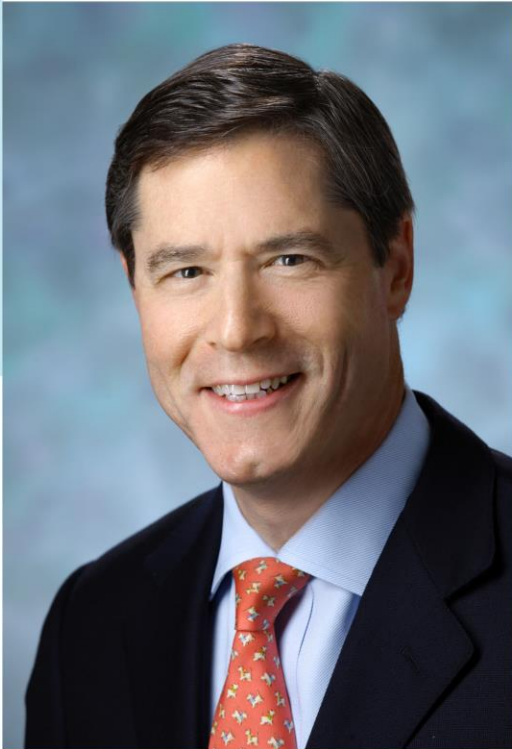




Our Vision Is Vision®



Impact of Diabetes Among Younger People
on Future Eye Disease

Neil Bressler, MD

Johns Hopkins University

Impact of Diabetes Among Younger People on Future Eye Disease

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School of Medicine

The James P. Gills Professor of Ophthalmology

Past Chair – Diabetic Retinopathy Clinical Research Network –
DRCR.net

Information from CDC, American Diabetes Association, Research
sponsored by the National Institutes of Health



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health
National Eye Institute

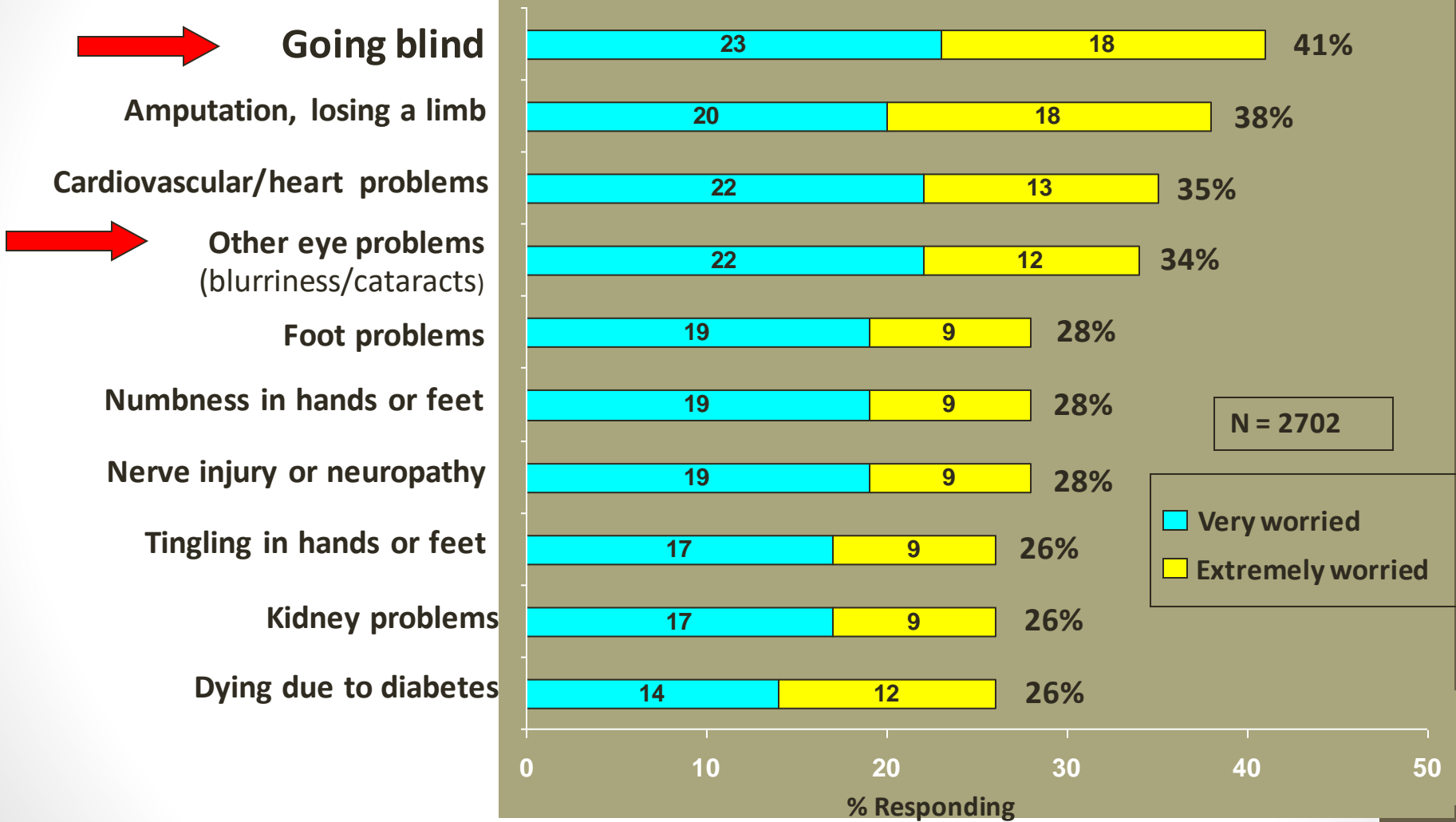


Overview: Diabetes and Eye Disease

- **Importance of eye disease in people with diabetes**

Two of Top 4 Concerns of Patients With Diabetes Are Vision-Related

Top 10 concerns of patients with diabetes



*An international survey based on experiences with diabetic microvascular complications, (2,702 patients with both type 1 and 2 diabetes), by Consumer Health Sciences and IPSOS for the Lions Club International Foundation, in association with and with the support of Eli Lilly and Company, 2002.



How Does Vision Loss Compare with Other Health Problems?

Ocular Disease Utility Value*	Systemic Health State Value

* Based on visual acuity in the better-seeing eye.

Adapted from Brown MM, et al. *Ophthalmology*. 2003;110:1076-1081, ©2003 with permission from the American Academy of Ophthalmology.

How Does Vision Loss Compare with Other Health Problems?

Ocular Disease Utility Value*		Systemic Health State Value	
Negligible visual loss (20/20-20/25)	0.88	Breast cancer, after radiotherapy	0.89
		Myocardial infarction	0.87
Minimal visual loss (20/30-20/50)	0.81	Colon cancer, poor prognosis	0.80
		AIDS	0.79
Moderate visual loss (20/60-20/100)	0.72	Stroke, moderate	0.73
		Home dialysis for 8 years	0.72
Severe visual loss (20/200-No Light Perception)	0.61	Tuberculosis: hospitalized for 3 mos	0.60
		Ulcerative colitis, before surgery	0.58

* Based on visual acuity in the better-seeing eye.

Adapted from Brown MM, et al. *Ophthalmology*. 2003;110:1076-1081, ©2003 with permission from the American Academy of Ophthalmology.

How Does Vision Loss Impact Quality of Life?

- **Mobility**, both ambulatory and driving¹
 - Recognition of landmarks, street signs
- **Reading** and related close work¹
 - Activities of daily living (cooking, shopping, check writing, etc)
- **Self Care Abilities**²
 - Reading of medicine bottles, nutritional labels
 - Preparing insulin injections, glucose testing
- **Social participation**^{1,2}
 - Feelings of vulnerability, emotional distress



Normal Vision



Moderate Vision Loss
(simulated)



Severe Vision Loss
(simulated)

