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Sedentary time and breast cancer incidence in African American women

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Abstract

PURPOSE—The objective of this study was to evaluate whether time spent sitting at work or watching television was associated with breast cancer risk among African American women.

METHODS—The Black Women's Health Study (analytic cohort=46,734) is an ongoing prospective cohort study of African American women ages 21–69 at baseline (1995). Questionnaire data was used to estimate sedentary time. Total time spent sitting at work and watching television (individually and combined) at baseline and updated through follow-up (1995–2001) and breast cancer incidence (N=2,041 incident cases, 1995–2013) was evaluated using proportional hazards regression.

RESULTS—Higher total time spent sitting at baseline (10 versus <5 hours/day HR=1.27, 95% CI: 1.06, 1.53) and updated through follow-up (10 versus <5 hours/day HR=1.38, 95% CI: 1.14, 1.66) was associated with an increased breast cancer risk. Associations were stronger for hormone receptor negative tumors (10 versus <5 hours/day HR=1.70, 95% CI: 1.12, 2.55) compared to hormone receptor positive tumors (10 versus <5 hours/day HR=1.16, 95% CI: 0.88, 1.52), but tests for heterogeneity were not statistically significant (p-heterogeneity=0.31). Positive associations between total time spent sitting and breast cancer incidence did not differ by physical activity level or body composition measurements.

CONCLUSIONS—Our findings suggest that high sedentary time may increase risk for breast cancer among African American women.

Keywords

Breast Cancer; Physical Activity; African American; Sedentary Time

INTRODUCTION

Breast cancer is the most common cancer type in African American women. While rates are higher among Caucasian American women, incidence rates among African American women are increasingly similar to those observed among Caucasian American women [1,2]. Additionally, African American women are more likely to be diagnosed prior to menopause and are more likely to be diagnosed with less treatable hormone receptor negative subtypes contributing to higher mortality rates than any other racial/ethnic group [1,3]. Lifestyle behaviors, such as sedentary time, may contribute to differences in breast cancer incidence, but have not been well studied among African American women [4,5].

Sedentary activities, defined as physically inactive tasks that require little to no additional energy expenditure beyond basal metabolic rate, accounts for a large proportion of time per day in the United States [6]. Among U.S. adults (ages 49–99 years) sedentary behavior accounted for 75–90% of participants' accelerometer wear time, even among the younger study participants [7]. Regardless of race/ethnicity, time spent sitting is high [8]; however, research suggests that sedentary behavior may be more prevalent among African Americans women [7], particularly time spent watching TV [8].

Sedentary time may contribute to breast cancer risk independently of physical activity [9]. A recently published review and meta-analysis observed a small (~8% increase), but statistically significant, association between sedentary time and breast cancer [10]. Most studies in this review evaluated either occupational sitting or time spent watching television and not combined sedentary activities. Studies that evaluated combined sitting time tended to be more likely to observe an association. Total sedentary time has also been shown to be associated with breast cancer-related biomarkers, including fasting insulin, homeostasis model assessment of insulin resistance and C-reactive protein [11,12]. Sedentary time may also be associated with obesity and weight gain, which could contribute to breast cancer risk, though results from previous studies have been inconsistent [13–16]. Additionally, many lifestyle factors appear to be differentially associated with specific breast cancer hormone receptor subtypes. Few studies have evaluated whether associations between sedentary behavior and breast cancer differ by hormone receptor subtype. Evaluating combined breast cancer subtypes could obscure associations for less common subtypes.

A previous analysis in the Black Women's Health Study (BWHS) observed an inverse association between physical activity levels and breast cancer risk [17]. There is very limited data on sedentary time and breast cancer risk in African American women, which given the prevalence of sedentary behavior could be an important risk factor for breast cancer in African American women. Therefore, we investigated the association between sedentary time and breast cancer incidence overall and by hormone receptor subtypes in the BWHS.

METHODS

Study population

The Black Women's Health Study is an ongoing prospective cohort study of 59,000 African American women who were 21–69 years of age and completed the mailed health

questionnaires at baseline (1995) [18]. Women were largely recruited among subscribers to Essence magazine. A small number were additionally recruited from several professional organizations or were friends or relatives of early respondents. Participants were followed via mailed questionnaires every two years after baseline. Deaths were identified by reports from family members, U.S. Postal Service and via the National Death Index. Follow-up of the baseline cohort is complete for 87% of potential years of follow-up through 2013. The study was approved by the Institutional Review Board of Boston University Medical Center and informed consent was obtained from all study participants.

Women who reported a previous history of cancer (excluding non-melanoma skin cancer) (n=1,262, including 732 breast cancer cases), who were pregnant at baseline (n=1,006), or who reported implausible energy intake (<600 kilocalories (kcal) or >3,800 kcal) (standard cut-points used in BWHS) or left more than 10 food frequency questionnaire (FFQ) items blank (n=7,640) were excluded. Women missing baseline sedentary time data were additionally excluded (n=2,635) for a final analytic cohort of 46,734.

Data collection

Demographics, medical and reproductive history, and lifestyle habit data were collected at baseline using self-reported questionnaires. Follow-up questionnaires were administered every other year following baseline. Data on physical activity level, time spent sitting, waist circumference, hip circumference, weight at age 18 and current weight were collected on the baseline questionnaire. Data on physical activity level (1997, 1999, 2001, 2007, 2009), time spent sitting (1997, 1999, 2001) and current weight (all follow-up questionnaires) were additionally collected on follow-up questionnaires. To assess sedentary time, participants were asked “On average, during the past year, how many hours each day did you spend: (1) watching TV, (2) sitting at work” (Response options: None, less than 1 hour, 1–2 hours, 3–4 hours, 5 or more hours). In 1997, it was modified to watching TV or videos, and in 1999 and 2001, it was modified to, “watching TV, videos, home computer”. For simplicity and consistency with baseline data this variable is referred to as “watching TV”. Time spent watching TV and sitting at work responses were coded as follows: None=0 hours, <1 hour=0.5 hours, 1–2 hours=1.5 hours, 3–4 hours=3.5 hours, 5 or more = 5 hours, which were then summed to estimate typical number of combined hours per day spent sitting. Physical activity levels were calculated from recreational time (hours/week) spent engaged in vigorous activity and walking for exercise. Objectively measured activity levels were associated with self-reported physical activity levels in a validation study among a subset of study participants [19]. Sedentary behavior questions were not specifically addressed in the physical activity validation report, but systematic reviews of sedentary time validation studies suggest the reliability and validity of self-reported sedentary time is similar to that of self-reported physical activity [20,21]. Height (1995) and current weight were used to calculate body mass index (BMI) (kilograms/meter²) (kg/m²). Adult weight change was calculated by subtracting weight at age 18 from current weight. Self-reported weight and height were previously shown to be highly correlated with technician measurements in a BWHS validation study [19].

