

SES Differentials in Health by Age and Alternative Indicators of SES

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Despite the general persistence and even increase of strong socioeconomic status (SES) differentials in health in the United States, research suggests that SES differentials in health may diminish or become nonexistent at older ages. However, most research has used only limited measures of SES (e.g. education, income), and has not thoroughly investigated intra-elderly age differences in this trend. The current study investigates how SES differentials in health vary by age in the United States, using fairly detailed age categories (through ages 85+), and 2 alternative indicators (home ownership and liquid assets) of a major additional dimension of SES, financial assets, which may be especially important at older ages. We address (a) how strongly financial assets are associated with health, considered both alone and net of education and income; (b) if the health effects of financial assets vary by age; and, more specifically, (c) if their effects are especially pronounced in older age, again considered both alone and net of or relative to education and income. Results show that financial assets, especially liquid assets, considered both alone and net of education and income, are associated with health throughout adulthood and old age, at least until ages 85+. Furthermore, financial assets remain associated with health until quite late in life and become more important relative to education and income at older ages for some measures of health.

Research has consistently shown that socioeconomic status (SES) is strongly related to health. Those with lower SES generally experience higher mortality and morbidity rates than those with higher SES

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(House et al., 1990; Newacheck, Butler, Harper, Piontkowski, & Franks, 1980; Syme & Berkman, 1976; Williams, 1990), and these SES differences appear to be increasing since the 1960s in the United States (Pappas, Queen, Hadden, & Fisher, 1993) and other nations (Mackenbach, 1992; Valkonen, 1993). Theory and some initial research suggest that SES affects health through a variety of mediating factors such as health behaviors; access to health care; exposure to environmental hazards; and psychosocial risk factors such as chronic and acute stress and lack of social relationships and supports, mastery, control, or self-efficacy (House et al., 1994; Williams, 1990), though much remains to be understood about the mechanisms linking SES to health.

How SES relates to the health of the elderly population is much less clear. More broadly based studies on SES differences in health have often excluded the elderly, while gerontological research has generally neglected SES differences in health. Yet knowledge about how patterns of SES differences in health vary by age, and particularly what the patterns look like in older age groups, is important in and of itself and also may help us understand the mechanisms that link SES to health throughout the life course.

Earlier research indicated that SES differences in mortality (Antonovsky, 1967; Feldman, Makuc, Kleinman, & Conroni-Huntley, 1989; Kaplan, Seeman, Cohen, Knudsen, & Guralnik, 1987; Kitagawa & Hauser, 1973; Makuc, Feldman, Kleinman, & Pierre, 1990) and morbidity (Newacheck et al., 1980; Satariano, 1986) are relatively small during young adulthood, large at middle ages, and then smaller again at older ages in the United States, and this result has been confirmed in the most recent national longitudinal mortality study (Rogot, Sorlie, Johnson, Glover, & Treasure, 1988; Xie, 1994). House et al. (1990, 1994) found similar results for morbidity and functional status: SES differences in health were small during young adulthood, largest among persons of middle and early old age (55-64 and 65-74), and smaller again among persons of advanced older ages (75+).

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*LIMITATIONS OF RESEARCH ON AGE VARIATIONS
IN THE RELATIONSHIP OF SES TO HEALTH*

There are two important limitations to previous research on how patterns of SES differences in health vary by age: the indicators of SES used, and the age groups considered.

Indicators of SES. In studies on SES differentials in health in the United States, income and/or education are usually used as the traditional indicators of SES. Although income and education may be good indicators of SES in middle age, they may not be as appropriate or consequential indicators of SES in older ages (Kaplan et al., 1987; Liberatos, Link, & Kelsey, 1988). Therefore, the observation that the relationship between SES and health diminishes at older ages may simply reflect limitations in the particular SES indicators used (Kaplan & Haan, 1989). Income has been especially criticized as an indicator of SES at older ages. Kaplan et al. (1987) suggest that because retirement is often associated with a decline in income, using only current income as an indicator of SES may mask the level of economic status experienced by older adults throughout their lives. From this perspective, looking at only current income ignores the cumulative effects of a lifetime of deprivation or privilege on the health of older adults. Wolfson, Rowe, Gentleman, and Tomiak (1993) found significant long-term effects of pre-retirement earnings of Canadian men on post-retirement mortality—effects that might be missed or underestimated in cross-sectional studies of SES differences in health among older adults. Income may also be an inadequate proxy for the contemporaneous financial resources available to a person in old age (George, 1992). Although two elderly people may report the same income, one may have significantly greater financial assets that could be used if necessary. In fact, considering financial resources more broadly, there seems to be greater financial inequality among those aged 65+ than among younger adults (Crystal & Shea, 1990). Therefore, level of financial assets may be a better measure of financial status than income for older adults, or at least a supplemental measure.

Occupational status or class is a traditional SES measure used frequently in other countries but less so in the United States. Occupation is particularly problematic to measure with older adults because

many are either not currently employed, never were employed, or held various jobs over their lifetimes. Should occupation be measured using older adults' "usual" lifetime occupation, current occupation, pre-retirement occupation, spouse's occupation, or some other measure?

Research conducted in other countries, most notably in Great Britain, has employed a number of alternative measures of material circumstances as indicators of SES. For example, Marmot, Kogevinas, and Elston (1987) found that in Great Britain, all-cause mortality is inversely related to access to cars and home ownership, beyond the effects of occupational class. Similarly, Shahtahmasebi, Davies, and Wenger (1992) found that survival was affected by home ownership, controlling for occupational class and income, for older adults in rural North Wales. Arber and Ginn (1993) reported that income, car ownership, and home ownership were significantly associated with self-assessed health for British elderly, after controlling for age and occupational class.

Research on SES differences in health in the United States has generally not considered alternative measures of financial status, such as level of liquid assets, or measures of material circumstances, such as home ownership or access to a car. These alternative SES indicators might be especially appropriate, both absolutely and in comparison to traditional SES indicators, when investigating SES differences in health among older adults. Which alternative SES measures are important to health may vary by a number of factors, including age, race, gender, and country. However, for older adults in the United States, overall financial assets, as indexed by level of liquid assets and home ownership, are likely to be an important additional dimension of overall SES.

Age. Although much research on SES differences in health can be criticized for ignoring age differences or for leaving older adults out of such studies altogether, even research that includes older adults has been limited by not looking at intra-elderly age differences. For example, Makuc et al. (1990) and Feldman et al. (1989) left older adults age 75+ out of their analyses. Other research has grouped older adults into one large age category, such as 65+ (e.g., Newacheck et al., 1980; Satariano, 1986), which masks any differences between those

in early and later old age. In examining such differences, House et al. (1990) found that SES differences in health persisted throughout early old age, diminished only slightly at ages 65-74, and then diminished substantially or became nonexistent at ages 75 and older.

THE PRESENT STUDY

The present study examines how patterns of SES differences in health vary by age group for a representative sample of adults in the United States. We address the limitations of previous research by using (a) two alternative indicators of SES (home ownership and liquid assets) that may be more appropriate measures of SES for older adults, and (b) fairly detailed age categories of the adult population in 10-year increments through age 85+. We have two major research questions: (a) Are alternative SES indicators, specifically, home ownership and liquid assets, significant predictors of health, after controlling for education, income, and demographic variables? and (b) What is the pattern of SES differences in health by age group when using alternative SES measures, specifically, home ownership and liquid assets? We expect that using alternative SES indicators that may be better measures at older ages will result in a pattern of persisting SES differences in health throughout old age. Any diminished relationship between SES and health at older ages should occur at later ages for liquid assets and home ownership than for education and income.

