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Comparison of the Racial/Ethnic Prevalence of Regular Aspirin Use for the Primary Prevention of Coronary Heart Disease from the Multi-Ethnic Study of Atherosclerosis

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Abstract

In 2002 the United States Preventive Services Task Force and the American Heart Association recommended aspirin for the primary prevention of Coronary Heart Disease (CHD) in individuals with a Framingham risk score $\geq 6\%$ or $\geq 10\%$, respectively. The regular use of aspirin (≥ 3 days per week) was examined in a cohort of 6452 White, Black, Hispanic, and Chinese individuals without cardiovascular disease in 2000–2002 and 5181 individuals from the same cohort in 2005–2007. Framingham risk scores were stratified into low ($< 6\%$), increased (6% to 9.9%), and high risk ($\geq 10\%$). In 2000–2002 the prevalence of aspirin use was 18% and 27% for those at increased and high risk, respectively. Whites (25%) used aspirin more than Blacks (14%), Hispanics (12%), or Chinese (14%) ($P < 0.001$) in the increased risk group. Corresponding prevalences for the high risk group were 38%, 25%, 17%, and 21%, respectively ($P < 0.001$). In 2005–2007 the prevalence of aspirin use was 31% and 44% for those at increased and high risk, respectively. Whites (41%) used aspirin more than Blacks (27%), Hispanics (24%), or Chinese (15%) in the increased risk group ($P < 0.001$). Corresponding prevalences for the high risk group were 53%, 43%, 38%, and 28%, respectively ($P < 0.001$). Racial/ethnic differences persisted after adjustment for age, gender, diabetes, income, and education. In conclusion, regular aspirin use in adults at increased and high risk for CHD remains suboptimal. Important racial/ethnic disparities exist for unclear reasons.

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Keywords

Framingham risk score; aspirin; coronary heart disease; race and ethnicity

INTRODUCTION

Few studies have examined the prevalence of aspirin use in a multi-ethnic cohort of individuals without known cardiovascular disease (CVD), especially since the publication of the United States Preventive Services Task Force (USPSTF) and the American Heart Association (AHA) guidelines for the primary prevention of coronary heart disease (CHD) in 2002.¹⁻² Despite its superior cost-effectiveness to other medicines³ and the proven benefit for reducing CHD,⁴⁻⁷ aspirin appears to be underutilized. Rodondi et al. assessed the trend in aspirin use from 1997-1998 to 2002-2003 among 2163 adults aged 68-80 years and reported an increase from 15% to 29% for those with a Framingham risk score of 6-9.9%, 18% to 35% for those with a risk of 10-20%, and 23% to 37% for those with a risk > 20%.⁸ An examination of nation-wide patient encounters from 1993 to 2003 in adults over age 21 found an increase in aspirin use from 3.6% to 16.3% among non-diabetic, "intermediate risk" patients. Intermediate risk was not defined by Framingham risk score, but rather by age and CVD risk factors.⁹ Although these studies included data up to 2003, it is unclear what effect, if any, the national guidelines had on the prevalence of aspirin use. There are no recent, nationally-representative, multi-ethnic studies examining the prevalence of aspirin use in individuals without known CVD. We used data from the Multi-Ethnic Study of Atherosclerosis (MESA), a population-based multi-ethnic cohort, to assess the prevalence, changes over time, and racial/ethnic disparities in aspirin use by Framingham risk score among individuals without known CVD.

METHODS

MESA is a multicenter cohort study conducted at 6 US field centers in Baltimore, Chicago, Forsyth County, North Carolina, Los Angeles, New York, and St. Paul, Minnesota. Between July 2000 and September 2002, 6814 persons between the ages of 45-84 were recruited into the study. Participants identified themselves as White, Black, Hispanic, or Chinese at the time of enrollment. Persons with a history of cardiovascular disease defined as physician-diagnosed MI, angina, stroke or transient ischemic attack, heart failure, resuscitated cardiac arrest, or having undergone procedures related to CVD (coronary artery bypass graft, angioplasty, valve replacement, pacemaker or defibrillator implantation, or any surgery on the heart or arteries) were excluded. The study was approved by the institutional review boards of each site, and all participants gave written informed consent. Details of the design of MESA have been reported previously.¹⁰

