

Diabetes and Prediabetes Care Involving DCES/CDE in Disease Management

2020 APRN PHARMACOLOGY & CLINICAL UPDATE
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Financial Disclosures

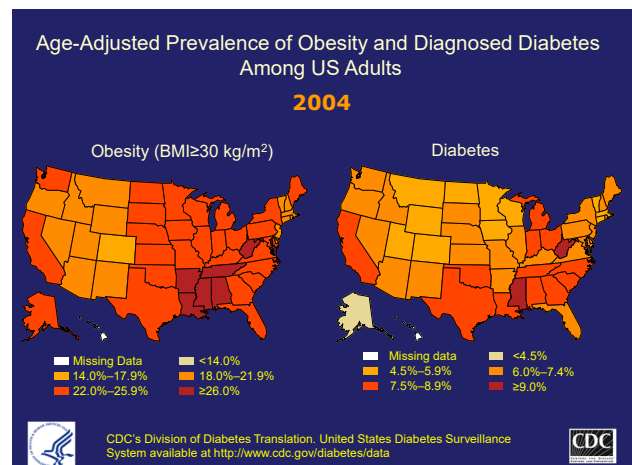
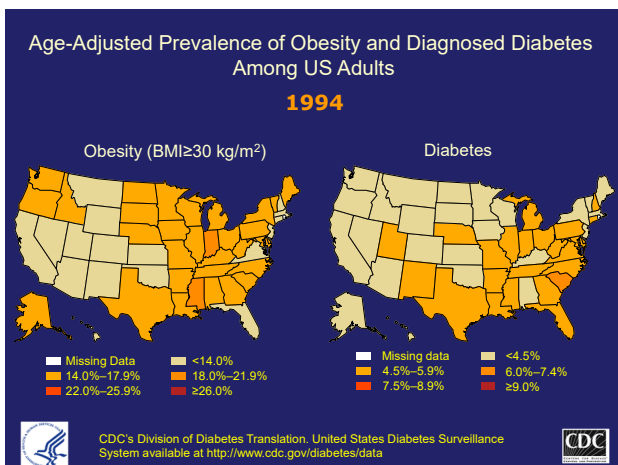
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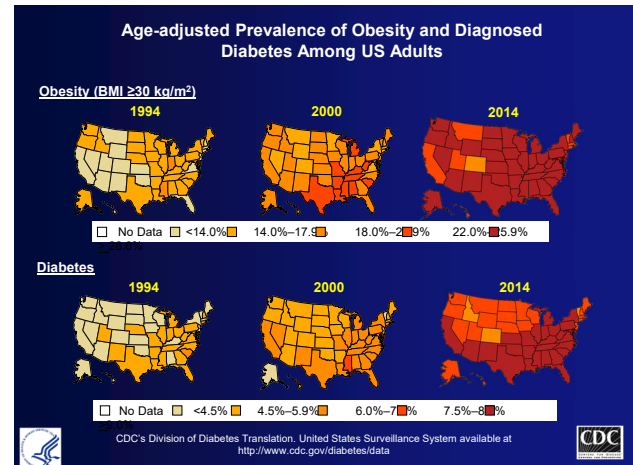
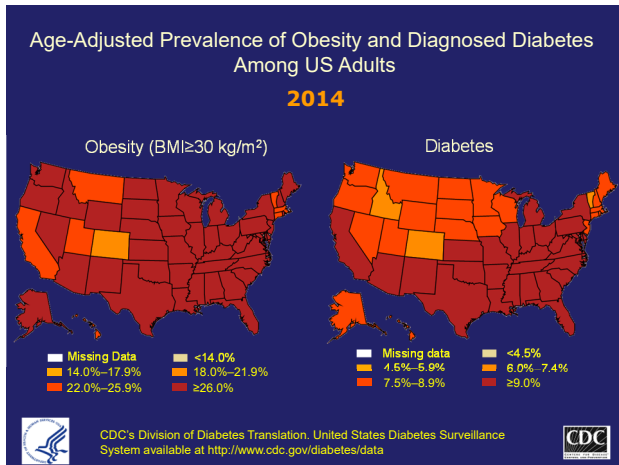
Learning Objectives

- ▶ Discuss updates with prediabetes and diabetes management.
- ▶ Describe how to use CDE in Diabetes and Prediabetes management.
- ▶ Discuss new medications in Diabetes management.
- ▶ Discuss Diabetes Prevention Program in Wisconsin.
- ▶ Discuss changes in Diabetes management during COVID-19 outbreak
- ▶ Learner will identify major anti-diabetes medications classes: mechanisms of action, special cautions & considerations.
 - ▶ Oral Agents
 - ▶ Insulin (Injectable, inhaled)
 - ▶ Non-insulin injectable
 - ▶ Devices

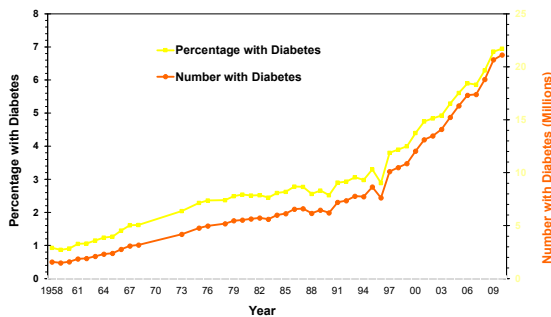
382 Million people World Wide - 2013 Data

- ▶ 138 Million Western Pacific (India)
- ▶ 72 Million South East Asia
- ▶ 56 Million Europe
- ▶ 37 Million North America and Caribbean
- ▶ 35 Million Middle East and North Africa
- ▶ 24 Million South and Central America
- ▶ 20 Million Africa





Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958–2010



CDC's Division of Diabetes Translation, National Diabetes Surveillance System available at <http://www.cdc.gov/diabetes/statistics>

Diabetes Epidemic in US

- ▶ **34.2 million with diabetes (10.5%)**
 - ▶ 26.8 million diagnosed
 - ▶ 7.3 million undiagnosed
 - ▶ 26.8% of those over age 65
 - ▶ **Projection for 2034: 44.1 million**
- ▶ **86 Million Age 18 and older have Pre-Diabetes**
- ▶ **State data at CDC:**
<http://apps.nccd.cdc.gov/ddtstrs/StateSurvData.aspx>
Wisconsin: 9 % of adult population

Diabetes by Race/Ethnicity

- ▶ 7.5 % of non-Hispanic white
- ▶ 9.2 % of Asian Americans
- ▶ 12.5 % of Hispanics
- ▶ 11.7 % of non-Hispanic blacks
- ▶ 14.7 % of American Indians/Alaskan Natives

- ▶ CDC National Statistics Feb 2020

Diabetes by Race/Ethnicity

The breakdown among Asian Americans:

- ▶ 5.6% for Chinese
- ▶ 10.4% for Filipinos
- ▶ 12.6 for Asian Indians
- ▶ 9.9 % for other Asian Americans.

The breakdown among Hispanic adults:

- ▶ 8.3% for Central and South Americans
- ▶ 6.5 % for Cubans
- ▶ 14.4 % for Mexican Americans
- ▶ 12.4% for Puerto Ricans.

