Published in final edited form as:

J Am Geriatr Soc. 2017 January ; 65(1): 83–90. doi:10.1111/jgs.14472.

Racial Differences in the Incidence of Cardiovascular Risk Factors in Older Black and White Adults

George Howard, DrPH¹, Monika M. Safford, MD², Claudia S. Moy, PhD³, Virginia J. Howard, PhD⁴, Dawn O. Kleindorfer, MD⁵, Fredrick W. Unverzagt, PhD⁶, Elsayed Z. Soliman, MD⁷, Matthew L. Flaherty, MD⁵, Leslie A. McClure, PhD⁸, Daniel T. Lackland, DrPH⁹, Virginia G. Wadley, PhD¹⁰, LeaVonne Pulley, PhD¹¹, and Mary Cushman, MD¹²

¹Department of Biostatistics, UAB School of Public Health, Birmingham, AL

²Division of General Internal Medicine, Weill Cornell Medical College, New York, NY

³NINDS, Bethesda, MD

⁴Department of Epidemiology, UAB School of Public Health, Birmingham, AL

⁵Department of Neurology, University of Cincinnati, Cincinnati, OH

⁶Department of Psychology, Indiana University, Indianapolis, IN

⁷Department of Epidemiology, Wake Forest University School of Medicine, Winston-Salem, NC

⁸Department of Epidemiology and Biostatistics, Drexel University School of Public Health, Philadelphia, PA

⁹Department of Neurosciences, Medical University of South Carolina, Charleston, SC

¹⁰Department of Gerontology, Geriatrics and Palliative Care, UAB School of Medicine, Birmingham, AL

¹¹Department of Health Behavior and Health Education, University of Arkansas for Medical Sciences, Little Rock, AR

¹²Department of Medicine, University of Vermont School of Medicine, Burlington, VT

Abstract

Background/Objectives—Few reports describe the incidence of cardiovascular risk factors, or race-related disparities in incidence, across the age spectrum in adults.

Corresponding Author: George Howard, DrPH; Professor; Department of Biostatistics; UAB School of Public Health; 1665 University Blvd; Birmingham, AL. Phone: 205-910-7081. Preferred ghoward@uab.edu.

Disclosures

Dr. Flaherty discloses: 1) participation on speaker's bureau, CSL Behring and Janssen, 2) Principal Investigator, phase II NINDS funded ICH study (STOP-IT Study), study drug supplied by Novo Nordisk, 3) co-founder, SENSE Diagnostics, LLC. A biotech start-up working on a non-invasive CNS sensor.

Author Contributions:

George Howard had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Drs. Safford, Moy, Virginia Howard, Kleindorfer, Unverzagt, Soliman, Flaherty, McClure, Lackland, Wadley, Pulley, and Cushman all played a critical role in the design of the study, the collection of the data, the development of the concept for the manuscript, and provided critical edits in the manuscript's development.

Design—Longitudinal cohort.

Setting—National sample.

Participants—Community-dwelling black and white population, recruited between 2003 and 2007.

Measurements—Incident hypertension, diabetes, dyslipidemia and atrial fibrillation over 10 years of follow-up in 10,801 adults, stratified by age as 45–54, 55–64, 65–74 or 75+ years.

Results—There was no evidence ($p = 0.68$) of an age-related difference in the incidence of hypertension for white men (average incidence of 38%), black men (48%), and black women (54%); however for white women incidence increased with age (27% for ages 45–54, to 40% ages 75+). Incidence of diabetes was lower at older ages for white men (15% for ages 45–54, to 8% for 75+), black men (29% age 45–54, to 13% for 75+), and white females (11% for 45–54, to 4% for 75+); however, there was no evidence ($p = 0.11$) of age-related changes for black women (average incidence 21%). For dyslipidemia, incidence for all race-sex groups was approximately 20% for ages 45–54, but was approximately 30% for ages 54–64 and 65–74, and approximately 22% for ages 75+. Incidence of atrial fibrillation was low at ages 45–54 (<5%), but by age 75+ was approximately 20% for whites and 11% for blacks. The incidence of hypertension, diabetes and dyslipidemia was higher in blacks across the age spectrum, but lower for atrial fibrillation.

Conclusion—Incidence of risk factors remains high in older adults. Blacks have a higher incidence of hypertension, diabetes, and dyslipidemia after age 45, underscoring the ongoing importance of prevention of all three conditions in mid- to later-life.

