POVERTY AND HEALTH: A NATIONAL STUDY OF THE DETERMINANTS OF EXCESS MORTALITY*

David R. Williams, Yale University
James M. Lepkowski

Socioeconomic status (SES) is a strong and consistent predictor of variations in morbidity and mortality. Persons of high social status live longer and enjoy better health than their less favored counterparts (1-4). Especially impressive is the persistence of SES differences in health status over time. Recent reviews indicate that socioeconomic differences in health status exists throughout Western Europe despite the ready availability of medical care, increased economic development, and marked improvements in the standard of living during this century (4-8). Despite the consistency with which socioeconomic factors predict changes in health status, the reasons underlying this relationship are yet to be clearly identified. There is growing recognition that social status variations in health reflect the location of social groups in a stratified social system and are therefore linked to the particular conditions of life under which these groups live (4). Accordingly, identifying the determinants of SES differences in health status will require the identification of the "general features of lower class living environments that compromise bodily defense" (3).

A broad range of social and behavioral factors have been nominated as potential linkages between social stratification and health status (4,9). These psychosocial factors such as marital patterns and health behaviors have also emerged as central determinants of health (10). The United States Surgeon General's report, for example, indicates that 50 percent of U.S. mortality is due to unhealthy behavior and lifestyle. In contrast, 20 percent is attributable to environmental factors, 20 percent to genetic factors and 10 percent to inadequate medical care (11). A growing body of evidence also suggests that these health enhancing psychosocial resources are all positively related to socioeconomic position (4,12).

Few attempts have been made to empirically verify the extent to which psychosocial factors can account for the association between SES and health status, and the available evidence is equivocal. House et al. (13) recently reported that adjustment for psychosocial factors completely accounts for the association between low socioeconomic status and self reported health. Rose and Marmot (14) found that adjustment for cholesterol, smoking, blood pressure, body mass index, blood glucose, physical activity, and height accounted for more than half of the increased risk of coronary heart disease mortality for manual and low-skilled white collar workers. On the other hand, a study in eastern Finland found that a significant association between heart disease mortality and low levels of education and income persisted after adjustment for age, cholesterol, smoking and blood pressure (15). Similarly, analyses of the Alameda County Study found that the significant association between poverty area residence and mortality remained virtually unchanged after adjustment for baseline health status, race, income, employment status, access to medical care, health insurance coverage, smoking, alcohol consumption, physical activity, body mass index, sleep patterns, social isolation, marital status, depression, and personal uncertainty (16). This study concluded that SES differences in mortality are not due to these social and behavioral risk factors.

The SES measure in the Alameda County Study was a dichotomous indicator of residence in poverty areas versus residence in nonpoverty areas. Race was more strongly related to poverty area residence than any other demographic, socioeconomic, or behavioral characteristic. Sixty-seven percent of poverty area residents were black compared to thirteen percent of nonpoverty area residents. Since the degree of residential segregation by race is still very high in most major metropolitan areas (17), it is likely that there is considerable variation in socioeconomic status, especially among blacks, within federally designated poverty areas. Thus, although the findings of the Alameda County Study clearly underscore that place of residence can be a potent determinant of adverse changes in health status, given the strong relationship between behavioral risk factors and individual level indicators of SES in Alameda County (10), these risk factors are likely to explain more of the socioeconomic variation in health outcomes when SES is measured at the individual as opposed to the ecological level.

More generally, studies that have assessed the role of psychosocial factors in explaining SES differences in mortality have varied in the behavioral risk factors assessed and have not uniformly considered a broad range of factors. The NHANESI Epidemiologic Followup Study provides a unique opportunity to study the determinants of socioeconomic differences in mortality in a large national probability sample. Specifically, we address the following research questions: 1) how are health behaviors including dietary frequency, marital status, and health care utilization linked to economic status and mortality, and 2) to what extent can these risk factors, considered singly and in combination, account for SES differences in mortality.

