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How Soon to Intervene?

Obesity Epidemic Among Very Young Children

Over the last few decades, the rate of overweight and obesity in the U.S. has increased substantially among all age groups.¹⁻³ Nationally representative cross-sectional surveys have documented a marked increase from the late 1970s to the present. The prevalence of overweight—defined as above the 95th BMI percentile in school-aged children aged 6–11—remained constant at 4% between the 1960s to the early 1970s, but increased to 7% in the late 1970s, 11% in the mid-1990s, and 15% in 1999–2000. This totals to a relative increase of 275% in the prevalence of overweight over the past 30 years. (See chart, “The Increase of Overweight.”)⁴⁻⁵





New information is coming to light that is even more alarming than what we've already seen—that not only do teens and young children struggle with overweight, but even toddlers and infants are now having similar problems.

For most healthcare workers, this information is nothing new. Indeed, the issue of childhood obesity has been emerging steadily over the last 25 years, and has recently ballooned to receive a lot of media attention. Government organizations, communities, and healthcare providers are beginning to work together to help educate parents about healthy foods and create a more active, healthier atmosphere for children both in school and at home. Meanwhile, scientists have delivered numerous studies on teens, school-age and preschool-age kids, to provide more data and hopefully reverse this dangerous trend. However, one age group has been virtually ignored in these studies—infants and toddlers. Thought to be insulated from the dangers of overweight, these little ones are now succumbing to some of the same influences that are affecting our young children. Studies are still sparse, but there is new information coming to light that is even more alarming than what we've already seen—that not only do teens and young children struggle with overweight, but even toddlers and infants are now having similar problems.



Skinfold Thickness Growing in Young Children

Skinfold thickness can be a more direct measure of adiposity than BMI because of its higher correlation with percent body fat.⁶ Gortmaker et al.⁷ reported an increase from 17.6% in 1963 to 27.1% in 1980 in the prevalence of overweight among children age 6–11 years of age (based on triceps skinfold measurements above the 85th percentile), and an increase in the prevalence of obesity above the 95th percentile from 5.9% to 11.7%. The Bogalusa Heart Study also reported a secular increase in adiposity among children aged 4–17 years between 1978–1994.⁸ Over a period of 15 years, the mean of subscapular and triceps skinfolds increased from 11.9 mm to 14.6 mm among 5–9 year olds and from 13.5 mm to 16.7 mm among 10–17 year olds, an approximate 23% increase for both age groups. Therefore, measures of skinfold thickness have provided evidence of increased adiposity among children during the past three decades.

The Increase of Overweight

The following chart details the prevalence of overweight among children and adolescents. Information drawn from the National Health Examination Survey (NHES) and the National Health and Nutrition Examination Survey (NHANES).*

Age [†]	NHES I 1963–65 /1966–1970 [‡]	NHANES I 1971–1974	NHANES II 1976–1980	NHANES III 1988–1994	NHANES 1999–2000	NHANES 2003–2004
6–23 months			7.2%	8.9%	11.6%	
2–5 years		5.0%	5.0%	7.2%	10.4%	13.9%
6–11 years	4.2%	4.0%	6.5%	11.3%	15.3%	18.8%
12–19 years	4.6%	6.1%	5.0%	10.5%	15.5%	17.4%

* Estimates not available for ages 6–23 months in the NHES I and NHANES I.

† Excludes pregnant women starting with 1971–1974. Pregnancy status not available for 1963–1965 and 1966–1970.

‡ Data for 1963–1965 are for children 6–11 years of age; data for 1966–1970 are for adolescents 12–17 years of age.¹

In 1999–2000, 10% of infants and toddlers (younger than 2 years) were overweight (at or above the 95th weight-for-height percentile). This rate has doubled since the 1970s.

Overweight Trends in Infants and Toddlers

Following are the relative increases in unadjusted prevalence, and the adjusted odds ratios (OR) for the increase in prevalence (time trend) of overweight. Listed as overall and by sociodemographic characteristics among children aged 0–71.9 months seen at well-child-care visits at a Massachusetts HMO.

Variable	Overweight			
	Unadjusted Prevalence* (%)		Trend	
Year	1980-81 (n=7,963)	2000-01 (n=27,453)	Relative Increase	Adjusted OR per Decade (95% CI)
Overall†	6.3	10.0	58.7	1.21 (1.17–1.25)
Gender‡				
Boys	7.2	10.8	50.0	1.0 (reference)
Girls	5.4	9.2	70.4	1.06 (1.00–1.12)
Age‡, months				
0–5.9	3.4	5.9	73.5	1.0 (reference)
6–11.9	7.5	9.0	20.0	0.87 (0.79–0.95)
12–23.9	10.3	12.3	19.4	0.95 (0.88–1.02)
24–35.9	5.4	10.6	96.3	1.14 (1.05–1.24)
36–71.9	5.9	10.3	74.6	1.06 (0.98–1.14)
Medicaid‡,1				
No	7.5	8.4	12.0	1.0 (reference)
Yes	9.7	11.0	13.4	1.02 (0.79–1.33)
Race/ethnicity‡2				
White	5.7	7.5	31.6	—
Black	7.6	10.3	35.5	—

* Unadjusted prevalence of overweight is defined as weight-for-height \geq 95th percentile, and at risk for overweight as weight-for-height \geq 85th, but $<$ 95th percentile according to CDC guidelines.¹⁶

† The overall adjusted ORs were estimated from a multivariate logistic regression with the covariates gender, age group, clinic site, and visit year, while accounting for repeated observations of individual children across years.

