Work family balance, stress, and salivary cortisol in men and women academic physicians

Bergman B, Ahmad F & Stewart DE

ABSTRACT

Background: The stress of medical practice has been recurrently studied, but work- and family-related determinants of health by gender remain under researched. Purpose: To test the hypothesis that cortisol excretion would be affected by the perceived severity of total workload imbalance. Method: By hierarchical regression analysis, the associations between work-family balance and diurnal salivary cortisol levels by sex in academic physicians (n = 40) were investigated. Results: Men physicians reported more paid work hours per week than women physicians and women more time in childcare, but their total working hours were similar. Controlling for sex and age, the mean of the diurnal cortisol release was associated with a combined effect of sex and responsibility at home. When morning cortisol, sex, and children at home were held constant, cortisol levels in the evening were associated with responsibility at home without significant gender interaction. Conclusion: With increasing responsibility at home, women and men reacted differently with regard to cortisol responses over the day. However, in the evening, controlling for the morning cortisol, these gender differences were not as obvious. These findings highlight traditional gender patterns among both women and men physicians in the challenge of finding a balance between work and family.

Keywords

Career, Stress, Cortisol, Work-family, Gender, Workload

The stress of medical practice have been recurrently studied (Arnetz, 1997; Cartwright, 1987; Howie, Hopton, Heaney, & Porter, 1992) but work- and family-related determinants of health by gender remain under researched (Cartwright, 1987; Howie et al., 1992; Weisman & Nathanson, 1985).

Discrepant findings by sex (Gross, 1997; Frank, McMurray, Linzer, & Elon, 1999) lead to questions of whether there are special stresses for women physicians. In general, women physicians tend to be disproportionately clustered in specialities that are less prestigious and lower paying, such as family practice, pediatrics, and psychiatry, and poorly represented in the higher-status, better-paying specialities of surgery and cardiology (Gross, 1997). In their personal life-sphere, women physicians in North America are more likely to have spouses who work full-time with similar occupational stress, whereas male physicians are more likely to benefit from their spouses working part-time (Bergman, Ahmad, & Stewart, 2003; Wortman, Biernat, & Lang, 1991). This may lead to more work-family imbalance stress for women physicians. In support of this, Stewart, Ahmad, Cheung, Bergman, and Dell (2000) found that high expectations, multiple roles, and work environment were major sources of stress for women physicians in the community. More recently, Bergman et al. (2003) found that the majority of physicians reported an excessive workload, but the sources of support when stressed varied significantly by gender.

Psychological and physiological stress research has focused on the hypothalamus-pituitary adrenocortical (HPA) axis and related endocrine circuits. In everyday life, cortisol is secreted in a well-documented circadian rhythm, with pulse amplitude highest in early morning hours shortly after awakening and lowest around midnight (Kirschbaum & Hellhammer, 1989, 1994). In situations with high ego-involvement, low predictability, low controllability, and novelty, corticotropin releasing hormone (CRH) and adrenocorticotrophic hormone (ACTH) are released with a subsequent rise in cortisol levels (Kirschbaum &

Hellhammer, 1994). Sustained levels of cortisol have been shown to be associated with numerous negative health effects, including cardiovascular disease (Björntorp, 1991). Frankenhaeuser (1996) reported that stressful situations primarily lead to sympathetic activation, with a concomitant rise in cortisol levels only if the situation was experienced as threatening. In an earlier study of white collar industrial employees, men had significantly higher cortisol excretion than women, but the decrease in the evening was significantly greater in men than women (Frankenhaeuser et al., 1989). Others have also reported a 1.5 to 2-fold higher cortisol release for men compared with women following psychological stress (Kirschbaum, Wust, & Hellhammer, 1992). The abovementioned circadian rhythm may be negatively affected by long-term stress and positively by psychological well-being (Anderzen & Arnetz, 2005; Lindfors & Lundberg, 2002). It is shown that healthy people living with chronic stress or suffering from posttraumatic stress disorder (PTSD) exhibit lower cortisols and flattened diurnal rhythms than matched comparisons, with cortisol concentrations decreasing further during periods of heightened stress (Raison & Miller, 2003).

In this study, we have addressed a presumably healthy group of women and men physicians and their pattern of cortisol excretion is expected to follow the well-documented circadian rhythm (Kirschbaum & Hellhammer, 1989, 1994).

