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# Factors influencing longitudinal stair climb performance from midlife to early late life: The Study of Women's Health Across the Nation Chicago and Michigan Sites

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## Abstract

**Objectives:** To quantify longitudinal change in stair climb performance—a measure indicative of both physical function and muscle power—determine whether physical activity is related to slower decline in performance, and to identify factors that modify the longitudinal change in performance among women from midlife to late life.

**Design:** Longitudinal cohort study with up to 15 study visits.

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**Setting:** Two sites of the Study of Women's Health Across the Nation.

**Participants:** Black (n=410) and white (N=419) women followed from median age 47.0 (44.6–51.9) to 62.0 (55.8–65.3) years.

**Interventions:** N/A

**Measurements:** Performance on a stair climb test (ascend/descend 4 steps, 3 cycles) was timed. Physical activity (PA) was assessed using the Kaiser Physical Activity Survey (KPAS; possible range 0–15 points). Sociodemographic and health factors were assessed via self-report. BMI was calculated with measured height/weight. Mixed-effects regression modeled longitudinal change in stair climb performance.

**Results:** Average baseline stair climb time was 18.12 seconds (95% CI: 17.83–18.41), with 0.98% (95% CI: 0.84–1.11) annual slowing. In fully adjusted models, higher levels of PA were associated with faster stair climb times (2.09% faster per point higher, 95% CI: −2.87- −1.30%), and black women had 5.22% (95% CI: 2.43–8.01) slower performance compared to white women. Smoking, financial strain, diabetes, osteoarthritis, fair/poor health, and stroke, were associated with 3.36% (95% CI: 0.07–6.65), 7.56% (95% CI: 4.75–10.37), 8.40% (95% CI: 2.89–13.92), 8.46% (95% CI: 5.12–11.79), 9.16% (95% CI: 4.72–13.60), and 16.94% (95% CI: 5.37–28.51) slower performance, respectively. In separate models, higher BMI (per 1-unit), osteoarthritis, fair/poor health, and diabetes, were each associated with 0.06% (95% CI:0.04–0.08), 0.48% (95% CI: 0.12–0.84), 0.81% (95% CI:0.35–1.28), 0.84% (95% CI:0.22–1.46), additional slowing per year over time.

**Conclusion:** Significant declines in function were evident as women transitioned from midlife to early late-life. Declines were amplified by indicators of poor health, emphasizing the importance of health in midlife for promoting healthy aging.

### Keywords

physical function; aging; midlife women

## INTRODUCTION

At all ages, women are disproportionally affected by limitations in physical function compared to men. During the midlife, physical function for women is influenced both by processes related to chronologic aging and hormonal changes occurring with ovarian aging.[1-4] Though limitations in physical function are most prevalent in late life (ages 65+ years), approximately 20% of women report limitations in physical functioning in midlife, the life stage reflecting ages 40–65 years.[5] Though much research has focused on physical function during either mid- *or* late life, considerably less is known about how physical function changes *during* the critical transition period moving from midlife to late-life.

In a broad sense, risk factors for worse physical function during midlife are largely consistent with risk factors during late life, including body composition and factors related health status.[6-9] In addition, considerable racial disparities have been previously identified in physical function at midlife between black and white women, with black women being more likely to have worse performance-based and self-reported physical function, as well as a higher prevalence of disability.[2,7,10-12] As in older adults, physical activity is an important protective factor for physical function during midlife.[13-15]

Limitations in midlife are evident in both self-report[2,5,16] and performance-based measures of physical function,[7] which is critical as self-report and performance-based measures are known to capture related, but distinct, concepts.[17-20] One commonly assessed aspect of physical function (self-report and performance-based) is stair climbing, as the ability to negotiate stairs is important in maintaining independence and community living. Slower performance-based stair negotiation time has been shown to be predictive of the development of functional limitations in older adults, even among those who report no difficulty with stairs.[21] Ascending and descending stairs encompasses multiple facets of physical and muscle function, and is a more complex kinematic task than walking, another commonly assessed aspect of physical function. Compared to other activities of daily living and aspects of mobility, the ability to climb stairs is among the first—and fastest—to decline with age.[22-24] Thus, this test may be preferable for assessing longitudinal physical function changes from mid to late life, a time period where changes in performance-based function may be subtle.

