

The Role of Socioeconomic Status Gradients in Explaining Differences in US Adolescents' Health

ABSTRACT

Objective. This study sought to determine whether socioeconomic status (SES) gradients exist among US adolescents for self-rated health and for 5 diseases that cause serious adolescent and continuing adult morbidity.

Methods. Baseline data from 15483 adolescent and parental surveys from the National Longitudinal Study of Adolescent Health were used. SES indicators included parental education and occupation, and household income. Dependent variables included self-rated health and the presence of depression, obesity, asthma, suicide attempt in the past year, and prior sexually transmitted disease.

Results. SES gradients were found for self-rated health, depression, and obesity ($P < .01$). Suicide attempt was linearly associated with income ($P < .01$). After adjustment for other SES and sociodemographic factors, education and income remained independent correlates of both depression and obesity; income remained an independent correlate of attempted suicide.

Conclusions. Differences in susceptibility to socially mediated etiologic mechanisms of disease may exist during adolescence. Understanding the sociostructural context and patterning of adolescents' lives is crucial to clearly understanding health and disease etiology throughout the course of life. (*Am J Public Health*. 1999;89:1522-1528)

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For the past 3 decades, the graded relationship between socioeconomic status (SES) and health has been the subject of intense research.¹⁻⁷ Although some studies of social determinants of health have focused on infant mortality and child health, most have focused on adults.^{4,8-18} The literature on social inequalities has contained little discussion of adolescence, the time of transition from childhood to adulthood, because the dominant hypothesis has been that social inequalities exist throughout life and interact longitudinally to increase the risks of morbidity and mortality.¹⁹⁻²³ European studies focusing on social class and adolescent health, however, suggest that the general pattern of an inverse relationship between SES and health evident among children and adults is inconsistently present during adolescence.²⁴⁻²⁸

Despite the vast literature on social class differences in health, answers to some simple yet fundamental and important questions about the social determinants of health remain elusive. In the United States, few studies of adolescents have addressed social determinants of health as etiologic factors.²⁹⁻³² If social class is measured, it is controlled in analyses or dichotomized, with a resulting focus on the extremes of the social class gradient.^{31,33-37} No information exists about the social-class patterning of health outcomes among US adolescents along the full SES gradient.

The present study, based on data from the National Longitudinal Study of Adolescent Health (Add Health), a recent nationally representative study of adolescent health, provides a broad look at the patterning of effects of SES on adolescent health. The study focused on 3 chronic and 2 acute diseases responsible for serious adolescent and continuing adult morbidity, which the *Healthy People 2000* program has targeted for reduction.³⁸ Each of these 5 diseases has a major impact on public health. The objective of the study was to determine whether SES gradients exist among US adolescents for self-rated health and these 5 disease states.

Methods

Although composite measures of SES have been widely used, current recommendations specify use of multiple indicators of social class rather than composite indices.^{39,40} This article therefore describes separate measures of income, education, and occupation. Also affecting the conclusions of a study and their applicability within society is whether measures of social class are regarded as quantitative (i.e., years of education) or discrete (i.e., educational certification).³⁹ Because the focus of this study was a description of socioeconomic class gradients that could be understood and linked to the larger literature on the SES gradient in health, the study used discrete, ordinal variables as indicators of SES. Classification into 5 ordered categories, referred to as classes 1 through 5, was done for measures of parental education and household income. Because of the way in which occupation was assessed, this indicator was categorized on 3 levels, as subsequently described.

Study Design and Sample

Add Health is a longitudinal study of US adolescents that focuses on their health and lives.^{34,41} Add Health uses a complex cluster sampling frame to identify a nationally representative sample of high school students and students from these high schools' "feeder

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schools." The present study used weighted data from the Add Health baseline, or wave 1, in-home interviews of adolescents and parents. Of the total sample of 20 745 adolescents in this round, 91% had a sample weight, and 82% of the total weighted sample ($n = 15\,483$) had a biological parent, stepparent, foster parent, or adoptive parent who was the parental respondent; these subject-parent dyads were included in the final sample for the present study.

Measures of SES

Parental respondents were asked to report, in thousands of dollars, total household income before taxes in 1994. A reported family income of zero was recoded as "missing." Income classification was determined in relation to 1994 poverty thresholds adjusted for household size, from household income tables available from the US Bureau of the Census. Poverty was defined as a household income below 1.5 times the adjusted poverty threshold.¹⁵ Thus, income was classified according to the following scheme: below 1.5 times the poverty threshold = class 1; 1.5 to less than 2.5 times the poverty threshold = class 2; 2.5 to less than 4 times the poverty threshold = class 3; 4 times the poverty threshold and higher but not in the top 5% of household incomes according to 1994 US Census information = class 4; and in the top 5% of 1994 US household incomes = class 5.

