Welcome to Diabetes MiniSeries – Class 1

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Diabetes in the 21st Century:
A Clinical and Educational Update

1. Describe impact of diabetes
2. Discuss prevention, management strategies
3. Discuss different types of diabetes
4. Describe insulin therapy
5. Review glucose patterns and determine how to adjust therapy to improve glucose.
6. Discuss medical nutrition therapy
7. Gain understanding of Type 2 Meds.
8. Demonstrate successful teaching strategies

CDC Announces

35% of Americans will have Diabetes by 2050

Boyle, Thompson, Barker, Williamson
2010, Oct 22:8(1)29
www.pophealthmetrics.com

Diabetes in America 2014

- 25.8 million or > 8.3%
- 12.6 million are women
- 79 million have pre diabetes

Diabetes

| 1994 | 2000 | 2009 |

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

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Type 2 in Kids

TODAY — Treatment Options for type 2 Diabetes in Adolescents & Youth

- 7 fold increase 1990
- 1 in 6 overwt kids (age 12- 19) have prediabetes.
- ~2,500 to 3,700 new cases in U.S. annually.
- Highest risk: very obese, minority, female, low socioeconomic status, limited education
- In age range 12-19, less than 1% have Type 2 – NHANES
- Environmental changes to urgently needed

Global Epidemic

- Every 10 seconds
  - 1 person dies with diabetes
  - 2 people develop diabetes
- Every year
  - 3 million deaths
  - 6 million new cases
- World Diabetes Day is November 14
- March is ADA Sound the Alert Day "find people w/ undetected diabetes"

World Diabetes Day
November 14

The right education for all

Diabetes: protect our future

www.worlddiabetesday.org

The right environment for all

Diabetes: protect our future

www.worlddiabetesday.org

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Why Should Zip Code Determine Life Expectancy?

STOCKTON
95202
Life Expectancy
73

IRVINE
92606
Life Expectancy
88

California Endowment – look up your zip code at www.measureofamerica.org

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Age-adjusted Diabetes Prevalence
20 yrs or older, by race/ethnicity— U.S. 2008

▸ Native Americans   16.5%
▸ Alaska Natives   16.5%
▸ Blacks   11.8%
▸ Hispanics   10.4%
▸ Asian Americans   7.5%
▸ Whites   6.6%

In 2002, Native Hawaiians and Japanese and Filipino residents of Hawaii aged twenty years or older were approximately 2 times as likely to have diagnosed diabetes as white residents of Hawaii

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Engaging and supporting Kids to help slow the epidemic
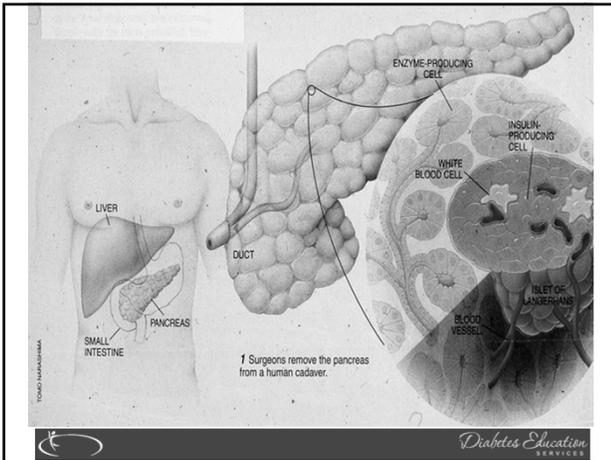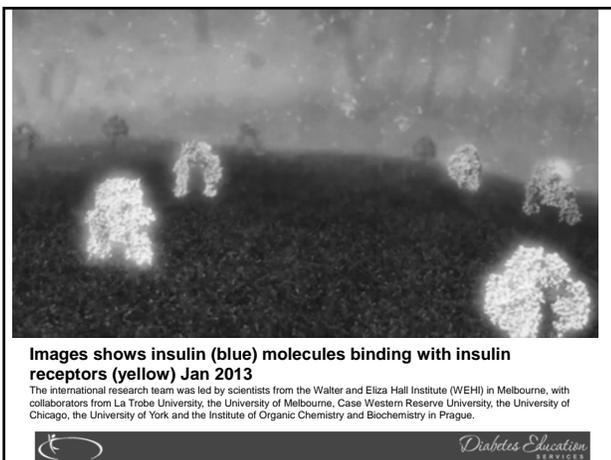
▸ Phases of Life
  ▸ During Childhood