The purpose of this study was to quantify the longitudinal change in stair climb performance among black and white midlife women transitioning to early late-life. We also sought to determine whether physical activity was associated with slower decline in performance over time, if performance differed between black and white women, and to identify other factors that modify the longitudinal change in stair climb performance from midlife to early late life.

## METHODS

### Participants

Participants were from the Michigan (southeast Michigan, Detroit-area) and Chicago, IL sites of the Study of Women's Health Across the Nation (SWAN), a longitudinal, multi-racial/ethnic, community-based cohort study of the menopausal transition. Recruitment and design of the SWAN study have been described in detail elsewhere.[25] Briefly, women were eligible for the SWAN study if they were between the ages of 42–52 years at baseline in 1996/97, had an intact uterus and at least one ovary, were premenopausal or early peri-menopausal (i.e., had at least one menstrual period in the past 3 months), and were not pregnant, breastfeeding or lactating. Women at the Chicago, IL site were recruited via a random population-based sampling in a contiguous area on the south side of Chicago (N=868).[26] Of these, 457 were recruited for the parent study (Chicago "core" cohort), with the remaining women being part of a sub-study (Chicago "site-specific" cohort). Both Chicago cohorts underwent identical clinical assessments. The Michigan site recruited from two communities in southeast Michigan using a community census based on electrical utility listings in Ypsilanti and Inkster, MI (N=543). By design, both the Michigan and Chicago sites recruited non-Hispanic black and white women. The Chicago and Michigan site protocols were approved by the Rush University Medical Center or the University of Michigan Health Sciences Institutional Review Boards, respectively. All participants provided written informed consent before enrolling and at each clinic visit.

A stair climbing test was assessed repeatedly at these SWAN sites. Stair climb tests commenced for the Michigan cohort at the main study baseline in 1996/97, the Chicago site-specific cohorts at their baseline in 1996/98, whereas the SWAN Chicago core cohort did not begin stair climb data collection until the 1998/1999 (Follow-up visit 2). Participants were asked to complete the stair climb test at near-annual follow-up visits. The initial visit where the stair climb test occurred in conjunction with a physical activity assessment was considered the analytic baseline for this analysis. Because physical activity was a particular predictor of interest and was not assessed in Follow-up visit 2, the 1999/2000 visit (Follow-up visit 3) study visit was used as analytic baseline for the Chicago core cohort. Participants were included in analyses if they completed each of the following: 1) the stair climb test at the analytic baseline or the immediate follow-up visit, 2) the stair climb test on at least one additional visit, and 3) the physical activity questionnaire at the analytic baseline. A total of 830 participants were included in longitudinal analyses using data through Visit 15, which occurred in 2015–17 (Figure 1). In total, up to 15 stair climb observations were possible for the Michigan and Chicago site-specific cohorts and up to 12 visits for the Chicago core cohort. Mean visits per participant per site were as follows: Michigan site 10.6 ± 4.0 (range 2–15), Chicago site-specific 6.5 ± 3.0 (range 2–12), Chicago core cohort 8.4 ± 3.0 (range 2–12).

Women who were excluded (N=582) versus those who were included did not differ by age (46.9±3.1 years vs. 47.1±3.2 years, p=0.21). However, excluded women were more likely to be black (57.2% vs. 49.5%, p=0.004), from one of the Chicago sites (82.7% vs. 46.7%, p<0.001), premenopausal (41.8% vs. 33.6%, p=0.03), and have fair or poor health (16.7% vs. 11.6%, p=0.01). Other demographic factors, including education, financial difficulty paying for basics, and marital status did not differ by inclusion status.

## Stair Climb Test

The timed stair climb task required participants to ascend and descend four standard stairs for three consecutive cycles. Participants were permitted to use the hand rail if necessary. Times at the Chicago site were collected in seconds, while times at the Michigan site were collected to the tenth of a second. For consistency, times from the Michigan site were rounded to the nearest second for analysis.

## Physical Activity Assessment

Self-reported physical activity was collected using the Kaiser Physical Activity Survey (KPAS) at analytic baseline.[27] This self-administered questionnaire is comprised of 38 items assessing physical activity in the past year, and was originally modified from the Baecke physical activity questionnaire.[28] Physical activity from three domains was assessed, including sports/exercise, active living, and household/caregiving. Responses are primarily categorical to assess frequency, duration, and relative intensity, with an open-ended question about sport/exercise participation. Total scores can range from 0 to 15, with higher values indicating greater physical activity participation.

