

Socioeconomic disadvantage and polygenic risk for high BMI magnify obesity risk across childhood: a longitudinal, population, cohort study



Jessica A Kerr, Dorothea Dumuid, Marnie Downes, Katherine Lange, Meredith O'Connor, Lukar Thornton, Suzanne Mavoa, Kate Lycett, Tim S Olds, Ben Edwards, Justin M O'Sullivan, Markus Juonala, David Burgner, Melissa Wake



Abstract

Background Across the life course, socioeconomic disadvantage disproportionately afflicts those with genetic predispositions to inflammatory diseases. We describe how socioeconomic disadvantage and polygenic risk for high BMI magnify the risk of obesity across childhood, and using causal analyses, explore the hypothetical impact of intervening on socioeconomic disadvantage to reduce adolescent obesity.

Methods Data were drawn from a nationally representative Australian birth cohort, with biennial data collection between 2004 and 2018 (research and ethics committee approved). We generated a polygenic risk score for BMI using published genome-wide association studies. We measured early-childhood disadvantage (age 2–3 years) with a neighbourhood census-based measure and a family-level composite of parent income, occupation, and education. We used generalised linear regression (Poisson-log link) to estimate the risk of overweight or obesity (BMI \geq 85th percentile) at age 14–15 years for children with early-childhood disadvantage (quintiles 4–5) versus average (quintile 3) and least disadvantage (quintiles 1–2), for those with high and low polygenic risk separately.

Findings For 1607 children (n=796 female, n=811 male; 31% of the original cohort [N=5107]), polygenic risk and disadvantage were both associated with overweight or obesity; effects of disadvantage were more marked as polygenic risk increased. Of children with polygenic risk higher than the median (n=805), 37% of children living in disadvantage at age 2–3 years had an overweight or obese BMI by adolescence, compared with 26% of those with least disadvantage. For genetically vulnerable children, causal analyses indicated that early neighbourhood intervention to lessen disadvantage (to quintile 1–2) would reduce risk of adolescent overweight or obesity by 23% (risk ratio 0.77; 95% CI 0.57–1.04); estimates for improving family environments were similar (0.59; 0.43–0.80).

Interpretation Actions addressing socioeconomic disadvantage could mitigate polygenic risk for developing obesity. This study benefits from population-representative longitudinal data but is limited by sample size.

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Contributors

JAK, MW, LT, and SM conceptualised the research question. JAK, DD, and MD planned and conducted the analyses, drafted the initial abstract, and reviewed and revised the abstract. KLa generated the polygenic risk score and reviewed and revised the abstract. MO'C, LT, SM, KLy, TSO, BE, JMO'S, MJ, and DB are cohort investigators or content experts and provided expert advice and critical review of this study and abstract. JAK, KLa, and KLy contributed to data creation. MW is the study principal investigator and provided critical review of this study and abstract. All authors approved the final abstract as submitted and agree to be accountable for all aspects of the work.

Declaration of interests

We declare no competing interests.

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Department of Psychological Medicine, University of Otago Christchurch, Christchurch, New Zealand (J Kerr PhD); Population Health Theme, Murdoch Children's Research Institute, Melbourne, VIC, Australia (J Kerr, M Downes PhD, K Lange PhD, M O'Connor PhD, S Mavoa PhD, K Lycett PhD, T S Olds PhD, M Wake MD); Infection and Immunity Theme, Murdoch Children's Research Institute, Melbourne, VIC, Australia (M Juonala PhD, D Burgner PhD); Department of Pediatrics (J Kerr, K Lange, M O'Connor, K Lycett, D Burgner, M Wake) and Melbourne School of Population and Global Health (S Mavoa), University of Melbourne, Melbourne, VIC, Australia; Alliance for Research in Exercise, University of South Australia, Adelaide, SA, Australia (D Dumuid PhD, T Olds); Department of Marketing, University of Antwerp, Antwerp, Belgium (L Thornton); Environment Protection Authority Victoria, Melbourne, VIC, Australia (S Mavoa); School of Psychology, Deakin University, Burwood, VIC, Australia (K Lycett); Centre for Social Research and Methods, Australian National University, Canberra, ACT, Australia (B Edwards PhD); Department of Pediatrics and The Liggins Institute (J M O'Sullivan PhD, M Wake MD) and The Maurice Wilkins Centre (J M O'Sullivan), University of Auckland, Auckland, New Zealand; Australian Parkinson's Mission, Garvan Institute of Medical Research, Sydney, NSW, Australia (J M O'Sullivan); MRC Lifecourse Epidemiology Unit, University of Southampton, Southampton, UK (J M O'Sullivan); Agency for Science Technology and

Research, Singapore Institute
for Clinical Sciences, Singapore
(J M O'Sullivan); Department of
Medicine, University of Turku,
Turku, Finland (M Juonala);
Division of Medicine, Turku
University Hospital, Turku,
Finland (M Juonala);
Department of Pediatrics,
Monash University, Melbourne,
Australia (D Burgner)

Correspondence to:
Dr Jessica Kerr, Department of
Psychological Medicine,
University of Otago Christchurch,
Christchurch 8011, New Zealand
jessica.kerr@otago.ac.nz