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We compared 356 older men and women and found that income, education, and marital status had significantly stronger associations with 6-year change in functioning for men; internal health locus of control was stronger for women. Large but not significant differences occurred for age, perceived health, and days going out per week (stronger for women) plus exercise and smoking (stronger for men). We found no difference for ethnicity, chronic conditions, and social contacts. Gender specific models incorporating factors amenable to change predicted significantly higher follow-up functioning for those with positive health behaviors, supporting the value of preventive interventions.
Key Words: Preventive behaviors, Risk factors, Disability

Gender Differences in Factors Associated With Change in Physical Functioning in Old Age: A 6-Year Longitudinal Study[1]

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Physical functioning underlies an older person's ability to remain independent and is central to arguments about active life expectancy and the compression of morbidity (Fries, 1980; Kaplan, 1991; Katz, Branch, Branson, Papsidero, Beck, & Greer, 1983). Knowledge of the risk factors associated with reduced functioning could lead to interventions that would extend active life expectancy and delay the onset of morbidity.

Women have been often omitted or gender differences ignored in studies that have looked at factors associated with subsequent disability or functional decline in older persons. Such omissions are surprising since women generally live longer than men yet suffer substantially more physical and mental disability and are more likely to be institutionalized (Jette & Branch, 1981; USDHHS, 1986, 1990; US Senate, 1987–1988).

In those few studies where gender comparisons have been made, results have been mixed and specific significance tests for observed gender differences have not been employed. Branch (1985) reported that baseline smoking was associated with subsequent onset of disability for older men followed for 5 years, while reduced physical activity at baseline was predictive for women. Mor et al. (1989) examined risk factors for a decline in function over 2 years and reported that prevalent diabetes predicted declines for both men and women, while lack of regular exercise and no longer working predicted declines only for men; never walking a mile, no college education, prevalent arthritis, and recent falls were predictive for women. Pinsky, Leaverton, and Stokes (1987) examined factors associated with 21-year maintenance of "good function," and found that while higher education predicted for both men and women, lower alcohol intake, not smoking, and slower heart rate predicted only for men. These three studies did employ significance tests for the relationships between the independent and dependent variables for both men and women but did not test to see if the observed gender differences were statistically significant from one another.

Our study builds on a previous analysis in which a number of factors were found to be related to physical functioning in a combined group of men and women aged 65 years and older (Kaplan, Strawbridge, Camacho, & Cohen, 1993). For the current analysis, we examine the sex-specific predictors of change in physical functioning and employ interaction tests to see if the observed gender differences are statistically significant from each other. We then take those factors that are: (1) amenable to change, and (2) found to be individually associated with improved functioning, and we then combine them in additive positive health behavior scales for each gender. These scales are then used to compare follow-up functioning of those scoring high at baseline with those scoring low. While factors like marital status are rarely changed for health reasons, others (such as smoking and lack of exercise) are amenable to change and worth the effort if they result in improved functioning. Such estimates of

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improved functioning associated with changeable behavior should be helpful for clinicians and health educators who counsel older persons on positive health behaviors.

Methods

Sample

The sample was drawn from the Alameda County Study. Respondents were part of the original cohort of 6,928 persons selected to represent the adult noninstitutionalized population of Alameda County in 1965. Surviving members were reinterviewed in 1974 and a representative 50% subsample was interviewed for a third time in 1983. Detailed design and sampling procedures for the 1965 to 1983 surveys have been reported elsewhere (Berkman & Breslow, 1983). Response rates exceeded 90%, and thorough tracing procedures were employed. Study members were followed regardless of geographic location, age, or illness.

