

# THE CONNECTION BETWEEN PEOPLE, NATURE AND HEALTH

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## INTRODUCTION

Though the benefits of urbanization for human society are unequivocal, it is now considered one of the most critical global health issues of the 21<sup>st</sup> century [1, 2], with high rates of chronic, non-communicable physical and mental health conditions in cities [3, 4]. There is growing recognition of the role green spaces could play in addressing this challenge [5, 6], with research demonstrating that experiences of nature are linked to improved physical health [7] [8] [9], mental wellbeing [10] [11, 12], greater social wellbeing [13], and positive health behaviours such as physical activity [14, 15]. Consequently, many municipalities are investing heavily in the provision, management and enhancement of urban green spaces to promote the health and wellbeing of city populations [16].

Despite the positive shifts towards improved green spaces in cities, advice about how to ensure health outcomes are realised from these efforts currently remains very general [17, 18]. Furthermore, the biodiversity in urban landscapes is heterogeneous [19] and land access arrangements are highly variable. As such, some people have greater access to urban green spaces than others [20]. Compounding this inequality is the possibility that some benefits of experiences with nature may be greater in more biodiverse areas [12]. These issues raise a number of questions that I will address in this talk. First, who in cities has access to green spaces, and is its presence alone enough to encourage its use by the community [21-23]?

In the second part of this talk I will examine the implications of green space use for health and wellbeing. Specifically, I will assess how the different components of nature experiences influence physical and mental health; this includes the *intensity* of nature experiences (i.e. the quality or quantity of nature itself), as well as the *duration* and *frequency* [24]. Deconstructing exposure to nature down in this way provides a means to explore exactly how peoples behaviours, or green spaces themselves might be modified to improve the health and wellbeing benefits received. Furthermore, we show how it allows a dose-response analysis to assess exactly what dose of nature is needed to gain the best benefits.

## METHODS

We delivered an online urban lifestyle survey to 1358 Brisbane residents in November 2012, prior to the onset of high summer temperatures. The respondent group closely reflects that of the actual population across several demographic criteria, and is relatively evenly spread spatially across the city. This was achieved through stratification of respondents to ensure that (i) participants were 18 - 70 years of age, (ii) equal numbers of participants above and below 40 years, (iii) equal numbers of females and males, (iv) the income quartiles of the participant group reflected those of the total Brisbane population, and (v) participants' addresses were spread evenly among four spatial zones reflecting the four quartiles of tree cover across the city.

Respondents provided their address or an approximate address, their age (selected from 11 brackets), sex, personal income (selected from 11 brackets) and their highest qualification (selected from 11 categories). Participants also provided an indication of their orientation towards nature by completing the nature relatedness scale [25], where 21 statements about nature were rated using a five-point Likert scale. A higher average nature relatedness score indicates a stronger connection with nature.

Survey respondents also provided information on their exposure to nature through a range of locations; here I focus on public parks as they are readily able to be manipulated by local management authorities. We measured experiences of nature across three components, including the usual frequency of park visits across a year and the average duration of visits across a week. The 'nature intensity' (in this case, the level of vegetation complexity within visited parks) was also determined by first spatially locating the visited place (a description or place name was provided by respondents, and these were manually geolocated), and then measuring complexity with LiDAR-derived maps of vegetation cover at a 5x5m resolution across five separate vegetation strata. The use of vegetation complexity here follows a hypothesis that higher levels of vegetation lead to greater health outcomes.

