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Association of Sexual Harassment and Sexual Assault With Midlife Women's Mental and Physical Health

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IMPORTANCE Sexual harassment and sexual assault are prevalent experiences among women. However, their association with health indices is less well understood.

OBJECTIVE To investigate the association of history of sexual harassment and sexual assault with blood pressure, mood, anxiety, and sleep among midlife women.

DESIGN, SETTING, AND PARTICIPANTS Nonsmoking women without cardiovascular disease were recruited from the community to undergo physical measurements (blood pressure, height, weight), medical history, and questionnaire psychosocial assessments (workplace sexual harassment, sexual assault, depression, anxiety, sleep).

EXPOSURES Sexual harassment and sexual assault.

MAIN OUTCOMES AND MEASURES Blood pressure, depressive symptoms, anxiety, and sleep characteristics.

RESULTS Among the 304 nonsmoking women aged 40 to 60 years who participated in the study, all were free of clinical cardiovascular disease, and the mean (SD) age was 54.05 (3.99) years. A total of 19% reported a history of workplace sexual harassment (n = 58), and 22% reported a history of sexual assault (n = 67). Sexual harassment was related to significantly greater odds of stage 1 or 2 hypertension among women not taking antihypertensives (odds ratio [OR], 2.36; 95% CI, 1.10-5.06; *P* = .03) as well as clinically poor sleep (OR, 1.89; 95% CI, 1.05-3.42; *P* = .03), after adjusting for covariates. Sexual assault was associated with significantly greater odds of clinically elevated depressive symptoms (OR, 2.86; 95% CI, 1.42-5.77; multivariable *P* = .003), clinically relevant anxiety (OR, 2.26; 95% CI, 1.26-4.06; *P* = .006), and clinically poor sleep (OR, 2.15; 95% CI, 1.23-3.77; multivariable *P* = .007), after adjusting for covariates.

CONCLUSIONS AND RELEVANCE Sexual harassment and sexual assault are prevalent experiences among midlife women. Sexual harassment was associated with higher blood pressure and poorer sleep. Sexual assault was associated with poorer mental health and sleep. Efforts to improve women's health should target sexual harassment and assault prevention.

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Sexual harassment and sexual assault are common experiences among women. In the United States, an estimated 40% to 75% of women have experienced workplace sexual harassment,[1] and over 1 in 3 women (36%) have experienced sexual assault.[2] With recent popular movements (eg, MeToo, #TimesUp), there is rising public awareness of sexual harassment and assault and their implications for women's health.

Both sexual harassment and sexual assault have been linked to poorer self-reported physical and mental health outcomes.[3-8] While these studies suggest that harassment and assault are associated with adverse outcomes broadly, these findings are limited by several issues. Survey studies, particularly of sexual harassment, largely assess physical health via self-report. These reports can be biased by mood, memory, and reporting of physical symptoms[9] and by awareness of health conditions, which can vary by socioeconomic status, health care access, and health literacy.[10] Another limitation is incomplete consideration of critical confounding factors, such as socioeconomic position, adiposity, and medication use. Furthermore, self-reported outcomes are often assessed using single-question items rather than full validated measures. Research on sexual harassment and assault using measured health indices, full multidimensional scales, and comprehensive consideration of confounders is warranted.

Among a well-characterized sample of 304 midlife women, we investigated the association of a history of sexual harassment and sexual assault with blood pressure (BP), depressed mood, anxiety, and sleep, important health issues affecting midlife women. Elevated BP is a major risk factor for cardiovascular disease (CVD), the leading cause of death in women,[11] and an important indicator of risk among midlife women who typically develop clinical CVD later in life.[12] Depression and anxiety show a doubling in rates in women relative to men,[13] and up to half of midlife women report problems with sleep.[14,15] We hypothesized that sexual harassment and assault would be associated with higher BP, more depressed mood and anxiety, and poorer sleep after accounting for key confounders.

Key Points

Question Do women with a history of sexual harassment or sexual assault have higher blood pressure, greater depression and anxiety, and poorer sleep than women without this history?