ADA Statistics About Diabetes

Diabetes is costly:

- ▶ Total cost of direct and indirect estimated cost of diagnosed diabetes in the United States in 2017: \$327 billion*
- ▶ Total direct estimated costs of diagnosed diabetes increased from \$188 Billion to 2012 to \$237 Billion in 2017; Total indirect costs increased from \$73 Billion to \$90 Billion in the same period (2017)
- ▶ People with diagnosed diabetes incur average medical expenditures of \$16,750 per year which \$960, is directly associated with diabetes \$9601 (2017)
- ▶ Estimated prevalence of diagnosed diabetes is 25% among nursing home population (2015 CMS data)

National Diabetes Statistics Report 2020... Estimates of Diabetes and It's Burden in the United States

Diabetes is costly:

- ▶ People with diagnosed diabetes, on average, have medical expenditures approximately 2.3 times higher than what expenditures would be in the absence of diabetes.
- ▶ Care for people with diagnosed diabetes accounts for more than 1 in 5 health care dollars in the U.S., and more than half of that expenditure is directly attributable to diabetes.
- ▶ Indirect costs include increased absenteeism (\$3.3 billion) and reduced productivity while at work (\$26.9 billion) for the employed population, reduced productivity for those not in the labor force (\$2.3 billion), inability to work as a result of disease-related disability (\$37.5 billion), and lost productive capacity due to early mortality (\$19.9 billion).

*Economic Costs of Diabetes in the US in 2017

Complications and Co-Morbid Conditions

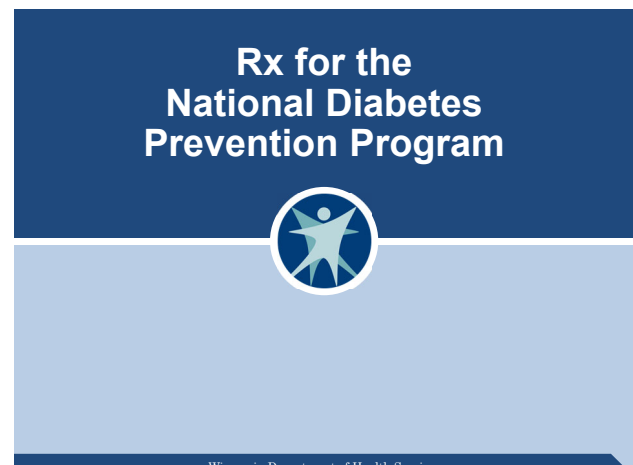
- ▶ **Hypoglycemia:** In 2011, about 282,000 emergency room visits for adults aged 18 years or older had hypoglycemia - a condition that occurs when one's blood glucose is lower than normal, usually less than 70 mg/dL.
- ▶ **Hypertension:** In 2009–2012, of adults aged 18 years or older with diagnosed diabetes, 71% had blood pressure greater than or equal to 140/90 millimeters of mercury or used prescription medications to lower high blood pressure.
- ▶ **Dyslipidemia:** In 2009–2012, of adults aged 18 years or older with diagnosed diabetes, 65% had blood LDL cholesterol greater than or equal to 100 mg/dl milligrams per deciliter (DESS-ih-lee-tur).

Complications/Co-morbid conditions

- ▶ **CVD Death Rates:** In 2003–2006, after adjusting for population age differences, cardiovascular disease of the heart and blood vessels (arteries, veins and capillaries). Death rates were about 1.7 times higher among adults aged 18 years or older with diagnosed diabetes than among adults without diagnosed diabetes.
- ▶ **Heart Attack Rates:** In 2010, after adjusting for population age differences, hospitalization rates for heart attack were 1.8 times higher among adults aged 20 years or older with diagnosed diabetes than among adults without diagnosed diabetes.
- ▶ **Stroke:** In 2010, after adjusting for population age differences, hospitalization rates for stroke condition caused by damage to blood vessels in the brain were 1.5 times higher among adults with diagnosed diabetes aged 20 years or older compared to those without diagnosed diabetes.

Complications /Co-morbid Conditions

- ▶ **Blindness and Eye Problems:** In 2005–2008, of adults with diabetes aged 40 years or older, 4.2 million (28.5%) people had diabetic retinopathy diabetic eye disease; damage to the small blood vessels in the retina.
- ▶ **Kidney Disease:** Diabetes was listed as the primary cause of kidney failure and end-stage renal (REE-nul) disease or ESRD in 44% of all new cases in 2011.
- ▶ **Amputations:** In 2010, about 73,000 non-traumatic lower-limb amputations were performed in adults aged 20 years or older with diagnosed diabetes.



Objectives

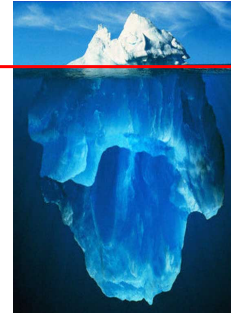
1	2	3
Describe the science and theory behind the National Diabetes Prevention Program.	Understand the CDC's Diabetes Prevention Recognition Program and requirements of recognition.	Identify opportunities for Nurse Practitioners to become involved with the National Diabetes Prevention Program.

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Magnitude and Burden

Diabetes*
548,000 adults

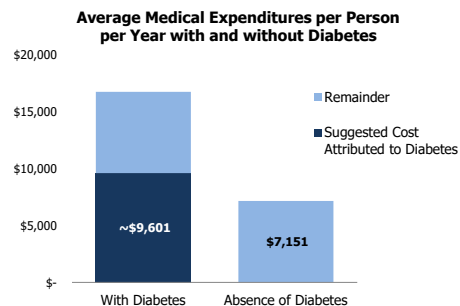
Prediabetes*
1,500,000 adults



Source: Wisconsin diabetes and prediabetes estimates are based on 2011-2014 National Health and Nutrition Examination Survey (NHANES) data reported in the Centers for Disease Control and Prevention's National Diabetes Statistics Report, 2017.
* Estimates are based on diagnosed and undiagnosed rates.

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Magnitude and Burden



American Diabetes Association, Economic Costs of Diabetes in the U.S. in 2017. Diabetes Care. 2018; doi: 10.2337/dci18-0007

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Department of Health Services Diabetes Strategies

- Improving access to/participation in diabetes self-management education and support (DSMES) programs in underserved areas
- Engaging providers in the provision of medication management or DSMES for people with diabetes
- Developing a statewide infrastructure to promote long-term sustainability and reimbursement for Community Health Workers

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Department of Health Services Diabetes Strategies

Improving access to/participation in the National Diabetes Prevention Program (National DPP)

- Assist health care organizations in implementing systems to identify people with prediabetes and refer them to a National DPP
- Collaborate with payers to expand availability as a covered benefit
- Implement strategies to increase enrollment in the National DPP

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National Diabetes Prevention Program (DPP)

- Year-long, evidence-based lifestyle change program
- FACILITATED by a trained Lifestyle Coach
- Months 1-6: minimum of 16 one-hour weekly classes
- Months 7-12: minimum of six one-hour monthly classes

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National Diabetes Prevention Program (DPP)

- Topics related to healthy eating, increased activity, identifying and addressing barriers
- Goal: weight loss of 5% to 7% from starting weight



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Participant Eligibility

- Age 18 years or older
- BMI of ≥ 25 (Asian Americans: ≥ 23)

AND

- Medical diagnosis of prediabetes, **OR**
- History of gestational diabetes, **OR**
Women with a history of gestational diabetes have a 35% to 50% chance of developing diabetes in the next 10–20 years.
- Positive screen on CDC Prediabetes Screening Test

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Evidence

- 3-year study: Diabetes Prevention Program research trial
- Led by National Institutes of Health (NIH)
- Largest clinical trial of lifestyle intervention for prevention of type 2 diabetes ever conducted
- Compared individuals with Impaired Glucose Tolerance (IGT)

Reduction in The Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. Diabetes Prevention Program Research Group. *N Engl J Med*. 2002 Feb 7;346(6):393–403.
10-year Follow-up of Diabetes Incidence and Weight Loss in the Diabetes Prevention Program Outcomes Study. Diabetes Prevention Program Research Group. *Lancet*. 2009 Nov 14;374(9702):1677–1686.

