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Original Article

Sleep duration and breast cancer risk among black and white women

Qian Xiao [a,*], Lisa B. Signorello [b], Louise A. Brinton [c], Sarah S. Cohen [d], William J. Blot [d,e], Charles E. Matthews [a]

[a] Nutritional Epidemiology Branch, Division of Cancer Epidemiology and Genetics, National Cancer Institute, National Institutes of Health, Rockville, MD, USA
[b] Division of Cancer Prevention, National Cancer Institute, National Institutes of Health, Rockville, MD, USA
[c] Hormonal and Reproductive Epidemiology Branch, Division of Cancer Epidemiology and Genetics, National Cancer Institute, National Institutes of Health, Rockville, MD, USA
[d] International Epidemiology Institute, Rockville, MD, USA
[e] Division of Epidemiology, Department of Medicine, Vanderbilt University Medical Center, Nashville, TN, USA

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ABSTRACT

Background: Sleep has been suggested to influence breast cancer risk; however, the evidence is mixed. Black women have a higher prevalence of both short (<6 h) and long (≥9 h) sleep duration and are more likely to develop more aggressive, hormone receptor-negative breast cancer. No study has examined the relationship between sleep and breast cancer in blacks. We focused on race-specific associations among the blacks.

Methods: In the Southern Community Cohort Study (SCCS), a prospective study of which two-thirds of the population were black, we prospectively investigated self-reported sleep duration in relation to overall breast cancer risk by estrogen (ER) and progesterone receptor (PR) status in all women and in black women alone.

Results: Sleep duration was not associated with risk of total or hormone receptor-positive breast cancer. However, we found an inverse relationship between sleep duration and risk of ER– and PR– breast cancer among all women and in black women alone. Compared to the reference group (8 h), black women who reported shorter sleep duration had an increased risk of ER– PR– breast cancer (odds ratios; ORs (95% confidence intervals; CIs): 2.13 (1.15, 3.93), 1.66 (0.92, 3.02), and 2.22 (1.19, 4.12) for <6, 6, and 7 h, respectively, (p for trend, 0.04).

Conclusions: Short sleep duration may be a risk factor for hormone receptor-negative breast cancer among black women.

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1. Introduction

Nighttime sleep, a critical component of the 24-h circadian rhythm, has been hypothesized to play a role in breast cancer development [1]. Mechanistic studies have shown that melatonin, a key hormone involved in circadian regulation, can interact with the estrogen signaling pathway and may act as a tumor suppressor [2]. Moreover, sleep deficit is associated with various breast cancer risk factors, including obesity [3], metabolic dysfunction [4], and chronic inflammation [5]. Previous studies have found an elevated breast cancer risk among night shift workers [6], further supporting a potential carcinogenic effect of circadian disruption.

Several epidemiologic studies have examined sleep duration in relation to breast cancer risk, but their findings are inconsistent [7–13]. Two prospective studies found an inverse association, with one reporting an elevated risk among short sleepers (<6 h) [10] and the other reporting reduced risk among long sleepers (≥9 h) [7], comparing women with 7–8 h of sleep. By contrast, a case–control study suggested a positive trend of modestly increased risk with longer sleep [9]. Four studies, one case–control [11] and three large cohort studies [8,12,13], had largely null findings.

In addition to these conflicting findings, another deficit in the literature is lack of examinations of sleep duration and breast cancer risk in black women. In the United States, blacks have the highest prevalence of both long (≥9 h) and short (<6 h) sleep durations [14], making it particularly important to understand the health consequences of insufficient and excessive sleep in this population. Moreover, black women are more likely to develop more aggressive, hormone receptor-negative breast cancer than white women

Abbreviations: BMI, body mass index; CIs, confidence intervals; MET, metabolic equivalent; MHT, menopausal hormone therapy; MVPA, moderate-to-vigorous physical activity; OR, odds ratio; SD, standard deviation.

* Corresponding author. Division of Cancer Epidemiology and Genetics, National Cancer Institute, 9609 Medical Center Dr, Rockville, MD 20850, USA. Tel.: +1 240 276 7207; fax: +1 240 276 7837.
E-mail address: qian.xiao@nih.gov (Q. Xiao).

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[15]. Causes of this disparity remain unclear and may involve biological, social, and lifestyle factors [16]. Little is known about whether the associations between sleep duration and breast cancer differ by tumor subtypes and whether racial differences in sleep duration contribute to racial disparities in breast cancer. To date, only two studies have examined the effect of sleep duration on breast cancer risk by estrogen receptor (ER) status, and both reported null findings for ER+ and ER– subtypes [11,13].

In this study, we investigated sleep duration in relation to breast cancer risk in the Southern Community Cohort Study (SCCS), a prospective study that enrolled a large number of blacks. We placed particular emphasis on tumor subtypes by ER and progesterone receptor (PR) status and examined the race-specific associations among the blacks.