Parental respondents reported their education and the education of their current partner. These responses, and the sex of the parental respondent, served as the basis for calculating variables corresponding to mother's education, father's education, and educational level of the most highly educated parent of an adolescent subject. Education was classified according to the following scheme: less than a high school degree = class 1; high school degree, general equivalency diploma, or vocational training instead of high school = class 2; vocational training after high school, or some college = class 3; college graduate = class 4; and professional training beyond college = class 5.

Adolescents were asked to identify only a resident mother's and/or father's occupation from a list of 14 possible groupings. No information was recorded for the occupations of nonresident parents. Because Add Health used broad occupational categories from the 1990 US Census codes, instead of the 1980 codes (on which known occupational prestige scales are based), the present study dichotomized occupational groupings into manual and non-manual occupations, as has been done in other studies of inequalities in health.^{7,25,28,42} This number was then corrected for number of parents with a coded occupation.

Disease States

Self-Rated Health. Respondents were asked whether their health was poor, fair, good, very good, or excellent. This variable was then used to separate respondents into those reporting fair to poor health and those reporting good to excellent health, as has been done in other studies of SES and health.^{27,43,44}

Depression. Two items from the Center for Epidemiologic Studies Depression Scale (CES-D) were modified in pretesting for the present study. Combining these items with the 16 of 20 items from the CES-D that are contained in Add Health^{45,46} led to an 18-item scale with excellent internal consistency (Cronbach $\alpha = 0.87$). The full CES-D score was imputed from the sum of these 18 items corrected for the number of missing items. Roberts et al. found that scores of 24 for females and 22 for males maximized the sensitivity and specificity of the CES-D for predicting major depressive disorder among adolescents.⁴⁶ Accordingly, in the present study, females scoring 24 or higher and males scoring 22 or higher were considered as being depressed.

Obesity. Calculation of body mass index (BMI), or weight in kilograms divided by height in meters squared, was performed with self-reported height and weight. Obesity was defined as a BMI of 95% or greater for age and sex.⁴⁷ The 95% figure was chosen as the cutpoint because this criterion is thought to provide better specificity for obesity than are the lower percentile cutoffs used for adults.^{48,49}

Asthma. A single item in the parental interview assessed whether an adolescent subject had asthma or emphysema. Because emphysema is not a disease of adolescence, a positive parental response to this question led to classification of an adolescent as having asthma.

Suicide attempt. Subjects were asked through a computer-based audiotape interview (audio-CASI [Computer Assisted Self-Interviewing] technology)⁵⁰ to report suicide attempts on a 5-point scale. On the basis of the reported number of actual attempts at suicide during the previous 12 months, responses were dichotomized into no suicide attempt in the past year and one or more suicide attempts in the past year.

Sexually transmitted disease (STD). Respondents who had indicated that they were sexually experienced were asked via audio-CASI to assess whether they had ever had chlamydia, gonorrhea, syphilis, HIV or AIDS, genital herpes, genital warts, or trichomonas. Respondents who reported having had any of these diseases were classified as having had an STD.

Basic demographics. Subjects were asked to indicate their racial/ethnic identities.

Race/ethnicity categories used in the study included non-Hispanic White, non-Hispanic Black, Hispanic, American Indian/Native American, Asian/Pacific Islander, and other. A separate variable indicated multiethnicity. Number of "parents" in the home was determined by categorizing answers to the relationship of an adolescent subject to those individuals identified by the subject as living in his or her house.

Data Analysis

Because the focus of this study was on determining whether SES gradients existed for health outcomes, bivariate analyses, with linear polynomial testing, were done to determine whether graded relationships existed between socioeconomic indicators and outcome variables of interest. Analyses using weighted data were done with SUDAAN version 7.5.2 (Research Triangle Institute, Research Triangle Park, NC), to adjust for the complex clustered sampling frame of Add Health.⁵¹ To adjust for the extremely large weighted sample size, Add Health sample weights were normalized and recalculated so that the weighted n for a particular sample was equal to the sample size.⁵² A value of $P < .05$ was considered statistically significant.

