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Authors
Goodman, Elizabeth
Maxwell, Sarah
Malspeis, Susan
et al.

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Developmental Trajectories of Subjective Social Status

Elizabeth Goodman, MD[a,b], Sarah Maxwell, AB[c], Susan Malspeis, SM[d], Nancy Adler, PhD[e,f,g]

abstract

BACKGROUND AND OBJECTIVE: Subjective social status (SSS), a person's sense of their (or for youth, their family's) position in the socioeconomic hierarchy, is strongly related to health in adults but not health in adolescence. Understanding this developmental discrepancy requires first understanding the developmental trajectory of SSS. The objective of this study was to identify the number and shape of SSS trajectories as adolescents transition to adulthood and explore if trajectory membership affects health.

METHODS: Using data from 7436 assessments from the Princeton School District Study, a decade-long cohort study of non-Hispanic black and white youth, latent class growth models with 3 to 7 SSS trajectories were developed. Model fit, trajectory structure, and shape were used to guide optimal model selection. Using this optimal model, the associations of trajectory membership with BMI and depressive symptoms in young adulthood were explored.

RESULTS: The 5-class model was optimal. In this model, trajectories were persistent high (7.8%), mid–high (32.2%), middle (43.4%), low–lower (7.4%), and high–low (9.1%). Non-Hispanic black race/ethnicity, lower household income, and low parent education were associated with membership in this high–low trajectory. High–low trajectory membership was associated with higher BMI and depressive symptoms in non-Hispanic white subjects but was not associated with depressive symptoms. It was associated with lower BMI only after adjustment for BMI in adolescence in non-Hispanic black subjects.

CONCLUSIONS: SSS is relatively stable in adolescence and the transition to adulthood, and it generally reflects objective markers of social advantage. However, socially disadvantaged youth with high SSS in early adolescence may be at increased health risk.

[a]MassGeneral Hospital for Children, Boston, Massachusetts; [b]Harvard Medical School, Boston, Massachusetts; [c]Medical University of South Carolina, College of Medicine, Charleston, South Carolina; [d]Section of Clinical Sciences, Division of Rheumatology, Immunology, and Allergy, Brigham & Women's Hospital, Boston, Massachusetts; and Departments of [e]Pediatrics, and [f]Psychiatry, and [g]Center for Health and Community, University of California School of Medicine, San Francisco, California

WHAT'S KNOWN ON THIS SUBJECT: Subjective social status (SSS), a person's sense of their or their family's position in the socioeconomic hierarchy, is strongly related to adult health but is not a robust predictor of adolescent health. Developmental trajectories of SSS underlying this discrepancy are unknown.

WHAT THIS STUDY ADDS: Five SSS trajectories are present in adolescence/emerging adulthood. Four stably reflect objective socioeconomic status. The fifth represents a subset of socially disadvantaged youth with "rose-colored glasses" early on. Lower SSS and membership in the fifth trajectory increase health risk.

Socioeconomic inequality is increasing and poses a major barrier to achieving the health equity goals of Healthy People 2020. Decades of research have shown that low socioeconomic status (SES) is associated with adverse health outcomes across diverse populations and age groups. SES has historically been studied by using objective measures such as education and income. Recently, subjective social status (SSS), "a person's belief about his location in a status order,"[1] has been recognized as an important dimension of social stratification.[2–7]

Although SSS was measured for decades based on social class identification,[8,9] social desirability influenced reporting, and the measure was limited in range. To address these concerns, a new SSS measure for use in health-related research was introduced for adults in 2000[2] and for adolescents in 2001.[7] This new measure was a self-anchoring "ladder" scale.[10] Using these ladders, relationships have been demonstrated between SSS and a range of adult health outcomes, particularly for non-Hispanic white populations.[11–13] These relationships are often stronger than those with objective SES measures.[5,6,11–18] Although SSS is associated with adolescent health outcomes, these associations seem weaker and less consistent than those demonstrated in adults.[2,3,18–28]

These developmental discrepancies suggest adolescence is a key period in the formation of an individual's SSS. Adolescence is characterized by rapid physiologic, socioemotional, and cognitive changes. The transition from childhood SES, defined by the family of origin, to adult social status, which is self-defined, begins. Education is often finalized, and entry into the workforce occurs. The capacity to think abstractly develops in adolescence, enabling greater awareness of social hierarchies and the effects of societal stratification.

