







## RESEARCH ARTICLE

# Exploring 12-Year trends in childhood obesity prevalence for the Republic of Ireland – a national study using survey data from 2002 and 2014 [version 1; peer review: 2 approved]

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## Abstract





**Background:** The prevalence of overweight and obesity among children may have reached a plateau in some developed countries, including Ireland. The aim of this study was to examine 12-year trends in the prevalence of overweight and obesity among primary-school-aged children in the Republic of Ireland between 2002 and 2014.

**Methods:** Two large-scale oral health cross-sectional surveys of primary-school-aged children aged 4–13 years were conducted 12 years apart in 2002 (n=14,055; response rate=68%) and 2014 (n=5,223; response rate=67%). Both surveys included standardised and calibrated height and weight measures. Ownership of a means-tested medical card determined economic status. Standard International Obesity Task Force criteria were applied to determine the prevalence of overweight and obesity.

**Results:** The overall prevalence of overweight/obesity among 4–13-year-olds significantly decreased from 26% (95% CI: 25.1%–26.5%) in 2002 to 24% (95% CI: 22.4%–24.7%) in 2014. Among boys and girls aged 4–13 years, the significant decrease was from 23% (95% CI: 22.1%–24.1%) to 20% (95% CI: 18.9%–22.0 and 28% (95% CI: 27.4%–29.5%) to 27% (95% CI: 25.0%–28.4%), respectively. Among 5-year-old children, the overall prevalence of overweight and obesity significantly decreased from 25% (95% CI: 23.7%–26.2%) to 22% (95% CI: 19.9%–23.4%). In 2002, the estimated prevalence of overweight/obesity was similar in children with and without medical cards, whereas in 2014, overall prevalence was higher in those with medical cards.

## Open Peer Review

Approval Status  

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**Conclusions:** Results suggest a fall in the prevalence of overweight/obesity between 2002 and 2014, and may suggest a favourable cohort effect. Despite this fall, the overall prevalence remains high and socioeconomic disparities have increased.

### Keywords

Overweight, Obesity, Children, Cohort, Economic disadvantage, Ireland



This article is included in the [Maternal and Child Health](#) collection.

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## Introduction

Childhood obesity remains a global public health priority. In the Republic of Ireland there was a sharp increase in the prevalence of overweight and obesity between the mid-20<sup>th</sup> century and the start of the 21<sup>st</sup> century. During this period, the average weight of 14-year-olds increased by 65% among boys and 48% among girls, with most of the increase occurring between 1970 and 2002<sup>1</sup>. This trend has been mirrored in most developed and developing countries over the last 30 years<sup>2</sup>.

A high body mass index (BMI) in childhood is related to adverse outcomes in adult life such as a greater risk of morbidity<sup>3</sup>, including some cancers<sup>4</sup> and type 2 diabetes<sup>5</sup>. It is also associated with a greater likelihood of premature death<sup>6,7</sup>. In addition, excess weight in childhood is positively related to lower socioeconomic status<sup>8</sup> and inversely associated with psychological well-being<sup>9-12</sup>. While the personal and social costs related to childhood overweight and obesity are incalculable, financial costs should also be considered. A recent study, conducted in 2017, estimated the total lifetime cost of childhood obesity to be €4.6 billion for the Republic of Ireland, with 21% of costs being direct healthcare costs and more than two-thirds (79%) being indirect costs due to absenteeism, premature mortality and lifetime income losses<sup>13</sup>. This research also suggested that a 1% and 5% reduction in population mean childhood BMI would be associated with a €270 million and €1.1 billion reduction in projected lifetime costs attributable to childhood overweight/obesity in Ireland.

Between 2002 and 2014, 14 nationally or regionally representative studies were carried out in Ireland to determine childhood obesity prevalence estimates. In a systematic review of these studies there was some evidence of a plateau in childhood overweight and obesity<sup>14</sup>. However, this apparent plateau was based on studies which were heterogeneous in their methods in terms of whether sampling frames were national or regional, in addition to varying response rates<sup>15</sup>.

In a large national oral health survey of over 14,000 children conducted in 2002, 26% of boys and girls in primary school in the Republic of Ireland were overweight or obese<sup>16</sup>. This survey also found that prevalence estimates did not vary greatly by economic status as defined on the basis of access to a medical card. In the current research, we have replicated the methods of the 2002 oral health survey in a sample of children recruited in 2014. The aim of this research was to estimate the prevalence of overweight and obesity among children in the Republic of Ireland (including variation by economic status), drawing on data from over 5,000 children aged 4–13 years, and to compare findings with results from the 2002 survey.