Introduction

American blacks have a high prevalence of many of the most potent cardiovascular disease (CVD) risk factors, particularly hypertension and diabetes,^{1, 2} which has been suggested as a major contributor to the higher risk of CVD disease in blacks. In the Multiple Risk Factor Intervention Trial (MRFIT), 34% of the black-white disparity in CVD risk was explained by disparities in the prevalence of risk factors.³ More recently, the REasons for Geographic And Racial Differences in Stroke (REGARDS) study reported that approximately 40% of the disparity in incident stroke was attributable to the prevalence of “traditional” risk factors and uncontrolled blood pressure.⁴ In addition, blacks have twice the risk of acute death from coronary heart disease, a risk almost entirely attributable to higher prevalence of risk factors in blacks.⁵

Strategies for CVD prevention include primordial prevention of the development of CVD risk factors, primary prevention to control risk factors once developed, and secondary prevention to prevent recurrence after CVD events.^{6–9} It has long been recognized that blacks have a much younger onset of risk factors.^{10, 11} Primordial prevention efforts are traditionally being targeted at younger populations,^{6, 12–15} and much of the clinical attention naturally shifting to control of prevalent risk factors at older ages. While some falsely consider primordial risk factor prevention as an effort to be targeted only at the young, both those promoting the value of primordial prevention^{6–9} and the recently passed Patient Protection and Affordable Care Act (PPACA) consider risk factor prevention as a “life

course” effort. While the incidence of risk factors continues in older age groups, there are few contemporary data on the incidence of CVD risk factors in older black and white adults.^{16–18} The primary objective of this study was to quantify the incidence of, and contrast the black-white differences in, CVD risk factors in older adults including hypertension, diabetes, hyperlipidemia, and atrial fibrillation.

Methods

The REGARDS study recruited 30,239 community-dwelling participants between January 2003 and October 2007. Participants were selected from commercial lists and recruited through a combination of mail and telephone contact. Because of a focus on geographic and racial disparities in stroke mortality, blacks were oversampled (44%) as were residents of the southeastern US stroke belt states (56%). The stroke belt states were defined as North Carolina, South Carolina, Georgia, Tennessee, Alabama, Mississippi, Arkansas, and Louisiana; with the remaining 44% of the participants selected from the remaining 40 contiguous US states. Eligibility criteria includes non-Hispanic black or white race, age of 45 or greater (no upper age limit), absence of conditions associated with a life-expectancy of less than 5 years, and not being in or on a waiting list for nursing home care. Participation rate was estimated as 33%, similar to other studies. For those agreeing to participate, the telephone staff conducted an interview to assess CVD risk factors and medical history. The interview was followed by an in-person assessment for direct measurement of risk factors (blood pressure, anthropometrics, and electrocardiogram) and collection of blood and urine samples. Participants were followed at 6-month intervals to detect suspected cardiovascular events. Details of the study design are provided elsewhere.¹⁹

Starting in April of 2013, participants were invited to undergo a second in-person risk factor assessment using a similar protocol approximately 10 years after the baseline. Through April 2015, 17,187 participants were invited and 14,983 (87%) telephone-administered risk factor assessments were completed, with 2045 (12%) participants declining participation in the second assessment. Of the 14,983 participants who agreed to participate, 10,801 (72%) in-person assessments have been performed. All participants provided signed informed consent at baseline and follow-up visits. The study was approved by institutional review boards of all participating universities.

We assessed incidence of hypertension, diabetes, dyslipidemia and atrial fibrillation as they are each major risk factors for heart disease or stroke, but are not associated with a high short-term mortality so that participants with an incident condition would be likely to survive for reassessment of risk factors. Hypertension, diabetes and dyslipidemia are well-established risk factors for heart disease,¹ with recent evidence that atrial fibrillation is also an important risk factor for incident heart disease.²⁰ Hypertension, diabetes and atrial fibrillation are also major risk factors for stroke.²¹ Dyslipidemia is a major risk factor for heart disease.¹ With the focus on incident risk factors, participants with prevalent heart disease and stroke were included in the analysis as they are also at risk for developing new incident risk factors. Each of the CVD risk factors was defined identically at baseline and follow-up. Blood pressure was determined as the mean of two blood pressures taken after 5-minutes of seated rest, and hypertension was defined as a systolic blood pressure of 140

mmHg, diastolic blood pressure of ≥ 90 mmHg, or self-reported current use of anti-hypertensive medication. Diabetes was defined as fasting plasma glucose of ≥ 126 mg/dL (or ≥ 200 mg/dL for those who did not fast), or self-report of current use of medications for glucose control. Dyslipidemia was defined as fasting total cholesterol of ≥ 240 mg/dL, fasting LDL of ≥ 160 mg/dL, fasting HDL of ≤ 40 mg/dL or less, or self-reported current use of lipid lowering medications. Atrial fibrillation was defined by ECG evidence or participant self-report of a physician diagnosis.²²

Poisson regression was used to calculate age-race-sex specific incidence rates (proportion of those risk-factor-free at baseline with the risk factor present at follow-up) and black-white incidence ratios. Age was considered in strata of 45–54 years, 55–64 years, 65–74 years and 75 years and older at baseline. Estimates were provided separately for men and women. Age-by-race interaction terms were calculated and considered significant at $\alpha = 0.10$.