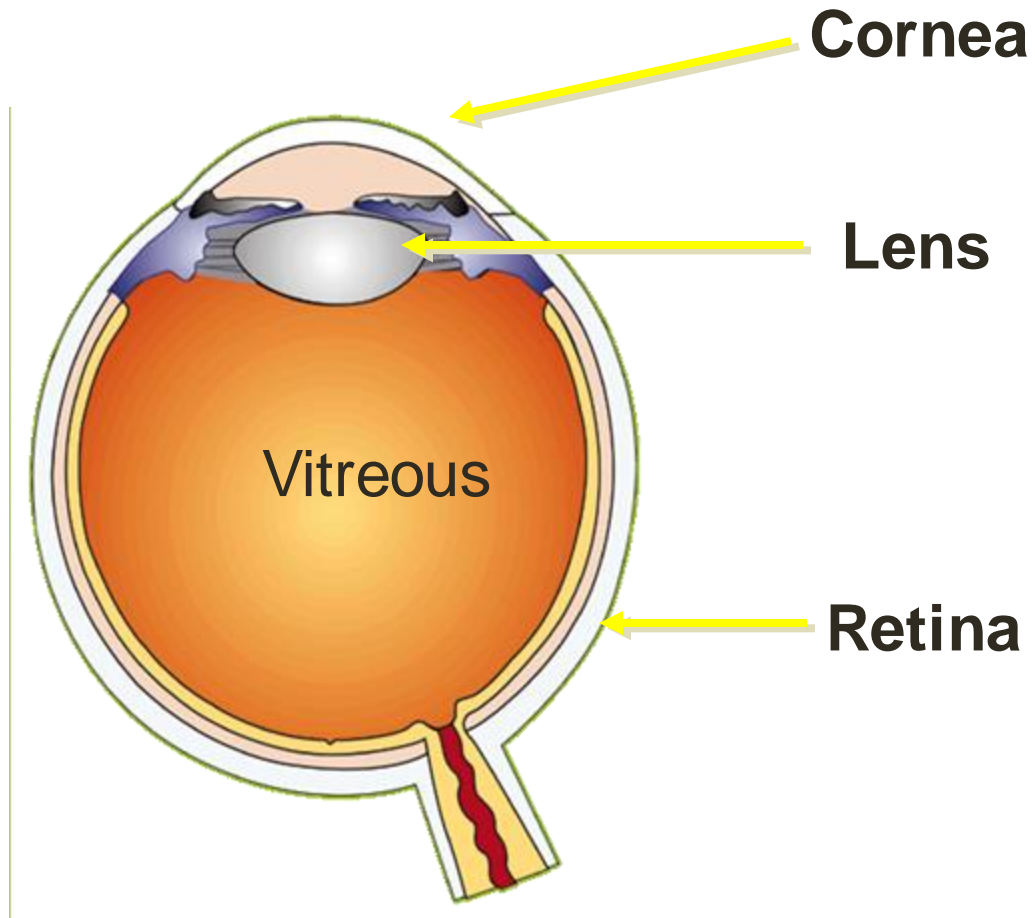
1. Lennie P, et al
Academy of Ophthalmology

2. Coyne KS, et al

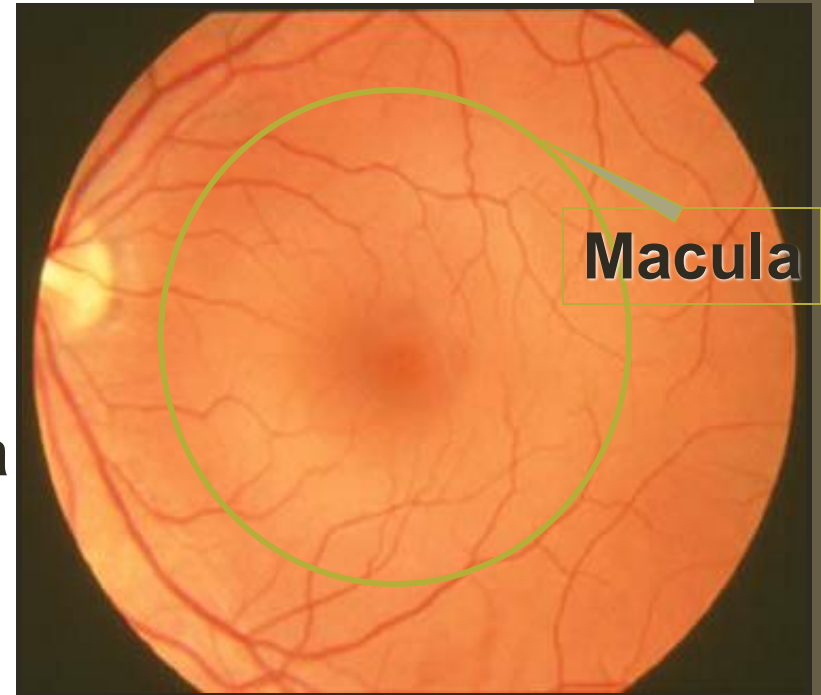
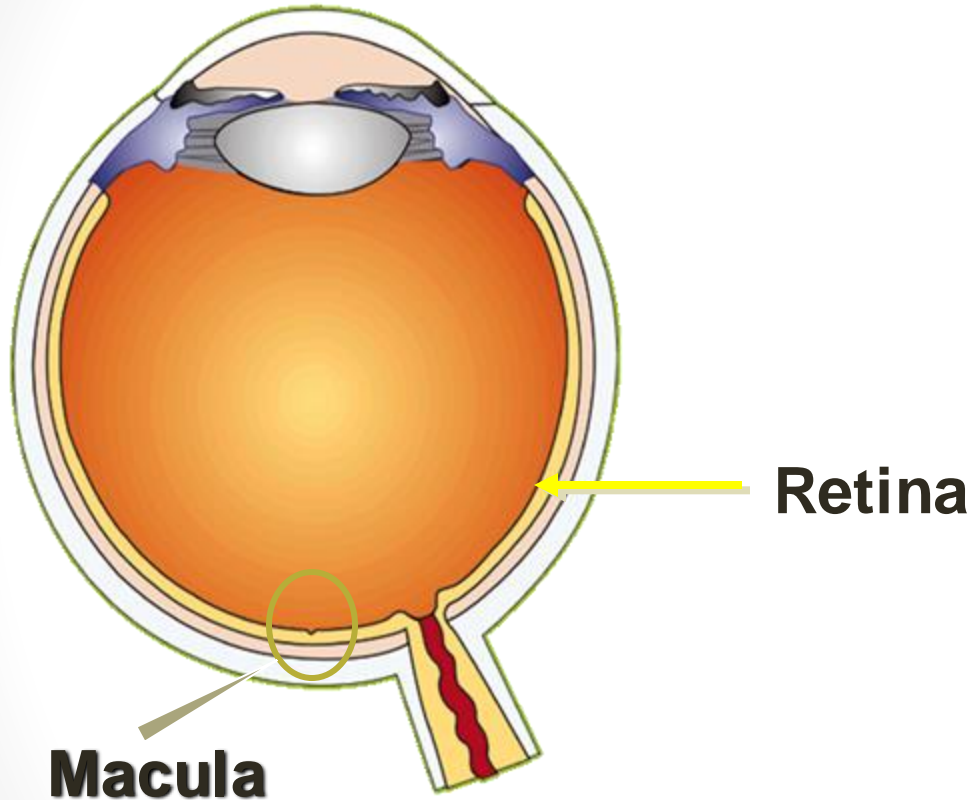
Overview: Diabetes and Eye Disease

- **Importance of eye disease in people with diabetes**
- **What is diabetic retinopathy?**