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Study Outcomes

- 50% experienced >7% weight loss from their starting weight
- Risk reduction:
 - **Lifestyle Change Program: 58%**
(71% for age 60 and older)
 - Metformin: 31%

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Health Impact

According to numerous studies, for every 100 high-risk adults (age 50) completing the program:

- Prevents 15 new cases of type 2 diabetes¹
- Prevents 162 missed work days²

¹ DPP Research Group. *N Engl J Med*. 2002 Feb 7;346(6):393–403

² DPP Research Group. *Diabetes Care*. 2003 Sep;26(9):2693–4

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Health Impact

- Avoids need for blood pressure or cholesterol medications in 11 people³
- Adds equivalent of 20 perfect years of health⁴
- Avoids \$91,400 in health care costs⁵

³ Ratner, et al. 2005 *Diabetes Care* 28 (4), pp. 888–894

⁴ Herman, et al. 2005 *Ann Intern Med* 142 (5), pp. 323–32

⁵ Ackermann, et al. 2008 *Am J Prev Med* 35 (4), pp. 357–363; estimates scaled to 2008 \$US

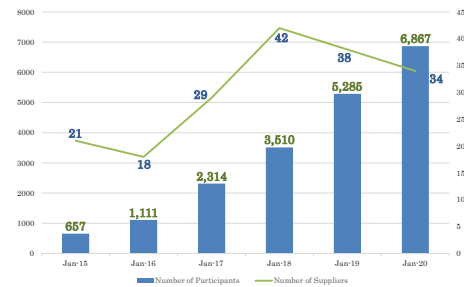
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Program Fidelity

- CDC Diabetes Prevention Recognition Program (DPRP)
- Three key objectives:
 - ✓ Assure program quality, fidelity to scientific evidence
 - ✓ Develop and maintain a registry of recognized organizations
 - ✓ Provide technical assistance in effective program delivery and problem-solving to achieve and maintain recognition status

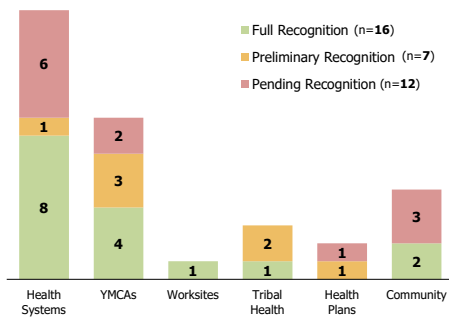
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National DPP Participants and Suppliers in Wisconsin, 2015-2020



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National DPP Suppliers in Wisconsin by Setting and Status (CDC DPRP, 4/23/2020)



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Why Become Involved?

- Nurse Practitioners are an essential part of today's health care system
- Nurse Practitioners know preventive care
- Nurse Practitioners have frequent patient encounters
- The entire medical provider workforce can benefit by applying clinical knowledge, motivational interviewing techniques, and helping prevent type 2 diabetes

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Supporting the National DPP

- **Tier 1:** Promote awareness of prediabetes and the National DPP among patients at risk
- **Tier 2:** Screen, test, and refer patients
- **Tier 3:** Offer the National DPP lifestyle change program

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Promote Awareness

Promotional materials from American Medical Association (AMA), CDC, and Ad Council

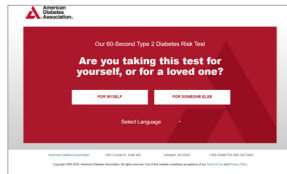
- Digital materials
- Social media
- Awareness campaigns



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► Screen, Test, and Refer

- **Screen** for prediabetes using American Diabetes Association/CDC Type 2 Diabetes Risk Test

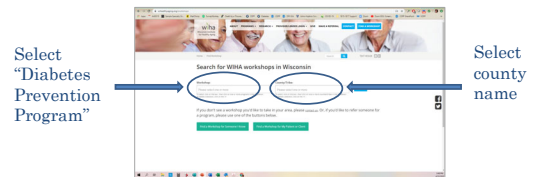


www.diabetes.org/widhsrisktest

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► Screen, Test, and Refer

- **Test** for prediabetes by offering a blood glucose test or referring to primary care
- **Refer** to a National Diabetes Prevention Program (<https://wihealthyaging.org/workshops>)



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► Offer Lifestyle Change Program

- Work with Chronic Disease Prevention Program to fully understand commitment
- Use CDC resources as a planning tool: www.cdc.gov/diabetes/prevention/program-providers.htm
- Develop referral plan/partnership
- Train Lifestyle Coaches
- Apply for CDC recognition
- Begin offering year-long program

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How People with Diabetes Benefit from DSMES

- Improved hemoglobin A1c levels
- Improved control of blood pressure and cholesterol levels
- Higher rates of medication adherence
- Fewer or less severe diabetes-related complications
- Healthier lifestyle behaviors, such as better nutrition, increased physical activity, and use of primary care and preventive services
- Enhanced self-efficacy
- Decreased health care costs, including fewer hospital admissions and readmission

Diabetes self-management education and support (DSMES)

- There is considerable evidence that DSMES services are cost-effective and have a positive impact on diabetes-related outcomes, utilization of DSMES services is suboptimal.
- In the United States, less than 5% of Medicare beneficiaries with diabetes and 6.8% of privately insured people with diagnosed diabetes have used DSMES services

Diabetes Self-Management Training (DSMT) (HCID 40.1)

HCPCS/CPT Codes

G0108 –

Diabetes outpatient self-management training services, individual, per 30 minutes

G0109 –

Diabetes outpatient self-management training services, group session (2 or more), per 30 minutes

ICD-10 Codes

NOTE: Additional ICD-10 codes may apply. See the [CMS ICD-10 webpage](#) for individual Change Requests (CRs) and Who is Covered

Certain Medicare beneficiaries when all of the following are true:

- Diagnosed with diabetes
- Got an order for DSMT from the physician or qualified NPP treating the Medicare beneficiary's diabetes

Frequency

- Initial year: Up to 10 hours of initial training within a continuous 12-month period
- Subsequent years: Up to 2 hours of follow-up training each calendar year after the initial 10 hours of training has been

Medicare Beneficiary Pays

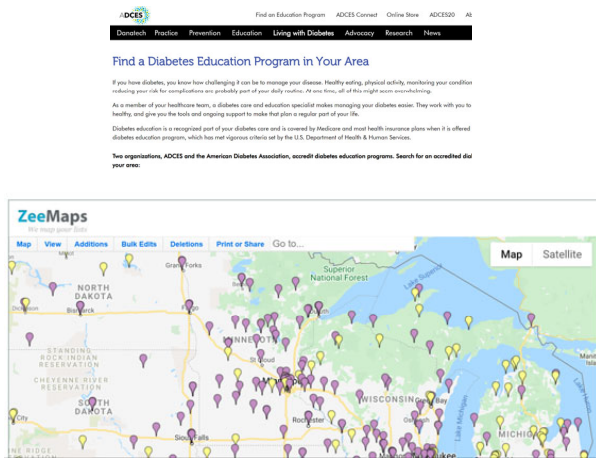
- Copayment/coinsurance applies
- Deductible applies

Other Notes

- Refer to [Provider Compliance Tips for Diabetic Test Strips](#) for more information.
- You cannot bill DSMT and Medical Nutrition Therapy (MNT) on the same date of service for the same beneficiary.
- For information on accreditation, see the [DSMT Accreditation Program webpage](#).