Data and Analyses

DATA SET AND VARIABLES

This study used data from Wave 1 (1986) of the Americans' Changing Lives (ACL) study (House, 1986). The ACL study used a multistage, stratified area probability sample of noninstitutionalized persons 25 years or older living in the 48 contiguous states, with an oversampling of both Blacks and people aged 60 or older. A total of 3,617 respondents were interviewed in their homes. The response rate was 68% for all eligible individuals, and 70% for sample households. The data were weighted to adjust for variation in probabilities of

Table 1
Description of Variables (N = 3,615)

	<i>Weighted %</i>
Gender	
Male	47.1
Female	52.9
Race	
Black	10.9
Non-Black	89.1
Age	
25-34	29.0
35-44	23.2
45-54	14.6
55-64	13.8
65-74	12.5
75-84	5.8
85+	1.2
Home ownership	
Home owner	69.9
Nonowner	30.1
Level of assets	
<\$10,000	44.9
\$10,000+	48.9
Missing	6.2
Family income	
<\$10,000	19.2
\$10,000-\$29,999	40.5
\$30,000+	40.3
Education	
0-11 years	25.6
12-15 years	54.7
16+ years	19.7
Functional health	
Most severe	3.2
Moderately severe	5.3
Least severe	6.8
No functional limitations	84.7
Number of chronic conditions ^a	
None	46.4
One	26.0
Two	14.5
Three	7.7
Four to seven	5.5
Range 1-7 conditions	
Mean 1.02 conditions	

Table 1 *Continued*

	<i>Weighted %</i>
Self-rated health	
poor	3.6
fair	11.6
good	20.6
very good	40.0
excellent	24.2

Note. Percentages may not add up to 100% due to rounding.

a. Number of chronic conditions are analyzed in their continuous form.

selection, variation in response rates by primary sampling units, and deviation of the sample from 1985 Bureau of Census estimates of the population by age, sex, and region.

Table 1 describes the variables included in our analyses. Both race and gender have been found to be related to health, and it is likely that this relationship is partially mediated by SES because Blacks and women generally have lower SES. Therefore, we controlled for race and gender in estimating the relationship between SES and health.

Age was classified into decades as follows: 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85+. Use of these age categories allowed for the analysis of intra-elderly differences in patterns of SES differentials in health. Missing age data were imputed for three cases based on a review of the full interview and interviewer observations.

One alternative indicator of SES was home ownership, measured by whether or not respondents owned their homes (including people with mortgages). Information was missing for two cases, which were dropped from the analyses.

The second alternative indicator of SES was liquid financial assets, measured by respondents' self-report of how much money they would have if they cashed in all of their assets (such as bank accounts, stocks, and real estate, but excluding their principal home). The lowest response category was *less than \$10,000* and there were a number of higher response categories. Previous research suggests that the largest contrast between assets groups in predicting mortality was between people in the lowest end of the asset distribution and people in the remainder of the asset distribution (Mare, 1990), and preliminary

analyses of our own data provided similar results. Hence, our liquid asset variable was categorized for these analyses into three groups of respondents: those reporting less than \$10,000 in assets, those reporting \$10,000 or more in assets, and those who did not respond to this question.

Income and education were used as "traditional" indicators of SES for part of the analyses. Occupation was not used because of problems classifying occupations, particularly for older adults. Income includes all sources of income received by the respondents and their spouses in the previous year. Income was coded in three categories: less than \$10,000, \$10,000-\$29,999, and \$30,000 or more. As with liquid assets, other analyses (e.g., House et al., 1990) have indicated that differences in health were minimal among persons with incomes above \$30,000 (about the median in 1986). Missing data were imputed for 311 cases on the income variable via a regression prediction equation. Education was coded in three categories: 0-11, 12-15, and 16+ years of education. Twelve cases of missing data were imputed for the education variable based on a review of the full interview and interviewer observations.

Most previous studies have used only one indicator of health when studying the relationship between SES and health. However, recent gerontological research indicates that health is a multidimensional construct, often seen as having three primary dimensions: disease, disability, and subjective health (Gibson, 1991; Liang, 1986). Socio-economic status might differentially affect different dimensions of health, and this effect may vary by age. Therefore, our analyses included three health outcomes to represent each of three dimensions of health. Functional health measures the disability dimension, number of chronic conditions measures the disease dimension, and self-rated health measures the subjective dimension.

Functional health is a 4-point index ranging from *severe functional limitations* (confinement to a bed or chair) to *no functional limitations* (able to do heavy work around the house without difficulty). Again, based on review of the full interview and interviewer observations, a handful of missing cases on the component variables of this index were imputed to create this index. The number of chronic conditions respondents reported experiencing in the previous year came from a list of 10 major chronic conditions: arthritis/rheumatism, lung disease, hyper-

tension, heart attack or heart trouble, diabetes, cancer/malignant tumor, foot problems, stroke, fractures or broken bones, and urinary incontinence. Fewer than 10 cases were missing for each chronic condition and they were treated as “no” responses to having the specified chronic condition. Self-rated health reflects how respondents rated their health at the time of the interview on a 5-point scale ranging from *poor* to *excellent*. Two cases of missing data were imputed for this variable, again based on review of the full interview and interviewer observations.

ANALYSES

We first examined our data descriptively by presenting six graphs of the weighted health means for each SES category within each age group for both alternative indicators of SES (home ownership and liquid assets) and for three different measures of health. In order to adjust for design effects of the ACL study’s complex sample design, we used the PSALMS program in OSIRIS IV to compute the standard errors of the means. House et al. (1990) presented similar data for a combined index of education and income.

We then tested whether alternative SES indicators (home ownership and liquid assets) predict health beyond the effects of traditional SES indicators (education and income), and whether any interaction between age and the alternative SES indicators remains, net of the additive effects of age, income, and education and of the interactions of age with education and income. Using ordinary least squares (OLS) multiple regression analyses, each of the three health indicators was regressed first on each SES measure, controlling for age, race, and gender. Then the health measures were regressed on each SES measure, controlling for age, race, gender, and either income and education or liquid assets and home ownership, or all three other SES indicators. Finally, interaction terms (the product of two variables) between age and liquid assets and age and home ownership were each entered into the equations to see whether age interacts with liquid assets and home ownership to predict health beyond the additive effects of income, education, liquid assets, home ownership, and demographic variables. The interactions between age and both liquid assets and home owner-

ship were also simultaneously tested net of interaction terms between age and education and age and income, as well as the additive effects of all variables. To adjust for design effects of the ACL study's complex sample design, we used the REPERR program of OSIRIS IV to compute standard errors of regression coefficients using a balanced half sample process. This procedure results in conservative estimates of which coefficients reach statistical significance. Because we find significant variation by age in the relation of SES to health, we then presented results of regressions *within* each of the 10-year age groups, where we evaluated the relative effects of the various SES indicators, considered alone and net of each other.

