THE PREVALENCE OF BLOOD PRESSURE AND CHOLESTEROL MONITORING IN BOSTON AMONG NON-HISPANIC BLACKS, HISPANICS, AND NON-HISPANIC WHITES

Eileen M. Stuart-Shor, PhD, APRN, FAHA; Angela Nannini, PhD, FNP; Mary Ostrem, DrPH; Gail E. Russell, EdD, RN; Murray A. Mittleman, MD, DrPH

Objectives: Racial and ethnic minorities are at increased risk for hypertension and hypercholesterolemia. Appropriate blood pressure and cholesterol monitoring is a critical first step in identification, treatment, and control of these conditions and the prevention of coronary artery disease. This study examines blood pressure and cholesterol monitoring among non-Hispanic Black, Hispanic, and non-Hispanic White subjects.

Design: Data were drawn from the 1999 Massachusetts Behavioral Risk Factor Surveillance Survey (BRFSS) Boston oversample. Monitoring for hypertension and hypercholesterolemia were compared across 2515 respondents to the 1999 Boston BRFSS oversample, including (67.6% White non-Hispanic, 18% Black non-Hispanic, and 14.4% Hispanic, any race). Chi-square analyses were used to test unadjusted race- and ethnicity-specific differences, and logistic regression was used to estimate the odds of inadequate blood pressure and cholesterol monitoring by race/ethnicity, adjusting for demographic characteristics, insurance, source of care, psychosocial factors, and neighborhood characteristics.

Results: No significant differences were seen in the adequacy of blood pressure and cholesterol monitoring among the racial/ethnic groups of interest, despite significant differences in sociodemographic characteristics and morbidity.

Conclusions: In this local dataset, non-Hispanic Blacks and Hispanics, as compared to non-Hispanic Whites, were not more likely to report inadequate blood pressure or cholesterol monitoring. The data suggest that safety net factors in place in Boston may have contributed to the observed parity in access to preventive care among the racial/ethnic groups of interest. The data also suggest that factors antecedent/subsequent to blood pressure and cholesterol monitoring may explain the observed disparities in blood pressure and cholesterol morbidity and control reported for racial/ethnic minorities. (*Ethn Dis*. 2006;16: 375–383)

Key Words: Blood Pressure, Cholesterol, Monitoring, Racial and Ethnic Minorities

From the Cardiovascular Epidemiology Research Unit, Cardiovascular Division, Department of Medicine, Beth Israel Deaconess Medical Center (ES, MM); School of Nursing, Bouvé College of Health Sciences, Northeastern University (ES, AN); College of Nursing, Doctoral Program in Nursing, and Health Policy, University of Massachusetts (ES, AN, GR); Boston Public Health Commission (MO); Boston, Massachusetts.

Address correspondence and reprint requests to Eileen M. Stuart-Shor, PhD, APRN; Beth Israel Deaconess Medical Center; 185 Pilgrim Road, Deaconess 306; Boston, MA 02215; 617-632-7695; 617-632-7698 (fax); estuarts@bidmc.harvard.edu

INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of death for both men and women in the United States, accounting for 1.4 million deaths in the year 2001. Disproportionate rates of CVD mortality for racial and ethnic minority populations have been noted.[1] National age adjusted CVD mortality rates (per 100,000 individuals in 1999) demonstrate higher rates of heart disease mortality for non-Hispanic Blacks (191.5) as compared to non-Hispanic Whites (129.8) and Hispanics (88.6).[2] At the community level, individuals of African descent residing in Boston have the highest heart disease mortality rates per 100,000 individuals (149) compared to non-Hispanic Whites (110) or Hispanics (81).[3] Not only do racial and ethnic disparities in CVD mortality exist, but these differences are increasing.[1,3] The public health burden of CVD is enormous and its disparate distribution among racial and ethnic minority populations is a major social, public health, and clinical issue.