These factors all influence SSS. However, developmental trajectories of SSS are unknown. To date, all but 1 study of SSS in adolescence have been cross-sectional.[23]

In the present study, data from a longitudinal cohort study were used to identify the number and shape of SSS trajectories as adolescents transition into young adulthood. We explored whether trajectory membership affects exemplar physiologic (BMI) and psychological (depressive symptoms) health outcomes known to be associated with objective SES. We hypothesized that developmental trajectories in SSS exist and that membership in trajectories associated with higher or increasing SSS would be associated with better health while membership in those with decreasing or lower SSS would be associated with poorer health.

METHODS

Study Description

Data were drawn from the PSD (Princeton School District) study, a longitudinal cohort study of cardiometabolic risk in adolescents who were in fifth through 12th grades in the Princeton City School District in Ohio in the 2001–2002 academic year. The study occurred in 2 phases. Phase 1 (2001–2005, n = 2245) included annual study visits (physical examination and student survey) in years 1 through 4 and a baseline parent survey in year 1 (2001–2002). Phase 2, which began in 2008 after a 3-year hiatus and focused on social inequalities in health, included study visits in years 8 (2008–2009) and 10 (2010–2011). Phase 2 targeted a specific subpopulation of the phase 1 cohort; that is, those with parent SES information and who were likely to continue in the study. Furthermore, because the phase 1 cohort was 95% non-Hispanic black or white, those from other racial/ethnic groups were excluded. Thus, phase 2 inclusion

criteria were: (1) non-Hispanic black or white race, hereafter referred to as "black" or "white"; (2) participation in both years 1 and 4 during phase 1; (3) had information on at least 1 SES measure from the baseline parent survey; and (4) were not incarcerated, taking steroids or, if female, pregnant during the data collection periods. Of the 1202 phase 1 subjects eligible for phase 2, a total of 816 (68%) participated (Table 1). All study procedures were approved by the institutional review boards of the associated hospitals and universities.

Trajectory Analysis Sample

To derive SSS trajectories, PSD study data were organized by using the accelerated longitudinal design. This design organizes data according to subjects' age, regardless of which study year that age was reached. We used data from black or white subjects who reported SSS at least twice in the trajectory analyses (N = 1851/1995) (Table 1). These 1851 subjects provided a total of 7436 SSS assessments from ages 12 to 28 years (Supplemental Table 5). The median number of SSS assessments was 4 (maximum possible: 6). The 144 (7.2%) subjects excluded from the trajectory analysis did not differ from those included according to gender, race/ethnicity, baseline score on the Centers for Epidemiologic Studies–Depression (CESD) Scale, or BMI z score, although they were slightly older at baseline (15.0 ± 2.7 years vs 14.4 ± 2.1 years; $P < .01$).

Trajectory Membership's Effect on Health Sample

After developing SSS trajectories, we explored whether trajectory membership affected health by using data from the 816 phase 2 participants followed up into young adulthood. These analyses used the traditional cohort design in which subject data are organized according to year of data collection. The first visit at which SSS was assessed

