



# Diabetes Management

2018 CHARLESTON APRN CONFERENCE

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## Objectives

- ▶ Review local and national epidemiology related to DM
- ▶ Define different types of DM
- ▶ Understand the pathophysiology of type 2 DM
- ▶ Review diagnosis criteria of pre-DM and DM
- ▶ Understand differences in management strategies among different patient populations
- ▶ Review strategies for prescribing oral antihyperglycemic medications
- ▶ Discuss initiation and titration of insulin therapy
- ▶ Discuss the role of statin therapy in DM management
- ▶ Discuss the role of antiplatelet therapy in DM management
- ▶ Discuss the importance of immunizations in DM management

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## Epidemiology

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### Statistics: The Good

- ▶ Proportion of patients with DM who meet goals for A1C, BP, and LDL levels has increased (American Diabetes Association [ADA], 2018)
- ▶ Mean A1C has declined (ADA, 2018)
  - ▶ 7.6% (1999-2002) → 7.2% (2007-2010)

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### Statistics: The Bad

- ▶ Younger adults less likely to meet treatment targets than older adults (ADA, 2018)
- ▶ 33-49% of patients do not meet targets glycemic, BP, or cholesterol control targets (ADA, 2018)
- ▶ Only 14% of patients with DM meet targets for all 3 measures while also avoiding smoking (ADA, 2018)
  
- ▶ What does this mean for us as health care providers?

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### Diagnosed Diabetes, Age-Adjusted Percentage, Adults with Diabetes - U.S. States, 1995, 2005, 2015

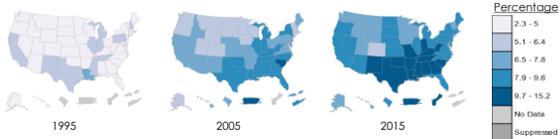


Figure 1. Percentage of Adults with DM (Centers for Disease Control and Prevention [CDC], n.d.)

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### Diagnosed Diabetes, Age-Adjusted Percentage, Adults with Diabetes, South Carolina

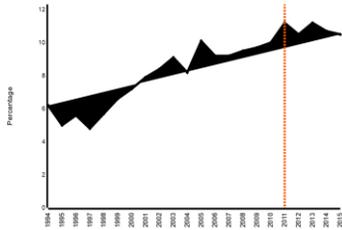


Figure 2. Diagnosed Diabetes in South Carolina. (CDC, n.d.)

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### Anatomy & Physiology

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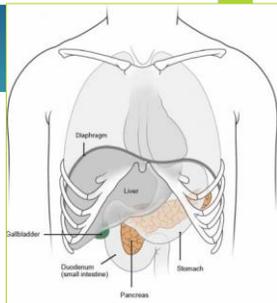
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### The Pancreas

- ▶ Endocrine gland
- ▶ Exocrine gland
- ▶ Size and location



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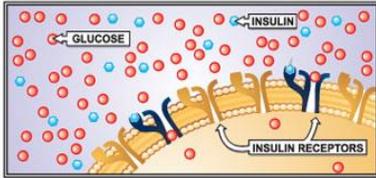
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## Type 2 DM

### INSULIN RESISTANT CELL




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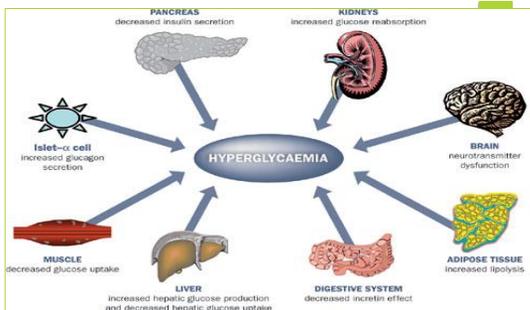
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(McCulloch & Robertson, 2016; Mintz, 2016; Robertson, 2016)

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## Classification of DM

- ▶ Type 1 DM
  - ▶ Beta-cell destruction → absolute insulin deficiency
- ▶ Type 2 DM
  - ▶ Progressive insulin secretory defect on top of insulin resistance
- ▶ Gestational DM
  - ▶ Diagnosed in 2<sup>nd</sup> or 3<sup>rd</sup> trimester of pregnancy
- ▶ Other
  - ▶ Neonatal DM; maturity-onset DM of the young; disease of exocrine pancreas—cystic fibrosis or pancreatitis; drug/chemical-induced (HIV drugs, antipsychotics, thiazide diuretics, glucocorticoids, etc...)

