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Research

Economic benefits of reducing childhood and adolescent overweight and obesity in Australia

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Key points

- Australia's National Obesity Strategy has set an aspirational goal of a 5% reduction in the prevalence of childhood and adolescent overweight and obesity by 2030
- Our modelled findings show that achieving this goal could result in lifetime cost savings of $7.44 billion (2030 Australian Dollars)
- The lifetime cost savings would potentially offset the government expenditure needed to implement primary prevention strategies and improve access to health services to achieve the National Obesity Strategy's goal

Abstract

Objectives: The Australian Government, through the National Obesity Strategy 2022–2032, has set an aspirational goal of reducing the prevalence of childhood and adolescent overweight and obesity by 5% by 2030 (from 25% to 20%). Our objective was to quantify the long-term economic benefits of achieving this goal.

Methods: Using a microsimulation model and a synthetic cohort of Australian children and adolescents aged 4–17 years, we estimated the excess per capita lifetime costs of overweight and obesity. Using these results and population projections for 2030, we estimated the potential lifetime cost savings that could be achieved through attaining the National Obesity Strategy goal.

Results: Compared with their peers of a healthy weight, children and adolescents with overweight and obesity were estimated to incur, per capita, excess lifetime costs (discounted) of approximately $19 700 and $46 700, respectively (in 2030 Australian dollars). Achieving the National Obesity Strategy's goal was estimated to save approximately $7.44 billion, predominantly through reductions in lifetime obesity-related healthcare costs and premature mortality.

Conclusion: Our results demonstrate the considerable economic benefits that could be achieved by reducing the current prevalence of childhood and adolescent overweight and obesity in Australia; they provide justification for investment in prevention and treatment for this demographic.

Introduction

Childhood and adolescent overweight and obesity is a major public health issue in Australia, affecting one in four young people aged 2–17 years in 2017–18.[1] This is a concern, not only because of the immediate impacts on physical and psychological health[2] but because excess weight tends to persist into adulthood[3], increasing the risk of obesity-associated morbidity and premature mortality.

The Australian Government has acknowledged the severity of this problem with the National Obesity Strategy 2022–2032, a 10-year framework for action to reduce the prevalence of overweight and obesity in Australia through prevention and treatment.[4] A primary aim of the National Obesity Strategy is to 'reduce individual, health and national economic costs due to overweight and obesity', partly through an aspirational goal of reducing overweight and obesity in children and adolescents by at least 5% by 2030.[4]

However, less than 2% of health expenditure targets prevention[5] and many children and adolescents with obesity lack access to appropriate weight management services[6]; thus, the health system's capacity to achieve this goal is insufficient.[4] This may be because, although the costs of interventions for childhood and adolescent overweight and obesity are incurred upfront, their benefits will not be fully realised for many years.[7] Faced with competing demands for scarce resources within short-term political cycles, decision-makers tend to favour investment in different patient populations with more immediate needs.

Demonstrating the long-term costs of childhood and adolescent overweight and obesity and the potential cost savings that could be achieved through reduced prevalence of these conditions could support the economic case for investment in prevention and treatment for this demographic.

As such, the aims of this study were to:

1. Estimate the excess lifetime costs for Australian children and adolescents with overweight and obesity, compared with their peers of a healthy weight; and
2. Estimate the potential lifetime cost savings that could be achieved through a 5% reduction in the prevalence of overweight and obesity among Australian children and adolescents aged 4–17 years by 2030 (from 25% to 20%).

Methods

To address our study aims, we used a previously validated microsimulation model (the Early Prevention of Obesity in Childhood [EPOCH] Life-course model)[8] and a synthetic cohort of Australian children and adolescents aged 4–17 to estimate the lifetime excess costs of childhood overweight and obesity. We then used these results and population projections for the year 2030 to estimate the difference in total costs of childhood overweight and obesity under a base case scenario (no change in current prevalence of overweight and obesity) and a scenario of a 5% reduction in the prevalence of overweight and obesity (from 25% to 20%).