2. Methods

2.1. Study population

The SCCS is a prospective study initiated in 2002 focusing on racial and socioeconomic disparities in the risk of cancer and other chronic diseases [17]. Between 2002 and 2009, over 85,000 men and women, aged 40–79, were recruited from 12 southeastern states. The majority of the participants (86%) were enrolled from 71 Community Health Centers (CHC), institutions providing basic health and preventive services mainly to low-income, underinsured, and uninsured individuals. The rest of the study participants (14%) enrolled in 2004–2006 by responding to a mailed questionnaire were sent to randomly selected residents of the same 12 states. Informed consent was obtained from each participant upon enrollment into the SCCS. Institutional Review Boards at Vanderbilt University (Nashville, TN, USA) and Meharry Medical College (Nashville, TN, USA) approved the study.

For this analysis, of the 48,970 women with information on sleep duration, we excluded those who reported a previous diagnosis of cancer except for nonmelanoma skin cancer ($N = 3872$) and those who resided outside the 11 states (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia) where cancer registry data were available ($N = 2145$). The final analytic sample included 42,953 women.

2.2. Breast cancer ascertainment

Incident breast cancer cases were identified via linkage to state cancer registries. Because information on follow-up times for cancer incidence varied from state to state and censoring dates were not rigid, we used a nested case–control design. All incident invasive breast cancers were included as cases ($N = 518$) and controls were all the other female participants who were free of breast cancer according to the most recent registry linkage ($N = 42,435$). Data on ER status and PR status were obtained from the cancer registries and supplemented by pathology reports and medical records. ER and PR status was available for 438 and 436 women, respectively (status for both ER and PR was available for 430 cases).

2.3. Assessment of sleep duration and covariates

In the baseline questionnaire, participants were asked the number of hours they usually slept in a 24-h period, on weekdays and weekends separately. In addition, we calculated a weighted average sleep duration per 24 h [(weekday sleep duration × 5) + (weekend sleep duration × 2)/7]. We grouped weekday and weekend into five categories: <6, 6, 7, 8, and ≥9 h. The average sleep duration was rounded off and grouped into the same five categories. The largest group (8 h) was considered as the reference. In the analysis of tumor subtypes among white women, we combined the 8 and ≥9 h groups to form the reference group to preserve statistical power. In order to examine the effects of different weekday versus weekend sleep patterns, we also categorized participants as consistently normal/long sleepers (≥8 h of sleep on both weekdays and weekends), consistently short sleepers (<8 h of sleep on both weekdays and weekends), weekday-only short sleepers (<8 h of sleep on weekdays but ≥8 h on weekends), and weekend-only short sleepers (<8 h of sleep on weekends but ≥8 h on weekdays).

The baseline questionnaire also collected comprehensive information on demographic characteristics, height and weight, medical history, reproductive history, hormone therapy use, family history of cancer, diet, and other lifestyle factors such as physical activity, alcohol drinking, and smoking.

2.4. Statistical analysis

Participants in the different sleep categories were compared using χ^2 statistics for categorical characteristics and the nonparametric Kruskal–Wallis test for continuous variables. Logistic regression models were used to estimate odds ratios (ORs) and 95% confidence intervals (CIs) for incident breast cancer for each category of sleep duration, with 8 h of sleep or consistent normal/long sleepers as the reference group. In the multivariable models, we adjusted for potential confounders and risk factors for breast cancer including age (continuous), enrollment year (continuous), race (black, white, other, or missing), enrollment state (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia), education (less than high school, high school or General Education Development (GED), some college or vocational training, college graduate or higher, or missing), marital status (single, married, separated, divorced or widowed, or missing), income (<$15,000, $15,000 –< $25,000, $25,000 –< $50,000, ≥$50,000, or missing), body mass index (BMI; <25, 25 –< 30, 30+ kg/m^2, or missing), moderate-to-vigorous physical activity (quartiles, metabolic equivalent), overall sitting (quartiles, hours/day), smoking status (current, former, never, or missing), pack-years of smoking (0, 0–20, 21–40, 40+, or missing), number of live births (0, 1, 2+, or missing), age at first birth (nulliparous, <20, 20 –< 30, 30 years, or missing), length of breast feeding (nulliparous, 0 –< 1 year, ≥1 year, or missing), age at menarche (≤12, >12 years of age, or missing), postmenopausal (yes, no, or missing), ever use of menopausal hormone therapy (yes, no, or missing), current use of multivitamins (yes, no, or missing), current use of aspirin (yes, no, or missing), history of diabetes (yes, no, or missing), family history of cancer among first-degree relatives (yes, no, or missing), average number of alcoholic drinks consumed per day (0, >0–1, >1, or missing), and daily intake of total fat (continuous), fiber (continuous), folate (continuous), and total calories (continuous). For all dietary intakes, missing values ($N = 2297$) were set at mean and were adjusted for total energy intake using the density method (dividing the intake amount by total calories). Tests for linear trend were performed by modeling a numeric value (1 through 5) for each sleep category.

We conducted additional subgroup analyses stratified by race (white/black) as well as by ER and PR status. In sensitivity analyses, we also excluded cases diagnosed within two years after enrollment. In addition, we tested for interactions between sleep duration and age, education, BMI, and menopausal status using the likelihood ratio test comparing models with the cross-product terms to those without. All analyses were performed using SAS (SAS 9.3; SAS Institute, Cary, NC, USA).

3. Results

At baseline, 28% of the women reported 8 h of sleep per night (our analytic referent) on weekdays, 59% reported <8 h and 13%