# Diabetes 2020

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## My Goal:

Clearly communicate to each of you what I think is important for you to know about diabetic eye disease

# What is Diabetic Eye Disease?

1. Is it premature cataracts?
2. Is it the premature presbyopia?
3. Is it a cause for double vision and or a droopy eyelid?
4. Can lead to a potentially fatal type of orbital infection?
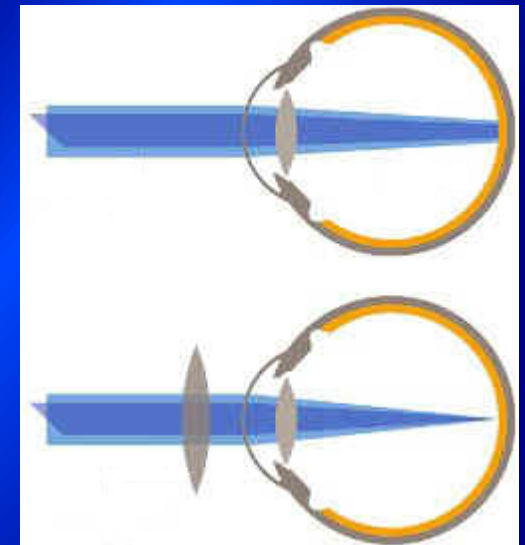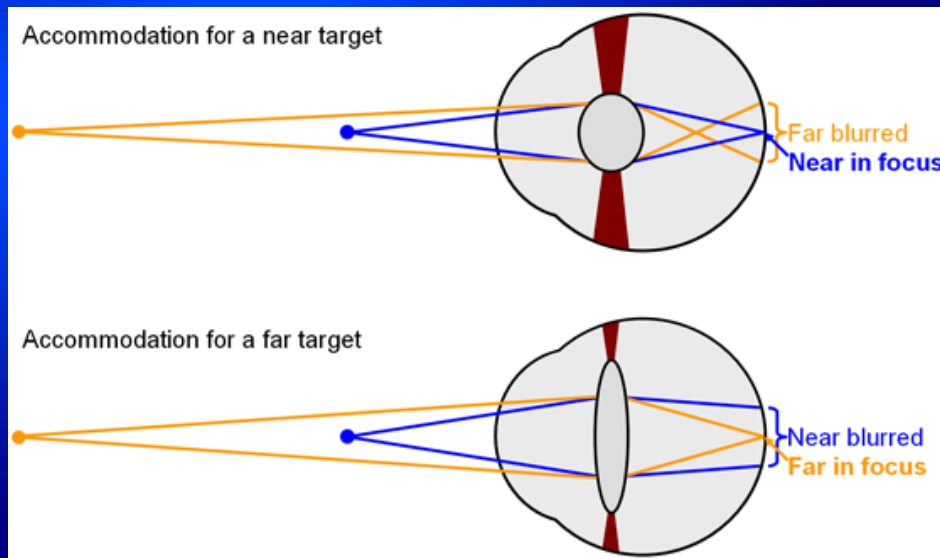5. Is it primarily a disease that effects the blood vessels of the retina?

## YES!!!

# Diabetic Eye Disease – Cataracts

1. Diabetic patients are twice as likely to develop visually significant cataracts.

2. These cataracts can occur earlier often in middle age (40's)

3. The surgery is the same as for nondiabetics, but depending on the retinal disease may also treat macular edema concurrently.

   1. They may have already been treated with intravitreal injections which can increase the risk of cataract surgery complications

   2. The cataract surgery may be planned to facilitate diabetic laser TX or may occur at the same time as PPV

# Diabetic Eye Disease – Early Reading Glasses

1. Presbyopia is the term used to describe the need for reading glasses that depending on glasses prescription (refraction) occurs in 40s

2. In diabetics this can occur earlier.

3. WHY?  Ischemic injury to ciliary muscle



Accommodation for a near target
Far blurred
Near in focus

Accommodation for a far target
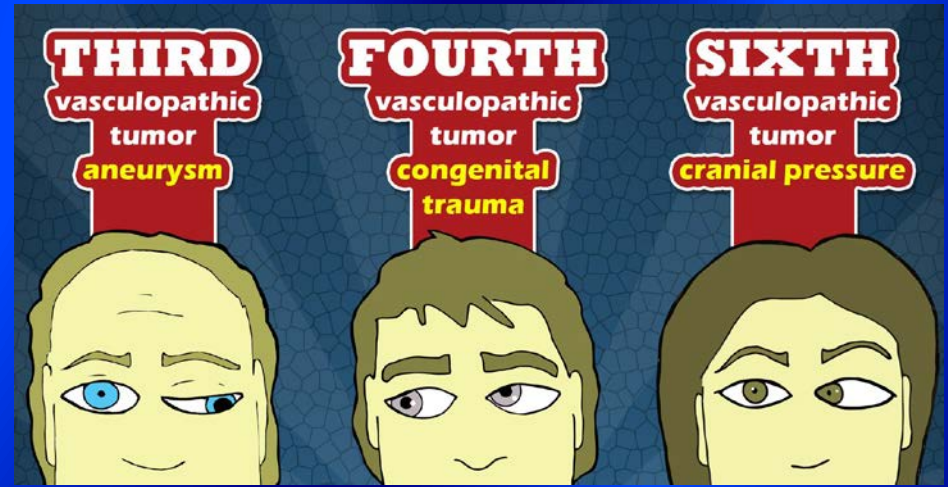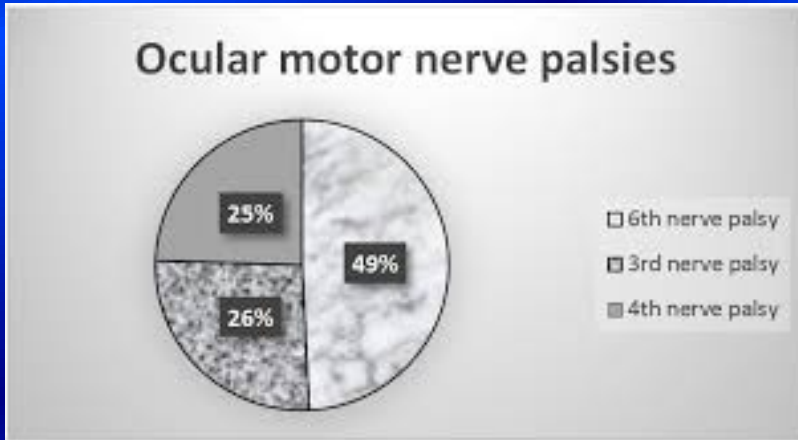Near blurred
Far in focus

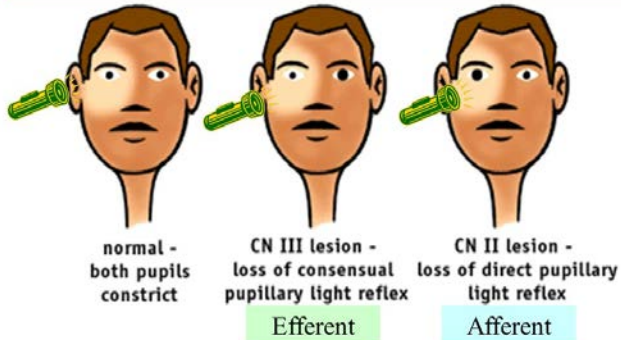# Diabetic Eye Disease: Double vision & droopy lids

1. Diabetic patients can experience double vision (diplopia) and a droopy lid (ptosis)
2. WHY = CN 3 palsy
   1. Diabetic related = usually sparing the pupil
   2. Aneurysm related = usually pupil involved

# Diabetic Eye Disease: Double vision & droopy lids



Ocular motor nerve palsies

- 6th nerve palsy — 25%
- 3rd nerve palsy — 49%
- 4th nerve palsy — 26%



**THIRD** vasculopathic tumor aneurysm

**FOURTH** vasculopathic tumor congenital trauma

**SIXTH** vasculopathic tumor cranial pressure



Pupillary Reflex

normal - both pupils constrict

CN III lesion - loss of consensual pupillary light reflex — Efferent

CN II lesion - loss of direct pupillary light reflex — Afferent

Consensual reflex: Both pupils should constrict at the same time [13]

# Diabetic Eye Disease: Orbital Mucormycosis
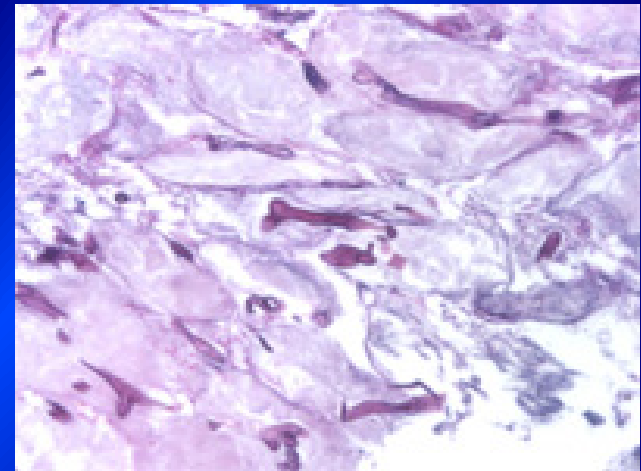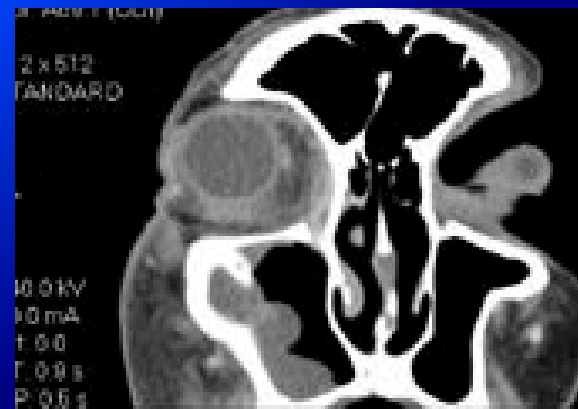
# Diabetic Eye Disease: Orbital Mucormycosis

1. Diabetic patients, especially those in DKA can experience a severe form of orbital fungal infection

    1. Ocular Symptoms:

        Ophthalmoplegia (poor or no eye movements), Proptosis, Visual Loss, Chemosis (swollen conjunctiva), Lid gangrene