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## Detection of DM and Treatment Goals

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## Vulnerable Populations

- ▶ Ethnic, cultural, religious, and gender differences, socioeconomic status
  - ▶ T2DM more common in AA, Native Americans, Hispanic/Latinos & Asian Americans
- ▶ Food Insecurity
- ▶ Lack of health insurance
- ▶ Cognitive dysfunction
- ▶ Mental illness
- ▶ HIV

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## Screening Criteria for DM/Pre-DM in Asymptomatic Adults

- ▶ Consider testing in overweight (BMI  $\geq 25$  or  $\geq 23$  in Asian Americans) adults with at least one additional risk factor:
  - ▶ First-degree relative with DM
  - ▶ High-risk race/ethnicity
  - ▶ History of CVD
  - ▶ HTN ( $\geq 140/90$  mmHg or on therapy for HTN)
  - ▶ HDL cholesterol level  $< 35$  mg/dL and/or triglyceride level  $> 250$  mg/dL
  - ▶ Women with PCOS
  - ▶ Physical inactivity
  - ▶ Other clinical conditions associated with insulin resistance
- ▶ Begin testing at age 45 years even if no risk factors and not overweight or obese

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### ADA Criteria for Diagnosis

Test	Pre-Diabetes	Diabetes
A1C	5.7-6.4%	≥6.5%*
FPG	100-125 mg/dL	≥126 mg/dL*
O-GTT	140-199 mg/dL	≥200 mg/dL*
RPG		≥200 mg/dL*

\*Should repeat test to confirm result in absence of unequivocal hyperglycemia.

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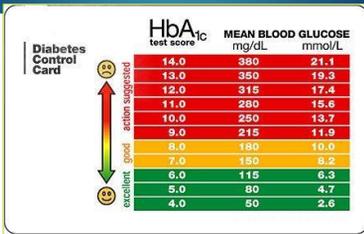
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### A1C and Glucose Comparison




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### Glycemic Targets: A1C

	ADA	AACE
Without concurrent serious illness and at low hypoglycemic risk	A1C < 7%	A1C < 6.5%
With concurrent serious illness, high hypoglycemic risk, limited life expectancy	A1C < 8-8.5%	A1C 6.5-8%

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## Glycemic Targets: Other Measures

Test	Goal
Preprandial capillary plasma glucose	80-130 mg/dL
Peak postprandial capillary plasma glucose	<180 mg/dL

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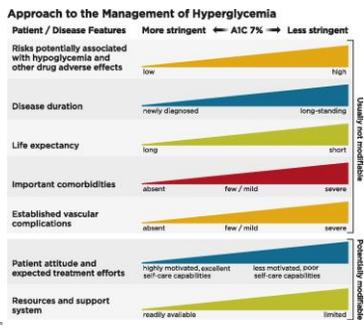
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American Diabetes Association. Diabetes Care 2018;41:1335-1344  
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## A1C Testing

DM control	A1C Testing Interval
If controlled	Two times per year (Q6mo)
If a change in therapy If not meeting glycemic target	Four times per year (Q3mo)

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## Management Strategies Among Different Patient Populations

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## Older Adults

- ▶ Avoid hypoglycemia
  - ▶ Avoid glyburide
- ▶ Varying glycemic goals based on chronic illness, cognition, and functional status

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## DM in Pregnancy

- ▶ Preconception care emphasizing glycemic control
  - ▶ A1C <6.5%
- ▶ Dilated eye exam before pregnancy or in first trimester
- ▶ If GDM:
  - ▶ Test for persistent diabetes or pre-diabetes at 4-12 weeks postpartum with O-GTT
  - ▶ Screen every 1-3 years if postpartum O-GTT is normal

