



## The relative importance of family socioeconomic status and school-based peer hierarchies for morning cortisol in youth: An exploratory study

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### ABSTRACT

This paper examines the relative importance of family socioeconomic status (SES) and school-based peer hierarchies for young people's psychoneuroendocrine response, represented by cortisol level. Data are drawn from a study of 2824, 15-year-olds in 22 Scottish secondary schools in 2006 who provided information on family SES (parental occupation, material deprivation and family affluence) and social position in school hierarchies, together with two morning salivary cortisol samples. School social position was assessed by participants placing themselves on seven 'ladders', from which three factors were derived, termed scholastic, peer and sports hierarchies. Controlling for confounds, there was little or no variation in cortisol by any SES measure. By contrast, each school hierarchy was independently associated with cortisol, but in different ways. For the scholastic hierarchy, an inverse linear relationship was found for females, cortisol increasing with lower position. For peer hierarchy, an opposite (direct) linear relationship occurred for males, while for females elevated cortisol was associated only with 'top' position. For sports, elevated cortisol among males was associated with 'bottom' position, among females with all except the 'top'. These results are interpreted in the context of Sapolsky's (Sapolsky, 2005) predictions for stress responses to hierarchical position in stable and unstable social systems, the former represented by the scholastic hierarchy involving elevated cortisol in lower positions, the latter by peer hierarchy with elevated cortisol in higher positions. Overall, the results highlight the greater importance of school-based peer groups than family SES for young people's psychoneuroendocrine response.

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### Introduction

All social systems are characterised by social hierarchies, a characteristic that applies as much to institutions within societies as it does to whole societies (Marmot, 2004). Whether based on differences in wealth, power, status, employment grade or simply popularity, an individual's position in a hierarchy is likely both to reflect, and have consequences for, a wide range of individual attributes. Most importantly this includes health, one hypothesized mechanism linking social position to health being 'stress', or more precisely the psychoneuroendocrine response (PSR) and subsequent impact on physiological processes. This paper focuses on the social hierarchies of young people, with the aim of assessing the relative importance of school-based peer hierarchies and family socioeconomic status for PSR, here represented by cortisol.

### *The broader context: Health inequalities, psychosocial mechanisms and the PSR*

In society as a whole, an individual's position in the social hierarchy is typically represented by socioeconomic status (SES) measured by various indicators such as income, deprivation and social class. There is now a substantial evidence-base demonstrating that SES in adulthood is systematically related to both physical and mental health (Demakakos, Nazroo, Breeze, & Marmot, 2008), those at the bottom of the social hierarchy experiencing poorest health, those at the top the best. Irrespective of SES measure, the relationship typically takes the form of a social gradient, a phenomenon not compatible with a simple materialist explanation (Macintyre, 1997).

While the causes of 'health inequalities' remain a matter of debate, recent work has emphasized psychosocial explanations, and particularly the role of 'stress' variously defined as differential exposure to cumulative environmental stressors (McEwen, 1998), perceived lack of control (Kunz-Ebrecht, Kirschbaum, & Steptoe, 2004) or negative

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feelings associated with unfavourable social comparisons (Wilkinson, 1996). This emphasis owes much to research on non-human primates, especially Sapolsky's (2005) work which has shown how cortisol is affected by an animal's position in the social hierarchy. The evidence shows different effects depending on the stability of the social hierarchy, more stable systems generally conferring advantages to dominant animals (lower cortisol) and disadvantages to subordinates (higher cortisol). By contrast, in unstable hierarchies dominant individuals lose the advantage of high status and are exposed to particularly high levels of competition or challenge resulting in heightened PSR. It is notable that in this work, disadvantage is reflected in elevated cortisol levels.

While the 'stress' explanation appears to fit in the case of adult health in stable societies, it is less obvious how it fits with that relating to the SES patterning of health in youth. At this stage in the life-course, when position in the wider social hierarchy is ascribed by family SES, most studies find little or no SES variation in a range of subjective health indicators (e.g. West & Sweeting, 2004), a pattern sometimes referred to as 'relative equality' (West, 1997). However, there is some evidence of variation by SES measure, a few studies finding stronger relationships with 'family affluence' (FAS) than parental social class (Holstein, Parry-Langdon, Zambon, Currie, & Roberts, 2004). Developed as an alternative indicator of material dimensions of SES (Currie et al., 2008), FAS is comprised of consumables (e.g. cars, home computers, holidays), which are visible indicators of a family's position in the SES hierarchy. Inasmuch as this generates negative social comparisons, FAS might be more strongly related to the PSR than other SES measures.

