

20/20 Vision Is Enough!

Is it?

A Review of CDC Statistics and Surveillance Trends
 Khashayar Tonekaboni, O.D.
 Indiana University School of Optometry
 Special thanks to Dean VanNasdale, O.D., Ph.D., F.A.A.O.
 Ohio State University

From JAMA, [September 8, 2015, Vol 314, No. 10](#)

Diabetes is a major cause of morbidity and mortality in the United States. The recent prevalence and trends in diabetes can be estimated using US survey data with information on a previous diabetes diagnosis and measured glucose levels.

This trend follows those of obesity, which has also been on the rise in the United States.

Costly disease

- Obesity+ poor diet+ lack of exercise=Metabolic syndrome
- Or stated in dollars=\$2.45 billion (use of health resources and loss of productivity)!
- 71,000 deaths per year (American Diabetes Association)
- 2/3 of adult Americans are obese (ADA)—Jennifer Marks
- Half the adults in the US are pre-diabetic or diabetic
 - Increase obesity, increased age=Health crisis



Super-size it!

- Eating due to hunger
 - But also due to social, emotional, and cultural reasons
- Ads for food. How many have you seen in the last week? Last two days? Last night?
- Fill the tummy
 - The grocery stores in low-income areas are not well-stocked with fruits and vegetables, which tend to be perishable, certainly more than bagged/canned foods
 - They are also pricier. Pound for pound, a bag of chips costs less than an apple.

Low ___ Diet

- It's like shoes: they go in and out of fashion, don't they?
- Low-carb diet?
- Low-fat diet?
 - We do not know the answers. Longer and larger studies are necessary to answer these questions
- What about moderation?
- Washington Post: Obesity has increased from 35% to 38% in about 8 years.
 - The writer poses the question: Why can't we get a handle on this?
 - Answer: Taxes and regulation, which are employed in Europe, but the idea does not attract the American consumer

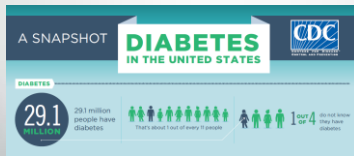
"Five foods you should NEVER eat."

- You have seen popups on the Internet. Have you ever looked at them?
- I call bollocks to this.
- But there is one basic "fact" that rings true to me: EAT ONE-INGREDIENT FOODS. That is, avoid pre-packaged foods that form many of our meals.

Emphasizing Diabetes

- Diabetes kills 23.6 million people in the United States and is the 7th cause of death.
- From CDC National Diabetic Fact Sheet:
 - Lowers life expectancy by 15 years.
 - Increases risk of heart disease by 2 to 4 times.
 - It is the leading cause of kidney failure, lower limb amputations, and adult-onset blindness

Snapshot




Prevalence 2012

	Numbers with Diabetes	Percentage with Diabetes (Unadjusted)
20 years or older	28.9	12.3
By age		
20-44	4.3	4.1
45-64	13.4	16.2
65 years or older	11.2	25.9
By sex		
Men	15.5	13.6
Women	13.4	11.2

Diagnosed and undiagnosed diabetes in the United States

- Total: 29.1 million people or 9.3% of the population have diabetes.
- Diagnosed: 21.0 million people.
- Undiagnosed: 8.1 million people (27.8% of people with diabetes are undiagnosed).

*"Prediabetes?"
Fact or Fiction?"*



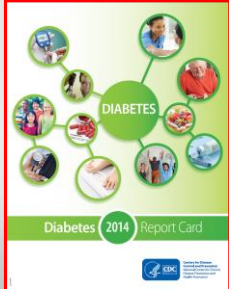
Diabetes	Diabetes	Diabetes
≥ 6.5%	≥ 126 mg/dl	≥ 200 mg/dl
< 6.5%	< 126 mg/dl	< 200 mg/dl
Prediabetes	Prediabetes	Prediabetes
≥ 5.7%	≥ 100 mg/dl	≥ 140 mg/dl
< 5.7%	< 100 mg/dl	< 100 mg/dl
Normal	Normal	Normal
A1C	FPG	OGTT

<http://www.diabetes.org/diabetes-basics/diagnosis/?loc=db-slabnav>

Expressed in terms of HbA1c:

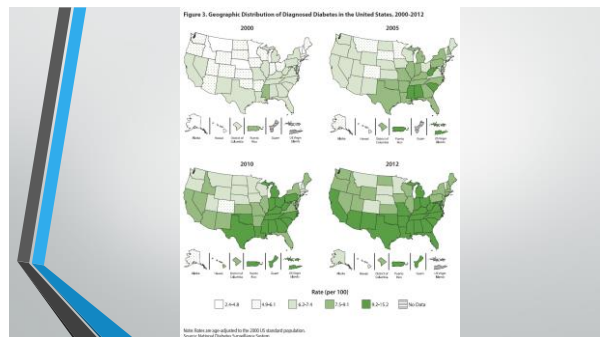
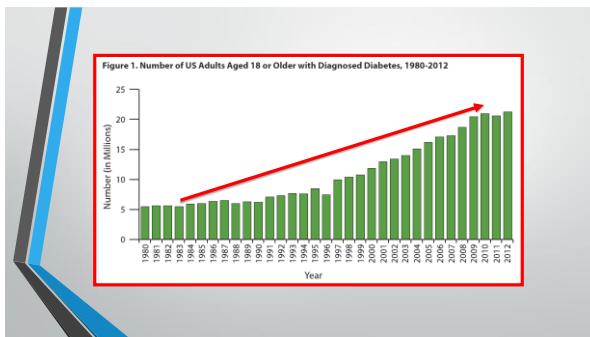
Result	HbA1c
Normal	Less than 5.7%
Prediabetes	5.7%-6.4%
Diabetes	6.5% or higher

Diabetes	29.1 Millions	Translates to 1 out of 11	1 out of 4 are unaware
Prediabetes	86 million	More than 1 out of 3 adults	9 out of 10 are unaware
Without exercise and wt. lost	Greater than 15-30% will develop diabetes within 5 years		
Cost	\$245 billion in total medical costs and lost work and wages for people with diabetes	This cost represents 2X the cost vs. people without diabetes	Diabetes Cost the United States an Estimated \$245 Billion in 2012 <ul style="list-style-type: none"> • \$176 billion in direct medical costs (insulin, oral drugs, and services) • \$69 billion in indirect costs from lost wages, reduced activity, disability, and early death.
Risk of Death	Twice as high for diabetics		
Complications	Blindness, kidney and heart failure, stroke, loss of toes, feet, legs		



Diabetes 2014 Report Card

<http://www.cdc.gov/diabetes/pdf/library/diabetesreportcard2014.pdf>



Public Health and Eye Care

V-1
 Increase the proportion of preschool children aged 5 years and under, who receive vision screening

Baseline: 40.1 percent of preschool children aged 5 years and under received vision screening in 2008
 Target: 44.1 percent
 Target-Setting Method: 10 percent improvement
 Data Sources: National Health Interview Survey (NHIS), CDC/NCHS

V-2
 Reduce blindness and visual impairment in children and adolescents aged 17 years and under

Baseline: 28.2 per 1,000 children and adolescents aged 17 years and under were blind or visually impaired in 2008
 Target: 25.4 per 1,000
 Target-Setting Method: 10 percent improvement

V-3.1
 Reduce occupational eye injuries resulting in lost work days

Baseline: 2.9 per 10,000 full-time workers had occupational eye injuries resulting in lost work days in 2008
 Target: 2.6 per 10,000 full-time workers
 Target-Setting Method: 10 percent improvement

V-3.2
 Reduce occupational eye injuries treated in ERs


Baseline: 12.9 per 10,000 full-time workers were treated for occupational eye injuries in EDs in 2008
 Target: 11.6 per 10,000 full-time workers
 Target-Setting Method: 10 percent improvement

V-4
 Increase the proportion of adults who have a comprehensive eye examination, including dilation, within the past 2 years

Baseline: 55.0 percent of adults aged 18 years and older had a comprehensive eye examination, including dilation, within the past 2 years in 2008 (age adjusted to the year 2000 standard population)
 Target: 60.5 percent
 Target-Setting Method: 10 percent improvement

