Dietary Patterns Are Associated With Incident Stroke and Contribute to Excess Risk of Stroke in Black Americans

Suzanne E. Judd, PhD; Orlando M. Gutiérrez, MD; P.K. Newby, PhD; George Howard, DrPH; Virginia J. Howard, PhD; Julie L. Locher, PhD; Brett M. Kissela, MD; James M. Shikany, DrPH

Background and Purpose—Black Americans and residents of the Southeastern United States are at increased risk of stroke. Diet is one of many potential factors proposed that might explain these racial and regional disparities.

Methods—Between 2003 and 2007, the REasons for Geographic and Racial Differences in Stroke (REGARDS) cohort study enrolled 30 239 black and white Americans aged ≥45 years. Dietary patterns were derived using factor analysis and foods from food frequency data. Incident strokes were adjudicated using medical records by a team of physicians. Cox-proportional hazards models were used to examine risk of stroke.

Results—During 5.7 years, 490 incident strokes were observed. In a multivariable-adjusted analysis, greater adherence to the plant-based pattern was associated with lower stroke risk (hazard ratio, 0.71; 95% confidence interval, 0.56–0.91; P_{trend}=0.005). This association was attenuated after addition of income, education, total energy intake, smoking, and sedentary behavior. Participants with a higher adherence to the Southern pattern experienced a 39% increased risk of stroke (hazard ratio, 1.39; 95% confidence interval, 1.05, 1.84), with a significant (*P*=0.009) trend across quartiles. Including Southern pattern in the model mediated the black–white risk of stroke by 63%.

Conclusions—These data suggest that adherence to a Southern style diet may increase the risk of stroke, whereas adherence to a more plant-based diet may reduce stroke risk. Given the consistency of finding a dietary effect on stroke risk across studies, discussing nutrition patterns during risk screening may be an important step in reducing stroke. **(*Stroke*. 2013;44:3305-3311.)**

Key Words: continental population groups ■ dietary habits ■ epidemiology ■ ethnicity ■ stroke

The risk of having and dying from a stroke is higher in the Southeastern United States than in other regions of the country.[1–3] Many causes for this regional disparity in stroke have been suggested, including demographic factors, socioeconomic status, and lifestyle differences between regions.[3–8] Among the most commonly proposed causes is a geographic difference in diet, potentially differentially influencing stroke risk through a multifaceted effect on stroke risk factors, including obesity, hypertension, diabetes mellitus, oxidative stress, and inflammation.[9–12] Because traditional risk factors, such as hypertension, do not fully explain geographic variability in stroke risk, behavioral factors, such as diet, are ideal targets to explore further.[13,14] Indeed, although dietary differences are frequently hypothesized to be the cause of this disparity, few prospective data are available to support the existence of regional differences in diet or whether potential differences contribute to the excess risk of stroke in the Southeastern United States. Using dietary patterns to measure dietary exposures has become popular because foods and nutrients are not eaten in isolation.[15] Two approaches are commonly used: a priori–defined dietary scores, such as the Healthy Eating Index or Mediterranean diet score[16] and a posteriori-identified patterns using factor or cluster analysis.[17] A data-driven method, factor analysis, measures of eating patterns in specific populations without making judgments about which foods are commonly consumed together or which foods provide health benefit. Using such empirically defined dietary patterns may help identify social or cultural influences that are more nuanced when it comes to food selection in a specific population and provides a novel method for examining diet in a heterogeneous population.[4]

An additional challenge in examining regional differences on the effect of diet on stroke risk is the potential confounding of race on regional differences. Black Americans have a greater risk of stroke than their white counterparts and also represent a larger proportion of the population in the Southeast compared with other regions in the United States.[18] Hence, it is possible that geographic disparities are confounded with

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From the Department of Biostatistics (S.E.J., G.H.), School of Public Health (S.E.J., O.M.G., G.H., V.J.H.), Division of Nephrology, Department of Medicine (O.M.G.), Department of Epidemiology (O.M.G., V.J.H.), Division of Gerontology, Geriatrics, and Palliative Care, Department of Medicine (J.L.L.), Division of Preventive Medicine, Department of Medicine, School of Medicine (J.M.S.), University of Alabama at Birmingham; Program in Gastronomy, Culinary Arts, and Wine Studies, Boston University, MA (P.K.N.); and Department of Neurology, School of Medicine, University of Cincinnati, OH (B.M.K.).

