The measurement of SES in health research: current practice and steps toward a new approach

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Abstract

The resurgence of social epidemiology has yet to induce corresponding research into basic measurement issues. This paper aims to motivate investigators to refocus attention on the measurement of socioeconomic status (SES). With a primarily American focus, we document striking paucity of basic research in SES, review the history of SES measurement, highlight the central limitations of current measurement approaches, sketch a new theoretical perspective, present new pilot results, and outline areas for future research. We argue (1) that lack of conceptual clarity and the bypassing of standard psychometric techniques have retarded SES measurement. And (2) social epidemiologists should revisit the measurement of SES and consider whether a richer, psychometrically induced, approach would be more useful. Our pilot study suggests a great deal of uniformity between existing SES measures and that a new approach may be worthy of pursuit. © 2002 Elsevier Science Ltd. All rights reserved.

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Introduction

Interest in social epidemiology has been increasing, as evidenced by recent editorials in scholarly publications (e.g., McKinlay & Marceau, 2000) and a US National Institutes of Health (NIH) conference on social science and health (June 27–28, 2000, Bethesda, MD). Several papers and chapters (Berkman & Kawachi, 2000; Krieger, 1994; Lantz et al., 1998; Macintyre, 1993) lend further support. More and more health researchers believe that a narrow focus on individuals outside of historical, social and biophysical contexts limits the understanding of disease etiology, health, and intervention modes.

Much of the attention to social factors in disease and health is given to socioeconomic status (SES), a central feature of the social structure of all complex societies. Accordingly, the number of studies of how disease and health relate to SES is growing. At least five reasons may

explain this. First, science, at least ideally, is cumulative and there is a great deal of precedent. The strong relationship between SES and health has been documented for centuries, dating back to ancient Greece, Egypt, and China (Krieger, Willains, & Moss, 1997; Liberatos, Link, & Kelsey, 1988; Lynch, Kaplan, Cohen, Tuomilehto, & Salonen, 1996). Recent studies have consistently shown that SES, which endeavors to "encapsulate complex information about a person's life" (Blane, 1995), continues to be linked to disability and disease (House et al., 1992, 1994; Williams & Collins, 1995).

Second, SES is important to agencies interested in understanding and explaining the public's health. NIH's interest in the topic as a subject of basic research has been strong (see PA-98-098 and ES-00-004). There should be no question that funding structures influence the research.

Third, in light of the declining impact of acute infections, SES is relevant to social policy concerning public health. A better understanding of the relationship between SES and disease etiology may reveal important new points for medical intervention and epidemiological

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screening (Taylor, Repetti, & Seeman, 1997), as well as public policy (House et al., 1994). Unlike some correlates of disease, SES arguably can be changed by social policy, and this is arguably good health policy (Kaplan & Lynch, 2001). Advances in the understanding of genetic predispositions will enhance the importance of such policy.

Fourth, the socioeconomic structures in the US, and elsewhere, are rapidly changing (Chevan & Stokes, 2000). Economic inequality in the US has increased, shifting a greater proportion of income and wealth to the upper SES and a corresponding relative impoverishment of those on the lower SES levels especially the concentrated poverty among racial minorities (Massey & Denton, 1993; Wilson, 1987). The composition of social strata is also changing with increasing numbers of female and minority executives, newly minted high-tech millionaires, fewer manufacturing jobs, a decline in labor union membership, substantial numbers of temporary or part-time employees, many partial retirees, 401(k) investments, multi-organizational careers, and increases in social mobility over the life-course (DiPrete & Grusky, 1990).

Finally, SES may be important to social epidemiologists because absence of good SES data, racial/ethnic disparities in health may be construed as signs of genetic differences or behavioral choices rather than powerful clues about how forms of racial discrimination and structural constraints, past and present, harm health (Krieger et al., 1997; Williams, 1996; and the November 2000 volume of the *American Journal of Public Health* 90(11)).

Despite the growing interest, Kaplan and Lynch (1997), among others, remind us of how little we know about the ways in which SES influences health. Although SES is not itself a causal factor, understanding the linkages between SES and health can provide clues to the actual mechanisms involved. Only by mapping such linkages will we learn how best to construct remedies.

It is anomalous that relatively little attention has been paid to either the conceptualization or measurement of SES, especially in America. Although the term "socioeconomic" was apparently coined by the American sociologist Lester Ward in 1883 (Jones & McMillan, 2001), there is still no consensus on a nominal definition of SES nor does a widely accepted SES measurement tool exist (Campbell, 1983; Rose, Pevalin, & Elias, 2001). Conceptualizing and measuring SES is among the more difficult and controversial subjects in social research. Prominent scholars have debated the theory, operationalization, and usefulness of SES constructs for about 125 years. Campbell and Parker (Campbell, 1983) conclude that the debate over SES will end when social research ends. Krieger et al. (1997) even suggest that we eliminate the notion altogether, and instead focus on

manifest variables. We tend to disagree, and think that SES is a conceptually useful proxy for describing access to resources and constructing remedies.

The importance of SES measurement is, ironically, well stated by Krieger et al. (1997) who write "…developing consistent and broadly comparable measures of [SES] that can be incorporated into a wide variety of federally and privately sponsored data sets is essential." This paper pursues those objectives. We (1) assess the relative attention paid to SES measurement, (2) review briefly the history of SES measurement in social science, (3) identify the central limitations of current measurement approaches, (4) sketch a new theoretical perspective, (5) present pilot results from the new perspective, and (6) draw some conclusions and outline areas for future research. Even if our proposed approach does not meet with favor, we will be satisfied if we motivate more basic research into the conceptualization and measurement of constructs fundamental to social epidemiology.

No single book, much less an article, could summarize the vast amount of research on SES. This paper's focus on American efforts is sufficiently daunting. We attempt to provide references as appropriate.

SES and Health

The use of SES as an explanatory variable in health research typically involves measuring the extent to which SES is related to health and/or using SES as a control in looking at other correlates of health. While these uses have increased dramatically since 1960, over the same period research into how to measure SES itself has remained relatively rare and fraught with both theoretical and methodological problems.

