

## Novel Self-Report Tool for Cardiovascular Risk Assessment

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**Background**—The currently used atherosclerotic cardiovascular disease risk calculator relies on several measured variables and does not incorporate some well-established risk factors such as family history of premature myocardial infarction and other nontraditional risk factors. Our study aimed to develop and validate a simple risk score to predict 10-year risk of incident cardiovascular events using patient-reported information.

**Methods and Results**—Using data from the Atherosclerosis Risk in Communities cohort, we identified adults with no previous history of cardiovascular disease and randomly divided the cohort into “development” (70%) and “validation” (30%) subgroups. Adjusted Cox regression modeling was used to develop a prediction model. The predictive performance of the new risk score was compared with the score derived from the atherosclerotic cardiovascular disease risk calculator. A total of 9285 individuals met the inclusion criteria. During follow-up (median 8.93 years), a total of 694 (7.47%) incident cardiovascular events occurred. The following 6 factors were included: male sex, age, current smoking, diabetes mellitus, hypertension, and family history of premature myocardial infarction. The C-statistic was 0.72 in the validation cohort with good calibration. The area under the curve for the simple risk score was comparable to the atherosclerotic cardiovascular disease risk score.

**Conclusions**—The novel simple risk score is an easy-to-use tool to predict cardiovascular events in adults from self-reported information without need for laboratory or physical examination data. This risk score included 6-items and had comparable predictive performance to the guideline recommended atherosclerotic cardiovascular disease risk score but relies solely on self-reported information. (*J Am Heart Assoc.* 2019;8:e014123. DOI: 10.1161/JAHA.119.014123.)

**Key Words:** cardiovascular disease • prediction statistics • risk assessment

Atherosclerotic cardiovascular disease (CVD) remains the most frequent cause of death in the United States.<sup>1</sup> The atherosclerotic cardiovascular disease (ASCVD) prediction score is widely recommended to guide estimates of CVD risk in asymptomatic subjects and to implement preventive measures such as initiating or augmenting statin therapy.<sup>2</sup> However, the ASCVD risk calculator relies on several laboratory-based measured variables such as lipids and blood pressure, so often the risk assessment cannot be completed at a single office visit.<sup>3</sup> In addition, the ASCVD

risk calculator does not incorporate other well-known traditional risk factors such as family history of premature myocardial infarction (MI), obesity, and physical activity status.<sup>4</sup> Moreover, there is growing evidence suggesting that nontraditional risk factors are associated with future cardiovascular events. These include migraine (particularly with aura), chronic kidney disease, rheumatoid arthritis, and systemic lupus erythematosus.<sup>5,6</sup> The exclusion of these factors from the ASCVD risk calculator might partially explain why the ASCVD risk calculator does not perform well in certain populations.<sup>7</sup> Furthermore, the application of a scoring system based on personal, self-reported information has the advantage of easing data collection<sup>8</sup> and also facilitating patient participation in their own health care (eg, “participatory medicine”). Accordingly, we aimed to develop and validate a simple risk score to predict 10-year risk of incident cardiovascular events based on self-reported patient information, and to evaluate the predictive performance of this novel risk score compared with the ASCVD risk calculator.

### Methods

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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An accompanying Table S1 is available at <https://www.ahajournals.org/doi/suppl/10.1161/JAHA.119.014123>

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## Clinical Perspective

### What Is New?

- A simple risk score based on self-reported patient information could be used to predict 10-year cardiovascular events.
- The risk score included 6 items: male sex, age, current smoking, diabetes mellitus, hypertension, and family history of premature myocardial infarction and had predictive performance comparable to the guideline-recommended ASCVD risk score.

### What are the Clinical Implications?

- This simple risk score could be easily used in clinical practice to assess the cardiovascular risk in 1 office visit without the need for any laboratory data.

## Data Source

Data from the ARIC (Atherosclerosis Risk in Communities) study was utilized for this study. Briefly, ARIC is a prospective epidemiologic study of 15 792 participants aged 45 to 64 years conducted in 4 US communities (Forsyth County, North Carolina; Jackson, Mississippi; suburban Minneapolis, Minnesota; and Washington County, Maryland). Details of the study design have been previously published.<sup>9</sup> All participants in the ARIC were enrolled for the baseline (first) visit between 1987 and 1989. For this analysis, we used as the baseline, ARIC visit 3 (years 1993–1995). We chose this as a baseline because it contained key candidate variables needed for the development of the risk score. The participants were examined every 3 years. In addition to visits every 3 years, participants also had annual follow-up contact via telephone, and in 2012 the follow-up contact was on a semi-annual basis. The institutional review board of the University of Florida approved the proposed study, and waived the need for informed consent since the patient information is de-identified.