Results

The description of the population is provided in Table 1. The median time between in-person assessments was 9.5 years (interdecile range: 8.4 to 10.0 years).

Over follow-up, 2,278 of 5,537 or 41% (95% CI: 40% – 42%) of the participants who were normotensive at baseline developed hypertension. Figure 1A shows little age-related difference in the incidence of hypertension for white men, black men or black women ($p = 0.68$), with an average (across age strata) incidence of 38% (95% CI: 36% – 40%), 48% (95% CI: 43% – 52%) and 54% (95% CI: 51% – 59%) respectively. In contrast, the incidence of hypertension in white women was 27% (95% CI: 23% – 33%) for ages 45–54, and was 40% (95% CI: 33% – 48%) for age 75+. Figure 1B shows that risk of incident hypertension was 1.24-fold (95% CI: 1.12 – 1.37) greater in black than white men, with no age-related differences ($p = 0.98$). By contrast, the increasing incidence in white women contributed to an age difference in the black-to-white risk of incident hypertension ($p = 0.08$). Black women aged 45–54 had a 1.93-fold (95% CI: 1.55 – 2.41) higher risk of incident hypertension, diminishing to a 1.18-fold (95% CI: 0.84 – 1.65) higher risk at age 75+.

Among the 8,806 participants without baseline diabetes, 1,279 or 15% (95% CI: 14% – 15%) developed diabetes. Figure 2A shows a relatively constant age-related decline in incident diabetes, with incidence rates at ages 45–54 of approximately 25% in blacks and 14% in whites, and above age 75 rates of 14% in blacks and 9% in whites. As shown in Figure 2B, there was no evidence of an age-related change in the black-to-white relative risk of incident diabetes for either men ($p = 0.64$) or women ($p = 0.11$). Overall, black men were 1.52-times (95% CI: 1.31 – 1.78) more likely, and black women were 2.14-times (95% CI: 1.86 – 2.46) more likely to develop diabetes than their white counterparts.

Among the 9,764 participants who were normolipidemic at baseline, 2,740 or 28% (95% CI: 27% – 29%) became dyslipidemic during follow-up. Figure 3B showed that for all four race-sex groups, the incidence of dyslipidemia was higher for those aged 55–64 and 65–74, (approximately 30%) than for those aged 45–54 or aged 75+ (approximately 20% and 22%

respectively). For men, the black-white relative risk of dyslipidemia increased with age ($p = 0.0975$) from 1.15 (95% CI: 0.82 – 1.61) for ages 45–54 to 1.26 (95% CI: 0.82 – 1.96) (Figure 3B). Likewise, the black-to-white relative risk of incident dyslipidemia increased steadily with age among women, from 0.97 (95% CI: 0.77 – 1.22) at ages 45–54, up to 1.39 (95% CI: 1.00 – 1.95) at ages 75+.

Of 10,677 participants without atrial fibrillation at baseline, 996 or 9% (95% CI: 9%–10%) developed atrial fibrillation during follow-up. There was an increasing incidence of atrial fibrillation at older ages in all four race-sex groups ($p < 0.01$), with incidences of only 2% to 6% at ages 44–54, and incidences of approximately 11% in blacks and 20% in whites at ages 75+ (Figure 4A). There was no evidence of an age-related difference in the likelihood of incident atrial fibrillation for either men ($p = 0.29$) or women ($p = 0.74$), with the risk of incident atrial fibrillation substantially lower for black men (RR = 0.51; 95% CI: 0.42 – 0.63) and black women (RR = 0.57; 95% CI: 0.47 – 0.70) compared to whites (Figure 4B).

Discussion

Older adults remain at a high risk for incident cardiovascular risk factors. Across the age-strata from 45–54 to 75+ there were stable (for white men, black men or black women) or increasing (for white women) incidence rates for hypertension. Likewise, incidence rates increased for all race-sex strata, albeit more rapidly for whites than blacks. These data suggest that the clinical management to prevent the develop of hypertension and atrial fibrillation should continue into the oldest age groups. In contrast, incidence of diabetes decreased with increasing age; however, even above age 75 the incidence of diabetes over a 10-year follow-up period was 15% in black men and 11% in black women (compared to 10% and 8% in white men and women). Hence, even at the oldest ages there is substantial risk of the development of diabetes, particularly for blacks. The incidence of dyslipidemia was lower for those age 45–54 (approximately 20%) than for those aged 54–64 or 65–74 (approximately 30%); however, this incidence decreased to “only” 22% for those aged 75+. The reasons for this increasing-then-decreasing pattern for dyslipidemia incidence are not known, but could be selective mortality in the oldest age group for those with dyslipidemia. However, for any of the age strata there was a at least a one-in-five risk of the development of dyslipidemia. In summary, the risk of the development of new risk factors remain high, even among those in the oldest age strata.

