

Relation of Demographic and Lifestyle Factors to Symptoms in a Multi-Racial/Ethnic Population of Women 40–55 Years of Age

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A community-based survey was conducted during 1995–1997 of factors related to menopausal and other symptoms in a multi-racial/ethnic sample of 16,065 women aged 40–55 years. Each of seven sites comprising the Study of Women's Health across the Nation (SWAN) surveyed one of four minority populations and a Caucasian population. The largest adjusted prevalence odds ratios for all symptoms, particularly hot flashes or night sweats (odds ratios = 2.06–4.32), were for women who were peri- or postmenopausal. Most symptoms were reported least frequently by Japanese and Chinese (odds ratios = 0.47–0.67 compared with Caucasian) women. African-American women reported vasomotor symptoms and vaginal dryness more (odds ratios = 1.17–1.63) but urine leakage and difficulty sleeping less (odds ratios = 0.64–0.72) than Caucasians. Hispanic women reported urine leakage, vaginal dryness, heart pounding, and forgetfulness more (odds ratios = 1.22–1.85). Hot flashes or night sweats, urine leakage, and stiffness or soreness were associated with a high body mass index (odds ratios = 1.15–2.18 for women with a body mass index ≥ 27 vs. 19–26.9 kg/m²). Most symptoms were reported most frequently among women who had difficulty paying for basics (odds ratios = 1.15–2.05), who smoked (odds ratios = 1.21–1.78), and who rated themselves less physically active than other women their age (odds ratios = 1.24–2.33). These results suggest that lifestyle, menstrual status, race/ethnicity, and socioeconomic status affect symptoms in this age group. *Am J Epidemiol* 2000;152:463–73.

ethnic groups; menopause; risk factors; smoking; social class; symptoms and general pathology

By the year 2025, the number of postmenopausal women in the United States is projected to double from the mid-1990s (1), with half a million women added annually to the midlife population for the rest of this decade (2). An estimated 3–5 billion dollars will be spent annually by the year 2005 for hormone replacement and physician monitoring alone (3). However, relatively little is known about the prevalence of symptoms in women in their fifth and sixth decades of life, and much of what is known is derived from studies of White women. Developing preventive strategies for such women who are undergoing social and physiologic transition requires understanding multiple factors that affect symptom reporting in women from different socioeconomic and racial/ethnic backgrounds.

In the present study, we investigated the relation of sociodemographic and lifestyle factors to a number of specific symptoms or conditions in a large, multiethnic, community-based sample of women from across the United States who participated in the first phase of the Study of Women's Health across the Nation (SWAN). We hypothesized that: 1) vasomotor and other estrogen-related symptoms would be more frequently associated with factors that result in decreased production of estrogen, such as surgical menopause, smoking, reduced body mass, and physical activity; 2) prevalence of non-estrogen-related symptoms would increase with age, independent of menopausal status; and 3) factors resulting in physiologic, economic, or social stress (lower education, being unmarried, difficulty paying for basics, and unemployment) would be associated with increased symptomatology but that the prevalence of specific symptoms would differ by race/ethnicity.

MATERIALS AND METHODS

Study population

The first phase of SWAN consisted of a cross-sectional survey conducted from 1995 through 1997 of 16,065 women from seven geographic areas in the United States (Boston, Chicago, Detroit, Los Angeles, Newark, Oakland, and Pittsburgh). The purpose of the survey was twofold: 1) to screen women for eligibility for enrollment into a longi-

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Abbreviation: SWAN, Study of Women's Health across the Nation.

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tudinal study of premenopausal women and 2) to investigate cross-sectional relations of a limited number of risk factors and health outcomes. Each site screened one minority population (African Americans in Pittsburgh, Boston, the Detroit area, and Chicago; Japanese in Los Angeles; Chinese in the Oakland area of California; and Hispanics in New Jersey) in addition to a Caucasian population. Community-based sampling, using established lists of populations at five sites and random digit dialing combined with a "snowball" approach at two sites (4) (those with the Hispanic and Japanese minority samples), was used to sample women aged 40–55 years, who resided in the area surrounding each clinical site. In the snowball technique, women first identified by a list-based or random digit dialing technique were asked for the names and contact information of other women who would meet the eligibility criteria, and these women in turn were contacted, screened for eligibility, and asked for the names of other appropriate women. This process continued until a sufficient number of eligible women was identified. Women were included who spoke English, Spanish, Cantonese, or Japanese at the respective sites where these languages were used and who identified themselves as Caucasian, African American, Hispanic, Japanese, or Chinese, depending on the site-specific population screened.

Data collection

Ascertainment of symptoms. Since the cross-sectional survey had to be brief, the presence of vasomotor, psychologic, and physical symptoms during the previous 2 weeks was determined from self-reported (yes/no) responses to closed-ended questions. Most interviews were computer-assisted telephone interviews, with about half being in-person at two sites. The specific symptoms included were based primarily on previous epidemiologic work on Caucasian women (5–7) and included the following: difficulty sleeping, night sweats, headaches, hot flushes or flashes, forgetfulness, vaginal dryness, leaking urine, feeling tense or nervous, feeling blue or depressed, and irritability or grouching. In addition, symptoms such as stiffness or soreness in joints, neck, or shoulders and heart pounding or racing were included, based on previous anthropologic work in the different race/ethnic groups (8, 9). Symptoms thought to be associated with menopause, such as hot flashes, night sweats, and vaginal dryness, were interspersed with other symptoms to minimize bias from stereotypic thinking about menopause (10). The relation of demographic and lifestyle variables to the psychologic symptoms is addressed elsewhere (L. H. Powell et al., Rush Presbyterian-St. Luke's Medical Center, unpublished manuscript), while the relations to physical symptoms are addressed here.