## Study Population

The population of interest included individuals aged 45 to 64 years who had data relevant to traditional and nontraditional cardiovascular risk factors at the time of visit 3 (data on the nontraditional CVD risk factors relevant to this study became available in the ARIC database starting from visit 3) and had follow-up data on incident cardiovascular events within 10 years since visit 3. Participants with a history of coronary heart disease, heart failure, or stroke at baseline were excluded.

## Candidate Variables

Candidate variables included both traditional and nontraditional CVD risk factors that could be assessed from the ARIC

database using a self-reported form. For a disease, we relied on self-reported response of whether the condition was acknowledged by a physician. For example, in case of hypertension: “Has a doctor ever said that you had high blood pressure or hypertension?”. Traditional CVD risk factors included the risk factors that are included in the ASCVD risk calculator, however, using a self-reported format: age, sex, smoking status, previous diagnosis of hyperlipidemia, previous diagnosis of hypertension, previous diagnosis of diabetes mellitus, as well as other traditional risk factors that are not included in the ASCVD risk calculator: obesity, family history of premature MI, and physical activity status. Nontraditional CVD risk factors included previous diagnosis of the following: systemic lupus erythematosus, rheumatoid arthritis, periodontitis, gout, chronic obstructive pulmonary disease, asthma, cancer, migraine with or without visual aura, and waist circumference.

## Outcome Measure

The outcome of this study was the first occurrence of a CVD event in 10 years, among coronary heart disease, stroke, or mortality. Visit 3 was used as the baseline for analysis of incident events until the end of follow-up on December 31, 2005. Ascertainment of mortality and classification of coronary heart disease and stroke in the ARIC have been previously described.<sup>10,11</sup> Briefly, coronary heart disease death and nonfatal MI were defined as fatal or nonfatal hospitalized MI, fatal coronary heart disease, silent MI identified by electrocardiography, or coronary revascularization.<sup>10</sup> Fatal and nonfatal stroke were defined as definite or probable ischemic or hemorrhagic stroke. A hospitalization was considered for validation if it contained a discharge diagnosis indicative of cerebrovascular disease (*International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes 430–438 and/or 1 of the following keywords in the discharge summary or nursing notes during the admission: stroke, transient ischemic attack, cerebrovascular disease, cerebral hemorrhage, cerebral infarction, subarachnoid hemorrhage, cerebral embolus, paralysis, aphasia, diplopia, lacunar infarction, dysarthria, cerebral angiography, carotid, or endarterectomy. A stroke event was also considered if confirmed by a computed tomography or magnetic resonance imaging scan with cerebrovascular findings or if the patient was admitted to a specialized neurological intensive care unit.<sup>11</sup>

## Risk Score Development and Validation

The study sample meeting inclusion criteria were randomly divided using 70% for model development, and 30% for model

validation. The  $\chi^2$  test was used to compare the differences in baseline characteristics for the development and validation cohorts. An adjusted Cox regression model was applied to develop the CVD prediction model. Correlation matrix was used to exclude collinear factors. Since migraine and migraine with aura, as well as obesity and waist circumference are strongly linked and would likely be collinear, they were entered separately to the adjusted models. The final predictors were selected using backward elimination with an entry  $P=0.1$ , and a  $P\leq 0.05$  for the final adjusted Cox model. Hazard ratios (HR) and 95% CIs were reported for the final adjusted model. The fitness of the model was assessed with Hosmer-Lemeshow goodness-of-fit test and calibration curves. The model was fitted in the development cohort using backward elimination, and the final selected model (ie, the one with best receiving operator curve using the best set of variables) was applied to the validation cohort without refitting. (ie, the same parameter estimates were maintained and applied to the validation cohort and prediction accuracy was evaluated). Discrimination and accuracy of the developed model was evaluated in the validation cohort and tested by computing the C-statistic reflected by the area under the receiving operator curve.<sup>12</sup> Calibration slope and intercept was reported to evaluate the model calibration (ie, a slope of 1 and an intercept of 0 indicates perfect calibration). The ASCVD risk score was then computed for each participant in the validation cohort.<sup>2</sup> The area under the receiving operator curve was calculated for the ASCVD and compared with the area under the receiving operator curve of the newly developed risk score using the  $\chi^2$  test.

