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Self-Rated Health: Changes, Trajectories, and Their Antecedents Among African Americans

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Abstract

Objective—Little is known about changes in self-rated health (SRH) among African Americans.

Method—We examined SRH changes and trajectories among 998 African Americans 49 to 65 years old who we reinterviewed annually for 4 years, using multinomial logistic regression and mixed effect models.

Results—Fifty-five percent had the same SRH at baseline and 4 years later, 25% improved, and 20% declined. Over time, men were more likely to report lower SRH levels, individuals with hypertension were less likely to report lower SRH levels, and those with congestive heart failure at baseline were more likely to report higher SRH levels. Lower SRH trajectory intercepts were observed for those with lower socioeconomic status, poorer health habits, disease history, and worse functional status. Those with better cognitive status had higher SRH trajectory intercepts.

Discussion—The decline in SRH levels among 49- to 65-year-old African Americans is comparable to that of Whites.

Keywords

self-rated health; African Americans; longitudinal modeling

Self-rated health (SRH) has been an important concept in gerontology and geriatrics for at least five decades (Maddox, 1962; Maddox & Douglass, 1973). Indeed, even a simple PubMed

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search for *self-rated health* yields more than 2,000 articles. Most of the interest in and literature on SRH has stemmed from its profound ability to predict subsequent adverse health outcomes, especially mortality (Ferraro & Kelley-Moore, 2001; Idler & Benyamini, 1997; Idler & Kasl, 1995; Idler, Russell, & Davis, 1992; Mossey & Shapiro, 1982). Simply put, it is well established that no matter what other potential confounders are taken into consideration, poor SRH always increases the risk of dying. Considerable work in the past decade has focused on evaluating the possible explanations for the relationship between SRH and adverse health outcomes suggested by Idler and Benyamini's (1997) seminal work (Wolinsky & Tierney, 1998).

Much less work, however, has been devoted to understanding the antecedents of SRH itself or especially to understanding SRH changes or trajectories over time. Among the few longitudinal studies that have been conducted, Benyamini and colleagues (Benyamini, Idler, Leventhal, & Leventhal, 2000) report that for older adults in a retirement community, measures of positive health, such as good energy levels, positive mood, available social support, and active functioning, affect SRH over time just as much as negative factors, such as disease history, disability, and negative mood. In contrast, most others, such as Leinonen and colleagues (Leinonen, Heikkinen, & Jylha, 2001, 2002), focus principally on negative factors, finding that among older adults, SRH declines are associated with decreased physical activity and cognitive performance, although stability in SRH over 5 to 10 years was the most common pattern.

To our knowledge, however, no studies of SRH trajectories and their antecedents have been published that focus on African Americans. This is surprising for two reasons. The first is the increased focus on health disparities reflected in the Institute of Medicine's (IOM; 2002) recent report. The second is evidence that African Americans report higher scores on the vitality and mental health scales of the SF-36 (the most widely used measure of health-related quality of life in the world; Brazier, Harper, & Jones, 1992; Ware, 1996; Ware, Kosinski, & Dewey, 2002) than their White counterparts, despite the greater physical illness burdens of African Americans as reflected on the six other SF-36 scales (Wolinsky, Miller, Andresen, Malmstrom, & Miller, 2004). Accordingly, in this article, we use multinomial logistic regression and mixed-effect models to examine SRH changes and trajectories across a 4-year period as well as the associations of those changes and trajectories with baseline factors. Data are from a large, population-based probability sample of older African Americans who were evaluated at five time points during the 4-year follow-up period. The set of baseline factors considered includes sociodemographic characteristics, socioeconomic status, health habits, disease history, and functional status.

Method

Sample

In this analysis, we use data from the African American Health project (AAH), whose sampling design has been described elsewhere (Wolinsky et al., 2004; Wolinsky, Miller, Andresen, Malmstrom, & Miller, 2005; Wolinsky, Miller, Malmstrom, et al, 2007). Simply put, the AAH includes 998 African Americans born in 1936 through 1950 (and thus were 49 to 65 years old at their baseline interviews) who lived either in a poor, inner-city area or near the northwest suburbs of St. Louis, Missouri. We recruited equal numbers of subjects from both geographic areas, but because of the smaller population in the inner-city area, it was oversampled. All analyses reported here, therefore, use probability-weighted data and are fully representative of both sampling areas.