Data on covariates (age, education, caloric intake, parity, age at menarche, menopausal hormone usage, oral contraceptive usage, mammography usage, family history of breast cancer and smoking status) were also collected by questionnaire. Menopausal status was defined by presence/absence of menstruation and age. Women who reported their periods had ceased due to natural causes, had both ovaries removed or had a hysterectomy but retained one or both ovaries and were older than 56 years were classified as postmenopausal. Premenopausal status was defined as ongoing menstrual cycles or a hysterectomy with retention of one or both ovaries among women less than 43 years of age. Dietary data was collected via a modified version of the Block FFQ (administered in 1995 and 2001) and caloric intake (kcal/day) were calculated using the National Cancer Institute's DietCalc software [22]

Case ascertainment

Primary breast cancer cases (n= 2,041) from baseline (1995) through 2013 (ICD-9 code 174/ ICD-10 code C50) were ascertained through self-report on the follow-up questionnaires and through linkage with 24 cancers registries in states in which 95% of participants lived. Hospital or registry pathology data were obtained for >85% of cases, among which 99.4% were confirmed. Unless a self-reported case was found to be incorrectly reported, all self-reported cases were included. Among breast cancer cases with immunohistochemistry reports there were 1,007 cases positive for hormone receptors (HR+) estrogen receptor (ER +) or progesterone receptor (PR+), 433 negative for both ER (ER-) and PR (PR-) (HR-), and 173 women diagnosed with triple negative breast cancer (ER-/PR-/HER2-).

Statistical analysis

Differences in time spent sitting by demographic, body composition, medical and reproductive history and lifestyle habits were evaluated using Wald χ^2 tests. Proportional hazards regression was used calculate hazard ratios (HR) and 95% confidence intervals (95% CI) for associations between time spent sitting at work (hours/day), time spent sitting watching television (hours/day), and total time spent sitting (sum of time spent sitting at work and watching television) and breast cancer incidence. Participants contributed person-time from baseline until the occurrence of breast cancer, loss to follow-up, death, or the end of follow-up in 2013. Average follow-up time between 1995 through 2013 was 15.4 years.

Time spent sitting at work and watching television were evaluated as four-level categorical variables (<1, 1–2, 3–4, or 5 hours/day). Combined time spent sitting was also evaluated as a four-level variable (<5, 5–<7, 7–<10, or 10 hours/day). To assess trend, total time spent sitting was additionally evaluated as a continuous variable. Analyses were conducted using baseline questionnaire data only and updated using follow-up questionnaire data to account for changes in behavior over time. The Andersen-Gill data structure was used to update the score variables and covariates at each time point where new data was available [23]. To evaluate differences by hormone receptor subtypes, all models were additionally run with breast cancer subtypes as the outcome (subtypes evaluated: HR+, HR- or triple negative). All analyses were repeated stratified by menopausal status.

Covariates in the adjusted model were chosen *a priori* based on factors known or suspected to be associated with breast cancer risk and with sedentary behavior. All adjusted models included age (continuous), geographic region of residence (Northeast, South, Midwest, West), daily caloric intake (continuous), smoking (never, former, <15 cigarettes/day, 15 cigarettes/day), BMI (<25, 25–<30, 30–<35, 35 kg/m²), physical activity level (high: 3–4 hours/week vigorous activity or 5–6 hours/week walking for exercise, moderate: 1–2 hours/week vigorous exercise or 1–4 hours/week walking for exercise, low: <1 hour/week vigorous exercise or walking for exercise), family history of breast cancer (yes/no), education (12, 13–15, 16 years), menopausal status (premenopausal, postmenopausal), duration of postmenopausal female hormone supplement use (none, <5 years, 5 years), duration of oral contraceptive use (never, <5 years, 5 years), mammography usage (ever, never) and parity (none, 1–2, 3). Categorical variables were modeled as indicator variables. Participants with missing data on covariates were included as a missing data indicator variable. BMI was included as a covariate due to the relationship between sedentary time and body composition; however, body composition was not associated with breast cancer risk in a previous analysis in the BWHS [24]. Alcohol intake in this study population is low (>94% consumed an average of <7 drinks/week) and was not associated with breast cancer incidence or time spent sitting; therefore, it was not included as a covariate.

To evaluate whether the associations between time spent sitting and breast cancer differed by measures of body composition or physical activity level, analyses were additionally repeated stratified by total physical activity level (low, moderate, high), vigorous physical activity (<1, 1–<3, 3 hours/week), walking for exercise (<2, 2–<5, 5 hours/week), current BMI (<25, 25–<30, 30 kg/m²), BMI at 18 years (<20, 20–<25, 25 kg/m²), adult weight gain (<10 kg, 10–19 kg, 20 kg), waist-to-hip ratio (WHR) (<0.75, 0.75–<0.85, 0.85), and waist circumference (<80, 80–88, >88 centimeters (cm)). Body measurement cut-points were chosen *a priori* based on previously reported health standards, when possible. BMI cut-points were based on standard BMI cut-points for adults [25]. WHR and waist circumference categories were based on cut-points set for risk of metabolic complications defined by the World Health Organization [26]. BMI at 18 years was based on previous work in the BWHS [24]. Tests for interaction by menopausal status (premenopausal vs. postmenopausal), body measurements and physical activity levels were evaluated using likelihood ratio tests. Additionally, total sitting time combined with physical activity levels and body measurements and breast cancer incidence were evaluated in relation to breast cancer incidence to assess the joint effects. Test for heterogeneity by breast cancer subtype were conducted using the Lunn and McNeil method adapted by Wang *et al* for assessing disease heterogeneity by subtype [27,28]. Heterogeneity was assessed comparing HR+ to HR– and comparing HR+ vs. HR–/HER2+ vs. triple negative. Results did not differ by approach. Presented p-values are from the assessment of all three subtypes.

Sensitivity analyses were completed excluding participants diagnosed with breast cancer within 4 years of baseline. Results did not differ; therefore, analyses including cases diagnosed since baseline are presented. Two-sided P-values are reported. Analyses were conducted using SAS 9.3 (SAS Institute, Inc.).

RESULTS

Baseline characteristics by level of sedentary time are presented on Table 1. Age, education, current BMI, BMI at 18, adult weight gain, WHR, waist circumference, physical activity level, caloric intake, age at menarche, parity and mammogram usage were associated with time spent sitting ($P<0.001$). Among women who completed both the baseline and 2001 follow-up questionnaire 43.0% reported the same amount of combined sedentary time on both, 19.7% reported less sitting time and 37.3% reported more sitting time. Approximately half of the women reported sitting similar amounts at work (49.4%) in 2001 compared to 1995, while 30.2% reported more and 20.5% less time sitting at work. Changes in reported time spent watching TV were similar with 46.5% reporting no change, 19.6% less time and 33.9% more time watching TV.