In order to develop a simple and utilizable risk calculation of the CVD incidence in the clinical setting, HRs were arbitrarily categorized and assigned to whole number risk points using a previously described method.<sup>3,8</sup> For example, HRs between 1.00 and 1.19 were categorized to “0 points,” HRs between 1.20 and 1.49 were categorized to “1 point,” HRs between 1.50 and 2.49 were categorized to “2 points,” etc. Since the purpose of our new risk score is to identify the “high risk” patients in a generalizable nationally representative population, we have performed additional analyses using the most recent data from the National Health and Nutrition Examination Survey (2015–2016). We compared the prevalence of the low-risk population versus the high-risk population as determined by the simple risk score (EZ-CVD) and the predicted ASCVD risk scores ( $n=2667$ , weighted  $n=11.8$  M). We used a cut-off of  $\geq 20\%$  versus  $<20\%$  to define the high- versus low-risk groups based on the predicted ASCVD risk. The cut-off point for high versus low risk in the EZ-CVD risk score was determined based on the prevalence that best represents the ASCVD risk group in the respective category.

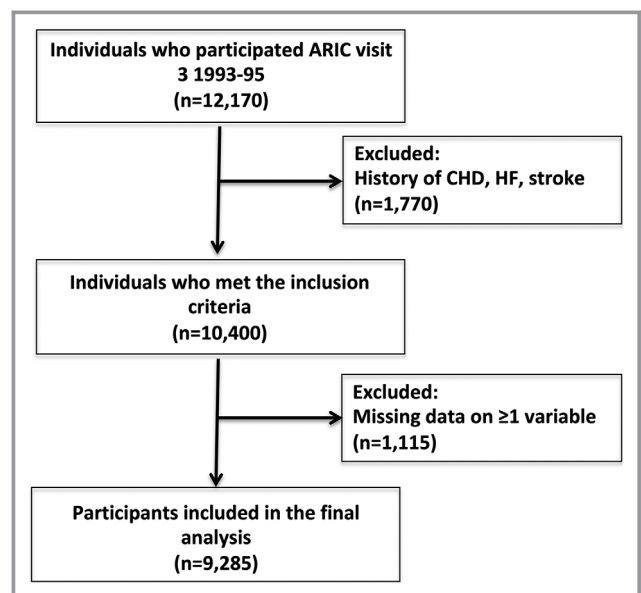
In a secondary model, we assessed the value of adding race to the final risk prediction model by computing and

comparing the C-statistics of the final prediction model with and without addition of race. All analyses were conducted using SAS software version 9.4 (SAS Institute, Inc., Cary, NC).

## Results

A total of 9285 patients met inclusion criteria (Figure 1); their pertinent baseline characteristics are summarized in Table 1. Their mean age was 59.7 years and they were mostly non-black (80%); the majority were women (57%). They were divided into the development ( $n=6500$ ) and validation cohorts ( $n=2785$ ). There were no significant differences in baseline characteristics between the development and validation cohorts, except for the prevalence of migraine with aura, which was slightly higher in the development cohort. During the follow-up period (median 8.93 years), a total of 694 (7.47%) incident cardiovascular events occurred.

Univariate analysis assessing the relationship between each risk factor and 10-year incidence of CVD are presented in Table S1. On multivariable Cox regression modeling, we found that 6 risk factors were independently associated with 10-year risk of incident CVD. These included the following: male sex (HR 1.78, 95% CI 1.47–2.15), age groups: 60 to 64 years (HR 1.80, 95% CI 1.34–2.41), 65 to 69 years (HR 2.19, 95% CI 1.63–2.93), and  $\geq 70$  years (HR 2.74, 95% CI 1.75–4.26), current smoking (HR 2.41, 95% CI 1.91–3.04), and histories of diabetes mellitus (HR 2.55, 95% CI 2.02–3.22), hypertension (HR 1.75, 95% CI 1.45–2.11), and a family member with premature MI (HR 1.43, 95% CI 1.07–1.91). Table 2 summarizes the HRs and 95% CIs for the multivariate Cox regression model predicting



**Figure 1.** Study flow diagram. ARIC indicates Atherosclerosis Risk in Communities; CHD, coronary heart disease; HF, heart failure.