In addition to providing a description of the incidence rates, these data provide insights to the racial disparities in incidence or risk factors. We previously demonstrated that as much as 40% of the black-white differences in stroke risk can be attributed to the higher prevalence and severity of “traditional” risk factors in blacks.⁴ A higher prevalence of risk factors in blacks is likely dependent on a higher incidence in blacks. In this analysis we found large racial disparities in incident hypertension, diabetes and dyslipidemia extending into the oldest age strata of participants. Disparities in onset of new risk factors were greatest for hypertension and diabetes in women. Findings suggest that aggressive primordial prevention efforts may be warranted even older adults, and that interventions specifically targeted at black Americans, especially women, are needed. The goal of this paper was to provide a broad overview of black-white differences in the incidence a spectrum of risk

factors, with a detailed analysis of contributors to individual risk factors in subsequent reports (i.e., the “risk factors for the incident risk factors”).

Hypertension is one of the most potent risk factors for both stroke and heart disease, present in over 50% of adult whites and over 70% of adult blacks.^{10, 23} These disparities in prevalence are a large contributor to the racial disparities in CVD.^{3, 4} While it is appropriate to focus on blood pressure control, the data reported herein suggest: 1) the high incidence of hypertension extend into the oldest age strata (with increasing risk of incident hypertension at older ages in white women), 2) a 24% higher incidence in black than white men, and 3) an age-related interaction in women, where for ages 45–54 black women had a 93% higher risk than white women. Collectively, these findings imply both a substantial increase in the burden of prevalent hypertension, and an ever-growing magnitude in the racial disparity in this prevalence. Preventing the development of hypertension is critical to risk reduction, as even with ideal blood pressure control there is a substantial increased risk of stroke.²⁴ Hence, while the importance of controlling blood pressure levels of hypertensive individuals cannot be discounted, our findings show that primordial prevention is essential throughout the age span, including among the oldest-old.

Largely because the risk of incident hypertension increases with age in white women, we showed here that among women there was a declining black-to-white relative risk of incident hypertension with increasing age ($p = 0.09$), but with the disparity still significant for ages 65–74. This declining pattern in women is consistent with previous reports that suggested that the magnitude of the black-white disparity in the incidence of hypertension may be smaller at older ages. Data from the National Health and Nutrition Examination Survey I Epidemiological Follow-up Study (NHEFS) showed the black-to-white incidence ratio for incident hypertension approximately a decade later was 2.3 for men and 2.8 for women aged 25–34 years, 1.5 for men and 1.8 for women aged 35–54 years, and only 1.10 for men and 1.00 for women over 55 years.¹⁶ Likewise, the Multiethnic Study of Atherosclerosis reported that the sex-adjusted black-to-white relative risk of incident hypertension declined from approximately 3.0 at age 45 down to 1.5 at age 70, but then fell rapidly so that there was no disparity by age 80.²⁵ By contrast, data from REGARDS showed a consistent black-to-white relative risk of incident hypertension in men across age strata with no evidence of a decline. Taken together, these studies support that primordial prevention of hypertension is essential for women at least through ages 65–74, and in men of all ages.

The black-to-white disparity in incident diabetes was substantially larger than that for hypertension, with black men having a 52% higher risk and black women a 114% higher risk than whites. Unlike hypertension, this disparity was consistent across age groups. Underlying this consistent black-to-white relative risk of diabetes was a consistent pattern of falling incidence of diabetes with increasing age in all four race-sex strata. Hence while the lower incidence of diabetes in the elderly may imply that primordial prevention of diabetes may be less important in the elderly, the relatively constant black-to-white relative risk of incident diabetes implies a relatively constant impact on the black-white disparity across the age spectrum.

Several previous reports have documented the higher incidence of diabetes in adults for blacks. Data from the Nurses' Health Study showed a black-to-white 20-year age-adjusted relative risk of incident diabetes identical to that observed here at 2.18 (95% CI: 1.82 – 2.61).²⁶ Estimates from Center for Medicare/Medicaid Services (CMS) administrative data show a black-to-white relative risk of incident diabetes ranging from 1.52 to 1.60 between 1994 and 2001.²⁷ To our knowledge, only the NHEFS has provided age-specific estimates of the incidence of diabetes, and similar to our findings, they showed a lack of age-related differences. Collectively, these data suggest that for both men and women there is no upper age above which a focus on primordial prevention is not important to reduce the racial disparities in diabetes.

