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Population Effect of Differences in Cholesterol Guidelines in Eastern Europe and the United States

Jerry C. Lee, MS, MPhil; Tomasz Zdrojewski, MD, PhD; Michael J. Pencina, PhD; Adam Wyszomirski, Eng; Mateusz Lachacz, Eng; Grzegorz Opolski, MD, PhD; Piotr Bandosz, MD, PhD; Marcin Rutkowski, MD, PhD; Zbigniew Gaciong, MD, PhD; Bogdan Wyrzykowski, MD, PhD; Ann M. Navar, MD, PhD

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IMPORTANCE The American College of Cardiology/American Heart Association (ACC/AHA) guidelines for the management of blood cholesterol and the current European Society of Cardiology/European Atherosclerosis Society (ESC/EAS) guidelines differ in how they identify adults in need of statin therapy; furthermore, it is unclear how this difference translates into numbers and characteristics of patients recommended for treatment.

OBJECTIVE To determine the effect of the ACC/AHA and ESC/EAS cholesterol guidelines when applied to a population-based sample.

DESIGN, SETTING, AND PARTICIPANTS We used nationally representative data for 3055 adults aged 40 to 65 years from the 2007-2012 National Health and Nutrition Examination Surveys (NHANES) for the United States and for 1060 adults aged 40 to 65 years from the 2011 Nadciśnienie Tętnicze w Polsce survey for Poland. Data analysis was conducted from May 1, 2014, to December 31, 2015.

MAIN OUTCOMES AND MEASURES The number and characteristics of adults recommended for statin therapy according to the ACC/AHA and ESC/EAS guidelines were evaluated, and characteristics were compared between adults with discordant recommendations.

RESULTS The 3136 US adults in NHANES (2007-2012) aged 40 to 65 years represented 100.1 million adults; after excluding the 81 patients with missing data, these population estimates translate to 97.9 million adults. Similarly, the 1060 Polish adults in NATPOL (2011) aged 40 to 65 years represent 13.5 million adults. Using weighted data, in the United States, 43.8% (95% CI, 40.9%-46.7%) of adults would be recommended for statin therapy according to ACC/AHA guidelines and 39.1% (95% CI, 36.4%-41.8%) according to ESC/EAS guidelines. In Poland, 49.9% (95% CI, 46.9%-52.9%) of adults would be recommended for statin therapy under ACC/AHA guidelines compared with 47.6% (95% CI, 44.6%-50.7%) under ESC/EAS guidelines. Among individuals without cardiovascular disease and not currently taking statins, 11.0% of US and 10.5% of Polish adults had discordant guideline recommendations. Compared with individuals recommended for statin therapy by the ESC/EAS guidelines but not the ACC/AHA guidelines, those recommended for statin therapy under the ACC/AHA guidelines only had less chronic kidney disease; however, these individuals were also more likely to smoke, have lower high-density lipoprotein cholesterol levels, and have higher predicted 10-year risk of cardiovascular disease.

CONCLUSIONS AND RELEVANCE Despite differences in the ACC/AHA and EAS/ESC guidelines, the numbers of adults aged 40 to 65 years recommended for cholesterol-lowering therapy under each guideline were similar when applied to nationwide representative samples from both the United States and Poland. Discordant recommendations were driven by differences in the risk equations used in the 2 guidelines and different recommendations for adults with chronic kidney disease.

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Author Affiliations: Duke University Medical Center, Durham, North Carolina (Lee, Navar); Department of Neurology, Medical University of Gdańsk, Gdańsk, Poland (Zdrojewski, Bandosz, Rutkowski, Wyrzykowski); Duke Clinical Research Institute, Durham, North Carolina (Pencina, Navar); Deputy Editor for Statistics, *JAMA Cardiology* (Pencina); Gdańsk University of Technology, Gdańsk, Poland (Wyszomirski, Lachacz); Department of Cardiology, Medical University of Warsaw, Warsaw, Poland (Opolski); Department of Internal Medicine, Hypertension and Vascular Disease, Medical University of Warsaw, Warsaw, Poland (Gaciong).

Corresponding Author: Ann M. Navar, MD, PhD, Duke Clinical Research Institute, 2400 Pratt St, Ste 7521, Durham, NC 27705 (ann.navar@dm.duke.edu).