Total time spent sitting was statistically significantly associated with higher breast cancer incidence overall in both the baseline models (1995 only) (10 vs. <5 hours/day HR=1.27, 95% CI: 1.06, 1.53) and models updated through follow-up (1995–2001) (10 vs. <5 hours/day HR=1.41, 95% CI: 1.16, 1.71) (Table 2). Total sitting time evaluated as a continuous variable was also associated with an increased risk for breast cancer (baseline model p-trend=0.01, time-varying model p-trend<0.001). When stratified by menopausal status, total time spent sitting was associated with breast cancer risk in premenopausal women in the models updated through follow-up only (10 vs. <5 hours/day HR=1.47, 95% CI: 1.09, 1.99). Among postmenopausal women, total time spent sitting was associated with breast cancer incidence in the baseline model (10 vs. <5 hours/day HR=1.36, 95% CI: 1.06, 1.76), but the association was no longer statistically significant in follow-up data models (10 vs. <5 hours/day HR=1.25, 95% CI: 0.95, 1.64). Evaluated separately, time spent sitting at work reported at baseline was modestly associated with breast cancer risk overall (5 vs. <1 hours/day HR=1.15, 95% CI: 1.01, 1.30), but not time spent watching television. In models incorporating follow-up data, neither time spent sitting at work or time spent sitting watching television were associated with breast cancer risk. Time spent sitting and work and watching television were not associated with breast cancer stratified by menopausal status. Tests for interaction between sedentary time and menopausal status were not statistically significant in baseline or follow-up models ($p>0.05$).

Total time spent sitting, when updated through follow-up, was positively associated with HR – (HR=1.70, 95% CI: 1.13, 2.55) and triple negative (HR=1.91, 95% CI: 1.04, 3.49) breast cancer tumors, but not associated with HR+ tumors (Table 3) (p-heterogeneity=0.31). Results were similar in models using baseline data only (Supplementary Table 1). Time spent sitting at work (p-heterogeneity=0.10) and watching television (p-heterogeneity=0.81) were not associated with specific breast cancer subtypes when evaluated separately in either baseline or follow-up models. Numbers of cases by subtypes were small when stratified by menopausal status, but results were suggestive of a positive association between total sitting time updated through follow-up and premenopausal ER–/PR– breast cancer (10 vs. <5 hours/day HR=2.10, 95% CI: 1.12, 3.91) (Table 4). Among postmenopausal women, time spent sitting was not associated with breast cancer risk, regardless of tumor type.

Physical activity levels overall were low in this study population particularly among women reporting sitting more than 10 hours, so results stratified by physical activity level should be interpreted with caution (Table 5). In general, sitting 10 or more hours per day was associated with breast cancer incidence regardless of physical activity level. Tests for interaction between time spent sitting and combined physical activity level ($P=0.27$) or time spent walking for exercise ($P=0.43$) were not statistically significant. Tests for interaction between total sitting time and vigorous activity was statistically significant ($p=0.04$), but few women who reported 10 or more hours of sitting time also reported regular vigorous exercise. In the joint effects analysis, there was no clear pattern across levels of total physical activity, vigorous exercise or walking for exercise (Supplementary Table 2). Sitting 10 or more hours/day in combination with either high physical activity (HR=1.70, 95% CI: 1.07, 2.70) or low physical activity levels (HR=1.66, 95% CI: 1.17, 2.36) was similarly associated with breast cancer incidence.

Associations between sitting time and breast cancer risk did not differ by current BMI (P -interaction=0.22), BMI at 18 (P -interaction=0.28), adult weight gain (P -interaction=0.26), WHR (P -interaction=0.65) and waist circumference (P -interaction=0.37) (Table 6). While associations were not always statistically significant for each individual stratum, hazard ratios for time spent sitting and breast cancer incidence stratified by body weight measurements were always positive and highest in among the women who sat 10 or more hours/day. In the joint effects analysis, breast cancer incidence typically increased across total time spent sitting categories, but there was not trend across body composition categories (Supplementary Table 3).

DISCUSSION

In this first evaluation of sedentary time and breast cancer incidence in a large population of African American women, combined time sitting at work and watching television was positively associated with breast cancer incidence. Associations were stronger in the analyses updated through follow-up and for hormone receptor negative tumor subtypes. Associations between sedentary time and breast cancer incidence did not differ by recreational physical activity time and body measurements.

Results from our study are in agreement with a recent meta-analysis that showed sedentary time to be associated with breast cancer, although associations in the present analysis were stronger than those observed in the meta-analysis. This may be due to evaluating combined time spent sitting at work and watching television as most prior studies evaluated either only occupational sitting or only television time [29,10]. Among the proposed possible biological mechanisms include adiposity-mediated pathways, the IGF-insulin pathway and inflammation-related pathways [9]. Associations between sedentary time and metabolic dysfunction [30,31,12,9] and inflammation-associated biomarkers [9,11] provide further support for these potential mechanisms.

Estrogen receptor negative tumors are disproportionately diagnosed in African American women [1,3]. In the present study, time spent sitting was most strongly associated with HR- and triple negative tumors, however, tests for heterogeneity were not statistically significant.

To our knowledge, few previous studies have investigated the relationship of sedentary behavior and breast cancer by tumor subtypes. A large prospective cohort previously evaluated leisure time sitting and breast cancer incidence by estrogen receptor status [32]. The p-value for test for heterogeneity was 0.08, but no effect estimates were reported in the article. This study also evaluated leisure time sitting only, and in the present study it was only combined total sedentary time that was associated with breast cancer subtypes. A previous case-control study observed an association between sitting time and hormone receptor positive subtypes, however, numbers when stratified by subtype were very small, particularly for hormone receptor negative tumors [33]. Further research is needed, but sedentary behavior may represent an important target for reducing the burden of less treatable hormone receptor negative tumors [3], particularly given the prevalence of sedentary behavior among African Americans in the United States [7,8].

Increasing recreational physical activity levels is often targeted to compensate for the increased time spent engaged in sedentary activities and counteract the prevalence of obesity [34,35]. In our study, the associations of combined time spent sitting and breast cancer incidence was remained even among women who engaged in regular physical activity. This result is consistent with previous research indicating the impact of sedentary behavior on health may not be due only to the absence of regular recreational physical activity [36–38]. This presents a unique public health challenge to understand the underlying mechanisms and how best to intervene to reduce the health burden of sedentary time.

Body weight and sedentary time are related, but it remains unclear whether the impact of sedentary behavior and obesity independently influence breast cancer risk. Results from some studies suggest that sedentary behavior may influence breast cancer both via adiposity-related pathways and through other mechanisms [11,12]. In the present study population, women who spent more time sitting were somewhat more likely to be overweight or obese, however, body composition measurements were generally not associated with breast cancer risk in a previous BWHS analysis [24]. Time spent sitting was generally positively associated, albeit not always statistically significantly, with breast cancer risk across measures of body size. The relationship between obesity and sedentary behavior may be less strong among African American women compared to Caucasian American women [39], and may indicate additional or alternative mechanisms by which sedentary behavior impacts health.