## Covariates

All covariates were used from the analytic baseline for each respective group unless otherwise specified. Sociodemographic characteristics including race (black or white), educational attainment, marital status, and financial strain were assessed via self-report. Age was calculated using date of birth and date of first included stair climb test. Health factors included menopausal hormone use (lifetime ever use, yes/no), menopausal status (pre-menopausal, peri-menopausal, post-menopausal, or unknown) characterized using bleeding criteria, and smoking status (never/former/current, combined to current vs. former/never for analyses). BMI ($kg/m^2$) was calculated from measured height and weight. Self-reported health status was self-reported as excellent, very good, good, fair, or poor (excellent/very good/good vs fair/poor combined for analyses). Severity of bodily pain in the past 4 weeks was assessed using a single-item question from the Short Form Health Survey (SF-36), with responses grouped to create categories of mild/very mild, moderate, or severe/very severe. Doctor-diagnosed history of stroke and osteoarthritis was collected by self-report. Diabetes status was determined via self-reported healthcare provider diagnosis, use of hypoglycemic medications, or fasting glucose ≥126 mg/dl. Hypertension was defined as measured resting blood pressure ≥140mmHg (systolic) or ≥90mmHg (diastolic) or use of antihypertensive medications. Depressive symptoms were assessed using the Center for Epidemiological Studies Depression Scale (CES-D; score of ≥16 indicating clinically significant level of depressive symptoms vs. <16).[29,30]

## Statistical Analyses

Descriptive statistics were compared between black and white women using t-tests or nonparametric alternatives as necessary for continuous factors and chi-squared tests for categorical factors. All statistical analyses were performed using SAS version 9.3 (SAS Institute, Inc., Carey, NC).

Stair climb times were natural-log transformed for analyses due to right-skewed data distribution. Repeated measures analysis using linear mixed models (SAS Proc Mixed) were performed including random slopes and intercepts and an unstructured covariance matrix. An unadjusted model with years since baseline as the only predictor was used to determine the average predicted stair climb time and the average change per year. Then, four sets of models were built: Model 1 included site, age, race, and time; Model 2 added physical activity; Model 3 added education, financial difficulty, and marital status; and Model 4 added BMI, bodily pain, health status, hormone use, menopausal status, smoking status, osteoarthritis, hypertension, stroke, diabetes, and depressive symptoms. In exploratory analyses, interactions with time were considered individually for factors included in the final model to determine whether the rate of change in stair climb time varied by sociodemographic, health, or health behavioral factors. In each model, though we considered several covariates, only factors reaching statistical significance ($p<0.05$) were retained. However, age and site were included a priori regardless of significance. Because the different sites had different numbers of total stair climb visits, sensitivity analyses restricting the Michigan and Chicago Site-Specific participants to only visits 1–13 so all sites had a maximum of stair climb assessments were performed.

## RESULTS

Overall, 830 women (Figure 1; N=411 black and N=419 white) were included in analyses. Median follow-up time was 15.5 years (interquartile range 8.4–18.3 years), and women were followed from a median age of 47.0 (44.6–49.6) to 62.0 (55.8–65.3) years at the analytic baseline visit.

Participant characteristics generally differed by race (Table 1), with white women being more likely to have more than a HS diploma (83.8% vs. 72.5%) more likely to be currently married (73.3% vs. 49.1%), less likely to have financial difficulty paying for basics (31.7% vs. 45.1%), and more likely to have ever used hormones (28.4% vs. 13.7%); p<0.001 for all comparisons. Regarding health status, black women generally had worse self-reported health (p<0.001), were more likely to be current smokers (25.1% vs. 18.9%, p=0.03), had higher BMI (30.8 kg/m$^2$, IQR [interquartile range]: 26.3–36.8 kg/m$^2$ vs. 28.2 kg/m$^2$, IQR: 24.3–34.3 kg/m$^2$; p<0.001), were more likely to report bodily pain (p<0.001), and were more likely to have CES-D scores ≥ 16 (25.5% vs 17.2%; p<0.001). Age, prevalence of diabetes, stroke, and osteoarthritis did not vary by race. Compared to white women, black women had lower mean KPAS scores (7.3±1.8 vs. 8.1±1.8, p<0.001), indicating that they were less physically active.

