

SPECIAL THEME: MENTAL HEALTH

Race and risk of schizophrenia in a US birth cohort: another example of health disparity?

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Background Immigrant groups in Western Europe have markedly increased rates of schizophrenia. The highest rates are found in ethnic groups that are predominantly black. Separating minority race/ethnicity from immigration in Western Europe is difficult; in the US, these issues can be examined separately. Here we compared rates of schizophrenia between whites and African Americans and evaluated whether the association was mediated by socioeconomic status (SES) of family of origin in a US birth cohort.

Methods Study subjects were offspring of women enrolled during pregnancy at Alameda County Kaiser Permanente Medical Care Plan clinics (1959–66) in the Child Health and Development Study. For schizophrenia spectrum disorders, 12 094 of the 19 044 live births were followed over 1981–97. The analysis is restricted to cohort members whose mothers identified as African American or white at intake. Stratified proportional hazards regression was the method of analysis; the robustness of findings to missing data bias was assessed using multiple imputation.

Results African Americans were about 3-fold more likely than whites to be diagnosed with schizophrenia [Rate Ratio (RR) = 3.27; 95% confidence interval (CI): 1.71–6.27]. After adjusting for indicators of family SES at birth, the RR was about 2-fold (RR = 1.92; 95% CI: 0.86–4.28). Using multiple imputation in the model including family SES indicators, the RR for race and schizophrenia was strengthened in comparison with the estimate obtained without imputation.

Conclusion The data indicate substantially elevated rates of schizophrenia among African Americans in comparison with whites in this birth cohort. The association may have been partly but not wholly mediated by an effect of race on family SES.

Keywords Race, schizophrenia, birth cohort, socioeconomic status

Introduction

Immigrant groups in Western Europe have markedly increased rates of schizophrenia, not explained by diagnostic bias,

higher rates in countries of origin, or selective migration.^{1–3} The highest rates are observed in immigrant ethnic groups who are predominantly black.^{1,4} A recent study in the UK reported a 9-fold higher rate of schizophrenia among individuals of Afro-Caribbean ethnicity, and nearly a 6-fold increased risk of schizophrenia among individuals of Black African descent compared with whites.⁵

Although the line of evidence is impressive, in these West European studies immigration and ethnicity are virtually inseparable. Therefore, the possible contribution of racial/ethnic minority status to these findings cannot be easily addressed. A comparison of the incidence of schizophrenia between African Americans and whites in the United States might shed light on this question. Equally important are the implications of a potential health disparity in the U.S. that has yet to be examined.

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In the United States, there are major health disparities between African Americans and whites, beginning before birth and continuing across the life course.^{6–9} It is possible that another manifestation of those disparities will be found in differences in the incidence of schizophrenia. The results of the three major community prevalence studies since the 1980s are compatible with but do not establish a higher incidence of schizophrenia-like illness among African Americans than whites. In the Epidemiologic Catchment Area study,¹⁰ the prevalence of schizophrenia was significantly higher in African Americans than whites. This disparity was attributed to racial differences in current socioeconomic and marital status. In a prevalence study, however, current socio-economic status and marital status may be a consequence rather than a cause of disorder. Subsequently, in the first National Comorbidity Study, the prevalence of clinician diagnosed non-affective psychosis was elevated among non-whites (RR=1.92; 90% CI: 0.92–3.98).¹¹ In the second National Comorbidity Study, there were too few cases for a stable estimate; findings were therefore inconclusive.¹² We are aware of only one published result on race and schizophrenia from a prospective study.¹³ Although the risk was elevated among African Americans, this was an incidental result within a paper not focused on race, and no information was provided about potential ascertainment bias.

