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Abuse victimization and risk of breast cancer in the Black Women's Health Study:

Abuse and breast cancer risk in black women

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Abstract

Few studies have examined the relation between abuse victimization and breast cancer, and results have been inconclusive. Using data from 35,728 participants in the Black Women's Health Study, we conducted multivariable Cox regression to estimate incidence rate ratios (IRRs) and 95% confidence intervals (CI) for the association of abuse across the life span (childhood, adolescence, and adulthood) with breast cancer. Incident breast cancer diagnoses were reported during 1995–2009, and abuse histories were reported in 2005. No associations were found between abuse victimization in either childhood or adolescence and breast cancer. We found a weak positive association between abuse in adulthood and breast cancer (IRR = 1.18, 95% CI = 1.03–1.34). IRRs for physical abuse only, sexual abuse only, and both physical and sexual abuse in adulthood, relative to no abuse, were 1.28 (95% CI = 1.09–1.49), 0.96 (95% CI = 0.76–1.20), and 1.22 (95% CI = 1.00–1.49), respectively. IRRs for low, intermediate, and high frequencies of physical abuse in adulthood, relative to no abuse, were 1.28 (95% CI = 1.07–1.52), 1.37 (95% CI = 1.04–1.79), and 1.24 (95% CI = 0.95–1.62), respectively. Our data suggest an increased risk of breast cancer among African-American women who reported physical abuse in adulthood, but there was little evidence of a dose–response relation. These results require confirmation in other studies.

Keywords

Breast cancer; Violence; African-American; Females; Risk factors

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Introduction

Breast cancer is the most common cancer among U.S. women, and breast cancer mortality is higher among black women than white women [1]. While it is well-established that abuse victimization can increase the risk of mental health disorders [2–4], some studies also suggest that abuse victimization can influence reproductive and physical health outcomes [3, 5, 6], including early menarche [7–11], pregnancy outcomes [12, 13], and the timing of the menopausal transition [14, 15]. A history of physical abuse has been associated with an increased risk of overall cancer incidence [16] and mortality [17], but little is known about whether such a history can influence risk of breast cancer in particular. To our knowledge, only two studies have assessed the relation of abuse victimization to breast cancer risk. The first, a cross-sectional study of 826 white women aged ≥50 years within a defined community setting, found that a history of sexual assault was positively associated with breast cancer risk (n = 55 cases; odds ratio [OR] = 2.21, 95% confidence interval [CI] = 1.12–4.33), with those reporting repeated sexual assault having the highest risk of breast cancer (n = 23 cases; OR = 3.94, 95% CI = 1.37–11.33) relative to those without assault histories [18]. The second, a case-series of 101 women with breast, cervical, endometrial, or ovarian cancer, found a higher prevalence of advanced-stage cancer among women with a history of abuse [19]. Individual cancer sites were not examined separately.

In nationally representative studies, African-American women consistently report higher rates of childhood abuse [20, 21] and intimate partner abuse [22–26] than white women. However, racial differences in rates of abuse become less pronounced when socioeconomic factors are accounted for [27, 28]. A mechanism by which abuse victimization could affect breast cancer incidence is through chronic activation of the hypothalamic–pituitary–adrenal (HPA) axis [4, 29, 30], which could influence ovarian function and the biosynthesis of steroid hormones involved in breast cancer etiology [31]. Later age at menopause and earlier age at menarche have been linked with experiences of abuse [7–11, 15], and both have been associated with an increased risk of breast cancer [32, 33].

In addition, psychosocial stress resulting from exposure to abuse could influence breast cancer incidence through adverse effects on immune function [34, 35] and poorer health behaviors in response to stress (e.g., physical inactivity, poor diet, or smoking) [36, 37]. However, current empirical evidence provides little support for an independent association between “stress” from various sources and breast cancer risk: while some studies report positive [38–41] or inverse [42] associations, most studies find no association [43–51]. Of note, few studies have evaluated differences in risk according to “resilience,” the ability to adapt successfully to acute stress. Individuals with greater resilience exhibit different neurobiological, hormonal, and behavioral traits when confronted with acute stress [52] and may be more likely to reduce or eliminate stress-induced HPA activation [53]. In studies of rats exposed to stress, “proactive” coping strategies reduced long-term activation of the HPA axis, decreased corticosteroid secretion, decreased the likelihood of developing mammary tumors, and lengthened life span relative to “reactive” coping strategies [54], similar to what has been shown in highly inbred mouse lines [55]. Thus, individual differences in responses to stressors could have implications for breast cancer biology. Of the four studies that have evaluated the modifying effects of coping or social/emotional support on the association between stress and breast cancer [38, 46, 49, 51], three studies found evidence of effect modification by these factors [38, 49, 51]. Specifically, a recent case–control study found that women who experienced a life stressor and reported no intimate emotional support were significantly more likely to develop breast cancer than those who experienced a life stressor but reported good emotional support [51]; an earlier case–control study found that, contrary to expectation, the women who experienced at least one severe life event within 5 years of diagnosis and who used coping skills to confront their stress had a higher risk of breast