Aside from age, there were three eligibility criteria: self-reported Black or African American race, Mini-Mental Status Examination (MMSE; Molloy, Alemayehu, & Roberts, 1991) scores ≥ 16 (only 15 participants scored < 20), and the ability and willingness to sign informed consent to participate in this institutional review board–approved study. In-home baseline (September

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2000 through July 2001) evaluations took 2.5 hours on average to complete, with a 76% response rate. We used telephone follow-ups at 12, 24, and 48 months, which averaged about 15 minutes in length. At 36 months after baseline, we again used in-home evaluations that averaged about 1 hour and 40 minutes to complete. Across four years, attrition was minimal, with 61 deaths (i.e., a 1.5% annual mortality rate), and 929, 893, 862, and 830 (weighted *N*s) of the 998 original subjects were successfully reinterviewed at 12, 24, 36, and 48 months after baseline, respectively, resulting in an 89% 4-year reinterview rate among survivors.

The SRH Measure

SRH was measured at each wave using the traditional question, How would you rate your health—would you say it is excellent, very good, good, fair, or poor? Although it is common practice to code these responses simply as 5-to-1 integers, respectively, that does not adequately represent the noninterval nature of the response set. In the SF-36 (Ware, 1996; Ware, Kosinski, & Dewey, 2000), the SRH question is recoded to be 5 for *excellent*, 4.4 for *very good*, 3.4 for *good*, 2 for *fair*, and 1 for *poor*. Although this is a substantial improvement over the 5-to-1 integer approach, we prefer the method of Diehr and colleagues (Diehr et al., 2001), which used longitudinal data from large studies of older adults to transform SRH to the probability of being healthy in the future, conditional on the current observed value. Their transformation resulted in a value of 95 for SRH of *excellent*, 90 for *very good*, 80 for *good*, 30 for *fair*, and 15 for *poor*, which is remarkably similar to the SF-36 approach when multiplied by a factor of 20. These transformed measures can also be thought of as a general measure of health, where 0 is *death* and 100 is *perfect health* (Diehr et al., 2001). Note that in this analysis, however, we censor the SRH of AAH participants at their deaths rather than assign the 0 code suggested by Diehr and colleagues. Our preference for the Diehr transformation notwithstanding, as an added safeguard, we conducted sensitivity analyses in which we replicated our analytic models using the traditional 5-to-1 integers as well.

Baseline Antecedents

We selected potential antecedents of SRH trajectories from five categories of variables that have been considered in prior studies (Benyamini et al., 2000; Leinonen et al., 2001, 2002; Wolinsky & Tierney, 1998): sociode-mographic characteristics, socioeconomic status, health behavior, disease history, and functional status. Sociodemographic characteristics included age, sex, marital status, and social support. Socioeconomic status indicators included education, income, sampling strata, and self-rated neighborhood quality. Health behavior included smoking status and the body mass index (BMI). Disease history included self-reported history of angina, arthritis, asthma, cancer, congestive heart failure, chronic obstructive pulmonary disease, diabetes, hypertension, kidney disease, and stroke. Functional status measures included depressive symptoms (Kohout, Berkman, & Evans, 1993), cognitive status (the MMSE; Molloy et al., 1991), fear of falling (Andresen et al., 2006), lower extremity disability (e.g., walking, stooping, sitting; Wolinsky et al., 2007), self-rated hearing and vision, and the Short Physical Performance Battery (SPPB; Guralnik et al., 1994) summary score (based on standard scoring methods calibrated to this population for gait speed, chair stands, and hierarchical balance tests; 0 = *worst*, 12= *best*).