Correspondence to Suzanne E. Judd, PhD, Department of Biostatistics, School of Public Health, University of Alabama at Birmingham, 1665 University Blvd, Birmingham, AL 35294-0022. E-mail sejudd@uab.edu

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racial disparities.[19] As such a large, geographically diverse population sample is needed to be able to identify first and confirm the dietary patterns, and then to test whether any potential association of diet with stroke risk is homogeneous across both race and region. The REasons for Geographic and Racial Differences in Stroke (REGARDS) study provides an ideal population for examining this association in the US blacks and whites.

Methods

Study Participants

The REGARDS study is specifically designed to examine racial and regional differences in stroke in the lower 48 continental states, and as such oversampled both black Americans and people residing in the Southeast, an area of the country known as the stroke belt (includes Louisiana, Arkansas, Mississippi, Alabama, Tennessee, Georgia, North Carolina, and South Carolina).[20] A total of 30 239 participants were recruited for the study. The cohort comprised 56% from the stroke belt and 42% black, 55% women.[21] Participants were recruited using commercially available lists from Genesys, Inc (Daly City, CA), which is the same list used by the Behavioral Risk Factor Surveillance Systems in the United States.[20] REGARDS participants were initially contacted through a personalized mailing and brochure to describe the study and inform them of an upcoming phone call. REGARDS staff then conducted a 45-minute telephone interview to obtain verbal consent and to collect data on demographics, socioeconomic status, stroke risk factor characterization, and medical history. The telephone response rate was 33% and cooperation rate was 49%, similar to other cohort studies.[22,23] After the telephone call, a trained health professional went to the participant's home to obtain written consent and collect blood and urine specimens. During this visit, an ECG was performed and blood pressure, waist circumference, height and weight were measured. The study was approved by the Institutional Review Board at all participating universities, and written informed consent was obtained from all participants.

Stroke Ascertainment

REGARDS participants are contacted via telephone for every 6 months to ascertain vital status and to obtain information on reasons for hospitalization, including stroke, transient ischemic attack, and stroke symptoms. Medical records are pursued if the participant reports seeking medical care for stroke or transient ischemic attack and was hospitalized for stroke symptoms or unknown reason. Once a medical record is received, it is reviewed by a committee of stroke neurologists to verify that a stroke occurred. Stroke is defined: (1) according to the World Health Organization definition of focal neurological deficit lasting >24 hours or (2) nonfocal neurological symptoms with imaging consistent of stroke.[21] The National Death Index is queried annually to identify stroke deaths that might not have been hospitalized. For this analysis, strokes occurring through September 1, 2011, were included.

Dietary Assessment

At the conclusion of the in-home visit, the health professional left the participant with self-administered forms, including the Block 98 Food Frequency Questionnaire (FFQ). The Block 98 version developed by Block Dietary Data Systems (Berkeley, CA) and distributed by NutritionQuest is an 8-page paper-and-pencil form with >150 multiple-choice questions based on 107 food items that can be completed in ≈30 to 40 minutes. The Block 98 allows for identification of higher and lower fat versions of food and added sugars in the diet and has been validated in populations similar to REGARDS.[24,25] Participants were asked to recall usual dietary intake for the past year. The participant completed the form and mailed it back to the operations center within 3 months of the in-home visit. NutritionQuest processed the forms to assess the mean daily intake (grams) of each individual food on the FFQ.

Dietary Pattern Identification

Pattern identification was based on the estimated quantity of the 107 individual food items. Before analysis, we combined some FFQ items on the basis of similarity of food content. For example, beverages containing some juice, such as Hi-C, were grouped with sugar-sweetened beverages because of nutritional content. Some individual food items were separated into 2 items because of hypothesized cardiovascular effect, such as high- and low-fat milk. Fried items of fish, potatoes, and chicken were separated from the non–fried items because of the high-fat content of fried foods and anticipated differences of use across race and regionally defined populations. Some items like Chinese food were left as a standalone food group because of the uniqueness of the item.[26] Five factors were retained from principal components analysis based on the eigenvalue (scree plot) and the solution providing the optimal congruence across region, sex, and race. Final factor loadings were derived in the full population using principal components analysis with varimax rotation. Descriptive names were assigned to the patterns on the basis of foods that contributed most highly to each pattern: convenience, plant based, sweets/fats, Southern, alcohol/salads (Appendix). A score was given to each participant reflecting their adherence to a specific pattern (higher scores reflecting closer adherence to the eating pattern).

