



CARDIOVASCULAR DISEASE (CVD) RISK MANAGEMENT

Lipid Cascade



Smart Testing for CVD and Current Perspectives on LDL Management

The causal link between high levels of low-density lipoprotein (LDL) particles in the development of cardiovascular disease (CVD) is well established: The longer there is exposure to elevated LDL, the greater the risk for CVD events.

Effective management of LDL requires reliable measurement, and our accurate assays can help

As you know, elevated LDL drives entry of atherogenic particles into the arterial wall, accelerating development of CVD. Therefore, use of LDL-lowering therapies is a core strategy in CVD risk reduction.³ Once therapy is initiated, LDL values may be monitored to assess individual patient response to therapy and guide decisions regarding the need for further treatment adjustments.³

Two ways we measure LDL

Traditional low-density lipoprotein cholesterol (LDL-C)—calculated or direct—is an estimate of LDL quantity based on the amount of cholesterol contained in the LDL particle.² However, the amount of cholesterol per particle varies between individuals—particularly in patients with Type 2 diabetes, statin-treated patients and those with the cardiometabolic risk (CMR) factors below.^{4,5}

- **Age:** men ≥ 45 years, women ≥ 55 years⁶
- **Elevated BP** ($\geq 130/\geq 85$ mmHg; on antihypertensive medication)⁷
- **Abdominal obesity/waist circumference:** men ≥ 40 inches (Asian ≥ 35 inches), women ≥ 35 inches (Asian ≥ 31 inches)⁷
- **Elevated triglycerides** (≥ 150 mg/dL), low HDL (men < 40 mg/dL, women < 50 mg/dL), increased numbers of small dense LDL particles^{4,7}; on drug treatment for elevated triglycerides or high-density lipoprotein cholesterol (HDL-C)
- **Elevated fasting blood glucose** (≥ 100 mg/dL)⁷, on drug treatment for elevated glucose
- **Insulin resistance (IR)**⁴

Because the per-particle amount of cholesterol varies in these at-risk patients, LDL-C may be an unreliable measure of LDL quantity for patient management.^{2,5,8}

Alternatively, the number of LDL particles (LDL-P) can be measured by nuclear magnetic resonance (NMR) or apolipoprotein B (Apo B) immunoassay. Neither measurement quantifies LDL-P in a manner that depends on the amount of cholesterol contained inside the LDL particle.

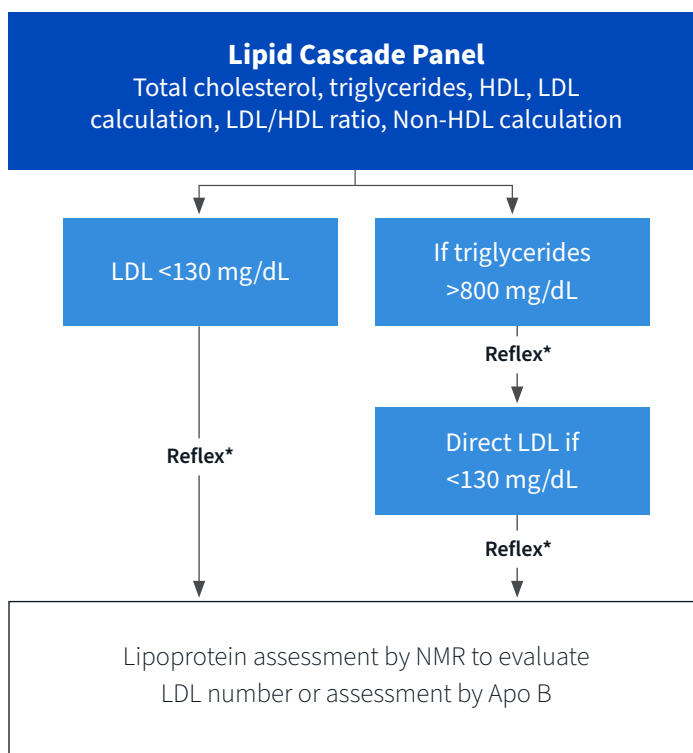


LDL particle number in clinical management

Studies have demonstrated when LDL measures are in agreement (concordant), LDL cholesterol values and particle number are equally associated with CVD risk.^{5,9} However, when LDL cholesterol values and particle measures disagree (discordant), CVD risk tracks with particle measure: LDL-P or Apo B.^{5,9,10} As a result, many experts advise that LDL-P or Apo B be used to adjudicate response to therapy and optimize treatment decisions in patients with Type 2 diabetes, statin-treated patients and those with CMR factors.^{4,5,8,11,12,13}