We showed racial disparities in the risk of incident dyslipidemia were modest compared to hypertension and diabetes, but an increasing pattern with age for both men and women. We could find no studies on the racial disparities in the incidence of dyslipidemia, and papers on disparities in the prevalence are sparse. Specifically, there were only minor black-white disparities in LDL of 160 and higher in either NHANES III (29.1% versus 26.3% respectively) or NHANES 1999–2004 (24.3% versus 25.8% respectively).²⁸ In the Multiethnic Study of Atherosclerosis (MESA)²⁹ and Kaiser Permanente of Northern California showed little evidence of disparities in the prevalence of lipids.³⁰ Further, the approaches for primordial prevention of dyslipidemia in adults is sparse, and an area requiring further development. Nevertheless, these results suggest that efforts focused on primordial prevention of incident dyslipidemia for all adult men, and for older adult women (ages 55+), could result in some reduction in the racial disparity in CVD mortality.

Our findings for incident atrial fibrillation by race were similar to the sparse literature on black-white differences in prevalence. We extend existing findings by reporting age differences in incidence by race, a topic not previously reported to our knowledge. A meta-analysis of 9 studies estimated that the odds of prevalent atrial fibrillation was 49% less in blacks than whites,³¹ and we could identify only one report that presented the hazard of incident atrial fibrillation in a population aged 65+, reporting a black-white HR of 0.47 (95% CI: 0.22 – 1.01).³² Our findings are consistent with this literature, finding a 49% lower incidence of atrial fibrillation in black compared to white men, and a 41% lower risk in black than white women, with no evidence of an age-related difference in these risks. These relatively constant racial disparities were a product of steadily increasing incidence of atrial fibrillation with age in all four race-sex groups. While the incidence of atrial fibrillation was relatively small, still approximately 10% of the population developed the condition, underscoring the need to consider primordial prevention. The paradox of lower rates of atrial fibrillation in blacks, despite blacks having more risk factors for the development of atrial fibrillation, remains.^{33–36}

Limitations of this analysis require consideration. There are no clinical trial data documenting that better prevention of risk factors in the blacks will reduce disparities in cardiovascular events; however, strong epidemiological data suggests that incident disease would be reduced if the population prevalence of risk factors in blacks were smaller. We did not consider all major CVD risk factors in this report. Smoking is one of the most powerful risk factors for CVD, but was not included since smoking initiation beyond age 30 is

uncommon.³⁷ Like all other reports of incident risk factors discussed herein, a weakness of this report is that bias might emanate from exclusion of participants who died or became too ill to participate in the second assessment. These non-participants would have most likely had higher rates of incident risk factors, so estimates of incidence are likely underestimated. Unless this effect was differential by race, it would not alter estimates of racial disparities in incidence. We hope that we have minimized this shortcoming by limiting our assessment to risk factors with relatively low short-term mortality/morbidity. Importantly, there were participants with prevalent risk factors at baseline who were classified as risk-factor-free at follow-up; however, this represented only a small group for hypertension and diabetes, but a larger group for dyslipidemia and atrial fibrillation (data not shown). It is possible that participants who become risk-factor-free have controlled their conditions through lifestyle changes such as diet, weight-loss or physical activity; however, it is also possible that these changes resulted from mis-reporting of medication use at either baseline or follow-up. Finally, the factors contributing to a higher risk of hypertension, diabetes, dyslipidemia and atrial fibrillation likely differ, and it is also possible that there are geographic differences confounding the likelihood of incident risk factors.³⁸ As such, a thorough assessment of the “risk factors for these risk factors” is beyond the scope of this work, and will be addressed in subsequent publications.

There are several strengths of this report. Clearly the greatest strength is the sizable study population, the high follow-up rates of the cohort, and the number of years between baseline and the second assessment. We used appropriate and consistent methods to assess risk factors at the two visits.

In conclusion, we described a high incidence of CVD risk factors over 9.5 years of follow-up in individuals aged 45+, finding that older adults remain at high risk of incident CVD risk factors. With the exception of incident atrial fibrillation, this incidence was higher among blacks than whites. This study supports aggressive primordial prevention efforts for all cardiovascular risk factors in middle-aged and older adults, especially for black Americans. These data suggest that to reduce the black-white disparities in cardiovascular disease, we need to begin to think of primordial prevention of risk factors as not just an activity for the young, but rather extending into the oldest-old age stratum. We look forward to the efforts already underway to assess the contributors to the racial disparity in hypertension, diabetes, and dyslipidemia.

Acknowledgments

The authors thank the investigators, staff, and participants of the REGARDS study for their valuable contributions. A full list of participating REGARDS investigators and institutions can be found at <http://www.regardsstudy.org>.

George Howard had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Drs. Safford, Moy, Virginia Howard, Kleindorfer, Unverzagt, Soliman, Flaherty, McClure, Lackland, Wadley, Pulley, and Cushman all played a critical role in the design of the study, the collection of the data, the development of the concept for the manuscript, and provided critical edits in the manuscript's development.

Funding Sources

This research project was supported by cooperative agreement U01-NS041588 from the National Institute of Neurological Disorders and Stroke, NIH.