    2. Non-ocular symptoms:

        1. Sinusitis, nasal discharge/ulceration, palatal necrosis

    3. Neuro symptoms:

        1. Cerebral lobe signs, hemiparsis

2. Emergent Systemic antifungals +/- surgery +/- are only chance for survival

# Diabetic Statistics

**Prevalence rate**:  10.5% or **34.3 million**

26.9 million diagnosed  (7.3 million undiagnosed)
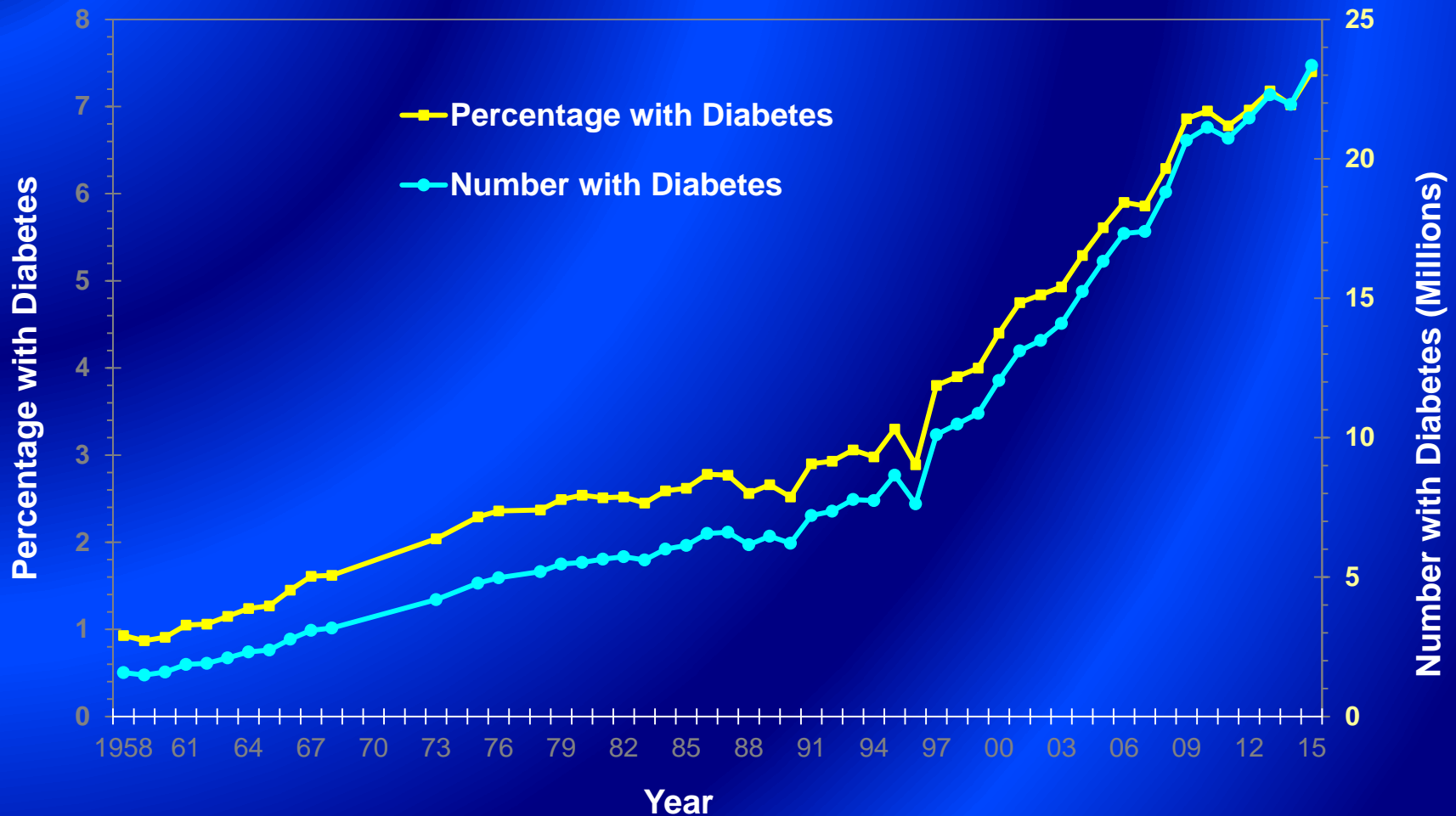
18-44    2.6%

45-64    12.9%

65-74    25.2%

75+       21.1%

**Incidence rate:** 0.7% or 1.5 million DX/yr

(6.5% of the prevalence rate)

**2030 the estimate is over 50 million diabetics in US**

# Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958-2015

## TYPES OF DIABETES

### TYPE 1

**BODY DOESN'T MAKE ENOUGH INSULIN**
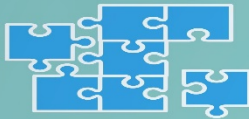- Can develop at any age
- No known way to prevent it

**Nearly 18,000 youth diagnosed** each year in 2011 and 2012

In adults, type 1 diabetes accounts for approximately

# 5%

**of all diagnosed cases of diabetes**

### TYPE 2

**BODY CAN'T USE INSULIN PROPERLY**
- Can develop at any age
- Most cases can be prevented

In adults, type 2 diabetes accounts for approximately

# 95%

**of all diagnosed cases of diabetes**

**More than 5,000 youth diagnosed** each year in 2011 and 2012

# 1.5
## MILLION

**People 18 years and older diagnosed in 2015**

## RISK FACTORS FOR TYPE 2 DIABETES:

**BEING OVERWEIGHT**

**HAVING A FAMILY HISTORY**

**BEING PHYSICALLY INACTIVE**

**BEING 45 AND OLDER**

# WHAT CAN YOU DO?

## You can **prevent** or **delay** type 2 diabetes

**LOSE WEIGHT** IF NEEDED

**EAT HEALTHY**

**BE MORE ACTIVE**

LEARN MORE AT
**www.cdc.gov/diabetes/prevention**
OR SPEAK TO YOUR DOCTOR

## You can **manage** diabetes

**WORK WITH A HEALTH PROFESSIONAL**

**EAT HEALTHY**

**STAY ACTIVE**

LEARN MORE AT
**www.cdc.gov/diabetes/ndep**
OR SPEAK TO YOUR DOCTOR
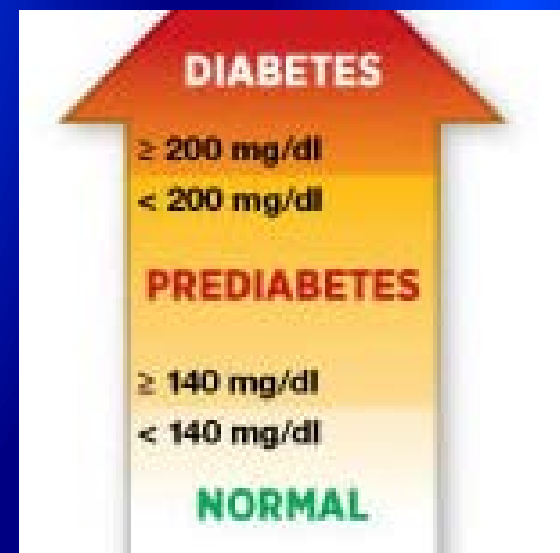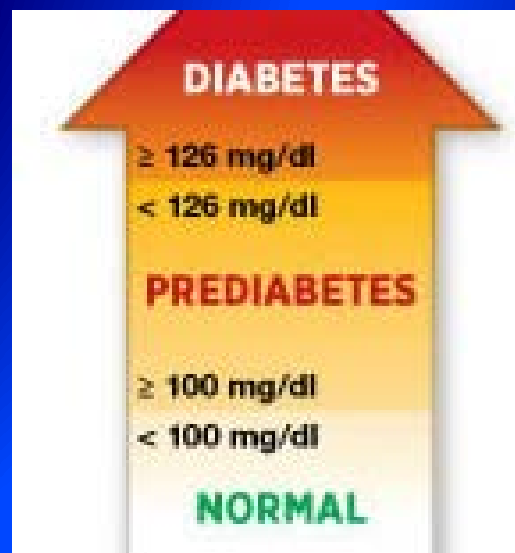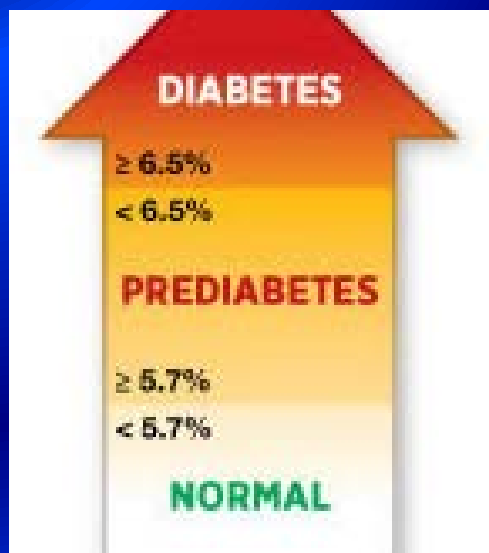
Prediabetic/Borderline Diabetic
34.9% of adults 18+
48.3% of adults 65+

# The Diabetic Statistics of Texas
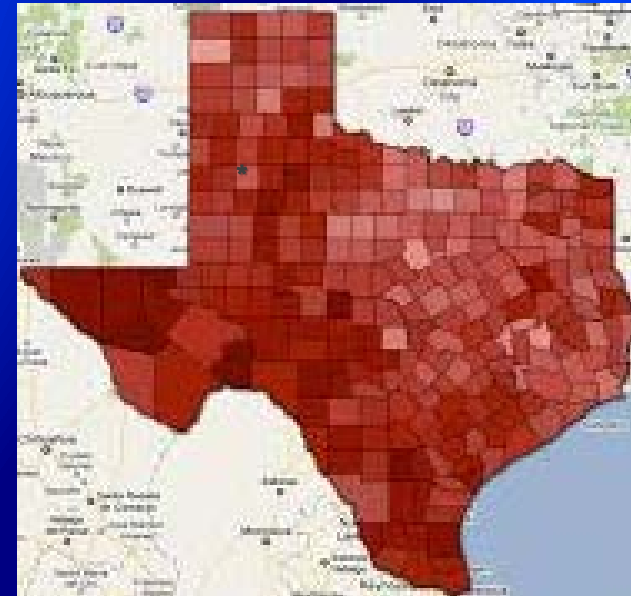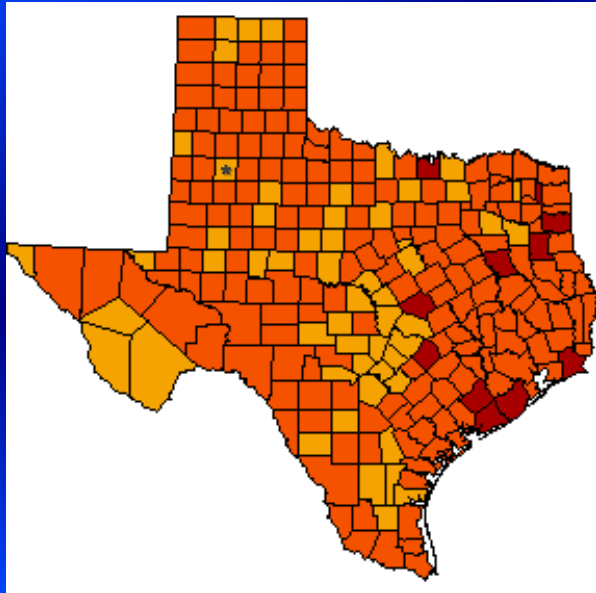


Texas **11.2%**
Lubbock  8.9%

# Age-adjusted Prevalence of Obesity and Diagnosed Diabetes Among US Adults

**Obesity (BMI ≥30 kg/m²)**

**2015**
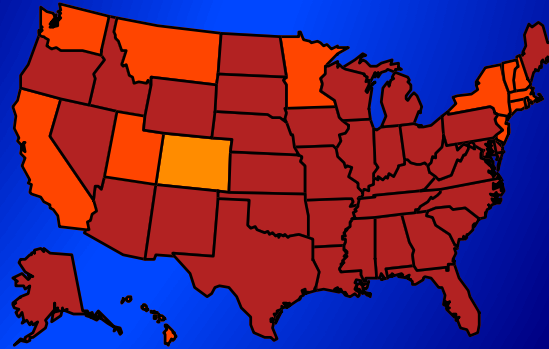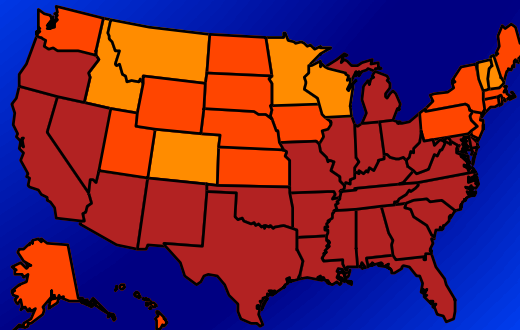
Legend: No Data | <14.0% | 14.0%–17.9% | 18.0%–21.9% | 22.0%–25.9% | ≥ 26.0%

