002
  – Prevalence varies significantly by region and age, with some studies showing corneal opacity as the most common cause of blindness in certain populations
Causes of visual impairment: Corneal opacity

• Management

  – Corneal transplantation is the treatment of choice for blinding corneal opacity but is not cost-effective in most developing countries due to limited resources (corneal surgeons, eye banks) and availability of long-term care.
  – Many causes of corneal opacity in developing countries are preventable or treatable, thus emphasizing the importance of establishing effective public health programs.

Causes of visual impairment: Diabetic retinopathy

• Background

  – A common complication of diabetes mellitus, there are two main types, **nonproliferative** and **proliferative**, distinguished by retinal examination:
    • Nonproliferative findings include hemorrhage, microaneurysms, cotton-wool spots, and macular edema with visual impairment
    • Proliferative findings include formation of new blood vessels (neovascularization) and scarring which may cause retinal detachment and profound visual loss
Causes of visual impairment: Diabetic retinopathy

Proliferative diabetic retinopathy demonstrating marked neovascularization. (Image: National Eye Institute, National Institutes of Health)
Causes of visual impairment: Diabetic retinopathy

- Epidemiology
  - In 2002 accounted for almost 5% of blindness worldwide
  - Particularly prevalent among working age people in developed countries
  - Duration of diabetes mellitus, particularly after puberty, is the most important predictor of diabetic retinopathy
Causes of visual impairment: Diabetic retinopathy

- Management
  - Annual eye examinations are recommended to assess for progression of disease
  - Strict blood glucose control slows the progression of retinopathy
  - Laser therapy may be helpful for selected patients with neovascularization
  - A surgical procedure called vitrectomy may be helpful in patients with severe complications of the disease


Causes of visual impairment: Vitamin A deficiency

• Background

  – Vitamin A is necessary for retinal function and ocular epithelial cell development
  – Vitamin A deficiency (VAD) can cause xerophthalmia, or dry eye, with a spectrum of severity ranging from night blindness to corneal ulceration and irreversible scarring
  – VAD also increases the risk and severity of infections such as measles
Causes of visual impairment: Vitamin A deficiency

• Epidemiology
  – Considered the leading cause of preventable blindness in children worldwide
  – It is estimated that 127 million preschool-aged children have VAD, with 4.4 million associated cases of xerophthalmia
  – Mortality estimates in preschool-aged children range from 1.3-2.5 million deaths annually
Causes of visual impairment: Vitamin A deficiency

- Management

- Vitamin A supplements are inexpensive and may decrease mortality in preschool-aged children by as much as 55% in some regions

- Public health initiatives also promote vitamin A-rich diets, breastfeeding, and food fortification

A Rwandan refugee child receives a vitamin A drop. (Image: UNICEF)

Causes of visual impairment: Trachoma

- Background

  - Caused by serotypes A-C of the bacterium *Chlamydia trachomatis*
  - Spread through contact with eye discharge from infected individuals, typically carried by flies
  - Recurrent infection causes scarring of the conjunctiva and eyelid deformities, which in turn can lead to corneal ulceration, scarring, and blindness
Causes of visual impairment: Trachoma

• Epidemiology

  – The most common infectious cause of blindness worldwide
  – Most prevalent in developing countries where crowding, poor hygiene, and limited access to water are prevalent

An Ethiopian girl covered in flies. The flies are attracted to eye secretions and aid in the transmission of trachoma. (Image: Elizabeth Gilbert, International Trachoma Initiative)
Causes of visual impairment: Trachoma

The Global Distribution of Active Trachoma

Country trachoma status:
- Green: No active trachoma
- Red: Data confirmed endemic active trachoma
- Yellow: No data identified, believed endemic active trachoma

(Image: WHO, http://gamapserver.who.int/mapLibrary/Files/Maps/global%20active%20may%202006.jpg)
Causes of visual impairment: Trachoma