## Methods

### Sample

The methods used in the 2002 study have been reported elsewhere<sup>16</sup>. Briefly, the sample was a stratified randomised cluster sample, with the school as the primary sampling unit. Schools were categorised according to health board region (Community Care Area), school size (small, medium or large) and, for oral

health reasons, whether they were located in a fluoridated or non-fluoridated area. Within each Community Care/Dental Area, schools were randomly selected to ensure a balance for fluoridation status (where appropriate) and for size of the school. A list of all children in Junior Infants (5-year-olds) and in 6<sup>th</sup> class (12-year-olds) was obtained from selected schools that consented to participate.

The selection of children was on the basis of age, sex, geographical location of the school attended and whether the school was located in a fluoridated or non-fluoridated area<sup>17</sup>. The required number of children from each class (age group) was selected randomly and consent forms were issued only to those children selected. Informed consent was obtained from the parents/guardians of participating children and assent from the 12-year-old children<sup>17</sup>. The sample of schools was prepared using stratified cluster random sampling. A list of primary schools in Dublin, Cork and Kerry in SY 2011–2012) formed the sampling frame for the study. Schools for children with special educational needs were not included in the sampling frame<sup>17</sup>. The final sample included 14,055 children attending primary schools in Dublin, Cork and Kerry; We have replicated the methods of the dental health survey from 2002 in a sample of 5,223 children recruited in the 2014 study period (November 2013 to May 2014)<sup>17</sup>. The Clinical Research Ethics Committee of the Cork Teaching Hospitals approved both oral health studies (National Survey of Children's Dental Health approved on 02/10/2001, FACCT (ECM 5 (2) 07/05/13).

### Measurement of height, weight and socioeconomic status

In the 2002 survey, height was measured using a Leicester height/length stadiometer (CMS Weighting Equipment, London, UK). Weights were measured using a Soehnle 7403 Mediscale (Soehnle Professional GmbH & Co, Murrhardt, Germany). For the 2014 survey, height was measured using a Seca 213 portable stadiometer (Seca, Birmingham, UK). Weight was measured using Tanita WB 100SMA weighing scales (Tanita Corporation, IL, USA). For both surveys, the weight scales were calibrated using 75kg calibration weights prior to the commencement of the study. BMI was calculated as weight divided by the square of height. Standard International Obesity Task Force (IOTF) criteria<sup>18</sup> were applied to determine prevalence estimates. Weight and height measurements were taken by researchers who were thoroughly trained according to the study research protocols.

Socioeconomic status was measured by medical card status (means-tested public sector healthcare). Anyone over the age of 16 years who is ordinarily resident in the Republic of Ireland can apply for a Medical Card (which entitles the holder to a range of free health services) or a GP visit card (which entitles the holder to visit the family doctor free-of-charge)<sup>19</sup>. People qualify for these cards by being means-tested; weekly income must be below an income threshold. Children whose parents had a Medical Card or GP visit card were categorised as being economically disadvantaged; children whose parents did not have a Medical Card/GP card were categorised as being non-economically disadvantaged.

### Data management and analysis

Data from the 2002 and 2014 surveys were recorded, cleaned and coded by the Oral Health Services Research Centre. Data analysis was conducted using SAS Version 9.4 (SAS Institute Inc., Cary, NC, USA). Two-sample t-tests between proportions were performed to determine statistical differences. Data are presented as proportions and 95% confidence intervals using binomial approximation. For all analyses, a *p* value (two-tailed) of less than 0.05 was considered to indicate statistical significance.

### Results

The overall response rates for children in the 2002 and 2014 surveys were 68% and 67%, respectively. The prevalence of childhood overweight and obesity for the years 2002 and 2014, according to the IOTF classification, are presented by age and sex in [Table 1](#)<sup>20</sup>. In 2014, among children aged 4–13 years, one-in-five boys (20%) and more than one-in-four girls (27%) were either overweight or obese. One-in-25 boys (4%) and approximately one-in-14 girls (7%) were obese. The prevalence of overweight was also higher in girls (20%) than boys (16%).