All cohort members who were aged 65 years or older in 1984 and who had been interviewed in 1983 were designated for this study. Of the 580 so designated, 30 died before the field work could be completed, 12 could not be located, and another 30 declined to be interviewed. Completed interviews were obtained with 508. At follow-up in 1990 there were 381 members of the 1984 cohort for whom there was no confirmation of death. Of these, all but 5 were located, and interviews were completed with 356 (20 declined to be interviewed). The total proportion of the original 508 who could not be located or who declined to be interviewed was 5%. Among the 356 survivors were 147 men (41%) and 209 women (59%). There were 62 blacks among the 508 baseline respondents (12%) and 42 among the surviving 356 (12%). Numbers for other ethnic groups were very small.

"Baseline" refers to information collected in 1983 or 1984. The mortality analyses presented here include all 508 persons interviewed in 1984; functional change analysis is based upon the 356 survivors interviewed in both 1984 and 1990. Nursing home residents (15 of the 356 in 1990) are included. Proxy respondents (nearly always spouses or adult children) numbered 35 in 1984 and 38 in 1990.

Independent Variables

In a previous study using the same sample with men and women combined (Kaplan et al., 1993) we found that the following baseline variables were significantly associated with subsequent 6-year change in physical functioning: age, income, perceived health, number of chronic conditions, prevalent stroke, prevalent heart attack, amount of physical exercise, number of days per week going out to do things, extent of social contacts, marital status, and internal health locus of control. Relatively strong (but not statistically significant) associations were found for ethnicity, smoking, and weight. Throughout the analyses we controlled for age and baseline physical functioning. For this study we used the same variables (except for prevalent stroke and heart attack where the number of occurrences were too small for the women for meaningful comparisons) but compared their associations with 6-year change in physical functioning for men and women separately.

For demographic variables we adjusted income for family size and measured education as number of years of school completed. The small number of Asians and Hispanics in the sample were combined with whites for black/non-black comparisons.

For health behaviors smoking was categorized as not current (previous or never) vs current smoker. Exercise was measured with a scale containing 5 items: exercises long enough to work up a sweat; takes part in any sports exercise; walks for exercise; does calisthenics or stretches; and does any other vigorous exercise. Scoring for each item is from 0 (no or never) to 4 (yes or often) with intermediate values based upon frequency. Responses to the 5 items were summed. The resulting scale had a range of 0–20, a mean of 8.0, and an internal consistency of .77 (standardized Cronbach's alpha). "Going out" measured how many days in an average week respondents went out to do things they enjoyed doing, like visiting friends, social events, movies, church activities, or sports. Scoring is from 1 (never) to 6 (every day).

Social variables included marital status and social contacts. We measured social contacts with the Social Network Index, which has been extensively described elsewhere (Berkman & Syme, 1979). For this analysis the index was categorized at the lowest score vs all higher scores. Someone receiving this lowest score has no group memberships or regular social contacts with friends or relatives.

Psychological variables included perceived health and internal health locus of control. We categorized perceived health as excellent vs good, fair, or poor. Internal health locus of control was based upon adding strength of agreement scores on two questions from the Multidimensional Health Locus of Control scale (Wallston, Wallston, & DeVellis, 1978): "When I feel ill, I know it is because I have not been taking care of myself properly" and "I am directly responsible for my health." The resulting score ranged from 2 to 8.

A prevalent chronic conditions scale was created by counting the number of conditions the respondent reported having experienced within 12 months of the 1983 or 1984 interview. The separate items were arthritis, stroke, heart disease, chronic obstructive pulmonary disease, cancer, diabetes, high blood pressure, or asthma.

Dependent Variable: Function Scale

To measure change in function over time we developed an 18-item, self-report scale. The specific items include 7 activities of daily living (bathing; eating; dressing; using the toilet; walking; transferring from bed to chair; and grooming), 3 instrumental activities of daily living (cooking; shopping; and housework),

2 mobility measures (walking 1/2 mile and climbing a flight of stairs), 5 Nagi physical performance items (push/pull a large object; crouching/kneeling; lifting a 10-pound weight; lifting arms over the head; and picking up small objects), and 1 item asking how much of a problem it was getting to places where the person wanted to go (Katz, Downs, Cash, & Grotz, 1970; Lawton & Brody, 1969; Nagi, 1976; Rosow & Breslau, 1966). Scales combining similar items have been used in longitudinal analyses of the Framingham Study (Pinsky, Leaverton, & Stokes, 1987), and in the East-West Study in Finland (Lammi, Kivela, Nissinen, Punsar, Puska, & Karvonen, 1989).