Data from the MESA baseline examination (2000-2002) and from a follow-up examination conducted approximately 5 years later (2005-2007) were used in these analyses. Of the 6814 participants at baseline (2000-2002) 6452 participants were included in these analyses (Figure 1). We excluded individuals who were subsequently found to have cardiovascular disease at baseline, users of anticoagulant therapy (since aspirin use for primary prevention in this population is not indicated), and participants with missing data for any variable. Follow-up analyses (2005-2007) were based on 5181 participants (Figure 1). Exclusion criteria included individuals who died or were lost to follow-up between baseline and 2005-2007, those found to have cardiovascular events during follow-up, users of anticoagulant therapy, and individuals with missing data for any variable.

Cardiovascular events during follow-up were defined as MI, resuscitated cardiac arrest, definite or probable angina (if followed by revascularization), stroke, or death due to stroke, CHD, or any other atherosclerotic or CVD. Cardiovascular events were initially identified by interviewers who contacted each participant or a family member by telephone to inquire about interim hospital admissions, outpatient diagnoses of CVD, and deaths. Self-reported diagnoses were verified by 2 physicians and an analysis of medical records. A more detailed description of the MESA follow-up methods is available at www.mesa-nhlbi.org.

Gender, race/ethnicity (based on questions modeled on the Year 2000 Census), income, and education were assessed at baseline. Information regarding age and insurance status was obtained at each examination using standardized questionnaires. Age was categorized into 10-year age groups. Individuals with any type of insurance were labeled “insured”; those without any type of insurance were labeled “uninsured”. Information regarding income was collected at baseline and at follow-up in 2004-2005. Income was sorted into 4 categories ranging from < \$12,000 to ≥ \$50,000, in concordance with categories established in a previous study.⁸ Response categories for highest level of education completed were collapsed into 3 categories: less than high school, high school (or equivalent), or more than high school. The 2003 American Diabetes Association criteria were employed such that diabetes mellitus was defined as a fasting glucose ≥ 126 mg/dL and/or the self-reported use of insulin and/or oral hypoglycemic agents.¹¹

We calculated the 10-year CHD risk for each subject using the National Cholesterol Education Program Framingham risk score, which estimates the risk for hard CHD (nonfatal MI and death from CHD).¹² The Framingham risk score has been validated for use in multiple ethnicities.¹³ The only exception was for adults with diabetes, for whom the 10-year CHD risk was assumed to be > 20% making them high risk by definition.² Information regarding age, gender, current cigarette use (defined as cigarette use within the past 30 days), and use of antihypertensive medications were acquired using standardized questionnaires. Systolic blood pressure was obtained by taking the average of 2 Dinamap Pro 1000 automated oscillometric sphygmomanometer (Critikon) measurements, in mmHg. Fasting total and high-density lipoprotein cholesterol were directly measured by a central laboratory. Since the Framingham risk score was designed for ages < 80, we assigned those with ages 80-85 a risk equivalent to age 79. For purposes of analysis, the 10-year CHD risk was stratified into 3 mutually exclusive categories based on the USPSTF and AHA guidelines from 2002: low risk (< 6%), increased risk (6% to 9.9%), and high risk (≥ 10%).¹⁻²

Information regarding regular aspirin use was obtained via standardized questionnaires at each examination. Regular aspirin use was defined as taking aspirin at least 3 days per week. This definition was intended to capture participants who use aspirin every day or every other day, since studies have shown both to be effective for preventing CHD.⁴⁻⁷ Aspirin use was presumed to be for cardioprotection and no information regarding aspirin allergies or analgesic use of aspirin was available.

Chi-square tests were used to test for differences in the prevalence of aspirin use across categories of participant characteristics. Logistic regression models were used to assess the association between aspirin use and each participant characteristic. Models were constructed using a forced entry method whereby all potential confounders were forced into the model. Independent variables were examined for multicollinearity and excluded from analysis if their tolerance value was < 0.10. Insurance status was excluded from the models given concerns for overadjustment and collinearity with income and education. Results are reported as odds ratios with 95% confidence intervals. Analyses were completed separately

for baseline examination data from 2000-2002 and follow-up data from 2005-2007. Results were contrasted. All analyses were conducted with PASW 17.0.