DSMES Programs

- [American Diabetes Association \(ADA\) and Association of Diabetes Care and Education Specialists \(ADCES\) program locations](#)



Diabetes Self-Management Education and Support (DSMES) Resources

- [American Diabetes Association \(ADA\) and Association of Diabetes Care and Education Specialists \(ADCES\) program locations](#)
- [Centers for Disease Control and Prevention's \(CDC\) DSMES Toolkit](#)
 - [Increasing referrals and overcoming barriers to DSMES participation](#)
- [ADCES practice papers](#)
- [ADCES algorithm of care](#)
- [ADCES algorithm action Steps](#)

Types of Diabetes

- ▶ Type 1
- ▶ Type 2
- ▶ LADA
- ▶ Pre-Diabetes
- ▶ Gestational
- ▶ Other (Drug induced, pancreatic, ect)

Latent Autoimmune Diabetes of Adults- LADA

- ▶ Latent autoimmune diabetes of adults, often also late-onset autoimmune diabetes of adulthood or aging, slow onset type 1 diabetes or diabetes type 1.5 is a form of diabetes mellitus type 1 that occurs in adults, often with a slower course of onset.
- ▶ Adults with LADA may initially be diagnosed as having type 2 diabetes based on their age, particularly if they have risk factors for type 2 diabetes such as a strong family history or obesity.

Risk Factors for Diabetes

- | | |
|--|----------------------------|
| ▶ Family history of diabetes | ▶ Polycystic Ovary Disease |
| ▶ High risk ethnic group | ▶ Abnormal cholesterol |
| ▶ Age | ▶ High TG > 250 mg/dl |
| ▶ Overweight | ▶ Low HDL < 40 mg/dl |
| ▶ Sedentary | ▶ High blood pressure |
| ▶ History of gestational diabetes having a baby weighing more than 9 lbs | ▶ Heart Disease |
| | ▶ Pre-diabetes |

Types of Diabetes: Type 1

- ▶ Previously called "IDDM", "Type I", "Juvenile onset"
- ▶ 5 – 10% of those with diabetes
- ▶ Unknown cause
- ▶ Usually 35 of years or younger** (LADA)
- ▶ Symptoms come on quickly
- ▶ Requires daily insulin balanced with food intake and activity



Types of Diabetes: Type 2

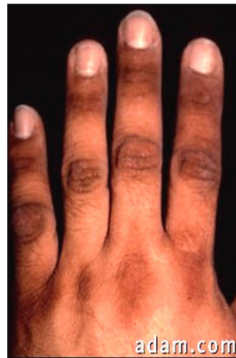


- ▶ Previously called "NIDDM", "Type II", "Adult onset"
- ▶ 90 - 95% of people with diabetes
- ▶ Strong family history with environmental/lifestyle impact
- ▶ Usually 45 years or older and overweight (increasing in children)
- ▶ Symptoms are usually mild or non-existent
- ▶ Pancreas still makes insulin; but is resistant to it.
- ▶ Treated with meal plan, activity and combination of pills/insulin

Type 2 Diabetes in Youth

- ▶ **Prevalence:** 2% (1980's) to 43% (now)
- ▶ More common in:
 - ▶ Those with strong family history of diabetes
 - ▶ Minority groups
 - ▶ Obesity
 - ▶ Girls more than boys
 - ▶ Mean age 12-14 yrs (Age range 4-19)
 - ▶ Acanthosis nigricans
- ▶ **Screen at age 10 or at onset of puberty if overweight PLUS 2 of the following:**
 - ▶ Family history of diabetes - Signs of insulin resistance**
 - ▶ High risk race/ethnicity - Maternal hx of DM or GDM
 - ▶ **Re-screen every 2 years.**

Acanthosis Nigricans



Risk Factors for Pre- Diabetes

- ▶ BMI >25 kg/m²
 - ▶ First degree relative with type 2 DM
 - ▶ Member high risk ethnic**
 - ▶ Delivered infant > 9lbs. Or GDM
 - ▶ HTN (>140/90)
 - ▶ HDL-C < 35mg/dl or TG's > 250mg/dl
 - ▶ Hx of IGT or IGF,
 - ▶ A1C >5.7%
 - ▶ PCOS
 - ▶ Habitually inactive
 - ▶ History of CVD disease
 - ▶ Markers of insulin resistance - acanthosis nigricans, waist and neck circumference
- **African American, Latino, Native American, Asian American, Pacific Islander

Pre-diabetes, just a little elevated blood sugar.....What's the big deal!

- ▶ **88 million with pre-diabetes aged 18 years or older (34.5% of adult US population)**
- ▶ 65 years and older: 24.2 million people aged 65 years or older have prediabetes.
- ▶ Prediabetes: increased CVD, retinopathy, nephropathy, neuropathy & mortality
- ▶ Up to 70% of people with prediabetes will develop DM 2 during lifetime

▶ CDC National Diabetes Statistics Report February, 14,2020

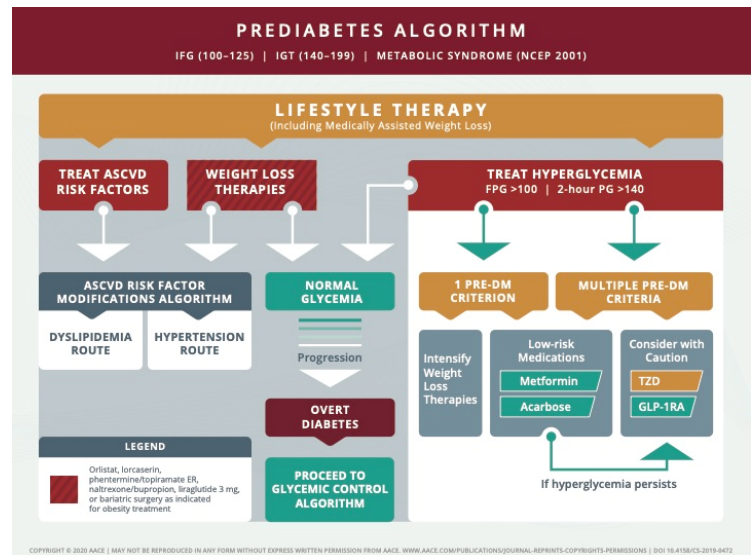
Diagnosis of Pre-diabetes

- ▶ Fasting glucose 100-125 mg/dl (**IFG**)
- or
- ▶ 2 hr OGTT 100-140 (**IGT**)
- or
- ▶ Hemoglobin A1C 5.7-6.4%

Result of beta cell failure and insulin resistance
50-70% of Diabetes can be prevented at this level!!!!

