

Skin Color, Ethnicity, and Blood Pressure II: Detroit Whites

ERNEST HARBURG, PHD, LILLIAN GLEIBERMANN, PHD, FERIDUN OZGOREN, MPH,
PETER ROEPER, MA, AND M. ANTHONY SCHORK, PHD

Abstract: Census areas in Detroit were ranked for their stress scores based on instability (e.g., crime, marital break up) and socioeconomic status. Four areas were selected for detailed study: 1) high stress, population predominantly black and 2) white, and 3) low stress, population predominantly black and 4) white. A sample was drawn from each area of persons of the predominant race, 25–60 years old, married and living with spouse, and having relatives in the Detroit Area. Nurses interviewed such persons; three blood pressure readings were taken during the first half-hour of medical history, and skin color was rated. While lighter skin color showed a negligible relation to higher blood pressure, a four-category division of European national background based on a skin color cline in Europe from Northern areas to the Mediterranean was significantly associated with a nurse-rating of skin color.

The rank order of this four category variable, white ethnicity, was related linearly to both systolic and diastolic blood pressure means. Respondents with parents from Mediterranean countries had the lowest pressures and those from Northern Europe had the highest. The relationship is stronger for women than men.

The relationship was independent of nine other control variables including age, overweight, smoking, etc., and high and low stress areas, although of greater magnitude for the high than low stress groups.

In this article, findings in whites are compared with prior results in blacks. Findings suggest that physiological and biological correlates exist that can be explored profitably by future research. (Am. J. Public Health 68:1184–1188, 1978.)

Introduction

This paper explores the serendipitous finding that among American whites in a Detroit study,¹ lighter skin and North European heritage are related to higher blood pressure. The term “white” or Caucasian is a “catch-all” for those individuals not labeled “black” or “yellow” and is certainly an oversimplification. It is obvious that American “whites” emerge from antecedent ethnic populations in Europe which differ from each other genetically, culturally, and environmentally.

Empirical observations have shown that a north-south cline exists in Europe for increasing pigmentation.² Thus, American Caucasians from Northern European origins are lighter skinned than those from lands whose national boundaries lie on the Mediterranean coast. Since distinguishing between rated skin colors of whites may be a dubious process, a grouping by European ethnic origins could be used as a means of categorization. Although the resultant grouping is roughly coterminous with genetic, cultural, and environmental distinctions, the ordering of the categories can be determined by the documented skin color cline in Europe.

Address reprint requests to Dr. Ernest Harburg, Research Scientist, Program for Urban Health Research, The University of Michigan, 405 Fourth Street, Ann Arbor, MI 48109. Dr. Harburg is also with the Departments of Epidemiology and of Psychology at the University; Dr. Gleibermann and Mr. Roeper are former Research Associates, and Mr. Ozgoren is currently Research Associate, with the Program for Urban Health Research; Dr. Schork is Professor, Department of Biostatistics, U-M School of Public Health. This two-part paper, submitted to the Journal December 2, 1977, was revised and accepted for publication May 19, 1978

McKusick has stressed the importance of using ethnic groupings in the problems of the epidemiology of disease,³ and prior research on hypertension has extensively utilized cross nationality and race comparison groups.⁴ Our objectives here are to examine whether: 1) whites, whose origins are classified by the north-south skin color cline in Europe differ in levels of blood pressure; and 2) whether these relations are contingent on other sociodemographic conditions, especially socioeconomic level and residence in stress areas.⁵

Method

Description of Sample and Measures

Prior articles have detailed the population and sample studied.^{1, 5, 6} Briefly, four census areas in Detroit were classified as high as low stress areas, predominantly black and predominantly white. Following a household census of these four areas, a sample was selected from a population of persons who lived in the area, were of the predominant race, 25–60 years old, married and living with spouse, and had relatives in the Metropolitan area. This sample was then interviewed by a team of 15 nurses of the same race as the respondents. During an interview of one hour or more, three blood pressures were taken in the first half-hour using a mercury sphygmomanometer.

The *blood pressure* values in this analysis are the means of the three readings (details described elsewhere.^{1, 7} *Skin color* ratings by the nurse on a four category scale are also described elsewhere^{1, 11}).

