Race and the Prevalence of Syphilis Seroreactivity in the United States Population: A National Sero-Epidemiologic Study

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Abstract: We used the 1978 National Health and Nutrition Examination Survey to examine the prevalence of positive syphilis serologies in the US population. Analysis of risk markers—gender, age, marital status, education, income, and residence—indicates that all except gender are associated with syphilis seroreactivity, independent of race. Controlling for associated risk markers, the Black-White odds ratio of syphilis seroreactivity is 4.7 (95% CI=2.7, 8.2). Current knowledge of racial differences in sexual and health care behavior does not explain the Black-White difference in the prevalence of syphilis seroreactivity. (*Am J Public Health* 1989; 79:467–470.)

Introduction

During the past 50 years, surveys with varying design have reported large racial differences in the incidence and prevalence of syphilis seroreactivity in the United States.[1–6] Among four million young male military recruits in the 1940s, syphilis rates were more than 13 times higher in Blacks than in Whites[1,2]; in community studies in Baltimore in 1939[4] and Savannah in 1945,[3] Black males were seroreactive at rates 9 to 16 times the rates for White males, and Black females between 16 and 21 times those of White females. Similarly, the first US population-based National Health Examination Survey (NHES-I) in 1960–62 found evidence of syphilis seroreactivity in 10 times as many Black as White men, and in eight times as many Black as White women.[5] Finally, a study of reported primary and secondary syphilis in New York State (outside of New York City) between 1975 and 1981 indicated a Black-White ratio of 8.4.[6]

To reduce the excess risk of syphilis among Blacks, and to control the incidence of syphilis in the general public, we must know not only the distribution of risk in the population, but also those aspects of the social environment which are related to incidence and which may be altered to reduce it. However, with the exception of NHES-I,[5] previous epidemiological analyses of racial differences[2–4] have been limited by sample selection and size, or by restriction to a small segment of the US population.

To further explore these relationships, we examined the distribution of positive syphilis serology in the US by analysis of the second (1978) National Health and Nutrition Examination Survey (NHANES-II)—the largest population-based health examination survey of the US conducted to date.[7] We tested the hypothesis that racial differences in syphilis seroreactivity are explained by differences in the distribution of sociodemographic risk markers—gender, age, marital status, residence, income, and education.

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Methods

Between 1976 and 1980, the National Center for Health Statistics conducted a stratified probability cluster survey of the US population, NHANES-II.[7] Of 27,801 civilian, noninstitutionalized individuals selected, 20,243 were Whites and Blacks 12 years of age and older. In this study we considered only Blacks and Whites age 12 and older. Of these, 18,094 (89 per cent) completed the interview regarding demographics and health and nutritional status; 14,196 subjects (70 per cent of those selected) were administered physical and laboratory examinations. The interview did not include questions on sexual history or history of sexually transmitted diseases (STD); the physical examination did not include the genitalia. Sera sufficient for syphilis testing were available from 12,989 subjects, 92 per cent of those examined. Tests for syphilis seroreactivity were conducted by the Sexually Transmitted Disease Laboratory Program at the Centers for Disease Control.

Sera were screened with the Automated Reagin Test (ART) and quantified with the Rapid Plasma Reagin Test (RPR). Sera reactive in the screening test were confirmed with subsequent reactive results on either the Microhemagglutination Assay for Treponema Pallidum (MHA-TP) or the Fluorescent Treponemal Antibody Absorption Test (FTA-ABS).[8,9]

Projections of US population characteristics based on the NHANES-II sample examined are generally comparable to projections based on the total sample.[10] Similarly, comparison of projected population characteristics from the NHANES-II sample interviewed but not tested for syphilis with projections from the sample tested suggests no major bias in study estimates based on the sample tested (see Appendix).