Treatment of Pre-diabetes

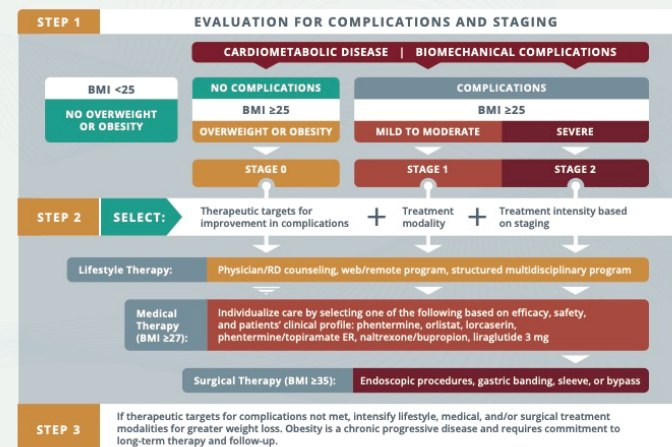
- ▶ Diet and exercise to achieve at least 5-10% weight loss
- ▶ Metformin therapy for prevention of type 2 diabetes may be considered in those with IGT, IFG, or and A1C of 5.7–6.4%, especially for those with BMI >35, aged 60 years, and women with prior GDM.
- ▶ Actos (pioglitazone), Acarbose
- ▶ Treat B/P and Cholesterol/LDL to goal the same as Diabetes with medication.
- ▶ Weight loss medication



Weight loss drugs

- Phentermine 15 mg, 30 mg or 37.5 mg daily * EKG needed prior to starting
 - Qsymia (phentermine/topiramate ER)
3.75mg/23mg QD
7.5mg/46mg QD
11.25mg/69mg QD
15mg/92mg QD
- Belviq—Locaserine—secelective serotonin C agonist 10 mg BID
- Orlistat—lipase inhibitor, wt loss and evidence of decreased progression from Pre-diabetes to DM. Same as Alli 75 mg OTC but at lower dose.
- Naltrexone/bupropion (Contrave); 2014 Two 8-mg/90mg BID
Liraglutide (Saxenda); 2015
***** Consider Contracting with patients for combined diet/exercise.

COMPLICATIONS-CENTRIC MODEL FOR CARE OF THE PATIENT WITH OVERWEIGHT/OBESITY (ADIPOSIITY-BASED CHRONIC DISEASE)



Diagnosis of Diabetes

- ▶ A1C > 6.5%
 - ▶ FPG 126 mg/dL . Fasting is defined as no caloric intake for at least 8 hr.*
 - ▶ 2-h plasma glucose 200mg/dL during an OGTT. (The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.)
- OR
- ▶ In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis (polyuria, polydipsia, polyphagia), a random plasma glucose 200 mg/dL

* ADA 2013 Practice Guidelines

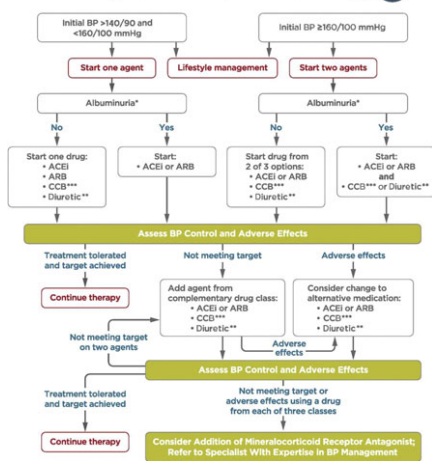
*In the absence of unequivocal hyperglycemia, result should be confirmed by repeat testing

Blood pressure goals for DM and Prediabetes

- ▶ Patients with diabetes and prediabetes are treated for blood pressure to reach a goal of 130/80 or below.
 - ▶ Patients with renal disease are treated to goal of 140/90 or below
 - ▶ Ace-inhibitors—first line treatment ex. Lisinopril
- Any combination of the following:
- HCTZ
 - Amlidopine
 - Metoprolol
 - ARB's- Losartan

Recommendations for the treatment of confirmed hypertension in people with diabetes. *An ACE inhibitor (ACEi) or ARB is suggested to treat hypertension for patients with a UACR 30–299 mg/g Cr and strongly recommended for patients with a UACR ≥300 mg/g Cr. **Thiazide-like diuretic; long-acting agents shown to reduce CV events, such as chlorthalidone and indapamide, are preferred. ***Dihydropyridine CCB. BP, blood pressure.

Recommendations for the Treatment of Confirmed Hypertension in People With Diabetes



American Diabetes Association Clin Diabetes 2020;38:10-38

Risk of CKD progression, frequency of visits, and referral to nephrology according to GFR and albuminuria.

CKD is classified based on:		Albuminuria categories		
		Description and range		
		A1	A2	A3
Cause (C)		Normal to mildly increased		
GFR (G)		Moderately increased		
Albuminuria (A)		Severely increased		
		<30 mg/g <3 mg/mmol	30-299 mg/g 3-29 mg/mmol	≥300 mg/g ≥30 mg/mmol
GFR categories (ml/min/1.73m ²) Description and range	G1 Normal or high	≥90	1 if CKD	Treat 2
	G2 Mildly decreased	60-89	1 if CKD	Treat 2
	G3a Mildly to moderately decreased	45-59	Treat 1	Treat 2
	G3b Moderately to severely decreased	30-44	Treat 2	Treat 3
	G4 Severely decreased	15-29	Refer* 3	Refer* 3
	G5 Kidney failure	<15	Refer 4+	Refer 4+

American Diabetes Association Clin Diabetes 2020;38:10-38

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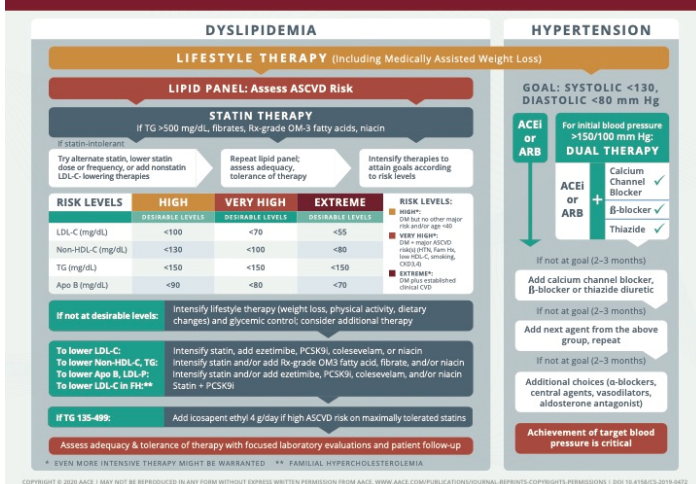
Cholesterol Guidelines

- Cholesterol needs to be below < 200 mg/dl
- HDL Greater than 40 (consider greater than 50 for women)
- ***LDL less than 100 (with heart disease, less than 70)
- Triglycerides –less than 150
- Statin therapy is gold standard.
- Yearly cholesterol (lipid profile) every year.

Cholesterol Guidelines

- Statin therapy should be added to lifestyle therapy, regardless of baseline lipid levels, for people with diabetes who have overt CVD.
- Statin therapy should be considered in individuals with diabetes who are without overt CVD but are at substantial risk of developing CVD (e.g., over age 40).
- Risk of CVD is increased more in people with type 1 diabetes compared with type 2 diabetes, but it is not known if routine use of statins in people with type 1 diabetes under age 40 is useful for primary prevention of CVD.
- The strongest evidence for statin use is in people with diabetes who are 45 to 75 years old.
- ASCVD Risk Estimator

ASCVD RISK FACTOR MODIFICATIONS ALGORITHM



Diabetic medications

- All diabetes pills sold today in the United States are members of seven classes of drugs that work in different ways to lower blood glucose levels:
- Sulfonylureas
- Meglitinides
- Biguanides
- Thiazolidinediones
- Alpha-glucosidase inhibitors
- DPP-4 inhibitors
- Sodium Glucose Inhibitor-(SGLT-2 Inhibitor) **New kid on the block**
- SGLT 1 & 2 investigational drug trials underway.

Oral Diabetic Medications

Sulfonylureas

- ▶ Sulfonylureas stimulate the beta cells of the pancreas to release more insulin. Sulfonylurea drugs have been in use since the 1950s. There are three second-generation drugs: glipizide (Glucotrol and Glucotrol XL), glyburide (Micronase, Glynase, and Diabeta), and glimepiride (Amaryl). These drugs are generally taken one to two times a day, before meals.