Findings Among 304 nonsmoking midlife women recruited from the community to undergo assessment and complete questionnaires for this prospective cohort study, those with a history of workplace sexual harassment had significantly higher odds of hypertension and clinically poor sleep than women without this history, after adjusting for covariates. Women with a history of sexual assault had significantly higher odds of clinically significant depressive symptoms, anxiety, and poor sleep than women without this history, after adjusting for covariates.

Meaning Sexual harassment and sexual assault have implications for women's health.

Methods

Study Participants

A total of 304 nonsmoking women aged 40 to 60 years were recruited from the community (Pittsburgh, Pennsylvania) via advertisements, mailings, and online message boards. The cohort was originally selected for a study designed to examine the association of menopausal hot flashes and subclinical atherosclerosis as assessed by carotid ultrasonography.[16] Per the original study design, half of the women reported menopausal hot flashes, and half reported no hot flashes.[16] Of the 1929 women who underwent telephone screening, 304 were eligible and enrolled. Exclusions, selected based on their impact on menopausal symptoms and cardiovascular health, included premenopausal status; hysterectomy or oophorectomy; reported history of CVD, arrhythmia, kidney failure, gynecological cancer; current pregnancy; or having used key medications in the past 3 months: oral/transdermal estrogen or progesterone, selective estrogen receptor modulators, selective serotonin reuptake inhibitors, serotonin norepinephrine reuptake inhibitors, gabapentin, insulin, β-blockers, calcium channel blockers, and α-2 adrenergic agonists. Procedures were approved by the University of Pittsburgh institutional review board, and all participants provided written informed consent.

Main Outcomes and Measures

Procedures included physical measurements, interviews, and questionnaires. Sexual harassment and assault were assessed from Brief Trauma Questionnaire items developed for the Nurses' Health Study II[17] adapted from the Brief Trauma Interview.[18,19] Items assessed workplace sexual harassment ("Have you ever experienced sexual harassment at work that was either physical or verbal?") and sexual assault ("Have you ever been made or pressured into having some type of unwanted sexual contact? [By sexual contact we mean any contact between someone else and your private parts or between you and someone else's private parts])?" Response options were yes/no. This measure has high interrater reliability relative to the *Diagnostic and Statistical Manual of Mental Disorders* (fourth edition) for presence of Criterion A1 trauma exposure ($\kappa = 0.70$).[17]

Seated BP was measured via a Dinamap device after a 10-minute rest. Height and weight were measured via a stadiometer and balance beam scale. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Depressive symptoms were assessed by the Center for Epidemiologic Studies Depression (CESD) scale,[20] trait anxiety via the Spielberger State-Trait Anxiety Inventory (STAI),[21] and sleep quality via the Pittsburgh Sleep Quality Index (PSQI)[22] considered continuously and via clinical cut points (CESD ≥16[20]; PSQI >5[22]; and STAI ≥40[23] and upper quartile of normative samples[21]). Demographics and medical history were assessed via structured interview. Women reported current medication use (eg, for BP: angiotensin converting enzyme inhibitors, angiotensin receptor blockers, diuretics; for sleep: melatonin, GABA-α agents (γ-aminobutyric acid-α); for anxiety: benzodiazepines; and for depression: bupropion, tricyclic agents). Physical activity was assessed via the Interna-