RESULTS

Table 1 shows the baseline (2000-2002) and follow-up (2005-2007) sociodemographic characteristics by Framingham risk score. The follow-up sample was older than the baseline sample and more likely to be female. Overall, at both time periods, approximately 40% were White, one-quarter were Black, one-fifth were Hispanic, and approximately 10% were Chinese. However, high risk groups were slightly less likely to be white and more likely to be Black or Hispanic than the lower risks groups. As expected, there was a clear positive association between age and Framingham risk score at both time points. Male gender was also associated with higher risk scores. Persons with diabetes comprised about 70% of high risk groups at both time points. Over 90% of each baseline and follow-up risk group had health insurance. Increasing risk was also associated with lower income and lower educational attainment.

Table 2 shows the prevalence of aspirin use by selected sociodemographic characteristics at baseline (2000-2002). The overall prevalence of aspirin use ranged from 13% for those at low risk to 27% for those at high risk. Older age was associated with a higher prevalence of aspirin use, although there was no clear pattern for those at increased risk. There was no difference in aspirin use between women and men in any risk group. Whites used aspirin more than Blacks, Hispanics, or Chinese in all risk groups. Those with diabetes used aspirin with the same frequency as non-diabetics in the high risk group. Aspirin use was greater in the insured than in the uninsured for all risk groups. There was also evidence that aspirin use was greater among higher income and higher education groups in the high risk group. In multivariable analyses (Table 2), age was associated with higher aspirin use for all risk groups. Blacks, Hispanics, and Chinese were all less likely than Whites to use aspirin in all risk groups. No clear trend can be drawn between aspirin use and income and education in multivariable analyses.

Table 3 shows the sociodemographic characteristics associated with the prevalence of aspirin use at follow-up (2005-2007). The overall prevalence of aspirin use ranged from 23% for those at low risk to 44% for those at high risk. In general, patterns for age, gender, insurance status, income, and education were similar to those described for baseline analyses. However, the difference in the prevalence of aspirin use between women and men at increased risk approached a significant difference. Racial/ethnic disparities persisted such that Whites continued to use aspirin more than Blacks, Hispanics, and Chinese in all risk groups. In multivariable analyses (Table 3), Blacks, Hispanics, and Chinese were all less likely than Whites to use aspirin in all risk groups.

DISCUSSION

We examined the prevalence of regular aspirin use in a multi-ethnic cohort of individuals without known CVD obtained from 6 U.S. field centers in 2000-2002 and in 2005-2007. Over the 5-year period there was an increase of 13 and 17 percentage points in aspirin use noted among the increased and high risk groups identified by the Framingham risk score, respectively. Despite these modest improvements, the overall prevalence of aspirin use in the increased (31%) and high risk groups (44%) at follow-up remained suboptimal for the recommended primary prevention guidelines. Our data further corroborates the findings of Rodondi et al, who reported remarkably similar prevalences of aspirin use by Framingham risk score in 2002-2003.⁸ Those data, obtained just after publication of the USPSTF and AHA guidelines on the primary prevention of CHD, as well as the 10 percentage point

increase in aspirin use noted among those at low risk in the present study, call into question the influence of guidelines on national prevalences of aspirin use. Since aspirin is available without a prescription, the increases in aspirin use noted among all risk groups may be due to direct-to-consumer advertising rather than physician practices. This is particularly true of the low risk group, in which aspirin for the primary prevention of CHD is not indicated by the guidelines.¹⁻²

Although the cardioprotective effects of aspirin in the primary prevention of CHD have not been explicitly established in non-White populations, the benefit is presumed to exist. Our study found racial/ethnic disparities in the prevalence of aspirin use that persisted from baseline to follow-up in all risk groups; this remained true even after adjusting for socioeconomic factors. The reason for these racial/ethnic disparities is unclear but is likely multifactorial in origin. Cultural attitudes, language barriers, issues of compliance, infrequent doctor visits, mistrust of the medical establishment, and differences in access to and quality of health care are all plausible factors. Unfortunately our study was insufficiently powered for further subgroup analyses by race/ethnicity. Previous research examining the role of race/ethnicity has been inconsistent: Blacks were less likely than Whites to use aspirin after adjusting for socioeconomic factors in one study⁸ while Stafford et al found no disparities in aspirin use between Whites, Blacks, Hispanics, or other racial/ethnic groups.⁹ Neither of these studies stratified analyses by Framingham risk.

