# Section 5: Cardiovascular Care

<table>
<thead>
<tr>
<th>Concern</th>
<th>Care/Test</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular Care</td>
<td>▪ Check fasting lipid profile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adult goals:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Total Cholesterol &lt; 200 mg/dL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Triglycerides &lt; 150 mg/dL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- HDL ≥ 40 mg/dL (men)</td>
<td></td>
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<tr>
<td></td>
<td>- HDL ≥ 50 mg/dL (women)</td>
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<tr>
<td></td>
<td>- Non-HDL (Cholesterol) &lt; 130 mg/dL</td>
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<tr>
<td></td>
<td>- Non-HDL (Cholesterol) &lt; 100 mg/dL (for very high risk)</td>
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<tr>
<td></td>
<td>- LDL &lt; 100 mg/dL (optimal goal)</td>
<td></td>
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<tr>
<td></td>
<td>- LDL &lt; 70 mg/dL (for very high risk)</td>
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<tr>
<td></td>
<td>▪ Start statin with ongoing lifestyle changes</td>
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<tr>
<td></td>
<td>▪ Check blood pressure,</td>
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<tr>
<td></td>
<td>Adult goal: &lt; 130/80 mmHg</td>
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</tr>
<tr>
<td></td>
<td>(limit total sodium to &lt; 1500 mg/day)</td>
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<tr>
<td></td>
<td>▪ Assess smoking/tobacco use status</td>
<td></td>
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<tr>
<td></td>
<td>▪ Start aspirin prophylaxis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(unless contraindicated)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Children: After age 2 but before age 10. Repeat annually if abnormal,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>repeat in 3 – 5 years if normal.</td>
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<tr>
<td></td>
<td>Adults: Annually. If abnormal, follow NCEP III guidelines.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adults with overt CVD; Age &gt; 40 yrs without CVD and one or more risk</td>
<td></td>
</tr>
<tr>
<td></td>
<td>factors for CVD; &lt; age 40 individualize</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Children: Each focused visit; follow National High Blood Pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Education Program recommendations for Children and Adolescents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adults: Each focused visit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Each visit: (5As: Ask, Advise, Assess, Assist, Arrange)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age &gt; 50 yrs for men and &gt; 60 yrs for women with diabetes and at least</td>
<td></td>
</tr>
<tr>
<td></td>
<td>one other major CVD risk factor; Men ≤ 50 yrs and women ≤ 60 yrs,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>individualize based on risk</td>
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</tr>
</tbody>
</table>

*More or less stringent Blood Pressure goals must be individualized if < 130/80 is not reasonable to achieve*

**Main Topics Included in this Section:**
- Lifestyle Modifications
- Tobacco Cessation
- Standard Lipid Assessment and Monitoring in Adults
- Treatment
- Additional Risk Stratification
- Lipid Screening and Treatment in Children and Adolescents
- Blood Pressure Control
- Accurate Blood Pressure Measurement
- Antiplatelet Therapy
- Baseline Electrocardiogram and Diagnostic Stress Testing
- Suggested Criteria for Cardiac Stress Testing in Diabetes
- Heart Failure
- Referral to a Cardiologist and Coordination of Care
- Additional Resources
- References
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Coronary artery disease is the leading cause of death in people with type 2 diabetes and is second only to end-stage renal disease (ESRD) as the leading cause of death in people with type 1 diabetes. About 65% of deaths among people with diabetes are related to heart disease and stroke. People with diabetes typically exhibit a combination of risk factors for vascular disease including dyslipidemia, hypertension, abnormal platelet function, and elevated serum markers for vascular inflammation. In addition, diabetes is an independent risk factor for heart disease and stroke. People with type 2 diabetes have equivalent cardiovascular disease risk as people without diabetes who have already had a myocardial infarction. The risk of heart disease and stroke is further increased in people with diabetes who smoke or use other tobacco products.