cancer than those who did not confront their stress [38]; and a recent prospective analysis of Women's Health Initiative data found that breast cancer risk increased monotonically with increasing number of stressful events among those with high but not low social support [49]. Other studies of coping in relation to breast cancer have found no direct association [50].

Abuse victimization could also influence preventive health care utilization. Most studies [56–61], but not all [19, 62], show higher annual health care utilization among women with a history of abuse in childhood or adulthood relative to nonabused women. Finally, researchers have speculated that physical trauma to the breast can cause cancer [63, 64]. A case–control study of women aged 50–65 years found that women with breast cancer were more likely than controls to report physical trauma to the breast in the previous 5 years (OR = 3.3, 95% CI = 1.3–10.8) [64]. According to models of epithelial cell generation, it is plausible that physical trauma could lead to cancer initiation [64, 65].

To investigate the hypothesis that a history of abuse victimization influences breast cancer incidence, we analyzed data from the Black Women's Health Study (BWHS), an ongoing prospective cohort study of 59,000 African-American women. We assessed whether physical and sexual abuse across the life span reported in 2005 was associated with an increased incidence of breast cancer diagnosed from 1995 to 2009. Because coping may buffer the stress response, we also evaluated whether coping skills modified the association between abuse victimization and breast cancer incidence.

Materials and methods

Study population and follow-up

The Black Women's Health Study (BWHS) is a large prospective cohort study of African-American women. Participants enrolled in 1995 by completing a 14-page health questionnaire mailed to subscribers to *Essence*, a magazine with a large readership of African-American women. Friends and relatives of early respondents and members of the National Education Association and Black Nurses' Association were also invited to enroll. Approximately 59,000 women aged 21–69 years at baseline from 17 states across the United States have been followed every 2 years through mail questionnaires. The baseline (1995) questionnaire elicited information on demographic and lifestyle factors, reproductive history, health care utilization, and medical conditions. Participants have been followed every 2 years by mailed questionnaires, and cohort retention has exceeded 80%. The institutional review board of Boston University Medical Center approved the study protocol.

Assessment of abuse victimization

On the 2005 BWHS follow-up questionnaire, participants were asked questions about abuse victimization across the life span, including exposure as a "child" (up to age 11), "teenager" (age 12–18), and "adult" (age 19 and older). The nine-item abuse assessment instrument was adapted from the Conflict Tactics Scale and the Pregnancy Abuse Assessment Screen [66, 67]. Response categories were "never," "1–3 times," or "≥4 times." We defined physical abuse as any report of a perpetrator having "pushed, grabbed, or shoved me," "threw something at me that could hurt me," "kicked, bit, or punched me," "hit me with something including hand or fist," or "physically attacked me in some other way" at a frequency of ≥4 times, or either "choked or burned me" or "seriously harmed someone I loved" at any frequency. We created a physical abuse summary score variable by assigning 1 point for each report of a physical abuse item occurring ≥4 times, with the exception of "choked or burned" or "seriously harmed someone I loved," where 1 point was assigned for reports that these occurred 1–3 times and 2 points for reports that these occurred ≥4 times, because we considered these events to be more severe. The resulting physical abuse severity score,

which ranged from 0 to 9, was further categorized as low (score = 1), intermediate (score = 2), and high (score ≥ 3). We defined sexual abuse as any report of a perpetrator having "exposed genitals against my will" ≥4 times or "been sexual with me against my will" at any frequency. We created a summary variable that separated out those who reported ≥4 incidents of sexual assault from those who experienced 1–3 incidents.

