Diabetes Management and Beyond

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President, Diabetes Education Services

Schedule of Topics

- Diabetes Overview
- Teaching Strategies
- Medication Therapy
- Insulin and Pattern Management Gone Crazy

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

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Quick Question

- What best describes the prevalence of diabetes in the U.S.?
  a. 30% of people above the age of 20 have type 2 diabetes.
  b. The prevalence of type 1 and type 2 diabetes are almost equal.
  c. 1 out 3 persons has type 2 diabetes.
  d. About 10% of Americans have diabetes.

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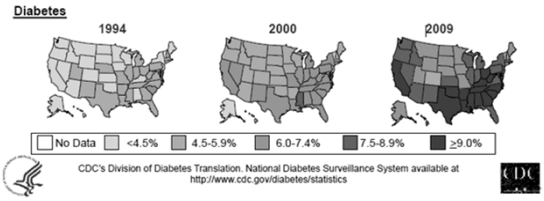
Diabetes in America 2016

- 29 million or > 9.3%
- 27% don't know they have it
- 37% of US adults have pre diabetes (86 mil)



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CDC Announces

35% of Americans will have Diabetes by 2050

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

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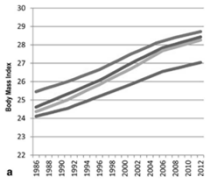
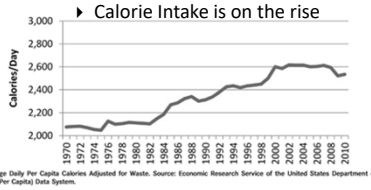
U.S. Weight - 68% overweight or obese



- ~~34% BMI 25-29~~
- 34% BMI 30 +
- 1/3 of all overwt people don't get diabetes
- We burn 100 cals less a day at work
- Overall, food costs ~ 10-15% of income
- Calorie Intake is on the rise



Average Daily Per Capita Calories Adjusted for Waste. Source: Economic Research Service of the United States Department ... ility (Per Capita) Data System.

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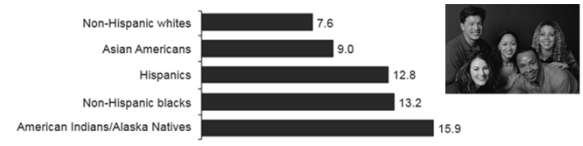
Age-adjusted Diabetes Prevalence

20 yrs or older, by race/ethnicity— U.S. 2014

Age-adjusted* percentage of people aged 20 years or older with diagnosed diabetes, by race/ethnicity, United States, 2010–2012



*Based on the 2000 U.S. standard population.
Source: 2010–2012 National Health Interview Survey and 2012 Indian Health Service's National Patient Information Reporting System.

1 out of 2 black men, Hispanic men and Hispanic women will develop Type 2 Diabetes during their lifetime. NDEP 2016

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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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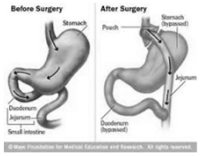
Bariatric Surgery

- Consider for adults with BMI 35 +, especially with comorbidities difficult to control through lifestyle
- Pt's lose about 70% of excess weight
- Increases gut hormone availability
- Improves gut bacteria diversity
- Need life long support and monitoring
- Remission*
  - 72% remission at 2 years
    - (vs 16% w/lifestyle and meds)
  - Highest remission rates
    - Shorter diabetes duration, lower A1c, higher serum insulin levels, and insulin non use
- Long term benefits still under investigation



*remission = BG levels normal without meds

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Signs of Diabetes

Polyuria	Glycosuria, H_2O losses
Polydipsia	Dehydration
Polyphasia	Fuel Depletion
Weight loss	Loss of body tissue, H_2O
Fatigue	Poor energy utilization
Skin and other infections	Hyperglycemia increases incidence of infection
Blurry vision	Osmotic changes

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Quick Question

- Which of the following level is considered pre-diabetes range:
  a. A1c of 6.2 %
  b. Fasting BG of 62
  c. A1c of 7.1 %
  d. After meal BG of 127

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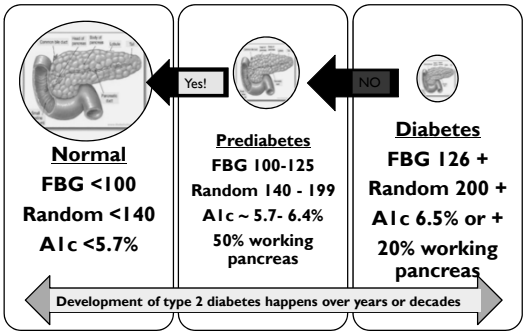
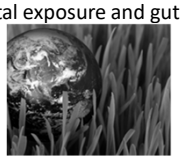
Natural History of Diabetes



Type 1 Diabetes

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?



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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)

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Type 1 Diabetes ~ 10%
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 disease susceptibility
- Risk Factors:
  - Autoimmunity tends to run in families
  - Higher rates in non breastfed infants
  - Viral triggers: congenital rubella, coxsackie virus B, cytomegalovirus, adenovirus and mumps.

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How do we know someone has Type 1 vs Type 2?

- Type 1
  - Positive antibodies
    - GAD
    - ICA
    - IAA and others
- Younger people develop quickly
- Older people take longer to develop
- Body wt and presentation

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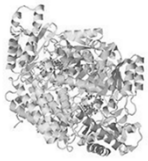
Autoantibodies Assoc w/ Type 1

Panel of autoantibodies –

- GAD65 - Glutamic acid decarboxylase –
- ICA - Islet Cell Cytoplasmic Autoantibodies
- IAA - Insulin Autoantibodies



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Quick Question

What factors would make you suspect type 1 diabetes?

a. Pt has a history of celiac disease

b. Pt presents with low HDL cholesterol

c. Friend tells you she has been eating "tons of sweets“

d. Pt is slightly overweight

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What Kind of Diabetes?

AJ, a 22 year old female admitted to the ICU with a blood glucose of 476 mg/dl and a pH of 7.1.

- What findings would make you suspect type 1 diabetes?

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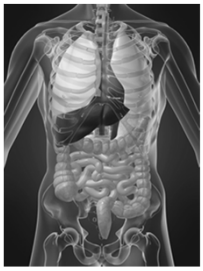
Type 1 Diabetes Associated with other immune conditions

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



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Medalist Study – Harvard Joslin Diabetes Center

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

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How to Get Screened? www.DiabetesTrialNet.org

- **How to get families linked to screening?**

AJ – Next Steps?

For AJ, a 22 year old newly diagnosed with T1DM

1. What baseline lab work, tests does she need?
2. What referrals?

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Diabetes Lab Evaluation - ADA

Test	Frequency
A1c	Dx and 2-4 x's a yr
Fasting lipid profile	Dx and Annually
Microalbuminuria	Dx and annually
Creatinine / GFR	Dx and Annually
Thyroid Stimulating Hormone (type 1 over 50, hyperlipidemia, women >50)	Dx and Annually
Screen for Celiac Disease	Type 1 Dx, repeat prn
Liver function test	Annually

ADA Clinical Practice Recommendations Diabetes Education SERVICES

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"
"I have diabetes, it doesn't have me"

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Path to Type 2 Diabetes

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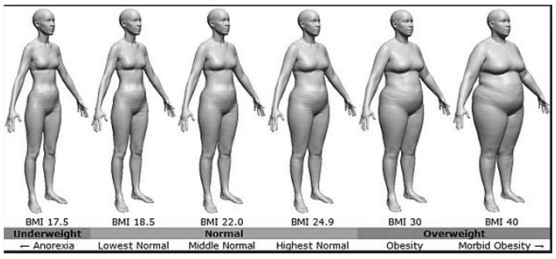
BMI – Visual Image



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Diabetes 2 – Who is at Risk?

