



Analysis

Every breath you take, every move you make: Visits to the outdoors and physical activity help to explain the relationship between air pollution and subjective wellbeing



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ABSTRACT

Why does living in a more polluted environment predict lower subjective wellbeing (SWB)? Though much evidence exists linking local air pollution to individuals' reports of their own wellbeing, the mechanisms giving rise to these relationships are not well understood. Using pooled cross-sectional data from Natural England's Monitor of Engagement with the Natural Environment survey, the current work investigates whether air pollution is related to engagement in physical activity and visits to the outdoors and whether frequency of engagement in these behaviours can help to explain the link between air pollution and SWB. The results indicate that local levels of particulate matter are negatively associated with the frequency with which individuals undertake both of these activities, that engagement in these behaviours wholly mediates the association between air pollution and how worthwhile individuals consider their activities to be, and that the frequency of visits to the outdoors partially mediates the negative association between local air pollution and life satisfaction. From a policy perspective, these findings highlight the need to understand the behavioural pathways through which environmental conditions relate to SWB, in order to know how to best promote it.

1. Introduction

Over the past number of decades there has been increasing interest in both research and policy circles in going beyond traditional measures of welfare, such as life expectancy and GDP, and assessing how individuals' lives are going using their own reports of their wellbeing (Kahneman et al., 1999; Diener and Seligman, 2004; OECD Better Life Initiative, 2013; Dolan et al., 2011; Layard, 2005). These subjective wellbeing (SWB) measures are not widely considered to be replacements for traditional welfare measures, but rather, complementary indicators which can provide new insights into who is doing well and who is doing badly and why (Graham, 2012).

A large body of literature has developed exploring how the characteristics of individuals' lives relate to their SWB. This literature has largely focused on a single evaluative measure of SWB – life satisfaction – and has explored its relationship to individuals' socio-demographics (Dolan et al., 2008). Increasingly, however, greater emphasis is being placed exploring the determinants of wellbeing in relation to how individuals report feeling day to day (their experiential wellbeing) and their sense of purpose and meaning (their eudemonic wellbeing), in addition to global assessments of their lives (Stone and Mackie, 2013).

Support for the use of these other measures of subjective wellbeing has grown in particular due to work which has found that the relationships between SWB and a number of life circumstances, such as income (Kahneman and Deaton, 2010) and unemployment (Knabe et al., 2010), depend on the measure of SWB used.

At the same time as multidimensional approaches to modelling SWB are becoming more common, the range of determinants under consideration has also expanded. Recent research has focused on investigating how peoples' wellbeing relates to not just who they are, e.g. in terms of their age, income, and marital status etc., but also where they live and what they do (White et al., 2013; White and Dolan, 2009). In particular there is a growing body of literature investigating how individuals' SWB relates to the quality of their environments (EQ). Due to the non-market nature of many elements of EQ, standard measures may provide limited insight (Frey and Stutzer, 2002), and can even paradoxically be positively related to environmental degradation (Halpern, 2016). As a result, SWB data may be of particular use when investigating EQ as a determinant of wellbeing (OECD Better Life Initiative, 2013).

Looking through the lens of SWB, environmental quality does appear to be an important predictor of individual wellbeing. The level of

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environmental goods and ‘bads’ in individuals’ environments – the proportion of green space (White et al., 2013), the proximity to the coast (Brereton et al., 2008), and the levels of both noise and air pollution (Van Praag and Baarsma, 2005; Welsch, 2006, 2002; MacKerron and Mourato, 2009) – have all been linked to how satisfied people report being with their lives. Work has also begun to document relationships between environmental conditions and other measures of SWB including individuals’ stress levels (Thompson et al., 2012), their happiness (Dolan and Laffan, 2016) and their sense of purpose (Larson et al., 2016).

Air pollution is by far the most widely explored feature of environmental quality in the EQ-SWB literature (Frey et al., 2009). Early macro-level studies carried out by Welsch (2006, 2002) find that, controlling for country-level characteristics such as GDP, country nitrogen dioxide levels are negatively associated with average SWB. Other more recent work, which has investigated equivalent relationships over longer time frames and controlled for individual-level characteristics, documents negative associations between life satisfaction and various pollutants including sulphur dioxide and particulate matter (Luechinger, 2010; Ferreira et al., 2013). In addition, micro-level analyses, focusing on regional or local differences in air quality, also find evidence of links between air pollution and life satisfaction, as well as other measures of SWB (Luechinger, 2009; MacKerron and Mourato, 2009; Schmitt, 2013; Li et al., 2014; Orru et al., 2016; Dolan and Laffan, 2016). Although identifying these relationships is an important first step, the insights gained from the existing body of evidence are limited by the fact that the mechanisms underlying these associations have rarely been explored and are not well understood.

