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Do Japanese American Women Really Have Fewer Hot Flashes than European Americans? The Hilo Women's Health Study

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Abstract

Objective—Many studies have found a significantly lower frequency of reported hot flashes (HFs) in Japanese and Japanese American (JA) populations, leading to speculation about possible dietary, genetic, or cultural differences. These studies have relied upon subjective reports of HFs. Accordingly, the purpose of this study was to compare both reported and objective HFs measured by sternal and nuchal skin conductance among JA and European American (EA) women.

Design—Two surveys of hot flash frequencies were carried out among women of either EA or JA ethnicity, aged 45–55, living in Hilo, Hawaii, and not using exogenous hormones. The first was a postal questionnaire (N=325), the second was carried out during a clinical study of hot flashes (N=134). Women in the second group underwent 24-hour ambulatory and 3-hour laboratory monitoring for objective HFs measured through skin conductance at sternal and nuchal sites. Subjective HFs were recorded on the monitor, or in a diary.

Results—JAs were significantly less likely to report having had HFs in the previous two weeks compared with EAs (postal sample: JAs: 30.9%, EAs: 43.9%, $\chi^2=6.9$, $p < .01$; monitored sample: JAs: 26.1%, EAs: 46.6%, $\chi^2=5.3$, $p < 0.05$). JAs were also significantly less likely to report experiencing other symptoms (15 out of 30 in the postal sample; 6 of 30 in the monitored sample) than EAs. However, JAs did not significantly differ in likelihood of reporting subjective HFs during the 24-hour ambulatory period (JAs: 51.1%, EAs: 55.8%, $\chi^2=0.3$, ns), nor in percentage of individuals displaying one or more objective HFs as measured by the skin conductance monitor (JAs: 77.8%, EAs: 72.1%, $\chi^2=0.5$, ns). JAs also did not have a significantly fewer number of objective HFs ($t=0.2$, ns) nor of subjective HFs ($t = 0.8$, ns) during the monitoring period, and these results were unchanged when analyses controlled for menopausal status and BMI.

Conclusions—The common finding of fewer reported HFs in people of Japanese ancestry may be a consequence of reporting bias: JAs report fewer symptoms of many conditions compared to people from other ethnic groups. This is likely due to cultural conceptions of what is appropriate to report.

Keywords

Hot flashes; Vasomotor symptoms; Menopause; Ethnicity; Skin conductance; Reporting bias

Introduction

Margaret Lock¹⁻³ reported a relatively low frequency of hot flashes (HFs) in women aged 45-55 residing in Japan, and numerous later reports have documented lower rates of reported HFs in Japanese populations, including Japanese American (JA) women in Los Angeles⁴ and in Hilo, Hawaii⁵. It has been hypothesized that the lower frequency of reported HFs among the Japanese may be due to a high dietary intake of soy,⁶ a faster transition through the perimenopause,⁷ or possibly due to genetic differences.⁸ While the frequency of reported HFs differs between studies due to population and methodological differences, the finding of an ethnic difference in reported HF frequency appears to be robust. Rates of reported HFs in Japan range from 12%¹ to 25.7%⁹ to as high as 47%,¹⁰ and rates of HFs in JA samples range from 11.8% (Avis et al. 2001) and 16%¹¹ to 28%.⁵ Differences between Japanese-derived and European-derived populations are unlikely to be due solely to language differences in interpretation of what is meant by a HF⁹ (Melby 2005), since English-speaking Japanese populations also have lower frequencies of HF reports, but the differences may be due to culturally-based reporting biases. One example of a culturally-based reporting bias appeared in a study of Asian immigrants to the United States, where Uppaluri et al.¹² reported that the Asian Americans reported significantly lower levels of stress than European Americans (EA), and that newer immigrants reported significantly less stress than long-term immigrants.

