A Dose of Nature

Addressing chronic health conditions by using the environment

A summary of relevant research

In a nutshell
Medical research from around the world demonstrates that a Green Prescription can deliver physiological and psychological benefits for patients, even if the exact mechanisms by which these accrue are not yet fully understood. The evidence also shows that doctors are ready and willing to give Green Prescriptions, and that an effective partnership with other providers is required.

1 Introduction

Evidence for the effectiveness of Green Prescriptions - doses of nature tailored to patients' needs - comes from many disciplines, but this brief summary concentrates on the medical and public health literature. The research demonstrates numerous correlations between different indices of health and wellbeing and exposure to nature, and the most recent overview shows that the evidence regarding these benefits is strong (Hartig *et al* 2014). What is missing, largely because studies for such interventions are often hard to design, is knowledge about cause-and-effect relationships.

2 Evidence concerning primary and clinical care

2.1 We know, via a randomised control trial (RCT) published in the *British Medical Journal*, that **referral to a suitable voluntary sector project results in additional patient benefits** compared with general practitioner care alone, in managing psychosocial problems (Grant *et al* 2000). This is particularly the case when the referral process is mediated by a dedicated person (Grayer *et al* 2008). We also know that, in particular, general practitioners would prefer to give a specifically 'green' social prescription but need to feel confident about patient follow-up mechanisms and the overall sustainability of such activities (Swinburn *et al* 1997).

2.2 The best evidence that can meet that need comes from the Green Prescription programme run directly by the New Zealand Ministry of Health. Studies published in the *British Medical Journal* found that **a Green Prescription increases physical activity levels and improves quality of life over 12 months,** without evidence of adverse effects. Such an initiative was found to be sustainable in general practice as for every ten Green Prescriptions written one person achieved and sustained 150 minutes of moderate or vigorous leisure activity (using up an additional 1000 kcal) per week; a **20–30 percent risk reduction in all-cause mortality** (Elley *et al* 2003).

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Such prescriptions were also shown, via an RCT, to be **cost effective at three different quality-adjusted life year thresholds**, for adults who were previously inactive (Leung *et al* 2012).

2.3 The New Zealand programme has also been subject to regular patient surveys. The most recent, from 2013[1], showed that six to eight months after receiving their Green Prescription: **63 percent of patients are still more active than they were before**; 72 percent have noticed positive changes in their health; 46 percent have lost weight; and 64 percent encouraged others to be active.

2.4 There is also clinical evidence from Asia, published in the *Journal of Cardiology*, that **spending time in a forest has therapeutic effects on hypertension** and induces inhibition of the renin-angiotensin system and inflammation, and is thus preventively efficacious against cardiovascular disorders (Mao *et al*, 2012). The same practice also results in improved immune function; regular trips to the forest result in an increase in natural killer cell activity (Li 2010).

2.5 We also know that **nature reduces the experience of pain**. A picture of a nature scene by the bed, and an audio tape of nature sounds, have been shown via an RCT to significantly reduce pain in patients undergoing flexible bronchoscopy (Diette *et al* 2003).

3 Evidence from a public health perspective

3.1 Such studies are backed up by epidemiological evidence that is strong enough to support calls for nature-assisted therapies to be part of public health and health promotion policies. **Significant improvements were found for varied outcomes in diverse diagnoses from obesity to schizophrenia** (Maller *et al* 2006). To be effective this means **bringing together primary health, social care and environmental management sectors** (Annerstedt and Währborg 2011). Systematic reviews and individual studies have demonstrated a number of factors, as follows.

3.2 **A population that is close to nature is healthier**. A study in the Netherlands looked at physician-assessed morbidity in 196 Dutch general practices, for 24 disease clusters, and after controlling for socio-economic factors found that disease prevalence was lower the more green space there was in a 1km radius (Maas *et al* 2009). The benefit of greater access to nature is pronounced in early to mid adulthood (Astell-Burt *et al* 2014). A study published in *The Lancet* (Mitchell and Popham 2008) found that populations exposed to the greenest environments also have the lowest levels of health inequality related to income deprivation.

3.3 In studies relating to obesity there is **a positive association between access to greenspace and physical activity**, weight and associated health conditions (Lachowycz and Jones 2011).