Results

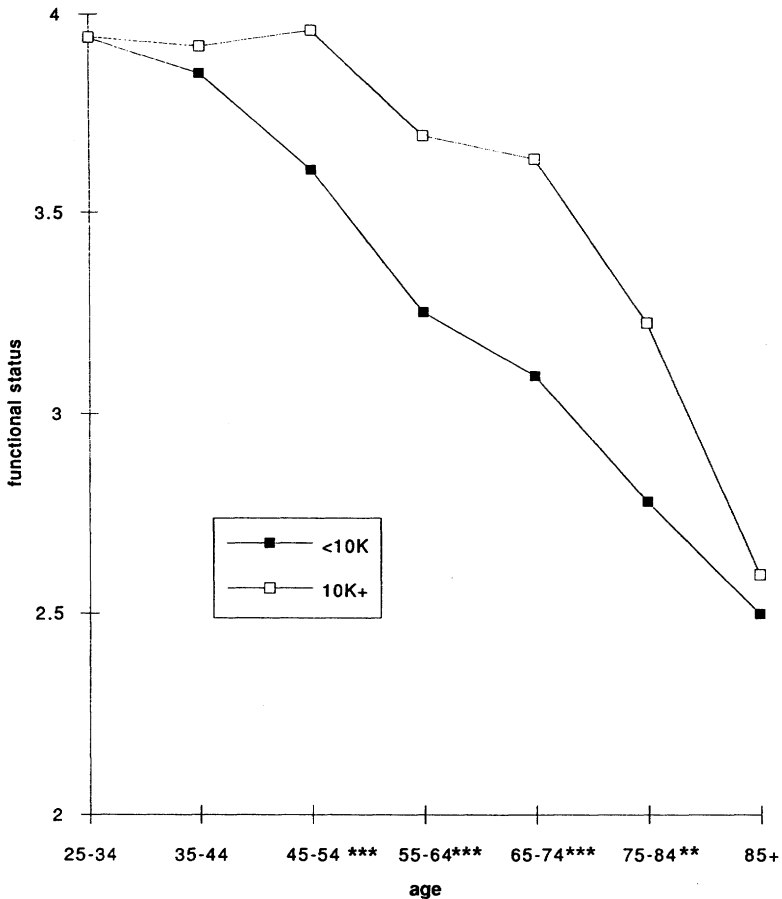
PATTERNS OF SES DIFFERENCES IN HEALTH BY AGE

To visually inspect how the pattern of SES differences in health varied by age group when alternative SES indicators were used, Figures 1 through 6 present graphs of the liquid asset and home ownership differentials in three health measures, within each age category.

Figure 1 shows that liquid asset differentials in functional health were nonexistent or small for those in early adulthood, but large for those in middle age and old age, until at least age 85. Figure 2 shows that, in general, home owners had better functional health than non-owners, among people ages 35-84 (although not statistically significant for those aged 55-64). This gap in functional health between home owners and nonowners was particularly large for those aged 75-84.

Figure 3 shows that liquid asset differentials in number of chronic conditions were nonexistent or small for those in early adulthood, but were generally larger for those in each older age category until at least age 85. Figure 4 shows that those who own their homes have fewer chronic conditions at all ages than nonowners, but these differences are only statistically significant at ages 35-44 and 55-64.

Figure 5 indicates that those with less than \$10,000 in liquid assets had worse self-rated health at all ages compared to those with \$10,000 or more in assets, except at ages 85 and over. The liquid asset differentials in self-rated health are largest for those ages 65-74 and



* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Significance tests are for the difference between group means within each age group

Figure 1. Functional status by liquid assets and age.

quite large for both those aged 55-64 and 75-84. Figure 6 indicates that home owners generally have better self-rated health between ages 35 and 74 than nonowners (although not statistically significant for those aged 45-54), with no statistically significant differences at ages 75 and older.

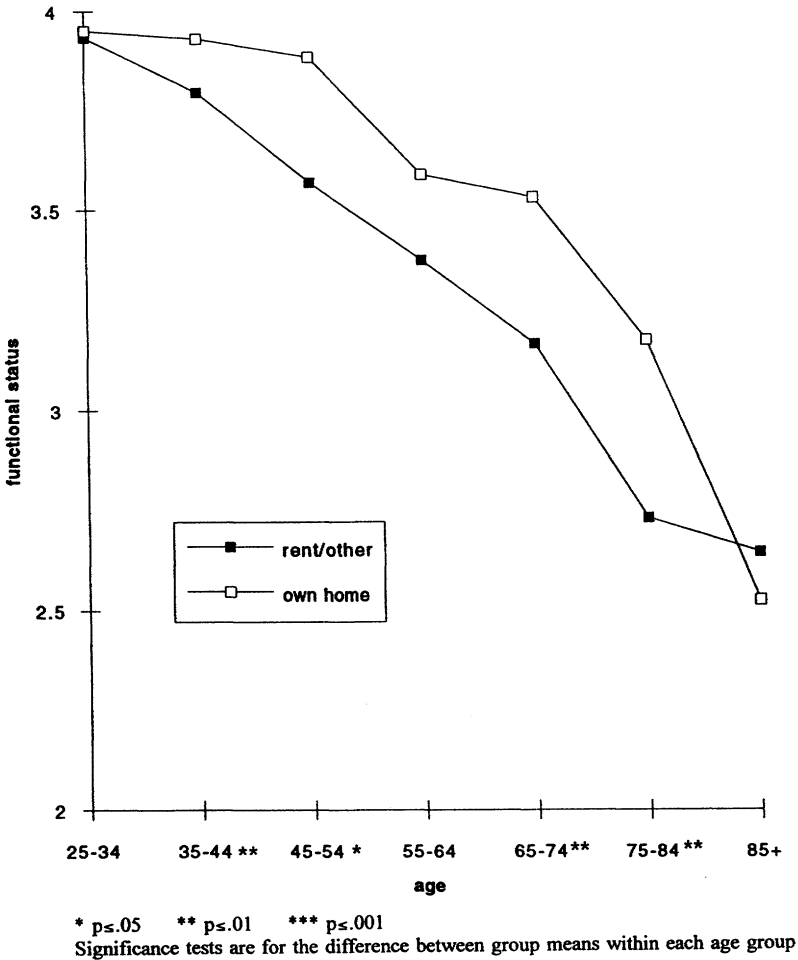


Figure 2. Functional status by home ownership and age.

In sum, Figures 1 through 6 indicate that liquid asset differentials in all three measures of health are seen until ages 85+. Furthermore, these differentials are generally widest for those ages 55-64, 65-74, and 75-84. In comparison, home ownership differentials in health are not as strong as the liquid asset differentials in health and are not as