The multi-ethnic population of Hawaii, which includes a large proportion of JAs, provides an excellent natural laboratory for the comparative study of HF experience. The JA population of Hawaii is comprised primarily of descendants of immigrants who came to Hawaii early in the 20th century to work on sugar plantations,¹³ and thus most individuals are third, fourth or higher generation Americans. It is unclear to what degree ethnic differences in self reports may be present in this highly acculturated population.

Accordingly, a study of women's health that included a focus on menopausal symptom experience was carried out in Hilo, Hawaii in a multi-ethnic community that included a sizeable percentage of JA women. A large sample of women were asked to report on symptom experience through a postal survey, and a smaller sample of the women took part in two monitoring sessions: an ambulatory phase in which they wore HF monitors for a 24 hour period while keeping diaries that included reports of HFs, and a laboratory phase in which women were monitored for skin conductance and HF reports while under partially controlled conditions designed to be conducive for HF stimulation.

Methods

Sample

A postal survey that included questions about 30 symptoms, including HFs and night sweats, was sent to a random sample of households in Hilo, Hawaii, in 2004 and 2005. Survey packets were delivered to 6,401 households based on tax maps, and 1,824 questionnaires were completed and returned. Analyses presented here are based on a subsample consisting of women aged 45 to 55 years of age and of either JA or EA ethnicity (N = 325). Based on reported date of last menstruation, women were classified as being pre- (menses within two months), peri- (menses 3-12 months previous), or post-menopausal (over 12 months without a menses). Women from this sample who were either of JA or EA ethnicity and aged 45 – 55 years old were included in analyses. Data from women in the monitored sample (described below) who were not in the original postal sample but answered the same questionnaire were included for a total sample size of 393.

A second, “monitored” sample was recruited to take part in a skin conductance monitoring study of both objective and subjective HFs. Eighty-four participants were drawn from the cross-

sectional postal survey. The remaining participants were recruited through word of mouth, through an advertisement in the local paper, and through telephone calls to local Japanese-American women who had participated in an earlier study of blood pressure (Brown et al. 2001.) A final sample of 208 women was recruited, and 200 ultimately participated in hot flash monitoring between October 2005 and January 2008. Only women between ages 45 – 55 and of JA or EA ethnicity were included in analyses (N = 134). This second sample was monitored twice: once during normal daily activities during a 24-hour ambulatory monitoring period, and once during a three hour laboratory session.

Measures

Women in the postal survey sample were asked for a variety of information, including their birth date, date of last menstruation, ethnicity, educational attainment and their current height and weight. Educational attainment was coded: 1) no high school, 2) some high school, 3) high school graduate, 4) some college, 5) college graduate, 6) some post graduate and 7) graduate degree. The women were also asked to note if they had experienced any of 30 symptoms – including HFs – within the previous two weeks. HF reports were embedded in the alphabetical listing of symptoms that included everyday complaints.³ The symptom report list is an extended version of similar lists that have been used in many studies of menopause, including those involving Japanese or JA populations such as the SWAN study.⁴ The women in the monitored sample wore both an ambulatory HF monitor (Biolog; UFI, Morro Bay, CA) to measure skin conductance and an ambulatory blood pressure monitor (SpaceLabs 90207) for a 24 hour period during which they filled out diary entries every 20 minutes that included notations of whether they had (subjectively) experienced a HF. HFs were also recorded by pressing recording buttons on the monitor, and these reports were added to diary entries to obtain the “ambulatory diary reports” of HFs.

All participants came to the biological anthropology laboratory at UH-Hilo for the application of electrodes and initializing of the monitor. About half (53%) started the study between 07:00 and 10:00. Women were instructed to wear two-piece comfortable clothing, to avoid strenuous activity, and to not shower or bathe while wearing the monitor. Ag/AgCl hot flash monitor electrodes (1081-HFD, UFI, Morro Bay, CA) filled with 0.05 potassium chloride Velvachol/glycol gel (Custom Med Apothecary, Indianapolis, IN) were placed about 4 inches apart on the upper chest between the second and third ribs to measure sternal skin conductance and about 4 inches apart on the back of the neck to measure nuchal skin conductance. Fourteen women wore just sternal electrodes. Each set of electrodes conducted a 0.5 volt constant circuit and was attached to a two-channel Biolog monitor where skin conductance levels were recorded.