Hypertension and hypercholesterolemia represent two of the major modifiable risk factors for developing CVD. Recent reports concerning the prevalence, detection, treatment, and control of hypertension and hypercholesterolemia at the national level document alarming trends. The high prevalence of hypercholesterolemia in this country has changed little since 1988, and rates of awareness, treatment, and control remain low.[4] The prevalence of hypertension in this country has increased from 1988 to 2000, while rates of hypertension awareness, treatment, and control have not improved significantly. Hypertension prevalence was highest in non-Hispanic Blacks.[5] This disparity in the distribution of burden of disease for non-Hispanic Black adults has also been reported at the state[6] and local level.[3]

Monitoring blood pressure and serum cholesterol is a critical first step in the timely identification, treatment, and control of hypertension and hypercholesterolemia and prevention of cardiovascular disease. Factors across the biopsychosocial domains have been linked to lower use of preventive cardiovascular services for racial and ethnic minorities. These biobehavioral and environmental factors include race, age, sex, insurance, having a source of care, low educational attainment, low income, depression, social isolation, and neighborhood characteristics.[5,7–15] early reports indicated disparities in monitoring for blood pressure and cholesterol for non-Hispanic Black and Hispanic adults compared to non-Hispanic White adults (hereafter called Blacks, Hispanics, and Whites).[16] Recent studies at the national level however have reported that Black and White adults

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more frequently receive preventive health care, including blood pressure and cholesterol measurement, than do Hispanic adults.[17,18] Little, however, is known about the prevalence of blood pressure and cholesterol monitoring, specifically for racial and ethnic minority populations, at the local level. The National Healthcare Disparities Report emphasized the need for local data to inform targeted efforts to reduce disparities at the point of service.[18] Therefore, our objectives were twofold: 1) to establish the proportion of adults who had their blood pressure and cholesterol measured at appropriate intervals by using a local dataset (Boston 1999 Behavioral Risk Factor Surveillancy Study [BRFSS] oversample)[19]; and 2) to determine if a difference existed in the prevalence of inadequate monitoring for Blacks and Hispanics as compared to Whites, adjusting for demographic, insurance, psychosocial, and neighborhood factors.

METHODS

Data Source

Data for this study were drawn from the 1999 BRFSS Boston oversample (hereafter called the Boston oversample), which was jointly funded by the Centers for Disease Control and Prevention (CDC), Massachusetts Department of Public Health (MDPH), and the Boston Public Health Commission (BPHC). The institutional review board of the University of Massachusetts Boston reviewed and approved the protocol for this secondary dataset analysis in compliance with human participant protection.

The Behavioral Risk Factor Surveillance Survey

The BRFSS is a national, state-based, random-digit-dialed (RDD) telephone survey of noninstitutionalized US adults ≥18 years of age, composed of core, standard modules, and state-added questions. The sampling of the survey population involved a list-assisted, stratified RDD sampling frame, which assures that Boston households with telephone numbers assigned after publication of the current directories, as well as households with deliberately unlisted numbers, are included in the sample in appropriate proportions. This method is designed to more efficiently and validly reach all telephone-equipped households and provide population estimates of health conditions and behaviors.[20] The states and CDC jointly develop questions for the core and standard modules. Cities and towns may add questions and may request oversampling of specific subpopulations.[21] The Boston oversample was conducted by the BPHC to identify the health needs of Boston residents and ensure that public health planning and policy are data driven. The study sample includes civilian, noninstitutionalized White, Black, and Hispanic respondents (N=2515) drawn from the Boston Oversample (N=2731). Response rates were calculated by MDPH using the Council of American Survey Research Organization (CASRO) measure where response rate is a combined efficiency/effectiveness measure.[20,22] The upper bound response rate measures respondent cooperation (Boston oversample 53.3%), and the lower bound response rate measures the efficiency of the sample assuming that all numbers are eligible (Boston oversample 14.9%).[20] The upper bound response rate is the most commonly used rate. The 1999 Boston BRFSS response rate of 53.3% is reflective of current trends for urban areas.[17,19,23]

National estimates of morbidity and preventive behaviors obtained from the National Health Interview Survey (measurement and self report) and the BRFSS (self-report) have been reported to be comparable,[24] and other studies suggest that the self-reported measures in the BRFSS are both valid and reliable in diverse populations.[25,26]

Sampling Method and Data Weighting

A disproportionate stratified random sampling design was used to identify the sample frame. A multistage weighting process adjusted for each respondent's probability of being selected to participate based on the number of telephones in the home, the number of adults in the home, and other factors. Poststratification weighting adjusted to the age and sex of the population of Boston from the most current intercensal estimates. Data weighting, respondent selection, treatment of no answers, non-English interviews, and quality control measures are detailed in the MDPH BRFSS Technical Manual.[20]