Analytic Methods

To begin our examination of changes in SRH, we first cross-classified SRH levels (i.e., the 5-to-1 integers) at baseline with those obtained 4 years later. From those results, we then used multivariable, multinomial logistic regression to compare and contrast those participants whose SRH either improved or declined by one or more levels with those participants whose SRH levels had not changed. Because the majority of participants had stable SRH levels, we used forward, backward, and stepwise modeling procedures to avoid overfitting (Concato, Feinstein,

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& Holford, 1993; Harrell, Lee, & Mark, 1996; Hosmer & Lemeshow, 1989). We then focused more granularly on SRH trajectories by using mixed-effect models, using both the Diehr-transformed and 5-to-1 integer coding schemes at each wave of data collection. The mixed-effect analyses followed standard guidelines for model development and evaluation (Diggle, Liang, & Zeger, 1994; Singer & Willett, 2003), beginning with estimation of the most comprehensive model hypothesized to explain the mean response using restricted maximum likelihood estimation. That model was then reestimated using a number of covariance constraints to identify the proper structure. After selecting the appropriate structural constraint, all factors associated with the SRH trajectory at the $p \leq .05$ level were retained, along with wave, sex, and the intercept. Each interaction term involving a fixed effect and aging (wave) was serially evaluated for inclusion in the model, and those associated with the SRH trajectory at the $p \leq .10$ level were retained. Because not all participants were included at each wave of data collection, sensitivity analyses were conducted to evaluate the potential for attrition bias. In those analyses, the final mixed-effects model was reestimated only among the subset of 780 subjects (weighted $N = 779$) for whom complete data were obtained at each wave of interviews.

Results

Sample Characteristics

Table 1 contains the means or percentages for the variables considered as potential antecedents of SRH changes or trajectories. These data underscore the disadvantaged status of the AAH sample. Mean age was 56.8, 58% were women, 13% were widowed, and 28% had annual incomes less than $20,000. Poor health habits were prevalent, with 30% being current smokers, 37% having quit smoking, and a mean BMI of 29.8. Morbidity was extensive, with 7% reporting a history of angina, 45% reporting arthritis, 26% reporting diabetes, 63% reporting hypertension, and 8% reporting having had a stroke. Functional status was also poor, with 21% having clinically relevant levels of depressive symptoms (Kohout et al., 1993), 26% expressing fear of falling, an average of 2.2 lower extremity difficulties (Wolinsky et al., 2007), 13% reporting poor hearing, 18% reporting poor vision, and a mean SPPB (8.1) below the established “at-risk” score of 9 (Guralnik et al., 1994). The mean baseline SRH Diehr-transformed score was 62.7, and at successive follow-ups, it was 68.8, 66.9, 64.8, and 66.9, reflecting a noticeable improvement because of early dropout from the study, followed by relative stability.

Cross-Classification Results

Table 2 contains the results of cross-classifying SRH levels reported at baseline with those reported 4 years later among the 829 subjects (weighted *N*) who responded to the SRH question at both time periods. For convenience, we have shaded the main diagonal, which represents those subjects whose SRH levels remained the same over time. Stability in SRH (i.e., falling on the main diagonal) was reported by the majority (55%) of respondents, whereas 20% reported declines in SRH over time (i.e., falling below the main diagonal), and 25% reported improvements in SRH over time (i.e., falling above the main diagonal). We note here that when decline or improvement in SRH occurs, the vast majority of it involved only a change in one SRH level, such as *good* to *fair*, or *good* to *very good*. Indeed, among those whose SRH declined, 85% declined by only one level, and among those whose SRH improved, 83% improved by only one level. Thus, in this most elementary analysis of SRH across the 4-year period, stability was the norm, with changes in SRH levels typically being quite modest.

Multinomial Logistic Regression Analyses

Because 84% of all changes in SRH over time involved just one response level, we limited our multinomial logistic regression analyses to focus on comparing and contrasting those participants whose SRH improved and those whose SRH declined with those participants

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having stable SRH (the reference group). We began by looking at crude differences in the distributions of our potential risk factors across the three target groups (stability, improvement, and decline in SRH) among the 829 participants (weighted *N*) who completed the baseline and 4-year follow-up interviews. As shown in Table 3, statistically significant crude differences in percentages (or means) were observed for seven risk factors. Men were more likely to have worsening SRH, whereas those who were widowed at baseline or who had greater body mass were less likely to have worsening SRH. Participants with congestive heart failure, diabetes, or hypertension were more likely to have stable or improving SRH. The relationship between changes in SRH with SPPB scores was such that participants who reported SRH declines had higher baseline SPPB scores, whereas those who reported SRH improvements had lower baseline SPPB scores.