Laboratory measurements were carried out on a separate day for three hours with a multi-channel physiological recorder (DataLab 2000, Lafayette Instruments). Before the start of the study, anthropometric measures were collected. Then, women were asked to sit in a reclining chair in a small (10' × 20'), quiet room that was not temperature controlled. Mean room temperature was 24.9 degrees C (s.d. 1.8) at the start, and rose to a mean of 25.5 degrees C (s.d. 1.7) by the end of the study. Humidity was 64% (s.d. 8.1). While reclining in the chair, women wore a BP and pulse monitor, as well as two sets of Ag/AgCl HF monitor electrodes (1081-HFD, UFI, Morro Bay, CA) filled with 0.05 potassium chloride Velvachol/glycol gel (Custom Med Apothecary, Indianapolis, IN). Women started the HF study at the mean hour of 13:03 (range 11:26-16:42, s.d. 1:06), and ended at the mean hour of 15:59 (range 14:00-19:42, s.d. 1:04). Participants were asked if they had smoked, consumed alcohol or caffeine, or had any HFs prior to the test. During the session, they also answered open-ended questions about menopause, relationships, their mother's menopause, and with whom they spoke about menopause.

To monitor HFs, galvanic skin conductance amplifiers measured changes in level of sweating using a constant voltage between the two sets of electrodes. One set of electrodes was placed about 4 inches apart on the upper chest. To determine the site for the second set of electrodes, women were asked, "Where do you feel hot flashes?" If women did not give a specific site, then a second set of electrodes was placed about 4 inches apart on the back of the lower neck to measure nuchal skin conductance. The second set of electrodes was placed on the back of the lower neck (85% of the time), on the face (9%), the upper neck (2%), and upper arm (1%). One individual had the second set of electrodes placed on a foot, one on the abdomen, and one on the lower back. Once, the second set of electrodes was moved from the back of the neck to the upper back during the study period.

All women were instructed to let the researcher know if they were having a HF at any time during the interview or during the remaining hours of the laboratory phase of the study. A researcher sat in the room with the participant to watch the computer monitor and ask the participant how she was feeling every 15 minutes unless she was sleeping. If the participant felt a HF she was asked to give the location of the HF and to let the researcher know when it stopped. If a HF was noticed on the computer screen, and if the participant was awake, the researcher would ask "How are you doing?" If the participant said she felt "warm," she was asked if she would call it a HF at home. For each objective HF the researcher coded the participant's response as "no," "yes" = subjective HF, "warm," or "asleep."

After 30 minutes, a circulating-water heating pad was placed on the lower abdomen and the participant was covered with a blanket. The participants were then invited to read, talk, or sleep, but they were asked to not eat, drink, or use their cell phone during the study period.

For both the ambulatory and laboratory phases, the criterion for an objective HF was a change in skin conductance level (SCL) of 2 μ mho within 30 seconds.¹⁴⁻¹⁵ Each ambulatory HF was coded by both AMR and PSM using the Biolog software. Each laboratory HF was coded by two investigators using the DataLab 2000 software. LLS was consulted to resolve ambiguities, particularly for the ambulatory measures. A HF was categorized as present if either of the electrode pairs met the criterion for a HF at a given time.

Analysis

Ethnic differences in HF or other symptom frequency were analyzed either by χ^2 tests or via logistic regressions using backwards elimination (with a criterion for elimination of $p > 0.1$), with menopausal status, body mass index (BMI: weight/stature², expressed as kg/m²) and educational attainment included as predictor variables. Ethnic differences in the number of HFs were analyzed by analysis of covariance, with ethnicity and menopausal status as predictor variables and BMI as a covariate.

