



COLORADO

Center for Health  
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Department of Public Health & Environment

# fact sheet

January 2017

Center for Health and  
Environmental Data

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## Colorado Child Health Survey

### Methodological Improvements: Shift in Body Mass Index Reporting for Children ages 2-14, 2011 to Present

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#### Introduction

The Colorado Child Health Survey (CHS) was initiated in 2004, in order to fill the health data gap for children ages 1-14. The CHS is a call-back survey from the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a statewide telephone survey developed by the Center for Disease Control and Prevention (CDC) to monitor lifestyles and behaviors related to chronic health conditions among individuals 18 years of age and older. Once the adult respondent completes the BRFSS, the interviewer inquires if they have a child in their household within the target age range (1-14) and about their willingness to complete the Child Health Survey. If the respondent agrees to participate they are called back approximately 10 days later and answer a variety of questions pertaining to the selected child's physical activity, nutrition, access to health and dental care, behavioral health, school health, sun safety, injury and many other topics. Approximately 1000 surveys are completed each year.

Increased interest in the prevalence of childhood obesity has caused body mass index (BMI) to be one of the most commonly requested indicators from the CHS. The American Academy of Pediatrics recommends using BMI to screen for overweight and obesity in children beginning at 24 months.<sup>1</sup> BMI percentiles for children ages two and older in the CHS are calculated using a CDC program based on growth charts from the year 2000.<sup>2</sup> This calculation uses each child's

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- 1 Centers for Disease Control and Prevention (CDC). Healthy Weight. 2015. [https://www.cdc.gov/healthyweight/assessing/bmi/childrens\\_bmi/about\\_childrens\\_bmi.html](https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html)
- 2 Centers for Disease Control and Prevention (CDC). Source code for 2000 growth charts. 2016. <https://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/cdc-source-code.sas>

exact age in months, gender, height (cm) and weight (kg). It calculates percentiles which are interpreted as a comparison with other children of the same gender and age. These percentiles are categorized into underweight (<5th percentile), healthy weight (5th- <85th percentile), overweight (85th-<95th percentile) and obese ( $\geq$ 95th percentile). In 2016, methodology changes to reporting of childhood BMI estimates were introduced. These changes are:

1. Calculating exact age in months for each child rather than age in years;
2. Reporting BMI estimates from the CHS for children starting at age 5 due to higher bias in parent reported height and weight in children ages 2-4;
3. Removal of values that are flagged as biologically implausible from BMI estimates; and
4. Suggestions for alternative data sources for BMI categories in Colorado children ages 2-4.

## Why the change now?

Research on this topic indicates that discrepancies in BMI among children exist between parent report and measured data sources. Bias of height and weight in parent reported survey data has been found to be more pronounced in younger children.<sup>3</sup> Review of child obesity estimates between various Colorado and national data sources indicated similar discrepancies. Methodology changes to reduce bias from parent report were warranted for BMI reporting from the CHS. This examination of methodology changes coincided with changes to the CDC growth chart

program, updated in early 2016, which were also incorporated into the new methodology.<sup>4</sup>

Within the CDC growth chart program, there is a calculation using z-scores that produces a flag for values of height, weight, and BMI that could be considered biologically implausible. These types of values are outlier observations that are more likely to be the result of inaccurate reporting rather than an accurate value of extreme growth. In the 2016 update, the CDC changed z-score cutoffs for these flags. This change was made due to research indicating that previous cutoffs were incorrectly flagging some extreme values as biologically implausible when they were legitimate values. Changing the cutoffs improved the accuracy of flagging for inaccurate values and reduced the likelihood of flagging and removal of true extreme values. In response to these changes, the Colorado Department of Public Health and Environment (CDPHE) decided to begin removing biologically implausible values from BMI estimates in children.

## Impact of the new methods in Colorado

The effect of changing BMI reporting accounts for the demonstrated unreliability of parent reported height and weight for children, especially preschool-aged children (ages 2-4). Excluding this subpopulation, as well as biologically implausible values from the data for BMI, provides more accurate and representative data. Since more accurate height and weight data are being analyzed to represent Colorado's child population, stakeholders should expect BMI prevalence estimates to change from previously reported estimates.

3 Weden MM et al. Parent-reported height and weight as sources of bias in survey estimates of childhood obesity. *Am J Epi*, 2013 Aug; 178(3): 461-73.

4 Centers for Disease Control and Prevention (CDC). A SAS Program for the 2000 CDC Growth Charts (ages 0 to <20 years). 2016. <https://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm>

While analyses of Colorado data do not indicate any significant change in BMI estimates when comparing pre- and post-methodology changes in individual years of data (Table 1), there is observed statistically significant change in three year aggregated data (Figure 1). Significant differences are defined as non-overlapping confidence intervals. The Health Surveys and Evaluation Branch (HSEB) of CDPHE retroactively applied the new methodology to previous years of data (2011-2015) to allow for BMI comparison over time.

The decision to apply this methodology from 2011 forward aligns with other methodological changes introduced to BRFSS and CHS in 2011. The inclusion of cell phones and application of a new weighting methodology render these newer data not directly comparable to data from 2010 and earlier. Thus, BMI data from CHS can only be trended for 2004-2010 and 2011-present and statistical significance can only be determined within those time periods.