**Table 1. Prevalence of overweight and obesity among primary school children in the Republic of Ireland in 2002 and 2014.**

	2002	2014	Change in prevalence 2002 and 2014
<b>4–13-year-olds</b>			
<b>Overweight</b>			
Boys	17% (16.4% to 18.2%)	16% (14.7% to 17.6%)	-1%
Girls	21% (20.3% to 22.2%)	20% (18.6% to 21.7%)	-1%
Total	19% (18.6% to 19.9%)	18% (17.1% to 19.2%)	-1%*
<b>Obese</b>			
Boys	6% (5.3% to 6.3%)	4% (3.5% to 5.1%)	-2%*
Girls	7% (6.6% to 7.8%)	7% (5.6% to 7.5%)	0%
Total	6% (6.1% to 6.9%)	5% (4.8% to 6.0%)	-1%*
<b>Overweight and obese</b>			
Boys	23% (22.1% to 24.1%)	20% (18.9% to 22.0%)	-3%*
Girls	28% (27.4% to 29.5%)	27% (25.0% to 28.4%)	-1%*
Total	26% (25.1% to 26.5%)	24% (22.4% to 24.7%)	-2%*
<b>5-year-olds</b>			
<b>Overweight</b>			
Boys	17% (15.3% to 18.3%)	13% (11.2% to 15.3%)	-4%*
Girls	22% (20.4% to 23.8%)	20% (17.4% to 22.3%)	-2%
Total	19% (18.2% to 20.4%)	16% (14.9% to 18.1%)	-3%*
<b>Obese</b>			
Boys	5% (3.9% to 5.6%)	4% (3.0% to 5.4%)	-1%
Girls	7% (5.6% to 7.6%)	6% (4.7% to 7.6%)	-1%
Total	6% (5.0% to 6.3%)	5% (4.2% to 6.1%)	-1%
<b>Overweight and obese</b>			
Boys	22% (19.9% to 23.1%)	17% (15.1% to 19.6%)	-5%*
Girls	29% (26.8% to 30.5%)	26% (23.3% to 28.7%)	-3%
Total	25% (23.7% to 26.2%)	22% (19.9% to 23.4%)	-3%*

	2002	2014	Change in prevalence 2002 and 2014
<b>12-year-olds</b>			
<b>Overweight</b>			
Boys	19% (17.2% to 21.5%)	18% (15.4% to 20.6%)	-1%
Girls	19% (16.9% to 21.0%)	21% (18.5% to 24.2%)	2%
Total	19% (17.7% to 20.6%)	20% (17.7% to 21.6%)	1%
<b>Obese</b>			
Boys	6% (4.6% to 7.2%)	4% (2.8% to 5.5%)	-2%*
Girls	6% (5.0% to 7.5%)	7% (5.1% to 8.6%)	1%
Total	6% (5.2% to 7.0%)	5% (4.4% to 6.6%)	-1%
<b>Overweight and obese</b>			
Boys	25% (22.9% to 27.6%)	22% (19.4% to 25.0%)	-3%*
Girls	25% (22.9% to 27.5%)	28% (25.1% to 31.4%)	3%*
Total	25% (23.6% to 26.8%)	25% (23.1% to 27.3%)	0%

\*statistically significant

Between 2002 and 2014, among children aged 4–13 years, there were statistically significant decreases in the prevalence of overweight from 19% (95% CI: 18.6%–19.9%) to 18% (95% CI: 17.1%–19.2%), of obesity from 6% (95% CI: 6.1%–6.9%) to 5% (95% CI: 4.8%–6.0%) and of overweight and obesity combined from 26% (95% CI: 25.1%–26.5%) to 24% (95% CI: 22.4%–24.7%). Among boys aged 4–13 years, there were significant decreases in both the prevalence of obesity from 6% (95% CI: 5.3%–6.3%) to 4% (95% CI: 3.5%–5.1%) and of overweight and obesity combined from 23% (95% CI: 22.1%–24.1%) to 20% (95% CI: 18.9%–22.0%). Among girls aged 4–13 years, a significant decrease was only seen in the prevalence of overweight and obesity combined from 28% (95% CI: 27.4%–29.5%) to 27% (95% CI: 25.0%–28.4%).

When only 5-year-olds were analysed, there was a statistically significant decrease in the prevalence of overweight from 19% (95% CI: 18.2%–20.4%) to 16% (95% CI: 14.9%–18.1%) and in the prevalence of overweight and obesity combined from 25% (95% CI: 23.7%–26.2%) to 22% (95% CI: 19.9%–23.4%) over the 12 years. Significant decreases were also observed among boys aged 5 years in the prevalence of overweight from 17% (95% CI: 15.3%–18.3%) to 13% (95% CI: 11.2%–15.3%) and in the prevalence of overweight and obesity combined from 22% (95% CI: 19.9%–23.1%) to 17% (95% CI: 15.1%–19.6%). Among 12-year-olds, while overall there were no statistically significant changes in prevalence between 2002 and 2014, among girls there was a significant increase in the prevalence of overweight and obesity combined from 25% (95% CI: 22.9%–27.5%) to 28% (95% CI: 25.1%–31.4%). Among boys aged 12 years, there were significant decreases in the prevalence of obesity from 6% (95% CI: 4.6%–7.2%) to 4% (95% CI: 2.8%–5.5%) and of overweight and obesity combined from 25% (95% CI: 22.9%–27.6%) to 22% (95% CI: 19.4%–25.0%).