**Table 1.** Baseline Characteristics of the Study Cohort

Characteristic	Total (n=9285)	Development Cohort (n=6500)	Validation Cohort (n=2785)	P Value
Age, y	59.7 (5.6)	59.7 (5.7)	59.8 (5.6)	0.833
Age, y (%)				
49–54	2094 (22.5)	1492 (22.9)	602 (21.6)	0.202
55–59	2601 (28.1)	1794 (27.6)	807 (29.0)	
60–64	2275 (24.5)	1586 (24.4)	689 (24.7)	
65–69	1963 (21.1)	1394 (21.4)	569 (20.4)	
≥70	352 (3.8)	234 (3.6)	118 (4.2)	
Male sex, %	3987 (42.9)	3732 (57.4)	1566 (56.2)	0.290
Race, %				P=0.579
Non-black	7467 (80.4)	5237 (80.6)	2230 (80.1)	
Black	1818 (19.6)	1263 (19.4)	555 (19.9)	
Family history of premature myocardial infarction, %	786 (8.5)	554 (8.5)	232 (8.3)	0.759
Obesity, %	2982 (32.1)	2093 (32.2)	889 (31.9)	0.792
Abnormal waist circumference, %	5761 (62.0)	4034 (62.1)	1727 (62.0)	0.963
Hypertension, %	3393 (36.5)	2390 (36.8)	1003 (36.0)	0.489
Systolic blood pressure, mm Hg	123.6 (18.3)	123.7 (18.3)	123.5 (18.5)	0.614
Diabetes mellitus, %	724 (7.8)	513 (7.9)	211 (7.6)	0.602
Hyperlipidemia, %	2952 (31.8)	2098 (32.3)	854 (30.7)	0.126
Total cholesterol, mg/dL*	207.8 (37.2)	208.1 (37.4)	207.0 (36.6)	0.183
High-density lipoproteins, mg/dL*	53.0 (18.1)	52.9 (18.0)	53.3 (18.5)	0.302
Smoking, %				
Never	3991 (43.0)	2807 (43.2)	1184 (42.5)	0.155
Former	3774 (40.6)	2605 (40.1)	1169 (42.0)	
Current	1520 (16.4)	1088 (16.7)	432 (15.5)	
Physical activity, %				
Seldom/rare	4903 (52.8)	3437 (52.9)	1466 (52.6)	0.693
Sometimes	2417 (26.0)	1702 (26.2)	715 (25.7)	
Often/very often	1965 (21.2)	1361 (20.9)	604 (21.7)	
Chronic obstructive pulmonary disease, %	637 (6.9)	452 (6.9)	185 (6.6)	0.586
Migraine, %	962 (10.4)	698 (10.7)	264 (9.5)	0.066
Migraine with aura, %	257 (2.8)	200 (3.1)	57 (2.0)	0.004
Asthma, %	541 (5.8)	383 (5.9)	158 (5.7)	0.679
Rheumatoid arthritis, %	468 (5.0)	334 (5.1)	134 (4.8)	0.507
Systemic lupus erythematosus, %	62 (0.7)	40 (0.6)	22 (0.8)	0.351
Gout, %	514 (5.5)	367 (5.6)	147 (5.3)	0.476
Periodontitis, %	2062 (22.2)	1441 (22.2)	621 (22.3)	0.891
History of cancer, %	768 (8.3)	530 (8.1)	238 (8.5)	0.531

\*Mean and SD were reported and compared with *t* test. For all other variables, frequencies (percentages) were reported and compared with  $\chi^2$  test.

the 10-year risk of incident CVD and associated risk points. There was no evidence of collinearity for the included risk factors. The proportional hazards assumptions were verified using Schoenfeld residuals. The area under the receiving

operator curve for the development and validation cohorts were similar: 0.714 and 0.721, respectively. The Hosmer and Lemeshow Goodness-of-Fit test indicated that the model had an optimal fit ( $P=0.274$ ). Calibration curves confirmed that the

**Table 2.** Adjusted Cox Multivariable Regression and Associated Component Scores for the Newly Developed Risk Score in the Validation Cohort