In unadjusted models, the mean baseline stair climb time was 18.1 seconds (95% CI: 17.8–18.4 seconds), and women slowed on average 0.98% (95% CI: 0.84%−1.1%) per year (results not shown). In adjusted models, smoking, financial strain, fair/poor health, osteoarthritis, and stroke, diabetes, and were associated 3.4% (95% CI:0.1–6.7), 7.6% (95% CI:4.8–10.4), 8.4% (95% CI:2.9–13.9), 8.5% (95% CI:5.1–11.8), 9.2% (95% CI: 4.7–13.6), 16.9% (95% CI:5.4–28.5), and slower stair performance, respectively (Table 2, Model 4). Each unit higher of BMI was associated with 0.95% (95% CI: 0.76–1.15%) slower stair climb times. We also considered bodily pain, menopausal status, hormone use, hypertension, and depressive symptoms, though these factors were not independently associated with stair climb time (p>0.05 for each) and were not retained in the models.

In separate models for the exploratory analyses testing for interactions among significant factors in Model 4, several factors were related to a difference in performance over time. Significant interactions with time were found such that higher BMI (per 1-unit higher), osteoarthritis, fair/poor health, and diabetes, and were each associated with 0.06% (95% CI: 0.04–0.08), 0.48% (95% CI:0.12–0.84), 0.81% (95% CI:0.4–1.3), 0.84% (95% CI:0.22–1.46), additional slowing per year over time, respectively, (Table 3; interactions also displayed in Figure 2).

Results remained consistent in sensitivity analyses restricting all sites to only 12 possible assessments (results not shown).

## DISCUSSION

In this longitudinal study, we found overall significant changes in stair climb time over a period transitioning from midlife to early late life, followed for an average of nearly 16 years. This degree of decline in physical function performance is notable, given that it occurs earlier than when physical function is typically considered to decline, suggesting the stair climb test may be a sensitive performance measure for early aging. Further, higher BMI, and certain prevalent conditions—including diabetes, history of stroke, and osteoarthritis—were each associated with accelerated performance deterioration, supporting the importance of promoting health at midlife to improve the likelihood of physical independence at old age.

We found a significant racial difference in stair climb times between black and white women. The 9.7% race group difference in stair climb time from the minimally adjusted model was ultimately attenuated nearly 50%, and a 5.2% difference between black and white women remained in the final model. Prior work has shown clear racial disparities among mid- and late-life women in a variety of aspects of physical function including a higher likelihood of clinically slow gait speed, worse performance-based physical function and self-reported functional limitations, and more disability in black women.[2,7,10-12,31-34] Still, in some of these studies racial differences were attenuated to non-significance when controlling for covariates, particularly prevalent health conditions, socioeconomic factors, BMI, pain, and osteoarthritis.[2,7,33] Additional research addressing the mechanisms underlying this racial disparity is warranted, though our results and others suggest that health inequities may play a role.

Physical activity was related to better stair climb performance at every time point, but it did not impact the rate of decline in stair climb over time. This is consistent with work in older adults showing that physical activity is related to better cardiovascular endurance, but does not influence the rate of endurance decline occurring with age.[35,36] Thus, our results indicate that the level of physical activity in midlife is particularly important to achieve a higher physical function prior to the decline associated with the aging process in early late life.

Though physical activity did not influence the rate of change in performance over time, several other factors did. These factors—including self-rated fair or poor health, higher BMI, osteoarthritis, stroke, and diabetes—could be important for developing targeted secondary prevention efforts in order for midlife women to maintain intact function through late life. Prior work has shown accelerated physical function decline and increased disability risk among adults with diabetes, with this effect being particularly profound in women.[37] Obesity at midlife is associated with higher risk of mobility limitations in late life compared to normal weight or overweight in midlife.[38] Reducing obesity in midlife is a particularly relevant intervention target in order to reduce diabetes, stroke, and osteoarthritis associated with functional decline.

Declines in stair climb performance were evident over a 15 year period among midlife women transitioning to late life, indicating this measure shows promise for wider use for assessing performance in midlife populations. A future direction is to establish age-based normative values and determine values associated with poor outcomes.

Though other studies have utilized stair climb tests, large protocol variations exist, making the comparison to prior work difficult.[39] In older adults (age 70+), age-normative values for stair ascent and descent times have been determined, as well as values of large meaningful change in stair ascent and descent performance, with a one year change of 1.15 seconds for ascent and 1.25 seconds for descent indicating large meaningful changes.[21,40] However, these studies utilized a substantially different protocol and are not directly comparable. A further variation is in using stair climb tests for assessing lower-extremity power based on ascend time.[41,42] Stair climb power is strongly related to mobility and lower-extremity performance in older adults.[41] Power could not be calculated, split times were recently completed as part of the updated protocol in SWAN at all sites and will be a future direction for analyses. While ascending and descending stairs is a common task for community living, the protocol for this particular stair climb test does not necessarily mimic stair climbing done in everyday life. Had we used a self-report assessment of stair climbing ability, we may have seen different longitudinal patterns.