The primary objective of this study was to investigate stressors of women and men physicians who are associated with cortisol levels. We hypothesized that (1) differences by gender would exist for perceived double-role responsibility, that is women physicians were expected to report more hours in childcare and more often perceive responsibility over childcare duties than their male colleagues, and men physicians were to report more hours in professional work and more often experience work demand than their female colleagues; (2) mean diurnal cortisol release would be associated with work-family imbalance, which means reported hours in paid and unpaid work as well as perceived work demand and responsibility at home; and (3) cortisol levels in the evening would be related to perceived demands from work and family during the day. Our a priori predictions were that cortisol excretion would be affected by the perceived severity of total workload imbalance.

Methods

Participants

Participants were a subset of academic physicians from a previously reported study conducted in a large teaching hospital in Toronto, Canada (474 active physicians; 103 women, 371 men) (Bergman et al., 2003). Respondents ($n = 161$) to a mailed anonymous survey study were asked about their willingness to participate in a forthcoming study involving measurements of salivary cortisol and a confidential survey. The exclusion criteria were pregnancy and using corticosteroid medication or oral contraceptives. Eligible physicians (32 women and 66 men) were later asked to take part in the study, and 40 (17 women and 23 men) consented from a range of specialities, including internal medicine, surgery, psychiatry, anaesthesia, family medicine, radiation oncology, and obstetrics/gynecology. Ethics approval was obtained from the institutional research board.

Procedure

The participants were requested to (1) complete a 4-page questionnaire, and (2) provide 4 salivary cortisol samples on a regular working day and complete a half-page point assessment of state of mood (Frankenhaeuser et al., 1989) with each saliva sample. The participants were asked to provide saliva samples (1) directly after awakening, (2) 30 min later before breakfast, (3) before supper, and (4) about 8 PM or one half-hour after supper. The participants were reminded twice by e-mail and phone calls and were sent a new set of cortisol strips if required.

Measures

The 4-page questionnaire collected information on sociodemographic characteristics (sex, age, height, weight, marital status, number and ages of children), and full-time/part-time status, years in practice, specialty, and childcare. Somatic symptoms, mental health, coping, support-in-stress, and healthy lifestyle were measured on Likert scales using reliable factor analysed survey instruments (Bergman & Wright, 2000; Bergman et al., 2003). Level of physical activity and time of breakfast and supper on the day of salivary cortisol collection were also queried.

Items about total workload, according to Lundberg, Mårdberg, and Frankenhaeuser (1994) and Mårdberg, Lundberg, and Frankenhaeuser (1991), were included. For this purpose, each participant reported the regular number of hours at work and the number of hours spent on different household duties, childcare, and "other activities" (taking care of elderly or sick relatives, volunteer work, etc.). Perceived workload and personal control in paid work and household work were assessed by 8 items on a 0–7 scale: work demand, tiredness after work, responsibility over household work, responsibility for childcare duties, stress in household work, stress in childcare, conflict between different roles, and stress from conflicting duties.

State of Mood (SM) (ability to concentrate, engagement, efficiency, energy, time pressure, pressure by demands, tiredness, irritation, sadness, relaxation, boredom, tenseness, anxiety, calmness, and

impatience) were gathered by items and scales ranging from 0 (not at all) to 10 (very much) developed by Lundberg and Frankenhaeuser (1980) and Frankenhaeuser et al. (1989). Mood self-ratings were made at each of the four times a salivary cortisol measurement was provided.

Prior to hypotheses testing and planned analyses, the assessed SM items were factor analysed (FA) with Kaiser Normalization Rotation Method (Tabachnick & Fidell, 2001) to reconfirm the structural relationship, as the source studies were not conducted with physicians. Three factors, *SM work overload, SM distress,* and*SM effort,* were obtained for each occasion, as discussed below, and accounted for a mean of 73% of the variance, range 68–77%. The mean of coefficient alpha was 0.64, range 0.59–0.68.

Saliva samples for cortisol analysis were chosen since this is a simple, non-invasive, and non-stressful method, which readily reflects plasma cortisol levels (Kirschbaum & Hellhammer, 1989, 1994). Salivary cortisol samples were collected using special filter paper strips, which participants were instructed to place in their mouth until a marked area on the strip was saturated with saliva. Participants were instructed not to brush their teeth, drink, smoke, or eat 15 min before sampling and to note the time of sampling as well the time of awakening for the first sample. The saliva samples were air dried and stored in zip-lock plastic bags in a freezer until returned with the completed questionnaires to the research team. The samples were then frozen to −18°C and analysed for cortisol radioimmunoassay.