In this article, we compare the incidence of schizophrenia for African Americans with whites in a US birth cohort.¹⁴ Because the Prenatal Determinants of Schizophrenia (PDS) birth cohort was established in a fully insured, urban born population, with comprehensive assessments at pregnancy and birth, this cohort provides a unique opportunity to examine race and risk of schizophrenia absent from the influence of gross disparities in health care access and socio-economic circumstances in family of origin (family SES). We focus on two questions: (i) Do African Americans have a higher risk of schizophrenia than whites? (ii) Is the increased risk mediated by family SES at birth?

Methods

As described in detail in Susser *et al.*,¹⁴ the PDS study cohort derives from the large birth cohort assembled in the Child Health and Development Study (CHDS) to investigate factors affecting pregnancy outcomes and child development. Women receiving prenatal care in Alameda County Kaiser Permanente Medical Care Plan (Health Plan) clinics during 1959–66 were recruited for study. The birth cohort comprised 19 044 live born offspring, all of whom were automatically enrolled in the Health Plan. The Health Plan membership was ethnically diverse¹⁵; the membership captured the middle of the income distribution in the region, and not the extremes.

Inclusion in the PDS study cohort was based on membership in the Health Plan at any time during the period 1981–97 ($n=12\,094$). The majority of departures among offspring from the Health Plan prior to 1980 occurred before age 5. In comparison with the original CHDS cohort, the PDS cohort slightly underrepresented offspring of low-income mothers (22.4% of original live births and 20.0% of PDS follow-up), and modestly overrepresented offspring of African American mothers (23.5% of original live births, 27.8% of PDS follow-up).

The Health Plan registries were used to screen for potential cases as described below. Although there was ongoing attrition from the Health Plan during 1981–97, the population at risk on any given date was defined and enumerated by the Health Plan membership registry. This complete enumeration allowed for the use of a survival analysis and the appropriate inclusion of all available follow-up information from censored as well as uncensored individuals (see statistical analysis).

Case ascertainment and diagnosis

Potential cases of schizophrenia and other schizophrenia spectrum disorders in the PDS cohort were identified through screening of computerized registries of treatments provided by or paid for by the Health Plan. Screening in the hospitalization registry identified PDS cohort members with any of several diagnoses that might be used for a non-affective or affective psychotic disorder (ICD-9 295, 296, 297, 298 and 299). Supplementary screening in outpatient and pharmacy registries was used to identify cohort members who may have been treated for psychosis without being hospitalized. Based on these procedures 183 subjects were targeted for diagnostic assessment (144 hospital + 39 outpatient/pharmacy registries).

Face-to-face assessments were completed on 107 of the 183 targeted. Assessments were conducted by clinicians with a minimum of a master's degree in a mental health related field using the Diagnostic Interview for Genetic Studies (DIGS)¹⁶ and trained to reliability. A DSM-IV¹⁷ diagnosis was assigned by consensus of three psychiatrists who reviewed the interview materials and charts. The remaining 76 of the 183 could not be interviewed: 13 were deceased, 24 could not be located and/or contacted, 32 refused participation and 7 could not be interviewed before the completion of the study (e.g. too ill, incarcerated). For these subjects, best-estimate chart diagnoses were made by psychiatrists trained in research diagnosis. Using these methods, we diagnosed 43 individuals with schizophrenia, 17 with schizoaffective disorder, 5 schizotypal, 1 delusional disorder and 5 'other schizophrenia spectrum psychosis'. The latter five were rated by chart review; information was sufficient for rating non-affective psychosis but not for a specific diagnosis.

Study sample for the current analysis

The derivation of the analytic sample used in this article is shown in Figure 1. As described in previous articles,¹⁴ we include only one child per family in the analytic sample of the PDS ($n=7796$). This approach simplifies the analysis by eliminating correlated observations for siblings. In the current analysis, the analytic sample is restricted to the offspring of African American or white mothers as defined below ($n=6636$).