Strengths of this study include the longitudinal design with a median follow-up of 15.5 years. This substantial follow-up allowed us to observe women's physical performance as they transitioned from midlife to early late life. This work builds upon prior work in SWAN (limited to only the Michigan site and only up to study Visit 12 in 2008) utilizing the stair climb test that focused on specific risk factors—peripheral neuropathy[6] and depressive symptoms[8]—by showing the role of physical activity in longitudinal stair climb performance, and also demonstrating how longitudinal performance is modified by factors related to poor health. In addition, the participants in this study were from two sites of a well-characterized cohort of initially midlife women, both black and white, which allowed us to examine a host of potential covariates to assess confounding. Importantly, the stair climb test is likely more sensitive to early changes in physical function compared to traditional tests in older populations such as gait speed or chair rise tests as stair climbing ability is one of the first aspects of physical function to decline with age.[22-24]

Limitations of this work must be considered when interpreting these results. First, the difference by site in timelines of when the stair climb test was introduced made data alignment complicated, and made for different follow-up periods by site. We performed sensitivity analyses restricting sites to the same possible number of follow-up visits, and adjusted all models for age and site to mitigate this limitation. In addition, women had to have at least two stair climb times in order to be included, with one of those being either the first or second visit where the test was offered. Potentially, women with the greatest decreases in function may have been less likely to return for clinic visits, excluding them from these analyses—leading to an underestimation of the change over time. In addition, though the stair climb protocol was the same at both the Chicago and Michigan sites, slight variations existed in the data collection forms. At the Chicago site stair climb times were recorded to the nearest second, while Michigan recorded times to the nearest tenth of a second. Additionally, use of the hand rail was not collected consistently by site, and therefore we could not adjust for hand rail use. Finally, racial/ethnic disparities in health are not limited to differences only between black and white women, though we were limited to only these comparisons due to recruitment at these sites, and SWAN by design only includes women and not men.

In conclusion, this study demonstrated worsening performance on a stair climb task in a cohort of midlife black and white women transitioning from midlife to late life. Women with higher levels of physical activity in midlife had better stair climb performance at midlife through early old age compared to women who were less physically active. Additionally, black women had overall slower stair climb times compared to white women, but there was no difference in their rate of change over time. Specific health-related factors (BMI, self-rated health, prior stroke, and diabetes) were associated with more rapid stair climb performance decline, and secondary prevention interventions should potentially target midlife women who already have chronic conditions, obesity, or report ill health in order to delay and prevent late life disability. Because midlife is a critical period where limitations in physical function begin, a greater focus on changes in physical function in this age group as well as sensitive methods to measure small, though significant, early changes is needed in order to identify people in need of early interventions to prevent significant disability in late life.