TABLE 1 Description of the Trajectory Analysis Sample and Phase 2 Subgroup

Characteristic	Trajectory Analysis Cohort (n = 1851)		Phase 2				
			Eligible (n = 1202)		Participated (n = 816)		P^a
	N	%	N	%	N	%	
Female	960	51.9	622	51.7	451	55.3	<.001
Non-Hispanic black[b]	931	50.3	537	44.7	355	43.5	.23
Highest parent education							.002
High school or less	375	20.3	268	22.3	158	19.4	
Some college	450	24.3	340	28.3	231	28.3	
College graduate	427	23.1	345	28.7	243	29.8	
Professional degree	312	16.9	249	20.7	184	22.5	
Missing	287	15.5	0	0	0	0	
Obese year 1	367	19.8	229	19.1	158	19.4	.69
	Mean	SD	Mean	SD	Mean	SD	
Year 1 age, y	14.7	1.7	14.5	1.6	14.5	1.7	.18
Household income ($1000)[c]	65.5	47.8	67.4	45.4	70.3	46.6	.003
Baseline characteristics							
SSS	6.6	1.4	6.7	1.4	6.7	1.3	.09
BMI z score	0.72	1.02	0.73	1.00	0.75	0.98	.29
CESD	14.6	8.9	14.1	8.6	14.0	8.4	.73

[a] P value from Mann-Whitney U test or χ^2 test as appropriate. P < .05 indicates difference between those eligible for Phase 2 and those who participated.
[b] Reference: non-Hispanic white.
[c] N = 268 missing income from the trajectory analysis cohort.

was considered "baseline" in modeling health outcomes, and the dependent variables were drawn from the last available phase 2 assessment.

Measures

Subjective Social Status

SSS was measured with the Subjective Social Status Scale–Youth Version.[7,23] This validated scale asked young people to report their family's position in US society. Scores range from 1 to 10, with higher scores representing higher SSS.

Socioeconomic Status

In year 1, a parent reported self and current spouse/partner education; the higher of these defined parental education.[29] Analysis categories were high school or less, some college or vocational training after high school, college graduate, and professional degree beyond college. The parent also reported total household income in the previous 12 months. Income was reported in 9 ordered categories ranging from less than $5000 to $100 000 or greater. Because the

ranges of these response options varied, the midpoints were used in the analyses. Household income was imputed for participants missing this variable (13.7%) by using multiple imputation.[19,20]

Health Measures

BMI

BMI was derived from measured height and weight. The protocols for collection of height and weight have been described previously.[20] In adolescence, BMI z score and categorization of weight status were based on the 2000 CDC Growth Chart standard.[30]

Depressive Symptoms

Depressive symptoms were measured by using the CESD scale.[31] This scale was developed to measure symptoms of depression within the community. It is a valid and reliable measure that has been widely used in studies of adolescents and adults. Scores can range from 0 to 60, with higher scores indicating more severe depressive symptoms.

Demographic Covariates

Date of birth, parent-identified race/ethnicity of the student, and gender were available from school records in phase 1. In phase 2, participants self-reported race/ethnicity and gender. If present, self-reported data were used.

Data Analysis

SSS Trajectories

Trajectories were modeled with Proc Traj[32] by using the censored normal distribution implemented in SAS version 9.2 (SAS Institute, Cary, NC). Proc Traj was chosen because it is widely used for developmental trajectory modeling, handles missing data well, and allows for uneven spacing of data points.[33] In these models, SSS trajectories could be defined as subgroups that differ in overall mean SSS levels and/or in rate and direction of change in SSS across the study period. We considered models with 3 to 7 trajectories and examined model-fit statistics, trajectory structure, and trajectory significance to identify the "optimal" trajectory model.[34] Subjects were then assigned the trajectory from the optimal model that they had the highest probability of membership in, a technique called "modal assignment." The assigned trajectory was used in analyses. Due to uncertainty in group membership, percentages based on modal assignment differed from population-level estimates of trajectory prevalence derived directly from Proc Traj.