Meglitinides

- ▶ Meglitinides are drugs that also stimulate the beta cells to release insulin. Repaglinide (Prandin) and nateglinide (Starlix) are meglitinides. They are taken before each of three meals.
- ▶ Because sulfonylureas and meglitinides stimulate the release of insulin, it is possible to have hypoglycemia (low blood glucose levels).

Oral Diabetic Medications Continued

Alpha-glucosidase inhibitors

- ▶ Acarbose (Precose) and miglitol (Glyset) are alpha-glucosidase inhibitors. These drugs help the body to lower blood glucose levels by blocking the breakdown of starches, such as bread, potatoes, and pasta in the intestine. They also slow the breakdown of some sugars, such as table sugar. Their action slows the rise in blood glucose levels after a meal. They should be taken with the first bite of a meal. These drugs may have side effects, including gas and diarrhea.

DPP-4 Inhibitors

- ▶ A newer class of medications called DPP-4 inhibitors help improve A1C without causing hypoglycemia. They work by preventing the breakdown of a naturally occurring compound in the body, GLP-1. GLP-1 reduces blood glucose levels in the body, but is broken down very quickly so it does not work well when injected as a drug itself. By interfering in the process that breaks down GLP-1, DPP-4 inhibitors allow it to remain active in the body longer, lowering blood glucose levels only when they are elevated. DPP-4 inhibitors do not tend to cause weight gain and tend to have a neutral or positive effect on cholesterol levels. Sitagliptin (Januvia), saxagliptin (Onglyza, Trajenta) and alogliptin (Nesina) are the (four DPP-4 inhibitors currently on the market. Janumet, Janumet (sitagliptin/metformin), Kazano (alogliptin/Metformin)

Injectible Medications –Non-insulin GLP-1 Receptors Agonists

GLP-1 Receptor Agonists slow gastric emptying and promotes satiety at the level of the central nervous system. Suppresses pancreatic glucagon secretion and lowers insulin secretion.

- ▶ Byetta (Exenatide) 5-10 mcg Twice daily
- ▶ Bydureon (Exenatide extended release) 2 mg Weekly
- ▶ Victoza (Liraglutide) 0.6mg 1.2 mg or 1.8 mg daily
- ▶ Lyxumia (lixisenatide) – taken once daily.
- ▶ Trulicity (dulaglutide) 0.75mg and 1.5mg; once weekly;

Oral Diabetic Medications Continued

Biguanides

- ▶ Metformin (Glucophage, Glucophage XR, Riomet, Glumetza) is a biguanide. Biguanides lower blood glucose levels primarily by decreasing the amount of glucose produced by the liver. Metformin also helps to lower blood glucose levels by making muscle tissue more sensitive to insulin so glucose can be absorbed. It is usually taken two times a day. A side effect of metformin may be diarrhea, but this is improved when the drug is taken with food.

Thiazolidinediones

- ▶ Rosiglitazone (Avandia) and pioglitazone (ACTOS) are in a group of drugs called thiazolidinediones. These drugs help insulin work better in the muscle and fat and also reduce glucose production in the liver. Both drugs appear to increase the risk for heart failure in some individuals, and there is debate about whether rosiglitazone may contribute to an increased risk for heart attacks. AVANDIA no longer available.

Oral Diabetic Medication Continued

SGLT2 Inhibitors

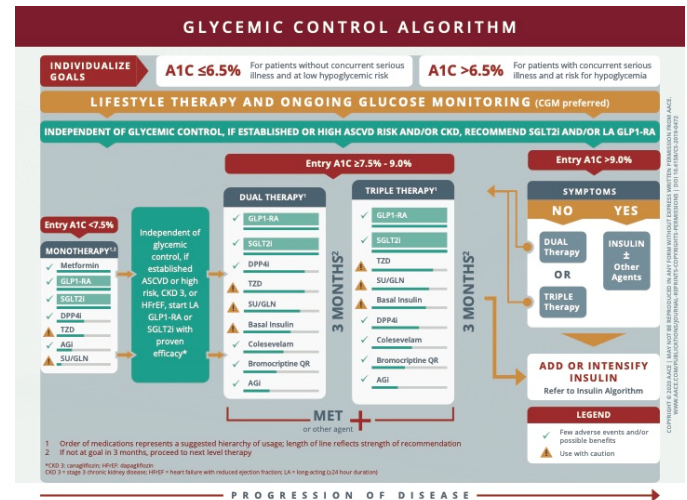
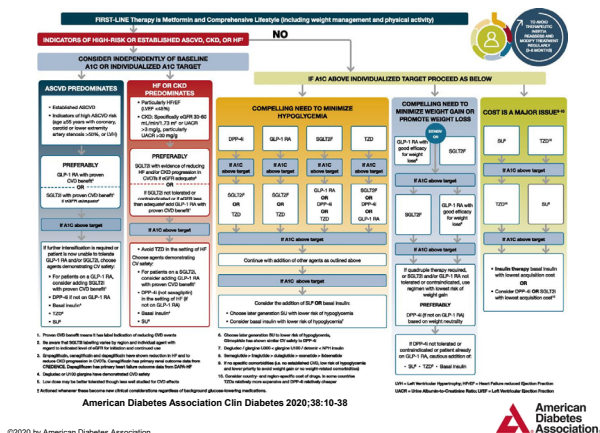
- ▶ Decreases reabsorption of glucose in the proximal renal tubules
- ▶ Increases glucose excretion
- ▶ + glycemic reduction, weight loss, improved BP
- ▶ Risk: hypotension, dehydration, genital yeast infections, UTIs
- ▶ Caution in renal impairment
- ▶ Invokana (canagliflozin) * Black box warning*
 - ▶ 100mg; 300mg; once daily dosing
- ▶ Farxiga (dapagliflozin) 5mg; 10mg; once daily dosing
- ▶ Jardiance (empagliflozin) 10mg; 25mg; once daily dosing
- ▶ Galvus (Vildagliptin) 50 mg; 100 mg once daily dosing

Best Combination in Diabetes management

- ▶ Metformin
- ▶ GLP-1
- ▶ SGLT-2

*** Bonus*** They all cause weight loss!

Glucose-lowering medication in type 2 diabetes: overall approach.



PROFILES OF ANTIHYPERGLYCEMIC MEDICATIONS												
	MET	GLP1-RA	SGLT2i	DPP4i	AGI	TZD (moderate/severe)	SU	COLSVL	BQR-CR	INSULIN	PRAMIL	
HYPO	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Moderate/Severe	Neutral	Neutral	Moderate to Severe	Neutral	
WEIGHT	Slight Loss	Loss	Loss	Neutral	Neutral	Gain	Gain	Neutral	Neutral	Gain	Loss	
RENAL / GU	Contra-Indicated (eGFR <30 mL/min/1.73 m²)	Exacerbate Not Indicated (eGFR <30 mL/min/1.73 m²)	Not Indicated for eGFR <45 mL/min/1.73 m² (Except Long-acting)	Dose Adjustment Necessary (Except Long-acting)	Neutral	Neutral	More Hypo Risk	Neutral	Neutral	More Hypo Risk	Neutral	
GI/GX	Moderate	Moderate	Potential Benefit of LA GLP1-RA	Neutral	Moderate	Neutral	Neutral	Mild	Moderate	Neutral	Moderate	
CHF	Neutral	Neutral	Prevent HF Hospitalization Manage HFET See #2	See #4	Neutral	Moderate	Neutral	Neutral	Neutral	CHF Risk	Neutral	
CARDIAC ASCVD	Neutral	Potential Benefit of LA GLP1-RA	See #3	See #4	Neutral	May Reduce Stroke Risk	Possible ASCVD Risk	Lowest LSA-C	Safe	Neutral	Neutral	
BONE	Neutral	Neutral	Neutral	Neutral	Neutral	Moderate Fracture Risk	Neutral	Neutral	Neutral	Neutral	Neutral	
KETOACIDOSIS	Neutral	Neutral	DKA Can Occur in Various Stress Settings	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	