Normal Eye

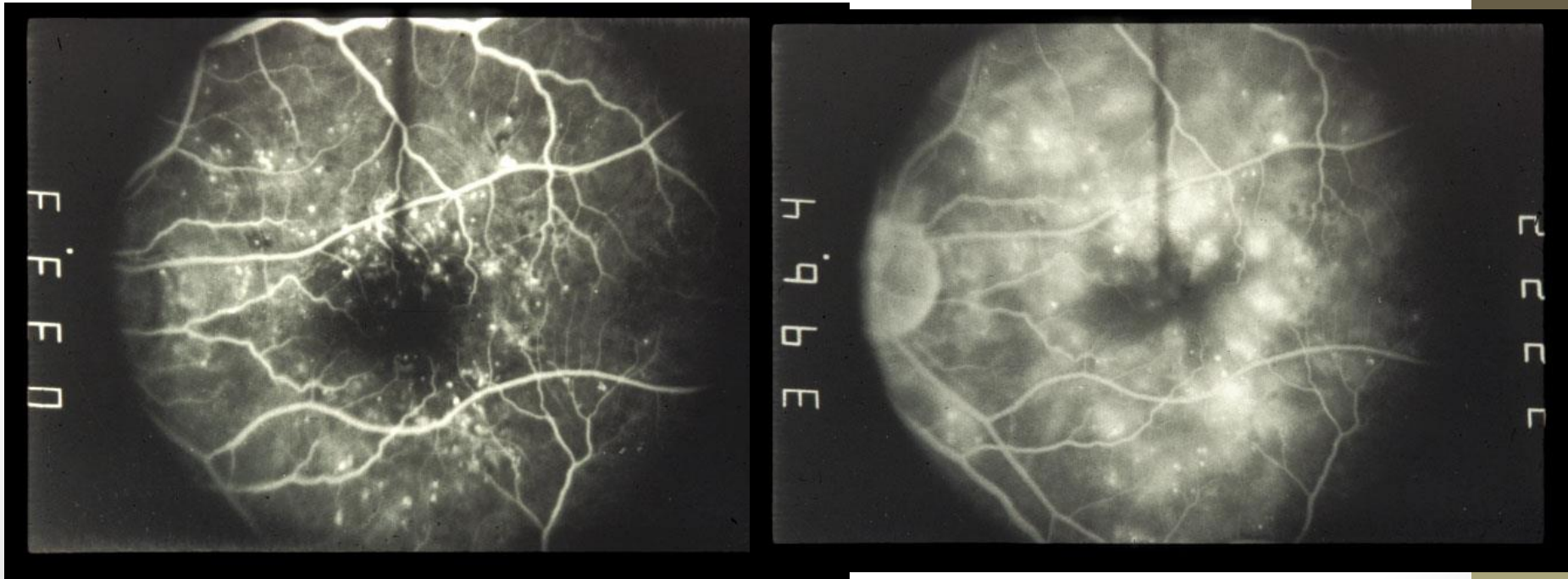


Macula: Center of the Retina



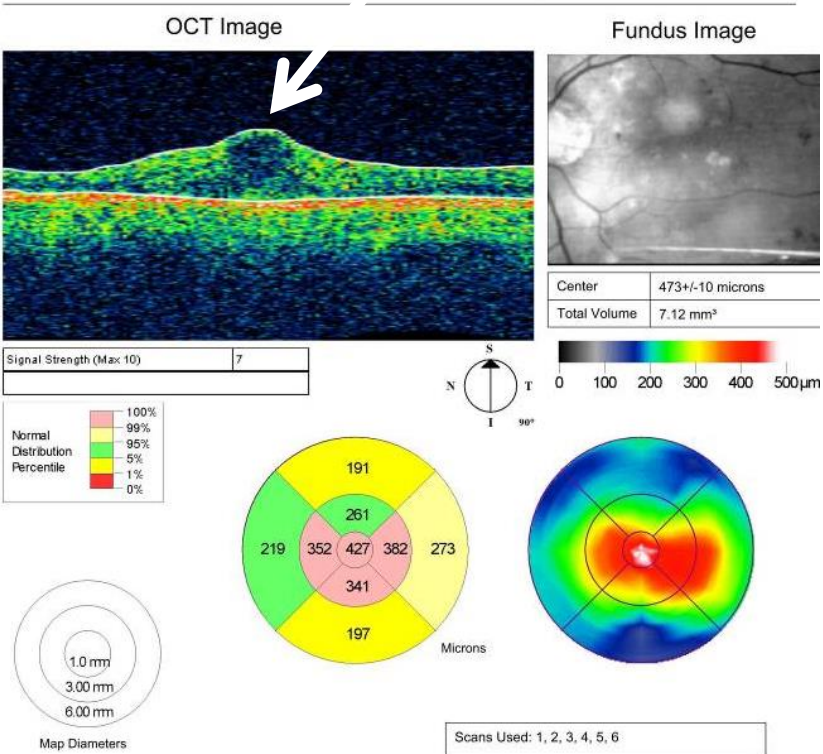
Consequences of Elevated Blood Sugar Levels: Leakage of Capillaries – Macular Edema

*Hyperpermeability easily visualized with
fluorescein angiography*

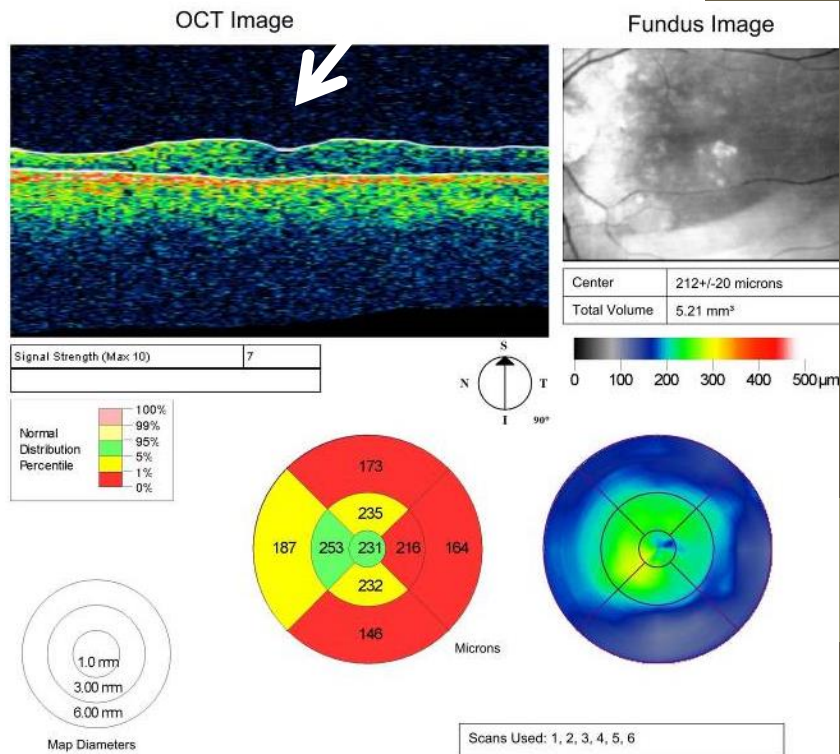


Consequences of Leakage of Capillaries: Macular Edema

*Retinal Thickening Readily Imaged
And Quantified by Ocular Coherence Tomography (OCT)*



Treat
→



Diabetic Macular Edema

- Most common cause of vision impairment or blindness among persons with diabetes

Legally Blind

N C V K D

20/200

C Z S H N

O N V S R

K D N R O

15 letter loss from
20/40, CANNOT
Drive or Read

15 letter loss =
3 line loss, CAN
Drive + Read

Z K C S V

20/80

D V O H C

O H V C K

H Z C K O

20/40

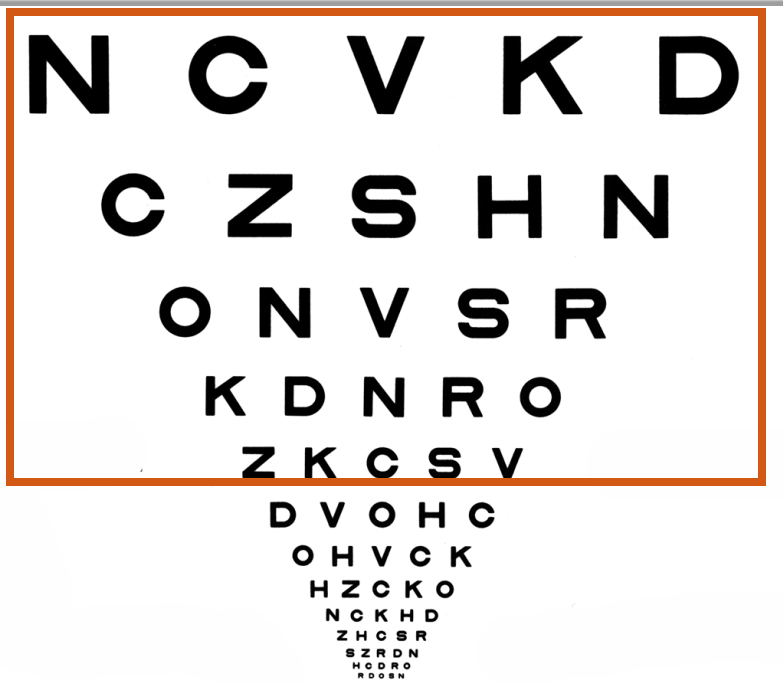
N C R H D

S Z R D N

20/20

R D O S N

Visual Acuity on An Eye Chart Translates into Impaired Vision Function



=

or

Marley was dead: to begin with. There is no doubt whatever about that. The register of his burial was signed by the clergyman, the clerk, the undertaker, and the parish council; all of whom were present. And Scrooge signed it. And Scrooge's name was good upon 'Change, and it glorified in the hand to.

Old Marley was as dead as a door-nail.

Mind! I don't mean to say that I know of my friend's particular dead about a door-nail. I might have been inclined, upon the occasion, to regard the deadest piece of iron mongery in the trade. But the wisdom of our country is of the simile; and my unhallowed hands shall not disturb it, or the Country's done for. You will therefore permit me to repeat emphatically, that Marley was as dead as a door-nail.