In our estimation of prevalences and odds ratios of seroreactivity, each subject was assigned a weight based on three characteristics: the probability of being sampled by NHANES-II, refusal to be examined (adjusted for age, income, urban residence, and region), and a poststratification factor to ensure that the weighted sample agreed with that of the US population in mid-1978 in distributions of gender, race, and age. Standard errors of prevalence and odds ratio estimates were made with a first order Taylor series approximation, incorporating the complex sample design.[11,12]

Several sociodemographic risk markers are associated with race in the NHANES-II population. Blacks are younger and less likely to be married; they live more commonly in central cities, have less education and lower incomes. These sociodemographic risk markers might confound the association of race and syphilis seroreactivity.

We estimated odds ratios for each sociodemographic risk marker (i.e., race, gender, age, income, etc.) while controlling for other factors, using logistic regression.[11] Because eventual education and marital status are less likely to be established by age 20, we restricted these analyses to subjects age 20 years and older. We also ascertained odds ratios for Blacks versus Whites in substrata defined simultaneously by education, income, and marital status, for which the sample was large enough ($n \geq 50$ for each race) for reasonable estimation.

Results

The prevalence of syphilis seroreactivity among persons 12 years of age and older in the 1978 US population is estimated to be 0.81 per cent (Table 1). The prevalence among Blacks is 3.05 per cent and among Whites it is 0.53 per cent, for a crude prevalence ratio of 5.7 (95% CI = 3.8, 8.6).

As expected, the prevalence of seroreactivity is related to age, marital status, residence, income, and education; prevalence is little affected by gender (Table 1). For the most part, the associations of these sociodemographic risk markers and syphilis seroreactivity hold both for the population as a whole and for the population stratified by race (Table 1). Prevalences for seroreactivity in Blacks relative to Whites are substantially elevated in all sociodemographic strata, except for those with income greater than $15,000.

The odds ratio of positive serologies, Blacks versus Whites, is 4.7 (95% CI = 2.7, 8.2) when the effects of other variables are controlled by logistic regression (Table 2). There is no statistically significant interaction between race and any of the variables for which we controlled. Prevalence of seroreactivity increases with age, and decreases with college education and greater income. The higher prevalences of seroreactivity among non-married persons and persons living in large cities (SMSAs) are reduced substantially after controlling for other risk markers. The independence of the association between race and seroreactivity is further supported by stratified analysis (data available on request to author).

TABLE 2—Odds Ratios of Syphilis Seroreactivity for Each Sociodemographic Risk Marker, Independent of all Others

Risk Marker	Odds Ratio (95% CI)
Race (Black vs White)	4.74 (2.74–8.20)
Age (per year)	1.05 (1.04–1.06)
Income (per $5,000 decrement)	1.30 (1.01–1.67)
Education	
No High School (HS) vs HS	1.14 (0.62–2.09)
HS vs some college	2.48 (1.07–5.76)
Residence (large city vs not)	1.30 (0.77–2.19)
Marital Status (not married vs married)	1.47 (0.82–2.66)
Sex (male vs female)	1.27 (0.77–2.10)

Discussion

We found Black race to be a strong risk marker of syphilis seroreactivity in the US population, independent of other standard sociodemographic risk markers, a finding consistent with earlier studies. While previous studies have used different serological tests and test sequences, our findings, along with another recent investigation,[6] indicate that the race differential may be narrowing. The crude prevalence ratios of syphilis for Blacks versus Whites appear to have declined from between 9 and 21 in the 1940s, to 8–10 in the 1960s, to 5–8 in the late 1970s. Nevertheless, a large and significant racial difference persists.

Because the syphilis tests used in NHANES-II may become nonreactive after longstanding infection, with or without treatment,[13] or after treatment of early syphilis,[14] this sequence provides a conservative estimate of prior

TABLE 1—Prevalence of Syphilis Seroreactivity in NHANES-II: Per Cent Seropositive (± 1.96 se)