The benefit of aspirin in the primary prevention of CHD in women < 65 years old remains controversial,¹⁴ and a recent cost-effectiveness analysis noted a disparity between women and men.¹⁵ There has also been a growing recognition of the limitation in risk-stratifying women according to the Framingham risk score, which may underestimate their true CHD risk;¹⁶⁻¹⁸ Due to these concerns, the AHA released updated guidelines on CVD prevention in women in 2007 which placed more emphasis on traditional risk factors to determine a woman's lifetime risk of CVD rather than her 10-year Framingham risk score.¹⁶ The USPSTF also recently revised their recommendations on aspirin use in primary prevention such that aspirin use in women is now targeted at ischemic stroke prevention using a 10-year stroke risk assessment model.¹⁹ We identified risk groups based on the Framingham risk score plus diabetes and found little evidence of gender differences in aspirin use. Previous studies have found women to be less likely than men to use aspirin in the primary prevention of CHD, though these studies did not stratify their analyses by Framingham risk.⁸⁻⁹

This study has several limitations which should be acknowledged during the interpretation of its findings. We did not have information on some contraindications to aspirin use such as aspirin allergies, aspirin intolerance, or bleeding disorders. However, a large survey looking at aspirin use for secondary prevention found contraindications in < 3% of participants.²⁰ The use of other antiplatelet agents was not factored into our analysis, though most indications for other antiplatelet agents involve a diagnosis of cardiovascular disease which would have excluded them from these analyses. We did not have information regarding analgesic use of aspirin, though analyses excluding individuals with a history of osteoarthritis yielded remarkably similar results (data not shown). Our sample was not designed to provide nationally representative samples of the 4 racial/ethnic groups and important geographic variations in aspirin use may exist. Lastly the Framingham risk score was designed for ages < 80, so the effect of assigning individuals with ages ≥ 80 the risk of a 79-year-old is unknown and likely underestimates their true 10-year CHD risk.

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Figure 1.
Flow chart of the study. CVD = Cardiovascular Disease; MESA = Multi-Ethnic Study of Atherosclerosis.

Table 1

Demographic Characteristics by Year in Study and Framingham Risk Score*

Variable	Baseline (2000-2002)			Follow-up (2005-2007)			P [†]	P
	Low Risk (N = 2658)	Increased Risk (N = 865)	High Risk (N = 2929)	Low Risk (N = 1750)	Increased Risk (N = 615)	High Risk (N = 2816)		
Age (years)							< 0.001	< 0.001
45-54	48%	30%	10%	25%	20%	6%		
55-64	30%	26%	26%	42%	31%	27%		
65-74	19%	31%	39%	27%	29%	34%		
75-84 [‡]	2%	13%	25%	7%	20%	33%		
Women	84%	46%	26%	93%	51%	30%	< 0.001	< 0.001
Men	16%	54%	74%	7%	49%	70%		
White	41%	40%	35%	43%	43%	37%	< 0.001	< 0.001
Black	27%	26%	29%	25%	26%	28%		
Hispanic	20%	21%	24%	21%	20%	23%		
Chinese	12%	13%	12%	12%	11%	12%		
Diabetes mellitus	0%	0%	28%	0%	0%	31%	< 0.001	< 0.001
Medical insurance	90%	91%	92%	93%	93%	96%	0.04	< 0.001
Income (\$)							< 0.001	< 0.001
< 12 000	9%	11%	14%	9%	11%	12%		
12 000-24 999	16%	22%	23%	15%	15%	20%		
25 000-49 999	30%	26%	29%	29%	29%	29%		
≥ 50 000	45%	42%	34%	47%	44%	39%		
Education							< 0.001	< 0.001
< High school	14%	18%	22%	13%	15%	18%		
High school	18%	17%	19%	18%	16%	19%		
> High school	69%	65%	59%	69%	70%	64%		