■ Few adverse events or possible benefits
 ■ Use with caution
 ■ Likelihood of adverse effects

1. Canagliflozin indicated for eGFR ≥30 mL/min/1.73 m² in patients with CKD 3 + albuminuria.
 2. Dapagliflozin—potential primary prevention of HF hospitalization & demonstrated efficacy in HFET.
 3. Empagliflozin—FDA approved to reduce CV mortality. Canagliflozin—FDA approved to reduce MACE events.
 4. Possible increased hospitalizations for heart failure with angiotensin and saxagliptin.

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 DOI 10.4196/10.2019-0403

Insulin Action

► **Rapid Acting Insulin Types:** Novolog, Humalog, Apidra, ***Humalog U200 (200units/ml)-more concentrated

- Onset: 0-15 minutes
- Peak: ½ - 1½ hours
- Duration: 3 – 5 hours

► **Short-Acting Insulin Type:** regular

- Onset: ½ - 1 hour
- Peak: 2 – 4 hours
- Duration: 5 – 8 hours

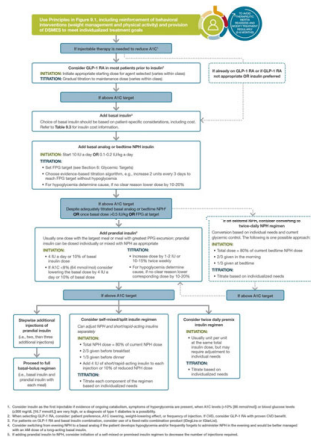
Insulin Action

- **Long Action Insulin: Lantus (glargine), Basaglar, Levemir (detemir)** -lasts up to 24 hours.
**Toujeo(glargine) 300 units/ml(more concentrated) Pen form only
- **NPH- Humulin R/Novolin R**-Lasts up to 10-16 hours
- **Premixed Intermediate-acting/rapid acting**
- Humalog Mix 75/25 Humulin 70/30, Novolin 70/30
- Novolog 70/30 Humalog 50/50

New Insulins

- Degludec **Tresiba®** U200 or 2 units per 0.1-Delay in 25 hr ½ life Duration 42 hours. Could be given every 8-40 hrs. Less Hypoglycemia.
- Humulin U500 has been on the market. Commonly used if patient is on 200-300 units of insulin daily.
- ** Use with caution due to concentration of insulin. 5 unts/0.1 ml. Gaining popularity again especially after newer concentrated insulins are available.

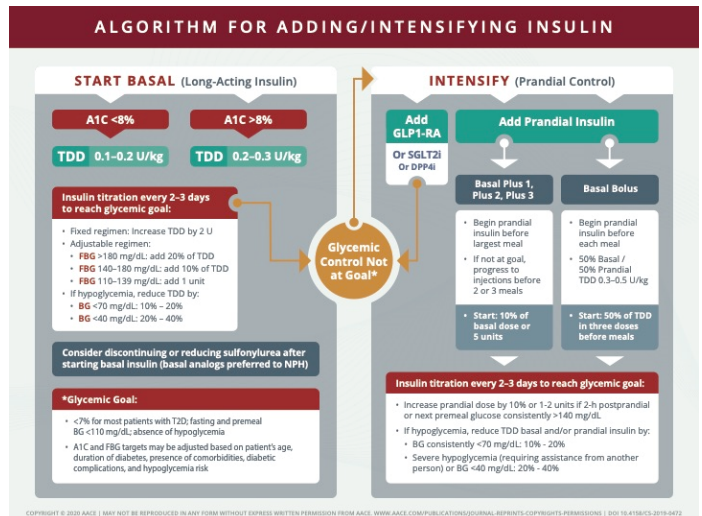
Intensifying to injectable therapies.



American Diabetes Association Clin Diabetes 2020;38:10-38



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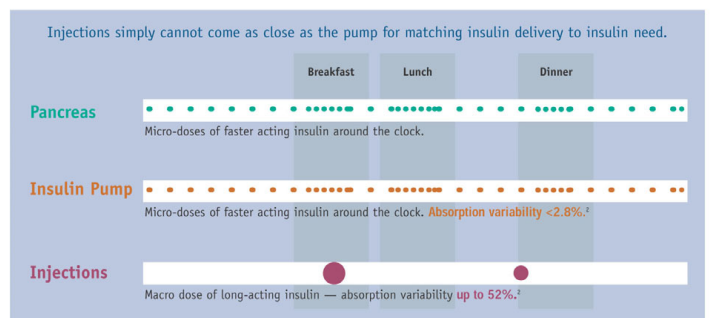


Today's Insulin Pump

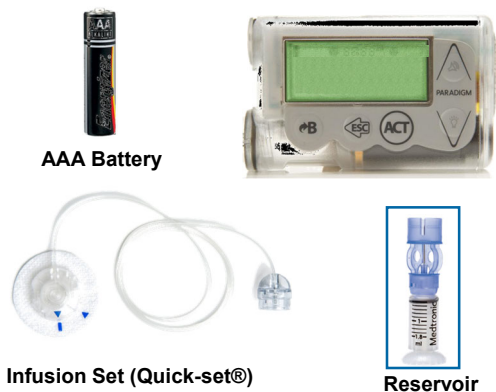


1. External insulin pumps deliver insulin through an infusion set.
2. The infusion set uses a tiny cannula you insert under your skin.
3. Pumps are worn in a variety of ways.

The Basis of CSII: Mimicking Pancreatic Insulin Delivery



Overview of the Pump



T Slim Pump Largest pump available (T-Flex 480 units)



Omni Pod

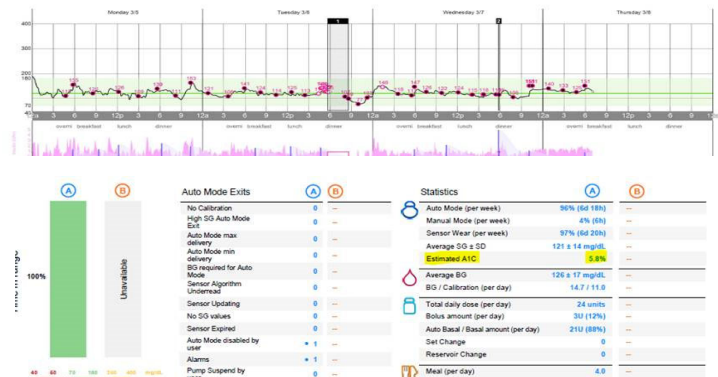
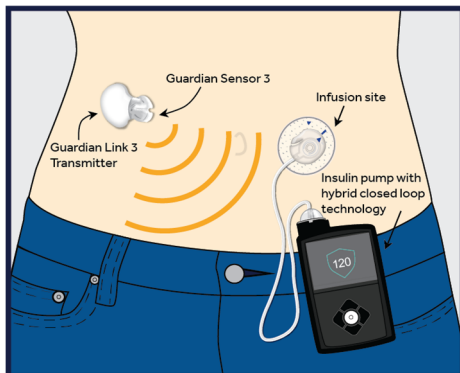
1. The Pod has a waterproof IPX8 rating for up to 25 feet for 60 minutes. The PDM is not waterproof.
 2. 530G User Guide states "you should avoid getting your pump wet." Important Safety Information
 3. IPX7 immersion for IPX7 immersion for 30 minutes at depth up to 3 feet.
 4. Pump is waterproof at 12 feet for 24 hours; Dexcom G4® sensor and transmitter is water-resistant up to 8 feet for 24 hours.
- Tubeless Pump