Ethnicity

For whites, subjects whose parental antecedents derived from the following countries were placed in the *North European* group: England, Scotland, Wales, Ireland, Netherlands, Denmark, Norway, Sweden, and Finland. Ten fathers from the United States and Canada were also added to this group. If the nationality of the respondent's parent was one of a number of countries bordering on the Mediterranean, these individuals were placed in the group called *Mediterranean*. The remaining countries belonging to the middle European latitudes formed a third group called *Central Europe*. France was somewhat problematic, having a north to south dimension, with its northern border in the North European group and its southern border on the Mediterranean. It was assumed that a portion of the French subjects might be of Mediterranean origin, and thus, it was expected that skin color for this group as a whole would tend to be somewhat darker than that of the Central Europeans but lighter than other countries bordering on the Mediterranean. Since it could not be determined from which locale in France the subject's parent originated, persons of *French* (and Belgian) ancestry were placed in a separate category.

The final code for white ethnicity (N = 492) was: 1) North European, 35 per cent; 2) Central Europe, 38 per cent; 3) French, 10 per cent 4) Mediterranean, 17 per cent. Only 7 per cent of parental marriages for whites were between mates from North European and Mediterranean areas, and therefore, results to be reported are similar whether paternal or maternal origins were considered. The results here presented are for paternal ethnicity.

Control Variables

Nine variables, selected for their known or suspected relation to blood pressure means are used as controls for the effects of health risk factors and environment on blood pressure. These variables, described in more detail elsewhere¹ were as follows: age, weight, height, smoking status, parental hypertension, educational level, family income, season of year, and respondent tension.

The effect of taking drugs for blood pressure was also examined. Analysis indicated that such persons were few per group: 8 of 240 white males, and 10 of 252 white females reported being on such medication. However the majority of those taking medication still showed elevated readings of 140+/90+: 6 of 8 and 9 of 10, respectively. Separate analysis including or excluding those on medication did not alter the results now to be reported.

Results

For whites, correlations showed that the lighter the skin, the higher the raw blood pressure; for both males and females, $r = -.04$, respectively. The magnitude was negligible and nonsignificant; but suggested further inquiry. If white ethnic subgroups ordered by the north-south skin color cline in Europe were in fact related to the rating of white skin color, further inquiry could proceed using this "surrogate" ethnic variable. Table 1 shows clearly that skin color is indeed associated significantly to white ethnicity for males and females in the expected rank order.

We next tested the relationship of white ethnicity to blood pressure levels. Table 2 shows that both systolic and diastolic pressures are significantly related to the rank ordering of white national origins ($p < .01$ and $.02$, respectively). The linear relationship of means indicates that among whites, the darker the skin, the lower the blood pressure. Figure 1 shows that for men, the distinction appears to be only between the two "northern" groups and the two "southern" groups, whereas for women, a linear relationship is evident.

These results might have been confounded by the distribution of the ethnic groups within the ecological stress areas. Data in Table 3 show there is an unequal distribution of the ethnic groups within the stress areas which does not follow a linear pattern. There is a preponderance of Northern Europeans (largely Irish) in the high stress area and Central Europeans (largely German) in the low stress area for both sexes.

TABLE 1—Per Cent Distribution of Skin Color in Whites by Ethnic Groups and Sex

	White Ethnicity							
	Males				Females			
	Northern Europe N = 85	Central Europe N = 80	French N = 28	Mediterranean N = 47	Northern Europe N = 86	Central Europe N = 111	French N = 20	Mediterranean N = 35
1. Fair	18	9	4	0	29	12	20	6
2. Somewhat fair	51	56	50	13	56	56	50	26
3. Somewhat dark	26	34	25	53	13	31	30	51
4. Dark	6	1	21	34	2	2	0	17
TOTAL	100	100	100	100	100	100	100	100

$$\chi^2_9 = 65.0; p < .001$$

$$\chi^2 = 49.4; p < .0001$$

TABLE 2—Means and Standard Deviations of Systolic and Diastolic Blood Pressure (Adjusted for Age and Per Cent Overweight) for Whites, by Ethnicity of Father

Ethnicity of Father	(N)	Whites (N = 492)			
		Systolic		Diastolic	
		\bar{x}	(SD)	\bar{x}	(SD)
1. Northern Europe	(171)	126.5	(15.0)	81.1	(9.5)
2. Central Europe	(191)	124.8	(16.0)	79.5	(10.5)
3. French	(48)	121.3	(14.8)	79.9	(9.5)
4. Mediterranean	(82)	120.4	(12.7)	76.8	(9.5)
Anova: 1 vs 4:		F = 3.78; p < .01 F = 9.20; p < .002		F = 3.46; p < .02 F = 10.07; p < .001	

