Prevent Blindness
Focus on Eye Health National Summit

Vision Impairment and Blindness in the U.S.: New National, State, and County-level Prevalence Data

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NORC at the University of Chicago

CDC's Vision Health Initiative: Current and Future Priorities

Elizabeth Lundeen, PhD, MPH

Centers for Disease Control and Prevention

National Center for Chronic Disease Prevention and Health Promotion

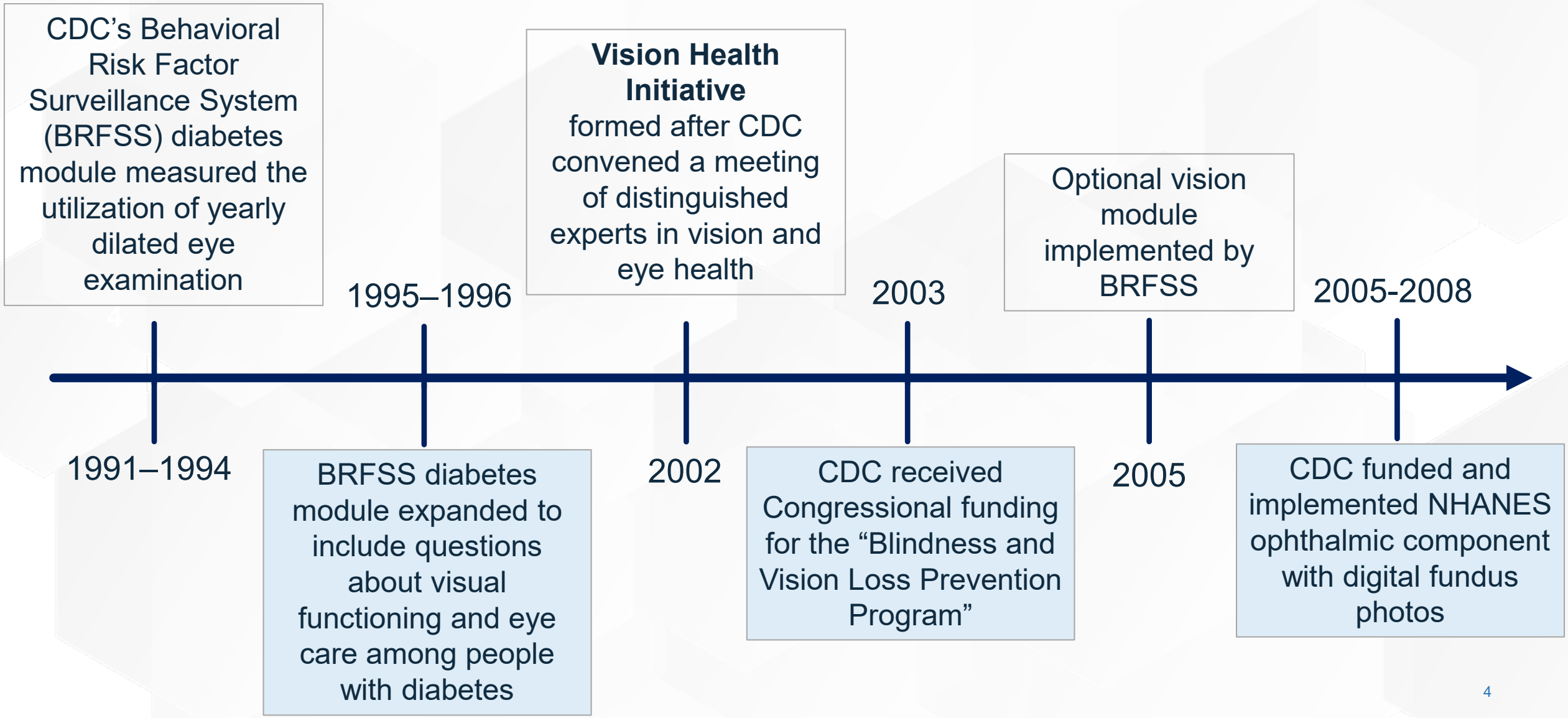
Division of Diabetes Translation

Vision Health Initiative of the Centers for Disease Control and Prevention

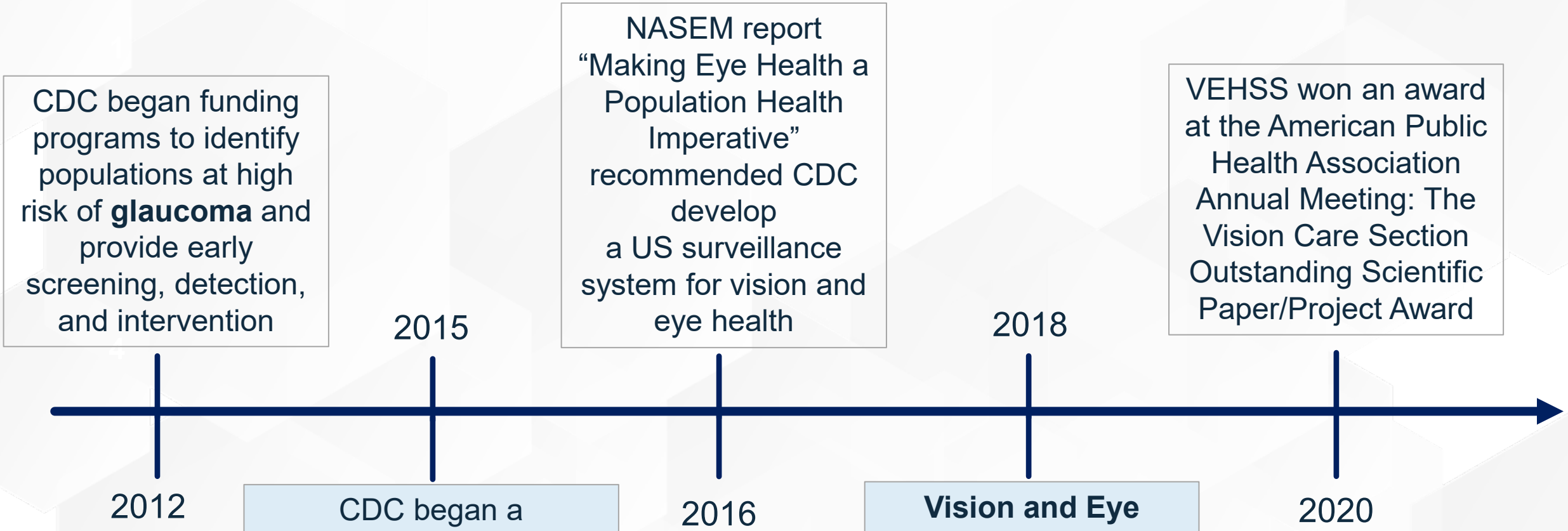
- The Vision Health Initiative (VHI) began in 2002
- Located in CDC's Division of Diabetes Translation
- Mission: to promote vision health and quality of life for all populations, throughout all life stages, by preventing and controlling eye disease, eye injury, and vision loss resulting in disability
- Aim: to enhance surveillance and applied research that provides the basis for effective public health programs and policy decisions to reduce the burden of vision loss