The ADL and physical performance measures making up the function scale were scored from 0 (cannot do or need help to do) to 4 (have no difficulty doing). Intermediate scores of 1–3 were based upon level of difficulty in doing the activity (a lot, some, a little). The 3 IADL items were scored 0 (could not do any without help), 2 (able to do some but not all), or 4 (could do all without help). The item eliciting how much a problem it was getting where one wanted to go was scored 0 (do not go out or a big problem doing so), 2 (a little problem), or 4 (no problem). The two mobility items were scored either 0 (need help to do) or 4 (able to do without help). The 18 items were summed; the resulting scale had a maximum possible value of 72 and a minimum of 0. Higher scores indicate better functioning. For 1990 the function scale had a mean of 62.3, with a standard deviation of 14.9 and a range of 0–72. The function scale obtained an excellent internal consistency of .94 (standardized Cronbach's alpha).

Analysis

In order to test the sensitivity of our function scale for mortality and to test for gender differences in this association, we first examined the relationships between baseline functioning and subsequent mortality separately for men and women using Cox proportional hazards models (Cox, 1972; SAS Institute, 1982) which examine time from baseline to year of death. To test the relative impacts of the function scale and age on subsequent mortality we included a mortality comparison for a 10-point lower difference in baseline function score compared with an 8-year older age. Then we looked at the relationships between these factors and 1990 functioning for men and women testing for gender differences by adding gender-by-factor interaction terms to the models.

Finally, for each gender we took the 3 strongest variables that were both significantly associated with physical functioning and amenable to change and tested their combined effects on functioning by entering them simultaneously in multiple regression equations with the function scale as the dependent variable. Two of the selected variables (not smoking and social contacts) had demonstrated similar associations with subsequent functioning for both men and women so they were used in both scales. Because exercise appeared to be more strongly associated with change in physical functioning for men and going out appeared to be more strongly associated with change in physical functioning for women, we used exercise in the initial model for men and going out in the initial model for women. Control variables included age, baseline function score, and number of prevalent chronic conditions.

When the two regression analyses were made, the regression coefficients for the 3 positive health behaviors in each set of equations were similar to one another, indicating that each positive behavior was associated with roughly the same change (about 3 points) in the function scale when all 3 were entered simultaneously. Given that the associations of these variables with the function scale were comparable, we then combined them into two health behavior scales to estimate the effect of positive vs negative health behavior scores on change in function over the 6-year period for men and women. With such scales it is possible to estimate the effect on subsequent functioning of doing positive activities (such as exercising and not smoking) compared with not doing the activities.

In order to make the findings more useful for clinicians, we used dichotomous forms of the measures for exercise and going out in the health behavior scales. Exercise was measured by whether respondents exercised enough to work up a sweat; for going out we used 3 days a week or more. Social contacts and not smoking were already dichotomous variables. The resulting scales have a range of 0 to 3 for both genders; values indicate the number of positive behaviors for each person.

Throughout the analysis we used a method recommended by Lee (1980) to perform regressions with a change score: the 1990 function scale score was entered as the dependent variable, while the 1984 score was entered as an independent variable along with the factor and control variables being examined. This procedure yields the same result as using the difference between the 1990 and 1984 function scores as the dependent variable and entering the 1984 score as a control variable along with the other variables. Given the low power of multiple regression interaction tests in general and the relatively small sample size for the follow-up analysis, we employed a .10 significance level to test for gender differences; however, to aid readers in evaluating our conclusions for the interaction tests, exact p values are reported.