‡ The ratios of adjusted ORs were estimated by the interaction terms between visit year and gender, age group, and Medicaid insurance based on dataset with imputed data for missing on Medicaid status, while accounting for repeated observations of individual children across years.

§ Because of the large amount of missing data, we do not present the adjusted ORs for race/ethnicity.

1. Because children with Medicaid insurance were not accepted before 1987 and missing data occurred after 1997, the relative increase for Medicaid status was calculated for the interval between 1987–88 and 1996–97.

2. Because of missing data, the relative increase for race/ethnicity was calculated for the interval between 1980–81 and 1996–97.

Minority Children Also More Overweight

A nationally representative cohort study, the National Longitudinal Survey of Youth (NLSY), reported the prevalence of overweight at 22% in 1998 among African Americans and Hispanics, and 12% among non-Hispanic white children aged 4–12 years.⁹ The rate of relative increase was 120% among African Americans and Hispanics and about 50% among whites between 1986–1998. These disproportional increases among racial /ethnic groups were still significant after controlling for other covariates, including family income.

This study also showed income disparities in the rate of increase in overweight, with the upper-income group defined as those with income \geq 400% of the poverty level and the low-income level as $<$ 150% of the poverty level based on 1980 census. Overweight among upper-income white girls moderately increased from 6.6% in 1986 to 8.7% in 1998, while overweight among low-income African American and Hispanic boys jumped from 6.5% to 27.4% over the same time period.

Children Under Five Years

Among children 5 years of age and younger, the prevalence of overweight was less striking compared with older age groups, but still steadily increased in the past 30 years. Between 1971 and 2004, the prevalence of overweight children aged 2–5 years increased from 5% to 13.9%. The Pediatric Nutrition Surveillance System (PedNSS) has also observed a remarkable but steady increase in overweight prevalence among low-income children less than 5 years of age. (PedNSS is the ongoing surveillance system monitoring the nutritional status of low-income children who participate in publicly funded health and nutrition programs such as the Special Supplemental Nutrition Program for Women, Infants, and Children [WIC], Early Periodic Screening, Diagnosis and Treatment Program, and clinics funded by federal Maternal and Child Health Programs.) PedNSS estimates show an increase from 8.5% in 1983 to 10.2% in 1995 based on the 95th percentile for weight-for-height (WHP).¹⁰ The



increase was seen in all subgroups of sex, race, and age, although the changes were greatest for children 4–5 years of age.

Infants and Toddlers, Too

Contrary to what we might hope, infants and toddlers have not been spared from the observed obesity epidemic. In 1999–2000, 10% of infants and toddlers (younger than 2 years) were overweight (at or above the 95th weight-for-height percentile). This rate has more than doubled since the 1970s.¹¹

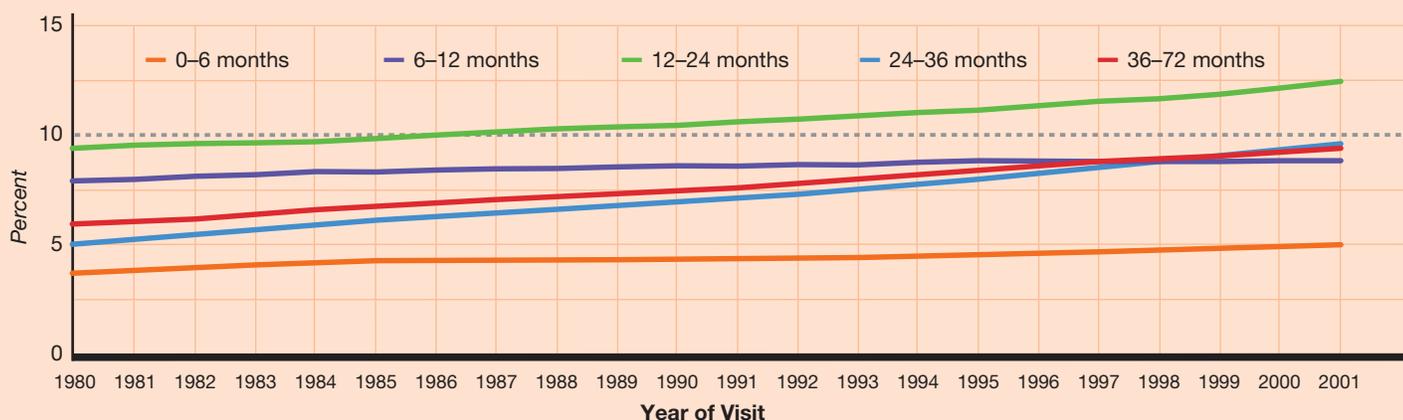
New reports of the NHANES 2001–2002 and 2003–2004 did not provide overweight estimates for children younger than two years old, partly because of the limited and inconsistent numbers of children enrolled in the surveys. In addition, infancy is the fastest growing period in life and therefore subject to fluctuating weight status due to nutrition and morbidity. Hence, there is no current definition of overweight or obesity for children younger than two years old.