• Management
  – Active infection is effectively treated with antibiotics (oral azithromycin or tetracycline eye ointment) but reinfection is common
  – Long-term control requires a multi-faceted approach, as promoted by the SAFE strategy:
    • Surgery for eyelid deformities
    • Antibiotics
    • Facial cleanliness
    • Environmental improvement

Causes of visual impairment: Onchocerciasis

• Background

  – A parasitic disease spread by a blackfly which breeds near fast-flowing rivers (hence the common name “river blindness”)
  – Larvae are transmitted to a human host, where they mature to adult worms and release larval worms (*microfilariae*) that migrate to the eyes and skin and cause local damage
Causes of visual impairment: Onchocerciasis

- Epidemiology
  - WHO estimates that almost 18 million people are infected, with 500,000 cases of visual impairment and 270,000 cases of blindness
  - Over 90% of onchocerciasis is located in 30 African countries, with the remainder in Yemen and Latin America

A young child leads a blind man with the aid of a stick, a common sight in some West African villages. (Image: WHO/TDR/OCP/Ward)
Causes of visual impairment: Onchocerciasis

- Management
  - Effectively treated with the anti-parasitic agent ivermectin, typically given every 6 to 12 months in endemic regions
  - Additional efforts include vector control through insecticidal spraying, avoidance of blackfly-infested areas, and the use of insect repellant and protective clothing

Causes of visual impairment: Refractive error

- Background
  - Occurs when an image is not focused clearly on the retina due to some problem with one of the optical components of the eye
  - Includes myopia (near-sightedness), hyperopia (far-sightedness), presbyopia (age-related loss of near focusing), and astigmatism
  - Also includes inadequate correction of refractive error in aphakic patients (i.e. those who have undergone lens removal for cataract without implantation of a synthetic intraocular lens)
Causes of visual impairment: Refractive error

- Epidemiology
  - May account for an additional 87-102 million cases of visual impairment worldwide
  - A significant problem in both developing and developed countries
  - Natural refractive error typically starts at a young age, thus causing greater socioeconomic burden compared to age-related eye disease
Causes of visual impairment: Refractive error

- Management
  - Most cases can be easily treated through the use of corrective lenses (spectacles, contact lenses) or refractive surgery such as LASIK, LASEK, or PRK
  - Availability of these resources is problematic in developing countries
  - Community vision screening programs are essential for identifying undiagnosed refractive error and are particularly important in preschool-aged children to prevent the development of amblyopia

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Global public health efforts

• In the last section of this module, we’ll discuss some of the public health efforts that are being made to address the global burden of visual impairment.

Patients at a high-volume microsurgical eye camp in Nepal are evaluated for postoperative complications following cataract surgery. (Image: Kurt Kelley)

Global public health efforts: VISION 2020

- Global initiative launched jointly in 1999 by WHO and the International Agency for the Prevention of Blindness (IAPB)
- Includes numerous government agencies, non-governmental organizations (NGOs), professional associations, eye care institutions, and corporations

http://www.v2020.org/
Global public health efforts: VISION 2020

• The goal of VISION 2020 is to eliminate the main causes of avoidable blindness by the year 2020:
  – Cataract
  – Trachoma
  – Onchocerciasis
  – Childhood blindness
  – Low vision

• In concert with this goal are efforts to increase awareness of the causes of avoidable blindness and to improve eye care resources worldwide through human resource and infrastructure development
Global public health efforts: VISION 2020

- Data from the first 5 years of VISION 2020 have been encouraging, with an overall reduction in blindness from ocular infections
- Cataract surgical rates have improved in some countries but remain low in others, particularly China and much of Africa
- Morocco, The Gambia, and India are examples of countries that have instituted successful eye care programs
Global public health efforts: GET2020

• The WHO Alliance for the Global Elimination of Trachoma by 2020 (GET2020) was established in 1997 to organize efforts by governments, NGOs, and academic centers toward the elimination of trachoma

• From 1998 to 2004 the number of cases of active trachoma infection is estimated to have decreased from 146 million to 84 million