▸ Environment
  ▸ Access to safe places to exercise
  ▸ Access to healthy foods
  ▸ Access to learning rich environments
  ▸ Access to health care

▸ LifeStyle
  ▸ Limit screen time to 2 hours a day
  ▸ 1 hour a day of activity
  ▸ Healthy Snacks
  ▸ Limit junk food, sugary beverages
  ▸ Fruits and Veggies

Images shows insulin (blue) molecules binding with insulin receptors (yellow) Jan 2013
The international research team was led by scientists from the Walter and Eliza Hall Institute (WEHI) in Melbourne, with collaborators from La Trobe University, the University of Melbourne, Case Western Reserve University, the University of Chicago, the University of York and the Institute of Organic Chemistry and Biochemistry in Prague.

Role of the Pancreas Endocrine Functions

Beta Cells - Insulin

Anabolic hormone - helps store glucose as glycogen in muscle, liver
- secreted in response to elevated glucose
- halts breakdown of glycogen in liver
- increases protein synthesis, fat storage
- powerful hypoglycemic

Beta Cells - Amylin
- secreted in 1:1 ratio with insulin
- Causes satiety
- Lowers post-prandial glucagon response
- Slows gastric emptying
- Type 1 make none
- Type 2 make less than normal amounts

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Role of the Pancreas Endocrine Functions

Alpha cells - Glucagon

Opposes action of insulin at the liver
- stimulated in response to low glucose levels
- stimulates liver to convert glycogen to glucose
- inhibits liver from glucose uptake
- causes hyperglycemia

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Hormones Effect on Glucose

Hormone	Effect
Glucagon (pancreas)	⬆
Stress hormones (kidney)	⬆
Epinephrine (kidney)	⬆
Insulin (pancreas)	⬇
Amylin (pancreas)	⬇
Gut hormones - incretins (GLP-1) released by L cells of intestinal mucosa, beta cell has receptors)	⬇

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GLP-1 Effects in Humans
Understanding the Natural Role of Incretins

GLP-1 secreted upon the ingestion of food

Promotes satiety and reduces appetite

↑ Beta-cell response

Alpha cells:
↓ Postprandial glucagon secretion

Liver:
↓ Glucagon reduces hepatic glucose output

Beta cells:
Enhances glucose-dependent insulin secretion

Stomach:
Helps regulate gastric emptying

Adapted from Flint A, et al. *J Clin Invest.* 1998;101:515-520
Adapted from Larsson H, et al. *Acta Physiol Scand.* 1997;160:413-422
Adapted from Nauck MA, et al. *Diabetologia.* 1996;39:1546-1553
Adapted from Drucker DJ. *Diabetes.* 1998;47:159-169

GLP-1 degraded by DPP-4 w/in minutes

Bariatric Surgery

▸ Consider on diabetes pts w/ BMI >35, esp with comorbidities

▸ Remission (BG normalized)
  ▸ rates range from 40 – 95%
  ▸ Better results with newer diabetes (more beta cell mass)
  ▸ Due to increase incretins (gut hormones)

▸ Still researching long term benefits, cost effectiveness and risk

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Natural History of Diabetes

Yes!   NO

Normal
FBG <100
Random <140
A1c <5.7%

Prediabetes
FBG 100-125
Random 140 - 199
A1c ~ 5.7- 6.4%
50% working pancreas

Diabetes
FBG 126 +
Random 200 +
A1c 6.5% or +
20% working pancreas

Development of type 2 diabetes happens over years or decades

Signs of Diabetes

- Polyuria
- Polydipsia
- Polyphasia
- Weight loss
- Fatigue
- Skin and other infections
- Blurry vision

- Glycosuria, H_2O losses
- Dehydration
- Fuel Depletion
- Loss of body tissue, H_2O
- Poor energy utilization
- Hyperglycemia increases incidence of infection
- Osmotic changes

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Diabetes Classifications

- Type 1
- Type 2
- Gestational
- Secondary

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Case Study

1. Pt profile: 5'8", 192 lb male

Diabetes 12 years, on insulin 3 yrs

What type of DM and how do you know?

2. Pt profile: 5'6", 108 lb female

On insulin 3u Novolog before meals, 10u Lantus at bedtime

What type of DM and how do you know?

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Type 1 Rates Increasing Globally

‣ 23% rise in type 1 diabetes incidence from 2001-2009
‣ Why?
  ‣ Autoimmune disease rates increasing over all
  ‣ Changes in environmental exposure and gut bacteria?
  ‣ Hygiene hypothesis
  ‣ Obesity?