Statistical Analyses

The 5 dietary patterns were grouped into quartiles to examine the association of diet with stroke. Descriptive statistics (χ^2, ANOVA, and log rank) were used first to examine the association of each pattern with demographic, socioeconomic, behavioral, and nutrient variables. Cox-proportional hazard analysis was used to examine the risk of stroke associated with each dietary pattern, and all participants were censored at date of stroke, date of withdrawal from the study, date of death, or September 1, 2011. Schoenfeld residuals were examined to ensure that proportional hazard assumptions were met. Models were built sequentially by first adding demographic variables (age, race, sex, age–race interaction). An age–race interaction term was found in previous work to be necessary because there is a large difference in stroke incidence between blacks and whites at younger ages, which does not exist in older ages.[21] After the addition of demographic variables, income and education were then added to the model followed by total energy intake. The final set of models included smoking history and television viewing (defined as watching >4 hours of television per day). The proportion of the racial and regional disparities in stroke risk attributable to adherence to specific diets was assessed using mediation analyses, where the β coefficient changes in the Cox models for both race and region were assessed before and after adjustment for diet adherence. Women and white participants were more likely to return the FFQ as were those who graduated college; therefore, we performed a sensitivity analysis to examine stroke risk factors in the nutrition subsample and the full REGARDS cohort.

Results

After excluding participants with a self-report of stroke (n=2032), 28 151 were available for the present analysis. FFQ were available on 20 251 (72%) participants. After a median of 5.7 years of follow-up, 490 strokes were observed (12% were hemorrhagic [n=59]; 82% were ischemic [n=402], and 6% were not classified). Participants who reported a stroke were more likely to be aged >65 years, have a history of hypertension, diabetes mellitus, heart disease, and atrial fibrillation and were less likely to be obese than the general REGARDS dietary cohort.

Pattern adherence (defined by greater proportion of participants in the fourth quartile compared with the first) to the convenience dietary pattern was more common in younger, male, white participants and those residing outside the Southeast (Table 1). In contrast, adherence to the plant-based pattern was more common in older, female, black participants and in those who graduated college. Income was not associated with the plant-based dietary pattern, but income <$20 000 per year was associated with decreased adherence to the convenience pattern. Those who were higher consumers of the sweets/fats and Southern patterns were more likely to reside in the Southeast, but the sweets/fats pattern was more likely to be consumed by white participants, whereas the Southern pattern was more likely to be consumed by black participants.

For all survival analyses, the first quartile (lowest adherence to specific diet pattern) was used as the reference group. In age-adjusted, race-adjusted, region-adjusted, sex-adjusted, and age–race interaction–adjusted models, greater adherence to the plant-based and sweets/fats dietary patterns were associated with a reduction in stroke risk, whereas greater adherence to the Southern pattern was associated with an increased risk of stroke (Table 2). The Southern pattern was associated with a 39% increased risk of stroke (hazard ratio, 1.39; 95% confidence interval, 1.05–1.84) when comparing the highest quartile with the lowest quartile (P_{trend}=0.009). This association was attenuated with the addition of covariates, but the direction of the association remained significant (*P*=0.05). In the sweets/fats pattern, the risk of stroke was lower in those with the greatest adherence than in those with the lowest adherence (hazard ratio, 0.80; 95% confidence interval, 0.61–1.04), and this association was strengthened and became significant with the adjustment for covariates. The risk of stroke was lowest in the plant-based pattern (hazard ratio, 0.71; 95% confidence interval, 0.56–0.91; P_{trend}=0.005). This association was attenuated and no longer significant after the addition of income, education, total energy intake, smoking, and sedentary behavior, but the direction of association persisted. Neither the convenience pattern nor the alcohol/salads pattern was associated with risk of stroke (*P*>0.05).