It is important for health care providers to explain the signs and symptoms of adverse cardiovascular events (e.g., myocardial infarction, cerebrovascular accident, and peripheral artery thrombosis) to people with diabetes so that they and their families know what action to take if such events occur.

Health care providers and other members of the diabetes care team can be instrumental in preventing cardiovascular complications and reducing the occurrence or recurrence of cardiovascular events by aggressively monitoring and treating cardiovascular risk factors, especially blood pressure and cholesterol. Likewise, discussing the benefits of and providing support for positive lifestyle changes, such as dietary modifications, regular physical activity, and tobacco cessation is an essential role of the diabetes care team.

Lifestyle Modifications

Aggressive use of lifestyle modifications can reduce or delay the need for medical interventions. A referral to a registered dietitian can assist people in making lifestyle and dietary modifications for reducing cardiovascular risk.

Modest weight loss (5-10%) and maintenance, when combined with moderate physical activity (e.g., minimum of 150 minutes over at least 3 days each week or vigorous-intensity aerobic activity for a minimum of 75 minutes over at least three days each week), may assist in controlling high blood cholesterol and triglycerides, high blood pressure, and high blood glucose levels, thereby reducing cardiovascular risk. Research demonstrates that structured programs involving health professionals are the most effective for supporting and maintaining lifestyle modifications. Keeping daily logs such as a daily or weekly food record or physical activity record can be useful when making lifestyle changes.

Sodium is an essential nutrient and is needed by the body in relatively small quantities. Many people consume more sodium than needed. A low sodium diet can assist in lowering blood pressure. Sodium recommendations are less than 1500 mg for all people with diabetes (CDC, 2012). Individuals can reduce their consumption of sodium in a variety of ways:

- Read the Nutrition Facts label for information on the sodium content of foods and purchase foods that are low in sodium. Consume more fresh foods and fewer canned, frozen or prepared foods with added sodium.
- Eat more home-prepared foods, where you have more control over sodium and use little or no salt/salt-containing seasonings when cooking or eating foods.
- When eating at restaurants, ask that salt not be added to your food or order lower sodium options, if available. Restaurant websites can help evaluate sodium content of foods.
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Evidence-based eating plans effectively targeting high cholesterol and high blood pressure are available. The National Cholesterol Education Program Adult Treatment Panel (ATP) III recommends the Therapeutic Lifestyle Changes (TLC) diet to treat elevated LDL cholesterol levels. The TLC diet limits saturated fat to 7% of calories consumed, dietary cholesterol to less than 200 mg/day and trans fat to less than 1% of total daily calories. If the LDL cholesterol goal is not achieved through use of the TLC diet, adding other cholesterol-lowering foods such as plant stanols/sterols, viscous (soluble) fiber, soy protein, and nuts could be effective in lowering LDL cholesterol further. Adding weight management, regular physical activity, and control of total carbohydrate intake (especially added sugar and fructose) to the TLC diet additionally targets high triglycerides and low HDL cholesterol. Additional information on the TLC diet is available at: http://www.nhlbi.nih.gov/cgi-bin/cht/step2intro.cgi.

The Dietary Approaches to Stop Hypertension (DASH) eating plan can significantly decrease blood pressure. The DASH eating plan is low in sodium and high in fruit, vegetables, low-fat dairy foods, whole grains, fish, poultry, and nuts. It is rich in magnesium, potassium, calcium, and fiber and low in saturated fat, cholesterol, and total fat. Menus and additional information on the DASH eating plan for 1500mg sodium per day are available at: http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf.

Oxidative stress is believed to play an important role in the initiation and progression of atherosclerotic vascular disease. Therefore, adequate intake of natural antioxidants found in a variety of fruits, vegetables, whole grains, and omega-3-rich foods is strongly recommended.

Antioxidant supplements, including vitamins A and E, are no longer recommended to reduce the impact of endogenous oxidative stress. Clinical trials of vitamin E use in people with diabetes failed to demonstrate a significant benefit for the reduction of CVD and showed possible blunting of benefits from statins. Vitamins A and C supplements also lack evidence of efficacy and are not advised. Use of vitamin D must be individualized, as there are no specific recommendations at this time.