Model input population

The synthetic cohort was created using data from the Longitudinal Study of Australian Children (LSAC).[9] This nationally representative, dual-cohort study has collected individual-level data in waves biennially since 2004, including direct measurements of height and weight for the calculation of body mass index (BMI). For our purposes, we used seven waves of data from the K cohort (calendar years between 2004 and 2016, with participant ages spanning 4–5 years to 16–17 years) to construct a synthetic cross-sectional cohort of 27 423 children and adolescents aged 4–17 years. The age distribution of the synthetic cohort was comparable with Australian population census estimates from 2021.[10] See Appendix 1, available from: https://figshare.com/articles/journal_contribution/Economic_benefits_of_reducing_childhood_and_adolescent_overweight_and_obesity_-_supplementary_materal/26567650?file=48388486.

Microsimulation model description

The EPOCH Life-course model simulates individual-level BMI trajectories of Australian children and adolescents at annual discrete time–steps over a lifetime time horizon. Weight status associated with all-cause mortality probability, healthcare costs and indirect costs are incorporated in the model, with each component described in detail below. The model code is written in Stata v16.1[11] and is available on request. A schematic illustration of the model and a summary of model assumptions is provided in Appendix 2 (see supplementary file, available from: https://figshare.com/articles/journal_contribution/Economic_benefits_of_reducing_childhood_and_adolescent_overweight_and_obesity_-_supplementary_materal/26567650?file=48388486).

Lifetime BMI trajectories

Annual BMI change is calculated from multi-variable equations based on individuals' age, sex and current BMI (at the start of the annual cycle). These equations were derived from LSAC data for children and adolescents 4–19 years[9,12] and from Australian National Health Survey data 1995–2012 for adults 20 years and older.[13] Weight status is categorised based on World Health Organization (WHO) BMI age and sex-specific cutpoints for children and adolescents 4–19 years (healthy weight, overweight and obesity)[14] and WHO BMI cutpoints for adults 20 years and older (underweight/normal weight, overweight and obesity classes 1–3).[15]

Mortality

Annual all-cause mortality probability is calculated based on age, sex and weight status using methods previously described.[13] Age- and sex-specific mortality rates were sourced from 2019–2021 Australian life expectancy tables[16], with differential mortality hazard ratios for each 5-point increase in BMI compared with healthy weight sourced from a meta-analysis involving approximately 900 000 participants.[17]

Healthcare costs

Annual healthcare costs are calculated based on age, sex and weight status using a 'top-down approach', as previously described.[18] These methods use Australian Institute of Health and Welfare (AIHW) records of disease expenditure in Australia 2018–19.[19] They apply percentage excess costs for those with overweight and obesity classes relative to healthy weight, derived from an Australian population-based study (for children and adolescents up to 14 years)[20] and a systematic review (for individuals aged 15 years and older).[21] See Appendix 3, available from:https://figshare.com/articles/journal_contribution/Economic_benefits_of_reducing_childhood_and_adolescent_overweight_and_obesity_-_supplementary_materal/26567650?file=48388486.

Indirect costs

Annual indirect costs from productivity losses caused by weight-associated absenteeism and premature mortality were calculated using a human capital approach, which reflects lost productive potential.[22] This included excess school absenteeism for children and adolescents aged 6–14 with obesity, excess paid work absenteeism for individuals aged 15–67 years, with overweight and obesity classes 1-3. Weight-associated absenteeism data were sourced from Australian studies.[23,24] School absenteeism was valued using the average daily wage (to represent lost caregiver productivity)[23]; absenteeism from paid work was valued using age and sex-adjusted average daily wage, accounting for participation and unemployment rates using an equation previously described.[8] Average daily wage rates were sourced from Australian Bureau of Statistics (ABS) data for the calendar year 2022.[25] See Appendix 4, available from: https://figshare.com/articles/journal_contribution/Economic_benefits_of_reducing_childhood_and_adolescent_overweight_and_obesity_-_supplementary_materal/26567650?file=48388486.