https://www.cdc.gov/visionhealth/index.htm

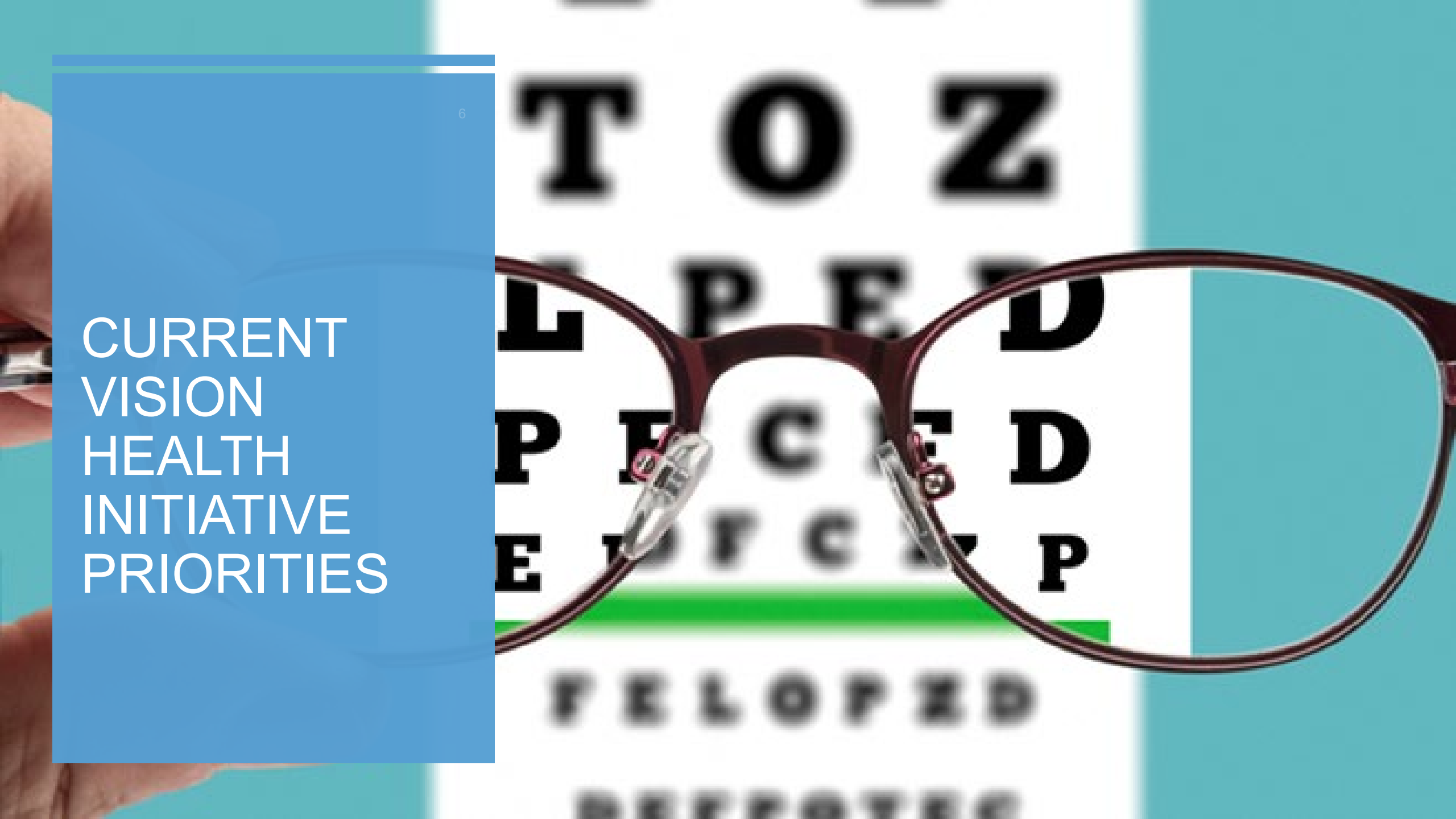
VHI Timeline: Major Milestones



VHI Timeline: Major Milestones



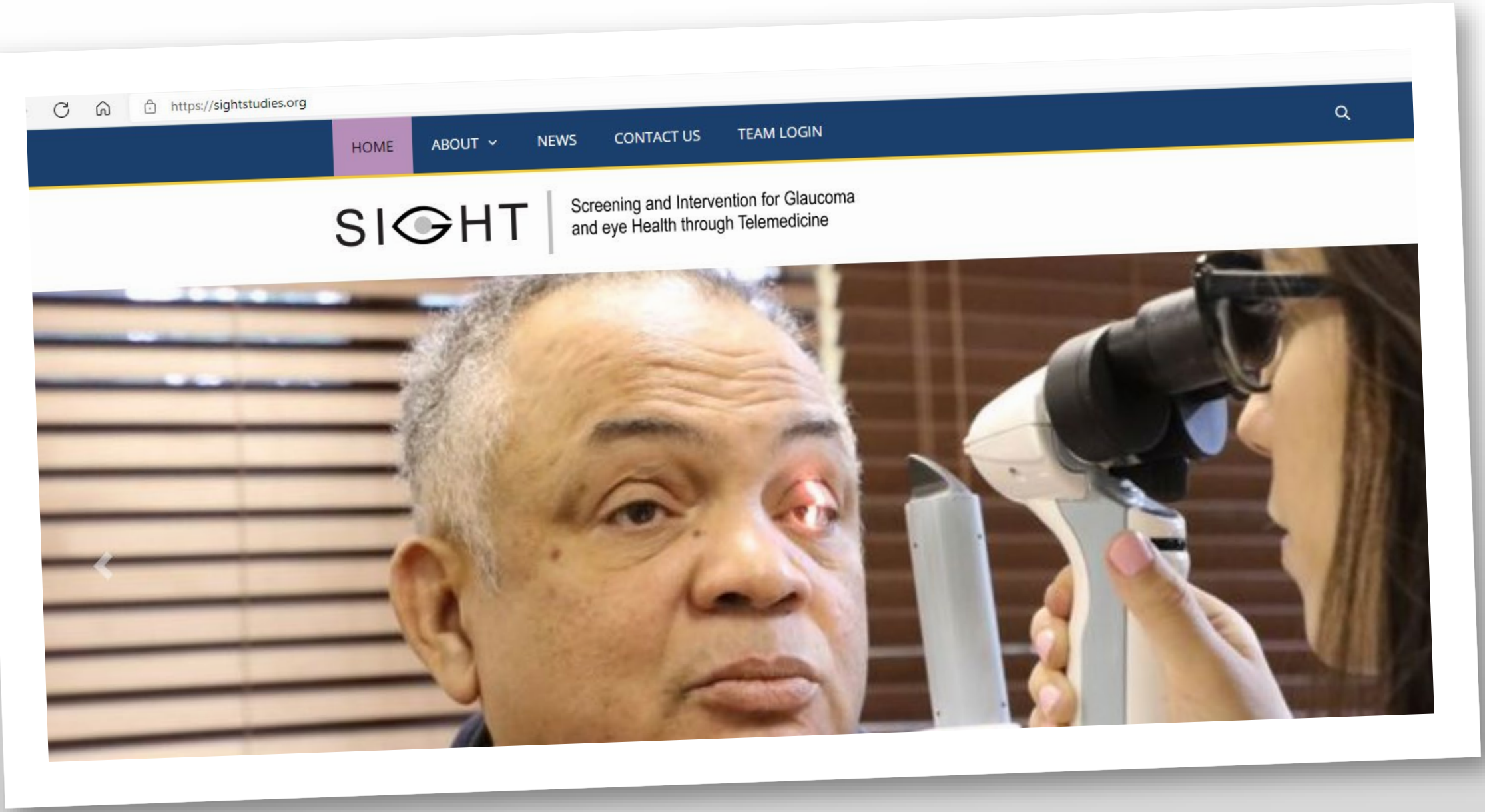
CURRENT VISION HEALTH INITIATIVE PRIORITIES



Promoting Health Equity and Reducing Health Disparities

- Vision Health Initiative seeks to:
  - Develop interventions that promote eye health and prevent vision loss and blindness in groups at high risk
  - Reduce disparities in vision loss and eye disease

- Since 2012, VHI has been providing funding through cooperative agreements to implement innovative strategies to identify and reach populations at the greatest risk of developing glaucoma by intervening with early screening, detection, and treatment in community-based settings



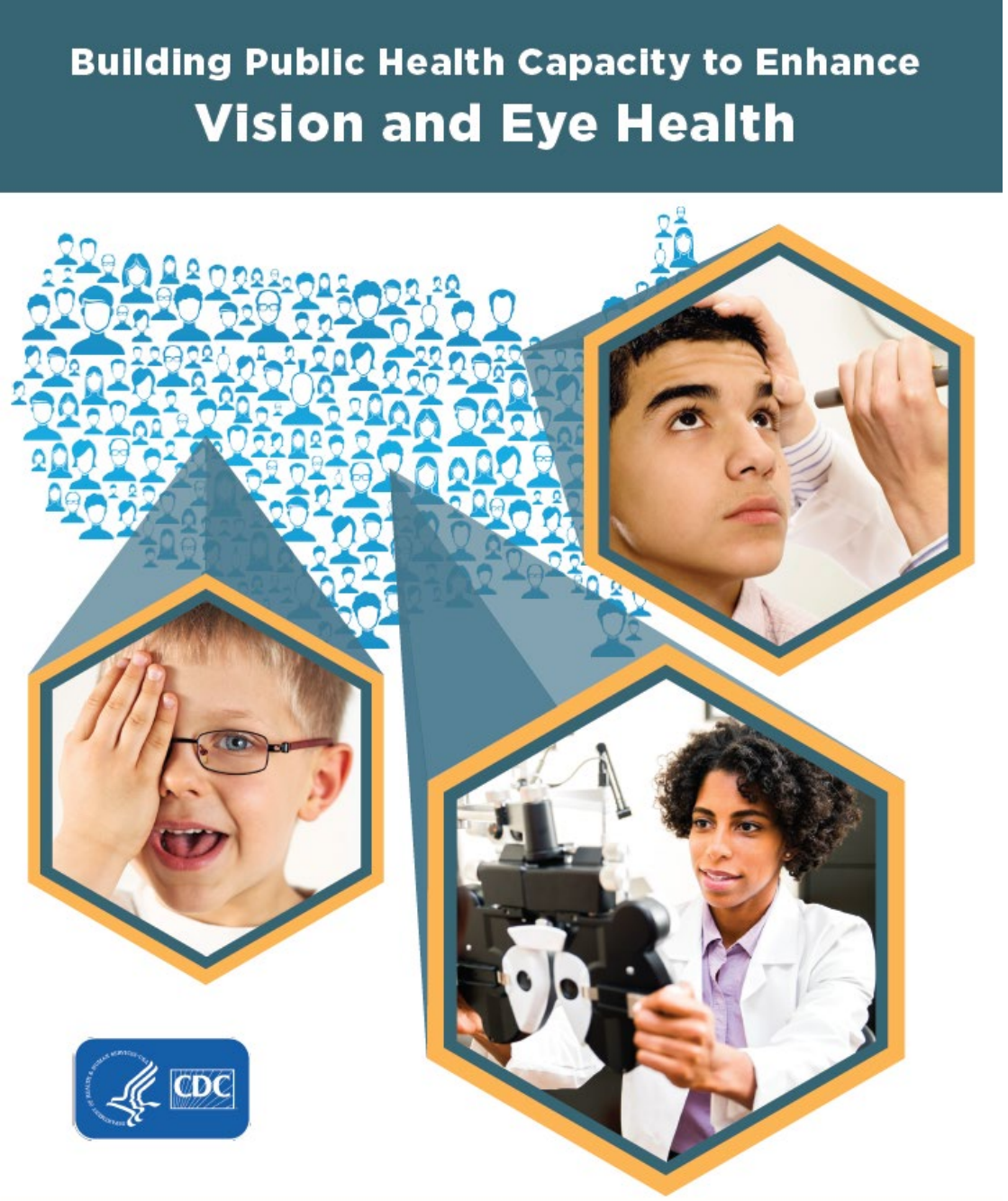
https://sightstudies.org/

Glaucoma Detection and Management: SIGHT Studies

- Columbia University (coordinating center)
  - Reaching racial and ethnic minority groups at highest risk of glaucoma and vision impairment by implementing a community vision screening and follow-up intervention for people living in affordable housing in the New York City neighborhoods of Harlem and Washington Heights
  - Using patient navigators to help patients get recommended follow-up eye care
- University of Michigan
  - Using a validated telemedicine approach to screen for glaucoma and other eye diseases among populations at high risk in community primary care clinics
  - Implementing personalized counseling and education programs through an electronic platform to improve glaucoma follow-up care
- University of Alabama at Birmingham
  - Implementing a primary care-based glaucoma screening program in Federally Qualified Health Centers in rural communities
  - Using portable device taken directly to patients to conduct optic nerve structure assessments

SUPPORTING STATE AND COMMUNITY PARTNERS

- Collaborate with the National Association of Chronic Disease Directors (NACDD)
  - Promote the dissemination of evidence-based vision health interventions
  - Integrate vision health activities into broader public health strategies and interventions
  - Fund eight state partners working to improve vision health equity in populations at higher risk of vision loss and least likely to have access to eye care
    - Providing access to vision screening in local health departments and community health clinics
    - Providing innovative telehealth services to people who are most likely to have health conditions such as diabetes that cause vision loss



Toolkit to help state, tribal, local, and territorial public health agencies and their partners:

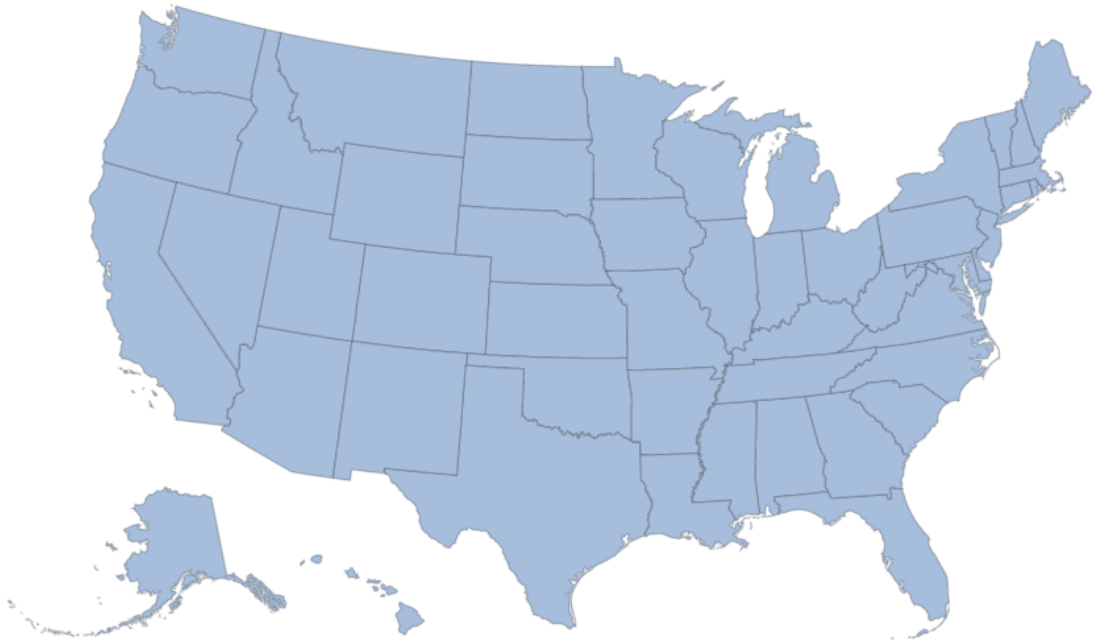
- Assess the level of vision impairment in their communities
- Build effective partnerships
- Implement effective and sustainable interventions to improve vision and eye health
- Evaluate the impact of vision-related interventions

https://www.cdc.gov/visionhealth/programs/vision-toolkit.html

State Profiles on Vision and Eye Health

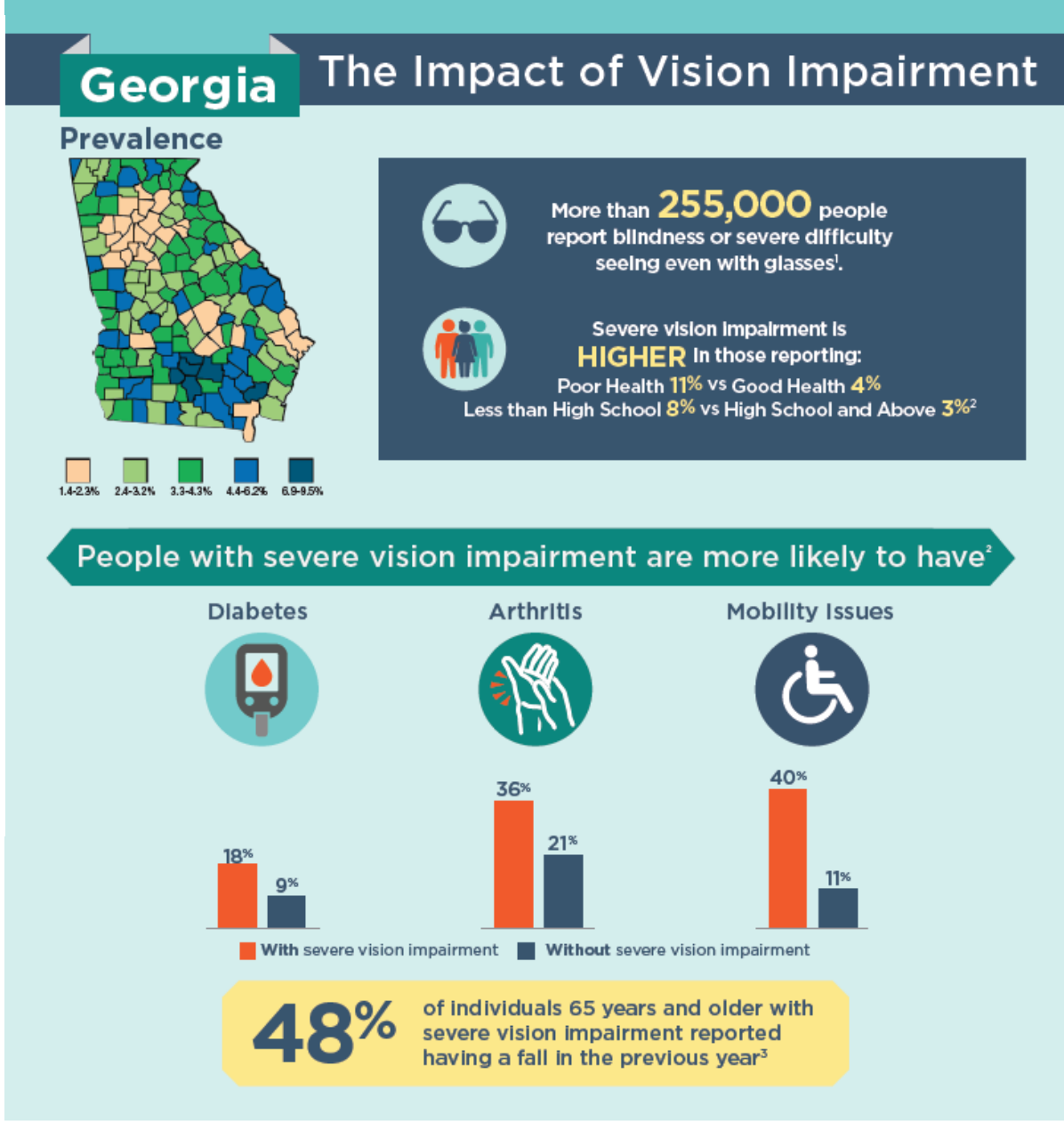
These state profiles present an overview of the impact of vision impairment and comorbid conditions in the United States in all 50 states. The profiles present nationally representative data from The American Community Survey (ACS) and The Behavioral Risk Factor Surveillance System (BRFSS). Select state profiles from the below map.

50 State Profile



State profiles provide data to help states assess the level of vision impairment in their communities

https://www.cdc.gov/visionhealth/data/state-profiles/index.htm



Economic Burden of Vision Loss and Eye Diseases

- Estimates of economic burden of vision loss and eye diseases published in 2006*
  - Annual total financial burden of major adult visual disorders was $35.4 billion
- Economic toolkit to update these estimates
  - Update estimates and provide state-specific economic burden of vision loss and eye diseases
  - Online interactive data repository
- Two papers (under peer review):
  - Estimate the economic burden of vision loss in the U.S. nationally and by state
  - Estimate Medicare payments for diagnosed major eye disorders among fee-for-service beneficiaries in 2018

*Rein et al. The Economic Burden of Major Adult Visual Disorders in the United States. *Arch Ophthalmol*. 2006;124:1754-1760.

Surveillance of Vision and Eye Health in the U.S.

- Assess the burden of vision loss and eye diseases nationally and by states and counties
- Understand differences in vision loss and eye diseases by:
  - Geography
  - Age
  - Sex
  - Race/ethnicity
  - Risk factors (diabetes)

Data:

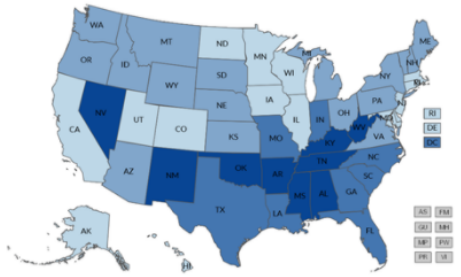
- National surveys
  - NHANES
  - NHIS
  - ACS
  - BRFSS
  - NSCH
- Administrative claims
  - Medicare
  - Medicaid
  - Marketscan
  - VSP Global managed vision care
- Electronic health record (EHR) registry
  - IRIS® (Intelligent Research in Sight)

THE VISION AND EYE HEALTH SURVEILLANCE SYSTEM

A national data system for vision and eye health

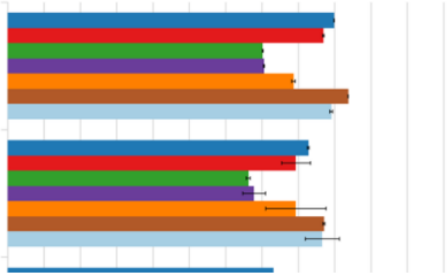
Data Highlights

American Community Survey



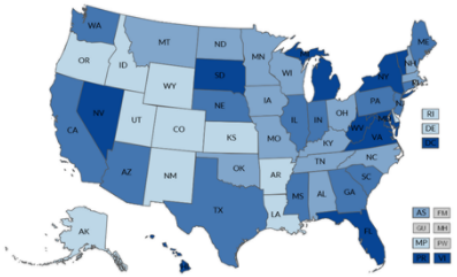
Prevalence of self-reported blindness and difficulty seeing

Medicare Claims



Racial disparities in eye examination rates

IRIS® Registry



Prevalence of diagnosed glaucoma

Summary:

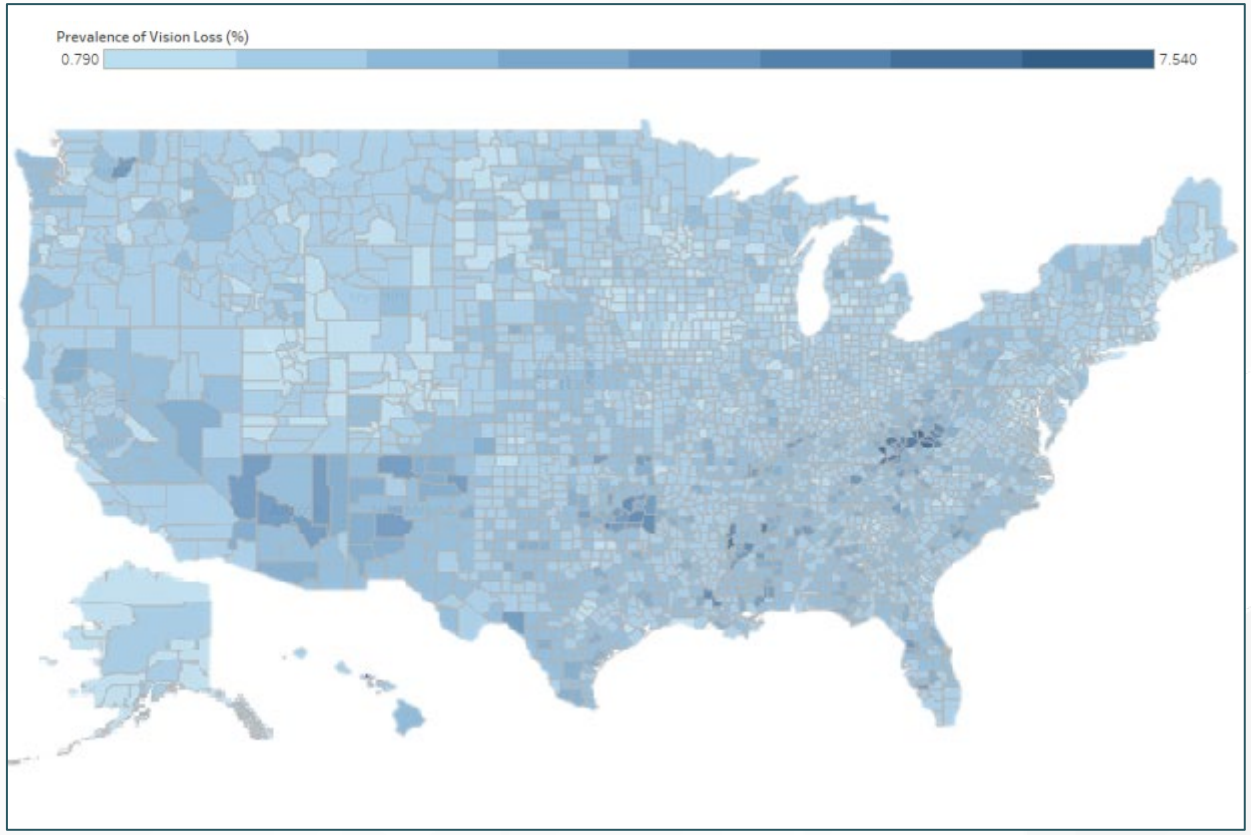
- 10 datasets (survey, EHR, claims)
- Over 220 vision and eye health indicators
- National-, state-, and county-level estimates

https://www.cdc.gov/visionhealth/vehss/index.html

VEHSS TOPICS

- Eye health conditions
  - Self-reported
  - Measured
  - Claims-based diagnoses
- Visual function
  - Measured visual acuity
  - Self-reported visual function
- Service utilization
  - Eye exams
  - Medical treatments
  - Low vision services
  - Vision correction

Prevalence of Vision Loss by U.S. County



FUTURE VISION HEALTH INITIATIVE PRIORITIES

Advancing Science and Epidemiology

- Validation study with University of Washington to assess the degree of concordance between different VEHSS indicators
  - Self-reported survey questions
  - Claims
  - Electronic health records
  - Clinical chart abstraction (gold standard)
- Advanced statistical methods (Bayesian meta-analysis) to develop composite estimates of the prevalence of vision loss and blindness in the U.S.

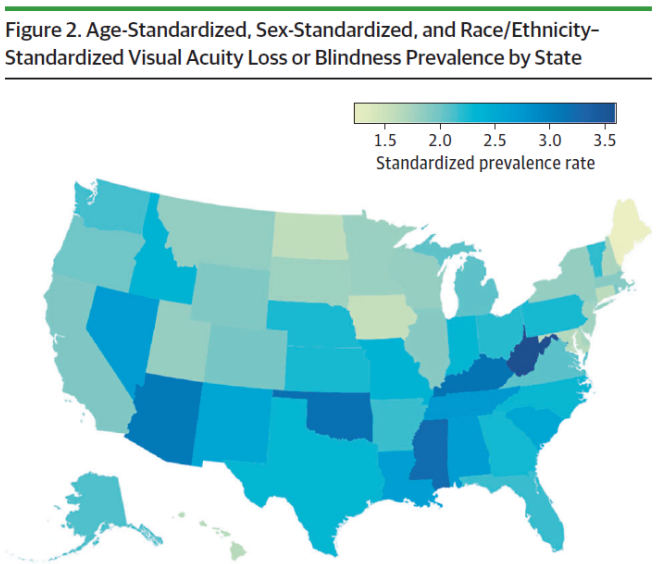
JAMA Ophthalmology | Original Investigation

Prevalence of Visual Acuity Loss or Blindness in the US
A Bayesian Meta-analysis

Abraham D. Flaxman, PhD; John S. Wittenborn, BS; Toshana Robalik, BS; Rohit Gulia, MS; Robert B. Gerzoff, MS; Elizabeth A. Lundeen, PhD, MPH; Jinan Saaddine, MD, MPH; David B. Rein, PhD, MPA; for the Vision and Eye Health Surveillance System study group

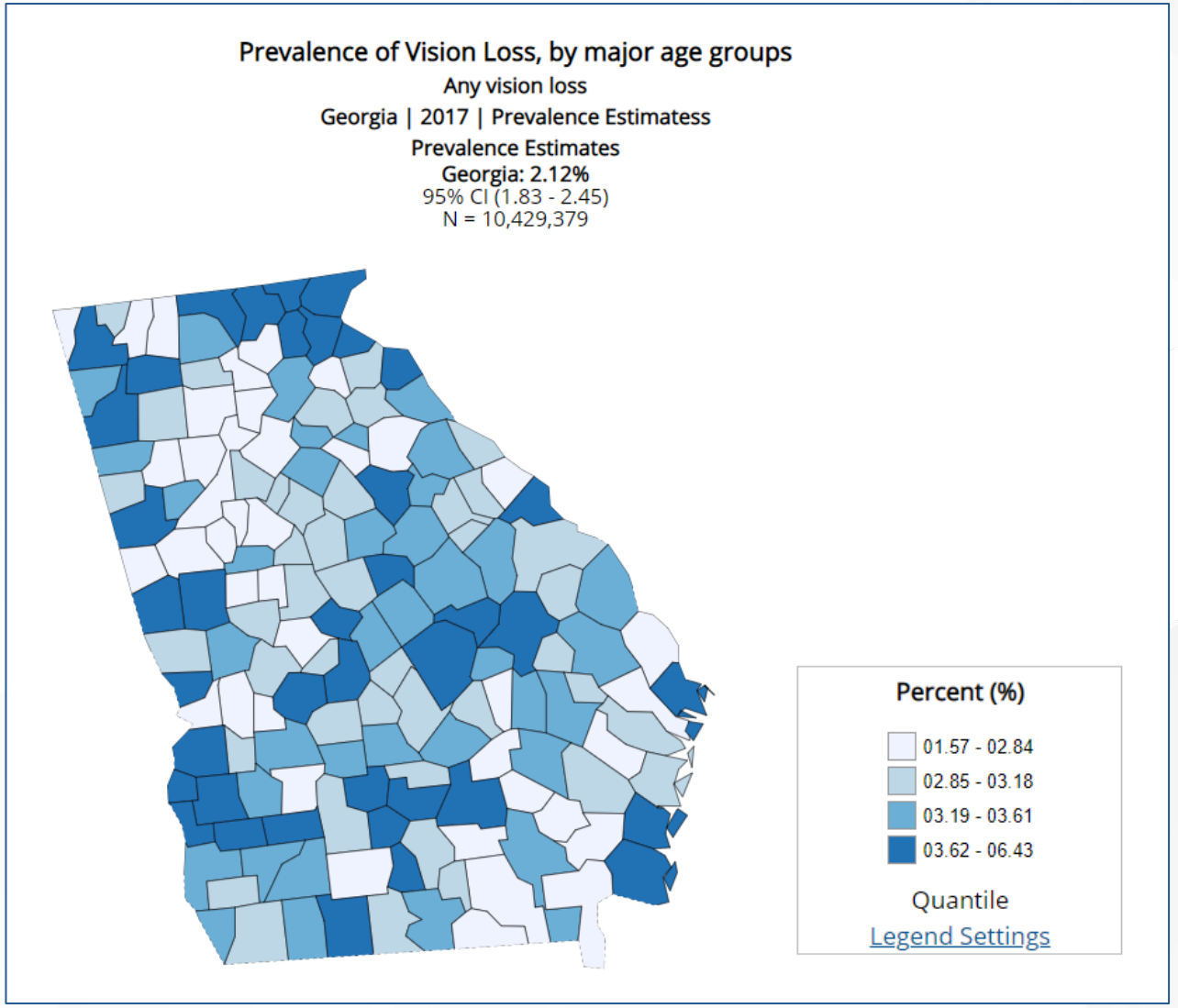
Flaxman et al. Prevalence of Visual Acuity Loss or Blindness in the US: A Bayesian Meta-analysis. *JAMA Ophthalmol*. 2021; e210527. Online ahead of print.

Figure 2. Age-Standardized, Sex-Standardized, and Race/Ethnicity-Standardized Visual Acuity Loss or Blindness Prevalence by State



Geographic Disparities: County-Level Surveillance Data

- Composite estimates of vision loss and blindness
- Medicare claims
- American Community Survey



Social Determinants of Vision and Eye Health

- Support research and surveillance to better understand the social determinants of vision and eye health

- Datasets:
  - National Health Interview Survey
  - American Community Survey
  - Behavioral Risk Factor Surveillance System
  - National Health and Nutrition Examination Survey

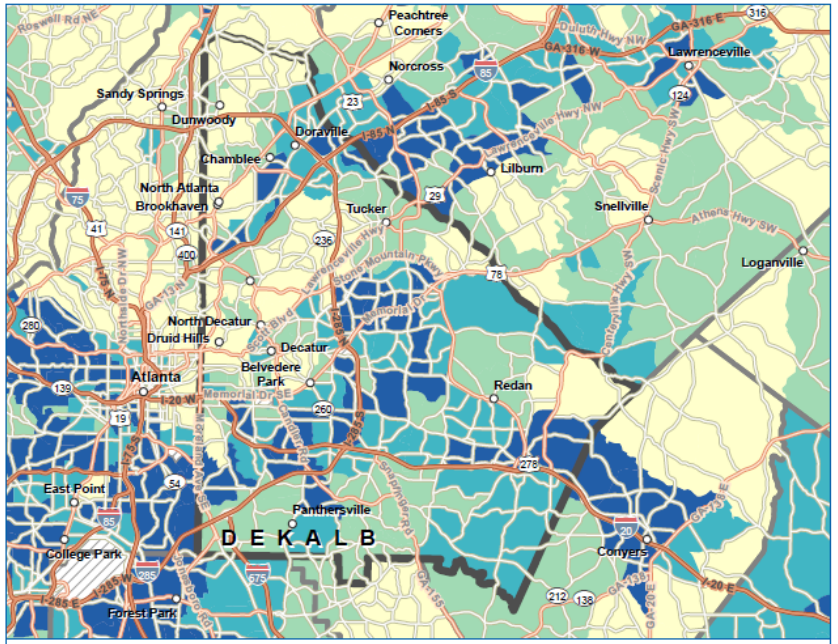
https://health.gov/healthypeople/objectives-and-data/social-determinants-health

CDC Social Vulnerability Index 2018

DeKalb County, Georgia

PART 1

Overall Social Vulnerability[1]



Highest (Top 4th) | Vulnerability (SVI 2018)[2] | Lowest (Bottom 4th)

Data Unavailable[3]

0 1.25 2.5 5 7.5 Miles

Social vulnerability refers to a community's capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills. The **CDC Social Vulnerability Index (CDC SVI 2018)[4] County Map** depicts the social vulnerability of communities, at census tract level, within a specified county. CDC SVI 2018 groups **fifteen census-derived factors** into **four themes** that summarize the extent to which the area is socially vulnerable to disaster. The factors include economic data as well as data regarding education, family characteristics, housing, language ability, ethnicity, and vehicle access. Overall Social Vulnerability combines all the variables to provide a comprehensive assessment.