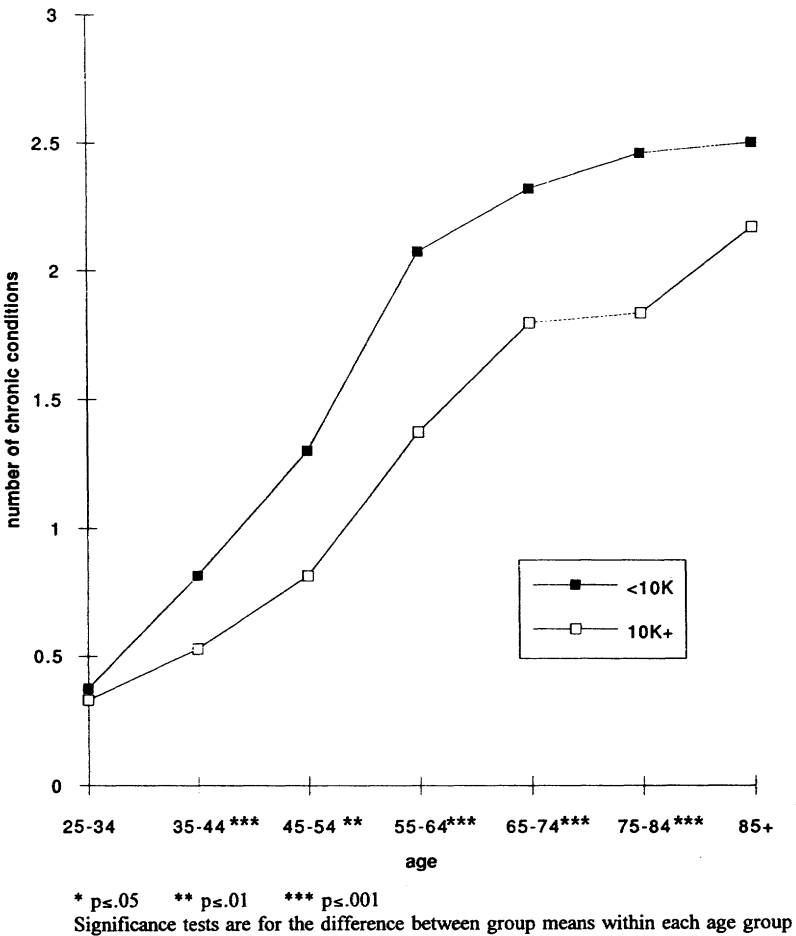


Figure 3. Number of chronic conditions by liquid assets and age.

consistent across measures of health. Home ownership differentials in number of chronic conditions are weak, whereas they are strong for functional health until age 85 and strong also for self-rated health until age 75.

We have compared these results to those reported by House et al. (1990) and to our own estimates of graphs such as Figures 1-6 for

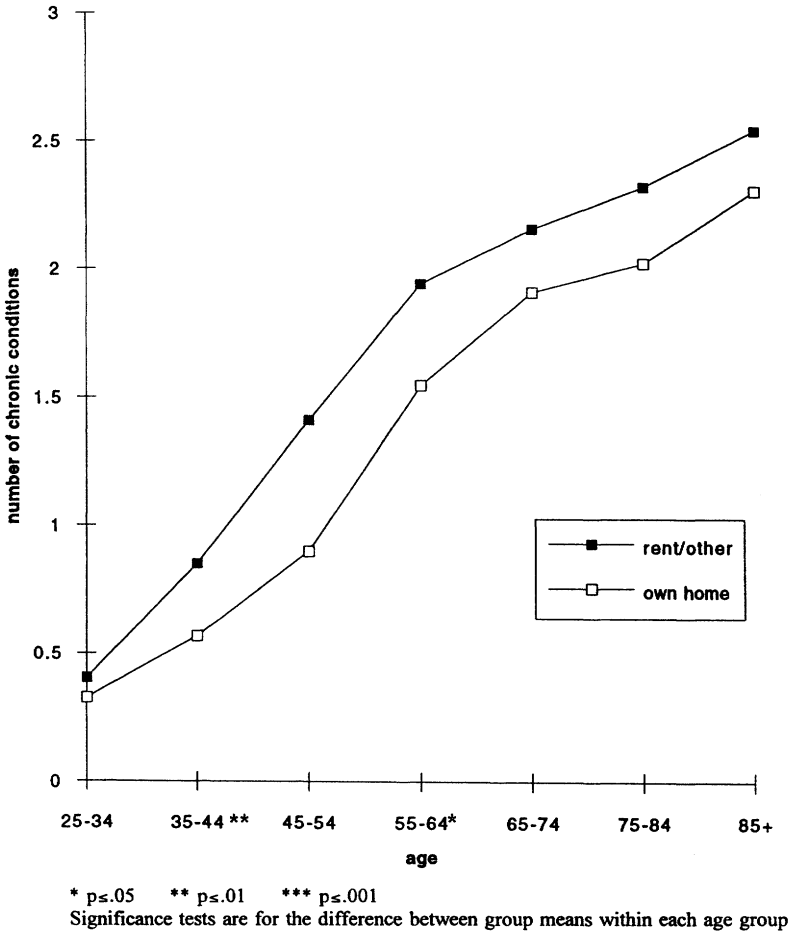
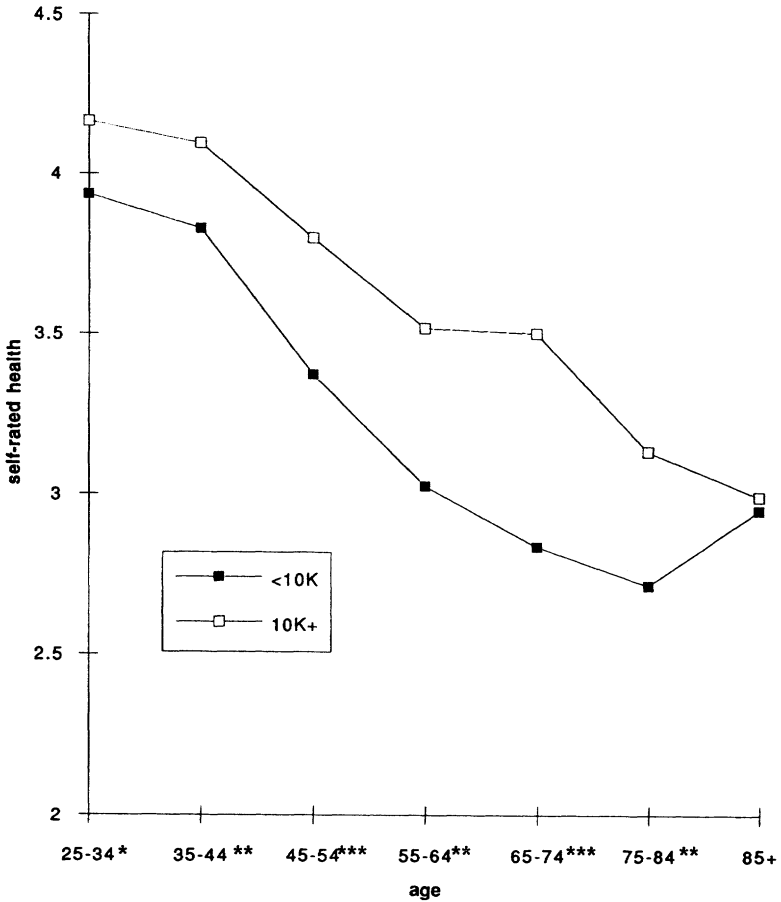


Figure 4. Number of chronic conditions by home ownership and age.