1. Northern Europe includes: England, Scotland, Holland, Denmark, Sweden, Norway, Finland
 3. French includes: France, Belgium
 4. Mediterranean includes: Spain, Italy, Greece, Yugoslavia, Turkey, Middle East

In a two-way analysis of covariance (data not shown) using white ethnicity and stress area as the grouping variables, on blood pressures with age and per cent overweight as covariates, results indicate that the effect of ethnicity was significant on diastolic pressure for both sexes ($p < .05$) and on systolic pressure for females only. Stress area had no significant effects, and there was no interaction.

We next examined the blood pressure means for each of the four white ethnic subgroups within the high and low stress area. We found that blood pressure maintained a linear relationship with the ordered skin color cline, but statistical significance varied. Within the high stress areas, for both sexes the light skinned Northern group had significantly higher systolic and diastolic pressures than the dark skinned Mediterraneans. In the low stress areas, while a linear relationship existed for pressure levels and the four subgroups, comparisons of means did not reach significance for either sex for either blood pressure measure.

A covariance analysis was performed with the nine control covariates (see Method) plus father's place of birth (foreign born or native born*). To view the effect of these control variables, they were tested in a least squares regression with blood pressure readings being the dependent variable, within the two white ethnic groups differing most by skin color. Table 4 shows the results of this analysis. For age, it appears that a significant relation to blood pressure emerges only for persons of Northern European background, while per cent overweight is significant in seven or eight tests. Unexpectedly, height appears negatively related in six of eight tests, with this trend being of more magnitude for females, though nonsignificant. Colder season and higher pressure emerges only for persons of North European origins, significant only for diastolic levels. Father's place of birth appears unrelated to blood pressure. Only age

and season therefore appear differentially related to blood pressure when controlling on ethnic origins ranked by skin color, i.e., older age and colder season are related to higher pressure for those of North European origin but not for persons from a Mediterranean background.

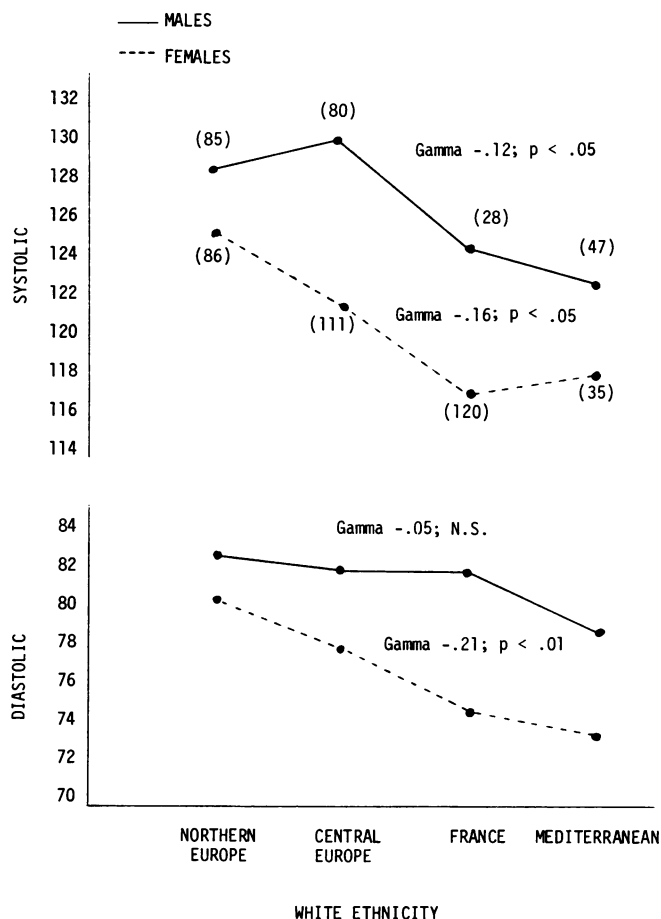


FIGURE 1—Blood Pressure (Adjusted for Age and Per Cent Overweight) and White Ethnic Groups, by Sex

*Father's place of birth was included because it was found that white females whose fathers were foreign born had significantly lower systolic and diastolic blood pressure, adjusted for age and per cent overweight, than female offspring of native born fathers. There was no similar findings for the males.