Assessment of independent variables. Independent variables of interest were self-reported current status related to demographic factors (age, race/ethnicity, educational attainment, employment, marital status, number of children, and ability to pay for basics), lifestyle factors (smoking, physical activity), height and weight, and menopausal status.

Race/ethnicity was self-defined as Black or African American, non-Hispanic Caucasian, Chinese or Chinese

American, Japanese or Japanese American, or Hispanic (Central American, Cuban or Cuban American, Dominican, Mexican or Mexican American, Puerto Rican, South American or Spanish, or other Hispanic). In addition, respondents could specify a race/ethnicity other than the defined categories or indicate "mixed" or no primary affiliation. Since most extant literature is based on non-Hispanic Caucasians, this was the reference group. Questions about smoking were modified from those of the American Thoracic Society (11). Physical activity was assessed with one question about activity level relative to other women of the respondent's age. The body mass index was calculated from self-reported height and weight and equals weight (kg)/height (m)².

Menopausal status was based on menstrual characteristics as: *surgical*, indicating menses had stopped as a result of hysterectomy and/or oophorectomy (thus not necessarily representing cessation of hormonal cycling); *postmenopausal*, indicating menses had stopped for at least 12 months without surgery; *late perimenopausal*, indicating menses had occurred in the past 12 months but not in the last 3 months; *early perimenopausal*, indicating menses had occurred in the past 3 months but had become less predictable; and *premenopausal*, indicating menses had occurred in the past 3 months with no decrease in predictability. Women whose menstrual periods had stopped because of medication, radiotherapy, pregnancy or lactation, or extreme weight change ($n = 311$), who reported use of exogenous female hormones in the past 3 months (since such use might reflect greater symptom prevalence or reduced symptom reporting and thus be uninterpretable, $n = 1,635$), or who reported their race/ethnicity as mixed/other (since this was a very non-homogeneous group, $n = 1,694$) were excluded, for a total of 12,425 included in the present analyses.

Data analyses

Crude prevalence odds ratios for the association between the selected characteristics and each symptom were computed. Multiple logistic regression was used to adjust prevalence odds ratios simultaneously for site and demographic, lifestyle, and reproductive characteristics (12). As a result of factor analyses (13), we combined hot flashes and night sweats into one outcome variable of hot flashes and/or night sweats. The odds ratios for the symptoms "difficulty sleeping," "forgetful," and "heart pounding or racing" were also adjusted for reporting irritability, feeling tense, or feeling anxious or depressed. Initial exploratory adjustment for diagnosis or treatment of arthritis was made for the symptom "stiffness or soreness in joints, neck, or shoulders," but this did not modify the results. Exploratory adjustment for language in which the interview was conducted, as an indicator of acculturation, also did not modify the results.

Parity was treated as a continuous variable. Four-year age groups and body mass index (14) were treated as categorical variables, since they were not linearly related to the prevalence of most of the symptoms. All categorical variables were treated as dummy variables in the logistic regression, thus assuming no particular ordering. Goodness-of-fit of

TABLE 1. Distributions of study population by race/ethnicity and selected characteristics, Study of Women's Health across the Nation (SWAN), 1995–1997

	African American		Non-Hispanic Caucasian		Japanese		Chinese		Hispanic	
	No.	%	No.	%	No.	%	No.	%	No.	%
Age (years)										
40–43	904	24.6	1,732	30.0	189	26.6	172	31.5	506	29.4
44–47	1,134	30.8	1,764	30.6	240	33.8	206	37.7	517	30.1
48–51	933	25.4	1,358	23.5	172	24.2	122	22.3	404	23.5
52–55	705	19.2	920	15.9	110	15.5	46	8.4	291	16.9
Education										
<High school	319	8.8	277	4.8	5	0.7	97	17.8	619	36.2
High school/equivalent	1,023	28.1	1,574	27.3	138	19.4	96	17.6	470	27.5
Some college	1,450	39.8	1,668	29.0	261	36.8	123	22.5	377	22.0
College graduate	412	11.3	1,063	18.5	212	29.9	136	24.9	179	10.5
Postgraduate	437	12.0	1,177	20.4	94	13.2	94	17.2	66	3.9
Difficulty paying for basics										
Very hard	480	13.1	492	8.6	24	3.4	34	6.3	526	30.8
Somewhat hard	1,321	36.1	1,746	30.3	192	27.1	147	27.2	799	46.7
Not at all hard	1,859	50.8	3,518	61.1	492	69.5	360	66.5	385	22.5
Marital status										
Never married	751	20.5	693	12.0	37	5.2	39	7.1	126	7.4
Married/living as	1,630	44.4	3,904	67.7	595	83.7	448	82.0	1,123	65.6
Separated	284	7.7	170	3.0	24	3.4	4	0.7	174	10.2
Widowed	206	5.6	171	3.0	11	1.6	10	1.8	85	5.0
Divorced	799	21.8	825	14.3	44	6.2	45	8.2	205	12.0
Parity										
0	322	8.8	1,254	21.7	102	14.4	76	13.9	136	7.9
1	641	17.4	953	16.5	107	15.0	85	15.6	284	16.6
2	1,039	28.3	1,869	32.4	320	45.0	256	46.9	541	31.6
3	800	21.8	1,044	18.1	147	20.7	97	17.8	427	24.9
≥4	872	23.7	649	11.2	35	4.9	32	5.9	326	19.0
Menstrual status										
Surgical	976	26.6	673	11.7	53	7.4	13	2.4	273	15.9
Postmenopausal	484	13.2	802	13.9	75	10.6	63	11.4	334	19.4
Late perimenopausal	169	4.6	317	5.5	30	4.2	19	3.5	78	4.5
Early perimenopausal	1,018	27.7	1,801	31.2	183	25.7	158	28.9	396	23.0
Premenopausal	1,029	28.0	2,181	37.8	370	52.0	294	53.8	637	37.1
Body mass index (weight (kg)/height (m) ²)										
<19	158	4.3	342	5.9	67	9.4	61	11.2	164	9.6
19–26.9	1,273	34.9	3,350	58.2	565	79.6	433	79.3	893	52.1
27–31.9	1,037	28.4	1,100	19.1	64	9.0	40	7.3	420	24.5
≥32	1,180	32.4	962	16.7	14	2.0	12	2.2	236	13.8
Smoking										
Never	1,822	49.7	2,687	46.6	497	70.1	463	94.7	1,117	65.2
Past	803	21.9	1,630	28.3	139	19.6	16	3.3	289	16.9
Current	1,044	28.4	1,450	25.1	73	10.3	10	2.0	306	17.9
Physical activity										
Much less	274	7.7	282	5.0	40	5.7	22	4.6	108	6.6
Somewhat less	649	18.3	828	14.6	103	14.8	69	14.3	196	12.0
Same	1,331	37.5	2,185	38.6	277	39.7	227	46.9	822	50.2
Somewhat more	753	21.2	1,572	27.8	181	25.9	94	19.4	261	15.9
Much more	544	15.3	795	14.0	97	13.9	72	14.9	251	15.3