Diagnostic outcomes

Because there is strong evidence of familial aggregation of a schizophrenia spectrum,¹⁸ the PDS was designed to allow both schizophrenia per se and schizophrenia spectrum disorders to be used as the study outcomes. In the present analysis, outcomes were: (i) schizophrenia spectrum disorder (SSD) ($n=62$), including any diagnosis in the schizophrenia spectrum (DSM-IV schizophrenia, schizoaffective disorder, other non-affective psychosis and schizotypal personality

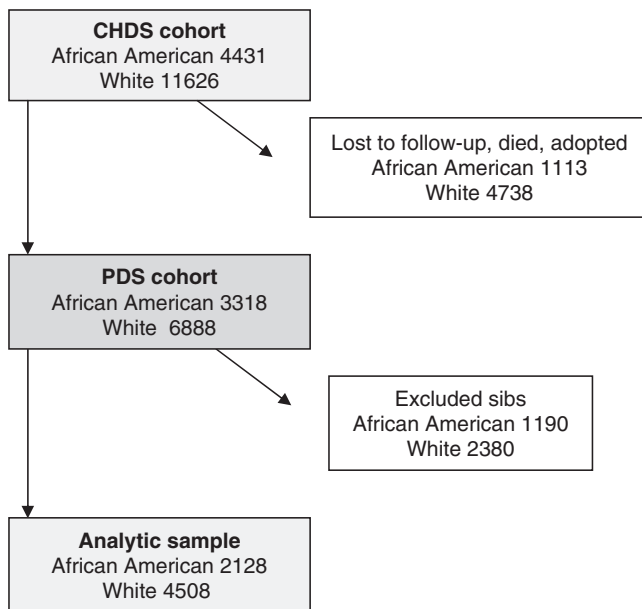


Figure 1 Derivation of the analytic sample

disorder); (ii) schizophrenia ($n=38$), including schizophrenia diagnosis only; and (iii) other SSD ($n=24$), including any SSD diagnosis other than schizophrenia. Note that the first outcome is the sum of the second and third outcomes.

Study definition of race

The race of the mother and father were obtained at the CHDS maternal intake interview; race of offspring was taken from birth certificates. In accord with previous analyses in the CHDS cohort, we use maternal race in these analyses. Maternal race is based on self-identification. Over the study period, the race category options were expanded, and ethnicity was added. Mothers were then asked two questions at the intake interview: 'What is your race?' (White, Negro, Oriental, Other; or White, Negro, Chinese, Japanese, Mexican, Other) and 'What is your nationality or ancestry?' Responses were recorded and used for coding of race/ethnicity in the CHDS.

'Negro/black' mothers are defined as African American, and 'European white' and 'other white' mothers are defined as white in the current analysis. Using these definitions yields 2128 African American and 4508 white subjects. (Figure 1). Generally, the husband was of the same race (98% for African American and 92% for white mothers). Members of other groups were too few for meaningful analysis, and therefore not included.

Covariates

Covariates associated with both race and schizophrenia can be construed either as confounders, or as mediators on the path between race and schizophrenia, depending on the causal pathway being investigated. From either perspective, it is informative to know if any association between race and disease persists after adjustment for these covariates. However, the interpretation of the adjusted result depends upon whether the covariate is hypothesized to be a confounder or mediator, among other considerations.¹⁹

Potential confounders

Four covariates were considered as potential confounders in the analysis: year of recruitment (1959–66), paternal age (<40 years, ≥ 40 years), maternal pre-pregnancy body mass index (BMI) (<27 kg/m², ≥ 27 kg/m²) and prior live births (<3, ≥ 3). Two of these covariates, maternal pre-pregnancy BMI and paternal age, were previously established as risk factors for schizophrenia in this sample.^{20,21}

