

# BLOOD PRESSURE, VASOMOTOR SYMPTOMS, AND EMOTIONAL STRESS IN MULTIETHNIC MENOPAUSAL WOMEN

Estrogen loss during menopause has tentatively been associated with various health problems, including hypertension. Also believed to play a key role in the development of hypertension is excessive emotional stress, which might easily be present during this time of change. Hypertension, which can lead to stroke and kidney disease, is a real danger for menopausal women. As part of the Hilo Women's Health Study, we sought to test the connection between menopause, emotional stress, and increased blood pressure (BP). A random sample of normotensive women aged 45–55 years who fulfilled specific conditions were recruited from Hilo's multiethnic population. Study participants were asked to wear an ambulatory BP monitor that measured BP at twenty minute intervals for 24 hours. Women recorded BP, mood, location, hot flashes, and current activity immediately after each reading. When negative moods (ie, anxiety, anger) were reported, participants' BP rose compared to times when their moods were not reported. This change is significant both statistically and clinically. Scores on a hassles and uplifts instrument were not significantly related to mean BP. And while not proving that menopause is a definite factor in long-term hypertension, these findings suggest that blood pressure in menopausal women is influenced considerably in the short-term by stress generated through negative emotional tension.

Student Researcher: Stacey Torigoe, Waiakea High School; Hilo, Hawaii  
Mentor: Daniel Brown, PhD, University of Hawaii at Hilo;  
Hilo, Hawaii

## INTRODUCTION

Hypertension, one of the leading causes of stroke and cardiovascular disease, is a real danger for women of all ages—but particularly for those past their childbearing years. It has been demonstrated that greater concentrations of estrogen in premenopausal women have protective effects on the arteries, thus assisting in the prevention of hypertension and atherosclerosis.<sup>1</sup> Hormonal changes during menopause have also been linked to temporary vasodilation, causing a momentary sensation of heat, flushed skin, and excessive sweating in what is more commonly known as a “hot flash.” These “hot flashes,” which are a common symptom of menopause, might also cause temporary BP changes.<sup>2</sup>

Blood pressure may also be elevated temporarily by negative moods (ie, anxiety, anger), which are associated with emotional stress.<sup>3,4</sup> As one aspect of the Hilo Women's Health Study, it was our objective to prove or disprove this tentative connection between menopausal vasomotor symptoms, hypertension, and negative emotional stress. We monitored the ambulatory blood pressure of 74 pre-, peri-, and postmenopausal women (who fulfilled certain conditions) while they kept a diary of blood pressure readings, mood, perceived hot flashes, and other health-related behaviors.

Many menopausal studies concentrate on samples that are racially dominated by Caucasians or only on symptomatic patients of gynecological clinics.<sup>2,3</sup> The ethnically diverse community of Hilo offered us a more accurate cross-section of the menopausal population.

## METHODS AND MATERIALS

Study participants were selected from Hilo's multiethnic population through a random postal survey. Participants included only those willing to participate in the study and fulfilling a set of specific criteria: being female, 45–55 years of age, normotensive, not on hormone replacement therapy or blood pressure medication, and not having had a hysterectomy. Participants were remunerated for time and inconveniences experienced, and were required to sign participation agreement forms before proceeding. The Hilo Women's Health Study was approved by an institutional review board at the Committee of Human Studies located at the University of Hawaii at Manoa.

For the 24-hour ambulatory research phase, participants were asked to go about their daily business while fitted with a Spacelabs 90207 ambulatory blood pressure monitor on the nondominant arm and a Biolog hot flash monitor with electrodes on sternal and upper back sites. Participants were asked to keep a diary and record blood pressure every 20 minutes, as well as mood, location, sitting position, current activity, any perceived hot flashes, and any consumption of caffeine, alcohol, or other medications. Participants also completed several surveys, including a “Hassles and Uplifts” instrument to measure perceived stress over a longer period.

## RESULTS

Using diary entries, 3,005 systolic/diastolic blood pressure readings from 74 participants recorded by the ambu-

latory BP monitor were computed into z-scores for each individual using a standard z-score formula ( $z = X - \mu/\sigma$ ) and SPSS 13. Separate variables were created for location (work, home, sleep, other), mood (positive, negative) and whether a hot flash had been perceived in the last five or twenty minutes (yes/no). BP readings taken during sleep were excluded because of the lack of mood and perceived hot flash information. Likewise, BP readings taken at other locations were excluded because of their environmental variability. Participants' systolic BP rose a mean of 0.288  $\sigma$  (z-score mean difference) when reporting a negative mood (two-tailed  $t$  tests,  $P < .001$ ). Likewise, participants' diastolic BP rose a mean of 0.267  $\sigma$  (z-score mean difference) when reporting a negative mood (two-tailed  $t$  tests,  $P < .001$ ). Having had a hot flash within the last five minutes was significantly related to an immediate dip in systolic BP, though not diastolic BP (two-tailed  $t$  tests,  $P < .02$ ,  $P > .05$  respectively).

A linear regression model, with "having a hot flash within five minutes" and "reporting negative moods" as predictors and systolic BP as a dependent variable confirmed the relationships between systolic BP and either negative mood or having a hot flash within five minutes (linear regression model,  $P < .014$ ,  $P < .001$ ). A second model corroborated that diastolic BP is not related to having a hot flash within five minutes, but *is* elevated when reporting a negative mood (linear regression model,  $P > 0.05$ ,  $P < 0.001$  respectively). However, there was no difference in BP (computed as a stan-

dardized score) between women who had hot flashes and women who did not (two-tailed  $t$  test,  $P > 0.05$ ). There was no significant relationship between reporting a negative mood and having a hot flash within five or twenty minutes (2-sided Pearson chi-square,  $P > 0.05$  for both). Perceived stress in the "past week" as a whole was computed as a sum "hassles" score from the "Hassles and Uplifts" survey. However, bivariate correlations tests revealed that there was no significant correlation between long-term perceived stress and BP ( $P > 0.05$ ).

## DISCUSSION

Past research has indicated possible links between menopause and hypertension. It is surmised that menopause causes cardiovascular problems because of a sudden loss of estrogen, which may be linked to cardiovascular health through the prevention of excessive thrombosis and encouraging healthy lipid ratios.

Stress caused by negative emotions and other factors seems to affect blood pressure momentarily, but has no effect long-term (ie, in the past weeks, months). This was demonstrated by the lack of correlation between sum "Hassles" scores, representing an estimate of total perceived stress, and BP. However, it is evident that negative mood, an emotional stressor, has an immediate impact on BP—in menopausal women, at least—that is significant. Whether this connection is significant enough to connect long-term

hypertension with emotional stress in menopausal and postmenopausal women remains to be discovered. If so, then removal of negative emotional stressors may be enough to treat hypertension in some cases where emotional stress is a major factor. Future longitudinal studies—controlling for differences in location and position—to affirm this may be necessary. And, despite tentative evidence for menopause as a cause of hypertension, menopausal vasomotor symptoms may actually lower blood pressure momentarily. Because vasodilation seems to decrease BP, perhaps women who experience hot flashes are actually less at risk for hypertension.

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