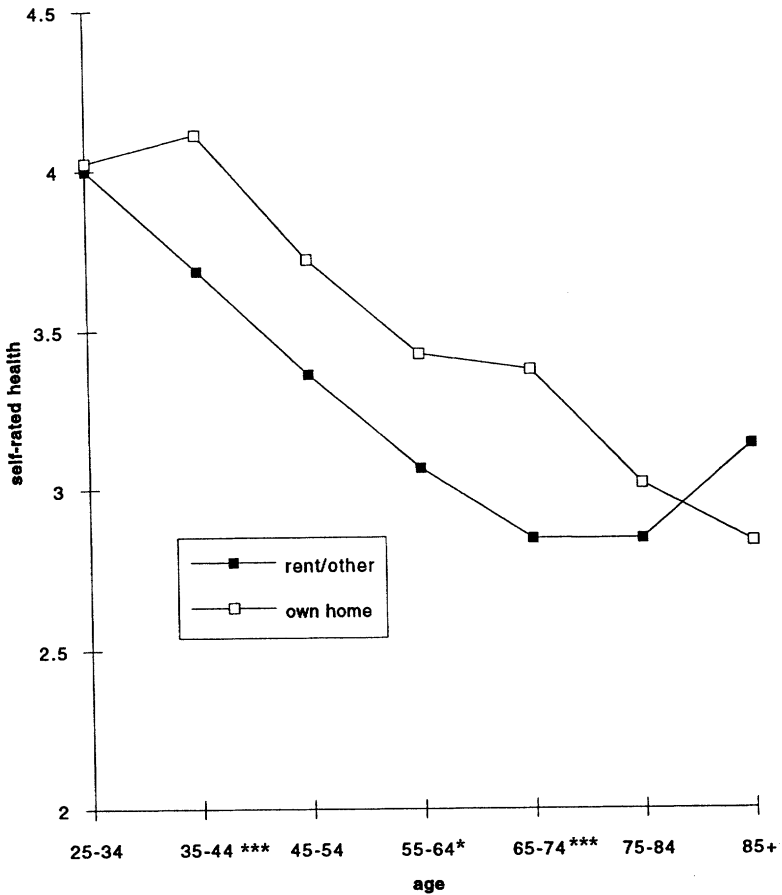
education and income. For these more traditional measures of SES one observes fairly similar patterns of small or nonexistent SES differences at ages 25-34, which become increasingly large through ages 55-64 and then begin to diminish again, becoming small or nonexistent by ages 85+. However, differences by income and education tend to be most pronounced from middle adulthood (35-44) to



* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$
 Significance tests are for the difference between group means within each age group

Figure 5. Self-rated health by liquid assets and age.

early old age (55-64), whereas differences by home ownership and liquid assets tend to be greatest at later ages (55-64 through 75-84). We will examine these age differences in more detail later in this article.



* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$
 Significance tests are for the difference between group means within each age group

Figure 6. Self-rated health by home ownership and age.

EFFECTS OF DIFFERENT SES INDICATORS IN THE TOTAL SAMPLE

It is unclear from Figures 1-6 whether liquid assets and home ownership predict health beyond the effects of traditional indicators of SES, or whether they are largely a function of traditional indicators of SES.

Table 2 shows the percent of variance (R^2) in each measure of health that is explained by each measure of SES or by combinations of SES measures. For each dependent health variable, Column 1 shows the effects of each measure of SES on health net of age, race, and gender, and Column 2 shows the effects net of age, race, gender, and either income and education or liquid assets and home ownership.

For each of the three measures of health, column 1 indicates that each of the four measures of SES is a significant predictor of health, net of age, race, and gender. Column 1 also indicates that for self-rated health and number of chronic conditions, education and income are each better predictors of health than home ownership and liquid assets, although the effect of liquid assets on number of chronic conditions approaches that of income. For functional health, income is the best predictor, followed next by liquid assets, education, and home ownership.

Column 2 of Table 2 for each health measure shows the effects of each SES measure after controlling for other SES indicators. For all three health measures, the effects of education and income remain, net of age, race, gender, liquid assets, and home ownership. Similarly, the effects of liquid assets on all three measures of health remain, net of age, race, gender, education, and income. The effects of home ownership on functional health persist net of age, race, gender, education, and income, but do not for self-rated health or number of chronic conditions, net of age, race, gender, education, and income. Again, income and education remain the best predictors of all three measures of health, although the effects of liquid assets on functional health approach the size of the effects of both education and income.

Table 3 shows the final full regression equations with all demographic and SES variables simultaneously predicting each health measure. Education, income, and liquid assets each predict all three measures of health, controlling for age, race, gender, and the other SES variables. Home ownership does not have independent effects on the health measures, controlling for the other SES and demographic variables. Table 3 also indicates that those who did not report information on the asset question (missing assets) are more like those with \$10,000 or more in liquid assets than those with less than \$10,000 in liquid assets. This is to be expected because those with assets are less likely to report that information in an interview.

Table 2
 R^2 (% of Variance) in Self-Rated Health, Functional Health, and Number of Chronic Conditions Explained by Different Measures of SES (N = 3,615)

SES Measure	Self-Rated Health			Functional Health			Chronic Conditions		
	Net Base Model ^a	Net Base Model Plus SES Pair ^b	Net Base Model Plus SES Pair	Net Base Model	Net Base Model Plus SES Pair	Net Base Model Plus SES Pair	Net Base Model	Net Base Model Plus SES Pair	Net Base Model Plus SES Pair
Education	.0401**** ^c	.0257***	.0080***	.0164***	.0081***	.0080***	.0209***	.0168***	.0129***
Income	.0458***	.0251***	.0081***	.0209***	.0081***	.0081***	.0168***	.0168***	.0066***
Education + income	.0617***	.0389***	.0124***	.0268***	.0124***	.0124***	.0271***	.0271***	.0153***
Own Home	.0091***	.0002	.0020**	.0085***	.0020**	.0020**	.0052***	.0052***	.0005
Liquid assets	.0230***	.0036***	.0072***	.0194***	.0072***	.0072***	.0137***	.0137***	.0036***
Own + assets	.0264***	.0036**	.0084***	.0228***	.0084***	.0084***	.0156***	.0156***	.0038***

a. Base model includes age, race, and gender.

b. Includes either income and education (last three rows) or home ownership and liquid assets (first three rows) as controls.

c. Significance test indicates level of significance of the change in R^2 test.

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

Table 3
Final Regression Equations for Each Measure of Health (N = 3,615)

	<i>Self-Rated Health</i>	<i>Functional Health</i>	<i>Chronic Conditions</i>
Intercept	3.377	3.654	.747
Age			
25-34	omitted	omitted	omitted
35-44	-.073	-.083**	.317***
45-54	-.373***	-.154***	.656***
55-64	-.587***	-.409***	1.208***
65-74	-.581***	-.460***	1.484***
75-84	-.785***	-.811***	1.548***
85+	-.746***	-1.269***	1.822***
Race (Black)	.010	.024	.130*
Female	-.0355	-.055*	.195***
Education			
0-11 yrs	omitted	omitted	omitted
12-15 yrs	.245***	.116**	-.231***
16+ yrs	.435***	.145***	-.406***
Income			
<\$10,000	omitted	omitted	omitted
\$10K-\$29,999	.309***	.138**	-.139
\$30,000+	.440***	.146*	-.223**
Own home	.023	.059	-.049
Liquid assets			
<\$10,000	omitted	omitted	omitted
\$10,000+	.137*	.125***	-.159**
Missing	.183	.160**	-.208*
R ²	.177	.190	.298

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

In Table 3, the beta coefficients in each equation indicate the magnitude of the net effects for each SES variable. For example, those with \$10,000 or more in assets have a predicted score for self-rated health that is .137 better than the predicted score for those with less than \$10,000 in assets, and those missing on the assets variable have a predicted score that is .183 (though not significantly) better than the predicted score for those with less than \$10,000 in assets, after controlling for all other SES and demographic variables. In comparison, those with 12-15 years of education have a predicted self-rated health score that is .245 better than the score of those with 0-11 years of education, and those with 16+ years of education have a predicted score that is .435 better than the predicted score for those with 0-11

years of education, or .190 (.435-.245) better than the predicted score for those with 12-15 years of education. People with incomes of \$10,000-\$29,999 have predicted self-rated health scores that are .309 better than the scores of people with less than \$10,000 in income, and those with incomes of \$30,000 or more have self-rated health scores .131 (.440-.309) higher than the scores of people with incomes of \$10,000-\$29,999. Levels of education and income have more of an effect on self-rated health than levels of assets. However, for functional health, the difference between successive asset groups (.125 and .035) is larger than the difference in functional health scores between successive education groups (.116 and .029). This asset effect also rivals the effect on functional health of having \$10,000-\$29,999 in income compared to having less than \$10,000 in income. For chronic conditions, the asset effects are generally smaller than the effects for education, but larger than the effects for income. These net effects of assets on all three measures of health are also generally larger than the effects of race and sex.