Family SES

As noted earlier, one of our key aims was to evaluate whether an effect of race was mediated by family SES. Information on four indicators of family SES was obtained at the CHDS maternal intake interview: *Maternal education* was categorized as less than high school graduate (grades 0–12 not graduating, trade school, special school), high school graduate (high school, high school plus special training) and some college or more (some college, college graduate, Registered Nurse). *Paternal occupation* was coded according to US Census categories (Working Paper No. 15),²² a ranking based on combined average levels of education and income for a given occupation, and redefined here as non-manual (professional/technical, managers/office/proprietors, clerical, sales) and manual (craftsmen/foreman, operative workers, service workers, labourers). Those reporting armed services employment ($n=40$), farm owners/workers ($n=7$) and unemployed ($N=36$) were grouped as other. *Total family income*—the sum of earned income and other income—was grouped into four categories (<\$5,000, \$5000–\$6999, \$7000–\$9999, \geq \$10000). *Maternal marital status* was categorized dichotomously as married and living with husband (presumed to be the advantaged social status), vs separated/divorced/widowed/never married.

Statistical analysis

General approach

Proportional hazards regression analysis was used to examine the association between maternal race and each of the three diagnostic outcomes defined earlier (SSD, schizophrenia, other SSD). This method accounts for varying duration of follow-up among subjects. The outcome for cases was defined as the time from birth to the date of first hospitalization, or first outpatient treatment for those not hospitalized. Cohort members who are non-cases were censored as of their last day of membership in the Health Plan within the study period (and then considered lost to follow-up), or the end of study follow-up, December 31, 1997 (end-of-study censoring), whichever came first.²³

Estimation of the race effect

We first computed the unadjusted estimate of the rate ratio (RR) [and 95% confidence interval (CI)] for African-American mothers vs white mothers obtained from the proportional hazards analysis for each of the three diagnostic outcomes. We then adjusted for the four potential confounders (year of intake, pre-pregnancy BMI, paternal age and prior live births), and possible family SES mediators. To evaluate the influence of confounders and possible mediation by family SES we fitted a series of stratified proportional hazards models. The stratified models specified maternal race as the sole predictor variable,

and used the confounders and indicators of family SES as adjustment variables to define strata over which to combine information regarding the association between race and diagnostic outcome. In contrast to a 'direct' adjustment approach (in which adjustment factors are added to the model as covariates), this approach requires fewer parametric assumptions.²³ It allows for arbitrary reference-group hazard functions for SSD within each stratum, so that the proportional hazards assumption is not required for the adjustment factors. The initial set of models adjusted for the each of the adjustment variables one at a time. Subsequent models stratified on multiple adjustment variables collectively.

Strategy for handling missing data

In the main analyses described earlier, each adjustment variable was treated as a categorical stratification factor, with 'missing' defined as one of the categories. For example, missing data percentages for maternal education, paternal occupation, total family income and marital status were 0.2%, 2.2%, 11.2%, and 0.2%, respectively. This approach allowed us to retain observations in the regression analysis, helping us to avoid bias by selective removal of subjects from the analysis.

In further evaluation of possible mediation by family SES, we conducted a multiple imputation analysis^{24,25} to assess the sensitivity of the findings for race to missingness of these factors. In brief, we used the switching regression technique (multiple imputation by chained equations, or MICE) to impute missing values based on observed values,²⁶ assuming the data are missing at random. Missing values for maternal education, paternal occupation, total family income and marital status were imputed using all available information on these variables, as well as year of intake (which is important in evaluating income levels), maternal race and maternal age. Analyses of five imputed data sets were combined in order to re-estimate the RR of SSD for children of African American mothers vs white mothers, using software written for the

STATA system.^{27,28} We compared the race RR estimated from the main analysis with that obtained via multiple imputation to assess consistency. While this comparison does not allow us to rule conclusively on possible bias introduced by missing observations, it can contribute to the overall body of evidence regarding the association between maternal race and schizophrenia in this sample. Observing a very different RR from the multiple imputation analysis might bring into question the validity of our findings without imputation; on the other hand, observing a very similar RR to that observed in the main analysis would lend support to those findings obtained without imputation. Like any missing data analysis, however, our inferences must be viewed as limited with respect to the degree to which missing data are similar to observed data.