Given concerns about the potential for overfitting the multinomial logistic regression models, we used forward, backward, and stepwise modeling procedures with appropriate guidelines (Concato et al., 1993; Harrell et al., 1996; Hosmer & Lemeshow, 1989). All three approaches identified the same three risk factors as being independently associated with SRH changes. Men were more likely to report lower SRH levels over time (adjusted odds ratio [AOR] = 2.118; $p < .001$), those with hypertension at baseline were less likely to report lower SRH levels over time (AOR = 0.665; $p < .05$), and those with congestive heart failure at baseline were more likely to report higher SRH levels over time (AOR = 2.810; $p < .05$). Thus, in this analysis of modest improvement or decline between baseline and 4-year follow-up SRH reports, few risk factors, none of which is modifiable, were independently predictive.

Mixed-Effect Model Analyses

Our multinomial logistic regression focused just on changes in SRH levels between baseline and the 4-year follow-up among the 829 (weighted *N*) participants who completed both interviews. In contrast, our mixed-effect model analyses included all 993 (weighted *N*) participants who completed at least one follow-up interview, used all 4,467 of their available contiguous year-to-year potential change segments, and relied on the Diehr transformation of the original SRH response levels. Table 4 contains the crude and partial fixed-effect estimates from these mixed-effect models for all variables that were retained throughout the model-building process (plus wave and sex), for which the covariance constraint was unstructured (UN). Because the effect of wave (aging) was initially found to be nonlinear, we used a square-root transformation to simplify the estimation and interpretation processes. Crude effect estimates were obtained from a series of models in which each independent variable (i.e., row) was individually included, along with wave as both a fixed and a random effect. Adjusted effect estimates were obtained from a model including all of the independent variables as fixed effects along with the inclusion of wave and the intercept as random effects. Approximate Wald tests indicated that both the random intercept and random wave effects were highly significant ($p < .0001$), indicating that their inclusion was essential to the proper specification of the model.

Interpreting fixed-effect estimates is similar to multiple linear regression analysis. Among binary risk factors such as income, the effect estimates reflect the contrast between the two categories at baseline, which is an intercept difference. For example, the partial effect of income reflects the fact that the average trajectory intercept for those having less than $20,000 is 3.10 Diehr-transformed SRH points lower than that for participants with higher incomes. Among continuous risk factors such as the MMSE, the effect estimate (0.43 Diehr-transformed SRH points) reflects the difference in the intercept of the SRH trajectory at baseline associated with each 1-point increase in the MMSE. Because the interval between each wave of data collection was 12 months, the fixed effect for the square root of wave is a nonlinear aging (longitudinal) effect, whereas the fixed effect for age reflects cross-sectional differences in age at baseline. The only interaction effect (i.e., slope differential or discontinuity effect) identified was for

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reporting diabetes at baseline. This effect indicates that the initially negative effects for those with diabetes are somewhat dissipated over time.

The largest relative effect sizes (all $p \leq .001$), in descending order, were for diabetes (−13.0 Diehr-transformed SRH points), congestive heart failure (−10.8 Diehr-transformed SRH points), lower extremity disabilities (−2.9 Diehr-transformed SRH points per disability), clinically relevant levels of depressive symptoms (−8.6 Diehr-transformed SRH points), poor self-rated vision (−8.2 Diehr-transformed SRH points), and poor self-rated hearing (−5.3 Diehr-transformed SRH points). Statistically significant, albeit much more modest, negative effects were found for angina, low income, poor perceived neighborhood quality, smoking, hypertension, and poor cognitive status. Age, sex, and wave were not independently associated with Diehr-transformed SRH trajectories in the final model. The single interaction (Variable × Wave) effect indicates that the initial negative effect of diabetes was diminished by about one half across the 4-year period.