V-5.1 Reduce visual impairment due to uncorrected refractive error

V-5.2 Reduce visual impairment due to diabetic retinopathy
 Revised



V-5.3 Reduce visual impairment due to glaucoma
 Revised

V-5.4 Reduce visual impairment due to cataract
 Revised

V-5.5 Reduce visual impairment due to age-related macular degeneration (AMD)
 Revised

V-6.1
 Increase the use of personal protective eyewear in recreational activities and hazardous situations around the home among children and adolescents aged 6 to 17 years

V-6.2
 Increase the use of protective eyewear in recreational activities and hazardous situations around the home among adults aged 18 years and older

V-7.1
 Increase the use of vision rehabilitation services by persons with visual impairment
 Revised

V-7.2
 Increase the use of assistive and adaptive devices by persons with visual impairment

V-8
 (Developmental) Increase the proportion of Federally Qualified Health Centers (FQHCs) that provide comprehensive vision health services

CDC Visual Health Initiative (VHI)

VHI Mission

The CDC VHI, a group in the [Division of Diabetes Translation](#), is designed 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.

VHI

VHI Goals

- Promote eye health and prevent vision loss.
- Improve the health and lives of people with vision loss by preventing complications, disabilities, and burden.
- Reduce vision and eye health related disparities.
- Integrate vision health with other public health strategies

VHI

VHI Objectives

1. To assess and monitor the burden of vision impairment and blindness. The VHI develops and refines vision surveillance at the state and national level and helps states develop their capacity to implement effective state-based surveillance systems.
2. To build capacity for conducting epidemiologic, behavioral, and health services research related to vision loss at all life stages and translate scientific evidence into public health practice, health policy, and health promotion strategies.
3. To identify, prioritize, and disseminate evidence-based, efficient, and cost-effective public health interventions to improve quality of life, increase access to needed eye care, and reduce health disparities among people with or at high risk for vision loss.
4. To leverage resources, facilitate strategic partnerships and provide technical assistance to national, state and community based partners to preserve, protect, and enhance vision health.
5. To integrate appropriate and effective vision health activities into existing state and community public health programs.

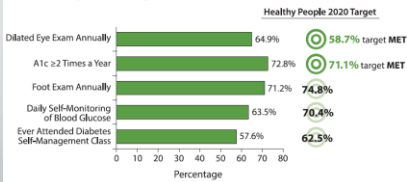
Diabetes Objective #10 (D-10): Increase the proportion of adults with diabetes who have an annual dilated eye examination.

Target: 58.7%

Baseline: 53.4% of adults ages 18 years and older with diagnosed diabetes had a dilated eye examination in the past year, as reported in 2008 (age adjusted to the year 2000 standard population).

This needs to change or we will have a much greater vision impairment problem in the United States as diabetes becomes more prevalent.

Figure 6. Healthy People 2020 Targets* and Percentage of US Adults Aged 18 or Older with Diagnosed Diabetes Who Reported Receiving Recommended Preventive Care Practices,** 2012



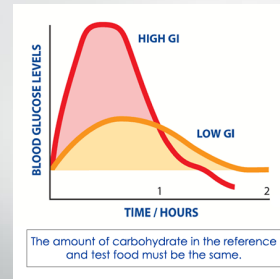
* Available on the Healthy People 2020 Diabetes website.
 ** Percentages are age-adjusted to the 2000 US standard population.
 Source: National Diabetes Surveillance System, Behavioral Risk Factor Surveillance System data.

Diabetes and Metabolic X-Syndrome

- Pathophysiology
 - Insulin deficiency, hepatic inefficiency in processing circulating glucose
 - Free fatty acid increase from vLDL, TGs, poor fibrin break-down from visceral adipose tissue (as opposed to sub-q)
 - HTN
 - Vicious cycle of increased glycation of vascular endothelium, hardening of vessels, all of which will lead to Na⁺ retention and renal HTN
 - Oxidative material (reactive oxygen species) accumulate due to free fatty acids resulting in vascular damage via biochemical cascades

Manipulating Mean Plasma Glucose (MPG)