Costs related to premature mortality were derived using an absolute approach: simulated deaths of individuals in the synthetic cohort before a threshold of 81 years for males and 85 years for females were deemed premature.[26] These threshold ages were based on current life expectancy at birth in Australia.[16] Potential years of life lost (PYLL) were calculated by subtracting the age of death from the respective threshold ages. To generate a monetary value for premature mortality, PYLL were multiplied by Australian GDP per capita: $93 022.40 in 2022 Australian dollars (AUD).[27] This method values the economic contributions of all individuals equally.[28]

Lifetime excess costs for children and adolescents with overweight and obesity

The synthetic cohort was simulated over a lifetime time horizon (until individuals reached death or 100 years). The base year and currency for costs were 2030 and AUD respectively, with unit costs inflated appropriately (assuming a 2% annual inflation rate).[29] Future costs incurred beyond 2030 (including premature mortality) were discounted by 5% annually in line with recommendations in Australia.[30] Mean lifetime costs per child/adolescent aged 4–17 years, stratified by starting weight status (healthy weight, overweight, obesity and overweight/obesity combined), were determined. Mean excess costs per child/adolescent aged 4–17 years with overweight, obesity and overweight/obesity combined were calculated by subtracting the mean lifetime costs per child/adolescent with healthy weight from the mean lifetime costs per child/adolescent from the respective weight categories.

Potential cost savings from a 5% reduction in overweight and obesity in 2030

A population of Australian children and adolescents aged 4–17 years for the year 2030 was estimated at 5 075 502 using the Australian Bureau of Statistics population projections under medium assumptions of fertility and migration rates.[31] We assumed the prevalence of childhood and adolescent overweight and obesity in 2030 would remain at 25%, the same as the most recent population estimates from the 2017-18 Australian National Health Survey.[1] We believe this assumption is valid given the plateau in the prevalence of childhood and adolescent overweight and obesity over the past decade.[32]

We calculated 'business as usual' total population costs by multiplying the projected 2030 population of children and adolescents aged 4–17 years with healthy weight and overweight/obesity (combined) by the mean lifetime costs for each weight category, respectively (from the synthetic cohort as described above). We then repeated these calculations under a 'scenario' where there was a 5% reduction in the population prevalence of overweight/obesity (combined) in 2030 from 25% to 20%. Population lifetime cost savings from achieving this scenario were derived from the difference between total population costs under 'business as usual' and 'scenario' conditions.

Uncertainty and sensitivity analyses

To explore uncertainty related to our lifetime costs and population cost savings estimates, we undertook multiple

one-way deterministic sensitivity analyses adjusting the following parameters:

- 2030 population projections under low or high assumptions of migration and fertility rates (n = 4 858 927 and n = 5 290 020 respectively)
- Discount rates for future healthcare costs and indirect costs of 3% and 7%
- Lower and upper interquartile ranges of weight-status-associated % excess healthcare cost estimates; and
- Upper and lower 95% confidence intervals of mortality hazard ratios associated with each 5-point increase in BMI.

Further, because a 5% reduction in the prevalence of overweight and obesity in children and adolescents is an aspirational goal, we estimated the population cost savings that could be achieved from a smaller 2.5% reduction in prevalence. Finally, because policymakers may be interested in what cost savings could be achieved during a shorter, more policy-relevant timeframe, we estimated the population cost savings of a 5% reduction in the prevalence of overweight and obesity by 2030 during a 10-year time horizon.

Results

Mean discounted lifetime costs ranged from $107 389 per child/adolescent with healthy weight to $154 110 per child/adolescent with obesity (Table 1). Compared with their peers of a healthy weight, children and adolescents aged 4–17 years with overweight and obesity were estimated to incur excess lifetime costs of $19 706 and $46 721, respectively. These estimates were largely comprised of excess healthcare and premature mortality costs; the effects of premature mortality were much greater in children and adolescents with obesity (comprising approximately 57% of total excess lifetime costs per child/adolescent with obesity).

