the diabetes epidemic: strategies for saving sight

financial disclosure

- I have no financial interests relevant to my presentation.

unlabeled-investigative use disclosure

- I will not discuss unlabeled and/or investigational uses of any commercial products.
diabetes mellitus

- health & socioeconomic burdens
- complications – macrovascular & microvascular
- prevention, control, & treatment
- role of self-management

international diabetes foundation

**438 million by 2030**

2010 U.S. diabetes estimates

- almost 26 million people have diabetes
- 18.8 million diagnosed
- 7.0 million undiagnosed
- 8.3% of population
- 26.9% ≥ 65 years old
- 11.8% men
- 10.8% women
- 10.2% non-Hispanic whites
- 18.7% non-Hispanic blacks
- 1.9 million ≥ 20 years old newly diagnosed
- 215,000 < 20 years old newly diagnosed
estimates of diagnosed diabetes in adults ≥ 20 years (2008)

Obesity epidemic

percentage of US adults: obesity & diabetes

obesity in diabetes

- Prevalence of obesity & overweight among adults
  - 85.2% overweight or obese
  - 54.8% obese
- Women aged 20-64 years vs ≥65 years had significantly higher prevalence of obesity (64.7% vs 47.4%) during 1999-2002

2005-2008 prediabetes* in the US

- 35% ≥ 20 years old
- 50% ≥ 65 years old
- Applied to 2010 population = 79 million ≥ 20 years old
- Most people with prediabetes undiagnosed

*Based on FBG or HgA1c

morbidity and mortality

- Leading cause of:
  - Kidney failure
  - Non-traumatic lower limb amputations
  - New cases of blindness among adults
- Major cause of heart disease and stroke
- Seventh leading cause of death in U.S.
diabetes treatment

- 16% - no medication
- 58% - oral medication only
- 12% - insulin only
- 14% - oral medication & insulin

economic costs (2007)

- $174 billion total costs
  - $116 billion – excess medical costs
  - $27 billion – direct treatment costs
  - $58 billion – related chronic complications
  - $33 billion – excess medical costs
  - $58 billion – reduced national productivity

- cost breakdown by payee
  - 50% – hospital inpatient
  - 12% – medications & supplies
  - 11% – medications to treat complications
  - 11% – office visits

economic costs

- average annual expenditures of a person with diabetes
  - $11,744 total
  - $6,649 attributed to diabetes

- ~2.3 times higher medical expenditures in those with diagnosed diabetes
  - ~1 in 5 health care dollars spent on care for those people
  - ~1 in 10 health care dollars attributed to diabetes

- $58.2 billion – indirect costs
  - 15 million absent work days
  - 120 million reduced productivity days
  - 6 million reduced productivity days for those not in labor force
  - 107 million days permanent disability
  - 284,000 deaths
direct and indirect costs

$232.2 billion

disease burden in 2050

- prevalence projected to increase from 1 in 10 to 1 in 3 adults (diagnosed & undiagnosed)
- incidence will increase from 8/1000 to 15/1000
- 3 key factors in increased disease burden:
  - aging of the population
  - increasing size of higher-risk minority populations
  - declining mortality among those with diabetes

standards of medical care

- classification & diagnosis
- testing in asymptomatic patients
- detection & diagnosis of gestational DM
- prevention or delay of type 2 DM
- diabetes care
- prevention & management of complications
- assessment of common comorbid conditions
- diabetes care in specific populations & settings
- strategies for improving diabetes care

diagnostic criteria

- **pre-diabetes**
  - FPG of 100 to 125 mg/dL (IFG) OR
  - 2 hour plasma glucose of 140-199 mg/dL (IGT) OR
  - HgA1c ≥ 5.7% to 6.4%

- **diabetes**
  - HgA1c ≥ 6.5% OR
  - FPG ≥ 126 mg/dL OR
  - 2 hour plasma glucose ≥ 200 mg/dL during an oral glucose tolerance test OR
  - random plasma glucose ≥ 200 mg/dL in a patient with classic symptoms of hyperglycemia

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testing recommendations

- in asymptomatic patients
  - consider in overweight or obese adults with one or more additional risk factors
  - if no risk factors begin testing at age 45
  - if normal, repeat at least every 3 years
  - use HgA1c, FPG or 2 hour OGTT

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diabetes mellitus

- **type 1**
  - autoimmune disorder – pancreatic β cell destruction
  - insufficient or absent insulin production – requires exogenous insulin
  - old terminology: juvenile onset, IDDM