• However, as of 2004 only 19 of 55 endemic countries reported implementing the SAFE strategy
Global public health efforts:
The Vitamin A Global Initiative

• A cooperative network of international organizations created in 1998 whose partners include UNICEF, the Micronutrient Initiative, the Canadian International Development Agency (CIDA), WHO, and USAID

• **Three-fold increase** from 1999-2004 in the number of priority countries providing effective coverage (two rounds of supplementation in at least 70% of children)

• The prevalence of childhood VAD appears to be decreasing, however maternal VAD and night blindness is becoming increasingly recognized as a major public health issue
Future challenges

• The prevalence of blindness due to age-related eye disease is expected to continue increasing as the world population increases in size and age.
• Similarly, diabetic retinopathy will require increasingly more attention and resources as long as the incidence of diabetes mellitus continues to rise.
• Human resource and infrastructure development will remain a top priority, particularly in developing countries.
• The prevalence of refractive error needs to be more accurately assessed and availability of corrective lenses and low vision services improved.
Quiz

• Now we invite you to take the module quiz and test your recent learning.
• This module quiz includes 12 questions about visual impairment and its causes.
• After completing the quiz, come back for the summary of this module presentation.
1. What is visual impairment (as defined by the World Health Organization)?

A  The inability to read the largest letter on a vision chart at a distance of 3 meters (10 feet).
B  The inability, even with corrective lenses, to clearly see at a distance of 6 meters (20 feet) what individuals with normal vision can clearly see at a distance of 18 meters (60 feet).
C  A broad category encompassing low vision and blindness, entities clinically defined by WHO.

According to WHO, in 2002, how many people were visually impaired?

A  9 million
B  37 million
C  55 million
D  84 million
E  161 million
3. Fill in the blanks: ______ is the most common cause of blindness worldwide, accounting for almost ___ of cases.

A  Age-related macular degeneration, 8.7%
B  Cataract, 50%
C  Corneal opacity, 5.1%
D  Glaucoma, 12.3%
E  Trachoma, 3.6%

4. Glaucoma is:

A  the most common ocular complication of diabetes mellitus.
B  caused by serotypes A-C of the bacterium Chlamydia trachomatis.
C  a group of diseases characterized by optic nerve cupping and irreversible vision loss, and is usually (but not always) associated with elevated intraocular pressure.
D  an opacity in the lens of the eye.
5. _____ is the third leading cause of blindness worldwide and the primary cause of blindness in developed countries, particularly in elderly individuals.

A Vitamin A deficiency
B Onchocerciasis
C Diabetic retinopathy
D Age-related macular degeneration

6. True or false: Strict blood glucose control has no effect on the progression of diabetic retinopathy.

A True
B False
7. Which of the following is not a cause of corneal opacity?

A  Trauma
B  Corneal infection
C  Vitamin A deficiency
D  Measles
E  Trachoma.
F  Harmful traditional practices
G  These are all possible causes of corneal opacity.

8. What is the leading cause of preventable childhood blindness worldwide?

A  Trachoma
B  Vitamin A deficiency
C  Refractive error
D  Cataract
9. Promotion of the SAFE strategy has been successful in several countries in the treatment of this disease:

A  Onchocerciasis  
B  Leprosy  
C  Vitamin A deficiency  
D  Trachoma  
E  Measles

10. What is the vector by which onchocerciasis is spread to humans?

A  The Simulium blackfly  
B  The Anopheles mosquito  
C  The tsetse fly (Glossina Genus)  
D  The phlebotomine sandfly  
E  The deer tick (Ixodes scapularis)
11. True or false: Refractive error (near-sightedness, far-sightedness, presbyopia, or astigmatism) occurs when an image is not focused clearly on the retina due to some problem with one of the optical components of the eye.