Multiple logistic regression analyses were done for diseases found to have SES gradients associated with them. Because of problems with multicollinearity, only a single indicator of education could be included in these models. Since indicators of education followed the same trends in all cases, educational level of the highest educated parent was used. Unadjusted odds ratios (ORs) were progressively adjusted to determine effects of socioeconomic indicators adjusted for other measures of SES and then to determine ORs adjusted for other sociodemographic factors (age, sex, race, multiethnicity, number of parents in the house) in addition to indicators of SES. Indicators of SES were entered as continuous variables in these models to determine linear effects of increasing SES. ORs and 95% confidence intervals are reported.

Results

Descriptive Analyses

Basic descriptive demographic characteristics of the study population, including sex, race/ethnicity, family environment, and health outcomes, are shown in Table 1. Mean age was 15.9 ± 1.8 years, with ages ranging from 11.4 to 21.4 years. The percentages of adolescents within the various SES indicator groupings are shown in Table 2. Although

fewer than 10% came from a family in which no parent had obtained a high school degree, almost one quarter of the subjects were living in poverty.

Bivariate Analyses: Self-Rated Health and Disease States

The relationships between self-rated health and disease states, sex, and parents having a manual occupation are shown in Table 3. Significant sex differences were found for all diseases except asthma. Females were more likely to report depression, a suicide attempt in the past year, and a prior STD, while males were more likely to be obese. Number of parents having a manual occupation was significantly linearly associated only with fair-to-poor self-rated health, depression, and obesity. Figure 1 presents data on the prevalence of fair-to-poor self-rated health and disease states among income and education groups. Fair-to-poor self-rated health, depression, and obesity were significantly associated with household income and with all indicators of education. There were no significant associations between indicators of SES and asthma or STD. A reported suicide attempt was associated with income.

Logistic Regression Analyses

Logistic regression analyses were done to determine independent correlates of depression, obesity, and suicide attempt (Table 4). Adjustment for other indicators of SES caused a significant change in the ORs for both depression and obesity; income and education remained independent correlates of both of these conditions, while occupation lost its significance. Addition of other sociodemographic factors did not affect these findings. Progressive adjustment caused no real change in the relationship between income and suicide attempt in the past year. For all 3 conditions, indicators of SES had comparable modest effects (OR range: 0.84–0.88).

Discussion

This study reveals that while SES indicators are significantly associated with disease states among adolescents, the adolescent population does not consistently show the SES–health gradient that is so pervasive among adults. Depression, obesity, and asthma are all chronic illnesses. In this study, indicators of SES were consistently linearly associated only with measures of depression and obesity, and not with those of asthma. Neither suicide attempt nor STD—the 2 acute conditions investigated in the study—

TABLE 1—Descriptive Demographics of Study Population

	Study Sample, % (Unweighted n = 15 483)
Sex	
Male	51.1
Female	48.9
Race/ethnicity	
Non-Hispanic White	69.2
Non-Hispanic Black	14.1
Hispanic	11.8
American Indian/Native American	0.7
Asian/Pacific Islander	2.8
Other	0.8
Multiethnic	4.1
Family environment	
Both parents born in the United States	41.8
Two parents at home	79.0
Parents currently married	71.1
Parents currently married, married once, and for at least 10 yr	48.4
Fair-to-poor self-rated health	6.5
Disease outcomes	
Depression	9.3
Obesity	8.6
Asthma	11.8
Suicide attempt	3.8
STD ^a	5.3
Two or more indicator diseases	5.0

Note. STD = sexually transmitted disease.

^aPercentage is of sexually active youth only.

was consistently associated with indicators of SES. What is notable is that the associations found for SES and self-rated health, depression, and obesity were robust. They remained independent when other sociodemographic factors often implicated in the SES–health relationship, such as race and number of parents in the home, were controlled.

Both depression and obesity have numerous health and psychosocial sequelae that can have sustained and long-term effects.^{33,48,49,53–55} Many of the correlates of both conditions, as well as their sequelae, are also related to SES. Additionally, both depression and obesity in adolescence are predictive of adult disease. The interrelationships between SES and health outcomes such as depression and obesity and the correlates or sequelae of these outcomes provide fertile ground for future research. Because SES is an antecedent factor in such outcomes, it may be a significant etiologic factor in many aspects of adolescent and adult psychosocial and biological functioning.

