



The Effect of Menopause on Grip and Pinch Strength: Results from the Chicago, Illinois, Site of the Study of Women's Health Across the Nation

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Women may experience a decline in physical function during menopause. Whether this decline is due to aging or to changes in hormonal status is unknown. The authors performed a longitudinal data analysis on data collected between 1996 and 2001 to determine the effects of menopausal status, age, race, and use of hormone replacement therapy (HRT) on 3-year changes in grip and pinch strength. Participants were 563 women from the Chicago, Illinois, site of the Study of Women's Health Across the Nation. According to adjusted analyses, women who became postmenopausal showed a 1.04-kg decline in grip strength ($p = 0.10$) and a 0.57-kg decline in pinch strength ($p = 0.002$) relative to women who remained premenopausal. Women who became early perimenopausal showed a 0.20-kg decline in pinch strength ($p = 0.04$), whereas women who transitioned to late perimenopause showed a 0.93-kg decline in grip strength ($p = 0.07$). Effects of menopausal status on grip and pinch strength did not vary by race. A significant HRT-by-race interaction for grip strength was found; African-American HRT users had greater grip strength during the study, whereas Caucasian HRT users did not ($p = 0.05$). Greater physical activity was the strongest predictor of grip and pinch strength ($p < 0.0001$). Results indicate that transition through menopause is associated with a decline in grip and pinch strength.

African Americans; aging; European continental ancestry group; exercise; hand strength; hormone replacement therapy; menopause; women's health

Abbreviations: CI, confidence interval; HRT; hormone replacement therapy; SWAN, Study of Women's Health Across the Nation.

Many women experience limitations in physical function during the perimenopausal and postmenopausal periods (1–4). A cross-sectional survey of over 14,000 women in the United States found that nearly 20 percent of those aged 40–

55 years reported at least some limitation in physical functioning (1). Whether these limitations represent a decline in physical function due to aging, changes in hormonal status associated with menopause, or other factors is controversial.

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Phillips et al. (3) attributed the decline in pinch strength they observed in postmenopausal women to decreased estrogen levels, since those women taking estrogen in the form of hormone replacement therapy (HRT) showed no change in muscle strength. However, findings from other studies of menopausal status, HRT, and physical function, most of which have been cross-sectional, have been inconsistent (3–8). This inconsistency may be due in part to the various measures of physical function used, including grip strength (8), quadriceps strength (9), triceps strength (1), and exercise capacity (4, 7, 10).

Evidence is emerging that women of different races experience the menopausal transition differently (11–14). For example, while Caucasian women report psychosomatic symptoms more frequently, African-American women more often report vasomotor symptoms (11, 12). Furthermore, estradiol and dihydroepiandrosterone sulfate levels decrease more rapidly during the late stages of the menopausal transition in African-American women than in Caucasian women (14). If changes in physical function are mediated by declines in estrogen, then African-American women might experience a more rapid decline in physical function over the menopausal period than Caucasian women do. To our knowledge, no published longitudinal studies have explicitly considered whether race modifies the relation between menopause and physical function.

The primary goal of this longitudinal study was to assess the impact of the menopausal transition on grip and pinch strength in a population sample of middle-aged African-American and Caucasian women. The secondary goal was to determine whether changes in grip or pinch strength varied by use of HRT.

MATERIALS AND METHODS

Study sample

The Study of Women's Health Across the Nation (SWAN) is a community-based, longitudinal cohort study of the menopausal transition in women enrolled from seven clinical sites nationally, as described previously (15). The information presented in this paper is limited to participants enrolled at the Chicago, Illinois, site. The Chicago cohort comprises a population-based sample of African-American and Caucasian women living in a contiguous area on the south side of Chicago. This area was chosen because, for both racial groups, the ranges of socioeconomic status are broad and overlapping. A complete census was conducted in this area in conjunction with a separate study of aging and risk factors for Alzheimer's disease (16). Using census information on age, sex, and race, we identified a random sample of African-American and Caucasian women. Women were invited to participate in the study if they were aged 42–52 years, had an intact uterus and at least one ovary, were not currently pregnant or breastfeeding, had not used exogenous hormone preparations affecting ovarian or pituitary function in the previous 3 months, and experienced menstrual bleeding in the preceding 3 months. Ninety-one percent of those contacted agreed to be screened for eligibility. Of those eligible, 72 percent ($n = 868$) agreed to participate.

