

Les McGrath: Effects of the Environment on Physical Activity in New Zealand

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Childhood obesity rates have risen steadily in recent decades along with increased urbanisation that has changed where children can play and roam freely, potentially reducing their daily energy expenditure. The relationship between aspects of the built environment and children's physical activity has therefore been identified as a public-health issue. This thesis represents a review, two studies that examined built-environment effects on children's activity, one play intervention study and two studies that investigated issues with accelerometer measurement of physical activity.

Chapter two addresses the need for a quantitative review of the effects of objectively measured built-environment factors on children's objectively measured physical activity. The review included studies that used geographical information systems (GIS) or street audits to quantify the built environment with physical activity quantified by accelerometers, pedometers or global positioning systems. A key insight was that danger from vehicle traffic appears to underlie the association between physical activity and some measures of the built environment. There was inadequate research on effects of neighbourhood walkability and on the confounding effects of weather, compliance and the intensity threshold for moderate-vigorous activity.

In Study 1, habitual physical activity of 227 children living in 48 residential neighbourhoods within four cities was measured with accelerometers and related to built-environment factors defined using GIS analysis and street-audit measures. Disparate built-environment effects on children's physical activity were rationalised by classifying neighbourhoods as either safe for children's walking or play or those where traffic danger constrained activity, which suggests that unsafe neighbourhoods need redesigning.

In Study 2 the same data were analysed with a particular focus on children's daily pattern of accelerometer steps at light and moderate-vigorous intensities. It was revealed that reductions in moderate-vigorous activity were associated with poor weather, darkness and non-school days. These reductions might be offset by interventions that encourage children to self-select outdoor or indoor activities at step cadences of ~80 per minute.

Modifying the built environment is a long-term health strategy towards developing child-walkable neighbourhoods where children can roam and play independently to increase their daily physical activity. A short-to-medium term intervention plan was implemented in Study 3, a crossover design for promoting children's increased physical activity through self-determined play during a supervised play period before school (08:00-09:00) with free access to play equipment. There were no clear changes in total activity, but during the play intervention there were trivial-small reductions in girls' body-mass index (BMI) while boys' BMI remained constant when normally BMI would be expected to increase. Reasons for excluding data from analysis in the intervention study were investigated in Study 4 and it was found that non-compliance and discomfort with wearing accelerometers along with monitor failure excluded half of the children from providing activity data for analyses. In the final study, the effect of accelerometer-count thresholds on the amount of activity classified as moderate-vigorous intensity was investigated and thresholds from published articles are recommended rather than manufacturer thresholds. In conclusion, future studies should investigate the effects of neighbourhoods designed to increase safety to encourage children's habitual activity. Measurement of physical activity should be undertaken by continuously wearing accelerometers (and global positioning system watches) and analysed using published count thresholds.