Understanding how social forces such as SES exert their effects and create differential states of health remains a critical challenge to researchers in public health. For any stage in life, the pathways through which social forces affect health are poorly elucidated.^{2,6,56} The failure of the present study to find a consistent relationship between socioeconomic indicators and asthma suggests the existence of dif-

ferences in susceptibility to socially mediated etiologic mechanisms of this disease. It is unknown whether SES expresses its effects through the same factors in asthma as in depression and obesity, the 2 chronic diseases associated with SES in this study. SES may act more profoundly on factors that underlie depression and obesity and have less of an effect on the etiologic mechanisms of asthma.

Factors proposed as mediating the SES–health gradient include health-related behaviors, psychological characteristics, residential characteristics, social support, and access to health care.^{2,6,56} Substantial research has been done on adolescent health risk–related behaviors. However, emphasizing health-related behaviors decontextualizes lifestyle and behavioral choices from the social structuring and patterning that underlie these behaviors.⁵⁷ Moreover, socioeconomic differences in mortality have been shown to persist even after control for health-related behaviors.⁵⁸ Thus, the SES–health gradient cannot be fully explained by health-related behaviors, and a direct effect of SES on health must be considered in addition to other mediating factors.

One possible mechanism for this effect is allostatic load. *Allostasis* refers to stability through change, such that an organism uses changes in its internal milieu to meet perceived and anticipated demands made by its environment.⁵⁹ *Allostatic load* is the toll on the

TABLE 2—Multiple Indicators of the Socioeconomic Status of American Adolescents

	Study Sample, % (Unweighted n = 15 483)
Mother's education	
Less than high school	14.1
High school or equivalent	31.0
Some schooling after high school, but not college graduate	27.2
College graduate	12.2
Professional training beyond college	8.0
Missing	7.5
Father's education	
Less than high school	11.1
High school or equivalent	23.5
Some schooling after high school, but not college graduate	19.9
College graduate	11.2
Professional training beyond college	8.8
Missing	25.5
Education of most highly educated parent	
Less than high school	9.4
High school or equivalent	25.0
Some schooling after high school, but not college graduate	29.1
College graduate	15.9
Professional training beyond college	13.1
Missing	7.5
Income^a	
<1.5 × poverty threshold	24.4
1.5 to <2.5 × poverty threshold	20.9
2.5 to <4 × poverty threshold	22.0
≥4 × poverty threshold, but not top 5% of US households	16.2
Top 5% of US households	3.1
Missing	13.3
Resident parents in a manual occupation	
No parent in a manual occupation	44.1
One of 2 parents in a manual occupation	15.1
Both parents in a manual occupation ^b	23.8
Missing	17.0

^aBased on 1994 US Census data adjusted for household size.

^bBoth parents or single parent in a family with only 1 parent working in a codable occupation.

organism over time as the organism attempts to adapt to its environment.⁶⁰ Allostatic load has been implicated in the aging process as well as in the poorer health of school-age children under chronic environmental stress.^{60,61}

Research is also needed on whether allostatic load provides the link between SES and

health. In addition, specific dimensions of SES may act differentially to cause some health outcomes but not others. That income was the only SES measure associated with suicide attempt in the present study supports such a multidimensional view of SES. Income is a more dynamic factor and is more relevant to

adolescents' daily lives than are parental education and perhaps parental occupation. Accordingly, pressures associated with lower household income may acutely affect adolescents' mood, social integration, self-esteem, and other factors known to predict suicidality, whereas effects of more chronic measures of SES such as parental education may cause affective changes but not suicidality.

