Northumbria Research Link

The Psychological, Endocrine, and Health Corollaries of Child Problem Behaviours in ASD, or ADHD Caregivers

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Abstract

Research has revealed a positive relationship between problem behaviours of the care recipient and psychological distress in the care provider. Rarely, however, have researchers assessed the relationship between problem behaviours of the care recipient and key physiological mechanisms, relevant for the physical health status of their caregivers. This study extends previous work by examining the psychological, endocrine, and health corollaries of child problem behaviours in parent caregivers of children with autism spectrum disorder, or attention deficit hyperactivity disorder. Caregivers (n = 18) completed self report measures of psychological distress, child problem behaviours, and incidences of common health problems. To capture important parameters of the diurnal cortisol pattern, caregivers collected salivary cortisol at waking, 30 minutes post waking, 1200h, and 2200h on two consecutive weekdays. Findings revealed a positive association between caregivers' perceived levels of stress and problems with child conduct behaviours. To the extent that caregivers reported more problems with child emotional and peer behaviours, they demonstrated flatter diurnal cortisol slopes, and reported increased frequencies of common health problems. The cortisol awakening response was also markedly diminished in caregivers that reported more problems with child hyperactivity behaviours. These findings have implications for interventions that aim to improve the psychophysiological well being of the caregiver through targeting the problem behaviours of the care recipient.

Key words: autism spectrum disorder (ASD); attention deficit hyperactivity disorder (ADHD); child problem behaviours; common health problems; caregivers; cortisol.

1. Introduction

The caregiver control model has been widely applied to assess the psychophysiological corollaries of chronic stress (Lovell & Wetherell, 2011). Caregivers of children with complex needs face demands that far exceed those of typically developing children such as: stigma, physical pressures, severe financial hardship, and enduring social isolation (Kuster et al., 2004; Seltzer et al., 2009). Unsurprisingly, increased psychological morbidity, as was manifest by greater feelings of anxiety and symptoms of depression, have been reported in caregivers of children with complex needs, relative to parents of typically developing children (Gallagher, Phillips, Oliver, & Carroll, 2008; Lovell, Moss & Wetherell, 2012a; Weiss et al., 2002). As the final effector hormone of the hypothalamic-pituitary-adrenal (HPA) axis, cortisol shows a robust basal diurnal pattern. That is, levels are high in the morning upon waking, peak between 30-45 minutes post waking (cortisol awakening response [CAR]), and steeply decline across the day (diurnal cortisol slope), reaching a nadir at around midnight (Smyth et al., 1997). Caring for a child with complex needs has been frequently linked with dysregulation of the HPA axis, as indexed by flattening of the diurnal cortisol slope (Miller, Cohen, & Ritchey, 2002; Seltzer et al., 2009), and hyposecretion of cortisol across the day (Bella et al., 2011; Seltzer et al., 2010). Dysregulated immune activity (Cohen & Pollock, 2005; Gallagher, Phillips, Drayson, & Carroll, 2009; Rohleder, Marin, Ma, & Miller, 2009), and greater incidences of commonly occurring ailments (Bella, Garcia, & Spadari-Bratfisch, 2011; Lovell, Moss, &Wetherell, 2012b) have also been widely evidenced in this population, relative to parent controls.

Within the caregiver group, however, increased feelings of anxiety and depression have been widely evidenced in caregivers that reported more problems with child behaviours (Baker, Blacher, & Olsson, 2005; Gallagher et al., 2008; Lecavalier, Leone, & Wiltz, 2006). Rarely, however, have researchers assessed the association between problem behaviours of the care recipient and key physiological mechanisms, relevant for the physical health status of their caregivers. To date, findings have revealed poorer antibody response to a pneumococcal vaccination in caregivers of children with ASD that reported more problems with child conduct behaviours (Gallagher et al., 2009). Dysregulated patterns of cortisol secretion (De Vugt, Nicolson, Aalten, Lousberg, Jolle, & Verhey, 2006) and increased frequencies of infectious illness (Dyck, Short, & Vitaliano, 1999) have also been demonstrated in elderly dementia caregivers that reported more patient problem behaviours.

To extend work in this area, we assessed the psychological, endocrine, and health corollaries of child problem behaviours in caregivers of children with ASD, or ADHD. Research has revealed that parents of children with ASD, or ADHD, are statistically indistinguishable with respect psychophysiological outcome measures, and in their assessment of care recipients' problem behaviours (Donenberg & Baker, 1993). To maximise sample size, therefore, the two caregiver groups were combined in the present study. On the basis of past work, we predicted: (a) greater psychological distress, (b) disrupted patterns of cortisol secretion, and (c) greater frequencies of common health problems in caregivers that reported more child problem behaviours.