Results

Mortality

Figure 1 presents the proportional hazards mortality analysis comparing the effect of a 10-point lower baseline function score on subsequent 6-year mortality for all 508 men and women controlling for age. For comparison purposes, the effect of an 8-year age difference at baseline on subsequent mortality controlling for baseline function is included. A 10-point difference at baseline was associated with a relative mortality risk of 1.75 for men compared to 1.44 for

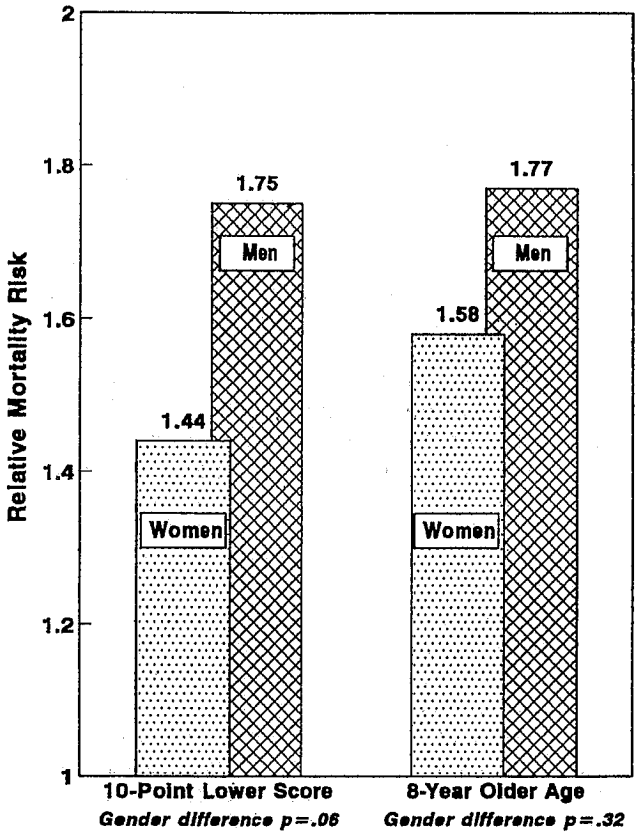

Figure 1. Relative mortality risk associated with a 10-point lower baseline function score compared with an 8-year older baseline age (n = 508).

women. Both of these relative risks were highly statistically significant ($p < .0001$). The gender difference was also statistically significant at $p = .06$. An 8-year older age at baseline was associated with a relative mortality risk of 1.77 for men and 1.58 for women. Again, these relative risks were highly statistically significant ($p < .001$) but the gender difference was not ($p = .32$).

Change in Function

Table 1 compares surviving men and women on baseline variables. Women were 1.4 years older, more likely to score in the lowest income and education categories, scored lower on the exercise scale, and had a higher smoking prevalence than the men. A smaller proportion of men were separated or divorced. Men had somewhat higher function scale scores both at baseline and follow-up than did the women. Over the 6 years the mean score of the women dropped 6.1 points while the mean score of the men dropped 4.9 points. Additional analysis (not shown) revealed that this difference in change during follow-up was due largely to the greater age of the women and their lower baseline function scores, both of which were associated with greater 6-year reductions in functioning.

The relative impacts of the baseline factors on change in function during follow-up for men and women are shown in Table 2. Regression coefficients for each factor are presented by gender. A gender

Table 1. Baseline Risk Factor Differences Between Surviving Men and Women and Function Scale Scores at Baseline and Follow-up (N = 356)