This is the first study to report on sedentary behavior and breast cancer risk among African American women. Strengths of the study include the prospective collection of data and the high follow-up rate. This study also has a large number of cases, which enabled the assessment of both premenopausal and postmenopausal breast cancer, and assessment of breast cancer subtypes. Additionally, data collected at multiple time points allowed for an analytic approach the updates data through follow-up to account for changes in behaviors over time.

Data was collected using self-reported questionnaires, which are subject to measurement error. A previous validation study in the BWHS indicated that self-reported data collected on physical activity and body measurements is sufficiently well reported for use in

epidemiologic studies [19]. Future studies with objectively measured sedentary time are needed to further explore this association. Sedentary time in this study includes only time spent sitting at work and watching television, so it may underestimate total sedentary time. Due to the increasing use of computer at later time points, watching computers (and videos) was added to the watching TV question on the 1999 and 2001 follow-up questionnaires. The inclusion of additional activities not on the baseline questionnaire could result in higher reported sedentary time on later questionnaires, however, results were generally consistent, between baseline data and time-varying models. A little over a third of participants reported higher combined sedentary time, but the increased time could be attributed to either increasing time sitting at work (30.2% reported increase) or watching TV (33.9% reported increase). There was also insufficient data on unemployment and retirement status for study participants, which could result in misclassification of sitting time for these participants. Among women who completed the 2001, 4,040 (10.5%) women reported having no job when asked about time spent walking at work. Breast cancer subtype information was not available for all breast cancer cases, which resulted in smaller numbers of cases available for this analysis, limiting our ability to detect associations.

Breast cancer disparities by race/ethnicity in the United States are well established [40,41] and differences in health behaviors may contribute to disparities. Increased time spent engaged in sedentary activities was associated with breast cancer risk and associations were strongest for hormone receptor negative tumors, which disproportionately impact African American women [1,3]. Previously reported frequent sedentary behavior among African Americans could contribute to breast cancer disparities and should be explored further in future studies.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations used

BWHS	Black Women's Health Study
BMI	Body mass index
cm	Centimeters
CI	Confidence intervals
ER–	Estrogen receptor negative

ER+	Estrogen receptor positive
FFQ	Food frequency questionnaire
HR	Hazard ratio
HR–	Hormone receptor negative
HR+	Hormone receptor positive
HER2–	Human epidermal growth factor 2 negative
kcal	kilocalories
kg	kilograms
m	meters
PR–	Progesterone receptor negative
PR+	Progesterone receptor positive
TV	Television
WHR	Waist-to-hip ratio

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Table 1

Baseline Characteristics by Level of Sedentary Time in the Black Women's Health Study

	Time Spent Sitting			P-value ^a
	<5 hours/day N (%)	5–9 hours/day N (%)	10 hours/day N (%)	
Cohort	10,924 (23.4)	32,098 (68.7)	3,712 (7.9)	---
Age (years)				<0.001
<30	2,187 (20.8)	7,384 (70.2)	942 (9.0)	
30–39	3,364 (21.1)	11,301 (70.8)	1,299 (8.1)	
40–49	2,981 (22.7)	9,104 (69.4)	1,028 (7.8)	
50–59	1,544 (29.0)	3,431 (64.4)	353 (6.6)	
60	848 (46.7)	878 (48.3)	90 (5.0)	
Education (years)				<0.001
12	2,303 (28.6)	4,897 (60.8)	859 (10.7)	
13–15	3,529 (20.9)	11,768 (69.8)	1,565 (9.3)	
16	5,071 (23.3)	15,387 (70.8)	1,276 (5.9)	
Current BMI (kg/m ²)				<0.001
<25	4,248 (23.7)	12,492 (69.8)	1,167 (6.5)	
25–29	3,502 (24.0)	9,879 (67.8)	1,184 (8.1)	
30–34	1,814 (24.9)	5,139 (67.7)	644 (8.5)	
35	1,261 (20.2)	4,308 (69.0)	678 (10.9)	
BMI at 18 years (kg/m ²)				<0.001
<20	4,533 (24.2)	12,795 (68.4)	1,388 (7.4)	
20–24	4,817 (23.1)	14,419 (69.2)	1,596 (7.7)	
25–29	1,043 (23.2)	3,170 (67.9)	453 (9.7)	
30	393 (20.2)	1,334 (68.7)	216 (11.1)	
Adult weight gain (kg)				<0.001
<10	3,691 (24.0)	10,624 (69.2)	1,048 (6.8)	
10–19	3,155 (23.0)	9,518 (69.5)	1,030 (7.5)	
20–25	1,398 (23.2)	4,082 (67.7)	547 (9.1)	
25	2,538 (22.9)	7,490 (67.7)	1,034 (9.4)	
Waist-Hip Ratio				<0.001
<0.70	1,074 (23.5)	3,206 (70.0)	298 (6.5)	
0.70–0.77	2,875 (23.8)	8,401 (69.6)	799 (6.6)	
0.78–0.85	2,164 (22.8)	6,579 (69.4)	738 (7.8)	
0.86	1,667 (24.5)	4,416 (64.9)	719 (10.6)	
Waist Circumference (cm)				<0.001
<71	2,446 (23.7)	7,197 (69.9)	660 (6.4)	
72–79	1,659 (23.8)	4,843 (69.5)	471 (6.8)	
80–87	1,799 (24.0)	5,092 (67.8)	619 (8.2)	
88	2,081 (22.9)	6,096 (67.2)	897 (9.9)	
Physical Activity ^b				<0.001

	Time Spent Sitting			P-value ^a
	<5 hours/day N (%)	5–9 hours/day N (%)	10 hours/day N (%)	
Low	4,188 (23.2)	12,296 (68.1)	1,564 (8.7)	
Moderate	2,704 (23.6)	8,023 (69.9)	747 (6.5)	
High	3,469 (22.8)	10,524 (69.1)	1,249 (8.2)	
Caloric intake (kcal)				<0.001
Quartile 1	2,778 (23.7)	8,189 (69.8)	763 (6.5)	
Quartile 2	2,804 (24.0)	8,057 (69.0)	815 (7.0)	
Quartile 3	2,692 (23.1)	8,056 (69.0)	931 (8.0)	
Quartile 4	2,650 (22.8)	7,796 (66.9)	1,202 (10.3)	
Age at menarche				<0.001
11 years	3,011 (22.5)	9,330 (69.7)	1,048 (7.8)	
12–13 years	6,787 (23.4)	19,906 (68.7)	2,284 (7.9)	
14 years	1,079 (25.8)	2,748 (65.5)	360 (8.6)	
Parity				<0.001
Nulliparous	3,175 (19.0)	12,010 (71.9)	1,523 (9.1)	
1–2 children	5,008 (23.9)	14,399 (68.7)	1,554 (7.4)	
3 children	2,688 (30.4)	5,534 (62.6)	618 (7.0)	
Family History				0.80
Yes	835 (23.8)	2,397 (68.4)	274 (7.8)	
No	10,089 (23.3)	29,701 (68.7)	3,438 (8.0)	
Mammogram				<0.001
Yes	6,544 (24.9)	17,805 (67.6)	1,986 (7.5)	
No	4,245 (21.3)	13,973 (70.2)	1,685 (8.5)	

Abbreviations: BMI, body mass index; cm, centimeters; kcal, kilocalories; kg, kilograms; m, meters.