Tobacco Cessation

Any type of tobacco is harmful to the health of all people, including those with diabetes and prediabetes. Morbidity and mortality caused by tobacco use disproportionately impacts certain populations. Wisconsin’s young adults, communities of color, low-income, less-educated, and blue-collar workers are the most susceptible to tobacco industry targeting and resulting tobacco addictions.

The Centers for Disease Control and Prevention emphasizes addressing tobacco control efforts in the broader context of tobacco-related diseases. Tobacco use in conjunction with other diseases and risk factors, such as sedentary lifestyle, poor diet, and diabetes, poses a greater combined risk for many chronic diseases than the sum of each individual degree of risk. Collaborative efforts among individuals and groups interested in prevention of cancers, lung diseases, and heart disease, together with those interested in tobacco control, have the potential to synergistically reach greater numbers and effectively improve outcomes for reducing the burden of tobacco-related diseases.

Smoking raises blood glucose, cholesterol, and blood pressure. Tobacco cessation lowers the risk for heart attack, stroke, nerve disease, kidney disease, and oral disease. Since individuals with diabetes are at a greater risk for negative health outcomes if they use tobacco, it is important that tobacco use screening, followed by information on cessation resources if the individual uses tobacco, be included in each diabetes-focused visit.
Interventions that increase quitting success can decrease premature mortality and tobacco-related health care costs in the short term. Tobacco use screening followed by a brief intervention is a top-ranked clinical preventive service in terms of its relative health impact, effectiveness, and cost-effectiveness. Tobacco use treatment is more cost-effective than other commonly provided clinical preventive services.

Health care providers play an important role in helping people with tobacco cessation efforts and in limiting exposure to second-hand and third-hand smoke. Assessing tobacco use status and readiness to quit at each visit is essential. Providers should provide clear and personalized advice on the effective interventions available including pharmacological agents that attenuate nicotine withdrawal and the symptoms associated with withdrawal. For additional information on pharmacological agents to treat tobacco dependence, see tool titled “Tobacco Treatment Chart” in the Tools Section.

Continual assessment of a person’s willingness to quit, especially if he/she was not initially successful, can lead to future cessation attempts and success. The “5 As” are a helpful tool to assist health care providers in promoting and discussing tobacco cessation. The 5 As are:

1. Ask “do you use tobacco?”
2. Advise quitting
3. Assess willingness to quit
4. Assist by offering resources (e.g., pharmacological, behavioral)
5. Arrange follow-up

Tobacco practice guidelines and cessation resources are available for both providers and consumers including:

- The Wisconsin Tobacco Prevention and Control Program provides links to more information and resources: [http://www.dhs.wisconsin.gov/tobacco/](http://www.dhs.wisconsin.gov/tobacco/)
- The University of Wisconsin Center for Tobacco Research and Intervention (UW-CTRI) provides a free Quit Line that offers people that use tobacco free counseling via 1-800-784-8669 (English) or 1-877-266-3869 (Spanish). Their website also provides cessation information: [http://www.ctri.wisc.edu/Smokers/smokers_FDA.Approved.Medications.htm](http://www.ctri.wisc.edu/Smokers/smokers_FDA.Approved.Medications.htm)

The Centers for Disease Control and Prevention’s Tobacco Information and Prevention Source (TIPS) provides the resource “How to Quit Smoking”: [http://www.cdc.gov/tobacco/how2quit.htm](http://www.cdc.gov/tobacco/how2quit.htm).
Standard Lipid Assessment and Monitoring in Adults

