Early Childhood Research Quarterly 34 (2016) 92–103

Contents lists available at ScienceDirect

Early Childhood Research Quarterly

The impact of program structure on cortisol patterning in children attending out-of-home child care

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ARTICLE INFO

Article history:
Received 8 October 2013
Received in revised form
12 September 2015
Accepted 23 September 2015

Keywords:
Child care
Cortisol
Stress
Program structure

ABSTRACT

Full-day center-based child care has repeatedly been associated with rising levels of cortisol, a hormone that helps the body manage challenge, across the day at child care. This article presents findings from two studies examining the relationship between child care program structure (number of days per week, and hours per day) and cortisol production across the day. Study 1 presents findings comparing cortisol production in 3- to 5-year-old children enrolled in either full-day ($N = 55$) or half-day ($N = 63$) Head-Start-funded programs. Study 2 presents findings comparing young children enrolled in either full-day full-time (5 days per week; $N = 37$) or full-day part-time (2–3days/week; $N = 41$) primarily tuition-funded programs. Using multilevel modeling and controlling for a number of child factors, attending full-day, full-time programs (as compared to either half-day or part-time programs) was associated with increased cortisol production across the day on child care and home days. Implications for early childhood educators are discussed.

Introduction

The increased use of non-parental child care has resulted in substantial research investigating the potential effects and associations of this important developmental setting on many aspects of child development, including school readiness and socio-emotional well-being. One way of assessing the impact of child care settings is by examining associations between child care characteristics and children's physiology, specifically examining production of cortisol, a hormone sensitive to stress and challenge. There has been a robust and replicated finding that preschool-aged children attending group child care settings may show a flat or rising pattern of cortisol production across the day at child care but a declining pattern at home (Geoffroy, Côté, Parent, & Séguin, 2006; Groeneveld, Vermeer, van IJzendoorn, & Linting, 2010; Vermeer & van IJzendoorn, 2006; Watamura, Coe, Laudenslager, & Robertson, 2010; Watamura, Kryzer, & Robertson, 2009). This flat or increasing pattern of cortisol across the day (typically resulting from elevated afternoon cortisol values) is limited to child care days, and by bedtime, cortisol levels on child care days are indistinguishable from bedtime cortisol levels on non-child care days (Sumner, Bernard, & Dozier, 2010; Watamura et al., 2009). While it remains unclear whether there are any consequences, positive or negative, of such patterning differences between home and child care, the evidence does suggest that a rising pattern across the day at child care is more pronounced in environments rated as lower in quality (Hatfield, Hestenes, Kintner-Duffy, & O'Brien, 2013; Sims, Guilfoyle, & Parry, 2006), is more common in children with more insensitive or intrusive teachers or who have less secure attachments to teachers (Badanes, Dmitrieva, & Watamura, 2012; Gunnar, Kryzer, Van Ryzin, & Phillips, 2010), and is associated with lower antibody production on subsequent weekend days (Watamura et al., 2010). The studies presented in this paper will address the role of preschool program structure (full-day/full-time, full-day/part-time, and half-day) as associated with group differences in children's diurnal cortisol patterning.

Over the past several decades, there has been a substantial shift in the normative developmental experiences for infants and young children in the US. Specifically, both social and cultural changes, such as the increased rates of maternal employment, have made non-parental child care a necessity for some families (Hernandez, 1995), and many families choose preschool programs to help prepare their children for school entry. The National Institute of Child Health and Development (NICHD) Early Child Care Research Net-

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http://dx.doi.org/10.1016/j.ecresq.2015.09.004
0885-2006/

work (ECCRN) reported that the average age of entry for ECE settings was just before six months of age and that the average enrollment arrangement was over 20 h per week (NICHD ECCRN, 1997). Many children participate in some form of non-maternal child care (NICHD ECCRN, 2006) often beginning in infancy, and many children participating in non-maternal child care are served by out-of-home child care centers, with over 50% of children between the ages of three and six enrolled in either a kindergarten or a pre-kindergarten program (U.S. Census Bureau, 2009). The widespread utilization of non-maternal care has resulted in early care and education (ECE) settings becoming the second most important context for many children, outside of the immediate family context, as school settings are for older children. Children will often experience a variety of child care options (e.g., kin care, family based child care, and center based preschool programs) before they enter school (Laughlin, 2013).

Child care influences depend heavily upon several factors including caregiver sensitivity, adult-to-child ratio, and stimulation provided in the environment. Empirical research has consistently highlighted an array of benefits which can be gained from group care and education prior to school, particularly when children come from disadvantaged home environments (Lamb, 1997, 2000; Phillips & Lowenstein, 2011). The NICHD ECCRN found that high-quality child care was associated with a wide range of benefits including higher levels of cognitive and language development (NICHD ECCRN, 2000, 2002, 2004) and more positive social and peer outcomes at 36 months (NICHD ECCRN, 1998, 2001). However, not all outcomes associated with child care attendance are positive as some negative associations with time spent in child care have also been demonstrated. Notably, more hours spent in child care has been linked to increased externalizing behaviors and more negative peer interactions in children (NICHD ECCRN, 1998, 2002, 2003, 2006; Phillips & Lowenstein, 2011; Vandell, 2004). If children benefit cognitively from high-quality early child care experiences, but are at an increased risk for externalizing problems if they spend long hours in these environments, a more comprehensive comparison of the costs and benefits associated with full and part-time programs is warranted.