2. Methods

2.1. Participants

All procedures received ethical approval by the School of Life Sciences Ethics Committee. Caregivers were recruited according to strict criteria: (a) parenting at least one child with clinically verified ASD, or ADHD, and without any secondary diagnoses (b) parenting an ASD, or ADHD, child that lives at home on a full time basis (c) not pregnant, breast feeding, taking steroidal and/or hormone replacement medication, and (d) not managing any chronic illness. Caregivers that satisfied these criteria were invited to provide informed consent. Caregivers (n = 18) were recruited from regional support groups, schools and charities, and reimbursed £10.00 for taking part. Table 1 presents means and standard deviations for demographic, behavioural, and biomedical characteristics of the sample.

INSERT TABLE 1 HERE

2.2. Procedures

Caregivers were asked to complete questionnaires and provided materials to perform ambulatory collection of salivary cortisol. Diurnal cortisol measurement can, on any one day, be influenced to a large extent by state factors, e.g., time of waking (Stalder, Hucklebridge, Evans & Clow, 2009), quality and duration of sleep (Griefahn & Robens, 2008), and exposure to light in the morning (Thorn, Hucklebridge, Esgate, Evans, & Clow, 2004). To increase the reliably of cortisol measurement, therefore, researchers have recommended that participants collect between four-six saliva samples on two consecutive days (Hellhammer et al., 2007). In the present study, caregivers were instructed to collect salivary cortisol at waking, 30 minutes post waking, 1200h, and 2200h on two consecutive weekdays. Cortisol was sampled noninvasively using the Salivette (Sarstedt Ltd). That is, caregivers were asked to chew sterile cotton swabs for 1-2 minutes and deposit saturated swabs into plastic

collection tubes. Poor adherence with the saliva collection protocol can invalidate the accuracy of cortisol measurement. That is, a delay > 10 minutes between waking and collection of the waking cortisol sample can lead to erroneous interpretations of the CAR, and diurnal cortisol slope (Griefahn & Robens, 2011; Kudielka, Broderick, & Kirschbaum, 2003; Okun et al., 2010). To encourage protocol adherence, therefore, all caregivers were invited to the lab and trained to accurately collect saliva using the Salivette. Caregivers also received detailed written instructions regarding the time sensitive nature of the hormone. To identify protocol non adherence, all caregivers were provided paper diaries and asked to record waking and sampling times as accurately as possible on all collection days. In line with previous work, a compliance window of > 10 minutes between waking and collection of the waking sample was applied for the exclusion of erroneous cortisol data (Kunz-Ebrecht, Kirschbaum, & Steptoe, 2004; Wright & Steptoe, 2005). Research has demonstrated that self report measures (i.e., paper adherence diaries) are preferred by participants (Kraemer et al., 2006), and equally reliable as more objective, electronic measures of adherence (Okun et al., 2010; Seltzer et al., 2010; Stalder, Hucklebridge, Evans, & Clow, 2009). To further encourage protocol compliance, caregivers were instructed to abstain from behaviours known to affect the measurement of cortisol in saliva for 45 minutes prior to the collection of any sample. These included: (a) consumption of food, caffeinated and alcoholic beverages, (b) exercise, (c) nicotine consumption, and (d) brushing teeth and/or use of mouthwash (Kudielka, Hellhammer, & Wust, 2009). For the present study, all caregivers collected salivary cortisol within the stipulated time parameters, and reported no other deviations from the agreed protocol. Data for all caregivers, therefore, was taken forward for statistical analysis.

Caregivers were instructed to store collected samples in a domestic freezer until returned, along with paper adherence diaries, to the research team. Returned samples were stored frozen at -20°C. Assays were performed in house using the luminescence immunoassay method (IBL Hamburg, Germany). The mean intra and inter-assay coefficients were 7.1%, and 10.7% respectively.

2.3. Psychological outcomes

Psychological distress was quantified using standardised questionnaires. The 10 item *Perceived Stress Scale* (PSS) was used to measure caregivers' feelings of being overwhelmed over the last month (Cohen, Kamarck, & Mermelstein, 1983). Scale responses range from 0 (*never*) to 4 (*very often*) and are summed to yield a total score. A total PSS score can range from 0-40, with higher scores indicating greater perceived levels of stress. 14 items, 7 reflecting anxiety and 7 reflecting depression, are scored along a 4 point scale, 0 (*never*) to 3 (*considerable*). Possible scores for anxiety and depression range between 0-21. Items for the two subscales are summed to yield a total score, with higher scores indicating more frequent feelings of anxiety and symptoms of depression. Scores ranging from 0-7 are considered normal. Scores ranging from 8-10 indicate borderline mood disorder, and scores > 11 indicate probable mood disorder (Snaith, 2003). The *Pennebaker Inventory of Limbic Languidness* (PILL) was used to assess how frequently caregivers reported 54 common health problems, e.g., nausea, running nose, cough, aches and pains (Pennebaker, 1982). Scale responses range from 1 (*never / almost never*) to 5 (*more than once per week*). Items experienced by the respondent more than once per month are summed to formulate an index of total problem frequency. A total problem score based on the 54 items can range from 0-54. The 25 item *Strengths and Difficulties Questionnaire* (SDQ) was used to quantify child problem