Table 1. Discounted lifetime costs (in 2030 Australian dollars) per child/adolescent aged 4–17

Cost category		Healthy weight (95% CI)	Overweight (95% CI)	Obesity (95% CI)	Overweight and obesity (95% CI)
Healthcare costs	Mean cost	$74 997 ($74 503, $75 491)	$83 386 ($82 524, $84 248)	$90 356 ($88 969, $91 743)	$85 863 ($85 024, $86 701)
	Excess costs		$8389 ($8022, $8756)	$15 359 ($14 467, $16 252)	$10 866 ($10 522, $11 209)
Absenteeism costs	Mean cost	$382 ($371, $391)	$1794 ($1773, $1815)	$5189 ($5122, $5255)	$3000 ($2914, $3086)
	Excess costs		$1413 ($1401, $1424)	$4807 ($4750, $4864)	$2619 ($2543, $2695)
Premature mortality costs	Mean cost	$32 011 ($31 774, $32 248)	$41 915 ($41 546, $42 285)	$58 565 ($57 539, $59 592)	$47 831 ($47 214, $48 449)
	Excess costs		$9905 ($9772, $10 037)	$26 555 ($25 765, $27 344)	$15 821 ($15 440, $16 202)
Total lifetime costs	Mean cost	$107 389 ($106 648, $108 130)	$127 095 ($125 843, $128 347)	$154 110 ($151 630, $156 590)	$136 694 ($135 152, $138 236)
	Excess costs		$19 706 ($19 195, $20 218)	$46 721 ($44 983, $48 460)	$29 305 ($28 504, $30 106)

CI = confidence interval.

Table 2. Estimated 2030 population lifetime costs and potential cost savings (in 2030 Australian dollars) under different scenarios of reduction in the prevalence of overweight and obesity

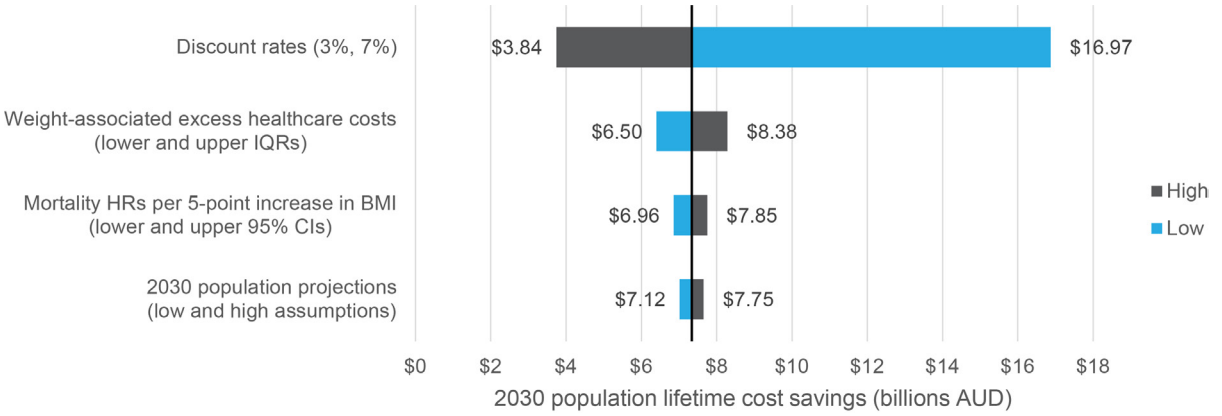
Scenario		Projected 2030 population of children and adolescents [A] *n* (%)	Estimated discounted lifetime cost per child/ adolescent [B]*(95% CI)	Population lifetime costs [A X B] (95% CI)
Business as usual	Healthy weight	[3 806 627] (75)	[$107 389] ($106 648, $108 130)	[$409 billion] ($406 billion, $412 billion)
	Overweight and obesity	[1 268 875] (25)	[$136 694] ($135 152, $138 236)	[$173 billion] ($171 billion, $175 billion)
	Total [C]	[5 075 502](100)		[$582 billion] ($577 billion, $587 billion)
5% reduction in prevalence of overweight and obesity	Healthy weight	[4 060 402] (80)	[$107 389] ($106 648, $108 130)	[$436 billion] ($433 billion, $439 billion)
	Overweight and obesity	[1 015 100] (20)	[$136 694] ($135 152, $138 236)	[$139 billion] ($137 billion, $140 billion)
	Total [D]	[5 075 502] (100)		[$575 billion] ($570 billion, $579 billion)
	Cost savings [C-D] (95% CI)		[$7.44 billion] ($7.23 billion, $7.64 billion)	
2.5% reduction in prevalence of overweight and obesity	Healthy weight	[3 933 514] (77.5)	[$107 389] ($106 648, $108 130)	[$422 billion] ($420 billion, $425 billion)
	Overweight and obesity	[1 141 988] (22.5)	[$136 694] ($135 152, $138 236)	[$156 billion] ($154 billion, $158 billion)
	Total [E]	[5 075 502] (100)		[$579 billion] ($574 billion, $583 billion)
	Cost savings [C-E] (95% CI)		[$3.72 billion] ($3.62 billion, $3.82 billion)	