The gap between "SES Measurement" and "SES and Health" studies is quite large. Extending the work of Kaplan and Lynch (1997), we conducted an electronic literature search to ascertain the relationship between the level of attention paid to SES measurement and the use of SES in health-related research. Peer-reviewed article citations on SES measurement were abstracted from databases covering all of the major and many minor social scientific publications: we relied on Sociofile, Psychlit, and Econlit. Medline databases on health research contain citations back to about 1964, depending on the journal.[1] SES measurement citations were available back to 1942.

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[1] We searched for SES, Socioeconomic, Status, Class, Social Standing, and Socioecon* in both title and subject headings. Citations were subjectively culled but we were conservative in the sense of including more rather than less. Indeed, we tried to be as inclusive as we could. For health studies, we relied on the Medline database accessed through the US National Library of Medicine's Grateful Med website. We concentrated on SES,
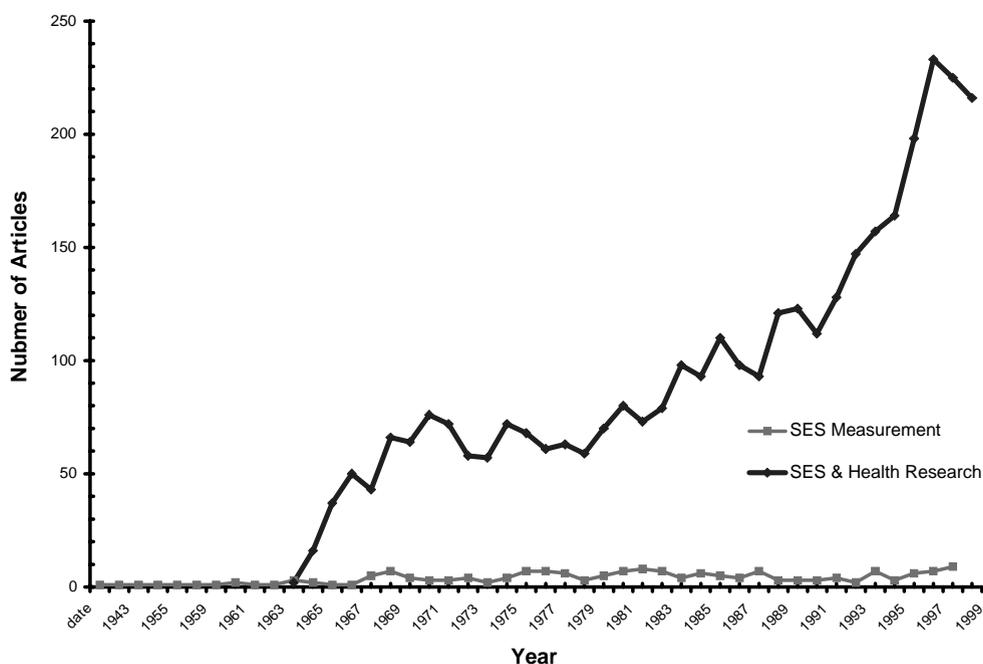
Fig. 1. SES and Health and SES measurement by year.

Fig. 1 plots the trends for articles on SES measurement and articles on the relationship between SES and health. The lower line indicates the number of articles pertaining to SES measurement issues.[2] The upper line indicates the number of articles published in health journals with the selected keywords in their titles. There has clearly been a dramatic increase in the use of SES in health research. In the nine years including 1990 through 1999, the mean number of published articles with SES keywords in TITLE fields was 175.6 (sd 43.99) per year. The cumulative total over the entire period is 3,544 articles.

The Oxford–Cambridge debate (e.g., Evans, 1998; Prandy, 1990) notwithstanding, Fig. 1 also shows that very little work has focused on defining SES, operationalizing existing definitions, or evaluating the properties of measures. This is not because the SES measurement problems are solved. Rather, it is because few have paid

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(*footnote continued*)
Socioeconomic, Status, Class, Social Standing, Socioecon* in the TITLE field. Citations from both datasets were compiled in Endnote and then transferred into the statistical package Stata. (Data/citations are available from the primary author upon request.)

[2] Relying on our own knowledge of the field we retained only those articles that actually focused on SES measurement as a central topic. A more inclusive criterion would produce a higher line but still much lower than the line for SES and health articles.

attention to the problem. Almost everyone has put the cart before the horse. By comparison, we note that work into the measurement of depression—another important latent explanatory variable—increases concomitantly with research into the relationship between depression and health (results not shown).

We are not the first to worry about measurement problems. SES measurement research uniformly urges caution in the use of existing measures (Jones & Cameron, 1984; Krieger et al., 1997; Liberatos et al., 1988). But building on Lynch and Kaplan (2000), among others, we believe that current conventional measures of SES, however well implemented, may be limited indicators of the social and economic forces that affect health.

SES measurement

Historical background

The primary reason why measuring SES has been so retarded is the lack of conceptual clarity about the essential nature of social stratification. Although the concepts of social structure, social class, and socioeconomic status, are central to the social sciences, theorists have not agreed on definitions. As a result, methodologists have rarely relied on explicit theory to operationalize the notions. While most agree that Marx's treatment of class-relations was discounted in

the US,[3] few seem to appreciate that Weber's theoretical formulation of stratification also did not play a central role in American efforts to operationalize SES (Powers, 1982; Rossi, 1951). This is in contrast to British researchers, who built on such classical sociological theory (see Rose & Pevalin, 2001) and remain committed to operationalizing the class structure through employment relations.

This is not to say that theory was ignored by Americans. American social theorists, especially Parsons (Parsons, 1940) and Davis and Moore (1944), provided functional analyses of social stratification; essays that were concerned primarily with the roles played by social stratification in the maintenance of societal structures. For example, Davis and Moore speculated that heavy rewards in valued goods were given to motivate individuals to perform important societal functions, with the heaviest rewards being given to those occupying positions of functional importance in the society for which qualifications in the society were relatively rare. But American theories of social stratification were not very useful to American's devising empirical measures of either the distributional characteristics of social stratification systems or in the identification of the positions of individuals, families or other social groups in such systems.

Based not on any specific theory but rather on a (normative) sense of social structure, census workers used the occupations of household heads, classified into a small number of levels, for the first widely appreciated socioeconomic analyses (Nam & Terrie, 1982). In 1913, Stevenson, a British Census worker, relied on "expert" knowledge of the class structure to develop the first Registrar General's Social Class (RGSC) scale (Rose & Pevalin, 2001). In 1917, US Census worker, Edwards (1938), expanded the previous four US Census occupational classes to ten (out of 428 in the 1910 Census) and conducted analyses on their correlates.