In 2002, 23% (n=3,244) of the sample were characterised as economically disadvantaged compared to 35% (n=1,831) in 2014. In the 2002 survey, children who were economically disadvantaged compared to those who were non-economically disadvantaged had only slightly higher rates of obesity (7.6% vs. 6.2%) and of overweight and obesity combined (26.1% vs. 25.7%) (Table 2)<sup>20</sup>. However, over the 12-year period this gap increased, with higher rates of overweight (20.5% vs. 16.6%) and obesity (7.6% vs. 4.2%) among children who were economically disadvantaged. The prevalence of overweight and obesity combined was 28.0% in 2014 among children who were from economically disadvantaged families compared to 20.9% among children who were non-economically disadvantaged.

## Discussion

This paper presents data from two large national studies of Irish children aged 4–13 years who were examined in 2002 and 2014 by trained oral health survey teams, coordinated by the Oral Health Services Research Centre, University College Cork, using standardised methods. In this 12-year period there has been evidence of a slight fall in the overall prevalence of overweight and obesity combined, with a statistically significant decrease of 2% among children aged 4–13 years. It should be noted that some of the differences observed may be due to the age distribution of the sample. The dental survey targeted Junior Infants and 6<sup>th</sup> class students, hence the majority of the sample are 5-year-olds and 12-year-olds, with a clustering of ages around these target years. Therefore, we focused on age-specific trends. There was no change in the prevalence of overweight and obesity among 12-year-olds. However, there was a significant decrease of 3% in the prevalence of overweight and obesity among 5 year-olds, which suggests a possible favourable cohort effect.

**Table 2. Prevalence of overweight and obesity among primary school children in the Republic of Ireland in 2002 and 2014 by Economic Disadvantage (ED) status.**

	2002	2014	Change in prevalence 2002 and 2014
<b>4-13-year-olds</b>			
<b>Overweight</b>			
Not ED	19.5% (2094)	16.6% (549)	-2.9%
ED	18.5% (600)	20.5% (372)	2.0%
Difference between ED and not ED	<b>-1.10%</b>	<b>3.81%</b>	<b>4.91%</b>
<b>Obese</b>			
Not ED	6.2% (660)	4.2% (139)	-2.0%
ED	7.6% (247)	7.6% (138)	0.0%
Difference between ED and not ED	<b>1.50%</b>	<b>3.38%</b>	<b>1.88%</b>
<b>Overweight or obese</b>			
Not ED	25.7% (2754)	20.9% (688)	-4.8%
ED	26.1% (847)	28.0% (510)	1.9%
Difference between ED and not ED	<b>0.40%</b>	<b>7.19%</b>	<b>6.79%</b>
<b>5-year-olds</b>			
<b>Overweight</b>			
Not ED	20.0% (740)	15.6% (216)	-4.4%
ED	16.7% (170)	17.8% (120)	1.1%
Difference between ED and not ED	<b>-3.30%</b>	<b>2.17%</b>	<b>5.47%</b>
<b>Obese</b>			
Not ED	5.5% (202)	4.2% (58)	-1.3%
ED	6.1% (62)	7.3% (49)	1.2%
Difference between ED and not ED	<b>0.60%</b>	<b>3.07%</b>	<b>2.47%</b>
<b>Overweight or obese</b>			
Not ED	25.5% (942)	19.8% (274)	-5.7%
ED	22.8% (232)	25.0% (169)	2.2%
Difference between ED and not ED	<b>-2.70%</b>	<b>5.24%</b>	<b>7.94%</b>
<b>12-year-olds</b>			
<b>Overweight</b>			
Not ED	18.3% (386)	18.2% (197)	-0.1%
ED	21.9% (129)	22.3% (116)	0.4%
Difference between ED and not ED	<b>3.70%</b>	<b>4.10%</b>	<b>0.40%</b>
<b>Obese</b>			
Not ED	5.6% (119)	4.0% (43)	-1.6%
ED	7.7% (45)	8.5% (44)	0.8%
Difference between ED and not ED	<b>2.00%</b>	<b>4.49%</b>	<b>2.49%</b>
<b>Overweight or obese</b>			
Not ED	23.9% (505)	22.2% (240)	-1.7%
ED	29.6% (174)	30.8% (160)	1.2%
Difference between ED and not ED	<b>5.70%</b>	<b>8.59%</b>	<b>2.89%</b>