CI = confidence interval.
*Sourced from the synthetic cohort in this study (see Table 1)

We estimated that achieving a 5% reduction in the prevalence of overweight and obesity (combined) among Australian children and adolescents aged 4–17 years by 2030 (from 25% to 20%) would lead to lifetime cost savings of approximately $7.44 billion (in 2030 AUD) (Table 2). Even with a smaller reduction in prevalence of overweight and obesity of 2.5%, considerable lifetime cost savings of approximately $3.72 billion could still be achieved (Table 2).

Our estimates were most sensitive to the discount rate used, with a 3% rate increasing the potential population cost savings to $16.97 billion and a 7% rate decreasing the cost savings to $3.84 billion (Figure 1). Other one-way sensitivity analyses were less impactful, with estimated population lifetime cost-savings falling within a range between $6.5 and $8.38 billion (Figure 1).

Figure 1. One-way sensitivity analyses of population lifetime cost-saving estimates (base case scenario = black line)



AUD = Australian dollars; BMI = body mass index; CI = confidence interval; HR = hazard ratio; IQR = interquartile range.

When using a shorter time horizon of 10 years for simulation, reducing the prevalence of overweight and obesity by 5% in 2030 was still estimated to lead to substantial cost savings of approximately $987 million (see Appendix 4, available from: https://figshare.com/articles/journal_contribution/Economic_benefits_of_reducing_childhood_and_adolescent_overweight_and_obesity_-_supplementary_materal/26567650?file=48388486).

Discussion

In this study, we have used a microsimulation model to demonstrate the excess lifetime costs of Australian children and adolescents aged 4–17 years living with overweight and obesity, as well as the potential population cost savings that could be achieved through a 5% reduction in the prevalence of these conditions in this age cohort by 2030 (from 25% to 20%). Achieving this reduction in prevalence, an aspirational goal of Australia's National Obesity Strategy 2022–2032, is estimated to lead to considerable population cost savings of $7.44 billion (in 2030 AUD), predominantly through healthcare costs avoided and reductions in premature mortality. These findings will be useful for policymakers in Australia because the estimated economic benefits would be likely to offset the projected expenditure required for implementing a range of primary prevention strategies[33] and strengthening the health system to improve access to early intervention and care.[4]

To the best of our knowledge, this is the first time that lifetime costs of childhood and adolescent overweight and obesity have been estimated using an Australian cohort. Previous international studies have estimated the excess lifetime healthcare costs of children and adolescents with obesity, including a 2014 systematic review of six US studies ($27 846 per child/adolescent with obesity in 2030 AUD)[34] and a 2018 systematic review of 13 studies from the US and Europe ($31 555 per boy/$38 179 per girl with obesity in 2030 AUD).[35] These estimates are greater than our findings of approximately $15 359 in excess lifetime healthcare costs per child/adolescent with obesity; this can be partly explained by the lower discount rate of 3% used in the other studies; using this lower rate would increase our estimate to $22 135 in 2030 AUD.