models was tested by the Hosmer and Lemeshow procedure (15). Because sites were not randomly selected and because sampling procedures varied by site to accommodate the difficulties in attaining adequate numbers of each racial/ethnic minority (i.e., formal representative sampling procedures were not exclusively used at two sites), use of estimation procedures based on formal sampling methods was inappropriate. The variance estimates used in the confidence intervals shown here were thus based on simple random sampling, but they should be interpreted with caution for these reasons.

Interactions of race/ethnicity or menstrual status with the association of each factor and symptom were first examined by stratifying on race/ethnicity or menstrual status to determine if the stratum-specific natural logarithms of the odds ratios differed from each other or from the unstratified natural logarithm odds ratio by more than two times the standard error for the unstratified effect. If so, the statistical significance of interaction terms was examined in the multiple logistic regression model.

RESULTS

Characteristics of the study population

Age distributions were generally similar by race/ethnic group, although a higher proportion of Chinese women were aged 40–43 years and a lower proportion were aged 52–55 years compared with other race/ethnic groups (table 1). Most women were premenopausal or in the early perimenopause; the proportion of women who had had surgical menopause was higher in African Americans, and the proportion who were postmenopausal was higher in Hispanics than in other race/ethnic groups. Hispanics had the lowest and Caucasians the highest educational attainment, while Japanese and Chinese women reported the least difficulty paying for basics. African-American and Hispanic women had higher parity, and African Americans had higher body mass index than did women in the other race/ethnic groups. Smoking rates were lower in Japanese and Chinese women. The perception of amount of physical

TABLE 2. Crude percentage of women with each symptom (of those reporting) by demographic and health characteristics, Study of Women's Health across the Nation (SWAN), 1995–1997

Characteristics*	Symptom (%)						
	Hot flashes/ night sweats (<i>n</i> = 3,963)†	Urine leakage (<i>n</i> = 2,135)	Vaginal dryness (<i>n</i> = 1,629)	Difficult sleep (<i>n</i> = 4,632)	Stiff/sore (<i>n</i> = 6,620)	Heart pounding (<i>n</i> = 2,315)	Forgetfulness (<i>n</i> = 4,843)
Age (years)							
40–43 (<i>n</i> = 3,493; 28.3%)	25.2	14.8	8.6	37.0	50.9	18.2	33.1
44–47 (<i>n</i> = 3,834; 31.0%)	31.2	17.0	11.3	35.8	52.0	19.0	39.2
48–51 (<i>n</i> = 2,965; 24.0%)	42.7	19.6	16.7	39.9	56.1	17.4	43.7
52–55 (<i>n</i> = 2,066; 16.7%)	46.4	19.3	19.8	39.1	56.1	20.8	42.4
Education							
<8 (<i>n</i> = 376; 3.1%)	41.0	22.9	23.7	41.5	56.1	34.3	52.9
8–11 (<i>n</i> = 935; 7.6%)	41.5	22.8	18.6	45.0	55.6	29.9	52.1
12/high school (<i>n</i> = 3,285; 26.7%)	39.7	17.8	14.1	37.5	53.5	20.6	40.7
Some college (<i>n</i> = 3,857; 31.4%)	36.6	17.3	13.0	38.3	54.6	18.2	38.5
College graduate (<i>n</i> = 1,992; 16.2%)	11.8	14.6	10.1	33.7	50.8	14.6	33.2
Postgraduate/professional (<i>n</i> = 1,855; 15.1%)	25.2	15.3	10.1	35.7	52.4	12.1	34.7
Difficulty paying for basics							
Very hard (<i>n</i> = 1,544; 12.6%)	45.8	24.8	19.6	53.5	63.9	33.7	54.6
Somewhat hard (<i>n</i> = 4,184; 34.0%)	37.4	18.5	13.7	40.4	54.6	20.7	43.0
Not at all hard (<i>n</i> = 6,579; 53.5%)	30.6	14.9	11.5	32.2	50.2	13.9	33.0
Race/ethnicity							
African American (<i>n</i> = 3,650; 29.5%)	45.6	16.7	14.8	34.9	55.7	19.2	43.0
Caucasian (<i>n</i> = 5,746; 46.5%)	31.2	18.2	11.2	40.6	54.6	17.0	35.2
Japanese (<i>n</i> = 707; 5.7%)	17.6	12.6	6.7	29.1	50.3	10.3	33.0
Chinese (<i>n</i> = 542; 4.4%)	20.5	11.0	10.2	31.9	48.2	14.1	40.5
Hispanic (<i>n</i> = 1,712; 13.8%)	35.4	19.7	20.4	38.6	47.1	28.1	46.0
Menstrual status							
Surgical (<i>n</i> = 1,988; 16.0%)	46.9	22.1	19.4	43.5	59.4	23.7	43.8
Postmenopausal (<i>n</i> = 1,753; 14.2%)	48.8	17.7	21.2	40.4	54.8	19.5	42.0
Late perimenopausal (<i>n</i> = 611; 4.9%)	56.8	19.6	18.2	43.9	58.4	20.7	44.8
Early perimenopausal (<i>n</i> = 3,547; 28.6%)	36.9	20.6	12.9	40.6	57.9	20.1	44.0
Premenopausal (<i>n</i> = 4,497; 36.3%)	19.4	12.3	7.1	30.9	45.8	14.7	31.2