Variable	Scoring (range)	Men (n = 147)	Women (n = 209)
	Demographic		
Age	Mean in years	71.1	72.5
Ethnicity	Percent black	9.7	13.4
Family income	Percent in lowest category	13.6	21.2
Education	Percent with 8 years or less	15.8	20.7
	Baseline Health		
Chronic conditions	Mean score on 8-item scale	1.2	1.5
	Behavioral		
Exercise	Mean score on 5-item scale	9.4	8.1
Going out	Mean on a 6-category question	3.9	3.9
Smoking	Percent current smoking	12.9	17.8
	Social		
Social contacts	Percent in lowest category on Social Network Index	7.5	8.1
Marital status	Percent separated or divorced	2.7	9.1
	Psychological		
Internal health locus of control	Mean score on 2-item scale	5.1	5.0
Perceived health	Percent fair or poor	17.7	26.3
	Function Scale Score		
Baseline score in 1984	Mean score on 18-item scale	69.8	66.6
Follow-up score in 1990	Mean score on 18-item scale	64.9	60.5

Table 2. Men and Women Compared on Baseline Characteristics Associated with 6-Year Change in Physical Function ($N = 356$)

Variable	Scoring	Regression Coefficients			Gender Difference Test *P*-value
		All	Men	Women	
	Demographic				
Age	Years (65–95)	−0.58***	−0.34*	−0.69***	.15
Ethnicity	Black/non-black	−2.06	−2.52	−1.79	.86
Family income	Lowest category/higher	−4.45***	−9.26***	−1.95	.04
Education	8 years or less/higher	−0.86	−4.73*	+1.36	.07
	Baseline Health				
Chronic conditions	One or more/none	−3.39**	−2.80	−3.84*	.75
	Behavioral				
Exercise	5-item scale (0–20)	+0.27***	+0.40**	+0.18	.31
Going out	Days per week (1–6)	+1.38***	+0.89	+1.71***	.38
Not smoking	Not current/current	+3.27*	+5.10*	+2.27	.43
	Social				
Social contacts	>Lowest score on Social Network Index/lowest	+5.48**	+5.57	+5.42*	.98
Marital status	Separated or divorced/other	−5.02**	−13.97**	−3.06	.10
	Psychological				
Internal health locus of control	2-item scale (2–8)	+0.76**	−0.21	+1.45***	.03
Perceived health	Excellent/good, fair, poor	+3.32**	+1.60	+4.67**	.29

Note: Regression coefficients (unstandardized) represent mean change in the 1990 function scale score for each one-point change in the predictor variable holding 1984 function and age constant. Gender difference tests are made by adding gender by risk factor interaction terms to each model.

*$p < .10$; **$p < .05$; ***$p < .01$.

difference significance test based upon a gender by factor interaction term is included.

Four factors achieved a gender difference p value of .10 or less. Family income, education, and marital status had stronger associations with functioning for men than for women, while internal health locus of control had a stronger association with functioning for women. Age, perceived health, exercise, going out, and smoking showed relatively large differences between men and women, although these differences were not statistically significant. There was no appreciable difference between men and women in the associations of ethnicity, number of chronic conditions, and social contacts with change in functioning.

Collective Impact of Health Behaviors Amenable to Change on Functioning

Figure 2 presents the results of the associations between the health behavior scales and functioning and indicates differences in 1990 function for men and women who were positive on one or more of the health behaviors amenable to change compared with those who were negative on all of them.

For men, each positive health behavior was associated with a 3.3 point advantage in the 1990 function scale score holding age, baseline functioning, and number of chronic conditions constant. Two positive behaviors (such as exercising and not smoking) increased the follow-up score by 6.6 points. A man who did not smoke, exercised, and had regular social

