Diabetes and Heart Disease

INSTRUCTOR
Jill Weisenberger, MS, RDN, CDE

Suggested CDR Learning Codes: 4040, 5160, 5190; Level 2

Learning Objectives:
1. Identify and quantify the increased risk of heart disease among people with diabetes.
2. Identify at least three ways to help people with diabetes lower their risk of heart disease.
3. Identify the most recent American Diabetes Association practice recommendations to reduce the risk of heart disease among people with diabetes.
4. Identify resources for teaching the relationship between diabetes and heart disease.

Session Description

Studies suggest that people with diabetes have the same risk of suffering a heart attack as those without diabetes who already have had a heart attack. This troubling correlation between diabetes and heart disease shows that RDs must be vigilant in stressing heart health for patients living with diabetes. This session reviews the link between diabetes and heart disease, discusses practice recommendations by the American Diabetes Association, and identifies strategies for heart disease prevention and treatment among people with diabetes.
Prevalence of CHD

26.5 million 2011

- CHD prevalence is declining
- CDC: CHD mortality rate has declined continuously over 50 years
- 47% of the decline in CHD mortality is attributed to improvements in treatment and 44% to a reduction in risk factors


(millions)

[cdc.gov/diabetes/statistics/prevalence/national/figpersons.htm]

Direct & Indirect Costs of CVD & Diabetes

<table>
<thead>
<tr>
<th></th>
<th>Estimated Direct Medical Costs</th>
<th>Estimated Indirect Medical Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVD</td>
<td>$296 billion</td>
<td>$152 billion</td>
</tr>
<tr>
<td>Diabetes</td>
<td>$116 billion</td>
<td>$58 billion</td>
</tr>
</tbody>
</table>

Note: these figures may not account for overlap. Sources: 2008 statistics American Diabetes Association & American Heart Association.
Abnormal Lipid Metabolism

- LDL ↑
- ApoB ↑
- HDL ↓
- TG ↑

Cardiometabolic Risk Global Diabetes / CVD Risk

- Smoking
- Physical Inactivity
- Unhealthy Eating
- Age, Race, Gender, Family History
- Inflammation
- Hypercoagulation
- Hypertension
- Smoking
- Physical Inactivity
- Unhealthy Eating
- Age, Race, Gender, Family History
- Inflammation
- Hypercoagulation
- Hypertension
- Smoking
- Physical Inactivity
- Unhealthy Eating
- Age, Race, Gender, Family History
- Inflammation
- Hypercoagulation
- Hypertension

Diabetes as a Risk Equivalent

Impact of Diabetes on Cardiovascular Disease Risk and All-Cause Mortality in Older Men

Influence of Age at Onset, Diabetes Duration, and Established and Novel Risk Factors

S. Goya Wannamethee, PhD; A. Gerald Shaper, FRCP; Prior H. Whincup, FRCP, PhD;
Lucy Lennon, MSc; Narved Sattar, MD, FRCP

Background: We have examined the influence of age at onset and duration on the impact of diabetes mellitus on cardiovascular disease risk and all-cause mortality among men aged 60 to 79 years.

Methods: A prospective study of 4045 men aged 60 to 79 years followed up for a mean of 9 years, during which there were 372 major coronary heart disease (CHD) events (fatal and nonfatal myocardial infarctions [MI]), 475 deaths from cardiovascular disease, and 1312 deaths from all causes. Men were classified as having (1) no history of MI and diabetes, (2) late-onset diabetes (diagnosed at ≥60 years of age), (3) early-onset diabetes (diagnosed before age 60 years), or (4) prior MI.

Results: Men who had both MI and diabetes were excluded. Both early and late onset of diabetes were associated with a significantly increased risk of major CHD events and all-cause mortality compared with nondiabetic men who had no CHD, even after adjustment for conventional risk factors and novel risk markers (levels of C-reactive protein and von Willebrand factor and eGFR dysfunction). Only men with early-onset diabetes (associated with a duration of 16.7 years) showed risk similar to those with previous MI and no diabetes. The adjusted relative risks (95% confidence intervals) for major CHD events were 1.00 (reference), 1.34 (1.07-2.61), 2.39 (1.43-4.11), and 2.31 (1.86-3.36) for groups 1 through 4, respectively.