Statistical Analyses

In addition to the aforementioned FA, data analyses included descriptive statistics, chi-square tests for discrete variables, and unrelated analysis of variance (ANOVA) for continuous variables. Changes over time were assessed using 2-way mixed ANOVA design for repeated measurements. Bonferroni post-hoc tests were used when repeated measurements revealed a significant effect. When no gender differences were found, women and men were grouped together in the subsequent analyses.

Changes in cortisol levels and state of mood between morning and afternoon were examined by calculating Pearson's product-moment correlation coefficients.

A hierarchy of variables presumed to be related to the dependent variables were entered into a multiple regression model to explain the variance in cortisol levels over the day and in the evening. The predictors included sex (dummy coded: 0 for females and 1 for males), age, children at home, hours in paid work, hours in unpaid childcare work, responsibility at home (the similar variables responsibility over household work and childcare duties were added) and work demand, and the interaction between sex and responsibility at home (created by multiplying responsibility at home by the dummy-coded sex variable) to capture the slope difference. In the second model, cortisol provided in the morning was entered in the first step to control for its effect on the dependent variable, which was cortisol in the evening. The models included three steps. The statistical software SPSS (Statistical Package for the Social Sciences, version 13.0; SPSS, Chicago, IL) was used.

Results

Description of the Participants

Forty academic physicians (17 women and 23 men) consented and completed the survey, and four salivary cortisol samples with point mood assessments, with a response rate of 53% for women and 30% for men physicians. The participants were similar to those of our earlier study (Bergman et al., 2003) in sociodemographic characteristics such as age, marital status, number of children living at home, as well as the age of the youngest child, partner's working situation, and number of years in practice. Physical or mental health, healthy lifestyle, coping styles, and support-in-stress did not differ significantly between the two study groups or between the sexes.

The mean age of the physicians was 47.2 (± 8.1) years, they had practiced a mean of 17.4 (± 8.7) years, and there were no differences between the sexes. More men (96%) than women (77%) physicians were married, but this was only a statistical trend (chi square = 3.29, $df = 1$, $p = 0.07$). Mean scores of physical health were within 1 SD of the mean scores of adult females and males in the population (Bergman & Wright, 2000), confirming their good health. Most (77.5%) physicians had children and 62.5 % still had children living at home. The mean number of children was 2.2, with 1.6 still living at home, and there were no significant differences between the sexes. For women physicians, the mean age of the youngest child was 8.2 years, and for men physicians 12.4 years ($F = 5.19$, $p = 0.03$). None was a single parent. About the same percentage of women (41%) and men (35%) physicians had childcare at home.

Most physicians of both sexes worked full-time (94.5%). Most women physicians' spouses (93%) worked full-time compared to men's spouses (65%), but the difference was only a trend (chi square = 3.48, $df = 1$, $p = 0.06$).

Regarding physical factors that may influence neuroendocrine activity, there were no significant differences in BMI and physical activity with respect to gender.

Description of the State of Mood

The factor SM effort (concentrated, energetic, efficient, and engaged) reached the midpoint of the scale, while the factors SM work overload and SM distress (bored irritated, impatient, and sad) were rated low. There were significant changes over time for SM-effort ($F(3, 114) = 63.49$, $p = 0.01$) and SM work overload ($F(3, 114) = 16.27$, $p = 0.01$); higher ratings before breakfast and supper and lower at bedtime, and no significant differences between the sexes.

Gender Differences

Concerning differences by gender for perceived double-role responsibility women and men had the same total workload (regular paid work, overtime, household duties, childcare, and other responsibilities) in hours (Table 1). However, men spent more time in professional work and women more time in childcare, and women perceived the main responsibility for childcare activities at home (Table 2). This illustrates that, apart from paid work, women physicians also were mainly responsible for unpaid work at home and thus carried a double workload.

Most participants had children over 7 years old and reported that they equally shared the responsibility with their partner for doing things with children, helping older children, teaching, and homework. However, women spent more time per week in childcare than men ($F(1, 38) = 7.9$, $p > 0.01$) and more total time in unpaid work (taking care of home, children, elderly, or sick relatives; volunteer work; etc.) ($F(1, 38) = 4.07$, $p = 0.05$). See Table 1. Supper time took place earlier for women and later for men ($F(1, 33) = 3.99$, $p = 0.05$), with no significant gender difference for breakfast hour.

