Commentary: Growing up optimally in societies undergoing the nutritional transition, public health and research challenges

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The question that underlies the study by Corvalán et al., published in this issue of *International Journal of Epidemiology*, has far-reaching consequences: what is the growth pattern that will lead to optimal health both in the short- and long-term for children living in countries in nutritional transition? A few decades ago, when obesity, hypertension, diabetes and coronary disease were marginal (or marginally recognized) public health problems in low-income countries, the answer was easy. The more infancy weight gain, the better, in order to prevent undernutrition, related infections, deaths and impaired physical and neurological development. The short-term benefits of sufficient infancy weight gain are unquestionable. But now that chronic adult diseases have become public health priorities in countries in nutritional transition and that the obesity epidemic is taking global proportions, the question of possible negative consequences of excessive infancy or childhood weight gain has become more relevant. Increasing evidence suggests that rapid weight gain during some periods of growth may be associated with the programming or imprinting of long-term obesity and other cardiovascular risk factors. The balance of benefits and risks has become more difficult to find in societies that deal with the ‘dual burden of [...] the unfinished agenda of infectious diseases and the emerging agenda of non-communicable diseases’. In this context, the challenge of public health nutrition is to define clear and coherent messages for health workers and parents to promote growth patterns that are optimal for short-term and long-term health.

The first condition for designing such messages is to have strong scientific evidences to support them. Unfortunately, when it comes to defining optimal growth for children in societies in nutritional transition, evidence remains very incomplete. The life course approach to chronic disease epidemiology provides a useful framework, but many scientific challenges have limited the interpretation and usefulness of existing research. First, most studies of obesity programming are observational and no matter how many are conducted and how well they are designed, observational studies will not demonstrate causality and therefore will have limited practical or public health implications. For example, unknown or unmeasured confounding factors, such as common genetic predisposition between the exposure and the outcome, cannot be eliminated in observational studies. Fortunately, in the context of a life course approach to chronic disease epidemiology, by definition, results of prospective randomized intervention studies will take a lifetime to become available. Meanwhile, decisions are made based on the follow-up of a few intervention studies designed for other purposes or based on observational studies.

Most observational studies are analyses of cohorts constituted to address questions other than our current concerns. Consequently, analyses are driven by data availability, rather than by a priori hypotheses. For example, birth weight is more widely available than infancy or childhood growth data and therefore many studies have focused on fetal growth. In contrast, in the study by Corvalán et al., growth status was assessed at several time points in a cohort where stunting and adult overweight are frequent, allowing the authors to plan a more hypothesis- rather than data-driven analysis. Another strength of this study is that data on infancy length and childhood height, as well as some assessment of adult lean mass, but also, predictive of adult adiposity, enabled the analysis of separate aspects of growth: changes in length vs changes in body mass index (BMI), as well as adult lean mass vs adiposity. The data show that changes in BMI during infancy and between the ages of 3 and 7 years, but not during fetal life or between the ages of 1 and 3 years, are predictive of adulthood adiposity. Changes in length during any period appear to be predictive of adult lean mass, but also, to some extent, of adult adiposity.

Even if ideal data are available, scientists face the challenges of choosing optimal analytical methods to identify periods of growth that are more strongly associated with adult outcomes. Human growth during one period is not independent from the growth in the previous period. Additionally, the magnitude of variance around the average growth pattern depends on the duration of the period considered and on the expected variance from the norm during that period. For example, moving from the 50th to the 95th percentile in the 4 months between birth and age four months represents a more important variance from the norm than moving between the same two percentiles in the 8 months between age 4 months and 1 year. Some periods, such as early infancy or puberty, are
characterized by wider physiological variability in growth patterns than other periods. Therefore, direct comparisons of β-coefficients to assess which period is ‘more critical’, are problematic, even after data normalization. Several methods have been proposed to resolve these analytical challenges, but none of them are widely recognized as the best method or are uncontroversial. Analysing the same data using different strategies can result in opposite conclusions.

An additional scientific challenge is to try to balance the benefit of early-life weight gain on infectious disease, infant mortality and neurological development with the risk of adult chronic disease. Such risk–benefit assessment would require quantification of short-term benefits and long-term risks using metrics that can be directly compared. This type of quantification is not only difficult, but is dependent on societal or individual values and priorities.

In conclusion, much work is still needed from researchers in epidemiology, biostatistics, public health, nutrition and paediatrics before we are ready to provide clear, uncontroversial and coherent public health messages for optimal child growth in countries in nutritional transition. Meanwhile, the prudent approach is probably to stick with the recommendations that are well established to be beneficial, such as the promotion of exclusive breastfeeding and the careful clinical monitoring of growth to detect and try to correct important deviations, whether they are downward or upward. The new WHO growth charts should help, as they reflect growth in optimal conditions rather than observed average growth.

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