Conclusion: Both early and late onset of diabetes are associated with increased risk of major CHD events and mortality, but only early onset of diabetes associated with ≥60-year duration appears to be a CHD equivalent.

Arch Intern Med. 2011;171(3):409-417
**Diabetes as a Risk Factor**

- Diabetes is an independent risk factor for CVD
- Hyperglycemia may
  - damage the endothelium
  - impair blood vessel dilation
  - modify LDL cholesterol
- Increased clotting
- Insulin resistance in type 2 diabetes may affect BP, lipids and more

**Insulin Resistance is Linked to CHD Mortality**

![Bar graph showing CHD death per 1,000](Fontbonne AM, et al. Diabetes Care. 1991;14:461-469)

**ABCs of Diabetes Care**

- A: A1C
- B: Blood Pressure
- C: Cholesterol
ABCs of Diabetes Care

Percent Meeting All Three

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>1.7%</td>
<td>7.1%</td>
<td>12%</td>
<td>18.8%</td>
</tr>
</tbody>
</table>

ADA BG Targets

<table>
<thead>
<tr>
<th>Measure</th>
<th>General Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1C</td>
<td>&lt; 7%</td>
</tr>
<tr>
<td>Fasting and before meals</td>
<td>70 – 130 mg/dl</td>
</tr>
<tr>
<td>1 – 2 hours after eating</td>
<td>&lt; 180 mg/dl</td>
</tr>
</tbody>
</table>

Targets should be individualized

Research on Glycemia (type 1)

- **DCCT**
  - A1C = 7 vs = 9
  - Retinopathy: 76%
  - Nephropathy: 50%
  - Neuropathy: 60%
  - CVD events: no difference

- **EDIC**
  - A1C = 8
  - Metabolic memory
  - CVD event: 42%
  - Combined nonfatal heart attack, stroke, death from CV causes: 57%
Research on Glycemia (type 2)

- **UKPDS**
  - Overall microvascular complications: 25%
  - 1% ↓ in A1c = 35% ↓ in risk of complications
  - 25% ↓ in DM-related deaths
  - 7% ↓ in all-cause mortality
  - CVD: trend toward reduction

- **UKPDS Follow-Up**
  - MI: 15% (sulfonylurea/insulin)
  - All-cause mortality: 13%
  - MI: 33% (metformin)
  - All-cause mortality: 27%

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Does A1C Affect CVD Risk?

- **ACCORD**: CVD or high risk
  - Stopped early b/c of increased death
  - Later analysis: highest risk among those with highest A1C

- **VADT**: uncontrolled (9.4%), insulin, max orals
  - Intensive control reduced CVD events in those with less atherosclerosis
  - Mortality in intensive group related to duration
    - < 15 years −
    - > 20 years −

- **Bottom line**: Intensive glycemic control may be harmful to people w/ diabetes of long duration, history of severe hypoglycemia, advanced atherosclerosis, elderly, frail

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ADA A1C Goals

- < 7% (< 7.5% elderly):
  - Associated with reduced microvascular complications
  - And reduced macrovascular disease, when implemented soon after diagnosis

- < 6.5%
  - Long life expectancy
  - Short duration of diabetes
  - No significant CVD
  - Low risk of hypoglycemia

- < 8% (< 8.5% elderly):
  - Limited life expectancy
  - History of severe hypoglycemia
  - Extensive complications and comorbidities

- Individualize

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What A1C Target?

- Mrs. R: 67 y.o.f
  - Type 2, 4 years, well-controlled
  - Comorbidity: HTN, controlled with medication
  - Walks daily with her husband
- Mr. L: 85 y.o.m.
  - New onset type 2, A1C = 9.1%
  - Comorbidities: HTN, hypothyroidism, dyslipidemia, osteoarthritis, moderate dementia
  - Lives in assisted living facility; wife is primary caregiver

Decision-Making for Glycemic Targets

<table>
<thead>
<tr>
<th>Loose Control</th>
<th>Tight Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe vascular problems &amp; comorbidities</td>
<td>Absent vascular problems &amp; comorbidities</td>
</tr>
<tr>
<td>Longstanding diabetes</td>
<td>Recently diagnosed diabetes</td>
</tr>
<tr>
<td>Short life expectancy</td>
<td>Long life expectancy</td>
</tr>
<tr>
<td>High risk of hypoglycemia</td>
<td>Low risk of hypoglycemia</td>
</tr>
<tr>
<td>Few resources, little support</td>
<td>Resources &amp; support</td>
</tr>
</tbody>
</table>