An additional three items asked how often the participant felt in danger, "physically or sexually," in each of the following places: home, neighborhood, and school/work-place. The latter three items served as a proxy for the perpetrator of abuse and were used in exploratory analyses only. Response categories for all items were "never," "1–3 times," or "≥4 times."

As reported in greater detail elsewhere [11], we conducted a principal components factor analysis of the childhood physical and sexual abuse items using an orthogonal rotation, which revealed two factors that confirmed the predetermined "physical" and "sexual" domains of abuse. The Cronbach alphas for the seven physical abuse items and the two sexual abuse items were 0.80 and 0.82, respectively, indicating high internal consistency. In addition, among 690 women who inadvertently returned a duplicate questionnaire in 2005, weighted kappa values indicated good reproducibility of responses to the abuse questions, with the sexual abuse questions (k = 0.68–0.78) showing higher agreement than the physical abuse questions (k = 0.48–0.60) [11].

Assessment of breast cancer

Incident cases of breast cancer were ascertained by self-report on biennial follow-up questionnaires from 1997 to 2009. Women who reported incident breast cancer were asked for written permission to review their medical records. We obtained medical record or cancer registry data for 85.3% of cases, and of these, 99.4% were consfirmed. We obtained death certificates when deaths were reported by family members or the US Postal Service, and we searched the National Death Index for death certificate data on all BWHS nonrespondents. Incident cases who died before 2005 and did not have the opportunity to complete the abuse instrument (n = 142) were more likely to have had a family history of breast cancer (19.7% vs. 11.3%) than cases who survived through 2005 (n = 819), but were similar with respect to age (mean: 46.2 vs. 45.7 years), educational attainment (mean: 14.4 vs. 14.9 years), age at menarche (mean: 12.3 vs. 12.2 years), parity (both 76.0%), age at first birth (mean: 22.5 vs. 22.9 years), BMI at age 18 (both mean: 20.7 kg/m^2), and ever use of postmenopausal hormones (26.8% vs. 27.8%).

Assessment of covariates

Data on breast cancer risk factors including age, age at first birth, age at menopause, type of menopause (natural, surgical, or medication-induced), parity, lactation, oral contraceptive use, female hormone use, current weight, vigorous physical activity, alcohol consumption, smoking, and recency of mammography use were obtained at baseline and were updated on all biennial follow-up questionnaires. Data on education, age at menarche, height, and weight at age 18 were obtained at baseline in 1995. Body mass index (BMI) was calculated as weight in kilograms divided by squared height in meters. Family history of breast cancer among first-degree relatives was asked on the 1995 and 1999 questionnaires. Women who reported a hysterectomy but retained one or both ovaries were classified as premenopausal if their current age was less than the 10th percentile of age at natural menopause in the BWHS (<43 years), as postmenopausal if their age was greater than the 90th percentile of age at natural menopause in the cohort (≥57 years), and as uncertain menopausal status at the age of 43–56 years. On the 2005 questionnaire, participants completed an abbreviated (9-item) scale based on an instrument developed by Carver [68] designed to assess (1) active coping,

(2) use of emotional support, (3) use of instrumental support, (4) positive reframing, and (5) acceptance. Higher scores on the coping scale indicated higher coping skills.

Exclusions

We excluded women with a history of breast cancer (n = 732) or other cancer except nonmelanoma skin cancer (n = 745) at baseline, women who did not complete the 2005 questionnaire (n = 15,354), and women who did not complete the abuse questions (n = 6,457), which left 35,728 women for the present analysis. Those excluded were slightly younger (38.4 vs. 39.0 years), had an earlier age at first birth (21.8 vs. 22.5 years), and had lower educational attainment (14.4 vs. 14.8 years) than those included, but were similar with respect to mean age at menarche (12.4 vs. 12.3 years), parity status (64.9 vs. 63.8% parous), menopausal status (76.8 vs. 76.4% premenopausal), ever use of postmenopausal hormones (16.4 vs. 17.4%), and family history of breast cancer (both 6.5%).

Statistical analysis

We categorized abuse according to occurrence in a given life stage (childhood, adolescence, adulthood), stage at first abuse, type of abuse (physical and/or sexual), and frequency of abuse type (defined above). Within each life stage, a mutually exclusive variable was created to identify women who had experienced none, one, or both types of abuse. The reference category for all analyses was “no abuse across the life span.”