Table continues

TABLE 2. Continued

Characteristics	Symptom (%)						
	Hot flashes/ night sweats (<i>n</i> = 3,963)	Urine leakage (<i>n</i> = 2,135)	Vaginal dryness (<i>n</i> = 1,629)	Difficult sleep (<i>n</i> = 4,632)	Stiff/sore (<i>n</i> = 6,620)	Heart pounding (<i>n</i> = 2,315)	Forgetfulness (<i>n</i> = 4,843)
Marital status							
Single (<i>n</i> = 1,646; 13.3%)	34.7	14.5	9.9	37.8	54.5	18.9	36.2
Married/living as (<i>n</i> = 7,700; 62.1%)	33.0	16.9	14.0	35.5	52.0	17.2	37.9
Separated/divorced (<i>n</i> = 2,574; 20.8%)	39.2	27.2	12.7	42.8	56.3	21.9	39.2
Widowed (<i>n</i> = 483; 3.9%)	40.8	19.9	12.4	41.0	54.9	23.6	44.1
Parity							
0 (<i>n</i> = 1,890; 15.2%)	29.2	12.4	10.0	37.2	53.1	14.0	30.2
1 (<i>n</i> = 2,070; 16.7%)	34.2	16.6	12.4	38.6	54.5	17.4	37.0
2 (<i>n</i> = 4,025; 35.4%)	34.5	16.7	13.4	36.1	52.6	17.2	39.0
≥3 (<i>n</i> = 4,429; 35.7%)	37.9	20.0	14.5	37.7	53.5	22.6	43.7
Body mass index (kg/m²)							
<19 (<i>n</i> = 792; 6.4%)	30.6	14.9	12.7	40.6	53.4	18.2	40.1
19–26.9 (<i>n</i> = 6,514; 42.7%)	29.9	13.3	12.1	35.2	48.7	16.6	35.7
27–31.9 (<i>n</i> = 2,661; 21.5%)	39.5	18.8	13.8	37.3	54.9	19.7	41.9
≥32 (<i>n</i> = 2,404; 19.4%)	43.8	27.5	15.8	43.4	64.5	23.0	44.4
Smoking							
Never (<i>n</i> = 6,566; 53.3%)	30.0	15.8	13.0	34.6	50.4	16.3	37.6
Past (<i>n</i> = 2,872; 23.3%)	35.5	19.2	13.7	38.0	56.7	19.7	42.0
Current (<i>n</i> = 2,875; 23.4%)	45.5	19.4	13.5	44.6	56.9	23.3	39.6
Physical activity							
Much less (<i>n</i> = 717; 6.0%)	52.5	29.8	21.6	60.8	73.1	35.6	56.9
Some less (<i>n</i> = 1,831; 15.3%)	42.2	22.9	15.2	50.1	65.1	25.1	47.0
Same (<i>n</i> = 4,822; 40.3%)	32.3	16.3	12.8	34.3	50.8	17.0	38.6
Some more (<i>n</i> = 2,853; 23.8%)	31.4	14.8	11.5	33.9	49.6	14.9	33.2
Much more (<i>n</i> = 1,752; 14.6%)	32.6	13.6	11.9	31.2	46.8	15.8	33.5

* Numbers are after exclusions and include those who had missing information for some variables, since for any cell the proportion missing was <2%.

† Numbers indicate those reporting “yes.”

activity compared with other women of the same age did not differ greatly by race/ethnic group.

Unadjusted relation of sociodemographic, health, and lifestyle factors to symptom prevalence

Increased age, lower educational level, difficulty paying for basics, race/ethnicity, increased parity, and employment were related to the prevalence of most symptoms (table 2). Virtually all symptoms, except stiffness and soreness in joints, neck, and shoulders, were less frequently reported in Japanese and Chinese women, while vasomotor symptoms (hot flashes or night sweats) were most frequently reported by African-American or Hispanic women. Urine leakage, vaginal dryness, and heart pounding or racing were more frequently reported by Hispanic women. The prevalence of most symptoms varied by site, thus warranting inclusion of site in multivariate logistic regression analyses.