A True
B False

12. VISION 2020: The Right to Sight is a global joint initiative that was launched in 1999 by WHO and the International Agency for the Prevention of Blindness (IAPB) to eliminate these avoidable causes of blindness by 2020:

A Cataract, glaucoma, age-related macular degeneration, diabetic retinopathy, and corneal opacity
B Glaucoma, diabetic retinopathy, onchocerciasis, childhood blindness, and refractive error
C Age-related macular degeneration, trachoma, onchocerciasis, childhood blindness, and low vision
D Cataract, trachoma, onchocerciasis, childhood blindness, and low vision
Now, check your answers against those provided in the next slides. A summary and references are in the final slides.
1. What is visual impairment (as defined by the World Health Organization)?

A The inability to read the largest letter on a vision chart at a distance of 3 meters (10 feet). Incorrect. (This is the WHO definition of blindness. By definition, visual impairment includes both low vision and blindness.)

B The inability, even with corrective lenses, to clearly see at a distance of 6 meters (20 feet) what individuals with normal vision can clearly see at a distance of 18 meters (60 feet). -- Incorrect. (This is the WHO definition of low vision. By definition, visual impairment includes both low vision and blindness.)

C A broad category encompassing low vision and blindness, entities clinically defined by WHO. Correct. – (Visual impairment includes both low vision and blindness, as clinically defined by WHO. Low vision is the inability, even with corrective lenses, to clearly see at a distance of 6 meters (20 feet) what individuals with normal vision can clearly see at a distance of 18 meters (60 feet). Blindness is the inability to read the largest letter on a vision chart at a distance of 3 meters (10 feet).)
According to WHO, in 2002, how many people were visually impaired?

A 9 million Incorrect.
B 37 million Incorrect.
C 55 million Incorrect.
D 84 million Incorrect.
E 161 million Correct. -- According to WHO, in 2002 more than 161 million people were visually impaired. Of those individuals, an estimated 37 million were blind. Including the estimated 82-107 million people with uncorrected refractive error, the total number of people with visual impairment increases to approximately 250 million.
3. Fill in the blanks: ______ is the most common cause of blindness worldwide, accounting for almost ____ of cases.

A  Age-related macular degeneration, 8.7% -- Incorrect. -- AMD is the third leading cause of blindness worldwide, accounting for 8.7% of cases (3.2 million people), and the primary cause of blindness in developed countries, particularly in elderly patients.

B  Cataract, 50% -- Correct. Cataract is the most common cause of world blindness, accounting for almost 50% of cases (18 million people).

C  Corneal opacity, 5.1% Incorrect. -- Corneal opacity is the 4th most common cause of blindness worldwide, accounting for 5.1% of cases in 2002. Its prevalence varies significantly by region and age, with some studies showing corneal opacity as the most common cause of blindness in certain populations.

D  Glaucoma, 12.3% -- Incorrect. -- Glaucoma is the 2nd most common cause of world blindness, accounting for 12.3% of cases (4.4 million people)

E  Trachoma, 3.6% -- Incorrect. -- Notably, trachoma is the most common infectious cause of blindness worldwide.
4. Glaucoma is:

A the most common ocular complication of diabetes mellitus. -- Incorrect. -- Diabetic retinopathy is the most common ocular complication of diabetes mellitus.

B caused by serotypes A-C of the bacterium Chlamydia trachomatis. -- Incorrect. -- Trachoma is caused by serotypes A-C of the bacterium Chlamydia trachomatis. It is the most common infectious cause of blindness worldwide.

C a group of diseases characterized by optic nerve cupping and irreversible vision loss, and is usually (but not always) associated with elevated intraocular pressure. -- Correct. -- The two most common forms of glaucoma are primary open-angle glaucoma (POAG) and angle-closure glaucoma (ACG). Risk factors include increasing age, African ethnicity (POAG), Asian ethnicity (ACG), increasing IOP, and genetic predisposition. The goal of treatment is to maintain normal IOP through the use of a variety of pharmacologic or surgical interventions. Regular eye examinations assessing IOP, visual fields, and changes in the appearance of the optic nerve are essential.