Thus, in absolute magnitudes as well as in percentage of variance accounted for, the effects of assets often rival or exceed the effects for standard indicators of socioeconomic status or for racial and gender stratification. More important, however, is how these results may vary by age.

AGE BY SES INTERACTIONS AND AGE-SPECIFIC EFFECTS

Interaction terms between age and each SES measure were each added to regression models including age, race, gender, and all four SES measures. Table 4 shows the additional variance explained by these interactions net of all additive effects and also net of the interactions of age with the other SES indicators (see Note b of Table 4). For each health measure, Column 1 shows that significant interaction terms were found between age and education, age and income, and age and liquid assets. Age by home ownership interactions were significant for both functional health and self-rated health, but not for number of chronic conditions. Further, Column 2 of Table 4 (for each health measure) shows that the interactions between income \times age together with education \times age add significantly to a base model that

Table 4
R² (% of Variance) in Self-Rated Health, Functional Health, and Number of Chronic Conditions Explained by Interactions Between Age and Each Measure of SES

	Self-Rated Health		Functional Health		Chronic Conditions	
	Net Base ^a	Net Base & Interactions ^b	Net Base	Net Base & Interactions	Net Base	Net Base & Interactions
Income × age	.0123*** ^c		.0132***		.0120***	
Education × age	.0054*		.0100***		.0076***	
Liquid asset × age	.0058*		.0156***		.0079***	
Home ownership × age	.0059***		.0066***		.0022	
Income × age and education × age	.0154***	.0156***	.0202***	.0164***	.0158***	.0111***
Liquid asset × age and home ownership × age	.0105**	.0107***	.0191***	.0153***	.0090***	.0043

- a. Base model includes age, race, gender, education, income, home ownership, and liquid assets.
- b. For the income × age and education × age row, this column controls for the base model plus liquid asset × age and ownership × age interactions; for the liquid asset × age and ownership × age row, this column controls for the base model plus income × age and education × age interactions.
- c. Significance test indicates level of significance of the change in *R²* test
 p* ≤ .05; *p* ≤ .01; ****p* ≤ .001.

includes liquid asset × age and home ownership × age interactions as well as all additive effects. Similarly, the interactions between liquid assets × age together with home ownership × age add significantly to a base model that includes income × age and education × age interactions for both self-rated health and functional health, but not for number of chronic conditions. In order to further explore these interaction effects, we next present age-specific results to evaluate more closely the relative effects of each measure of SES within each age group.

Tables 5 to 7 show the age-specific effects of each SES variable on each health measure, net of race, gender, and either income and education or liquid assets and home ownership. Table 5 shows the results for self-rated health. Looking across rows, education is a predictor of self-rated health net of race, gender, liquid assets, and home ownership through ages 75-84. Its effects are strongest at ages 45-54, with lesser effects at 55-64 and 65-74. Income is a predictor through

Table 5
 R^2 (% of Variance) in Self-Rated Health Explained by Different Measures of SES, Within Each Age Group, Net Race, Gender, and SES Pair^a

SES Measure	Self-Rated Health						
	25-34	35-44	45-54	55-64	65-74	75-84	85+
Education	.0236*** ^b	.0180**	.0493***	.0385***	.0324***	.0229*	.0136
Income	.0255***	.0145*	.0691***	.1058***	.0206***	.0047	.0180
Education + income	.0416***	.0285**	.0941***	.1150***	.0400***	.0282*	.0355
Own home	.0063*	.0236***	.0005	.0011	.0119**	.0023	.0100
Liquid assets	.0042	.0186***	.0029	.0052	.0184***	.0136	.0175
Own + assets	.0105*	.0377***	.0036	.0057	.0256***	.0148	.0376

a. Includes either income and education (last three rows) or home ownership and liquid assets (first three rows) as controls.

b. Significance test indicates level of significance of the change in R^2 test.

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

ages 65-74 with its strongest effects at ages 45-54 and 55-64. Home ownership is a predictor net race, gender, and other SES variables at ages 25-34, 35-44, and 65-74. The effects of liquid assets are significant only at ages 35-44 and 65-74. Looking down the columns, we can compare the relative effects of each SES measure at each age. Looking at the older ages, we note that all four SES indicators are significant predictors at ages 65-74, net other SES indicators, but both income and education are stronger predictors than liquid assets and home ownership. At ages 75-84, education is the only significant SES predictor, net of the other SES variables. These results do not support the hypothesis that financial assets predict self-rated health better than traditional SES measures at older ages. However, they suggest that financial assets add substantially to our ability to predict self-rated health both at younger (25-44) and older (65+) ages, relative to middle age (45-64), where financial assets add nothing to our ability to predict self-rated health beyond the effects of education and income.

Table 6 presents the results for functional health. Looking across rows, we see that the effects of education, net other SES variables, are significant at ages 45-54, 55-64, and 85+. (The last effect is large and anomalous but is based on only 44 weighted and 73 unweighted cases.) The effects of income are strongest and significant at ages 45-54 and 55-64, with lesser but still significant effects at ages 35-44 and 75-84. Home ownership is significant at ages 35-44, 65-74, and 75-84, with

Table 6
 R^2 (% of Variance) in Functional Health Explained by Different Measures of SES, Within Each Age Group, Net Race, Gender, and SES Pair^a

SES Measure	Functional Health						
	25-34	35-44	45-54	55-64	65-74	75-84	85+
Education	.0020 ^b	.0092	.0161*	.0160**	.0061	.0062	.1800***
Income	.0028	.0215**	.0330***	.0371***	.0038	.0154*	.0031
Education + income	.0039	.0300**	.0397**	.0422***	.0077	.0294*	.1878**
Own home	.0000	.0110**	.0079	.0009	.0079*	.0285***	.0385
Liquid assets	.0014	.0022	.0174*	.0221***	.0295***	.0368***	.0111
Own + assets	.0014	.0121	.0237*	.0221***	.0327***	.0574***	.0423

a. Includes either income and education (last three rows) or home ownership and liquid assets (first three rows) as controls.

b. Significance test indicates level of significance of the change in R^2 test.

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

the strongest effects at ages 75-84. The liquid assets indicator has independent effects between ages 45-84, and its effects increase with each age group, with the greatest effects at ages 75-84. Looking down columns, we note that at younger ages, education and income are the best predictors of functional health. At ages 55-64, income is the best predictor, but the liquid assets indicator is better than education. At ages 65-74 and 75-84, liquid assets and home ownership are better predictors than income and education. These results support the hypothesis that liquid assets and home ownership are particularly good predictors of functional health at older ages, even controlling for traditional SES indicators.