Vasomotor symptoms were much more frequently reported by women in the late perimenopause or by women who were surgically or naturally postmenopausal compared

with premenopausal women (table 2). Most other symptoms were also more frequent in women who were peri- or postmenopausal, but the differences were not as large. Prior to adjustment for other covariates, the prevalences of hot flashes or night sweats increased with age in most menstrual status categories, except for postmenopausal women in whom it declined (data not shown). However, the prevalence of most symptoms varied more by menstrual status than by age. Heart pounding or racing and difficulty sleeping were not independently related to age (data not shown). Reporting of all other symptoms increased with age, although not in a monotonic trend. Current smoking, engaging in less physical activity than other women of the same age, and increased body mass index were associated with increased prevalence of almost every symptom, although the trends were not monotonic.

Multivariate adjusted associations of risk factors to symptoms

Age. After adjustment for the other covariates in table 1, vasomotor symptoms and urine leakage were not related

TABLE 3. Adjusted* prevalence odds ratios for each symptom by selected characteristics, Study of Women's Health across the Nation (SWAN), 1995–1997

Characteristic	Hot flashes/ night sweats (n = 4,324)		Urine leakage (n = 2,135)		Vaginal dryness (n = 1,629)		Stiff/sore (n = 6,620)		Heart pounding† (n = 2,315)		Forgetful† (n = 4,843)		Difficulty sleeping† (n = 4,632)	
	OR‡	95% CI‡	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age (years)														
40–43§	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
44–47	1.26	1.13, 1.41	1.13	0.99, 1.29	1.26	1.08, 1.48	1.01	0.92, 1.11	1.07	0.94, 1.21	1.33	1.20, 1.48	0.94	0.84, 1.04
48–51	1.68	1.49, 1.89	1.27	1.10, 1.46	1.65	1.40, 1.95	1.12	1.00, 1.24	0.91	0.79, 1.06	1.62	1.44, 1.83	1.08	0.96, 1.21
≥52	1.49	1.27, 1.72	1.17	0.98, 1.39	1.63	1.34, 1.98	1.07	0.94, 1.23	1.11	0.92, 1.33	1.52	1.31, 1.76	1.00	0.86, 1.17
Education														
<12 years	1.76	1.45, 2.13	1.10	0.88, 1.38	1.25	0.97, 1.60	1.04	0.87, 1.23	1.69	1.33, 2.15	1.25	1.03, 1.50	0.92	0.76, 1.12
12/GED‡	1.76	1.45, 2.13	0.92	0.78, 1.12	1.09	0.88, 1.35	0.92	0.80, 1.05	1.48	1.21, 1.82	1.00	0.92, 1.25	0.84	0.72, 0.98
Some college	1.54	1.32, 1.80	0.97	0.81, 1.16	1.09	0.89, 1.34	0.98	0.86, 1.11	1.33	1.09, 1.63	0.98	0.85, 1.13	0.96	0.83, 1.11
College graduate	1.15	0.98, 1.35	0.98	0.81, 1.19	0.97	0.78, 1.22	1.02	0.89, 1.16	1.26	1.02, 1.55	0.92	0.79, 1.07	0.88	0.76, 1.03
Postgraduate/professional§	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Employed														
No	1.09	0.97, 1.22	1.11	0.96, 1.27	1.04	0.89, 1.22	0.97	0.88, 1.08	1.10	0.95, 1.26	1.12	1.00, 1.26	1.06	0.95, 1.19
Part-time	1.06	0.97, 1.22	1.04	0.93, 1.18	1.03	0.90, 1.17	0.96	0.88, 1.06	1.12	0.99, 1.26	1.08	0.98, 1.20	1.22	1.05, 1.30
Full-time§	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Difficulty paying for basics														
Very hard	1.47	1.29, 1.68	1.52	1.30, 1.77	1.48	1.24, 1.75	1.77	1.56, 2.02	1.38	1.18, 1.61	1.51	1.32, 1.73	1.52	1.32, 1.74
Somewhat hard	1.21	1.10, 1.32	1.19	1.06, 1.27	1.12	0.99, 1.27	1.23	1.13, 1.33	1.09	0.97, 1.22	1.26	1.14, 1.38	1.20	1.09, 1.31
Not at all hard§	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Race/ethnicity														
African American	1.56	1.39, 1.75	0.64	0.55, 0.73	1.17	1.00, 1.37	0.84	0.75, 0.93	1.10	0.95, 1.27	1.42	1.27, 1.60	0.70	0.62, 0.79
Japanese	0.63	0.49, 0.82	0.84	0.62, 1.16	0.70	0.47, 1.02	0.96	0.78, 1.18	1.07	0.77, 1.48	1.50	1.19, 1.89	0.71	0.56, 0.91
Chinese	0.65	0.49, 0.87	0.56	0.40, 0.79	0.80	0.54, 1.17	0.84	0.66, 1.08	1.22	0.86, 1.73	1.63	1.24, 2.12	0.80	0.61, 1.05
Hispanic	1.10	0.93, 1.31	1.26	1.02, 1.56	1.85	1.48, 2.33	0.81	0.69, 0.95	1.43	1.17, 1.74	1.50	1.26, 1.78	0.76	0.63, 0.90
Caucasian§	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Marital status														
Never married	0.84	0.74, 0.96	0.82	0.69, 0.96	0.62	0.52, 0.75	0.97	0.86, 1.09	1.13	0.96, 1.33	0.95	0.83, 1.08	1.04	0.91, 1.18
Married/living as§	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Separated	1.11	0.91, 1.30	1.24	1.01, 1.52	0.90	0.72, 1.13	1.12	0.94, 1.33	1.16	0.94, 1.42	0.91	0.76, 1.09	1.30	1.08, 1.56
Widowed	0.76	0.62, 0.93	0.96	0.75, 1.22	0.54	0.40, 0.72	0.93	0.77, 1.13	1.16	0.91, 1.48	1.02	0.83, 1.25	1.09	0.88, 1.34
Divorced	0.85	0.76, 0.96	0.97	0.84, 1.11	0.62	0.53, 0.74	1.00	0.90, 1.12	1.07	0.92, 1.22	1.11	0.98, 1.24	1.07	0.95, 1.21
Parity (per child)	0.98	0.95, 1.01	1.07	1.03, 1.10	1.00	0.96, 1.04	0.98	0.96, 1.01	1.08	1.04, 1.12	1.06	1.03, 1.09	0.97	0.94, 1.00
Menstrual status														
Surgical	2.40	2.11, 2.73	1.64	1.41, 1.92	2.39	2.00, 2.85	1.50	1.33, 1.69	1.43	1.22, 1.68	1.27	1.11, 1.44	1.52	1.33, 1.74
Postmenopausal	2.81	2.43, 3.24	1.24	1.04, 1.49	2.57	2.12, 3.12	1.31	1.14, 1.50	1.17	0.97, 1.40	1.28	1.11, 1.49	1.37	1.18, 1.60
Late perimenopausal	4.32	3.58, 5.21	1.42	1.12, 1.79	2.30	1.80, 2.96	1.48	1.24, 1.78	1.29	1.20, 1.64	1.43	1.18, 1.74	1.48	1.22, 1.80
Early perimenopausal	2.06	1.86, 2.29	1.67	1.48, 1.90	1.77	1.52, 2.07	1.48	1.35, 1.62	1.19	1.05, 1.35	1.44	1.30, 1.59	1.25	1.13, 1.38
Premenopausal§	1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Body mass index (kg/m²)														
<19	0.94	0.79, 1.12	1.04	0.84, 1.29	0.90	0.71, 1.14	1.14	0.98, 1.32	0.98	0.80, 1.21	1.08	0.91, 1.28	1.19	1.00, 1.41
19–26.9§	1.0		1.0		1.0		1.0		1.0		1.0		1.0	
27–31.9	1.15	1.04, 1.28	1.42	1.25, 1.62	0.93	0.81, 1.07	1.19	1.08, 1.31	1.01	0.89, 1.15	1.08	0.97, 1.20	0.97	0.87, 1.08
≥32	1.18	1.05, 1.32	2.18	1.92, 2.48	1.01	0.87, 1.17	1.53	1.38, 1.70	1.05	0.92, 1.21	0.99	0.88, 1.11	1.05	0.93, 1.17