Sensitivity Analyses

To address the potential for attrition bias, the mixed-effects model shown in Table 4 was replicated among the subset of participants who were successfully reinterviewed at all four annual follow-ups (N = 780 unweighted; N = 779 weighted). Those results (data not shown) were remarkably consistent with those in Table 4. This indicates that our findings did not result from potential attrition bias. Similarly, we replicated the mixed-effects model shown in Table 4 using the 5-to-1 integer coding of SRH (instead of the Diehr transformation). Those results (data not shown) were also remarkably consistent with those shown in Table 4. This indicates that our findings did not result from potential coding bias because of the Diehr transformations of the 5-to-1 integer coding.

Discussion

Our study has five important strengths. First, it is one of only a few investigations of SRH changes, trajectories, and their antecedents. Second, we used the transformation method developed by Diehr and colleagues (Diehr et al., 2001), which we consider to be superior to the traditional 5-to-1 integer approach because it more accurately reflects the magnitudes of the differences in the meanings of the response option levels for the SRH question. As an added safeguard, however, we replicated our findings using the traditional 5-to-1 integer approach and found no meaningful differences. Third, we examined SRH changes and trajectories in a large, community-based probability sample of 49- to 65-year-old African American men and women. Fourth, we used multinomial logistic regression to compare and contrast participants whose SRH at baseline and at the 4-year follow-up were the same with participants whose SRH during this period improved or declined by at least one response level. Finally, we used rigorous mixed-effect models to analyze the 4-year trajectories derived from five annual interviews.

These important strengths notwithstanding, our findings did not actually differ much from the extant literature (Benyamini et al., 2000; Ferraro & Kelley-Moore, 2001; Idler & Kasl, 1995; Idler et al., 1992; Leinonen et al., 2001, 2002; Wolinsky & Tierney, 1998). Overall, SRH changes, trajectories, and their antecedents in late-middle-aged African Americans were much like those observed for somewhat older, majority adults. Specifically, SRH was stable (unchanged) for the majority of subjects (55%) across the 4-year period, and among the 45% whose SRH did change over time, 84% changed by only one response level. This pattern is also reflected in the baseline and successive annual follow-up means using the Diehr transformation, which were 62.7, 68.8, 66.9, 64.8, and 66.9, reflecting a noticeable improvement because of those who dropped out of the study early, followed by relative stability. No evidence of any independently significant age-related effects was found in either the final multinomial logistic or mixed-effect models. That is, there was no independently

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significant cross-sectional effect of age at baseline, and there was no independently significant longitudinal effect of aging (wave).

Only three significant risk factors were found in the multinomial logistic regression model comparing and contrasting participants whose SRH levels either improved or declined with those whose SRH levels remained the same between baseline and the 4-year follow-up. Recall that this analysis focused only on the 829 participants (weighted *N*) who completed both the baseline and 4-year follow-up interviews. Here we found that men were more likely to report lower SRH levels over time, those with hypertension at baseline were less likely to report lower SRH levels over time, and those with congestive heart failure at baseline were more likely to report higher SRH levels over time.

In contrast, our mixed-effect model analyses included 993 (weighted *N*) participants who completed at least one follow-up interview, used all 4,467 of their available contiguous year-to-year potential change segments, and relied on the Diehr transformation of the original SRH response levels. Among the antecedents of Diehr-transformed SRH trajectories, the major drivers identified in our mixed-effects model were disease history (diabetes and congestive heart failure) and functional status (lower extremity disability, poor self-rated vision, poor self-rated hearing, and clinically relevant levels of depressive symptoms), all of which lowered the Diehr-transformed SRH trajectory intercepts (or start values). Only one of the antecedent variables that affected SRH trajectories—the negative effect of diabetes—substantially diminished over time.

We conclude this article by emphasizing its simple take-home message and its complex implications. Simply put, among late-middle-aged, community-dwelling African American men and women living in socioeconomically disadvantaged circumstances with significant morbidity, SRH is robust (i.e., high) and stable (i.e., unchanging). That much is quite clear from our analyses. What is not at all clear is why this occurs. Although that question cannot be resolved with the current data, here we speculate that the answer lies in the resilience of these AAH participants. What we do not know, but are currently exploring, is whether their resilience involves emotional vitality (Penninx et al., 1998), positive affect (Ostir et al., 2002), sense of control (Mirowsky & Ross, 1999), or collective efficacy (Sampson, Raudenbush, & Earls, 1997). Each of these explanations suggests a different causal pathway. Moreover, current measures associated with each of these interpretations have noticeable overlap. Thus, further research is needed that focuses specifically on the etiology, as opposed to the epidemiology, of the robust and stable SRH trajectories found among these African American men and women who live their lives with significant morbidity under disadvantaged socioeconomic conditions.