Finding census data conceptually restrictive, later American empirically driven studies were of single small communities.[4] Social status was assigned to households through an unarticulated theory based on individuals' reputations. Underlying this approach is the assumption that everyone in a small community knows its status hierarchy and can place most individuals in it. Locating each household into the hierarchy was a matter of ascertaining what status-level fellow community members believed the household to belong (Hollingshead, 1971; Lynd & Lynd, 1929; Warner, 1949).

In the post WWII period, the development of sample survey methodology made possible original data collection in large communities, regions and whole nations. Because the status reputation approach could not be used in sample surveys, new American approaches based on information obtainable from individual respondents began to be developed.

Some progress was made, albeit inadvertently, to give substance and practicality to that aspect of Weber's status dimension reflected in the American occupational structure. In 1947, Cecil C. North and Paul K. Hatt of the National Opinion Research Center conducted a national sample survey[5] asking respondents to rate on a 5 point scale "the social standing" of 90 occupations. The average social standing given to each occupation can be regarded as the societal consensus (circa 1947) concerning the status of each occupation. These social standing averages (also known as prestige scores) were the first measures of the American national consensus on occupational status. Questions were raised, however, about the theoretical foundation and methodology for scores (Nam & Terrie, 1982; Warren, Sheridan, & Hauser, 1998). Critics, especially British sociologists, also questioned the use of prestige score because of their "subjectivity."

While key British researchers (i.e., Goldthorpe, 1974)) aimed to evolve Stevenson's original classification scheme based on employment relationships, an alternative American approach was to define SES through the "objective" characteristics of educational levels and income associated with occupations. This approach held that the face validity of education requirements for and income derived from an occupation were sufficient to define SES (Nam & Powers, 1965). The idea was that educational attainment determined who could be considered for entry into occupations and the incomes from jobs were the rewards given for investments in education. Accordingly, occupational status—a proxy for SES—was a simple function of educational attainment and income derived from a given occupation. The latent construct came to be known as "status."

When social mobility research showed that the correlation between father and son's "objectively" defined occupational status was much larger than the correlation between father and son's "subjectively" defined prestige scores (Featherman & Hauser, 1976), American stratification researchers viewed prestige as epiphenomenal and an inferior measure of SES. More in

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[3] The Marxian formulation of social class had almost no influence at the time. It was not until the 1970s that attempts were made to measure class position in Marxian terms (see Wright, 1982; Wright, 1985).

[4] An exception to the community approach was Chapin's (1935) early attempt to measure SES as a latent construct. Directed toward problems related to social welfare, Chapin's "Living Room Scale" aimed to rank individuals/families by the items in their living room.

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[5] The survey was funded by the US Science Board, a federal agency concerned that the postwar departure from federal employment of physical scientists and mathematicians was due to the lower prestige of defense work.

tune with the British model, occupational status thus gained dominance in the American sociological literature—although Hodge (1981) and others (Rossi & Berk, 1987) have since argued that the so-called "subjective" measures should remain a central element in SES measurement because they better reflect societal norms.

For the most part, then, SES measurement today relies almost entirely on data from occupational position, education, and/or income. This is not bad. But whereas the task of traditional stratification research is to describe the structure of social stratification and to specify the processes by which it is generated and maintained (Blau & Duncan (1967); see also cites in Grusky & Takata (1992)), public health research aims to investigate how levels of inequality and variation in social context affect health outcomes. SES measures for public health may thus need to capture more of the social context than the indexes of income, education or occupational position can offer. Indeed, it is the richness of the embedded social context (i.e., networks and environment) that public health researchers appear most interested in. Occupational status or relationships may not be as useful to public health as they are to stratification researchers. It is time to take stock of the situation and consider if things can be improved.

A good place to begin is with the question, What would an ideal SES measure for public health research look like? Once asked, it does not take long to be overwhelmed by obstacles and conceptual cloudiness in the desiderata. As a first pass, we suggest that the following properties may be useful for comparative and instrument design purposes. The ideal SES measure for public health surveys would, at least: (1) Be based on a unified and well-developed theoretical framework that allows testable hypotheses; (2) have sound psychometric properties; (3) permit analyses across the life-course; (4) be amenable, if not restricted, to "aggregation" for analyses at higher (more macro) levels such as household or neighborhood; (5) be adaptable to temporal changes in the socioeconomic structure; (6) employ terms/concepts that policy-makers understand; and perhaps most importantly, (7) be practical and useful in applied public health and epidemiologic surveys. Since meeting each of these properties seems impossible, a major research goal would be to develop measures that come as close as possible to meeting these goals and evaluate if they make a difference in our understanding of health and social structure–an empirically testable proposition.

Existing measures

A brief review of the more contemporary and widely known SES measures is useful to highlight the central methodological problems new research must confront. In addition, we aim to assist social epidemiologists in advancing basic research by offering some perspective on the subtle nuances of previous efforts. See (Jones & McMillan, 2001; Krieger et al., 1997; Liberatos et al., 1988; Prandy, 1990; Rose & Pevalin, 2001; Bills, Godfrey, & Haller, 1985; Haug, 1977; Hauser & Warren, 1997; Najman, 1998; Powers, 1982) for more comprehensive and international reviews.

Stemming from a 1949 community study, August Hollingshead's measurement effort evolved into a three-factor scale for use in a mental health epidemiologic study of New Haven, CT (see Hollingshead & Redlich, 1958). The scale was subsequently modified (Hollingshead, 1971; Hollingshead, 1975) for more general use and became the widely known two-factor Index of Social Prestige (ISP), which was based upon occupation and education. The former score was meant to be an estimate of the "skill and power an individual possessed;" basically one's position and opportunities in the economic system. The latter score estimated one's "cultural tastes" (Hollingshead cited in Haug & Sussman, 1971)). Hollingshead constructed his index by assigning scores to occupations and education levels, the weighted sum of which constituted an ISP for that person. He then divided the ISP range into quintiles.

The ISP has been severely criticized on methodological grounds, and was quickly considered out-dated (see Haug & Sussman, 1971). Even though the ISP was never published in a peer-reviewed journal it seems to have enjoyed modest success in American psychology (cf. Mueller & Parcel, 1981).