The findings from this study are consistent with previous evidence suggesting that childhood obesity rates have stabilised in the Republic of Ireland<sup>14,15,21</sup>, in addition to some countries in Europe and in Australia, Japan and the USA<sup>22</sup>; they may be decreasing in other countries such as Sweden<sup>23</sup>, Denmark<sup>24</sup> and Switzerland<sup>25</sup>. However, while there may be a favourable trend overall, the prevalence gap between economically disadvantaged and non-economically disadvantaged children in the Republic of Ireland is cause for concern. It should be noted that the 2002 survey was carried out at time of affluence in Ireland at the height of the Celtic Tiger years, whereas the 2014 study was held against the backdrop of the 2008 recession. Nevertheless, the socioeconomic gap in childhood obesity is also evident in the United Kingdom<sup>26,27</sup>, while widening socioeconomic disparities in childhood overweight have been reported in Sweden<sup>28</sup> and other countries across Europe<sup>29</sup>.

The Irish research evidence suggests that socioeconomic inequalities create living conditions that are damaging to health, most particularly for poor and vulnerable members of society. In this context, gathering best evidence on tackling health inequalities and reconfiguring what needs to be done has never been more important<sup>30</sup>. From a public health perspective, these findings suggest that targeted strategies to reduce the impacts of socioeconomic inequalities are needed. Children attending disadvantaged schools deserve special attention, especially as they approach adolescence, and health promotion policies should target the obesogenic environment they are exposed to<sup>31</sup>. However, there is a lack of evidence of the health inequality impact of existing policies and interventions in the Irish context<sup>30</sup>.

The Healthy Weight for Ireland Obesity Policy and Action Plan 2016–2025 outlines a 5-year target of reducing the prevalence of overweight and obesity combined amongst children in the Republic of Ireland by 0.5% per annum. It also aims to reduce the gap in obesity levels between the highest and lowest socioeconomic groups by 10%<sup>32</sup>. If these targets were achieved, we would expect to see a further fall in the prevalence of childhood overweight and obesity from 24% to 21% by 2020. Actions that have been implemented, or which are soon to be realised, include a tax on sugar-sweetened beverages, a formal review of the advertising of energy dense food and drinks to children, the expansion and wide scale implementation of effective school initiatives/interventions on healthy eating and physical activity in schools as well as the introduction of national food standards for primary schools.

The inclusion of obesity prevention and care as part of primary care (including implementation of an appropriate child growth monitoring system) is another important development within Ireland<sup>32</sup>. As previously noted, to date, childhood obesity prevalence rates in Ireland have been assessed using studies that are heterogeneous in their methods with regard to national or regional sampling frames. Information from general practices could supply an annual source of objectively measured child BMI data that might provide accurate and reliable population-based data for the routine monitoring of childhood overweight and obesity in order to examine patterns

and trends. These data could also be used for assessing the efficacy of the obesity prevention health interventions outlined above. Data collected could also include information on utilisation of healthcare services (both primary care and hospital services) and illness-related productivity loss and absenteeism from work and school for conducting cost-of-illness studies and other related health economic analysis<sup>13</sup>. In particular, data from general practices could provide an annual source of BMI/health-related data for children who are under 5 years of age – which has been lacking.

### Strengths and limitations

A major strength of this study is that response rates were very similar in the 2002 and 2014 surveys (68% and 67%, respectively) and that the socioeconomic backgrounds of study participants broadly reflect the national data. In 2002, 1.2 million people (30% of the population) were covered by medical cards ; in 2014, 1.8 million people (39% of the population) were covered by medical cards and 142,668 people (3% of the population) were in receipt of GP visit cards<sup>19</sup>. A potential limitation of this research is that the 2014 survey included a smaller number of schools and participants than the 2002 survey and the sample was recruited from Counties Cork and Kerry and six community care areas in Dublin. However, considering that both studies used the same sampling methods, this is unlikely to result in any socio-demographic differences between the two study samples. When the same geographical areas (Cork, Kerry and Dublin) were compared in 2002 and 2014, the direction and magnitude of the effect was the same. Results are therefore sensitive at a sub-population level.

### Conclusions

The findings from this research are consistent with stabilisation, and a possible declining trend, in the prevalence of overweight and obesity among Irish children aged 4–13 years between 2002 and 2014. The trend was most marked and statistically significant within the subgroup of five-year-old children, raising the possibility of a favourable birth cohort effect. However, evidence for an increase in social inequality among overweight and obese children is important and should be a key public health policy issue.