Type 1 Diabetes Facts

- As many as **3 million Americans** may have type 1 diabetes.

- Each year, approximately **80 people per day** are diagnosed with type 1 diabetes in the U.S.

- Approximately **85 percent** of people living with type 1 diabetes are adults, and **15 percent** are children.

- The rate of type 1 diabetes incidence among children under age 14 is estimated to **increase by 3 percent annually** worldwide.

- Type 1 diabetes accounts for **$14.9 billion** in healthcare costs in the U.S. each year.

Source: JDRF

Type 1 – 10% of all Diabetes
Genetics and Risk Factors

➢ Auto-immune pancreatic beta cells destruction
➢ Most commonly expressed at age 10-14
➢ Insulin sensitive (require 0.5 - 1.0 units/kg/day)

🍀 Combo of genes and environment:
  🍀 Autoimmunity tends to run in families
  🍀 Higher rates in non breastfed infants
  🍏 Viral triggers: congenital rubella, coxsackie virus B, cytomegalovirus, adenovirus and mumps.

Incidence of Type 1 in Youth

- **General Pop 0.3%**
- **Sibling 4%**
- **Mother 2-3%**
- **Father 6-8%**
- Rate doubling every 20 yrs
- Many trials underway to detect and prevent (Trial Net)

Autoantibodies Assoc w/ Type 1

Panel of autoantibodies –

- GAD65 - Glutamic acid decarboxylase –
- ZnT8 - Zinc Co-Transporter 8
- ICA - Islet Cell Cytoplasmic Autoantibodies
- IA-2A - Insulinoma-Associated-2 Autoantibodies
- IAA - Insulin Autoantibodies

Type 1 Diabetes Associated with other immune conditions

- Celiac disease (gluten intolerance)
- Thyroid disease
- Addison's Disease
- Rheumatoid arthritis
- Other

Medalist Study – Harvard Joslin Diabetes Center

▸ After 50 years with diabetes
  ▸ Many still produced some insulin
  ▸ Many had no eye disease

FOR 50 COURAGEOUS YEARS WITH DIABETES
GIVEN BY JOSLIN DIABETES CENTER
BOSTON MASS USA

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Type 1 Summary

▸ Autoimmune
▸ Complete pancreatic destruction
▸ Need insulin shots
▸ Often first present in DKA

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Type 1 in Hospital

▸ 43 yr old admitted to evaluate angina.
▸ Morning blood sugar is 92.
▸ Based on Regular insulin sliding scale, no insulin required.
▸ Breakfast tray shows up and patient says, I need my insulin shot before I eat.
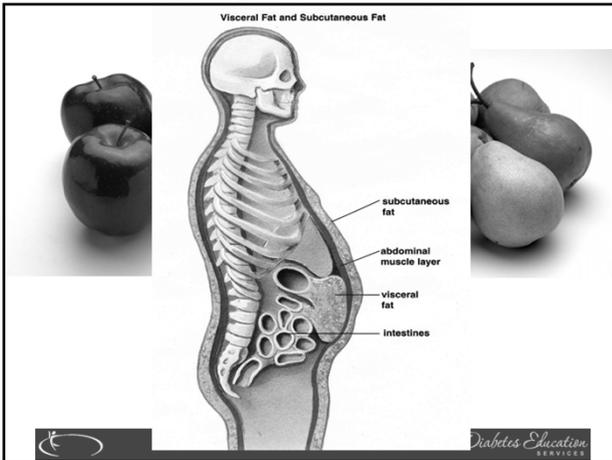
What do you say?

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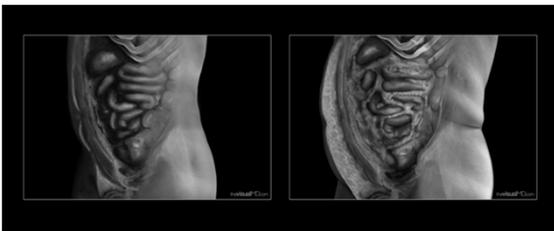Patti Labelle "divabetic" -- that's a mix of diabetic and diva