Procedures

The institutional review boards of Rush University Medical Center and the University of Chicago approved this study. Beginning in January 1996, trained interviewers screened women with telephone interviews and home visits. Eligible women who agreed to participate underwent a baseline interview—83 percent within the next month. Interviews took 3–4 hours and consisted of questions about medical history, reproductive and menstrual history, life-style, psychosocial factors, and physical symptoms as well as brief physical and cognitive tests (16). Follow-up assessments were conducted annually. At baseline, participation rates were 72 percent for both African-American and Caucasian women. At the three successive follow-up visits, retention rates among surviving participants who completed the baseline interview were 77, 74, and 77 percent for African-American women and 83, 84, and 85 percent for Caucasian women.

Outcome variables. Beginning in August 1997, grip and pinch strength were measured at the Chicago site with a standard handgrip dynamometer and pinch gauge (Baseline Corp., Irvington, New York), respectively. Participants were seated, with the elbow against the side of the body and the lower arm at a right angle to the body. For grip strength, the hand was parallel to the body and the wrist was bent slightly backward. Participants performed three grip tests with each hand. For pinch strength, the hand was parallel to the floor, and measures were taken in three positions: 1) the thumb tip to the tip of the index finger, 2) the thumb tip to the side of the middle portion of the index finger, and 3) the thumb tip to the tips of both the index and middle fingers. Three pinch tests were performed in each position with each hand. For both grip and pinch strength, measurements were recorded in kilograms and were rounded up to the nearest kilogram, with values averaged across hands. The averaged grip and pinch strength measures were analyzed as continuous variables. Annual quality control procedures assessed interviewer drift.

Main predictor variables. Race was self-reported as African American or non-Hispanic Caucasian (the referent category), following the convention used in the 2000 US Census (17). Menopausal status, assessed annually, was defined by bleeding criteria, as follows, and was modeled categorically: premenopausal (having menstruated within the last 3 months without irregularity (the referent category in analyses)), early perimenopausal (experiencing menstrual irregularities but having menstruated within the last 3 months), late perimenopausal (having menstruated within the last 12 months but not within the last 3 months), and postmenopausal (having had no menstrual period within the last 12 months). To be eligible for participation in the SWAN study, all women had to be either premenopausal or early perimenopausal at baseline. At follow-up visits, menopausal status was coded as undetermined for those women for whom menopausal status could not be clearly specified either because of nonconformity with bleeding criteria or because medication usage affected menstrual cycles. Use of HRT in the period since enrollment, including estrogen pills, patches, or oral contraceptives, was self-reported and was modeled as a binary variable.

Covariates. Covariates included time (i.e., study visit), age, household income, body mass index, smoking, and physical activity. Self-reported annual income was divided into five categories. Body mass index was calculated as weight divided by height squared (kg/m^2). Standardized protocols were used to measure weight and height (15). Physical activity was measured by using a questionnaire adapted from Baecke et al. (18) that assessed frequency of activities in three domains: sports, household/child care, and nonsport leisure-time or daily routine. Domain-specific scores, ranging from 1 to 5, were assigned based on the average of individual items within each domain, with higher scores indicating more physical activity. A total physical activity score was calculated as the sum of the domain-specific scores, with a range of 3 to 15. The total score was used in the analyses. Smoking status was categorized as never, former, or current smoking.

Inclusion criteria. To be eligible for inclusion in the primary analyses for this paper, participants had to have pinch or grip strength measurements from at least two annual study visits. Of the initial 868 women included in the Chicago SWAN cohort, 563 met these criteria. Fourteen women who reported having had a stroke prior to or during the study or who had an unknown stroke history were excluded from analyses, and 25 women who experienced surgical menopause during the study period were included only until the time of surgery.

For secondary analyses of HRT use and changes in grip and pinch strength, eligible participants were required to have data on HRT use and grip or pinch strength measurements from at least two of the three follow-up visits. All women were non-HRT users at baseline, per SWAN eligibility criteria; therefore, analyses of HRT use excluded baseline data. Criteria for stroke history and surgical menopause were the same as those for the primary analyses. Data on a total of 550 women were included in the final analyses.

Statistical analysis

To examine whether menopausal status predicted changes in grip or pinch strength over 3 years and whether these changes varied by race, we included in the first model menopausal status at each visit as the main predictor and a term for time (i.e., study visit), with separate analyses for grip and pinch strength. Subsequently, we added a term representing race and then menopausal-status-by-race and time-by-race interaction terms. Adjusted analyses included age, body mass index, income, smoking status, and physical activity as covariates. Our analyses of the three hand positions for pinch strength yielded similar results. For ease of presentation, here we report the results for only the second pinch measurement and hereafter refer to it as pinch strength.