Studies demonstrate the beneficial effects of LDL cholesterol reduction on morbidity and mortality from coronary artery disease. Diabetes is usually accompanied by a secondary dyslipidemia characterized by elevated LDL cholesterol, elevated triglycerides, and/or low HDL cholesterol. In this situation, the LDL particles tend to be smaller and more atherogenic. When triglycerides are over 400 mg/dL the LDL-C can no longer be “calculated,” and is often omitted on the lab report or reported as “Unable to calculate.” When people with type 2 diabetes have elevated triglyceride levels but relatively normal LDL cholesterol values, measuring their non-HDL cholesterol (total cholesterol – HDL cholesterol) can be useful in assessing risk and guiding treatment. The non-HDL cholesterol measures not only LDL cholesterol, but also cholesterol contained in metabolic “remnants” of very low-density lipoproteins (VLDL), the main carriers of triglycerides. Like LDL cholesterol, these remnants promote the buildup of plaque in arteries. In those individuals with triglycerides over 200 mg/dL, the ATP-III Guidelines advise the use of non-HDL cholesterol as a secondary target for therapy once the LDL-cholesterol goal is achieved. Health care providers can use non-HDL cholesterol levels for the initial or follow-up evaluation of serum lipids for people seen in a non-fasting state. Many people with diabetes will require one or more lipid-lowering medications to achieve optimal lipid levels.

The 2004 National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III Guideline panel considers diabetes a coronary heart disease (CHD) risk equivalent, meaning that having diabetes confers that same high risk for a major coronary event (e.g., heart attack) as having known coronary heart disease. For people with CHD and CHD-risk equivalents, ATP III recommends lowering LDL cholesterol to < 100 mg/dL. In addition, ATP III describes an optional LDL cholesterol goal of < 70 mg/dL for very high risk individuals. A person with diabetes and established cardiovascular disease (known stenosis of any major artery such as the coronary, carotids, renal, and iliofemoral arteries) is considered a very high risk individual. Table 5-1 describes current NCEP ATP III recommendations.

Undetected hypothyroidism is a potential secondary cause of an elevated LDL cholesterol level especially in those with type 1 diabetes and in women age > 60. A TSH level should be obtained to rule out hypothyroidism as a cause of the elevated LDL cholesterol.

In female patients on oral contraceptives with elevated triglycerides, consideration should be given to changing to a lower estrogen containing preparation or using other forms of contraception. Post menopausal women using hormone replacement therapy may blunt the effect on hormones and triglycerides by using transdermal preparations.

Table 5-1: Lipid Therapy Goals for Adults with Diabetes

<table>
<thead>
<tr>
<th>Test</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cholesterol</td>
<td>&lt; 200 mg/dL</td>
</tr>
<tr>
<td>LDL-Cholesterol</td>
<td>&lt; 100 mg/dL (optimal goal)</td>
</tr>
<tr>
<td></td>
<td>&lt; 70 mg/dL (optimal goal for very high risk individuals)</td>
</tr>
<tr>
<td>HDL-Cholesterol</td>
<td>Men ≥ 40 mg/dL</td>
</tr>
<tr>
<td></td>
<td>Women ≥ 50 mg/dL</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>&lt; 150 mg/dL</td>
</tr>
<tr>
<td>Non-HDL Cholesterol</td>
<td>&lt; 130 mg/dL (optimal goal)</td>
</tr>
<tr>
<td></td>
<td>&lt; 100 mg/dL (optimal goal for very high risk individuals)</td>
</tr>
</tbody>
</table>

Source: National Cholesterol Education Program Adult Treatment Panel III Guidelines

● Non-HDL Cholesterol = Total Cholesterol – HDL Cholesterol
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Treatment

Statin therapy is recommended in addition to medical nutrition therapy, physical activity, and weight loss (if body mass index (BMI) ≥ 25 kg/m^2) for:

- people who have diabetes with overt CVD
- people over age 40 with diabetes but without CVD who have at least one or more CVD risk factors
- people with overt dyslipidemia

The statin class of drugs (HMG-CoA reductase inhibitors) has proven to be effective for primarily lowering LDL cholesterol but also provides smaller reductions in triglycerides and increases in HDL cholesterol in some people. A number of clinical trials have reported significant reductions in cardiovascular events in people with diabetes treated with statins. Statins also provide a number of favorable effects that are independent of lipid lowering. These effects include reduction of inflammatory markers (i.e., C-reactive protein) and restoration of endothelial function. Recently FDA approved important safety label changes for statins.