METHODS

Study Population. The data for our analyses come from the First National Health and Nutrition Examination Survey (NHANESI) Epidemiologic Followup Study (NHEFS). NHANESI is a multi-stage, stratified, national probability sample of the noninstitutionalized civilian population (18,19). The study was conducted between 1971 and 1974 and was augmented by an additional national sample during 1974 and 1975 that increased the size of certain subpopulations. The total NHANESI sample is 23,808 persons, 1 to 74 years of age. NHANESI is composed of six distinct subsamples of the U.S. population and not all participants received the same questionnaires or examination components.

The NHEFS population comprises all of the 14,407 NHANESI participants who were 25 to 74 years of age when they were first interviewed and medically examined between 1971 and 1975 (20,21). Data collection in NHEFS took place between 1982 and 1984 and included tracing the vital status of each NHANESI subject. Ninety-three percent of the original NHANESI cohort were successfully traced. The length of followup ranged from 5 to 12 years, with an average of 9.5 years.

Measures. Mortality from all causes is the central dependent variable in all analyses. Our measure of SES is the federal definition of poverty originally developed at the Social Security Administration in 1964 and revised by Interagency Committees in 1969 and 1980 (22). The poverty thresholds are updated every year to reflect changes in the consumer price index. We classified all respondents into one of four categories: 1) poor (0-100% of the poverty level), 2) near poverty (101-150% above

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Table 1

THE ASSOCIATION BETWEEN RISK FACTORS, CONSIDERED SINGLY AND IN COMBINATION, AND MORTALITY, FOR MALES AND FEMALES[1]

Risk Factors	Males		Females	
	Bivariate	Adjusted	Bivariate	Adjusted
Marital Status				
1. Married	-.79***	-.34*	-.72***	.06
Health Behavior				
2. Exercise	-.49***	-.31***	-.37***	-.18***
3. Alcohol				
a. Moderate Drinker	-.45***	-.08	-.60***	.07
b. None/Heavy (omitted)				
4. Weight				
a. Average	-.39***	-.32**	-.33***	-.43***
b. Over/Under (omitted)				
5. Smoking				
a. Non-Smoker	-.27**	-.74***	.24	-.38**
b. Smoker (omitted)				
Diet Frequency				
6. Fish				
a. Some	-.92***	-.57***	-.35*	.12
b. Never (Omitted)				
7. Cheese				
a. Once/day or more	.11	.43**	-.40**	-.42*
b. 6/weekly or less (omitted)				
8. Fruits/Vegetables				
a. Once/day or more	.69***	.11	-.28+	-.04
b. 6/weekly or less (omitted)				
9. Desserts/sweets				
a. Once/week or more	-.60***	.07	-.36***	-.06
b. L/T once/week (omitted)				
10. Candy				
a. Some	-.60***	.11	-.45***	-.14
b. Never (omitted)				
11. Snacks				
a. Some	1.25***	-.41***	-.92***	-.18
b. Never (omitted)				
Health Status				
12. Cholesterol	.00***	.00	.01***	-.00
13. Systolic	.03***	.01***	.03***	.01***
14. Diabetes (1=yes)	1.59***	.69***	1.45***	.52**
Medical Care				
15. Insurance (1=None)	.61**	.26	.56*	.52
16. Last checkup				
a. Never	.60**	.11	.69***	-.21
b. Last year	.29	.38	-.00	.33
c. Over 1 year (omitted)				
17. Place of Care				
a. M.D. office	-.13	.12	-.67***	-.44
b. Other (omitted)				

*=p<.05; **=p<.01; ***=p<.001

[1]The adjusted model includes all covariates listed as well as age, race and poverty status.

poverty), 3) above poverty (151%-200% above poverty), and 4) well above poverty (201% or more above poverty).