Men and women physicians rated most of their workload and personal control alike except "responsibility for childcare duties" which women rated significantly higher ($F(1, 24) = 4.65$, $p = 0.04$) (see Table 2).

Table 1. *Rated Time Spent in Paid and Unpaid Work and Total Workload during a Week (n = 40). Statistic Significance of Mean Differences Tested by ANOVA.*

	Women $n = 17$	Men $n = 23$
Hours spent in professional work[a]	54.65 ± 10.61	64.35 ± 12.14
Total hours spent in unpaid work[a] (household, childcare, other activities)	20.18 ± 15.61	11.83 ± 10.58
Hours doing household	6.62 ± 5.02	5.83 ± 4.18
Hours in child care[b]	12.00 ± 13.98	3.17 ± 4.93
Hours in other activities (elderly or sick relatives, volunteer work)	1.53 ± 3.06	2.83 ± 6.40
Total workload in hours	74.79 ± 15.86	76.17 ± 12.69

[a] $p < 0.05$, [b] $p < 0.01$.

Table 2. *Perceived Workload and Personal Control in Paid Work and Household Work (n = 40). Statistic Significance of Mean Differences Tested by ANOVA.*

Variables Scale 0–7	Women $n = 17$ mean/SD	Men $n = 23$ mean/SD
Work demand[a]	4.65 ± 2,23	5.70 ± 1.15
Tiredness after work[a]	4.18 ± 1.98	5.13 ± 1.32
Responsibility over household work	5.88 ± 1.76	5.35 ± 1.94
Responsibility over childcare duties[b]	5.45 ± 2.30	3.57 ± 2.06
Stress in household work	2.41 ± 1.97	2.48 ± 1.95
Stress in childcare	2.91 ± 1.64	2.80 ± 1.93
Conflict between different roles	2.75 ± 2.29	2.04 ± 1.89
Stress from conflicting duties	2.59 ± 1.66	2.26 ± 1.60

[a] $p < 0.10$, [b] $p < 0.05$.

Mean Cortisol Level

Since 2-way ANOVA revealed no significant sex differences in levels of cortisol, women and men were grouped together in the subsequent analyses. Our hypothesis that the variability in cortisol secretion would be associated with variability in work-family balance was tested by hierarchical regression analyses. Results are given in Table 3. In a model with the mean of the provided four cortisol samples as dependent variable, the variables sex and age were entered first and explained 10% of the variance of the dependent variable. The four predictors were entered in a second step, and in a third step the variable interaction between sex and responsibility was entered. The proportion of variance that was added by the interaction variable was 13% ($F(1, 27) = 5.66$, $p = 0.03$). Totally, 38% of the variance was explained by the predictors ($F(7, 27) = 2.36$, $p = 0.05$). When controlling for sex and age and the four predictors, the variable interaction between sex and responsibility ($t = 2.38$, $p = 0.03$) became significant. The results suggest that there is a combined effect of sex and responsibility at home on mean levels of cortisol release over the day. The difference between women and men physicians varies at different levels of responsibility at home.

Cortisol Pattern

Figure 1 shows the diurnal changes of salivary cortisol levels (microgram/dl = μg/dl)[1] in men and women physicians ($F(1, 38) = 40.93$, $p = 0.01$ for the cubic trend and $F(1, 38) = 87.31$, $p = 0.01$ for the linear trend of the curve). Consistent with the well-defined

[1] For conversion to SI units, the following equality holds: nmol/l = 27.6 μg/dl.

Table 3. *Summary of Hierarchal Regression Analysis for Variables Predicting the Mean of Cortisol Diurnal Levels ($n = 40$).*

Dependent Variable	R^2	R^2 Change	Predictor	B	SE B	β
Mean total cortisol	0.10	0.10	Step 1			
			Sex	−0.12	0.10	−0.20
			Age	0.01	0.01	0.28
	0.25	0.15	Step 2			
			Sex	−0.25	0.13	−0.42
			Age	0.01	0.01	0.33
			Hours in paid work	0.01	0.01	0.37
			Hours in childcare	−0.01	0.01	−0.09
			Responsibility at home	−0.01	0.05	−0.02
			Work demand	0.02	0.04	0.12
	0.38[a]	0.13[a]	Step 3			
			Sex	−0.94	0.32	−1.63[b]
			Age	0.01	0.01	0.33
			Hours in paid work	0.01	0.01	0.50[b]
			Hours in childcare	−0.01	0.01	−0.18
			Responsibility at home	−0.11	0.06	−0.64
			Work demand	0.02	0.04	0.17
			Sex[a] responsibility	0.16	0.07	1.15[a]