As a primary aim for the parent study is to identify causes for disparities in stroke, the effect of diet on racial and regional differences in stroke was also considered. Because the Southern dietary pattern was the only pattern associated with increased risk of stroke, mediation analyses were only done for this pattern. Examining the change in the β coefficients for race, the Southern dietary pattern was associated with a 63% reduction in the association of black race with stroke risk in participants aged <65 years where the racial disparity is most prevalent. Southern dietary pattern did not mediate regional disparities in stroke.

Discussion

Our findings suggest that racial and regional differences in diet do exist, and that these differences may contribute to disparities in stroke risk for black Americans. We did not find evidence that regional differences in diet were associated with increased stroke risk; however, adherence to a Southern style diet is more common among residents of the Stroke Belt and among black participants in the study. This eating pattern is also associated with increased risk of stroke, suggesting that it is a potential contributor to the racial but not regional disparities in stroke. We have further shown that a Southern dietary pattern mediates the racial disparity in stroke by 63%. Previous work by our group demonstrated that traditional risk factors, such as hypertension and atrial fibrillation, mediated only 50% of the excess stroke in black Americans,[14] which further supports the important role for diet in determining stroke risk.

Using factor analysis to derive dietary patterns is a well-accepted method for studying the relationship between diet and cardiovascular disease risk.[17,27,28] Yet most studies have considered stroke as a composite outcome with other cardiovascular events thus not allowing identification of dietary effects that may be unique to stroke but not to heart disease. Only 1 study (Nurses' Health Study) has used factor analysis to examine dietary patterns and stroke risk.[29] Even though the previous study was limited to women, similar results were observed.[29] Our study extends the findings from the Nurses' Health Study to a diverse population of black and white Americans across a wide range of income and education levels, suggesting that the effect of diet on stroke risk goes beyond race and socioeconomic status. One main difference between the 2 studies was in the number of dietary patterns observed. REGARDS is not the first study to observe >2 dietary patterns. The Multi-Ethnic Study of Atherosclerosis investigators also identified >2 dietary patterns and have published extensively on these patterns and cardiovascular risk factors.[26,30–33] However, Multi-Ethnic Study of Atherosclerosis is restricted to only 4 geographic regions and may not be reflective of national dietary patterns.

Although few studies have used factor analysis to examine diet and stroke, other methods have been used. A recent review found that strong evidence exists to recommend increasing potassium, fatty fish, fruits, vegetables, whole grains, and limiting sodium intake for stroke prevention.[10] The plant-based pattern identified in this article as being protective in terms of stroke risk includes many of the foods (fish, fruit, and vegetables) listed above. In the Northern Manhattan Study (NOMAS) examining a priori dietary patterns (Mediterranean diet score), the Mediterranean diet score was not associated with risk of stroke[34] but was associated with a lower degree of white matter hyperintensity volume (a marker of small vessel damage) in the brain.[35] Although not identical to the Mediterranean diet score, the plant-based pattern observed in our study was associated with reduction in stroke risk and had more than double the number of events observed in the NOMAS study. Diet quality was recently tested in the interventional study PREVIMED in which participants were randomized to a Mediterranean style diet.[36] Those randomized to the Mediterranean style diet had significantly lower risk of stroke than those eating the control diet, suggesting that dietary change has a strong effect on stroke outcomes. The consistency across cohort studies and this randomized clinical trial is striking and suggests discussing dietary change as part of a general health screening has the potential to reduce the burden of stroke.

The sweets/fats pattern was associated with a reduction in stroke risk that was strengthened by the addition of covariates. This was contrary to our hypothesis given that a diet high in added sweets and saturated fats is considered to be adverse in

Table 1. Demographic Characteristics by Quartile of Dietary Pattern in the REasons for Geographic and Racial Differences in Stroke (REGARDS) Study