All authors with the exception of Dr. Moy have salary support from the REGARDS study.

Sponsor's Role:

As a representative of the funding agency, Dr. Moy has served as a voting member of the Executive Committee. In this role, she has contributed to the design of the study and methods, provided oversight of the recruitment process and data collection, and participated in the preparation of the paper. The contents of the paper reflect the views of the authors, and not that of NINDS

Conflict of Interest Disclosures:

Elements of Financial/Personal Conflicts	*Author 1 GH		Author 2 MMS		Author 3 CSM		Author 4 VJH	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation	X		X			X	X	
Grants/Funds	X		X			X	X	
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X		X		X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X		X
Patents		X		X		X		X
Personal Relationship		X		X		X		X

Elements of Financial/Personal Conflicts	*Author 5 DOK		Author 6 FWU		Author 7 EVS		Author 8 MLF	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation	X		X		X		X	
Grants/Funds	X		X		X		X	
Honoraria		X		X		X		X
Speaker Forum		X		X		X	X	
Consultant		X		X		X		X
Stocks		X		X		X	X	
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X		X
Patents		X				X	X	
Personal Relationship		X				X		X

Elements of Financial/Personal Conflicts	*Author 9 LAM		Author 10 DTL		Author 11 VGW		Author 12 LP	
	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation	X		X		X		X	
Grants/Funds	X		X		X		X	

Elements of Financial/Personal Conflicts	* Author 9 LAM		Author 10 DTL		Author 11 VGW		Author 12 LP	
	Yes	No	Yes	No	Yes	No	Yes	No
Honoraria		X		X		X		X
Speaker Forum		X		X		X		X
Consultant		X		X		X		X
Stocks		X		X		X		X
Royalties		X		X		X		X
Expert Testimony		X		X		X		X
Board Member		X		X		X		X
Patents		X		X		X		X
Personal Relationship		X		X		X		X

Elements of Financial/Personal Conflicts	* Author 13 MC	
	Yes	No
Employment or Affiliation	X	
Grants/Funds	X	
Honoraria		X
Speaker Forum		X
Consultant		X
Stocks		X
Royalties		X
Expert Testimony		X
Board Member		X
Patents		X
Personal Relationship		X

* Authors can be listed by abbreviations of their names.

For all “Yes” responses, provide a brief explanation here:

All authors receive salary support and are investigators in the REasons for Geographic And Racial Differences in Stroke (REGARDS). Dr. Safford also report salary support from investigator initiated research from Amgen. Dr. Flaherty discloses: 1) participation on speaker's bureau, CSL Behring and Janssen, 2) Principal Investigator, phase II NINDS funded ICH study (STOP-IT Study), study drug supplied by Novo Nordisk, 3) co-founder, SENSE Diagnostics, LLC. A biotech start-up working on a non-invasive CNS sensor.

References

1. Mozaffarian D, Benjamin EJ, Go AS, et al. Heart disease and stroke statistics--2015 update: A report from the American Heart Association. *Circulation*. 2015; 131:e29–e322. [PubMed: 25520374]
2. Cooper RS, Wolf-Maier K, Luke A, et al. An international comparative study of blood pressure in populations of European vs. African descent. *BMC Med*. 2005; 3:2. [PubMed: 15629061]
3. Thomas AJ, Eberly LE, Davey Smith G, et al. Race/ethnicity, income, major risk factors, and cardiovascular disease mortality. *Am J Public Health*. 2005; 95:1417–1423. [PubMed: 16006418]

