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Short report

Is physical activity in natural environments better for mental health than physical activity in other environments?

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ABSTRACT

Experimental evidence suggests that there may be synergy between the psychological benefits of physical activity, and the restorative effects of contact with a natural environment; physical activity in a natural environment might produce greater mental health benefits than physical activity elsewhere. However, such experiments are typically short-term and, by definition, artificially control the participant types, physical activity and contact with nature. This observational study asked whether such effects can be detected in everyday settings at a population level. It used data from the Scottish Health Survey 2008, describing all environments in which respondents were physically active. Associations were sought between use of each environment, and then use of environments grouped as natural or non-natural, and the risk of poor mental health (measured by the General Health Questionnaire (GHQ)) and level of wellbeing (measured by the Warwick Edinburgh Mental health and Wellbeing Score (WEMWBS). Results showed an independent association between regular use of natural environments and a lower risk of poor mental health, but not for activity in other types of environment. For example, the odds of poor mental health (GHQ $\geq$ 4) among those regularly using woods or forests for physical activity were 0.557 (95% CI 0.323–0.962), compared to non-users. However, regular use of natural environments was not clearly associated with greater wellbeing, whilst regular use of non-natural environments was. The study concludes that physical activity in natural environments is associated with a reduction in the risk of poor mental health to a greater extent than physical activity in other environments, but also that activity in different types of environment may promote different kinds of positive psychological response. Access to natural environments for physical activity should be protected and promoted as a contribution to protecting and improving population mental health.

Background

There is now considerable research and policy attention on the potential for contact with natural environments to protect or enhance human mental health (Nilsson, Sangster, & Konijnendijk, 2011). Experimental studies have demonstrated effects of contact with natural environments on both biomarkers and self-reports of stress, on mood and reported levels of fatigue (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Hartig et al., 2011; Hartig, Evans, Jamner, Davis, & Garling, 2003; Park, Tsunetsugu, Kasetani, Kagawa, & Miyazaki, 2010; Ward Thompson et al., 2012). The restorative effects appear to operate partly through psycho-neuro-endocrine mechanisms; the perception of a natural environment by the brain triggers positive psychological and physiological reactions (Kaplan, 1995; Sternberg, 2009; Ulrich, 1983). Studies have also examined the relationships between natural environments and physical activity and intriguingly, there may be synergy between the well-established physiological and psychological benefits of physical activity, and the restorative effects of contact with a natural environment (Bodin & Hartig, 2003; Hug, Hartig, Hansmann, Seeland, & Hornung, 2009; Pretty et al., 2007; Pretty, Peacock, Sellens, & Griffin, 2005; Thompson Coon et al., 2011). Physical activity in a natural environment might produce greater mental health benefits than physical activity elsewhere.

Whilst experimental studies have been essential for demonstrating restorative effects of natural environments, the studies are largely small scale and short-term (Bowler et al., 2010; Thompson Coon et al., 2011). They usually draw on homogenous, healthy and young participants and contact with natural environment is controlled rather than being part of, prompted by, or perhaps restricted by, everyday life. It is therefore questionable whether the effects demonstrated by experiment have meaning for population health and wellbeing. This short study used an observational design to ask whether such effects can be detected in everyday settings, at a population level. The research question was: *do people who visit/*

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pass through natural environments as part of their physical activity have better mental health and wellbeing than those who are physically active in non-natural environments?

Methods

The research question could not be answered by simply seeking a relationship between reported use of natural environments for physical activity, and mental health or wellbeing. Those who use natural environments might also use other types of environment. Use of *all* environments needed to be taken into account to assess any independent benefit of physical activity in natural environments.

Data came from the 2008 Scottish Health Survey (SHS), a large cross-sectional population health survey which captures a range of behavioural, physiological and contextual information. This study included all respondents aged 16+ years, with required items. The publicly available 2008 SHS data set was augmented by a variable capturing the amount of green space in a respondent's area of residence. The variable is described in detail elsewhere (Mitchell, Astell-Burt, & Richardson, 2011; Richardson & Mitchell, 2010). In brief, the data estimate the proportion of land cover in a respondent's area of residence that is green space, including for example, parks, forests and grass, but excluding domestic gardens. Area of residence is defined by Census Area Statistics (CAS) ward, a small areal unit used in the collection of the UK census with a mean population size of 4144. Each respondent was assigned the green space value for their CAS ward of residence. The geo-location of the SHS respondents was not disclosed in an anonymised procedure carried out by SHS data managers.

