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Review

Secular trends in the prevalence of childhood overweight and obesity across Australian states: A meta-analysis

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ABSTRACT

Objective: To describe secular trends in the prevalence of overweight and obesity in Australian children in each state and territory.
Design: Systematic search and numerical meta-analysis.
Methods: A systematic search was conducted to identify all sources that objectively measured the height and weight of Australian children (aged 2–18 years) and had a sample size of at least 300. Raw and summary data were requested from authors and divided into age × sex × state × yearly slices to derive estimates of the prevalence of overweight and obesity. Following a double arcsine transformation to facilitate meta-analysis, all estimates were standardised for age, stratified by sex and analysed using sample-weighted non-linear regressions.
Results: The systematic search identified 73 eligible sources (47 raw and 26 summary datasets), with 72.8% of data sourced from Victoria and South Australia. Prevalence trends varied from state to state, with three states or territories showing a marked plateau, two showing a decline in the more recent years and three showing continued linear increases. Tasmania and Northern Territory generally had the highest prevalence (30.2% and 24.3% overweight and obesity respectively), and the Australian Capital Territory had the lowest (12.4% overweight and obesity).
Conclusions: Prevalence, as well as prevalence trends, varied amongst Australian states and territories. At a national level, the prevalence trend has nearly plateaued for the past 15 years. However, upward prevalence trends appear to be persisting in Western Australia, South Australia and Tasmania. Findings highlight the need for ongoing efforts to address the issue of childhood obesity.

1. Introduction

Obesity reduces a child's health-related quality of life[1] and has many associated health risks and consequences.[2] Being overweight or obese as a child is also strongly associated with being overweight or obese as an adult,[3] which can lead to long-term health issues in adulthood. These include an increased risk of premature mortality (for obesity) and certain types of cancer, type II diabetes, metabolic syndrome and multiple cardiovascular risk factors.[4,5]

Measuring the prevalence of childhood obesity and monitoring changes over time is important from a population health surveillance perspective, and can assist with developing interventions for prevention and treatment. A variety of socio-demographic factors are associated with an increased prevalence of overweight and obesity such as: age (typically peaking at 13 years[6–8]) and low socio-economic status (SES).[9–11] Other evidence suggests overweight and obesity levels are elevated in Aboriginal children[12,13] and young people of Pacific Islander, Middle Eastern/Arabian descent.[9–11] Place of residence (metropolitan vs rural) may also impact on the prevalence of overweight and obesity, though evidence is mixed, with some studies suggesting the prevalence in children living in metropolitan locations is higher for boys but not girls.[9,10] Other studies, however, have suggested that the prevalence of overweight and obesity is unrelated to place of residence[14,15] or that the prevalence is in fact higher in rural areas.[13]

Secular trends are changes across time, and can be charted by collating data from a number of cross-sectional studies undertaken at different points in time.[16,17] Multiple studies suggest the prevalence of overweight and obesity in Australian children substantially

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increased from 1985 until 1996/1997.[16–18] Following this increase, the prevalence of overweight and obesity in Australian children began to plateau from the late 1990s onwards.[17–19] Data from the Australian Bureau of Statistics[6] has shown that the prevalence of overweight or obesity increased from 1995 to 2007/2008, however this is a very slight increase and statistically similar to what Olds et al.[17] reported.

Although evidence suggests a plateau, or very small increase in the prevalence of overweight and obesity in the past 10–15 years at the national level, it is possible that the prevalence of overweight and obesity is still changing more quickly in specific subgroups. For example, there is mixed evidence suggesting that the prevalence may still be increasing in children of low to middle SES, with some studies supporting this conclusion[20,21] and others reporting mixed results.[22,23] No studies, to date have examined potential differences in secular trends in paediatric overweight and obesity across Australian states and territories. This study aims to map secular changes in the prevalence of overweight and obesity in Australian children on a state-by-state basis. The results will be presented in animated colour-coded maps, similar to those produced annually by the Centres for Disease Control (CDC) to track changes in obesity in adults across the states of the United States.[24] This will enable a clear comparison of prevalence across states and territories, showing how the prevalence of overweight and obesity has changed over time and highlighting the states and territories with the highest and lowest prevalences.

2. Methods

This study employed a numerical meta-analysis. Data sources were identified firstly via a systematic search of academic databases. Suitable keywords were determined and databases were chosen based on a prior study[17] and in consultation with an academic librarian. Trial systematic searches were also conducted to ensure searches would locate sources within the desired scope, before the final search strategies were determined.