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Table 1

Baseline Means (and Standard Deviations) or Percentages of the Potential Antecedents of Self-Rated Health Changes and Trajectories (weighted *N* = 998)

Variable	Mean or Percentage
Sociodemographics	
Age (range of 49 to 65 years)	56.8 (4.4)
Men	42%
Widowed	13%
Poorest social support quintile	22%
Socioeconomics	
Grade-school education	6%
Income less than $20,000	28%
Inner-city residence	21%
Poorest rated neighborhood quality quintile	24%
Health habits	
Former smoker	37%
Current smoker	30%
Body mass index	29.8 (6.5)
Disease history	
Angina	7%
Arthritis	45%
Asthma	10%
Cancer	7%
Congestive heart failure	5%
Chronic obstructive pulmonary disease	5%
Diabetes	26%
Hypertension	63%
Kidney disease	5%
Stroke	8%
Functional status	
Meets the 11-item CES-D screen threshold	21%
MMSE score (range 0 to 30)	27.9 (2.6)
Expressed fear of falling	26%
Lower extremity disability (range of 0 to 9 [*none* to *all*] with difficulty)	2.2 (2.8)
Poor self-rated hearing	13%
Poor self-rated vision	18%
SPPB summary score (range of 0 to 12 [*worst* to *best*])	8.1 (3.3)

Note: Binary variables coded 1 = yes, 0 = no. CES-D = Center for Epidemiological Studies Depression Scale (Kohout, Berkman, & Evans, 1993); MMSE = Mini-Mental Status Examination (Molloy, Alemayehu, & Roberts, 1991); SPPB = Short Physical Performance Battery (Guralnik et al., 1994).

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Table 2

Self-Rated Health (SRH) Levels at Baseline and at the 4-Year Follow-Up (weighted $N = 829$)

	Poor at Follow-Up	Fair at Follow-Up	Good at Follow-Up	Very Good at Follow-Up	Excellent at Follow-Up
Poor at baseline	19.3	28.2	11.1	0.3	0.0
Fair at baseline	25.3	122.5	74.5	12.8	0.3
Good at baseline	5.0	40.9	214.3	55.6	9.1
Very Good at baseline	1.5	6.3	60.0	66.6	11.5
Excellent at baseline	0.0	0.0	12.2	18.2	33.4

Note: Shaded cells (i.e., the main diagonal) represent participants with stable SRH levels (55%), cells above the main diagonal represent participants with improving SRH levels, and cells below the main diagonal represent participants with declining SRH levels.

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Table 3

Baseline Means (and Standard Deviations) or Percentages of the Potential Antecedents of Self-Rated Health (SRH) Changes and Trajectories (weighted *N* = 829)

	SRH in Wave 5 Compared to Wave 1			
Variable	**Worse (*n* = 169)**	**Same (*n* = 456)**	**Better (*n* = 203)**	***p* value**
Sociodemographics				
Age	56.6 (4.4)	56.93 (4.4)	56.7 (4.2)	.656
Men	56%	36%	44%	< .001
Widowed	6%	13%	10%	.045
Poorest social support quintile	19%	20%	25%	.250
Socioeconomics				
Grade-school education	5%	6%	6%	.867
Less than $20,000 income	20%	27%	30%	.137
Inner-city residence	21%	18%	24%	.237
Poorest rated neighborhood quality	25%	23%	24%	.924
Health habits				
Former smoker	34%	39%	39%	.519
urrent smoker	35%	26%	32%	.052
Body mass index	28.7 (5.4)	30.6 (7.0)	30.1 (6.2)	.009
Disease history				
Angina	8%	7%	9%	.747
Arthritis	42%	44%	45%	.857
Asthma	10%	9%	10%	.926
Cancer	2%	5%	7%	.114
Congestive health failure	1%	23%	6%	.007
Chronic obstructive pulmonary disease	5%	4%	6%	.715
Diabetes	17%	26%	32%	.006
Hypertension	52%	66%	60%	.014
Kidney disease	4%	4%	3%	.837
Stroke	7%	7%	8%	.952
Functional status				
CESD threshold met	13%	21%	23%	.052
MMSE score	27.9 (3.2)	28.1 (2.5)	28.1 (2.2)	.801
Expressed fear of falling	22%	26%	29%	.368
Lower extremity disability	1.8 (2.4)	2.1 (2.6)	2.3 (2.8)	.254
Poor self-rated hearing	11%	12%	15%	.369
Poor self-rated vision	17%	16%	18%	.827
SPPB summary score	8.8 (2.8)	8.2 (3.3)	7.8 (3.2)	.024