TABLE 3—Per Cent Distribution of White Ethnic Groups by Stress Area

Ethnicity of Father	Males		Females	
	High Stress N = 120	Low Stress N = 120	High Stress N = 130	Low Stress N = 122
	%	%	%	%
1. Northern Europe	48	23	49	18
2. Central Europe	19	48	29	61
3. French	10	13	11	5
4. Mediterranean	23	17	12	16
	100	100	100	100
$\chi^2_3 = 27.4; p < .001$ $\chi^2_3 = 36.5; p < .0001$				

Discussion

Although we recognize the presence of the “unmeltable ethnics”⁸ in the United States, there is little systematic data on ethnic differences related to cardiovascular risk factors,

except for a few early studies^{9, 10} Skin color, a quantitative genetic trait as well as a trait of social status, has been used to stratify American “whites.” This grouping by ethnicity categorized by the North-South skin color cline in Europe based on parental national origins showed lower pressures with more southerly cultures (and darker skins) for “whites” independently of other factors. An earlier paper dealing with blacks only showed higher pressures related to persons with darker skin and to those having a heritage from the “West Indies”.¹ The following comments will emphasize comparisons of results between whites and blacks in this and the prior article.

For whites, cultural differentiation of regional types in Europe must be considered as a possible contributor to the observed blood pressure differences. Popular stereotypes picture the Northern European as stolid, serious, and the Mediterranean as outgoing and easily angered. These stressor response types could be transmitted psycho-socially within ethnic groups in the United States, and find secondary expression in blood pressure regulation.¹¹ A similar hypothesis for blacks could explain the higher pressures of West Indians.

Some of the contrasting results of our analyses are also of interest; higher blood pressure for blacks was related to being taller, but for whites, to being shorter. Although the

TABLE 4—Least Square Regression of Blood Pressures by Sex and Northern Europeans and Mediterraneans

Control Variables	Partial Correlations							
	Males				Females			
	Northern Europeans (N = 85)		Mediterraneans (N = 47)		Northern Europeans (N = 86)		Mediterraneans (N = 35)	
	Sys.	Dias.	Sys.	Dias.	Sys.	Dias.	Sys.	Dias.
1. Age	.31**	.29**	.30	.26	.45***	.41**	.19	.16
2. Per Cent Overweight	.25*	.10	.58***	.39*	.35**	.47**	.59**	.48**
3. Height	-.05	-.10	.00	.07	-.17	-.11	-.15	-.24
4. Cigarettes Daily	.13	-.01	-.07	-.07	-.03	-.08	.32	.36
5. Parents High Blood Pressure	-.01	-.03	.09	.07	.20	.13	-.02	-.14
6. Education	-.01	-.01	-.03	-.05	.04	-.02	.00	.00
7. Family Income	.05	.07	-.04	.13	.23*	.10	.30	.43
8. Season (warm to cold)	.12	.27*	.07	.07	.13	.28*	-.06	-.02
9. Rated Tension	.28**	.31**	.02	.00	-.07	-.23*	.21	.14
10. Father Native Born (No, Yes)	-.12	-.11	.16	-.04	.05	.05	.04	.06
R =	.52	.54	.69	.54	.62	.68	.72	.68
R ² =	.27	.29	.47	.29	.39	.46	.52	.47

*p < .05
 **p < .01
 ***p < .001

trend for whites was weak and nonsignificant, the contradiction, like that for skin color and blood pressure, should be noted for further analysis. Similarly, within whites, older age and colder season were significantly related to higher pressure for persons of North European background, but not for those from a Mediterranean origin. This suggests that white ethnicity, ranked by skin color or *other clines*, might be used to explore further differential effects of heritage in other epidemiological inquiry into blood pressure. Finally, smoking was positively and independently related to blood pressure for blacks, especially females, but appeared to have negative and negligible correlation for females of Northern European background (especially for white females, over forty years old, data not shown).

