



# The role of public and private natural space in children's social, emotional and behavioural development in Scotland: A longitudinal study



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## ABSTRACT

**Introduction:** Poor mental health in childhood has implications for health and wellbeing in later life. Natural space may benefit children's social, emotional and behavioural development. We investigated whether neighbourhood natural space and private garden access were related to children's developmental change over time. We asked whether relationships differed between boys and girls, or by household educational status.

**Methods:** We analysed longitudinal data for 2909 urban-dwelling children (aged 4 at 2008/9 baseline) from the Growing Up in Scotland (GUS) survey. The survey provided social, emotional and behavioural difficulty scores (Strengths and Difficulties Questionnaire (SDQ)), and private garden access. Area (%) of total natural space and parks within 500 m of the child's home was quantified using Scotland's Greenspace Map. Interactions for park area, total natural space area, and private garden access with age and age<sup>2</sup> were modelled to quantify their independent contributions to SDQ score change over time.

**Results:** Private garden access was strongly related to most SDQ domains, while neighbourhood natural space was related to better social outcomes. We found little evidence that neighbourhood natural space or garden access influenced the trajectory of developmental change between 4 and 6 years, suggesting that any beneficial influences had occurred at younger ages. Stratified models showed the importance of parks for boys, and private gardens for the early development of children from low-education households.

**Conclusion:** We conclude that neighbourhood natural space may reduce social, emotional and behavioural difficulties for 4–6 year olds, although private garden access may be most beneficial.

## 1. Introduction

Poor mental health in childhood has implications for health and wellbeing in later life, and presents a considerable burden for families and wider society. In the short term, for example, school attainment may be impaired (Trout et al., 2003), while in the longer term persistent mental health issues, higher mortality rates and wider inequalities may result (Dube et al., 2003; Jokela et al., 2009). Recent decades have seen substantial increases in the prevalence of childhood social, emotional, and behavioural problems (Layard and Dunn, 2009). To address this upward trend, and the consequent growing societal burden now and in the future, it is imperative to identify the determinants of these childhood problems. Individual, family, and household characteristics contribute, but they do not explain all of the variation in risk (Bradshaw

and Tipping, 2010; Wilson et al., 2012). Environmental influences – including noise (Forns et al., 2015), air pollution (Forns et al., 2015), and a lack of contact with natural space (Amoly et al., 2014) – have also been identified as possible risk factors for poor mental health in childhood.

Our study examines the role that natural space might play in children's development. Louv (2005) argued that there are substantial negative effects of 'alienation' from nature, and that these may be the root cause of increases in childhood developmental problems. Today's children spend less time outdoors in nature than previous generations (Gaster, 1991), and tend to be less physically active and more obese (Anon, 2013). Urbanisation, increasingly indoor pastimes, and parental concerns about safety may all have contributed to declining childhood nature experiences (Strife and Downey, 2009; Valentine and

**Abbreviations:** CI, Confidence Interval; GUS, Growing Up in Scotland survey; IQR, Interquartile Range; SDQ, Strengths and Difficulties Questionnaire; SF-12, The 12-item Short Form health questionnaire; SGM, Scotland's Greenspace Map; SIMD, Scottish Index of Multiple Deprivation

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McKendrick, 1997).

A growing body of research has found that children who live or spend time in more natural surroundings typically have fewer social, emotional and behavioural problems than those in less green settings (Amoly et al., 2014; Faber Taylor and Kuo, 2009). A number of causative mechanisms have been suggested. Firstly, experiences of natural environments may directly restore a child's attention by giving fatigued cognitive processes the opportunity to rest ("Attention Restoration Theory", Kaplan and Kaplan, 1989). In a US study schoolchildren who moved to more natural settings exhibited greater improvement in their attention levels than others (Wells, 2000), and in Barcelona, children with greener surroundings had better memory and attention levels (Dadv and et al., 2015). Secondly, natural environments may support stress reduction through favourable physiological responses ("Psychoevolutionary Theory"; Ulrich, 1983). Wells and Evans (2003) reported that levels of nearby nature buffered the impact of stressful life events on schoolchildren. Thirdly, natural environments may increase opportunities for play (Almanza et al., 2012), which in natural settings is typically more creative, adventurous, social, and challenging than play elsewhere (Hart, 1979). Indeed, increased usage of green space in urban areas has been linked to improved health and wellbeing in Scottish schoolchildren (McCracken et al., 2016). Fourthly, natural space availability may indirectly affect the child via effects on their carer. Exposure to natural spaces has been linked with better mental health in adulthood (Hartig et al., 2014), and the carer's mental health can influence early childhood development (Marryat and Martin, 2010).