Women contributed person-years from the beginning of follow-up on 1 March 1995, until the diagnosis of breast cancer, death, loss to follow-up, or the end of follow-up on 1 March 2009, whichever occurred first. Cox regression models, stratified by age in 1-year intervals and questionnaire cycle, were used to estimate incidence rate ratios (IRR) and 95% confidence intervals (CI) for risk of breast cancer in association with categories of abuse, within each life stage of abuse. Multivariable models were adjusted for breast cancer risk factors, including age at menarche (<12, 12–13, ≥14 years), BMI at age 18 (<20, 20–24, ≥25 kg/m^2), family history of breast cancer (mother or sister), education (≤12, 13–15, ≥16 years), parity (0, 1, 2, ≥3 births), age at first birth (<20, 20–24, ≥25 years), oral contraceptive use (never, use in last 5 years, use ≥5 years ago), menopausal status (postmenopausal, premenopausal, uncertain), age at menopause (<45, 45–49, 50–55, ≥55 years), duration of menopausal female hormone use (never, <5 years, ≥5 years duration), vigorous physical activity (none, 1–4, ≥5 h/week), smoking status (never, past, current), and alcohol intake (none, 1–3, 4–6, ≥7 drinks/week). For covariates that varied over time (e.g., parity), cases and person-time were reassigned every 2 years according to the value reported at the start of the questionnaire cycle.

To examine whether associations were modified by other risk factors, a cross-product term between the exposure and potential effect modifier was included in the multivariable model. Two-sided p-values for tests of interaction were obtained from a likelihood ratio test with the degrees of freedom equal to the difference in the number of parameters between the null and alternative models. We also evaluated effect modification by examining the IRRs for abuse variables within strata of other covariates. Departures from the proportional hazards assumption were tested by the likelihood ratio test comparing models with and without interaction terms for age and calendar time with the main exposure variables.

Results

Baseline characteristics of the study participants according to type of abuse, within each life stage, are shown in Table 1. Forty-eight percent of women reported abuse in childhood (42% physical and 18% sexual), 37% in adolescence (27% physical and 20% sexual), and

40% in adulthood (31% physical and 20% sexual). Relative to women who reported no abuse across the life span, those who reported childhood abuse were younger, had an earlier menarche, were more often parous, had an earlier age at first birth, and were more likely to smoke and consume alcohol. Patterns were generally similar for women who reported abuse in adolescence, but weaker for those who reported abuse in adulthood.

During 462,432 person-years of follow-up, there were 1,064 incident cases of breast cancer. Table 2 shows results for abuse across the life span in relation to breast cancer incidence. There was little evidence of an association between breast cancer risk and abuse in either childhood or adolescence, whether examined overall or according to abuse type or frequency (data not shown). However, there was a positive association between abuse in adulthood and breast cancer (IRR = 1.18, 95% CI = 1.03–1.34). Physical abuse accounted for the increase in risk: IRRs for physical abuse only, sexual abuse only, and both physical and sexual abuse in adulthood, relative to no abuse, were 1.28 (95% CI = 1.09–1.49), 0.96 (95% CI = 0.76–1.20), and 1.22 (95% CI = 1.00–1.49), respectively. There was little support for a dose–response relation between frequency of adult physical abuse and breast cancer risk: relative to no abuse, IRRs were 1.28, 1.37, and 1.24 for low, intermediate, and high frequency categories, respectively.

When we stratified the data according to individual types of adult physical abuse, multivariable IRRs were all above 1.0 with the exception of “seriously harmed someone I love” (Table 3). After excluding this item from our definition of “physical abuse,” the IRR for adult physical abuse increased to 1.35 (95% CI = 1.11–1.64) but again no dose–response relation was observed (data not shown). Among women who reported adult physical abuse, the IRR for breast cancer was weakly elevated for those who said they felt in danger at home (1.15, 95% CI = 0.93–1.43) but not for those who felt in danger in their neighborhood (0.81, 95% CI = 0.64–1.04) or at work/school (1.04, 95% CI = 0.80–1.36), relative to women who did not feel in danger in any of these places.