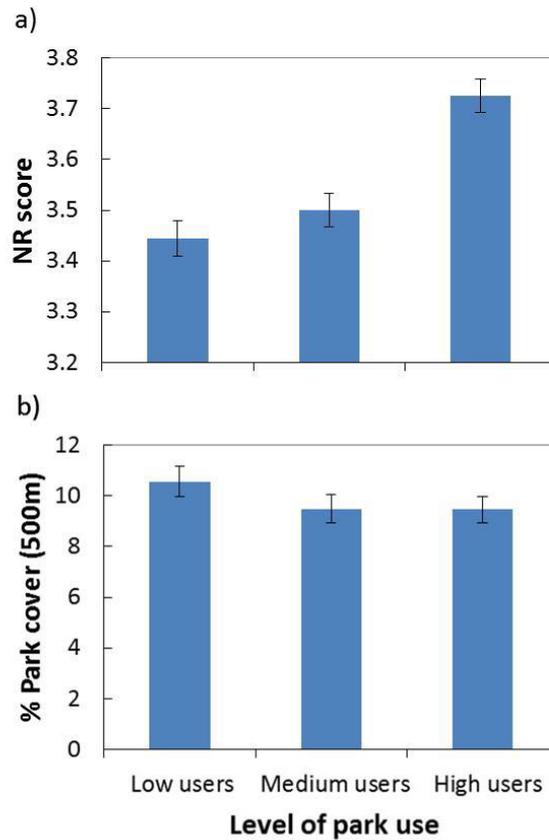
## **Analysis**

Full details of all analyses can be found in the references cited here-in. In brief, we analysed the data to address a series of questions. First we explored what proportion of the population engages with public parks, and what physical, social or personal factors were associated with their use [21-23]. These factors included vegetation cover within the parks or backyards themselves, socio-demographic factors such as age or sex, and also the extent to which a person feels oriented towards nature.

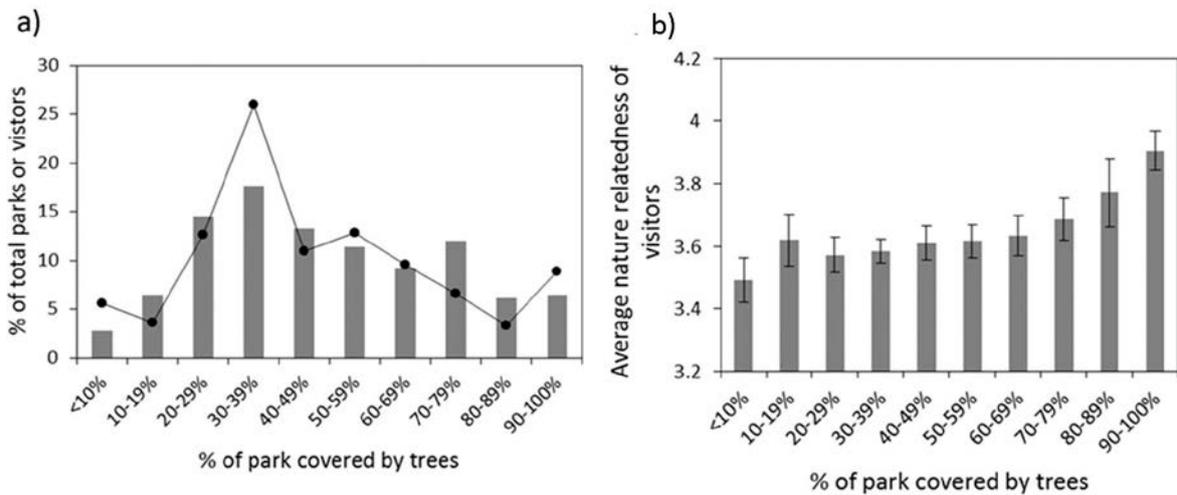
We also explored whether either nature intensity, duration or frequency of exposure to nature in parks had a greater influence on health and wellbeing outcomes, after accounting for other socio-demographic correlates of poor health (age, gender, Body Mass Index, and socio-economic indicators including the income, education, and neighborhood socio-economic disadvantage) [26]. The main health outcomes of interest were high blood pressure and depression. We then examined the dose-response relationship between the odds of a respondent being recorded as having high blood pressure or depression and incremental increases in the duration of nature experiences, while accounting for covariates. Finally, we assessed the fraction of cases of depression or high blood pressure in the population that could be attributable to not spending enough time in nature (population attributable fraction analysis; i.e. the proportion of the population would benefit from greater exposure to nature).

## **RESULTS**

We found that around 40% of Brisbane residents did not visit public parks in the week they were surveyed. Furthermore, we found that orientation towards nature was more closely associated with use than availability of parks, and that people tended to prefer visiting places with moderate vegetation complexity [21, 22]. There were a range of other socio-demographic correlates with green space use, including age, sex and highest qualification [21, 22].