To assess whether HRT use influenced grip or pinch strength, we fit a model with HRT use at each follow-up visit as the main predictor and included the menopausal status categories and a term for time. Subsequently, a term for race was added to the model and then the HRT-use-by-race interaction term. Further statistical adjustments were made for age, body mass index, income, smoking status, and physical activity.

TABLE 1. Baseline characteristics of participants from the Chicago, Illinois, site of the Study of Women's Health Across the Nation, 1996–1998*

	African Americans (n = 238)	Caucasians (n = 325)	p value†
Menopausal status (%)			0.43
Premenopausal	56.4	59.8	
Early perimenopausal	43.6	40.2	
Age in years	46.0 (2.8)	45.6 (2.8)	0.14
Body mass index‡	30.3 (6.3)	27.3 (5.9)	<0.0001
Total physical activity score§	7.4 (1.5)	8.2 (1.7)	<0.0001
Income category (%)			<0.0001
<\$20,000	9.8	1.9	
\$20,000–49,999	28.1	19.6	
\$50,000–74,999	29.5	32.3	
\$75,000–99,999	14.7	22.8	
≥\$100,000	17.9	23.4	
Smoking status (%)			0.0005
Never	60.1	44.9	
Former	18.4	31.7	
Current	21.5	23.4	

* Values are expressed as mean (standard deviation) unless otherwise indicated.

† From linear regression analyses or chi-square tests, as appropriate.

‡ Weight (kg)/height (m)².

§ Physical activity was coded such that a higher score represents greater physical activity (range = 3–15).

We used generalized estimating equations to account for the lack of independence among repeated measures within subjects. Because grip and pinch strength were continuous variables with normal distributions, we used linear regression. After examining the correlation matrices for pinch and grip strength within subjects, we selected an exchangeable correlation structure. Empirical standard error estimates were used because they are robust and do not depend on the correctness of the structure imposed on the working correlation matrix (19). When the normal errors structure assumption is met, there should be no difference between generalized estimating equations models and mixed models (20). Mixed models including random intercepts yielded essentially the same results as the generalized estimating equations models; for simplicity, here we present results from the generalized estimating equations analysis only. All analyses were conducted by using the GENMOD procedure in SAS, version 8 software (SAS Institute, Inc., Cary, North Carolina).

RESULTS

Participant characteristics

At baseline, African-American and Caucasian women did not differ significantly in age or the proportion who were premenopausal or early perimenopausal (table 1). Compared

TABLE 2. Menopausal status and grip and pinch strength of midlife African-American and Caucasian women at four clinical examinations at the Chicago, Illinois, site of the Study of Women's Health Across the Nation, 1996–2001*,†

	African Americans				Caucasians			
	Baseline (n = 39)	Year 1 (n = 162)	Year 2 (n = 216)	Year 3 (n = 204)	Baseline (n = 58)	Year 1 (n = 243)	Year 2 (n = 309)	Year 3 (n = 281)
Menopausal status (%)‡								
Premenopausal	64.1	32.1	18.1	14.2	79.3	33.7	20.4	12.8
Early perimenopausal	35.9	52.5	55.1	49.5	20.7	53.5	58.2	53.8
Late perimenopausal		4.3	8.8	10.3		3.3	4.5	7.8
Postmenopausal		8.0	12.9	21.1		2.1	6.5	12.1
Undetermined§		3.1	5.1	4.9		7.4	10.4	13.5
Grip strength (kg)	31.5 (4.7)	31.3 (5.4)	30.8 (5.7)	31.1 (5.4)	29.9 (4.8)	30.6 (5.3)	30.2 (5.2)	30.3 (5.2)
Pinch strength (kg)	7.4 (1.2)	7.3 (1.4)	7.0 (1.4)	7.1 (1.3)	6.8 (1.1)	6.9 (1.2)	6.7 (1.2)	6.7 (1.3)

* Values are expressed as mean (standard deviation) unless otherwise indicated.

† The *n* values in parentheses for each visit represent all women for whom valid grip and pinch strength measures were available at that visit. Three or more observations for grip and pinch strength were available for nearly 59% of the women in the study.

‡ Per eligibility criteria, all participants were either premenopausal or early perimenopausal at the baseline examination.