- Studies indicate that 10% decrease in HbA1c lowers risk of diabetic retinopathy by 43%
 - $MPG = 35.6 \times (HbA1c) - 77.3$
 - MPG 2 hr. post-prandial must be less than 150 mg/dl
 - Glycemic Index (varies depending on carbohydrate containing foods)
 - GI of 55 or less will metabolize and absorb more slowly, reducing the amount of circulating glucose and the insulin needed
 - Range is 0-100
 - The statement "lowering carbohydrate intake" is no longer enough, which was the recommendation in 2005 because of the above



Selected Agents and Medications

- Insulin (Lantus, Humalog, Novolog)
 - Types I and II
 - Potentiates uptake of circulating glucose
 - Problems with weight gain and hypoglycemia
- SFUs—Sulfanylureases (Micronase, Glucotrol, Amaryl)
 - Type II
 - Stimulate endogenous insulin release
 - Same problems as above

Continued

- Biguanides (Glucophage)
 - Type II
 - Improve peripheral insulin sensitivity and decrease hepatic breakdown of glycogen
 - GI symptoms
- TZDs—Thiazolidinediones (Actos, Avandia)
 - Type II
 - Improve peripheral insulin sensitivity
 - Edema and weight gain

Continued

- Chromium picolinate
 - Increases sensitivity to insulin
 - Facilitates cellular uptake of circulating glucose
- Depression and diabetes
 - Rate at least twice in diabetics, especially women
 - Depression reduces insulin sensitivity
 - Overeating

Continued

- Tryptophan a precursor to serotonin
 - Serotonin stabilizes mood, suppresses appetite
- Depression causes "sticky" serotonin receptors, which hang on to the substance
- CP supposedly helps the receptors to release the substance
 - Controversial
 - 1989: TAKE CP. It's the best
 - 2013: Eh, not so much, and it might cause toxicity
 - Kidney problems
 - Mutations in animals

Risk Factors

- Metabolic syndrome (formerly Syndrome X): Insulin resistance, a root cause
 - Can lead to prediabetes
 - If left uncontrolled, it will lead to Type II
 - Risk of prostate cancer is included
 - PCOS (polycystic ovarian syndrome)
 - Ovaries produce testosterone in response to insulin

Continued

- Insulin resistance
 - Abdominal fat—waist size of 40" in men; 35" in women
 - "Apple-shaped body"
- High circulating sugars and TGs
- BP of greater than 130/85
- FHx

Inflammation

- C-Reactive Protein
 - Vascular, specifically, coronary artery inflammatory disease in relation or response to damage from circulating substances
 - High levels associated with heart attack
 - Connection no well-understood
 - Evidence is a great number of heart disease patients have normal levels of cholesterol
 - What is normal?

Co-Enzyme Q10

- National Cancer Institute rates the evidence of any benefit of this non-vitamin as "weak."
- Still, there are studies that point to "Co Q10" to be of some benefit in reducing symptoms of heart attack.
 - NOTE: Is this a good thing?
 - It was found to in lower amounts in patients with multiple types of cancer
 - A total of 41 women in three different studies showed improvement after the use of the supplement.

Healthy Behavior

- Exercise
 - Lowers body subcutaneous body fat
- Effect on visceral fat
 - September 2005: Duke physiologist makes the statement that the nation has to think "Health Gain," rather than "Weight Loss."
 - Deep belly and waist fat can be reduced with regular exercise
- Raises HDL
- Myocardial manipulation

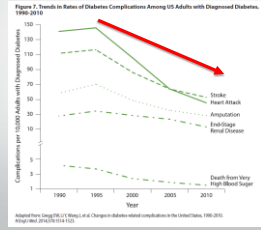
Continued

- Flossing
 - Connection between periodontal disease and—
 - Stroke, MI, diabetes, pre-term/low birth weight births, Alzheimer's, cancers
 - This connection is through bacteremia and CRP/inflammation

Keeping Track

- BRFSS – The Behavioral Risk Factor Surveillance System is a continuous, random, telephone survey of a state population-based sample of civilian noninstitutionalized adults aged 18 or higher. The BRFSS is administered and supported by CDC and its aim is to measure behavioral risk factors in adult population
- NHANES – National Health and Nutrition Examination Survey is an ongoing series of cross-sectional national surveys in the population, adults and children. The National Center of Health Statistics aims to assess the health and nutritional status of adults and children in the U.S. The NHANES is a unique survey that combines interviews and physical examination
- NHIS – National Health Interview Survey of the NCHS. Conducted since 1957, the NHIS is a health survey of the household population of the U.S. Information on the health on prevalence and incidence of disease, disability extent, and use of healthcare services.