Results

Table 1 shows characteristics of the samples. JA women in the postal sample were significantly less likely to either smoke or drink alcohol. They ate soy foods more frequently, and had greater educational attainment. For both samples, JA women were shorter, lighter, with a lower mean BMI, more likely to be married, had higher reported incomes, reported more financial comfort, and were more likely to have been born in Hawaii than EA women. For women not born in Hawaii, the age at which they moved to the state (mean $\pm$ standard deviation) was 34.1 ± 11.1 for the postal sample and 34.0 ± 10.6 for the monitored sample.

Reported Hot Flashes in Previous Two Weeks

Japanese American women were significantly less likely to report they had experienced a HF in the past two weeks in each of the two samples (postal survey sample: JAs: 30.9%, EAs: 43.9%, $\chi^2 = 6.9$, $p < 0.01$; monitored sample: JAs: 26.1%, EAs: 46.6%, $\chi^2 = 5.3$, $p < 0.05$). For the postal sample, the woman's educational attainment ($t=3.2$, $p < 0.01$), income ($t=2.7$, $p < 0.01$), financial comfort ($t=2.1$, $p < 0.05$, and BMI ($t=2.2$, $p < 0.05$) were significantly related to likelihood of reporting HFs in the past two weeks, but drinking alcohol ($\chi^2=0.8$, ns), currently being a smoker ($\chi^2=0.2$, ns), and frequency of eating foods with soy ($t=-0.6$, ns) were not significantly related to likelihood of reporting a HF. For the monitored sample, the likelihood of reporting a HF in the past two weeks was significantly related to education level ($t=2.3$, $p < 0.05$) and BMI ($t=-2.0$, $p < 0.05$) but not to household income ($t=1.3$, ns) nor frequency of eating soy ($t=0.0$, ns).

As shown in Table 2, when linear logistic regression analyses were carried out with reported HFs as the dependent variable and JA ethnicity, menopausal status, education and BMI as predictor variables, there was no significant ethnic effect on HF reports in either sample.

Reports of Other Symptoms in Previous Two Weeks

For both samples, JAs reported significantly fewer symptoms than EAs (postal sample: JAs: 6.4 ± 4.6 , EAs: 9.3 ± 5.7 , $t=5.5$, $p < 0.001$; monitored sample: JAs: 5.5 ± 4.5 , EAs: 9.1 ± 5.5 ; $t=3.9$, $p < 0.001$).

In the postal sample, JA women were significantly less likely than EAs to report having experienced everyday symptoms for 14 of 30 symptoms ($p < 0.05$, χ^2 tests) within the past two weeks. Similarly, in the monitored sample, JAs were significantly less likely to report experiencing 7 of 30 everyday symptoms and neared significance levels for three others. As shown in Table 3, for the postal survey sample, logistic regressions for symptom reports with JA ethnicity, menopausal status and BMI as predictor variables showed that JA women were significantly less likely to report symptom experience in the previous two weeks than EA women for 14 of 30 listed symptoms. For the smaller monitored sample, JA women were significantly less likely to report symptom experience in the previous two weeks for seven of the 30 symptoms, and neared significance levels for two additional symptoms (Table 3). It was particularly for symptoms of a psychological nature that JAs reported fewer symptoms. Among menopausal symptoms, JAs were less likely to report experiencing HFs or night sweats, but were not significantly less likely to report such symptoms as loss of sexual desire or vaginal dryness.

Reported Hot Flashes During Monitoring

There was no significant difference between JA and EA women in the percentage of individuals reporting any HFs in ambulatory diaries ($\chi^2 = 0.3$, ns). JAs were also not significantly less likely to report hot flashes in logistic regression analyses after controlling for menopausal status, education and BMI (see Table 4). There was also no significant difference between these ethnic groups in the mean number of reported HFs in the 24 hour ambulatory period (JAs: 2.42 ± 4.21 ; EAs: 3.00 ± 3.98 ; $t = 0.8$, ns), and this was also the case when analyses controlled for menopausal status, education and BMI (analysis of covariance: ethnicity: $F=0.3$, ns).