When we confined the analysis to cases diagnosed from 2005 to 2009 (245 cases, 77,330 person-years), the time period after which the abuse histories were reported (Table 4), we still found a positive association of abuse in adulthood with breast cancer (IRR = 1.29, 95% CI = 1.02–1.64). The increase was largely accounted for by physical abuse: IRRs for physical abuse only, sexual abuse only, and both physical and sexual abuse in adulthood, relative to no abuse, were 1.30 (95% CI = 0.97–1.73), 1.19 (95% CI = 0.81–1.74), and 1.40 (95% CI = 0.97–2.01), respectively. As before, there was no clear dose–response relation between frequency of physical abuse in adulthood and breast cancer: IRRs comparing low, intermediate, and high frequency categories to no abuse were 1.24, 1.49, and 1.38, respectively. IRRs increased monotonically with increasing frequency of adult sexual abuse, but the number of cases reporting ≥4 incidents of sexual abuse was small.

Because coping skills were measured in 2005, after the diagnosis of breast cancer for most cases, we assessed effect modification by this variable during the 2005–2009 period only. Contrary to what we hypothesized, associations of abuse in adulthood and risk of breast cancer were stronger among women with higher coping skills, defined as those who scored at or above the median on the abbreviated Carver coping scale. Relative to no abuse, IRRs for adult physical abuse only and breast cancer incidence were stronger among women with higher (IRR = 1.60, 95% CI = 1.07–2.39) vs. lower (IRR = 0.94, 95% CI = 0.58–1.53) coping skills (*p-interaction* = 0.26). The IRRs for low, intermediate, and high frequencies of physical abuse among women with higher coping skills were 1.47 (95% CI = 0.94–2.31), 1.47 (95% CI = 0.73–2.98), and 2.36 (95% CI = 1.28–4.33). No differences were found in the IRRs for adult sexual abuse comparing women with lower vs. higher coping skills.

Multivariable results for abuse in adulthood were stronger among women with less education. The IRRs comparing adult physical abuse to no abuse were 1.80 (95% CI = 1.24–2.61) among those with ≤12 years of education, 1.23 (95% CI = 0.94–1.62) among those with 13–15 years of education, and 1.16 (95% CI = 0.92–1.46) among those with ≥16 years of education (*p-interaction* = 0.009. Results did not vary appreciably by age (<45 vs. ≥45 years), menopausal status, recency of mammography (<2, ≥2 years ago), or family history of breast cancer (data not shown).

Discussion

The present study is the largest to assess the relation between abuse victimization and risk of breast cancer and the first to include a prospective component. While no association was found for breast cancer incidence in relation to abuse victimization in either childhood or adolescence, breast cancer incidence was elevated among women who reported physical abuse in adulthood. The positive association with adult physical abuse was stronger among less educated women and among women with higher coping skills. The associations of abuse in adulthood with breast cancer risk persisted when we conducted a prospective analysis based on a smaller subset of cases.

The only previous epidemiologic study of abuse and breast cancer, a cross-sectional study, found a positive association of history of sexual abuse with risk of breast cancer [18]. Given this study examined only sexual abuse, it is unclear whether confounding by physical abuse could have explained the association. In a case–control study, physical trauma to the breast in the previous 5 years—whether accidental or related to abuse—was positively associated with breast cancer incidence [64]. We had no information in our study on what part of the body had been affected by physical abuse.

Our data suggest that cumulative exposure to abuse across the life span was no more likely to increase breast cancer risk than abuse only in adulthood. Of the studies that have evaluated stressful life events and breast cancer risk, most have evaluated only adult exposure to stress [40,42–44, 46, 48, 49, 51], and a lifecourse perspective was rarely used [39, 45]. In the European Prospective Investigation into Cancer (EPIC) Study, although none of the results reached statistical significance, the strongest association was observed for losses in adulthood (hazard ratio per “loss” event in past 5 years = 1.21, 95% CI: 0.98, 1.51) [45]. Similarly, in a Finnish prospective cohort study, results were stronger when the authors assessed stressful life events in the past 5 years as opposed to total number of stressful life events [39]. Two separate reports from a Finnish case–control study generated stronger associations with stressful life events occurring in adulthood [40] compared with early life [41]. Additional studies that use a lifecourse perspective to assess abuse victimization and breast cancer risk are needed for comparison.