Note: CES-D = Center for Epidemiological Studies Depression Scale (Kohout, Berkman, & Evans, 1993); MMSE = Mini-Mental Status Examination (Molloy, Alemayehu, & Roberts, 1991); SPPB = Short Physical Performance Battery (Guralnik et al., 1994).

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Table 4

Estimates of Crude and Partial Fixed Effects on Diehr-Transformed Self-Rated Health Trajectories With the Square Root of Wave Included as Both a Fixed and a Random Effect (weighted participant $N = 993$; segment $N = 4{,}467$)

	Crude Effects[a]			Partial Effects[b]		
Baseline Variable	**Estimate**	**95% C.I.**	***p* value**	**Estimate**	**95% C.I.**	***p* value**
Square root of wave (i.e., 1.0, 1.4, 1.7, 2.0, 2.2)	1.15	−0.22, 2.51	.098	0.26	−1.29, 1.80	.742
Age (coded in years)	−0.45	−0.79, −0.12	.008	0.06	−0.19, 0.32	.637
Men	0.21	−2.85, 3.26	.895	−1.77	−4.05, 0.51	.127
Less than $20,000 income	−15.59	−18.52, −12.65	< .001	−3.10	−5.61, −0.59	.015
Self-rated poor neighborhood quality	−7.93	−11.17, −4.69	< .001	−3.30	−5.77, −0.83	.009
Current smoker	−6.24	−9.38, −3.11	< .001	−3.90	−6.29, −1.51	.001
Angina	−19.38	−24.83, −13.92	< .001	−6.37	−10.67, −2.08	.004
Congestive heart failure	−27.41	−33.81, −21.01	< .001	−10.75	−15.88, −5.63	< .001
Diabetes	−16.72	−20.12, −13.32	< .001	−13.03	−18.75, −7.32	< .001
Hypertension	−13.59	−16.56, −10.63	< .001	−5.95	−8.31, −3.58	< .001
CES-D threshold met	−21.01	−24.25, −17.76	< .001	−8.60	−11.40, −5.81	< .001
MMSE score (0–30)	1.96	1.42, 2.49	< .001	0.43	−0.00, 0.86	.051
Lower extremity disability (0–9)	−4.82	−5.25, −4.39	< .001	−2.94	−3.39, −2.50	< .001
Self-rated poor vision	−20.99	−24.42, −17.56	< .001	−8.18	−11.06, −5.30	< .001
Self-rated poor hearing	−16.51	−20.66, −12.35	< .001	−5.29	−8.54, −2.05	.001
Interaction of square root of wave with diabetes	2.93	−0.27, 6.12	.072	3.07	−0.10, 6.23	.058

Note: C.I. = confidence interval; CES-D = Center for Epidemiological Studies Depression Scale (Kohout, Berkman, & Evans, 1993); MMSE = Mini-Mental Status Examination (Molloy, Alemayehu, & Roberts, 1991).

[a] Crude effect estimates were obtained from a series of models in which each independent variable (i.e., row) was individually included along with wave as both a fixed and a random effect (except for the model for the interaction term, which also included the main effect of diabetes).

[b] Adjusted effect estimates were obtained from a model including all of the independent variables as fixed effects along with the inclusion of wave and the intercept as random effects. Approximate Wald tests indicated that both the random intercept and random wave effects were highly significant ($p < .0001$), indicating that their inclusion was essential to the proper specification of the model.