Guidelines for Management of Dyslipidemia and Prevention of Cardiovascular Disease

Writing Committee

Chair:
Paul S. Jellinger, MD, MACE

Co-Chair:
Yehuda Handelsman, MD, FACP, MACE

Members:
David S. H. Bell, MD, FACP, FACE
Zachary T. Bloomgarden, MD, MACE
Eliot A. Brinton, MD, FAHA, FNLA
Michael H. Davidson, MD, FACC, FACP, FNLA
Sergio Fazio, MD, PhD

Vivian A. Fonseca, MD, FACE
Alan J. Garber, MD, PhD, FACE
George Grunberger, MD, FACP, FACE
Chris K. Guerin, MD, FNLA, FACE
Jeffrey I. Mechanick, MD, FACP, FACE, FACN, ECNU
Rachel Pessah-Pollack, MD, FACE
Paul D. Rosenblit, MD, PhD, FNLA, FACE
Donald A. Smith, MD, MPH, FACE
Kathleen Wyne, MD, PhD, FNLA, FACE

Reviewers:
Michael Bush, MD
Farhad Zangeneh, MD

View full guideline at www.aace.com/publications/guidelines
## ASCVD Risk Categories and LDL-C Treatment Goals

<table>
<thead>
<tr>
<th>10-YEAR RISK (%)</th>
<th>Risk Category</th>
<th>Risk factors/10-year risk</th>
<th>Treatment Goals (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>LDL-C</td>
</tr>
</tbody>
</table>
| >30              | Extreme risk | - Progressive ASCVD including unstable angina in individuals after achieving an LDL-C <70 mg/dL  
 |                  |              | - Established clinical cardiovascular disease in individuals with DM, stage 3 or 4 CKD, or HeFH  
 |                  |              | - History of premature ASCVD (<55 male, <65 female) | <55 | <80 | <70 |
| >20              | Very high risk | - Established or recent hospitalization for ACS, coronary, carotid or peripheral vascular disease, 10-year risk >20%  
 |                  |              | - DM or stage 3 or 4 CKD with 1 or more risk factor(s)  
 |                  |              | - HeFH | <70 | <100 | <80 |
| 10 - 20          | High risk    | - ≥2 risk factors and 10-year risk 10%-20%  
 |                  |              | - DM or stage 3 or 4 CKD with no other risk factors | <100 | <130 | <90 |
| <10              | Moderate risk | - ≤2 risk factors and 10-year risk <10% | <100 | <130 | <90 |
| <10              | Low risk     | - 0 risk factors | <130 | <160 | NR |

**Treating LDL to Goal**

**Extreme Risk**
- Lifestyle + high intensity statin
  - 6–8 weeks
- If LDL-C > 55 mg/dL
  - Add ezetimibe or PCSK9i depending on required LDL-C lowering
  - 6–8 weeks
- If LDL-C > 55 mg/dL
  - Add ezetimibe or PCSK9i depending on required LDL-C lowering

**Very High Risk**
- Lifestyle + high intensity statin
  - 6–8 weeks
- If LDL-C > 70 mg/dL
  - Add ezetimibe or PCSK9i depending on required LDL-C lowering
  - 6–8 weeks
- If LDL-C > 70 mg/dL
  - Add ezetimibe or PCSK9i depending on required LDL-C lowering
- If LDL-C > 70 mg/dL
  - Add ezetimibe or PCSK9i depending on required LDL-C lowering

**High-Moderate Risk**
- Lifestyle + moderate intensity statin
  - 6–8 weeks
- If LDL-C > 100 mg/dL
  - Add ezetimibe
  - 6–8 weeks
- If LDL-C > 100 mg/dL
  - Increase to high intensity statin
  - 6–8 weeks
- If LDL-C > 100 mg/dL
  - Add ezetimibe

**Low Risk**
- Lifestyle
  - 3 months
- If LDL-C > 130 mg/dL
  - Add moderate intensity statin
  - 6–8 weeks
- If LDL-C > 130 mg/dL
  - Increase to high intensity statin
  - 6–8 weeks
- If LDL-C > 130 mg/dL
  - Add ezetimibe

---

**WHEN LDL GOAL IS ACHIEVED, IF TG > 200 MG/DL, CONSIDER FIBRATE THERAPY**

**HIGH-INTENSITY STATIN THERAPY**
- Atorvastatin 40–80 mg
- Rosuvastatin 20–40 mg

**MODERATE-INTENSITY STATIN THERAPY**
- Atorvastatin 10–20 mg
- Fluvastatin XL 80 mg
- Pitavastatin 2–4 mg
- Rosuvastatin 5–10 mg
- Fluvastatin 40 mg twice daily
- Lovastatin 40 mg
- Pravastatin 40–80 mg
- Simvastatin 20–40 mg