- Pre Diabetes & Type 2- Screening Guidelines
- Start screening at age 45 or for anyone who is overweight (BMI ≥ 25, Asians BMI ≥ 23) with one or > additional **risk factor**:
  - 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 associated w/ insulin resistance:
  - Severe obesity, Acanthosis Nigricans (AN)

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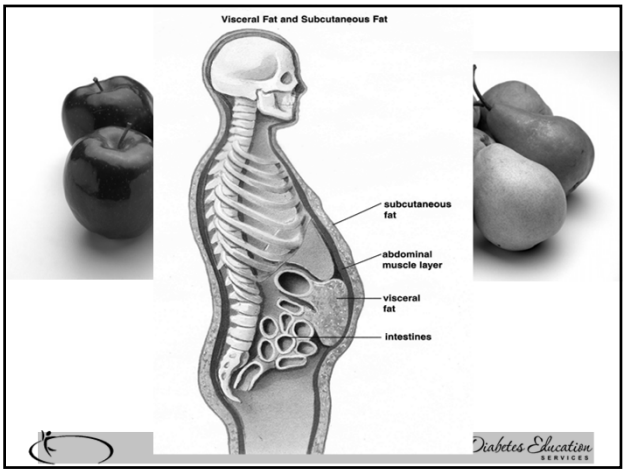
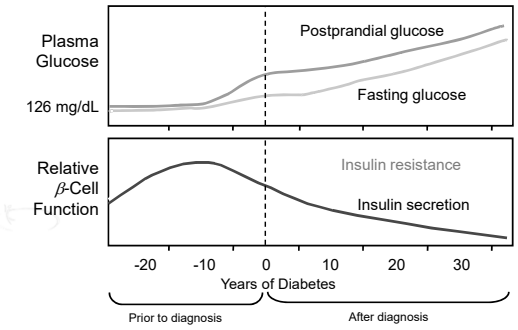
Acanthosis Nigricans (AN)

- 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

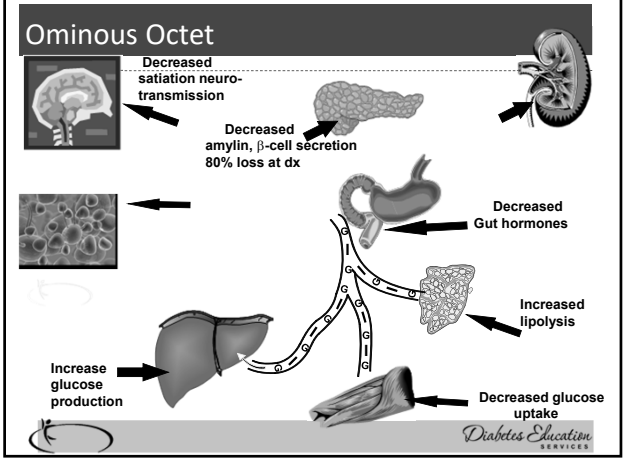


Natural Progression of Type 2 Diabetes



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

Ominous Octet



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?

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

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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

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How will blood glucose testing 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 2 on orals – Medicare covers 100 strips for 3 months
- Based on individual - Consider:
  - Types and timing of meds
  - Goals
  - Ability (physical and emotional)
  - Finances / Insurance

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Comparison of Type 1,Type 2, LADA

	Type 1	Type 2	LADA
Obesity	x	xxx	x
Insulin dependence	xxx	30%	6mos
Respond to oral agents	0	xxx	x
Ketosis	xxx	x	x
Antibodies present	xxx	0	xx
Typical Age of onset	teens	adult	adult
Insulin Resistance	0	xxx	x

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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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"Getting diabetes saved my life."
~ Sherri Sheperd

Sherri Shepard decided to embrace diabetes and use it as a motivator to improve her health.

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Other Specific Types of DM

- Medications such as: steroids, protease inhibitors and Prograf®
- Secondary to Agent Orange
- Liver failure
- TPN or tube feedings
- Pancreatic cancers or removal
- Cystic fibrosis, pancreatitis
- Other

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Regardless of the cause, hyperglycemia needs to be treated.

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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 A1c, Blood pressure, Cholesterol
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 __% beta cell function is lost
B Diabetes – random glucose ____ or greater

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Goals of Care – ADA 2016

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Quick Question

- What is the preferred approach when providing diabetes education with patients?
  a. Provide patient centered self-management support
  b. Instruct all patients to meet national standards
  c. Highlight risk of complications when goals aren't met
  d. Remind them that insulin treatment can be beneficial.

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1. Keep it Patient Centered

- "it is clear that optimal diabetes management requires an organized, systematic approach and the involvement of a coordinated team of dedicated health professionals, working in an environment where patient centered care is a high priority".

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Exercise – Getting Active

- "Physical activity is the closest thing we have to a wonder drug,"
- "Being active is one of the most important things people of all ages, sizes, and shapes can do to improve their health."
- *Dr. Thomas Frieden, Director of CDC*

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Good Exercise Info / Quotes

- 20% of people walk 30 mins a day
- Exercise decreases A1c 0.7%
- No change in body wt, but 48% loss in visceral fat
  - ADA PostGrad 2010

- "If you don't have time for exercise, you better make time for disease."

"I don't have time to exercise, I MAKE time."

Mike Huckabee

4. Exercise Recommendations

- **Activity update –Don't sit more than 90 minutes**
- Evidence supports that everyone, including people with diabetes should be encouraged to reduce sedentary time
- DO NOT sit for more than 90 minutes at a time.
- It is recommended that people with pre diabetes and diabetes engage in 150 minutes of activity a week and at **least 2 weekly sessions of resistance exercise.**

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4. Vaccinations- Immunizations

- Influenza vaccine
  - every year starting at age 6 months
- Hepatitis B Vaccine
  - For diabetes pts age 19 – 59 (not previously vaccinated)
  - Double risk of Hep B due to lancing devices/ glucose meter exposure

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4. Pneumonia Vaccinations

- Pneumonia polysaccharide PPSV23 vaccine to all patients starting at age 2
- **Adults ≥ 65 years of age**, if not previously vaccinated, should receive pneumococcal conjugate vaccine 13 (PCV13), followed by PPSV23 6-12 months after initial vaccination.
- **Adults ≥ 65 years of age**, if previously vaccinated with PPSV23 should receive a follow-up ≥ 12 months with PCV13.

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3. Smoking and Diabetes

Smoking increases risk of diabetes 30%

- **Ask at every visit**
- **Assess**
- **Advise**
- **Assist with stop smoking**
- **Arrange for referrals**
- **Organize your clinic**

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Quick Question

- According to the Diabetes Prevention Trial, losing 5-7 % of body weight and accumulating 150 minutes activity a week can:
  a. Help prevent type 1 diabetes
  b. Lower risk of getting prediabetes
  c. Decrease risk of getting diabetes
  d. Prevent type 2 diabetes

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Financial Advisor

- Mid 30s, friendly, he smiles to greet you and you notice his gums are inflamed. You'd guess a BMI of 26 or so, with most of the extra weight in the waist area.
- If you could give him some health related suggestions, what would they be?

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Can we stop pre diabetes from progressing?