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## Prevention or Delay of Type 2 Diabetes

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## Recommendations: Lifestyle

- ▶ Patients with prediabetes should be referred to an intensive behavioral lifestyle intervention program modeled on the Diabetes Prevention Program to achieve and maintain 7% loss of initial body weight and increase moderate-intensity physical activity (such as brisk walking) to at least 150 min/week.
- ▶ Technology-assisted tools including Internet-based social networks, distance learning, and mobile applications that incorporate bidirectional communication may be useful elements of effective lifestyle modification to prevent diabetes.

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## Recommendations: Pharmacotherapy

- ▶ Metformin therapy for prevention of type 2 diabetes should be considered in those with prediabetes, especially for those with BMI  $\geq 35$  kg/m<sup>2</sup>, those aged <60 years, and women with prior gestational diabetes mellitus.
- ▶ Long-term use of metformin may be associated with biochemical vitamin B12 deficiency, and periodic measurement of vitamin B12 levels should be considered in metformin-treated patients, especially in those with anemia or peripheral neuropathy.

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Metformin:  
New Recommendations from FDA

eGFR	Recommendation
≥ 60 mL/min/1.73m <sup>2</sup>	No dose adjustments; monitor renal function annually
45 – 60 mL/min/1.73m <sup>2</sup>	May continue treatment; monitor renal function q3-6months
30 – 45 mL/min/1.73m <sup>2</sup>	Do not initiate treatment. May continue treatment cautiously. Consider 50% dose reduction. Monitor renal function q3months.
< 30 mL/min/1.73m <sup>2</sup>	Contraindicated

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Prescribing  
Strategies for Oral  
Antihyperglycemic  
Medications

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"The need for medication therapy should not be interpreted as a failure of the lifestyle management but as an adjunct to it" (AAACE, 2018).

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### SGLT-2 Inhibitors (-gliflozins)

Category	Effect
Efficacy	Intermediate
Hypoglycemia	No
Weight Change	Loss
CV Effects	ASCVD: benefit with canagliflozin, empagliflozin* CHF: benefit with canagliflozin, empagliflozin*
Cost	High
Oral/SQ	Oral
Renal Effects	Progression of DKD: benefit Dosing: varies
Additional Considerations	<b>Black box warning:</b> risk of amputation (canagliflozin) Risk of bone fx, DKA, GU infection, volume depletion, inc. LDL

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### GLP-1 RAs (-tides)

Category	Effect
Efficacy	High
Hypoglycemia	No
Weight Change	Loss
CV Effects	ASCVD: Benefit for liraglutide CHF: neutral
Cost	High
Oral/SQ	SQ
Renal Effects	Progression of DKD: benefit Increased risk of SE with renal impairment; varies
Additional Considerations	<b>Black Box Warning:</b> risk of thyroid C-cell tumors GI SE (n/v/d); injection site reaction; ?acute pancreatitis risk

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### DPP-4 Inhibitors (-gliptins)

Category	Effect
Efficacy	Intermediate
Hypoglycemia	No
Weight Change	Neutral
CV Effects	ASCVD: neutral CHF: potential risk with saxagliptin, alogliptin
Cost	High
Oral/SQ	Oral
Renal Effects	Progression of DKD: neutral Renal dose adjustment required
Additional Considerations	Potential risk for acute pancreatitis Joint pain

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## Thiazolidinediones (-glitazones)

Category	Effect
Efficacy	High
Hypoglycemia	No
Weight Change	Gain
CV Effects	ASCVD: potential benefit (pioglitazone) CHF: increased risk
Cost	Low
Oral/SQ	Oral
Renal Effects	Progression of DKD: neutral No dose adjustment required; caution due to potential fluid retention if patient has renal impairment
Additional Considerations	<b>Black box warning:</b> CHF Fluid retention; benefit in NASH, risk of bone fractures; bladder cancer (pioglitazone); inc. LDL (rosiglitazone)