Perhaps the most widely known American SES scale is Duncan's (1961) SEI, which also classified occupations according to education and income. The underlying logic behind the SEI was to regard education as a prerequisite for an occupation and income a reward. This led Duncan to view occupational prestige as an intervening measure of activity between the two variables and hence a good single indicator of them both. Duncan wanted to "fill in" scores for occupations/persons not included in the 1947 North-Hatt study (Hauser & Warren, 1997). Using the 1950 US Census, he calculated the (1) age-adjusted proportion of male incumbents who graduated high school and (2) the age-adjusted proportion who reported incomes of $3500 or more. Duncan then used multiple regression to incorporate the prestige dimension of 45 occupations in the original NORC study. Because Duncan's regression of prestige on income and education explained 83% of the variance in prestige, he argued that the equation could be used to predict prestige for any occupation for which income and education was measured. Accordingly, all 1950 Census occupations were given an SEI score.

The SEI is often criticized for employing the 1947 NORC scores as a dependent variable as it was considered biased. Others thought that the SEI failed

to capture the richness of SES not reflected in education and income (e.g., Powers, 1982). Still others reanalyzed Duncan's data and found potential analytic problems. Nevertheless, Duncan's original SEI, along with its updates and advances (e.g., Hodge, Siegel, & Rossi, 1964; Nakao, Hodge, & Treas, 1990; Stevens & Featherman, 1981), has enjoyed widespread use.

In a 1965 article (Nam & Powers, 1965), Nam and Powers advocated an "objective" approach to SES measurement. Nam–Powers occupational status scores (OSS) were calculated by using a combination of median education and median income levels for all US Census occupations. The scoring procedure was as follows: Occupations were ranked by median income and, separately, median education levels. Starting with the lowest-ranked occupation, the cumulative interval of persons in each occupation was then determined for both the income and education vectors. Finally, the midpoints of the two cumulative intervals were averaged and divided by the total number of persons in all occupations. The resulting scores range from 0 to 100 and have a direct interpretation: the percentage of persons in the civilian labor force who are in occupations having combined average levels of education and income below that occupation (Powers, 1982).

Nam and Powers went on to develop an SES indicator based on their occupational status score, education, and family income for key persons in a family and assigned results for all persons in a family. Note that the OSS scores position individuals and households within the combined rankings of occupations according to education and income. The components of the index were selected because they are readily available in most datasets and because each represents different aspects of stratification. Components were weighted equally in calculating the OSS scores because, at the time, there was no basis for differential weighting (Nam & Terrie, 1982, p. 38).

Green (1970) developed a composite measure of stratification for health behavior based on income, education and occupation, which maximally correlates with health behavior. Green's weights were derived from a "statewide" sample of $N = 1592$ California families with at least one child less than five. His scale is occasionally used for measuring SES in applied health behavior research. Not a direct measure of SES itself, this index is based on expected health behavior of an individual for use in sample screening and behavioral analyses. Green writes that his measure aims to get at health norms, which are thought to correlate with SES. The principal criticism here is that the weights are estimated by a regression equation predicting health behavior, not some notion of SES (see Mueller & Parcel, 1981).

In 1974, Rossi and colleagues demonstrated a method of assigning status scores to households—a household prestige (HHP) score (Rossi, Sampson, Bose, Jasso, & Passell, 1974). Anticipating Krieger et al. (1997) interest in measuring status at several levels of aggregation, Rossi argued that the household be considered the primary unit of stratification. He employed his factorial survey (Rossi & Anderson, 1982) approach where husband's occupation and education, along with wife's occupation were randomly varied in a set of vignettes. Rossi recruited a convenience sample of $N = 146$ white adults in Baltimore and asked them to rate the social standing of households described in terms of spouses' occupations, incomes, and ethnicities. He then regressed the resulting ratings on characteristics of vignette examples to infer the relative influence (regression coefficients) of the social characteristics of families. The resultant equation permits investigators to assign status scores to households based on the occupations, educational levels and ethnicities of spouses. Nock and Rossi (1979, 1978) later applied this method to national samples and calculated weights that apply more generally. This approach has not received widespread attention.

Treiman (1975) combined data from 55 national studies of occupational prestige to construct his Standard International Occupational Prestige Score (SIOPS). The innovation here was the inclusion of multinational data. Treiman's approach remains one of the few available to cross-national researchers (who focus on industrialized societies).

More recently, Wright, (1985) offered a novel social class scale for America. Neomarxist in origin, the scale measures class in terms of relationships to means of production and presumes that class is defined by three interrelated forms of exploitation. Wright operationalized his constructs by defining social class as the degree of control over investments, decision making, other people's work, and one's own work. He employed data from a representative US telephone sample of $N = 1,761$ adults. Wright's analysis consisted of categorizing persons into his theoretically derived class categories. A key advantage of this scale is that it comes in a short version that contains only four questions and is quite practical for use in surveys (see Krieger et al., 1997; Wohlfarth, 1997).

Most recently, British researchers devoted a great deal of energy to developing, testing, and debating SES measures. In fact, Rose and Pevalin (2001) quip that a "cottage industry" has emerged in testing and debating aspects of the new and older scales. Regardless, progress has been made in two especially important efforts. First, the Cambridge Scale (CS) (see Prandy, 1990) aims to overcome problems associated with the "intuitively developed" Registrar General's scale, and its derivatives: Socio-economic Groups (SEG) and the Goldthorpe schema. Unlike these earlier efforts, CS developers wanted to both steer clear of "subjective"

and "deductive" opinions and incorporate social theory. To over-simplify, the CS relies on data from survey respondents who are asked to name the occupations of four friends. While less than transparent, it seems the occupational rankings of the respondent and friends are then analyzed with multidimensional scaling techniques which yield a continuous (ordinal) scalar CS score for each respondent, which is the CS ranking.

In contrast to the Cambridge Scale, National Statistics Socioeconomic Classification (NS-SEC) is the latest British attempt to capture occupational relationships (see Rose & O'Reilly, 2001). Based on extensive research originating with the Goldthorpe schema, the NC-SEC relies on employment theory and groups persons into, typically, eight nominal classes or strata. Note that the classes are not ordered but "relational." Compared to Americans, the important aspect of British efforts is their focus on occupational relationships, not status rankings.