§ Menopausal status was "undetermined" at any given follow-up visit for women who did not meet established bleeding criteria regarding status.

with Caucasian women, African-American women had a significantly higher body mass index, were significantly less physically active, were significantly more likely to have lower income levels, and were significantly more likely to have never smoked.

Table 2 presents unadjusted data on menopausal status and grip and pinch strength at baseline and at every follow-up examination. At each follow-up visit, a greater proportion of African Americans than Caucasians had progressed to postmenopausal status. At the third examination, 21.1 percent of African Americans and 12.1 percent of Caucasians were postmenopausal. Thirteen percent of Caucasians and 14 percent of African Americans remained premenopausal.

Menopausal status and grip and pinch strength

Grip strength. With time as the only covariate in the model, progression to late perimenopausal status was associated with a 0.94-kg decrease in grip strength (95 percent confidence interval (CI): -1.86, -0.02; $p = 0.04$) compared with premenopausal status. Postmenopausal women had a 0.85-kg weaker grip strength, compared with premenopausal women, but this difference was not significant (95 percent CI: -2.12, 0.41; $p = 0.18$). Grip strength did not change significantly across study visits (-0.08 kg, 95 percent CI: -0.28, 0.13; $p = 0.45$). Adding race to the model showed that African-American women had a 0.86-kg greater grip strength than Caucasian women did (95 percent CI: 0.06, 1.67; $p = 0.04$).

No significant menopausal-status-by-race or time-by-race interactions were observed, without or with risk factor adjustments. Consequently, the adjusted models we report on include terms for the main effects for menopausal status and race but exclude the interaction terms.

After adjustment for all covariates, the association between late perimenopausal status and grip strength became marginally significant, although the size of the difference between late perimenopausal and premenopausal women was unchanged (table 3). In the adjusted analyses, the difference in grip strength between postmenopausal and premenopausal women increased slightly and was marginally significant (table 3). Race remained a significant predictor of grip strength; African Americans had greater strength than Caucasians did. Both body mass index and physical activity were positively and significantly associated with grip strength. Age was not significantly associated with grip strength.

Pinch strength. Women who transitioned to postmenopausal status showed a significant 0.53-kg decline in pinch strength (95 percent CI: -0.86, -0.20; $p = 0.001$) compared with women who remained premenopausal, after adjustment for time. Relative to premenopausal women, women who transitioned to early perimenopause also showed a significant decline in pinch strength (-0.19 kg, 95 percent CI: -0.36, -0.01; $p = 0.03$). Transition to late perimenopause was not significantly associated with changes in pinch strength. Time was not significantly associated with changes in pinch strength (-0.04 kg, 95 percent CI: -0.11, 0.02; $p = 0.16$). Further analysis showed a significant effect of race; compared with Caucasian women, African-American women had a 0.42-kg greater pinch strength (95 percent CI: 0.23, 0.60; $p < 0.0001$).

As with grip strength, no significant interactions between race and menopausal status or between race and time were observed with pinch strength as the outcome, with or without adjustment for risk factors. Thus, the risk-factor-adjusted models reported on here include only the main effects of race and menopausal status.

TABLE 3. Risk-factor-adjusted generalized estimating equations models examining the association between the menopausal transition and change in grip and pinch strength over 3 years of follow-up at the Chicago, Illinois, site of the Study of Women's Health Across the Nation, 1996–2001*