Many people with diabetes require combinations of lipid lowering agents (such as fibrates, nicotinic acid, ezetimibe, resins, and fish oils) to control more complex and refractory dyslipidemias, although outcomes data on event reduction from these agents is variable. Use caution when prescribing fibrates (gemfibrozil or fenofibrate) or high-dose niacin (> 2 g/day) in combination with statins, because the potential for myopathy increases especially in those with impaired renal function.

The American Heart Association endorses the use of 2000-4000 mg (2-4 grams) per day of omega-3 fatty acids (EPA + DHA) in the form of fish oil to manage elevated triglycerides (> 150 mg/dL), but only under the supervision of a physician as high doses of fish oil can lead to excessive bleeding. The EPA and DHA content of fish oil preparations should be carefully reviewed since brands of fish oil vary significantly and reaching the EPA + DHA goal may require the use of multiple capsules each day. For people with diabetes and documented heart disease, it is recommended to take a daily supplement of 1000 mg (1 gram DHA + EPA) of omega-3 fatty acids (fish oil).

It is essential for people with fasting triglyceride levels > 500 mg/dL to be referred to a lipid specialist or cardiologist for treatment and management as well as to an RD for nutrition counseling. Hyperglycemia can also affect triglyceride levels; therefore, as blood glucose levels improve, triglycerides are likely to improve. In addition, reducing alcohol consumption can help reduce triglycerides. When triglycerides are over 500 mg/dL, the treatment of triglycerides rather than LDL cholesterol is the primary lipid target.
Additional Risk Stratification

At this time specialized lipoprotein testing is available and being used. Testing measures the subgroups of lipoproteins, the size/density of lipoproteins, and the numbers of particles. People with diabetes or metabolic syndrome are more likely to have atherogenic small dense LDL particles. Measuring LDL particle size in addition to a lipid profile can be helpful to further stratify risk and optimize lipid goals for people at greatest risk. These measurements may be helpful when considering combination lipid-altering drug treatments but are not necessary before initiating LDL cholesterol-reducing medications such as statins.

Various tests can be used to measure small dense LDL including:
- Berkeley HeartLab, Inc. ([www.bhlinc.com](http://www.bhlinc.com)) uses an LDL gradient gel electrophoresis
- LipoScience, Inc. ([www.lipoprofile.com](http://www.lipoprofile.com)) LipoProfile® test uses nuclear magnetic resonance (NMR) spectroscopy to provide rapid, simultaneous, and direct measurement of LDL cholesterol particle number and size, as well as direct measurement of HDL cholesterol and very low density lipoprotein (VLDL) cholesterol subclasses
- Arthertec, Inc. ([www.thevaptest.com](http://www.thevaptest.com)) uses a vertical auto profile

An emerging measure of cardiovascular risk is ApolipoproteinB (ApoB), which is the main structural protein of the atherogenic lipoproteins and provides a good measure of the number of LDL particles. This measure can be especially helpful in conditions like diabetes and metabolic syndrome, which are associated with atherogenic small dense LDL particles.

Although it is currently not a target for cholesterol treatment in the American Diabetes Association (ADA) Clinical Practice Guidelines or the NCEP ATP III guidelines, a consensus panel convened by ADA and American College of Cardiology (ACC) recommended adding ApoB as a therapeutic target in people with diabetes and clinical cardiovascular disease. Suggested goals:
- for those at high risk are: ApoB < 90 mg/dL (along with LDL < 100 mg/dL and non-HDL < 130 mg/dL)
- for those at highest risk are: ApoB < 80 mg/dL (along with LDL < 70 mg/dL and non-HDL < 100 mg/dL)