^aWald chi-square test

^bLow=<1 hour vigorous activity per week and/or <2 hours walking for exercise per week; Moderate=1–<3 hours vigorous activity per week and/or 2–<5 hours walking for exercise per week; High= 3 hours vigorous activity per week and/or 5 hours walking for exercise per week.

Sedentary Time and Pre- and Postmenopausal Breast Cancer Incidence (1995–2013)

Table 2

	Sedentary Time at Baseline (1995 only)				Sedentary Time through Follow-up (1995–2001)			
	Cases/Person-years	Age-adjusted ^a HR (95% CI)	P-trend	Adjusted ^b HR (95% CI)	P-trend	Cases/Person-years	Age-adjusted ^a HR (95% CI)	Adjusted ^b HR (95% CI)
Overall								
Total sitting time								
<5 hours/day	461/166,531	Reference	0.01	Reference	0.01	369/139,501	Reference	Reference
5–<7 hours/day	834/305,578	1.09 (0.97, 1.22)		1.08 (0.96, 1.21)		749/278,659	1.13 (1.00, 1.28)	1.14 (0.99, 1.33)
7–<10 hours/day	522/191,517	1.12 (0.99, 1.27)		1.11 (0.98, 1.26)		635/223,167	1.16 (1.02, 1.32)	1.21 (1.04, 1.42)
10 hours/day	167/55,650	1.27 (1.06, 1.51)		1.27 (1.06, 1.53)		228/76,835	1.20 (1.01, 1.41)	1.41 (1.16, 1.71)
Sitting at work								
<1 hour/day	352/129,404	Reference	0.01	Reference	0.03	69/49,702	Reference	Reference
1–2 hours/day	229/83,932	1.06 (0.90, 1.26)		1.05 (0.89, 1.25)		93/52,258	1.02 (0.86, 1.22)	1.01 (0.82, 1.24)
3–4 hours/day	381/129,299	1.21 (1.05, 1.40)		1.19 (1.03, 1.38)		163/84,720	1.10 (0.94, 1.28)	1.10 (0.91, 1.32)
5 hours/day	1,022/376,641	1.17 (1.03, 1.32)		1.15 (1.01, 1.30)		426/233,410	1.11 (0.97, 1.28)	1.16 (0.91, 1.37)
Watching TV ^c								
<1 hour/day	237/83,582	Reference	0.70	Reference	0.53	156/29,348	Reference	Reference
1–2 hours/day	767/280,894	0.95 (0.82, 1.10)		0.95 (0.82, 1.10)		669/130,210	0.90 (0.75, 1.07)	0.89 (0.73, 1.09)
3–4 hours/day	692/253,267	0.97 (0.83, 1.13)		0.97 (0.83, 1.13)		774/137,962	0.94 (0.79, 1.12)	0.96 (0.79, 1.17)
5 hours/day	288/101,533	1.02 (0.86, 1.20)		1.04 (0.87, 1.24)		385/62,864	1.01 (0.84, 1.22)	1.11 (0.89, 1.38)
Premenopausal^d								
Total sitting time								
<5 hours/day	156/89,005	Reference	0.69	Reference	0.43	121/75,758	Reference	Reference
5–<7 hours/day	328/181,203	1.03 (0.85, 1.25)		1.01 (0.83, 1.22)		301/169,883	1.12 (0.90, 1.38)	1.11 (0.88, 1.39)
7–<10 hours/day	210/115,939	1.07 (0.87, 1.32)		1.08 (0.87, 1.33)		239/130,332	1.17 (0.94, 1.46)	1.18 (0.92, 1.50)
10 hours/day	58/34,418	1.01 (0.75, 1.36)		1.08 (0.80, 1.46)		90/43,904	1.32 (1.00, 1.73)	1.54 (1.13, 2.08)
Sitting at work								
<1 hour/day	98/66,903	Reference	0.12	Reference	0.26	69/49,702	Reference	Reference
1–2 hours/day	83/46,339	1.21 (0.84, 1.50)		1.06 (0.79, 1.43)		93/52,258	1.18 (0.86, 1.61)	1.18 (0.83, 1.68)
3–4 hours/day	146/76,618	1.22 (0.94, 1.57)		1.14 (0.88, 1.48)		163/84,720	1.28 (0.96, 1.69)	1.32 (0.96, 1.81)

	Sedentary Time at Baseline (1995 only)				Sedentary Time through Follow-up (1995–2001)				
	Cases/Person-years	Age-adjusted ^a HR (95% CI)	P-trend	Adjusted ^b HR (95% CI)	P-trend	Cases/Person-years	Age-adjusted ^a HR (95% CI)	Adjusted ^b HR (95% CI)	P-trend
5 hours/day	425/230,706	1.19 (0.96, 1.49)	0.09	1.14 (0.91, 1.42)	0.41	426/233,410	1.28 (0.99, 1.65)	1.31 (0.98, 1.75)	0.99
Watching TV ^c									
<1 hour/day	110/50,001	Reference		Reference		83/38,642	Reference	Reference	
1–2 hours/day	301/163,302	0.86 (0.69, 1.07)		0.87 (0.69, 1.08)		265/156,802	0.77 (0.60, 0.99)	0.80 (0.61, 1.05)	
3–4 hours/day	251/148,155	0.83 (0.66, 1.04)		0.87 (0.69, 1.09)		276/155,993	0.83 (0.65, 1.07)	0.84 (0.65, 1.12)	
5 hours/day	90/59,108	0.78 (0.60, 1.03)		0.87 (0.65, 1.16)		128/68,915	0.88 (0.66, 1.16)	1.03 (0.76, 1.41)	
Postmenopausal ^d									
Total sitting time			0.01		0.04				0.36
<5 hours/day	256/60,142	Reference		Reference		209/48,993	Reference	Reference	
5–<7 hours/day	388/90,349	1.08 (0.92, 1.27)		1.07 (0.92, 1.26)		341/78,292	1.10 (0.93, 1.31)	1.11 (0.90, 1.37)	
7–<10 hours/day	239/54,755	1.13 (0.94, 1.35)		1.09 (0.91, 1.31)		307/68,287	1.12 (0.93, 1.34)	1.20 (0.97, 1.49)	
10 hours/day	82/15,101	1.41 (1.10, 1.82)		1.36 (1.06, 1.76)		106/24,449	1.08 (0.85, 1.37)	1.25 (0.95, 1.64)	
Sitting at work			0.13		0.18				0.16
<1 hour/day	214/49,227	Reference		Reference		174/37,687	Reference	Reference	
1–2 hours/day	121/28,421	1.07 (0.85, 1.34)		1.08 (0.86, 1.35)		148/33,383	1.01 (0.81, 1.26)	0.96 (0.73, 1.26)	
3–4 hours/day	181/39,410	1.18 (0.96, 1.44)		1.18 (0.96, 1.45)		223/48,831	1.04 (0.85, 1.28)	0.95 (0.75, 1.22)	
5 hours/day	449/103,289	1.15 (0.97, 1.37)		1.14 (0.96, 1.35)		418/100,206	1.03 (0.86, 1.25)	1.02 (0.81, 1.27)	
Watching TV ^c			0.36		0.65				0.40
<1 hour/day	113/24,731	Reference		Reference		62/14,010	Reference	Reference	
1–2 hours/day	354/85,740	0.89 (0.72, 1.10)		0.87 (0.70, 1.08)		306/73,988	0.90 (0.69, 1.19)	0.83 (0.60, 1.14)	
3–4 hours/day	340/78,146	0.93 (0.75, 1.15)		0.90 (0.72, 1.11)		388/89,483	0.92 (0.70, 1.20)	0.95 (0.69, 1.30)	
5 hours/day	158/31,729	1.06 (0.83, 1.35)		1.01 (0.79, 1.30)		209/42,763	1.03 (0.77, 1.36)	1.10 (0.79, 1.53)	