[a] $p < 0.05$, [b] $p < 0.01$.

circadian rhythm of adrenocortical activity, peak salivary cortisol concentrations were observed during the 30 min after morning awakening ($F(1, 38) = 87.99$, $p = 0.01$), and decreased throughout the day without significant differences between the sexes. The physicians' mean morning levels were 1.18 ± 0.62 μg/dl on awakening, 1.44 ± 0.59 μg/dl 30 min after awakening, 0.59 ± 0.60 μg/dl in the late afternoon, and 0.55 ± 0.34 μg/dl in the evening. Interestingly, for the men, when changes between the mean of the morning cortisol (directly after awakening and 30 min later before breakfast) and evening cortisol (before supper and about 8 PM) and changes in perceived SM-mood between morning and evening were correlated, changes in distress correlated significantly with changes in cortisol ($r = 0.50$, $p = 0.01$, $n = 23$), but there were no significant changes for the women physicians.

Evening Cortisol Level

Considering associations between morning and evening cortisol, a second hierarchical regression analysis was carried out (Table 4), with the mean of the cortisol provided in the evening (before supper and about 8 PM) as dependent variable. In order to control for the cortisol provided in the morning (directly after

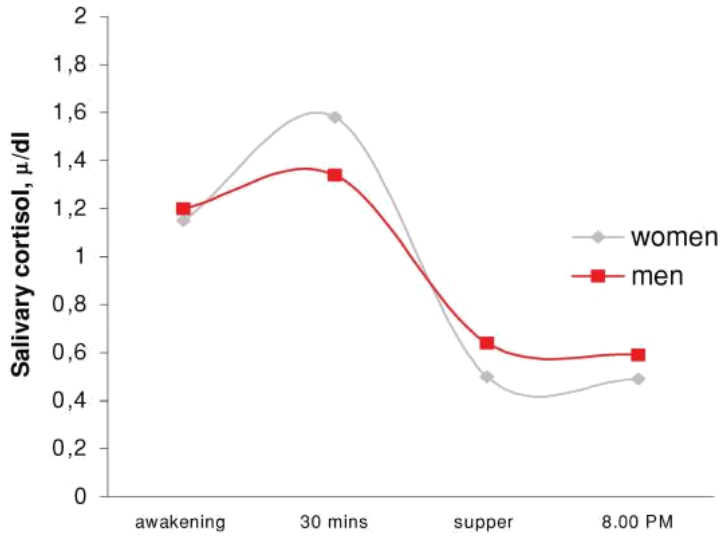

Figure 1. Diurnal mean salivary cortisol levels (μg/dl) in women and men physicians during a workday. No significant differences by gender.

Table 4. *Summary of Hierarchal Regression Analysis for Variables Predicting Cortisol Evening Levels ($n = 40$)*

Dependent Variable	R^2 Change	R^2	Predictor	B	SE B	β
Cortisol mean in the afternoon	0.07	0.07	Step 1			
			Cortisol mean in the morning	0.13	0.09	0.26
	0.18	0.11	Step 2			
			Cortisol mean in the morning	0.12	0.09	0.24
			Sex	0.10	0.08	0.21
			Children at home	0.13	0.09	0.26
	0.50[a]	0.32[a]	Step 3			
			Cortisol mean in the morning	0.16	0.10	0.30
			Sex	0.21	0.11	0.43
			Children at home	0.18	0.10	0.35
			Hours in paid work	0.01	0.01	0.04
			Hours in unpaid work	0.01	0.01	−0.01
			Responsibility at home	0.08	0.03	0.57[a]
			Work demand	−0.01	0.03	−0.07

[a] $p < 0.05$.

awakening and 30 min later before breakfast), the mean of this variable was entered first and 7% was explained. To control for sex and children at home, these variables were entered in a second step and R^2 increased by 11%. Adding the four predictors in a third step, R^2 was significantly increased by 32% ($F(4, 24) = 3.79$, $p = 0.02$). In all, 50% of the variance in the dependent variables was explained ($F(7, 24) = 3.37$, $p = 0.01$). In the third step, perceived responsibility at home showed significance ($t = 2.37$, $p = 0.03$). The results indicate that the more perceived responsibility at home, the higher cortisol level in the evening. This concerns both women and men as analysis by interaction between sex and responsibility showed no significance.

