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Secular trends in pediatric BMI

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Studies that use cross-sectional data have shown an increase in the prevalence of childhood obesity, as assessed by BMI (weight in kilograms divided by height in meters squared), over the past 30 y in the United States (1). Between the 1960s and 2000 the distribution of BMI among children became more skewed, whereas between 2000 and 2010 there was relatively little change among either boys or girls (1). Further elucidation of the trend in obesity can be understood on the basis of both longitudinal and cross-sectional analyses of longer time periods such as Johnson et al (2) have published in the current issue of the Journal with the use of data from the Fels Longitudinal Growth Study.

The Fels study began enrolling pregnant women who lived in the Yellow Springs, Ohio, region in 1929 (3). Longitudinal data on weights and heights, among other measures, have been collected on participants. The authors explored differences in BMI growth velocity between 3 birth cohorts (1929–1953, 1954–1972, and 1973–1999) in the Fels study, comparing various parameters of growth curves. The differences observed between the birth cohorts show increased BMI growth velocity among children born during 1973–1999 compared with the earlier cohorts. This change is generally consistent with the pattern of increases in obesity prevalence seen in national cross-sectional data from the 1980s and 1990s.

As the authors state, their analyses of the European-American children in the Fels study may not be applicable to other populations. The Fels cohorts of white children from the Ohio area do not represent the race-ethnic and geographic diversity in the US pediatric population. Because there are substantial race-ethnic differences in obesity prevalence and in body fat composition (4), changes in some aspects of the BMI growth patterns in the white Fels population may not reflect the trends in the US population.

Much of the discussion in the article by Johnson et al (2) focuses on the age of adiposity rebound, or the BMI nadir, which has been shown to be related to BMI later in life (5). On the basis of multilevel models that accounted for the repeated measurements in the Fels study, the BMI curves show, and the Abstract states, that the BMIs of children under 5 y (2–5 y) born during 1973–1999 (the most recent period) were lower than those of children in the earlier cohorts. Differences across cohorts in the estimated age of the adiposity rebound, however, were significant, however, only among girls (Tables 3 and 4 in their article).

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National cross-sectional data do not show similar results: 2- to 5-y-olds examined in recent national studies do not have lower BMIs than do those who were examined decades ago. For example, among 3-y-olds in the United States, mean BMIs (in kg/m^2) were 15.7 in 1971–1974 (n = 292) and 16.0 in 1999–2002 (n = 173) among girls and 16.0 in 1971–1974 (n = 308) and 16.2 in 1999–2002 (n = 209) among boys (6). In addition, the mean BMIs of 50,000 3-y-olds in England were found to increase by ~0.6 between 1988 and 2003 (7). These time periods represent the period of increase in obesity prevalence seen in both the United States and England. The difference between the United States, England, and the Fels results may be due to the fact that the data for the United States and England (6, 7) are cross-sectional, whereas the BMIs of 2- to 5-y-olds in the Fels data were estimated from longitudinal data. However, in the analysis of the Fels data, 29 of 855 subjects were excluded, not because of invalid data but because the fitted, multilevel models yielded implausible results, such as negative ages at the BMI nadir. This raises the possibility that the models may be misspecified. Another explanation for the differences may be that the Fels data are not nationally representative, which highlights the need for additional analyses of data from various ethnic groups and geographic regions in the United States.

The authors of the current study do note that there are questions concerning the significance of the adiposity rebound. For example, a previous article from the Fels study (8) found that, among women, age at BMI rebound was associated with adult BMI but not with total or percentage body fat; among men, the rebound age was not associated with adult BMI or body fatness. It has been suggested that an early rebound simply identifies those children who already have a high BMI or have a BMI that is increasing (9).

An evaluation of the changes in BMI growth velocity between the Fels birth cohorts might also have considered infant feeding. Infants born between 1929 and 1974 were primarily formula fed (10). Infant feeding practices affect weight gain, and breastfeeding appears to have a small protective effect against obesity (11). The distribution of breastfeeding and its influence on BMI growth velocities in the latter birth cohorts is not clear. If the Fels sample is similar to the national US population, breastfeeding rates would be higher in the later birth cohorts.

The analysis of BMI in different birth cohorts from the Fels data contributes to our understanding of the increase in obesity prevalence seen in national cross-sectional national data by showing the increased velocity in BMI trajectories of children born after 1973 compared with earlier years. Given the unique population represented by the Fels data, it is important to consider that other subgroups of the population may not have experienced the same pattern of BMI growth, yet these subgroups have contributed to the high prevalence of childhood obesity in the United States. Further research among other nonwhite populations would help to explain the changes in BMI in the US population.

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