Relationship of Class Membership to Health Outcomes

Generalized estimating equations were used in multivariable analyses of the relationship of trajectory membership to health outcomes to account for sibships in the study. Of the 673 phase 2 families, 81.7% (n = 550) had no siblings, 15.3% (n = 103) had 2 siblings, and 2.0% (n = 20) had 3 siblings in the study. Because the literature and early modeling

TABLE 2 Summary of Model Fit and Trajectories for Models Assessing 3 to 7 SSS Trajectory Groups

Trajectory No.	Model Fit Statistics			Trajectory Structure			
	Bayesian Information Criterion	Akaike Information Criterion	L	Flat	Linear	Curvilinear	Nonsignificant
3	−12245.44	−12210.99	−12200.99	0	2	1	0
4	−12191.86	−12150.52	−12138.52	2	2	0	0
5	−12169.26	−12117.60	−12102.60	2	1	2	0
6	−12175.18	−12092.52	−12068.52	2	0	3	1
7	−12179.49	−12083.05	−12055.05	1	0	4	2

indicated that race/ethnicity was an important moderator, generalized estimating equation modeling was stratified according to race/ethnicity. Models were built in 3 steps by using SPSS version 19 (IBM SPSS Statistics, IBM Corporation, Armonk, NY). Model 1 assessed if the SSS trajectory was related to the health outcome adjusting for gender, age at first assessment, and length of follow-up. Model 2 added adjustment for objective SES. In model 3, the baseline (adolescent) level of the health outcome of interest was included.

RESULTS

SSS Trajectories

Optimal Trajectory Number

Table 2 presents the trajectory models. The 5-trajectory model had

the lowest Bayesian information criterion and provided trajectory separation and structure while maintaining adequate group size. We adopted this model as our optimal trajectory model for the remaining analyses.

The 5-Trajectory Model

Figure 1 illustrates the 5-trajectory model and associated model-derived probabilities. There were 2 flat trajectories (mid–high and middle), 2 curvilinear trajectories (high–high and high–low), and 1 linear trajectory (low–lower). The flat trajectories accounted for the majority (75.6%) of trajectory class membership. These trajectories illustrate that most adolescents believed that their families were slightly above the middle in status rank and that these perceptions did not shift during the

transition to adulthood. Although the high–high trajectory (7.8%) did have a slight dip during late adolescence/early adulthood, this trajectory was distinguished by its remaining above the other trajectories, signaling persistent high SSS relative to all others. Mirroring the persistent high trajectory was the low–lower trajectory, which identified a low status group of similar proportion to the persistent high SSS group (7.4%). For these 4 trajectories, SSS measured at 1 point in adolescence could adequately describe SSS into young adulthood. The only trajectory group for whom this outcome was not the case was the high–low trajectory (9.1%). This trajectory describes a group with high SSS in early adolescence whose SSS drops well below the majority and then rebounds slightly in young adulthood but remains low.

Correlates of trajectory membership are found in Table 3. Although there were no gender differences in trajectory membership, there were racial and SES differences. Compared with white subjects, black subjects were less likely to be in the mid–high trajectory and more likely to be in the high–low trajectory (P = .004). Those with a professionally educated parent were more likely to be in the persistent high SSS trajectory and less likely to be in the high–low or low–lower trajectory (P < .001). Household income also differed according to SSS trajectory (P < .001). Post hoc testing with Scheffé's test indicated that the 5 trajectories fell into 3 groups in relation to household income (P < .05): (1) the low–lower trajectory had the lowest
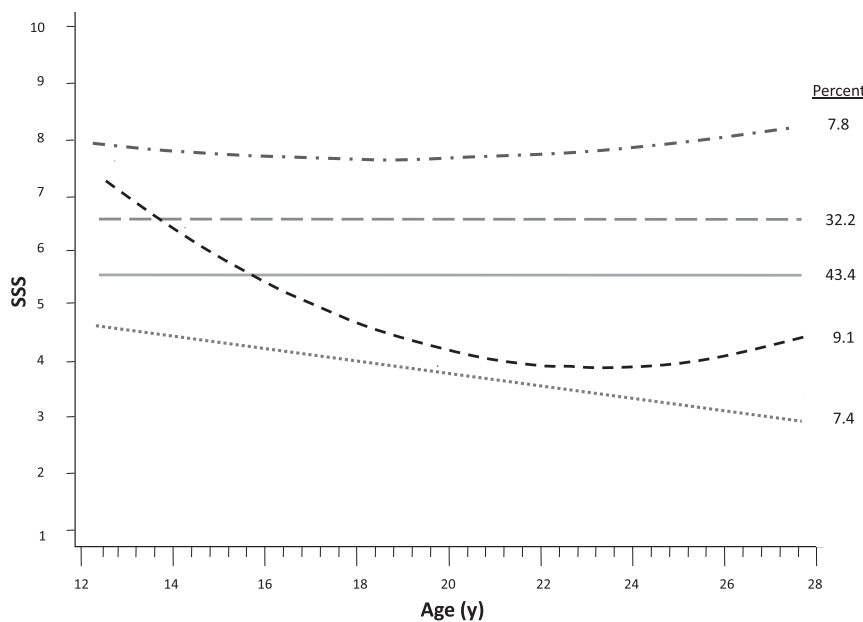
FIGURE 1
SSS trajectories from the SAS Proc Traj 5-group censored normal model. Percentages reflect averages of group membership probabilities.