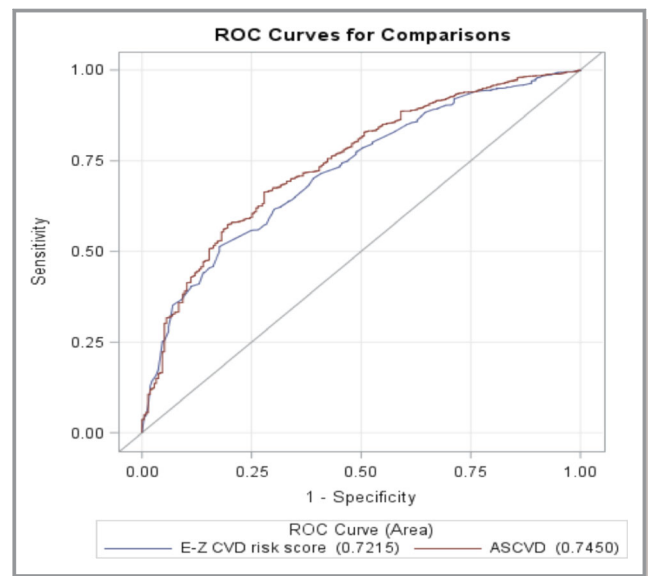
Characteristic	HR	95% CI	Score Point
<b>Age, y</b>			
49–54	...	...	0
55–59	1.26	0.92–1.72	0
60–64	1.80	1.34–2.41	2
65–69	2.19	1.63–2.93	2
≥70	2.74	1.75–4.26	3
<b>Sex</b>			
Male	1.78	1.47–2.15	2
Female	...	...	0
<b>Smoking</b>			
Current	2.41	1.91–3.04	2
Former	1.05	0.84–1.31	0
Never	...	...	0
<b>Diabetes mellitus</b>			
Yes	2.55	2.02–3.22	3
No	...	...	0
<b>Hypertension</b>			
Yes	1.75	1.45–2.11	2
No	...	...	0
<b>Family history of premature MI</b>			
Yes	1.43	1.07–1.91	1
No	...	...	0
<b>Total</b>			<b>13</b>

HR indicates hazard ratio; MI, myocardial infarction.

model had good calibration. The ASCVD risk score had a C-statistic of 0.745 in the validation cohort compared with 0.721 for the newly developed risk score. Chi square area under the receiving operator curves comparisons showed a nonsignificant difference between the newly developed and the ASCVD risk scores ( $P=0.083$ ) (Figure 2).

The prevalence of individuals with low CVD risk in the National Health and Nutrition Examination Survey data using an ASCVD risk cut-off point of 20% was 80% and 73% using the EZ-CVD risk score, while the prevalence for high-predicted CVD risk was 27% using the EZ-CVD risk score. This corresponded to a scoring algorithm of 0 to 5 and  $\geq 6$  total score points in the EZ-CVD risk score for the low and high predicted CVD risk, respectively (Figure 3).

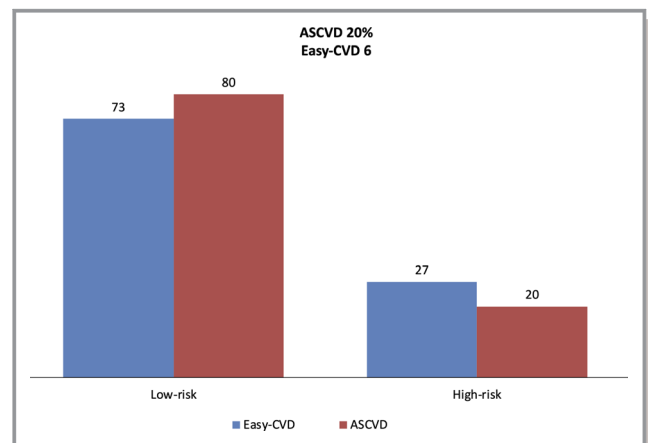
In a secondary model, when race was included as a candidate variable, it was selected in the final adjusted Cox regression model, as well as the other 6 variables that were previously selected. The C-statistics for the risk score, after

**Figure 2.** Comparisons of the ROC of the newly developed risk score with the ASCVD pooled cohort equation. ASCVD indicates atherosclerotic cardiovascular disease; E-Z CVD, simple risk score; ROC, receiving operator curve.

including race, were 0.721 and 0.724 in both the development and validation cohorts, respectively. The area under the receiving operator curves comparisons of the EZ-CVD risk score with and without race were similar ( $P=0.952$ ).