Two Lipid Cascade Test Options

Test Name	Test No.
Lipid Cascade with Reflex to Lipoprotein Particle Assessment by NMR	123836
Lipid Cascade with Reflex to Apolipoprotein B	363676



*Additional charge

Requiring a single blood draw, Labcorp's Lipid Cascade options offer convenient, step-wise testing by reflexing from a traditional lipid panel to lipoprotein particle testing by NMR or Apo B (depending upon the ordered test option) when the LDL value is <130 mg/dL.

Visit the online Test Menu at [Labcorp.com](https://www.labcorp.com) for full test information, including CPT codes and specimen collection requirements.

Both Lipid Cascade options are available as part of Labcorp's CVD Report

Order number **910385** in addition to a lipid panel, either Lipid Cascade option, or NMR LipoProfile, to receive the CVD Report on an individual patient basis. Alternatively, generate the CVD Report for all your patients when ordering a lipid panel, either

Lipid Cascade option or NMR LipoProfile, by completing the CVD Report Physician Request and Acknowledgement form. See your Labcorp representative for more information and to obtain the form. There is no additional charge for the report.

PATIENT Patient Name	DATE OF BIRTH XX/XX/19XX	GENDER M	DATE OF SERVICE XX/XX/2015	PHYSICIAN Physician Name
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DISCLAIMER: These assessments and treatment suggestions are provided as a convenience in support of the physician-patient relationship and are not intended to replace the physician's clinical judgment. They are derived from the national guidelines in addition to other evidence and expert opinion. The clinician should consider this information within the context of clinical judgment and the individual patient.

SEE GUIDANCE FOR CARDIOVASCULAR RISK REPORT: National Heart, Lung, and Blood Institute's Third Report of the NCEP Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (ATPIII) (2002; NIH publication 02-5215); Brunzell et al. Diabetes Care 2008; 31(6):812-822; Condit et al. Clin Chem 2009; 55(3):407-415; Stone NJ et al. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 2014;129(suppl 2):S1-S45.

Note: Please refer to your Labcorp Report for all results as well as any test-specific and specimen-specific comments.

Cardiovascular Report

Patient Assessment

Current available clinical information suggests the patient's risk is at least HIGH. Your patient has an eGFR result (<60) that could indicate the presence of a CKD risk equivalent (chronic kidney disease). Two additional major risk factors are present (age over 45 and HDL-C was less than 40). Insulin resistance, obesity, excessive alcohol use, smoking, nephrotic syndrome, liver disease, and certain medications can cause secondary dyslipidemia. Consider evaluation if clinically indicated.

Therapeutic lifestyle changes are always valuable to achieve optimal blood lipid status (diet, exercise, weight management).

Lipid Management

Select one patient risk category based upon medical history and clinical judgment. Additional risk factors such as personal or family history of premature CHD, smoking, and hypertension modify a patient's goals of therapy. In CVD prevention, the intensity of therapy should be adjusted to the level of patient risk. MODERATE intensity statin therapy generally results in an average LDL-C reduction of 30% to less than 50% from the untreated baseline. Examples include (only doses) atorvastatin 15-20 mg, rosuvastatin 5-10 mg, simvastatin 20-40 mg, pravastatin 40-80 mg, lovastatin 40 mg. HIGH intensity statin therapy generally results in an average LDL-C reduction of 50% or more from the untreated baseline. Examples include (only doses): atorvastatin 40-80 mg and rosuvastatin 20 mg.

ANALYTE / RESULT	LOW	INTERMEDIATE	HIGH
LDL-C 84 mg/dL			
non-HDL 113 mg/dL			
LDL-P 1434 nmol/L			

Lipid Assessment

LDL-C is optimal, was 88 and now is 84 mg/dL. Non-HDL Cholesterol is optimal, was 115 and now is 113 mg/dL. LDL-P is acceptable, was 1286 and now is 1434 nmol/L.	LDL-C is optimal, was 88 and now is 84 mg/dL. Non-HDL Cholesterol is optimal, was 115 and now is 113 mg/dL. LDL-P is borderline high, was 1286 and now is 1434 nmol/L.	LDL-C is normal, was 88 and now is 84 mg/dL. Non-HDL Cholesterol is normal, was 115 and now is 113 mg/dL. LDL-P is high, was 1286 and now is 1434 nmol/L.
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Treatment Suggestions