**Diabetes**

**2015**

Legend: No Data | <4.5% | 4.5%–5.9% | 6.0%–7.4% | 7.5%–8.9% | ≥9.0%

# Prevalence¶ of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2015
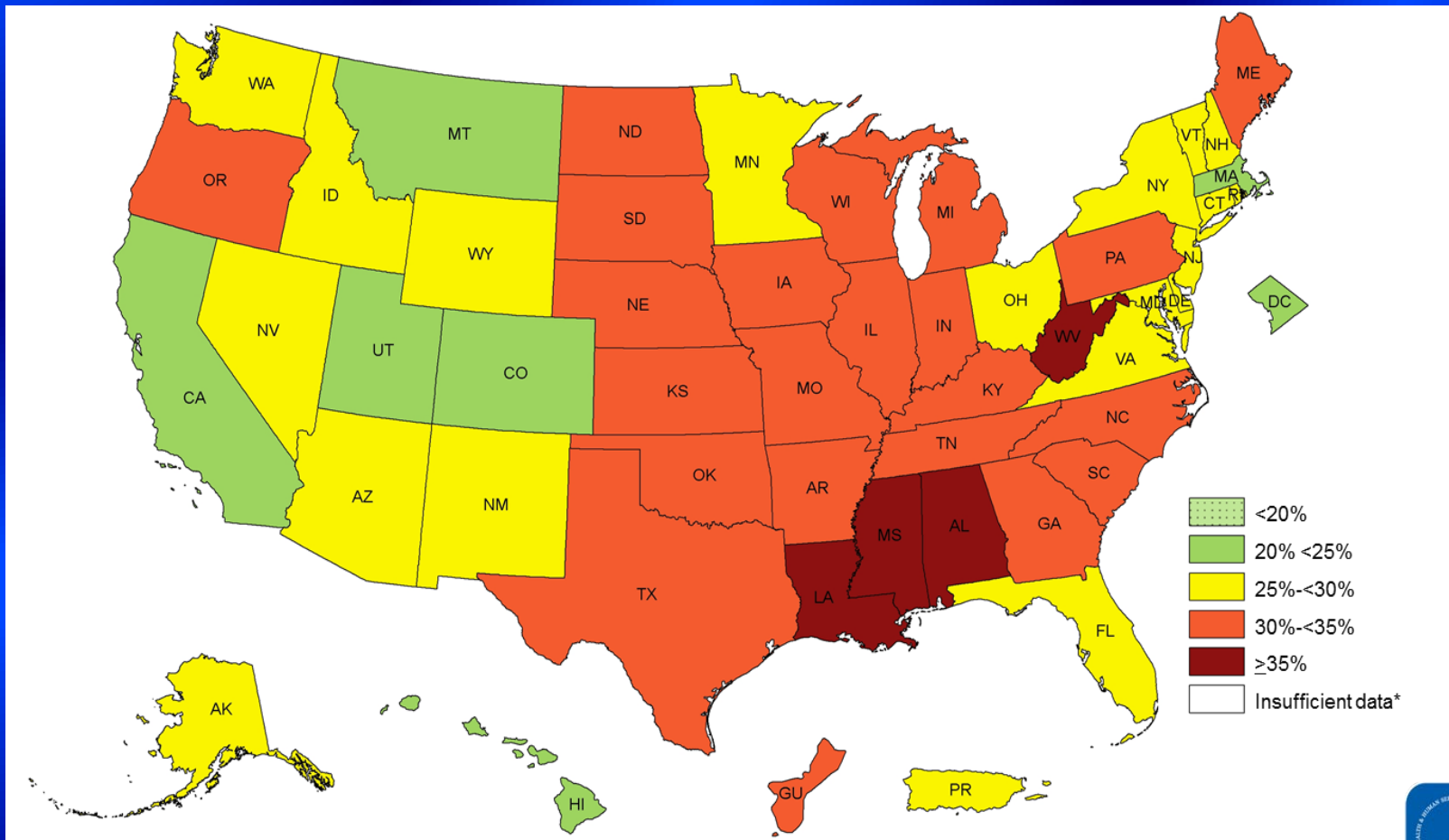


Legend:
- <20%
- 20% <25%
- 25%-<30%
- 30%-<35%
- ≥35%
- Insufficient data*

*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.

# Prevalence¶ of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2016

¶ Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.



*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.

# Prevalence¶ of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2017

¶ Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.



*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.

# Prevalence¶ of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2018

¶ Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011.



Legend:
- <20%
- 20%–<25%
- 25%–<30%
- 30%–<35%
- ≥35%
- Insufficient data*
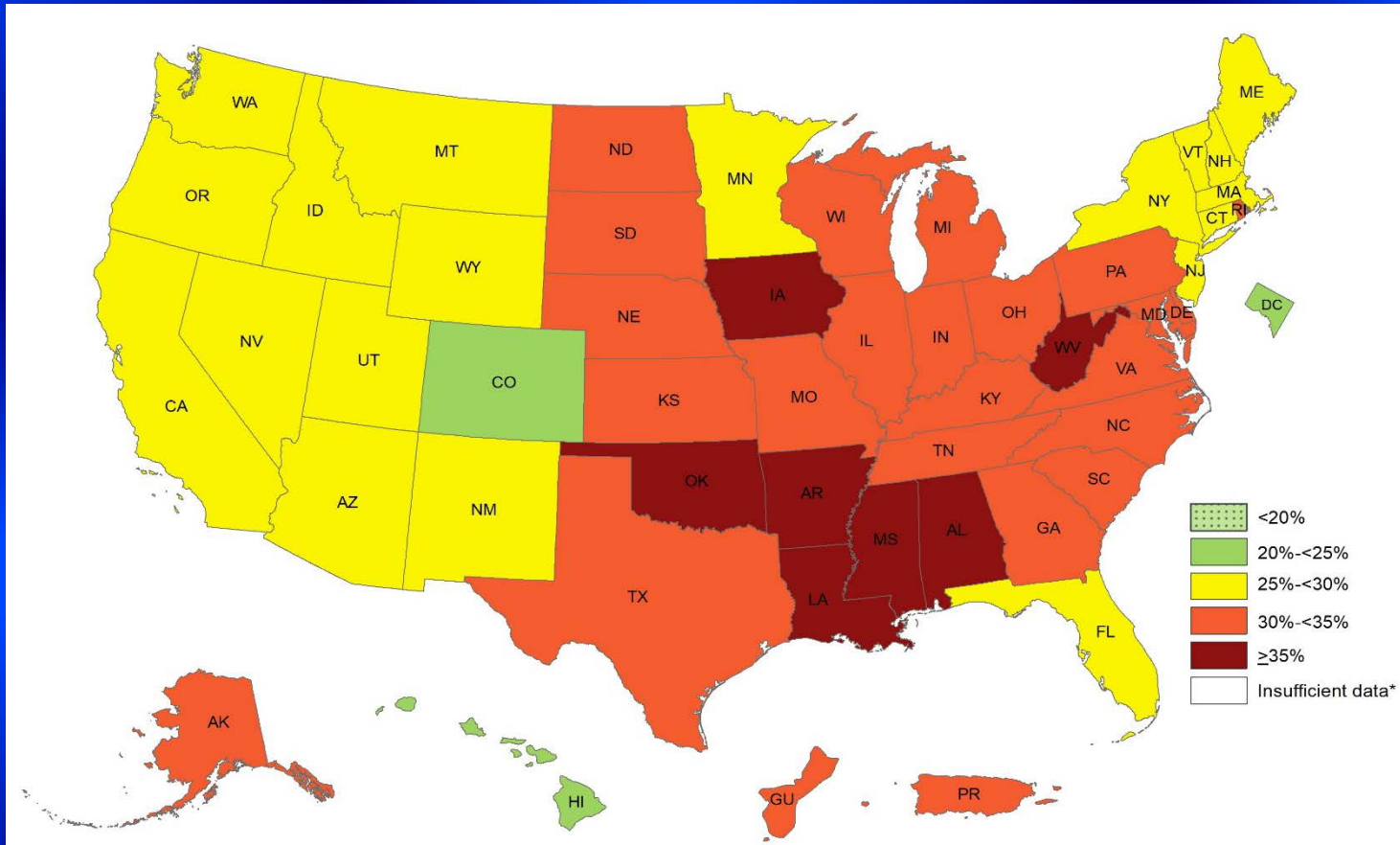
*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.

# Where Diabetes is Most Prevalent in the U.S.

Percent of adults who have ever been told by a doctor that they have diabetes (2017*)



**Legend:**
- >12 percent
- 11.0-11.9 percent
- 10.0-10.9 percent
- 9.0-9.9 percent
- <9 percent

Map labels:
- 15.2 WV
- 13.1 TN
- 13.4 SC
- 14.1
- 14.2 MS / AL
- LA 13.6
- AL (inset)
- HI (inset)
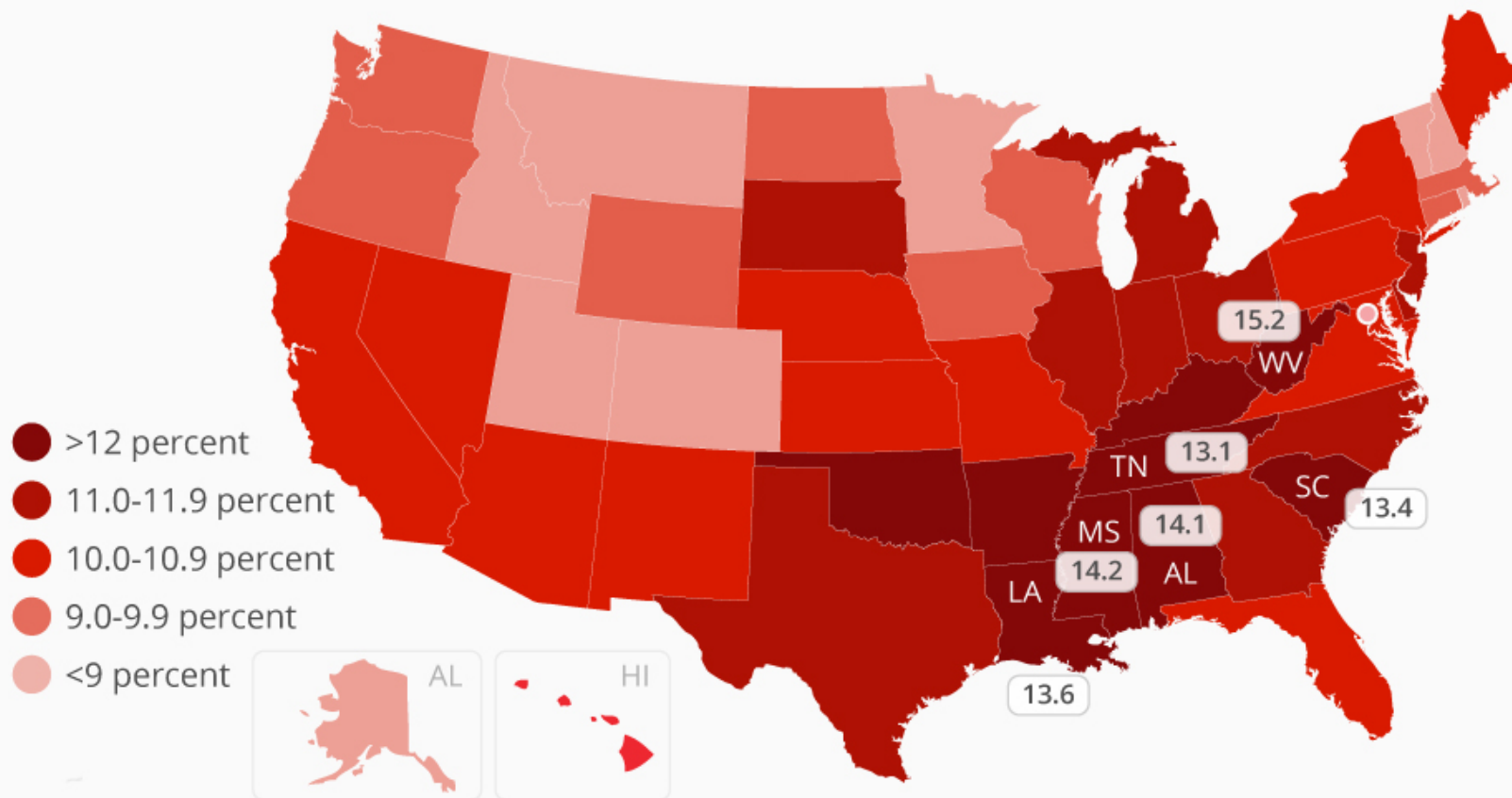
Includes pregnancy-related diabetes, percentages are weighted to reflect population characteristics (e.g. average age)
* latest on record