Any 3 line loss of acuity equates to substantial loss of vision related quality of life

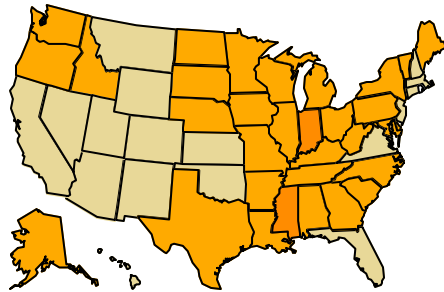
Overview: Diabetes and Eye Disease

- **Importance of eye disease in people with diabetes**
- **What is diabetic retinopathy?**
- **Prevalence**

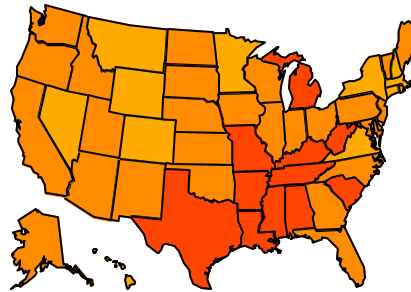
Age-Adjusted Prevalence of Obesity and Diagnosed Diabetes Among U.S. Adults Aged 18 Years or older

Obesity (BMI ≥ 30 kg/m²)

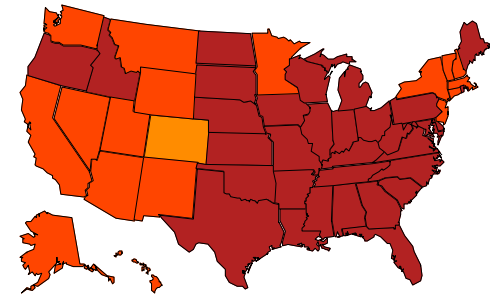
1994



2000



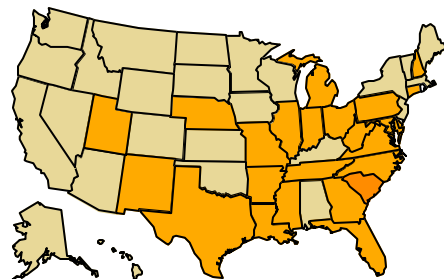
2010



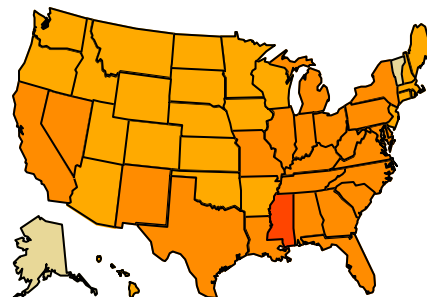
□ No Data ◻ <14.0% ◻ 14.0-17.9% ◻ 18.0-21.9% ◻ 22.0-25.9% ◻ ≥26.0%

Diabetes

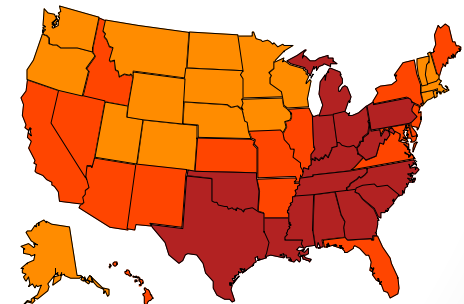
1994



2000



2010



□ No Data ◻ <4.5% ◻ 4.5-5.9% ◻ 6.0-7.4% ◻ 7.5-8.9% ◻ ≥9.0%

CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at <http://www.cdc.gov/diabetes/statistics>

Diabetes in Youth

- **About 208,000 Americans under age 20 are estimate to have diagnosed diabetes (~0.25% of that population or 1 out of 400 under age 20).**
- **Type 2 diabetes in the U.S. accounts for 10-11% of all diabetes in children <20 years of age and the relative frequency approaches or exceeds 50% of minority adolescents with new onset diabetes**
- **The overall prevalence of type 2 diabetes among American youths aged 10-19 years rose by 35% between 2001 and 2009.**

Diabetes in Youth (continued)

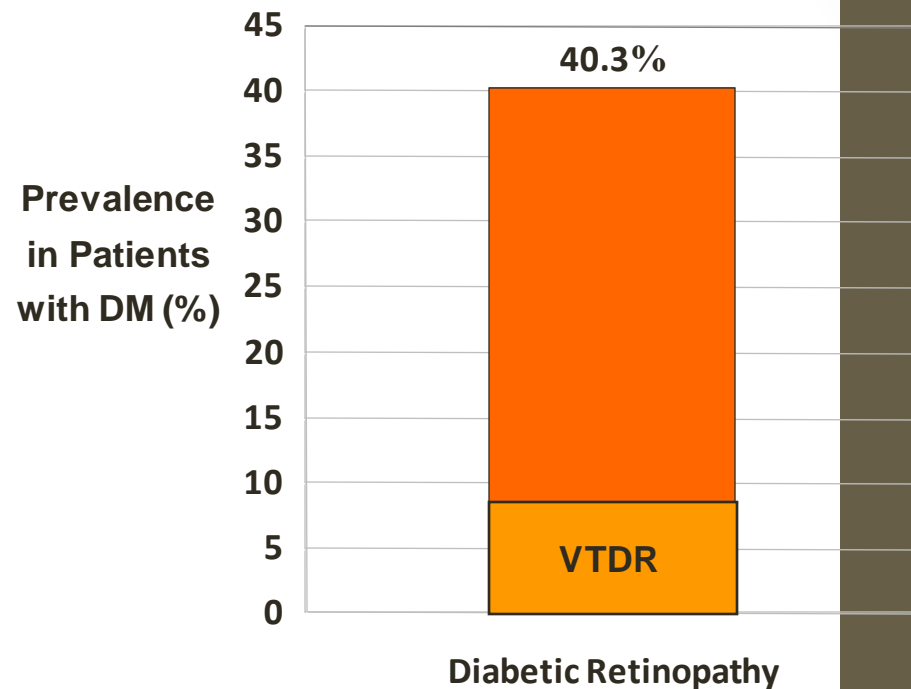
- **The greatest increase in the prevalence of type 2 diabetes from 2001 to 2009 was observed in Hispanic youths (from 0.45 per 1000 to 0.79 per 1000), followed by blacks (from 0.95 per 1000 to 1.06 per 1000), and whites (from 0.14 per 1000 to 0.17 per 1000).**
- **There were no significant changes in prevalence for either American Indians or Asian Pacific Islanders.**

Treatment of Diabetes Eye Disease

- **Recent technology to assist with blood glucose control (hemoglobin A1C)**
 - **Insulin pumps**
 - **Continuous glucose monitoring**
- **Fewer than 50% of youth with type 1 diabetes use pumps and only about 5% use continuous glucose monitors**
- **Less use of technology in African Americans and those with higher hemoglobin A1C levels**

Diabetic Retinopathy (DR): A Major Cause of Vision Loss

- DR is the leading cause of blindness in adults 20-74 yrs
- DR occurs in ~40% of patients diagnosed with diabetes aged ≥ 40 years:^{*}
 - 20% of patients with DR have vision-threatening DR[†] (VTDR)



^{*}Pooled analysis of data from 8 population-based eye surveys was used to estimate the prevalence, among persons with DM (T1DM or T2DM), of DR and vision-threatening diabetic retinopathy (VTDR).

[†] Vision-threatening diabetic retinopathy (VTDR) defined as severe non-proliferative DR, proliferative DR, and/or macular edema.

Kempen JH, et al. *Arch Ophthalmol.* 2004;122:552-563.

Prevalence estimates among U.S. Adults ≥ 40 years With Self-reported and Undiagnosed Diabetes

Population	NHANES Sample Size	% of U.S. population aged ≥ 40 years with diabetes [†] (95% CI)	No. of Adults in the U.S. population aged ≥ 40 years with diabetes [‡]
Diabetes	1,038	100%	20.3 million (18.1-22.7 million)

DME = diabetic macular edema; DR = diabetic retinopathy

*Data previously presented at Retina Society 2012 Annual Meeting, Oct 4-7, 2012, Washington, DC and American Academy of Ophthalmology 2012 Annual Meeting, Nov 10-13, 2012, Chicago, IL.

[†]Estimates include self-reported and undiagnosed diabetes.

[‡]Prevalence estimates were applied to the 2010 Census population to calculate the total number of cases ≥ 40 years in the U.S.

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Diabetes without DR or DME	713	72.2% (68.7–75.7%)	14.6 million (12.9-16.5 million)

DME = diabetic macular edema

*Data previously published in

Ophthalmology 2010;119:1000-1006

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Diabetes without DR or DME	713	72.2% (68.7–75.7%)	14.6 million (12.9-16.5 million)
DR without DME	270	24.0% (20.8–27.3%)	4.9 million (4.1-5.8 million)

DME = diabetic macular edema

*Data previously published in

Ophthalmology 2010;119:1031-1037

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DR without DME	270	24.0% (20.8–27.3%)	4.9 million (4.1-5.8 million)
DME	55	3.8% (2.7–4.9%)	839,000 (602,000- 1,117,000)

DME = diabetic macular edema; DR = diabetic retinopathy

*Data previously presented at Retina Society 2012 Annual Meeting, Oct 4-7, 2012, Washington, DC and American Academy of Ophthalmology 2012 Annual Meeting, Nov 10-13, 2012, Chicago, IL.