behaviours (Goodman, 1997). The SDQ is composed of five subscales, one that assesses pro-social behaviour (e.g., often volunteers to help others), and four that assess different child problem behaviours: emotional symptoms (e.g., nervous or clingy in new situations), conduct problems (e.g., often fights with other children), hyperactivity behaviours (e.g., restless, overactive, cannot sit still for long) and peer relationships (e.g., generally liked by other children). For this study, only scores for problem behaviour subscales were taken forward for analyses. Caregivers were asked to rate whether child behaviours are, 0 *(not true),* 1 *(somewhat true),* or 2 *(certainly true).* For each subscale, scores can range from 0-10. Total scores for each subscale are calculated by summing across items, with higher scores indicating more child problem behaviours. For the emotional behaviour subscale of the SDQ, scores ranging from 5-10 have been deemed abnormal and indicative of mental health disorder. The same is true for scores ranging from 4-10 on the conduct and peer problem behaviour subscales, and scores ranging from 7-10 on the hyperactivity subscale (Goodman, 1997).

All psychosocial measures have achieved excellent psychometrics (all $\alpha > .76$) in previous research with caregivers of children with complex needs (Gallagher et al., 2008, 2009; Goodman & Scott, 1999; Miller et al., 2008; Rohleder et al., 2009). Internal consistency in the current sample was also high (all $\alpha > .86$).

2.4. Physiological outcomes

To normalize distributions, raw cortisol values were $\log_{10}$ transformed and data for each sampling day used to estimate indices of the CAR, diurnal cortisol slope, and mean diurnal cortisol output. The CAR was calculated as the difference between cortisol at waking and 30 minutes post waking, and mean diurnal cortisol output was estimated by summing all four

cortisol values (Lovell, Moss, & Wetherell, 2011). To assess the diurnal cortisol slope, a regression line was fitted separately for each participant that predicted cortisol values from time since waking. Steeper slopes indicate greater rate of diurnal change and are represented by smaller β values (larger negative values). Higher β values (as they approach / cross zero) indicate flatter cortisol slopes and dysregulation of the HPA axis (Smyth et al., 1997). In keeping with recent work, cortisol values were averaged across the two sampling days to provide more reliable markers of HPA activity (Lovell et al., 2012a; Turner Cobb et al., 2010).

3. Results

3.1. Preliminary analyses

Demographic, behavioural, and biomedical data were collected to assess the possibility that relationships between problem behaviours of the care recipient and psychophysiological outcomes in their caregivers might reflect the contribution of other variables. These included: gender, age, weight, body mass index (BMI), phase of the menstrual cycle, use of antidepressants and oral contraceptives, nicotine and alcohol consumption, frequency of exercise, annual income, marital status, and number of children in the home. Results yielded a significant, inverse relationship between perceived levels of stress and caregivers' weight ($r = -0.49$, $p = 0.05$). The diurnal cortisol slope was also positively correlated with caregivers' weight ($r = 0.51$, $p = 0.04$), and body mass index (BMI) ($r = 0.51$, $p = 0.04$). Caregivers that reported being married or in a *de facto* relationship also displayed flatter cortisol slopes ($t\,(12.70) = 2.53$, $p = 0.03$). To avoid spurious relationships between child problem behaviours and psychophysiological outcomes in their caregivers, subsequent analyses adjusted for these variables.

INSERT TABLE 2 HERE

3.2. Psychological outcomes and CPB

Questionnaire data revealed that caregivers' appraisals of child emotional, conduct, hyperactivity and peer behaviours all fell within the clinical range. Table 2 presents means and standard deviations for caregivers' appraisals of child problem behaviours, and psychophysiological outcome measures. The SDQ, therefore, clearly discriminates between parents' appraisals of problem behaviours in children with ASD, or ADHD, and normative SDQ data (Meltzer, Gatward, Goodman, & Ford, 2000).