A limitation of our study is the cross-sectional nature of the primary analyses. Women were followed for breast cancer incidence from 1995 to 2009, but experiences of abuse across the life span were ascertained in 2005. Although *experiences* of abuse victimization in childhood or adolescence would have preceded the occurrence of breast cancer in the BWHS, the temporal sequence of events is less clear for experiences in adulthood. Moreover, the *reporting* of abuse experiences, whether they occurred earlier or later in life, did not precede the diagnosis for most cases in our analysis. Thus, the positive association we observed with adult abuse victimization and breast cancer incidence could be due to reverse causation or reporting bias. However, participants were unaware of the study hypothesis and there has been virtually no information in the media linking breast cancer to a history of abuse. In addition, if the reporting of abuse was affected by having been diagnosed with breast cancer, such that cases would be more likely than noncases to recall

or acknowledge abuse, we would have expected elevated IRRs for all stages of exposure, not just adulthood. Finally, the strongest evidence against reporting bias as the explanation for our results is that adult abuse victimization was positively associated with breast cancer in analyses restricted to cases diagnosed *after* the reports of abuse (2005–2009).

Another limitation is that only those cases who survived their breast cancers until at least 2005 had the opportunity to complete the abuse instrument in 2005. Therefore, the cases analyzed from 1995 to 2005 may under-represent the most advanced cases of breast cancer in the overall cohort. Nevertheless, our findings for physical abuse and breast cancer incidence were still evident—and generally stronger in magnitude—when we confined the incident period to 2005–2009, suggesting that the inclusion of less severe cases did not explain our overall results.

We were unable to validate the occurrence, type, or severity of abuse in our study. However, the instruments on which our abuse questions were based have been used in different populations and demonstrate high reproducibility both within our cohort and in other studies [66, 67]. Factor analysis within our cohort confirmed the preconceptualized domains of abuse, indicating that the questions identified the underlying constructs they were intended to measure [11].

Strengths of our study include the high accuracy of self-reported breast cancer, adjustment for a wide range of putative confounders, and minimal loss to follow-up. The BWHS is a convenience sample of women with higher levels of education than the general population, but prevalence estimates of abuse victimization were generally similar to those found in nationally representative studies [17, 20, 21, 69–72].

The exact mechanisms by which physical abuse in adulthood might increase breast cancer risk are unclear. It is unlikely that differences in mammography screening explain the excess breast cancer incidence among women reporting physical abuse because results were similar among women who were and were not compliant with mammography recommendations. And while our results are consistent with the hypothesis that physical trauma can cause of breast cancer [63, 64], information on location and severity of physical trauma was lacking. Contrary to what we hypothesized, the association of adult physical abuse with breast cancer was stronger among women with higher coping skills. This finding agrees with the results of two studies [38, 49], but not of two others [46, 51], that investigated modification of the association between stress and breast cancer by coping or emotional support. While our finding does not seem to support a role for stress as a mechanism, it may be that higher coping skills result from greater abuse severity. Of the few studies have examined this hypothesis directly [73–77], severity of intimate partner violence was positively associated with active forms of coping that involve leaving the relationship or using the criminal justice system [74–76], but not with other active forms of coping that involve talking to friends or seeking counseling services [73, 77]. Given that the vast majority of longitudinal studies of stress and breast cancer report no direct association [43–51], other yet unidentified mechanisms could be at play.

In conclusion, the present study of African-American women shows a positive relation between physical abuse victimization in adulthood and breast cancer incidence, but no evidence of a dose–response relation. No associations with breast cancer were found for abuse occurring in either childhood or adolescence. These findings require confirmation in future studies.

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Table 1

Selected characteristics of 35,728 BWHS participants according to abuse victimization reported as child, teenager, or adult

