Stress and the City

new methodologies for measuring the impact of green space

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Are our cities causing poor mental health?

- Rising levels of schizophrenia and other serious mental-health problems (Abbott, Nature 2012 & Camberwell study, 2003);
- GB has highest rate of days ‘off sick’ for depression in Europe (26%) (IDEA, 2012).

Impact of stress on health

- 23% increased risk of cardiovascular heart disease (work stress)(Kivimäki et al., 2012 *Lancet*);
- Faster aging, a greater risk of Parkinson's disease, type 2 diabetes and cancer (Ahola K et al., 2012)
- Increased risk of dementia, with 65% of women at greater risk (mid-life stress) (Johansson et al., *Brain*, 2010)

How do we measure stress?

Cortisol – ‘stress hormone’ - secreted in the adrenal glands

- Non-invasive method
- Diurnal pattern of cortisol

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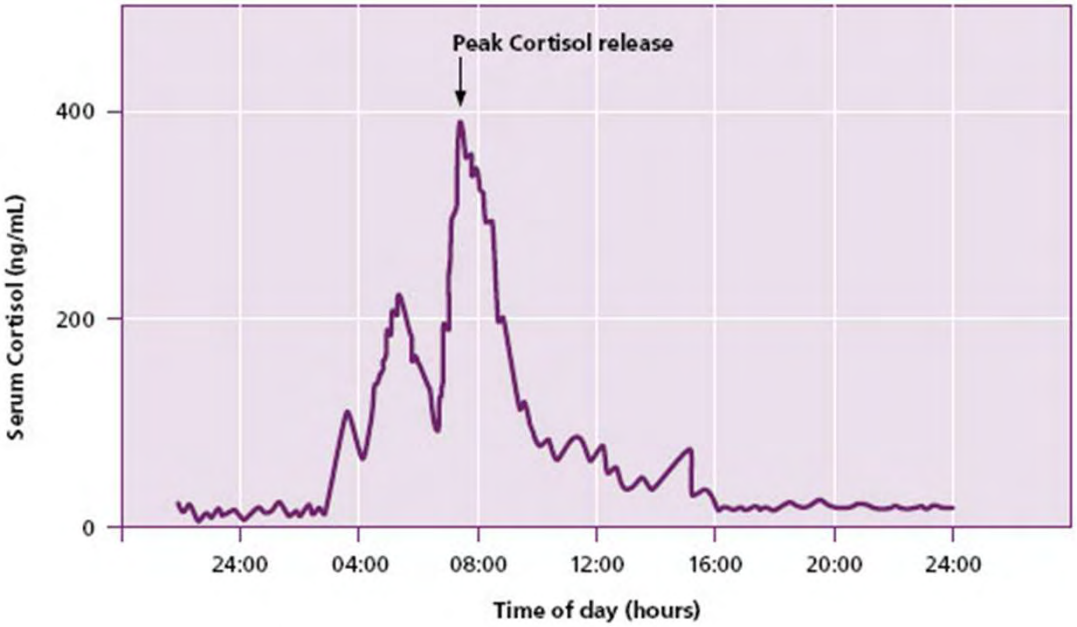

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GreenHealth Cortisol Study on Stress

High green space

Low green space

Case study: Dundee

Principal research question

1. Among residents of deprived urban areas in Scotland, is the presence of different levels of green space in the home environment associated with stress as measured by diurnal patterns of cortisol secretion and perceived stress and wellbeing?

2. Are there any sub-group patterns?

Study framework

- **Study 1**: exploratory cortisol study, January 2010 (n=23) Ward Thompson et al., 2012

- **Study 2**: repeat cortisol study, May-June 2010 (n=106) (combining samples since no significant effect of seasonality), submitted for publication.

Methods common to both studies

Study design: cross-sectional study, city-wide in Dundee (highly deprived neighbourhoods targeted with varying levels of green space).

Sample: People not in work, aged 35-55, male and female.

Recruitment:

Study 1 via unemployment centres

Study 2: door-to-door (via survey company) with follow-up by research team.

Outcome measures

Primary outcome measures:
salivary cortisol (collected over 2 days/4 times per day), perceived stress (PSS).

Secondary outcome measures:
perceived mental wellbeing, levels of physical activity.

Demographic measures:
gender, age, level of deprivation (Carstairs 2001), no. of children, having a garden, incoming coping.

salivettes

Study 1, January 2010, n=25

Ward Thompson et al., 2012, *More green space is linked to less stress in deprived communities: evidence from salivary cortisol patterns*. Landscape and Urban Planning 105, 221-229.

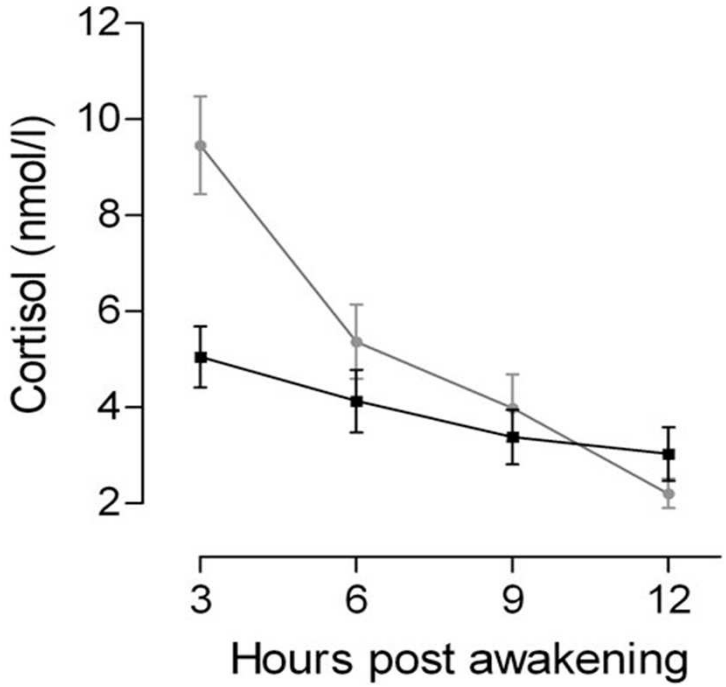
Study 1 main findings

Percentage of green space in the living environment is a significant predictor of:

- Perceived stress ($p<0.01$);
- And diurnal salivary cortisol patterns (slope measurement) ($p<0.05$)
- Compliance with the study protocol.

Differences in cortisol slope between sub-groups

We found two sub-groups: a group with a flatter slope (solid black line) with lower overall cortisol levels - indicative of more chronic and prolonged stress - and a group with a steeper slope (grey line) indicative of a more healthy cortisol secretion system.



Key: the black line shows the mean pattern of slope for participants with mean slope score ≤ 3.92 (n=10); the grey shows the mean pattern of slope for participants with mean slope score > 3.92 (n=10).

Using a non-invasive salivary biomarker of chronic stress to demonstrate beneficial effects of urban green spaces is an innovative and elegant approach.

Andrey Egorov,

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Study 2 findings submitted for publication 2013

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