Physical exercise, alcohol consumption, weight status, smoking, and nutrition are the indicators of health behavior utilized. The two item physical exercise index estimates how active respondents are in their usual daily activities and in their recreational pursuits. Alcohol consumption, measured in ounces of ethanol consumed per day is, divided into three categories: 1) non-users, less than .01 on the ethanol scale, b) moderate-users, between .01 and .99, and c) heavy users, a score over 1.0 (23). Moderate-users are compared to other users. The body mass index (BMI), weight in kilograms divided by the square of height in meters, contrasts persons with moderate weight to all others. The top quartile of BMI is defined as overweight, the middle two quartiles as moderate weight, and the bottom quartile as underweight (24). Smoking data was initially collected only for a subset of NHANESI respondents (N=6,913). Smoking status at baseline was imputed from the smoking history obtained at followup for NHANESI respondents with missing data (25). Non-smokers are contrasted with current smokers. Six nutritional variables, (the frequency of consuming fish, cheese, fruits and vegetables, desserts and sweets, candy, and snacks), which showed significant relationships to mortality in initial analyses are utilized. We followed the strategy suggested by Murphy et al. (24) of focusing on those individuals at the extremes of the distribution of

THE DISTRIBUTION OF RISK FACTORS BY POVERTY, NHEFS
MEANS AND PROPORTIONS(P)

Risk Factors	Poverty Status Poor	100-150%	151-200%	201%+
Marital Status				
1. Married	.52+	.69*	.81*+	.85*+
Health Behavior				
2. Exercise	3.81+	3.95*	4.13*+	4.20*+
3. Alcohol				
a. Heavy Drinker (P)	.08	.09	.07	.11*+
b. Moderate Drinker (P)	.35+	.43*	.48*+	.59*+
b. Non-Drinker (P)	.58+	.48*	.45*	.30*+
4. Weight				
a. Average (P)	.43	.45	.53*+	.52*+
5. Smoking				
a. Non-Smoker (P)	.69	.67	.65	.69
Diet Frequency (P)				
6. Fish	.85+	.89*	.93*+	.94*+
a. Some				
7. Cheese				
a. Once/day or more	.08+	.11*	.12*	.16*+
8. Fruits/Vegetables				
a. Once/day or more	.76+	.85*	.89*+	.95*+
9. Desserts/sweets				
a. Once/week or more	.73+	.78*	.85*+	.83*+
10. Candy				
a. Some	.70	.73	.79*+	.79*+
11. Snacks				
a. Some	.65	.66	.71*+	.77*+
Health Status				
12. Cholesterol	219+	224*	218+	220+
13. Systolic	140+	137*	132*+	130*+
14. Diabetes (1=yes)	.06	.06	.03*+	.03*+
Medical Care (P)				
15. Insurance (1=None)	.29+	.16*	.11*+	.06*+
16. Last checkup				
a. Never	.32+	.26*	.17*+	.13*+
b. Last year	.25	.25	.28	.32*+
c. Over 1 year	.43+	.50*	.55*	.56*+
17. Place of Care				
a. M.D. office	.39+	.48*	.53*	.61*+

*=significantly different from below poverty (p<.05)
+=significantly different from 100-150% of poverty (p<.05)

dietary intake patterns.

Age in years at first interview and race (1=black, else=0) are the sociodemographic control variables employed in the analyses. Marital status (married=1, unmarried=0) is the measure of social integration employed. Three measures of initial health status are available for the entire sample: 1) serum cholesterol (mg/100ml); 2) systolic blood pressure; and 3) the respondent's report of a physician's diagnosis of diabetes (1=yes, 0=no). Two additional measures of initial health status, forced expiratory volume in one second (FEV_1) and perceived health, are available in the smaller subsample.

Three indicators of medical care are available for respondents in the 20 percent subsample of NHANESI. Medical insurance is a dichotomous indicator of the presence of some versus no health insurance. Last checkup is a measure of the recency of contact with the health care system for non-emergency care. It has three categories: 1) never had a checkup, 2) had a checkup in the last year, and 3) had a checkup over one year ago. Place of care contrasts receiving care in a private physician's office (M.D.'s office) to the receipt of care elsewhere.

Statistical analysis. Simple descriptive analyses are used to present the distribution of risk factors by poverty. However, this report relies primarily on the multiple logistic regression analyses using maximum likelihood estimation procedures for assessing the magnitude and statistical significance of the relationships among poverty, risk factors and mortality. All analyses are weighted for differential sampling probability and to make analyses generalizable to the population of the United States.