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Taken at face value, current US and European cholesterol guidelines seem to have substantial differences.[1-3] Although guidelines in both regions recommend statin therapy for adults with atherosclerotic cardiovascular disease (CVD), type 1 or type 2 diabetes, and possible familial hyperlipidemia, the 2011 European Society of Cardiology/European Atherosclerosis Society (ESC/EAS) guidelines for the management of dyslipidemias also recommend therapy for adults with severe hypertension and chronic kidney disease (CKD).[1] In the United States, guidelines endorsed by the American College of Cardiology/American Heart Association (ACC/AHA) do not identify these groups as automatic candidates for statin therapy.[2] Notably, the ACC/AHA and ESC/EAS guidelines differ in their approaches to identify high-risk adults in need of statin therapy for primary prevention, as well as those ultimately recommended statins for other reasons. The ACC/AHA guidelines use the Pooled Cohort Equations (PCE), which recommend statin therapy for adults aged 40 to 75 years with a 10-year risk of atherosclerotic CVD risk of 7.5% or more.[2] The ESC/EAS guidelines use estimates developed from the Systematic Coronary Risk Evaluation (SCORE) project,[4] which predicts the 10-year risk of CVD mortality for adults aged 40 to 65 years. Statins are recommended based on both low-density lipoprotein cholesterol (LDL-C) levels and a SCORE risk of 5% or more.[1]

The ACC/AHA guidelines were shown to potentially lead to higher rates of statin recommendations than the ESC/EAS guidelines in 2 low-risk Western European cohorts owing to higher numbers of adults meeting the CVD risk thresholds for primary prevention.[5,6] Nevertheless, the population-wide implications of the ACC/AHA and ESC/EAS guidelines remain unclear given other differences between the 2 guidelines. Furthermore, how the guidelines differ when applied to a country with higher overall risk of CVD is uncertain. Prior studies comparing cholesterol guidelines were conducted in the Netherlands and Switzerland; both of these countries are classified by the ESC/EAS guidelines as low risk for CVD, and both use a different set of sex-specific intercepts and regression coefficients to formulate their SCORE equations. Based on the 2 different guideline formulations, we hypothesized that (1) more adults would be recommended for statin therapy under the ACC/AHA guidelines when compared with the ESC/EAS guidelines, (2) those recommended for treatment by the ESC/EAS guidelines would have higher rates of CKD, (3) those recommended for treatment by ESC/EAS guidelines would have higher levels of LDL-C, (4) those recommended for statin therapy by the ACC/AHA guidelines would include more men, and (5) those recommended for statin therapy by the ACC/AHA guidelines would have higher 10-year risk estimates.

Key Points

Question When applied to population-based samples from 2 high-risk countries, how do statin recommendations in the American College of Cardiology/American Heart Association guidelines differ from those in the European Society of Cardiology/European Atherosclerosis Society guidelines?

Findings In analyses of 2 nationally representative surveys, 43.8% of US adults would be recommended for statin therapy under ACC/AHA guidelines and 39.1% under ESC/EAS guidelines, and 49.9% of adults in Poland would be recommended for statin therapy under ACC/AHA guidelines, compared with 47.6% under ESC/EAS guidelines.

Meaning Despite apparent differences in the 2 guidelines, both result in similar numbers and types of patients recommended for statin therapy.

Methods

Data Sources

We performed our comparison in the United States and Poland. We obtained US data using information from the nationally representative National Health and Nutrition Examination Survey (NHANES). We obtained Polish data using information from the Nadciśnienie Tętnicze w Polsce (NATPOL) survey, a cross-sectional assessment of CVD risk in Poland, one of the largest countries in Eastern Europe, and considered by the ESC/EAS as a high-risk region for CVD. Based on data from NHANES and NATPOL, we evaluated the number and characteristics of adults in the United States and Poland recommended for statin therapy under current ACC/AHA and ESC/EAS cholesterol guidelines.

For US data, we used the NHANES subsample of fasting adults (2007-2012) in order to use data on LDL-C levels. Of the available 3136 participants aged 40 to 65 years, 81 were excluded for missing data that were required to determine statin recommendations for both guidelines, leaving 3055 adults. To account for the complex multistage probability sampling design of NHANES, we used appropriate sample weights for the subsample of fasting adults, which accounts for oversampling and nonresponse within NHANES.[7]

For the Polish sample, we used data from 1060 adults aged 40 to 65 years who participated in the 2011 cross-sectional NATPOL survey. The survey has previously been described in detail.[8] Briefly, NATPOL was designed to assess the prevalence and control of CVD risk factors across Poland. A total of 2413 participants aged 18 to 79 years were randomly recruited using a multistage clustered design stratified by age, sex, and location; the participation rate was 67%. Participants were interviewed at home by 234 trained study nurses who collected fasting blood samples and measured blood pressure according to a standardized protocol. Comorbidities were derived from self-report and from nurse review of hospital discharge reports. The unweighted sample in those aged 40 to 65 years provides a reasonable representation of the Polish population.

Data from NHANES are publicly available, and the participants provided written informed consent; NHANES has been approved by the National Center for Health Statistics Ethical Review Board. The NATPOL study and this analysis were approved by the Bioethics Commission of the Medical University of Gdańsk. Before enrolling in NATPOL, each participant provided written informed consent.