D an opacity in the lens of the eye. -- Incorrect. -- Cataract is an opacity in the lens of the eye. It is most often age-related, but can also be genetic, congenital, or the result of disease, trauma or medication use.
5. _____ is the third leading cause of blindness worldwide and the primary cause of blindness in developed countries, particularly in elderly individuals.

A Vitamin A deficiency -- Incorrect. -- VAD is considered the leading cause of preventable blindness in children worldwide.

B Onchocerciasis -- Incorrect. -- Onchocerciasis accounts for 0.8% of blindness worldwide. Over 90% of onchocerciasis is located in 30 African countries, with the remainder in Yemen and Latin America.

C Diabetic retinopathy -- Incorrect. -- Diabetic retinopathy accounts for almost 5% of blindness worldwide and is particularly prevalent among working age people in developed countries.

D Age-related macular degeneration **Correct.** -- AMD is a chronic, degenerative condition common in older individuals that affects the part of the eye responsible for central vision. It is classified into two main types, dry and wet. Studies have shown a possible benefit from antioxidants such as vitamins C and E, beta-carotene, and zinc. Laser therapy, intravitreally injected medications, and photodynamic therapy are options for treatment of the wet form.
6. True or false: Strict blood glucose control has no effect on the progression of diabetic retinopathy.

A True -- Incorrect. -- The Diabetes Control and Complications Trial (DCCT) and United Kingdom Prospective Diabetes Study (UKPDS) showed that intensive blood glucose control significantly reduced the rate of progression of retinopathy in type I and type II diabetics, respectively.

B False -- Correct. -- The Diabetes Control and Complications Trial (DCCT) and United Kingdom Prospective Diabetes Study (UKPDS) showed that intensive blood glucose control significantly reduced the rate of progression of retinopathy in type I and type II diabetics, respectively.

7. Which of the following is not a cause of corneal opacity?

A Trauma Incorrect.
B Corneal infection -- Incorrect.
C Vitamin A deficiency -- Incorrect.
D Measles -- Incorrect.
E Trachoma -- Incorrect.
F Harmful traditional practices -- Incorrect.

G These are all possible causes of corneal opacity. -- Correct. -- Trauma, corneal infection, vitamin A deficiency, measles, trachoma, onchocerciasis, leprosy, and harmful traditional practices are all possible causes of corneal opacity. Corneal transplantation is the treatment of choice for blinding corneal opacity but is not cost-effective in developing countries due to limited resources (corneal surgeons, eye banks) and availability of long-term care. Many causes of corneal opacity in developing countries are either preventable or treatable, thus emphasizing the importance of establishing effective public health programs.
8. What is the leading cause of preventable childhood blindness worldwide?

A  Trachoma  Incorrect. -- Trachoma is the most common infectious cause of blindness worldwide but is not the leading cause of preventable childhood blindness.

B  Vitamin A deficiency  -- Correct. -- It is estimated that 127 million preschool-aged children have VAD, with 4.4 million associated cases of xerophthalmia. Mortality estimates in preschool-aged children range from 1.3 to 2.5 million deaths annually.

C  Refractive error  Incorrect. -- Refractive error is an important cause of visual impairment worldwide but is not considered the leading cause of preventable childhood blindness.

D  Cataract  Incorrect. -- Cataract is the most common cause of blindness worldwide. Several types of cataract may occur during infancy or childhood (such as congenital or traumatic cataract) but it is not the leading cause of preventable childhood blindness.

9. Promotion of the SAFE strategy has been successful in several countries in the treatment of this disease:

A  Onchocerciasis  Incorrect.

B  Leprosy  Incorrect.

C  Vitamin A deficiency  Incorrect.

D  Trachoma  Correct. -- The SAFE strategy was developed to aid in the elimination of trachoma as a blinding disease. Starting in 1997, promotion of the WHO-developed SAFE strategy has been successful in several countries, such as Morocco and Oman. The components of the strategy are: Surgery for eyelid deformities; Antibiotics; Facial cleanliness; Environmental improvement

E  Measles  Incorrect.
10. What is the vector by which onchocerciasis is spread to humans?