## Discussion

This study aimed to develop and validate a novel, simple risk score (EZ-CVD) to predict 10-year risk of incident cardiovascular events based only on patient-reported information, and to evaluate the utility of the EZ-CVD risk score compared with the ASCVD risk calculator using a large US community-based

**Figure 3.** Frequency of predicted low- and high-risk groups. ASCVD indicates atherosclerotic cardiovascular disease; Easy-CVD, simple risk score.

cohort. The EZ-CVD risk score included 6 self-reported factors: male sex, age, current smoking, history of diabetes mellitus, history of hypertension, and family history of premature MI. We found that the model performed well in the development and validation cohorts, with good calibration. The predictive performance of the EZ-CVD risk score was comparable with the ASCVD.

The EZ-CVD risk score is a 6-item risk predictor with several advantages over the current guideline-recommended ASCVD risk score. First, the EZ-CVD risk score was developed using only patient-reported information, which facilitates application in the office setting, especially primary care.<sup>13,14</sup> The ASCVD risk score requires laboratory data such as lipid panel information that often necessitates a follow-up visit to obtain these data to complete the risk calculation. This is a major limitation that has the potential to lead to a considerable number of patients being overlooked for CVD risk assessment and receiving guideline recommendations for preventative therapy. The EZ-CVD risk score showed comparable CVD risk prediction despite the fact that hyperlipidemia was not included in the final model, suggesting that the EZ-CVD simplifies risk prediction since it can be completed within a single office visit.<sup>3,8</sup> Even though information about lipid panel results could be extracted from the electronic health record to calculate the ASCVD, it may be outdated and therefore might have questionable validity. Second, the ASCVD has been criticized for not including family history of premature MI as a risk factor.<sup>4,7</sup> Family history of premature MI is an easy-to-assess self-reported risk factor that has been included in other CVD prediction risk scores such as the QRISK3 risk calculator.<sup>6</sup> Third, the EZ-CVD risk score could be calculated by individuals without the need to actually visit a clinic or have their blood drawn. This feature should maximize the proportion of the eligible population who undergo prediction for future CVD events, visit the provider's office for further evaluation, and eventually receive preventative therapy.

Unlike the ASCVD risk score, hyperlipidemia was not associated with cardiovascular events in the EZ-CVD risk score. Hyperlipidemia is a spectrum of several disorders including low HDL-cholesterol (C), high LDL-C, elevated total-C, and elevated triglycerides.<sup>15</sup> Importantly, the contribution of each of these disorders to the CVD risk is not the same, and the independent effect of low HDL-C, for example, is more pronounced. In our study, we used a self-reported diagnosis of hyperlipidemia based on the question "Has a doctor ever said that you had high blood cholesterol," which is not equivalent to a low HDL-C level. Furthermore, patients who are aware that they have an elevated cholesterol level are more likely to be receiving a statin as opposed to others with undiagnosed hyperlipidemia, which might have modified the relationship between a self-reported diagnosis of hyperlipidemia and

incident cardiovascular events in this study. This could be considered an advantage for the EZ-CVD risk score since patients could calculate their CVD risk even if they did not have any recent laboratory assessment for lipids. Additionally, this "self-report" activity helps to encourage patients to participate in their own health promotion or care (eg, participatory medicine).

In the secondary analysis, we included race as a candidate variable, yet addition of race did not improve the prediction of incident cardiovascular events by the EZ-CVD risk score. Studies have shown that the racial differences in the CVD risk are likely related to traditional CVD risk factors among the non-white races (ie, blacks and Hispanics)<sup>16</sup>; thus the independent role of race in the EZ-CVD risk score was likely minimal. Although race was a significant predictor in the ASCVD risk score, it did not improve CVD prediction in the EZ-CVD risk score, which might be because of the underrepresentation of individuals with black race in the ARIC data. Nonetheless, the predictive ability of the EZ-CVD risk score remained very comparable with the ASCVD risk score. This emphasizes the fundamental purpose of developing CVD risk scores with the best minimal set of factors that accurately predict CVD risk.

There has been a growing body of evidence suggesting an association between several nontraditional CVD risk factors such as rheumatological disorders, respiratory diseases, periodontitis, migraine, and incident cardiovascular events.<sup>5,17–22</sup> In fact, some of these risk factors (such as systemic lupus erythematosus, rheumatoid arthritis, and migraine) were included in the recent QRISK 3 risk score.<sup>6</sup> Several reasons could explain the lack of association between these nontraditional CVD risk factors and incident cardiovascular events in our study. Studies have suggested that the effect size for the association between some of the nontraditional risk factors and cardiovascular events is relatively small.<sup>18–22</sup> Therefore, a very large sample size, like that included in the QRISK 3 risk calculator (>11 million), would be needed to show such an association. In addition, we relied on a self-reported diagnosis of the condition without further details regarding the duration and severity, which might play an important role in the association between nontraditional risk factors and cardiovascular events. For example, studies suggested that the duration of migraine, and the presence of aura are strongly linked with cardiovascular events.<sup>5</sup>