- **type 2**
  - begins as insulin resistance
  - progressive insulin secretory defect
  - over time requires exogenous insulin
  - old terminology: adult onset, NIDDM
prevention or delay of type 2 in patients with prediabetes

- targeted weight loss of 7% of body weight
- at least 150 minutes/week moderate physical activity
- follow up counseling important for success
- insurance programs should cover such programs based on cost-effectiveness
- consider metformin
- monitor for DM annually
- screen for & treat modifiable risk factors for cardiovascular disease

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diabetes care

- complete evaluation
  - history
  - physical exam
  - laboratory evaluation
- referrals
  - ophthalmology
  - family planning (for ♀ of child-bearing age)
  - dietician
  - self-management education
  - dentist
  - mental health professional, prn

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diabetes care team

- patient
- physicians
- nurse practitioners
- physician’s assistants
- nurses
- dietitians
- pharmacists
- mental health professionals
glycemic control

- self-monitoring of blood glucose (SMBG)
- HbA1c

recommended monitoring

- on multiple dose insulin or pump therapy
  - before meals & snacks (at least)
  - after eating (occasionally)
  - at bedtime
  - before exercise
  - suspicion of low glucose
  - after treating low glucose until normoglycemic
  - before critical tasks (e.g., driving)
- continuous glucose monitoring
  - intensive insulin regimens in adults 25 and older with type 1
  - those with hypoglycemia unawareness or frequent hypoglycemia

A1c monitoring

- at least twice yearly in stable patients meeting treatment goals
- quarterly in patients changing therapy or not meeting glycemic goals
glycemic goals

- HbA1c to 7% or below
  - reduces microvascular complications
  - associated with long-term reduction in macrovascular disease if implemented soon after dx
- HbA1c to <6.5%
  - in select patients (short duration of DM, long life expectancy, no significant CVD)
  - if patients don’t get significant hypoglycemia

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- HbA1c to <8% may be appropriate
  - hx of severe hypoglycemia
  - limited life expectancy
  - advanced microvascular or macrovascular complications
  - extensive comorbid conditions
  - longstanding DM and difficult goal attainment despite
  - self-management education
  - appropriate glucose monitoring
  - effective doses of multiple glucose lowering agents including insulin

- glycemic recommendations*

- HbA1c >7%
  - preprandial CPG between 70 to 130 mg/dL
  - peak postprandial CPG <180 mg/dL
  - goals should be individualized

*nonpregnant adults
insulin therapy in type 1 DM

- multidose insulin (3-4 injections/day of basal and prandial insulin)
- continuous infusion is good alternative
- patients need to know how to match prandial insulin dose to CHO intake, preprandial CPS, & anticipated activity
- most should use insulin analogs to reduce risk of hypoglycemia

therapy in type 2 DM

- metformin preferred as initial pharmacological agent
- consider insulin therapy (with or without other agents at the outset if newly diagnosed and markedly symptomatic or with very elevated blood glucose or HgA1c levels
- add second oral agent if not within goal in 3 to 6 months on noninsulin monotherapy
- patient-centered approach & recognition that insulin therapy eventually indicated for many

recommended eye exams

- type 1
  - initial exam 3-5 years after diagnosis
  - subsequent follow up yearly
- type 2
  - initial exam at time of diagnosis
  - subsequent follow up yearly
- pregnancy
  - prior to conception
  - early in 1st trimester
  - every 3-12 months if ≤ mild/moderate NPDR
  - every 1-3 months if ≥ severe NPDR
scope of diabetic retinopathy

- one of leading causes of new blindness in U.S. adults 20 to 74 years of age
- estimated projections for adults ≥ 40 years of age by 2050
  - DR: 5.5 – 16 million
  - vision-threatening DR: 1.2 – 3.4 million
- estimated projections for adults ≥ 65 years of age by 2050
  - DR: 2.5 – 9.9 million
  - vision-threatening DR: 0.5 – 1.9 million

epidemiology of DR

- type 1
  - 5 years – 25%
  - 10 years – 60%
  - 15 years – 80%
- type 2
  - < 5 years
    - 40% of those taking insulin
    - 24% of those not taking insulin
  - 5 to 19 years
    - 84% of those taking insulin
    - 53% of those not taking insulin