Similarly, there was no significant ethnic difference in frequency of women reporting HFs during the three hour laboratory monitoring session ($\chi^2=1.8$, ns; Table 4), nor in the mean number of HFs reported (analysis of covariance: ethnicity $F=0.2$, ns, menopausal status $F=2.9$, $p=0.06$, BMI $F=0.0$, ns).

Objectively Recorded Hot Flashes on Skin Conductance Monitors

JA ethnicity was not a significant predictor of HFs recorded objectively by skin conductance monitoring, neither for the demonstration of a HF (yes/no) during the 24-hour ambulatory monitoring period (logistic regressions, shown in Table 5), nor for the mean number of HFs objectively recorded (analyses of covariance, main effects from ethnicity: $F=0.1$, ns, and menopausal status: $F=5.4$ $p < 0.01$; covariate BMI: $F=3.2$, $p < 0.1$). Similarly, during the laboratory portion of the study, ethnicity was not a predictor of objectively recorded HFs (yes/no) when analyses controlled for BMI, education and menopausal status (see Table 5), nor of the number of HFs objectively recorded (analyses of covariance, main effects from ethnicity: $F=0.6$, ns, and menopausal status: $F=0.0$, ns; covariate BMI $F=0.1$, ns).

Discussion

The general finding of a lower frequency of HF reports among Japanese or Japanese-derived populations when compared to European-derived populations has been hypothesized as being due to many factors, including a faster transition through the perimenopause.⁷ A previous report on results from the postal sample, with the age group of women expanded to between 40 – 60 years of age, showed a significantly lower frequency of HF reports in JA women than in EAs,⁵ a result replicated here with a narrower age range of 45-55 years. In the current study, significantly fewer JAs in the monitored sample are categorized as peri-menopausal, suggesting that they may indeed move through the menopausal transition faster than EAs, although a longitudinal study is necessary to test this proposition adequately. When analyses are confined only to perimenopausal women, JAs are still significantly less likely to report HFs (only 1 in 11 versus 21 of 39 EA women, $\chi^2=5.0$, $p < 0.05$), and thus the significantly smaller frequency of HF reports noted in this study is not due to a smaller percentage of JA women in the perimenopausal group.

Frequency of HF reports have increased in more recent studies in Japan, and this has been alternatively explained by dietary change or by differences in the methodological details on how the HF reports were ascertained.¹⁶ In a previous report on the postal sample for women aged 40 to 60 years of age, it was noted that JA women reported eating soybeans or soy products significantly more frequently than EAs; however, eating soy was not associated with hot flashes in logistic regression analyses.^{5,17} Similarly, in the current analyses of both the postal and monitoring samples using a smaller age range (45-55), there is no significant relationship between frequency of eating soy and frequency of HF reports.

The significant ethnic difference in HF reports on questionnaires is not seen in the subjective reports of HFs during ambulatory or laboratory monitoring of HFs when women were asked to report on HFs at the time they were experienced. This, combined with the general tendency of Japanese American women to complain less about many symptoms, suggests that a large component of the ethnic difference in reporting HFs is likely due to a reporting bias that is related to cultural differences in what is appropriate to report on a questionnaire. Thus, the suggestion that the change in frequency of HF reports over time in Japan is due to methodological changes in how HFs are reported is given support by the results of this study. Ethnic differences in frequency of symptom reporting appear to be specific to given symptoms. For instance, there was no ethnic difference in the frequency of reports of vaginal dryness, a finding reported elsewhere among postmenopausal Japanese women¹⁸.

Educational attainment is also a significant factor in likelihood of reporting HFs on the questionnaire in this sample, with less educated women more likely to report a HF within two weeks. However, educational attainment was not significantly related to the likelihood of HF reporting during monitoring periods, nor to the likelihood that an objective HF would be measured by skin conductance monitoring. This suggests that some of the variation in rates of

reported HFs noted between studies may be due to socioeconomic differences in the studied populations, but that this effect of SES is sensitive to the method for reporting HFs.