Partial correlation, adjusting for caregivers' weight, revealed a significant, positive association between caregivers' perceived levels of stress and problems with child conduct behaviours ($r = 0.64$, $p < 0.01$, one tailed). Self reported incidences of common health problems were markedly greater in caregivers that reported more problems with child emotional ($r = 0.47$, $p = 0.03$, one tailed), and peer behaviours ($r = 0.46$, $p = 0.03$, one tailed). Table 3 presents correlation coefficients between scores on all SDQ subscales and psychophysiological outcomes.

INSERT TABLE 3 HERE

3.3. Physiological outcomes and CPB

Partial correlation, adjusting for caregiver weight, BMI and marital status, revealed markedly flatter cortisol slopes in caregivers that reported more problems with child emotional behaviours ($r = 0.54$, $p = 0.05$). Bivariate correlation further revealed that the CAR was markedly diminished in caregivers that reported more problems with child hyperactivity

behaviours ($r = -0.48$, $p = 0.04$). Analyses failed to detect a statistically significant relationship between mean diurnal cortisol output and scores on the SDQ subscales (all ps > 0.24).

4. Discussion

Perceived levels of stress were markedly greater in caregivers that reported more problems with child conduct behaviours. These findings corroborate previous work that has demonstrated a positive relationship between problem behaviours of the care recipient and psychological distress in the care provider (Baker et al., 2005; Blacher et al., 2006; Gallagher et al., 2008; Lecavalier et al., 2006). Caregivers that reported more problems with child emotional and hyperactivity behaviours demonstrated alterations in cortisol secretion patterns, characterised by flatter cortisol slopes and attenuation of the CAR. These findings are commensurate with other work that has revealed dysregulated cortisol secretion in caregivers of children with ASD, or ADHD (Seltzer et al., 2009, 2010). Dysregulation of the HPA axis has been frequently implicated in the aetiologies of deleterious health outcomes. That is, flatter cortisol slopes have been linked with poorer mental and physical well being (Hagger-Johnson, Whiteman, Wawrzyniak, & Holroyd, 2011; Sjogren, Leanderson, & Kristenson, 2006), while attenuation of the CAR has emerged as a diagnostic index of functional somatic syndromes such as, burnout and vital exhaustion (Heim, Ehlert, & Hellhammer, 2000). The immunomodulatory influence of cortisol has been well documented in the stress literature (Elenkov, 2004). Disrupted patterns of cortisol secretion and associated alterations in immune efficacy, therefore, might provide one pathway that mediates the positive relationship between problem behaviours of the care recipient and frequencies of common health problems in their caregivers reported here. In support, research has demonstrated alterations in the CAR (De Vugt et al., 2006), dysregulated immune function

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(Gallagher et al., 2009), and increased frequencies of infectious pathologies (Dyck et al., 1999) in caregivers that reported more patient problem behaviours. Research has demonstrated how quality of life for the care recipient is inextricably linked with the health and happiness of the care provider (Burgess & Gutstein, 2007), and how the harmful effects of caregiver stress can seriously impede the ability of the parent to provide consistent, sustainable and effective support for the child (Addington, 2003; Byrne, Hurley, Daly, & Cunningham, 2010; Edworthy, 2005). To this end, future research might build on preliminary findings that have demonstrated adaptive changes in psychological well being, and beneficial effects on important biological parameters such as, the immune response, in caregivers taught to more effectively manage the problem behaviours of the care recipients (Garand, Buckwalter, Lubaroff, Tripp-Reimer, Frantz, & Ansley, 2002).

The findings of the study, however, must be discussed in the context of its limitations. Clinical diagnosis of ASD, or ADHD, in the present study was based on parent report only. Failure to incorporate a uniformly determined and standardized assessment protocol to verify ASD, or ADHD, diagnoses, therefore, was significant limitation of the study (Le Couteur, Haden, Hammal, & McConachie, 2008). Effect sizes indicate that the small sample size might have prevented the observation of statistically meaningful associations between problem behaviours of the care recipient and some of the psychophysiological measurement parameters. A larger sample, therefore, is needed to better delineate these relationships. The study does, however, have unique strengths in terms of its methodology. Research has demonstrated how single day assessment can bias diurnal cortisol measurement to state, rather than trait characteristics (Adam & Kumari, 2009; Hellhammer et al., 2007). To optimise the reliability cortisol measurement, therefore, saliva was collected on two consecutive weekdays (Stalder et al., 2009).

In conclusion, psychological distress was markedly elevated in caregivers that reported more problems with child conduct behaviours. Dysregulated patterns of cortisol secretion and increased frequencies of common health problems were also demonstrated in caregivers that reported more problems with child emotional and hyperactivity behaviours. These findings have implications for interventions that aim to improve the psychophysiological well being of the caregiver, with a view to enhancing quality of life for the care recipient.

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