3.4 There is an **additional positive benefit** of a walk or run in a natural environment in comparison to a synthetic environment (Bowler *et al* 2010).

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[1] Accessed at http://www.health.govt.nz/our-work/preventative-health-wellness/physical-activity/green-prescriptions/green-prescription-research/green-prescription-patient-survey

4 Psychological dimensions

4.1 A lot of the medical literature on the relationship between nature and wellbeing looks at psychological health in particular; the perceived greenness of a neighbourhood is more strongly associated with mental health than it is with physical health (Sugiyama *et al* 2008). Research has indicated a range of specific benefits.

4.2 Exercising in natural environments - compared to exercising indoors - is associated with **greater feelings of revitalisation**, and a greater intention to repeat the activity (Coon *et al* 2011).

4.3 Gardening provides **relief from acute stress** (van den Berg and Custers 2011).

4.4 Walking in nature, or even viewing nature, improves the **capacity to direct and restore attention** (Berman *et al* 2008), a result backed up experimentally (Berto 2005), and in patients facing particular clinical situations such as newly diagnosed breast cancer (Cimprich and Ronis 2003).

4.5 Being in an arboretum for 50 minutes provides cognitive and affective benefits for people suffering **depression** (Berman *et al* 2012).

4.6 Short and intense engagements in outdoor exercise have the greatest dose-responses for two other key indicators of mental health, **self-esteem and mood** (Barton and Pretty 2010).

4.7 Green outdoor settings **reduce ADHD symptoms in children** across a wide range of individual, residential, and case characteristics (Kuo and Taylor 2004).

4.8 When immersed in nature a common response is of a **connected fascination**; this has been demonstrated empirically to be an active element in generating positive psychological affect (Gonzalez *et al* 2010).

5 Aspects of nature

5.1 Determining how exposure to nature actually results in such benefits - the mechanisms that are involved in delivering a ‘natural health service’ - remains a generally elusive goal. However some elements of the natural environment have been studied with this in mind.

5.2 In England there is evidence that **the closer one lives to the coast the better one’s health**, and that this effect might be greater in deprived communities (Wheeler *et al* 2012*).*

5.3 Another meta-analysis of 1252 patients showed that, whilst every green environment improved both self esteem and mood, **the presence of water generated greater effects** (Barton and Pretty 2010).

5.4 There is evidence of a positive relationship between the mental wellbeing of greenspace users and both perceived (Dallimer *et al* 2012) and actual (Fuller *et al* 2007) **levels of biodiversity**, and this is supported by a recent systematic review (Lovell et al 2014).

5.5 A RCT in the *British Medical Journal* demonstrated that there is a direct therapeutic benefit to be gained from **engaging with animals** (Antonioli and Reveley 2005).

References

Annerstedt M and Währborg P (2011) Nature-assisted therapy: systematic review of controlled and observational studies. *Scandinavian Journal of Public Health* 39, 371–388

Antonioli C and Reveley M (2005) Randomised controlled trial of animal facilitated therapy with dolphins in the treatment of depression. *British Medical Journal* 331 (7527) 1231-1234

Astell-Burt T, Mitchell R and Hartig T (2014) The association between green space and mental health varies across the lifecourse. A longitudinal study. *Journal of Epidemiology and Community Health* 68 (5) 578-583

Barton J and J Pretty (2010) What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environmental Science and Technology* 44, 3947-3955

Berman M, Jonides J, and Kaplan S (2008) The cognitive benefits of interacting with nature. *Physiological Science* 19 (12) 1207-1212

Berman M G Kross E and Jonides J (2012) Interacting with nature improves cognition and affect for individuals with depression. *Journal of Affective Disorders* 140 (3) 300-305

Berto R (2005) Exposure to restorative environments helps restore attentional capacity. *Journal of Environmental Psychology* 25 (3) 249-259

Bowler D, Buyung-Ali L, Knight T and Pullin A (2010) A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health* 10 (456) 1-10

Cimprich B and Ronis D (2003) An environmental intervention to restore attention in women with newly diagnosed breast cancer. *Cancer Nursing* 26 284–292

Coon J Thompson, Boddy K, Stein K, Whear R, Barton J, and Depledge M (2011) Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environmental Science and Technology* 45, 1761-1773

Dallimer M, Irvine K, Skinner A, Davies Z, Rouquette J, Maltby L, Warren P, Armsworth P, and Gaston K (2012). Biodiversity and the feel-good factor: understanding associations between self-reported human well-being and species richness. *BioScience* 62, 47–55.