Disease duration: major risk factor

diabetic retinopathy

- non-proliferative – earlier stage of DR (NPDR)
  - Microaneurysms
  - dot-blot or flame-shaped retinal hemorrhages
  - cotton-wool spots
- severe NPDR
  - 4 quadrants of microaneurysms (>20 in each quadrant)
  - 2 quadrants of venous beading or 1 quadrant of IRMA
  - 15% chance of progressing to proliferative DR within 1 year
- proliferative – later stage of DR (PDR)
  - abnormal blood vessels on optic disc, retina, iris, angle structures
  - vitreous/pre-retinal hemorrhage
  - associated with severe vision loss
CDME
- clinically significant macular edema
- retinal thickening at or within 500 microns of macula
- hard exudates at or within 500 microns of macula if associated with thickening of the adjacent retina
- zone(s) of retinal thickening one disc area in size, any part of which is within 1 disc diameter of the macula
- may be present in NPDR or PDR
- if present, requires increased vigilance/treatment

proliferative DR
- type 1
  - 50% in patients with 20 years disease duration*
  - 18% in patients with > 15 years disease duration**
- type 2
  - 2% in patients with < 5 years disease duration***
  - 25% in patients with ≥ 25 years disease duration****


landmark research
- DCCT
  - diabetes control & complications trial
- EDIC
  - epidemiology of diabetes interventions & complications
- DRS
  - diabetic retinopathy study
- ETDRS
  - early treatment diabetic retinopathy study
- DRVS
  - diabetic retinopathy vitrectomy study
- UKPDS
  - united kingdom prospective diabetes study
glycemic control

- exponential relationship between mean HgA1c and risk of DR

- HgA1c by 10% (e.g. from 9.0% to 8.1%) → risk of retinopathy progression by 39%

- no glycemic threshold at which risk was eliminated above non-diabetic range of HgA1c (4.0% to 6.05%)


glycemic control

- good control of hyperglycemia works
- reduction in complications
  - cardiovascular disease
  - kidney disease
  - neuropathy
  - retinopathy

take home message

management & treatment

- normal or minimal NPDR & no CSME
  - FU 12 months

- mild to moderate NPDR
  - no CSME – FU 6-12 months
  - with CSME
    - FU 2-4 months
    - IVF – usually
    - focal or grid laser – usually

management & treatment

severe NPDR & non-high-risk PDR

- no CSME
  - FU 2-4 months
  - PRP – sometimes*
  - IVF – rarely
  - focal or grid laser – no

- With CSME
  - FU 2-4 months
  - PRP – sometimes*
  - IVF – usually
  - Focal or grid laser – usually

*may be considered if approaching high-risk PDR


management & treatment

high-risk PDR

- no CSME
  - FU 2-4 months
  - PRP – usually
  - IVF – rarely
  - focal or grid laser – no

- with CSME
  - FU 2-4 months
  - PRP – usually
  - IVF – usually
  - focal or grid laser – usually


management & treatment

inactive or involuted PDR

- no CSME
  - FU – 6-12 months
  - PRP – no
  - IVF – no
  - focal or grid laser – usually

- with CSME
  - FU – 2-4 months
  - PRP – no
  - focal or grid laser – usually

cost effectiveness of treatment

- study of treating retinopathy in type 1 DM
- substantial savings compared to direct costs
- didn’t include indirect costs in lost productivity and human suffering

- computer model
- ophthalmic care decreased prevalence of blindness by 52%
- direct costs of care were less than productivity losses & costs of disability facilities


knowledge needs

- ophthalmic complications

- other information
  - diet & exercise
  - pharmacologic therapies
  - oral agents
  - insulin
  - symptoms of hypoglycemia

nursing implications

- holistic approach is crucial
  - self-management is key
  - multiple health care professionals often involved

- education is a major component of care
  - ophthalmic-related
  - other health aspects
nursing interventions

- communication with PCP
- written report following every eye examination
- direct communication when indicated

- patient education
  - list of useful resources – print and web-based
  - handout for every patient with diabetes – ABCs
    - HbA1c – less than 7%
    - Blood pressure – 140/80 or below
    - Cholesterol – LDL less than 100
Goldblum blindness.

appointments your first vitreous be new eye. Treating Diabetes. The you healthy. over make problems. Keeping term Preventing retina causes cataracts blood

holesterol ___________

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Your ______

A Diabetes. Diabetic

Eye TEAM.

Blood Sugar Basics (American College of Endocrinology)

• factsheet11.htm

• www.diabetes.org

• http://www.bloodsugarbasics.com

• American Diabetes Association

10/8/13