The absence of ethnic differences in objective HFs measured by skin conductance in either ambulatory or laboratory settings provides further evidence for a reporting bias in subjective reporting of HFs. It is unlikely that the lack of an ethnic difference in skin conductance measures of HFs is due to ethnic differences in sweating, since there is no evidence of a difference between Japanese and European populations in either sweat gland counts or sweating rates that is independent of acclimatization to heat¹⁹⁻²¹, and the vast majority of both the EA and JA women in these samples have lived in Hawaii for many years, suggesting that they are all heat acclimatized. Also, the site at which hot flashes began on the body did not differ between JA and EA participants in the earlier analyses (Table 6 in Sievert et al.¹⁷).

While the results here suggest that reporting bias is an important element in the ethnic difference in reported HF frequency, attributing the relatively low frequency of reported HFs in Japanese and Japanese-derived populations solely to reporting bias is premature. The warm, humid climate of Hilo, Hawaii implies that the women are all well heat acclimatized, and thus are likely to have a faster onset of sweating than women who are not acclimatized. Also, the Hilo climate makes ambulatory monitoring of HFs more difficult, because one must distinguish sweating caused by the climate from that due to a HF, with the latter usually identified by its faster onset. Still, the similar findings in the laboratory phase of the study gives greater confidence that the finding of no significant ethnic difference in objective HFs is not simply an artifact of Hilo's climate. A future study that concentrates on perimenopausal women would allow a focus on women at highest risk for HFs and better account for the effects of menopausal status.

There are limitations to this study that must be noted. First, the samples used here are fairly small, and thus the power to observe subtle relationships is limited. Second, the cultural differences noted here in self reports may be specific to the Hawaiian environment. JAs of the sampled age group in Hawaii tend to be 3rd, 4th or even higher generation Americans, and they have lived in a multiethnic population that is in many ways unique. Thus, future studies comparing Japanese populations with women from other ethnic backgrounds for reported and objectively measured HFs need to be carried out in multiple settings before these results can be generalized beyond the Hawaii setting.

In conclusion, this study provides evidence that JA women are less likely to report having a HF on standard questionnaires, but this ethnic difference is not present when women are asked to report having a HF at the time it occurs during a monitoring period. Also, there are no significant ethnic differences in frequency or number of objective HFs measured by skin conductance monitoring. These results suggest that, at least in this sample in Hawaii, the less frequent reporting of HFs in Japanese Americans is due to a reporting bias, rather than to some biological difference between ethnic groups.

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Table 1
 Characteristics of the samples by ethnicity. Means $\pm$ standard deviations, unless otherwise noted.

	Postal Sample		Monitored Sample	
	Japanese Americans	European Americans	Japanese Americans	European Americans
N (#)	181	212	46	88
Age (Mean (std. dev))	50.3 $\pm$ 2.9	50.3 $\pm$ 2.6	50.6 $\pm$ 3.1	51.0 $\pm$ 2.9
Menopausal Status (%)			*	
Pre	46.0	53.5	41.3	19.8
Peri	13.1	21.5	28.3	48.8
Post	40.9	34.9	30.4	31.4
Stature (cm)	155.9 $\pm$ 5.4 ***	163.8 $\pm$ 7.6	157.0 $\pm$ 5.0 ***	163.7 $\pm$ 8.2
Weight (kg)	61.3 $\pm$ 13.5 ***	71.8 $\pm$ 18.8	59.9 $\pm$ 14.8 ***	71.8 $\pm$ 15.8
BMI (kg/m ²)	25.2 $\pm$ 5.2 **	26.8 $\pm$ 6.4	23.6 $\pm$ 3.9 ***	26.8 $\pm$ 5.4
Married (%)	79.6 **	66.8	88.9 *	63.2
With Children (%)	83.3	84.9	88.9	83.0
Income (%)	***		***	
< \$30,000	8.5	27.1	5.7	40.0
\$30,000 - \$79,999	55.3	54.7	31.4	47.5
$\geq$ \$80,000	36.2	18.2	62.9	12.5
Financial Comfort (%)	**		**	
Struggling	11.8	22.6	6.5	34.5
OK	43.3	44.3	47.8	40.2
Comfortable	43.8	30.7	45.7	21.8
Well Off	1.1	2.4	0.0	3.4
Education Level (%)	***			
Some high school	0.0	1.8	0.0	3.4
High school grad.	2.5	20.7	2.2	12.5
Some college	11.8	24.4	17.4	26.1
Two year degree	21.7	12.8	17.4	17.0
Four year degree	39.1	17.1	23.9	17.0
Some post graduate	6.8	7.3	13.0	6.8