As research continues to accumulate about the impact of cholesterol particle size and composition on the atherogenic potential, such tests will likely factor more prominently into lipid management plans and covered by more insurance plans. Clarification of LDL cholesterol targets and emphasis on non-HDL cholesterol and LDL particle number will likely be a topic for the NCEP ATP IV guidelines, expected in 2012. Until then, the lipid therapy goals for adults with diabetes remain as indicated in Table 5-1.
Lipid Screening and Treatment in Children and Adolescents

Childhood overweight and obesity in the United States continues to increase. Coincident with this increase in overweight and obesity, more children and adolescents are developing hypertension, metabolic syndrome, type 2 diabetes, and dyslipidemia. The development of atherosclerosis can begin in childhood and there is increasing evidence that risk reduction delays progression toward clinical disease. Children and adolescents with type 1 or 2 diabetes are at increased risk for accelerated atherosclerosis, and as a result, more aggressive screening is recommended for this population. Screening children earlier than age two is not recommended because lipid concentrations are age- and maturation-dependent.

Various recommendations for lipid screening in children and adolescents exist and differ slightly thus, it is important to individualize after age two. For a complete detailed summary and discussion of lipid screening and treatment in children and adolescents refer to:


Blood Pressure Control

Aggressive evaluation and management of blood pressure to achieve levels of < 130/80 mmHg is critical for people with diabetes. Blood pressure should be monitored at each clinic visit. Lifestyle modifications are effective in lowering blood pressure and may allow some people to achieve normotension without antihypertensive drug therapy. Lifestyle modifications and antihypertensive drug therapy is recommended for people with a baseline blood pressure ≥ 140/90 mmHg. Most people with diabetes require two or more antihypertensive drugs to attain blood pressure control of < 130/80 mmHg. There is some controversy about the safety of lowering blood pressure below 130/80 in people with diabetes and its efficacy for further reducing cardiovascular events. This may depend on an individual’s degree of renal dysfunction and proteinuria.

Angiotensin suppression using either angiotensin-converting enzyme inhibitors (ACE inhibitors) or angiotensin receptor blockers (ARBs) is strongly recommended for initial treatment. These agents are especially effective in lowering blood pressure and reducing both cardiovascular events and diabetic nephropathy. Even in people with mild to moderate reduction in renal function, consider ACE inhibitors or ARB treatment because the potential benefits for cardiovascular protection outweigh the possibility of additional impairment of renal function. For people with mild impairment of renal function, start ACE inhibitors or ARB therapy at lower dosages and carefully titrate according to blood pressure response, as well as serum creatinine and potassium levels.

Other classes of antihypertensive drugs are also effective and should be added as necessary. Thiazide diuretics are an option when used in low doses (12.5-25 mg); they can add beneficial effectiveness to ACE inhibitors or ARB therapy and do not affect blood glucose control. However, thiazide diuretics at higher doses may worsen glycemic control; therefore, close monitoring is necessary.
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Recent analysis from the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT) shows that for men and women with metabolic syndrome, and for both black and non-black (Caucasian, Hispanic, Asian/Pacific Islander, and American Indian/Alaskan Native) participants, the less costly chlorthalidone consistently controlled blood pressure and is equally beneficial in preventing heart attacks and coronary heart disease death. Depending on overall risk, it may be as beneficial as newer antihypertensive medications in preventing one or more other forms of cardiovascular disease, including heart failure and stroke.

Selective beta-blocker agents are strongly recommended for people with diabetes who have had a myocardial infarction, as beta-blocking agents are highly effective in reducing recurrent ischemic cardiac events. Past reluctance to use beta-blocker agents in people with diabetes was due to the potential masking of hypoglycemic symptoms and the possibility of worsening glycemic control, for which there are only rare instances documented.

For pregnant women with diabetes and chronic hypertension, blood pressure targets of 110-129/65-79 mmHg are recommended to reduce the risk for poor birth outcomes.