3, 234 people w/ Pre-Diabetes randomized:

- Placebo
- Diet/Exercise or
- Metformin

over a three year period

Diabetes Prevention Program (DPP) 2001

NATIONAL Diabetes PREVENTION PROGRAM

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Diabetes Prevention Program

- Standard Group - 29% developed DM
- Lifestyle Results - 14% developed DM
  - 58% (71% for 60yrs +) Risk reduction
    - 30 mins daily activity
    - 5-7% of body wt loss
- Metformin 850 BID - 22% developed DM
  - 31% risk reduction (less effective with elderly and thinner pt's)

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4. Use Technology to Prevent Diabetes

- Recent studies support content delivery through virtual small groups, internet social networks, cell phones and mobile devices.
  - Validated studies that these approaches can:
    - Support wt loss
    - Reduce A1c (prediabetes)
  - The CDC Diabetes Prevention Program is incorporating these tools into their program content

Download Success! Get Our Free CDE® Coach App

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Weight loss and Prevention

- For every 2.2 pounds of weight loss, risk of type 2 diabetes was reduced by 13%.

NATIONAL Diabetes PREVENTION PROGRAM

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ABC's of Diabetes

A1C

Blood Pressure

Cardiovascular risk reduction

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6. Glycemic Targets

- **Adult non pregnant A1c goals**
  - **A1c < 7%** - a reasonable goal for adults.
  - **A1c < 6.5%** - may be appropriate for those without significant risk of hypoglycemia or other adverse effects of treatment.
  - **A1c < 8%** - may be appropriate for patients with history of hypoglycemia, limited life expectancy, or those with longstanding diabetes and vascular complications.
  - Frequency:
    - If pt meeting goal - At least 2 times a year
    - If pts *not* meeting goal – Quarterly

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6. A1c and Estimated Avg Glucose (eAG)

A1c (%)	eAG
5	97
6	126
7	154
8	183
9	212
10	240
11	269
12	298

Order teaching tool kit free at diabetes.org

eAG = 28.7 x A1c-46.7 ~ 29 pts per 1%

Translating the A1c Assay Into Estimated Average Glucose Values – ADAG Study
Diabetes Care: 31, #8, August 2008

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6. Glucose Goals 2016
Individualize Targets – ADA

- Pre-Prandial BG 80- 130
- 1-2 hr post prandial < than 180

*for nonpregnant adults

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8. BP Goal 2016

BP < 140 / 90

- Some pts may benefit from B/P 130/80 (younger and achieved with undue tx burden)
- Studies indicate that the previous B/P target of 140/80 didn't improve outcomes enough to balance the risk of side effects such as orthostatic hypotension and polypharmacy.

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Poll Question

- What percent of the population over the age of 65 has type 2 diabetes?

A. 9.3%
B. 18%
C. 26%
D. 34%

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Older People and Diabetes Stats

- Rate of older population with diabetes growing rapidly in coming decades.
- Diabetes prevalence to double in next 20 years, in part due to the aging population
- 26% of Americans age 65 or older have diabetes (11.8 million seniors)
- **20%** of new cases occur in ages 65–79
- Adults 75+ highest rates of complications: myocardial infarction, amputations, visual impairment, kidney disease.

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Healthy & Good Functional Status

- Set more intensive goals if:
  - Good cognitive and physical function
  - Expected to live long enough to reap benefits of intensive management,
- Ongoing follow-up to eval safety
- **Goals:**
  - Reasonable A1c goal <7.5%,
  - Fasting BG 90 – 130
  - Blood Pressure < 140/90
  - Statin unless contraindicated or not tolerated

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Patients with Complications and Reduced Functionality - Less Intense Goals

- Adjusted based on shared - decision making and safety.
- Keep it realistic
- Consider DE-Intesification
- Goals:
  - Reasonable A1c goal <8.0%
  - Fasting BG 90 – 150
  - Blood Pressure < 140/90
  - Statin unless contraindicated or not tolerated

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ABCs of Diabetes

- A1c less than 7% (avg 3 month BG)
  - Pre-meal BG 80-130
  - Post meal BG <180
- Blood Pressure < 140/90
- Cardiovascular risk reduction
  - Triglyceride < 150 , HDL >40/50
  - Eval if statin therapy indicated
  - noon

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"Legacy Effect"

- For participants of DCCT and UKPDS
  - long lasting benefit of early intensive BG control prevents
    - microvascular complications
    - Macrovascular complications (15-55% decrease)
  - Even though their BG levels increased over time
  - Message – Catch early and Treat aggressively

"The highest form of wisdom is kindness."
The Talmud

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A 78 yr old man, smokes ppd

- A1c was 8.1% (down from 10.4%)
- B/P 136/76 AM BG 100, 2 hr pp 190
- Chol – TG 54, HDL 46, LDL 98
- Meds:
  - Insulin – 16 units Lantus at HS
  - Benazepril 20 mg
  - Metoprolol 50mg
  - Actos 15 mg
  - Daily aspirin

What class of meds is this patient on?
Any special instructions?
Any med missing?

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8. Cardiovascular Disease and Risk Management

- Cardiovascular disease is the leading cause of mortality and morbidity in diabetes
- Largest contributor to direct and indirect costs
- Controlling cardiovascular risk improves outcomes
- Large benefits are seen when multiple risk factors are addressed globally

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F.A.S.T. is an easy way to remember the sudden signs of stroke. When you can spot the signs, you'll know that you need to **call 9-1-1 for help** right away. F.A.S.T. is:

F **Face Drooping** – Does one side of the face droop or is it numb? Ask the person to smile. Is the person's smile uneven?

A **Arm Weakness** – Is one arm weak or numb? Ask the person to raise both arms. Does one arm drift downward?

S **Speech Difficulty** – Is speech slurred? Is the person unable to speak or hard to understand? Ask the person to repeat a simple sentence, like "The sky is blue." Is the sentence repeated correctly?

T **Time to call 9-1-1** – If someone shows any of these symptoms, even if the symptoms go away, call 9-1-1 and get the person to the hospital immediately. Check the time so you'll know when the first symptoms appeared.

Signs of A Stroke

Beyond F.A.S.T. – Other Symptoms

Sudden **NUMBNESS** or weakness of face, arm, or leg, especially on one side of the body

Sudden **CONFUSION**, trouble speaking or understanding speech

Sudden **TROUBLE SEEING** in one or both eyes

Sudden **TROUBLE WALKING**, dizziness, loss of balance or coordination

Sudden **SEVERE HEADACHE** with no known cause

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Diabetes Care Guidelines- ADA

Test / Exam	Frequency
A1c	At least twice a year
B/P	Each diabetes visit
Cholesterol (HDL, Tri)	Yearly (less if normal)
Weight	each diabetes visit
Microalbumin/GFR/Creat	Yearly
Eye exam	Yearly
Dental Care	At least twice a year
Comprehensive Foot Exam	Yearly (more if high risk)
Physical Activity Plan	As needed to meet goals
Preconception counseling	As needed

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ABCs of Diabetes

- **A**1c less than 7% (avg 3 month BG)
  - Pre-meal BG 80-130
  - Post meal BG <180
- **B**lood Pressure < 140/90
- **C**ardiovascular risk reduction
  - Triglyceride < 150 , HDL >40/50
  - Eval if statin therapy indicated
  - noon

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Mr. Jones - What are Your Recommendations?

Patient Profile

64 yr old with type 2 for 11 yrs. Hx of CVD.