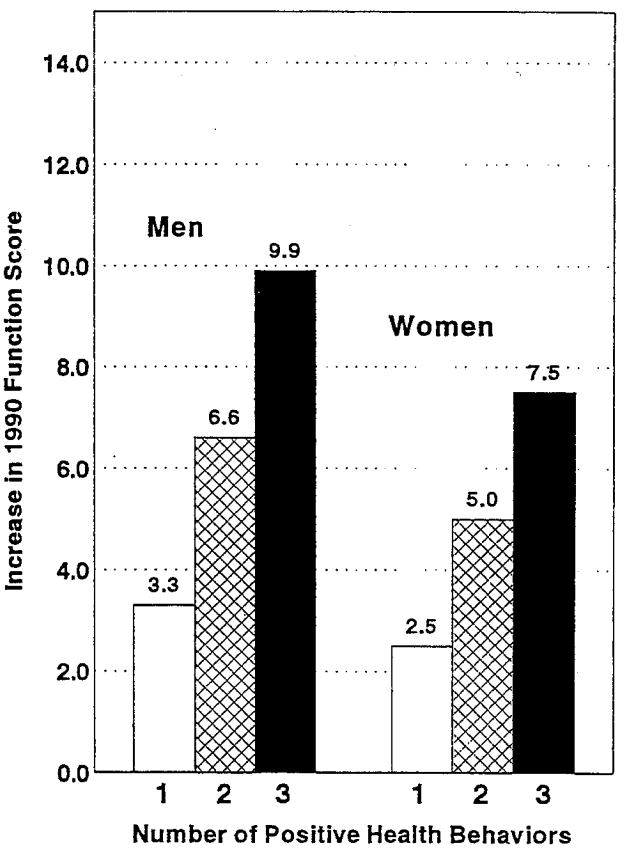

Figure 2. Increase in 1990 function score by number of positive health behaviors for men and women ($n = 356$).

contacts had an estimated 1990 function score 9.9 points higher than a man who smoked, did not exercise, and had no regular social contacts. The association of the health behavior scale with functioning for men was significant ($p = .03$). The multiple regression model with the scale and the control variables explained 17% (adjusted R^2) of the variance in 1990 functioning for the men.

For women, each of the 4 positive health behaviors was associated with a 2.5 point advantage in the 1990 function scale score holding age, baseline functioning, and number of chronic conditions constant. Two positive behaviors increased the score by 5.0 points. A woman who went out 3 days a week or more, did not smoke, and had regular social contacts had an estimated 1990 function score 7.5 points higher than a woman who did none of the 3 positive health behaviors. The association of health behaviors with functioning for women was also significant at $p = .03$. The multiple regression model with the scale and the control variables explained a large 48% (adjusted R^2) of the variance in 1990 functioning for the women.

Discussion

Given the importance of functioning for maintaining independence in old age, it is worth examining factors affecting function that are amenable to intervention. The possibly stronger relationship between exercise and functioning for men coupled with the relatively stronger association of days going out per week on functioning for women suggests either that different questions may be needed to capture physical activity for each gender or that older men and women have different physical activities. A similar gender difference regarding exercise has been noted in risk factors affecting mortality: Rakowski and Mor (1992) reported that the number of days per week women walked a mile or more was more strongly related to subsequent mortality than was the practice of a regular exercise routine; for men regular exercise was a stronger predictor of mortality. In our study we controlled for baseline functioning and prevalent chronic conditions, so exercise and going out are not simply surrogates for baseline health. Our analysis suggests that older men and women approach physical activity in different ways; men do more structured activities like formal exercise, while physically active women are involved with family, peer, or community activities not tapped by questions about exercise. Older men might do better if encouraged to exercise; older women if encouraged to keep physically active by going out on a regular basis and doing things they enjoy.

The very large difference in the association of internal health locus of control with functioning for women compared with the association for men is difficult to explain. A similar (though not statistically significant) difference was noted for perceived health. In the latter case there is evidence from other studies that perceived health is a stronger predictor of health outcomes for women of all ages than for men (Kaplan & Camacho, 1983). Women may understand their own symptoms better than do men or be able to articulate them more easily. Feeling responsible for one's own health, however, is different from perceiving what it actually is. Perhaps such responsibility translates into better health behavior. This variable merits further study.