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## Sulfonylureas (2<sup>nd</sup> generation)

Category	Effect
Efficacy	High
Hypoglycemia	Yes
Weight Change	Gain
CV Effects	ASCVD and CHF: Neutral
Cost	Low
Oral/SQ	Oral
Renal Effects	Progression of DKD: neutral Glyburide-not recommended; initiate glipizide and glimepiride conservatively
Additional Considerations	<b>FDA Special Warning</b> on inc. risk of CV mortality based on studies of an older sulfonylurea (tolbutamide)

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## Insulin

Category	Effect
Efficacy	Highest
Hypoglycemia	Yes
Weight Change	Gain
CV Effects	ASCVD and CHF: neutral
Cost	Low for human insulin; High for analogs
Oral/SQ	SQ
Renal Effects	Progression of DKD: neutral Lower doses required with a decrease in eGFR
Additional Considerations	Injection site reactions Highest risk of hypoglycemia with human insulin (NPH or premixed formulations) vs analogs

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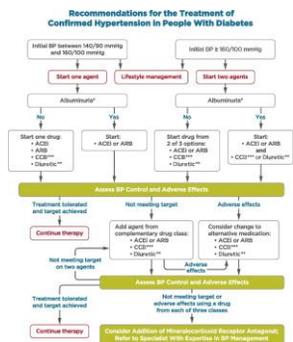
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## Hypertension Control in patient with Diabetes



American Diabetes Association. Diabetes Care 2014;37:1404-1414. ©2015 by American Diabetes Association.



## Hypertension Management Pearls

- ▶ Avoidance of ACEI and ARB combination therapy
- ▶ Lab monitoring
- ▶ AKI and Potassium abnormalities
- ▶ Treatment of resistant hypertension
- ▶ Bedtime dosing

## Statin Therapy

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## Lipid Management in Diabetes

- ▶ In adults not taking statins or other lipid-lowering therapy, it is reasonable to obtain a lipid profile at the time of diabetes diagnosis, at an initial medical evaluation, and every 5 years thereafter if under the age of 40 years, or more frequently if indicated.
- ▶ Obtain a lipid profile at initiation of statins or other lipid-lowering therapy, 4–12 weeks after initiation or a change in dose, and annually thereafter as it may help to monitor the response to therapy and inform adherence.

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## Lipid Management in Diabetes

Age	ASCVD	Recommended Statin Intensity and combination treatment
<40 years	No	*None
	Yes	High <ul style="list-style-type: none"> <li>• If LDL <math>\geq</math>70 mg/dL despite max tolerated statin dose, consider adding additional LDL-lowering therapy (e.g., ezetimibe or PCSK9 inhibitor)</li> </ul>
$\geq$ 40 years	No	**Moderate
	Yes	High <ul style="list-style-type: none"> <li>• If LDL <math>\geq</math>70 mg/dL despite max tolerated statin dose, consider adding additional LDL-lowering therapy (e.g., ezetimibe or PCSK9 inhibitor)</li> </ul>

\*If high risk for ASCVD, may consider moderate-intensity statin.  
 \*\*If high risk for ASCVD, may consider high-intensity statin.

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## Lipid Management in Diabetes

### High-intensity Statin Therapy (lowers LDL $\geq 50\%$ )

Atorvastatin 40-80 mg  
Rosuvaastatin 20-40 mg

### Moderate-intensity Statin Therapy (lowers LDL by 30% to 50%)

Atorvastatin 10-20 mg  
Rosuvaastatin 5-10 mg  
Simvastatin 20-40 mg  
Pravastatin 40-80 mg  
Lovastatin 40 mg  
Fluvastatin XL 80 mg  
Pitavastatin 2-4 mg

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## ACC/AHA ASCVD risk calculator

[my.americanheart.org](http://my.americanheart.org) → Prevention Guidelines

- ▶ Gender
- ▶ Age
- ▶ Race
- ▶ Total cholesterol
- ▶ LDL cholesterol
- ▶ HDL cholesterol