Please refer to assessment and treatment suggestions under high risk category.	Please refer to assessment and treatment suggestions under high risk category.	Cardiovascular risk may be further increased due to elevated LDL-P. Begin statin. If statin already in use, consider increasing dose to achieve at least a 50% LDL reduction from baseline. Moderate or high intensity statin is preferred. If statin cannot be tolerated or increased, alternatives include use of an intestinal agent (ezetimibe or bile acid sequestrant) or niacin.
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PATIENT PATIENT NAME	DATE OF BIRTH XX/XX/19XX	GENDER F	DATE OF SERVICE 09/30/2015	PHYSICIAN PHYSICIAN NAME
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Patient Results Summary

Cholesterol comes in different forms and has varying effects on your heart health. Some cholesterol is "good" and not known to cause disease: this is HDL. The rest of cholesterol causes disease by clogging your arteries; this is non-HDL. LDL cholesterol is the largest component of the non-HDL cholesterol. Lowering your levels of "bad" cholesterol will lower your risk for disease.

- **LDL cholesterol (LDL-C)** is the largest component of the non-HDL cholesterol ("bad" cholesterol).
- **non-HDL** is composed of many different types of cholesterol (not just LDL-C) and high levels cause disease.
- **ApoB** is another measure thought to give a better estimate of heart disease risk other than just measuring LDL cholesterol.

The level to which your LDL must be lowered depends on the risk for developing heart disease or having a heart attack. The higher your risk for heart disease, the lower your LDL goal.

Contributing Risk Factors For Heart Disease

<input type="checkbox"/> Heart and/or vascular disease	<input type="checkbox"/> Cigarette (tobacco) smoking
<input type="checkbox"/> High blood pressure	<input type="checkbox"/> Low HDL (men less than 40)
<input type="checkbox"/> Diabetes	<input type="checkbox"/> Family history of early onset
<input type="checkbox"/> Chronic kidney disease	<input type="checkbox"/> Man over 45 years or woman
<input type="checkbox"/> Obesity	<input type="checkbox"/> Familial Hypercholesterolemia

Your Heart Disease Risk C

Test / Your Results

Test / Your Results	Low	Intermediate
LDL-C 81 mg/dL		
non-HDL 91 mg/dL		
Apo-B 62 mg/dL		

▼ Your Result: Left (Green) = Optimal, Center = Acceptable, Right (Red) = High Risk

Your Care Plan (as selected by your physician)

<input type="checkbox"/> Change your diet: limit saturated / trans fats and cholesterol, increase fiber	<input type="checkbox"/> Control any other medical condition
<input type="checkbox"/> Exercise	<input type="checkbox"/> Visit your doctor as schedule recommended
<input type="checkbox"/> Lose weight	<input type="checkbox"/> Take all of your medications
<input type="checkbox"/>	<input type="checkbox"/>

DISCLAIMER: You should discuss this information with your physician. Labcorp does not have a doctor-patient relationship. Medical history or a physical examination that would be necessary for a complete diagnosis and comprehensive treatment plan is required. REFERENCES: National Heart, Lung, and Blood Institute's Third Report of the NCEP Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (ATPIII) (2002; NIH publication 02-5215); National Heart, Lung, and Blood Institute's Your Guide to Cholesterol in Adults (ATPIII) (2002; NIH publication 02-5215); National Heart, Lung, and Blood Institute's Your Guide to Cholesterol in Adults (ATPIII) (2002; NIH publication 02-5215); Stone NJ et al. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 2014;129(suppl 2):S1-S45.

PATIENT CVD TEST 1	DATE OF BIRTH 01/30/1966	GENDER M	DATE OF SERVICE 12/20/2011	PHYSICIAN Liblink, Testing
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Testing: Liblink MD
2250 West Campbell Park Dr
Chicago, IL 60612

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Laboratory Director's Notes

Laboratory test values flagged with an asterisk (*) within this report refer to the following commentary from our physicians and quality assurance staff. Please feel free to call us at 800-338-4333 with questions you may have regarding this information.

13245678 12/20/2011 **Hemoglobin A1c** Increased risk for diabetes: 5.7 - 6.4 Diabetes: >6.4 Glycemic control for adults with diabetes: <7.0

13245678 12/20/2011 **estimated eGFR** Self-reported race was not provided; eGFR was calculated as if the patient was not African American. Multiply eGFR by 1.55 if African American.