[†]Estimates include self-reported and undiagnosed diabetes.

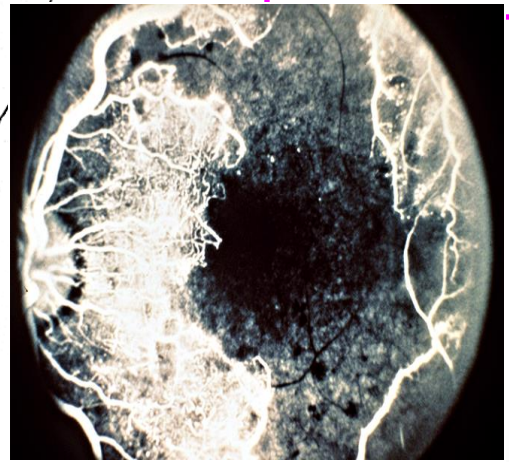
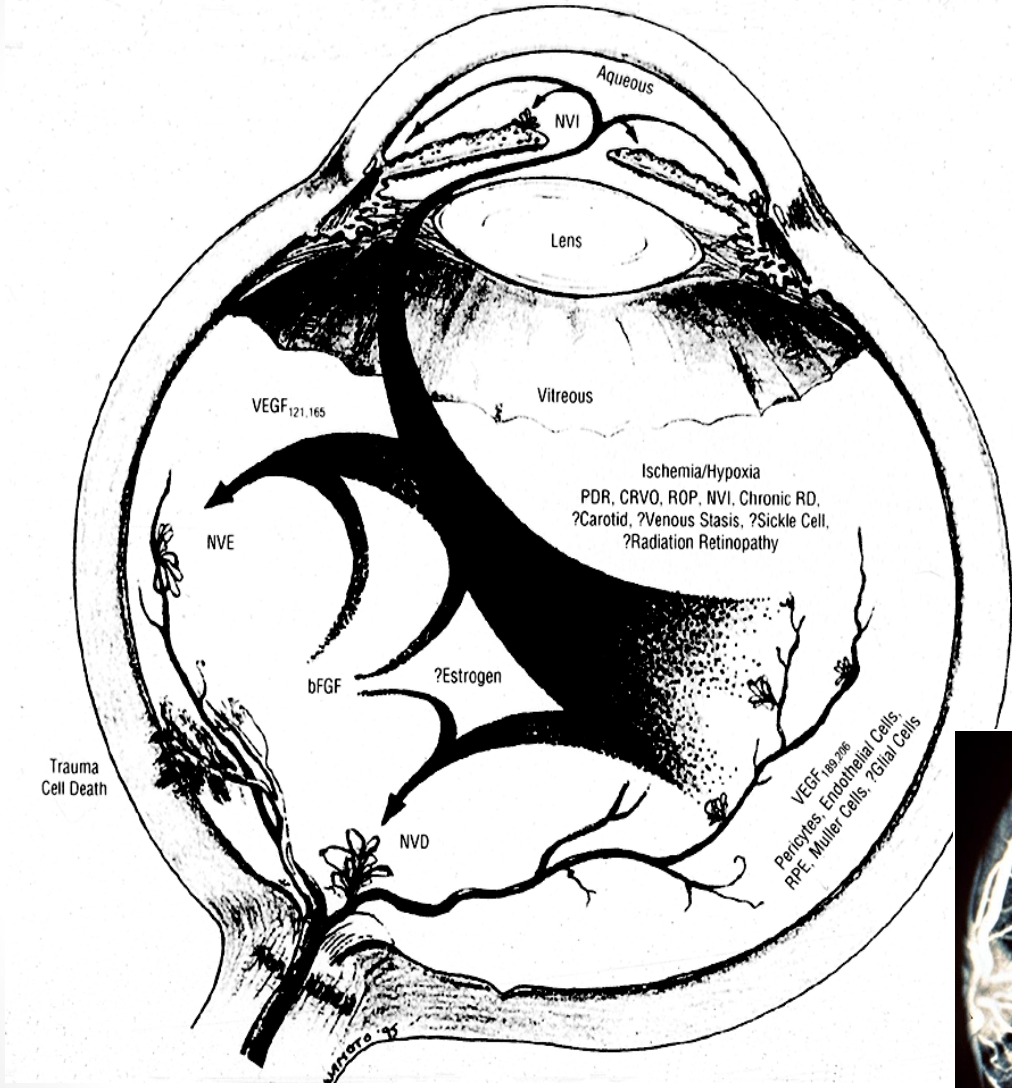
[‡]Prevalence estimates were applied to the 2010 Census population to calculate the total number of cases ≥ 40 years in the U.S.

Overview: Diabetes and Eye Disease

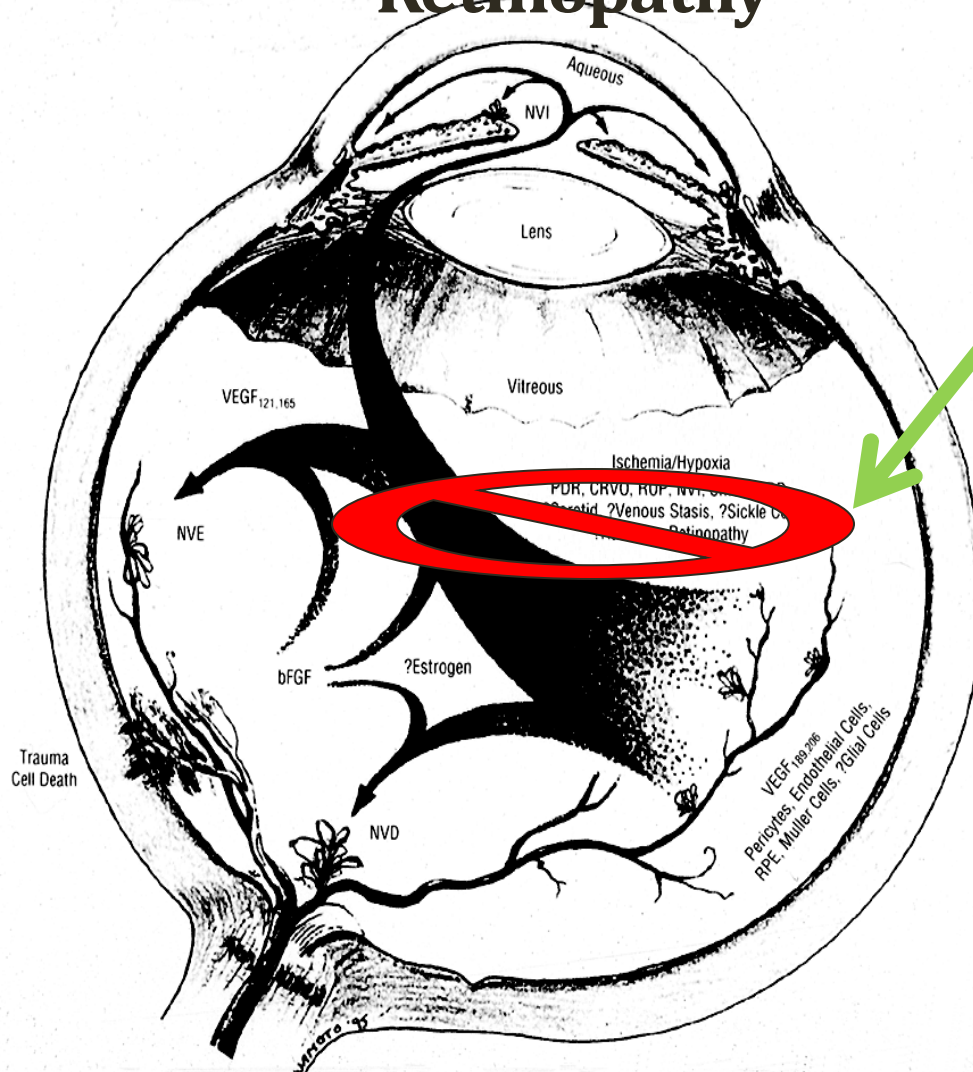
- **Importance of eye disease in people with diabetes**
- **What is diabetic retinopathy?**
- **Prevalence**
- **Treatment**

Growth Factors in Diabetic Retinopathy

VEGF, GH,
IGF, FGF,
HGF, PDGF,
TGF, Ang,
ATII
&
many
more...