	Total	White	Black	Relative Prevalences (95% CI)
Overall	0.81 (± .17)	0.53 (± .14)	3.05 (± .87)	5.7 (3.8,8.6)
Sex				
Male	.79 (± .27)	.57 (± .24)	2.68 (± .90)	4.7 (3.0,7.2)
Female	.83 (± .20)	.50 (± .18)	3.36 (±1.33)	6.8 (3.7,12.4)
Age (years)				
12–29	.10 (± .07)	.06 (± .06)	.39 (± .44)	6.2 (1.2,33.5)
30–44	.67 (± .31)	.42 (± .28)	2.88 (±2.23)	6.9 (2.2,21.1)
45–59	1.05 (± .41)	.60 (± .42)	5.08 (±2.69)	8.5 (3.1,23.4)
60–74	2.75 (± .63)	1.92 (± .55)	12.28 (±2.78)	6.4 (4.5,9.0)
Education*				
<High School	2.13 (± .59)	1.27 (± .41)	6.52 (±2.12)	5.1 (3.4,7.8)
High School	.77 (± .31)	.57 (± .35)	2.88 (±1.63)	5.1 (2.0,12.8)
>High School	.33 (± .16)	.28 (± .18)	1.01 (±1.09)	3.5 (0.8,14.9)
Income				
<$6,000	2.42 (± .83)	1.45 (± .67)	5.91 (±1.92)	4.1 (2.5,6.7)
$6–9,999	1.03 (± .51)	.68 (± .33)	3.02 (±2.45)	4.4 (1.8,10.8)
$10–15,000	.54 (± .19)	.42 (± .25)	1.79 (±2.10)	4.3 (0.8,21.8)
>$15,000	.28 (± .17)	.28 (± .17)	.32 (± .13)	1.2 (0.6,2.3)
Marital Status*				
Single	0.63 (±0.45)	0.46 (±0.46)	1.59 (±1.10)	3.5 (1.2,10.5)
Married	0.72 (±0.21)	0.48 (±0.16)	3.51 (±1.67)	7.3 (4.1,12.8)
Separated/Divorced	2.16 (±0.96)	1.14 (±0.60)	6.16 (±3.94)	5.4 (2.3,12.3)
Widowed	3.28 (±1.59)	2.22 (±1.37)	9.07 (±4.03)	4.1 (2.2,7.6)
Residence				
SMSA, Central City	1.39 (± .55)	.82 (± .43)	3.12 (±1.08)	3.8 (2.5,5.7)
SMSA, Non-Central City	.53 (± .24)	.43 (± .25)	2.14 (±1.74)	4.9 (1.6,15.0)
Non-SMSA	.64 (± .27)	.46 (± .24)	3.72 (±2.49)	8.2 (3.5,19.0)

*only those over 20 are considered
**Standard Metropolitan Sampling Area

infection. The test sequence also introduces a possible bias in the comparison of race-specific seroreactivity. If Blacks receive medical treatment less frequently, or delay more often than Whites in seeking treatment, they would be more likely than Whites to be detected by the NHANES-II test sequence, given infection. Such ascertainment bias would artificially raise the odds ratios of Blacks over Whites.

Black-White differences in syphilis seroreactivity might be mediated by increased susceptibility to infection among Blacks, given the same exposure, or by greater capacity to sustain or transmit infection. However, while Blacks and Whites are reported to manifest differing symptoms in later stages of syphilis,[15] no studies have demonstrated either differential susceptibility to infection or differential capacity to transmit. Studies which purport to show racial differences in the likelihood of disease transmission per sexual contact[16] have not assured comparable exposures among Black and White subjects.

Higher rates among Blacks than among Whites have been found for a variety of sexually transmitted diseases. Reported gonorrhea is 10 times higher in Blacks in the US population[17]* and between 4.5 and 10.7 higher among women of reproductive ages, adjusted for several measures of sexual activity.[18] Black women in the US population report 1.8 times the rate of ambulatory or hospitalized treatment for pelvic inflammatory disease (PID) as do Whites,[19] and observed hospitalization for PID is 2.5 times more common in Blacks than in Whites.[20] Rates of infertility are 1.9 times greater in Blacks than in Whites.[21] Herpes simplex virus type 2 antibody, controlling for gender, is 3.4 times higher in Blacks,** while hepatitis B antibody, controlling for a variety of sociodemographic risk markers, is 4.6 times higher in Blacks.† AIDS has affected Blacks at a rate 3.1 times that for Whites.[22] Cervical cancer, suspected of an STD etiology,[23] is 2.3 times more common in Blacks.[24]