Table 1. Study Participant Characteristics

Characteristic	Participants, No. (%) (n = 304)			
	Workplace Sexual Harassment		Sexual Assault	
	Yes (n = 58 [19%])	No (n = 246 [81%])	Yes (n = 67 [22%])	No (n = 237 [78%])
Age, mean (SD), y	53.93 (3.53)	54.08 (4.09)	53.73 (4.06)	54.14 (3.97)
Race/ethnicity				
White	45 (77.59)	175 (71.14)	50 (74.63)	170 (71.73)
Nonwhite[a]	13 (22.41)	71 (28.86)	17 (25.37)	67 (28.27)
Education[b]				
<College	17 (29.31)	112 (45.53)	23 (34.33)	106 (44.73)
≥College	41 (70.69)	134 (54.47)	44 (65.67)	131 (55.27)
Marital status				
Married/partnered	28 (48.28)	142 (57.72)	32 (47.76)	138 (58.23)
Divorced/widowed	14 (24.14)	64 (26.02)	17 (25.37)	61 (25.74)
Single	16 (27.59)	40 (16.26)	18 (26.87)	38 (16.03)
Financial strain, yes[c]	27 (46.55)	68 (27.98)	26 (38.81)	69 (29.49)
BMI, mean (SD)	27.85 (6.07)	29.26 (6.89)	27.80 (6.20)	29.32 (6.88)
Alcohol use				
<Monthly	21 (36.21)	109 (44.31)	29 (43.28)	101 (42.62)
Monthly but <weekly	20 (34.48)	77 (31.30)	23 (34.33)	74 (31.22)
Weekly	17 (29.31)	60 (24.39)	15 (22.39)	62 (26.16)
Leisure physical activity (IPAQ score), median (IQR)[d]	458 (0-1286)	396 (0-1298)	297 (0-1188)	438 (0-1386)
Snoring	27 (46.55)	109 (44.31)	31 (46.27)	105 (44.30)
Nightshift work	3 (5.17)	17 (6.91)	5 (7.46)	15 (6.33)
Medication use				
BP-lowering	9 (15.52)	39 (15.85)	7 (10.45)	41 (17.30)
Sleep	2 (3.45)	12 (4.88)	1 (1.49)	13 (5.49)
Antidepressants	1 (1.72)	5 (2.03)	1 (1.49)	5 (2.11)
Anxiolytics	1 (1.72)	4 (1.63)	1 (1.49)	4 (1.69)

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); BP, blood pressure; IPAQ, International Physical Activity Questionnaire[24]; IQR, interquartile range.

[a] Nonwhite race/ethnicity includes African American, Asian, Hispanic, or biracial.

[b] Education level varied significantly by harassment status ($P < .05$).

[c] Financial strain was defined as somewhat hard or very hard to pay for basic necessities of life, and it varied significantly by harassment status ($P < .05$).

[d] Physical activity was square-root transformed for analysis.

tional Physical Activity Questionnaire[24] and snoring via the Berlin Questionnaire.[25]

Data Analyses

All PSQI values were natural log-transformed for analysis. Differences between participants by harassment or assault history were tested using linear regression, Wilcoxon rank sum, and χ^2 tests. Associations between exposures and outcomes were tested in regression models. Covariates were factors associated with the outcome at $P < .15$, with select variables selected a priori for inclusion (medications and for sleep models snoring and nightshift work). Residual analysis and diagnostic plots were conducted to verify model assumptions. Analyses were performed with SAS software, version 9.4 (SAS Institute Inc). Models were 2 sided, $\alpha = .05$.

Results

Participants were on average 54 years old (**Table 1**). Nineteen percent of women (n = 58) reported a history of workplace sexual harassment, and 22% reported a history of sexual assault (n = 67). Ten percent of women reported both sexual harassment and assault (n = 30). Women with a history of sexual harassment had higher education yet more financial strain. No characteristics varied by sexual assault.

Women with a history of sexual harassment had significantly higher systolic BP (SBP), marginally higher diastolic BP (DBP), and significantly poorer sleep quality than women without a history of harassment, after adjusting for covariates (all supporting data provided in **Table 2**). When considering clinical cut points, harassment was associated with significantly higher likelihood of stage 1 or 2 hypertension among women not taking antihypertensive medications (SBP ≥130 or DBP ≥80 mm Hg; odds ratio [OR], 2.36; 95% CI, 1.10-5.06; multivariable $P = .03$) and of poor sleep consistent with clinical insomnia (OR, 1.89; 95% CI, 1.05-3.42; multivariable $P = .03$) (**Figure 1**).