Results

Characteristics of the study sample are shown in Tables 1 and 2. Offspring of African American mothers tended to be born later in the study, into families with a greater number of live born children.

Family SES indicators vary with race, reflecting relative social disadvantage of African American Health Plan members on all measured dimensions (Table 2). Nonetheless, African American families were represented in all income, occupational and educational categories. Nearly all African American and white mothers were married and living with their husbands.

SSDs

We diagnosed 32 cases of SSD (22 men and 10 women) among African Americans and 30 (20 men and 10 women) among whites (Table 3). The proportion of SSD cases diagnosed with schizophrenia was higher among African Americans (23/32) than among whites (15/30). Within diagnostic categories, the mean age at index treatment was similar for African

Table 1 Child/Parent characteristics of the study sample

Maternal race		White N = 4508	African American N = 2128
Year of birth	Age during study period		
1959	21–38	1.5%	1.2%
1960	20–37	17.1%	11.5%
1961	19–36	17.0%	11.3%
1962	18–35	18.6%	14.8%
1963	17–34	15.3%	16.0%
1964	16–33	11.8%	15.2%
1965	15–32	8.6%	13.2%
1966	14–31	8.3%	14.2%
1967	13–30	1.8%	2.6%
Maternal age—mean years (SD)		28.14 (6.1)	27.81 (6.4)
Paternal age ^a —mean years (SD)		31.02 (6.9)	31.41 (7.5)
Previous live born infants—mean number (SD)		1.5 (1.5)	2.2 (2.0)
Maternal pre-pregnancy BMI ^a (%) ≥27		6.4%	16.9%
Maternal smoking ^a (%)—ever		55.3%	46.1%
Maternal pre-pregnancy alcohol ^a (%) ≥1 drink per month		64.6%	41.8%

^a Among known.

Table 2 Family SES indicators by race

Maternal race	White N = 4508	African American N = 2128
Maternal education^a		
Less than HS	575 (12.8%)	520 (24.6%)
HS grad	1810 (40.2%)	814 (38.4%)
Some College or more	2116 (47.0%)	785 (37.0%)
Paternal occupation^b		
Non-manual	2630 (59.3%)	557 (26.2%)
Manual	1804 (40.7%)	1497 (70.4%)
Family income^c		
<\$5000	622 (15.4%)	506 (27.5%)
\$5000–\$6999	1150 (28.4%)	582 (31.6%)
\$7000–\$9999	1336 (33.0%)	480 (26.1%)
≥\$10,000	944 (23.3%)	272 (14.8%)
Marital status^d		
Married	4449 (98.8%)	2036 (96.0%)
Sep/div/wid/never	55 (1.2%)	84 (4.0%)

^{a-d} Percentage among non-missing; N missing *a* = 16, *b* = 148, *c* = 744, *d* = 12.

Table 3 Case characteristics by race

Maternal race	White	African American
Cases SSD		
Schizophrenia (N)	15	23
Other SSDs (N)	15	9
<i>Schizoaffective</i>	10	5
<i>Schizotypal</i>	3	1
<i>Delusional Disorder</i>	1	–
<i>SSD-other</i>	1	3
Total	30	32
Age at index treatment (years)		
Schizophrenia (mean)	23.9	22.5
Other SSDs (mean)	26.8	26.3
Gender		
Male	20	22
Female	10	10
Method of assessment		
Face-to-face Interview	20	19
Chart Review	10	13

American and white cases (22.5 and 23.9 years for schizophrenia, 26.3 and 26.8 years for other SSDs, respectively).

Race

In regression models with race as the sole predictor (African American vs white), the estimated RRs were 2.28 for SSD (95% CI: 1.39–3.76); 3.27 for schizophrenia (95% CI: 1.71–6.27) and 1.29 for other SSDs (95% CI: 0.56–2.95).