Two contrasting measures of mental health and wellbeing were selected from the SHS; the shorter form General Health Questionnaire (GHQ12) and the Warwick Edinburgh Mental health and Wellbeing Score (WEMWBS). The GHQ12 assesses mental health via a series of questions about respondent experiences in recent weeks (Goldberg & Williams, 1991). Each question asks the respondent if they have experienced a particular symptom or feeling on a scale ranging from "less than usual" to "more than usual". Symptoms or feelings assessed include problems with sleep, inability to make decisions, lack of self-confidence and feeling stressed. Following Goldberg & Williams (Goldberg & Williams, 1991), this study distinguished between respondents with a GHQ12 score of 4 or more and the rest. A score of 4 or more indicates possible minor psychiatric morbidity and such respondents were labelled as having 'high GHQ' and regarded as having 'poor mental health'.

WEMWBS is a comparatively new measure designed to capture positive mental wellbeing (Tennant et al., 2007). It contains 14 statements related to wellbeing in the 2 weeks prior to interview; for example "I've been feeling optimistic about the future", or "I've been dealing with problems well". Respondents are asked to indicate how often they have had these thoughts or feelings on a scale ranging from "None of the time", to "All of the time". The resulting score is normally distributed around a mean of 50. WEMWBS is not a diagnostic tool; there are no established thresholds which denote particularly good or poor wellbeing. For this study, WEMWBS was treated as a linear variable in which higher scores denoted greater wellbeing.

The SHS asked about time spent doing different types of physical activity, including housework, walking, sport and manual work. A derived variable was available, giving the average hours of physical activity per week. This total included both moderate activity such as walking or housework, and vigorous activity, such as running. For a random subsample of individuals ($n = 2269$), the SHS then also asked the following question: "*In the past 4 weeks have you made use of any of the places listed… for any of the physical activities you have just told me about, for example for walking, cycling, sports or doing any heavy housework or gardening?*" The options listed were: a woodland, forest or tree covered park; an open space or park; country paths (not on tarmac); a beach/sea shore/loch/river or canal (NB, loch is a Scottish term for lake); sports fields or outdoor courts; a swimming pool; a gym or sports centre; pavements or streets in your local area; your home or garden; somewhere else; and none of these places. The SHS did not capture the form or quantity of physical activity in each environment. However, frequency of use was reported for each environment, as follows: not used, once in the last 4 weeks, 2–3 times in the last 4 weeks, once a week, 2–3 days a week, 4–6 days a week, every day.

For each specific environment, two different classifications of use were explored to try and assess the importance of frequency of use. The first distinguished between 'not used', 'used less than once a week' and 'used at least once a week or more'. The second distinguished between 'not used', 'used less than twice a week' and 'used twice a week or more'. A measure capturing the use of *any* natural environment was also derived, combining reported use of Woods/Forest, Open space/park, Non-tarmac paths and/or Beach/water-side bank. First, reported use of each environment over the last four weeks was converted from a category to a number; for each environment, use 'everyday in the last four weeks' was converted to use 28 times, '4–6 days a week' was converted to use 16 times, '2–3 days a week' was converted to use 8 times, 'once a week' was converted to use 4 times, and '2–3 times' was converted to use twice. Use of any natural environment per week was simply the sum of occasions in which any of the natural environments was used, divided by four. Combining use of Sports pitch/outdoor courts, Swimming pool, Gym/sports centre, Local pavements or streets and Home/garden in the same way gave use of any non-natural environment. Use of environments described as 'Somewhere else' was rare and was excluded.

Multivariate models first sought any independent relationship between use of *each* environment and risk of high GHQ or WEMWBS score. They then sought association between use of *any* natural or non-natural environment and risk of high GHQ or WEMWBS score. Logistic regression was used to model risk of high GHQ, linear regression was used to model WEMWBS. Since all environments were entered into the models simultaneously, the association between use of a specific environment and mental health or wellbeing was, in effect, adjusted for use of all other environments. All models adjusted for age group (10 year bands, top coded at 75+), sex, equivalised household income, average hours of physical activity per week, urban/rural status (using an 8 category classification (Scottish Government, 2008)) and green space in a respondent's neighbourhood. These were chosen on the basis of exploratory bi-variate analyses which confirmed their association with mental health and wellbeing.

Adjustment for physical activity was important because it is related to mental health (Hamer, Stamatakis, & Steptoe, 2009) and because some environments might host greater amounts of activity than others. An apparent protective effect for a specific environment might plausibly have been due to the quantity of activity that took place there, rather than the environment *per se*. Adjustment for quantity of green space in a respondent's neighbourhood allowed for the possibility that residence in a greener environment might be restorative through providing visual contact with nature and/or might itself be selective for good health. It was not possible to adjust for spatial clustering of the respondents within neighbourhoods because information on their location was withheld to secure anonymity.

There were 1890 respondents with all required information for the GHQ models and 1860 for the WEMWBS models. All analyses

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