Labs:

- A1c 9.3%
- HDL 37 mg/dl
- Triglyceride 260mg/dl
- Proteinuria - neg
- B/P 152/94

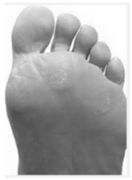
Self-Care Skills

- Walks dog around block 3 x's a week
- Bowls every Friday
- 3 beers daily
- *What meds?*
- *What referrals?*
- *My foot hurts*

Diabetes Education SERVICES

LR Life Study

- Diabetes Type 2 for 8 years
- On glyburide for 8 years
- A1c 8.7%
- Doesn't know how to check blood glucose
- Smokes pack per day
- Has calluses on his feet that he trims with a razor



Diabetes Education SERVICES

Diabetes and Amputations

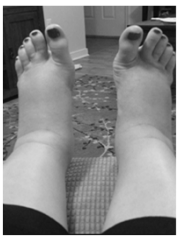
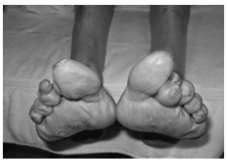
- Diabetes = 8 fold risk of amputations
- Highest rate in those over 75
- 50% of amputations can be avoided through self-care skill education and early intervention
- Rate declined by 65% from 1996-2008
  - From 11.2 per 1000 to 3.9 per 1000

Stats from CDC 2012

Diabetes Education SERVICES

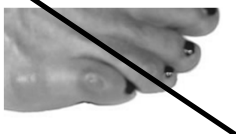
Lower Extremities

- Lift the Sheets and Look at the Feet

Diabetes Education SERVICES

No Bathroom Surgery





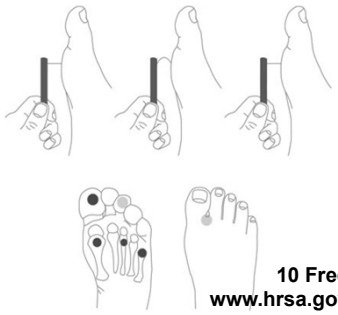

Diabetes Education SERVICES

You Can Make A Difference

- Assess
  - Nail condition, nail care, in between the toes
  - Who trims your nails
  - Have you ever cut your self?
  - Shoes – type and how often
  - Socks
  - Skin/skin care and vascular health
  - Ability to inspect
  - Loss of protective sensation

Diabetes Education SERVICES

5.07 monofilament delivers 10gms linear pressure



10 Free Monofilaments
www.hrsa.gov/hansensdisease/leap/

Diabetes Education SERVICES

Three Most Important Foot Care Tips

- Inspect and apply lotion to your feet every night before you go to bed.
- Do NOT go barefoot, even in your house. Always wear shoes!
- Every time you see your doctor, take off your shoes and show your feet. Report any foot problems right away!

Diabetes Education SERVICES

DiaBingo- G

G ADA goal for A1c is less than _____%

G People with DM need to see their provider at least every month

G Blood pressure goal is less than

G People with DM should see eye doctor (ophthalmologist) at least

G The goal for triglyceride level is less than

G Goal for my HDL cholesterol is more than

G The goal for blood sugars 1-2 hours after a meal is less than:

G People with DM should get this shot every year

G People with DM need to get urine tested yearly for _____

G Periodontal disease indicates increased risk for heart disease

G The goal for blood sugar levels before meals is:

G The activity goal is to do ___ minutes on most days

Diabetes Education SERVICES

Medication Therapy – A Case Management Approach

1. Describe the main action of the different categories of type 2 diabetes medications.
2. Discuss strategies to determine the right medication for the right patient using ADA and AACE Algorithm
3. Use a case study approach to figure out the best pharmacologic intervention given the situation

Diabetes Education SERVICES

Diabetes Agents Considerations

- Diabetes medications can be used as monotherapy, in combo or with insulin
- Combining agents from different classes has additive effect
- Most reduce A1c 0.5 – 2.0%
- Not to be used during preconception, pregnancy or when breastfeeding

Diabetes Education SERVICES

Quick question

- When starting patients on medications, what is the most important factor to consider?

a. Their level of compliance
b. Their diabetes pathology
c. Their education level
d. Their preferences, needs and values

Diabetes Education SERVICES

Patient Centered Approach

"...providing care that is respectful of and responsive to individual patient preferences, needs, and values - ensuring that patient values guide all clinical decisions."

- **Gauge patient's preferred level of involvement.**
- **Explore, where possible, therapeutic choices.**
- **Utilize decision aids.**
- **<u>Shared</u> decision making – final decisions re: lifestyle choices ultimately lie with the patient.**

ADA-EASD Position Statement: Management of Hyperglycemia in T2DM

Diabetes Care **2012;35:1364–1379**
Diabetologia **2012;55:1577–1596**

Diabetes Education SERVICES

Approach to the management of hyperglycemia

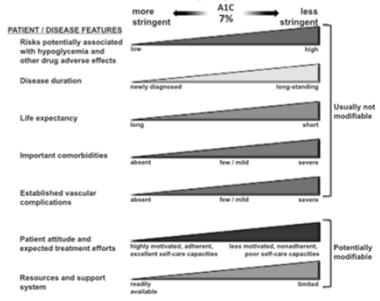


Figure 6.1—Depicted are patient and disease factors used to determine optimal A1C targets. Characteristics and predicaments toward the left justify more stringent efforts to lower A1C; those toward the right suggest less stringent efforts. Adapted with permission from Inzucchi et al. (45).

ADA Standards of Care 2016

Diabetes Education SERVICES

Quick question

- According to the AACE and ADA Glycemic Control Algorithm, what is the first step to control hyperglycemia in type 2?

a. Lifestyle modification
b. Start insulin
c. Start metformin
d. Start 2 meds if their A1c is 7.4%

Diabetes Education SERVICES

Anti Hyperglycemic Therapy – 1st Step

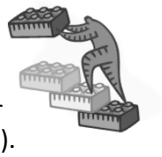
- Lifestyle Changes
  - Weight control
  - Healthy eating
  - Activity

ADA-EASD Position Statement: Management of Hyperglycemia in T2DM

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

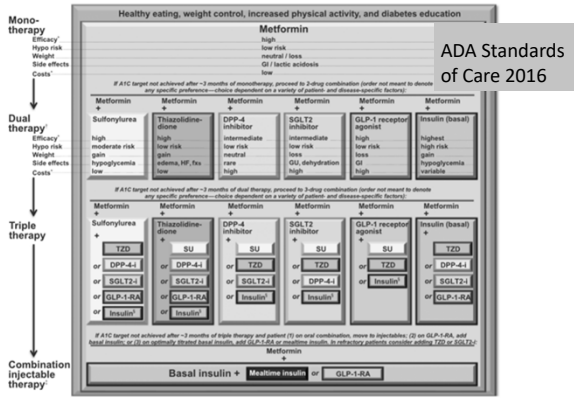
Diabetes Education SERVICES

ADA Step Wise Approach to Hyperglycemia 2016



- Start with lifestyle coaching
- When lifestyle alone is not achieving A1c goal – Metformin should be added at, or soon after diagnosis (unless contraindicated).
- Metformin has a long standing evidence base for efficacy and safety, is cheap and may reduce CV risk.

Diabetes Education SERVICES



ADA Standards of Care 2016

Diabetes Education SERVICES

Biguanides – Suppressor
Metformin (Glucophage®)

- Action: suppresses release of glycogen from the liver
- Who?
  - Fasting hyperglycemia
  - Dysmetabolic Syndrome
  - For pediatrics starting age 10
    - (XR age 17)

Glycogen Stopper and **GLP Enhancer?**

Diabetes Education SERVICES

Biguanides - Metformin

- **Action:** decrease hepatic glucose (glycogen)
- **Names:**
  - Metformin (Glucophage)
    - Starting dose: 500 BID, max 2500mg daily
  - Metformin extended release (3 different versions)
    - Starting dose 500mg at dinner, max dose 2000 to 2500 mg daily
  - **Efficacy:**
    - Decrease fasting plasma glucose 60-70 mg/dl
    - Reduce A1C 1.0-2.0%

Diabetes Education SERVICES

Biguanides - Metformin

- Benefits
  - Decrease LDL cholesterol and triglycerides
  - No weight gain, possible modest weight loss
  - Cancer protective?
- Concerns
  - Diarrhea and abdominal discomfort – Use XR (may see pill shell in stool – okay)
  - Lactic acidosis if improperly prescribed
  - Watch for B12 deficiency
  - Hold before and 48 hours after IV contrast dye studies. Resume when kidney function adequate.