However, national surveillance systems use the term “overweight” for the purpose of monitoring growth among infants and toddlers. The consensus definition of overweight for children younger than two years is those who are at or above the 95th weight-for-height percentile using the 2000 Centers for Disease Control and Prevention (CDC) growth charts.¹² Thus, interpreting or labeling weight status based on one-time measurements deserves caution.



For the infant age group alone, we are lacking specific prevalence and trend estimates. However, one recent study did separate infants and toddlers when documenting the prevalence and secular trend in overweight in primarily middle-income families during a 22-year period.¹³ Authors extracted children younger than 72 months who were seen for well-child visits at any of the 14 health centers of Harvard Vanguard Medical Associates (HVMA) from 1980–2001. Of the complete 702,456 visits, 366,109 were randomly selected to provide one visit per child, per calendar year, thus avoiding double counting of children with multiple records per year.

Trends in Prevalence of Overweight Among Children Aged 0-71 Months by Age: Health Maintenance Organization Nutritional Surveillance System (HMONSS)*



Overweight (weight-for-height \geq 95th percentile)

Adjusted by sex, age and clinic site

* HMONSS is the first study we created using HMO data, modeled after the Pediatric Nutritional Surveillance System (PNSS) in the CDC.¹³



Since 1980, overweight rates had increased among all subgroups of children, but it is disheartening to observe about a 74% increase among infants younger than 6 months. Relative increases were greater among girls than boys.

For the entire study period, the mean number of visits per child was 3.0 (i.e., the same child contributed to the study an average of three times during the study period). This study built an HMO-based surveillance system that had a large number of infants less than one year of age, which provides more robust estimates for the infant age group. Results showed that in 2001–2001, 6% of infants

younger than 6 months, 9% of infants between 6–12 months, and 12% of toddlers between 12–24 months were overweight. (See chart, “Overweight Trends in Infants and Toddlers,” page 4.) Since 1980, overweight rates had increased among all subgroups of children, but it is disheartening to observe about a 74% increase among infants younger than 6 months. Relative increases were greater among girls than boys, Hispanic children than white or black children, and children insured by Medicaid than those not on Medicaid. This study showed the prevalence of overweight has continuously increased among infants and toddlers, as well as preschool-aged children, from predominantly middle-income families.

A prospective longitudinal study showed that rapid weight gain is more prevalent (25.4%) during infancy than during early childhood (8.8%).¹⁴ It also showed that the population-attributable risk of rapid weight gain was slightly higher in infancy (15.7%) than early childhood (11.7%). Another longitudinal study¹⁵ showed that children who were above 50th BMI percentile between the ages of 2–5 years continued to increase BMI percentile and were more likely to become overweight at age of 12. The risk was higher for those who were at higher end of BMI percentiles than those of lower end. These results illustrate that we need to see ‘weight status’ as a continuous spectrum originating from very early life.

Stopping the Problem Where it Starts

The first few years of life may constitute a key period for the development of overweight and its long-term health consequences. Accumulating evidence supports the importance of overweight status and rapid weight gain during early infancy as a risk factor for persistent overweight during preschool years¹⁶ and later childhood and adulthood overweight.^{17–20} In a U.S. cohort, rapid weight gain during the first week as well as during the first 4 months of life was associated with adult overweight.²¹ Rapid weight gain may be especially harmful to children born with low birth weights. This accelerated weight gain—termed “catch-up growth”—was associated with higher BMI, central obesity in early childhood²² and higher adult systolic blood pressure.²³

We currently do not know how much weight gain nor how much of weight-percentile crossing indicates future development of overweight. Some European



studies defined a ‘rapid weight gain’ as at or above 0.67 change in weight Standard Deviation (SD) score, which corresponds to the distance between each percentile line on growth charts.²⁴ However, we are not sure ‘how much’ of weight, and ‘how early’ in age we should intervene to prevent the development of overweight and related metabolic features. Thus, it is important to achieve moderate weight gain for all infants during the first year of life. Considering the persistent and continuing nature of overweight, preventive efforts even in infancy may be important to public health. Monitoring and understanding modifiable determinants from the very first visit may provide an important avenue for pediatric obesity prevention. •

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