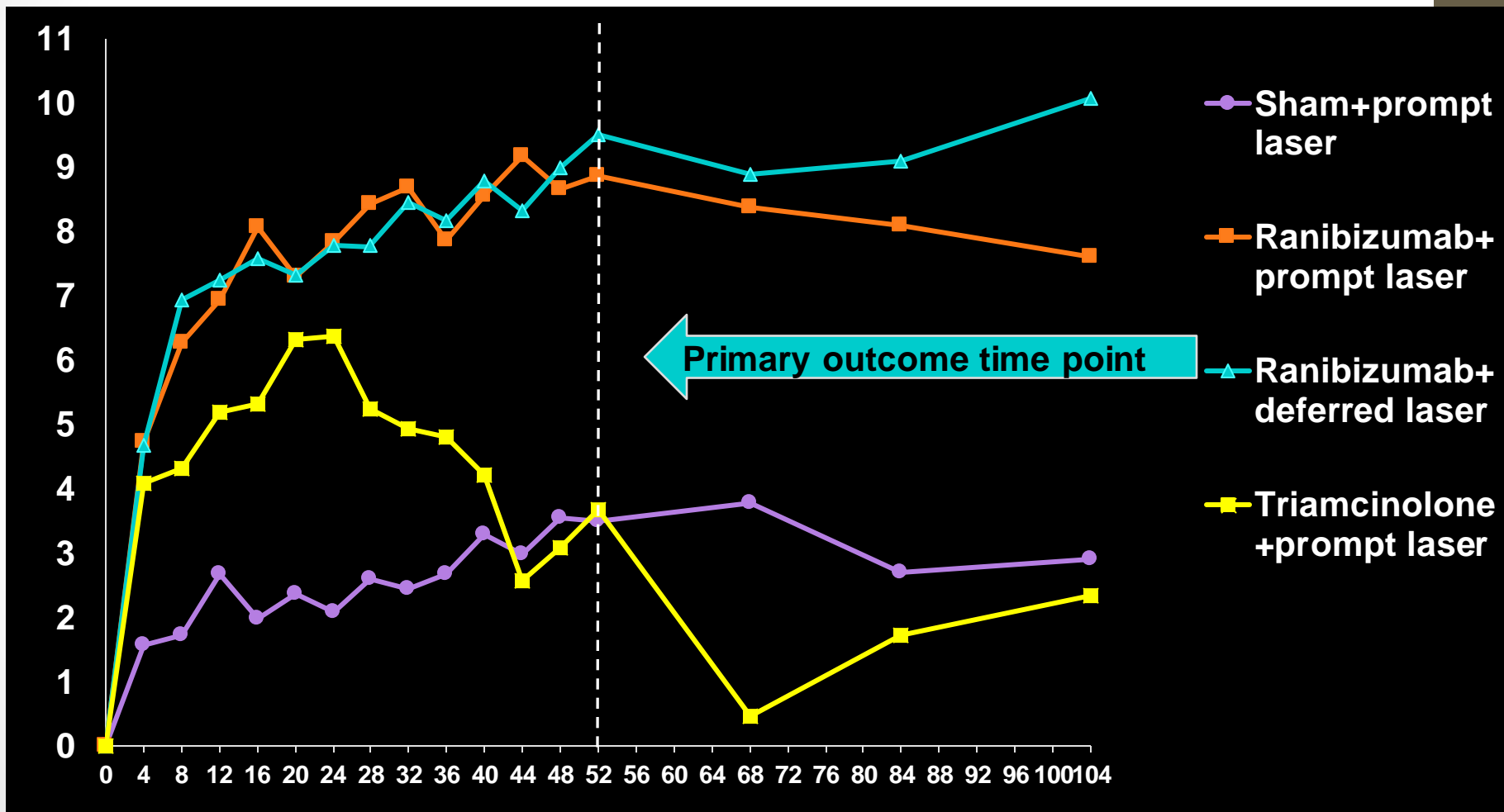
“Anti-”Growth Factor to Treat Diabetic Retinopathy



Intravitreal injection into middle cavity of eye

Positive Effects On:
Angiogenesis
And
Hyperpermeability

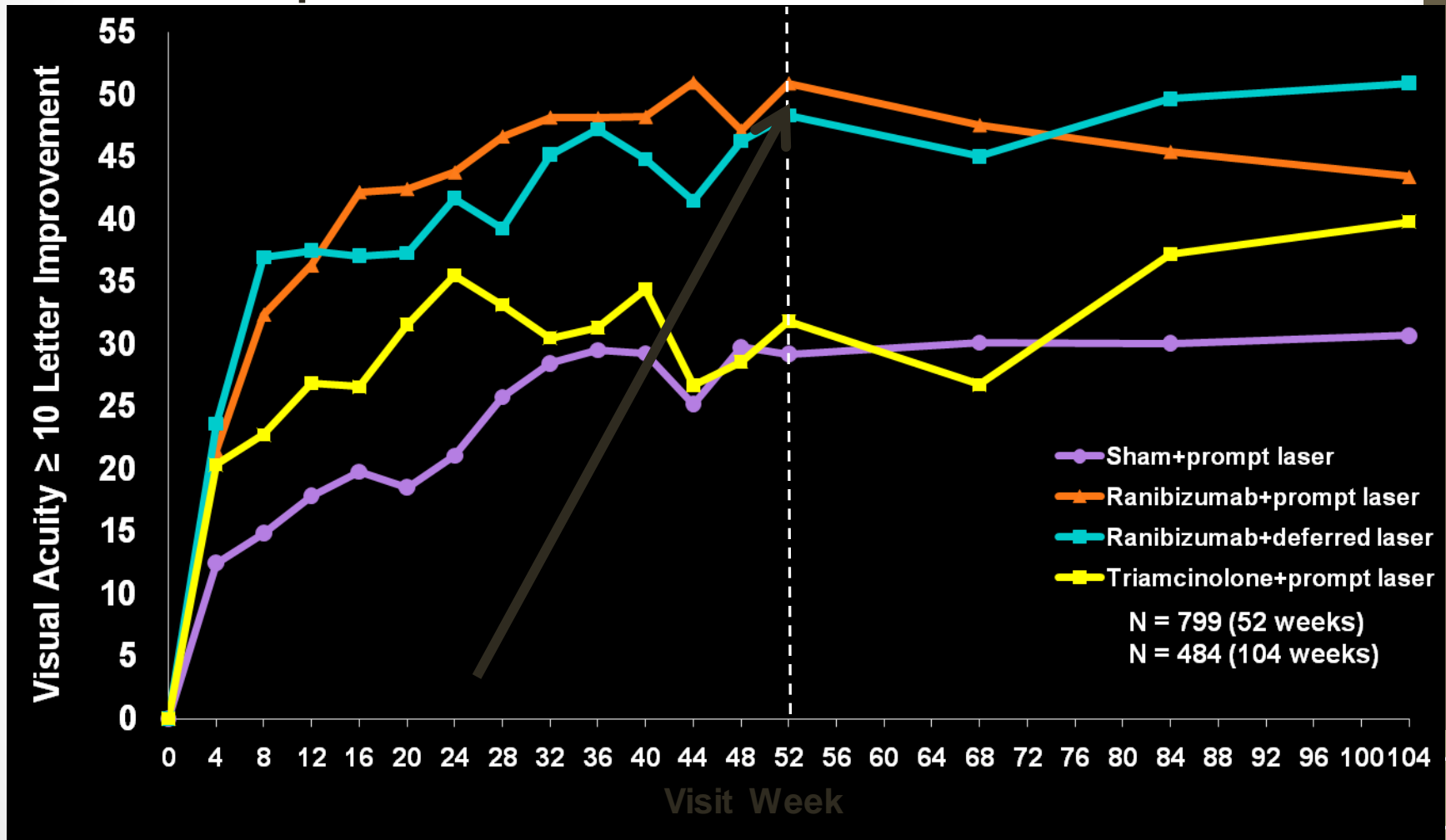
Mean Change in Visual Acuity (Letters)* at Follow-up Visits