	Postal Sample		Monitored Sample	
	Japanese Americans	European Americans	Japanese Americans	European Americans
Graduate degree	18.0	15.9	26.1	17.0
Smokers, currently (%)	7.2 **	17.1	2.2	12.5
Drink alcohol, currently (%)	39.0 ***	57.1	46.7	59.1
Grew up in Hawaii (%)	95.0 ***	37.3	92.7 ***	20.5
Frequency of eating soy, currently (%)	**			
Never	0.0	8.6	0.0	5.9
At times	16.7	58.6	50.0	58.8
Frequently	33.3	25.0	43.2	28.2
Every day	50.0	7.8	6.8	7.1

* Ethnic comparisons: $p < 0.05$,

** Ethnic comparisons: $p < 0.01$,

*** Ethnic comparisons: $p < 0.001$

Table 2
Results of logistic regression analyses for reported hot flashes among Japanese American and European Americans (95% CI).

	Postal Survey Sample	Monitoring Sample
Ethnicity		
Japanese-American (ref)		
European-American	1.56 (0.99 – 2.47) [†]	2.14 (0.90 – 5.08) [†]
Menopausal Status		
Premenopausal	0.31 (0.19 – 0.51) ***	0.17 (0.06 – 0.50) ***
Perimenopausal	0.78 (0.42 – 1.42)	0.36 (0.15 – 0.88) **
Postmenopausal (ref)		
Body Mass Index		
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Education		
	0.84 (0.72 – 0.96) *	0.80 (0.64 – 1.02) [†]

--- eliminated from model;

[†] p < 0.1;

* p < 0.05;

** p < 0.01;

*** p < 0.001

Table 3

Results of logistics regression analyses using backwards elimination (criterion: $p < 0.1$) for reported symptoms among Japanese American (reference) and European American women, with menopausal status (postmenopausal status=reference) and BMI as additional independent variables. Odds ratios (for ethnicity, refer to the relative risk for European Americans relative to Japanese Americans) and significance level.