Multiple logistic models for the association between SES and mortality were estimated under five conditions. In the first model, a continuous age variable and a dummy variable for race are included along with poverty. To this base model each class of risk factors is added one at a time while a final model includes the covariates from all previous models. Thus, the second model adds marital status, the third model considers the health behavior variables, the fourth, the measures of initial health status, and the final equation considers the combined effect of all of these variables. When the smaller subsample is utilized, an additional model that includes the medical care variables is added. The primary interest in models 2-4 is in assessing change in the logistic coefficients for poverty between the model under consideration and the first one. Reductions in the size of the coefficients for poverty (or the odds ratios calculated from these), indicates that the variables in that particular model are partly responsible for the observed SES differentials in mortality.

RESULTS

Table 1 shows the logistic regression coefficients for the association between the risk factors and mortality for males and females. Two models are presented. The first shows the unadjusted bivariate relationship between each risk factor and mortality. The second model has all

Table 3

ODDS RATIOS FOR THE ASSOCIATION BETWEEN POVERTY AND MORTALITY NHEFS, MALES[1]

	Age & Race[a]	Adjusted for Marital Status	Health Behavior	Health Status	All Vars.
ALL MALES					
Poverty					
a. Poor	2.32***	2.08***	1.44*	2.24***	1.43*
b. 100-150% above	2.39***	2.27***	1.76***	2.31***	1.74***
c. 151-200% above	1.18	1.18	1.03	1.18	1.04
d. 201% + (omitted)	1.00	1.00	1.00	1.00	1.00
			N=4,133		
MALES 25-44					
Poverty					
a. Poor	6.03***	5.65***	4.55***	5.97***	4.76***
b. 100-150% above	3.28**	3.16**	1.77	3.23**	1.99
c. 151-200% above	1.44	1.43	.68	1.50	.77
d. 201% + (omitted)	1.00	1.00	1.00	1.00	1.00
			N=1,375		
MALES 45-64					
Poverty					
a. Poor	2.18***	1.85**	1.24	2.09***	1.15
b. 100-150% above	3.20***	2.95***	2.29***	3.01***	2.13***
c. 151-200% above	1.04	1.06	.95	1.03	.95
d. 201% + (omitted)	1.00	1.00	1.00	1.00	1.00
			N=1,256		
MALES 65+					
Poverty					
a. Poor	1.78*	1.65*	1.36	1.78*	1.30
b. 100-150% above	1.44	1.42	1.21	1.44	1.20
c. 151-200% above	1.21	1.21	1.05	1.23	1.06
d. 201% + (omitted)	1.00	1.00	1.00	1.00	1.00
			N=1,502		

*=p<.05; **=p<.01; ***=p<.001
[a]Age and race are included in all subsequent models
[1]From logistic regression analysis

of the other risk factors as well as age, race, and poverty status. There are few surprises in Table 1. Marital status is inversely related to mortality, but this association remains significant only for males when adjusted for all the other covariates. Exercise, alcohol consumption, weight status, and cigarette smoking display the expected associations with mortality, but the inverse association between moderate alcohol consumption and mortality does not remain significant for either sex when adjusted for the other risk factors. Most of the significant bivariate associations between dietary frequency and mortality do not survive controls for the other risk factors. However, the consumption of fish remains significantly inversely related to mortality for men; cheese consumption is positively related to mortality for men but inversely related for women; and men who consume snacks have a lower mortality risk than those who never snack between meals. The health status and medical care measures also show the expected patterns of association with mortality. It is worth noting, though, that none of the medical care measures remain significant after adjusting for the other covariates.

Table 2 shows the distribution of the risk factors by poverty status. Economic status is positively related to being married, getting regular exercise, consuming alcohol, maintaining normal weight, eating fish, cheese, fruits and vegetables, desserts, candy and snacks, having health insurance, getting regular checkups, and receiving health care in a physician's office. This positive association between economic well-being and the consumption of desserts, sweets and candy probably accounts in large part for the inverse association noted in Table 1 between these variables and mortality. The general pattern in Table 2, though, is for the risk factors known to be related to adverse changes in health status to be more prevalent in the poor and the near-poor groups.