* The Framingham risk scores were stratified into three mutually exclusive categories based on the United States Preventive Services Task Force and American Heart Association guidelines from 2002: low risk (< 6%), intermediate risk (6% to 9.9%), and high risk (≥ 10%)

[†] Chi square tests for trend

[‡] Age group is 75-84 for the baseline data and 75-90 for follow-up data

Table 2
Demographic Characteristics Associated with Aspirin Use at Baseline (2000-2002), by Framingham Risk Score*

Variable	Prevalence of Aspirin Use					Adjusted Odds Ratio of Aspirin Use (95% CI)				
	Low Risk	P [†]	Increased Risk	P	High Risk	Low Risk	P [‡]	Increased Risk	P	High Risk
Overall population	13%	< 0.001	18%	< 0.001	27%					
Age (years)										
45-54	8%		8%		14%	1.0		1.0		1.0
55-64	17%		21%		20%	3.2 (2.3-4.4)		3.5 (2.0-6.4)		1.6 (1.1-2.3)
65-74	18%		25%		32%	3.7 (2.5-5.3)		9.0 (4.4-18.3)		3.1 (2.2-4.5)
75-84	37%		17%		32%	8.0 (4.2-15.4)		6.4 (2.6-15.8)		3.6 (2.4-5.3)
Women	13%	0.76	19%	0.46	26%	1.0	< 0.001	1.0	0.07	1.0
Men	13%		17%		28%	2.1 (1.4-3.1)		1.7 (1.0-3.0)		1.2 (0.9-1.5)
White	19%	< 0.001	25%	< 0.001	38%	1.0	< 0.001	1.0	0.01	1.0
Black	11%		14%		25%	0.5 (0.4-0.7)		0.5 (0.3-0.8)		0.6 (0.5-0.7)
Hispanic	8%		12%		17%	0.4 (0.3-0.6)		0.5 (0.3-0.9)		0.4 (0.3-0.5)
Chinese	6%		14%		21%	0.3 (0.2-0.5)		0.5 (0.3-0.9)		0.5 (0.4-0.7)
Diabetes mellitus		NA		NA			NA		NA	
No	13%		18%		26%	NA		NA		1.0
Yes	NA		NA		28%	NA		NA		1.6 (1.3-2.0)
Medical insurance		< 0.001		0.01			NA		NA	NA
No	5%		7%		13%	NA		NA		NA
Yes	14%		19%		28%	NA		NA		NA
Income (\$)		0.10		0.01			0.38		0.01	
< 12 000	12%		21%		21%	1.0		1.0		1.0
12 000-24 999	9%		13%		22%	0.7 (0.4-1.1)		0.6 (0.3-1.1)		1.0 (0.7-1.4)
25 000-49 999	13%		12%		29%	0.9 (0.6-1.5)		0.5 (0.3-1.1)		1.4 (1.0-1.9)
≥ 50 000	14%		22%		32%	0.9 (0.5-1.4)		1.2 (0.6-2.5)		1.3 (1.0-1.9)
Education		0.03		0.46			0.59		0.74	
< High school	9%		15%		20%	1.0		1.0		1.0
High school	14%		16%		24%	1.1 (0.7-1.9)		0.9 (0.4-1.7)		1.1 (0.8-1.6)

Variable	Prevalence of Aspirin Use				Adjusted Odds Ratio of Aspirin Use (95% CI)							
	Low Risk	$P^{\dagger}$	Increased Risk	P	High Risk	P	Low Risk	$P^{\ddagger}$	Increased Risk	P	High Risk	P
> High school	14%		19%		31%		1.3 (0.8-2.0)		1.1 (0.6-2.0)		1.4 (1.0-1.8)	

CI = Confidence Interval, NA = Not Applicable

*The Framingham risk scores were stratified into three mutually exclusive categories based on the United States Preventive Services Task Force and American Heart Association guidelines from 2002: low risk (< 6%), increased risk (6% to 9.9%), and high risk (≥ 10%)

