Residual Dyslipidemia Among United States Adults Treated With Lipid Modifying Therapy (Data from National Health and Nutrition Examination Survey 2009-2010)

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Despite available medications for dyslipidemia, many treated patients still have suboptimal lipid levels. The aim of this study was to examine the extent of residual dyslipidemia in United States adults. Of 2509 United States adults aged ≥18 years from the National Health and Nutrition Examination Survey (NHANES) 2009-2010, 1,129 (41.8% weighted) had hyperlipidemia on the basis of modified treatment guidelines for low-density lipoprotein (LDL) cholesterol according to risk category or pharmacologic treatment. Of these, 484 (42.4%) were treated with lipid-modifying therapy, and the proportions of subjects who still had LDL cholesterol, high-density lipoprotein (HDL) cholesterol, triglycerides, or non-HDL cholesterol not at recommended levels were examined. In this cohort treated for hyperlipidemia, the mean age was 60.1 ± 14.9 years, and 52% were men. Only 36.5% of subjects receiving treatment for hyperlipidemia were at goal or normal levels for all 3 lipids (LDL cholesterol, HDL cholesterol, and triglycerides). LDL cholesterol remained higher than goal for 37.5% of subjects, 28.9% had low HDL cholesterol, and 36.3% had elevated triglycerides. One, 2, and 3 lipid parameters were at abnormal levels in 32.4%, 23.0%, and 8.2% of subjects, respectively; 36.5% had no lipid disorder. In addition, 38.6% of treated subjects were above non-HDL cholesterol goal, and even in those at LDL cholesterol goal, 12.9% were not at non-HDL cholesterol goal. Those with cardiovascular disease conditions had poorer goal attainment of LDL cholesterol, HDL cholesterol, and composite all lipids than those without cardiovascular disease. In conclusion, despite widely available treatments for dyslipidemia, many patients remain at suboptimal lipid levels, indicating need for greater adherence to lifestyle and medical therapies to address these gaps in the management of dyslipidemia.   © 2013 Elsevier Inc. All rights reserved. (Am J Cardiol 2013;112:373−379)

Despite widespread publicity of the National Cholesterol Education Program guidelines, recently published United States data indicate that despite significant improvements in low-density lipoprotein (LDL) cholesterol levels in the population, many subjects still have suboptimal levels of LDL cholesterol, and hypertriglyceridemia has actually increased in recent years.[1] We and others have reported that only 1/3 of those with cardiovascular disease (CVD) or diabetes have optimal LDL cholesterol levels, and very few are at recommended levels for all lipids (LDL cholesterol, high-density lipoprotein [HDL] cholesterol, and triglycerides).[2−4] National treatment recommendations focus on management of LDL cholesterol as the primary target of therapy, so statin medications have played a central role in the management of dyslipidemia.[5,6] Although statin use has contributed to observed improvements in population LDL cholesterol levels,

residual risk remains, often due to low HDL cholesterol and/or elevated triglycerides. No recent population-based data are available on the extent of recommended lipid level achievement and residual dyslipidemia in those treated for hyperlipidemia. In a large United States population−representative sample of adults surveyed in 2009 and 2010, we examined the distribution of lipid levels (LDL cholesterol, HDL cholesterol, triglycerides, and non-HDL) in patients with hyperlipidemia, specifically those treated with lipid-modifying therapy.

Methods

We used the National Health and Nutrition Examination Survey (NHANES) 2009-2010 to assess United States adults aged ≥18 years who had complete lipid and other risk factor information. Conducted by the Centers for Disease Control and Prevention, NHANES is a cross-sectional survey with demographic information, medical history, and medical examination data among a population-based sample of noninstitutionalized adults.[7]

We defined subjects with hyperlipidemia as those with elevated LDL cholesterol or evidence of treatment from subjects' medication bottles brought into the examination visit (any prescription for statins, bile acid sequestrants, fibric acid derivatives, cholesterol absorption inhibitors, niacin, or omega-3 polyunsaturated fatty acids as previously

Table 1
Lipid characteristics in United States adults with hyperlipidemia[§]