Diabetes Education SERVICES

Considerations
Biguanide - Metformin (Glucophage®)

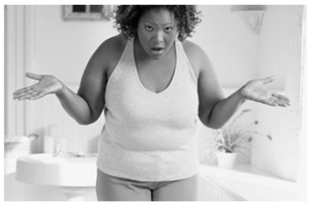
- Contraindications due to risk of lactic acidosis:
  - creatinine >1.4 females, >1.5 males
  - liver disease
  - alcohol abuse
  - over 80 years old
  - risk of acidosis
  - during IV dye study
  - CHF requiring meds

FDA 2016 suggests GFR more appropriate measure. If GFR <45 – don't start new pts and eval benefit vs risk. If GFR <30, stop metformin.

Diabetes Education SERVICES

Start Metformin therapy

- For women with PreDiabetes and History of GDM



Diabetes Education SERVICES

Quick Question

- John is started on Metformin 500mg BID. Which of the following is true?

a. Hold metformin if your blood glucose is below 90 mg/dl.
b. If you forget to take metformin before the meal, hold the dose.
c. Take metformin with meals
d. Always hold metformin if you are sick

Diabetes Education SERVICES

Sulfonylureas - Squirts

- Action: Increase endogenous insulin secretion throughout day
- Efficacy:
  - Decrease FPG 60-70 mg/dl
  - Reduce A1C by 1.0-2.0%
- Side Effects:
  - Weight gain, hypoglycemia
- Benefits:
  - Cheap, effective

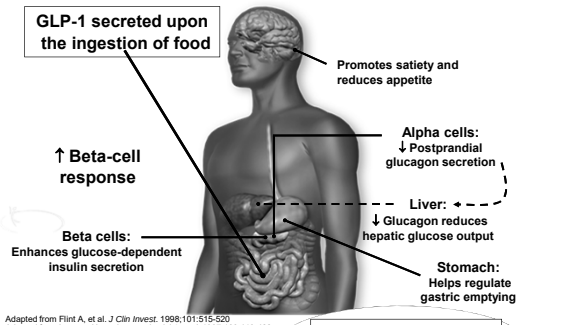
Diabetes Education SERVICES

Meglitinides - Squirts

- **Action**: stimulate insulin secretion (rapid and short duration) when glucose present
- **Names**:
  - repaglinide (Prandin)
    - **Dosing**: 0.5 to 4 mg a.c. Max dose 16mg
    - Metabolized by liver and mostly excreted in feces (some renally).
  - nateglinide (Starlix)
    - **Dosing**: 120 mg tid with meals
    - Metabolized by liver, excreted by kidney
- Efficacy:
  - Decreases peak postprandial glucose
  - Decreases plasma glucose 60-70 mg/dl
  - Reduce A1C 1.0-2.0%

Diabetes Education SERVICES

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



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

Diabetes Education SERVICES

Incretin Mimetics
Byetta, Bydureon, Trulicity, Tanzeum

- **Action (synthetic gut hormone)**
  - Insulin release in response to meal
  - Slows gastric emptying
  - Causes Satiety – promotes wt loss
  - Preserves Beta Cells
- **Details:**
  - Daily and long acting version - 1x week injection
  - **Efficacy:** Decreases A1c by 0.5 – 1.6%, wt by 3lbs +
- **Benefits/Issues** – wt loss, no hyp. Expensive, N/V
  - □ Pancreatitis Warning – report signs immediately

Diabetes Education SERVICES

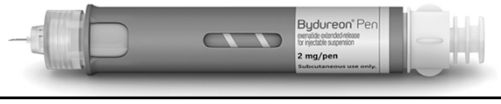
Incretin Mimetics
Exenatide (Byetta), Exenatide XR (Bydureon)

- **Action:**
  - Insulin release in response to meal
  - Slows gastric emptying
  - Causes Satiety
  - Protects Beta Cells
- **Exenatide Dosing**:
  - 5-10 mcg before break, dinner
  - Long acting version - 1x week (available in pens in 2015)
- **Efficacy:** Decreases A1c by 0.7%, wt by 3lbs
- **Indication**: For type 2s only - mono or in combo
- 

Diabetes Education SERVICES

Incretin Mimetics – Exenatide XR - Bydureon

- **Once a Week Dosing**: 2mg
- **Efficacy:** Decreases A1c by 1.6%, wt by ~6lbs
- **Indication**: For type 2s only
- **Other**: – Available in pen
- **Caution**:
  - not indicated for pt's w/ history of medullary thyroid tumor
  - pancreatitis warning



DPP-4 Inhibitors – "Incretin Enhancers"

Januvia (sita*gliptin*) – Tradjenta (lina*gliptin*)
Onglyza (saxa*gliptin*) Nesina (alo*gliptin*)

- **Action:**
  - Increase insulin release w/ meals
  - Suppress glucagon
- **Dosing**: Januvia – 100mg a day
  Onglyza – up to 5mg a day
  Tradjenta – 5mg a day
  Nesina – up to 25 mg a day
- **Efficacy:** Decreases A1c by 0.6 -0.8%
- **Indication**: For type 2s

Diabetes Education SERVICES

DPP-4 Inhibitors – "Incretin Enhancers"

Januvia (sita*gliptin*) – Tradjenta (lina*gliptin*)
Onglyza (saxa*gliptin*) Nesina (alo*gliptin*)

- Januvia, Onglyza eliminated via kidney, lower dose needed
- Can cause sudden onset of joint pain
- Saxagliptin and alogliptin can increase risk of heart failure. Notify MD for shortness of breath, edema, weakness, etc.
- Do not cause wt gain or hypoglycemia
- Side effects – headache, runny nose, sore throat - watch for pancreatitis
- Cost $100 - $150 mo

Diabetes Education SERVICES

For all the Previous GLP-1 Agonists

- Pancreatitis Warning
  - Please tell all patients to report signs right away and discontinue meds
  - Signs include:
  - Sudden abdominal pain, nausea and vomiting
-

Diabetes Education SERVICES

SGLT2 Inhibitors- "Glucoretics"

- **Action**: "Glucoretic" decreases renal reabsorption in the proximal tubule of the kidneys (reset renal threshold and increase glucosuria)
- **Names**:
  - Canagliflozin (Invokana)
  - Dosing: 100 – 300 mg once daily ac first meal
    - If eGFR 45-60: do not exceed 100mg a day
    - If eGFR <45, do not use
  - Empagliflozin - Jardiance
    10 – 25 mg daily
    If GFR < 45, don't use
  - Dapagliflozin (Farxiga)
  - Dosing: 5 – 10 mg once daily ac first meal
    - If eGFR <60, do not use
    - Don't use if pt has bladder cancer and report blood in urine
- **Efficacy:**
  - Weight loss of 1-3 lbs
  - Reduce A1C ~0.7-1.5%

Diabetes Education SERVICES

EMPA-REG OUTCOME®: Summary

- Empagliflozin, as used in this trial, for 3 years in 1,000 patients with type 2 diabetes at high CV risk:
- Empagliflozin reduced hospitalisation for heart failure by 35%
  ¤ 14 fewer hospitalisations for heart failure (42 vs 28)
- Empagliflozin reduced CV death by 38%
  ¤ 25 lives saved (82 vs 57 deaths)
    - 22 fewer CV deaths (59 vs 37)

- Empagliflozin improved survival by reducing all-cause mortality by 32%
  ¤ 53 additional genital infections (22 vs 75)

Diabetes Education SERVICES

Considerations

- Cost
- Hypoglycemia
- Age
- Weight
- Comorbidities
  - Kidney disease
  - Heart disease – CHF, CAD
  - Liver dysfunction

