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Health anxiety moderates the daytime cortisol slope

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Abstract

Objectives: Edwards et al. argue that a steeper daytime cortisol slope indicates increased symptom awareness [Edwards S, Huckle-bridge F, Clow A, Evans P. Components of the diurnal cortisol cycle in relation to upper respiratory symptoms and perceived stress. Psychosom Med, 2003;65:320–7]. Theory suggests that health anxiety (HA) is associated with increased symptom awareness. Therefore, this study tests the hypothesis that higher levels of HA are associated with a steeper daytime cortisol slope and is the first to examine the daytime diurnal cortisol slope for HA. **Methods:** Forty-two healthy working adults completed measures of HA and neuroticism as well as indices to measure the severity and frequency of symptom reporting. Participants also provided eight consecutive days of salivary cortisol data. Two cortisol measures were taken each day — once prior to lunch and once in the early evening — the timing of these was synchronized to waking times. The data were analyzed using multilevel modeling. **Results:** The hypothesis was supported, with those scoring higher on HA showing a steeper daytime cortisol slope. There were no significant relationships between cortisol (average production and slope) and either neuroticism or symptom reporting (severity and frequency). **Conclusions:** The results are interpreted as consistent with theories of HA that emphasis increased awareness of nonspecific symptoms.

Keywords: Health anxiety; Hypochondriasis; Cortisol; Diurnal variability

Introduction

Health anxiety (HA) or hypochondriacal concerns represent the fears, worries, beliefs, and attitudes associated with hypochondriasis and abnormal illness behavior [1,2] and have an estimated population prevalence rate of 6–10% [3–5]. Theory suggests that HA is associated with increased somatic awareness [6–10] that is based on a general tendency toward somatic distress [11]. While there is considerable evidence to support the role of cognitive processes associated with somatic awareness and symptom interpretation [9–14], much less work has focused on biological correlates of HA, and this represents a significant gap in our current understanding of HA [15].

To start to close this gap in the literature, we focus, in this study, on the relationship between HA and cortisol. A limited number of studies have shown that increased levels of cortisol are associated with higher levels of psychometrically assessed HA and abnormal illness behavior [16,17] as well as with somatizing patients [18]. However, no study has explored the association between HA and the cortisol slope.

Cortisol daytime slope, health, and HA

The cortisol diurnal profile is characterized by an initial rise on awaking that peaks about 30 min after awaking and remains elevated for the next 60 min. Over the rest of the day, cortisol shows a steady decline and starts to rise again early the following morning before waking [19]. The shape of the cortisol slope is important with respect to health-related outcomes. In particular, there is evidence that a flatter cortisol slope is predictive of objective disease states and mortality [20,21]. However, it is argued here that HA should be associated with a steeper daytime cortisol slope [22].

HA and the cortisol daytime slope

Evidence indicates that the awakening and the remaining daytime cortisol responses are regulated by different

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mechanisms [22–24], and as such, it is argued that the waking and daytime components deserve separate investigation [19]. A number of observations made by Edwards et al. [22] on the relationship between the daytime cortisol slope and symptom reporting led them to argue that individuals with a cortisol profile that is characterized, in part, by '… steeper-than-normal declines in cortisol over the day time period...'(p. 326: 21) had a greater awareness of symptoms — without necessarily being vulnerable to illness. These features of greater symptom awareness, without increased vulnerability to illness, are central characteristics of HA [8–10]. Therefore, it is predicted that a steeper daytime cortisol slope will be observed for those with higher levels of HA [22].

Differentiating HA from neuroticism and symptom reporting

While Edwards et al. [22] observed that increased daily symptom reporting was predicted by steeper daytime cortisol slopes, it is not clear if this relationship is observed for a general tendency to report symptoms. To examine this, we considered two indices of a general tendency to report symptoms: frequency and severity [25,26]. However, as HA and symptom reporting are associated with each other and both are related to neuroticism [27–32], it is necessary to show that the association with the daytime cortisol slope is specific to HA.

Hypothesis

The central hypothesis tested in this study is that increased levels of HA will be related to a steeper daytime cortisol slope [22].

Method

Procedure

Participants were drawn from a survey of 711 working adults (covering the public sector and manufacturing industries). Participants completing the survey provided measures of HA, neuroticism, and both symptom severity and frequency. They were asked if they would be willing to volunteer to take part in a further diary study involving saliva sampling. The diary study was conducted over an 8-day period (running from Monday to Monday) 11 to 15 months after the survey.

Participants provided two cortisol samples each day, once in the morning around noon and again in the evening [33–35].[1] Two cortisol assessments (morning and afternoon) provide a reliable index of the daytime slope [33,35] and reduce participant burden, thus helping to enhance compliance over the 8-day period of the study [36].

Time data for each saliva sample were recorded in terms of (a) the time the participants awoke, (b) the time they took the first daily cortisol sample, and (c) the time they took the second daily cortisol sample. Cortisol samples were collected using the Omni-Sal saliva collection system. The Omni-Sal system has been shown to be a valid saliva collection system [37] and to have high sensitivity compared to serum testing [38]. Samples were retuned at the end of each of the 8 days to the research team sealed in individual test tubes protected within plastic cases for transportation. On receipt, all samples were immediately frozen and stored at −20°C.

The two daily cortisols were synchronized to the time of waking by assessing (in minutes) the time from waking to the collection of the first and second cortisol [22,23,33].[2] Prior to starting the diary, participants provided brief details of their medical history. At the end of each day, they described their health behaviors for that day (e.g., how much caffeine they consumed that day). These were assessed to check that the cortisol responses were not influenced by participants' medical history or health behaviors [39]. The study received ethical approval from the school's ethical review board.

Issues of compliance have recently been raised with respect to the accuracy of timings associated with cortisol sampling [40,41]. However, the major effect of noncompliance is observed on the awakening response and not the slope [41,42], making issues of compliance less of a problem for this study with its focus on the daytime slope. Participants returned their samples at the end of each day to ensure compliance between days. Some validity for the accuracy of these timings was indicated by participants reporting waking, on average, 85 min later on weekends ($P<.001$) and 89 min later on nonworkdays ($P<.001$). Neither HA, neuroticism, symptom severity, nor symptom frequency was associated with any of the recorded times.

Participants

Of the original 711 participants who took part in the survey, 44 participants consented to take part in the diary study, and usable data was attained from 42 participants. Table 1 indicates that the 42 participants in the cortisol diary study did not differ significantly from those in the main survey in terms of demographic indices as well as HA. There were, however, marginally significant effects for neuroticism and symptom frequency, with those volunteering scoring higher on both of these measures.

[1] An initial sample was also taken, with participants instructed to take this within 10 min. This was not included in these analyses for theoretical reasons.

[2] The pattern of results remained the same when time was treated dichotomously as a.m. (scored 0) and p.m. (scored 1).