The final search strategy was conducted on August 7, 2014, in the following databases: MEDLINE (1946 to August 7, 2014), Embase + Classic Embase (1947 to August 6, 2014), CINAHL (1982 to August, 2014), SPORTSdiscus (1949 to August, 2014), PsycINFO (1806 to Week 4 July, 2014) and Web of Science Core Collection (1950 to August 6, 2014). It employed the following keyword string:

(Obes* OR overweight OR BMI OR body mass index OR thinness OR leanness OR body constitution OR body composition OR anthropometr* OR height OR weight OR body size OR weight status OR body weight OR adiposity OR fat)
AND
(child* OR adolescen* OR young OR youth* OR p#?diatric OR preschool OR teenage*)
AND
(Australia* OR South Australia* OR New South Wales OR Victoria* OR Northern Territory OR Australian Capital Territory OR Tasmania OR Queensland OR Western Australia*).
where possible, searches were limited to sources written in English, those that examined children aged 0–18 years and were peer-reviewed journal articles.

One of the researchers (NSH) compiled all sources identified from the search and removed duplicates. All sources were then screened by title and abstract according to points 1–6 of the eligibility criteria (below). The screening process was replicated by another member of the research team (CM), on a subset of 492 sources to determine inter-rater reliability of the data selection process.

The full-text versions of the remaining articles were obtained, and appraised to determine eligibility for inclusion in the meta-analysis. If insufficient details were presented in the articles to determine eligibility, authors were contacted for clarification.

Sources were included based on the following eligibility criteria:

(1) Sources had at least 300 participants in their original sample (on the rationale that smaller samples would be quantitatively insignificant and may yield very labile prevalence estimates);
(2) Participants were Australian children aged between two and eighteen years (since the International Obesity Task Force (IOTF) weight status criteria only cover these ages)[25];
(3) Height and weight were objectively measured (since the prevalence of overweight and obesity may be inaccurate when calculated from self or proxy-reported data)[26,27];
(4) The sample populations were not chosen according to any criterion likely to result in a non-representative sample (e.g. a specific ethnic or socio-economic group) or were not drawn from populations likely to have abnormal adiposity (e.g. athletes, children with specific weight-related morbidities);
(5) Sources were published as full text; and,
(6) Sources were not reviews, conference abstracts, letters or editorials.

National, state/territory and regional-level sources and datasets were all eligible; and no time limit was placed. However, since the IOTF criteria were only introduced in 2000, using sources published before then required access to raw data.

Authors of all potential sources were contacted via email and asked to provide raw, which was preferred, or summary data. If necessary, authors were also asked to clarify details about their source's methodology. Sources were excluded if the first or last author of the paper did not reply within two weeks after initial contact. If the source however, had published prevalences of overweight and obesity for a specific state or territory in summary form using the IOTF classification system, it was still included. For sources described in multiple publications, the paper providing summary data using the smallest age slice was included.

Data from included sources were entered into a Microsoft Excel spread sheet (version 14.5.3; Microsoft Corporation, Redmond, WA, USA) in either raw or summary form. If the year of measurement was not specified, and could not be provided by the author, it was assumed to be two years prior to publication, this being the median time gap between data collection and publication in studies where both were known. If there were multiple years of measurement in a single age/sex or data slice, the median year was chosen (e.g. 2006.5 would have been chosen as the median time point for data measured in 2004–2008). Data extraction was undertaken primarily by one member of the research team (NSH) and duplicated on a subset of 17 sources by another (NS) to determine inter-rater reliability of this process.

Data treatment was undertaken in Microsoft Excel along with SPSS (Macintosh) version 22.0 (IBM Corporation, Armonk, NY, USA). Each source was treated separately. In the case of sources, where a cohort was followed longitudinally and there was less than a year between consecutive points of data collection, alternative waves of data were removed. This was done to prevent individual participants from having undue influence on the prevalence estimate of a data slice.

Exact ages were also calculated if the birthdate was provided. However, if rounded ages were given (i.e. age at last birthday) instead of the exact age recorded at the time of measurement, it was assumed that it has been six months since their last birthday. Body mass index was calculated for each participant. Outliers ($10\,kg\,m^{-2} < BMI > 55\,kg\,m^{-2}$) were removed.

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