ADA-EASD Position Statement: Management of Hyperglycemia in T2DM

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

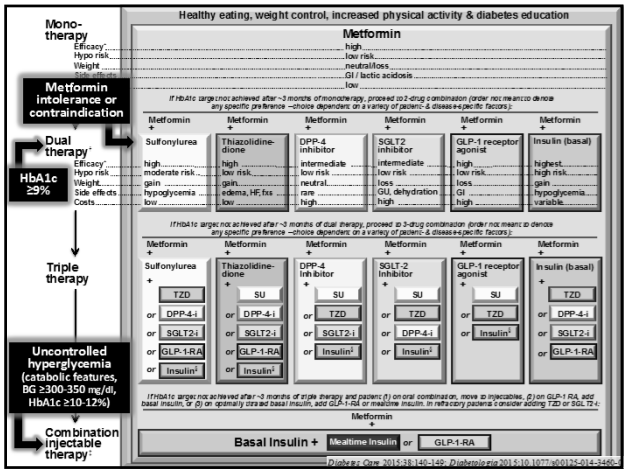
Diabetes Education SERVICES

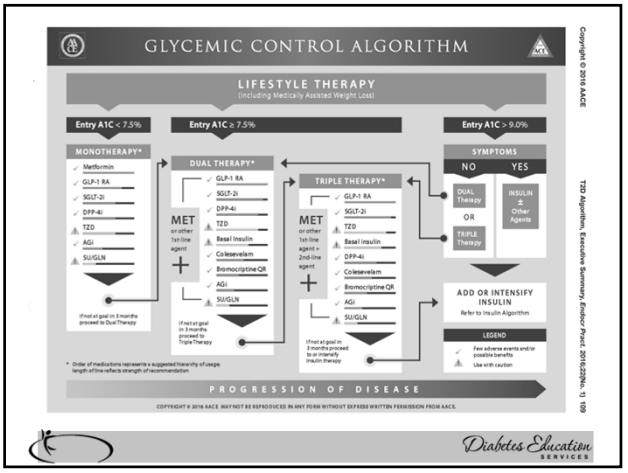
When goal is to minimize cost

- Go generic. Metformin and Sulfonylureas
- Walmart offers 3 month supply of following meds for ~ $10
  - Metformin and Metformin XR
  - Glipizide, Glyburide, Glimepiride

- Other generics include
  - Actos and Avandia
  - Acarbose
  - Can still cost up to $100 a month

Diabetes Education SERVICES





Diabetes Education SERVICES

Treating Hyperglycemia with Meds

- For all of the following case studies, we assume we are providing ongoing education on lifestyle
- In describing what meds match the patient best, we act as patient advocates and consultants

Diabetes Education SERVICES

What kind of Diabetes?

- Pt is 58, states she has had type 1 diabetes for 18 years. Quit smoking a year ago and gained about 20 lbs. BMI 25.
- Meds
  - Humalog 18-23 units before each meal
  - Lantus 28 units at bedtime
  - Metformin 500mg TID
- What tests would you recommend?

Diabetes Education SERVICES

Double Diabetes – An Increasing Problem

- Defined as a person who presents w/ features of both type 1 and type 2 diabetes.
- Someone with type 1 diabetes gains significant weight and manifests the clinical features of insulin resistance and type 2
- or in those with type 2 who develop autoantibodies to beta cells and manifest type 1 (esp in kids)

Diabetes Education SERVICES

Double Diabetes in Adults – Type 1 then add on Type 2

- Seem to be especially susceptible if both parents had type 2 diabetes
- Treatment?
  - **REMOVAL** study (Reducing with Metformin Vascular Adverse Lesions) - adding metformin to insulin
  - GLP-1 Agonists – Victoza use early in type 1 may help preserve beta cells. Also helps with wt loss, lower insulin dose and improved A1c
  - SGLT-2 Inhibitors – add on to insulin in Type 1 also improve A1c and leads to wt loss

Diabetes Education SERVICES

What type of Diabetes?

- 72 Years old
- A1c 3 months prior 6.2%
- A1c now 13.9%
- BMI 24.5
- Lost about 10 pounds over last month

Diabetes Education SERVICES

Latent AutoImmunity Diabetes in Adults (LADA)

- Antibody positive to 1-2 of below
  - GAD-65 autoantibodies
  - Insulin Autoantibodies
  - Islet Cell antigen-2
- Adult Age at onset
- Usually need insulin w/in first 6 months of diagnosis
- Early insulin therapy may preserve beta cell function

Diabetes Care 26:536-538, 2003
Jerry P. Palmer, MD and Irl B. Hirsch, MD

Diabetes Education SERVICES

LADA Clinical Features Compared to Type 2

Feature	LADA	Type 2
Age <50	63%	19%
Acute hyperglycemia	66	24
BMI < 25	33	13
Hx of autoimmune dx	27	12
Family hx autoimmune	46	35

Practical Diabetology March 08, Unger MD

Diabetes Education SERVICES

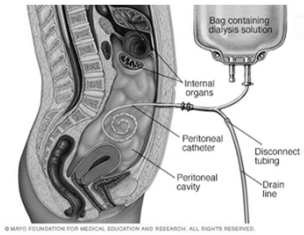
LADA Treatment

- Basal insulin – start with low dose 0.1-0.2 units/kg
- Plus oral therapy
  - Metformin
  - DPP-IV
  - Sulfonylurea

Diabetes Education SERVICES

Peritoneal dialysis and Diabetes

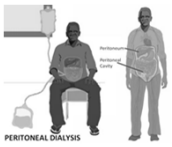
- A1c Goal
  - A1c 7-8%
  - If creat 1.3 or greater, insulin and oral meds last longer, increasing risk of hypoglycemia
  - Important to use low dose diabetes medication



Diabetes Education SERVICES

Peritoneal dialysis and Diabetes

- Medication Management
  - Insulin – may need to decrease dose by ½ if GFR <30
- Start with their baseline
  - Bolus before start dialysis or inject insulin into bag
  - Continue basal once or twice daily
  - Preferred Orals –
    - Glipizide, Prandin



Diabetes Education SERVICES

Life Study

- 61 year old overweight woman with type 2 diabetes 3 months. Has been trying to control diabetes with diet and exercise. GFR in 90s. Worried about weight gain.
- Most recent A1c 6.9%
  - Medication of choice?

Diabetes Education SERVICES

Life Study

- 61 year old overweight woman with type 2 diabetes 3 months. Has been trying to control diabetes with diet and exercise. GFR in 90s. Worried about weight gain.
- Most recent A1c 6.9%
- Solutions?
  - Consider no meds and monitor
  - Or Start Metformin XR

Diabetes Education SERVICES

Life Study

- 64 year old overweight woman with type 2 diabetes 3 years. Has been trying to control diabetes with diet and exercise. GFR in 40s. Worried about weight gain.

- A1c increased to 7.7%
- What med?

Diabetes Education SERVICES

Life Study

- 64 year old overweight woman with type 2 diabetes 3 years. Has been trying to control diabetes with diet and exercise. GFR in 40s. Worried about weight gain.

- A1c increased to 7.7%
- Solution?
  - DPP-IV Inhibitor – Tradjenta*
    - *KP guidelines – pt started on Tradjenta should be within 1% of their A1c goal. D/C after 6 months if A1c target not achieved.
  - Is glipizide an option?

Diabetes Education SERVICES

When goal is to avoid weight gain

- These meds are weight neutral
  - Metformin
  - DPP-IV Inhibitors: Januvia, Onglyza, Tradjenta, Nesina
  - Acarbose

- These meds associated with wt loss
  - GLP-1 agonists (Byetta, Bydureon, Victoza, Tanzeum, Trulicity)
  - SGLT-2 Inhibitors (Canagliflozin, Dapagliflozin, Empagliflozin)
  - Symlin (Pramlintide)

Diabetes Education SERVICES

Life Study

- 54 year old smoker, has CVD disease, creatinine 1.2, BMI 28. Not checking BG, even though he has glucose meter. On Metformin 1000mg BID for past 4 months. Had bad experience with hypoglycemia on glyburide.
- Most recent A1c 8.9%
  - What med add on?