Characteristic[a]	Stage and type of abuse									
	No abuse across life span	Childhood			Adolescence			Adulthood		
		Physical only	Sexual only	Physical and sexual	Physical only	Sexual only	Physical and sexual	Physical only	Sexual only	Physical and sexual
Number of women	11,392	10,736	2,173	4,356	6,090	3,593	3,412	7,082	3,289	3,955
Age at baseline, years (mean)	40.6	38.3	37.6	36.8	37.8	37.7	37.5	38.7	38.6	39.2
Age at menarche, years (mean)	12.4	12.3	12.1	12.1	12.4	12.3	12.2	12.3	12.4	12.3
Parous, %	60.0	63.1	64.5	66.6	63.8	67.0	70.5	70.2	61.3	73.3
Age at first birth, years (mean)[b]	23.0	22.6	22.2	21.6	22.1	22.0	20.9	21.6	23.1	21.5
Oral contraceptive use, years (mean)	4.1	4.1	3.7	3.6	3.9	3.9	3.8	3.9	4.1	3.8
Education, years (mean)	14.9	15.0	14.9	14.8	14.8	14.8	14.6	14.6	15.1	14.6
BMI at age 18, kg/m^2 (mean)	21.3	21.4	21.8	21.7	21.4	21.5	21.6	21.4	21.3	21.3
Menopausal status, %										
Premenopausal	76.7	76.6	76.4	76.0	75.7	76.7	75.7	74.3	75.3	75.2
Postmenopausal	17.0	16.9	17.2	17.3	17.1	16.4	17.6	18.5	18.0	17.8
Uncertain	6.3	6.4	6.4	6.7	7.2	6.9	6.7	7.2	6.6	7.0
Age at menopause, years (mean)[c]	43.7	43.7	43.3	42.9	43.5	43.6	42.2	43.4	43.5	43.4
Family history of breast cancer, %	6.5	6.6	6.3	6.4	6.9	6.5	5.9	6.4	6.6	6.9
Female hormone use, ever %	14.1	15.6	13.7	18.0	16.1	15.6	17.5	17.0	16.2	16.8
Vigorous exercise, ≥5 h/wk %	12.9	13.2	14.1	13.4	13.5	12.7	13.7	12.8	12.4	12.9
Smoking, current%	12.3	14.8	14.7	17.1	16.0	15.1	20.6	17.8	14.0	18.8
Alcohol, drinks/wk (mean)	1.2	1.5	1.3	1.6	1.5	1.5	1.7	1.6	1.5	1.8
Coping score (mean)	25.1	25.9	26.1	26.3	25.9	25.9	26.3	26.0	25.9	26.0
Mammography use, never %	41.5	40.9	41.9	41.1	40.6	41.0	39.4	37.6	37.9	39.3
Recency of physician visit, %										
<1 year ago	86.9	88.8	87.8	88.6	88.8	88.3	88.7	88.6	88.1	89.8
≥1 year ago	12.5	10.5	11.5	10.9	10.6	10.8	10.7	10.8	11.1	9.6

[a] Characteristics are presented as means or percents within abuse categories and are age-standardized to distribution of cohort at baseline

[b] Restricted to parous women only

[c] Restricted to postmenopausal women only

Table 2

Association of abuse victimization with breast cancer incidence

	Cases	Person-years	Age-adjusted IRR (95% CI)	Multivariable IRR (95% CI)[a]
No abuse across the life span[b]	359	146,801	1.00 (referent)	1.00 (referent)
Any abuse in childhood	474	224,194	0.99 (0.87–1.13)	0.98 (0.86–1.12)
Any abuse in adolescence	341	169,957	0.88 (0.76–1.02)	0.90 (0.78–1.04)
Any abuse in adulthood	448	185,572	1.15 (1.01–1.31)	1.18 (1.03–1.34)
Stage of first abuse				
Childhood	474	224,194	1.01 (0.88–1.17)	1.02 (0.89–1.18)
Adolescence	89	42,038	0.98 (0.78–1.24)	1.01 (0.80–1.27)
Adulthood	142	49,399	1.20 (0.99–1.46)	1.22 (1.00–1.48)
Stage at which abuse occurred				
Childhood only	135	61,083	1.05 (0.86–1.28)	1.03 (0.85–1.26)
Adolescence only	39	21,277	0.87 (0.63–1.21)	0.88 (0.63–1.22)
Adulthood only	142	49,399	1.20 (0.99–1.46)	1.22 (1.00–1.48)
Childhood and adolescence	83	47,698	0.89 (0.70–1.13)	0.90 (0.71–1.15)
Childhood and adulthood	87	35,191	1.11 (0.88–1.41)	1.12 (0.88–1.41)
Adolescence and adulthood	50	20,761	1.10 (0.81–1.47)	1.14 (0.85–1.54)
All three life stages	169	80,222	1.01 (0.84–1.21)	1.04 (0.87–1.26)
Childhood				
Type of abuse				
Physical abuse only	315	139,290	1.03 (0.89–1.19)	1.01 (0.88–1.17)
Sexual abuse only	55	28,245	0.91 (0.69–1.20)	0.89 (0.68–1.18)
Both physical and sexual abuse	104	56,659	0.93 (0.74–1.17)	0.93 (0.74–1.17)
Adolescence				
Type of abuse				
Physical abuse only	161	79,019	0.88 (0.73–1.06)	0.90 (0.75–1.09)
Sexual abuse only	95	46,674	0.90 (0.72–1.12)	0.91 (0.73–1.13)
Both physical and sexual abuse	85	44,264	0.84 (0.66–1.06)	0.90 (0.70–1.13)
Adulthood				
Type of abuse				