Sources: Kaiser Family Foundation, CDC

statista

## BMI Chart

**Weight in Pounds**

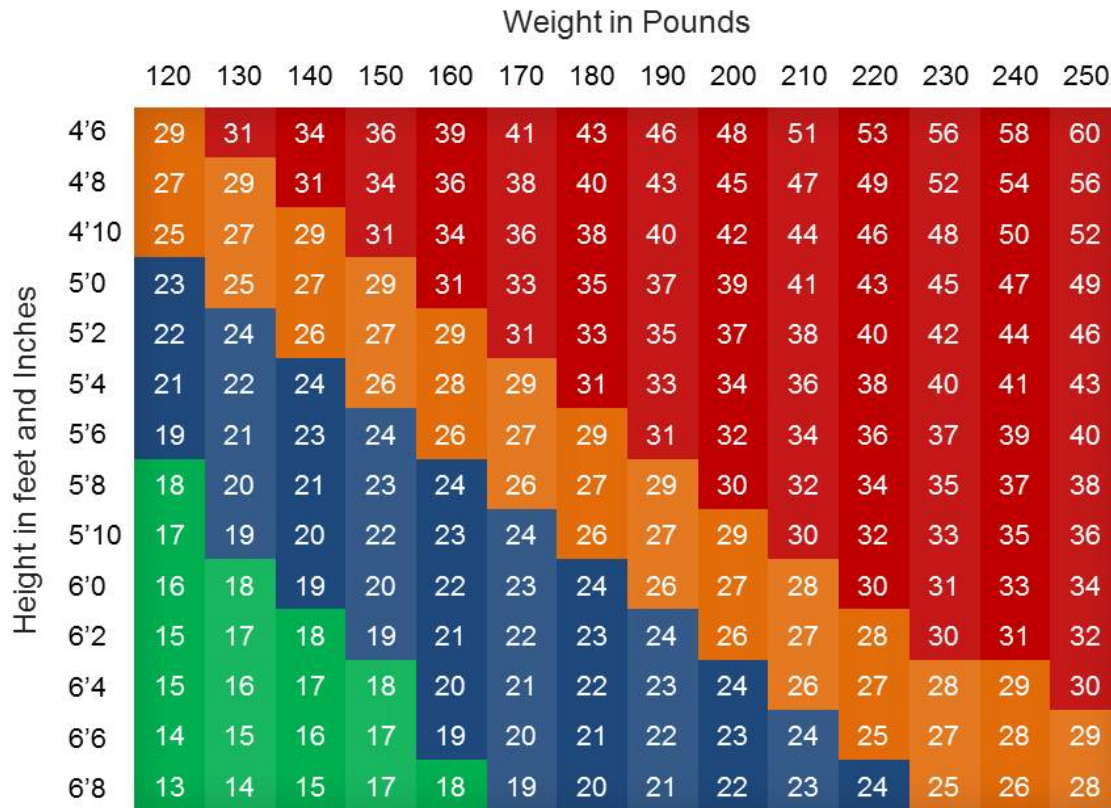| Height | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4'6 | 29 | 31 | 34 | 36 | 39 | 41 | 43 | 46 | 48 | 51 | 53 | 56 | 58 | 60 |
| 4'8 | 27 | 29 | 31 | 34 | 36 | 38 | 40 | 43 | 45 | 47 | 49 | 52 | 54 | 56 |
| 4'10 | 25 | 27 | 29 | 31 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 |
| 5'0 | 23 | 25 | 27 | 29 | 31 | 33 | 35 | 37 | 39 | 41 | 43 | 45 | 47 | 49 |
| 5'2 | 22 | 24 | 26 | 27 | 29 | 31 | 33 | 35 | 37 | 38 | 40 | 42 | 44 | 46 |
| 5'4 | 21 | 22 | 24 | 26 | 28 | 29 | 31 | 33 | 34 | 36 | 38 | 40 | 41 | 43 |
| 5'6 | 19 | 21 | 23 | 24 | 26 | 27 | 29 | 31 | 32 | 34 | 36 | 37 | 39 | 40 |
| 5'8 | 18 | 20 | 21 | 23 | 24 | 26 | 27 | 29 | 30 | 32 | 34 | 35 | 37 | 38 |
| 5'10 | 17 | 19 | 20 | 22 | 23 | 24 | 26 | 27 | 29 | 30 | 32 | 33 | 35 | 36 |
| 6'0 | 16 | 18 | 19 | 20 | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 33 | 34 |
| 6'2 | 15 | 17 | 18 | 19 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 32 |
| 6'4 | 15 | 16 | 17 | 18 | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 29 | 30 |
| 6'6 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 27 | 28 | 29 |
| 6'8 | 13 | 14 | 15 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 28 |

Height in feet and Inches

Legend:
- Obese
- Overweight
- Healthy Weight
- Underweight

This is a sample text. Insert your desired text here.

Source: US Surgeon General – Chart is for Adults (aged 20 years and older)

**Imperial English BMI Formula**

$$\text{weight (lbs)} \times 703 \div \text{height (in}^2)$$

**Metric BMI Formula**

$$\text{weight (kg)} / \text{height (m}^2)$$

# Risk Factors for Complications

1.  **Smoking**
    16% // 35%        (active//former)

2.  **Overweight**
    87.5%                (BMI > 25)

3.  **Physical Inactivity**
    40.8%                (self-reported)

4.  **High Blood Pressure**
    74%                (SBP>140 //DPB > 90)

5.  **High Cholesterol**
    58% // 67%        (-CVD + statin // +CVD +statin)

6.  **High Blood Glucose**
    16%                (A1c >9%)

# Diabetic Disease Load

1. **Death rate:**

   #7  (2x non-DM)

2. **Morbidities:**

   Heart Disease (2x)

   Stroke (2x)

   Kidney Failure  (HTN and DM)

   Extremity numbness and amputations

   Sexual Dysfunction

   Pregnancy Challenges

   **Vision loss/blindness** (#1 in adults 20-70ys)

# Diabetic Retinopathy (DR) Statistics

Overall DR Prevalence 30%

30% are undiagnosed

5% have vision-threatening DR (VTDR)

Less than 60% of patients
get yearly eye exams

# Natural History of DR

**Good data from clinical research**

Natural Course

DR moves orderly from mild to severe stages

Treatment Options and Outcomes

80% effective at preventing severe vision loss

Less predictable at restoring vision after vision  loss has occurred

# Natural History I

1. Impact of Type of DM and Duration
2. Type 1

    < 5 yrs:  Basically no disease

    > 5 yrs:  25%  have DR

    >10 yrs: 60% have DR

    >15 yrs: 80% have DR

    >20 yrs: 95% have DR and 50% have VTDR

# Natural History II

1. Impact of Type 2 DM and Duration
2. Type 2

    < 5 years

        20% have DR at diagnosis (-insulin)

        40% have DR at diagnosis (+insulin)

        2% have VTDR at diagnosis

    > 20 years

        60% any DR,

        30% VTDR

# DR Care Process:  Evaluation

Recommended Eye Exam for DR

Type I DM
     Initial Exam          5 years after Diagnosis
     Follow-up           Yearly with no DR
                               Sooner based on DR severity

Type 2 DM
     Initial Exam          At Diagnosis
     Follow-up           Yearly
                               Sooner Based on DR severity

Pregnancy
     Initial Exam          1st trimester
     Follow-up           No DR at end of pregnancy
                               + DR Q3 months or sooner

# DR Severity Scale I

No DR = no abnormalities seen

Mild NonProliferative NPDR = microaneurysms (MAs)

Moderate NPDR = > MAs but < Severe NPDR

Severe NPDR = "4-2-1 Rule" & no proliferative Δs

        4 quadrants of severe hemorrhages

        2 quadrants of venous beading

        1 quadrants of IRMA

          IntraRetinal Microvascular Abnormality

# DR Severity Scale II  VTDR

**Proliferative Diabetic Retinopathy PDR**

    one or both:

        Neovascularization

        Vitreous/preretinal Bleeding

**Diabetic macular Edema DME**

    absent

    present

        mild = distant from center macula

        moderate = closer to center macula

        severe = involving center of macula

**DR related tractional Retinal Detachment TRD**

# Retinopathy Exam

Direct ophthalmoscopy (-/+ dilation)

"a long run for a short slide"

(blasphemy for a retina surgeon)

 +  ≠ 
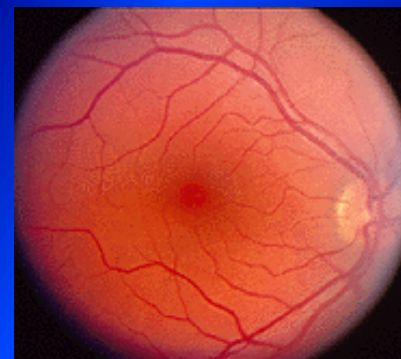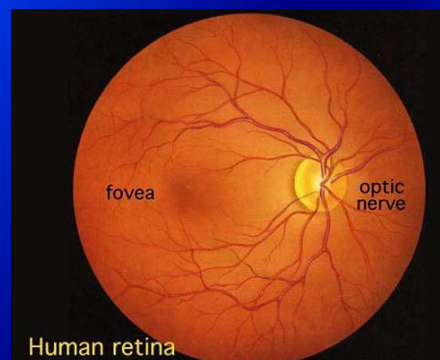
**Important exceptions:**

