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EDITORIAL

# Overweight in children: a growing problem☆,☆☆

## Sobrepeso em crianças: um problema cada vez maior

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In this issue, Silveira et al. report on analyses of three nationally representative studies of Brazilian children, conducted in 1989, 1996, and 2006/7.[1] The analytic sample was restricted to ages 24 to 60 months. Silveira et al. find that the prevalence of overweight in this age group increased from 3.0% in 1989 to 7.8% in 2006/7, that most of the increase occurred between 1996 and 2006/7, and that the increase has occurred in all regions of the country, with some variation in the rate of increase across regions. In the second section of the article, the authors analyzed the most recent survey in more detail to identify cross-sectional correlates of overweight, finding that markers of higher socioeconomic position are predictors of increased prevalence of child overweight. Specifically, households in the more developed Southeastern Region, from the upper social classes, and whose mothers had seven or more years of schooling had elevated prevalence of overweight. In addition, consumption of caloric sweetened beverages four or more times weekly (reported by 9% of the sample) was associated with overweight.

Based on nationally-representative samples, the present analysis provides country-wide estimates that will be of value to policy-makers. However, one might quibble with the statistical approach on two grounds. First, the use of samples for which the primary outcome measure was defined using varying reference curves. The World Health Organization (WHO) Multicentre Growth Reference Study (MGRS) has characterized patterns of child growth that are presumed to be optimal, as they were derived from a large series of singleton, term children from upper-middle class households in six countries, including Brazil (the other countries were Ghana, India, Norway, Oman, and the USA), with access to clean water and adequate nutrition (including intention to exclusively breastfeed for up to six months), who were therefore free of objective conditions likely to hinder growth.[2] These standard reference curves provide two major improvements on the previously used references, many of which were derived from cross-sectional samples. First, they show that the primary variation in the patterns of growth across countries is due to socioeconomic class differentials, suggesting that the MGRS reference provides an excellent resource to compare samples of children from different countries and over time. Second, all prior reference curves are biased away from providing a standard to be emulated, as they include relatively large numbers of formula-fed children, whose growth patterns differ from those of breast-fed infants. Of note, an analysis of lengths and weights of children in 54 low- and middle-income countries found that failure of linear growth is widespread prior to age 2 years, but that there is no comparable decrease in weight for height.[3] It is important, therefore, to use these MGRS percentile distributions consistently, as inferences using prior reference curves may reflect deviations from a statistical norm rather than from a physiological goal.

Second, the authors used a 'flat' regression approach with arbitrary and data-driven rules for model building rather than a hierarchical model that might better capture the nuances of a clustered data set in which the outcome is thought to reflect individual, familial, and underlying determinants of weight status, all of which may interact

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with each other, and a rigorous theoretical framework to guide model building. From a policy perspective, it is hard to know what to make of an analysis that shows that measures of affluence, at a state or at a household level, are associated with increased prevalence of overweight in children. An analysis which focuses on how factors that are modifiable at the household or individual level act in the context of either poverty or affluence would enable development of a nuanced set of evidence-based interventions. A more refined analysis is anticipated, and in particular, one that conducts replicate individual-level analyses of all three data sets to allow for the examination of the stability of these cross-sectional associations over time.

Our interest in child growth, whether linear or in weight relative to linear growth, is at least in part because of the long-term consequences for these children as they become adults. Child overweight and obesity track over the life course,[4] and adult obesity is a strong predictor of cardiometabolic disease.[5] Turning to low- and middle-income settings, the COHORTS project has documented the long-term consequences of patterns of growth through adulthood. This collaborative group has conducted pooled analyses of data collected from participants in five birth cohorts from Brazil, Guatemala, India, Philippines and South Africa, with a total study sample exceeding 8,000 in many analyses.[6] These data have recently shown that child linear growth and relative weight (weight controlling for length, in other words a measure of obesity) have different relationships with adult outcomes.[7] In general, increases in relative weight that occur in the first or second year of life have little consequence for the development of elevated blood pressure, disglycemia, or obesity in young adulthood, while increases that occur from mid-childhood and later are strongly predictive of these outcomes. Increases in linear growth at any age are strongly predictive of final adult height, as would be expected, but have only modest associations with cardiometabolic disease.

In this context, the decision of the authors of the present paper to focus on the epidemiology of overweight and obesity in children over age 2 is reasonable, as it is in these children that rapid relative weight gain starts to develop associations with adverse risk in adulthood. The authors report on a previous analysis of these data that suggests that the increase in overweight is restricted to children above age 24 months.[8] Studies in the US have also demonstrated that the increase in the prevalence of overweight since the 1970's has been more marked among older children, with children less than 2 years of age relatively spared.[9] Silveira et al. suggest that the persistent low prevalence of overweight in children younger than 24 months is due to the increasing prevalence and duration of breastfeeding in Brazil. The benefits of exclusive breastfeeding are widely known,[10] and further research on this relationship in the Brazilian context is clearly warranted.

Child growth is a sensitive marker of overall health. Growth in height is an indicator of adequacy of overall nutrition in the first years of life. More importantly, perhaps, is the relationship between growth and measures of human capital. Stunting is associated with decreased cognitive potential.[11] Hoddinott et al. have recently shown that stunting at age 2 years is strongly associated with a wide range of measures of human and social capital.[12] There is substantial evidence that interventions to increase linear growth are effective when delivered in the first 2 to 3 years,[13] and that these interventions have long-standing impacts on cognitive functioning[14,15] and on productivity[16] Others have suggested that there may be periods in life after the 'first 1,000 days' in which interventions may be effective in incrementing height,[17] but while there is variance in growth after that age[18] and children who do recover also show improvements in cognitive attainment,[19] there is to date no experimental evidence that specific interventions can remediate the consequences of growth failure that has already occurred, and there is the danger that efforts to encourage additional growth through additional feeding may in fact prompt early cessation of growth. Thus there needs to be continued emphasis on prevention of growth failure in the first 1,000 days, followed by efforts to ensure appropriate linear growth and prevent the rapid weight gain that is all too common in many settings. Well-intentioned but misguided programs such as feeding programs in child care and school settings need to be monitored to ensure that they are not providing too many empty calories – in this regard, the changes in the National Nursery School Council Program (JUNJI) in Chile are notable.[20]

The precise dietary factors that will facilitate linear growth while preventing the onset of obesity are the subject of intense debate. There is widespread concern regarding the high consumption of sugar-sweetened beverages,[21] while others have focused on the more general phenomenon of high intakes of refined carbohydrates, whether these be 'liquid calories' or white breads, candies, and desserts.[22] The epidemiology of consumption of these items provides a sufficient explanation for the observed epidemiology of child overweight. At low levels of national development, few children outside of the wealthiest households have the opportunity to consume these products, and hence overweight is rare, and concentrated among the wealthy. As society develops and becomes more aspirational, the frequency of consumption rises dramatically, in part representing additional calories and in part displacing more nutritious alternatives. Thus, overweight becomes more widely prevalent in the wider society. Coupled with the recently emerging paradigms of developmental programming and mismatch of the early and later environments,[23] these manifestations of affluence portend a future epidemic (already emerging in some countries)[24] of diabetes and other non-communicable diseases.

We owe our children a better future. We need an evidence base that provides policy-makers with data on the emerging epidemic of obesity and its sequelae, and with evidence-based options to tackle the determinants of these epidemics. The article by Silveira et al. sounds an alarm. How will we respond?

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