Short Communication

Long-term Recreational Physical Activity and Breast Cancer in the National Health and Nutrition Examination Survey I

Epidemiologic Follow-up Study

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Abstract

Our purpose was to study the association between long-term recreational physical activity and breast cancer in the Epidemiological Follow-up Study (NHEFS) of the first National Health and Nutrition Examination Survey (NHANES I, 1971–1975). The analytic cohort included 6160 women who were free of breast cancer at the first NHANES follow-up in 1982–1984 and had interview data on recreational physical activity (low, moderate, and high) in 1982–1984 and 10 years earlier, in 1971–1975. We created categories of long-term (1982–1984 + 1971–1975) recreational physical activity: (a) consistently low; (b) moderate/inconsistent; and (c) consistently high. Data were analyzed using Cox proportional hazard regression models. A total of 138 women developed breast cancer between 1982–1984 and 1992. In women ≥50 years of age in 1982–1984, consistently high (versus consistently low) recreational physical activity was associated with a 67% reduction in breast cancer risk (n = 96 cases; relative risk, 0.33; 95% confidence interval, 0.14–0.82; P for trend = 0.03); in women <50 years of age (n = 42 cases), there was no association. Associations were not modified by body mass index or by weight gain as an adult. High recreational physical activity over the long-term may reduce breast cancer risk in women ≥50 years of age; in this sample, it did so regardless of weight history.

Introduction

Physical activity is a modifiable behavior with the potential to reduce the risk of breast cancer (1). Whereas some prospective studies have reported significant inverse associations (2–4), others have reported null findings for various groups (3, 5–7). The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked advertisement in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

1 Received 11/17/00; revised 4/13/01; accepted 5/7/01.

2 The abbreviations used are: BMI, body mass index; NHANES, National Health and Nutrition Examination Survey; NHEFS, NHANES I Epidemiologic Follow-up Study; RR, relative risk; CI, confidence interval; NCHS, National Center for Health Statistics.

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get much exercise, moderate exercise, or little or no exercise?” In 1971–1975, NHANES I participants were asked: “Do you get much exercise in things you do for recreation (sports, or hiking, or anything like that), or hardly any exercise, or in between?” We categorized responses as low, moderate, and high and created summary categories to describe long-term recreational physical activity (i.e., activity in 1982–1984 + 10 years earlier in 1971–1975). The summary categories, which were created to closely resemble those used in an earlier analysis by Thune et al. (2), were as follows: (a) consistently low, low at both times; (b) consistently high, high at both times or moderate at one time and high at the other; and (c) moderate/inconsistent, all other combinations.

Data on Other Risk Factors. In 1982–1984, weight was measured, and interview data were collected on live births, menstrual status, history of breast cancer in first-degree female relatives, use of hormone replacement therapy, and self-reported weight at age 25 years. In 1971–1975, height and weight were measured, and interview data were collected on education and age at menarche. BMI was calculated as kg/m². We created the variable “adult weight change” (weight change from age 25 years to age at the 1982–1984 interview), which was categorized as follows: (a) lost ≥5.0 kg; (b) stable ± 4.99 kg; (c) gained 5.0–9.99 kg; (d) gained 10.0–19.99 kg; and (e) gained ≥20.0 kg. In selected analyses in which we excluded the lost ≥5 kg category (because weight may have been lost due to disease), we refer to this variable as “adult weight gain.”

Statistical Analysis. Data were analyzed using Cox proportional hazard regression models. The response variable was age at breast cancer diagnosis or age at death, if breast cancer was the cause, and no other records were available (n = 1) (10). Women who did not develop breast cancer were censored at their last interview or date of death. To adjust for birth cohort effects, the baseline hazard was stratified by 5-year intervals of birth year.

We performed analyses using models variously adjusted for BMI in 1982–1984, BMI in 1971–1975, BMI at age 25 years, adult weight change, adult weight gain, and breast cancer risk factors (education, age at menarche, parity, menstrual status, and family history of breast cancer), stratified by age in 1982–1984 (<50 years and ≥50 years). The following interactions were considered: (a) BMI in 1982–1984 and long-term recreational physical activity; (b) adult weight gain and long-term recreational physical activity; and (c) hormone replacement therapy and weight gain. Tests of trend were performed using ordinal scores for categories of recreational physical activity and adult weight change.

The NHEFS has a complex design that involves sample weighting, stratification, and clustering (11). To account for the sample weighting, we included the following sample design variables (i.e., variables used by NCHS to derive sample weights) in our final models: (a) age (<65 versus ≥65 years); (b) poverty census enumeration district (residence versus non-residence); (c) family income (<3,000, $3,000–$6,999, $7,000–$9,999, $10,000–$14,999, and $15,000+); and (d) race [black versus nonblack (Hispanics were included with whites; Ref. 12)]. Analyses were performed using SAS version 6.12 (SAS Institute, Cary, NC). All significance tests were two-tailed (5% level of significance).

### Results

Demographics and Physical Activity Distribution. In 1982–1984, 15.3% of the analytic cohort were <40 years old, 26.7% were 40–49 years old, 21.5% were 50–59 years old, 14.3% were 60–69 years old, and 22.2% were ≥70 years old. Most (85%) were white.

Consistently high recreational physical activity (low, moderate, and high) were in the same categories in 1982–1984 and 10 years earlier (1971–1975) in 49% of the women; only 7% shifted between extreme categories (low to high or high to low).

Consistently high recreational physical activity was more likely among women who were younger, had higher education, who ever took hormone replacement therapy, who weighed less, or who gained less weight as adults than their counterparts.

Recreational Physical Activity and Breast Cancer. Results were similar in adjusted and unadjusted models.