	1.0	1.12, 1.37	1.0	1.08, 1.37	1.0	1.0	0.93, 1.22	1.0	1.13, 1.36	1.0	1.11, 1.52	1.0	1.07, 1.31	1.0	0.94, 1.16
Smoking	1.0														
Never\$	1.24	1.12, 1.37	1.21	1.08, 1.37	1.07	1.0	0.93, 1.22	1.24	1.13, 1.36	1.25	1.11, 1.52	1.18	1.07, 1.31	1.04	0.94, 1.16
Past															
Current															
<10/day	1.50	1.28, 1.76	0.97	0.78, 1.20	0.85	1.16	0.67, 1.07	1.16	0.99, 1.35	1.23	1.00, 1.50	0.76	0.64, 0.91	1.19	1.01, 1.41
10-19/day	1.65	1.42, 1.92	1.15	0.95, 1.39	1.04	1.15	0.85, 1.29	1.15	0.99, 1.33	1.14	0.95, 1.37	0.82	0.70, 0.96	1.23	1.05, 1.44
≥20/day	1.68	1.46, 1.94	1.50	1.27, 1.77	0.96	1.23	0.79, 1.18	1.23	1.07, 1.41	1.16	0.98, 1.38	0.92	0.79, 1.06	1.17	1.01, 1.35
Physical activity															
Much less	1.71	1.42, 2.07	1.66	1.34, 2.06	1.64	2.33	1.29, 2.08	2.33	1.92, 2.82	1.65	1.33, 2.05	1.51	1.24, 1.84	2.00	1.64, 2.43
Somewhat less	1.33	1.16, 1.54	1.36	1.14, 1.61	1.24	1.78	1.02, 1.50	1.78	1.56, 2.03	1.34	1.13, 1.59	1.30	1.33, 1.51	1.65	1.43, 1.91
Same	0.96	0.85, 1.08	1.03	0.88, 1.18	1.02	1.12	0.87, 1.20	1.12	1.00, 1.23	1.00	0.86, 1.16	1.12	1.00, 1.26	1.06	0.94, 1.20
Some more	1.02	0.90, 1.16	1.03	0.88, 1.21	1.03	1.09	0.86, 1.24	1.09	0.97, 1.22	0.97	0.82, 1.15	0.96	0.84, 1.09	1.09	0.96, 1.24
Much more\$	1.0		1.0		1.0	1.0		1.0		1.0		1.0		1.0	

* Each covariate adjusted for all others as well as for site; with parity, adjusted as a continuous variable.
† Forgetful and heart pounding/racing also adjusted for irritability, depression, and tense/anxious; difficulty sleeping adjusted for these and any other symptoms.
‡ OR, odds ratio; CI, confidence interval; GED, high school equivalency.
§ Referent category.

to age in postmenopausal and late perimenopausal women (data not shown).