A  The Simulium blackfly — Correct. -- Onchocerciasis is spread by the Simulium blackfly which breeds near fast-flowing rivers (hence the common name “river blindness”). Larvae are transmitted to the human host, where they mature to adult worms and release larval worms (microfilariae) that migrate to the eyes and skin and cause local damage. The infection can be effectively treated with the anti-parasitic agent ivermectin, typically given every 6 to 12 months in endemic regions
B  The Anopheles mosquito — Incorrect. -- The Anopheles mosquito is the vector for malaria.
C  The tsetse fly (Glossina Genus) — Incorrect. -- The tsetse fly is the vector for African trypanosomiasis (“sleeping sickness”).
D  The phlebotomine sandfly — Incorrect. -- The phlebotomine sandfly is the vector for leishmaniasis.
E  The deer tick (Ixodes scapularis) — Incorrect. -- The deer tick (Ixodes scapularis) is the vector for Lyme disease.
11. True or false: Refractive error (near-sightedness, far-sightedness, presbyopia, or astigmatism) occurs when an image is not focused clearly on the retina due to some problem with one of the optical components of the eye.

A True -- Correct. -- Refractive error may account for an additional 87-102 million cases of visual impairment worldwide and is a significant problem in both developing and developed countries. Most cases of refractive error can be easily treated through the use of corrective lenses (spectacles, contact lenses) or refractive surgery such as LASIK, LASEK, or PRK. However, availability of these resources is problematic in developing countries. Community vision screening is particularly important in preschool-aged children to prevent the development of amblyopia.

B False -- Incorrect.
12. VISION 2020: The Right to Sight is a global joint initiative that was launched in 1999 by WHO and the International Agency for the Prevention of Blindness (IAPB) to eliminate these avoidable causes of blindness by 2020:

A  Cataract, glaucoma, age-related macular degeneration, diabetic retinopathy, and corneal opacity Incorrect.

B  Glaucoma, diabetic retinopathy, onchocerciasis, childhood blindness, and refractive error Incorrect.

C  Age-related macular degeneration, trachoma, onchocerciasis, childhood blindness, and low vision Incorrect.

D  Cataract, trachoma, onchocerciasis, childhood blindness, and low vision  -- Correct. -- Additional goals of the VISION 2020 initiative are to increase awareness of visual impairment and to improve eye care infrastructure and human resources worldwide. Numerous government agencies, non-governmental organizations (NGOs), professional associations, eye care institutions and personnel, and corporations are involved in this effort.
Summary

• Visual impairment, which includes low vision and blindness, is a significant global health problem.
• The major causes of visual impairment are cataract, glaucoma, diabetic retinopathy, age-related macular degeneration, corneal opacity, vitamin A deficiency, trachoma, onchocerciasis, and refractive error.
• At least 75% of the causes of visual impairment are thought to be entirely treatable or preventable.
• A number of encouraging global public health initiatives and organizations are working to address the causes of visual impairment with some success, though much work remains to be done.
Credits

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General References

• Books

• Web links
1. WHO. *Blindness*: www.who.int/topics/blindness/en/
   This is an excellent website that includes an enormous amount of information on the epidemiology of visual impairment, priority eye diseases, and public health efforts, as well as a variety of associated publications.
   This is the official website for VISION 2020 and includes background information on the initiative as well as news, information on upcoming training and workshops, general information about the major causes of avoidable blindness, and links to member organizations.
   The “Health Information” section of the National Eye Institute website is a good resource for more information on eye anatomy and a variety of eye diseases and disorders.
References

Visual impairment: definition, magnitude, and significance

Cataract

Age-related macular degeneration

Corneal opacity

Diabetic retinopathy

Vitamin A deficiency
References

Vitamin A deficiency

Trachoma

Onchocerciasis

Refractive error

Global public health efforts and future challenges
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