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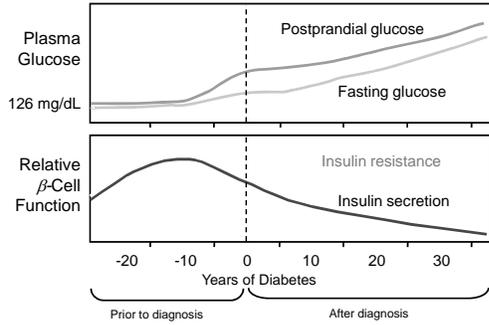
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Visceral Fat and Subcutaneous Fat

subcutaneous fat

abdominal muscle layer

visceral fat

intestines

_____

_____

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_____

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Visceral Fat – "Endocrine Organ"

_____

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Natural Progression of Type 2 Diabetes

Plasma Glucose

Postprandial glucose

126 mg/dL

Fasting glucose

Relative β-Cell Function

Insulin resistance

Insulin secretion

-20   -10   0   10   20   30

Years of Diabetes

Prior to diagnosis   After diagnosis

Adapted from Bergenstal et al. 2000; International Diabetes Center.

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Cardio Metabolic Risk -
5 Hypers -

- Hyperinsulinemia (resistance)
- Hyperglycemia
- Hyperlipidemia
- Hypertension
- Hyper"waistline"emia (35" women, 40" men)

Manifestations of Insulin Resistance

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Diabetes 2 - Who is at Risk?
(ADA Clinical Practice Guidelines)

1. Testing should be considered in all adults who are overweight (BMI $\geq$ 25) and have additional **risk factors**:

   - First-degree relative w/ diabetes
   - Member of a high-risk ethnic population
   - Habitual physical inactivity
   - PreDiabetes
   - History of heart disease

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Diabetes 2 - Who is at Risk?
(ADA Clinical Practice Guidelines)

Risk factors cont'd

- HTN - BP > 140/90
- HDL < 35 or triglycerides > 250
- baby >9 lb or history of Gestational Diabetes Mellitus (GDM
- Polycystic ovary syndrome (PCOS)
- Other conditions assoc w/ insulin resistance:
  - Severe obesity, acanthosis nigricans (AN)

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Acanthosis Nigricans (AN)

- Signals high insulin levels in bloodstream
- Patches of darkened skin over parts of body that bend or rub against each other
  - Neck, underarm, waistline, groin, knuckles, elbows, toes
  - Skin tags on neck and darkened areas around eyes, nose and cheeks.
- No cure, lesions regress with treatment of insulin resistance
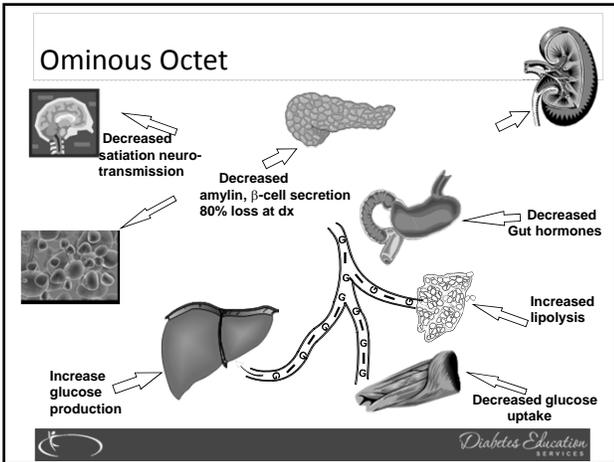
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Diabetes Detectives Needed

- On average – takes 6.5 years to diagnose diabetes
- 1/4 of all people with diabetes don't know they have it

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Ominous Octet

Decreased satiation neuro-transmission

Decreased amylin, β-cell secretion 80% loss at dx

Decreased Gut hormones

Increased lipolysis

Increase glucose production

Decreased glucose uptake

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Comparison of Type 1 and Type 2

	Type 1	Type 2
Obesity	x	xxx
Insulin dependence	xxx	30%
Respond to oral agents	0	xxx
Ketosis	xxx	x
Antibodies present	xxx	0
Typical Age of onset	teens	adult
Insulin Resistance	0	xxx

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Diabetes is also associated with:

‣ Fatty liver disease
‣ Obstructive sleep apnea
‣ Cancer; pancreas, liver, breast
‣ Alzheimer's
‣ Depression

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Gestational DM ~ 7% of all Pregnancies

- GDM prevalence increased by
  - ~10–100% during the past 20 yrs
- Native Americans, Asians, Hispanics, African-American women at highest risk
- Immediately after pregnancy, 5% to 10% of GDM diagnosed with type 2 diabetes
- Within 5 years, 50% chance of developing DM in next 5 years.