Variable Definition

All data are self-reported and include demographic characteristics, illness, insurance, source of care, perceived health, psychosocial factors, neighborhood characteristics and use of preventive health services. Respondents self-identified as White or Black race and Spanish, Hispanic, or Latino ethnicity and were coded as non-Hispanic White; non-Hispanic Black; or Hispanic, any race. Participants who reported having their blood pressure or cholesterol measured at least once were asked whether a healthcare provider ever told them that they had high blood pressure

or high cholesterol. Inadequate blood pressure monitoring was defined as the self-report of never having had it measured or if the last blood pressure measurement by a healthcare provider was more than two years ago or greater than six months ago if blood pressure was known to be high. Inadequate cholesterol monitoring is defined as the self-report of never having had cholesterol measured or if the last cholesterol measurement by a healthcare provider was more than five years ago or greater than one year ago if cholesterol was known to be high. The criteria for determining thresholds for inadequate monitoring are derived from national prevention guidelines.[27–29]

Illnesses were defined based on respondents reporting that a doctor or other health professional had told them that they had one or more of the following conditions: high blood pressure, high cholesterol, heart disease, and/or diabetes. Designations of overweight (body mass index [BMI]≥25) and obesity (BMI≥30) were calculated from self-reported height and weight. Respondents were considered current smokers if they reported having smoked >100 cigarettes in their life and were currently smoking. The primary language spoken at home and place of birth were collapsed to two categories, English or non-English and United States or outside mainland United States, respectively.

Respondents self-identified the kind and type of healthcare coverage they carried, described the source of their routine care (community health center, doctor's office, health management organization, hospital emergency room, or other), identified if they needed to see a doctor in the last 12 months but could not because of the cost, and length of time since they last visited a doctor for a routine checkup.

Respondents reported how often they got the social and emotional support they needed (usually, often, sometimes, rarely, never) and described their health in general (excellent, very good, good, fair, poor). Poor physical/mental health was defined as respondents who reported their physical health, including physical illness and injury, and their mental health, which includes stress, depression, and problems with emotions, as not good for ≥15 days in the past month. Depression was defined as feeling blue, sad, or depressed for ≥15 days in the past month. Chronic drinkers were defined as those who drank ≥60 alcoholic drinks per month.

Community/neighborhood characteristics, including violence, availability of medical care, and poverty, were examined. Self-reported neighborhood of residence was matched to US Census tracts. The MDPH Weapon-Related Injury Surveillance System (WRISS) injury rates were calculated for each Boston neighborhood, based on emergency room reporting of injuries during 1999.[30] Neighborhoods in the upper tertile of WRISS rates were considered high risk. The measure of availability of medical care and poverty was drawn from the federal Health Resources and Services Administration–Bureau of Health Professions MUA/MUP Database, which delineates service areas (census tracts) that have been identified as medically underserved areas (MUA).[31] Neighborhoods in which >60% of the census tracts were designated MUA were considered medically under-served for the purpose of this study.

Statistical Methods

All analyses were performed using the survey estimation function in Stata version 7 (StataCorp LLC, College Station, Tex), which can calculate weighted means, percentages, confidence intervals (CI), odds ratios (OR), standard error (SE), and logistic regression models that adjust for the complex BRFSS sampling design.[32] Race- and ethnicity-specific prevalence and 95% CI for inadequate blood pressure and cholesterol monitoring were calculated for Whites, Blacks, and Hispanics. Weighted Pearson chi-square estimates of row and column independence were used to examine the association between the monitoring variables and the covariants in the theoretical model. Prevalence estimates and unadjusted analyses are reported as unweighted frequencies and weighted percents. Where the categories "don't know" and "refused" are a possible response, these categories were recoded to "missing" unless otherwise specified.

Logistic regression analysis, taking the survey weights into account, was used to estimate the odds of inadequate blood pressure and cholesterol monitoring by race or Hispanic ethnicity. Separate models were constructed for blood pressure and cholesterol monitoring based on monitoring thresholds that reflect current prevention guidelines and the presence or absence of known high blood pressure or high cholesterol. Race and Hispanic ethnicity was the stratifying variable. To control for known and potential differences in demographic, insurance, psychosocial, and neighborhood factors, a number of variables were included as covariates including age, sex, marital status, annual household income, educational attainment, employment status, health insurance, ability to pay for care, source of care, regular care, perceived health, depression, social support, chronic alcohol intake, and neighborhood indicators of violence and poverty.