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Analytic Approach

Obesity was defined as having a body mass index of 30 or more (calculated as weight in kilograms divided by height in meters squared). Chronic kidney disease was defined as an estimated glomerular filtration rate less than 60 mL/min assessed using the Modification of Diet in Renal Disease equation.[9] The age cutoff of 40 to 65 years was selected to correspond with SCORE estimates, which are provided in the ESC/EAS guidelines for adults aged 40 to 65 years. Low-density lipoprotein cholesterol levels in NATPOL and NHANES are estimated using the equation by Friedewald et al[10]; therefore, LDL-C levels were unavailable for adults with triglyceride levels higher than 400 mg/dL (to convert to millimoles per liter, multiply by 0.0113). Patients who reported taking any lipid-lowering medications were considered to be appropriately treated by both guidelines. Adults eligible for statin therapy by each guideline were identified using the following hierarchical criteria. For the 2011 ESC/EAS guidelines, adults recommended for immediate drug intervention included those (1) with LDL-C levels of 70 mg/dL or more (to convert to millimoles per liter, multiply by 0.0259) and at very high risk, defined as either prevalent CVD (myocardial infarction, stroke, peripheral vascular disease, percutaneous coronary intervention, or coronary artery bypass surgery), diabetes, or CKD (estimated glomerular filtration rate <60 mL/min assessed by the Modification of Diet in Renal Disease equation) or a 10-year SCORE risk of 10% or more; and (2) with LDL-C levels of 100 mg/dL or more and at high risk, defined as severe hypertension (systolic blood pressure ≥180 mm Hg or diastolic blood pressure ≥110 mm Hg), familial dyslipidemia (LDL-C levels >200 mg/dL), or 10-year SCORE risk between 5% and 10%. For the 2013 ACC/AHA guidelines, adults recommended for immediate drug intervention included those with (1) prevalent CVD, defined as myocardial infarction, stroke, peripheral vascular disease, percutaneous coronary intervention, or coronary artery bypass surgery; (2) LDL-C levels of 190 mg/dL or more; (3) diabetes and LDL-C levels of 70 mg/dL or more; and (4) CVD risk of 7.5% or more and LDL-C levels of 70 mg/dL or more based on the PCE.[4] These recommendations emphasize the importance of individualized assessments of patient factors, in conjunction with risk assessment tools, and presume discussions of risk between the patient and clinician before the initiation of therapy.

For estimation of risk, we used participant self-reported blood pressure treatment and the use of lipid-lowering therapy from NHANES and NATPOL. For SCORE estimations, Poland is considered a high-risk country by the ESC/EAS guidelines. Specifics of the factors used by SCORE and the PCE are detailed in the eAppendix in the Supplement. We elected to analyze the United States as a high-risk country for 2 main reasons: (1) CVD risk factor and CVD prevalence rates are higher in the United States than in most European countries[11]; and (2) atherosclerotic CVD mortality in the United States exceeds the threshold of more than 220 per 100 000 males and more than 160 per 100 000 females used to define *high risk* in the ESC/EAS guidelines.[1,12] In sensitivity analysis, we estimated the number of adults in the United States recommended for statin therapy by the ESC/EAS guidelines if the United States was considered a low-risk country.

Statistical Analysis

Data analysis was conducted from May 1, 2014, to December 31, 2015. We first estimated proportions and total numbers of individuals eligible for statin therapy in the United States and Poland based on the 2 sets of guidelines. We summarized the risk factor profiles for individuals in each group. We also estimated the average 10-year risk of CVD using the PCE and the average 10-year risk of CVD death using the SCORE calculator. Next, individuals without CVD were evaluated to determine the difference between the 2 sets of guidelines in primary prevention. We also contrasted the risk factor profiles of individuals without CVD with discordant recommendations between the 2 sets of guidelines (ie, recommended for statin therapy by the ESC/EAS guidelines but not the ACC/AHA guidelines and vice versa). For the NATPOL sample, differences in the risk factor profiles for adults with discordant recommendations under the guidelines were compared using χ^2 tests with Yates continuity correction for proportions and the independent 2-sample *t* test for means. For NHANES data, means and proportions were compared using the adjusted Wald F statistic to account for the weighted nature of the data.

Results

We used the data from NHANES and NATPOL to represent the population at large. The 3136 US adults in NHANES (2007-2012) aged 40 to 65 years represented 100.1 million adults; after excluding the 81 patients with missing data, these population estimates translate to 97.9 million adults. Similarly, the 1060 Polish adults in NATPOL (2011) aged 40 to 65 years represent 13.5 million adults. **Table 1** shows the characteristics of adults surveyed and the proportion of these individuals recommended for statin therapy under the ACC/AHA and ESC/EAS guidelines in the United States and Poland. Overall, individuals in the US sample had higher rates of CVD, diabetes, CKD, statin therapy, and obesity, with lower rates of smoking and lower lipid values compared with those in the Polish sample.