	Q1 n (%)	Q2 n (%)	Q3 n (%)	Q4 n (%)
Convenience				
Age <65 y	2016 (40)	2452 (48)	2731 (53)	3183 (63)
Black	2255 (45)	1879 (37)	1402 (27)	1147 (23)
Men	1975 (39)	2416 (47)	2764 (54)	3068 (62)
Residence in the Southeast	3068 (62)	2925 (58)	2828 (55)	2589 (51)
College graduate	1567 (31)	1865 (37)	2080 (41)	2200 (43)
Income <$20 000	1003 (20)	799 (16)	641 (13)	621 (12)
Current smoker	658 (13)	678 (13)	653 (13)	726 (14)
Obese (BMI≥30 kg/m^2)	1774 (36)	1813 (36)	1774 (35)	1978 (39)
Sedentary (>4 h of TV per day)	635 (13)	629 (12)	552 (11)	655 (13)
Plant based				
Age <65 y	3105 (61)	2530 (50)	2363 (46)	2384 (47)
Black	1374 (27)	1687 (34)	1747 (34)	1875 (37)
Men	2688 (53)	2257 (45)	2080 (41)	1853 (37)
Residence in the Southeast	2829 (56)	2922 (58)	2842 (56)	2817 (55)
College graduate	1616 (32)	1792 (36)	2048 (40)	2256 (44)
Income <$20 000	768 (15)	766 (15)	779 (15)	751 (15)
Current smoker	1163 (23)	683 (14)	492 (10)	377 (7)
Obese (BMI≥30 kg/m^2)	1874 (37)	1831 (36)	1835 (36)	1799 (35)
Sedentary (>4 h of TV per day)	842 (17)	660 (13)	540 (11)	429 (8)
Sweets/fats				
Age <65 y	2732 (54)	2458 (49)	2522 (50)	2670 (53)
Black	2256 (44)	1640 (33)	1401 (28)	1386 (27)
Men	1985 (39)	2280 (45)	2709 (54)	2490 (48)
Residence in the Southeast	2704 (53)	2787 (55)	2844 (56)	3075 (61)
College graduate	2020 (40)	2057 (41)	1959 (39)	1676 (33)
Income <$20 000	797 (16)	714 (14)	709 (14)	844 (17)
Current smoker	623 (12)	588 (12)	659 (13)	845 (17)
Obese (BMI≥30 kg/m^2)	1917 (38)	1803 (36)	1790 (35)	1829 (36)
Sedentary (>4 h of TV per day)	549 (11)	546 (11)	571 (11)	805 (16)
Southern				
Age <65 y	2601 (50)	2527 (50)	2465 (49)	2789 (56)
Black	483 (9)	1217 (24)	2018 (40)	2965 (60)
Men	1904 (37)	1985 (39)	2280 (45)	2709 (54)
Residence in the Southeast	2490 (48)	2752 (54)	2971 (59)	3197 (64)
College graduate	2621 (51)	2138 (42)	1720 (34)	1233 (25)
Income <$20 000	424 (8)	617 (12)	858 (17)	1165 (23)
Current smoker	411 (8)	548 (11)	736 (15)	1020 (20)
Obese (BMI≥30 kg/m^2)	1362 (26)	1690 (33)	1937 (39)	2350 (47)
Sedentary (>4 h of TV per day)	414 (8)	541 (11)	665 (13)	851 (17)
Alcohol/salads				
Age <65 y	2240 (45)	2507 (50)	2677 (52)	2958 (57)
Black	2456 (50)	1904 (38)	1338 (26)	985 (19)
Men	1777 (36)	2006 (40)	2404 (47)	2691 (52)
Residence in the Southeast	2903 (59)	2976 (59)	2887 (56)	2644 (51)
College graduate	1417 (29)	1704 (34)	2051 (40)	2540 (49)
Income <$20 000	1228 (25)	822 (16)	603 (12)	411 (8)
Current smoker	545 (11)	652 (13)	748 (15)	770 (15)
Obese (BMI≥30 kg/m^2)	1841 (37)	1856 (37)	1811 (35)	1831 (35)
Sedentary (>4 h of TV per day)	720 (15)	670 (13)	555 (11)	526 (10)

BMI indicates body mass index; and TV, television.