Of course there have been other attempts to combine income and education. Commentators report that there have been no systematic validations of this approach and it is difficult to compare results across studies (Liberatos et al., 1988). Various conceptual and methodological concerns remain.

Underlying measurement issues

Space limitations prevent us from fully evaluating each existing measure on the seven criteria outlined above. Instead, we concentrate on two underlying problems; the second of which has profound implications and generates many other difficulties.

The first and foremost problem in the measurement of SES is the lack of consensus on a nominal definition (Hauser & Warren, 1997; Krieger et al., 1997; and others). The absence of consensus means that empirical researchers must either adapt vague theories and develop idiosyncratic indicators or use whatever vaguely related data elements exist to construct ad hoc measures of SES, which they then argue comport with what they believe "theory" indicates (DeVellis, 1991).

The second major problem, which cannot be over-emphasized, is the absence of the application of sound measurement theory to the construction of SES measures (cf. Nunnally & Bernstein, 1994; Streiner & Norman, 1995). The rich tradition of psychometrics has not been exploited in the development, testing, and validation of many SES measures. Ironically, this is routinely done in latent constructs, such as depression. It is indeed unfortunate that early efforts of Lundberg (1940) and Gordon (1952), and the empirical efforts of Rossi (1951) to apply psychometric methods to the measurement of SES have been overlooked.

Application of the psychometric framework and methods would help researchers to understand the degree of (normative) consensus on, and measurement error in, the distribution of social units in stratification systems (see Rossi & Berk, 1987) and lead to the identification of measurement techniques. It would also permit empirical debate on the problem of whether SES is best viewed as an ordinal or continuous construct, and if ordinal how many categories. Furthermore, psychometric techniques would inform the ongoing debate over whether a single composite or disaggregated measure of SES is best, and for which purposes (cf. Campbell, 1983; Hauser & Warren, 1997). Finally, application of psychometric techniques would likely assist in overcoming the many other problems faced in basic SES research, including the measurement of income (Robert & House, 1996; see also Land & Russell, 1996 for a discussion of the demographic covariates of wealth attainment across the life course); education (Goodman, 1969); unit of interest such as individual-, household- or neighborhood-level constructs (Kaplan, 1996; Krieger et al., 1997; Macintyre, Maciver, & Sooman, 1993; Robert, 1998; Rossi et al., 1974); and SES over the life-course (Mare & Mason, 1980; Robert & House, 1996).

Steps toward a new approach

Criticism without an alternative is usually of little use. This section sketches some ideas for a new composite measure of SES. Although separate variables, such as education and income, are preferred when statistically controlling for SES in a regression model, we believe a single composite measure remains best for stratified analyses, graphical presentations, and explanations to lay audiences–tasks common in health-related research. With respect to our proposed approach: we rely on established social theory, traditional psychometric techniques, and the early guidance of (Lundberg, 1940; Rossi, 1951).

SES defined

We define SES as differential access (realized and potential) to desired resources. This definition is not new: Wohlfarth (1997) argues that people are rank ordered according to the amount of socially valued "good" they possess; Hauser and Warren (1997) think that SES is a shorthand expression for variables that characterize the placement of persons, families, or neighborhoods with respect to the capacity to consume valued goods; Krieger et al. (1997) add that prestige- or rank-related characteristics pertain to relative position in socially ranked hierarchies and chiefly concern status in relation to access to and consumption of goods, services, and knowledge; and Nock and Rossi (1979) state that SES is that dimension of

stratification which translates the objective distribution of societal resources into meaningful perceptions of relative desirability. Still, our definition diverges from the many notions more closely related to occupational class and employment relationships (see Rose & Pevalin, 2001 for review; and Nam & Terrie (1982) for a critique of occupational reliance). We also depart from Krieger et al. (1997) who think notions of prestige and status should be conceptually distinct from material goods.

Stratification theory & SES

We suggest an SES measure based on the Coleman's (1990) social theory. The goal should be to build on existing research and develop a practical, focused tool for applied health researchers.[6]

Constraints force us to merely note that Coleman's theory aims to understand and explain the functioning and organization of the social system. The theory is rooted in the purposive action of an individual agent. It is based on two kinds of elements and two ways in which they are related: The elements are (1) actors and (2) resources, related through (3) interests and (4) control. Upon this simple framework Coleman builds a sophisticated yet coherent theory of social organization and action. Components of the theory have been increasingly subjected to theoretical and empirical scrutiny, with many pleasing results (see, for example, Furstenberg & Hughes, 1995; Morgan & Sorensen, 1999; Portes, 1998; Sandefur & Laumann, 1998).

Coleman's central concern is with how positions constituting social structures emerge and how persons are motivated to occupy such positions. Accordingly, social inequality results from differences in interests and control over scarce resources, and power depends on the relationship between the two. Since resources may take the form of (1) material and monetary goods, (2) skills and capabilities, and (3) the strengths of social relationships, three dimensions may be defined. Implicit is the notion that status is a function of "market" power and results from the accumulation of resources in various forms. SES may thus be viewed as not only a measure of access to resources but as a function of (1) material endowments (e.g., earned income, investment income, real property, and other fungible goods), (2) skills, abilities and knowledge, and (3) one's social network and the status, power, trustworthiness, and abilities of its members. These three domains, which we call material capital, human capital, and social capital, respectively, uniquely locate the status of individuals in

the social structure. That is,

$$\text{SES} = f(\text{Material Capital, Human Capital,}\\ \text{Social Capital}).$$

Note that the equation is also applicable to families, households, neighborhoods and other social aggregates. It also provides a unified theoretical framework that may help researchers begin to overcome the SES measurement obstacles. Fleshing out each dimension may explain more about how individuals realize their health goals than existing measures of SES, especially over the life-course. Because the theory specifies SES as a function of "capital," we call our nascent scale CAPSES.

Domains defined

The success of CAPSES, or any new measure, depends heavily on how well the domains involved are defined and operationalized.

Material capital: When people hear the term "capital" they typically think of material capital, which generally refers to owned materials, such as homes, cars, refrigerators, income stocks and flows, such as earnings, savings, investments and known expected wealth, such as inheritances. For the most part, material capital is observable and tangible, or at least easily convertible into such forms (e.g., stock options).