Variable	n (N[‖])	LDL Cholesterol (mg/dl)		HDL Cholesterol (mg/dl)		Triglycerides (mg/dl)		Non-HDL Cholesterol (mg/dl)		All Lipids[¶]
		Mean ± SD	At Goal	Mean ± SD	Normal	Mean ± SD	Normal	Mean ± SD	At Goal	At Goal
Overall	1,129 (37.7)	131.2 ± 40.1	26.5%	51.7 ± 14.8	66.4%	139.6 ± 64.9	63.6%	159.2 ± 43.7	32.6%	15.5%
Men	589 (19.6)	127.7 ± 40.0[†]	27.2%	48.1 ± 13.1*	73.2%[†]	131.9 ± 64.7*	69.9%[†]	154.1 ± 43.5*	35.5%	17.6%
Women	540 (18.2)	135.1 ± 40.0	25.7%	55.6 ± 15.4	58.9%	147.9 ± 64.8	56.8%	164.7 ± 43.5	29.6 %	13.1%
Age 18−65 yrs	641 (24.7)	139.3 ± 38.4*	22.8%*	49.8 ± 13.9*	62.2%	143.7 ± 67.2[†]	61.3	168.0 ± 41.2*	29.5%[‡]	12.1%[†]
Age >65 yrs	488 (13.0)	115.9 ± 37.1	33.6%	55.4 ± 15.4	74.2%	131.9 ± 60.8	68.0%	142.3 ± 40.9	38.7%	31.8%
White	609 (28.3)	129.7 ± 40.0	29.5%[†]	52.2 ± 15.5[‡]	66.4%	140.3 ± 64.9*	63.9%*	157.7 ± 44.3	34.0%[‡]	17.0%[‡]
Hispanic	290 (4.0)	137.4 ± 40.4	19.9%	49.5 ± 13.7	67.2%	160.9 ± 66.9	50.1%	169.6 ± 43.7	26.9%	10.6%
Black	179 (3.6)	137.2 ± 38.1	13.2%	52.9 ± 14.3	65.9%	116.7 ± 54.6	75.6%	160.6 ± 40.8	25.9%	10.1%**
Global risk										
Low (<10%)	310 (12.4)	141.1 ± 40.6*	30.8%	53.8 ± 14.5*	68.5%	130.4 ± 59.6[†]	67.7%[†]	167.2 ± 44.6*	41.2%[†]	20.9%[‡]
Intermediate (10%−20%)	281 (10.3)	138.6 ± 39.9	26.9%	52.6 ± 15.0	69.3%	147.2 ± 65.4	60.9%	168.0 ± 43.0	28.7%	15.2%
High (>20%)	313 (8.0)	126.2 ± 34.4	21.7%	48.7 ± 14.2	64.5%	149.6 ± 67.8	58.7%	156.1 ± 37.6	24.0%	11.2%**
CVD	225 (8.0)	103.5 ± 34.4	22.7%	49.3 ± 15.3	59.1%	133.9 ± 66.7	65.6%	130.2 ± 39.8	31.9%	9.7%
Disease group										
No disease	236 (9.6)	149.2 ± 37.5	24.0%	55.3 ± 15.3	82.4%	120.3 ± 48.2	79.0%	173.3 ± 40.4	35.9%	20.4%
CVD	225 (6.0)	103.5 ± 34.4*	22.7%	49.3 ± 15.3[†]	59.1%[†]	133.9 ± 68.0[‡]	65.6%[†]	130.2 ± 39.8*	31.9%	9.7%[†]
CHD	161 (4.4)	99.9 ± 32.8*	16.7%	49.4 ± 16.1[†]	58.0%[‡]	134.0 ± 69.0[†]	65.7[‡]	126.7 ± 38.6*	30.0	5.8[†]***
Heart failure	62 (1.6)	103.1 ± 29.4***	28.5%**	51.6 ± 19.5	59.0%[†]	138.1 ± 69.4[‡]	60.4[‡]	130.7 ± 35.4***	28.8%**	13.7%**
Stroke	71 (18.7)	115.9 ± 39.6***	21.9%**	48.8 ± 14.7[†]	44.2%[†]	127.4 ± 67.7	72.1	141.4 ± 43.7*	29.2	9.4[‡]
Diabetes	291 (7.9)	106.8 ± 34.2*	38.6%[†]	48.9 ± 12.4*	61.4%*	144.6 ± 72.9*	58.5*	135.8 ± 39.4*	38.5	17.8
Metabolic syndrome	499 (16.3)	128.2 ± 38.3*	25.6%	45.8 ± 12.8*	39.6%*	172.3 ± 71.5*	37.9*	162.7 ± 42.9*	24.3[‡]	5.8**
Chronic kidney disease	171 (5.1)	116.7 ± 36.8*	27.7%	53.6 ± 14.8	64.7%[‡]	136.1 ± 60.4[†]	69.2	144.0 ± 40.2*	31.0	14.7**
Treatment group										
Treatment	484 (16.0)	100.3 ± 31.7*	62.5%*	52.2 ± 14.4	71.1%	136.2 ± 67.8	63.7	127.6 ± 36.3*	61.4*	36.5*
No treatment	645 (21.7)	154.0 ± 31.2	—	51.4 ± 15.0	62.9%	142.1 ± 62.7	63.6	182.4 ± 34.9	11.5	0

LDL cholesterol goal: <70 mg/dl if CHD; <100 mg/dl if ≥2 risk factors and Framingham risk score >20% or other previous CVD, diabetes, or chronic kidney disease; <130 mg/dl if ≥2 risk factors or Framingham risk score 10% to 20%; <160 mg/dl if <2 risk factors and Framingham risk score <10%. Risk factors include age, low HDL cholesterol, hypertension, smoking, and family history. Non-HDL cholesterol goal was 30 mg/dl higher than LDL cholesterol goal across groups. HDL cholesterol normal levels: ≥40 mg/dl in men and ≥50 mg/dl in women. Triglyceride normal level: <150 mg/dl.

* $p < 0.001$, [†] $p < 0.01$, and [‡] $p < 0.05$, comparison across strata for gender, age, ethnicity, global risk, and treatment groups (disease groups compared with no disease).

[§] Means and proportions represent sample-weighted values.

[‖] Weighted sample size in millions.

[¶] LDL cholesterol, HDL cholesterol, and triglycerides.

** Represents sample size <30, suggesting that the estimate may be unreliable.