Adjustment for each of the four potential confounders did not substantially change the race results; no change was >10% (either on the hazard ratio scale or the log hazard ratio scale).

For example, the RR for schizophrenia (which was computed as 3.27 in the crude analysis) varied little after adjustment by stratification, from 3.12 when adjusted for BMI to 3.43 when adjusted for parity (Table 4). Although adjustment for year of intake did not affect the estimated RR for race substantially, it is included in the regression models for subsequent analyses of family SES because of its importance in properly adjusting for income (since income levels changed over the duration of the recruitment period).

Race and family SES

To examine mediation by family SES we first examined the four family SES indicators one at a time (Table 4). In stratified analyses, adjusting for each of the four family SES indicators individually did not substantially impact the magnitude of the race effect. Specifically, race continued to be associated with approximately a 2-fold increased risk for SSD, and approximately a 3-fold increased risk of schizophrenia among offspring of African American mothers compared with white mothers. Adjusting for all four family SES indicators and year of intake had a more substantial impact on the race effect, resulting in still sizeable but statistically non-significant RR estimates: 1.60 (95% CI: 0.84–3.07) for SSD and 1.92 (95% CI: 0.86–4.28) for schizophrenia.

To help evaluate the impact of missingness, multiple imputation was used in the model including all four family SES indicators and year of intake; the estimated RR (African American vs white) for SSD was 1.73 (95% CI: 0.92–3.23), and for schizophrenia, 2.40 (95% CI: 1.09–5.31).

Discussion

In this US birth cohort, African Americans were about 3-fold more likely than whites to be diagnosed with schizophrenia (RR = 3.27; 95% CI: 1.71–6.27). After adjusting for indicators of family SES, the RR was still about 2-fold (RR = 1.92; 95% CI: 0.86–4.28). Thus, the association may have been partly but not wholly mediated by an effect of race on family SES.

Ascertainment bias

A paramount concern in the interpretation of these data is that the detection and/or diagnosis of cases may have differed for African Americans and whites. Our screening relied on the clinical diagnoses in the Health Plan registries. To be targeted for a full diagnostic assessment, a cohort member must have sought treatment. Available evidence suggests, however, that African Americans may be less likely than whites to seek psychiatric care.²⁹ This would have diminished rather than accentuated the association with race in our study.

It has been suggested that clinicians more readily diagnose schizophrenia and less readily diagnose affective psychoses among African Americans than whites with psychotic symptoms.^{30–32} In the study screening, such practices would be unlikely to introduce appreciable bias because in the hospitalization registry we screened for any possible psychosis regardless of whether it was a non-affective or an affective psychosis. In the study diagnoses, a chart review diagnosis should be more vulnerable to race bias than a standardized

Table 4 Rate ratios and 95% confidence intervals estimated from Cox Models for race/ethnicity, adjusted via stratification^a for: (i) potential confounding variables; and (ii) mediating variables relating to family socioeconomic status

Adjustment variables	Estimated RR for Race/Ethnicity (95% CI)		
	All SSD	Schizophrenia	Other SSD
Confounding variables			
None	2.28 (1.39, 3.76)	3.27 (1.71, 6.27)	1.29 (0.56, 2.95)
BMI (≥ 27 vs < 27)	2.18 (1.32, 3.63)	3.12 (1.61, 6.05)	1.24 (0.53, 2.88)
Number of live born children (≥ 3 vs < 3)	2.29 (1.39, 3.80)	3.43 (1.78, 6.62)	1.20 (0.52, 2.78)
Paternal age (≥ 40 vs < 40)	2.26 (1.37, 3.74)	3.35 (1.74, 6.44)	1.22 (0.53, 2.80)
Year of intake	2.18 (1.31, 3.61)	3.20 (1.65, 6.20)	1.18 (0.51, 2.74)
Family SES mediating variables			
Maternal education (in three categories)	2.08 (1.25, 3.45)	2.92 (1.50, 5.66)	1.21 (0.52, 2.81)
Paternal occupation (manual vs non-manual)	2.01 (1.19, 3.40)	2.91 (1.46, 5.80)	1.12 (0.47, 2.66)
Family income (in four categories)	2.08 (1.26, 3.45)	2.90 (1.50, 5.60)	1.23 (0.53, 2.84)
Family income, Year of intake	1.88 (1.11, 3.19)	2.72 (1.37, 5.40)	1.01 (0.41, 2.45)
Marital status	1.94 (1.16, 3.23)	2.61 (1.34, 5.10)	1.17 (0.50, 2.72)
ALL of the ABOVE ^b	1.60 (0.84, 3.07)	1.92 (0.86, 4.28)	1.13 (0.37, 3.46)