MAP PRODUCED 3/19/2020

GRASP

Agency for Toxic Substances and Disease Registry

Division of Toxicology and Human Health Sciences

ATSDR

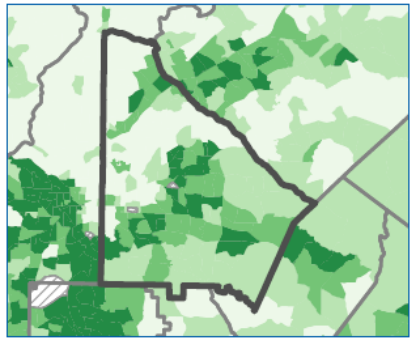
FINAL - FOR EXTERNAL USE

CDC SVI 2018 – DEKALB COUNTY, GEORGIA

PART 2

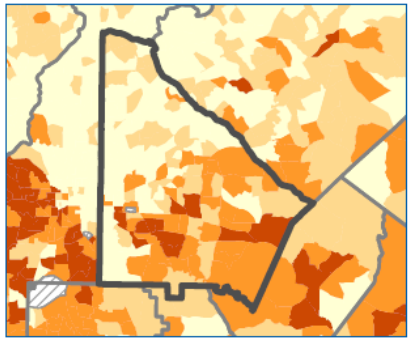
CDC SVI Themes

Socioeconomic Status[5]



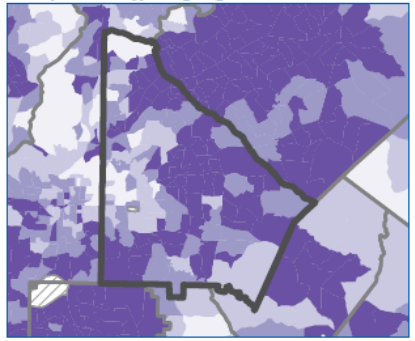
Highest (Top 4th) | Vulnerability (SVI 2018)[2] | Lowest (Bottom 4th)

Household Composition/Disability[6]



Highest (Top 4th) | Vulnerability (SVI 2018)[2] | Lowest (Bottom 4th)

Race/Ethnicity/Language[7]



Highest (Top 4th) | Vulnerability (SVI 2018)[2] | Lowest (Bottom 4th)

Data Sources: [2]CDC/ATSDR/GRASP, U.S. Census Bureau, Esri® StreetMapTM Premium.
Notes: [1]Overall Social Vulnerability: All 15 variables. [2]Census tracts with 0 population. [3]Th
2014-2018 variables, for the state, at the census tract level. [5]Socioeconomic Status: Pove
Disability: Aged 65 and Over, Aged 17 and Younger, Single-parent Household, Aged 5 and o
Type/Transportation: Multi-unit, Mobile Homes, Crowding, No Vehicle, Group Quarters.
Projection: NAD 1983 Georgia Statewide Lambert.
References: Flanagan, B.E., et al., A Social Vulnerability Index for Disaster Management. Jour
CDC SVI web page: http://svi.cdc.gov.

FINAL - FOR E

Percentage of people who are blind or have serious difficulty seeing even when wearing glasses

Response: Yes

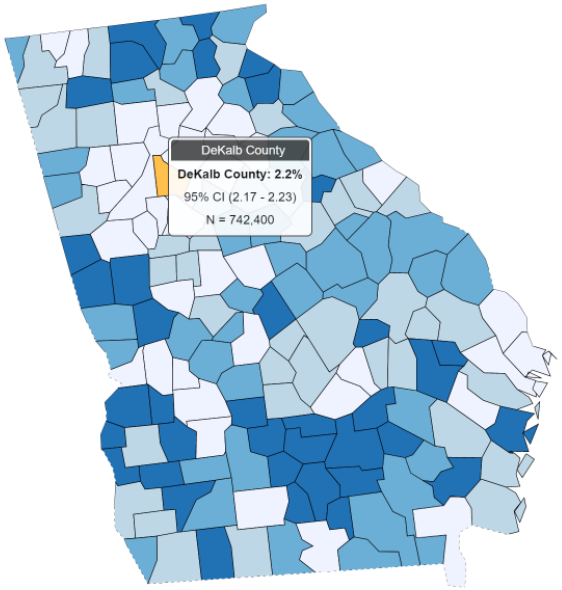
Georgia | 2018 | ACS

Crude Prevalence

Georgia: 2.58%

95% CI (2.44 - 2.72)

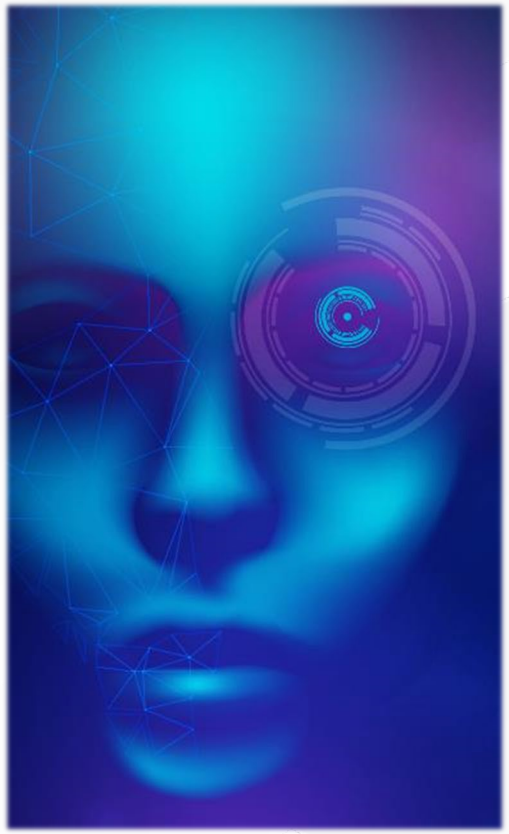
N = 10,519,500



https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

NHANES Retinal Fundus Photo Artificial Intelligence Project

- National Health and Nutrition Examination Survey (NHANES) 2005–2008
  - Performing a validation study comparing retinal fundus photo grading for diabetic retinopathy performed by deep learning algorithms to the gold standard ophthalmologist grading
  - Evaluate the potential for using deep learning algorithms in future NHANES surveys to provide faster and less expensive grading of retinal photos



Support Future NHANES Ophthalmology Module

- National Health and Nutrition Examination Survey (NHANES) ophthalmology module (last implemented in 2005–2008)

- Only nationally-representative prevalence estimates using measured vision and eye health data:
  - Visual acuity
  - Eye diseases
    - Diabetic retinopathy
    - Glaucoma
    - Age-related macular degeneration

- Timing of future repeat to be determined

Thank You

CONTACT:

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ELUNDEEN@CDC.GOV

Centers for Disease Control and Prevention

National Center for Chronic Disease Prevention and Health Promotion

Division of Diabetes Translation

Prevent Blindness

Focus on Eye Health
National Summit

Our Changing Vision

Vision Impairment and Blindness in the U.S.

New National, State, and County-level Prevalence Data

07.14.21 : Version 1.1

David B. Rein, Ph.D.

On Behalf of the Vision and Eye Health Surveillance System Study Group

NORC at the University of Chicago

Agenda

Paper: Prevalence of Visual Acuity Loss or Blindness in the US: A Bayesian Meta-analysis [1]

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Abraham Flaxman,
Toshana Robalik,
Rohit Gulia

John Wittenborn,
David Rein

Bob Gerzoff,
Elizabeth Lundeen,
Jinan Saaddine

1 Flaxman, A. D., Wittenborn, J. S., Robalik, T., Gulia, R., Gerzoff, R. B., Lundeen, E. A., Saaddine, J. & D.B. Rein on behalf of the Vision and Eye Health Surveillance System Study Group. (2021). Prevalence of Visual Acuity Loss or Blindness in the US: A Bayesian Meta-analysis. JAMA Ophthalmol. doi:10.1001/jamaophthalmol.2021.0527

Background

NORC at the University of Chicago

United States prevalence of uncorrectable visual impairment or blindness previously estimated at 4.2 million [2,3]

Limitations of Previous Estimate

- By design, excluded persons younger than age 40
- Excluded institutionalized populations
  - Nursing homes and other long term care.
  - Prisons
- Population-based study data: 8 to 36 years old
- No direct measurements at the state level