It is interesting that the level of air pollution in a local area is negatively linked to the life satisfaction of London residents (MacKerron and Mourato, 2009), for example, but it does not provide insights into what it is about living under these conditions that makes people worse off. MacKerron and Mourato (2013) highlight a number of potential pathways from EQ to SWB: environmental ‘bads’ may impact wellbeing via their effect on individuals’ health; environmental quality may shape individuals’ perceptions of safety and social cohesion in an area; and, lastly, environmental conditions may influence the activities the individuals engage in. Apart from a couple of studies which explore the relationship between air pollution and SWB with and without health controls, no other work exists which empirically investigates the pathways from air pollution to SWB (Schmitt, 2013; Dolan and Laffan, 2016). The results of these studies suggest that while health appears to be one channel, it is not the whole story. We presently, therefore, have only a limited understanding of the production process that converts air pollution into ill-being.

The current work seeks to address this gap. It looks to behavioural factors to provide further explanation, hypothesising that living in a polluted environment might negatively influence SWB by discouraging behaviours that are positively linked to wellbeing. The two types of behaviour investigated in this study are 1) visits to the outdoors and 2) physical activity. Existing research, further detailed below in Sections 1.2 and 1.3, links the quality of individuals’ environments to both of these activities (Foster et al., 2004; Roberts et al., 2014), and separate work has found these activities to be related to SWB (MacKerron and Mourato, 2013; Dolan et al., 2014). Together this literature highlights these behaviours as potential mediators of the relationship between air pollution and SWB. Understanding whether they play a role will expand our theoretical understanding of the relationship between EQ and human wellbeing, as well as contribute to scholarship on the determinants of SWB.

Exploring the pathways from EQ to SWB may also yield important policy insights. First, from an efficiency perspective, policymakers might, on the basis of the findings of MacKerron and Mourato (2013), for example, take measures to decrease air pollution with the goal of enhancing life satisfaction. If, however, the air pollution–wellbeing relationship arises from the behaviours being discouraged by high air pollution levels, more cost-effective policies options involving the facilitation and encouragement of those behaviours may exist. Second,

relating to equity concerns, if the wellbeing benefits of improvements in air quality are conditional on individuals changing their behaviour in reaction to these improvements, then they are likely to have heterogeneous effects across populations. Individuals who are less able to engage in the mediating activities, for example those who have less leisure time, would stand to benefit less from the air quality improvements. Gaining a better idea of not only how, but also why, environmental goods and ‘bads’ are related to SWB can help to inform policies on how best to promote wellbeing.

The following sections detail the literature which motivates the exploration of both visits to the outdoors and physical activity as potential mediators of the relationship between SWB and air pollution. Section 1.1 considers work which investigates links between EQ and these activities. Section 1.2 discusses existing research which focuses on the relationships between these activities and measures of SWB. Finally, Section 1.3 outlines the current work and the epidemiological research it draws on for its methodological approach.

1.1. The Relationship Between EQ, Spending Time Outdoors and Physical Activity

There is a growing body of evidence which suggests that the conditions of individuals’ local environments are related to how they spend their time. The majority of this work focuses on green space. How green individuals’ local areas are is predictive of their engagement in a wide range of activities related to the outdoors. Sugiyama et al. (2008), for example, find that individuals’ perception of the greenness of their local area is significantly positively associated with recreational walking and social interaction. Other studies find that visits to open public spaces and walking are both positively related to the proximity and attractiveness of public open spaces (Foster et al., 2004; Giles-Corti et al., 2005; Tilt et al., 2007). Thompson et al. (2013) also show that improvements in EQ can lead people to visit the outdoors more frequently. They find that self-reported visits to the outdoors and perceived EQ significantly increase in areas which are targeted by a Scottish environmental improvement programme called ‘Woods in and around Town’, compared to those that are not. Relatedly, there is some emerging evidence that green space is related to individuals’ levels of exercise. Mytton et al. (2012) find that living in the greenest quintile in England, compared to the least green quintile, is associated with 27% higher odds of achieving recommended physical activity levels. Similar work in New Zealand also finds that the greener a neighbourhood is, the more physical activity the residents report engaging in (Richardson et al., 2013). Importantly, the research is not conclusive, and there has also been some work which fails to find an association between green space and exercise (Ord et al., 2013).

Although the literature is less well developed, some studies also link environmental ‘bads’ to individuals’ activities. Much of this research explores short-run behavioural adjustments in response to air pollution alerts on high pollution days. Zivin and Neidell (2009), for example, find evidence that fewer people visit outdoor attractions in California on alert days, and Noonan (2014) documents evidence of lower park use among joggers and the elderly in response to these warnings. These alerts are also linked to reduced time spent on vigorous outdoor activity (Ward and Beatty, 2016), and cycling for leisure purposes (Saberian et al., 2017). Although we know less about the long-run adjustments people make to negative environmental conditions, a small number of studies exist which suggest that normal levels of environmental ‘bads’ are also linked to how people spend their time. In a Swiss study, Foraster et al. (2016) find that long-term noise annoyance is associated with reduced physical activity. Roberts et al. (2014) find that higher community level air pollution is associated with lower levels of leisure-time physical activity in a nationally representative US sample. Taken together, this literature suggests that the worse the quality of individuals’ environments the less they tend to visits to the outdoors and engage in physical activity.

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