Table 3 presents odds ratios for the association between poverty and mortality for males. The first panel of Table 3 shows the results for all males, while the subsequent panels present the results for males divided into three subgroups: 25 to 44 years of age, 45 to 64 years of age, and over 65 years of age. The first column of the top panel in Table 3 shows that men who fall beneath the federal poverty threshold and men who are in the near poverty group (100 to 150 percent above poverty), are 2.3 and 2.4 times more likely, respectively, to have died in the followup period compared to men who were at more than twice the federal poverty limit. Importantly, men who are between one and one-half and twice the poverty level do not have a higher mortality risk than those who are well above the poverty level.

Adjustment for each class of risk factors produces some reduction in the association between poverty and

Table 4

ODDS RATIOS FOR THE ASSOCIATION BETWEEN POVERTY AND MORTALITY, NHEFS, NUTRITION AND DETAILED HEALTH EXAMINATION ONLY MALES AND FEMALES[1]

	MALES					
		ADJUSTED FOR				
	Age & Race[a]	Marital Status	Health Behavior	Health Status	Medical Care	All Vars.
Poverty						
a. Poor	1.94*	1.64	1.20	1.77*	1.63	0.95
b. 100-150%	1.23	1.13	0.99	1.23	1.14	0.92
c. 151-200%	1.05	1.05	1.01	0.99	1.04	0.96
d. 201%+ (omitted)	1.00	1.00	1.00	1.00	1.00	1.00
			N = 1660			
	FEMALES					
		ADJUSTED FOR				
	Age & Race[a]	Marital Status	Health Behavior	Health Status	Medical Care	All Vars.
Poverty						
a. Poor	1.69*	1.70*	1.57	1.53	1.45	1.39
b. 100-150%	1.09	1.10	1.07	1.03	0.96	0.94
c. 151-200%	1.29	1.29	1.38	1.25	1.15	1.28
d. 201%+ (omitted)	1.00	1.00	1.00	1.00	1.00	1.00
			N = 1844			

*=p<.05
[a]Age and race are included in all subsequent models
[1]From logistic regression analysis.

mortality with health behavior making the largest contribution. The odds ratios for the poor and near-poor groups are reduced from 2.3 and 2.4 adjusted for age and race to 1.4 and 1.8, respectively, when adjusted for the health behavior variables. It is also worth noting that the variables considered produced larger reductions in the coefficient for the lowest poverty category than for the next highest one. However, even after adjustment for all of the risk factors, the poor and near-poor groups are still 1.4 and 1.7 times more likely to have died in the followup period than the nonpoor.

When the results are considered by age, we note that the strongest association between poverty and mortality is among the 25-44 age group with the association becoming progressively weaker with increasing age. However, the pattern observed for the total population persists in the age groups, with health behavior playing the largest role in reducing the association between poverty and mortality and with significant relationships remaining between poverty and mortality (except in the oldest group where the association is weakest) even after adjustment for all risk factors.

Analyses, similar to those in Table 3, assessed the relationship between poverty and mortality for females. Surprisingly, there is no significant association between poverty and mortality for females in these data. The pattern of odds ratios are similar to those observed for males in that the largest odds ratios are found for women in the 25-44 age group. But even here, none of these associations achieve statistical significance.

We also considered the role of medical care in accounting for the association between poverty and mortality in the Nutrition and Detailed Health Examination component of NHANESI. This subsample of NHANESI respondents is a national probability sample of 3,854 respondents. Table 4 presents the results of these analyses. Models are presented similar to those in Table 3, except that there is an additional model that explicitly considers the role of the medical care utilization variables. Table 4 reveals that the association between poverty and mortality is slightly weaker for males and slightly stronger for females than that reported earlier. For men, marital status, health behavior and medical care reduce the relationship between poverty and mortality to nonsignificance, while for females a similar result is achieved when this association is adjusted for health behavior, health status and medical care. The health behavior variables produce a larger reduction in the odds ratios for poverty than the medical care variables for males but not for females.