### Data availability

#### Underlying data

Zenodo: Exploring 12-Year Trends in Childhood Obesity Prevalence for the Republic of Ireland – A National Study Using Survey Data from 2002 and 2014. <http://doi.org/10.5281/zenodo.4265394><sup>20</sup>

This project contains the following underlying data:

- Excel File BMI data 2002 and 2014 (Aggregate data for 2002 and 2014, BMI, Age, Medical card (MC, economic disadvantage)).
- Excel File FACCT Ireland 2002 and 2014 (Individual data, Year of survey, Height (cm), Weight (kg), calculated BMI, Age, Medical card (MC, economic disadvantage)).

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/) (CC-BY 4.0).

## References

1. Perry IJ, Whelton H, Harrington J, *et al.*: **The heights and weights of Irish children from the post-war era to the Celtic tiger.** *J Epidemiol Community Health.* 2009; **63**(3): 262–4.  
[PubMed Abstract](#) | [Publisher Full Text](#)
2. Lobstein T, Jackson-Leach R, Moodie ML, *et al.*: **Child and adolescent obesity: part of a bigger picture.** *Lancet.* 2015; **385**(9986): 2510–20.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
3. Llewellyn A, Simmonds M, Owen C, *et al.*: **Childhood obesity as a predictor of morbidity in adulthood: a systematic review and meta-analysis.** *Obes Rev.* 2016; **17**(1): 56–67.  
[PubMed Abstract](#) | [Publisher Full Text](#)
4. Park M, Falconer C, Viner R, *et al.*: **The impact of childhood obesity on morbidity and mortality in adulthood: a systematic review.** *Obes Rev.* 2012; **13**(11): 985–1000.  
[PubMed Abstract](#) | [Publisher Full Text](#)
5. Juonala M, Magnussen CG, Berenson GS, *et al.*: **Childhood adiposity, adult adiposity, and cardiovascular risk factors.** *N Engl J Med.* 2011; **365**(20): 1876–85.  
[PubMed Abstract](#) | [Publisher Full Text](#)
6. Adami F, de Vasconcelos FdAG: **Childhood and adolescent obesity and adult mortality: a systematic review of cohort studies, 2005-2008.** *Cad Saude Publica.* 2008; **24** Suppl 4: s558–s68.  
[PubMed Abstract](#) | [Publisher Full Text](#)
7. Reilly JJ, Kelly J: **Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review.** *Int J Obes (Lond).* 2011; **35**(7): 891–8.  
[PubMed Abstract](#) | [Publisher Full Text](#)
8. Ogden CL, Lamb MM, Carroll MD, *et al.*: **Obesity and socioeconomic status in children and adolescents: United States, 2005-2008.** *NCHS Data Brief.* National Center for Health Statistics. 2010; (51): 1–8.  
[PubMed Abstract](#)
9. Wu YP, Reiter-Purtill J, Zeller MH: **The role of social support for promoting quality of life among persistently obese adolescents: importance of support in schools.** *J Sch Health.* 2014; **84**(2): 99–105.  
[PubMed Abstract](#) | [Publisher Full Text](#)
10. Wynne C, Comiskey C, Hollywood E, *et al.*: **The relationship between body mass index and health-related quality of life in urban disadvantaged children.** *Qual Life Res.* 2014; **23**(6): 1895–905.  
[PubMed Abstract](#) | [Publisher Full Text](#)
11. Wang F, Wild T, Kipp W, *et al.*: **The influence of childhood obesity on the development of self-esteem.** *Health Rep.* 2009; **20**(2): 21–7.  
[PubMed Abstract](#)
12. Strauss RS: **Childhood obesity and self-esteem.** *Pediatrics.* 2000; **105**(1): e15.  
[PubMed Abstract](#) | [Publisher Full Text](#)
13. Perry IJ, Millar SR, Baland K, *et al.*: **What are the estimated costs of childhood overweight and obesity on the island of Ireland?** 2017.  
[Reference Source](#)
14. Keane E, Kearney PM, Perry IJ, *et al.*: **Trends and prevalence of overweight and obesity in primary school aged children in the Republic of Ireland from 2002-2012: a systematic review.** *BMC Public Health.* 2014; **14**(1): 974.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
15. Bel-Serrat S, Heinen M, Murrin C, *et al.*: **The Childhood Obesity Surveillance Initiative (COSI) in the Republic of Ireland: Findings from 2008, 2010, 2012 and 2015.** 2017.  
[Reference Source](#)
