# Comparison of risk scores for the prediction of stroke in African Americans: Findings from the Jackson Heart Study

Randi E. Foraker, PhD, MA, FAHA,[a] Melissa Greiner, MS,[b] Mario Sims, PhD,[c] Katherine L. Tucker, PhD,[d] Amytis Towfighi, MD,[e] Aurelian Bidulescu, MD, PhD, MPH,[f] Abigail B. Shoben, PhD,[g] Sakima Smith, MD, MPH,[h] Sameera Talegawkar, PhD, MHSc,[i] Chad Blackshear, MS,[j] Wei Wang, PhD,[j] Natalie Chantelle Hardy, MPH,[b] and Emily O'Brien, PhD[b] *Columbus, OH; Durham, NC; Birmingham, AL; Lowell, MA; Los Angeles, CA; Bloomington, IN; Baltimore, MD; and Jackson, MS*

**Background** Evidence from existing cohort studies supports the prediction of incident coronary heart disease and stroke using 10-year cardiovascular disease (CVD) risk scores and the American Heart Association/American Stroke Association's cardiovascular health (CVH) metric.

**Methods** We included all Jackson Heart Study participants with complete scoring information at the baseline study visit (2000-2004) who had no history of stroke (n = 4,140). We used Kaplan-Meier methods to calculate the cumulative incidence of stroke and used Cox models to estimate hazard ratios and 95% CIs for stroke according to CVD risk and CVH score. We compared the discrimination of the 2 models according to the Harrell *c* index and plotted predicted vs observed stroke risk calibration plots for each of the 2 models.

**Results** The median age of the African American participants was 54.5 years, and 65% were female. The cumulative incidence of stroke increased across worsening categories of CVD risk and CVH. A 1-unit increase in CVD risk increased the hazard of stroke (1.07, 1.06-1.08), whereas each 1-unit increase in CVH corresponded to a decreased hazard of stroke (0.76, 0.69-0.83). As evidenced by the *c* statistics, the CVH model was less discriminating than the CVD risk model (0.59 [0.55-0.64] vs 0.79 [0.76-0.83]).

**Conclusions** Both scores were associated with incident stroke in a dose-response fashion; however, the CVD risk model was more discriminating than the CVH model. The CVH score may still be preferable for its simplicity in application to broad patient populations and public health efforts. (Am Heart J 2016;177:25-32.)

*From the [a]Division of Epidemiology, The Ohio State University, Columbus, OH, [b]Duke Clinical Research Institute, Durham, NC, [c]Department of Medicine, University of Mississippi Medical Center, Birmingham, AL, [d]Department of Clinical Laboratory and Nutritional Sciences, University of Massachusetts at Lowell, Lowell, MA, [e]Keck School of Medicine, University of Southern California, Los Angeles, CA, [f]School of Public Health, Indiana University, Bloomington, IN, [g]Division of Biostatistics, The Ohio State University, Columbus, OH, [h]The Ohio State University Medical Center, Columbus, OH, [i]Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD, and [j]Center of Biostatistics and Bioinformatics, University of Mississippi Medical Center, Jackson, MS.*

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*Reprint requests: Randi Foraker, PhD, MA, FAHA, The Ohio State University, 1841 Neil Ave, 334 Cunz Hall, Columbus, OH 43210.*
*E-mail: rforaker@cph.osu.edu*

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Evidence from existing cohort studies supports the prediction of incident coronary heart disease (CHD) and stroke using 10-year cardiovascular disease (CVD) risk scores[1] and the American Heart Association (AHA)/American Stroke Association's (ASA's) cardiovascular health (CVH) metric.[2,3] African Americans have higher rates of acute stroke compared with non-Hispanic whites, yet CVD risk scores have historically been validated in primarily white populations.[1,4] It remains unknown which risk scoring algorithm (10-year CVD risk vs CVH) is most accurate for predicting stroke in an African American population.

A recent American College of Cardiology (ACC)/AHA collaboration resulted in guidelines for the clinical assessment of CVD risk.[1] Applying these guidelines requires measurement of patient characteristics such as age, sex, race, cholesterol, blood pressure (BP), smoking status, diabetes, and antihypertensive treatment. Ten-year CVD risk scores stem from these new guidelines and reflect risk estimates for *fatal* CHD and stroke and

*nonfatal* myocardial infarction and stroke.[1,4] The ACC/AHA suggests that it is appropriate to use the updated 10-year CVD risk algorithm among non-Hispanic whites and African Americans.[1]

Efforts to prevent CVD by promoting healthy behaviors and evidence-based treatments are underway via the Centers for Disease Control and Prevention's *Million Hearts* initiative,[5] in partnership with AHA/ASA's *Life's Simple 7*.[6] *Life's Simple 7* comprises 7 modifiable CVH behaviors and factors: body mass index, cholesterol, BP, smoking status, fasting glucose, physical activity, and diet. The Reasons for Geographic And Racial Differences in Stroke (REGARDS) study recently reported a lower risk of stroke for every unit increase in CVH score among whites and African Americans.[2] Although the 10-year CVD risk score may have a broader appeal to clinicians, given the recently released statin treatment guidelines,[4] CVH may have greater public health relevance and ease of use outside of the clinical setting.