In sum, our analyses underscore the continuing significance of economic status as a determinant of mortality. Persons in or near poverty experience higher death rates than the nonpoor. This relationship is stronger for men than for women, largest in the 25-44 age group, and weakest for the over 65 age group. The risk factors considered, marital status, health behavior, health status and medical care all vary by economic status and play a role in accounting for some of the excess mortality within the poverty population.

DISCUSSION

Our analyses document that the risk factors considered are differentially distributed by poverty status. Research is needed that would go beyond the mere demonstration of associations to elucidate the specific intervening mechanisms that link socioeconomic status to these risk factors. For example, we noted that persons in poverty were less likely to be married than the nonpoor. We need to understand the ways in which both the propensity to marry and rates of marital disruption are linked to larger social processes. For example, Bishop (26) indicates that unemployment, declines in income, and high job turnover are all associated with increased rates of marital dissolution; the number of female headed households decline when males' earnings rise and rise when male unemployment increases. In other words, to understand poverty status variations in the rates of marriage we must address the larger social and political forces that affect employment opportunities for males (and females) and the consequences that these have on marital patterns.

It is important to distinguish basic causes from superficial or surface causes (27). Basic causes are those factors that are responsible for generating a particular health outcome. Changes in these forces produce change in the outcome. In contrast, surface causes are related to the outcome but changes in these factors do not produce change in the outcome. It is likely that our system of social stratification is the fundamental cause for the observed poverty differences in health (4). The risk factors considered are the superficial causes, the current intervening mechanisms. However, as long as the basic causes remain operative, the modification of surface causes are likely to give rise to new intervening mechanisms to maintain the same outcome.

It is doubtful that the complete elimination of inequality is politically feasible in our society. Our analyses suggest though, that it may not be necessary to absolutely eliminate inequality to reduce the excess levels of ill health in low SES groups. In these data, persons whose income was at least one and one-half, but not more than twice, the poverty level did not have elevated rates of death. Thus, societal changes that move deprived populations above some minimal threshold of economic well-being, may produce substantial improvements in the health status of low socioeconomic groups, even though some inequality persists. More generally, efforts to improve the health and risk factor profile of the poor must include attempts to improve their socioeconomic conditions and life chances.