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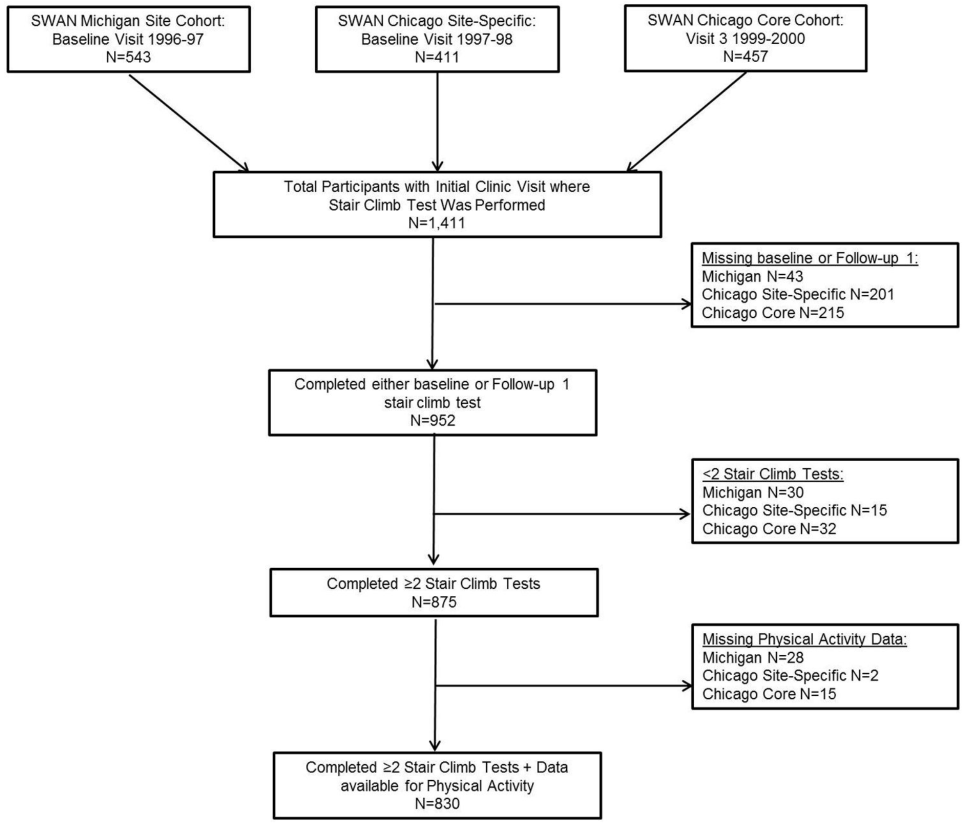


**Figure 1:**

Participants from Michigan and Chicago SWAN Sites

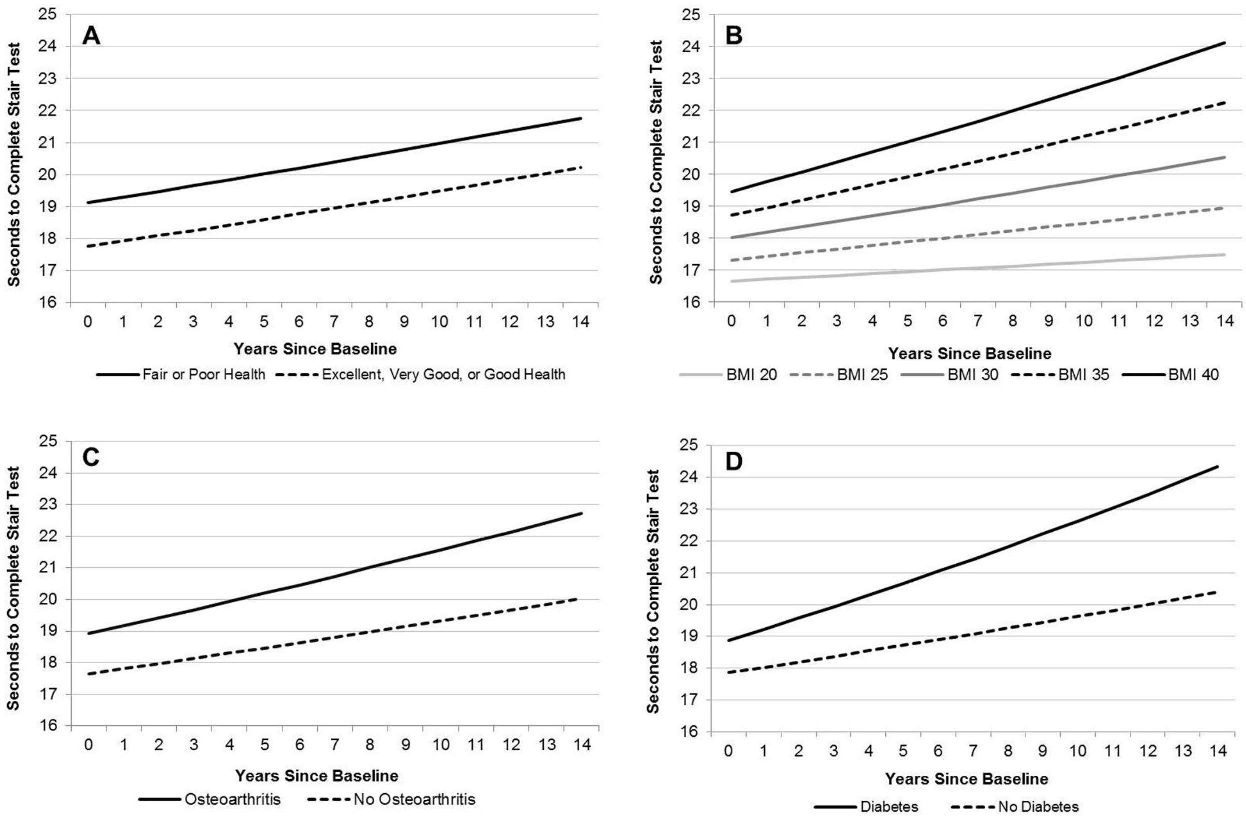


**Figure 2:**

Longitudinal change in stair test completion time; depicting interactions for A) self-reported health status, B) body mass index (BMI), C) osteoarthritis, and D) diabetes.

