



Optimal child growth and the double burden of malnutrition: research and programmatic implications^{1–3}

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Latin American children are getting taller, but they are also becoming fatter. These 2 simultaneous shifts have been widely documented: both the distributions of height (length) for age and of weight relative to height (length) are moving to the right side (1–3). These changes are not restricted to Latin America. With the possible exception of sub-Saharan Africa, the prevalence of stunting is rapidly decreasing. Child overweight is increasing in all regions, including Africa (3), at a faster rate than adult overweight (4). Whereas only a few years ago the major concern was with undernutrition, in particular with its impact on morbidity, mortality, and child development, the nutrition transition has shifted the focus to the risk of adult noncommunicable diseases (NCDs) related to early growth patterns. In fact, nutrition-related factors still contribute to almost half of all deaths of children <5 y of age (3), so that the global burden of undernutrition is still immense.

In recent years, we have learned much about how growth in different age ranges during childhood affects long-term outcomes. It has been confirmed globally that growth faltering is particularly concentrated in the first 1000 d from conception to the second birthday (5).

Cohort analyses from low- and middle-income countries (LMICs) initially focused on weight gain, which includes linear growth but also increases in relative adiposity, or greater weight for length or height. These analyses showed that rapid weight gain during the 1000-d window is associated with greater human capital, expressed in terms of intelligence, productivity, adult height, or next-generation reproductive outcomes (6). Contrary to what may have been expected, rapid gains in this period showed variable associations with NCD markers measured in young adults, which somewhat increased risks for some markers and no associations or protection against others (6). Rapid weight gains after the first couple of years, however, were consistently associated with higher concentrations of markers for NCDs, and did not contribute to improving human capital.

These analyses were further elaborated by using conditional growth analyses to disentangle linear growth from relative weight gain, above and beyond what would be predicted from a child's linear growth (7). The data from LMIC cohorts suggest that higher birth weight and fast linear growth—particularly in the first 2 y—had important positive effects on human capital and few adverse trade-offs in terms of NCD markers. Gaining weight faster than expected in terms of linear growth, on the other hand, not only did not contribute to future human capital but markedly increased the risk of NCD markers, particularly if this occurred after the age of

2 y. These conclusions are well in line with earlier results from the only randomized nutrition supplementation trial that followed up its participants until adulthood, the Guatemala Instituto de Nutrición de Centro America y Panama (INCAP) study (8).

Two main conclusions arise from these results. First, it does matter when rapid growth occurs. Second, looking solely at weight gain fails to separate 2 types of growth with different prognostic implications: linear growth and relative weight gains.

Do these findings apply to children from high-income countries? We don't know yet. Children in the LMIC cohorts suffered from a high prevalence of intrauterine growth retardation and stunting, which is not the case in present-day populations in high-income settings and in some middle-income countries as well. However, the nutritional situation of the cohort children is quite typical of what is happening currently in low-income countries where most of the world's children are born.

These findings have programmatic implications. Programs aimed at promoting weight gains in children >2 y—except of course in populations in whom wasting is prevalent—may do more harm than good.

Typically, as is the case for school feeding programs (9), such interventions lead to faster weight gain than is the case for linear growth, at an age range in which long-term risk of NCDs may be affected. The WHO is currently undertaking a review of the nutrition programs it promotes to assess whether these may be having such undesirable side effects.

The findings also have important research implications. Can we further improve nutrition programs so that these lead primarily to improving linear growth rather than increase weight for height? Which interventions—breastfeeding promotion, zinc supplementation, high quality proteins, etc.—are most likely to lead to fast linear growth?

Implications for monitoring and evaluation are important. Incorporating measurement of length or height in health services is not an easy task, but one should not rely solely on weight for

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monitoring the status of children and populations, nor for evaluating the impact of specific interventions.

Last, the days for carrying out nutritional studies with a single outcome are over. Recent research shows that in addition to considering the short-term effects of growth and nutritional status, it is important to measure outcomes later in childhood (e.g., psychomotor development) as well as long-term impact on human capital and risk of NCDs. As shown above, results may vary according to the indicator used. For example, being taller is systematically associated with increased blood pressure and the risk of some cancers (6), but tallness also relates positively to human capital (6) and is associated with lower overall mortality (10). Any study that makes recommendations on the basis of a single outcome will likely miss the full picture.

The topic of how shifts in the double burden of malnutrition will affect the long-term health and human capital of children from LMICs is a complex one. In particular, the age ranges in which the shift is most pronounced, and the characteristics of the shift, will define whether we can look forward to a healthier and more productive future generation or to one at higher risk of NCDs.

This supplement issue presents evidence of the coexistence of stunting and excess body weight at country and household levels and within the same individual in 6 of 7 Latin American countries for which information on the double burden is presented. The articles also inform that in most countries interventions and programs aimed at the prevention of stunting and other forms of undernutrition are in place. A few countries are also implementing policies to curb the obesity epidemic, but the strategies to prevent stunting and excess weight gain are unconnected in most countries. Only one country (Mexico) is slowly moving to integrated interventions during gestation and the first years of life that are aimed at promoting healthy growth, namely fostering linear growth without excessive weight for length gain, including monitoring both length and weight-for-length gains.

How can countries move to cohesive interventions to curb the double burden of malnutrition? On the one hand, research is needed to identify efficacious interventions for promoting healthy growth to inform programs and policies. On the other hand,

programs that have already incorporated or will incorporate healthy growth promotion as an objective should be evaluated to identify their effectiveness in terms of multiple outcomes.

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