TABLE 3 Association of Assigned Trajectory Group Membership to Sociodemographic Characteristics and Health Outcomes

Characteristic	Assigned Trajectory Group										P^a
	Persistent High (n = 123 [6.6%])		High–Low (n = 89 [4.8%])		Mid–High (n = 616 [33.3%])		Middle (n = 900 [48.6%])		Low–Lower (n = 123 [6.6%])		
	N	%	N	%	N	%	N	%	N	%	
Gender											.08
Female	57	5.9	52	5.4	299	31.1	481	50.1	71	7.4	
Male	66	7.4	37	4.2	317	35.6	419	47.0	52	5.8	
Race/ethnicity											.004
Non-Hispanic white	61	6.6	33	3.6	335	36.4	441	47.9	50	5.4	
Non-Hispanic black	62	6.7	56	6.0	281	30.2	459	49.3	73	7.8	
Highest parent education											<.001
High school or less	20	5.3	21	5.6	85	22.7	207	55.2	42	11.2	
Some college	19	4.2	32	7.1	114	25.3	248	55.1	37	8.2	
College graduate	17	4.0	26	6.1	166	38.9	195	45.7	23	5.4	
Professional degree	49	15.7	2	0.6	157	50.3	102	32.7	2	0.6	
At time of last phase 2 visit[b]											
Lived with parent	20	16.3	26	29.2	103	16.7	158	17.6	23	18.7	.07
Lived alone	11	8.9	18	20.2	45	7.3	52	5.8	14	11.4	<.001
Married	5	4.1	4	4.5	19	3.1	28	3.1	1	0.08	.54
Had a child	7	5.7	7	7.9	24	3.9	36	4.0	10	8.1	.11
No longer a student	8	6.5	12	13.5	32	5.2	51	5.7	10	8.1	.032
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Baseline household income[c]	92.2	53.3	52.4	34.3	81.8	49.3	56.0	39.5	36.0	25.7	<.001
Health outcomes											
Baseline BMI z score	0.52	0.97	0.94	0.97	0.65	1.00	0.77	1.04	0.67	1.02	.007
Baseline CESD	13.3	9.7	15.6	8.3	13.4	8.7	14.9	8.6	18.6	10.1	<.001
Phase 2 BMI[b]	25.5	4.6	29.1	8.7	26.5	6.6	28.5	8.4	27.7	5.9	.002
Phase 2 CESD[b]	10.7	10.1	16.2	10.5	10.7	8.6	12.7	8.8	15.8	11.7	<.001

[a] P values derived from the χ^2 test or the Kruskal-Wallis test, as appropriate.
[b] Phase 2, N = 816.
[c] Post hoc tests from analysis of variance by using Scheffé's test.

income; (2) the persistent high and mid–high trajectories had household income in the middle, and their incomes did not differ from each other; and (3) the middle and high–low trajectories had the highest incomes and could not be distinguished from each other. Trajectory group membership was not associated with living with parent(s), being married, or having a child at the time of the last study visit. However, membership in the high–low trajectory was associated with living alone (20.2%, P < .001) and no longer being a student (13.5%, P = .032).