RESULTS

The sample is composed of 2515 respondents who completed interviews for the 1999 Boston BRFSS oversample. Mean age was 41.6 years, ranging from 18 to 96; 50.0% of respondents were between the ages of 18 and 37 years. Fifty-three percent were female (n=1019). Individuals who self-reported their race as Black non-Hispanic and ethnicity as Hispanic (any race) made up 18.0% and

Table 1. Bio-behavioral and environmental characteristics of racial/ethnic groups

Variable	*n*	White *n* (%)	Black *n* (%)	Hispanic *n* (%)	*P* value
Demographics					
Race/ethnicity	2515				
White		1597 (67.6)			
Black			546 (18.0)		
Hispanic				372 (14.4)	
Age	2846				<.001
18–39	1366	816 (57.4)	289 (55.9)	261 (71.0)	
40–64	822	527 (26.1)	201 (31.8)	94 (23.3)	
≥65	298	235 (16.5)	47 (12.3)	16 (5.6)	
Sex	2515				<.001
Male	1019	686 (49.6)	201 (42.7)	129 (36.6)	
Female	1496	908 (50.4)	345 (57.3)	243 (63.4)	
Marital status	2505				.001
Never/div/sep/widowed	1771	1127 (73.3)	408 (78.8)	236 (65.6)	
Married	734	464 (26.2)	135 (21.2)	135 (34.3)	
Annual household income	1935				<.001
<$25,000	573	286 (22.4)	161 (41.7)	126 (52.3)	
$25,000–$34,999	315	179 (13.7)	91 (22.6)	45 (21)	
$35,000–$49,999	356	247 (17.3)	82 (18.5)	27 (11.3)	
$50,000–$74,999	304	230 (18.4)	49 (10.6)	25 (9.3)	
≥$75,000	387	347 (28.2)	26 (6.6)	14 (5.9)	
Education	2501				<.001
<High school	279	81 (4.6)	70 (14.7)	128 (32.6)	
High school	660	362 (21.2)	181 (31.9)	117 (30.7)	
Some college	552	323 (22)	167 (31.7)	62 (18.2)	
College	1010	827 (52.1)	120 (21.8)	63 (18.5)	
Employed for wages	2500				.71
No	754	469 (31.8)	164 (33.8)	121 (33.8)	
Yes	1746	1119 (68.1)	377 (66.1)	250 (66.2)	
Primary language at home	1951				<.001
English	1714	1219 (99.2)	401 (93.7)	94 (30.7)	
Not English	237	9 (.8)	28 (6.3)	200 (70.3)	
Morbidity					
Hypertension	490	287 (16.6)	149 (27.1)	54 (13.8)	<.001
High cholesterol	449	295 (21.2)	102 (25.0)	52 (18.9)	.2
Diabetes	107	57 (2.9)	40 (8.3)	10 (2.8)	<.001
Heart disease	119	84 (5.3)	24 (5.5)	11 (2.8)	.2
Obesity (BMI>30)	401	194 (10.9)	131 (25.2)	76 (18.6)	<.001
Smoking	458	297 (18.0)	103 (19.9)	58 (15.8)	<.001
Co-morbidity	1826				<.001
0 or 1 morbidity	1395	934 (80.2)	258 (64.9)	203 (77.5)	
≥2 morbidities	431	249 (19.8)	128 (35.1)	54 (22.6)	
Insurance/source of care					
Health insurance	2514				<.001
Insurance	2241	1506 (94.2)	501 (90.7)	348 (93.4)	
No insurance	273	124 (8.31)	74 (14.5)	75 (21.1)	
Medicaid	1799				<.001
No	1621	1406 (96.5)	407 (86.8)	241 (82.4)	
Yes	178	61 (3.5)	64 (13.1)	53 (17.6)	
Medicare	2231				.485
No	1800	1180 (80.0)	378 (77.8)	242 (81.9)	
Yes	431	286 (20.1)	93 (22.2)	52 (18.1)	

14.4% of the sample respectively. Twenty-four percent of the sample was born outside the United States, and 13% did not speak English as the primary language at home. For those born outside the mainland United States, mean time in this country was 15.5 years. Thirty-four percent of the sample reported being in a two-person committed relationship. Ten percent of the sample had less than a high school education, 24.5% had at least a high school education and 41.9% had completed college. Thirty percent of the sample had annual household incomes that fell below $25,000, while 21.9% reported incomes that exceeded $75,000. Most of the study sample was employed for wages (69.8%).

Racial/Ethnic Distribution of Bio-behavioral and Environmental Characteristics

Significant differences in the distribution of demographic, morbidity, insurance, source of care, psychosocial, and neighborhood characteristics were noted by race and Hispanic ethnicity and are outlined in Table 1. Hispanic respondents, compared to Blacks and Whites, were more likely to be young, female, and speak primarily Spanish. They were also more likely to report little social or emotional support and that they were not able to see a physician in the past 12 months because of cost.