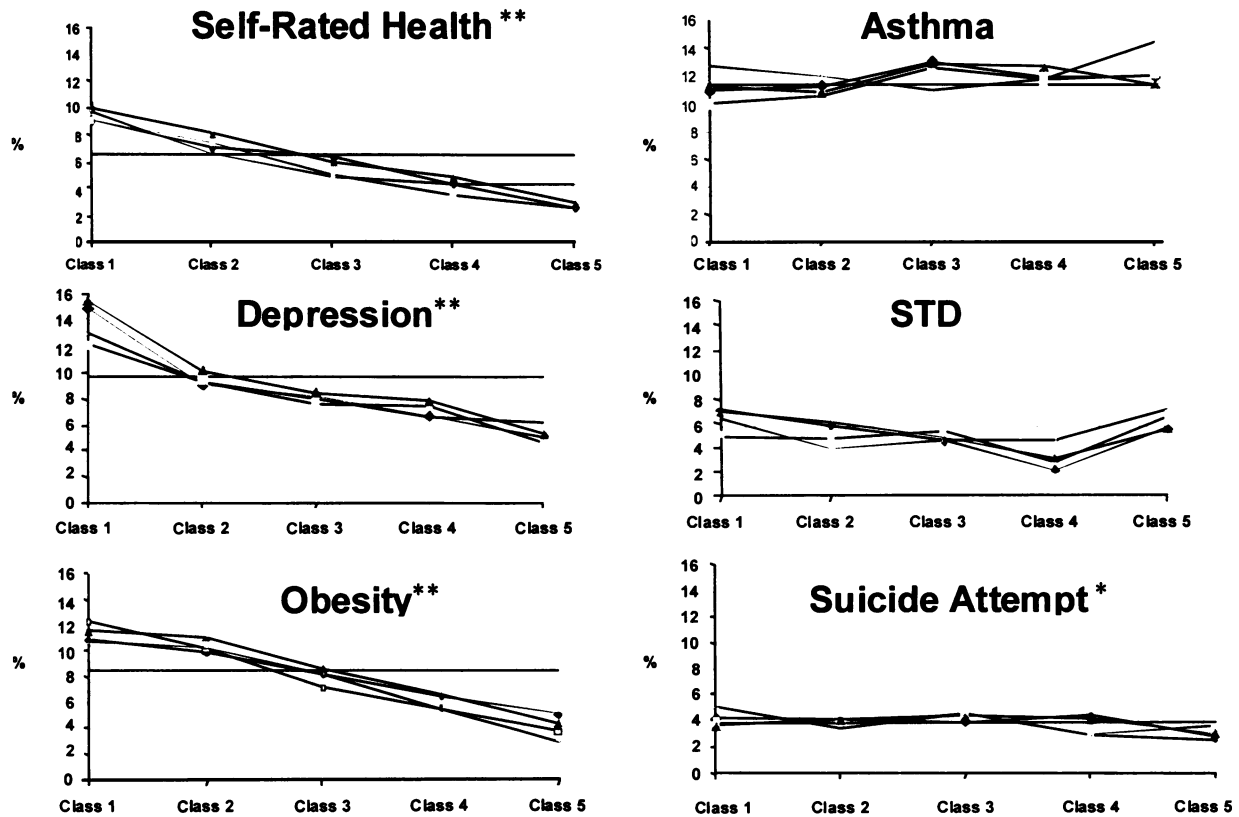
Asthma was the most prevalent morbidity assessed in the present study. This is the first report of asthma rates in a large, nationally representative sample of adolescents. The Centers for Disease Control and Prevention (CDC) Asthma Surveillance System reports age-adjusted prevalence rates for this disease.⁶² The prevalence reported herein (11.8%) is much higher than that reported by the CDC (7.4% for 5- to 14-year-olds and 5.9% for those aged 15 to 34 years) but is not as high as that reported among 12- to 17-year-olds in an urban inner-city environment (15.3%).^{62,63} Crain et al. concluded that an urban environment may in itself have important effects in explaining a higher incidence of childhood asthma, beyond any possible effects of poverty.⁶³

Nevertheless, studies of the relationship between childhood asthma and SES have reached contradictory conclusions, and none has reported data from a large, nationally representative sample of youths, such as that of Add Health.⁶³⁻⁶⁸ The present study found no association between asthma among adolescents and multiple indicators of SES. Because SES gradients have been demonstrated for respiratory disease among adults,^{8,69} the lack of a graded relationship between SES and adolescent asthma supports differences in etiologic mechanisms in adolescent and adult asthma. Behaviors such as cigarette smoking, which have been associated with SES in youth, have been implicated in adult respiratory disease and may be a mechanism through which SES acts longitudinally to produce illness.^{8,30}

TABLE 3—Relationship of Sex and Occupation to Fair-to-Poor Self-Rated Health and Disease States

	Fair-to-Poor Self-Rated Health, %	Depression, %	Obesity, %	Asthma, %	Suicide Attempt, %	STD, %
Sex						
Male	5.4	8.0	10.0	12.4	2.3	3.4
Female	7.7	10.6	7.2	11.4	5.5	7.4
χ^2 P	.0001	<.0005	<.0005	NS	<.0005	<.0005
Occupation						
No parent in a manual occupation	5.0	7.6	6.6	12.5	3.6	4.5
One of 2 parents in a manual occupation	6.1	8.4	10.0	10.8	3.8	4.1
Both parents in a manual occupation ^a	8.1	12.9	10.6	11.1	4.1	6.6
Linear polynomial P	<.005	<.005	<.005	NS	NS	NS

^aBoth parents or single parent in a family with only 1 parent working in a codable occupation.