Research into the potential role of nature in childhood development focusses on school-aged children. However, considering younger children is critical because of the important capabilities in exploration, imagination, socialisation, and control that develop through increasingly independent play at younger ages (Bee, 1992; Erikson, 1963). Further, different types of natural space may be more or less beneficial for children's development, but this has been little researched. The developmental benefits of play are optimised when children are able to explore the space and construct things (e.g., shelters) with minimal adult intrusion, and to interact with others (Hart, 1979). Expansive public spaces may therefore be more beneficial (e.g. parks rather than private gardens or overall natural space). Indeed, Lithuanian 4–6 year olds had fewer emotional and behavioural problems if they had better availability of parks nearby, although these problems were not related to overall green space (Balseviciene et al., 2014). Alternatively, play with minimal supervision – particularly for young children – may satisfy parents' safety concerns more if it takes place in a private garden rather than a public space. In this case having access to a private garden may be more important than natural space in the neighbourhood: 3–7 year old children in England with access to a garden had lower levels of social, emotional and behavioural problems, but neighbourhood green space was unrelated (Flouri et al., 2014).

Evidence for the determinants of early childhood development problems is urgently needed to inform public health interventions. Here we expand the evidence base by investigating whether social, emotional and behavioural development for young children (age 4 at baseline) is better for those with more natural space around their homes, and particularly more public park space, or whether access to a private garden is more important. We explore differences by sex and household socioeconomic status, given known differences in how these groups use and are affected by their local environments (Cleland et al., 2010; de Vries et al., 2003).

## 2. Methods

### 2.1. Study population

We analysed data from the Growing Up in Scotland (GUS) survey (Scottish Centre for Social Research, 2012). GUS's nationally-

representative birth cohort sample was selected in 2005/2006 ( $n = 5217$  achieved interviews) from families with babies of approximately 12 months in receipt of child benefits (97% of families with children in Scotland) – at that time a non-means-tested benefit paid to carers of children under 16 – and was followed up annually thereafter. Sampling stratification ensured a representative selection of areas of differing socioeconomic status within each local authority (Wilson et al., 2012). We selected respondents from wave five (age 5, 2009/2010;  $n = 3833$  achieved interviews) because these children's home postcodes were available through a secure setting. There are over 200,000 postcodes in Scotland, each representing approximately 15 households. We selected the 2909 children (76%) living in areas of Scotland covered by the urban natural space data (see Section 2.3) at wave five. The child's wave four (age 4) and six (age 6) survey data could be included if they had been living at their wave five address then (i.e., non-movers), resulting in an additional 2650 wave four and 2482 wave six observations.

### 2.2. Outcome variables

Social, emotional and behavioural difficulties were assessed using the 25-item Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) in waves four, five and six. The SDQ – a behavioural screening tool designed for children between 3 and 16 years old – has been widely used internationally, owing to its good psychometric properties and clinical utility (Theunissen et al., 2015). The questionnaire was self-completed by the main carer, usually the mother.

For each SDQ domain - Hyperactivity Problems, Emotional Problems, Peer Problems, Conduct Problems, and Prosocial Behaviour - the respondent was asked whether each of five items (Table 1) was 'Not true', 'Somewhat true' or 'Certainly true' of the child's behaviour over the last six months. Responses were scored 0, 1, or 2, with 2 being the most negative (or most positive, in the case of Prosocial Behaviour). The scores were summed to give a domain score of 0–10, and a Total Difficulties score (ranging 0–40) was calculated by summing all domains except Prosocial Behaviour. Higher scores indicated worse problems (opposite for Prosocial Behaviour).

**Table 1**  
Items within the Strengths and Difficulties Questionnaire (SDQ) domains.

SDQ domain	Items
Hyperactivity Problems	Restless, overactive, cannot stay still for long Constantly fidgeting or squirming Easily distracted, concentration wanders Thinks things out before acting Sees tasks through to the end, good attention span
Emotional Problems	Often complains of headaches, stomach aches or sickness Many worries, often seems worried Often unhappy, downhearted or tearful Nervous or clingy in new situations, easily loses confidence
Peer Problems	Has many fears, is easily scared Rather solitary, tends to play alone Has at least one good friend Generally liked by other children Picked on or bullied by other children Gets on better with adults than with other children
Conduct Problems	Often has temper tantrums or hot tempers Generally obedient, usually does what adults request Often fights with other children or bullies them Often lies or cheats Steals from home, school or elsewhere
Prosocial Behaviour	Considerate of other people's feelings Shares readily with other children Helpful if someone is hurt, upset or feeling ill Kind to younger children Often volunteers to help others (parents, teachers, other children)

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