Women with a history of sexual assault had higher depressive symptoms, anxiety, and poorer sleep quality than women without a history of sexual assault (Table 2). Assault was associated with significantly higher odds of clinically elevated depressive symptoms (OR, 2.86; 95% CI, 1.42-5.77; multivariable $P = .003$), anxiety (OR, 2.26; 95% CI, 1.26-4.06; multivariable $P = .006$), and poor sleep (OR, 2.15; 95% CI, 1.23-3.77; multivariable $P = .007$) (**Figure 2**).

Table 2. Workplace Sexual Harassment and Sexual Assault Associated With BP, Mental Health, and Sleep Indices[a]

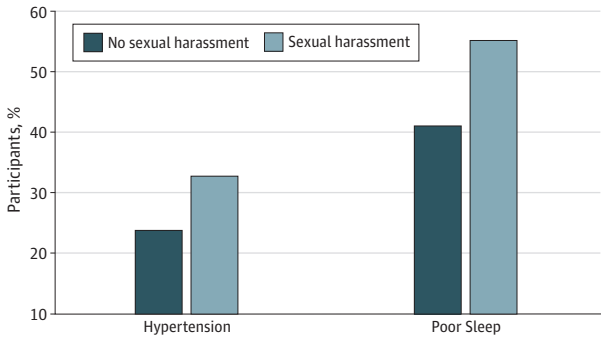
Characteristic	Sexual Harassment, B (SE)	*P* Value	Sexual Assault, B (SE)	*P* Value
SBP	3.96 (1.94)	.04	1.55 (1.85)	.40
DBP	2.40 (1.29)	.06	1.49 (1.23)	.23
Depressive symptoms	2.27 (1.21)	.06	4.01 (1.13)	<.001
Anxiety	1.55 (1.43)	.28	3.78 (1.34)	.005
Sleep quality[b]	0.15 (0.07)	.03	0.24 (0.06)	<.001

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); BP, blood pressure; B (SE), unstandardized beta (standard error); DBP, diastolic blood pressure; SBP, systolic blood pressure.

[a] All models adjusted for age, race/ethnicity, education, BMI; BP models adjusted for use of BP-lowering medication; depression/anxiety models adjusted for use of antidepressants or anxiolytics; sleep models adjusted for snoring, use of sleep medication, nightshift work.

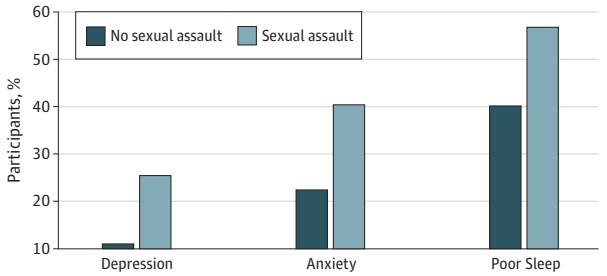
[b] Sleep quality natural log transformed for analysis.

Figure 1. Association of Sexual Harassment With Prevalence of Hypertension and Poor Sleep



For hypertension, the adjusted odds ratio (aOR) was 2.36 (95% CI, 1.10-5.06) (*P* = .03); for sleep, aOR, 1.89 (95% CI, 1.05-3.42) (*P* = .03). Hypertension models were adjusted for age, race/ethnicity, education, and BMI among women not using antihypertensive medications; hypertension stage 1 or 2 was defined as systolic blood pressure of 130 mm Hg or higher or diastolic blood pressure of 80 mm Hg or higher. Sleep models were adjusted for age, race/ethnicity, education, BMI, snoring, use of sleep medication, and nightshift work.

Figure 2. Association of Sexual Assault With Depressed Mood, Anxiety, and Sleep Quality



For depressed mood, the adjusted odds ratio (aOR) was 2.86 (95% CI, 1.42-5.77) (*P* = .003); for anxiety, aOR, 2.26 (95% CI, 1.26-4.06) (*P* = .006); for sleep, aOR, 2.15 (95% CI, 1.23-3.77) (*P* = .007). Depression and anxiety models were adjusted for age, race/ethnicity, education, BMI, use of antidepressants, and use of anxiolytics; sleep models were adjusted for age, race/ethnicity, education, BMI, snoring, use of sleep medication, and nightshift work.