**Pediatric Red Reflex**



**Optic Nerve Evaluation**
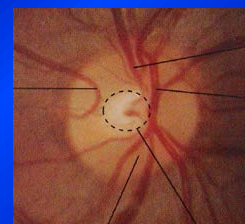
# Mild Non Proliferative Diabetic Retinopathy (NPDR)

# Moderate Non Proliferative Diabetic Retinopathy NPDR

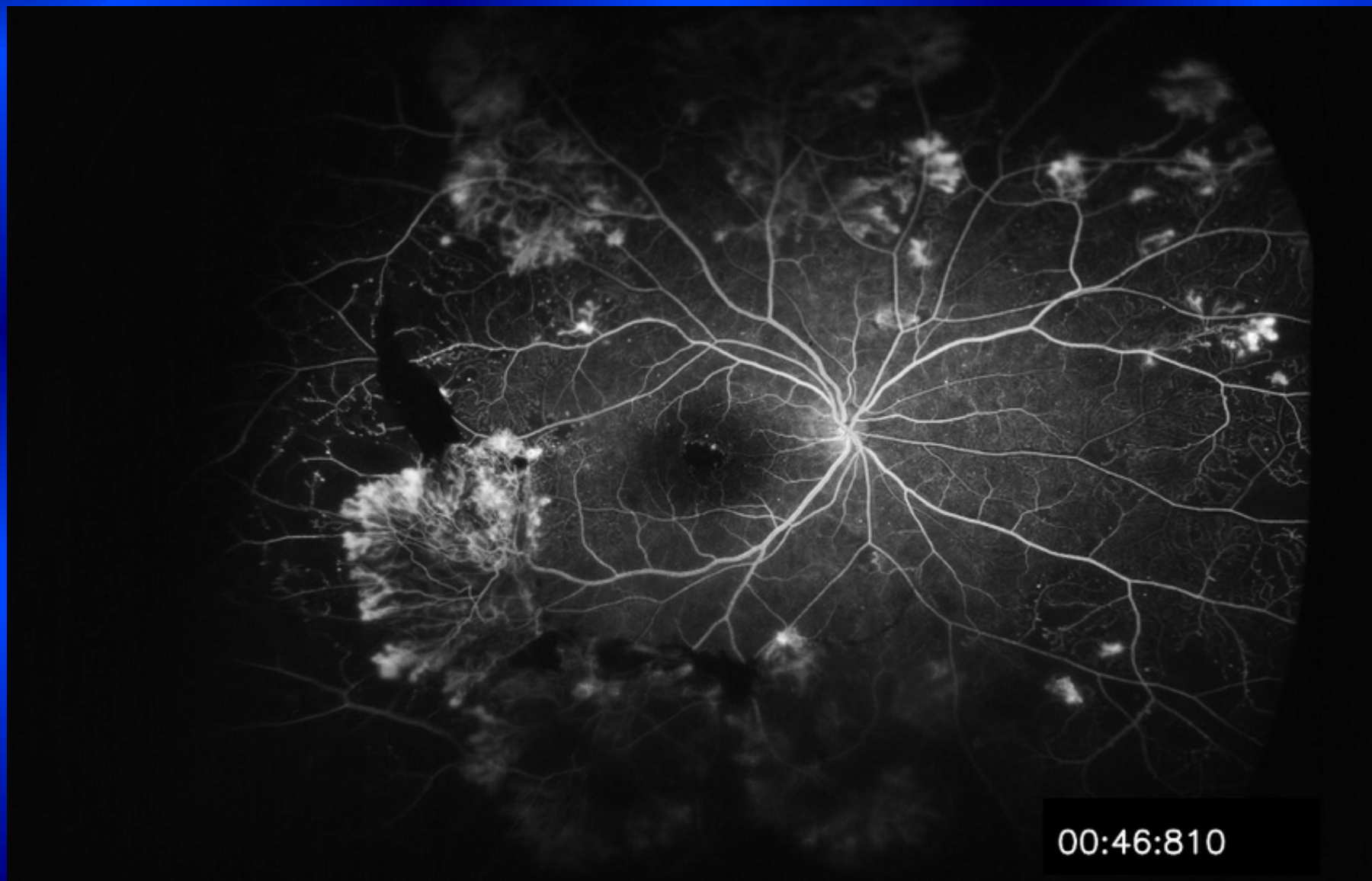# Severe Non Proliferative Diabetic Retinopathy  NPDR

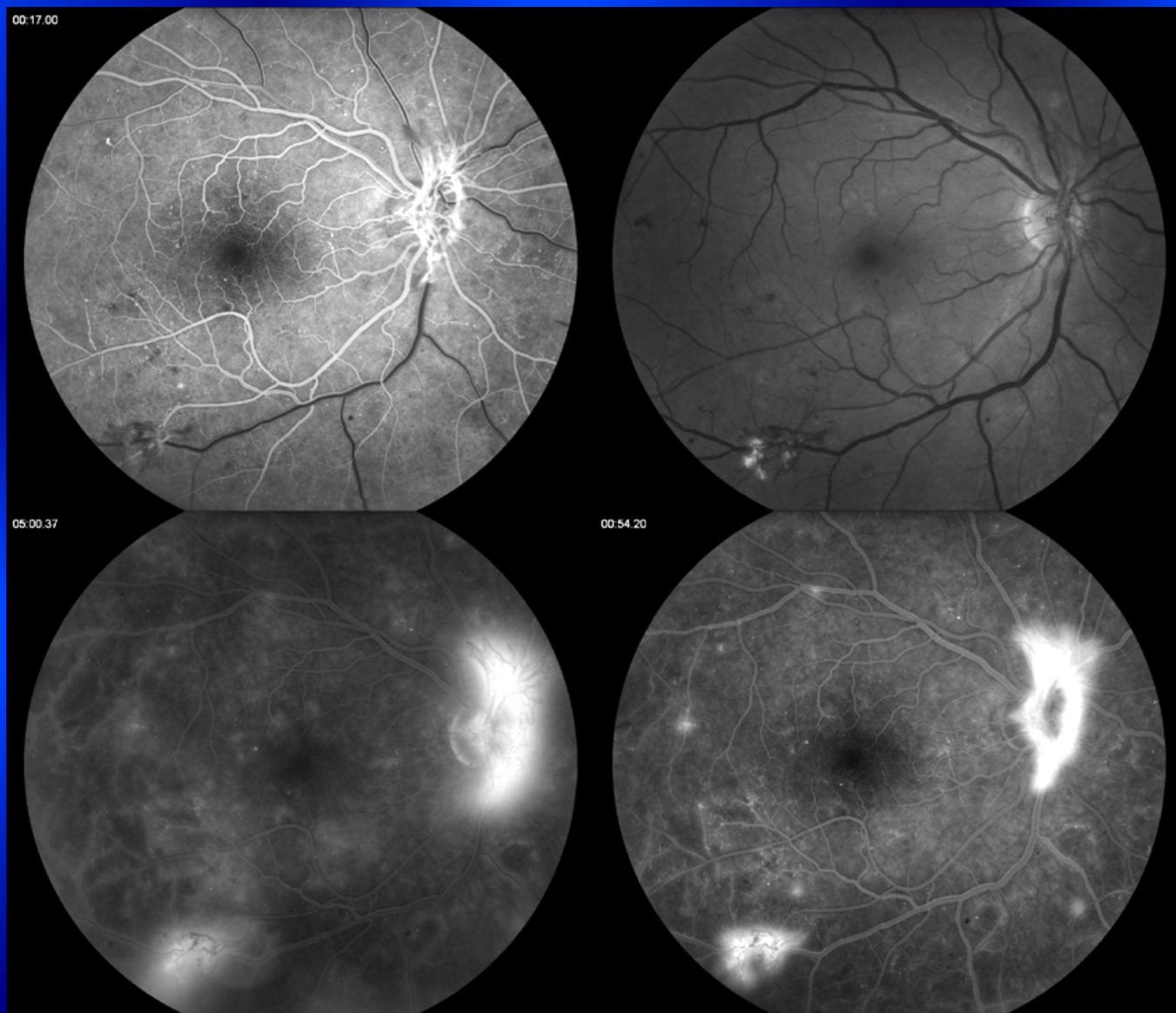# Proliferative Diabetic Retinopathy (PDR)
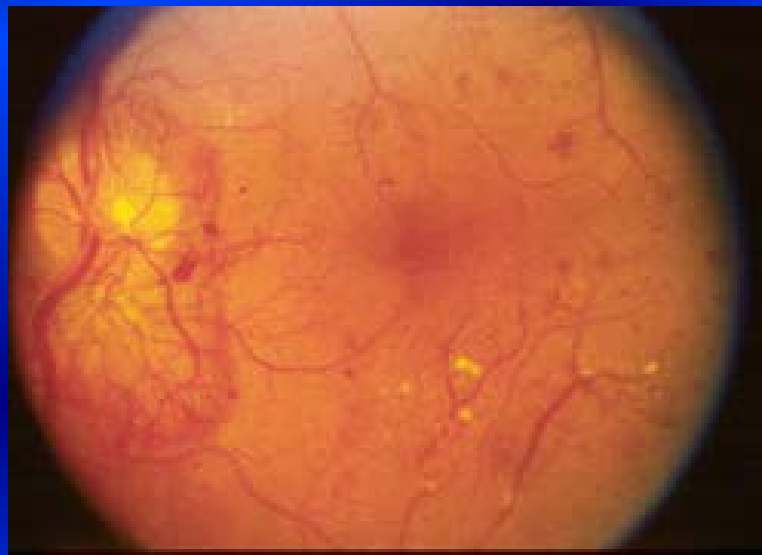
# Proliferative Diabetic Retinopathy (PDR)
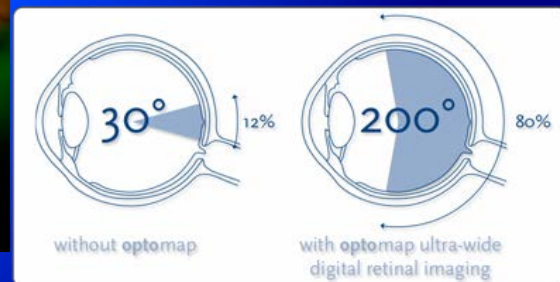
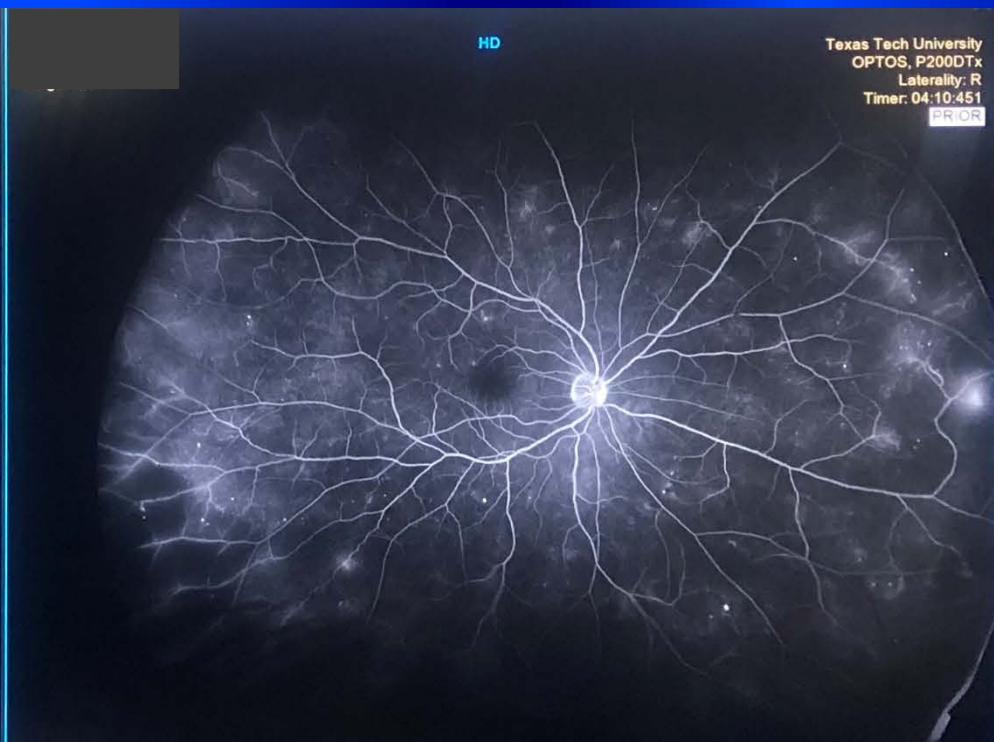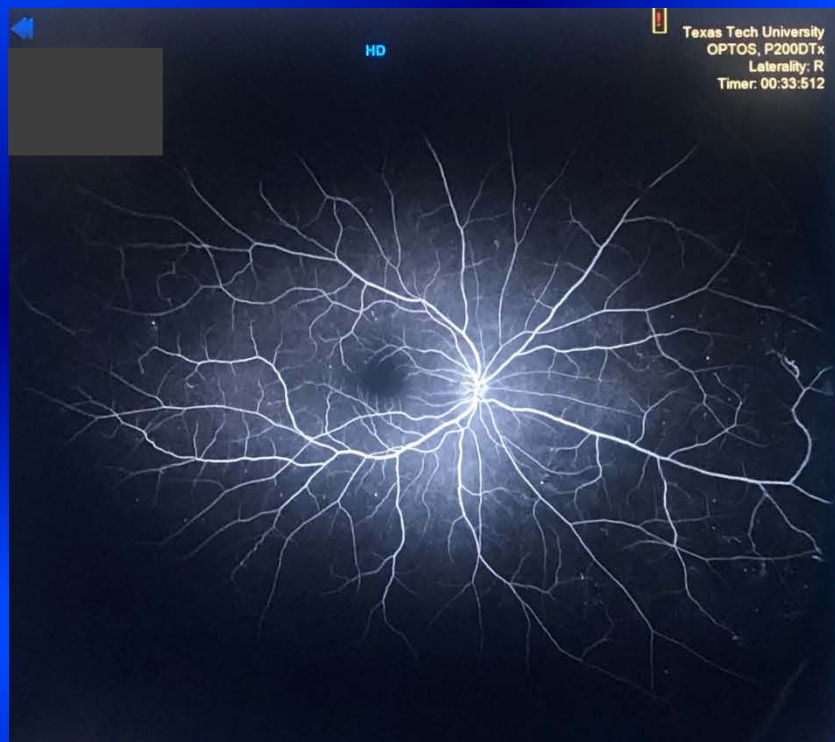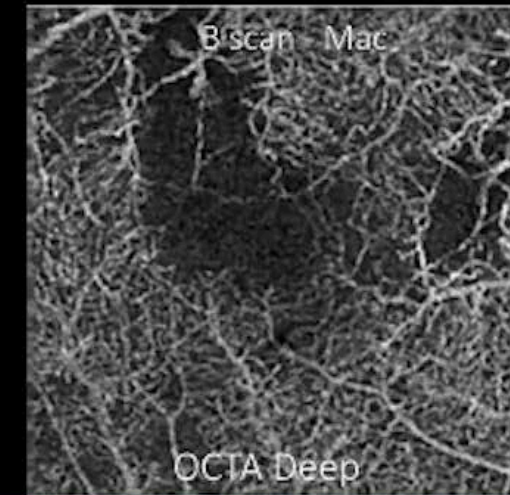# Proliferative Diabetic Retinopathy (PDR)
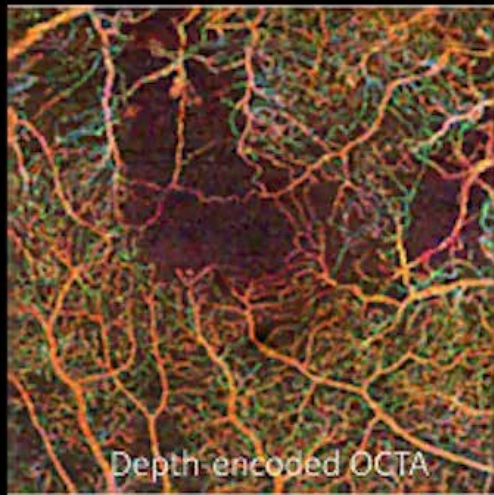