Diabetes Education SERVICES

When goal is to avoid Hypoglycemia

- Avoid sulfonylureas
- Conservative insulin dosing
- May need to up adjust glucose goals
- Monitor kidney function
- Use Meds that don't cause weight gain
  - GLP-1 RA
  - SGLT-2 Inhibitors
  - DPP-IV Inhibitors
  - Metformin
  - Acarbose

Diabetes Education SERVICES

Life Study

- 54 year old smoker, has CVD disease, creatinine 1.2, BMI 27. Not checking BG, even though he has glucose meter. On Metformin 1000mg BID for past 4 months. Had bad experience with hypoglycemia on glyburide.
- Most recent A1c 8.9%
- Solution:
  - Consider Glipizide
  - Add GLP-1 RA – Byetta*
  - Tradjenta*
    - *KP guidelines – pt started on Byetta/Tradjenta should be within 1% of their A1c goal. D/C after 6 months if A1c target not achieved. Rx by Endo Physicians

Diabetes Education SERVICES

Life Study

- 71 year old woman with type 2 diabetes for past year. BMI 24. Has been trying to control diabetes by limiting carbs and exercise. GFR 62. Good social support.
- Most recent A1c 8.6%
  - She hates needles

Diabetes Education SERVICES

Older Adults - Considerations

- Reduced life expectancy
- Higher CVD burden
- Reduced GFR
- At risk for adverse events from polypharmacy
- More likely to be compromised from hypoglycemia

✓Less ambitious targets
✓A1c <7.5–8.0%
✓Focus on drug safety

Diabetes Care 2012;35:1364–1379
Diabetologia 2012;55:1577–1596

Diabetes Education SERVICES

Life Study

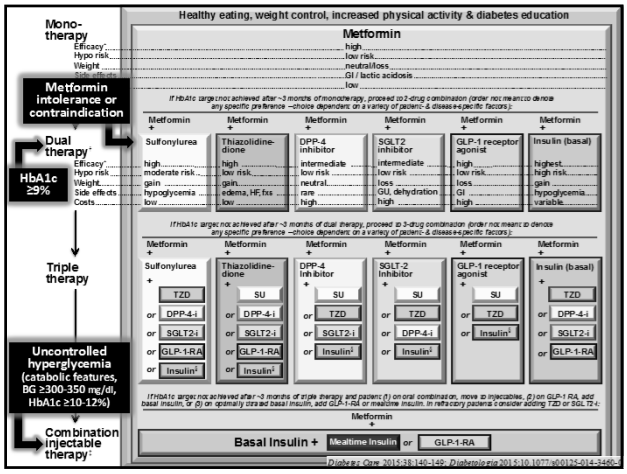
- 71 year old woman type 2 diabetes. BMI 24. Has been trying to control diabetes by limiting carbs and exercise. GFR 62. Good social support.
- Most recent A1c 8.6%
- Solutions
  - Metformin
  - Eval eating disorder

Diabetes Education SERVICES

What next?

- 69 year old male, BMI 31, on Metformin 2000mg a day and Glipizide 40mg a day.
- A1c 9.1%. Creat 1.2
- Pt is obese, 11 yr history of diabetes
  - What next?

Diabetes Education SERVICES



What next?

- 69 year old male, BMI 31, Metformin 2000mg a day and Glipizide 40mg a day. Wt 100kg
- A1c 9.1%. GFR 58
- Pt is obese, 11 yr diabetes
- Solutions
  - Continue metformin
  - Add basal insulin
  - Stop Glipizide?
  - Consider Byetta?

Diabetes Education SERVICES

Starting Insulin?

- Basal
  - Start with 10 units
  - Or 0.1 – 0.2 units/kg of body weight
- 100 kg
  - 10 to 20 units basal at HS (NPH)
- If meal time BG still elevated, add bolus at largest meal –
  - 10% of basal or 4 units
- Solutions
  - Continue metformin
  - Consider 70/30
    Stop Glipizide? Consider stopping when bolus insulin started

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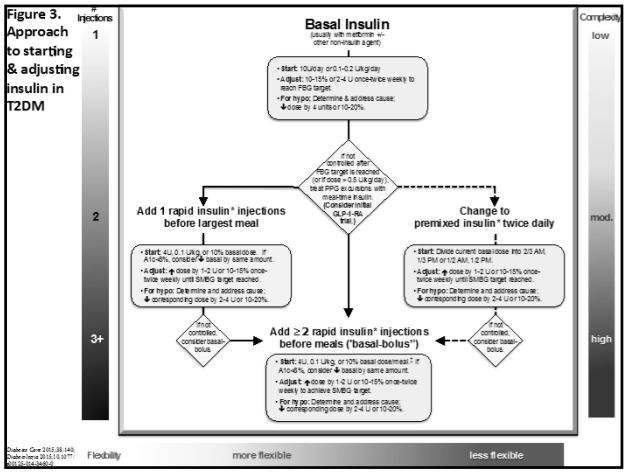
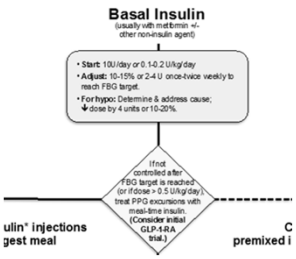


When is it Too much basal insulin?



Diabetes Education SERVICES

Case Study

- 70 yr old, weighs 100kg
- History of CABG
- A1c – 11.3%, BG 400-500 for past weeks
- Insulin – 100+ units Lantus at hs (solostar).
- Metformin 1000mg BID, glyburide 20mg daily
- What is max basal insulin should he be on?
- Should he be on glyburide?

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Cost Per Vial in Northern CA

Per vial cost	Walmart	Walgreens	Costco
Regular Insulin	$25*	$92	$99
NPH	$25*	$92	$99
70/30	$25*	$92	$101
Humalog	$200	$220	$178
Novolog	$197	$217	$178
Apidra	$180	$246	$178
Levemir	$300	$300	$300
Lantus	$226	$221	$206

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Case Study

What is max basal insulin should he be on?

- 100kg x 0.5 = 50 units a day
- What can we do next to improve BG?
  - Add bolus insulin to largest meal
  - Switch him to 70/30 insulin ac breakfast and dinner
    - Total previous basal dose – 100 units
    - 2/3 in am – 65 units am (43 NPH and 22 regular)
    - 1/3 pre dinner – 35 units pm (23 NPH and 12 regular)

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Case Study

- 70 yr old, weighs 100kg
- History of CABG, tobacco
- A1c – 11.3%, BG 400-500 for past weeks
- What will inform you of how to proceed?
  - His willingness to stick to a complex regimen
  - His ability to self-monitor
  - His social support and connection to his medical team

Diabetes Education SERVICES

Basal + Metformin
Type 2, 80kg – A1c 8.7%

	Break	Lunch	Dinner	HS
Mo 1	170s			298 10u NPH
Mo 2	160s			233 20u NPH
Mo 4	140s	283	265	206 40u NPH