The number of adults recommended statin therapy was similar for the ESC/EAS and ACC/AHA guidelines. In the United States, ACC/AHA guidelines recommended statin therapy for 43.8% (95% CI, 40.9%-46.7%) of adults compared with 39.1% (95% CI, 36.4%-41.8%) under the ESC/EAS guidelines. In Poland, 49.9% (95% CI, 46.9%-52.9%) of adults would be recommended for statin therapy under the ACC/AHA guidelines compared with 47.6% (95% CI, 44.6%-50.7%) under the ESC/EAS guidelines.

Population Estimates of Statin Recommendations

Figure 1A and B demonstrates population estimates for the number of adults recommended for statin therapy under each guideline. Under the ACC/AHA guidelines, all adults with CVD are recommended for statin therapy, whereas under the ESC/EAS guidelines, adults with prevalent CVD are recommended for statin therapy only if they also have LDL-C levels of 70 mg/dL or more. As a result, the ESC/EAS guidelines would not recommend statin therapy for 482 531 US adults (0.5% over-

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Table 1. Characteristics of Individuals Aged 40 to 65 Years in the United States and Poland Recommended for Statin Therapy Under ACC/AHA and ESC/EAS Guidelines

	NHANES Sample: US Adults (n = 3055)[a]			NATPOL Sample: Polish Adults (n = 1060)[a]		
Characteristic	All Adults	ACC/AHA Guidelines	ESC/EAS Guidelines	All Adults	ACC/AHA Guidelines	ESC/EAS Guidelines
Statins advised, %		43.8 (40.9-46.7)	39.1 (36.4-41.8)		49.9 (46.9-52.9)	47.6 (44.6-50.7)
Male sex, %	48.6 (46.7-50.6)	59.5 (55.3-63.6)	55.9 (51.8-60.0)	50.7 (47.7-53.8)	61.8 (57.7-66.0)	60.0 (55.7-64.3)
Age, mean, y	52 (51-52)	55 (55-56)	55 (54-56)	53 (41-64)	58 (45-65)	58 (46-65)
Prior MI, %	3.3 (2.6-4.3)	7.6 (6.0-9.6)	7.8 (6.1-10.0)	1.6 (0.9-2.4)	3.2 (1.7-4.7)	3.2 (1.6-4.7)
Prior stroke, %	2.4 (1.7-3.4)	5.5 (3.9-7.7)	5.9 (4.2-8.2)	1.9 (1.1-2.7)	3.8 (2.2-5.4)	4.0 (2.3-5.7)
Type 1 or 2 diabetes, %	14.7 (12.7-17.0)	32.7 (28.6-37.1)	35.8 (31.3-40.6)	6.6 (5.1-8.1)	13.4 (10.5-16.3)	14.0 (10.9-17.1)
CKD, %[b]	5.0 (4.2-6.0)	6.6 (5.1-8.6)	12.0 (9.5-15.0)	1.8 (1.0-2.6)	12.5 (1.2-3.8)	3.8 (2.1-5.5)
Obesity, %[c]	38.1 (35.3-40.9)	48.3 (43.7-53.0)	50.0 (44.8-55.1)	28.4 (25.7-31.1)	33.8 (29.8-37.9)	32.5 (28.4-36.6)
Smoking, %	21.1 (18.6-23.8)	26.9 (23.9-30.2)	24.4 (21.2-28.0)	32.5 (29.6-35.3)	41.9 (37.7-46.1)	39.5 (35.2-43.8)
Hypertension, %	41.4 (39.0-43.8)	60.5 (56.7-64.2)	59.8 (56.1-63.5)	42.9 (39.9-45.8)	59.9 (55.7-64.1)	59.2 (54.9-63.5)
SBP, mean, mm Hg	121 (120-122)	126 (125-127)	125.5 (124.1-126.9)	129 (106-167)	135 (111-174)	136 (110-174)
LDL-C, mean, mg/dL	122 (120-124)	123 (119-126)	121 (118-125)	134 (81-193)	137 (75-204)	137 (76-204)
LDL-C ≥190 mg/dL	3.7 (2.8-5.0)	8.5 (6.5-11.1)	7.4 (5.3-10.2)	6.2 (4.8-7.7)	12.5 (9.7-15.3)	13.1 (10.1-16.0)
Total cholesterol, mean, mg/dL	202 (200-205)	202.2 (198.3-206.1)	201 (197-206)	210 (147-281)	214 (140-291)	214 (143-291)
HDL-C, mean, mg/dL	55 (54-55)	51 (49-52)	52 (50-53)	49 (32-77)	45 (31-71)	47 (32-78)
Taking lipid-lowering medication	21.0 (18.8-23.4)	47.9 (43.9-51.9)	53.6 (49.6-57.7)	15.9 (13.7-18.1)	31.8 (27.8-35.7)	33.3 (29.2-37.4)

Abbreviations: ACC/AHA, American College of Cardiology/American Heart Association; CKD, chronic kidney disease; ESC/EAS, European Society of Cardiology/European Atherosclerosis Society; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; MI, myocardial infarction; NATPOL, Nadciśnienie Tętnicze w Polsce; NHANES, National Health and Nutrition Examination Survey; SBP, systolic blood pressure.