*P = .01 for income only; **P < .01 for all socioeconomic status indicators.

FIGURE 1—Education and income effects on self-rated health and 5 diseases.

TABLE 4—Logistic Regression Analyses: Independent Effects of Socioeconomic Status (SES) on Depression, Obesity, and Suicide Attempts in the Past Year

	Unadjusted		Adjusted for Other SES Indicators ^a		Adjusted for Other SES Indicators and Socio-demographic Factors ^b	
	OR	95% CI	OR	95% CI	OR	95% CI
Depression						
Education	0.77	0.72, 0.83	0.87	0.78, 0.97	0.88	0.79, 0.98
Income	0.80	0.74, 0.86	0.86	0.77, 0.96	0.85	0.77, 0.95
Occupation	0.80	0.73, 0.89	0.95	0.85, 1.07	0.95	0.84, 1.07
Obesity						
Education	0.77	0.72, 0.83	0.88	0.79, 0.98	0.88	0.79, 0.98
Income	0.79	0.73, 0.85	0.85	0.76, 0.96	0.88	0.78, 0.99
Occupation	0.78	0.69, 0.87	0.89	0.77, 1.02	0.88	0.76, 1.01
Suicide attempt						
Education	0.96	0.88, 1.04	1.08	0.94, 1.23	1.08	0.95, 1.23
Income	0.85	0.77, 0.94	0.84	0.73, 0.96	0.84	0.72, 0.98
Occupation	0.92	0.79, 1.07	0.94	0.79, 1.12	0.92	0.76, 1.10

Note. CI = confidence interval; OR = odds ratio.

^a Variables included educational level of highest educated parent, household income, and parents in a manual occupation.

^b Variables included educational level of highest educated parent, household income, parents in a manual occupation, age, sex, race/ethnicity, multiethnicity, and number of parents in the house.

Like adult asthma and its link to cigarette smoking during youth, suicide attempts and STDs have been linked to adolescent health risk-related behaviors that in turn have significant relationships with indicators of SES.^{30,70} Yet, the present study failed to show a consistent, graded relationship between 2 acute disease states and SES. This may have been due in part to poor sensitivity of the measures included in Add Health for assessing these disease states. The prevalences of both reported suicide attempts and STDs in Add Health were lower than would have been expected from the information provided by the CDC on suicidality and STDs.⁷¹⁻⁷³ Furthermore, the STD variable was created from items in Add Health for assessing specific STDs by name. Adolescents may not be familiar with the specific medical names of STDs or the organisms responsible for them.

This study has several other limitations. Add Health is a school-based study and therefore does not include out-of-school youths, who may be disproportionately affected by illness. Youths with chronic disease are more likely to be out of school, as are homeless and runaway youths, who often

experience significant morbidity.⁷⁴ The information obtained in wave 1 of Add Health is obtained through self-reporting and includes no physiologic data. Add Health assesses the prevalence and not the severity or chronicity of disease. Although the CES-D has been validated among adolescents, it is an epidemiologic instrument and not a diagnostic interview. Additionally, census-based occupational codes were not available in Add Health, and thus the occupation measure used in this study, although used in other studies of SES and health, is crude. Furthermore, although the complex issues involved in measuring and conceptualizing social class/SES have been the subject of intense study, little consensus or clarity exists about how to measure this elaborate construct.^{39,75}

Although it is tempting to continue to seek a single strand in the "web of causation" to explain the effects of SES gradients on health, a better focus might be on "two spiders," one biologic and one social, spinning a joint web of societal factors and health.⁷⁶ The translation of social factors into biologic and pathologic processes (the sociobiologic translation³) is a thorny and complex process that may involve different mechanisms and have different effects at distinct stages in life and that may act differentially for specific disease states. Understanding this translation continues to be a critical objective of research.

The data in the present study provide information about ways in which social factors are related to adolescent disease states that presage adult disease. Although a gradient of SES with adolescent health is not pervasive, these data indicate that socioeconomic factors have meaningful patterns of association with the health of adolescents along the entire spectrum of SES. It is crucial to consider the social context and patterning of the lives of adolescents to clearly understand health and disease etiology. In the case of adolescents, this includes examination of their school and family environments, as well as their broader sociostructural environments. □

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