

Unconditional or conditional change: does it matter? Growth charts for monitoring weight gain during pregnancy^{1,2}

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Recent interest in the Developmental Origins and Health and Adult Disease (DOHaD) hypothesis has led to several studies assessing how events taking place at a given time in development (embryonic or fetal life) can affect the health of the offspring in later life (1). The simplest way of assessing “healthiness” during pregnancy is by monitoring maternal weight gain. However, defining a “healthy” weight-gain pattern is not easy.

The first issue to consider is whether to use unconditional or conditional growth charts (2). Unconditional charts are based on attained weight, mostly derived from cross-sectional data. They take into account differences by sex (ie, in children) or age (gestational age in the case of pregnancy); weight measurements are commonly expressed as a centile or an SD (z score) relative to a reference population. These charts are used to assess size; in other words, they assess whether a given weight for a given gestational age is below or above the values of the reference population. These charts are also used to monitor the rate of weight gain (ie, whether changes in weight gain over time are below or above those of the reference population) under the assumption that normality corresponds to growth within the same centile. This latter use is not appropriate because longitudinal data should be used to establish reference values for changes over time. In contrast to unconditional charts, conditional growth charts are based on longitudinal data. Thus, they are suitable to assess whether growth has deviated from its normal trajectory. A valid concern in assessing weight change is that, on the basis of “random error,” extreme observations become closer to the population mean in subsequent measurements; this is called “regression to the mean” (3). Thus, a major advantage of “conditional growth charts” is that they account for this phenomenon by considering the previous weight in predicting the expected future weight; from a statistical perspective, this is the “correct” way of assessing weight changes.

In this issue of the Journal, Xu et al (4) develop and validate both unconditional (cross-sectional) and conditional (longitudinal) maternal weight-gain charts for use in an African population; they provide centiles to calculate z scores and an electronic spreadsheet that facilitates the use of the charts. This article is an important contribution for those working in maternal and infant health in Africa; however, the correct use and interpretation of these charts should be made with caution. In the case of unconditional weight charts, a given centile at a set gestational age

indicates how far (above or below) that value is from the median of the reference population. Thus, unconditional charts provide an idea of the size of a pregnant woman. It is generally assumed that those in the extremes (low or high) are at increased risk of maternal and offspring complications (5). However, in the case of conditional charts, a given centile indicates whether a weight change is below or above the expected value on the basis of the initial weight and the trajectories of the reference population. The median (50th centile) in a conditional growth chart does not necessarily represent a “normal” weight change but rather the “expected weight change” for a given starting weight. Thus, the clinical interpretation of weight-gain percentiles needs to take into account baseline size. Weight gain that follows the 50th centile trajectory is not the same for a woman of normal weight compared with a woman with low weight; in the latter, an assumption that weight gain is appropriate (following the 50th centile) may result in unintentionally perpetuating a poor growth trajectory.

Regardless of the type of chart used for monitoring weight, 2 additional issues are relevant in interpreting growth data. The first one relates to the selection of the reference population (6). Given that actual weight measurements are compared with the reference population, the baseline characteristics of the reference population become critical in assessing what should be considered normal or abnormal. For example, if the reference population is composed mainly of women who exceed the weight-gain recommendations, the 50th centile will correspond to weight gains that exceed the recommended values. If this were the case, a certain weight change classified as being in the 50th percentile could be incorrectly interpreted as “normal” when, in fact, it would be excessive relative to the recommendations. In their article, Xu et al avoid this problem by defining what they have termed a “healthy” reference that theoretically fulfilled the prerequisites to achieve an adequate weight gain during pregnancy. They considered a number of conditions, including adequate nutritional status, absence of diseases, and adequate perinatal outcomes, claiming that they developed a true “growth standard” (ie, they described weight-gain patterns under optimal

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conditions). However, a number of other aspects that might affect fetal growth, such as dietary behaviors, environmental exposures, and physical activity, were not considered; moreover, enrollment took place between 14 and 25 wk of gestation; this time frame may already be too late, considering that some risks may be present at the time of conception (7).

The second issue relates to the fact that risks are usually arbitrarily defined below or above a certain statistical threshold (ie, ± 2 SDs or below the fifth centile) rather than based on functional outcomes. Maternal weight-gain charts should be validated considering both short-term (ie, survival, morbidity) as well as long-term (ie, adult stature, mental development, cardiovascular and metabolic health) health and well-being. Analyses linking unconditional weight centiles and conditional weight-gain centiles with short- and longer-term maternal (ie, preterm delivery, delivery complications, weight retention) and offspring (ie, mortality, high birth weight, diarrhea, metabolic diseases) health outcomes will not only contribute to defining the correct cutoffs to assess clinically relevant risks but may also contribute to defining whether the effects are the same throughout pregnancy or whether there are critical time periods. Studies in this area may also contribute to defining

whether the “quality” (ie, distribution and functionality of adipose tissue) rather than the “quantity” of weight gain is what matters for optimal short- and long-term outcomes.

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