Blood Pressure

Effects of Insulin Resistance
- Increased sympathetic nervous system
- Renal sodium retention
- Decreased nitric oxide
Hypertension

- Increases risk of CVD & microvascular complications
- Affects ~30% of Americans, but most people with diabetes
- 20% of Americans with HTN are unaware
- 47% have their HTN under control
- CDC: contributes to 1,000 deaths per day
- More common in men & African Americans
  - Develops earlier in African Americans & is more severe
- Affected by inactivity, poor diet, overweight and obesity, insulin resistance, tobacco use & excessive alcohol intake

ADA BP Goals & Treatment

- Initiate lifestyle changes if BP >120/80
- < 140/80 mm Hg
  - PROMPT treatment
- < 130 mm Hg SBP for younger, healthier
  - “without undue treatment burden”
- First drug should be an ACE inhibitor or ARB
- Improved CVD outcomes
- DASH-style diet with sodium restriction
Sodium

- ADA
  - ≤ 2300 mg sodium/day
  - Individualized if have both DM and HTN
- Dietary Guidelines for Americans
  - 1500 mg – diabetes, HTN, chronic kidney disease, ≥ 51 years, African Americans
- AHA
  - 2400 mg for people with HTN
  - Ideally 1500 mg
  - At least reduce by 1000 mg
  - As part of DASH

Practice Pearls

- White coat HTN may lead to sustained HTN
- Most will need at least 2 drugs
- One should be taken at night
- Identify 3 – 5 changes to lower sodium intake

Classification of Blood Pressure in Adults

<table>
<thead>
<tr>
<th>Blood Pressure Classification</th>
<th>Systolic Blood Pressure (mm Hg)</th>
<th>Diastolic Blood Pressure (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120</td>
<td>and &lt;80</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>120-139</td>
<td>or 80-89</td>
</tr>
<tr>
<td>Hypertension Stage 1</td>
<td>140-159</td>
<td>or 90-99</td>
</tr>
<tr>
<td>Hypertension Stage 2</td>
<td>&gt;160</td>
<td>or ≥100</td>
</tr>
</tbody>
</table>
### Lifestyle & Behavior Changes

<table>
<thead>
<tr>
<th>Modification</th>
<th>Approximate Lowering of SBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lose weight</td>
<td>5 – 20 mm Hg for 22 pound weight loss</td>
</tr>
<tr>
<td>Engage in regular cardiovascular activity</td>
<td>4 – 9 mm Hg</td>
</tr>
<tr>
<td>Alcohol in moderation</td>
<td>2 – 4 mm Hg</td>
</tr>
<tr>
<td>Reduce sodium to ≤ 2400 mg/day</td>
<td>2 – 8 mm Hg</td>
</tr>
<tr>
<td>Consume a DASH eating plan</td>
<td>8 – 14 mm Hg</td>
</tr>
</tbody>
</table>

Source: NHLBI

### Cholesterol

- Measure fasting lipid profile at least yearly
- Ok to measure every two years if patient has low risk values.

### Type 2 Dyslipidemia

Insulin resistance results in increased lipolysis

- FFA ➔ Liver ➔ VLDL
- TG from VLDL ➔ HDL & LDL ➔ VLDL
- Cholesterol from HDL & LDL ➔ VLDL
  - Low HDL Cholesterol
- LDL is TG-rich ➔ hydrolyzed by hepatic lipoprotein lipase ➔ Small LDL Particles
LDL-Size and Insulin Resistance

Large LDL Pattern  Intermediate LDL Pattern  Small LDL Pattern


Glucose intolerant, hyperinsulinemic, hypertensive, lower HDL cholesterol concentration

ADA Lipid Goals

<table>
<thead>
<tr>
<th>Lipid</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL</td>
<td>&lt; 100 mg/dl</td>
</tr>
<tr>
<td></td>
<td>&lt; 70 mg/dl if overt CVD</td>
</tr>
<tr>
<td></td>
<td>*or 30-40% reduction</td>
</tr>
<tr>
<td>HDL</td>
<td>&gt; 40 mg/dl in men</td>
</tr>
<tr>
<td></td>
<td>&gt; 50 mg/dl in women</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>&lt; 150 mg/dl</td>
</tr>
</tbody>
</table>