The notion of material capital captures much of what Marxists find lacking in traditional measures of SES, namely the material endowments under an individual's control. The critical issue is that material capital is more than just earnings or income (see Robert & House, 1996; Spilerman, 2000). Material endowments of all sorts need to be measured since they are controlled resources potentially useful for acquiring good housing, health care, or education. Consider a young person with no job but a large trust fund, or a retiree with little income but substantial equity in an expensive home. Neither may have any earned income, but both control considerable material capital.

Human capital: Human capital refers to fixed endowments of an actor, such as being 6′9″ and able to play point-guard, being handsome or beautiful, or having innate ability in mathematics or music. The same goes for innate cognitive functioning, instinctual motivation or drive, stamina, and congenital disease. However, human capital also refers to the education, skills, abilities and knowledge one may acquire. It is thus mutable through "investment" of time and labor (Becker, 1964).

Human capital is a critical component of SES since it is a resource that may be used to acquire socially valued goods. It is fungible in a market economy: those with specialized knowledge have (monopoly) control over a

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[6] Although we learned of their work subsequent to this project, this approach has also been suggested by Entwistle and Astone (1994).

scarce resource. Schultz (1971) adds that in the modern economy, laborers have become capitalists not from a diffusion of the ownership of a corporation, as "folklore" would have it, but from the acquisition of knowledge and skills they possess.

Social capital: Many social epidemiologists are now interested in social capital (e.g., Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997; Lomas, 1998). The concept may be traced back to the early sociologists such as Durkheim, who used it to emphasize that active social group membership was an antidote to anomie and self-destruction, or to Karl Marx, who pointed out the difference between atomized self and a mobilized actualized class (Portes, 1998). The term was introduced by the economist Loury (1977) to describe resources that are a function of the social system. Although Bourdieu (1985) provided the first systematic analysis of it, Coleman (1988, 1990) popularized the term. Despite divergent early definitions, Portes (1998) states that there is a growing consensus that social capital stands for the ability of actors to secure benefits by virtue of membership in social networks and other social structures. To possess social capital, a person must be related to others, and it is in the potential of those relationships where social capital lies. The notion of social capital stands in sharp contrast to atomistic views of society, such as in Walrasian economics (see Bowles & Gintis, 2000), natural rights philosophy, and perhaps some risk-factor epidemiology.

Readers familiar with these concepts may note that our approach to social capital is somewhat different than that currently advocated (Putnam, 2000). Whereas Lochner, Kawachi, and Kennedy (2000) conclude that there is a general agreement that social capital should be distinguished from individual characteristics and measured at the community level, we maintain that for our purposes social capital also can be viewed as an individual, family or household-level trait. We think this is a complementary view to those advocating higher levels of aggregation.

There are various forms of social capital, including obligations to and from others, information channels, norms, and reputation effects (Coleman, 1988; Portes, 1998). Social capital has been empirically shown to have many positive impacts on individuals and aggregates. Examples include increased educational achievement, social mobility, employment opportunities, decreased welfare dependency, and low levels of teenage pregnancy. However, there are negative impacts as well when high levels of social capital lead to social exclusion, excessive conformity and oppression (Portes, 1998). Researchers are now empirically testing other aspects of the theory (see Furstenberg & Hughes, 1995; Morgan & Sorensen, 1999; Portes, 1998 and cites therein).

There are several advantages to incorporate social capital into a measure of SES. It provides for an understanding of the variation in social contexts. It provides for analysis and explanations of "upstream" or system-level outcomes. And social capital assists in understanding the all important micro–macro (man to structure and structure to man) transitions, and thus family and neighborhood—and institutional-level impacts and outcomes. Social capital thus provides a mechanism through which behavioral norms are generated and maintained (Coleman, 1990) and promises to provide a link between individuals, society and health (see Taylor et al., 1997).

Note that CAPSES does not incorporate a domain for race, ethnicity, sex or age. Although we firmly believe that such variables are critical components in any health-related socio-economic analysis, we have five reasons for excluding them from our scale. First and foremost, we agree with the NIH (PA-98-098) that it is critically important to examine SES within racial, ethnic, sex, and age categories. We think it important to study the relationships between SES and, say, race because we are likely to find them to be more complicated than simple additive models would imply. Empirical research supports this position (Taylor et al., 1997; Williams & Collins, 1995). Second, race, sex, and age are not included in the theoretical framework. Although correlated with it, being a 50 yr-old white male is not a form of capital. Third, prior research shows that net of other effects, race was not a consistently significant predictor of household prestige (Sampson & Rossi, 1975), although it is clearly an important dimension in social distance studies (cf. Farley & Jackson, 1987). Fourth, as recently highlighted by US Census-2000 (see the entire November 2000 (Vol. 90, No. 11) edition of the *American Journal of Public Heath*), there is no easy way to measure race and ethnicity. Incorporating politically charged, error prone and evolving items into an SES scale would only further complicate things. Finally, we think a humanistic and congenial meta-message is sent by excluding direct measures of race/ethnicity, sex, and age from an SES measure: The CAPSES scale implies that such components should not be a factor in one's SES.

Operationalizing CAPSES

Constructing a practical CAPSES scale with high conceptual fidelity is the next step. Fig. 2 presents a basic model of the relationships between actual scale items (i.e., instrument questions), latent constructs (i.e., material, human and social capital, and SES), and the instrument variables used to estimate the weights for our overall SES score.

We omit correlations between constructs and Greek letters. An especially useful aspect of the model is that it is in the form of a widely used MIMIC (Multiple Indicator, Multiple Cause) structural equation model
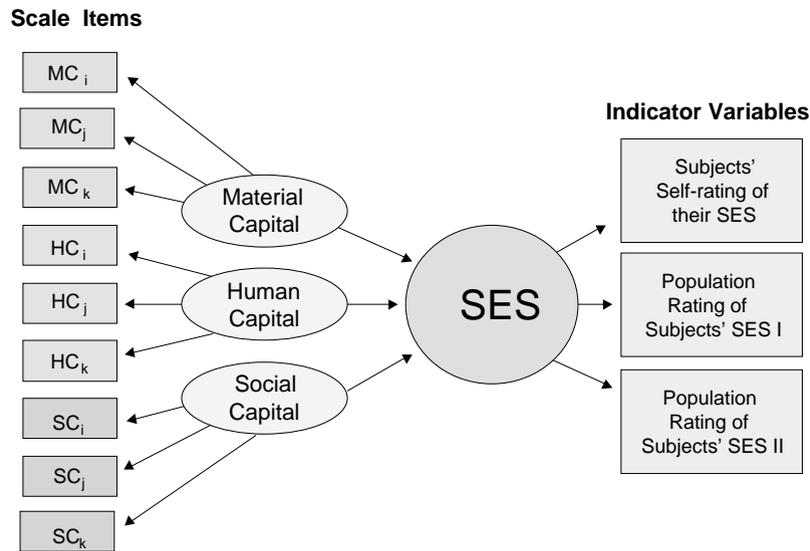
Scale Items

Fig. 2. Structural equation model to estimate SES.