Trajectory Membership and Health Outcomes

Trajectory membership was associated with both BMI and depressive symptoms (Table 3). In young adulthood, the high–low

trajectory had the highest BMI and highest depressive symptoms, higher even than the low–lower trajectory. Membership in this trajectory was associated with a 1.6-fold increased risk of depressive symptoms in the range predictive of major depressive disorder in adults (CESD >16)[33] and 1.7-fold increased risk of obesity (P < .01 for both). A gradient was seen across these outcomes. This outcome was also true for BMI z score in adolescence. For baseline CESD, mean depressive symptoms for the high–low trajectory level fell between the middle and low–lower trajectory groups.

Multivariable analyses further explored the relationship of SSS trajectory membership to health in young adulthood. Because all but the high–low trajectory could be described with a single SSS

measurement, we used baseline SSS plus a dichotomous variable representing membership in the high–low trajectory to model SSS in these multivariable models. Results are presented in Table 4. Baseline SSS was not associated with BMI in young adulthood for black or white subjects. However, BMI was associated with membership in the high–low trajectory, and this relationship differed according to race/ethnicity. For white subjects, high–low trajectory membership was associated with higher BMI, but this finding disappeared with adjustment for baseline adiposity. In contrast, for black subjects, a relationship between high–low trajectory membership and BMI did not appear until adjustment for baseline adiposity. The relationship detected was inverse to that hypothesized. For CESD, both lower baseline SSS and membership

TABLE 4 GEE Modeling of the Relationship of SSS to Heath Outcomes in the Phase 2 PSD Study Cohort (N = 816)

Model	Black Subjects			White Subjects		
	B	SE	P	B	SE	P
BMI models						
Model 1						
Baseline SSS	−0.21	0.72	.78	−0.13	0.57	.82
High–low trajectory membership	−2.24	1.43	.12	5.59	2.25	.013
Model 2						
Baseline SSS	1.00	0.51	.052	−0.16	0.61	.79
High–low trajectory membership	−2.74	1.82	.13	4.51	2.29	.05
Model 3						
Baseline SSS	0.16	0.48	.73	−0.28	0.20	.16
High–low trajectory membership	−3.44	1.21	.004	2.05	1.80	.25
CESD models						
Model 1						
Baseline SSS	1.09	0.43	.01	−0.98	0.33	.003
High–low trajectory membership	−1.89	2.49	.45	8.68	2.31	.001
Model 2						
Baseline SSS	4.88	2.32	.70	−0.72	0.36	.046
High–low trajectory membership	4.88	2.32	.83	7.84	2.34	.001
Model 3						
Baseline SSS	0.26	0.33	.42	−3.29	0.86	<.001
High–low trajectory membership	−0.15	1.55	.92	8.46	2.49	.001

For both BMI and CESD models, model 1 adjusted for age at baseline, length of follow-up, and gender; model 2 added adjustments for objective SES measures of parent education and household income; and model 3 added adjustments for the baseline (adolescent) level of the outcome of interest (BMI z score or CESD, respectively). GEE, generalized estimating equations.

in the high–low trajectory were associated with elevated depressive symptoms in young adulthood among white subjects. These findings strengthened after adjusting for depressive symptoms in adolescence. Among black subjects, baseline SSS was associated with increased CESD only in model 1 and became nonsignificant with adjustment for objective SES. Membership in the high–low trajectory was not associated with depressive symptoms for black subjects.

DISCUSSION

This is the first study, to our knowledge, to assess SSS in adolescents transitioning to adulthood. We found, on a population level, 5 distinct trajectories of SSS during this developmental period. Four of the 5 reflect external markers of social status and were stable over time whereas the fifth represents a group for whom SSS, while high early in adolescence, decreased during the transition into adulthood. Black youth with low SES were more likely to belong to this downward SSS trajectory group. This distinct subset of socially disadvantaged youth represents young people with "rose-colored glasses" early in life whose perceptions adjust over time to be more congruent with objective, external measures.