00:46:810

# Proliferative Diabetic Retinopathy

# Proliferative Diabetic Retinopathy

# Proliferative Diabetic Retinopathy



OCTA of Diabetic Retinopathy: Impaired Perfusion
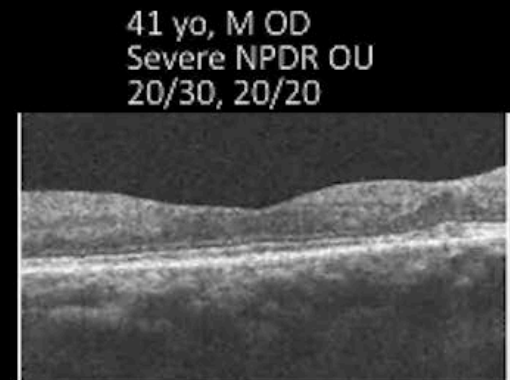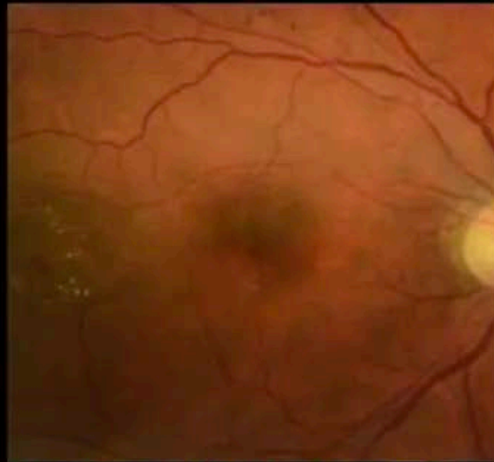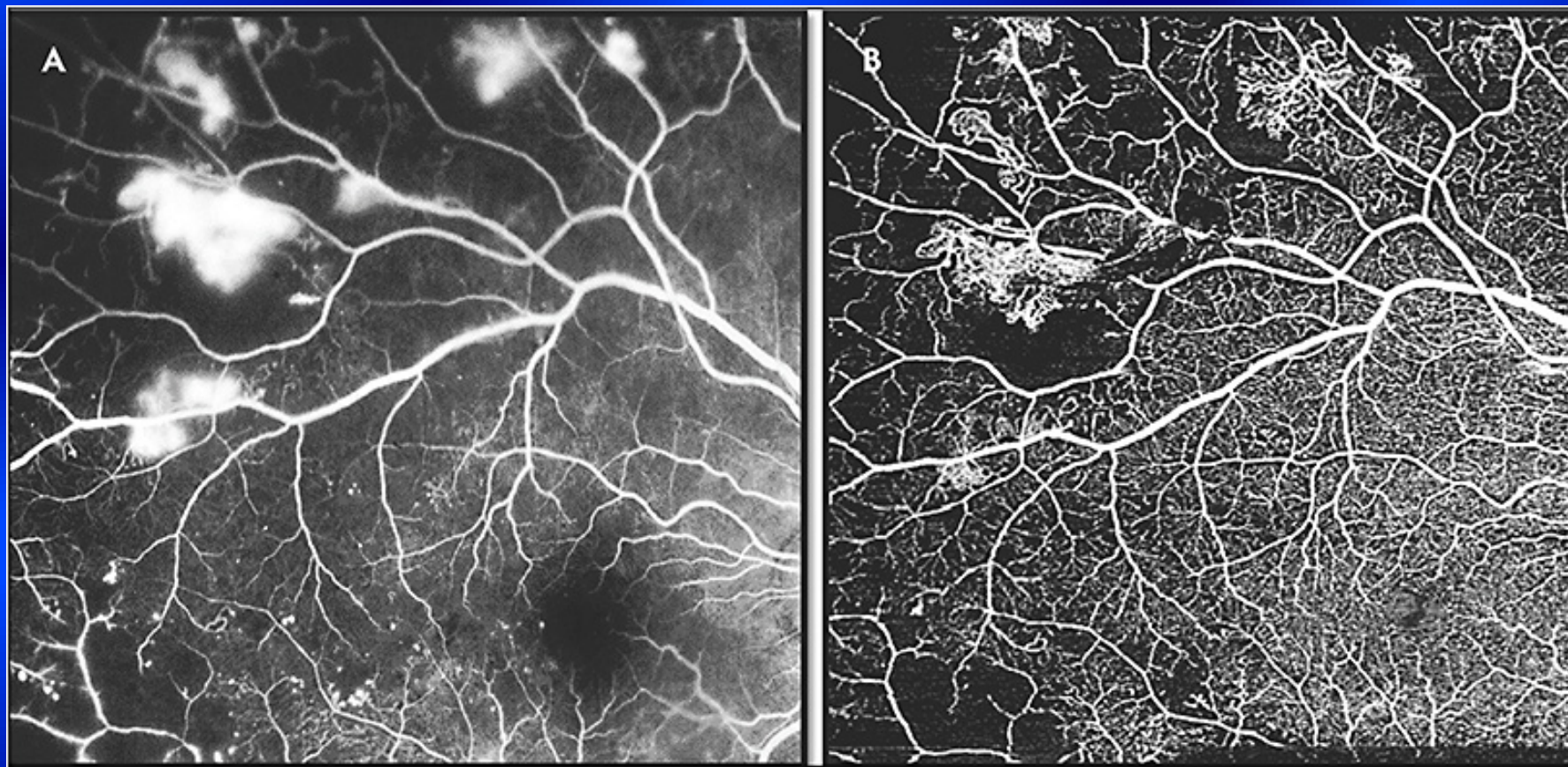
# Proliferative Diabetic Retinopathy

# Proliferative Diabetic Retinopathy
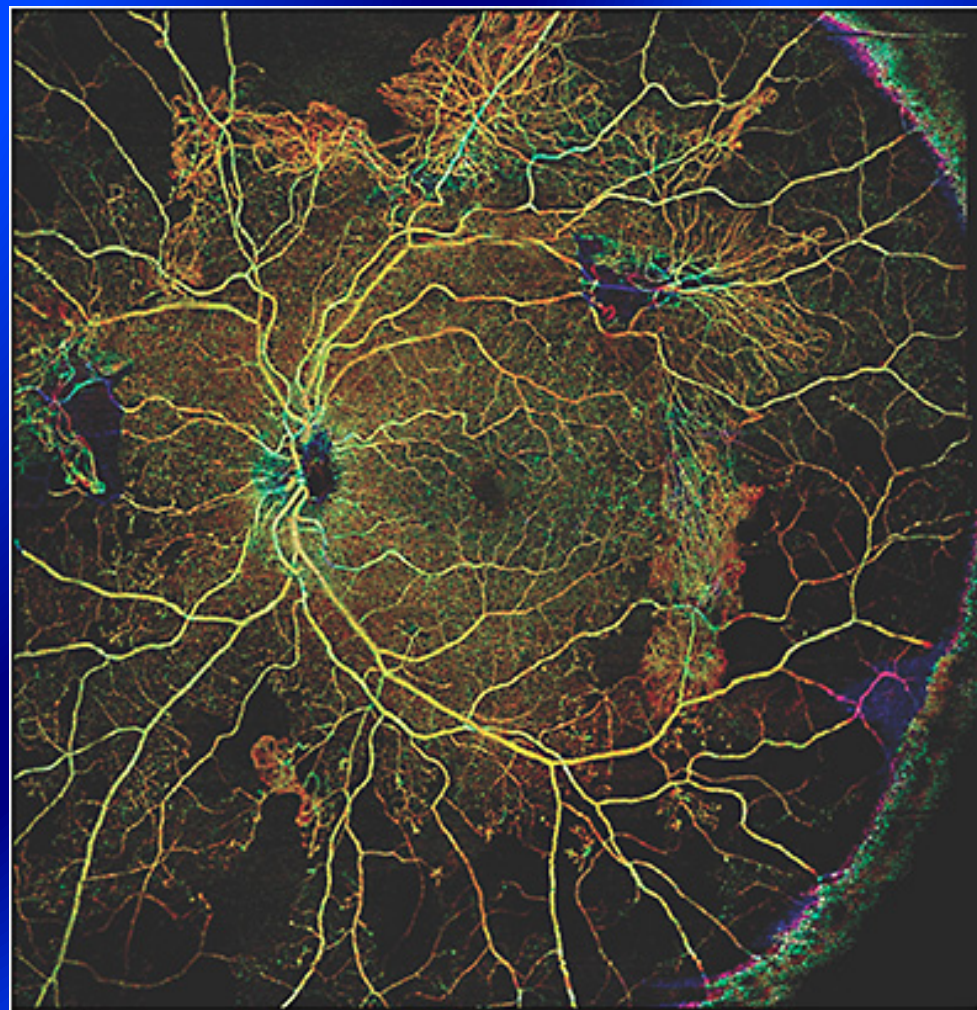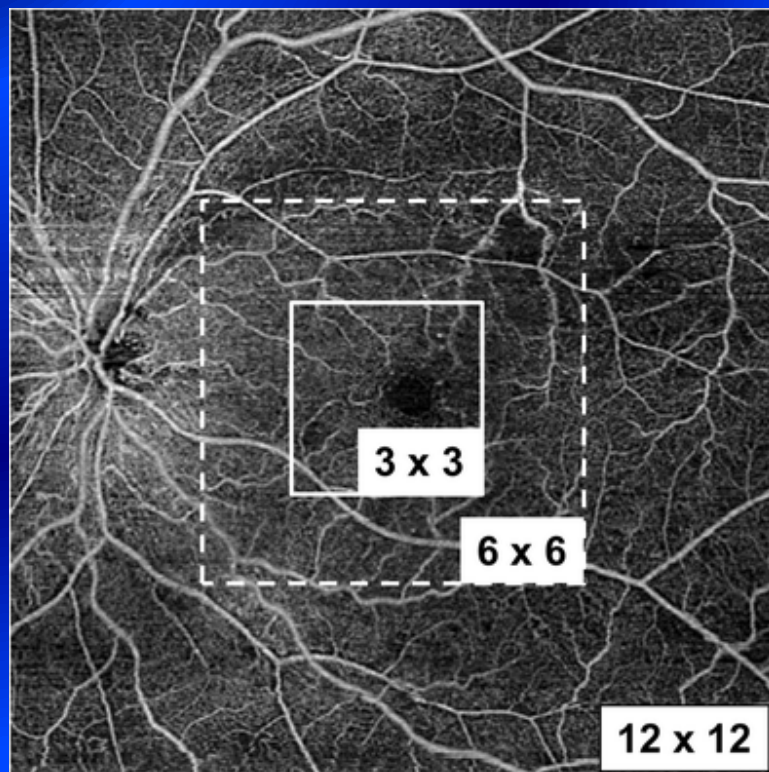
# Diabetic Macular Edema