**Table 1. Comparing individual years of child BMI prevalence estimates with pre- and post-methodology change, Colorado Child Health Survey, 2011-2015.**

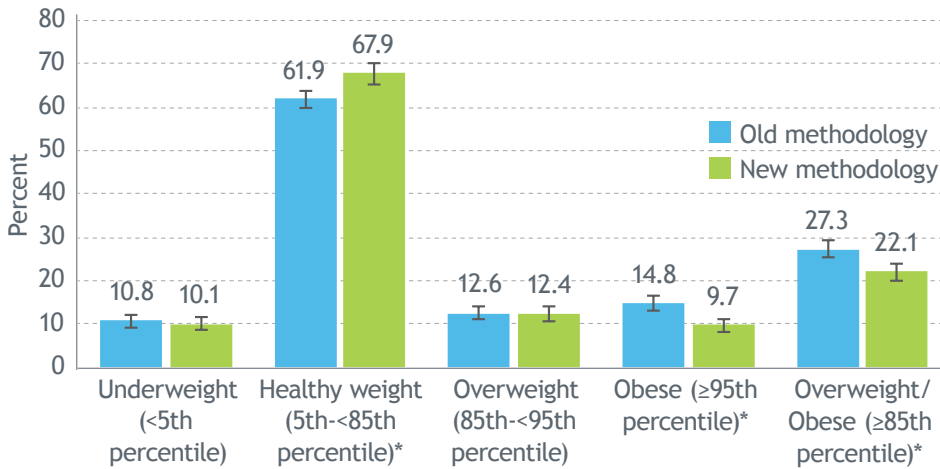
Year	Body Mass Index	Old methodology †		New methodology †	
		Estimate	95% C.I.††	Estimate	95% C.I. ††
2011	Underweight (<5th percentile)	7.9	(5.9-9.9)	8.9	(5.8-12.0)
	Healthy weight (5th-85th percentile)	62.7	(58.0-67.4)	66.9	(61.7-72.2)
	Overweight (85th-<95th percentile)	12.7	(9.4-16.1)	10.2	(7.5-12.9)
	Obese (≥95th percentile)	16.7	(12.9-20.5)	14.0	(9.5-18.4)
	Overweight/ Obese (≥85th percentile)	29.4	(24.8-34.0)	24.2	(19.3-29.0)
2012	Underweight (<5th percentile)	12.3	(9.9-14.8)	9.7	(7.2-12.2)
	Healthy weight (5th-85th percentile)	59.1	(55.5-62.6)*	67.1	(63.3-71.0)*
	Overweight (85th-<95th percentile)	13.4	(10.9-15.8)	13.0	(10.3-15.8)
	Obese (≥95th percentile)	15.2	(12.5-17.9)	10.1	(7.5-12.7)
	Overweight/ Obese (≥85th percentile)	26.4	(23.2-29.6)	23.2	(19.6-26.7)
2013	Underweight (<5th percentile)	9.0	(6.9-11.1)	8.5	(6.2-10.7)
	Healthy weight (5th-85th percentile)	64.6	(61.1-68.1)	71.2	(67.5-74.9)
	Overweight (85th-<95th percentile)	12.0	(9.6-14.3)	10.6	(8.2-13.0)
	Obese (≥95th percentile)	14.5	(11.8-17.1)	9.7	(7.2-12.2)
	Overweight/ Obese (≥85th percentile)	26.4	(23.2-29.6)	20.4	(17.1-23.6)
2014	Underweight (<5th percentile)	11.1	(8.4-13.8)	12.1	(8.9-15.2)
	Healthy weight (5th-85th percentile)	62.0	(58.0-66.0)	65.3	(60.9-69.6)
	Overweight (85th-<95th percentile)	12.3	(9.6-15.0)	13.6	(10.4-16.8)
	Obese (≥95th percentile)	14.6	(11.6-17.6)	9.1	(6.5-11.7)
	Overweight/ Obese (≥85th percentile)	26.9	(23.3-30.6)	22.7	(18.8-26.5)
2015	Underweight (<5th percentile)	.		9.3	(5.4-13.1)
	Healthy weight (5th-85th percentile)	.		63.1	(56.6-69.6)
	Overweight (85th-<95th percentile)	.		16.0	(10.9-21.2)
	Obese (≥95th percentile)	.		11.6	(7.3-15.9)
	Overweight/ Obese (≥85th percentile)	.		27.6	(21.5-33.7)

† Old methodology represents children ages 2-14; New methodology represents children ages 5-14.

†† 95% confidence interval.

\* indicates statistically significant changes.

Figure 1. Comparing aggregated years of data for child BMI prevalence estimates with pre- and post-methodology changes, Colorado Child Health Survey, 2012-2014.



\*indicates statistically significant changes.

## Interpretation of prevalence estimate changes – what does a higher or lower estimate mean?

Decreases in previously reported prevalence estimates for childhood BMI may cause concern for programs and stakeholders, however, the change in methodology provides a more accurate picture of childhood obesity in Colorado. Programs utilizing CHS BMI data should take into consideration the caveats of parent reported height and weight, and by proxy BMI; CHS BMI data are estimated values rather than actual measured data. **There is a risk of misinterpretation of the estimate changes in BMI as ‘real change’ rather than the result of the methodology update.** However, by retroactively applying the methodology change starting with 2011 data, it is intended that stakeholders will be better able to monitor important trend data in childhood BMI.

## Next steps

The HSEB of CDPHE will continue to provide stakeholders with important information regarding the BMI methodology update. In addition, the HSED will recommend that programs requesting BMI estimates for children ages 2-4, utilize data from the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). It should be noted that WIC estimates cannot be used to generalize early childhood BMI statewide; however, it still provides useful data for public health programming. More information regarding WIC BMI estimates can be found on the CDPHE [website](#).<sup>5</sup> The CHS is a unique surveillance tool specific to Colorado, therefore the BMI estimates generated from this survey are not comparable to any national level data. Programs interested in comparing childhood BMI estimates to other state or national estimates, should refer to Colorado data from the National Survey of Children’s Health or National Health and Nutrition Examination Survey.

5 Colorado Department of Public Health and Environment (CDPHE). WIC reports. 2016. <https://www.colorado.gov/pacific/cdphe/wic-reports>