What drives some early adolescents to have elevated perceptions of social standing relative to their family's objective social position is unknown, as are the factors that lead to the downward shift in SSS over time. However, our findings offer some clues. The high–low trajectory group was characterized by the highest levels of depressive symptoms and BMI in adolescence as well as in young adulthood. The presence of these health disparities in adolescence suggests that this group becomes distinct and at increased risk earlier in life. The group may represent young people whose childhoods were particularly challenging, leading to increased allostatic load.[35] Alternatively, early in adolescence, these young people may have been shielded from the reality of their circumstances by their families or may simply not have appreciated the ramifications of stratification. Over time, with the profound cognitive changes and broader world experience that occur during the second decade of life, their perceptions of family social position shift downward, coalescing with objective markers of SES.

The present study has important implications for research. External measures of SES have been the gold standard for documenting, monitoring, and studying health disparities over the life course. These external measures are often difficult to obtain reliably in adolescence. Adolescents are usually not privy to information on household income and may not truly understand parental occupation, assets, or even education. Furthermore, research studies of adolescent health frequently obtain waivers of parental consent and/or do not collect information directly from parents. Thus, despite the recognized need to incorporate social determinants of health into adolescent health research studies,[36] SES data are frequently either lacking or inaccurate. Our findings suggest that adolescents' SSS, which is easily obtained with the single-item ladder question, can both serve as a marker of family SES and provide information on the subjective dimension of social status. Objective SES remains a critically important social determinant of health, and it should be measured when possible. However, when such data cannot be obtained, studies could assess SSS.

Assessing SSS may also have a role in the context of health care delivery. If measured at annual well-adolescent visits, lower SSS in white subjects may signal increased future health risk; measured over time, decreasing SSS might signal membership in the high–low trajectory and, therefore, additional risk. For black subjects, a single SSS assessment could also

provide useful information, especially if objective information on SES is absent. In such circumstances, our findings indicate that higher SSS is associated with increased depressive symptoms. This finding may be due to high levels of discrimination faced by black youth with high SES.[37] Thus, high SSS could prompt providers caring for black adolescents to discuss not only mental health but also social circumstances that lead to increased discrimination and stress.

This study has some limitations worth noting. The cohort included only 2 racial/ethnic groups, which reflected the demographic characteristics of the area at the time the cohort began. Whether the findings would generalize to other racial/ethnic groups is unknown, although downward social mobility in SSS has been associated with depressive symptoms in Latino and Asian adult immigrants.[38,39] There was some loss to follow-up, leading to slightly greater representation of female subjects and those from

higher SES families in the phase 2 cohort. Both these factors may affect generalizability. However, there were no differences in our key predictor (SSS) or the baseline levels of our outcome variables (BMI z score and CESD) between those who were eligible for Phase 2 and those who participated, suggesting selection bias is not a major concern. Finally, how perceptions of family social standing (which SSS in adolescence and the transition to adulthood assesses) shape perceptions of the individual's own social status (which is what adult SSS measures assess) remain to be determined.

CONCLUSIONS

The present study showed that, for most adolescents, SSS is stable through the transition into adulthood and reflects objective SES measures. However, for 1 subset of youth, representing slightly <10% of the population, SSS started high and then shifted downward over time, ending below that of the vast majority of

young adults. Membership in this downward trajectory is associated with social disadvantage. Furthermore, our findings indicate that SSS, particularly membership in the high–low trajectory, is associated with young adult health outcomes and that these associations are stronger for non-Hispanic white subjects than for black subjects and for depressive symptoms than for BMI. Although the mechanisms underlying these racial/ethnic differences require further investigation and the findings should be replicated in other diverse cohorts, these data suggest that measurement of SSS may be useful for both research and the delivery of health care to adolescents and young adults.

ABBREVIATIONS

CESD: Center for Epidemiologic Study–Depression Scale
SES: socioeconomic status
SSS: subjective social status

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