Opportunities for new estimate

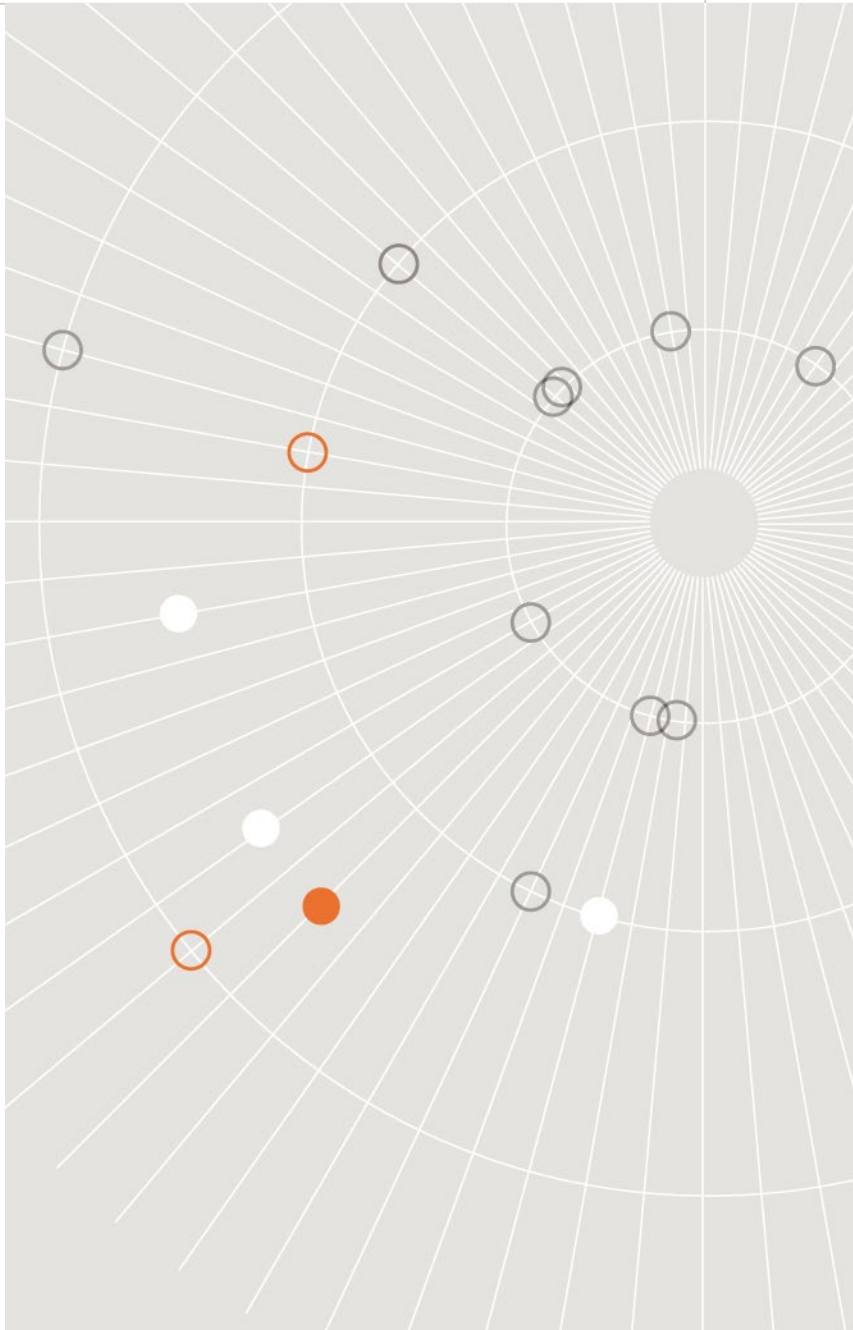
- New data sources and methods
- VEHSS platform for data dissemination

2. Prevent Blindness America. Vision problems in the US: prevalence of adult vision impairment and age-related eye disease in America. Published 2012. Accessed September 30, 2019. http://www.visionproblemsus.org/
3. Varma R, Vajaranant TS, Burkemper B, et al. Visual impairment and blindness in adults in the United States. JAMA Ophthalmol. 2016;134(7):802-809. doi:10.1001/jamaophthalmol.2016.1284

Objective: Produce new estimates of visual acuity loss and blindness by age, sex, race/ethnicity, and US state.

Address limitations in existing estimates

- Utilize population-representative data sources.
- Update population-based study data.
- Include previously excluded population groups.
- Use empirical self-report measurements to estimate state variation and provide additional information for under-represented groups (children and the oldest old).



Data & Methodology

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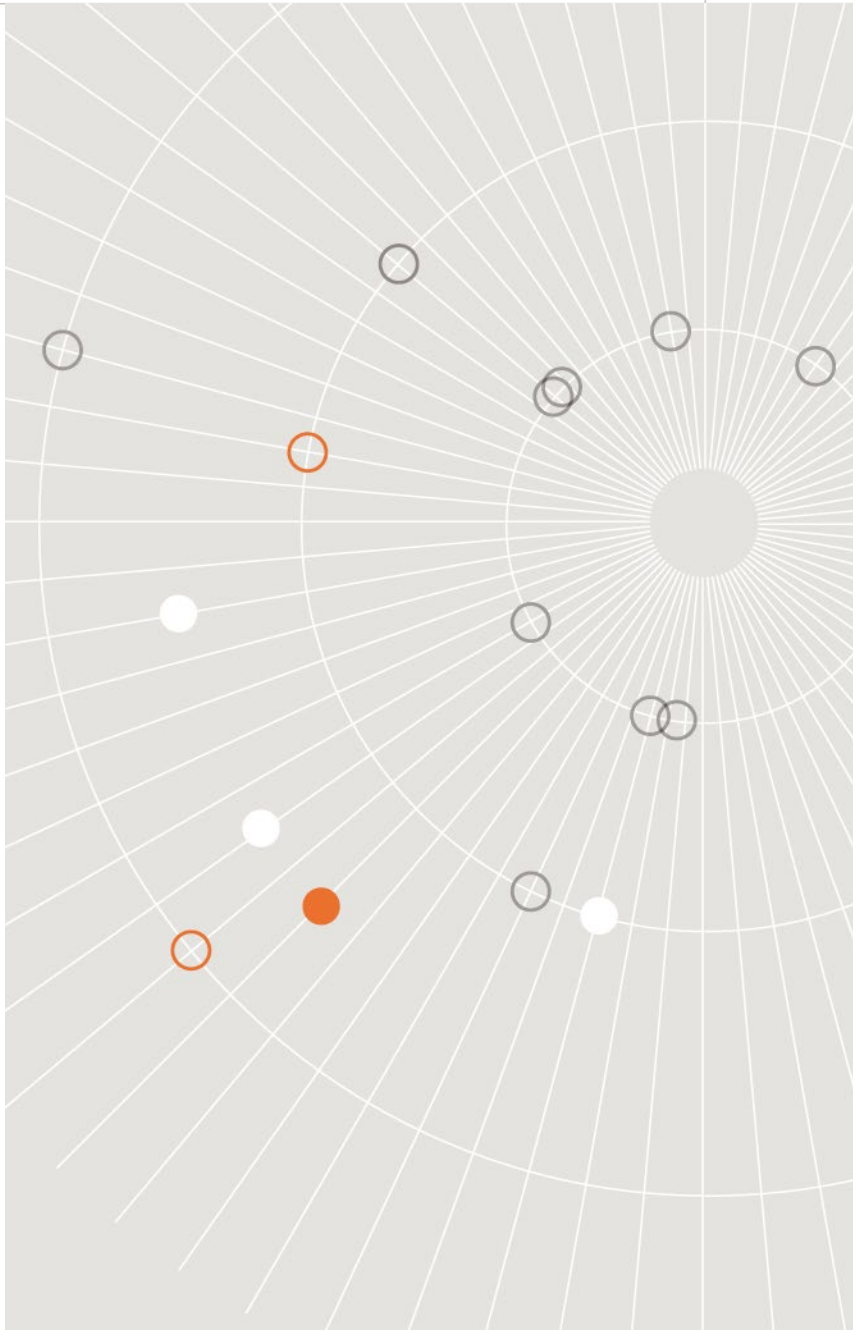
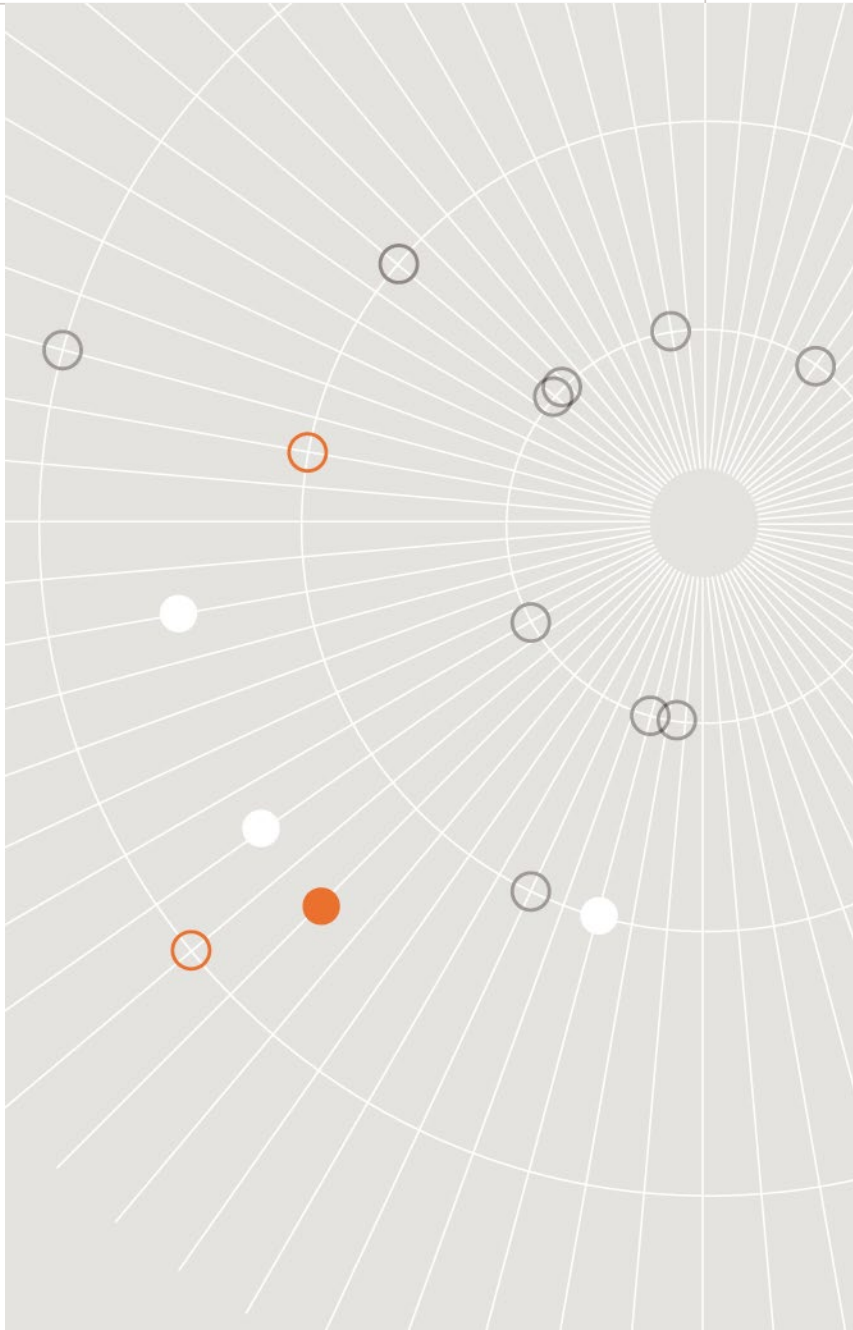
Data Sources