	Grip strength (kg)				Pinch strength (kg)			
	β	95% CI†	t-test value	p value	β	95% CI	t-test value	p value
Menopausal status								
Postmenopausal	-1.04	-2.29, 0.21	-1.6	0.10	-0.57	-0.94, -0.21	-3.1	0.002
Late perimenopausal	-0.93	-1.94, 0.08	-1.8	0.07	-0.27	-0.61, 0.08	-1.5	0.13
Early perimenopausal	0.15	-0.57, 0.88	0.4	0.68	-0.20	-0.38, -0.01	-2.1	0.04
Undetermined‡	0.21	-0.90, 1.33	0.4	0.71	-0.24	-0.55, 0.07	-1.5	0.14
Premenopausal	Reference category				Reference category			
Study visit	-0.09	-0.32, 0.14	-0.7	0.46	-0.04	-0.11, 0.03	-1.0	0.29
Race								
African American	1.22	0.30, 2.14	2.6	0.01	0.38	0.17, 0.59	3.5	0.0004
Caucasian	Reference category				Reference category			
Age (years)	-0.07	-0.22, 0.08	-0.9	0.37	-0.01	-0.05, 0.02	-0.8	0.45
Income category								
<\$20,000	-1.35	-3.67, 0.96	-1.1	0.25	-0.19	-0.76, 0.38	-0.7	0.51
\$20,000–49,999	-0.93	-2.08, 0.22	-1.6	0.11	-0.03	-0.29, 0.24	-0.2	0.84
\$50,000–74,999	Reference category				Reference category			
\$75,000–99,999	-0.61	-1.82, 0.61	-1.0	0.33	-0.01	-0.29, 0.26	-0.1	0.92
≥\$100,000	-0.69	-1.84, 0.46	-1.2	0.24	-0.05	-0.31, 0.20	-0.4	0.68
Body mass index	0.10	0.02, 0.17	2.6	0.009	0.05	0.03, 0.06	6.2	<0.0001
Smoking status								
Current	0.39	-0.64, 1.41	0.7	0.46	0.15	-0.10, 0.39	1.2	0.23
Former	0.54	-0.51, 1.58	1.0	0.31	-0.10	-0.33, 0.14	-0.8	0.42
Never	Reference category				Reference category			
Total physical activity score	0.72	0.44, 1.00	5.0	<0.0001	0.15	0.09, 0.21	5.0	<0.0001

* Results shown are from two generalized estimating equations models estimating the association between menopausal status and grip or pinch strength. Because of missing data on covariates, the sample size for each analysis was 485. Women for whom data were missing did not differ significantly from women included in the analysis in terms of menopausal status, grip strength, or pinch strength.

† CI, confidence interval.

‡ Menopausal status was "undetermined" at any given follow-up visit for women who did not meet established bleeding criteria regarding status and was coded as a separate dummy-coded category for analysis purposes.

The associations between progression to postmenopausal or early perimenopausal status and decline in pinch strength were relatively unchanged after adjusting for all covariates (table 3). Race remained a highly significant covariate. Total physical activity and body mass index were positively and significantly associated with pinch strength. Age was not significantly associated with pinch strength.

HRT use and grip and pinch strength. By the third follow-up visit, approximately twice as many Caucasians as African Americans reported HRT use (14.2 vs. 7.3 percent, chi-square test = 5.6 (1 df); $p = 0.02$). In unadjusted analyses, women who became HRT users had marginally greater grip strength compared with non-HRT users (1.15 kg, 95 percent CI: -0.12, 2.41; $p = 0.08$). However, a significant race-by-HRT-use interaction term ($\beta = 2.02$, 95 percent CI: 0.02, 4.03; $p = 0.05$) showed that African-American HRT users had significantly increased grip strength, whereas Caucasian

HRT users did not. This interaction was unchanged after subsequent adjustment for covariates. In addition, with adjustment for these factors and HRT use, we observed significant declines in grip strength among postmenopausal women (-1.39 kg, 95 percent CI: -2.80, 0.02; $p = 0.05$) and late perimenopausal women (-0.93 kg, 95 percent CI: -2.02, 0.16; $p = 0.10$). Body mass index and physical activity were both highly significant covariates ($p = 0.01$ and $p < 0.0001$, respectively).

HRT use was not related to pinch strength, with or without covariate adjustment. Furthermore, we found no evidence of a race-by-HRT-use interaction for pinch strength.

DISCUSSION

Progression to postmenopausal status was associated with a significant decline in pinch strength and a marginally

significant decline in grip strength for all women in our study. The relation between menopausal status and grip and pinch strength did not differ significantly by race. Grip and pinch strength did not decline significantly over time or with age, and, overall, African-American women had greater grip and pinch strength than Caucasian women did.

The results of our study are consistent with the hypothesis that changes in hormonal status from pre- to postmenopause contribute to declines in physical function. Studies have shown a greater decline in fine dexterity and hand strength with aging in women than in men (21); it is possible that this difference is attributable to changes in estrogen levels in aging women. For example, estrogen could influence the number of or force production of cross-bridges in the muscle (22, 23). While normative aging data consistently document a greater decline in pinch versus grip strength, our data revealed a greater decline in pinch versus grip strength in relation to menopausal status, possibly due to the impact of hormones on the sensory aspect of motor function. Pinch is a more precise movement than grip, requiring refined tactile afferent input to coordinate the movement and maximize force output (24). The peripheral and central nervous systems contain estradiol-sensitive cells that respond to the absence of ovarian steroids (25), and we hypothesize that sensory integration for pinch, compared with grip, may be impacted more substantially by hormone status. However, an explicit test of this hypothesis awaits data on the pattern of change in endogenous hormones in women transitioning through menopause.