(SEM) with four latent variables (see Bollen, 1989, p. 331; Borhnstedt, 1977; Joreskog & Goldberger, 1975; Stapleton, 1978).

Fig. 2 shows that the three dimensions of capital are separate causes of a person's SES. Each domain is measured by multiple scale items (to be determined). Each domain may be used independently, in the same way researchers currently use income, education and occupation as model covariates.

This last point merits further attention.

We maintain that SES is best viewed and measured as a social norm (cf. Rossi, 1951; Rossi & Berk, 1987), and that SES is in fact a measurable component of the social system. Asking people to assign an SES score to (real or hypothetical) prototypical individuals is thus a valid approach to identify indicator variables. The coefficients/weights leading from each type of capital to the SES construct provide an estimate of the relative contribution of each domain to overall SES. Weights, estimated from the MIMIC model, may be used in an algorithm to optimally score SES from item responses. If they are approximately equal, then a simple summated scoring system could be used (see Nunnally, 1994; Streiner & Norman, 1995).

Pilot results

We conducted a pilot study to see whether the proposed theory could be supported with existing survey data. Our goal was limited in determining if our nascent approach deserved further pursuit or if it should be abandoned early on. The aim here is therefore not to present a detailed empirical analysis, but to suggest possibilities.

We decided to use data from the National Survey of Families and Households (NSFH).[7,8] The main advantage of using an existing dataset is that the costs are minimal. In addition, NSFH contains items that could be used to compute conventional SES measures such as the SEI, OSS, and HHP hence facilitating comparisons with CAPSES.[9] However, there is also a serious disadvantage. The designers of NSFH did not have CAPSES in mind when selecting survey items, although they did include many that are close to the indicators we would like to use. Using NSFH is, therefore, a partial test; a fuller test must await data especially collected CAPSES.

We selected items (i.e., questions) as consistent as possible with the three dimensions of capital (human,

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[7] We originally selected data from the then General Social Survey (GSS), but it did not sufficiently suit our needs. To the extent that it did, however, the GSS results were consistent with those of the NSFH.

[8] The NSFH was a two-wave survey study with $N = 13{,}007$ (Wave 1) and $N = 10{,}007$ (Wave 2) respondents from a representative US sample. The survey was fielded in 1987–1988 (Wave 1) and 1992–1994 (Wave 2). One adult per household was randomly selected as the primary respondent. A considerable amount of life-history information was collected, including education, employment histories, income and wealth measures, and general health outcomes. See "www.ssc.wisc.edu/nsfh/home" for more.

[9] We computed OSS scores from data generously sent to us by Professor Charles Nam. HHP scores were calculated according to the equations in Nock and Rossi (1979, Table 2).

Table 1
Pairwise Pearson correlation coefficient among SES Measures

	HH Inc	Inc	Educ	SEI	OSS	HHP	CAPSES
Household income	1.000						
Personal income	0.725	1.000					
Educational attainment	0.366	0.368	1.000				
SEI	0.370	0.396	0.606	1.000			
OSS	0.369	0.400	0.545	0.927	1.000		
HHP	0.452	0.386	0.672	0.845	0.881	1.000	
CAPSES	0.520	0.510	0.639	0.574	0.583	0.638	1.000

$N = 3875$.

material, and social), as well as outcomes. Included were composite variables constructed by combining answers to several items, such as net-worth, total liquid assets, equity in home or business, earned wages, educational attainment, extent and magnitude of kin- and friendship ties, and social involvement measured through participation in clubs. Item reduction was done through principal components factor analysis.

The first analytic task was to determine whether the selected items showed a latent structure consistent with the capital theory of SES. A principal components factor analysis yielded results remarkably consistent with the proposed model. Scree plots revealed that three factors provided a reasonable solution, each with loadings more or less as the theory would predict. Net-worth, liquid-assets, and equity appear to reflect material capital. Education, wages, and the OSS load together and, as they appear to serve as proxy measures for skills, may be viewed as reflecting human capital. Membership in clubs and social ties reflects social capital.

The next analytic objective was to evaluate the criterion validity of a CAPSES score. We generated a CAPSES score from factor weights for each individual and compared it to Duncan's SEI, Nam–Powers' OSS, Nock–Rossi's HHP and univariate measures of SES. Although not optimal, we assumed that the three CAPSES components (i.e., factor scores) were summative with weights equal to unity.

Table 1 presents, to our knowledge for the first time, Pearson correlations between these SES measures on NSFH data—a representative sample of the US. Because we could only use records which contained non-missing values income and occupation, the sample size was reduced to 3875, less than half of the total NSFH sample. The reason for this displeasing reduction is the magnitude of missing values in occupation and income for primary respondents. In addition, persons who were not in the labor force (mostly retired), or were in the military had to be excluded along with those who refused to give their incomes. Replacement of, say, a wife's SEI with her husband's SEI appears common but

it is not without problems for such a tactic necessarily changes the measure from individual to household SES. Although Rossi and colleagues (Nock, 1982; Nock & Rossi, 1979; Nock & Rossi, 1978) illuminated a path to understanding within-household prestige, we do not as yet have comparable guides for aggregating material and social capital for households. Extensive conceptual and empirical research is needed to end up with household measures for these key components of social stratification.

Table 1 shows the relatively low correlation (average $r = 0.489$) between the conventional univariate measures (i.e., household income, personal income, and educational attainment) and composite measures (i.e., SEI, OSS, HHP, CAPSES). Univariate measures capture different, or differently, the constructs tapped by the composites.

Focusing on CAPSES, Table 1 shows that it correlates with univariate measures at least as well as the other composites. More importantly, CAPSES correlates well with the more conventional composite measures: its average correlation is 0.598. That CAPSES moves more or less with the other composites, but captures something different, is an indication of criterion validity. If it correlated perfectly, it would be useless.