16. Whelton H, Harrington J, Crowley E, *et al.*: **Prevalence of overweight and obesity on the island of Ireland: results from the North South Survey of Children's Height, Weight and Body Mass Index, 2002.** *BMC Public Health.* 2007; **7**(1): 187.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
17. James P, Harding M, Beecher T, *et al.*: **Fluoride And Caring for Children's Teeth (FACCT): Clinical Fieldwork Protocol [version 1; peer review: 2 approved].** *HRB Open Res.* 2018; **1**: 4.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
18. Monasta L, Lobstein T, Cole T, *et al.*: **Defining overweight and obesity in pre-school children: IOTF reference or WHO standard?** *Obes Rev.* 2011; **12**(4): 295–300.  
[PubMed Abstract](#) | [Publisher Full Text](#)
19. Irish Medical Organisation: **IMO Position Paper on Medical Card Eligibility.** Dublin: Irish Medical Organisation. 2005.  
[Reference Source](#)
20. Millar SR, Harding MA, McCarthy LE, *et al.*: **Exploring 12-Year Trends in Childhood Obesity Prevalence for the Republic of Ireland – A National Study Using Survey Data from 2002 and 2014 (Version 1.0.0) [Data set].** *Zenodo.* 2020.  
<http://www.doi.org/10.5281/zenodo.4265394>
21. O' Donnell A, Buffini M, Kehoe L, *et al.*: **The prevalence of overweight and obesity in Irish children between 1990 and 2019.** *Public Health Nutr.* 2020; **23**(14): 2512–20.  
[PubMed Abstract](#) | [Publisher Full Text](#)
22. Rokholm B, Baker JL, Sørensen TIA: **The levelling off of the obesity epidemic since the year 1999—a review of evidence and perspectives.** *Obes Rev.* 2010; **11**(12): 835–46.  
[PubMed Abstract](#) | [Publisher Full Text](#)
23. Bergström E, Blomquist HKS: **Is the prevalence of overweight and obesity declining among 4-year-old Swedish children?** *Acta Paediatr.* 2009; **98**(12): 1956–8.  
[PubMed Abstract](#) | [Publisher Full Text](#)
24. Schmidt Morgen C, Rokholm B, Sjöberg Brixval C, *et al.*: **Trends in prevalence of overweight and obesity in danish infants, children and adolescents—are we still on a plateau?** *PLoS One.* 2013; **8**(7): e69860.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
25. Aeberli I, Ammann RS, Knabenhans M, *et al.*: **Decrease in the prevalence of paediatric adiposity in Switzerland from 2002 to 2007.** *Public Health Nutr.* 2010; **13**(6): 806–11.  
[PubMed Abstract](#) | [Publisher Full Text](#)
26. Stamatakis E, Zaninotto P, Falaschetti E, *et al.*: **Time trends in childhood and adolescent obesity in England from 1995 to 2007 and projections of prevalence to 2015.** *J Epidemiol Community Health.* 2010; **64**(2): 167–74.  
[PubMed Abstract](#) | [Publisher Full Text](#)
27. Stamatakis E, Wardle J, Cole TJ: **Childhood obesity and overweight prevalence trends in England: evidence for growing socioeconomic disparities.** *Int J Obes (Lond).* 2010; **34**(1): 41–7.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
28. Sundblom E, Petzold M, Rasmussen F, *et al.*: **Childhood overweight and obesity prevalences levelling off in Stockholm but socioeconomic differences persist.** *Int J Obes (Lond).* 2008; **32**(10): 1525–30.  
[PubMed Abstract](#) | [Publisher Full Text](#)
29. Knai C, Lobstein T, Darmon N, *et al.*: **Socioeconomic patterning of childhood overweight status in Europe.** *Int J Environ Res Public Health.* 2012; **9**(4): 1472–89.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
30. **Health Inequalities and Young People in Ireland: A Review of the Literature.** 2014.  
[Reference Source](#)
31. Bel-Serrat S, Heinen MM, Mehegan J, *et al.*: **School sociodemographic characteristics and obesity in schoolchildren: does the obesity definition matter?** *BMC Public Health.* 2018; **18**(1): 337.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
32. Irish Department of Health: **A Healthy Weight for Ireland: Obesity Policy and Action Plan 2016-2025.** Dublin: The Stationary Office, 2016.  
[Reference Source](#)