Diabetes in pregnant mothers associated with …

- Offspring
  - Fetal Complications
  - Obesity and diabetes later in life
- Mother
  - More complicated pregnancy and delivery
  - Diabetes later in life
- Intrauterine environment is important

Screen Pregnant Women Before 13 weeks

- Screen for undiagnosed Type 2 at the first prenatal visit using standard risk factors.
- Women found to have diabetes at their initial prenatal visit treated as "Diabetes in Pregnancy"
- If normal, recheck at 24-28 weeks

Increasing Prevalence –
A public health perspective

- Body weight before and during pregnancy influences risk of GDM and future diabetes
- Children born to women with GDM at greater risk of diabetes
- Focus on prevention

Postnatal Health:
Maternal Behavior

- Encourage breastfeeding for one year
  - (25% of women achieving this goal)
- Screening 6-12 weeks post partum using non-pregnant OGTT criteria (50%)
- Repeat at 3 yr intervals or signs of DM
- Encourage weight control and exercise
- Make sure connected with health care
- Preconception counseling

Start Metformin therapy

- For women with PreDiabetes and History of GDM

Other Causes of Hyperglycemia

- Steroids
- Agent Orange
- Tube feedings / TPN
- Transplant medications
- Cystic Fibrosis

Regardless of cause, requires treatment
- Insulin always works
- Sign of pancreatic malfunction

Life Study – Mrs. Jones

Mrs. Jones is 62 years old, overweight and complaining of feeling tired and urinating several times a night. She is admitted with a urinary tract Infection. Her WBC is 12.3, glucose 237. She is hypertensive with a history of gestational diabetes. No ketones in urine.

- What are her risk factors, signs of diabetes
- What type of diabetes does she have?
- Does she have insulin resistance?

What Do You Say?
Mrs. Jones asks you

- What is type 2 diabetes?
- Will this go away?
- Will I get complications?
- Will I need to take diabetes medication for the rest of my life?
- How come I got diabetes?
- Do I have to check my blood sugars?

Running into Roadblocks?

▸ *HUG Patients*

▸ Help with
▸ Unconditional
▸ Guidance and Support

Anne Peters, MD, CDE
ADA Post Grad

> ▸ **Unconditional Positive Regard –**
> *involves showing complete support and acceptance of a person no matter what that person says or does.*
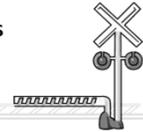> *Carl Rogers*

No one is Unmotivated

.... to lead and long and healthy life

▸ **These are the 3 usual Critical Barriers**
  ▸ Perceived worthlessness
  ▸ Too many personal obstacles
  ▸ Absence of support and resources

Bill Polonsky, PhD, CDE

Overcoming barriers

▸ Confront the key misbelief. Ask the question, does dm cause complications?
▸ Offer pts evidence based hope message –
▸ Frequent contact
▸ Paired glucose testing

▸ Ask pt, "Tell me 1 thing that is driving you crazy about your diabetes"
▸ Discuss medication beliefs
▸ To improve outcomes, see pts more often

Bill Polonsky, PhD, CDE

How will it help me?

- See if your treatment plan is working
- Make decisions regarding food and/or med adjustment when exercising
- Find out how that pizza affected your BG
- Avoid unwanted weight gain
- Enhanced athletic performance
- Find patterns
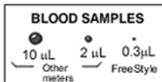- Manage illness

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How Often Should I Check?

- Be realistic!!
- Type 1 – as often as needed
- Type 2 – as needed
- Consider:
  - Types and timing of meds
  - Goals
  - Ability (physical and emotional)
  - Finances

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New Meters – a little goes a long way

BLOOD SAMPLES

10 uL — Other meters   2 uL   0.3µL — FreeStyle

- 0.3 microliters of blood
- minimal pain

Customer Service (toll-free): Look for 800 number

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DiaBingo

B Frequent skin and yeast infections

B A BMI of _____ or greater is considered overweight

B To reduce complications, control **A**1c, **B**lood pressure, **C**holesterol

B PreDiabetes – fasting glucose level of ____ to _____

B Erectile dysfunction indicates greater risk for _____

B Diabetes – fasting glucose level_____ or greater

B Type 1 diabetes is best described as an _____ disease

B People with diabetes are _____ times more likely to die of heart dx

B Elevated triglycerides, < HDL, smaller dense LDL

B Each percentage point of A1c = _____ mg/dl glucose

B At dx of type 2, about __% of the beta cell function is lost

B Diabetes – random glucose _____ or greater

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Thank You

▸ Questions?

▸ Email bev@diabetesed.net

▸ Web www.diabetesed.net

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