#### *Social hierarchies in youth*

The lack of relationship between family SES and health raises questions about the salience of the SES hierarchy as a source of stress in youth and directs attention to other social institutions in which young people are located. Chief among these is the school, which is quintessentially hierarchical in nature. Within any school, pupils are differentiated by school year, ability and academic achievement, either formally in groups or by individual test results or grades. Schools also have a regulative purpose, differentially rewarding pupils for 'good' behaviour. In combination with academic success, this defines what makes a 'good' pupil, placing them on a hierarchy we have termed 'scholastic' (Sweeting, West, Young, & Kelly, submitted for publication). Furthermore, in many societies, schools are the source of officially sanctioned extra-curricular activities, a notable example of which is sport. On the assumption of stability, it might be expected that a pupil's position in the 'official' school hierarchy (e.g. academic or sports success) would be inversely associated with the PSR, lower positions incurring greater 'stress'.

The school, however, is not simply comprised of a single 'official' hierarchy but constitutes an arena within which peer group structures and related hierarchies are developed. Such hierarchies refer to a range of attributes with particular salience for young people as desirable youth identities, typically involving judgments about physical appearance, body shape, clothing and style. A voluminous literature testifies to the important role such attributes play as signifiers of group membership, youth subculture, and position in the peer social hierarchy (Milner, 2006). The evidence also shows this is particularly important in mid-adolescence when peer group activity is at a maximum (Giordano, 2003), and popularity in males is generally associated with physical prowess and sports success, in females with attractiveness and spending power (Meisinger, Blake, Lease, Palardy, & Olejnik, 2007). While most research has focused on those who occupy low status in the peer group, and who are most likely to be exposed to 'stress', more

recent studies have focused on the top of the peer hierarchy and on different dimensions of popularity (Cillessen & Rose, 2005). The precariousness of top positions is indicated in one study which found 'top girls' not only experienced, but were perceived as experiencing, considerable pressure to maintain their high status identity as attractive, cool and popular (Michell & Amos, 1997). This association of higher position with negative consequences is similar to that described by Sapolsky for unstable social systems, and may characterize some peer generated hierarchies in youth.

School-based peer groups are, therefore, unlikely to be unidimensional either in respect of social hierarchy, or the direction of associated effects on the PSR. To date, however, there are few studies which have directly investigated school hierarchies. One (Goodman et al., 2001), which bears close comparison with our own, involved young people ranking their family's SES position and their own position in school on a 'ladder', the 'top' referenced by students with 'most respect, the highest grades and highest standing', the bottom by those 'no one respects, no one wants to hang around with and have the worst grades'. The results revealed low correlations between school position and family SES, suggesting the two are largely separate domains; further, lower school position was more strongly related to overweight and depression. While the study failed to distinguish different dimensions of school-based hierarchies, it suggests that position in the peer group may be more important than family SES for health in youth. Unfortunately, cortisol was not measured so it is not possible to directly assess the role of the PSR in the relationship.

#### *Cortisol*

The most widely used measure of the PSR is salivary cortisol. In addition to responding to stressors, cortisol is governed by the hypothalamic–pituitary–adrenal (HPA) system and follows a daily circadian rhythm in most people. Levels are generally lowest around midnight and begin to rise before waking, thereafter rising sharply for 30–40 min as part of the cortisol awakening response (Pruessner et al., 1997). This is followed by a rapid decline for the next few hours, then a gradual decline over the remainder of the day (Kirschbaum & Hellhammer, 1989). Time of day and time of awakening, therefore, have significant effects on measured levels, which may also vary by day of the week (Maina, Palmas, & Larese Filon, 2007). Cortisol levels also vary by sex, females exhibiting higher morning cortisol (Steptoe, Cropley, Griffith, & Kirschbaum, 2000), and there is some evidence among adolescents of positive associations with age, body mass and pubertal stage (Tornhage & Alfen, 2006) and personality characteristics (Hauner et al., 2008). Over and above these variables, cortisol is responsive to a number of states and behaviours including acute illness, corticosteroid medication, eating, caffeine consumption, smoking, exercise and involvement in aggression (Kelly, Young, Sweeting, Fischer, & West, 2008). It is clear that cortisol levels respond to an individual's environment and activities, the underlying assumption being that frequent and/or sustained increases in cortisol involve negative consequences (Sapolsky, 2005).

While cortisol levels typically return to normal quite quickly after exposure to acute stressors, exposure to chronic stressors, such as those associated with lower SES position, is thought to cause dysregulation of the HPA system, typically resulting in repeatedly elevated levels (McEwen, 1998) though it may also involve particularly low levels caused by blunting of the cortisol response (Li, Power, Kelly, Kirschbaum, & Hertzman, 2007). Research on the SES/cortisol relationship is complicated by problems of capturing the diurnal rhythm, variations in the mode of collection and differences in the measures used, very few studies adequately controlling for the biological and behavioural confounds outlined above. Nevertheless, what evidence

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