Discussion

Among the study participants, 19% reported a history of workplace sexual harassment, and 22% reported a history of sexual assault. Sexual harassment was associated with higher BP and poorer sleep, and sexual assault with depressed mood, anxiety, and poor sleep. Associations persisted after adjusting for demographic and biomedical covariates.

Approximately 1 in 5 women reported having been sexually harassed or sexually assaulted. Although high, these rates are lower than those of national samples.[1,2] Variations in estimates can arise from sample characteristics, assessment methods, and willingness of participants to report these sensitive experiences. Our sample was somewhat lower risk in sociodemographic and physical characteristics than the average population because we excluded women who were smokers, who had undergone hysterectomy, or who were using common antidepressants and certain cardiovascular medications. Few characteristics distinguished between women who had been sexually harassed and those who had been sexually assaulted, with the exception that women who were sexually harassed were more highly educated yet more financially strained. Notably, women who are younger or are in more precarious employment situations are more likely to be harassed, and financially stressed women can lack the financial security to leave abusive work situations.[3] Why more highly educated women in the present study were more likely to be harassed is unclear; these women may more often be employed in male-dominated settings, be more knowledgeable about what constitutes sexual harassment, or be perceived as threatening; sexual harassment is an assertion of hierarchical power relations.[3,26]

This study examines sexual harassment and assault in relation to measured BP, an advance over previous work relying largely on self-reports. An exception is work by Krieger and colleagues,[27] who examined workplace hazards in relation to BP among low-income participants, finding that only sexual harassment was associated with SBP among women. Notably, the magnitude of increase in SBP observed in the present study associated with a history of harassment (approximately 4 mm Hg in SBP) is clinically significant (eg, a 20% increased risk for CVD).[28] Importantly, harassed women not taking antihypertensive agents had more than 2-fold increased odds of BP consistent with hypertension.

Sexual assault was related to poorer mental health. Assaulted women had almost 3-fold greater odds of symptoms consistent with a major depressive disorder and more than 2-fold greater odds of elevated anxiety. Conversely, sexual assault appeared less

related to BP; a relation that may depend on the severity or chronicity of the victimization history.[29] Sexual assault and harassment were each associated with a 2-fold increased odds of poor sleep consistent with clinical insomnia. Notably, poor sleep,[30,31] depressed mood,[32] and anxiety[33] are themselves linked adverse physical health outcomes.

Strengths and Limitations

This work has limitations. Study exposures were assessed via 2 questions. Future work should use a full multidimensional scale that measures the severity and chronicity of exposures. Women recalled harassment and assault and reported exclusionary medical conditions that may incorporate reporting biases. The sample had somewhat limited representation of racial/ethnic minority groups and reflected several exclusions; thus, findings may not be generalizable to all women. Future work should include more diverse samples. This work incorporates multiple comparisons. Finally, this study cannot establish the causality or temporality of exposures associated with outcomes.

This study has several strengths. We considered sexual harassment and assault, prevalent yet understudied exposures in women. We considered measured BP and a range of mental health indices assessed with full, validated scales. We adjusted for a range of key covariates. We studied these associations in a well-characterized sample of women.

Conclusions

Among midlife women, workplace sexual harassment was associated with higher BP and poorer sleep, and sexual assault with depressed mood, anxiety, and poorer sleep. Future work should consider whether preventing or mitigating sexual harassment and sexual assault can improve women's mental and cardiovascular health. Given the high prevalence of sexual harassment and assault, addressing these prevalent and potent social exposures may be critical to promoting health and preventing disease in women.

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Correction: This article was corrected on November 5, 2018, to correct the y-axis in Figure 1, which had made the percentage of participants display incorrectly in the bar graph.

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Author Contributions: Dr Thurston had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Concept and design: Thurston, Matthews, Koenen.
Acquisition, analysis, or interpretation of data: Thurston, Chang, von Känel, Koenen.
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