Abbreviations: CI, confidence interval; HR, hazard ratio; TV, television.

^aCox proportional hazards regression, with values updated using Anderson-Gill method, adjusted for age

^bCox proportional hazards regression, with values updated using Anderson-Gill method, adjusted for: age (continuous), geographic region of residence (Northeast, South, Midwest, West, other), BMI (<25, 25–<30, 30–<35, 35 kg/m²), education (<12, 12–15, 16 years), recreational physical activity (low, moderate, high), caloric intake (continuous), parity (0, 1–2, 3), age at menarche (<11, 11–13, 14), menopausal hormone use (premenopausal, postmenopausal-never, postmenopausal-5 years, postmenopausal-5 years), oral contraceptive use (never, 0.5–5, 5 years), family history of breast cancer (yes/no), mammogram (ever, never), smoking (never, former, current-15 per day, current-15 per day).

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1995-Watching TV only, 1998-Watching TV or videos, 1999 and 2001-Watching TV, videos, home computer.
Likelihood ratio tests for interaction by menopausal status were not statistically significant in baseline or time-varying models ($p > 0.05$).

Sedentary Time and Breast Cancer Incidence by Hormone Receptor Status (1995–2013) in the Black Women's Health Study

Table 3

	ER+ or PR+				ER- and PR-				ER- and PR- and Her2-			
	Cases/Person-years	Adjusted ^a HR (95% CI)	P-trend	Cases/Person-years	Adjusted ^a HR (95% CI)	P-trend	Cases/Person-years	Adjusted ^a HR (95% CI)	P-trend	Cases/Person-years	Adjusted ^a HR (95% CI)	P-trend
Total sitting time ^c			0.17			0.02			0.04			
<5 hours/day	190/136,670	Reference		82/136,521	Reference		30/136,006	Reference				
5–<7 hours/day	371/275,055	1.00 (0.82, 1.23)		162/272,534	1.21 (0.88, 1.68)		59/271,588	1.05 (0.62, 1.78)				
7–<10 hours/day	330/220,587	1.11 (0.90, 1.36)		136/218,531	1.24 (0.88, 1.75)		58/217,899	1.23 (0.72, 2.09)				
10 hours/day	116/76,073	1.16 (0.88, 1.52)		51/75,389	1.70 (1.13, 2.55)		26/75,177	1.91 (1.04, 3.49)				
Sitting at work ^c			0.52			0.62			0.18			
<1 hour/day	129/96,139	Reference		59/95,380	Reference		18/94,945	Reference				
1–2 hours/day	146/94,967	1.05 (0.79, 1.39)		61/94,158	1.03 (0.65, 1.64)		25/93,840	1.31 (0.61, 2.82)				
3–4 hours/day	228/147,606	1.05 (0.81, 1.37)		87/145,966	1.04 (0.68, 1.59)		41/145,572	1.42 (0.70, 2.88)				
5 hours/day	504/371,006	1.08 (0.85, 1.37)		244/367,802	1.39 (0.96, 2.02)		89/366,642	1.55 (0.81, 3.00)				
Watching TV ^{b,c}			0.53			0.20			0.18			
<1 hour/day	69/57,775	Reference		36/57,305	Reference		14/57,111	Reference				
1–2 hours/day	352/256,624	0.92 (0.69, 1.23)		145/254,233	1.09 (0.70, 1.70)		56/253,410	1.42 (0.64, 3.16)				
3–4 hours/day	406/271,850	1.03 (0.78, 1.38)		167/269,414	1.03 (0.66, 1.61)		64/268,501	1.32 (0.59, 2.94)				
5 hours/day	181/123,881	0.99 (0.72, 1.36)		85/122,779	1.38 (0.86, 2.23)		39/122,384	1.89 (0.82, 4.36)				

Abbreviations: CI, confidence interval; ER-, estrogen receptor negative; ER+, estrogen receptor positive; HR, hazard ratio; Her2-, human epidermal growth factor 2 negative; PR-, progesterone receptor negative; PR+, progesterone receptor positive; TV, television.

^aCox proportional hazards regression, with values updated using Anderson-Gill method, adjusted for: age (continuous), geographic region of residence (Northeast, South, Midwest, West, other), BMI (<25, 25–<30, 30–<35, ≥35 kg/m²), education (<12, 12–15, ≥16 years), recreational physical activity (low, moderate, high), caloric intake (continuous), parity (0, 1–2, ≥3), age at menarche (<11, 11–13, ≥14), menopausal hormone use (premenopausal, postmenopausal-never, postmenopausal-≤5 years, postmenopausal-5 years), oral contraceptive use (never, 0.5–5, ≥5 years), family history of breast cancer (yes/no), mammogram (ever, never), smoking (never, former, current-≤15 per day, current-16 per day).

^b1995-Watching TV only, 1998-Watching TV or videos, 1999 and 2001-Watching TV, videos, home computer.

^cTest for heterogeneity by subtype: Total time sitting, p=0.31; Sitting at work, p=0.10; Watching TV, p=0.81.