Table 7 presents the results for number of chronic conditions. Looking across rows, education has significant net effects on chronic conditions at ages 35-74, with stronger effects at younger ages. Income has significant net effects between ages 35-64, with strongest effects at ages 55-64. Home ownership has no significant net effects at any age. Liquid assets showed significant net effects, but in an inconsistent age pattern. Looking down columns, education is the only significant predictor at ages 65-74, net other SES variables. In contrast, the liquid assets indicator is the only significant predictor at ages 75-84, net other SES variables. Income and education generally have stronger effects at most other ages. These results partially support the hypothesis that financial assets may be a better predictor of chronic conditions than

Table 7
R² (% of Variance) in Number of Chronic Conditions Explained by Different Measures of SES, Within Each Age Group, Net Race, Gender, and SES Pair^a

SES Measure	Chronic Conditions						
	25-34	35-44	45-54	55-64	65-74	75-84	85+
Education	.0024 ^b	.0286***	.0351***	.0187**	.0267***	.0128	.0192
Income	.0008	.0125**	.0167*	.0427***	.0055	.0124	.0720
Education + income	.0030	.0331***	.0460***	.0473***	.0271***	.0198	.0762
Own home	.0007	.0048	.0048	.0006	.0000	.0012	.0004
Liquid assets	.0016	.0159**	.0052	.0132**	.0070	.0152*	.0170
Own + assets	.0024	.0189**	.0092	.0132*	.0071	.0157	.0191

a. Includes either income and education (last three rows) or home ownership and liquid assets (first three rows) as controls.

b. Significance test indicates level of significance of the change in R^2 test.

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$.

traditional measures of SES at older ages. The liquid assets indicator seems to be a particularly good predictor of chronic conditions at later ages, but home ownership does not.

Discussion

Previous research has indicated that although there are strong SES differences in health in the United States, the relationship between SES and health seems to diminish at older ages. There are a number of competing explanations for this diminished relationship at older ages (Robert & House, 1994). This study tested one hypothesis that suggests that the diminished relationship between SES and health at older ages results from using SES indicators that may be less appropriate at older ages. Using two alternative SES indicators that might be more appropriate at older ages (liquid assets and home ownership), we investigated whether these alternative SES indicators would predict health beyond traditional SES indicators (income and education), and whether these alternative indicators would predict health better at older ages, resulting in patterns of persisting rather than diminishing SES inequalities in health throughout old age.

We first looked at how patterns of SES differentials in health varied by age in the United States, using liquid assets and home ownership as alternative indicators of SES. The results indicated that when liquid

assets were used as an alternative measure of SES, there were sizeable differences in health throughout adulthood and old age until age 85. Patterns of liquid asset differentials in functional health and number of chronic conditions were similar to those found by House et al. (1990), who used a combined income and education indicator of SES to look at SES differences in these two measures of health. In their study, House et al. found that SES differences in functional health and number of chronic conditions were small in young adulthood, largest in middle age and early old age, and smaller again at ages 75+ (the oldest age category). Our study differed by using 85+ as the oldest age category and found that liquid asset differentials in functional health and number of chronic conditions were small in young adulthood and largest in middle and old age, not diminishing until ages 85+. We found the same pattern for liquid asset differentials in self-rated health, although these results cannot be compared to the findings of House et al. because they did not use this measure of health.

When we used home ownership as an alternative indicator of SES, the findings were not as consistent or robust. Home ownership differentials in functional health were strong until age 85, and home ownership differentials in self-rated health were strong until age 75. These patterns are relatively consistent with our results for liquid asset differentials in health and with House et al.'s (1990) results for traditional SES differentials in health. However, home ownership differentials in number of chronic conditions were weak at all ages.

The next stage of our analysis went beyond looking at patterns of SES differences in health to see whether our alternative SES indicators were simply a function of the traditional SES indicators (which might be expected since the patterns we found for the alternative SES indicators looked similar to those found by House et al. [1990] using traditional SES indicators). We found that the effects of alternative SES indicators are not simply a function of the effects of traditional SES indicators. The effects of liquid assets on all three health measures persisted even after controlling for age, race, gender, income, and education. The effects of home ownership persisted only for functional health. Although income and education remained the best predictors of all three health measures, the effects of liquid assets on functional health approached the size of both the education and income effects.

We next tested whether these alternative SES measures were particularly good predictors of health at older ages. Initial analyses of interactions between age and each SES measure indicated that the effects of both the traditional SES measures (income and education) and the alternative indicators (liquid assets and home ownership) varied significantly by age. Subsequent age-specific analyses allowed us to more closely evaluate these interactive effects. These analyses indicated that alternative SES indicators are better predictors of health at older ages for some health measures, but not for others. Liquid assets and home ownership were not better predictors than income and education at older ages for self-rated health, although their effects were much larger at older and younger ages than at middle ages. Both liquid assets and home ownership were better predictors than income and education for the functional health of older adults ages 65-74 and 75-84. Income and education had the strongest effects on number of chronic conditions at most ages, but liquid assets was the only predictor of chronic conditions at ages 75-84.

Our measurement of liquid assets is relatively crude and probably less reliable than our measures of education, income, or home ownership. With more precise measurements its absolute and relative effects on health might loom even larger. We conclude that alternative SES indicators are particularly important to include when predicting the health of older adults but that attention also needs to be paid to the measures of health status used. The observed importance of alternative SES indicators in older ages is consistent with the argument that traditional SES indicators may be less appropriate SES indicators for people in older ages for some health measures. Information about liquid assets and home ownership as well as information about income and education may provide a more accurate picture of overall socio-economic stratification in older ages (Crystal & Shea, 1990). Research in the United States needs to follow the lead of other countries to consider alternative SES indicators. Whereas this study looked at home ownership and liquid assets as two alternative SES indicators, the relationship to health of these and other SES indicators, such as car ownership or house value, needs to be investigated using different data sets. In particular, home value should be looked at in the future. Perhaps the weaker results for home ownership result from the fact

that it is more important to know the home value rather than simply whether or not a home is owned. Unfortunately, we were unable to look at home value in our study due to limitations of the data.

Because our data are cross-sectional, it is not certain whether liquid assets and home ownership have a strong influence on health or whether health influences liquid assets and home ownership. This is not a new problem in the interpretation of SES differentials in health using cross-sectional data. Although declines in health can result in declines in SES, research has found that this explanation accounts for comparatively little of the overall SES differentials in health, particularly among older adults (e.g., Mare, 1990; Wilkinson, 1989). However, those studies did not look at health-related loss of financial assets such as liquid assets and home ownership. In fact, if there are declines in SES due to poor health among older adults, level of financial assets might be the first indicator of SES to show decline. For example, if a person experiences the onset of a debilitating disease in later life, the cost of accommodating that illness may be less likely to drastically change one's gross income immediately because income often comes from a fairly stable source at older ages (i.e., social security, pension). However, the cost of accommodating illness is more likely to drastically change one's expenditures of income and assets, which might be reflected first in self-reported level of assets rather than level of income.

Alternatively, however, possessing assets may be especially important in facilitating functional adaptation to health problems. Those with assets are more likely to be able to afford physical therapy or mechanical aids or modification of their living environment, probably without dropping their asset level below \$10,000. Those with less than \$10,000 in assets, however, are much more likely to lose functional capacity as a result of illness. Overall, we believe that assets, like other measures of SES, are more determinants of health than consequences of health. Research using longitudinal data will be necessary in order to understand the direction of causal effects between alternative measures of SES and health, and to determine whether these processes differ by age and by measures of SES and health.