ADA Treatment Recommendations

- Lifestyle modification for all
- Statins –
  - overt CVD
  - > 40 years with at least 1 risk factor
  - LDL > 100 mg/dl or multiple risk factors
  - 20% reduction in vascular events, 35% reduction in all-cause mortality
    - Meta-analysis, 18,686 pwd
- Lower TG if at risk for pancreatitis
  - > 1000 mg/dl
- Combination therapy isn't helpful
- ACCORD Trial

ADA Treatment Recommendations

American Diabetes Association Standards of Medical Care in Diabetes 2014. Diabetes Care 2014 37;S14-S80
ACC/AHA Guidelines

- No evidence for specific LDL-C goals
- Out of date: Treat to target, Lower is best
- Statins for those at risk
  - Moderate intensity: >30% LDL reduction
  - High intensity: >50% LDL reduction
- 5 – 6% Kcals from saturated fat
- There is insufficient evidence to determine whether restricting dietary cholesterol reduces LDL-C
- Follow DASH style diet
- Okay in diabetes
- OMNI Heart

Look AHEAD Trial

- Research Question: In overweight people with type 2 diabetes, does an intensive lifestyle program designed to achieve and maintain weight loss protect against CVD?
- Headlines: Lifestyle Changes Don’t Protect the Diabetic Heart
- Truth:
  - Control: final weight loss of 3.5%
  - Intervention: final weight loss of 6%, greater improved fitness, mobility, sleep apnea, QOL, depression, urinary incontinence
  - More insulin and cholesterol & BP meds in control group

Smoking Cessation

Smoking Dangers

- Endothelial dysfunction
- Decreases HDL cholesterol
- Increases LDL modification
- Increases blood clotting
- Increases blood pressure
- Decreases exercise tolerance
- Increases microvascular complications
- Even minimal smoking raises risk of CVD
Dietary Fats

- **Saturated fatty acids**
  - Increase total cholesterol, LDL-cholesterol, CVD risk
  - Increase markers of insulin resistance, T2 DM risk
  - Stearic acid is neutral (chocolate)
- **Replace 5% of energy** from SFA with MUFAs or PUFAs to decrease risk & to improve insulin resistance
- **Omega-3 PUFAs**
  - Seafood providing an average of 250 mg per day of long-chain n-3 fatty acids is associated with reduced cardiac mortality from CHD or sudden death in persons with and without CVD.
  - n-3 fatty acids from plant sources may reduce mortality among persons with existing CVD
- **Nuts favorably impact lipids**

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<table>
<thead>
<tr>
<th></th>
<th>MUFAs Replace SFA</th>
<th>MUFAs Replace CHO</th>
<th>PUFAs Replace SFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>↓ 6 – 10%</td>
<td>No change</td>
<td>↓ 8 – 12%</td>
</tr>
<tr>
<td>LDL Cholesterol</td>
<td>↓ 6 – 10%</td>
<td>↓</td>
<td>↓ 8 – 12%</td>
</tr>
<tr>
<td>HDL Cholesterol</td>
<td>No change</td>
<td>↑</td>
<td>↑ with omega-3 PUFAs</td>
</tr>
<tr>
<td>Total HDL Ratio</td>
<td>↑</td>
<td>↓</td>
<td>↓ (even with ↑ on HDL from omega-6s)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>No change</td>
<td>↓</td>
<td>↓ with omega-3 PUFAs</td>
</tr>
<tr>
<td>Insulin Sensitivity</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
</tr>
</tbody>
</table>

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Positive Messages

- Eat fatty fish at least twice weekly.
- Toss tuna or salmon from a pouch onto a salad or mix with pasta
- Snack on a handful of nuts instead of sweets.
- Spread nut butter or mashed avocado on toast.
- Sauté thinly sliced garlic in oil over low heat until just golden. Remove the pan from the heat and toss with steamed vegetables.
Positive Messages

- When baking
  - Replace ¼ cup of butter with 3 tablespoons of olive or canola oil
  - Chocolate chip cookies: ½ butter, ½ canola oil
  - Replace butter with mashed avocado with 1:1 ratio
- Substitute all or half of the butter in your recipe with canola oil.
- Dip into hummus instead of blue cheese dressing.
- Spray oil onto oven-fried chicken for even coating.