- Population-based studies:
  - Baltimore Pediatric Eye Disease Study (BPEDS), 2003-2007
  - The Chinese American Eye Study (CHES), 2010-2013
  - Eye Disease Prevalence Research Group (EDPRG), 1985-1998
  - Los Angeles Latino Eye Study (LALES), 2000-2003
  - Multi-Ethnic Study of Atherosclerosis Cohort, 2000-2004
- National Health and Nutrition Examination Survey (NHANES), 1999-2008
- National Survey of Children's Health (NSCH), 2016
- American Community Survey (ACS), 2017



High Level Methods

- Bayesian, Meta-regression
  - Statistical tool to estimate regression models using multiple data sources
- Intuition
  - NHANES is used as a the reference group. The total amount of vision loss or blindness is based on NHANES evaluations of best-corrected visual acuity in the better seeing eye.
    - Any visual impairment = 20/40 or worse in the better seeing eye
    - Blindness = subset of any visual impairment = 20/200 or worse in better seeing eye
  - Self-reported responses to "Are you blind, or do you have serious difficulty seeing even when wearing glasses?" were used to estimate relative variation
    - By state
    - Among groups not included in NHANES
      - Children younger than 12
      - Persons in long term care and prisons
      - The oldest old
- Accounted for missing data in NHANES, and used PBS data for additional evidence



New Estimates

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Prevalence of Visual Impairment or Blindness

7.08 mil

(95% UI, 6.32 -7.89)

Prevalence of Visual Impairment or Blindness ages 0 to 39

1.62 mil

(95% UI, 1.32 – 1.92)

Prevalence Rate Across All Ages

2.17%

(95% UI, 1.94% - 2.42%)

Prevalence of Visual Impairment or Blindness in Group Quarters

358,000

(95% UI, 263k – 472k)

Prevalence of Blindness

1.08 mil

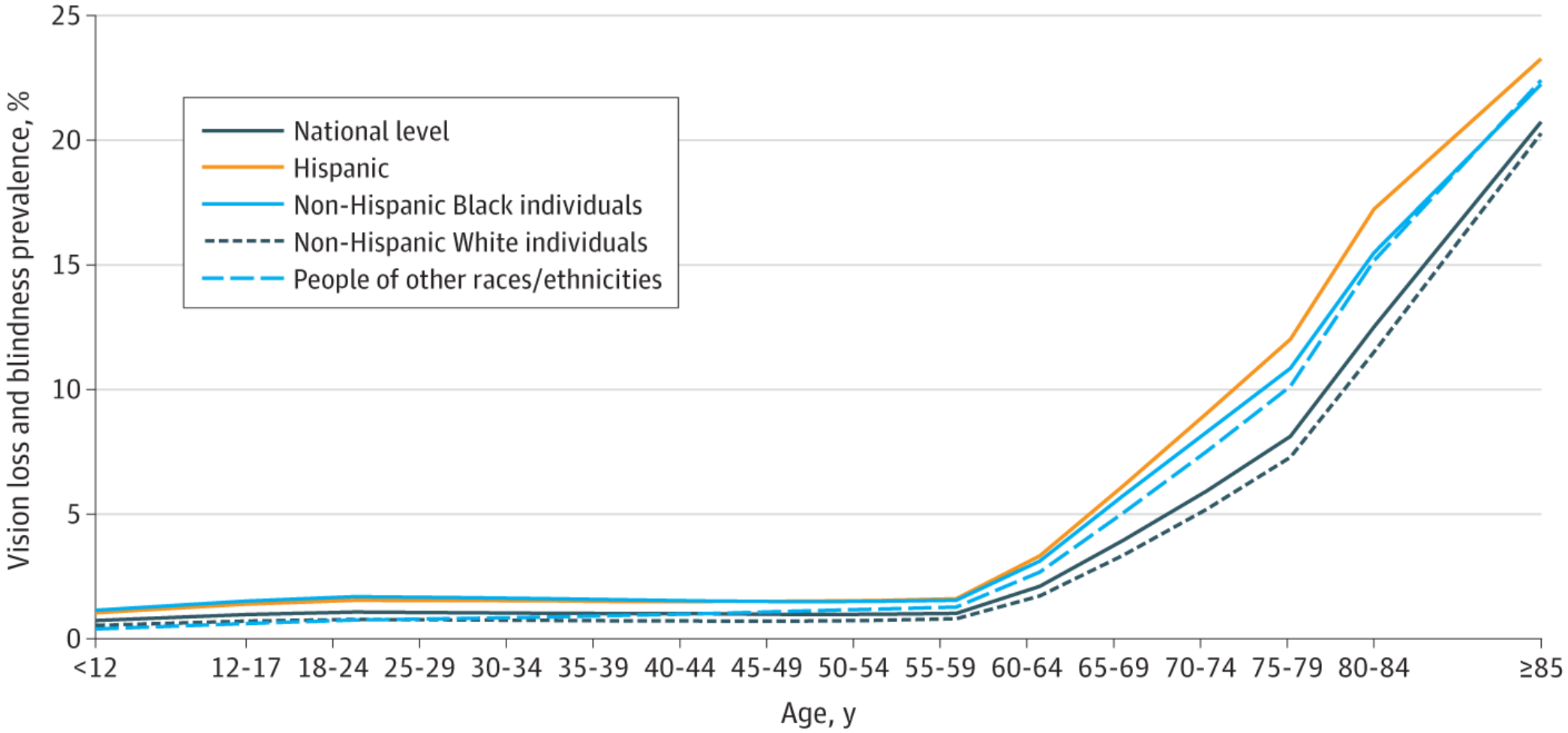
(95% UI, 0.82 – 1.30)

Prevalence Rate was Higher for Women than Men

w. 2.52%

m. 1.82%

Prevalence rates increased with age and varied by race/ethnicity (although uncertainty intervals by race/eth overlapped)