Because our study was particularly interested in issues of older age, SES, and health, it is important to note that the ACL survey excluded

a group of people who are likely to be the least healthy and the most poor—those residing in nursing homes. By excluding the institutionalized population, the relationship of SES with health in older ages may be understated in this study.

We also approach conclusions for those aged 85+ with caution because we view the age-specific results for this age group as somewhat unstable. The benefit of separating this group from those aged 75-84 rather than combining these two age groups is that we are able to closely look at trends for those aged 75-84, which most studies have not done. This age distinction has allowed us to detect continued SES differences in health through ages 75-84, where others have noted diminished relationships for the broader 65+ or 75+ age groups. Future research should examine data that might be better suited for studying the oldest old.

Future research also needs to replicate the approach of this study by looking at multiple health indicators. Our results indicate that functional health was strongly linked to both the liquid assets and home ownership of older adults. Number of chronic conditions at older ages was predicted by liquid assets but not by home ownership. Self-rated health was less strongly linked to alternative SES measures, although even here the relative importance of assets generally increases with age. Future research needs not only to use different health measures, as we have here, but also to explore why SES seems to be linked more closely to some dimensions of health than others.

Finally, this research simply controlled for race and gender in order to focus on the effects of age and SES on health. However, future investigations need to consider the interaction of socioeconomic and age stratification systems with other stratification systems, such as those based on race and gender, and to look at their interactive and combined impact on health.

REFERENCES

- Antonovsky, A. (1967). Social class, life expectancy and overall mortality. *The Milbank Quarterly*, 45, 31-73.
- Arber, S., & Ginn, J. (1993). Gender and inequalities in health in later life. *Social Sciences and Medicine*, 36, 33-46.

- Crystal, S., & Shea, D. (1990). Cumulative advantage, cumulative disadvantage, and inequality among elderly people. *The Gerontologist*, *30*, 437-443.
- Feldman, J. J., Makuc, D. M., Kleinman, J. C., & Cornoni-Huntley, J. (1989). National trends in educational differentials in mortality. *American Journal of Epidemiology*, *129*, 919-933.
- George, L. K. (1992). Economic status and subjective well-being: A review of the literature and an agenda for future research. In N. E. Cutler, D. W. Gregg, & M. P. Lawton (Eds.), *Aging, money, and life satisfaction* (pp. 69-99). New York: Springer.
- Gibson, R. C. (1991). Race and the self-reported health of elderly persons. *Journal of Gerontology*, *46*, S235-S242.
- House, J. S. (1986). *Americans' changing lives: Wave 1* [Computer file]. Ann Arbor, MI: Survey Research Center (producer), 1989. Ann Arbor: Inter-University Consortium for Political and Social Research (distributor), 1990.
- House, J. S., Kessler, R. C., Herzog, A. R., Mero, R. P., Kinney, A. M., & Breslow, M. J. (1990). Age, socioeconomic status, and health. *The Milbank Quarterly*, *68*, 383-411.
- House, J. S., Lepkowski, J. M., Kinney, A. M., Mero, R. P., Kessler, R. C., & Herzog, A. R. (1994). The social stratification of aging and health. *Journal of Health and Social Behavior*, *35*, 213-234.
- Kaplan, G. A., & Haan, M. N. (1989). Is there a role for prevention among the elderly? Epidemiological evidence from the Alameda County study. In M. G. Ory & K. Bond (Eds.), *Aging and health care: Social science and policy perspectives* (pp. 27-51). New York: Routledge.
- Kaplan, G. A., Seeman, T. E., Cohen, R. D., Knudsen, L. P., & Guralnik, J. (1987). Mortality among the elderly in the Alameda County study: Behavioral and demographic risk factors. *American Journal of Public Health*, *77*(3), 307-312.
- Kitagawa, E. M., & Hauser, P. M. (1973). *Differential mortality in the United States: A study in socioeconomic epidemiology*. Cambridge, MA: Harvard University Press.
- Liang, J. (1986). Self-reported physical health among aged adults. *Journal of Gerontology*, *41*, 248-260.
- Liberatos, P., Link, B. G., & Kelsey, J. L. (1988). The measurement of social class in epidemiology. *Epidemiologic Reviews*, *10*, 87-121.
- Mackenbach, J. P. (1992). Socio-economic health differences in the Netherlands: A review of recent empirical findings. *Social Science and Medicine*, *34*, 213-226.
- Makuc, D., Feldman, J. J., Kleinman, J. C., & Pierre, M. B. (1990). Sociodemographic differentials in mortality. In J. C. Cornoni-Huntley, R. R. Huntley, & J. J. Feldman (Eds.), *Health status and well-being of the elderly* (pp. 155-171). New York: Oxford University Press.
- Mare, R. D. (1990). Socio-economic careers and differential mortality among older men in the United States. In J. Vallin, S. D'Souza, & A. Palloni (Eds.), *Measurement and analysis of mortality* (pp. 362-387). Oxford, UK: Clarendon Press.
- Marmot, M. G., Kogevinas, M., & Elston, M. A. (1987). Social/economic status and disease. *Annual Review of Public Health*, *8*, 111-135.
- Newacheck, P. W., Butler, L. H., Harper, A. K., Piontkowski, D. L., & Franks, P. E. (1980). Income and illness. *Medical Care*, *18*, 1165-1176.
- Pappas, G., Queen, S., Hadden, W., & Fisher, G. (1993). The increasing disparity in mortality between socioeconomic groups in the United States, 1960 and 1986. *New England Journal of Medicine*, *329*, 103-109.
- Robert, S., & House, J. S. (1994). Socioeconomic status and health over the life course. In R. P. Abeles, H. C. Gift, & M. G. Ory (Eds.), *Aging and quality of life*. New York: Springer.

- Rogot, E., Sorlie, P. D., Johnson, N. J., Glover, C. S., & Treasure, D. W. (1988). *A mortality study of one million persons by demographic, social, and economic factors: 1979-1981 follow-up*. Washington, DC: U.S. Department of Health and Human Services.
- Satariano, W. A. (1986). Race, socioeconomic status, and health: A study of age differences in a depressed area. *American Journal of Preventive Medicine*, 2, 1-5.
- Shahtahmasebi, S., Davies, R., & Wenger, G. C. (1992). A longitudinal analysis of factors related to survival in old age. *The Gerontologist*, 32, 404-413.
- Syme, L. S., & Berkman, L. F. (1976). Social class, susceptibility, and sickness. *The American Journal of Epidemiology*, 104, 1-8.
- Valkonen, T. (1993). Problems in the measurement and international comparisons of socio-economic differences in mortality. *Social Science and Medicine*, 36, 409-418.
- Wilkinson, R. G. (1989). Class mortality differentials, income distribution and trends in poverty 1921-1981. *Journal of Social Policy*, 18, 307-335.
- Williams, D. R. (1990). Socioeconomic differentials in health: A review and redirection. *Social Psychology Quarterly*, 53, 81-99.
- Wolfson, M., Rowe, G., Gentleman, J. F., & Tomiak, M. (1993). Career earnings and death: A longitudinal analysis of older Canadian men. *Journal of Gerontology*, 48, S167-S179.
- Xie, Y. (1994). Log-multiplicative models for discrete-time, discrete-covariate event-history data. In P. V. Marsden (Ed.), *Sociological methodology* (pp. 301-340). San Francisco: The American Sociological Association.