Discussion

As expected, all the academic physicians had a heavy workload, with both women and men spending about 75 total hours per week at work and family tasks. However, in spite of their high-status jobs, the sex role patterns were traditional: men spent more time on paid work, and women more on unpaid work with main responsibility for childcare activities. These long hours might suggest a risk for long-lasting stress and lowered cortisol levels (Raison & Miller, 2003). However, our physicians reported good physical and mental health, and the state of mood given with each saliva sample shows that they perceived more positive effort involvement than negative workload or distress. This may explain why the cortisol response pattern followed the well-known circadian rhythm (Kirschbaum & Hellhammer, 1989, 1994).

Hierarchical regression analysis indicated associations with the mean of salivary cortisol levels over the day by the predictor interaction between sex and responsibility controlling for sex, age, hours in paid and unpaid activities, and work demand. Our a priori predictions that cortisol release would be associated by the perceived severity of work-family imbalance seemed to concern these women physicians, considering their experience of responsibility at home. Investigation of individual differences in morning and evening cortisol release resulted in association with the predictor of responsibility at home without any significant gender difference. For the male physicians, changes in distress from morning to evening correlated significantly with changes in morning and evening cortisol release. This may be a signal of the effect of long hours reported by men. Considering that one third of the male physicians had a part-time working spouse and paid household help, the interaction between sex and responsibility at home and evening cortisol level may be a little surprising. However, besides a long workday, perceptions of high work demand and tiredness after a workday, with late supper feelings of responsibility for household activities, may add stress and result in heightened evening cortisol release.

Unlike other studies of white collar workers (Frankenhaeuser et al., 1989), our women physicians did not have lower morning levels of cortisol than men, nor did they have lower overall cortisol levels than men when stressed (Kirschbaum et al., 1992). However, in our study, women more than men physicians were more likely to have younger children who required more care, and had partners who were more likely to be working full-time and presumably less available to help with household and childcare duties. Indeed, women reported doing the lion's share of household/childcare tasks and also reported a higher perceived sense of responsibility for these duties. Considering the women's double burden, only 40% women physicians had paid household help; lack of household help may also explain the women's cortisol levels in the day, as meal preparation, childcare, and homework may be stressful in the morning and after a full day's work in the hospital. When responsibility for household work was added

to responsibility for childcare duties in the hierarchical regression model, this new variable was significantly associated with elevated salivary cortisol during the day. Other investigators have reported that working women with children at home, independent of marital status and social support, excrete greater amounts of cortisol and experience higher levels of home strain than those without children (Luecken et al., 1997). Domestic responsibility, together with a challenging profession, demands juggling between home and work roles and increases sensitivity to work overload for women (Frankenhaeuser et al., 1989; Hall, 1989; Wortman et al., 1991). In our sample, virtually all of the female physicians were married to men who worked full-time, and women professionals often have husbands who carry over their status hierarchy in the workplace into the home (Wortman et al., 1991). In spite of careers of equal status, women and men professionals arrange their lives differently; consequently, involvement in daily household work and childcare is usually determined by gender and results in double work for women (Lundberg et al., 1994; Wortman et al., 1991). This may have been amplified by the women in our study having younger children than the men. In spite of career opportunities being formally equal, women doctors' careers are still more affected by family responsibilities than those of their male colleagues (Gjerberg, 2003; Gross, 1997).

The limitation of our study was that the sample size was small and not randomly composed, although it was a representative subset of the larger academic physician group from which it was drawn (Bergman et al., 2003). The physicians were recruited from only one large university network hospital, and therefore the generalizability of our findings to other physician populations is unknown. It may also be that less-stressed physicians were more likely to volunteer for this study, as participation itself may have been perceived as more stress to already stressed physicians. One reason given for nonresponse among those who volunteered for the study was that they could not find time to complete the questionnaire and cortisol measures over a workday. In addition, the interpretation of the multiple regression models to predict rises in levels of cortisol must be considered in light of the predictors entered in the regression equation, which did not constitute an exhaustive list.

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