* Values that were ± 30 letters were assigned a value of 30

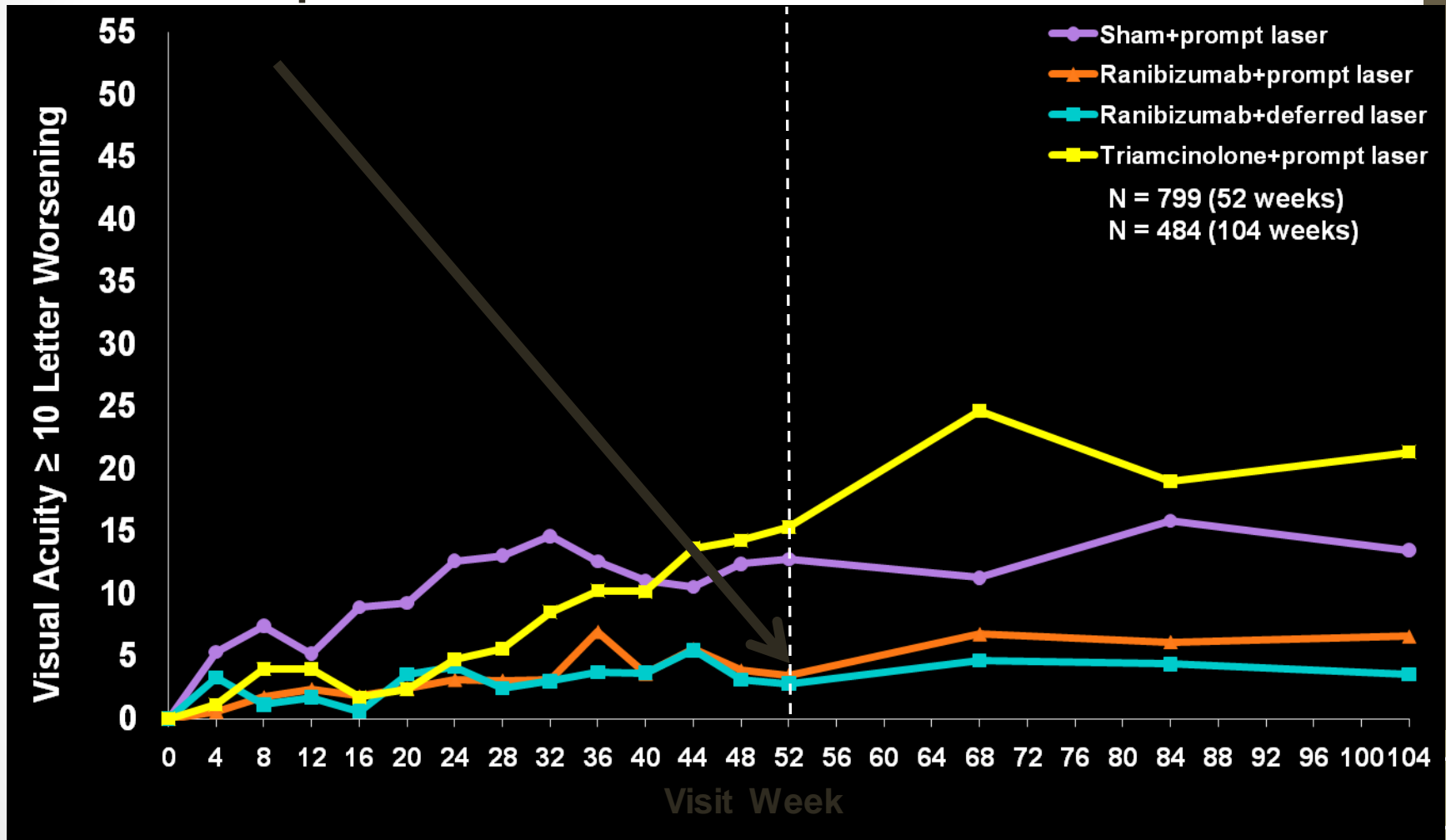
P-values for difference in mean change in visual acuity from sham+prompt laser at the 52-week visit:
ranibizumab+prompt laser <0.001; ranibizumab+deferred laser <0.001; and triamcinolone+prompt laser=0.31.

≥10 Letter Improvement in Visual Acuity at Follow-up Visits



P values for the difference in proportion of 10 letter improvement in visual acuity from sham+prompt laser at the 52-week visit: ranibizumab+prompt laser <0.001; ranibizumab+deferred laser <0.001; triamcinolone+prompt laser = 0.16

≥10 Letter Worsening in Visual Acuity at Follow-up Visits



P values for the difference in proportion of 10 letter worsening in visual acuity from sham+prompt laser at the 52-week visit: ranibizumab+prompt laser <0.001; ranibizumab+deferred laser =0.001; triamcinolone+prompt laser = 0.75

Overview: Diabetes and Eye Disease

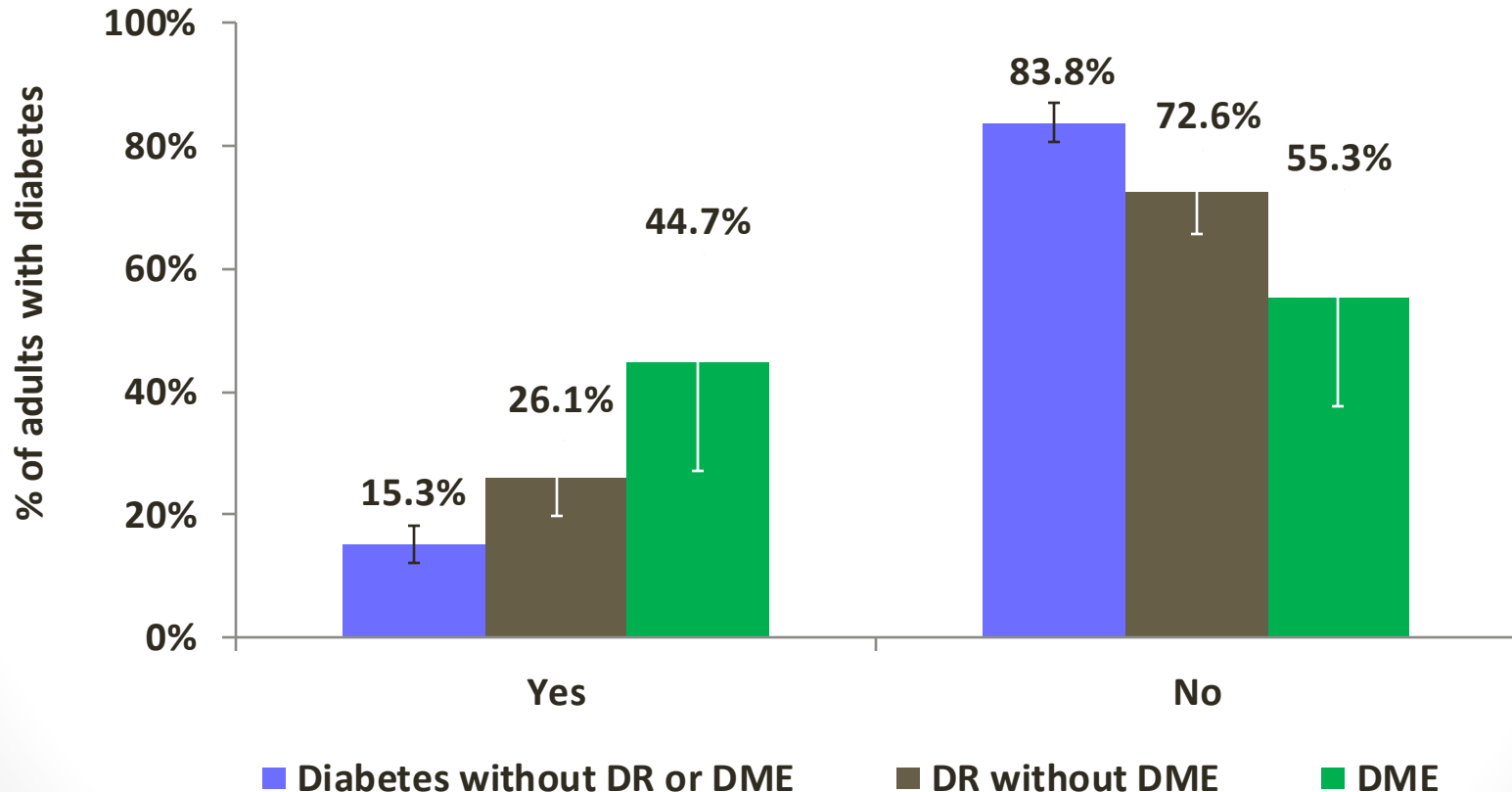
- **Importance of eye disease in people with diabetes**
- **What is diabetic retinopathy?**
- **Prevalence**
- **Treatment**
- **Limitations to getting treatment**

Methods: Definitions of Study Outcomes

- **Among those with self-reported diagnosis of diabetes:**
 - **"Have you been told by a doctor that diabetes has affected your eyes or that you had retinopathy?"**
 - **"When was the last time you saw a diabetes nurse educator, or dietitian or nutritionist for your diabetes?"**
 - **"When was the last time you had an eye exam in which the pupils were dilated? This would have made you temporarily sensitive to bright light."**

Awareness of Eye Diseases for U.S. Adults ≥ 40 years With Self-reported Diabetes

Have you been told by a doctor that diabetes has affected your eyes or that you had retinopathy?