SI conversion factors: To convert total, low-density lipoprotein, and high-density lipoprotein cholesterol to millimoles per liter, multiply by 0.0259.

[a] Continuous variables presented as weighted mean (95% CI); dichotomous variables presented as weighted % (95% CI).

[b] Defined as estimated glomerular filtration rate <60 mL/min by the Modification of Diet in Renal Disease.

[c] Defined as body mass index ≥30 (calculated as weight in kilograms divided by height in meters squared).

all) and 37 752 Polish adults (0.3% overall). Although more adults meet recommendations under the ACC/AHA guidelines based on 10-year atherosclerotic CVD risk than meet recommendations in the ESC/EAS guidelines based on SCORE risk, this number is offset by the additional adults recommended for statin therapy based on CKD or severe hypertension under the ESC/EAS guidelines.

Discordance Analysis Between Guidelines for Primary Prevention

Overall, the ACC/AHA and ESC/EAS guidelines had concordant recommendations for 91.2% (95% CI, 89.7%-92.6%) of US adults and 91.3% (95% CI, 89.5%-92.9%) of Polish adults, with discordant recommendations for 8.8% (95% CI, 7.4%-10.3%) and 8.7% (95% CI, 7.1%-10.5%) of US and Polish adults, respectively (**Figure 2**). Adults without CVD and not already taking lipid-lowering medications were analyzed to evaluate the proportion of adults with discordant statin therapy recommendations for primary prevention; characteristics of these adults are shown in **Table 2**. Among all adults aged 40 to 65 years, 11.0% of US adults and 10.5% of Polish adults eligible for initiation of statins for primary prevention had discordant recommendations between the ACC/AHA and ESC/EAS guidelines. More adults were recommended for therapy under the ACC/AHA guidelines but not the ESC/EAS guidelines (8.3% in the United States and 6.5% in Poland) than were recommended for statin therapy by the ESC/EAS guidelines alone (2.7% in the United States [$P < .001$] and 4.0% in Poland [$P = .03$]).

In both the United States and Poland, individuals recommended for statin therapy under only the ACC/AHA guidelines had higher rates of smoking (37.7% vs 15.1% in the United States and 54.6% vs 29.4% in Poland), lower levels of high-density lipoprotein cholesterol (49.2 vs 62.8 mg/dL in the United States, and 38.3 vs 63.9 mg/dL in Poland), and higher estimates of 10-year risk using the PCE (Table 2). Individuals recommended for statin therapy by only the ESC/EAS guidelines had higher rates of CKD.