**Table 1:**

Participant Characteristics[1] at Initial Stair Climb Visit Overall and by Race

| Participant Characteristics | All Women N=830 | Black Women N=411 | White Women N=419 | P-Value |
|---|---|---|---|---|
| Age, years, Median (IQR) [2] | 47.0 (44.6, 49.6) | 46.7 (44.4, 49.5) | 47.1 (44.8, 49.7) | 0.28 |
| Site Group | | | | <0.001 |
| Michigan | 442 (53.3) | 262 (63.7) | 180 (43.0) | |
| Chicago Core | 212 (25.5) | 104 (25.3) | 108 (25.8) | |
| Chicago Site Specific | 176 (21.2) | 45 (10.9) | 131 (31.3) | |
| Education ≤High School | 617 (78.2) | 285 (72.5) | 332 (83.8) | <0.001 |
| Currently Married | 488 (61.2) | 197 (49.1) | 291 (73.3) | <0.001 |
| Financial difficulty paying for basics, n (%) | 305 (38.5) | 180 (45.1) | 125 (31.7) | <0.001 |
| Menopausal Status, n (%) | | | | 0.21 |
| Postmenopausal | 31 (3.9) | 19 (4.8) | 12 (3.0) | |
| Perimenopausal | 403 (50.8) | 211 (52.9) | 192 (48.7) | |
| Premenopausal | 333 (42.0) | 159 (39.8) | 174 (44.2) | |
| Unknown/Missing | 26 (3.3) | 10 (2.5) | 16 (4.1) | |
| Hormone Use: Ever, n (%) | 167 (21.0) | 55 (13.7) | 112 (28.4) | <0.001 |
| Self-Rated Health, n (%) | | | | <0.001 |
| Excellent | 143 (18.0) | 52 (13.0) | 91 (23.1) | |
| Very Good | 301 (37.9) | 135 (33.8) | 166 (42.1) | |
| Good | 258 (32.5) | 150 (37.5) | 108 (27.4) | |
| Fair | 78 (9.8) | 53 (13.3) | 25 (6.3) | |
| Poor | 14 (1.8) | 10 (2.5) | 4 (1.0) | |
| BMI, median (IQR) | 29.7 (25.0, 35.5) | 30.8 (26.3, 36.8) | 28.2 (24.3, 34.3) | <0.001 |
| Current Smoker, n (%) | 181 (21.9) | 102 (25.1) | 79 (18.9) | 0.03 |
| Prevalent Diseases/Conditions, n (%) | | | | |
| Hypertension | 299 (36.2) | 185 (45.1) | 114 (27.4) | <0.001 |
| Diabetes | 50 (6.2) | 30 (7.5) | 20 (5.0) | 0.14 |
| Stroke | 10 (1.2) | 7 (1.7) | 3 (0.7) | 0.19 |
| Osteoarthritis | 186 (22.5) | 97 (23.7) | 89 (21.3) | 0.41 |
| Bodily Pain | | | | <0.001 |
| None | 110 (13.3) | 61 (14.8) | 49 (11.7) | |
| Mild/Very Mild | 466 (56.1) | 201 (48.9) | 265 (63.2) | |
| Moderate | 200 (24.1) | 108 (26.3) | 92 (22.0) | |
| Severe/Very Severe | 54 (6.5) | 41 (10.0) | 13 (3.1) | |
| CES-D[3] Score ≥16 | 177 (21.3) | 105 (25.5) | 72 (17.2) | <0.001 |
| KPAS[4] Score, mean (STD[5]) | 7.7 (1.8) | 7.3 (1.8) | 8.1 (1.8) | <0.001 |

[1]Percentages are reflective of participants with complete data for the measure. Missing data <5%.

[2]Interquartile range.

[3]Center for Epidemiological Studies Depression Scale.

[4]Kaiser Physical Activity Questionnaire.