Optical Coherence Tomography

Extensive intraretinal fluid with retinal schisis

Posterior hyaloid detachment

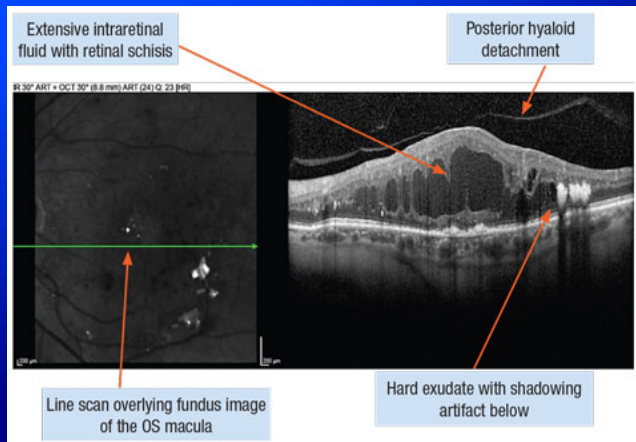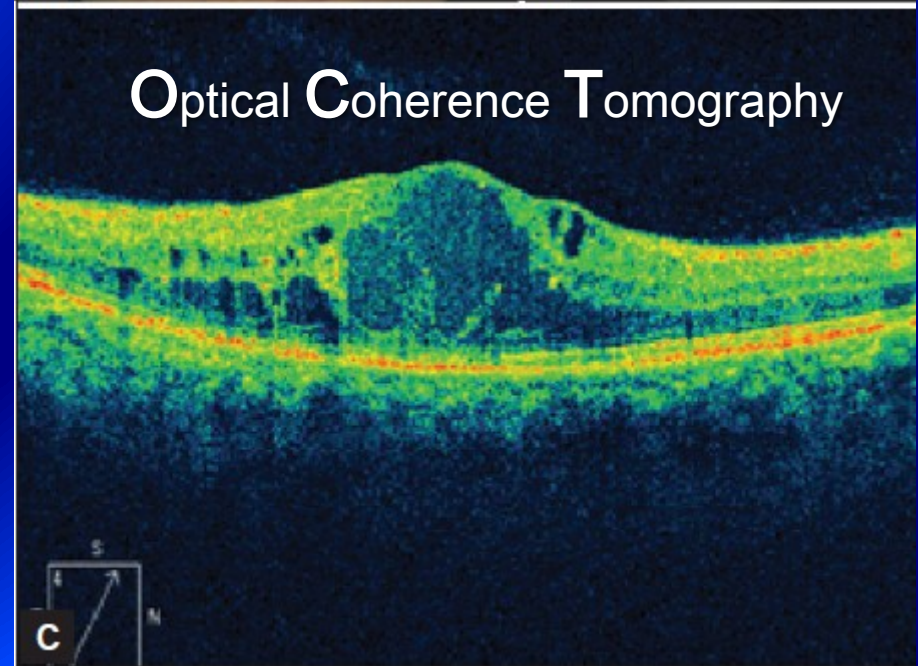Line scan overlying fundus image of the OS macula

Hard exudate with shadowing artifact below
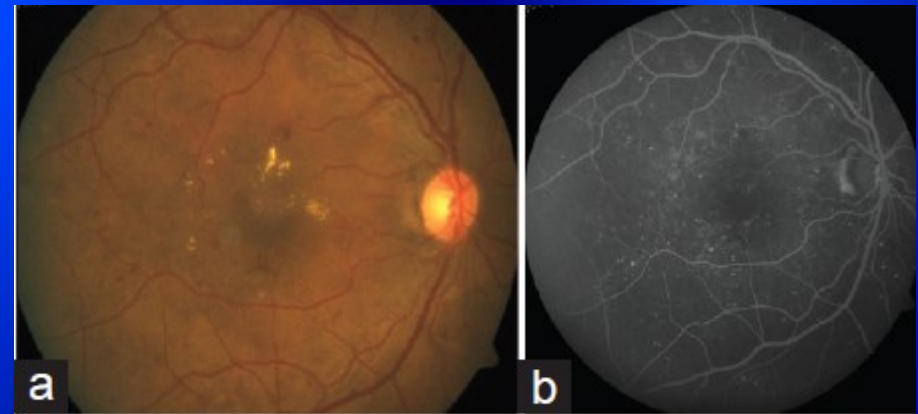
# Proliferative Diabetic Retinopathy
## PDR with traction retinal detachment TRD
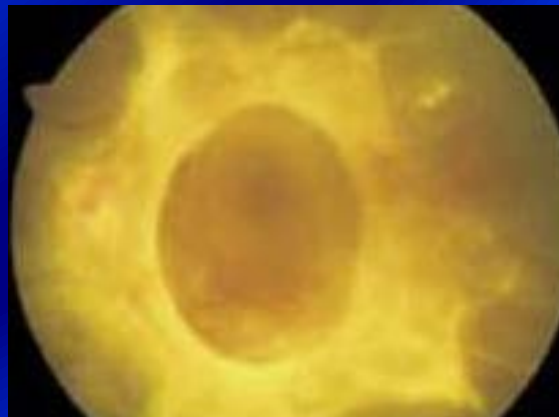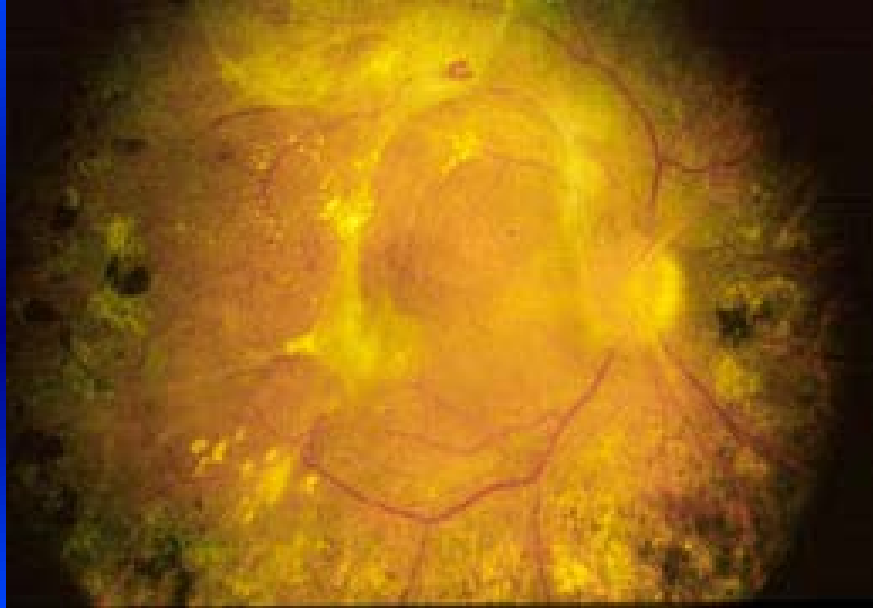
# DR Care Process:  Systemic Risks

Blood Sugar

Blood sugar Levels:

**Blood sugar by the numbers**

**Fasting blood glucose**

| | | |
|---|---|---|
| ▶ Normal | less than 100 mg/dL |
| ▶ High risk | 100–125 mg/dL |
| ▶ Diabetes | 126 mg/dL or higher |

**Hemoglobin A1c**

| | | |
|---|---|---|
| ▶ Normal | less than 5.7% |
| ▶ High risk | 5.7–6.4% |
| ▶ Diabetes | 6.5% or higher |

A1-C levels:  measures glycosylated protein n RBCs        which gives a 2-3 month average of BS

28.7 X A1C – 46.7 = eAG (estimated Average Glucose)

**Better control reduces** onset and slows progression of DR  (DCCT):

delayed start of DR by 76%

delayed progression by 54%

delayed nephropathy by 40%

# DR Care Process:  Systemic Risks

Blood Pressure

In Diabetic Patients

American Diabetes Association (ADA)

defines hypertension as SBP ≥140 mmHg and DBP ≥90 mmHg that is confirmed during separate clinic visits

In nondiabetic Patients

Normal: Less than 120/80 mm Hg:

Elevated: Systolic between 120-129 and diastolic less than 80;

Stage 1: Systolic between 130-139 or diastolic between 80-89;

Stage 2: Systolic at least 140 or diastolic at least 90 mm Hg;

Hypertensive crisis:

Systolic over 180 and/or diastolic over120, with patients  needing prompt changes in medication if there are no other indications of problems, or immediate hospitalization if there are signs of damage.