**EZETIMIBE**
- Ezetimibe 10 mg

**PCSK9 INHIBITORS (PCSK9I)**
- Evolocumab 140 mg q 2wks, 420 mg q 4 wks
- Alirocumab 75mg-150 mg q 2 wks
# Major Atherosclerotic Cardiovascular Disease Risk Factors

<table>
<thead>
<tr>
<th>Major Risk Factors</th>
<th>Additional Risk Factors</th>
<th>Nontraditional Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advancing age</td>
<td>Obesity, abdominal obesity</td>
<td>Lipoprotein (a)</td>
</tr>
<tr>
<td>▲ Total serum cholesterol level</td>
<td>Family history of hyperlipidemia</td>
<td>Clotting factors</td>
</tr>
<tr>
<td>▲ Non-HDL-C</td>
<td>Small, dense LDL-C</td>
<td>Inflammation markers (hsCRP; Lp-PLA₂)</td>
</tr>
<tr>
<td>▲ LDL-C</td>
<td>Apo B</td>
<td>Homocysteine levels</td>
</tr>
<tr>
<td>Low HDL-C</td>
<td>LDL particle concentration</td>
<td>Apo E4 isoform</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Fasting / postprandial hypertriglyceridemia</td>
<td>Uric acid</td>
</tr>
<tr>
<td>Hypertension</td>
<td>PCOS</td>
<td>TG-rich remnants</td>
</tr>
<tr>
<td>Stage 3 or 4 chronic kidney disease</td>
<td>Dyslipidemic triad</td>
<td></td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family history of ASCVD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### How is Risk Assessed?

<table>
<thead>
<tr>
<th>Recommendation (R)</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R4.</strong></td>
<td>The 10-year risk of a coronary event (high, intermediate, or low) should be determined by detailed assessment using one or more of the following tools:</td>
</tr>
</tbody>
</table>
| | • Framingham Risk Assessment Tool  
| | • MESA 10-year ASCVD Risk with Coronary Artery Calcification Calculator  
www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx |
| | • Reynolds Risk Score, which includes hsCRP and family history of premature ASCVD  
www.reynoldsriskscore.org |
| | • UKPDS risk engine to calculate ASCVD risk in individuals with T2DM  
www.dtu.ox.ac.uk/riskengine |
| **R7.** | When the HDL-C concentration is greater than 60 mg/dL, one risk factor should be subtracted from an individual's overall risk profile. |
| **R8.** | A classification of elevated TG should be incorporated into risk assessments to aid in treatment decisions. |

See online publication at [www.aace.com/publications](http://www.aace.com/publications) for evidence grading of Recommendations.
### Who Should be Screened for ASCVD Risk and When?

<table>
<thead>
<tr>
<th>Screening Category</th>
<th>Recommendations Associated With This Question</th>
</tr>
</thead>
</table>
| Familial Hypercholesterolemia          | **R9.** Individuals should be screened for FH when there is a family history of:  
• Premature ASCVD (definite MI or sudden death before age 55 years in father or other male first-degree relative or before age 65 years in mother or other female first-degree relative) or  
• Elevated cholesterol levels (total, non-HDL, and/or LDL) consistent with FH. |
| Adults With Diabetes                   | **R10.** Annually screen all adult individuals with T1DM or T2DM for dyslipidemia.                                                                                               |
| Young Adults (Men 20-45 Years, Women 20-55 Years) | **R11.** Evaluate all adults 20 years of age or older for dyslipidemia every 5 years as part of a global risk assessment.                                                            |
| Middle-Aged Adults (Men 45-65 Years, Women 55-65 Years) | **R12.** In the absence of ASCVD risk factors, screen middle-aged individuals for dyslipidemia at least once every 1 to 2 years. More frequent lipid testing is recommended when multiple global ASCVD risk factors are present.  
**R13.** The frequency of lipid testing should be based on individual clinical circumstances and the clinician’s best judgment. |
| Older Adults (>65 Years)               | **R14.** Annually screen older adults with 0 to 1 ASCVD risk factor for dyslipidemia.                                                                                               
**R15.** Older adults should undergo lipid assessment if they have multiple ASCVD global risk factors (i.e., other than age).  
**R16.** Screening for this group is based on age and risk, but not gender; therefore, older women should be screened in the same way as older men. |
| Children and Adolescents              | **R17.** In children at risk for FH (e.g., family history of premature cardiovascular disease or elevated cholesterol), screening should be at 3 years of age, again between ages 9 and 11, and again at age 18.  
**R18.** Screen adolescents older than 16 years every 5 years or more frequently if they have ASCVD risk factors, have overweight or obesity, have other elements of insulin resistance syndrome, or have a family history of premature ASCVD. |