Table 2. Risk of Stroke by Quartile of Dietary Pattern in the REasons for Geographic and Racial Differences in Stroke (REGARDS) Study

	Q1	Q2	Q3	Q4	P_{trend}
Convenience					
n strokes/n total	144/4981	127/5082	116/5106	103/5082	…
Model 1	Ref	0.97 (0.76, 1.24)	0.93 (0.72, 1.19)	0.98 (0.75, 1.27)	0.75
Model 2	Ref	0.98 (0.77, 1.25)	0.95 (0.74, 1.22)	0.99 (0.76, 1.30)	0.67
Model 3	Ref	0.99 (0.78, 1.26)	0.97 (0.75, 1.25)	1.08 (0.81, 1.45)	0.72
Model 4	Ref	0.97 (0.76, 1.24)	0.96 (0.75, 1.25)	1.09 (0.82, 1.46)	0.69
		0.97 (0.76, 1.24)	0.93 (0.72, 1.19)	0.98 (0.75, 1.27)	
Plant based					
n strokes/n total	135/5056	122/5033	111/5086	122/5076	…
Model 1	Ref	0.74 (0.58, 0.95)	0.65 (0.50, 0.83)	0.71 (0.56, 0.91)	0.005
Model 2	Ref	0.76 (0.59, 0.97)	0.67 (0.52, 0.87)	0.75 (0.58, 0.96)	0.02
Model 3	Ref	0.76 (0.60, 0.98)	0.68 (0.52, 0.88)	0.78 (0.59, 1.02)	0.04
Model 4	Ref	0.80 (0.62, 1.02)	0.74 (0.57, 0.96)	0.85 (0.65, 1.12)	0.20
Sweets/fats					
n strokes/n total	125/5076	136/5043	126/5065	103/5067	…
Model 1	Ref	1.01 (0.79, 1.30)	0.93 (0.73, 1.20)	0.80 (0.61, 1.04)	0.03
Model 2	Ref	1.00 (0.78, 1.28)	0.91 (0.71, 1.17)	0.75 (0.58, 0.98)	0.07
Model 3	Ref	1.00 (0.78, 1.27)	0.90 (0.70, 1.18)	0.74 (0.54, 1.02)	0.05
Model 4	Ref	0.99 (0.78, 1.27)	0.88 (0.68, 1.14)	0.72 (0.53, 0.99)	0.04
Southern					
n strokes/n total	109/5156	107/5101	136/5017	138/4977	…
Model 1	Ref	0.98 (0.75, 1.28)	1.22 (0.94, 1.59)	1.39 (1.05, 1.84)	0.009
Model 2	Ref	0.96 (0.73, 1.25)	1.15 (0.89, 1.51)	1.27 (0.96, 1.70)	0.05
Model 3	Ref	0.93 (0.71, 1.22)	1.15 (0.88, 1.50)	1.37 (1.02, 1.84)	0.04
Model 4	Ref	0.93 (0.71, 1.22)	1.12 (0.86, 1.47)	1.30 (0.97, 1.76)	0.05
Alcohol/salads					
n strokes/n total	142/4943	121/5019	122/5119	105/5170	…
Model 1	Ref	0.91 (0.72, 1.17)	0.96 (0.75, 1.24)	0.86 (0.66, 1.12)	0.37
Model 2	Ref	0.93 (0.73, 1.19)	1.00 (0.78, 1.29)	0.94 (0.72, 1.23)	0.79
Model 3	Ref	0.93 (0.73, 1.19)	1.01 (0.79, 1.30)	0.97 (0.74, 1.27)	0.96
Model 4	Ref	0.91 (0.71, 1.17)	0.97 (0.75, 1.24)	0.93 (0.71, 1.23)	0.71

Model 1 adjusts for age, race, region, sex, and age–race interaction; model 2 adds income and education to the above; model 3 adds total energy to the above; model 4 adds smoking and sedentary behavior (watching >4 h of television per day) to the above.

terms of cardiovascular health.[37] It is possible that adherence to a pattern, such as this is associated with an increased risk of cancer or heart disease that might lead to death before a stroke, could occur.[38,39] As additional data are collected, future studies of these data are needed to the mechanism behind the observed protective effect.

REGARDS is a large national sample of black and white Americans in the United States with excellent ascertainment of stroke outcomes and provides a unique opportunity to examine dietary components as stroke risk factors. Because the group used in this analysis is a subsample of the full REGARDS population, selection bias needs to be considered. The hazard ratios were not significantly different for known stroke risk factors in the dietary subsample and the full REGARDS sample. This would indicate that any bias introduced in the sample does not alter conclusions on risk of stroke in the dietary subsample. This limitation is further overcome in that there were >20 000 participants from 48 states available for analysis.