Table 4

Sedentary Time (1995–2001) and Breast Cancer Incidence (1995–2013) by Hormone Receptor Status Stratified by Menopausal Status

Premenopausal					
ER+ or PR+			ER– and PR–		
	Cases/Person-years	Adjusted ^a HR (95% CI)	P-trend	Cases/Person-years	Adjusted ^a HR (95% CI)
Total sitting time			0.81		
<5 hours/day	61/74,882	Reference		26/74,341	Reference
5–<7 hours/day	150/167,993	0.97 (0.70, 1.35)		68/166,605	1.33 (0.79, 2.22)
7–<10 hours/day	116/128,928	1.00 (0.71, 1.42)		58/127,925	1.35 (0.79, 2.32)
10 hours/day	39/43,509	1.06 (0.66, 1.68)		21/43,237	2.10 (1.12, 3.91)
Sitting at work			0.84		
<1 hour/day	29/49,066	Reference		17/48,852	Reference
1–2 hours/day	55/51,746	1.45 (0.87, 2.41)		19/51,307	0.95 (0.44, 2.07)
3–4 hours/day	78/83,869	1.24 (0.76, 2.00)		37/82,980	1.31 (0.66, 2.59)
5 hours/day	204/230,843	1.23 (0.79, 1.92)		100/229,179	1.46 (0.79, 2.70)
Watching TV ^b			0.55		
<1 hour/day	38/155,063	Reference		14/37,819	Reference
1–2 hours/day	135/155,063	0.81 (0.55, 1.19)		61/153,773	1.38 (0.70, 2.72)
3–4 hours/day	142/154,293	0.90 (0.61, 1.33)		68/153,114	1.30 (0.65, 2.58)
5 hours/day	52/68,256	0.76 (0.47, 1.22)		30/67,866	1.85 (0.89, 3.85)
Postmenopausal					
ER+ or PR+			ER– and PR–		
	Cases/Person-years	Adjusted ^a HR (95% CI)	P-trend	Cases/Person-years	Adjusted ^a HR (95% CI)
Total sitting time			0.32		
<5 hours/day	116/48,256	Reference		42/47,721	Reference
5–<7 hours/day	167/77,074	0.92 (0.69, 1.23)		72/76,313	1.18 (0.74, 1.90)

Prenopausal						
	ER+ or PR+			ER- and PR-		
	Cases/Person-years	Adjusted ^a HR (95% CI)	P-trend	Cases/Person-years	Adjusted ^a HR (95% CI)	P-trend
7<10 hours/day	169/67,520	1.10 (0.83, 1.46)	0.58	63/66,669	1.30 (0.80, 2.12)	0.26
10 hours/day	62/24,216	1.11 (0.77, 1.60)		19/23,878	1.27 (0.67, 2.40)	
Sitting at work						
<1 hour/day	92/37,017	Reference		29/36,545	Reference	
1-2 hours/day	77/32,911	0.85 (0.59, 1.23)		35/32,619	1.18 (0.63, 2.21)	
3-4 hours/day	121/48,197	0.91 (0.65, 1.27)	0.14	44/47,678	0.92 (0.50, 1.70)	0.57
5 hours/day	224/99,035	0.88 (0.65, 1.20)		88/97,835	1.33 (0.78, 2.26)	
Watching TV ^b						
<1 hour/day	38/38,170	Reference		17/13,707	Reference	
1-2 hours/day	135/155,063	0.92 (0.57, 1.48)		63/72,193	0.78 (0.41, 1.49)	
3-4 hours/day	142/154,293	1.10 (0.69, 1.75)		79/87,329	0.87 (0.46, 1.65)	
5 hours/day	52/68,256	1.15 (0.70, 1.89)		39/41,574	1.00 (0.50, 2.01)	

Abbreviations: CI, confidence interval; ER-, estrogen receptor negative; ER+, estrogen receptor positive; HR, hazard ratio; PR-, progesterone receptor negative; PR+, progesterone receptor positive; TV, television.

^aCox proportional hazards regression, with values updated using Anderson-Gill method, adjusted for: age (continuous), geographic region of residence (Northeast, South, Midwest, West, other), BMI (<25, 25-<30, 30-<35, ≥35 kg/m²), education (<12, 12-15, ≥16 years), recreational physical activity (low, moderate, high), caloric intake (continuous), parity (0, 1-2, ≥3), age at menarche (<11, 11-12, ≥13, ≥14), menopausal hormone use (premenopausal, postmenopausal-never, postmenopausal-<5 years, postmenopausal-≥5 years), oral contraceptive use (never, 0.5-5 years), family history of breast cancer (yes/no), mammogram (ever, never), smoking (never, former, current-<15 per day, current-≥15 per day).

^b1995-Watching TV only, 1998-Watching TV or videos, 1999 and 2001-Watching TV, videos, home computer.

Table 5

Total sitting time	Cases/Person-years	Adjusted HR (95% CI) ^a	Cases/Person-years	Adjusted HR (95% CI) ^a	Cases/Person-years	Adjusted HR (95% CI) ^b	P _{int} ^c
		Low Physical Activity^a		Moderate Physical Activity^a		High Physical Activity^a	
<5 hours/day	202/74,132	Reference	99/36,629	Reference	62/26,951	Reference	0.27
5–7 hours/day	442/150,425	1.20 (0.98, 1.46)	207/75,219	1.12 (0.85, 1.48)	96/50,423	1.03 (0.70, 1.51)	
7–<10 hours/day	394/129,301	1.28 (1.04, 1.57)	146/56,783	1.06 (0.79, 1.43)	94/35,412	1.40 (0.94, 2.07)	
10 hours/day	154/46,915	1.51 (1.18, 1.94)	35/16,185	0.97 (0.63, 1.51)	37/13,203	1.66 (1.03, 2.69)	
		P-trend=0.001		P-trend=0.94		P-trend= 0.01	
		Vigorous <1 hour/week		Vigorous 1–<3 hours/week		Vigorous 3 hours/week	
<5 hours/day	246/85,544	Reference	85/33,666	Reference	10/9,767	Reference	0.04
5–<7 hours/day	491/169,841	1.11 (0.93, 1.34)	185/69,859	1.21 (0.90, 1.64)	40/20,339	1.38 (0.85, 2.26)	
7–<10 hours/day	443/144,241	1.22 (1.01, 1.48)	126/52,276	1.06 (0.80, 1.47)	40/13,728	1.87 (1.13, 3.11)	
10 hours/day	182/52,627	1.48 (1.18, 1.86)	30/15,054	1.12 (0.70, 1.77)	10/3,841	1.59 (0.81, 3.11)	
		P-trend=0.004		P-trend=0.95		P-trend=0.03	
		Walking <2 hours/week		Walking 2–<5 hours/week		Walking 5 hours/week	
<5 hours/day	285/110,837	Reference	36/14,081	Reference	45/13,779	Reference	0.43
5–<7 hours/day	630/227,359	1.18 (1.00, 1.39)	70/27,066	1.08 (0.68, 1.71)	47/22,999	0.85 (0.52, 1.41)	
7–<10 hours/day	532/185,718	1.24 (1.05, 1.47)	55/19,752	1.21 (0.75, 1.97)	47/16,913	1.07 (0.63, 1.81)	
10 hours/day	189/62,738	1.43 (1.16, 1.78)	11/5,951	0.79 (0.35, 1.76)	26/7,886	1.83 (1.01, 3.31)	
		P-trend<0.001		P-trend=0.89		P-trend=0.06	

Abbreviations: CI, confidence interval; HR, hazard ratio; P_{int}, P-interaction.