REFERENCES

1. Antonovsky A. 1967. "Social Class, Life Expectancy and Overall Mortality." *Milbank Memorial Fund Quarterly* 45:31-73.
2. Stockwell, E.G. 1961. "Socioeconomic Status and Mortality in the United States." *Public Health Reports* 76:1081-1086.
3. Syme, S.L. and L. Berkman. 1976. "Social Class, Susceptibility and Sickness." *American Journal of Epidemiology* 104:1-8.
4. Williams, D.R. 1990. "Socioeconomic Differentials in Health: A Review and Redirection," *Social Psychology Quarterly* 53(2): 81-99.
5. Marmot, M.G., M. Kogevinas and M.A. Elston. 1987. "Social/Economic Status and Disease," *Annual Review of Public Health* 8:111-135.
6. Haan, M.N. and A.G. Kaplan. 1986. "The Contribution of Socioeconomic Position to Minority Health," *Report of the Secretary's Task Force on Black and Minority Health*, 2:69-103 Washington, D.C.: U.S. Department of Health and Human Services.
7. Morris, J.N. 1979. "Social Inequalities Undiminished." *Lancet* 1:87-90.
8. Department of Health and Social Security. 1980. *Inequalities in Health: Report of a Research Working Group* (The Black Report). London: Department of Health and Social Security.
9. House, J.S., R. Kessler, R. Herzog, R. Mero, A. Kinney and M. Breslow. 1990. "Age, Socioeconomic Status, and Health." *Milbank Quarterly* 68:383-411.
10. Berkman, L.F. and L. Breslow. 1983. *Health and Ways of Living*. New York: Oxford University Press.
11. Department of Health, Education and Welfare. 1979. *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention.* Washington, D.C.:DHEW.
12. Williams, D.R. and J.S. House. 1991. "Stress, Social Support, Control and Coping: A Social Epidemiological View." In Ilona Kickbusch and Bernhard Badura (eds.) *An Introduction to Health Promotion Research*. Copenhagen: World Health Organization.
13. House, J.S., R.C. Kessler, A.R. Herzog, A.M. Kinney, R.P. Mero and M.J. Breslow. 1991. "The Social Stratification of Aging and Health," Institute for Social Research, University of Michigan, Ann Arbor, MI.
14. Rose, G. and M.G. Marmot. 1981. "Social Class and Coronary Heart Disease." *British Heart Journal* 45:13-19.
15. Salonen, T.J. 1982. "Socioeconomic Status and Risk of Cancer, Cerebral Stroke, and Death Due to Coronary Heart Disease and Any Disease: A Longitudinal Study in Eastern Finland. *Journal of Epidemiology and Community Health* 36:294-7
16. Haan, M., G. Kaplan and T. Camacho. 1987. "Poverty and Health: Prospective Evidence from the Alameda County Study." *American Journal of Epidemiology* 125:989-998.
17. Jaynes, G.D. and R. Williams. 1989. *A Common Destiny: Blacks and American Society*. Washington, DC, National Academy Press. (date)
18. National Center for Health Statistics. 1977. Plan and Operation of the Health and Nutrition Examination Survey, United States, 1971-1973. *Vital and Health Statistics*, Series 1, No. 10b. DHEW Publications No. (PHS) 79-1310. Washington, DC: U.S. Government Printing Office.
19. National Center for Health Statistics. 1978. Plan and Operation of the NHANESI Augmentation Survey of Adults 25-74 Years, United States, 1974-1975. *Vital and Health Statistics*. Series 1, No. 14, DHEW Publication No. (PHS) 78-1314. Washington, DC: U.S. Government Printing Office.
20. Cornoni-Huntley , J., H.E. Barbano, J.A. Brody, B. Cohen, J.J. Feldman, J.D. Kleinman and J. Madans. 1983. "National Health and Nutrition Examination I--Epidemiologic Followup Survey," *Public Health Reports* 98:245-251.
21. Madans, J.H., J.C. Kleinman, C.S. Cox, H.E. Barbano, J.J. Feldman, B. Cohen, F.F. Finucane and J.Cornoni-Huntley. 1986. "10 Years After NHANESI: Report of Initial Followup, 1982-84," *Public Health Reports* 101:465-473.
22. U.S. Bureau of the Census. 1990. *Statistical Abstract of the United States: 1990*. Washington, DC: U.S. Government Printing Office.
23. Schatzkin, A, D.Y. Jones, T.B. Harris, P.R. Taylor, R.N. Hoover, C.L. Carter, R.G. Ziegler and L.A. Brinton. 1990. "Epidemiologic Investigations of Cancer in NHEFS." Pp. 71-114 in J. Cornoni-Huntley, R. Huntley, and J. Feldman (eds.). *Health Status and Well-Being of the Elderly*. New York, Oxford University Press.
24. Murphy, S.P., D.F. Everett, and C.M. Dresser. 1990. "Dietary Patterns." Pp. 184-209 in J. Cornoni-Huntley, R. Huntley and J. Feldman (eds.). *Health Status and Well-Being of the Elderly*. New York: Oxford University Press.
25. Machlin, S.R., J.C. Kleinman and J.H. Madans. 1989. "Validity of Mortality Analysis Based on Retrospective Smoking Information," *Statistics in Medicine* 8:397-1009.
26. Bishop, J. 1977. *Jobs, Cash Transfers, and Marital Instability: A Review of the Evidence*. Madison: Institute for Research on Poverty, University of Wisconsin.
27. Lieberson, S. 1985. *Making It Count: The Improvement of Social Research and Theory*. Berkeley: University of California Press.

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