While changeable only in the long run, differences in demographic factors may still help us understand differences in functioning in old age. The stronger association between income and education and functioning for men may reflect the closer relationship of these first 2 variables with occupational history for men and hence broader lifetime activities. Given the much higher proportion of women who are widowed, divorced, or separated, present income also may be less representative of earlier conditions than is true for men. The marital status difference is likely related to the fact that most older men who are divorced or separated remarry (Botwinick, 1984); those who do not may be much sicker to start with than are those who do. Divorced or separated older women face a shrinking pool of eligible men, so the health differences between those women who do remarry and those who do not may be less than for the men.

While not statistically significant, the stronger association of smoking with subsequent functioning for men than for women is consistent with Branch's analysis of gender differences in factors affecting incident disability (1985) and the Pinsky, Leaverton, and Stokes study of factors predicting "good function" for men vs women (1987). Part of the reason may be that men who smoke have a more extensive smoking history than women. The stronger association of age with functioning for women was also not significant but may reflect the greater longevity of older women following onset of disability compared with men (Strawbridge, Kaplan, Camacho, & Cohen, 1992).

Three factors had the same association with functioning for men as for women. Social contacts have been shown to predict mortality and institutionalization (Berkman & Syme, 1979; Seeman, Kaplan, Knudsen, & Guralnik, 1987; Steinbach, 1992). We have shown here that they are also related to maintenance of functioning in old age and appear to impact men and women equally. While number of chronic conditions showed no gender difference, our scale was a count of conditions and would not rule out the possibility that individual conditions or measures which reflect severity of illness could affect men and women differently. For ethnicity the association with functioning for the entire sample with men and women combined was not statistically significant to begin with, and gender comparisons are hampered by the relatively small number of blacks in the sample.

The large differences in subsequent functioning we observed for men and women scoring high on our health behaviors scale vs those scoring low may have important implications for maintaining functioning in old age. Differences of 5 to 7 points (representing a difference of 2 positive health behaviors)

are equal to the mean drop in functioning over the 6-year follow-up for the entire sample.

The 3 behaviors for men of smoking, not exercising enough to work up a sweat, and having no regular social contacts with other persons are matters that can be discussed by clinicians with patients and addressed in community health education programs.

The 3 behaviors for women are also relatively straightforward. Smoking and having no regular social contacts are the same behaviors as for the men and could be addressed in similar ways. The third (going out less than 3 days a week) has already been discussed and most likely reflects the importance of more general physical activity as opposed to formal exercise. "Use it or lose it" appears to be good advice for both older men and women even though the specific mechanisms involved may be different. One may choose to run around a track while another may choose to chase after grandchildren. Either way, our data imply that better physical functioning in old age will result.

In conclusion, our gender-specific models demonstrated relatively large differences in subsequent functioning for those scoring high on positive health behaviors amenable to change compared with those scoring low. Our analyses also indicated similarities and differences between older men and women in factors related to 6-year change in physical function. Such similarities and differences coupled with the impact of positive health behaviors provide insights for clinicians and health educators that may be useful in helping older persons maintain physical functioning by changing high risk behaviors.

References

Berkman, L. F., & Syme, S. L. (1979). Social networks, host resistance, and mortality: A nine-year follow-up study of Alameda County residents. *American Journal of Epidemiology, 109,* 186–204.

Berkman, L. F., & Breslow, L. (1983). *Health and ways of living: The Alameda County study.* New York: Oxford University Press.

Botwinick, J. (1984). *Aging and behavior. A comprehensive integration of research findings.* New York: Springer Publishing.

Branch, L. G. (1985). Health practices and incident disability among the elderly. *American Journal of Public Health, 75,* 1436–1439.

Cox, D. R. (1972). Regression models and life tables (with discussion). *Journal of the Royal Statistical Society B, 34,* 187–220.

Fries, J. F. (1980). Aging, natural death, and the compression of morbidity. *New England Journal of Medicine, 303,* 130–135.

Jette, A. M., & Branch, L. G. (1981). The Framingham disability study: II. Physical disability among the aging. *American Journal of Public Health, 71,* 1211–1216.

Kaplan, G. A. (1991). Epidemiologic observations on the compression of morbidity: Evidence from the Alameda County study. *Journal of Aging and Health, 3,* 155–171.

