

RESEARCH SUMMARY

Child care setting affects salivary cortisol and antibody secretion in young children

Sarah Enos Watamura, Christopher L. Coe, Mark L. Laudenslager & Steven S. Robertson

Psychoneuroendocrinology (2010) **35**, 1156-1166

doi: 10.1016/j.psyneuen.2010.02.001

The normal response to stress in humans involves the production of a hormone known as cortisol from the adrenal glands near the kidneys. Secreted cortisol levels can be easily measured in samples of saliva, and higher levels are produced in situations that are known to be stressful. Changes in the normal daily pattern of cortisol secretion have also been associated with stress. The hormone is produced throughout the lifespan, including in infancy and early childhood, and studies over more than ten years have consistently noted rises in average cortisol levels and changes in the daily pattern of its release in babies and young children in daycare. These changes are fairly small, however.

In both adults and children, cortisol levels are normally highest in the mornings and fall during the day, reaching their lowest levels in the evening. The main change that has been noted consistently in young children in daycare is an afternoon rise in cortisol levels leading to a “flattening” of the overall pattern. Similar patterns have been observed in children living with chronic stress, including one study of children living near the site of a major earthquake. Researchers have suggested that the elevated cortisol levels seen in childcare might be associated with changes for the worse in the children’s physical or mental health.

Sarah Enos Watamura of Cornell University in New York and her colleagues at the universities of Wisconsin and Colorado in the USA set up a study of the influence of daycare-associated cortisol changes on the physical health of children. They enrolled seventy-nine three to six year old children attending three different daycare centres in New York State in this study. The participating centres had all been rated as good to excellent using the widely used Early Childhood Environment Rating Scale (Revised). Children who attended the centre for only part of the working week, who had delayed development or who attended a centre that did not use their first language were excluded from the study.

Samples of saliva were taken from each child at similar times during the morning, afternoon and evening on two days at the centre and on two weekend days when they were at home. These samples were tested for cortisol levels and also for levels of a secreted antibody called immunoglobulin A (known here as sigA). This is a protein that is produced as part of the immune response to infectious agents; like cortisol, its release into the saliva follows a daily rhythm, with the highest quantities secreted in the mornings. SigA secretion generally decreases in chronically stressful

situations such as child neglect or abuse, while episodes of acute stress – such as, in childhood, an exam or a dental appointment – may be associated with either increased or decreased secretion. Parents and caregivers of the participating children were also asked to record how often during the study their children suffered from coughs, colds, fever, stomach aches and other illnesses. None of the studies took place in the summer months when childhood infections are least common.

Watanabe and her colleagues used the statistical techniques of bivariate analysis and analysis of variance (ANOVA) to determine whether there were significant correlations between cortisol secretion patterns, antibody secretion patterns, and reported illness, and the extent to which cortisol and antibody secretion patterns varied between weekday (childcare) and weekend (home-based) days. As expected, average afternoon cortisol levels were found to be raised in the childcare setting compared to the home, although a decrease between the afternoon and evening measurements was observed in both settings and there was little change in average evening cortisol level between childcare and home-based days.

A significant difference in the pattern of antibody (IgA) secretion was observed between daycare and weekend days. When the children were at home, average IgA levels decreased during the day, mirroring the pattern that is observed with cortisol; at daycare, however, children's IgA levels remained constant between morning and afternoon and rose in the evening. Interestingly, this effect was much more marked with the younger children; weekday evening cortisol levels actually decreased very slightly in pre-school children over 4½ years old, although less than at weekends. There was also a correlation between cortisol and IgA secretion in individual children; those children with higher afternoon cortisol levels in childcare secreted less antibody, particularly on weekend mornings. This indicates that the effect of stress (as seen in higher cortisol levels) on antibody secretion might be a delayed one.

The researchers also observed that children with higher cortisol levels experienced more reported episodes of illness, particularly infections of the upper respiratory system (colds and coughs). They were unable to tell which of these was the cause and which the effect, and noted that children may be stressed by frequent minor illness. However, studies in older children have suggested an association between high cortisol secretion, low IgA secretion and poor health, perhaps particularly during periods of exam stress. In this study, perhaps surprisingly, cortisol levels were found to be a better predictor than antibody levels of reported ill health.

Watanabe and her colleagues concluded by observing that the children in their study came from well educated, middle-class families and that the daycare centres they attended had been rated very highly. The cortisol levels they recorded were among the lowest that had been reported in childcare settings. The fact that these children also had raised cortisol levels in daycare, and that there was a clear connection between raised cortisol, decreased antibody secretion and minor illnesses, suggests that full-time childcare itself will stress young children regardless of the quality of that care. Similar work in lower quality childcare settings and with children considered to be at greater risk would be invaluable.

Dr C. Sansom