13245678 12/20/2011 **Sedum** **Please note reference interval change**

Mitchell S. Liska, PhD - Laboratory Director

Current Laboratory Results

Blood Draw Date: 12/20/2011	Date Received: 12/21/2011	Date Completed: 12/21/2011	Fasting: YES
Comp. Metabolic Panel (14)			
ALT	12.1	0-40	U
Albumin	4.6	3.8-5.2	U
BUN	6.24	6-20	U
Creatinine	0.76	0.6-1.2	U
Sodium	134.84	136-144	U
Potassium	3.5-5.2	3.5-5.2	U
Chloride	97.188	98-108	U
Carbon Dioxide	20.93	23-29	U
Calcium	8.12	8.5-10.2	U
Lipid Cascade			
Glucose	67.99	60-90	U
BUN	6.24	6-20	U
Cholesterol	150	150-200	U
HDL-C	49	40-140	U
LDL-C	99	70-130	U
LDL-P	103	100-130	U
non-HDL cholesterol	101	70-130	U
LDL-HDL Ratio (ratio)	2.0	0.3-0.4	U

C-Reason: Primary, Cholesterol

References

1. Cromwell WC and Barringer JD. Low-density lipoprotein and apolipoprotein B: clinical use in patients with coronary heart disease. *Current Cardiol Rep*. 2009; 11(6):468-475.
2. Toth PP, Grabner M, Punekar RS, et al. Cardiovascular risk in patients achieving low-density lipoprotein cholesterol and particle targets. *Atherosclerosis*. 2014;235(2):585-591.
3. Stone NJ, Robinson JG, Lichtenstein AH, et al. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circ*. 2014;129:S1-S45.
4. Brunzell JD, Davidson M, Furberg CD, et al. Lipoprotein management in patients with cardiometabolic risk. Consensus statement from the American Diabetes Association and the American College of Cardiology Foundation. *Diabetes Care*. 2008 April; 31(4):811-82.
5. Sniderman AD, Williams K, Contois JH, et al. A meta-analysis of low-density lipoprotein cholesterol, non-high-density lipoprotein cholesterol, and apolipoprotein B as markers of cardiovascular risk. *Circ Cardiovasc Qual Outcomes*. 2011;4:337-345.
6. National Heart, Lung, and Blood Institute. Executive Summary. The Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), National Institutes of Health. May 2001. *NIH publication* 01-3670; 1-28.
7. Grundy SM, Cleeman JI, Daniels SR, et al. Diagnosis and management of the metabolic syndrome: An American Heart Association/National Heart, Lung, and Blood Institute scientific statement: Executive Summary. *Circulation*. 2005; 112 e285-e290.
8. Garber AJ, Abrahamson MJ, Barzilay JI, et al. American Association of Clinical Endocrinologists' comprehensive diabetes management algorithm 2013. Consensus statement from the American Association of Clinical Endocrinologists. *Endocr Pract*. 2013;19(Suppl 2):1-48.
9. Mora S, Buring JE, and Ridker PM. Discordance of low-density lipoprotein (LDL) cholesterol with alternative LDL-related measures and future coronary events. *Circulation* 2014;129:553-561.
10. Cromwell WC, Otvos JD, Keyes MJ, et al. LDL particle number and risk of future cardiovascular disease in the framingham offspring study - implications for ldl management. *J Clin Lipidol*. 2007;1:583-592.
11. Contois JH, McConnell JP, Sethi A, et al. Apolipoprotein b and cardiovascular disease risk: Position statement from the aacc lipoproteins and vascular diseases division working group on best practices. *Clin Chem*. 2009;55:407-419.
12. Davidson MH, Ballantyne CM, Jacobson TA, et al. Clinical utility of inflammatory markers and advanced lipoprotein testing: Advice from an expert panel of lipid specialists. *J Clin Lipidol*. 2011;5:338-367.
13. Jellinger PS, Smith DA, Mehta AE, et al. American association of clinical endocrinologists' guidelines for management of dyslipidemia and prevention of atherosclerosis. *Endocr Pract*. 2012;18(Suppl 1):1-78.



Visit the online test menu at [Labcorp.com](https://www.labcorp.com) for additional test options and full test information, including CPT codes and specimen collection instructions.

