Flattening the (BMI) Curve: Timing of Child Obesity Onset and Cardiovascular Risk

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The worldwide prevalence and severity of childhood obesity has steadily risen over the last 50 years.1 Although there have been some indicators of recent stabilization,2 it has been suggested that we have simply reached our upper genetic limit.3 Whether this is true, the current prevalence is shockingly high; one-third of children aged 2 to 19 have a BMI >85th percentile, and 18.5% have a BMI >95th percentile,4 consequently affecting 13.7 million children in the United States and 340 million children worldwide.

It makes intuitive sense that childhood obesity is a serious health problem. However, at exactly what age obesity begins to predict future disease has proven an elusive question. The evidence is clear that (1) child obesity predicts adult obesity,5 (2) adult obesity predicts cardiometabolic disease and early mortality,6 and (3) obesity in late adolescence predicts early mortality, the majority of which is related to cardiovascular disease.7 But is obesity something to be concerned about in a 3-year-old?

Researchers in previous studies have demonstrated that single time-point measures of early obesity poorly predict adult outcomes. For example, in a 2016 meta-analysis of 37 studies that included child BMI data and adult endpoints, it was shown that although the association between high childhood BMI adult disease was significant, only 31% of adults with diabetes and 22% with hypertension diagnoses were overweight as children.8 Researchers of a 2012 systematic review of 39 studies found that the association between child BMI and adult outcomes was attenuated when adult BMI was considered.9 The inevitable conclusion is that child BMI is important through its impact on adult BMI rather than directly worsening health.

When repeatedly measured over time, however, other more-concerning patterns emerge. Geserick et al10 managed a cohort (n = 51 505) from birth through age 18 and showed that 50% of adolescents with obesity had developed it by age 5; 90% of children who had obesity by age 3 remained obese at age 18. The Project Viva cohort demonstrated that BMI acceleration after age 1 predicts excess adiposity by age 6 to 10.11 Smego et al12 showed that obesity by age 4 to 6 months predicted obesity by age 6. Although these show the persistence of obesity, what they mean for later disease has been more difficult to study.

In this issue of Pediatrics, Lyczett et al13 evaluate 5107 Australian children at repeated time points from infancy examining BMI and cardiometabolic markers up to age 11 to 12, with 1811 children retained throughout the time period. The growth data fell into 4 relatively distinct BMI trajectories: always low, always normal, always high, and normal to high. This important and comprehensive study has 2 important implications: first, high BMI by age 2 to 3 tends to stay high, and second, normal BMI occasionally increases to high BMI, but the reverse is rarely true.
Simply put, infants and toddlers with obesity are unlikely to “grow out of it.”

The question remains, “is this a problem?” Lycett et al13 attempted to answer this question by collecting a cardiovascular risk assessment using metabolic syndrome, carotid-femoral pulse wave velocity, and carotid intima-media thickness at age 11 to 12. They found that obesity by age 3 and being overweight by age 6 predicted metabolic syndrome at age 11. Obesity by age 6 predicted subclinical atherosclerotic changes by age 11. Most strikingly, obesity that started at 3 and persisted appeared to accumulate risk over these early years of life, and those children demonstrated significant and detectable markers of silent atherosclerotic disease by 11 years of age. An important caveat is that although the relationships were significant, the amount of variance attributable directly to child BMI was small. Even small impacts are important on a population level, but this highlights the complexity of the relationship between obesity and health.

In this study, it is definitively established that obesity by age 3 is predictive of future obesity up to early adolescence, and evidence is added that risk for cardiovascular disease accumulates the earlier children develop their obesity. The point cannot be understated: early-onset obesity is unlikely to change and, if it persists, will lead to detectable precursors of atherosclerosis by the time a child enters middle school.

Parents14 and primary care physicians15 are less likely to perceive obesity as a concern in younger children. Measuring and defining obesity in children <2 years of age is challenging. However, current predictions reveal that if we continue current patterns of watchful waiting, 57.3% of today’s children will have obesity by age 35.16

Our best chance to “flatten the curve” of cardiovascular disease may be to slow down BMI increases early in life, delaying (or preventing) the onset of obesity as long as possible to minimize accumulation of risk.

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