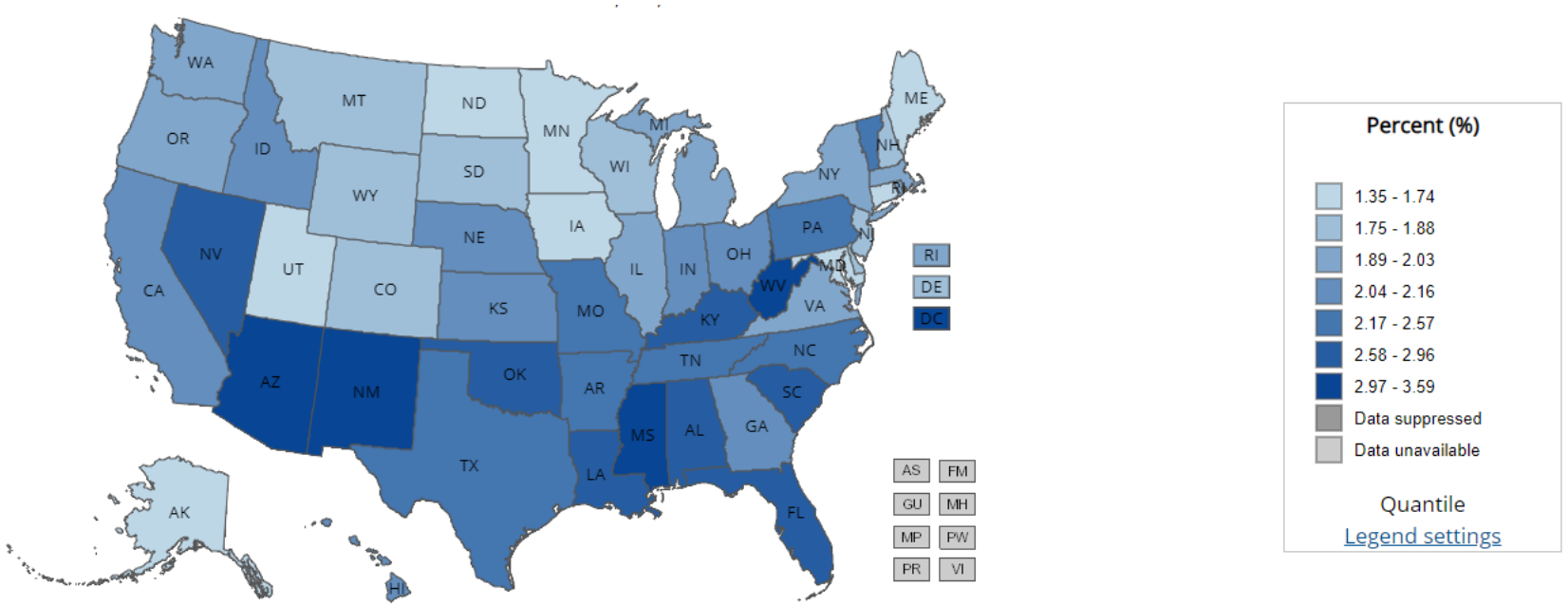


Highest Prevalence

- WV 3.6%
- MS 3.3%
- DC 3.2%
- NM 3.0%
- AZ 3.0%

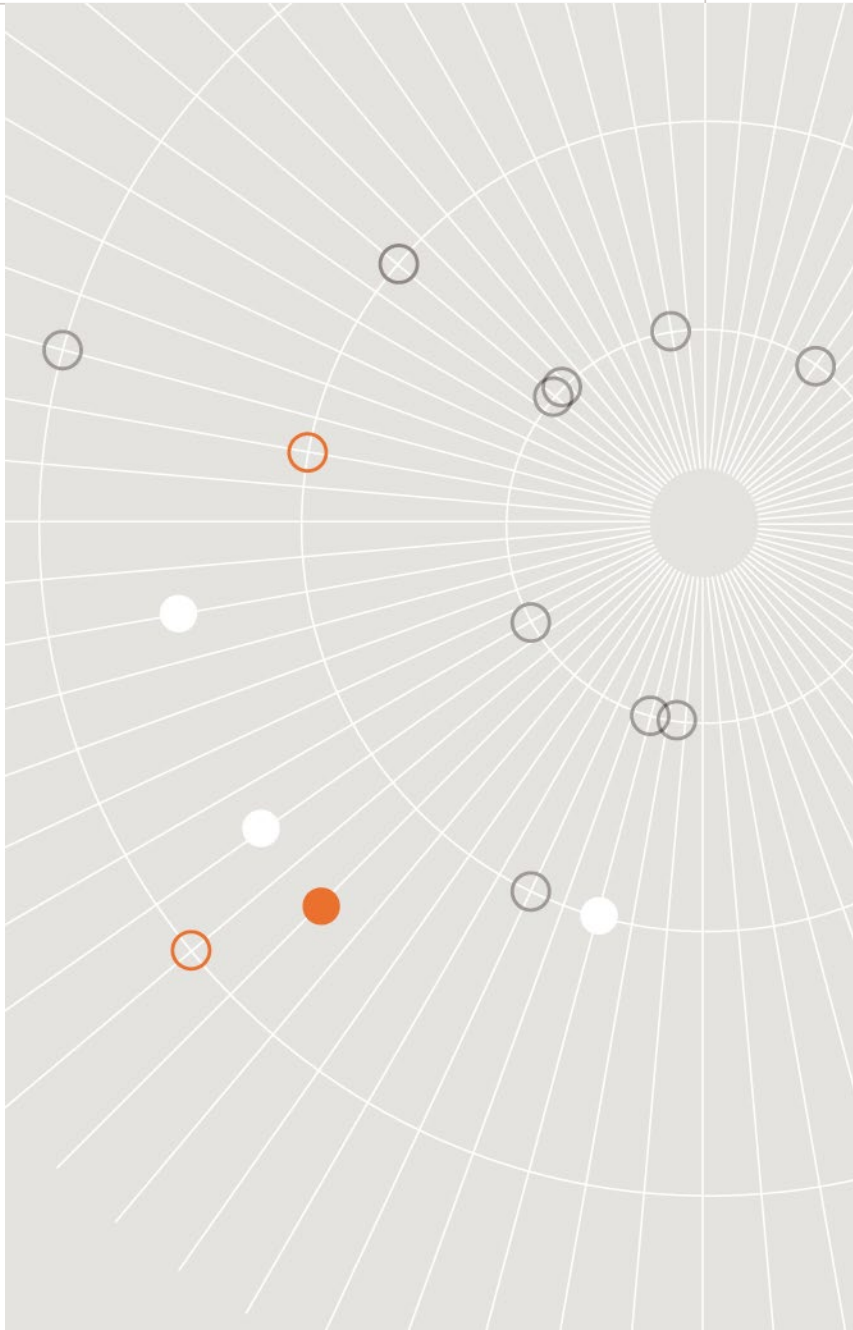
Lowest Prevalence

- ME 1.4%
- UT 1.4%
- IA 1.5%
- ND 1.6%
- AK 1.7%



Primary Limitations

- Missing data in NHANES
  - Approximately 12% of NHANES observations had missing autorefractor data
  - Accounting for missing data increased mean prevalence rate from 1.7% to 2.2%
- Older data
  - Newer waves of NHANES examination data would be very valuable
- Self-reported measurements used to estimate variation
  - Assumption is self-reports are strongly correlated with evaluated visual impairment
  - Forthcoming research supports this assumption, but self-reports are imperfect
- Potentially, the inclusion of additional data sources could improve these estimates



Conclusions & Extensions

NORC at the University of Chicago

Conclusions

- We estimated that 7.08 million people were living with vision impairment or blindness in the United States in 2017;
  - 5.46 million with visual impairment (20/40 to >20/200)
  - 1.62 million with U.S. defined blindness (20/200 or worse)
- Compared to earlier estimates, 68% higher overall
  - Proportion of all visual impairment or blindness that is blindness is lower
- Based on self-reported data, we estimated substantial and meaningful variation at the state level
- Moving forward, these methods can be used to update estimates of state variation and population, but new waves of NHANES-like evaluation-based measures of best-corrected visual acuity are badly needed

Visit the Vision and Eye Health Surveillance System (VEHSS)
Google: VEHSS CDC

Want to Learn How to Use VEHSS? Thursday, July 15, Session 3E

Prevent Blindness

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Moderated Discussion 3E

Topic: Vision and Eye Health Surveillance System: Using National, State, and County-level Prevalence Data

Session Moderator: Elizabeth Lundeen, PhD, MPH
Vision Health Initiative, U.S. Centers for Disease Control and Prevention

John Wittenborn
NORC at the University of Chicago

Dean VanNasdale, OD, PhD, FAAO
The Ohio State University College of Optometry

2:40 pm - 3:25 pm

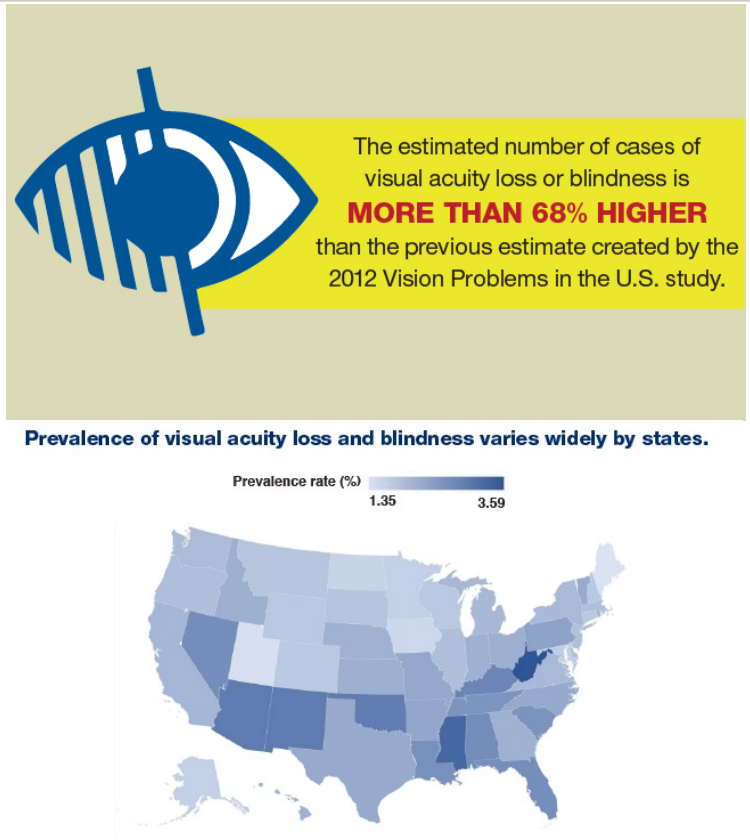
Session 4: Keynote Presentation: The Role of Public Health in Advancing Eye Health

Ross C. Brownson, PhD
Lipstein Distinguished Professor of Public Health, Washington University in St. Louis

3:25 pm - 3:30 pm

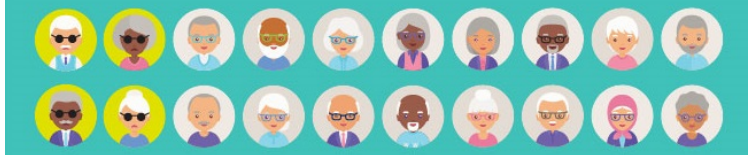
Closing Remarks

Jeff Todd
President & CEO, Prevent Blindness

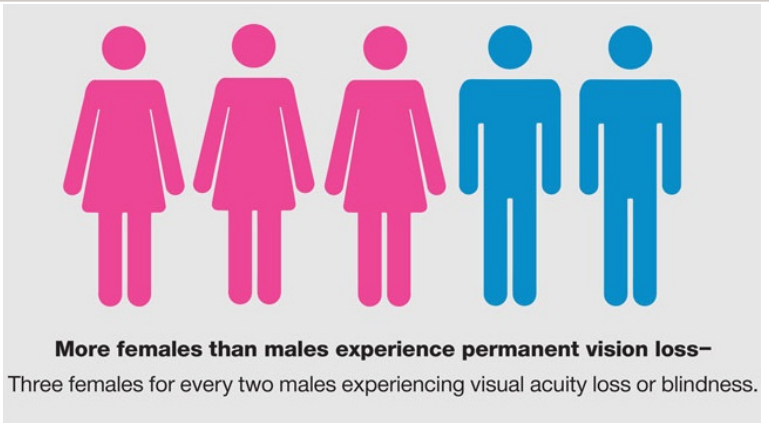


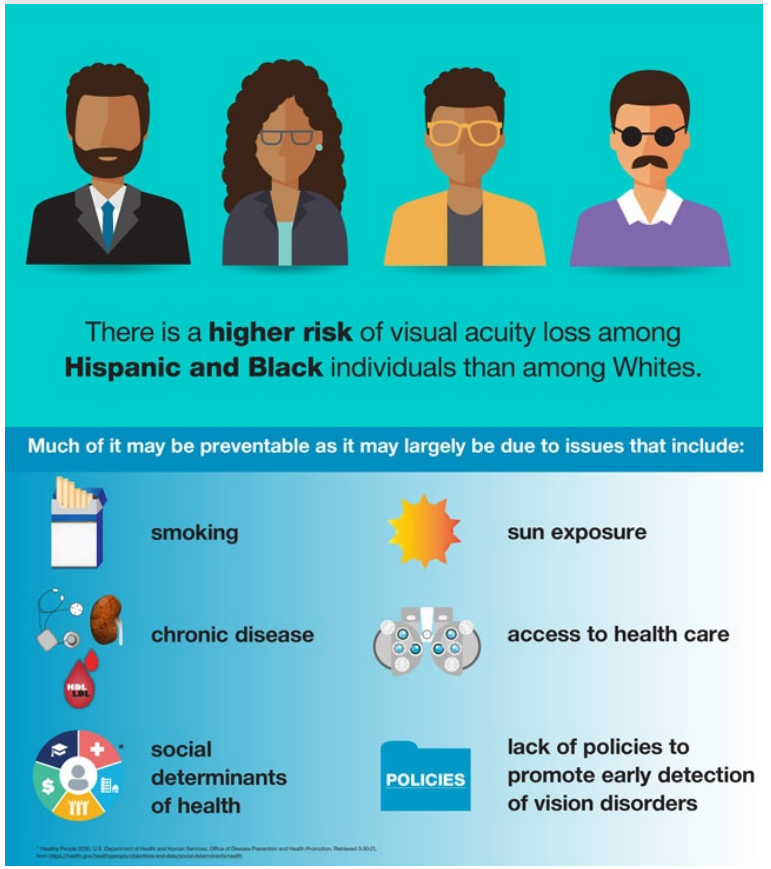
Materials for your next presentation.

https://preventblindness.org/prevalence-visual-acuity-loss-blindness-us



20% of all individuals age **85 and older** in the U.S. experience **permanent vision loss**.





Thank you.

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On behalf of the VEHSS Study Group

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