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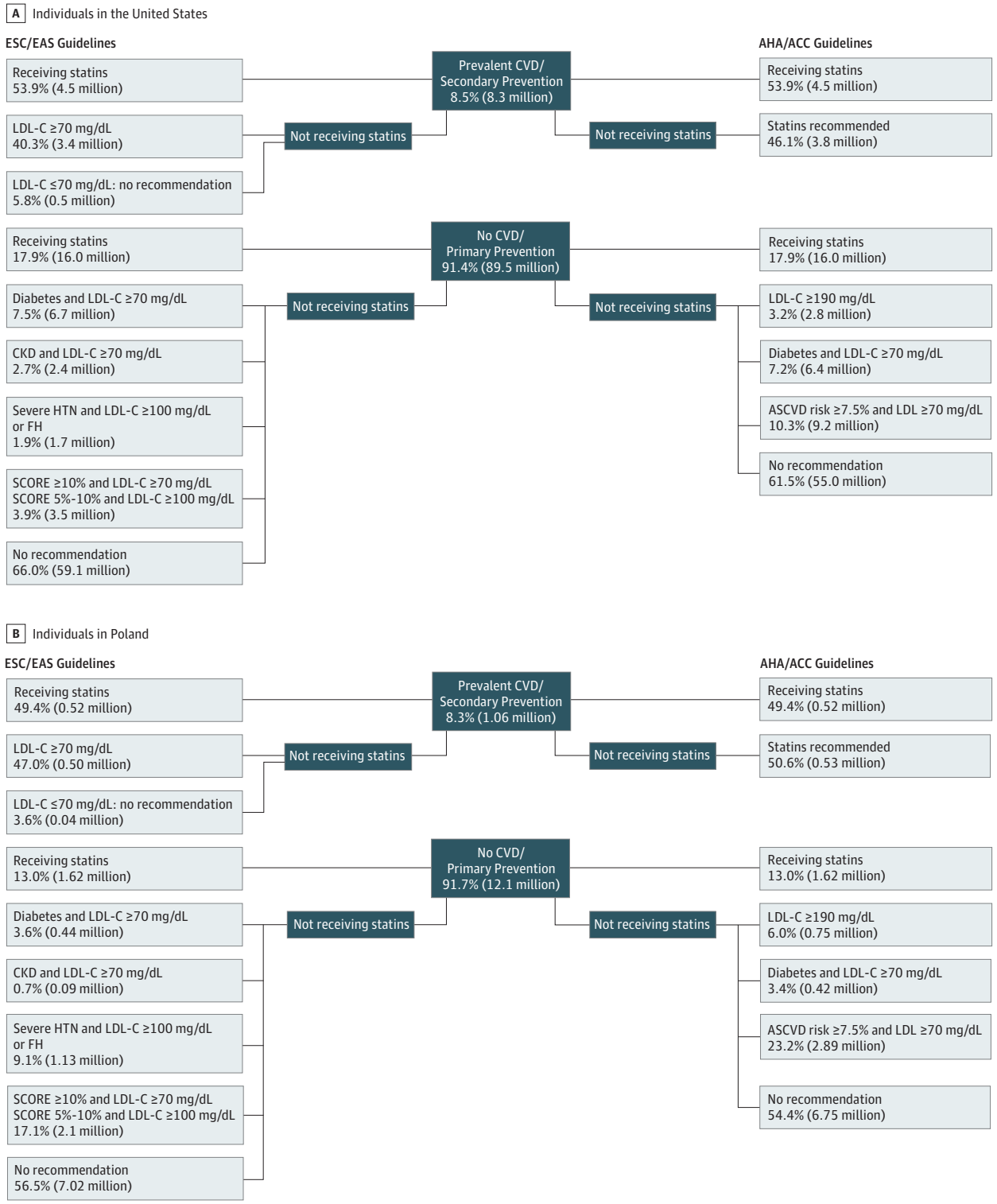
Figure 1. Application of European Society of Cardiology/European Atherosclerosis Society (ESC/EAS) and American College of Cardiology/American Heart Association (ACC/AHA) Cholesterol Guidelines in US and Polish Individuals Aged 40 to 65 Years in the NATPOL Sample



A, Proportion and population totals for statin recommendations for adults aged 40 to 65 years in the United States. B, Proportion and population totals for statin recommendations for adults aged 40 to 65 years in Poland. ASCVD indicates atherosclerotic cardiovascular disease; CKD, chronic kidney disease; CVD, cardiovascular disease; FH, familial hypercholesterolemia; HTN, hypertension; LDL-C, low-density lipoprotein cholesterol; NATPOL, Nadciśnienie Tętnicze w Polsce (Arterial Hypertension in Poland); and SCORE, Systematic Coronary Risk Evaluation.

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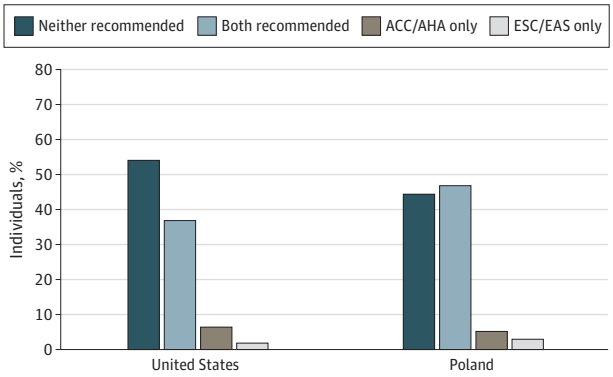
Discussion

The 2013 ACC/AHA guidelines for management of blood cholesterol in the United States departed from a prior paradigm focused on lipid levels toward a paradigm focused primarily on CVD risk. By contrast, the 2011 ESC/EAS guidelines for the management of hyperlipidemia rely on a combination of lipid levels and CVD risk to identify adults in need of statin therapy. Despite these differences, we found that when the 2013 ACC/AHA US guidelines and the 2011 ESC/EAS European guidelines are applied to adults in both the United States and Poland, there is an insignificant difference in the number of individuals recommended for statin therapy. Under either the ACC/AHA or ESC/EAS guidelines, approximately 40% of US adults and 50% of Polish adults aged 40 to 65 years are recommended for statin therapy. Moreover, with the exception of CKD, the risk factor profiles of those recommended for statin therapy for primary prevention under each guideline were also similar.