4. Howard G, Cushman M, Kissela BM, et al. Traditional risk factors as the underlying cause of racial disparities in stroke: Lessons from the half-full (empty?) glass. *Stroke*. 2011; 42:3369–3375. [PubMed: 21960581]
5. Safford MM, Brown TM, Muntner PM, et al. Association of race and sex with risk of incident acute coronary heart disease events. *JAMA*. 2012; 308:1768–1774. [PubMed: 23117777]
6. Weintraub WS, Daniels SR, Burke LE, et al. Value of primordial and primary prevention for cardiovascular disease: A policy statement from the american heart association. *Circulation*. 2011; 124:967–990. [PubMed: 21788592]
7. Proceedings from the international symposium on primordial prevention of cardiovascular disease risk factors. International symposium honoring the career and research of henry blackburn, m.D. *Prev Med*. 1999; 29:S1–S135. [PubMed: 10712136]
8. Stamler J, Fortmann SP, Levy RI, et al. Primordial prevention of cardiovascular disease risk factors: Panel summary. *Prev Med*. 1999; 29:S130–S135. [PubMed: 10641831]
9. Labarthe DR. Prevention of cardiovascular risk factors in the first place. *Prev Med*. 1999; 29:S72–S78. [PubMed: 10641821]
10. Wolz M, Cutler J, Roccella EJ, et al. Statement from the national high blood pressure education program: Prevalence of hypertension. *Am J Hypertens*. 2000; 13:103–104. [PubMed: 10678279]
11. Burt VL, Whelton P, Roccella EJ, et al. Prevalence of hypertension in the us adult population. Results from the third national health and nutrition examination survey, 1988–1991. *Hypertension*. 1995; 25:305–313. [PubMed: 7875754]
12. Kumanyika SK, Obarzanek E, Stettler N, et al. Population-based prevention of obesity: The need for comprehensive promotion of healthful eating, physical activity, and energy balance: A scientific statement from american heart association council on epidemiology and prevention, interdisciplinary committee for prevention (formerly the expert panel on population and prevention science). *Circulation*. 2008; 118:428–464. [PubMed: 18591433]
13. Gidding SS, Dennison BA, Birch LL, et al. Dietary recommendations for children and adolescents: A guide for practitioners: Consensus statement from the american heart association. *Circulation*. 2005; 112:2061–2075. [PubMed: 16186441]
14. Hayman LL, Williams CL, Daniels SR, et al. Cardiovascular health promotion in the schools: A statement for health and education professionals and child health advocates from the committee on atherosclerosis, hypertension, and obesity in youth (ahoy) of the council on cardiovascular disease in the young, american heart association. *Circulation*. 2004; 110:2266–2275. [PubMed: 15477426]
15. Williams CL, Hayman LL, Daniels SR, et al. Cardiovascular health in childhood: A statement for health professionals from the committee on atherosclerosis, hypertension, and obesity in the young (ahoy) of the council on cardiovascular disease in the young, american heart association. *Circulation*. 2002; 106:143–160. [PubMed: 12093785]
16. Cornoni-Huntley J, LaCroix AZ, Havlik RJ. Race and sex differentials in the impact of hypertension in the united states. The national health and nutrition examination survey i epidemiologic follow-up study. *Arch Intern Med*. 1989; 149:780–788. [PubMed: 2784957]
17. He J, Klag MJ, Appel LJ, et al. Seven-year incidence of hypertension in a cohort of middle-aged african americans and whites. *Hypertension*. 1998; 31:1130–1135. [PubMed: 9576125]
18. Rywik SL, Williams OD, Pajak A, et al. Incidence and correlates of hypertension in the atherosclerosis risk in communities (aric) study and the monitoring trends and determinants of cardiovascular disease (pol-monica) project. *J Hypertens*. 2000; 18:999–1006. [PubMed: 10953989]
19. Howard VJ, Cushman M, Pulley L, et al. The reasons for geographic and racial differences in stroke study: Objectives and design. *Neuroepidemiology*. 2005; 25:135–143. [PubMed: 15990444]
20. Soliman EZ, Safford MM, Muntner P, et al. Atrial fibrillation and the risk of myocardial infarction. *JAMA Intern Med*. 2014; 174:107–114. [PubMed: 24190540]
21. Wolf PA, D'Agostino RB, Belanger AJ, et al. Probability of stroke: A risk profile from the framingham study. *Stroke*. 1991; 22:312–318. [PubMed: 2003301]
22. Soliman EZ, Howard G, Meschia JF, et al. Self-reported atrial fibrillation and risk of stroke in the reasons for geographic and racial differences in stroke (regards) study. *Stroke*. 2011; 42:2950–2953. [PubMed: 21817138]