Accurate Blood Pressure Measurement

Accuracy of blood pressure measurement is essential in determining proper diagnosis and titrating anti-hypertensive agents. The American Heart Association guidelines for blood pressure measurement provide clear, detailed, and compelling guidance for healthcare professional to improve blood pressure measurement. A wide range of studies show average blood pressure measurement error of between 5-15 mm/Hg (NHBPEP, NHLBI, AHA).

Measuring blood pressure accurately can save money (NHBPEP, NHLBI, AHA). There are multiple factors that can affect accuracy. The chart below lists some of these factors.

### Factors Affecting Accuracy of Blood Pressure Measurements

<table>
<thead>
<tr>
<th>Factors</th>
<th>Magnitude of systolic/diastolic blood pressure discrepancy (mmHg)</th>
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</thead>
<tbody>
<tr>
<td>Talking or active listening</td>
<td>10/10</td>
</tr>
<tr>
<td>Distended bladder</td>
<td>15/10</td>
</tr>
<tr>
<td>Cuff over clothing</td>
<td>5-50/unknown</td>
</tr>
<tr>
<td>Smoking within 30 minutes of measurement</td>
<td>6-20/unknown</td>
</tr>
<tr>
<td>Back unsupported</td>
<td>6-10/unknown</td>
</tr>
<tr>
<td>Arm unsupported, sitting</td>
<td>1-7/5-11</td>
</tr>
<tr>
<td>Arm unsupported, standing</td>
<td>6-8/unknown</td>
</tr>
</tbody>
</table>

Adopted from: Wisconsin Heart Disease and Stroke Program Blood Pressure Toolkit.

Home blood pressure measurements using reliable recording units can be useful for those who exhibit “white coat hypertension” during clinic visits.

This toolkit provides information and resources regarding a “refresher” of the salient elements needed to address accuracy for blood pressure measurement in health systems.

The “Standardized Measurement: First Line of Defense in Blood Pressure Control” series is another self-instructional educational opportunity available for all health care providers to improve measurement of blood pressure. For more information on this and other educational opportunities, see: [http://sharedcareinc.com/index.html](http://sharedcareinc.com/index.html).

### Antiplatelet Therapy

Platelet inhibition may be beneficial for the prevention of both primary and secondary ischemic cardiovascular events in people with diabetes. Aspirin therapy (75-162 mg/day) is recommended for men > 50 years of age and women > 60 years of age with diabetes and one or more additional major CVD risk factor. For men ≤ 50 years and women ≤ 60 years with diabetes, individualized therapy based on risk is recommended. People with overt CVD history and diabetes should receive aspirin therapy (75-162 mg/day) for secondary prevention. Consider common contraindications, such as an aspirin allergy or gastric bleeding. Previous concerns that aspirin therapy may aggravate retinal hemorrhage are not substantiated.

Aspirin resistance and the increased level of inflammation present in vascular structures may partially attenuate the relative benefit of aspirin therapy in people with diabetes. Consider other platelet inhibitors, such as clopidogrel (75 mg/day) in higher risk people with known CVD or peripheral arterial disease, and for those who have undergone coronary stent placement.

### Baseline Electrocardiogram and Diagnostic Stress Testing

A baseline reference electrocardiogram (ECG) is recommended for all people with new onset type 2 diabetes. For people with type 1 diabetes, it is reasonable to obtain a baseline ECG based on clinical judgment and the number of years the person has had diabetes. The incidence of asymptomatic ischemia or infarction increases significantly in people with longer-standing or poorly-controlled diabetes, especially those with diabetic autonomic neuropathy, which may mask symptoms of angina.

Routine diagnostic stress testing is not necessary for people with lower risk who have well-controlled risk factors. However, consider stress testing for low-risk people prior to starting a physical activity program involving moderate- to high-intensity activities (e.g., tennis, jogging, and aerobics).