Figure 2. Proportion of Adults in the United States and Poland With Concordant and Discordant Recommendations for Statin Therapy Under the American College of Cardiology/American Heart Association (ACC/AHA) and European Society of Cardiology/European Atherosclerosis Society (ESC/EAS) Guidelines



Despite generally similar numbers of adults recommended for statin therapy, few adults (approximately 10% in each country) had discordant recommendations between the guidelines. An examination of the characteristics of adults with discordant recommendations highlights key differences between the guidelines. First, individuals recommended for statin therapy by the ESC/EAS guidelines alone had higher rates of CKD, reflecting the specific recommendation by the ESC/EAS guidelines for patients with CKD, which is not present in the ACC/AHA guidelines. Next, because the ACC/AHA guidelines focus more on predicted risk to identify treatment candidates, average 10-year CVD risk profiles were higher in individuals recommended for statin therapy by the ACC/AHA guidelines alone than in those recommended for statin therapy by the ESC/EAS guidelines alone. The emphasis on the PCE by the ACC/AHA guidelines also enriched the population recommended for statin therapy by the ACC/AHA guidelines alone, with risk factors that are heavily weighted by the PCE, including lower levels of high-density lipoprotein cholesterol (which

Table 2. Discordance Analysis of Individuals Recommended for Statin Therapy for Primary Prevention[a]

Characteristic	Discordant Recommendations, US[b]			Discordant Recommendations, Poland[b]		
	ACC/AHA Guidelines Only	ESC/EAS Guidelines Only	*P* Value[c]	ACC/AHA Guidelines Only	ESC/EAS Guidelines Only	*P* Value[c]
Population, %	8.3 (6.8-10.0)	2.7 (2.0-3.7)	<.001	6.5 (4.8-8.1)	4.0 (2.7-5.3)	.03
Male sex, %	75.1 (68.3-80.8)	42.3 (23.9-63.2)	.003	78.2 (67.3-89.1)	61.8 (45.4-78.1)	.15
Age, mean, y	55 (55-56)	53 (49-57)	.19	53 (51-55)	54 (51-56)	.64
Type 1 or 2 diabetes, %	0	0		0	0	
CKD, %[d]	0	7.8 (2.0-26.0)	<.001	0	17.7 (4.8-30.5)	.005
Obesity, %[e]	35.3 (25.8-46.1)	45.9 (30.2-62.4)	.27	49.1 (35.9-62.3)	35.3 (19.2-51.4)	.29
Smoking, %	37.7 (29.5-46.6)	15.1 (5.2-36.6)	.03	54.6 (41.4-67.7)	29.4 (14.1-44.7)	.04
Hypertension, %	56.7 (47.0-65.9)	35.4 (19.8-54.9)	.03	61.8 (49.0-74.7)	50.0 (33.2-66.8)	.38
SBP, mean, mm Hg	128.7 (126.3-131.1)	123.9 (118.9-128.8)	.06	136.7 (131.8-141.5)	140.4 (132.9-147.8)	.41
LDL-C, mean, mg/dL	137.8 (132.6-143.0)	126.6 (117.9-135.4)	.03	129.2 (118.5-140.0)	134.9 (127.1-142.8)	.39
Total cholesterol, mean, mg/dL	216.4 (210.9-221.9)	213.6 (205.5-221.7)	.61	213.1 (199.7-226.6)	221.5 (211.0-231.9)	.33
HDL-C, mean, mg/dL	49.2 (46.9-51.5)	62.8 (56.0-69.7)	<.001	38.3 (35.8-40.8)	63.9 (57.5-70.3)	<.001
ACC/AHA 10-y risk, %	9.0 (8.5-9.4)	3.7 (3.0-4.3)	<.001	10.1 (9.5-10.7)	5.2 (4.6-5.9)	<.001
ESC/EAS SCORE risk, %	3.4 (3.2-3.7)	1.8 (1.3-2.3)	<.001	5.0 (4.4-5.6)	4.7 (3.9-5.4)	.49

Abbreviations: ACC/AHA, American College of Cardiology/American Heart Association; CKD, chronic kidney disease; ESC/EAS, European Society of Cardiology/European Atherosclerosis Society; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; SBP, systolic blood pressure; SCORE, Systematic Coronary Risk Evaluation.

SI conversion factors: To convert total, low-density lipoprotein, and high-density lipoprotein cholesterol to millimoles per liter, multiply by 0.0259.

[a] Primary prevention indicated for individuals without cardiovascular disease and not taking lipid-lowering medication.

[b] Continuous variables presented as weighted mean (95% CI); dichotomous variables presented as weighted % (95% CI).

[c] *P* values indicate differences among individuals with discordant recommendations.

[d] Defined as estimated glomerular filtration rate <60 mL/min by Modification of Diet in Renal Disease.

[e] Defined as body mass index ≥30 (calculated as weight in kilograms divided by height in meters squared).