		Postal Survey				Monitoring Sample			
Symptom	Ethnicity	Pre-Menopause	Peri-Menopause	BMI	Ethnicity	Pre-Menopause	Peri-Menopause	BMI	
Aches	--	--	--	--	--	--	--	--	
Backaches	--	--	--	--	2.18 *	--	--	--	
Breast tenderness	--	3.05 ***	1.58	---	--	3.42 †	4.46 *	1.10 *	
Bloating	1.48 †	2.28 **	4.37 ***	1.05 *	--	2.30	3.54 **	1.11 **	
Diarrhea/constipation	--	0.93	1.84 †	1.04 †	--	--	--	1.08 *	
Difficulty concentrating	2.19 **	0.97	2.18 *	1.05 *	--	0.36 †	1.21	1.08 *	
Dizzy spells	2.85 **	--	--	--	--	--	--	--	
Feel depressed	3.82 ***	--	--	1.03 †	3.58 **	0.37 †	0.87	--	
Fluid retention	--	1.37	5.29 ***	1.09 ***	--	1.41	3.22 *	1.08 *	
Headaches	--	--	--	--	--	--	--	1.09 *	
Hot flashes	1.70 *	0.32 ***	0.80	1.03 †	2.47 *	0.18 **	0.39 *	--	
Irritability	2.05 ***	--	--	--	1.94 †	1.22	2.04 †	--	
Lack energy	1.77 **	--	--	1.04 *	--	--	--	--	
Leg cramps	--	--	--	1.07 ***	--	1.17	2.62 †	--	
Loss of appetite	6.96 **	--	--	--	6.39 †	--	--	--	
Loss of sexual desire	--	0.54 *	1.16	--	--	--	--	--	
Menstrual cramps	1.68 †	20.34 ***	18.60 ***	--	--	21.19 ***	20.75 ***	1.12 *	
Mood swings	2.93 ***	--	--	--	2.57 *	--	--	--	
Nervous tension	2.94 ***	1.04	2.42	--	3.37 *	--	--	--	
Night sweats	1.82 **	0.70	1.62	--	2.83 **	0.34 *	0.79	--	
Numbness in legs	--	--	--	1.08 **	--	--	--	1.08 *	
Persistent cough	--	--	--	1.05 †	--	--	--	--	
Pins and needles	2.13 **	--	--	1.08 ***	--	--	--	1.10 *	

Symptom	Postal Survey				Monitoring Sample			
	Ethnicity	Pre-Menopause	Peri-Menopause	BMI	Ethnicity	Pre-Menopause	Peri-Menopause	BMI
Rapid heart rate	2.44 **	---	---	---	---	---	---	---
Shortness of breath	3.03 **	---	---	1.08 **	---	---	---	1.13 *
Sore throat	---	---	---	---	---	---	---	---
Trouble sleeping	2.12 ***	0.55 **	1.12	---	3.52 ***	0.44 †	0.65	---
Upset stomach	---	---	---	---	---	---	---	---
Urinary infection	---	---	---	---	---	---	---	---
Vaginal dryness	---	0.28 ***	0.51 †	---	---	0.16 ***	0.28 *	---

-- eliminated from model;

† p < 0.1;

* p < 0.05;

** p < 0.01;

*** p < 0.001

Table 4

Results of logistic regression analyses for reporting subjective hot flashes (yes/no) during monitoring periods among Japanese American and European Americans (95% CI).

	Ambulatory Phase	Laboratory Phase
Ethnicity		
Japanese-American (ref)		
European-American	1.02 (0.44 – 2.33)	1.79 (0.74 – 4.29)
Menopausal Status		
Premenopausal	0.28 (0.11 – 0.73) **	0.20 (0.07 – 0.58) **
Perimenopausal	0.76 (0.32 – 1.77)	0.58 (0.25 – 1.36)
Postmenopausal (ref)		
Body Mass Index		
	0.98 (0.91 – 1.05)	0.94 (0.87 – 1.02)
Education		
	0.89 (0.71 – 1.10)	1.14 (0.90 – 1.45)

**
p < 0.01

Table 5

Results of logistic regression analyses for exhibiting objective hot flashes (yes/no) from skin conductance monitoring among Japanese American and European Americans (95% CI).

	Ambulatory Phase	Laboratory Phase
Ethnicity		
Japanese-American (ref)		
European-American	0.92 (.36 – 2.39)	0.55 (0.26 – 1.17)
Menopausal Status		
Premenopausal	0.51 (0.16 – 1.61)	1.76 (0.66 – 4.69)
Perimenopausal	0.34 (0.12 – 0.97) *	1.00 (0.43 – 2.35)
Postmenopausal (ref)		
Body Mass Index	0.99 (0.91 – 1.07)	1.00 (0.93 – 1.08)
Educational Attainment	1.06 (0.83 – 1.36)	0.90 (0.72 – 1.12)

*
p < 0.05