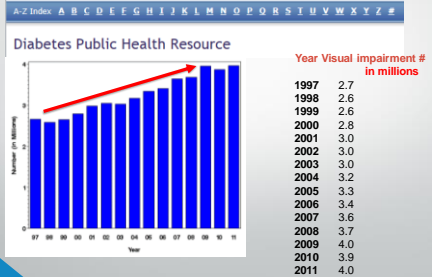
Comorbidity



Good news, right?

- But look at this:

CDC Home
CDC Centers for Disease Control and Prevention
 CDC 24/7: Saving Lives. Protecting People.™



Working together

From: NDEP (National Diabetes Education Program)

- Toolkit: What is PPOD?
 - Pharmacy
 - Podiatry
 - Optometry
 - Dentistry

What Can PPOD Providers Do?

- Embrace a team approach
- **Recognize signs of diabetes and systemic concerns across all PPOD areas**
- Reinforce the importance of annual screenings and healthy habits
- Educate patients about diabetes
- Encourage self-management
- Provide treatment

Feet



- Peripheral artery or vascular disease (PAD or PVD)
 - Intermittent claudication (pain only during movement)
 - Pain at rest
 - Numbness
 - Weakness of calf muscle
 - Hair loss
 - Coldness

Continued



- More than 60% of non-traumatic lower-limb amputations occur in people with diabetes
- This means diabetics are 15-26 times more likely to have an amputation
- Up to 20% of diabetics who participate in routine foot care will have a treatable problem

Key Questions on Foot Health



- Do you get a full foot exam at least once a year?
- Do you know how diabetes can affect your feet?
- Do you know how to self-monitor?

Continued



- Encourage regular (annual or more frequent) oral exams
- Educate patients about:
 - The link
 - Self-management skills to properly care for teeth

Teeth



- Chronic halitosis
- Chronic or recurrent gingivitis
 - Can lead to periodontal disease (bone involvement)
- Poor healing
- 85% of patient with type 2 diabetes report that they have received no information on the association between diabetes and oral health
- Periodontal disease has been associated with poor glycemic control
- Tobacco use and poor nutrition are risk factor for compromised oral health

Key Questions About Oral Health



- Do you visit your dental provider at least once a year for a full mouth exam?
- Do you know how diabetes can affect your teeth and gums?
- Do you know the early signs of tooth, mouth, and gum problems?

Pharmacist



- Pharmacists are unique members of the health care team because:
 - Patients often see them seven times more often than their doctor
 - They are often available all day and into evenings and weekends – no appointments needed.
 - They monitor drug regimens
 - Work with patient to develop a plan to reduce risk of side effects and drug interactions
 - Advise patient on how to take the meds properly
 - Provide other information to help control diabetes
 - Communicate with health care team

American Diabetes Association. Standards of medical care in diabetes—2012. *Diabetes Care* 2012;35(1):S11–S63. Available at http://care.diabetesjournals.org/content/35/Supplement_1/S11.full.

Key Questions about Medications



- Refer patient to a pharmacist if the answers to these questions are “no” or “unsure.”
 - Do you have a list of all your medications, vitamins, and supplements?
 - Do you know the reason why you take each medication?
 - Have you reported any side effects from your medicines to your pharmacist?

And... Eye Health



- 11% of U.S. adults with diabetes have a form of visual function impairment
- Adults with visual function loss are at least 90% more likely to have depression than those without any impairment

CDC. National diabetes fact sheet: National estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011. Available at <http://www.cdc.gov/diabetes/about/factsheets.html>.
Zhang, X, Bullard, KM, Cotch, MF, et al. Association between depression and functional vision loss in persons 20 years of age or older in the United States. *WJAMES* 2009-2008. *JAMA Ophthalmol*. 2013; 33(5): 573-82. Doi: 10.1002/jama.ophtholmol.2013.3537. Available at <http://archophth.jamanetwork.com/mobile/article.aspx?articleid=366093>.

