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22.21 Prevalence and incidence of autoimmune diseases

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Prevalence and incidence of autoimmune diseases	**Health and Wellbeing**
Description and justification	Numerous authors stress the relevance of immune-regulatory mechanisms in the manifestation of the generally expected beneficial effects of exposure to nature (Hanski et al, 2012; Kuo, 2015; Rook, 2013; von Hertzen et al., 2015). Rook (2013) argue that multiple physiological consequences of exposure to the natural environment (e.g., sunlight, physical exercise) supplement the immune-regulatory effects of microbial biodiversity (i.e., low CRP levels, low inflammation, low cytokine response to stress) and the psychological rewards of interaction with nature (e.g., relaxation, restoration, exercise, social capital). These notions have been brought forth by *the hygiene hypothesis (i.e., Old Friends mechanism, biodiversity hypothesis)* that explains the increasing prevalence of chronic inflammatory diseases (autoimmunity, allergy and inflammatory bowel diseases) in urban communities in high-income countries by a predisposition to poor regulation of inflammation gradually developed through

	reduced exposure to immunoregulation-inducing macro- and microorganisms, and microbiota that accompanied mammalian evolution (Haahtela et al., 2013; Rook, Lowry, & Raison, 2013; von Hertzen et al., 2015). Rook (2013) suggests that the rapid occurrence of psychological effects could explain the fact that most studies have been oriented towards the psychological explanations, while there is still limited empirical evidence as to the contribution of immunoreglatory processes in the positive experience of exposure to nature (i.e., immunoregulatory mechanisms require prolonged exposure, especially during childhood when much of immune system training occurs). There is evidence to suggest however that exposure to biodiverse urban green space (with a variety of microorganisms) is likely to be important in both reducing systemic inflammation and boost immune defence (Lee et al., 2012; Park et al., 2010). For examples, studies on immersion into forest environments have shown positive effects on natural killer cells, as well as intracellular anti-cancer proteins in lymphocytes (Li, 2010). Some support has been gathered for the hypothesis that such effects might be due to the effect of essential oils from trees as well as the stress reduction effects of green environments (Li, 2010) and that the effects lasted for up to 7 days after trips (Li et al., 2011). Above all, there is a stringent need for empirical evidence of the relationship between biodiversity and immunoregulation, as well as improved control of AIDs' evolution.
Definition	**AID** is a condition which is triggered by the immune system initiating an attack on self-molecules due to the deterioration of immunologic tolerance to auto-reactive immune cells. The initiation of attacks against the body's self-molecules in AIDs, in most cases is unknown, but a number of studies suggest that they are strongly associated with factors such as genetics, infections and /or environment (Page, du Toit, & Page, 2011). For most AIDs, cure is unusual, and survival is generally measured in years or decades. Hence, the chronicity of autoimmune disease leads to a high prevalence despite a relatively low annual incidence (National Institutes of Health. Autoimmune diseases coordinating committee—Autoimmune diseases research plan, n.d.). Most prevalence surveys are limited by their reliance on self-reporting of disease status rather than a physician-confirmed diagnosis. Self-reporting of AIDs can result in misclassification and underreporting (National Institutes of Health. Autoimmune diseases coordinating committee—Autoimmune diseases research plan, n.d.).

	Prevalence is a measure of the burden of disease in a population in a given location and at a particular time, as represented in a count of the number of people affected (Ward, 2013). Prevalence is a function of both the incidence and duration of disease. In turn, duration is affected by the availability and effectiveness of curative treatments and by survival times of afflicted individuals (National Institutes of Health. Autoimmune diseases coordinating committee—Autoimmune diseases research plan, n.d.). **Incidence** represents how quickly new cases occur relative to population size and the passage of time. Incidence is calculated as the ratio of the number of new cases of a disease occurring within a population during a given time to the total number of people in the population (National Institutes of Health. Autoimmune diseases coordinating committee—Autoimmune diseases research plan, n.d.). While the prevalence represents the existing cases of a disease, the incidence reflects the number of new cases of disease within a certain period and can be expressed as a risk or an incidence rate (Noordzij, Dekker, Zoccali, & Jager, 2010).
Strengths and weaknesses	+ empirical support to the notion that exposure to biodiverse urban green space is important in both reducing systemic inflammation and boost immune defence (Lee et al., 2012; Jin Park, 2010) - limited empirical evidence as to the contribution of immunoreglatory processes in the positive experience of exposure to nature (Rook, 2013; von Hertzen et al., 2015)
Measurement procedure and tool	☒ *Quantitative*: epidemiological data (Health Data Administration/Cities) Incidence of AID relevant for a measurement, along prevalence, as it indicates the number of new cases of disease within a certain period (for example, since the implementation of the NBS), and can be expressed as a risk or an incidence rate. Recommended variables for inflammatory processes and immunoregulation: o prevalence/incidence of inflammatory disorders o prevalence/incidence of cardiovascular disease o prevalence/incidence of asthma o prevalence/incidence of depression o stress resilience o CRP (C-Reactive protein) levels (blood test) o atopic sensitization (i.e., allergic disposition) (see Hanski et al., 2012)

Scale of measurement	-
Data source	
Required data	✓ Essential: NBS characteristics for each city/site
Data input type	Quantitative
Data collection frequency	Before and after NBS implementation (longitudinal)
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	HW3 General Wellbeing and Happiness HW4 Life expectancy and healthy life years expectancy HW6 Prevalence, incidence, morbidity, mortality of cardiovascular diseases (CVDs) HW7 Prevalence, incidence, morbidity, mortality of respiratory diseases (RIDs) HW8 Incidence of obesity/obesity rates (adults and children) HW10 Prevalence, incidence, morbidity of chronic stress HW11 Mental Health Wellbeing: Depression and Anxiety HW12 Restoration-Recreation: Enhanced physical activity and meaningful leisure
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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