Prevalence of lipid abnormalities in the United States: The National Health and Nutrition Examination Survey 2003–2006

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BACKGROUND: The association between increased low-density lipoprotein cholesterol (LDL-C) and increased risk for cardiovascular events is well established, with treatment focusing on LDL-C lowering. Other lipid abnormalities are also associated with increased cardiovascular risk (eg, low high-density lipoprotein cholesterol [HDL-C], high triglycerides [TG], and high non-HDL-C). Despite national lipid guidelines, the prevalence of these abnormal lipid parameters alone or in combination (mixed dyslipidemia) is not well recognized.

OBJECTIVE: We assessed the prevalence of high LDL-C, low HDL-C, high TG, high non-HDL-C, and mixed dyslipidemia by using National Health and Nutrition Examination Survey (NHANES) data to estimate the proportions of U.S. adults not at guideline-recommended lipid goals.

METHODS: NHANES 2003–2006 fasting blood serum data were used to categorize adults aged ≥20 years by LDL-C (risk stratum–specific), HDL-C (men, <40 mg/dL; women, <50 mg/dL), non-HDL-C (in subjects with TG ≥200 mg/dL), and TG (≥150 mg/dL) target levels with use of the NCEP ATP III definitions based on coronary heart disease (CHD) risk.

RESULTS: An estimated 53% (105.3M) of U.S. adults have lipid abnormalities: 27% (53.5M) have high LDL-C, 23% (46.4M) have low HDL-C, and 30% (58.9M) have high TG. Among patients with serum TG levels ≥200 mg/dL, approximately 13% (25.7M) of adults have non-HDL-C levels ≥130 mg/dL. Also, 21% (42.0M) of U.S. adults have mixed dyslipidemia (high LDL-C with either low HDL-C and/or high TG), with nearly 6% (11.6M) having all three lipid abnormalities. For LDL-C, an estimated 23M adults with CHD or a CHD risk equivalent and 17M with ≥2 risk factors but a Framingham risk ≤20% are not at goals of <100 and <130 mg/dL, respectively.

CONCLUSION: Prevalence of dyslipidemia in the United States continues to be high, with the majority of U.S. adults now affected by some form of lipid abnormality. Efforts to promote screening, risk stratification, and initiating appropriate treatment should be intensified.
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Coronary heart disease (CHD) and peripheral forms of atherosclerotic disease remain highly prevalent in the United States.[1] The association between elevated low-density lipoprotein cholesterol (LDL-C) and increased risk for cardiovascular events (eg, myocardial infarction,

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ischemic stroke, and death) is well established.[2] On the basis of the findings of a number of randomized prospective clinical trials,[3–6] lowering LDL-C levels is the primary target of both primary and secondary CHD prevention.[7] However, other lipid parameters are also predictive of cardiovascular risk, including high non–high-density lipoprotein cholesterol (non–HDL-C; a surrogate of apolipoprotein B and measure of total atherogenic lipoprotein burden in serum),[2] low high-density lipoprotein cholesterol (HDL-C),[8,9] and elevated triglyceride (TG) levels.[10]

In this investigation, we had two primary goals: (1) to determine the proportion of the U.S. population with abnormalities in the standard lipid profile (LDL-C, HDL-C, TG), alone and in combination, by using National Health and Nutrition Examination Survey (NHANES) data; and (2) to describe the patient characteristics and the prevalence of selected cardiovascular risk factors among the U.S. population with high LDL-C or high non-HDL-C and those with abnormal measurements for all three standard lipid parameters (LDL-C, HDL-C, and TG).

Methods

Data source and study population

NHANES, an annual complex sample survey conducted by the National Center for Health Statistics, is designed to assess the health and nutritional status of adults and children in the U.S. civilian noninstitutionalized population. NHANES interviews and examines a nationally representative sample of approximately 5000 persons annually, with oversampling of those subjects aged 60+ years, African–American subjects, and Hispanic subjects. The subset of adult (aged ≥20 years) participants who provided fasting blood and urine samples are included in these analyses (see: http://www.cdc.gov/nchs/nhanes/about_nhanes.htm). Data from the 2003 through 2006 NHANES surveys were combined to increase sample size and improve point estimate and 95% confidence interval precision.

Variable definitions

LDL-C, HDL-C, and TG target levels were defined by NCEP ATP III guidelines and metabolic syndrome definitions (HDL) and vary by Framingham risk scores and presence of CHD, CHD risk equivalents, and major CHD risk factors.[2] NCEP ATP III variable definitions and components were matched as well as possible to the data available in NHANES. CHD and CHD risk equivalents were ascertained through self-report of a past diagnosis of CHD, angina, myocardial infarction, stroke, or diabetes mellitus. Patients with fasting blood glucose ≥126 mg/dL or who self-reported taking an antidiabetic medication also were categorized as diabetic. Current cigarette smoking, history of congestive heart failure, and family history of premature CHD (a parent or sibling diagnosed with a myocardial infarction or angina before age 50) were assessed through interview. Hypertension was defined as blood pressure (measured on examination) >140/90 mm Hg. Body mass index (BMI) and waist circumference were determined at examination. Metabolic syndrome was defined per NCEP ATP III guidelines.

Table 1 Dyslipidemia definitions based on NCEP ATP III guidelines

Cholesterol parameter	Measurement	NCEP ATP III categorization
LDL-C*		
CHD or CHD risk equivalent or 10-year Framingham risk >20%	≤100 mg/dL	At goal
CHD or CHD risk equivalent or 10-year Framingham risk >20%	≥100 mg/dL	Above goal
2+ risk factors or 10-year Framingham risk ≤20%	≥130 mg/dL	Above goal
0–1 risk factor	≥160 mg/dL	Above goal
HDL-C†	<40 mg/dL (men); <50 mg/dL (women)	Low
	>40 mg/dL (men); >50 mg/dL (women)	Normal
TG‡	<150 mg/dL	Normal
	150–199 mg/dL	Borderline high
	200–400 mg/dL	High
Non–HDL-C§	<130 mg/dL	Desirable
	130–159 mg/dL	Borderline high
	160–189 mg/dL	High
	≥190 mg/dL	Very high

CHD, coronary heart disease; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; NCEP ATP III, National Cholesterol Education Program Adult Treatment Panel III; non–HDL-C, non–high-density lipoprotein cholesterol; TG, triglycerides.

*NCEP ATP III guidelines based on risk categories.

†NCEP ATP III clinical definition of metabolic syndrome.

‡LDL-C was calculated from total cholesterol, HDL-C, and TG using the Friedewald calculation, which is valid when TG is ≤400 mg/dL. Therefore, this analysis includes patients with TG ≤400 mg/dL.

§Non-HDL-C was calculated by subtracting HDL-C values from total cholesterol for patients with TG ≥200 mg/dL.