Black respondents, compared to Whites and Hispanics, were more likely to have high blood pressure, obesity, and diabetes or be currently smoking and to have two or more co-morbidities. They were also more likely to rate their physical and mental health as poor and to admit to feeling sad, blue, or depressed on ≥15 days in the past month.

Hispanic and Black adults, compared to Whites, were more likely than their White counterparts to report low educational attainment and income, lack of health insurance, and reliance on publicly funded insurance (Medicaid) and community health centers for

Table 1. Continued

Variable	*n*	White *n* (%)	Black *n* (%)	Hispanic *n* (%)	*P* value
Routine care	1978				<.001
CHC	451	237 (17.8)	148 (32.4)	66 (24.2)	
MD/HMO	1179	875 (70.0)	180 (40.3)	124 (45.6)	
ER	205	91 (7.3)	89 (21.5)	25 (8.1)	
Other	143	57 (4.9)	25 (5.8)	61 (22.2)	
Missed care because of cost	2508				<.001
No	2277	1471 (92.5)	500 (91.4)	306 (82.4)	
Yes	231	120 (7.5)	45 (8.7)	66 (17.6)	
Last MD visit	2496				.001
≤1 year	1986	1217 (77.1)	458 (84.3)	311 (83.8)	
>1 year	510	369 (22.9)	81 (15.7)	60 (16.2)	
Perceived health/psychosocial					
Health fair/poor	2510				<.0001
No	2187	1421 (89.9)	459 (84.1)	307 (84.2)	
Yes	323	172 (10.1)	87 (15.9)	64 (15.8)	
Physical/mental health	2433				<.001
<15 days poor	2077	1338 (88.0)	425 (80.4)	314 (87.5)	
≥15 days poor	356	212 (12.1)	95 (19.6)	49 (12.5)	
Depressed (*n=2387)*	2387				.005
<15 days sad/depressed	2204	1422 (93.7)	452 (89.1)	330 (93.2)	
≥15 days sad/depressed	183	108 (6.3)	48 (11.1)	27 (6.8)	
Social support	2392				<.001
Usually/often	1691	1217 (80.9)	316 (62.6)	158 (45.5)	
Rarely/never	701	310 (19.1)	194 (37.4)	197 (54.5)	
Chronic drinking	2464				.004
No	2374	1497 (94.6)	523 (97.0)	354 (98.5)	
≥60/month	90	72 (5.4)	13 (3.1)	5 (1.5)	
Neighborhood					
WRISS	2286				<.001
Lower WRISS rate	1553	1163 (8.6)	198 (33.7)	192 (59.2)	
High WRISS rate	733	296 (18.4)	302 (66.1)	135 (41.1)	
MUA	2286				<.001
Not MUA neighborhood	870	732 (49.5)	66 (13.8)	72 (22.5)	<.001
MUA neighborhood	1416	727 (50.5)	434 (86.2)	255 (77.5)	

P values for between group/category differences, unweighted frequencies, weighted percents, and column proportions.

White=non-Hispanic White; Black=non-Hispanic Black; Hispanic=any race.

MUA=medically underserved area: neighborhoods with ≥60% Census tracts in neighborhood designated MUA.

WRISS=weapon related injury surveillance survey - rate/100,000 population: high=neighborhoods with WRISS rate/upper 1/3 of neighborhoods.

BMI=body mass index; CHC=community health center; MD/HMO=doctor/health maintenance organization; ER=emergency room.

their health care. They were more likely to rate their health as fair/poor on a scale that ranged from excellent to poor. In addition, Black and Hispanic respondents were more likely than Whites to live in a neighborhood with high prevalence of poverty, violence, and medical under-service. White respondents, compared to Blacks and Hispanics, were most likely to be older, not have had a routine health check-up in the past 12 months, and self-report alcohol intake of ≥60 drinks per month.

Blood Pressure Monitoring

Race- and ethnicity-specific prevalence and 95% CI for inadequate blood pressure monitoring (last measure >2 years ago or >6 months ago in those with known hypertension) were calculated for White, Black, and Hispanic adults. In the crude analysis, no statistically significant differences in blood pressure monitoring by race or Hispanic ethnicity were observed for those with (*P* value =.79) or without (*P* value=.16) known hypertension (Table 2). After adjusting for demographic, insurance, psychosocial, and neighborhood factors, no clear association was noted by race or Hispanic ethnicity in the adequacy of blood pressure monitoring for those with or without known hypertension (Table 3).