In women ≥50 years of age (n = 96 cases), consistently high recreational physical activity was associated with a significant reduction in breast cancer risk (RR, 0.33; 95% CI, 0.14–0.82; P for trend = 0.026; Table 1). Exclusion of women diagnosed within 1 year of their 1982–1984 interview resulted in a similar RR (0.37) and wider CI (0.15–0.91; P = 0.048). Table 2 presents results from models stratified by BMI in 1982–1984 and stratified by adult weight gain. Whereas there was some variation in RRs across strata, the CIs were wide. On formal testing using models that included interaction between physical activity and BMI in 1982–1984 or between physical activity and adult weight gain, it was determined that neither interaction was statistically significant (data not shown).

In women <50 years of age (n = 42 cases), there was no statistically significant association between consistently high recreational physical activity and breast cancer (Table 1).

### Additional Analyses. We separately examined data on recreational physical activity from 1982–1984 and 1971–1975 in our analytic cohort. Using 1982–1984 data, the RRs for breast cancer according to level of recreational physical activity were as follows: (a) for all women, 1.00 (low = referent), 0.88 (0.61–1.27), and 0.71 (0.39–1.28), P = 0.393; and (b) for women ≥50 years of age in 1982–1984, 1.00, 0.82 (0.53–1.27), and 0.86 (0.44–1.69), P = 0.519. Using 1971–1975 data, the RRs for breast cancer were as follows: (a) for all women, 1.00, 0.98 (0.68–1.41), and 0.75 (0.43–1.31), P = 0.395; and (b) for women ≥50 years of age in 1971–1975, 1.00, 0.86 (0.56–1.31), and 0.39 (0.17–0.91), P = 0.036.

### Table 1

<table>
<thead>
<tr>
<th>Activity level</th>
<th>Person-years of observation</th>
<th>No. of cases</th>
<th>Multivariate-adjusted RR (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>All women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistently low</td>
<td>11,553</td>
<td>36</td>
<td>1.0 Particularly high</td>
</tr>
<tr>
<td>Moderate/inconsistent</td>
<td>30,429</td>
<td>86</td>
<td>0.92 (0.62–1.38)</td>
</tr>
<tr>
<td>Consistently high</td>
<td>8,799</td>
<td>16</td>
<td>0.58 (0.31–1.07)</td>
</tr>
<tr>
<td>P for trend</td>
<td></td>
<td></td>
<td>0.107</td>
</tr>
<tr>
<td>Women &lt;50 yrs of age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistently low</td>
<td>4,082</td>
<td>7</td>
<td>1.0 Particularly high</td>
</tr>
<tr>
<td>Moderate/inconsistent</td>
<td>13,856</td>
<td>25</td>
<td>1.07 (0.46–2.51)</td>
</tr>
<tr>
<td>Consistently high</td>
<td>4,582</td>
<td>10</td>
<td>1.19 (0.43–3.30)</td>
</tr>
<tr>
<td>P for trend</td>
<td></td>
<td></td>
<td>0.732</td>
</tr>
<tr>
<td>Women ≥50 yrs of age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistently low</td>
<td>7,472</td>
<td>29</td>
<td>1.0 Particularly high</td>
</tr>
<tr>
<td>Moderate/inconsistent</td>
<td>16,574</td>
<td>61</td>
<td>0.87 (0.55–1.38)</td>
</tr>
<tr>
<td>Consistently high</td>
<td>4,218</td>
<td>6</td>
<td>0.33 (0.14–0.82)</td>
</tr>
<tr>
<td>P for trend</td>
<td></td>
<td></td>
<td>0.026</td>
</tr>
</tbody>
</table>

* Models were adjusted for height, BMI at age 25 years, adult weight change (age 25 years to age at 1982–1984 interview), and sample design variables. Results were similar in unadjusted models.

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**Note:** Table 1 shows the results of multivariate-adjusted analyses for breast cancer risk according to combined levels of recreational physical activity in 1982–1984 and 10 years earlier, in 1971–75. The table includes all women and women <50 years of age, with and without adjustment for adult weight change and adult weight gain. The risk ratios (RRs) and corresponding 95% confidence intervals (CIs) are presented for each level of recreational physical activity, categorized as: consistently low, moderate/inconsistent, and consistently high. The analyses were adjusted for height, BMI at age 25 years, and other relevant risk factors. The P-values for trend are also provided.
Tests of trend were performed including/excluding women who lost a substantial amount of weight. The RRs of breast cancer were as follows: $1.00, 0.96 (0.75–1.22), and 0.78 (0.54–1.13)$.

For all women, $P = 0.030$. The RR of breast cancer was nearly statistically significant for women who lost $>10$ kg and was statistically significant for women who lost $>20$ kg. The RR calculated that RR using low activity as the referent to facilitate comparison with our results (re-calculated RR, 0.59). When we performed a similar analysis with follow-up for an additional 10 years, through 1992, our RR was 0.44 and was statistically significant.

The major strength of our study was prospective data collection in a sample national in scope. The major limitations were relatively small numbers of breast cancer cases, crude assessment of recreational physical activity (low, moderate, and high), and inability to capture patterns between assessments. Due to small numbers of cases, we were unable to examine outcomes for alternative combinations of recreational physical activity categories, for example, inconsistent activity, a potentially prevalent pattern. In older women, among whom we had the greatest number of cases, results using the NHEFS three-category physical activity variable were comparable with results from larger studies having more detailed assessments of recreational physical activity. Similar congruence has been observed in other NHEFS studies using this variable (14–16), including one (14) that demonstrated significant correlation between physical activity and physiological measures related to fitness. Limited assessments of physical activity in surveys other than the NHEFS have been found to correlate with physiological parameters and to successfully rank-order participants (17).

The results of our study contribute to the consistency of the evidence linking long-term recreational physical activity to reduced risk of breast cancer in older women.

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**References**

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