Menstrual status. Menstrual status had the largest adjusted prevalence odds ratios of any risk factor for most symptoms, particularly vasomotor (table 3). All symptoms were more frequent in women who were not premenopausal. Vasomotor symptoms were particularly frequent in women who were in the late perimenopause, although the numbers in this category were relatively small.

Sociodemographic factors. Adjusted prevalence odds ratios for vasomotor symptoms and heart pounding or racing generally increased with decreasing level of educational attainment (table 3). The prevalences of vaginal dryness and forgetfulness were elevated only in women with less than a high school education. All symptoms were increased in women who reported difficulty paying for basics, and prevalence increased with greater difficulty. Heart pounding or racing, forgetfulness, and difficulty sleeping increased in women who were not employed full time. Vasomotor symptoms, urine leakage, and vaginal dryness were reported less frequently among never married, widowed, or divorced than currently married women (data not shown).

Race/ethnicity. All symptoms, except heart pounding and forgetfulness, were reported less frequently by Japanese and Chinese women compared with non-Hispanic Caucasians. This finding persisted after adjustment for language as a measure of acculturation (data not shown). Urine leakage and difficulty sleeping were reported significantly less often, but vasomotor symptoms and vaginal dryness were reported significantly more frequently by African-American than by Caucasian women. Hispanic women reported urine leakage, vaginal dryness, heart pounding or racing, and forgetfulness more frequently than did non-Hispanic Caucasian women. All minority ethnic groups reported difficulty sleeping significantly less frequently than did Caucasians after adjusting for other covariates. No marked interaction of race/ethnicity with prevalence odds ratios for risk factors and symptoms was observed.

Body mass index. Hot flashes or night sweats, urine leakage, and stiffness or soreness in joints, neck, or shoulders were reported more frequently in women with a body mass index of 27 kg/m² or greater compared with women with a body mass index of 19–26.9 kg/m² (or less). This relation was particularly marked for urine leakage, for which prevalence increased more than twofold for women with a body mass index of 32 kg/m² or greater. However, hot flashes or night sweats were not associated with an increased body mass index in postmenopausal and late perimenopausal women (data not shown).

Smoking. Past smoking and current smoking were related to prevalence of most symptoms, except vaginal dryness and forgetfulness (the latter being positively related only to past smoking). No clear trends with amount currently smoked were observed.

Physical activity. All symptoms (particularly stiffness or soreness, heart pounding or racing, forgetfulness, and difficulty sleeping) were more frequent among women who reported getting less physical activity compared with

women who reported getting much more or somewhat more physical activity than women of the same age. A trend appeared of increasing prevalence of these symptoms with decreasing physical activity.

DISCUSSION

The present SWAN cross-sectional study is one of the largest multiethnic studies of demographic and lifestyle factors associated with symptom reporting in midlife women, and the findings have potentially important preventive implications. We found significant independent effects of age, educational level, difficulty paying for basics, race/ethnicity, body mass, smoking, physical activity, and menstrual status on the prevalence of vasomotor and other physical symptoms.

Despite the use of quite varied methodologies, in numerous cross-sectional studies of clinical, psychosocial, and sociodemographic factors associated with the menopausal transition in Caucasian women, a few major findings have emerged. First, vasomotor symptoms, such as hot flashes or flushes and night sweats, are unequivocally linked to hormonal changes (16–18). Longitudinal studies have largely confirmed the relation between vasomotor symptoms and the climacteric (6, 18–21), and reports of vasomotor symptoms at peri- or postmenopause have been found to be inversely related to the level of serum estrogens (6, 16). Menopause and reduction in endogenous estrogen levels result in atrophic changes of epithelial tissues including the skin and vaginal wall (22). Other symptoms, such as sleep difficulties, are less consistently associated with menopausal status (23–27). Further, a subset of women with low socioeconomic status who experience difficulties with personal and social functioning during the climacteric may report more symptoms (17).

Menstrual status and age

The results from our study indicate that over half of late perimenopausal women report hot flashes or night sweats. This estimate is in agreement with other studies showing that the occurrence of hot flashes increases with irregularity in menses, peaking at 50 percent just prior to menopause, and later declining in the postmenopause (28). The prevalence of hot flashes in perimenopausal women of Anglo-European origin is reported to be 50–85 percent (25, 27).

The prevalence of vaginal dryness in the present study was 13.1 percent, in agreement with several studies (29–32). However, in a cross-sectional study of 5,990 Swedish women, aged 46–62 years, the prevalence of vaginal dryness was 21 percent, with prevalence increasing with age to about 34 percent in 62-year-old women (33). Wilbur et al. (16) noted a higher prevalence (29 percent in women aged 35–69 years), with the wider age range than our population possibly accounting for the higher prevalence. Another limitation of previous work, however, is using age as a surrogate for menstrual status, whereas the present study used reported bleeding patterns.

Socioeconomic status

In the present study, lower educational attainment and greater difficulty paying for basics were related to increased symptom prevalence. In addition, lack of full-time employment was associated with heart pounding or racing, forgetfulness, and difficulty sleeping. These findings are consistent with those of a number of others (16, 24, 34, 35).

Race/ethnicity

The prevalence of vasomotor symptoms in developed countries in largely Caucasian populations has previously been examined in cross-sectional (22, 25, 32, 33, 36) and prospective (20, 21) studies, with considerable variability in results. The finding in the present study that more African-American women reported hot flashes or night sweats than Caucasian women (37 percent vs. 24 percent) is of interest. In a study of Caucasian and African-American women from a population-based study of reproductive cancers, 71 percent of participants reported experiencing hot flashes at menopause, with no racial differences in prevalence (34). Our finding of increased reporting of vaginal dryness in African-American women also differs from recent unadjusted findings by Wilbur et al. (16), which also indicate an increased risk of urine leakage in African-American women, while we found a reduced prevalence of this symptom in this group compared with Caucasians. Also of interest in the present study, Hispanic women reported the highest prevalence of vaginal dryness. Asian women (9, 36–39) report fewer hot flashes than do Caucasian women. Because of simultaneous adjustment of multiple variables in the present study, differences among race/ethnic groups in these other variables (e.g., body mass index or smoking) do not account for differences in symptom reporting among the groups.