23. Howard G, Prineas R, Moy C, et al. Racial and geographic differences in awareness, treatment, and control of hypertension: The reasons for geographic and racial differences in stroke study. *Stroke*. 2006; 37:1171–1178. [PubMed: 16556884]
24. Howard G, Banach M, Cushman M, et al. Is blood pressure control for stroke prevention the correct goal? The lost opportunity of preventing hypertension. *Stroke*. 2015; 46:1595–1600. [PubMed: 25953369]
25. Carson AP, Howard G, Burke GL, et al. Ethnic differences in hypertension incidence among middle-aged and older adults: The multi-ethnic study of atherosclerosis. *Hypertension*. 2011; 57:1101–1107. [PubMed: 21502561]
26. Shai I, Jiang R, Manson JE, et al. Ethnicity, obesity, and risk of type 2 diabetes in women: A 20-year follow-up study. *Diabetes Care*. 2006; 29:1585–1590. [PubMed: 16801583]
27. McBean AM, Li S, Gilbertson DT, et al. Differences in diabetes prevalence, incidence, and mortality among the elderly of four racial/ethnic groups: Whites, blacks, hispanics, and asians. *Diabetes Care*. 2004; 27:2317–2324. [PubMed: 15451894]
28. Hyre AD, Muntner P, Menke A, et al. Trends in atp-iii-defined high blood cholesterol prevalence, awareness, treatment and control among u.s. Adults. *Ann Epidemiol*. 2007; 17:548–555. [PubMed: 17395483]
29. Goff DC Jr, Bertoni AG, Kramer H, et al. Dyslipidemia prevalence, treatment, and control in the multi-ethnic study of atherosclerosis (mesa): Gender, ethnicity, and coronary artery calcium. *Circulation*. 2006; 113:647–656. [PubMed: 16461837]
30. Frank AT, Zhao B, Jose PO, et al. Racial/ethnic differences in dyslipidemia patterns. *Circulation*. 2014; 129:570–579. [PubMed: 24192801]
31. Hernandez MB, Asher CR, Hernandez AV, et al. African american race and prevalence of atrial fibrillation: A meta-analysis. *Cardiol Res Pract*. 2012; 2012:275624. [PubMed: 22548197]
32. Psaty BM, Manolio TA, Kuller LH, et al. Incidence of and risk factors for atrial fibrillation in older adults. *Circulation*. 1997; 96:2455–2461. [PubMed: 9337224]
33. Soliman EZ, Prineas RJ, Case LD, et al. Ethnic distribution of ecg predictors of atrial fibrillation and its impact on understanding the ethnic distribution of ischemic stroke in the atherosclerosis risk in communities (aric) study. *Stroke*. 2009; 40:1204–1211. [PubMed: 19213946]
34. Soliman EZ, Prineas RJ. The paradox of atrial fibrillation in african americans. *J Electrocardiol*. 2014; 47:804–808. [PubMed: 25112176]
35. Soliman EZ, Alonso A, Goff DC Jr. Atrial fibrillation and ethnicity: The known, the unknown and the paradox. *Future Cardiol*. 2009; 5:547–556. [PubMed: 19886781]
36. Kamel H, Okin PM, Longstreth WT Jr, et al. Atrial cardiopathy: A broadened concept of left atrial thromboembolism beyond atrial fibrillation. *Future Cardiol*. 2015; 11:323–331. [PubMed: 26021638]
37. Thompson AB, Tebes JK, McKee SA. Gender differences in age of smoking initiation and its association with health. *Addiction Research and Theory*. 2015; 23:413–420. [PubMed: 27499723]
38. Levine DA, Lewis CE, Williams OD, et al. Geographic and demographic variability in 20-year hypertension incidence: The cardia study. *Hypertension*. 2011; 57:39–47. [PubMed: 21135358]

Figure 1.

A: Probability of incident hypertension over 10-years by race and sex, shown across age strata and within age strata, with p-values for equality across age strata for each race-sex stratum. Figure 1B: Black-to-white relative risk of incident hypertension by sex, shown across all age strata and within age strata, with p-values for an equal black-to-white risk of incident hypertension over 10-years.

Figure 2.

A: Probability of incident diabetes over 10-years by race and sex, shown across age strata and within age strata, with p-values for equality across age strata for each race-sex stratum. Figure 2B: Black-to-white relative risk of incident diabetes by sex, shown across all age strata and within age strata, with p-values for an equal black-to-white risk of incident hypertension over 10-years. Note that the upper limit of the 95% confidence interval for women aged 75+ was 6.9.

Figure 3.

A: Probability of incident dyslipidemia over 10-years by race and sex, shown across age strata and within age strata, with p-values for equality across age strata for each race-sex stratum. Figure 3B: Black-to-white relative risk of incident dyslipidemia by sex, shown across all age strata and within age strata, with p-values for an equal black-to-white risk of incident hypertension over 10-years.

Figure 4.

A: Probability of incident atrial fibrillation over 10-years by race and sex, shown across age strata and within age strata, with p-values for equality across age strata for each race-sex stratum. Figure 4B: Black-to-white relative risk of incident atrial fibrillation by sex, shown across all age strata and within age strata, with p-values for an equal black-to-white risk of incident hypertension over 10-years.

Description of study population. Note that 11% of participants refused to provide income, and these are excluded from calculation of percent

Table 1

	Black Females n=2511 (23%)	Black Males n=1405 (13%)	White Females n=3448 (32%)	White Males n=3437 (32%)
Age (mean $\pm$ SD)	63.0 $\pm$ 8.2	63.4 $\pm$ 7.8	63.5 $\pm$ 8.3	64.6 $\pm$ 8.0
Number of participants with risk factor evaluated at baseline and follow- up (% Baseline Prevalence)	Hypertension	1404 (66.4)	3440 (44.4)	3425 (48.1)
	Diabetes	2306 (26.0)	3220 (9.9)	3286 (14.5)
	Dyslipidemia	2460 (29.6)	3330 (30.6)	3348 (37.8)
	Atrial Fibrillation	2273 (7.4)	3241 (7.0)	3254 (7.3)
Description of Characteristics (%)	Education high school	42.3	29.4	23.2
	Income < \$35K	59.7	41.5	24.8