National Center for Health Statistics

CDC Extended BMI-for-age Growth Charts: What to know

Why were these growth charts created?

In the US, the prevalence of obesity and severe obesity has increased over the last 40 years and in 2017-2018 more than 4.5 million children and adolescents had severe obesity. The 2000 CDC BMI-for-age growth charts do not extend to BMI values high enough for use in children with extremely high BMIs and those with severe obesity. More specifically, the 2000 growth charts have an upper limit of the 97th percentile based on reference data from 1963 to 1980 for most children and adolescents, a period when the prevalence of obesity was lower than today, and data were sparse above this level. Although percentiles above the 97th can be extrapolated beyond the data, the charts provide no information about actual growth patterns above the 97th percentile.

How were the Extended BMI-for-age growth charts created?

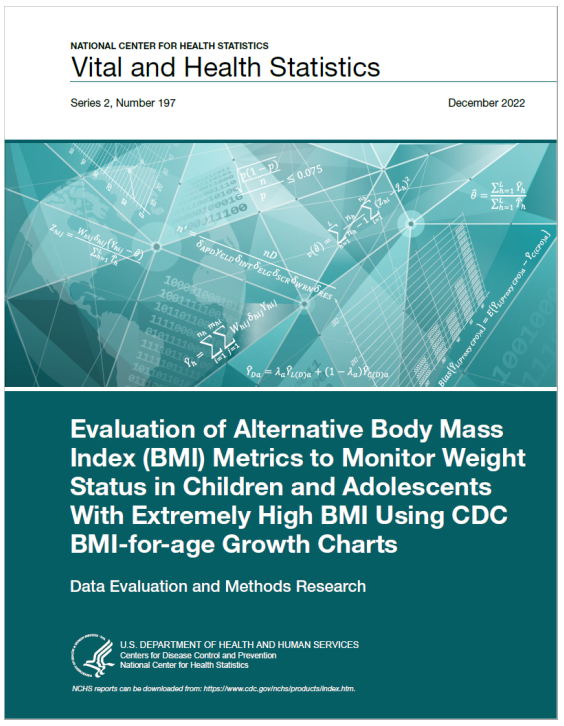
CDC developed a specialized growth chart tool by adding extended reference curves or percentiles to monitor very high BMI values in children and adolescents. These extended curves are based on additional data for children and adolescents with obesity from 1988-2016, increasing the data available in the reference population for children and adolescents above the 95th percentile. Unlike other options for monitoring growth in children with very high BMI values which use theoretical or statistical extrapolations, the CDC extended BMI-for-age growth charts are based on actual data from nationally representative samples. Pediatric health care providers and researchers can track a child's trajectory against these new curves that reflect measurements of real children with obesity.

Will the extended BMI-for-age growth charts replace the 2000 CDC BMI-for-age growth charts? Can the 2000 charts still be used?

For most children and adolescents, the 2000 CDC BMI-for-age growth charts remain the most appropriate tool to assess growth and weight status.

The CDC extended BMI-for-age growth charts provide an additional and specialized tool for clinicians and researchers to monitor BMI in children and adolescents with very high BMI. They do not replace the 2000 CDC BMI-for-age

View the report for additional information



growth charts. Instead, they are an extension of the existing curves to be used by those needing to track very high BMIs.

When should the 2000 CDC BMI-for-age growth charts be used and when should the Extended CDC BMI-for-age growth charts be used?

The 2000 CDC BMI-for-age growth charts should be used for children at or below the 95th percentile. The extended CDC BMI-for-age growth charts can be used for children above the 95th percentile and are specially designed for children with very high BMI values because these children can be harder to track on the 2000 BMI-for-age growth charts. In most cases, use of the 2000 CDC and the extended charts should be seamless.

In many pediatric clinics, percentile and z-score calculations are incorporated into the electronic health record (EHR). If the EHR has incorporated the extended method for calculating percentiles and z-scores above the 95th percentile, these will be the default percentiles and z-scores reported for children above the 95th percentile and no decision about what chart to use is required. Data tables, computer programs, and instructions for calculating percentiles and z-scores are available at SAS Program (ages 0 to < 20 years) | Resources | Growth Chart Training | Nutrition | DNPAO | CDC to help with EHR integration.

