

Exposure to the natural environment and rurality is protective of ADHD in a large birth cohort of New Zealand children

Donovan G, Michael Y², Gatzolis D¹, 't Mannetje A³, Douwes J³

¹USDA Forest Service, ²Drexel University, ³Center for Public Health Research, Massey University

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Background: Several small experimental studies and cross-sectional observational studies have found that exposure to the natural environment may protect against Attention Deficit Hyperactivity Disorder (ADHD), or can moderate symptoms in children diagnosed with ADHD.

Methods: We test whether exposure to the natural environment protects against ADHD and whether this hypothesized protective effect varies across a child's life course. The sample consisted of all children born in New Zealand in 1998 (n=49,923). We used Statistics New Zealand's Integrated Data Infrastructure (IDI) to identify children with ADHD and define covariates. ADHD was defined using hospitalization and pharmacy records. Exposure to the natural environment (or "green space"), from prenatal to age 18, was measured using the Normalized Difference Vegetation Index (NDVI) and land-use data from Landcare Research New Zealand. We estimated logit models of ADHD incidence controlling for gender, ethnicity, education, income, smoking status, birth order, and premature or underweight birth.

Results: Children who lived in a rural area after age 2 were less likely to develop ADHD (OR 0.67; 95% CI 0.46-0.98), as were those with increased minimum NDVI exposure after age 2 (standardized OR for exposure quartile 2 (Q2) 0.84, 95%CI 0.7-1.0; Q3 OR 0.81, 95%CI 0.68-0.96; and Q4 OR 0.66, 95%CI 0.55-0.81). In early life (prenatal to age 2), neither rural living nor NDVI were protective.

Conclusions: In this first longitudinal study of the relationship between the natural environment and ADHD, we found that rurality and increased minimum greenness were strongly and independently associated with a reduced risk of ADHD.