These findings implicate physiological and biochemical correlates of race and ethnicity. The relationship of skin color to the tyrosine-melanin pathway and its possible effect on blood pressure regulation has been discussed.^{1, 12} The relationship of colder season to blood pressure in Northern Europeans but not in Mediterraneans suggests that differences in thermoregulatory mechanisms should be investigated with respect to vasoconstriction and vasodilation. Recently differences in kallikrein, a vasodilator, have been reported between "whites" and "blacks".¹³ Plasma renin activity has also been related to blood pressure and differs between "whites" and "blacks".¹⁴⁻¹⁶ The hypothesis that "blacks" appear to retain more salt in their bodies than "whites" has been revived for further research on blood pressures.¹⁷ *Reactivity levels of these physiological processes should be examined for effects between white ethnic groups as well as between black skin color groups.* Finally, because of the intricacies of isolating these specific mechanisms related to blood pressure, most of the work must necessarily be specialized, but there may be high yields from combining the leads from several specialty areas into an integrated project. Thus such biological factors as adrenal products (aldosterone, norepinephrine) might be compared both among and between key ethnic groups along with controls on socioenvironmental factors (socioeconomic status), psychosocial behavior (expressions of emotions, such as anger), and hereditary factors in concurrent investigation.¹⁸

REFERENCES

1. Harburg E, Gleiberman L, Roeper P, et al: Skin color, ethnicity and blood pressure—I: Blacks. *Am J Public Health* 68:000-000, 1978.
2. Garn SM: *Human Races*, 3rd edition, Springfield: Charles C Thomas, 1971

3. McKusick VA: The ethnic distribution of disease in the United States. *J Chron Dis* 20:115-118, 1967
4. Stamler J, Stamler R, Pullman TN (eds): *The Epidemiology of Hypertension*. New York: Grune and Stratton, Inc, 1967
5. Harburg E, Erfurt JC, Chape C, et al: Socio-ecological stressor areas and black-white blood pressures: Detroit. *J Chron Dis* 26:595-611, 1973
6. Harburg E, Erfurt JC, Schull WJ, et al: Heredity, stress and blood pressure, a family set method: I. Study aims and sample flow. *J Chron Dis* 30:625-647, 1977
7. Harburg E, Schork MA, Erfurt JC, et al: Heredity, stress and blood pressure, a family set method: II. Results of blood pressure measurement. *J Chron Dis* 30:649-658, 1977
8. Novak M: *The Rise of the Unmeltable Ethnics*. New York: Macmillan Publishing Co Inc, 1971
9. Epstein FH, Boas EP, Simpson R: The epidemiology of atherosclerosis among a random sample of clothing workers of different ethnic origins in New York City. I. Prevalence of atherosclerosis and some associated characteristics. *J Chron Dis* 5:300-328, 1957
10. Stamler J, Lindberg HA, Berkson DM, et al: Prevalence and incidence of coronary heart disease in strata of the labor force of a Chicago industrial corporation. *J Chron Dis* 11:405-420, 1960
11. Harburg E, Erfurt JC, Hauenstein LS, et al: Socio-ecological stress, suppressed hostility, skin-color and black-white male blood pressure: Detroit. *Psychosom Med* 35:276-296, 1973
12. Korol B, Bergfeld GR, McLaughlin LJ: Skin color and autonomic nervous system measures. *Physiology and Behavior* 14:575-578, 1975
13. Zinner S, Margoulous H, Rosner B, et al: Urinary kallikrein and blood pressure in black and white children. Paper presented at the American Heart Association 18th Annual Conference on Cardiovascular Disease Epidemiology, Orlando, FL, March 13-15, 1978
14. Kaplan NM, Kem DC, Holland OB, et al: The intravenous furosemide test: A simple way to evaluate renin responsiveness. *Ann Int Med* 84:639-645, 1976
15. Channick BJ, Adlin EV, Marks AD: Suppressed plasma renin activity in hypertension. *Arch Int Med* 123:131-140, 1969
16. Helmer OM: The renin-angiotensin system and its relation to hypertension. *Prog Cardiovasc Dis* 8:117-128, 1965
17. Luft F, Block R, Grim C and Weinberger M: Racial differences in blood pressure responses to extremes of sodium (Na+) intake in normal man. Paper presented at the American Heart Association 18th Annual Conference on Cardiovascular Disease Epidemiology, Orlando, FL, March 13-15, 1978
18. Tyroler HA: The Detroit project studies of blood pressure. A prologue and review of related studies and epidemiological issues. *J Chron Dis* 30:613-624, 1977

ACKNOWLEDGMENTS

Funded by National Heart and Lung Institute, #HE 13329-01, 02, 03; Michigan Heart Association, American Heart Association; National Institute of Mental Health, #MH 20621-01; Fannie E. Rippe Foundation.