- ▶ Treatment with statin
- ▶ Systolic Blood Pressure
- ▶ Treatment of Hypertension
- ▶ History of Diabetes
- ▶ Current Smoker
- ▶ Aspirin therapy

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## Combination Therapy

- ▶ Statin + Ezetimibe
- ▶ Statin + PCSK9 Inhibitor
- ▶ Statin + Fibrate
- ▶ Statin + Niacin

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## Antiplatelet Therapy

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## Antiplatelet Agents

- ▶ Use aspirin therapy (75-162 mg/day) as a secondary prevention strategy in those with diabetes and a history of ASCVD.
- ▶ For those with documented ASCVD and aspirin allergy, use clopidogrel (75 mg/day).
- ▶ Dual antiplatelet therapy (with low-dose aspirin and a P2Y12 inhibitor) is reasonable for a year after an ACS and may be benefits beyond this period.
- ▶ Consider ASA therapy (75-162 mg/day) as a primary prevention strategy in those with DM who are at increased CV risk. This includes most men and women with diabetes aged  $\geq 50$  years who have at least one additional major risk factor and are not at increased risk of bleeding.
- ▶ Aspirin is not recommended for those at low risk of ASCVD.

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## Immunization Recommendations

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## Immunizations

- ▶ Provide routinely recommended vaccinations for children and adults with diabetes by age.
- ▶ Annual vaccination against influenza is recommended for all people ≥6 months of age, including those with diabetes.
- ▶ Vaccination against pneumococcal disease with 13-valent pneumococcal conjugate vaccine (PCV13) is recommended for children before age 2 years. People with diabetes ages 2 through 64 years should also receive 23-valent pneumococcal polysaccharide vaccine (PPSV23). At age ≥65 years, regardless of vaccination history, additional PPSV23 vaccination is necessary.
  - ▶ [Pneumococcal Vaccine Timing for Adults](#)
- ▶ Administer 3-dose series of hepatitis B vaccine to unvaccinated adults with diabetes ages 19 through 59 years.
- ▶ Consider administering 3-dose series of hepatitis B vaccine to unvaccinated adults with diabetes ages ≥60 years.

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## References

- ▶ American Diabetes Association. (2018). Standards of medical care in diabetes-2018 abridged for primary care providers. *Diabetes Care*, 41 (Suppl. 1):S1-S159. <https://doi.org/10.2337.cd17-0119>
- ▶ Centers for Disease Control and Prevention (CDC). (n.d.). Diagnosed Diabetes, Age-Adjusted Percentage, Adults with Diabetes - U.S. States [Image file.] Retrieved from: <https://qis.cdc.gov/>
- ▶ Centers for Disease Control and Prevention (CDC). (n.d.). Diagnosed Diabetes, Age-Adjusted Percentage, Adults with Diabetes, South Carolina [Image file.] Retrieved from: <https://qis.cdc.gov/>
- ▶ Garber, A. J., Abrahamson, M. J., Barzilay, J. I., Blonde, L., Bloomgarden, Z. T., Bush, M. A., ... Umpierrez, G. E. (2018). Consensus statement by the American association of clinical endocrinologists and American college of endocrinology on the comprehensive type 2 diabetes management algorithm - 2018 executive summary. *Endocrine Practice*, 24(1), 91-120. doi: 10.4158/CS-2017-0153

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## References

- ▶ Lowes, R. & Nainggolan, L. (2016). FDA: Metformin safe for some patients with renal problems. *Medscape*. Retrieved from <http://www.medscape.com/viewarticle/861708>
- ▶ McCulloch, D. K., & Robertson, R. P. (2017). Pathogenesis of type 2 diabetes mellitus. Retrieved on January 12, 2018 from <https://www.uptodate.com>
- ▶ Mintz, M. L. (2016). Role of the kidney in type 2 diabetes and mechanism of action of sodium glucose cotransporter-2inhibitors. *Journal of Family Practice*, 65(12 suppl).
- ▶ Robertson, R. P. (2016). Pancreatic beta cell function. Retrieved on January 12, 2018 from <https://www.uptodate.com>

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