[†] Chi square tests for trend

[‡] Wald test from logistic regression models (age, gender, race/ethnicity, diabetes mellitus, income, and education included in models)

Table 3
Demographic Characteristics Associated with Aspirin Use at Follow-up (2005-2007), by Framingham Risk Score*

Variable	Prevalence of Aspirin Use				Adjusted Odds Ratio of Aspirin Use (95% CI)							
	Low Risk	P†	Increased Risk	P	High Risk	P	Low Risk	P‡	Increased Risk	P	High Risk	P
Overall population	23%	< 0.001	31%	< 0.001	44%	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Age (years)												
45-54	13%		19%		30%		1.00		1.00		1.00	
55-64	22%		27%		37%		2.1 (1.5-3.1)		2.1 (1.2-4.0)		1.4 (1.0-2.1)	
65-74	30%		36%		47%		2.9 (2.0-4.4)		4.8 (2.3-10.3)		2.5 (1.7-3.6)	
75-90	38%		42%		48%		4.5 (2.7-7.4)		6.4 (2.7-15.1)		3.0 (2.0-4.4)	
Women	23%	0.09	35%	0.05	44%	0.66	1.00	0.55	1.00	0.09	1.00	0.04
Men	17%		27%		44%		1.2 (0.7-2.1)		1.7 (0.9-3.0)		1.2 (1.0-1.5)	
White	29%	< 0.001	41%	< 0.001	53%	< 0.001	1.00	< 0.001	1.00	< 0.01	1.00	< 0.001
Black	19%		27%		43%		0.5 (0.4-0.7)		0.5 (0.3-0.8)		0.6 (0.5-0.7)	
Hispanic	20%		24%		38%		0.6 (0.4-0.8)		0.6 (0.3-1.0)		0.6 (0.4-0.7)	
Chinese	14%		15%		28%		0.4 (0.3-0.6)		0.3 (0.1-0.6)		0.3 (0.2-0.4)	
Diabetes mellitus		NA		NA		< 0.001		NA		NA		< 0.001
No	23%		31%		41%		NA		NA		1.00	
Yes	NA		NA		51%		NA		NA		2.2 (1.8-2.7)	
Medical insurance		< 0.001		0.01		< 0.001		NA		NA		NA
No	9%		14%		21%		NA		NA		NA	
Yes	24%		33%		45%		NA		NA		NA	
Income (\$)		0.89		0.50		0.01		0.66		0.87		0.17
< 12 000	23%		23%		38%		1.00		1.00		1.00	
12 000-24 999	22%		34%		42%		0.9 (0.5-1.4)		1.4 (0.6-2.9)		1.1 (0.8-1.5)	
25 000-49 999	24%		30%		42%		1.0 (0.6-1.6)		1.2 (0.6-2.4)		1.0 (0.8-1.4)	
≥ 50 000	22%		32%		47%		0.8 (0.5-1.3)		1.3 (0.6-2.7)		1.3 (0.9-1.8)	
Education		0.45		0.01		0.04		0.79		0.32		0.52
< High school	21%		18%		39%		1.00		1.00		1.00	
High school	26%		38%		43%		1.1 (0.7-1.8)		1.8 (0.8-3.9)		1.0 (0.8-1.4)	

Variable	Prevalence of Aspirin Use				Adjusted Odds Ratio of Aspirin Use (95% CI)							
	Low Risk	<i>P</i> [†]	Increased Risk	<i>P</i>	High Risk	<i>P</i>	Low Risk	<i>P</i> [‡]	Increased Risk	<i>P</i>	High Risk	<i>P</i>
> High school	23%		33%		45%		1.0 (0.7-1.6)		1.7 (0.8-3.4)		1.1 (0.9-1.5)	

CI = Confidence Interval, NA = Not Applicable

*The Framingham risk scores were stratified into three mutually exclusive categories based on the United States Preventive Services Task Force and American Heart Association guidelines from 2002: low risk (< 6%), increased risk (6% to 9.9%), and high risk (≥ 10%)

[†] Chi square tests for trend

[‡] Wald test from logistic regression models (age, gender, race/ethnicity, diabetes mellitus, income, and education included in models)