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is not included in the SCORE risk equations used by the ESC/EAS guidelines), higher rates of smoking, higher blood pressure, and more males. Furthermore, the atherosclerotic CVD risk calculator inclusion of antihypertensive medication use markedly raises an individual's risk. Consequently, the subcohort identified by the ACC/AHA guidelines alone has significantly higher rates of hypertension but comparable mean systolic blood pressure.

Smaller studies that compared previous versions of the US and European guidelines found significant differences in CVD risk assessments.[13,14] A Swiss study using the PCE and European SCORE risk estimates found that more adults qualified for statin therapy based on the US PCE 10-year predicted risk than under the European guidelines.[6] This finding is not surprising given that the ACC/AHA and ESC/EAS guidelines use different risk thresholds for recommendations for statin therapy. The ACC/AHA guidelines recommend statin therapy for adults with a 10-year risk of atherosclerotic CVD of 7.5% or more. On the other hand, the ESC/EAS guidelines recommend immediate therapy for all adults with a 10% or more SCORE predicted risk of death from CVD and an LDL-C level of 70 mg/dL or more or a SCORE risk of 5% or more to less than 10% and an LDL-C level of 100 mg/dL or more. Since the SCORE predicted risk of CVD death is considered to be approximately one-third of the predicted rate of fatal and nonfatal cardiovascular events,[1] the US guidelines appear to have a lower threshold for initiation of statin therapy. When SCORE estimates were applied to a cohort of adults in the Netherlands, more individuals met CVD risk thresholds for statin recommendations for primary prevention under the ACC/AHA guidelines than under the ESC/EAS guidelines.[5] These studies' findings contrast with ours, with several possible reasons for this discrepancy.

First, our study population differed from the Rotterdam cohort study population. Rotterdam study participants were older (mean age, 65.5 years) than adults included in our analysis, which is significant since the recommendations for statin therapy in the ACC/AHA guideline increase substantially for older adults.[15] We excluded adults older than 65 years since the ESC/EAS guidelines are less definitive regarding recommendations for statin therapy for this age group. Second, SCORE risk estimations for the Rotterdam study participants were derived using the calculations for low-risk countries, whereas Poland is considered a high-risk region by the ESC/EAS guidelines. Estimates of CVD mortality in the United States exceed the threshold set by the ESC/EAS guidelines for determining a high-risk region, so we chose to apply the high-risk SCORE equations to the US sample.[12] As a sensitivity analysis, we estimated that using the low-risk SCORE equations would have decreased the proportion of US adults recommended for statin therapy from 43.8% to 36.1%, which roughly translates to a difference of 8 million adults. This estimate demonstrates the potential for significant differences in recommendations using the high- or low-risk SCORE equations. Efforts to calibrate SCORE equations for the purposes of creating country-specific risk estimates will help to improve the potential variability of application of the ESC/EAS guidelines in Europe.

Another possible reason for the disparity in our findings is that our analysis incorporated the entire guideline, not just the population meeting recommendations by risk. The increased number of adults meeting criteria recommending statin therapy based on CVD risk under the ACC/AHA guidelines is offset by other recommendations in the ESC/EAS guidelines, including guidance for additional populations comprising adults with CKD, severe hypertension, and familial hyperlipidemia. Analyses focused solely on SCORE risk and risk based on the PCE do not take into consideration these additional criteria.

Our study had several limitations. First, we restricted this analysis to adults aged 40 to 65 years owing to the ESC/EAS guidelines being less definitive in their recommendations for older and younger adults. Second, other studies have shown that the ACC/AHA guidelines result in markedly elevated rates of recommendations of statin therapy among older adults.[15] Third, given that our study was based on survey data, some limitations ensue, including reliance on participant report of comorbidities, which may lead to underestimates of overall comorbidity rates and, therefore, underestimates of the number of adults recommended for statins under both guidelines. Finally, the US sample was markedly more heterogeneous than the Polish sample, and it is unknown whether race is an important mediator in the risk analysis of the 2 countries.

Conclusions

Despite differences in the 2013 ACC/AHA US guidelines and the 2011 ESC/EAS European guidelines for blood cholesterol treatment, the overall number of adults in the United States and Poland aged 40 to 65 years recommended for statin therapy was similar under both guidelines in a population-based sample. Under either guideline, nearly half of all adults aged 40 to 65 years were recommended for statin therapy. Among those without CVD, the 2 guidelines led to discordant recommendations for approximately 10% of adults, driven largely by differences in the risk equations used in each guideline and differing recommendations for statins for adults with CKD.

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Study concept and design: Lee, Zdrojewski, Pencina, Rutkowski, Gaciong, Wyrzykowski, Navar.
Acquisition, analysis, or interpretation of data: Lee, Zdrojewski, Pencina, Wyszomirski, Lachacz, Opolski, Bandosz, Rutkowski, Gaciong, Navar.
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