**Table 2:**

Longitudinal stair climb performance linear mixed models

| | Model 1 | | | Model 2 | | | Model 3** | | | Model 4** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Model Parameters** | **Estimate** | **95% CI Lower** | **95% CI Upper** | **Estimate** | **95% CI Lower** | **95% CI Upper** | **Estimate** | **95% CI Lower** | **95% CI Upper** | **Estimate** | **95% CI Lower** | **95% CI Upper** |
| Intercept (Seconds) | 17.72 | 17.23 | 18.22 | 23.29 | 21.74 | 24.95 | 23.18 | 21.56 | 24.93 | 18.96 | 17.71 | 20.30 |
| Time (Effect per year) | 0.92% | 0.77% | 1.07% | 0.92% | 0.77% | 1.07% | 0.97% | 0.81% | 1.12% | 0.95% | 0.80% | 1.11% |
| Age*** | 0.81% | 0.28% | 1.33% | 0.75% | 0.25% | 1.26% | 0.82% | 0.31% | 1.34% | 0.77% | 0.30% | 1.24% |
| Black Race | 9.72% | 6.63% | 12.81% | 7.43% | 4.42% | 10.44% | 6.19% | 3.14% | 9.24% | 5.22% | 2.43% | 8.01% |
| Physical Activity | | | | −3.53% | −4.35% | −2.71% | −3.59% | −4.42% | −2.77% | −2.09% | −2.87% | −1.30% |
| Some college or higher | | | | | | | −3.94% | −7.63% | −0.25% | NS | --- | --- |
| Difficulty Paying for Basics | | | | | | | 10.41% | 7.38% | 13.45% | 7.56% | 4.75% | 10.37% |
| Health Fair or Poor | | | | | | | | | | 9.16% | 4.72% | 13.60% |
| BMI*** | | | | | | | | | | 0.95% | 0.76% | 1.15% |
| Current Smoker | | | | | | | | | | 3.36% | 0.07% | 6.65% |
| Diabetes | | | | | | | | | | 8.40% | 2.89% | 13.92% |
| Stroke | | | | | | | | | | 16.94% | 5.37% | 28.51% |
| Osteoarthritis | | | | | | | | | | 8.46% | 5.12% | 11.79% |

* Model sample size N=781, also considered marital status but removed due to non-significance;

** Model sample size N=755, also considered bodily pain, menopausal status, hormone use, hypertension, and depressive symptoms, but removed due to non-significance. Education was removed in Model 4 as it was attenuated to non-significance by the addition of other covariates. All models also adjusted for site.

*** Age and BMI each centered at their respective medians.

Note: Beta estimates for all parameters (except intercept) were multiplied by 100 to interpret as percentage difference in stair climb time. Negative coefficients indicate lower stair climb time, and thus better performance (i.e. faster), while positive values indicate slower stair climb time.

## Table 3:

Separate longitudinal mixed models predicting longitudinal change in stair climb time, significant interactions*

| | BMI Interaction | Health Status Interaction | Diabetes Interaction | Osteoarthritis Interaction |
|---|---|---|---|---|
| **Model Parameters** | **Estimate (95% CI)** | **Estimate (95% CI)** | **Estimate (95% CI)** | **Estimate (95% CI)** |
| Intercept (Seconds) | 18.99 (17.73, 20.33) | 19.02 (17.76, 20.37) | 18.99 (17.73, 20.33) | 19.03 (17.77, 20.37) |
| Time (Effect per year) | −0.99 (−1.62, −0.36) | 0.86 (0.70, 1.02) | 0.90 (0.74, 1.06) | 0.84 (0.67, 1.02) |
| Main Effect | 0.76 (0.56, 0.96) | 6.65 (1.99, 11.32) | 5.80 (−0.04, 11.64) | 6.96 (3.44, 10.48) |
| Interaction | 0.06 (0.04, 0.08) | 0.81 (0.35, 1.28) | 0.84 (0.22, 1.46) | 0.48 (0.12, 0.84) |

*Adjusted for all factors included in Table 2, Model 4, including site, age, race, physical activity, difficulty paying for basics, health status, BMI, current smoking, diabetes, stroke, and osteoarthritis.

Note: Beta estimates for all parameters (except intercept) were multiplied by 100 to interpret as percentage difference in stair climb time. Negative coefficients indicate lower stair climb time, and thus better performance (i.e. faster), while positive values indicate slower stair climb time.