The preschool years are an important developmental period during which many physiological processes are developing and experiences during this time period may help establish long-term physiological parameters, such as set points for stress reactivity (Gunnar & Cheatham, 2003). One widely studied physiological system is the hypothalamic–pituitary–adrenal (HPA) axis. The HPA-axis is a physiological system that serves regulatory functions for many different biological processes (e.g., metabolism, immune function) and helps manage the stress response. In humans, the primary downstream product of the HPA-axis is the glucocorticoid hormone cortisol. The HPA-axis may increase cortisol production in response to external threats to increase the amount of energy available for immediate use so that an organism may navigate the situation efficiently before returning to baseline. This system is most effective when used in a targeted fashion to help the body increase its energy levels in situations where immediate action may be warranted, while chronic activation of this system can incur a high metabolic cost (Dallman, 1993).

In adults in the absence of acute stress, cortisol production typically follows a circadian rhythm which peaks in the morning, sharply declines following the awakening peak, and then gradually decreases across the remainder of the day until reaching its lowest point around midnight (Kirschbaum, Kudielka, Gaab, Schommer, & Hellhammer, 1999). Circadian cortisol patterning is not present at birth and, depending on individual characteristics, a morning peak and evening nadir can start to emerge at various times across the first year of life (de Weerth, Zijl, & Buitelaar, 2003). Throughout the infant and toddler years, cortisol patterning further matures so that by age three, children show a decreasing pattern across the day, including across the afternoon under at-home, basal conditions (Larson, White, Cochran, Donzella, & Gunnar, 1998; Price, Close, & Fielding, 1983; Watamura, Donzella, Kertes, & Gunnar, 2004). Atypical cortisol patterning (flat or rising across the day instead of falling) has also been documented in both youth (White, Gunnar, Larson, Donzella, & Barr, 2000) and adults (Giese-Davis, Sephton, Abercrombie, Durán, & Spiegel, 2004; Sephton, Sapolsky, Kraemer, & Spiegel, 2000; Stone et al., 2001; White et al., 2000) and in these age groups, this atypical cortisol patterning is usually associated with difficult life experiences (Miller, Chen, & Zhou, 2007) or physical or mental health conditions (Herbert, 2013). A particularly problematic pattern is flat and very low cortisol across the entire day and/or a failure to respond to stress (Gunnar & Vazquez, 2001) which has been documented in high-risk preschoolers (Badanes, Watamura, & Hankin, 2011; Hankin, Badanes, Abuela, & Watamura, 2010). This has been referred to as hypocortisolism, hypocortisolemia, or attenuated cortisol.

Research has begun to elucidate possible risk and buffering effects which contribute to many young children showing flat or increasing cortisol across the day at child care (generally resulting from elevated afternoon levels) while showing the age-typical decreasing pattern at home. Possible buffering factors for children displaying these patterns at child care include child care characteristics such as increased levels of attention and stimulation by the caregiver (Dettling, Parker, Lane, Sebanc, & Gunnar, 2000), higher industry standards for classroom quality (Sims et al., 2006), more positive and cohesive classroom environments (Watamura et al., 2009), and classroom emotional support (Hatfield et al., 2013). Child characteristics, including age (Dettling, Gunnar, & Donzella, 1999), secure attachments to mothers (Ahnert, Gunnar, Lamb, & Barthel, 2004) and caregivers (Badanes et al., 2012) have also been shown to buffer this effect. A number of risk factors for elevated cortisol patterning at child care have also been identified including intrusive or over-controlling caregiving styles (Gunnar et al., 2010), classroom interactional demands (Watamura et al., 2010), and a mis-match in quality between the home environment and the child care environment (Berry et al., 2014). Child characteristics including internalizing symptoms in boys (Tout, de Haan, Campbell, & Gunnar, 1998) and younger age (Dettling et al., 2000) have also been associated with increased cortisol production at child care. Note that in this literature, child care attendance has not been associated with the particularly problematic flat and low cortisol profile discussed above.

While family needs and funding constraints are critical determinants of child care options, understanding the cognitive, social-emotional, physical, and physiologic impacts of various program structures will help caregivers and parents make informed decisions about offering and choosing program types for individual children (when choice is possible). In the current studies, we examined whether salivary cortisol patterning differed across the day in programs with different structures. In order to assess the effects of program structure without confounding family characteristics or program goals (and within the constraints of program options offered in our community), we conducted two studies, one comparing full-day/full-time to half-day (morning only) Head Start programs and one comparing full-day/full-time (5 days/week) to full-day/part-time (2–3days/week) tuition-supported child care programs. Methods across the studies were kept very similar to allow for a more integrated discussion.

To our knowledge, there has not been any published research examining program structure (i.e., half-day or part-time vs. full-day/full-time attendance) on children's cortisol patterning, although the long hours spent in full-time child care may be a contributing factor to the flat or rising cortisol patterning some preschoolers show on child care days. Specifically, we hypothe-