^a Note that each model treats race/ethnicity as a direct effect, while stratifying on all adjustment variables in the model. Subjects with missing data are included, having specified a "missing" category as one of the levels of each of the categorical adjustment variables.

^b Cox model for race/ethnicity, stratified on maternal education, paternal occupation, family income, year of intake, and marital status (including a "missing" category for each adjustment variable).

diagnostic interview because charts only include information collected in clinical settings. However, when we restricted the analysis to cases diagnosed by face-to-face interviews, the result for schizophrenia was the virtually the same (RR = 3.75, 95% CI: 1.57–8.94).

While we cannot explain the observed association between race and schizophrenia by these sources of bias, the absence of association between race and other SSDs (RR = 3.75, 95% CI: 0.56–8.94) may have been due to bias. Other SSDs are usually less severe than schizophrenia, and more likely to be treated on an outpatient basis. Some evidence suggests that African Americans are less likely than whites to receive outpatient psychiatric care even in insured populations.³³ If this occurred within our cohort, it would have diminished the observed association between race and other SSDs.

Family SES

We had only limited ability to examine what might mediate an effect of race on schizophrenia. We could, however, examine one of the most significant candidates, family SES. After adjusting for any one factor (maternal education, paternal occupation, total family income, maternal marital status), estimates for direct effects of schizophrenia ranged from 2.6–2.9; after adjusting for all indicators and year of intake, the direct effect was ~2-fold. Although interpretation of direct and indirect effects from regression models should be guarded,³⁴ these results do suggest that causal pathways involving family SES played some role, but were by no means the only pathways.

Our measures of SES were limited in two respects: first, the measures did not include indicators of wealth (assets, home ownership); second, the measures were available only at birth. It is possible that a more comprehensive longitudinal measurement of family SES would have revealed greater mediation of

the race effect by these factors at other points in childhood/adolescence, or a cumulative effect of exposure over childhood.

Other causal pathways

Other causal pathways from the societal to individual levels should be considered.^{35–37} At the societal level, African American race may be conceived as indicating exposure of all group members to status discrimination such as segregated neighbourhoods, differences in educational systems, opportunity structures and racist climate. A downstream effect of societal racism, and a potential mediator of discrimination, is perceived discrimination.³⁸ We could not examine these pathways in our data. It must be kept in mind, however, that not all differences between African Americans and whites are rooted in discrimination. Although race is a very poor proxy for genetic differences, there are genetic factors associated with self-identified race that have been hypothesized to be related to schizophrenia (e.g. factors related to Vitamin D status).³⁹

At present, empirical data on these and other potentially mediating factors are scant. A further complication is that the impact of race may be mediated through different mechanisms at different times, and/or be cumulative. Pending additional studies, including verification of the elevated risk among African Americans found here, it may be wise to keep a broad view of the possible pathways.

Strengths and limitations

This study has a number of strengths, deriving from the study design and the unique nature of the sample. Foremost, the study is based in a well-defined population that includes African American and white families in all income brackets examined. Additionally, because the cohort captures employed

families in a comprehensive prepaid health care system the findings cannot be explained by unequal access to care.