Population-based surveys of the US[25] have not yet provided comprehensive information on sexual behavior or racial differences in sexual behavior. The most current information compares White and Black women of reproductive age in Los Angeles‡ and in the US population.[26] Several reported characteristics of Black women place them at greater risk of STD. The initiate sexual activity earlier and are more sexually active until age 25, when this difference diminishes[26,‡]; they use barrier methods of contraception less frequently than Whites.‡ Both Black and White women prefer same ethnicity sexual partners‡; thus Blacks are more likely than Whites to have sex in a high prevalence population.

In contrast, other characteristics place Whites at greater risk of STD. Whites report greater numbers of sexual partners than Blacks,‡ and more frequent sexual activity.[‡,26] From these initial current findings, the overall picture of (female) Black-White differences in sexual behavior does not clearly put either group at higher risk.

Evidence on racial differences in treatment for syphilis, other STDs, and other health problems is also sketchy and inconsistent. With regard to health care in general, Blacks are far less likely to be covered by private or federal health insurance[27]; in both good and poor health, Blacks have consistently fewer physician contacts per year.[28] With regard to treatment for STDs, in Columbus, Ohio, fewer White than Black heterosexual patients reported curtailing their sexual activity when they perceive dysuria or urinary tract discharge; patients' response to symptoms of syphilis were not elicited in this study.[29] Whites also delay clinic visits between 30 per cent and 90 per cent longer than Blacks with similar symptoms.[29] It is unclear how findings on health care seeking in general or on sexually transmitted disease clinic patients with discharge or dysuria might apply to patients from the general population with syphilis infection.

Race specific differences may be explained in part by historical differences in prevalence and by the predominance of intraracial sexual relations. While the present study demonstrates the significantly greater prevalence of syphilis seroreactivity among Blacks than among Whites, we do not yet know enough about racial differences in sexual behavior through which infection is acquired, or about racial differences in ways in which infection is eliminated to explain persisting differences in prevalence.

APPENDIX
Demographic Characteristics of Population Projections from NHANES-II Sample Not-tested and Tested

Characteristics	Not-Tested	Tested
Sex		
Male	45.6	47.8
Female	54.5	52.2
Race		
White	86.4	86.7
Black	11.6	10.7
Other	2.0	2.6
Age (years)		
12–29	37.5	41.9
30–44	22.4	23.7
45–59	22.3	20.2
60–74	17.8	14.3
Education		
< HS	32.1	35.9
HS	33.7	28.5
Some college	34.2	35.7
Residence		
Central City	30.9	27.9
SMSA, non-central	34.1	34.7
Non-SMSA	35.1	37.3
Income ($)		
< 6,000	15.8	14.2
6–9,999	21.9	20.3
10–15,000	17.1	18.2
< 15,000	39.0	43.5
unknown	6.3	3.9
Region		
Northeast	26.1	22.4
Midwest	24.5	25.1
South	26.9	25.6
West	22.6	27.0
Marital Status		
Married	67.7	69.6
Single	14.2	14.8
Separated/Divorced	10.3	9.2
Widowed	7.5	6.1

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New Name: Advisory Council on Nurses Education

A name change—from the former National Advisory Council on Nurse Training—and a new charter were announced recently by HRSA. Now known as the Advisory Council on Nurses Education, the council will be increased in size from 19 to 21 members appointed by the Secretary of Health and Human Services. The changes implement provisions of the Nursing Shortage Reduction and Education Act of 1988.

The nursing council will continue to advise and make recommendations to the HHS Secretary and the HRSA Administrator on regulations and policy matters arising from the administration of nurse training programs, and review grant applications and make recommendations for various nurse education programs authorized under Title VIII of the Public Health Service Act.

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