Examining dietary patterns as the main exposure may be accounting for cultural or social practices that influence stroke risk from a young age. Previous studies have indicated that birth in the Southeast is associated with a greater risk of stroke than birth outside the Southeast.[4] It is possible that diet is modeled from birth and from practices observed during childhood. Additionally, dietary patterns associated with cultural foodways are more likely to persist in the region where they originated and become less likely to persist as individuals or groups migrate from a region.[40] Future studies examining the complex interactions between region of residence, migration, and dietary pattern adherence will help tease out these cultural–diet interactions.

Dietary patterns explain some of the racial disparity in stroke risk observed in the United States. Additional analyses are needed with these patterns to determine how they are associated with other outcomes, such as cardiovascular disease and cancer, and to determine to what degree dietary patterns are inherited from childhood. Data from this and future studies would help identify culturally specific interventions in diet that would help reduce racial and geographic disparities in stroke risk.

Appendix

Final Factor Loadings Derived in the Entire REasons for Geographic and Racial Differences in Stroke (REGARDS) Population (Showing Only Those With Absolute Value >0.15 for Simplicity)

	Convenience	Healthy	Sweets/ Fats	Southern	Alcohol/ Salads
100% fruit juice	…	0.25	…	0.17	−0.17
Added fats	…	…	0.40	0.38	0.25
Beans	0.36	0.38	…	…	…
Beer	…	−0.16	…	…	0.23
Bread	…	…	0.47	0.37	…
Bread: whole grain	…	0.30	0.18	…	…
Butter	…		0.17	…	0.32
Candy	…	…	0.40	…	…
Cereal	…	0.38	…	…	−0.20
Cereal: high fiber	…	0.24	…	−0.25	…
Chinese food	0.44	…	…	…	…
Chocolate	…	…	0.46	…	…
Coffee	…	…	0.22	−0.16	0.30
Condiments	0.25	…	0.31	…	0.29
Desserts	0.20	…	0.53	…	−0.17
Eggs and egg dishes	…	…	…	0.42	0.29
Fish	0.27	0.38	…	…	0.21
Fried food	0.24	…	…	0.56	…
Fried potatoes	0.37	…	0.28	0.16	…
Fruit	…	0.58	…	…	…
High-fat dairy	0.18	…	0.37	…	0.21
Liquor	…	…	…	…	0.31
Low-fat dairy	…	0.20	…	−0.19	…
Margarine	…	…	0.37	…	…
Mexican dishes	0.48	…	…	…	…
Milk alternatives	…	0.18	…	…	…
Milk: high fat	…	…	0.18	0.24	…
Milk: low fat	…	0.16	…	−0.42	…
Miscellaneous sugar	…	…	0.54	0.19	…
Mixed dishes with meat	0.61	…	…	…	…
Organ meat	0.17	…	…	0.47	…
Pasta dishes	0.59	…	0.17	…	…
Pizza	0.45	−0.18	0.20	…	…
Potatoes	0.36	…	0.26	…	…
Poultry	0.29	0.31	…	…	…
Processed meats	0.25	…	0.26	0.45	0.22
Red meat	0.45	…	0.18	0.26	0.26
Refined grains	0.31	0.17	0.20	0.20	
Salad dressing/sauces	…	0.30	…	…	0.55
Salty snacks	0.32	…	0.30	…	…
Seeds, nuts	…	0.26	0.19	…	0.19
Shell fish	0.28	…	…	0.23	0.24
Soda	…	−0.23	…	0.24	…
Soup	0.44	0.32	…	…	
Sugar-sweetened beverages	…	…	…	0.37	−0.15
Sweet breakfast foods	0.19	…	0.39	…	…
Tea	…	…	0.31	…	…
Vegetable	…	…	…	…	…
Cruciferous	…	0.59	…	…	…
Dark yellow	…	0.41	…	…	−0.17
Green leafy	0.16	0.49	…	−0.22	0.48
Other	…	0.48	…	…	…
Tomato	…	0.32	…	…	0.27
Mixed dishes	0.35	0.31	…	…	−0.25
Water	…	0.32	…	…	…
Wine	…	…	…	…	0.36
Yogurt	…	0.31	…	−0.25	…

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Disclosures

None.

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