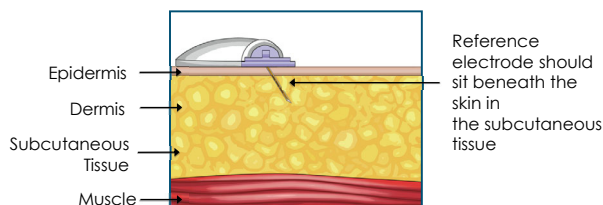
Medtronic 670G



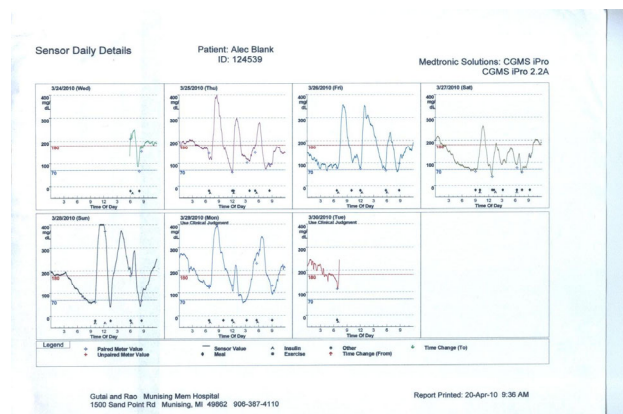
Medtronic 670G – First Insulin Pump with Hybrid closed Loop Technology.



Continuous Glucose Monitor



Testing Insulin to Carb Ratios



Dexcom CGM



Freestyle Libre CGM



A single reader device is used to activate and scan all FreeStyle Libre Pro Sensors

Reader stays in your office



Small and discreet

- The sensor is placed on the back of the upper arm

- Water-resistant*

Very thin filament

Filament is <0.4 mm thick and inserted 5 mm beneath the skin surface to measure interstitial fluid

No finger-stick calibration

Less for patients to do

Diabetes Management - Patient Centered Focus

Hypoglycemia in ACCORD Trial

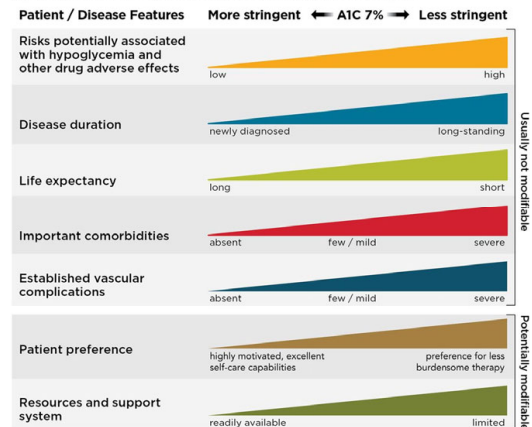
- ▶ 10,251 middle aged/older adults with Type 2 Diabetes at high risk for a CVD event
- ▶ Primary question: does a therapeutic strategy that targets an A1C <6.0% reduce CVD events more than a strategy that targets an A1C between 7.0%-7.9% (with expectation of achieving a median level of 7.5%)?
- ▶ ACCORD Trial stopped because of 20% greater risk of death in subjects randomized to achieve A1C of <6.0% compared to subjects randomized to achieve A1C of 7.1%-7.9%

ADA

- ▶ "A patient-centered approach should be used to guide choice of pharmacological agents. Considerations include efficacy, cost, potential, side effects, effects on weight, co-morbidities, hypoglycemia risk and patient preference."

Depicted are patient and disease factors used to determine optimal A1C targets.

Approach to Individualization of Glycemic Targets



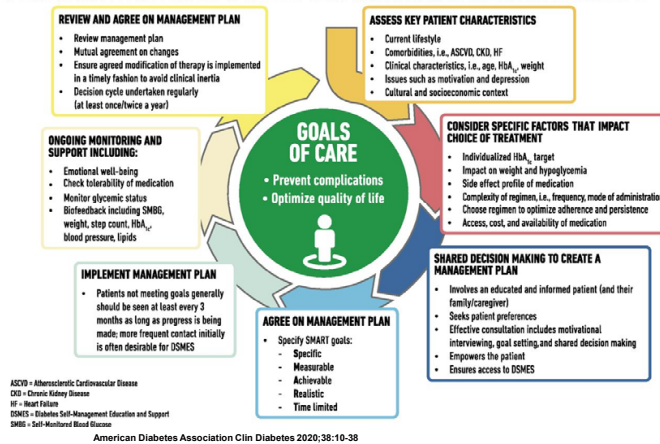
American Diabetes Association Clin Diabetes 2020;38:10-38

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Decision cycle for patient-centered glycemic management in type 2 diabetes.

DECISION CYCLE FOR PATIENT-CENTERED GLYCEMIC MANAGEMENT IN TYPE 2 DIABETES



Low Carb Diets, Low Fat Diet, Low Glycemic.....Meal replacements

- ▶ Feeding study-Low carbohydrate, Low GI and Very low Carbohydrate
 - ▶ High Protein/Low GI best for weight loss maintenance
 - ▶ Usually low carb is high fat diet
 - ▶ Greater weight gain in 6 months on VLC
 - ▶ High protein diet has most energy expenditure
 - ▶ ??More studies needed. What is the set point for weight loss. Future diets- individualized to patient to keep weight off.
 - ▶ Keto ?

ADA Position Statement on LCD

1. Weight loss is recommended for all overweight or obese individuals who have or are at risk for diabetes.
2. For weight loss, either low-carbohydrate, low-fat calorie-restricted, or Mediterranean diets may be effective in the short-term (up to 2 years).
3. For patients on low-carbohydrate diets, monitor lipid profiles, renal function, and protein intake (in those with nephropathy) and adjust hypoglycemic therapy as needed.
4. Physical activity and behavior modification are important components of weight loss programs and are most helpful in maintenance of weight loss.

- ▶ Meal replacements
 - ▶ Provide mixture of protein, carbohydrate and fat along with added vitamins and minerals.
 - ▶ Designed to mimic low calorie meal or snack . Easy to transport and prepare with no clean up.
 - ▶ Reduced dense calories and less decision making.
 - ▶ ADA recommends meal replacement for usual meals once or twice per day may result in significant weight loss, however meal replacement therapy may need to be maintained indefinitely.
 - ▶ Many studies have proved 7.8%-8.6% of body weight.
 - ▶ Combined with 150 minutes of exercise weekly >10% of body weight.

Diabetes and COVID-19

- ▶ COVID -19 and Diabetes: Glucose control is key.
- ▶ COVID-19 and Obesity: Under 60's face greater risk for hospitalization and severe disease.
- ▶ Patient's on Captopril do not seem to do as well as other ACE inhibitors.
- ▶ Patient's with low Vitamin D levels seem to have worse outcomes.
- ▶ COVID-19 deaths highlight longstanding racial disparities.
- ▶ Practices are seeing less patient volume, revenue and staff doing more.

So much
more to
learn...

THANK YOU!!!