22.22 Prevalence, incidence and morbidity of chronic stress

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Prevalence, incidence and morbidity of chronic stress	**Health and Wellbeing**
Description and justification	Numerous authors emphasize that modern urban wellbeing challenged by chronic stress and insufficient physical activity can be healthily nurtured by natural environment exposure which promotes mental and physical health and reduces morbidity and mortality in urban residents by providing psychological relaxation and stress alleviation, enhancing immune function, stimulating social cohesion, supporting physical activity, and reducing exposure to air pollutants, noise and excessive heat (Braubach, Egorov, Mudu, Wolf, Ward Thompson, & Martuzii, 2017; Hartig, Mitchell, de Vries, & Frumkin, 2014). The psychological pathways to the beneficial effects of exposure to/engagement with nature have been founded on two complementary theoretical frameworks. Attention Restoration Theory (ART) emphasizes the role of nature in relieving mental fatigue and proposes that nature allows restoration from directed attention fatigue and enable more effective cognitive performance (Kaplan, 1995). Stress Recovery Theory (SRT) emphasizes the role of nature in relieving physiological stress and posits that natural environments influence affective states by promoting recovery from stress, and diminishing arousal and negative thoughts through psycho-physiological pathways (Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991). Psychological Stress is thought to be a significant factor in the onset, course and exacerbation of various diseases, like depression, cardiovascular diseases, immune-related disorders, and it has been related to higher overall mortality (Cohen, Janicki-Deverts, & Miller, 2007; Hammen, 2005; Klein, Brähler, Dreier, Reinecke, Müller, Schmutzer, Wölfling, & Beutel, 2016). The psychological approach to stress brings forth the role of subjective perception of stressful situations in coping and resilience, and focuses on the person's appraisal of the significance of the stressor (primary appraisal) and the individual coping abilities (secondary appraisal) within a person environment transaction (Klein et al., 2016).

	Given the complex psychophysiological pathways of stress, measurement is usually approached holistically through collection of both subjective psychological (i.e., subjective rating scales, self-report measures) and objective physiological data (most frequently, salivary analysis due to the validity, reliability and ease of collection of salivary data) (Beil & Hanes, 2013). For instance, van den Berg and Custers (2011) measured salivary cortisol levels and self-reported mood to demonstrate that gardening alleviated acute stress faster than reading. Beil and Hanes (2013), Roe, Thompson, Aspinall, Brewer, Duff, Miller, Mitchell, and Clow (2013), and Ward Thompson, Roe, Aspinall, Mitchell, Clow, and Miller (2012) used diurnal cortisol to demonstrate that exposure to green space reduced chronic stress in adults living in deprived urban neighborhoods. Hair cortisol was used as a biomarker of chronic stress in research documenting similar relationships between green space and stress reduction (Gidlow, Randall, Gillman, Smith, & Jones, 2016; Wippert, Honold, Wang, & Kirschbaum, 2014).
Definition	*Stress* is the process by which an individual responds psychologically, physiologically, and often with behaviors, to a situation that challenges or threatens well-being (Baum, Fleming, & Singer, 1985 as cited in Ulrich et al., 1991, p. 202). The psychological component includes cognitive appraisal of the situation, emotions such as fear, anger, and sadness, and coping responses (Ulrich et al., 1991). *Psychological stress* occurs when an individual perceives that environmental demands tax or exceed his or her adaptive capacity (Cohen, Kessler, & Gordon, 1995 as cited in Cohen et al., 2007).
Strengths and weaknesses	+ reliable indicator of physical and mental health, well-being, and satisfaction with own life (Braubach et al., 2017; Frumkin et al., 2017; Klein et al, 2016) + solid empirical evidence as to relationship between levels of stress/perception of stress and exposure to nature and urban green space (parks, playgrounds, and residential greenery) - complex psychophysiological pathways of stress – construct cannot be measured via a single marker, and both psychometric and physiological data need to be collected
Measurement procedure and tool	☒ *Quantitative P*: Scale/Scale inventory/Questionnaire (survey procedure, paper-and-pencil administration, computer-based administration) o T: *Perceived Stress Scale* (Cohen, Kamarck, & Mermelstein, 1983), a self-report measure intended to capture the degree to which persons perceive situations in their life as

	excessively stressful relative to their ability to cope. To date, there are three standard versions of the PSS: the original 14-item form (PSS-14), the PSS-10, and a four-item form (PSS-4) Cohen et al., 1983). Cohen and Williamson (1988) suggested that the PSS-10 is the best form of the PSS and recommended the PSS-10 be used in future research (as cited in Taylor, 2015, p. 90). ☒ *Quantitative P*: biochemical assessments of diurnal cortisol secretion (hair, blood, salivary cortisol) o T: e.g., saliva sampling devices; morning blood samples; cortisol levels extracted from a 3cm sample of scalp hair can reflect the past 3 months of cortisol secretion, offering a stable and feasible measure of long term stress exposure, where higher HCC reflects higher chronic stress levels (Gidlow et al., 2016)
Scale of measurement	▪ Perceived Stress Scale (Cohen et al., 1983) *The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.* *For each question choose from the following alternatives:* *0. never* *1. almost never* *2. sometimes* *3. fairly often* *4. very often* In the last month, how often… 1 …have you been upset because of something that happened unexpectedly? 2 …have you felt that you were unable to control the important things in your life? 3 …have you felt nervous and “stressed”? 4 …have you felt confident about your ability to handle your personal problems? (R) 5 …have you felt that things were going your way? (R) 6 …have you found that you could not cope with all the things that you had to do? 7 …have you been able to control irritations in your life? (R)

	8 …you felt that you were on top of things? (R) 9 …you been angered because of things that were outside your control? 10 …have you felt difficulties were piling up so high that you could not overcome them?
Data source	
Required data	✓ Essential: NBS characteristics for each city/site, more specifically nature of activities one can get involved into while engaging with nature, opportunities for social interaction and for physical exercise, etc. ✓ Essential: Data on SC6 (Place Attachment-Sense of Place: Place Identity); HW3 (GWB and Happiness); HW11 (MH WB: Depression and Anxiety) ✓ Desirable: Data on symbolic/affective meanings assigned to NBS (case studies, participatory data collection methods) – see also indicator SC6 (Place Attachment)
Data input type	Quantitative
Data collection frequency	After NBS implementation and aligned with timing relevant to biochemical assessments (e.g., 2-3 months after implementation for hair cortisol levels)
Level of expertise required	☒ Methodology and data analysis requires high expertise in psycho-social research ☒ Quantitative data collection requires no expertise
Synergies with other indicators	SC6 Place attachment (Sense of Place): Place Identity SC7 Geographical access to NBS SC8 Perceived access to NBS SC11.1 Positive environmental attitudes motivated by contact with NBS SC11.2 Environmental Identity HW3 General Wellbeing and Happiness HW4 Life expectancy and healthy life years expectancy HW5 Prevalence and incidence of auto-immune diseases HW6 Prevalence, incidence, morbidity, and mortality of cardiovascular diseases HW7 Prevalence, incidence, morbidity, and mortality of respiratory diseases HW8 Incidence of obesity/obesity rates (adults and children) HW11 Mental Health Wellbeing: Depression and Anxiety HW12 Restoration-Recreation: Enhanced physical activity and meaningful leisure HW13 Levels of aggressiveness and violence HW14 Improvement of behavioural development and symptoms of attention-deficit/hyperactivity disorder (ADHD) HW15 Exploratory behaviour in children
Connection with SDGs	Goal 3. Ensure healthy lives and promote well-being for all at all ages

	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
Opportunities for participatory data collection	-
Additional information	
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