## Study Limitations

The strength of the findings from this study should be interpreted in the context of several potential limitations. First, the ARIC population consists predominately of whites. Thus, our results might not be generalizable to other racial groups, and external validation of the risk score in cohorts that

comprise a wider diversity of races is warranted. Second, some potential nontraditional CVD risk factors could not be included in this study such as histories of human immunodeficiency virus, atrial fibrillation, and chronic kidney disease.<sup>6</sup> Although some of these factors could be ascertained using laboratory values, this was not in line with the purpose of our study to develop a risk stratification tool using only patient-reported information, which was not available for these factors in the ARIC. Third, we did not assess associations between certain women-specific risk factors (eg, pre-eclampsia, gestational diabetes mellitus, age of menarche, age of menopause, parity, etc.) that have been linked with risk for CVD events,<sup>23</sup> since the purpose of our study was to create a widely used risk score, rather than a sex-specific score. Inclusion of women-related risk factors could be an important area for future study. Fourth, we relied on a self-reported physician diagnosis of disease. This could introduce misclassification of diagnosis in some individuals who might have an undiagnosed condition. Fifth, management of major CVD risk factors, such as diabetes mellitus and hypertension, has remarkably improved over the past decades,<sup>24</sup> and this might have resulted in overestimation of CVD risk. Finally, the EZ-CVD risk score does not account for the effect of treatment of risk factors on CVD risk among individuals. Nevertheless, the EZ-CVD risk score was designed to identify individuals who would benefit from preventative therapy rather than to estimate CVD risk variation among the treated population with CVD. Future risk score taking into consideration the effect of treatment and risk factor modification on CVD risk are encouraged.

## Conclusions

The EZ-CVD risk score is an easy-to-use risk score to predict cardiovascular events in adults utilizing only self-reported information without need for further laboratory or physical examination data. The risk score included 6 variables: age, sex, a self-reported physician diagnosis of hypertension, diabetes mellitus, smoking, and family history of premature MI. This novel EZ-CVD risk had a similar predictive performance to the guideline-recommended ASCVD risk score, relied solely on self-reported information, and included family history of premature MI, a risk factor not included in the ASCVD risk score. The EZ-CVD risk score could be easily used by physicians, especially primary care, to assess risk of patients and guide therapeutic decisions regarding statin therapy. Future studies are needed to externally validate this risk score in cohorts with wide racial diversity, and to assess the applicability of this new risk score in routine clinical practice.

## Disclosures

None.

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# **SUPPLEMENTAL MATERIAL**

**Table S1. Univariate Cox analysis showing the association between the individual risk factors and the incidence of the outcome.**

<b>Characteristics</b>	<b>Hazard ratio</b>	<b>95% Confidence interval</b>
Age years		
49-54 (reference)		
55-59	1.26	0.97-1.63
60-64	1.85	1.45-2.37
65-69	2.40	1.88-3.06
≥70	2.90	2.03-4.14
Male sex	1.78	1.54-2.08
Race (%)		
Non-black (reference)		
Black	1.43	1.20-1.69
Family history of premature MI	1.25	1.02-1.68
Obesity	1.29	1.10-1.50
Abnormal waist circumference	1.10	0.94-1.28
Hypertension	1.86	1.60-2.15
DM	3.18	2.65-3.83
Hyperlipidemia	1.07	0.92-1.26
Smoking		
Never (reference)		
Former	1.19	1.00-1.41
Current	2.10	1.74-2.54
Physical activity		
Seldom/rare	1.29	1.05-1.57
Sometimes	1.03	0.82-1.30
Often/very often (reference)		
COPD	1.63	1.28-2.09
Asthma	1.07	0.78-1.48
Migraine	0.92	0.72-1.19
Migraine with aura	1.02	0.65-1.59
RA	1.37	1.02-1.82
SLE	1.01	0.45-2.27
Gout	1.51	1.15-1.99
Periodontitis	0.93	0.77-1.11
History of cancer	1.06	0.81-1.38

COPD= chronic obstructive pulmonary disease; DM= diabetes mellitus; MI= myocardial infarction