	Cases	Person-years	Age-adjusted IRR (95% CI)	Multivariable IRR (95% CI)[a]
Physical abuse only	235	91,528	1.24 (1.06–1.45)	1.28 (1.09–1.49)
Sexual abuse only	87	42,925	0.97 (0.77–1.21)	0.96 (0.77–1.20)
Both physical and sexual abuse	126	51,119	1.18 (0.96–1.44)	1.22 (1.00–1.49)
Physical abuse frequency[c]				
Low	208	81,226	1.25 (1.05–1.48)	1.28 (1.07–1.52)
Intermediate	67	25,144	1.31 (1.00–1.71)	1.37 (1.04–1.79)
High	86	36,277	1.15 (0.89–1.49)	1.24 (0.95–1.62)
Sexual abuse frequency[d]				
1–3 incidents	182	82,125	0.96 (0.76–1.21)	0.95 (0.76–1.19)
≥4 incidents	31	11,919	1.00 (0.65–1.54)	1.02 (0.66–1.57)

[a] Adjusted for age, education, age at menarche, BMI at age 18, parity, age at first birth, OC use, menopausal status, age at menopause, FH use, vigorous activity, smoking status, alcohol intake, and family history of breast cancer. Adjusted for type and stage of abuse, when applicable

[b] Reference group for all analyses

[c] Excludes women who reported sexual abuse only

[d] Excludes women who reported physical abuse only

Table 3

Association of adult physical abuse with breast cancer incidence

	Cases	Person-years	Multivariable IRR (95% CI)[a]
No abuse across the life span[b]	359	146,801	1.00 (referent)
Physical abuse type (≥4 times)			
Pushed, grabbed, or shoved me	115	43,128	1.26 (1.03–1.54)
Threw something at me	31	13,705	1.08 (0.75–1.55)
Kicked, bit, or punched me	75	27,729	1.25 (0.98–1.59)
Hit me with hand or fist	100	38,541	1.19 (0.96–1.47)
Choked or burned me	24	7,933	1.46 (0.97–2.21)
Physically attacked me in other way	63	22,835	1.27 (0.98–1.65)
Seriously harmed someone I love	25	12,575	0.91 (0.61–1.35)

[a] Adjusted for age, education, age at menarche, BMI at age 18, parity, age at first birth, OC use, menopausal status, age at menopause, FH use, vigorous activity, smoking status, alcohol intake, and family history of breast cancer. Adjusted for sexual abuse

[b] Reference group for all analyses

Table 4

Association of adult abuse with breast cancer incidence, restricted to 2005–2009 incident period

	Cases	Person-years	Multivariable IRR (95% CI)[a]
No abuse across the life span[b]	105	33,895	1.00 (referent)
Any abuse in adulthood	140	43,435	1.29 (1.02–1.64)
Adulthood			
Type of abuse			
Physical abuse only	68	21,322	1.30 (0.97–1.74)
Sexual abuse only	32	10,214	1.19 (0.81–1.74)
Both physical and sexual abuse	40	11,899	1.40 (0.97–2.01)
Physical abuse frequency [c]			
Low	60	19,003	1.24 (0.90–1.72)
Intermediate	21	5,804	1.49 (0.91–0.243)
High	27	8,414	1.39 (0.86–2.24)
Sexual abuse frequency [d]			
1–3 incidents	61	19,372	1.18 (0.81–1.74)
≥4 incidents	11	2,741	1.57 (0.76–3.26)

[a] Adjusted for age, education, age at menarche, BMI at age 18, parity, age at first birth, OC use, menopausal status, age at menopause, FH use, vigorous activity, smoking status, alcohol intake, and family history of breast cancer. Adjusted for type and stage of abuse, when applicable

[b] Reference group for all analyses

[c] Excludes women who reported sexual abuse only

[d] Excludes women who reported physical abuse only