^aLow= ≤ 1 hour vigorous activity per week and/or ≤ 2 hours walking for exercise per week; High= ≥ 3 hours vigorous activity per week and/or ≥ 5 hours walking for exercise per week.

^bCox proportional hazards regression, with values updated using Anderson-Gill method, adjusted for: age (continuous), geographic region of residence (Northeast, South, Midwest, West, other), BMI (<25, 25–30, 30–35, 35 kg/m²), education (12, 13–15, 16 years), recreational physical activity (low, moderate, high), caloric intake (continuous), parity (0, 1–2, 3), age at menarche (11, 12–13, 14), menopausal hormone use (premenopausal, postmenopausal–never, postmenopausal–<5 years, postmenopausal–5 years), oral contraceptive use (never, 0.5–5, 5 years), family history of breast cancer (yes/no), mammogram (ever, never), smoking (never, former, current–<15 per day, current–15 per day).

Likelihood ratio chi-square test.

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Table 6

Sedentary Time and Breast Cancer Incidence (1995–2013) by Body Composition Measurements

Total sitting time	Cases/Person-years	HR (95% CI) ^a	Cases/Person-years	HR (95% CI) ^a	Current BMI	HR (95% CI) ^a	Current BMI	HR (95% CI) ^a	P _{int} ^b
		Current BMI <25 kg/m ²		Current BMI 25–<30 kg/m ²		Current BMI		30 kg/m ²	
<5 hours/day	113/42,852	Reference	137/48,103	Reference	115/47,658	Reference	Reference	0.22	
5–<7 hours/day	192/84,180	0.99 (0.75, 1.29)	243/91,067	1.12 (0.88, 1.44)	308/101,911	1.31 (1.01, 1.70)			
7–<10 hours/day	131/55,605	0.89 (0.66, 1.20)	217/70,327	1.38 (1.07, 1.78)	286/96,175	1.33 (1.02, 1.73)			
10 hours/day	44/16,829	1.36 (0.93, 1.98)	75/22,831	1.49 (1.07, 2.08)	109/36,866	1.44 (1.06, 1.97)			
		P-trend=0.03		P-trend=0.002		P-trend=0.54			
		BMI at 18 years <20 kg/m ²		BMI at 18 years 20–<25 kg/m ²		BMI at 18 years		25 kg/m ²	
<5 hours/day	181/58,409	Reference	155/61,992	Reference	27/17,310	Reference	Reference	0.28	
5–<7 hours/day	346/113,918	1.18 (0.95, 1.46)	324/125,478	1.09 (0.87, 1.37)	66/36,174	0.94 (0.56, 1.57)			
7–<10 hours/day	278/87,307	1.13 (0.90, 1.41)	291/99,300	1.34 (1.06, 1.69)	63/34,031	0.96 (0.57, 1.63)			
10 hours/day	93/29,302	1.18 (0.88, 1.58)	104/33,407	1.60 (1.20, 2.13)	27/12,294	1.30 (0.70, 2.39)			
		P-trend=0.44		P-trend<0.001		P-trend=0.34			
		Adult weight gain <10 kg		Adult weight gain 10–<20kg		Adult weight gain		20 kg	
<5 hours/day	74/34,943	Reference	103/39,389	Reference	187/63,720	Reference	Reference	0.26	
5–<7 hours/day	119/66,592	0.85 (0.61, 1.18)	213/78,132	1.35 (1.02, 1.79)	405/131,498	1.12 (0.91, 1.38)			
7–<10 hours/day	79/44,267	0.89 (0.61, 1.28)	168/58,618	1.47 (1.10, 1.98)	385/118,239	1.19 (0.97, 1.47)			
10 hours/day	30/14,072	1.21 (0.75, 1.96)	55/18,296	1.85 (1.27, 2.69)	139/43,766	1.27 (0.98, 1.64)			
		P-trend=0.05		P-trend=0.001		P-trend=0.74			
		Waist-Hip Ratio <0.75		Waist-Hip Ratio 0.75–<0.85		Waist-Hip Ratio		0.85	
<5 hours/day	84/34,707	Reference	114/39,491	Reference	69/23,305	Reference	Reference	0.65	
5–<7 hours/day	188/72,748	1.16 (0.86, 1.56)	299/78,679	1.20 (0.91, 1.58)	103/42,160	0.79 (0.55, 1.14)			
7–<10 hours/day	127/51,122	1.01 (0.72, 1.40)	197/65,431	1.24 (0.94, 1.65)	101/37,556	1.00 (0.69, 1.44)			
10 hours/day	43/15,686	1.42 (0.94, 2.16)	70/21,767	1.42 (0.99, 2.03)	45/14,829	1.19 (0.77, 1.85)			
		P-trend=0.28		P-trend=0.06		P-trend=0.37			

Total sitting time	Cases/Person-years	HR	95% CI ^a	Cases/Person-years	HR	95% CI ^a	Cases/Person-years	HR	95% CI ^a	P ^b
	Waist Circumference <80 cm			Waist Circumference 80–88 cm			Waist Circumference >88 cm			
<5 hours/day	123/52,629	Reference		79/23,433	Reference		74/24,024	Reference		0.37
5–<7 hours/day	264/109,666	1.22 (0.94, 1.58)		133/41,285	0.97 (0.70, 1.35)		137/47,466	1.02 (0.72, 1.43)		
7–<10 hours/day	199/78,057	1.30 (0.99, 1.71)		113/36,240	0.88 (0.63, 1.24)		126/44,218	1.01 (0.72, 1.44)		
10 hours/day	68/23,988	1.56 (1.10, 2.23)		37/12,262	1.12 (0.72, 1.74)		60/17,638	1.41 (0.94, 2.10)		
		P-trend=0.15			P-trend=0.96			P-trend=0.01		

Abbreviations: BMI, body mass index; cm, centimeters; CI, confidence interval; HR, hazard ratio; kg, kilograms; m, meters; P_{int}, P-interaction.

^aCox proportional hazards regression, with values updated using Anderson-Gill method, adjusted for: age (continuous), geographic region of residence (Northeast, South, Midwest, West, other), education (12, 13–15, 16 years), recreational physical activity (low, moderate, high), caloric intake (continuous), parity (0, 1–2, 3), age at menarche (11, 12–13, 14), menopausal hormone use (premenopausal, postmenopausal-never, postmenopausal-<5 years, postmenopausal- 5 years), oral contraceptive use (never, 0.5–5, 5 years), family history of breast cancer (yes/no), mammogram (ever, never), smoking (never, former, current-<15 per day, current- 15 per day).

^bLikelihood ratio chi-square test.