See online publication at [www.aace.com/publications](http://www.aace.com/publications) for evidence grading of Recommendations.
### Screening Test Recommendations Associated With This Question

<table>
<thead>
<tr>
<th>Screening Test</th>
<th>Recommendations Associated With This Question</th>
</tr>
</thead>
</table>
| **Fasting Lipid Profile** | **R19.** Use a fasting lipid profile to ensure the most precise lipid assessment; this should include total cholesterol, LDL-C, TG, and non-HDL-C.  
**R20.** Lipids, including TG, can be measured in the non-fasting state if fasting determinations are impractical.                                                                 |
| **LDL-C**            | **R21.** LDL-C may be estimated using the Friedewald equation: LDL-C = (total cholesterol – HDL-C) – TG/5; however, this method is valid only for values obtained during the fasting state and becomes increasingly inaccurate when TG levels are greater than 200 mg/dL, and becomes invalid when TG levels are greater than 400 mg/dL.  
**R22.** LDL-C should be directly measured in certain high-risk individuals, such as those with fasting TG levels greater than 250 mg/dL or those with diabetes or known vascular disease. |
| **HDL-C**            | **R23.** Measurement of HDL-C should be included in screening tests for dyslipidemia.                                                                                                                                                             |
| **Non-HDL-C**        | **R24.** Non-HDL-C (total cholesterol minus HDL-C) should be calculated to assist risk stratification in individuals with moderately elevated TG (200 to 500 mg/dL), diabetes, and/or established ASCVD.  
**R25.** If insulin resistance is suspected, non-HDL-C should be evaluated to gain useful information regarding the individual's total atherogenic lipoprotein burden. |
| **Triglycerides**    | **R26.** TG levels should be part of routine lipid screening: moderate elevations (≥150 mg/dL) may identify individuals at risk for insulin resistance syndrome and levels ≥200 mg/dL may identify individuals at substantially increased ASCVD risk. |
| **Apolipoproteins**  | **R27.** Apo B and/or an apo B/apo A1 ratio calculation and evaluation may be useful in at-risk individuals (TG ≥150, HDL-C <40, prior ASCVD event, T2DM, and/or insulin resistance syndrome [even at target LDL-C levels]) to assess residual risk and guide decision-making.  
**R28.** Apo B measurements (reflecting the particle concentration of LDL and all other atherogenic lipoproteins) may be useful to assess the success of LDL-C-lowering therapy. |

---

**Which Screening Tests Should be Used?**


See online publication at [www.aace.com/publications](http://www.aace.com/publications) for evidence grading of Recommendations.
What Treatments are Available for Dyslipidemia?

**Recommendation Associated With This Question**

R47. A comprehensive strategy to control lipid levels and address associated metabolic abnormalities and modifiable risk factors is recommended primarily using lifestyle changes and patient education with pharmacotherapy as needed to achieve evidence-based targets.

**Treatment Categories for Dyslipidemia**

<table>
<thead>
<tr>
<th>Lifestyle Changes</th>
<th>Pharmacologic Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Physical activity</td>
<td>• Statins</td>
</tr>
<tr>
<td>• Medical nutrition therapy</td>
<td>• Cholesterol absorption inhibitors</td>
</tr>
<tr>
<td>• Smoking cessation</td>
<td>• Fibrates</td>
</tr>
<tr>
<td></td>
<td>• PCSK9 inhibitors</td>
</tr>
<tr>
<td></td>
<td>• Omega-3 fish oil</td>
</tr>
<tr>
<td></td>
<td>• MTP inhibitor</td>
</tr>
<tr>
<td></td>
<td>• Niacin</td>
</tr>
<tr>
<td></td>
<td>• Combination therapies</td>
</tr>
<tr>
<td></td>
<td>• Bile acid sequestrants</td>
</tr>
</tbody>
</table>


This AACE Lipid Guideline pocket guide is made possible through a grant from AMGEN.