Gradual z-score equation and further details

2025-01-07

$$Gradual\_Z = \frac{WHO\_Z \times (5 - ageyears) + CDC\_Z \times (ageyears - 2)}{3}$$

Gradual_Z: A weighted average of the WHO and CDC z-scores from 2 to 5 years

WHO_Z: The WHO z-score for weight, height, or body mass index (BMI)

CDC_Z: The CDC z-score for weight, height, or BMI

ageyears: Age in days divided by 365.25. For example, 1000 days = 2.7378508 ageyears.

We recommend using WHO z-scores from 0-730 days, gradual z-scores from 731-1825 days, and CDC z-scores from 1826 days onward.

Further explanation and implementation details

-Goal: The gradual z-score is a simple weighted average of the WHO z-score and CDC z-score from 2 to 5 years. The purpose is to smooth the disjunction between the WHO and CDC z-scores at 2 and 5 years (primarily 2 years, where the disjunction is much larger). The WHO z-score is weighted higher the closer the age is to 2 years, and the CDC z-score is higher the closer the z-score is to 5 years. Please see the publication below for further details.

-Dividing age in days by 365.25 accounts for leap years. This generally works well, but it can cause issues when trying to precisely determine if someone has reached two years of age, because 2 years = 730.5 days, and a child will have an age of either 730 or 731 days. That is why we use age in days for the determination of when to use which z-score: WHO <=730 days, gradual 731-1825, CDC >=1826. The R and Stata code that we provide in separate files generates gradual z-scores using these age cutoffs.

-Although we use age in days for determining when to use which z-score, we typically use age in fractional years for the weighted average calculation because it makes the equation more clear. Feel free to change this in your code.

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Daymont et al., Pediatrics, 2025