Continued



- Annual comprehensive vision evaluation with a dilated retinal exam:
 - Educate high-risk patients on how to care for and monitor their eye health
 - Prevent low-risk patients from becoming high-risk

Entry Point

- PPOD providers may be the first to see a person with a problem
 - Patients reach out to us before consulting their PC physicians
 - Regular communication between PPOD providers and PC physicians keeps diabetes on the patient's radar screen

Managing Diabetes

- Helps to gain an overview of team approach to care
- Includes details for each PPOD specialty area on:
 - Current data and trends
 - Common diabetes-related complications
 - Assessment techniques
 - Patient education
- Serves as a “cross-sectional” resource, not a comprehensive guide to subspecialty care

Considerations

- Guide provides a "quick course" on each specialty and its relation to diabetes
- Each section is written for providers OUTSIDE of the specialty to read
- Your own specialty section may seem "simplistic."
- The goal of the PPOD Guide is to relay consistent messages across the disciplines

Key Message: Control the ABCS

- A1c: Blood glucose control
- B: Blood pressure control
- C: Cholesterol (blood lipid) control
- S: Smoking (and use of other tobacco products) cessation (and don't start)
- In addition:
 - Preventive care for eyes, kidneys, feet, teeth, and gums

CDC. National diabetes fact sheet: National estimates and general information on diabetes and prediabetes in the United States, 2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011. Available at <http://www.cdc.gov/diabetes/pubs/factsheets11.htm>.

PPOD in Action

- 40-year-old woman notices blurry vision and asks her pharmacist about reading glasses
- Pharmacist discovers that patient was diagnosed with diabetes last year but did not return for follow-up
- Pharmacist advises that the changes in vision may be a sign of diabetes, not a need for reading glasses
- Pharmacist arranges PC visit and eye exam for follow-up
- Pharmacist also refers the patient to NDEP website at www.cdc.gov/diabetes/ndep for more materials

Case

- 51-year-old Caucasian female; type 2 diabetic since 2010, but treatment initiated only a week before the visit
- Complaints of vision blur and fluctuation
- Original visit August 2015
 - HbA1c as of "last week" was 11.3
 - FBS = 300
 - ROS: Only other problem "joint pain/arthritis" for which patient pursues no formal therapy
 - Patient has no insurance and was referred to IU clinic by VIM (Volunteers in Medicine) organization

Average Blood Sugar or Estimated Average Glucose (eAG) and HbA1c

- Formula (American Diabetic Association) is as follows:
 - $HbA1c\% = (eAG + 46.7) \div 28.7$

HbA1c test (%) & estimated Average Glucose (mg/dl)												
eAG for plasma calibrated meters												
HbA1c	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9		
Glucose	68	71	74	77	80	82	85	88	91	94		
HbA1c	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9		
Glucose	97	100	103	105	108	111	114	117	120	123		
HbA1c	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9		
Glucose	123	128	131	134	137	140	143	146	148	151		
HbA1c	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9		
Glucose	154	157	160	163	166	169	171	174	177	180		
HbA1c	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9		
Glucose	183	186	189	192	194	197	200	203	206	209		
HbA1c	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9		
Glucose	212	214	217	220	223	226	229	232	235	237		
HbA1c	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9		
Glucose	240	243	246	249	252	255	258	260	263	266		
HbA1c	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9		
Glucose	289	292	295	298	300	303	306	309	311	314		
HbA1c	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9		
Glucose	298	301	303	306	309	312	315	318	321	324		
HbA1c	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9		
Glucose	326	329	332	335	338	341	344	346	349	352		

Continued

- Medications include Metformin, cyclobenzaprine (Flexeril), meloxicam, Neurotonin.
- Clearly, and based on the what we have covered, the patient doesn't know why she is taking all her medications.

Continued

- BVA OD 20/25+ OS 20/30-
- Anterior exam:
 - Mild EBMD and guttae were the only remarkable finding
 - No iris neovascularization
- Posterior exam: Severe nonproliferative retinopathy with mild DME OD, severe nonproliferative retinopathy and moderate DME OS.

Continued

- Patient recalled for a month follow-up. VAs unchanged, but objectively, the edema seemed worse