All people at higher risk should receive diagnostic stress testing (see the following topic “Suggested Criteria for Cardiac Stress Testing in Diabetes”). Baseline ST-segment and T-wave abnormalities are present in 15-20% of people with diabetes > 40 years. Such baseline ECG abnormalities reduce the reliability of ECG monitoring for detecting stress-induced ischemic changes. Stress testing protocols for these individuals should include radionuclear or echocardiographic imaging to maximize the detection of true ischemic responses.
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Suggested Criteria for Cardiac Stress Testing in Diabetes

Due to increased risk for people with diabetes, a cardiac stress test is recommended; however, the recommendations vary from person to person. Below are six criteria that might suggest the use of a cardiac stress test:

- Prior to scheduled major surgery or moderate-risk surgery if person has functional limitation (e.g., not able to climb two flights of stairs)
- Prior to starting a physical activity program involving moderate- to high-intensity activities
- Typical or atypical cardiac symptoms (chest, back, or arm pain; dyspnea; or fatigue)
- Resting ECG suggestive of ischemia or infarction
- Presence of peripheral or carotid arterial disease
- Two or more of the following CVD risk factors:
  - Tobacco use
  - Persistent hypertension (blood pressure ≥ 130/80 mmHg with treatment)
  - Dyslipidemia (LDL cholesterol > 130 mg/dL or HDL cholesterol < 40 mg/dL [men], < 50 mg/dL [women])
  - Microalbuminuria

It is important to note that people with diabetes who have an apparently normal radionuclear stress test remain at increased risk for subsequent cardiac events. Despite a normal stress perfusion scan, people with diabetes showed an unexpectedly higher rate (~6%) of fatal CVD events over a three-year interval. Therefore, consider a periodic re-evaluation, especially in those people at higher risk.

Heart Failure

Heart failure is a frequent complication in people with diabetes and its prognosis is significantly worse than that of CVD. There are four classes of heart failure; symptoms are described below:

- Class I – No symptoms and no limitation in ordinary physical activity
- Class II – Mild symptoms and slight limitation during usual activity; comfortable at rest
- Class III – Modest symptoms, with considerable limitation in activity due to symptoms (even during minimal daily activities); comfortable at rest only
- Class IV – Severe symptoms and limitations, symptoms even while at rest

Treatment of heart failure using combinations of diuretics, digoxin, ACE inhibitors, ARBs and/or aldosterone antagonists, plus beta-blocking agents is as equally effective in people with diabetes as in those unaffected by diabetes. However, several agents commonly used for glycemic control may aggravate heart failure:

- Metformin is contraindicated in people with symptomatic heart failure (classes III and IV), due to the increased potential for lactic acidosis secondary to impaired cardiac output and reduced renal function
- Thiazolidinediones (TZDs) reduce blood glucose by improving sensitivity to insulin in skeletal and adipose tissue. This class of pharmacological agents has a beneficial effect on dyslipidemia, vascular inflammation, and associated endothelial dysfunction. However, TZD treatment is frequently complicated by fluid retention, lower extremity edema, and potential aggravation of heart failure. See the black box warning on the drug insert for more detailed information. FDA has restricted use of rosiglitazone.
Guidelines recommend careful evaluation of people with diabetes for signs and symptoms of heart failure prior to initiating TZD treatment. For people with asymptomatic left ventricular dysfunction or mild, controlled heart failure, reduce the initial dosage of TZDs (by half) and then gradually titrate to higher levels according to individual response. Avoid concomitant treatment with other fluid retaining drugs (e.g., non-steroidal anti-inflammatories, vasodilators, calcium channel blockers). Treatment with TZDs is not recommended for people with advanced heart failure (class III or IV). For all TZDs, it is imperative that health care professionals become familiar with the medication prescribing inserts and warnings.

**Referral to a Cardiologist and Coordination of Care**

People with diabetes and/or known CVD can benefit from seeing a cardiologist or lipid specialist to achieve optimal primary and secondary prevention outcomes. Offering referrals for cardiac rehabilitation, as well as individual instruction, group education, and support groups, are important as these can provide a unique, cost-effective opportunity for peer support of lifestyle changes.

**Additional Resources**


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References


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