Body mass index

In the present study, women with a body mass index of at least 32 kg/m² had a greater prevalence of hot flashes or night sweats (43.8 percent) than did those having a body mass index of less than 19 kg/m² (30.6 percent). A higher body mass index has been associated with increased symptom reporting during the menopausal transition in one study (40) and with fewer hot flashes in other studies (34, 41, 42). Since adrenal androgens are converted to estrogen in adipose tissue (43), and since vasomotor symptoms are thought to be related to reduced estrogen levels, a lower prevalence of vasomotor symptoms is expected in heavier women. The reasons for the present findings are unclear. Possibly the rate (and steepness) of the decline in or the widely fluctuating levels of estradiol (44) may affect symptoms more than absolute levels (which would be associated with body weight). Differences in study design (cross-sectional vs. prospective), sample size, methods in ascertaining body mass index (self-report vs. direct measurement), and simultaneous control of covariates (especially smoking) may also account for discrepant findings.

Smoking

Past smoking and current smoking were positively associated in the present study with prevalence of vasomotor symptoms, in agreement with most but not all (34) others (45–48). Women who smoke would be expected to have a higher prevalence of vasomotor symptoms because of the antiestrogenic effects of smoking (49–51); however, the lack of association of smoking with vaginal dryness is thus unexpected, suggesting that other factors may be more important in the occurrence of vaginal dryness. We did observe that vaginal dryness was significantly less often reported among never married, widowed, or divorced women compared with married women, suggesting that opportunity for sexual activity may be related to reporting of vaginal dryness.

Physical activity

In contrast to the present study, previous cross-sectional surveys have generally failed to find any association between physical activity and vasomotor symptoms (46, 52–55). One study reported a lower prevalence of hot flashes among regularly active perimenopausal women compared with population controls whose activity level was not determined (30). The inconsistency between the present findings and those of previous investigations may be due, in part, to the assessment method. The present study asked about the respondent's perception of activity level but not what she actually did. This may predispose women who are having more symptoms to perceive themselves as less active than their peers. Alternatively, previous studies, with more limited sample sizes, may not have had the statistical power of the present study to detect significant relations between activity and vasomotor symptoms. Most cross-sectional surveys have observed fewer somatic symptoms (52) and better health status (53, 55) in active women compared with sedentary women. Given the cross-sectional design of all of these studies, it is not possible to determine whether women feel better because they are active or are less active because they are symptomatic.

Limitations of the present study

The present study was cross-sectional. Thus, for certain variables, such as body mass index and physical activity, we could not be certain that the factor actually preceded and thus predisposed to the occurrence of symptoms. However, a number of the factors (e.g., education, parity, and smoking) were unlikely to have changed recently for most women and thus were likely to have preceded symptom reporting. Nonetheless, the temporal sequence of these associations will be better established in the next phase of SWAN, the longitudinal study.

Another limitation is self-reporting, particularly of symptoms, body mass index, and menstrual status. The use of standard questions for these items enhances the comparability of these results with those of prior studies. Again, however, these assessments will be improved in longitudinal assessment and correlation with biologic measures of endocrine status in the next phase of SWAN.

A third limitation is the varied sampling methods used among sites, necessitated by difficulties in achieving needed sample size of minority populations, making use of formal estimation procedures inappropriate. Thus, the present confidence intervals should be interpreted with caution.

A final limitation is the potential for inadequate detail on variables of interest and inadequate control of potential confounding factors. In this limited interview, it was not possible to examine all such potential factors. In particular, more detailed questions could not be asked about both symptoms (e.g., nature of headaches and difficulty with sleep) and additional risk factors, such as diet, nature of occupation, income, pack-years of smoking, and nature and intensity of physical activity. Thus, uncontrolled confounding and insufficient detail are potential limitations that will be better addressed in the SWAN longitudinal study.

Strengths of the present study

This is the first study to have large numbers of women at various stages of the menopausal transition and from five race/ethnic groups. Women were selected to be generally representative of their racial/ethnic group in their geographic area and came from several geographic areas in the United States. Thus, these results should apply to a large segment of women in this age group in this country. In addition, the use of standardized methods of data collection over several geographic areas is an important strength. Finally, the effects of each variable were examined while controlling for many others.

Conclusions

The results of the SWAN cross-sectional survey indicate that a number of potentially modifiable factors affect symptom reporting. Thus, for women for whom medical treatment is contraindicated, undesired, or not tolerated, alternatives may be offered in lifestyle changes. In particular, smoking cessation was associated with lower prevalence than in current smokers of vasomotor symptoms and difficulty sleeping. Increased physical activity was associated with lower prevalence of virtually all symptoms. Overweight was associated with hot flashes/night sweats, urine leakage, and stiffness or soreness. All of these factors are, of course, also associated with a number of other adverse health effects. Our results also provide guidance to health care providers in assessing symptoms by increasing their sensitivity to differences in symptom-reporting patterns by race/ethnicity and menstrual status. Importantly, our results also show that most indicators of low socioeconomic status, particularly low educational level and difficulty paying for basics, were associated with significantly increased reporting of almost all symptoms.

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