The study also has several limitations. First, as noted earlier, this study relies on treated cases and diagnoses not blinded to race.

Second, differential loss to follow-up might create an artifactual association with race. This could occur if African American 'cases' were less likely than white 'cases' to be lost between onset and first treatment. The converse seems more plausible, however, since African American youth are more frequently in social circumstances that would be associated with loss to follow-up (e.g. unemployment, homelessness) in the interval between onset and first treatment. Furthermore, overall African American and white losses to follow-up were similar during the PDS study period (60.3% and 63.7%, respectively).

Third, in an observational study it is crucial to consider potential confounding. In the main analysis, we considered four potential confounders. To increase confidence in our findings we conducted additional analyses examining other potential covariates including birth weight, maternal age, timing of first prenatal visit, alcohol use and smoking. Individually, none of those examined impacted the significance of the race-schizophrenia association.

Fourth, in the analysis of family SES, as in many studies, a considerable proportion was missing data for income (11%), particularly among African American cases. However, the estimates were similar without and with imputed family SES data, providing some reassurance that the main findings were not explained entirely by bias.

Conclusion

We found that rates of schizophrenia were elevated among African Americans in comparison with whites in a U.S. cohort. If validated in subsequent studies, these findings potentially offer guidance to further investigations exploring the social patterning of schizophrenia and related causal pathways. They are also relevant to examining mechanisms of race-based disparities in health outcomes.

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Commentary: Race and mental health—more questions than answers

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Research on racial disparities in health has a striking paradox. On almost every indicator of physical health status African-Americans (or blacks) have higher rates of morbidity and mortality than whites,¹ but, surprisingly, blacks have lower rates of commonly occurring, mood, anxiety and substance disorders than whites.² However, racial disparities in mental health are complex with the pattern varying for different indicators of mental health status. Compared with whites, African-Americans report lower levels of psychological well being (e.g. life satisfaction and happiness),³ and more often than not, have higher rates of psychological distress.⁴ At the same time, blacks also report higher levels of flourishing (high levels of psychological well-being and being free of current mental disorders) than whites.⁵

The Prenatal Determinants of Schizophrenia (PDS) study highlights an additional dimension of complexity by documenting a 3-fold elevated risk of schizophrenia in a California birth cohort for African-Americans compared with whites.⁶ There has long been the suggestion that blacks have higher levels of schizophrenia than whites but serious questions exist about the accuracy of the available mental health data on this topic. Studies of state psychiatric hospitals find that blacks are

over-represented with schizophrenia,⁷ but these facilities do not provide a comprehensive coverage of schizophrenia cases. Existing data from broad-based population studies also have serious limitations. The Epidemiologic Catchment Area (ECA) study found that while there was little racial variation in the rates of most of the common mental disorders, blacks had rates of schizophrenia that were slightly higher than those of whites, a difference that was reduced to non-significance when adjusted for socio-economic status (SES) and demographic variables.⁸ However, while the ECA study provided good population-based data, the absence of clinical judgement raised serious questions about the validity of the diagnoses for psychotic disorders. The National Comorbidity Study Replication (NCS-R) sought to address some of the limitations of the ECA study by having a clinical re-appraisal interview in which clinicians used a structured diagnostic instrument to re-interview respondents who had earlier completed a psychosis screen. This study found higher rates of non-affective psychosis in blacks compared with whites, but with the national estimate of the prevalence of non-affective psychosis based on extrapolations from a mere 73 clinical re-interviews, there was inadequate statistical power to obtain a stable estimate.⁹

The PDS study avoids some of the limitations of prior research and since it sampled persons with health insurance; it likely excludes the extremes of SES. Accordingly, the racial gap documented here is likely to be smaller than in the general population. However, the PDS study does not rule out longstanding concerns that the higher rate of schizophrenia

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