Diette G, Lechtzin N, Haponik E, Devrotes A and Rubin H (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy - a complementary approach to routine analgesia. *Chest Journal* 123 941–48

Elley C, Kerse N, Arroll B, and Robinson E (2003) Effectiveness of counselling patients on physical activity in general practice: cluster randomised control trial. *British Journal of General Practice* 326 (7393), 793-796

Fuller R, Irvine K, Devine-Wright P, Warren P and Gaston K (2007) Psychological benefits of green space increase with biodiversity. *Biological Letters* 3: 390-394

Gonzalez M, Hartig T, Patil G, Martinsen E and Kirkevold M (2010) Therapeutic horticulture in clinical depression: a prospective study of active components. *Journal of Advanced Nursing*, 66 (9) 2002–2013

Grant C, Goodenough T, Harvey I and Hine C (2000) A randomised controlled trial and economic evaluation of a referrals facilitator between primary care and the voluntary sector. *British Medical Journal* 320 (7232) 419-423

Grayer J, Cape J, Orpwood L, Leibowitz J and Buszewicz M (2008) Facilitating access to voluntary and community services for patients with psychosocial problems: a before-after evaluation. *BMC Family Practice* 9 (1) 27-36.

Hartig T, Mitchell R, de Vries S and Frumkin H (2014) Nature and health. *Annual Review of Public Health* 35, 207-228

Kuo F and Taylor A (2004) A potential natural treatment for Attention-Deficit/Hyperactivity Disorder: evidence from a national study. *American Journal of Public Health* 94 (9) 1580-1586

Lachowycz K and Jones A (2011) Greenspace and obesity: a systematic review of the evidence. *Obesity Reviews* 12, e183–e189

Leung W, Ashton T, Kolt G, Schofield G, Garrett N, Kerse N and Patel A (2012) Cost-effectiveness of pedometer-based versus time-based Green Prescriptions: the Healthy Steps Study. *Australian Journal of Primary Health* 18 (3) 204-211

Li Q (2010) Effect of forest bathing trips on human immune function. *Environmental Health and Preventive Medicine* 15 (1) 9-17

Lovell R, Wheeler B, Higgins S, Irvine K, Depledge M (2014) A systematic review of the health and well-being benefits of biodiverse environments. *Journal of Toxicology and Environmental Health Part B* 17, 1–20

Maas J, Verheij R, de Vries S, Spreeuwenberg P, Schellevis F and Groenewegen P (2009) Morbidity is related to a green living environment. *Journal Of Epidemiology And Community Health* 63 (12) 967-973

Maller C, Townsend M, Pryor A, Brown P, and St. Leger L (2005) Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations. *Health Promotion International* 21: 45-54

Mao G-X, Cao Y-B, Lan X-G, He Z-H, Chen Z-M, Wang Y-Z, Hu X-L, Lv Y-D, Wang G-F, and Yan J (2012) Therapeutic effect of forest bathing on human hypertension in the elderly. *Journal of Cardiology* 60 (5-6) 495-502

Mitchell R and Popham F (2008) Effect of exposure to natural environment on health inequalities: an observational population study. *The Lancet* 372 (9650) 1655-1660

Sugiyama T, Leslie E, Giles-Corti B and Owen N (2008) Associations of neighbourhood greenness with physical and mental health: do walking, social coherence and local social interaction explain the relationships? *Journal of Epidemiology and Community Health* 62 (5) e9

Swinburn B, Walter L, Arroll B, Tilyard M, and Russell D (1997) Green prescriptions: attitudes and perceptions of general practitioners towards prescribing exercise. *British Journal of General Practice* 47, 567-569

van den Berg A and Clusters M (2011) Gardening promotes neuroendocrine and affective restoration from stress. *Journal of Health Psychology* 16, 3-11

Wheeler B, White M, Stahl-Timmins W, Depledge M (2012) Does living by the coast improve health and wellbeing? *Health and Place* 18 (5) 1198-1201