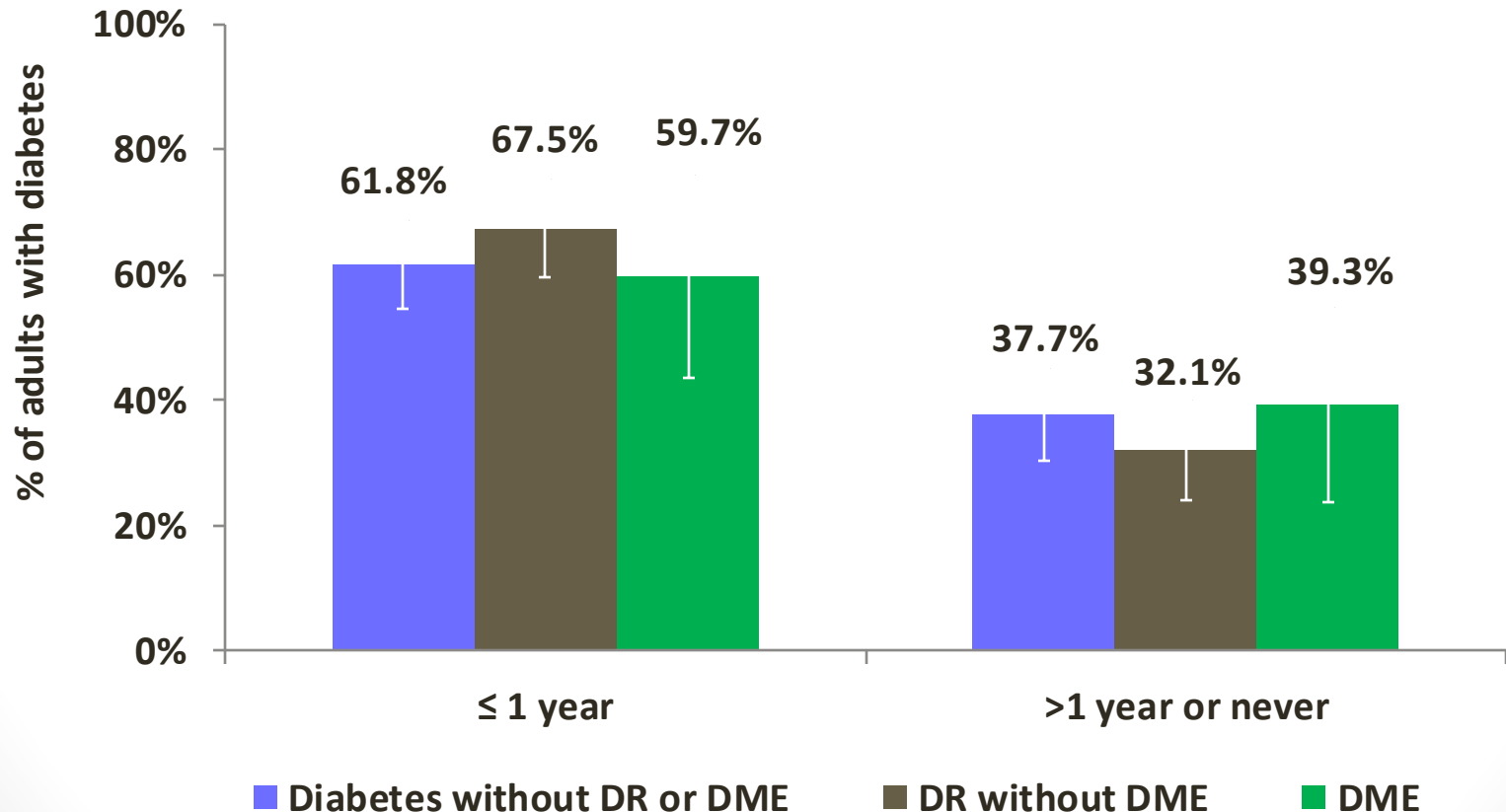


Error bars represent 95% CI's. If the total for each cohort does not equal 100%, the difference represents subjects who responded as "don't know" to this question (not shown).

Percentages reported are weighted; data for participants who responded "yes" for self-reported diabetes

Pupil Dilation Exam for U.S. Adults ≥ 40 years With Self-reported Diabetes

When was the last time you had an eye exam in which the pupils were dilated?

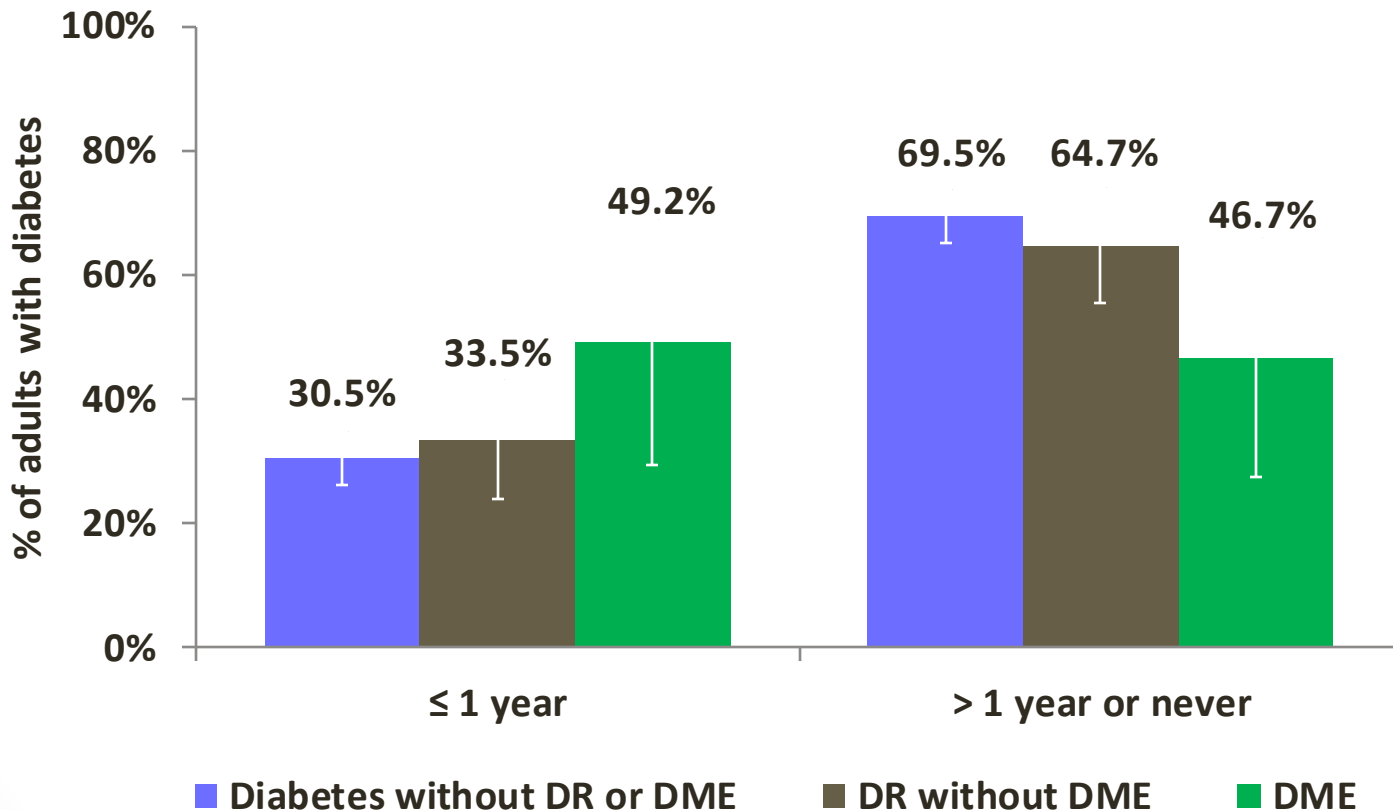


Error bars represent 95% CI's. If the total for each cohort does not equal 100%, the difference represents subjects who responded as "don't know" to this question (not shown).

Data for participants who responded yes for self-reported diabetes

Visits to Diabetes Specialist for U.S. Adults ≥ 40 years With Self-reported Diabetes

When was the last time you saw a diabetes nurse educator, or dietitian or nutritionist for your diabetes?



Error bars represent 95% CI's. If the total for each cohort does not equal 100%, the difference represents subjects who responded as "don't know" to this question (not shown).

Data for participants who responded yes for self-reported diabetes

Overview: Diabetes and Eye Disease

- **Importance of eye disease in people with diabetes**
- **What is diabetic retinopathy?**
- **Prevalence**
- **Treatment**
- **Limitations to getting treatment**
- **Where do we go from here?**
 - **Recognize prevalence of diabetes in youth and adults with Type 2 diabetes and diabetic macular edema increasing**
 - **Find ways to increase access and use of insulin pumps and continuous glucose monitoring**
 - **Realize that about half of the people with diabetes and treatable eye may be underusing health care to prevent vision loss and blindness**

Thank You

