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Enhancing causal inference in observational research through the study of twin pairs and families using linked population-level data

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Background
Data linkage across whole-population administrative datasets can identify associations between risk factors and health, social, economic and other outcomes throughout the life-course. However, causal inference from such observational work is often difficult. With limited ability to adjust for unmeasured confounders, associations are prone to confounding including unmeasured familial confounding. We propose that, by identifying and studying twin pairs and families within these datasets, analyses can be conducted that better address causation.

Objectives
1: Identify twin pairs in linked Australian administrative datasets that are suitable for population health research.
2: Demonstrate our novel approach, Inference about Causation from Examination of FAmiLial CONfounding (ICE FALCON) to show its applicability.

Methods
We investigated linked longitudinal whole-population resources in Australia to establish the feasibility of identifying twin pairs and applied ICE FALCON to several large twin and family studies using Australian data.

Results
We identified 203,590 twin pairs across five different Australian cohorts. Analyses provided evidence consistent with, for example: (i) BMI in early adulthood having a causal effect on BMI in mid-life; (ii) change in BMI between early adulthood and mid-life having a causal effect on diagnosis of Type II diabetes in mid-life, and (iii) infantile asthma causing asthma with hay fever in childhood.

Conclusions

There is potential for twin and family studies within linked population-complete administrative datasets to uncover targets for intervention that are likely causal, and to exclude those doomed to failure. This will help ensure that translation of Big Data health research brings real benefits to Australian healthcare.