Prior studies of the relation between menopausal status and physical function have been inconsistent. Several cross-sectional studies showed no differences among women in different menopausal stages regarding strength (handgrip or leg strength) (6) or cardiorespiratory fitness (4, 10). In contrast, Petrofsky et al. (2) showed that grip strength was significantly weaker in postmenopausal women than in premenopausal women, even after controlling for age. Phillips et al. (3) observed a dramatic decline in pinch strength around the time of menopause, although they did not formally test this observation. The association between menopausal transition and declining grip and pinch strength observed here is bolstered by the fact that we used a longitudinal design that included a population-based sample of African-American and Caucasian women. However, a relatively small proportion of our participants had become postmenopausal after 3 years of follow-up. In addition, the clinical significance of the declines in grip and pinch strength that we observed was not evaluated. Thus, more longitudinal studies are needed to confirm that the menopausal transition negatively influences overall physical function.

It is possible that the observed declines in grip and pinch strength are attributable to motivational deficits due to psychological changes associated with the menopausal transition. To test this hypothesis, we ran additional generalized estimating equations models using continuous depressive symptom scores as a time-dependent covariate in the fully adjusted models. Depressive symptoms were not significantly associated with grip or pinch strength, and the results for the main predictors and other covariates remained unchanged, indicating that the changes in grip and pinch

strength observed were likely not due to psychological factors.

In our study, African-American women had greater grip and pinch strength than Caucasian women did, but we did not observe a significant race-by-menopausal-status interaction. Few prior studies of menopause and physical function have specified the race of the participants; in those that did, participants were primarily Caucasian (5, 8). In the cross-sectional screening survey for the SWAN study (1), Caucasian women were most likely to report "some" limitations, whereas African-American women were most likely to report "substantial" limitations. However, that report assessed self-reported global physical functioning and not a specific parameter of function.

Interestingly, after controlling for menopausal status and other covariates, we observed no significant effect of age on either grip or pinch strength. Many cross-sectional studies have shown decreases in strength or cardiorespiratory fitness with advancing age (2–4, 6, 26); however, most studied women over a wide range of ages, including some women in their second decade. The women in our study were between 42 and 52 years of age, and we followed them for just 3 years. It is possible that the women in the SWAN study are still too young to suffer age-related decrements in hand strength, that our follow-up period is still too short, or that we lacked the variation in age necessary to detect an effect.

We observed a positive association between total physical activity and both grip and pinch strength. This result is consistent with the findings of Cauley et al. (26), who showed that physical activity was positively associated with muscle strength in postmenopausal women. Physical activity may influence one's performance on grip and pinch testing through a variety of metabolic and neurologic mechanisms, both central and peripheral (27). However, the interplay of sex hormones in these various domains remains to be fully elucidated. Although we did not explicitly test this possibility, it is reasonable to expect that increasing physical activity could minimize losses in strength that accompany menopause.

HRT use was unrelated to pinch strength in our study. We did observe a significant race-by-HRT-use interaction for grip strength, however. African-American women who initiated HRT use during the study had increased grip strength, whereas Caucasian women did not. These results must be interpreted with caution, because relatively small numbers of women used HRT during the course of the study. Prior research on HRT and strength is inconsistent with some studies finding a protective effect of HRT use on muscle strength and exercise capacity (3, 9, 28, 29) and other clinical trials and cross-sectional studies reporting no effect (5, 8, 26, 30). When the SWAN study was initiated, it was even found that hormone use was significantly associated with substantial physical limitation, as measured with Short Form-36 from the Medical Outcomes Survey (1, 31). Now that significant risks of heart disease, stroke, and breast cancer have been linked to HRT (32–34), its use has declined dramatically, and physicians are no longer recommending HRT for long-term health benefits. As HRT use declines, it is unlikely to impact menopause-related declines in strength or physical function.

To our knowledge, this is the first longitudinal study to document the effects of the natural menopausal transition on changes in physical function in a biracial, population-based sample. We observed declines in grip and pinch strength among women who became postmenopausal over the 3-year follow-up period relative to women who remained premenopausal. Early perimenopausal women also experienced significant declines in pinch strength relative to premenopausal women. It is possible that reduced levels of estrogen or changes in other reproductive hormones are responsible for the decline in strength observed. Continued data collection will further elucidate the effects of menopausal status and hormonal changes on physical function in women.

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