The 2018 systematic review mentioned above also reported lifetime excess indirect costs of $258 555 (in 2030 AUD) for boys and $249 967 for girls with obesity, in line with literature that suggests the indirect costs of obesity are greater than the direct healthcare costs.[35] Although this is consistent with our findings, the magnitude of excess indirect costs we report is considerably less than these estimates (at approximately $31 362 per child/adolescent with obesity). This can be explained by the exclusion of weight-status associated income penalties in our study, which made up most of the indirect costs in the estimates from the systematic review.[35]

Our study adds to the limited literature demonstrating the economic benefits of reducing the prevalence of childhood and adolescent overweight and obesity. A US study estimated lifetime medical cost savings of $1.02 billion or $127 per capita (in 2030 AUD) from a 1% reduction in the prevalence of overweight and obesity in adolescents aged 16–17 years.[36] A German study modelled a much larger 14% reduction in the prevalence of childhood and adolescent overweight and obesity, which was estimated to result in lifetime indirect cost savings of $54.6 million (in 2030 AUD).[37] Our estimated population cost savings of $7.44 billion ($2.75 billion in healthcare cost savings and $4.68 billion in indirect cost savings; approximately $1465 per capita) are much larger than these estimates. This is likely accounted for by our inclusion of both healthcare and indirect cost savings, a greater population prevalence reduction than the US study and different methods in valuing productivity losses attributable to overweight and obesity compared to the German study.

Strengths of our study include our microsimulation modelling approach, which allows the simulation of obesity I, II and III classes in adults, where costs are generally greater than obesity alone.[38] Further, our range of sensitivity analyses demonstrated that a reduction in the prevalence of childhood and adolescent overweight and obesity will result in considerable cost savings. This is regardless of which model parameters are used, whether a smaller than intended reduction is achieved (2.5%), or even if policymakers prefer to focus on the economic benefits that could be achieved with a shorter, more policy-relevant timeframe.

A limitation of our study is our use of longitudinal data to construct a synthetic cross-sectional cohort of children and adolescents. This was because we needed individual-level data for the model input population and because a cohort dataset of all children aged 4–17 years in Australia was unavailable. Secondly, we only included a limited range of indirect costs in our modelling. There is evidence that excess weight is associated with presenteeism (reduced productivity while at work) and permanent work loss, resulting in greater workers' compensation payments and disability pensions[39]; other studies have accounted for weight-associated income penalties.[35] We did not include these indirect costs because of a lack of data in the Australian context. Further, we do not account for economic costs related to decreased utility or 'quality of life' for individuals with overweight and obesity. This means we have potentially underestimated the lifetime indirect costs of childhood and adolescent overweight and obesity and, in turn, the economic benefits that could be achieved through a reduction in population prevalence. Finally, our modelling does not account for the presence of unobserved factors influencing the development of overweight and obesity and associated costs, such as ethnicity and socio-economic position.[40,41] This would be an important area of future research.

Conclusion

In summary, Australian children and adolescents with overweight and obesity are estimated to incur significant excess costs during their lifetime compared with their peers of a healthy weight. If prevalence remains at current levels, this will translate to a considerable future health and economic burden to society. However, if the goal of Australia's National Obesity Strategy is achieved and current prevalence is reduced by 5% (from 25% to 20%), there is estimated to be a population cost saving of approximately $7.44 billion (in 2030 AUD), likely offsetting the expenditure required to deliver interventions to achieve this goal. These results will be valuable to decision-makers in justifying investment in the prevention and treatment of childhood and adolescent overweight and obesity in the face of competing demands for scarce resources.

Ethics statement

Ethics approval for the study has been granted by the University of Sydney Human Research Ethics Committee (2018/726).

Data availability

The data that support the findings of this study are available from the Department of Social Services, Australian Government, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are available from the authors on reasonable request and with permission of Department of Social Services, Australian Government. Additionally, the Stata code for the microsimulation model in this study is available from the authors on reasonable request.

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Peer review and provenance

Externally peer reviewed, not commissioned.

Competing interests

The authors declare there is no potential conflict of interest.

Author contributions

JC, TL and AH conceived the study design. JC conducted all data analyses with feedback from TL and AH. All authors contributed to the writing and editing of the manuscript.

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