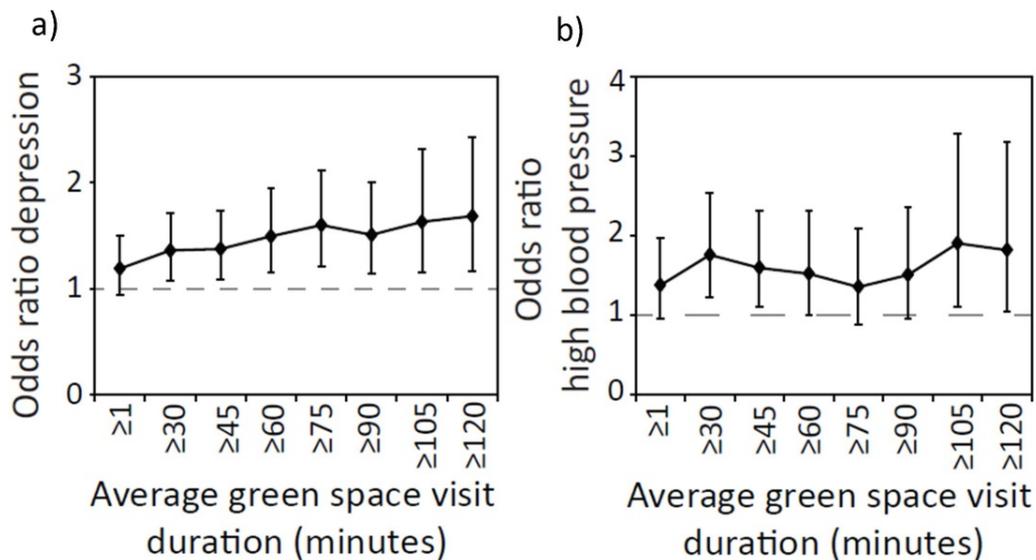


**Figure 1:** The level of a) nature relatedness (orientation towards nature), b) % park cover around the home (opportunity for nature experiences), and c) time spent in yards for survey respondents clustered into low, medium or high users. Adapted from [21]



**Figure 2:** Graphs showing a) frequency of visitation to parks with different levels of tree cover, and b) nature relatedness of visitors to parks with different levels of tree cover. Adapted from [22].

We also found that nature experiences affected people across multiple health and wellbeing outcomes, including depression, high blood pressure [26]. When considering the three different components of nature dose, duration had the greatest association with the prevalence of depression and high blood pressure over both frequency of visits and intensity (vegetation complexity) of visited locations. We found that the odds of having either depression or high blood pressure were significantly lower than the null model when reported green space visits were an average of 30 minutes or more (i.e. the confidence interval did not overlap with an odds ratio of one; Figure 3a), with a slight increase in mean gains after that.



**Figure 3:** Dose-response graphs showing the adjusted odds ratio from logistic regression for increasingly increasing average duration of visits to parks. 95% confidence intervals are shown. An odds ratio above one indicates an individual is more likely to have the disease where the threshold of green space visitation is not met. From [26].

The proportion of cases of depression and high blood pressure in the population that could be attributed to city residents failing to spend an average of 30 minutes or more during a green space visit across the course of their week (the ‘population attributable fraction’) was 0.07 for depression, and 0.09 for high blood pressure; that is, up to 7% of depression cases and 9% of high blood pressure cases recorded in the study could potentially be reduced if the green space visitation duration was 30 minutes or more [26].

## DISCUSSION

A surprisingly high proportion of people (40%) rarely engage with the outdoors, with a range of important mediating factors influencing this including socio-demographic and personal correlates such as age, sex and income. We also found that orientation towards nature (measured here as nature relatedness) had a critically important role in influencing whether people actually venture out and use public greenspaces, even more so than the availability of green space.

Characteristics of parks themselves also have an important association with park usage, with those with 30-40% of tree cover receiving the highest frequency of visits. However, an interesting pattern revealed in this study was that there was an almost linear relationship between vegetation cover within parks and the average nature relatedness of visitors. This suggests that orientation towards nature is not only important in determining whether people use green spaces, but also what types of spaces they visit [21-23]. This has potential implications for health and wellbeing, but also how parks are designed to fit the needs of different communities.

We have developed here the first ever recommendation for a minimum dose of nature, which in this case is a 30 minute visit to a green space during the week to lower levels of high blood pressure and depression in the population [26]. Furthermore, the dose response relationship shown here contributes to the evidence for causality between nature and health at the population level [27]. This analysis further revealed that the proportion of the population that could benefit from additional visits to green spaces is high, with 7% for depression and 9% for high blood pressure. These could amount to considerable savings for the public health purse, with depression costing Australian society AUD\$12.6 billion per annum.

What does all this mean for urban green space management? Interventions in cities need to go beyond provision alone to encourage use through either mechanisms, such as park programming, or through fostering a greater connection between people and nature in the general population. This approach is critical to ensure the entire community can access and gain the health benefits of spending time in nature.

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