PDF files are available for download of the 2000 CDC BMI-for-age growth charts and Extended CDC BMI-for-age growth charts. The 2000 CDC BMI-for-age growth charts can be used to plot BMI up to 37 kg/m^2. Two versions of the CDC Extended BMI-for-age growth charts are available and show the existing 5th through 95th percentiles, which are identical to the 2000 CDC BMI-for-age growth charts. Both the percentile and z-score versions of the Extended growth charts allow plotting BMI up to 60 kg/m^2. Above the 95th percentile, the percentile version of the growth chart provides reference curves up to the 99.99th percentile, while the z-score version provides reference curves up to a z-score of 5. Note that percentile and z-score values are interchangeable and are merely expressed on different scales. Both the percentile and z-score values give an indication of how far away a child's BMI is from the median age- and sex-specific BMI value (50th percentile which is equivalent to a z-score of 0).

How are the extended percentiles interpreted?

The BMI-for-age growth charts allow comparison of a child's BMI to a reference population, similar to using and interpreting other growth charts such as weight-for-age and height-for-age. Percentiles and z-scores based on the reference population provide metrics for monitoring change in BMI over time and for setting threshold values for overweight and obesity. For most children, the reference for the CDC BMI-for-age growth charts came from a nationally representative sample of children aged 2-19 during 1963-1980, a period before recent increases in childhood obesity prevalence.

The 2000 CDC BMI-for-age curves do not extend beyond the 97th percentile because there were too few children in the reference population with very high BMI values to create percentile curves using real data. Curves above the 97th in the 2000 CDC BMI-for-age charts, however, can be mathematically

created or extrapolated for convenience, such as percentages of the 95th percentile. In the extended charts, the newly added percentiles above the 95th percentile are based on nationally representative data for children with obesity from the growth chart reference population and additional data from 1988-2016. The extended z-scores associated with these new percentiles accurately reflect patterns among real children at extremely high BMI values.

With very high BMI values above the extended 99th percentile, the z-score may be an easier number for clinicians, patients, and families to understand. For example, the value of z-score=1 is nearly equivalent to the 85th percentile–the threshold for overweight status. A z-score of 4 is equivalent to the extended 99.9th percentile, but z-scores of 4 and 1 may easier to convey to patients and families compared to extended 99.9th and 85th percentiles.

Why not just use percent of the 95th percentile, which people are already familiar with since severe obesity is defined using 120% of the 95th percentile? Are there implications for the definition of severe obesity and severity classes?

The extended BMI-for-age charts are based on data from US children in the National Health and Nutrition Examination Survey. Percentage of the 95th percentile is not based on data on actual children but is a statistical extrapolation. Because 120% of the 95th percentile is the definition of severe obesity, this line is included on the extended BMI-for-age growth charts images.

In addition, the extended BMI-for-age percentiles are an extension of the 2000 CDC BMI-for-age growth charts so they can be used seamlessly together, unlike the percentage of the 95th percentile.

See the report on alternative BMI metrics for more details on the differences between these metrics.

Will the Extended BMI-for-age growth charts affect the definition of overweight, obesity, or severe obesity in children and adolescents?

No. The Extended BMI-for-age growth charts are an extension of the 2000 CDC BMI-for-age growth charts. The percentiles up to the 95th percentile (the threshold for obesity) remain unchanged. Therefore, the definitions of overweight and obesity are unchanged. The current threshold for severe obesity (120% of the 95th percentile) is shown as a separate curve on the Extended CDC BMI-for-age Growth Chart PDFs.

How can these new growth charts be implemented in my practice/EHR?

Data tables, computer programs, and instructions for calculating percentiles and z-scores are available at SAS Program (ages 0 to < 20 years) | Resources | Growth Chart Training | Nutrition | DNPAO | CDC to help with EHR integration.

Why haven't the 2000 CDC growth charts been updated to reflect today's US children and adolescents?

There are no plans to update the growth charts.

The 2000 CDC growth charts were created using a reference population from national surveys from 1963 to 1980 for most children and adolescents – before the increase in obesity prevalence. They serve as a 'ruler' to compare children today to a historical reference. Because of the increase in average childhood BMI over time, updating the charts with newer data would result in a shift in the percentiles. Specifically, the 95th percentile, the cut point for obesity, would shift upward. Using a new 95th percentile to define obesity would lead to some children being below the 95th percentile who were above using the 2000 charts. As an example, during 2017-March 2020, 19.7% of US children and adolescents were above the 95th percentile of the 2000 CDC BMI-for-age growth charts and had obesity . If the charts were updated to include only these children, 5%, not 19.7%, would be above the 95th percentile. This would lead to two problems for surveillance of child growth and obesity. First, this new 5% of children would have much higher BMI values than the 5% of children in the original 2000 growth chart reference population who were over the 95th percentile. The health implications of these higher BMI values would require new research and definitions. Second, there would be no meaningful point of reference if the growth charts were continuously updated to change the location of the 95th percentile according to the most recent data. For example, the increases in obesity prevalence over the past few decades would not have been identified if the point of reference was changed from the original reference data.

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