The final objective was to assess the construct validity of CAPSES in terms of health outcomes. Fortunately, NSFH contains several acceptable health indicators. We selected a self-reported general overall health question, a physical functioning scale (activities of daily living, ADL), a mental health scale (CESD, measuring depression), and self-reported presence of chronic conditions, such as diabetes and cardiovascular disease. All six measures are widely used in health research.[10]

We regressed each of the health measures on each of the SES measures and summarized results in Table 2. The first panel presents the proportions of (adjusted) variance explained, representing the sex and age

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[10] The summary details, psychometric properties, and citations for the CESD and the ADL may be found in McDowell and Newell (1996).

Table 2
Proportion of Variance Explained[a] and Odds Ratios[b] of Seven SES Measures[c] Predicting "Good Health"

	HH Inc	Pers Inc	Educ	SEI	OSS	HHP	CAPSES
Variance explained, R^2							
General health	0.023	0.019	0.031	0.023	0.023	0.028	0.041
Activ. daily living	0.061	0.056	0.064	0.057	0.060	0.064	0.063
Depression	0.039	0.030	0.044	0.048	0.054	0.059	0.049
Odds ratios							
General health	1.33	1.34	1.46	1.34	1.33	1.40	1.52
Activ. daily living	1.65	1.77	1.47	1.38	1.34	1.43	1.51
Depression	1.50	1.36	1.42	1.34	1.37	1.41	1.41
Chronic conditions	1.24	1.25	1.26	1.23	1.22	1.24	1.27
Diabetes—all	n.s.	n.s.	1.37	1.25	1.24	1.38	1.29
CVD	1.09	1.11	1.17	1.25	1.20	1.22	1.21

[a] From OLS regressions of health outcome on SES measure, sex and age of respondent.
[b] Odds ratios adjusted for age and sex.
[c] Measures are standardized for comparison.
n.s. indicates $p > 0.05$; all odds ratios are significant at $p < 0.05$.
$N = 4663$.

adjusted association of SES and health outcomes.[11] Notice the great uniformity across measures and outcomes, showing that each of the SES measures are not only related to health measures but are also of the same magnitude. The R^2 for general health on CAPSES is 0.041, or 4.1%. This is the largest value and suggests that CAPSES is the best predictor of overall health.

It is also apparent that whichever SES measure is used, only a small proportion of the variation in health status is explained. When compared to the combined influence of other factors in health, SES, however measured, does not loom large.

We were also interested in the predictive odds ratios of SES on health indicators and so dichotomized the outcomes: top 2 levels of overall health, top two-thirds of the ADL distribution, and a CESD score <16. The remaining outcomes are naturally dichotomous. SES measures were standardized for comparative purposes. Logistic regression was used: the dichotomous outcomes ($1 =$ good health; $0 =$ all else) were regressed on the standard SES measures, adjusted for age and sex.

Results are presented in the second panel of Table 2, showing that CAPSES is *slightly* more predictive of good health than the other measures. Interpretation should be done in terms of standard deviations: a one unit change in the positive direction of CAPSES increases the odds of reporting being healthy by 51%.

One should not conclude that this limited pilot study provides convincing evidence that our approach ought

to supplant previous efforts. Empirical results suggest that *all* SES measures are related to health. We view this pilot study as suggesting that the application of Coleman's theory of capital accumulation, operationalized through CAPSES, *may* yield a promising measure of SES for use in applied settings.

We cannot emphasize enough that the CAPSES scores generated here are not optimal. We have neither finalized items nor fielded an evaluation study. Results here come from existing data more or less patched together. The point of this analysis is to motivate further discussion, not to draw incontrovertible inferences.

Conclusions

Constructing a valid measure of SES may be one of the most controversial topics in social and behavioral science. With few exceptions, this methodological issue has been ignored by health researchers and social epidemiologists. Yet if we wish to know about the relationship between SES and health outcomes, and understand the mechanisms through which SES affects health, we must critically evaluate our measurement of SES. To do otherwise may yield spurious relationships and undermine the credibility of social epidemiology. The horse must come before the cart.

Although focused on American efforts, this paper documented the paucity of SES-measurement research. We outlined the history of measurement and reviewed relevant existing approaches, highlighting the major deficiencies in them and pointing to international reviews. We argued that the lack of conceptual clarity and the bypassing of standard psychometric techniques

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[11] Some have found complex relationships between SES and health (Backlund et al., 1996, 1999). Preliminary analysis found quadratic terms added little to R^2 so, since this is merely a pilot study, we ignored them.

has retarded SES measurement. And, in light of the apparent demands for a richer notion of SES, it is time that social epidemiologists to take stock and consider a new approach. We then sketched a new approach based on an established social theory and offered pilot results that included, for the first time, a comparison of seven SES measures on several endpoints.

Pilot results showed a striking level of consistency in social structure and measures thereof. The popular composites SEI and OSS are about the same, while the HHP and CAPSES seem to capture more of the embedded social complexities. Although univariate measures such as income and education are compared well, the fact that composites aim to capture more context suggests that a composite measure may be the preferred tool for health researchers. It just may be that a theoretically grounded composite measure, refined through rigorous and, yes, expensive, psychometric procedures, will shed substantial light on social epidemiological problems. It may also be that such measures perform differently, even better, when better endpoints, such as mortality, are employed.

Future research should include basic studies into the conceptual and operational definitions of SES. Studies aimed at updating earlier measures of aggregates, such as Nock and Rossi's household prestige (HHP) scale, are warranted. Longitudinal research is requisite. Investigators should focus on parsimony, remembering that a long scale will rarely be employed in real-world surveys. Finally, studies into the components and mechanisms of SES as they relate to health outcomes is critical. For example, investigations into the marginal contribution of material, human, and social capital may shed substantial light on the mechanisms of the social determinants of health. This is especially true over the life course.

Researchers will do well to remember that the development of a new approach to measuring SES is sure to be fraught with problems. CAPSES, especially in its crude form, is no silver bullet. However, the identification of the problems and efforts to overcome them ought to proceed with at least as much vigor as expended on the use of SES. A lively debate among social epidemiologists and social scientists working on health-related topics may be everyone's best medicine.

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