Other Key Messages

- Single high saturated-fat meal may harm blood vessels\(^1\)
- Traces of trans fats add up
  - Avoid partially hydrogenated oils
- Eggs: 1 egg/day does increase lipids & CVD risk among pwd, type 2 but NOT among healthy populations\(^2\)
- Red meat increases CVD risk\(^3\)
- SFA & cholesterol
- Microbiota produce TMAO

Phytosterols

- NCEP: Consuming 2 g plant sterols/stanols lowers LDL-cholesterol by as much as 15\(^\%\).
- Average intake: 300 – 400 mg/d
- Vegetable oils, nuts, seeds
- Consume with meals, 2 – 3 times per day

“Foods containing at least 0.5g per serving of plant sterols eaten with meals or snacks for a daily total intake of 2g as part of a diet low in saturated fat and cholesterol, may reduce the risk of heart disease.”
Phytosterols

- Benecol and Take Control Spreads
- Minute Maid Heart Wise OJ
- Various milks and cheeses
- Benecol Smart Chews & Quest Cardio Chews
- VitaMuffin Dark Chocolate Pomegranate VitaTops
- Various breads, pasta, etc

My Diabetes Health Assessment

People with type 2 diabetes are at an increased risk of developing cardiovascular disease (CVD), such as heart attack or stroke. By just a few simple changes you can lower your risk of having a heart attack or stroke in the next 10 years.

Inputs your current numbers such as blood sugar, weight and blood pressure. It then gives you what you can do to reduce your risk of CVD, and provides you with personalized action plans to help you make lifestyle changes and lower your risk of CVD.

Get Started Now!

http://www.heart.org/HEARTORG/Conditions/Diabetes/DiabetesToolsResources/My-Diabetes-Health-Assessment_UCM_313901_Article.jsp

Personalized Reports

My Diabetes Health Assessment

| My Goals: | | | |
| Current Blood Pressure: | | | |
| Recommendation: | | | |
| My Goal: | | | |

High blood pressure puts an extra strain on your body – especially your heart, blood vessels and kidneys. It increases your risk of stroke, heart attack, kidney failure and heart failure.

When high blood pressure exists with obesity, smoking, high blood cholesterol levels or diabetes, the risk of heart attack or stroke increases several times.

You can help lower your blood pressure by:
- Losing weight
- Getting regular physical activity
- Limiting salt and alcohol
- Limiting stress

http://www.heart.org/HEARTORG/Conditions/Diabetes/DiabetesToolsResources/My-Diabetes-Health-Assessment_UCM_313901_Article.jsp
National Diabetes Education Program

Diabetes and Heart Health

People with diabetes should be aware of their heart health. Having diabetes makes heart disease and stroke more likely. Most heart disease is preventable. NDEP has shown that people with diabetes can lower their risk for heart disease and other heart problems by managing the risk factors for diabetes—high blood pressure, cholesterol—and stopping smoking. NDEP provides educational resources for people with diabetes and health care professionals to raise awareness of the risk of diabetes on heart health.

Resources for Heart Health

- Getting Your Heart Ready: Manage Your Diabetes
- Diabetes and Your Heart Health: Prevention and Care

CMR Toolkit

Protect Your Heart: Plan and Cook Heart-Healthy Meals

You can protect your heart and lower your risk for future heart problems simply by making heart-healthy meals. Here are some ideas for getting started:

- Choose healthy meals and snacks:
  - Low fat meals and snacks
  - Take the time to prepare meals
  - Plan your meals
  - Use fresh, healthy ingredients

- Choose healthy fats and oils:
  - Use healthiest fats and oils:
    - Olive oil
    - Canola oil
    - Margarine
    - Low-fat margarine
    - Lard
    - Butter
    - Safflower oil

- Choose lean meats, poultry, and fish:
  - Choose lean meats:
    - Chicken
    - Turkey
    - Fish
    - Lean meat
  - Choose lean poultry:
    - Turkey
    - Chicken
  - Choose lean fish:
    - Salmon
    - Tuna
    - Sardines

- Choose whole-grain breads:
  - Choose whole-grain breads:
    - Whole wheat
    - Whole oats
    - Barley
  - Choose whole-grain cereals:
    - Oat bran
    - Rolled oats
    - Bran flakes

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Upcoming Books

The Overworked Person's guide to Better Nutrition

21 Things You Need To Know About Diabetes And Your Heart