## Open Peer Review

Current Peer Review Status:  

### Version 1

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**Frank Sullivan** 

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**Katrin Metsis**

University of St Andrews, St Andrews, UK

The aim of the study by Millar *et al.* 2021 is to examine 12-year trends of overweight and obesity among primary-school-aged children in the Republic of Ireland. The study uses data from the large oral health surveys completed in 2002 and 2014. The particular interest is the possible existence of a plateau in childhood overweight and obesity, and the variation of overweight and obesity by the economic status. Overall, this study is very timely and beneficial because there is not much measured height and weight data available. We would like to make the following comments.

- The aim of the study is stated differently in the Abstract and Introduction.

*The aim of this study was to examine 12-year trends in the prevalence of overweight and obesity among primary-school-aged children in the Republic of Ireland between 2002 and 2014.*

V

*The aim of this research was to estimate the prevalence of overweight and obesity among children in the Republic of Ireland (including variation by economic status), drawing on data from over 5,000 children aged 4–13 years, and to compare findings with results from the 2002 survey.*

**Suggestion: While neither of the stated aims is incorrect, it would be beneficial to state that in coherent way throughout the study.**

- Reference to the “large-scale oral health survey” is confusing. The study which used data from the 2002 survey, refers to the survey as “the North South Survey of Children’s Height, Weight and Body Mass Index, 2002” (Whelton *et al.* 2007). Because of the reference to the “large oral health survey” the impression is that weight and height measurements were a part of the oral health survey.

**Suggestion: It would be desirable to include the explicit references to the 2002 and 2014 surveys within the article.**

- Measurement of the BMI. The measurement of the BMI is complex in children and there is no universally agreed criteria for doing this.

Question: the current study refers to the IOTF criteria in the 2011 publication by Monasta *et al.* (2011). The study by Monasta *et al.* (2011) compares the IOTF standard to the WHO standard by using the data for 24–60-month-old children. The population of the current study is 4- to 13-year-olds. For example, study by Whelton *et al.* (2007) has referred to the IOTF 2002 publication, this uses cut points as proposed by Cole *et al.* 2000.<sup>1</sup>

**Suggestion: Clarify the criteria used at different ages.**

- Use of the medical card to denote socioeconomic status may reduce generalisability to other health systems. A description of how the cards are provided and the extent of uptake in the target group may allow comparison with other health and social care systems.
- It was interesting that study by Whelton *et al.* (2007) which used 2002 data did not find differences by the socioeconomic disadvantage as measured by the ownership of the Medical Card. A good possible explanation is provided for this, the RI had a period of affluence during the 2002 survey which seemingly benefitted also disadvantaged population groups.

Question: In the study by Whelton *et al.* (2007), the differences by socioeconomic disadvantage were examined separately for boys and girls by age. Current study finds differences in the boys and girls overweight and obesity prevalence, however, the differences by disadvantage are examined by the age only. Did you try analysis by gender, and if yes, were the results different for boys and girls?

- A Table 1 comparing the composition of the 2 samples wrt age, sex and socioeconomic status would be useful.

Table titles: Table 1 add “by age and gender”; Table 2 add “by age”.

- Include “overweight” in the title. Also using the term trends may be misleading in a repeated cross-sectional study e.g. patterns or measures or a comparison.....
- Good discussion of strengths and limitations: similar response rates for 2002 and 2014 survey, and similarity of socioeconomic background of study respondents compared to the national data. Also, the potential limitation of the overall smaller number of respondents and schools in the 2014 survey is highlighted. This limitation is well discussed.

## References

1. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH: Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*. 2000; **320** (7244): 1240-3 [PubMed Abstract](#) | [Publisher Full Text](#)

### **Is the work clearly and accurately presented and does it cite the current literature?**

Partly

### **Is the study design appropriate and is the work technically sound?**

Partly

### **Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

### **If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Clinical epidemiology, adolescent health.

**We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Reviewer Report 06 April 2021

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**Duarte Henriques-Neto** 

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This manuscript aimed to estimate the prevalence of overweight and obesity among children in the Republic of Ireland in 2014 and compare with data from 2002. Also, the variation between 2002 and 2014 was stratified by economic status. For doing so the authors used the BMI categories. Main findings suggest that the overall prevalence of overweight/obesity among 4–13 year-olds significantly decreased between 2002 and 2014. It is a well-written manuscript and clear to read.

I have only a few suggestions/remarks to do. When we study weight status or other fitness attributes, the maturity stage is an important variable to be accountable for, but at the same time, difficult to assess in epidemiologic studies, especially in this age range (10-13yrs). In fact, one of the major limitations of the study is the lack of adjustment to confounding variables (e.g. socioeconomic status, physical activity, nutrition, maturity), especially considering that these were two independent samples. This should be stated as a limitation.

Also, the authors affirm using a two-sample t-tests between proportions, however it is not clear whether this was an independent sample t-test or a paired sample t-test. From what I understood it was an independent sample t-test because the sample is different, is that so?

Overall, congratulations to the authors for this important work.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Physical Fitness; Physical Activity and Health in youth. Bone Health in young athletes.

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Author Response 25 May 2021

**Mairead Harding**, University College Cork, Cork, Ireland

Thank You Duarte,

We are very grateful to receive your feedback and compliment on the research completed.

In our study we used an independent t-test.

We will continue to research in this area and conduct further analysis with the available data.

Kind regards

Máiréad Harding

**Competing Interests:** No competing interests were disclosed.

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