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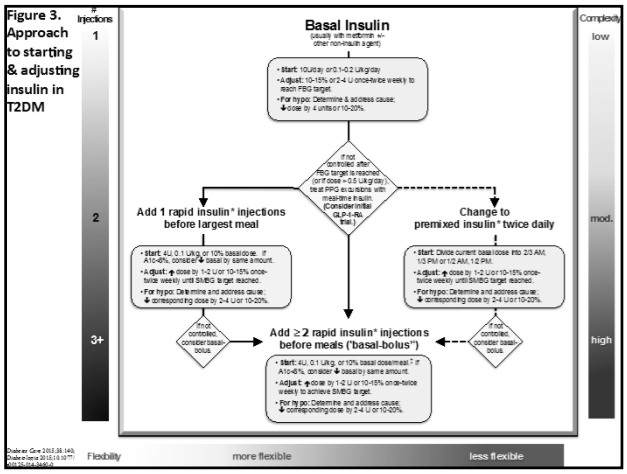

Next Steps

- At max basal dose
  - 80 x 0.5 = 40 units
- Start bolus insulin at largest meal
- Or switch to 70/30 Insulin

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Combo Sub-Q Insulin

Insulin Type	Onset	Peak
Humalog Mix 75/25: 75% NPL, 25% lispro 50/50: 50% NPL, 50% lispro	0.25 - 0.5 hr	0.5-6.5 hrs
NovoLog Mix 70/30: 70% NPA, 30% aspart	0.25 - 0.5 hr	1 – 4 hrs
NPH + Reg Combo 70/30: 70%N /30%R 50/50: 50%N /50%R	0.5 – 1.0 hr	2 - 16 hrs

Considerations:

- Pre-mixed, difficult to fine tune therapy

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Next Steps – Switch from 40 units basal to 70/30 Insulin

- Switch to 70/30 Insulin
- Take current dose and give 2/3 in am and 1/3 in pm.
  - 2/3 of basal in am
    - 40 units x 0.6 = 24 units 70/30
  - 1/3 of basal in *pm
    - 40 units x 0.4= 16 units 70/30
  - *pm = before dinner

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Next Steps – Switch from 60 units basal to 70/30 Insulin

- Switch to 70/30 Insulin
- Take current dose and give 2/3 in am and 1/3 in pm.
  - 2/3 of basal in am
    - 60 units x 0.6 = ___ units 70/30
  - 1/3 of basal in *pm
    - 60 units x 0.4=____ units 70/30
  - *pm = before dinner

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24u 70/30 am, 16 u 70/30 pm Patterns? Changes needed?

	Break	Lunch	Dinner	HS
Day 1	102	63	92	181
Day 2	112	67	106	195
Day 3	98	56	112	201
Day 4	99	71	132	211

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Poll Question

- Which is his largest meal from a carb perspective?
  - A. Breakfast
  - B. Lunch
  - C. Dinner
  - D. Breakfast or Lunch

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Food diary – Finding Largest Meal

- Breakfast
  - Big bowl of oatmeal with walnuts, banana, coffee
- Lunch
  - Sandwich and piece of fruit
  - A few cookies around 3pm
- Dinner
  - Big salad, BBQ meat, dinner roll, glass of wine
- Late night snacking
  - Peanut butter on celery, nuts, cheese

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Bolus – Insulin Sliding Scale

Starts at 150, 2 units for every 50 mg/dl >150

	Break	Lunch	Dinner	HS
Day 1	94 no insulin	212 4 uR	148 no insulin	254 6 uR
Day 2	243 4uR	254 6 uR	201 4uR	199 no insulin
Day 3	189 2uR	243 4uR	162 2uR	244 4uR
Day 4	66 No insulin	287 6uR	144 none	272 6uR

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Dawn Phenomena or Somogyi?

Dawn Phenomena

- 4am rise in BG due to growth hormones, cortisol
- Mostly with type 1
- Liver overproducing glucose due to low basal insulin
- Manage with basal insulin at hs

Somogyi

- "Rebound" hyperglycemia
- Hypoglycemia causes release of stress hormones
- Evaluate for episodes of undetected hypoglycemia and down-adjust medications

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Now What?

- Patient ate lunch and forgot to take 3 units regular insulin

- Patient took 4 units regular insulin and is too nauseated to eat.
- Nighttime BG is 250, pt increases bedtime NPH by 4 units

Approach Depends on Patient

- Insulin dosing is relative to body weight
  - Kidney function
  - Other meds
  - Activity level
  - Social support
  - Goals of care
  - Patients ability

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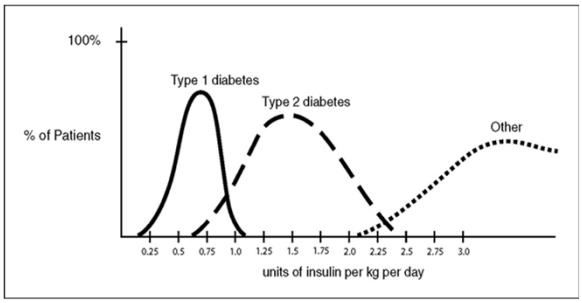
Insulin Dosing Type 1 & 2



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More than 200 units a day?

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Humulin Regular U-500

Concentrated & Inhaled Insulins *DiabetesEd.net*

Name/Concentration	Insulin/Action	Considerations
Humulin Regular U-500 • 500 units insulin/mL • KwikPen or Vial	Regular Bolus / Basal	5 xs concentration of u-100 insulin. Indicated for pts taking 200+ units insulin daily. 3 mL Pen – Once opened, good for 28 days. 20 mL Vial – Once opened, good for 40 days. Use designated U-500 insulin syringe.

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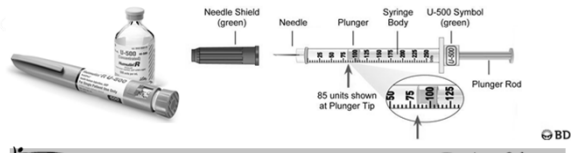
Consider U-500 High Potency Insulin

5 x's the concentration of u100

- 500 units per mL vs 100 units per mL
  - 20 mL a vial. 500 units per mL= 10,000 unit
  - Costs ~ ~~$400~~ $1,200 per vial
  - Less volume



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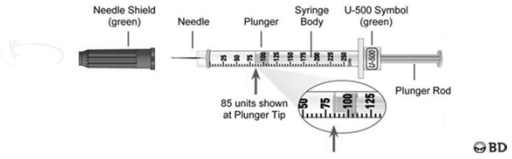
Dedicated U-500 Insulin Syringe

- Manufactured by BD – Nov 2016
- 5 unit increments
- No conversion or calculation required
- If 85 units of U-500 R Insulin is ordered…



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Humulin R U-500 Updated Package Insert

- Patients using the U-500 vial must be prescribed the U-500 insulin syringe
- Administer U-500 two to three times daily 30 minutes before a meal
- Don't mix U-500 with other insulins
- Do not perform dose conversion when using U-500 KwikPen or U-500 Insulin syringe.
- Do not transfer U-500 from the KwikPen into any syringe.

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Dosing Strategies u-500

- Dosing – take total daily needs and split into 2-3 doses
  - 2 doses: 60% am / 40% pm or
  - 3 doses: 40/30/30 or 40/40/20
- No basal insulin needed, because U-500 has bolus and basal action
- Needs careful monitoring/ education

- Example - Pt on 240 units of insulin a day
  - 140 units am / 100 units pm (2 doses)
  - 100 / 70 / 70 or 100 / 100/ 40

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Quick Calculation - U500

- Pt takes:
- 300 units of insulin a day.
- A1c 10.3%
- Convert patient to u-500
- 60% am / 40% pm
  - Morning dose
  - Before dinner dose

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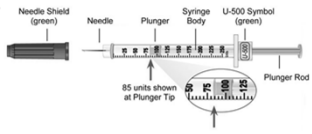
Quick Calculation u-500

- Pt takes: 300 units insulin
- Convert patient to u-500
- 60% am / 40% pm
  - 300 x 60% = 180 units of u500
  - 300 x 40% = 120 units of u500



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Thank You

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