. . . we found no significant differences in the adequacy of blood pressure and cholesterol monitoring among the racial/ethnic groups of interest, despite significant differences in sociodemographic characteristics.

Cholesterol Monitoring

Similarly, race and ethnicity-specific prevalence and 95% CI for inadequate cholesterol monitoring (last measure >5 years ago or >1 year ago in those with known hypercholesterolemia) were calculated for the racial and ethnic groups of interest. The crude analysis did not reveal statistically significant differences in cholesterol monitoring by race or Hispanic ethnicity for those with (*P* value=.68) or without (*P* value=.33) known hypercholesterolemia (Table 2). After adjusting for demographic, insurance, psychosocial, and neighborhood factors, no clear association was noted by race or Hispanic ethnicity in the adequacy of cholesterol monitoring for those with or without known hypercholesterolemia (Table 4).

Table 2. Blood pressure and cholesterol monitoring by race/ethnicity

	Blood Pressure Monitoring			
	Last BP Measure		Last BP/Known Hypertension	
Variable	≤2 years	>2 years*	≤6 month	>6 month†
Race/ethnicity	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Non-Hispanic White	1510 (95.5)	75 (4.5)	249 (87.3)	33 (12.7)
Non-Hispanic Black	528 (97.2)	14 (2.8)	132 (89.6)	17 (10.4)
Hispanic	347 (94.4)	20 (5.6)	47 (87.7)	7 (12.3)
	Cholesterol Monitoring			
	Last Chol Measure		Last Chol/Known High Chol	
Variable	≤5 years	>5 years‡	≤1 year	>1 year§
Race/ethnicity	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Non-Hispanic White	1197 (77.5)	340 (22.5)	234 (79.6)	59 (20.4)
Non-Hispanic Black	406 (76.4)	122 (23.6)	79 (76.9)	22 (23.2)
Hispanic	270 (73.5)	96 (26.5)	42 (83.2)	10 (16.8)

* Last BP measure by a healthcare provider >2 years (includes those who never had BP measured).
† BP measured by a healthcare provider at least once, and told had high blood pressure, but last measure >6 months.
‡ Last cholesterol measured by a healthcare provider >5 years (includes those who never had cholesterol measured).
§ Cholesterol measured by a healthcare provider at least once, and told had high cholesterol, but last measure >1 year.
Unweighted frequencies and weighted percents for row proportions.
BP=blood pressure; chol=cholesterol.

DISCUSSION

In this study of the prevalence of blood pressure and cholesterol monitoring among White, Black, and Hispanic respondents, we found no significant differences in the adequacy of blood pressure and cholesterol monitoring among the racial/ethnic groups of interest, despite significant differences in sociodemographic characteristics. Our study findings have several public health implications that can inform urban health care and policy.

First, adequate monitoring of blood pressure and cholesterol, major modifiable risk factors in the development of coronary artery disease, is a critical first step in the identification of hypertension and hypercholesterolemia. The prevalence of adequate blood pressure and cholesterol monitoring in this study population closely approximates state and national reports. Estimates of adequate blood pressure monitoring in 1999 (blood pressured by a healthcare provider within the past two years) in this local dataset including White, Black and Hispanic respondents at the state[2] and national level[33] are 95.5%, 96.3%, and 94.5%, respectively. Estimates of adequate cholesterol monitoring in 1999 (cholesterol measured within the past five years) in this local dataset, and at the state[2] and national level[33] are 75.7%, 76.6%, and 69.1%, respectively. Our

Table 3. Associations among racial/ethnic groups, covariants, and inadequate blood pressure measurement

	Last BP Check >2 years*					High BP and Check >6 months†				
	White	Black		Hispanic		White	Black		Hispanic	
	OR	OR	CI	OR	CI	OR	OR	CI	OR	CI
Age/sex	1.00	.65	.34–1.24	1.38	.80–2.4	1.00	.65	.32–1.35	.64	.25–1.66
Demographics‡	1.00	.51	.23–1.13	.61	.21–1.8	1.00	.94	.38–2.3	2.10	.37–11.5
Age/sex/insurance/source of care§	1.00	.73	.31–1.7	.87	.37–2.1	1.00	1.00	.37–2.7	1.10	.37–3.4
Age/sex/psychosocial variables‖	1.00	.68	.34–1.4	1.12	.57–2.2	1.00	.40	.17–.92	.51	.17–1.5
Age/sex/neighborhood¶	1.00	.68	.35–1.3	1.37	.79–2.4	1.00	.65	.29–1.5	.77	.29–2.0
Fully adjusted model	1.00	.72	.24–2.2	.60	.17–2.1	1.00	.7	.15–3.1	5.00	.95–26.3