The objective of this study was to determine the predictive ability of 2 risk scores (10-year CVD risk vs CVH score) for stroke among participants of the Jackson Heart Study (JHS), a community-based cohort of African Americans in Jackson, Mississippi. The JHS presented an ideal setting in which to evaluate risk scores for the prediction of stroke in African Americans because baseline and follow-up data were carefully collected. We hypothesized that, at baseline, 10-year CVD risk would be high (and CVH low) in this population. We additionally anticipated that both the 10-year CVD risk and the CVH scores would predict incident stroke in this population, but the 10-year CVD risk score would more strongly predict incident stroke due to its inclusion of nonmodifiable, yet highly predictive, risk factors.

## Materials and methods

We analyzed data from the JHS, a study designed to investigate risk factors for CVD among African Americans.[7] The JHS enrolled 5301 participants aged 21 to 95 years from 4 sources between 2000 and 2004: community volunteers from the Jackson metropolitan area (25%), residents of Jackson selected at random (17%), eligible residents in the Jackson site of the Atherosclerosis Risk in Communities (ARIC) cohort study[8] (31%), and family members of JHS participants (22%) or ARIC participants (5%). All participants underwent a baseline examination and data were collected on demographic characteristics, socioeconomic characteristics, medical history, physical examination results, laboratory values, cardiac testing, behavioral factors, and medications. Deaths and nonfatal events were subsequently ascertained via annual telephone calls, review of death certificates, and abstraction of medical records for relevant *International Classification of Diseases, Ninth Revision, Clinical Modification* codes through 2011. The JHS was approved by the institutional review boards of Jackson State University, Tougaloo College, and the University of Mississippi Medical Center. All study participants provided informed consent. The institutional review boards of the Duke University Health System and The Ohio State University approved use of JHS data for our study.

We included all JHS participants with complete risk score information at the baseline study visit. Participants who reported a history of stroke were excluded from all analyses (n = 234/5,301). Among the remaining 5,067 participants, the primary analysis excludes 927 participants with any missing CVD risk or CVH score components (complete case), for a final total of 4,140 (Supplementary Table 1).

The primary outcome of interest was incident stroke. Strokes were ascertained via directed patient queries during annual telephone follow-up and ongoing surveillance of hospitalizations, with subsequent transmission of hospital records and death certificates to a medical record abstraction unit for review. A computer-generated diagnosis with physician adjudication was used to classify hospitalized and fatal stroke events. We included all ischemic and hemorrhagic strokes that occurred within 10 years of the baseline examination date based on a median of 9 years of follow-up time and a 75th percentile of 10 years.

Ten-year CVD risk scores were calculated using published coefficients.[1] Specifically, we used published race-specific coefficients from pooled cohort equations, as recommended by the ACC/AHA and endorsed by the National Heart, Lung, and Blood Institute,[1] to calculate a 10-year CVD risk score for each member of the JHS cohort at baseline (Supplementary Table 2). We then multiplied the CVD risk score times 100 to calculate a CVD risk percentage. For selected analyses, we assigned categories of CVD risk according to cutpoints in the extant literature: low (0-<5.0%), medium (5.0%-<7.5%), and high (≥7.5%).[9,10]

We estimated CVH using the Life's Simple 7 scoring system.[3] introduced by the AHA/ASA and shown in detail in Supplementary Table 3, to investigate the association between CVH at baseline and incident stroke.[11] We hypothesized that few JHS participants (ie, <1%) would be classified as having ideal CVH for all behaviors and factors, based on other local and national community samples.[3,12,13] Thus, we incorporated the approach used by Kulshreshtha et al[2] to use an overall CVH score to represent the continuum of CVH that is based on the number of ideal (2), intermediate (1), and poor (0) CVH metrics present at baseline. The overall CVH score was summed to a total of 0 (worst) to 14 (best) points according published CVH categories.[3] For selected analyses, we used categories of CVH as follows: ideal CVH (10-14), intermediate CVH (5-9), and poor CVH (0–4).[14]