Kaplan, G. A., & Camacho, T. (1983). Perceived health and mortality: Nine-year follow-up of the Human Population Laboratory cohort. *American Journal of Epidemiology, 117,* 292–304.

Kaplan, G. A., Strawbridge, W. J., Camacho, T., & Cohen, R. D. (1993). Factors associated with change in physical functioning in the elderly: A six-year prospective study. *Journal of Aging and Health, 5,* 140–153.

Katz, S., Branch, L. G., Branson, M. H., Papsidero, J. A., Beck, J. C., & Greer, D. S. (1983). Active life expectancy. *New England Journal of Medicine, 309,* 1218–1224.

Katz, S., Downs, T. D., Cash, H. R., & Grotz, R. C. (1970). Progress in the development of an index of ADL. *The Gerontologist, 10,* 20–30.

Lammi, U. K., Kivela, S. L., Nissinen, A., Punsar, S., Puska, P., & Karvonen, M. (1989). Predictors of physical disability in elderly Finnish men — A longitudinal study. *Journal of Clinical Epidemiology, 42,* 1215–1225.

Lawton, M. P., & Brody, E. M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *The Gerontologist, 9,* 179–186.

Lee, J. (1980). Correcting for base-line differences in repeated measurement data. *Journal of Clinical Nutrition, 33,* 2399–2400.

Mor, V., Murphy, J., Masterson-Allen, S., Willey, C., Razmpour, A., Jackson, M. E., Greer, D., & Katz, S. (1989). Risk of functional decline among well elders. *Journal of Clinical Epidemiology, 42,* 895–904.

Nagi, S. Z. (1976). An epidemiology of disability among adults in the United States. *Milbank Memorial Fund Quarterly, 54,* 439–468.

Pinsky, J. L., Leaverton, P. E., & Stokes III, J. (1987). Predictors of good function: The Framingham study. *Journal of Chronic Diseases, 40,* 159S–167S.

Rakowski, W., & Mor, V. (1992). The association of physical activity with mortality among older adults in the Longitudinal Study of Aging (1984–1988). *Journal of Gerontology: Medical Sciences, 47,* M122–M129.

Rosow, I., & Breslau, N. (1966). A Guttman health scale for the aged. *Journal of Gerontology, 21,* 556–559.

SAS Institute. (1982). *SAS supplemental user's guide: The PHLGM procedure.* Cary, NC: SAS Institute.

Seeman, T. E., Kaplan, G. A., Knudsen, L., Cohen, R., & Guralnik, J. (1987). Social network ties and mortality among the elderly in the Alameda County study. *American Journal of Epidemiology, 126,* 714–723.

Steinbach, U. (1992). Social networks, institutionalization, and mortality among elderly people in the United States. *Journal of Gerontology: Social Sciences, 47,* S183–S190.

Strawbridge, W. J., Kaplan, G. A., Camacho, T. C., & Cohen, R. D. (1992). Dynamics of disability and functional change in an elderly cohort: Results from the Alameda County study. *Journal of the American Geriatrics Society, 40,* 799–806.

U.S. Department of Health and Human Services, National Institutes of Health. (1986). *Established populations for epidemiologic studies of the elderly: Resource data book.* NIH publication no. 86-2443. Bethesda, MD: National Institute on Aging.

U.S. Department of Health and Human Services, National Institutes of Health. (1990). *Established populations for epidemiologic studies of the elderly, volume II: Resource data book.* NIH publication no. 90-2495. Bethesda, MD: National Institute on Aging.

U.S. Senate Special Committee on Aging. (1987–1988). *Aging America: Trends and projections.* Washington, DC: Department of Health and Human Services.

Wallston, K. A., Wallston, B. S., & DeVellis, R. (1978). Development of the multidimensional health locus of control (MHLC) scales. *Health Education Monographs, 6,* 160–170.