Logistic regression, odds ratio (OR), and 95% confidence intervals (CI): non-Hispanic White, non-Hispanic Black, and Hispanic race/ethnicity.
* Last blood pressure check >2 years (including those who never had it checked).
† Last blood pressure check >6 months for those with known high blood pressure.
‡ Demographic variables: age, sex, married, annual household income, education, employed for wages, primary language not English.
§ Insurance/source of care variables: no health insurance, missed health care because of cost, last MD visit >12 months, where get routine care.
‖ Perceived health/psychosocial variables: health fair/poor, poor physical/mental health >15 days/month, depressed, social support rarely/never, ≥60 drinks/month.
¶ Neighborhood variables: weapon related injury surveillance survey rate/100,00 population, medically under-served area.

Table 4. Associations among racial/ethnic groups, covariants and inadequate cholesterol measurement

	Last Cholesterol Check >5 years*					High Cholesterol and Check >1 year†				
	White	Black		Hispanic		White	Black		Hispanic	
	OR	OR	CI	OR	CI	OR	OR	CI	OR	CI
Age/sex	1.00	1.01	.76–1.35	1.18	.87–1.62	1.00	1.00	.53–1.88	.68	.31–1.51
Demographics‡	1.00	.76	.53–1.0	.52	.28–.99	1.00	.83	.81–4.48	.77	.24–2.49
Age/sex/insurance/source of care§	1.00	1.07	.77–1.5	1.07	.74–1.6	1.00	.77	.35–1.8	.92	.35–2.4
Age/sex/psychosocial variables‖	1.00	.97	.71–1.34	.94	.66–1.3	1.00	1.20	.65–2.5	.93	.40–2.2
Age/sex/neighborhood¶	1.00	1.01	.75–1.4	1.20	.90–1.7	1.00	1.00	.54–1.9	.62	.27–1.4
Fully adjusted model	1.00	.74	.46–1.2	.62	.31–1.25	1.00	1.65	.15–2.81	.93	.17–5.26

Logistic regression, odds ratio (OR), and 95% confidence intervals (CI): non-Hispanic White, non-Hispanic Black, and Hispanic race/ethnicity.
* Last blood pressure check >5 years (including those who never had it checked).
† Last blood pressure check >1 year for those with known high blood pressure.
‡ Demographic variables: age, sex, married, annual household income, education, employed for wages, primary language not English.
§ Insurance/source of care variables: no health insurance, missed health care because of cost, last MD visit >12 months, where get routine care.
‖ Perceived health/psychosocial variables: health fair/poor, poor physical/mental health >15 days/month, depressed, social support rarely/never, ≥60 drinks/month.
¶ Neighborhood variables: weapon related injury surveillance survey rate/100,00 population, medically under-served area.

findings indicate that while the overall frequency of blood pressure monitoring is adequate (Healthy People 2010 goal is 95%), the overall frequency of cholesterol monitoring is unacceptably low (Healthy People 2010 goal is 80%).[33] Improvement in the frequency of cholesterol monitoring should be a priority to reduce the burden of hyperlipidemia-related morbidity and mortality.

Second, contrary to earlier reports in the literature,[34] but consistent with a recent report at the national level,[9] no significant differences were seen in the adequacy of monitoring blood pressure and cholesterol by race or Hispanic ethnicity in this dataset. This lack of disparity in preventive measures may be due in part to effective public policy in Boston during the study period (1999). Specific policies at that time addressed barriers to access to preventive cardiovascular services for under-served populations through an aggressive Medicaid enrollment program and a strong network of community health centers and may have provided a safety net that facilitated parity in monitoring.