DCCT and UKPDS:

With BP control both DR and related nephropathy are reduced

# DR Care Process: Systemic Risks

Cholesterol targets in Adults with Diabetes

LDL cholesterol <100 mg/dl (2.60 mmol/l)

HDL   cholesterol >40 mg/dl (1.02 mmol/l)

In women, who tend to have higher HDL cholesterol Levels than men, HDL goal 10 mg/dl higher

Triglyceride levels are <150 mg/dl (1.7 mmol/l)

Control of Cholesterol will help reduce both system CVD risks of heart attacks and strokes and also **diabetic edema**

Aspirin

Aspirin does not slow progression of DR

Aspirin (for CVD TX) does not make DR worse

# DR Care Process:  Evaluation

1.  ## Comprehensive Exam
    1.   If IOP is elevated with screening devices
         1.    Goldman if still high
         2.    Gonio Exam
2.  ## Undilated exam not that useful Unless paired with widefield imaging does have a role
         Very Good Screening tool
         Good Treatment Tool
4.  ## OCT (ideally Spectral Domain or Swept Source)
    4.    If Va is 20/20 likely not standard of care/required
    5.    If Va is less than 20/20 (even 20/25) OCT should be done.
5.   ## Angiography (FA and OCTA)
    4.    When is the ideal time to do is the most important question

# DR Care Process:  Evaluation

## Treatment Indications for VTDR

Severe NPDR

Diabetic Macular Edema

PDR

Retina detachment related to DR

Glaucoma related to DR

# DR Care Process:  Treatment

## Treatment options for VTDR

<u>Medical Therapy</u>

Intraocular antiVEGF TX

Intraocular steroid TX

<u>Surgical Therapy</u>

Ocular Laser

Ocular Surgery (Vitrectomy)

# DR Care Process:  Treatment

Treatment options for VTDR
  **Medical > Surgical**
      Diabetic Macular Edema
          Intraocular anti-VEGF TX
          Intraocular steroid TX
  **Surgical mixed in with Medical supported by new studies**
      Severe NPDR
      PDR
      Glaucoma related to PDR
  **Surgical > Medical**
      Retina detachment related to DR
      Glaucoma related to PDR
          Ocular Laser
          Ocular Surgery (Vitrectomy)

# DR Care Process: Treatment
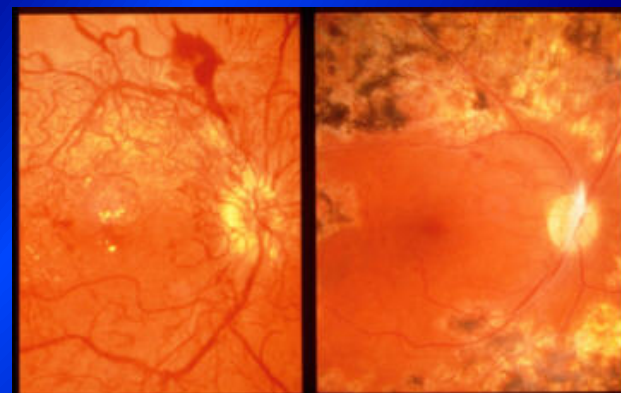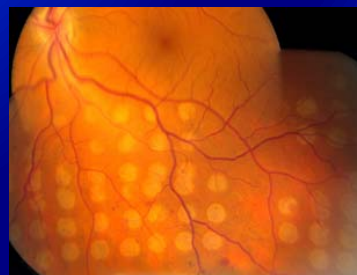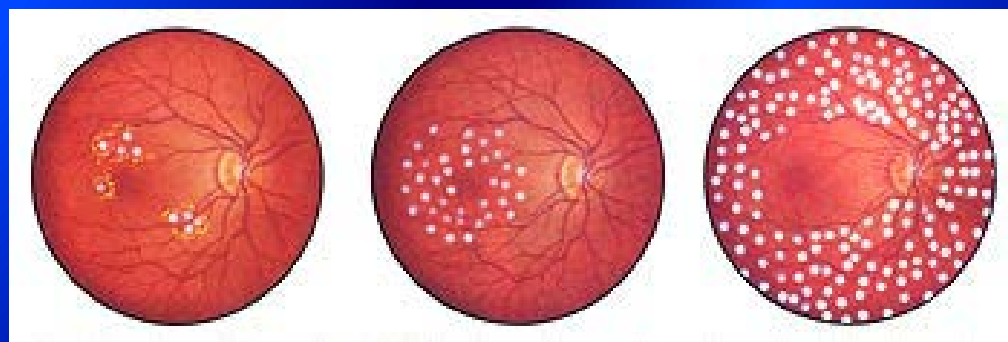
Laser Treatment:

Pan retinal Photocoagulation or focal

Green, Red, Yellow

Single shot

Multiple shot

Computer Guided

# DR Care Process: Treatment

Medical Treatment:

Intravitreal Injections

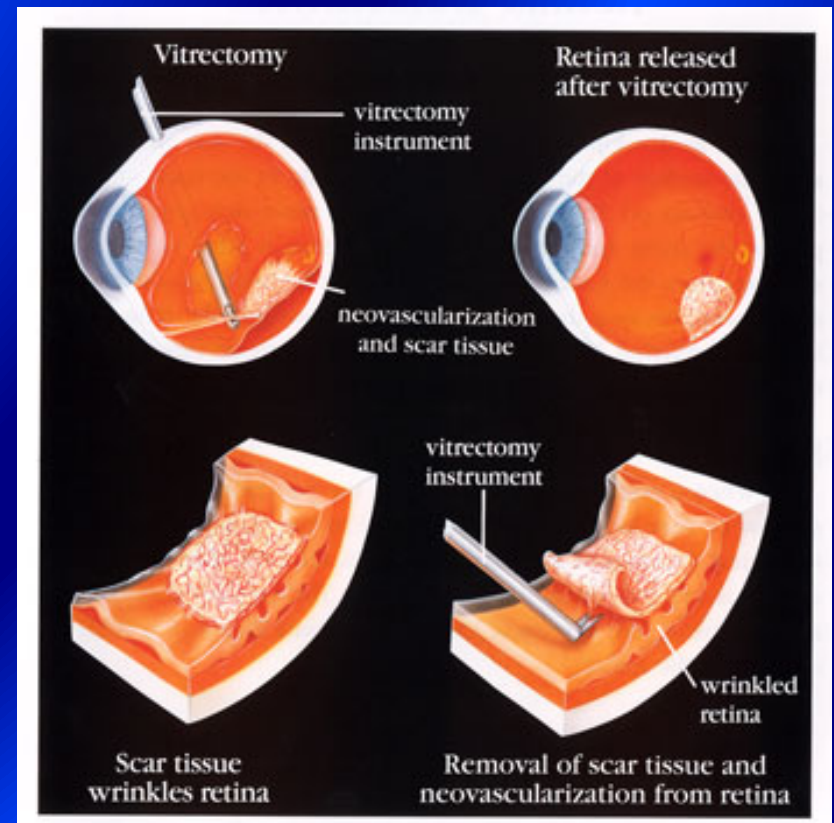AntiVEGFs: Avastin,Lucentis, Eylea

Steroids:

Injection: Preservative free Kenolog

Implants: Dexamethosone, Fluocinolone

# DR Care Process: Treatment

## Vitrectomy 20, 23, 25, 27 Gauges
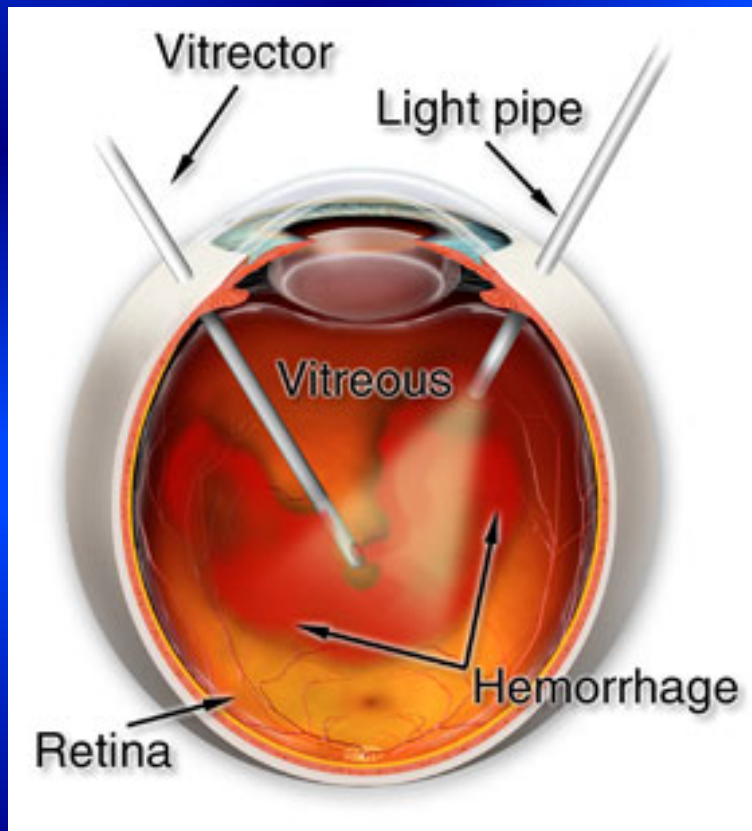
# DR Care Process:  Informed Medical Team

Reinforce with patients our combined efforts & Communicate with each other

Diabetic Control, Hypertension, Weight, Cholesterol

## Determine Severity of Retinopathy

Frequency of follow-up
- Normal or mild = yearly
- Moderate = 6 months
- Severe or advanced = treatment and close follow up

Treatment recommendations
- Minimize retinal edema
- Minimize abnormal new blood vessels
- Minimize Vitreous hemorrhage or tractional retinal detachment

# DR Care Process:  Follow-up

**Normal or mild NPDR no macular edema**
   Yearly follow-up
**Mild NPDR with macular edema**
   4-6 month follow-up
**Moderate NPDR with or without macular edema**
   4-6 month follow-up
**Severe NPDR with or without macular edema**
   2-4 month follow-up without treatment
   Close follow-up during treatment
**Proliferative Retinopathy PDR (+/-Glaucoma or TRD)**
   Close follow-up during treatment
   Close follow-up means 1 month or less

- A 50 year old Hispanic male notes a gradual decrease in vision in both eyes over several months.

- His medical history includes 20 years of DM of which 15 years with insulin for "control" but in all 20 years his blood sugar control has been ok. He remembers an eye exam for glasses about 2 years ago. At this exam: Visual acuity in 20/200 OU both eyes. Blood pressure in 150/95, Recent HbA1C is 9.5, Dilated exam of his left eye shows:

**Q1:**

This fundus picture best represents what type of diabetic retinopathy?

A.  Mild, Non-Proliferative diabetic retinopathy

B.  Moderate, Non-Proliferative diabetic retinopathy

C. Proliferative diabetic retinopathy with presence of extensive neovascularization of the disc

D.  Proliferative diabetic retinopathy with presence of  tractional  retinal detachment


C. High Risk, Proliferative diabetic retinopathy with presence of extensive neovascularization of the disc

**Q2:**

Which of the following pairs in this patient's history are the most important **RISK FACTORS** to the development of severe diabetic retinopathy?

A.  Length of History of diabetes in years <u>and</u> hypertension

B.  Level of high blood sugars <u>and</u> high cholesterol

C.  Length of history of diabetes in years <u>and</u> level of high blood sugars

D.  Duration of obesity <u>and</u> level of high blood sugars

C.  Length of history of diabetes in years <u>and</u> level of high blood sugars

**Q3:**

Which of the following paired eye exam findings to potential treatment (s) is most correct for this patient?

A.  Proliferative diabetic retinopathy <u>and </u>prompt (in 1 wk) pan-retinal laser with or without injection of anti-VEGF

B.  Vitreous Hemorrhage <u>and</u> urgent (in 24-48 hours) vitrectomy surgery with or without injection of anti-VEGF

C.  Clinical Suspicion of orbital Mucor in patient with DKA  <u>and</u> routine outpatient ENT referral

D.  Clinical Diagnosis of visual insignificant diabetic related cataract <u>and</u> routine (6 month) referral for evaluation for cataract surgery

A.  Proliferative diabetic retinopathy <u>and </u>prompt (in 1 wk) pan-retinal laser with or without injection of anti-VEGF

# Questions?