Of note, Black and Hispanic survey respondents were more likely than their White counterparts to lack health insurance; however, they were more likely to have seen a physician in the past year. This finding is in contrast to published 1999 national data regarding health care delivered to adults where Whites were reported to have higher rates of visits than Blacks; (293.2 vs 210.7 visits per 100 persons per year).[35,36] The fact that individuals of African descent and Hispanic ethnicity in this study were more likely to have Medicaid or receive free care and were more likely to receive their care from a community health center may explain this dichotomy. Boston has a strong network of Community health centers, and these community health centers provide culturally and linguistically competent care regardless of ability to pay; visit costs are supported by Medicaid, the free care pool, and grants from the federal government. In addition, these community health centers provide transportation to medical visits, hire from within the community, and are more likely to provide linguistically competent services. Language is a significant barrier to care and contributes to poor appointment attendance and poor risk factor control.[37,38] In this dataset, Hispanic patients, 70% of whom reported Spanish or Portuguese to be their primary language at home, were more likely to have seen a physician in the past year than their White counterparts and were equally as likely to have had their blood pressure or cholesterol measured; this finding may indicate the relevance of linguistic competence at these community health centers.

A strong network of community health centers may provide a safety net for individuals with limited insurance and income, low educational attainment, and language barriers. Thus, in the context of this study, enrollment in Medicaid, access to affordable or free care, and receiving care through a community health center may have provided a safety net that influenced the findings we observed. If these factors help explain the lack of disparity observed, trends in funding are worrisome. Community health centers evolved under the premise that they would serve all patients, regardless of their ability to pay. Since 1990, the system has witnessed declining levels of federal contribution,[38] and recent studies suggest that community health centers are providing care to fewer uninsured patients as part of their effort to manage their Medicaid population, as well as declining funds for Medicaid and the free care pool.[39]

Finally, despite the finding that race or Hispanic ethnicity is not associated with inadequate blood pressure and cholesterol monitoring, significant health and socioeconomic inequalities were observed for the racial and ethnic minorities represented in the study. Individuals of African descent and Hispanic ethnicity in this study reported

lower educational attainment and income levels, lived in neighborhoods with high violence and poverty characteristics, and were more likely to suffer high rates of morbidity and comorbidity, including psychological distress. These data are similar to the socioeconomic inequalities reported for Black and Hispanic communities, using both survey and direct measurement methods.[17,18] Prevalence estimates of morbidity by race/Hispanic ethnicity observed in this self-reported sample are comparable to national estimates that were obtained by direct and survey measurement and state estimates using the BRFSS.[6,24,33]

This study has several limitations that deserve comment, including issues related to subject selection, absence of information about provider behaviors, and the relatively small size of subgroups. Having a phone is a criterion for entry into the study; therefore residents without a phone are excluded, creating de facto self-selection. Most US households currently have a telephone, however, even in low-income and geographically isolated areas; therefore this problem is not as great as it might have been in the past.[6,19] In Boston, phone coverage is estimated at ≈90%,[3] thus this limitation is unlikely to have had a major impact on the findings. The BRFSS uses self-reported measures of behavior; however, it has been tested for validity and reliability over the past 30 years, including its utility in minority populations.[25,26,40] In addition, the responses on the Boston oversample compare well to state and national datasets that used both direct measure and multiple survey methods to assess morbidity, monitoring prevalence, and socioeconomic characteristics.[2,6,33,41] Thus, the integrity of the sample and design allay some of the concerns about self-reported measures of behaviors.

The Institute of Medicine Report, *Unequal Treatment*, delineates several factors that can influence treatment and control of cardiac risk factors including access to care, environmental factors (safe affordable places to exercise, access to healthy food, neighborhood characteristics, stress of racism), attention to psychosocial factors, quality of care, and institutional racism.[38] The recent release of the CDC Public Health Action Plan to Prevent Heart Disease and Stroke calls for aggressive policies that place prevention (primary and secondary) at the apex of treatment.[6,24,33,42] In our study, despite the fact that Blacks were more likely to be seen by a physician in the past 12 months and were equally likely to have had blood pressure monitoring, they had significantly higher rates of hypertension and were more likely to report two or more comorbidities. This finding raises the issue of the quality of services provided and moves the discussion beyond screening/monitoring (identification) to prevention (early and aggressive lifestyle interventions in at-risk individuals) and care (effective treatment and control).

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AUTHOR CONTRIBUTIONS

Design concept of study: Stuart-Shor, Nannini, Russell
Acquisition of data: Stuart-Shor, Ostrem
Data analysis interpretation: Stuart-Shor, Nannini, Ostrem, Russell, Mittleman
Manuscript draft: Stuart-Shor, Nannini, Mittleman
Statistical expertise: Ostrem
Administrative, technical, or material assistance: Ostrem
Supervision: Nannini, Ostrem, Russell, Mittleman