Global Prevalence of Small for Gestational Age Births

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Abstract

Fetal growth restriction is found both in babies who are preterm or full-term, and in either case has important adverse effects on subsequent survival, health, growth and development. Fetal growth restriction is usually assessed by comparing the weight of the newborn with the expected weight for the child's gestational age using less than the 10th centile of a reference population for fetal growth as the threshold for being called small for gestational age (SGA). We estimate that in 2010 32.4 million babies were born SGA in low- and middle-income countries, constituting 27% of all live births. The estimated prevalence of SGA is highest in South Asia and in Sahelian countries of Africa. India has the world's largest number of SGA births, 12.8 million in 2010, due to the large number of births and the high proportion, 46.9%, of births that are SGA. The prevalence of SGA births is approximately double the prevalence of low-birthweight births (using the common indicator of <2,500 g birthweight) globally and in the world's regions. Thus, given the adverse effects of being born SGA, even weighing 2,500 g or more, it is important that maternal, neonatal and child health programs seek and use information on gestational age as well as birthweight to appropriately assess the newborn’s risks and direct care.

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Introduction

The importance that optimum fetal growth has for survival, growth and development after birth has long been recognized [1]. Newborns weighing less than 2,500 g, the most commonly used definition of low birthweight (LBW), are at risk of poor health and development outcomes as a consequence of being born prematurely, having fetal growth restriction or both. While this definition of an
at risk population has been useful for nutrition programs, it underestimates the size of a population of newborns at risk because it does not include babies who have fetal growth restriction, but weigh 2,500 g or more [1]. The comparison of weight at birth with a fetal growth reference by week of gestation permits the identification of newborns who are small for their gestational age (SGA) for both preterm and full-term births. This chapter will focus on the estimation of the global prevalence of SGA births.

**Low-Birthweight Births**

LBW has been defined by the World Health Organization as a weight of <2,500 g at birth and very low birthweight (VLBW) as <1,500 g. Births that are <1,000 g are defined as extremely low birthweight (ELBW). Neonatal complications, including hypothermia, hypoglycemia, asphyxia, respiratory distress, fluid and electrolyte imbalances, hyperbilirubinemia, infection and neurological and sensory problems, are more common in LBW births. These complications are accentuated in VLBW and especially in ELBW births. Compared to babies with birthweights of at least 2,500 g, LBW babies have lower survival rates, which decline monotonically with lower birth weights. Lower birthweights are also associated with increased risk of developmental delay and overweight and related noncommunicable disease in adulthood. The outcome of the complications is very influenced by the level of care that is available for the newborn and young infant. In settings with sophisticated neonatal intensive care, most babies of 1,500–500 g survive, although many have lifelong adverse health effects. In low-income countries with much more limited care options, most babies below 1,500 g at birth do not survive.

It has been estimated by UNICEF that 15% of births globally are <2,500 g at birth, resulting in over 20 million LBW newborns annually (childinfo.org) [2]. The regional importance of LBW births is highest in South Asia where the percentage is more than 25%. Half of the LBW births are in just three countries, India, Pakistan, and Nigeria. India alone has nearly 7.5 million births of babies with weight <2,500 g annually, 38% of the global total. In high- or upper-middle-income countries, 5% or less of births are LBW, largely due to preterm deliveries. The percentage of births in these settings has declined historically from the higher rates seen now in the low-income countries, but in some countries has increased recently because of mistimed Cesarean section deliveries leading to more preterm births and increased multiple births due to fertility treatment.

LBW continues to be used in neonatal health programs because it can be measured with reasonable accuracy. Nevertheless, in areas of the world with the
highest rates of LBW births, most newborns are not weighed because of home deliveries, late postnatal visits and insufficient capacity of health workers. Efforts need to be increased to ensure that all births are registered, weighted and medically assessed because the information is useful to direct home care and health services. In addition, the prevalence of LBW births has been adopted as a World Health Assembly [3] nutrition indicator with a global target of 30% reduction in prevalence by 2025, recognizing the importance of LBW for survival, development and health in the lifespan.

Birthweight is largely determined by two factors, the duration of gestation and the rate of fetal growth. Babies can be <2,500 g because they are born prematurely, i.e. before 37 completed weeks of gestation, with or without fetal growth restriction. Or they can be born at or after 37 weeks but have restricted fetal growth. Furthermore, newborns that are ≥2,500 g may also have fetal growth restriction. Fetal growth restriction is assessed by comparing the weight of the newborn with a reference population thought to have normal fetal growth. The assessment of the adequacy of fetal growth requires knowledge of the gestational age of the newborn, usually by documentation of the last menstrual period or ideally fetal ultrasound examination early in pregnancy. Thus, fetal growth restriction is assessed in regard to achievement of the expected weight for a given gestational age. Being small for gestational age (SGA) is usually defined as having a birthweight below the 10th percentile for gestational age compared to an appropriate reference population. Some of these babies will be small at birth because they are constitutionally small, but for many the fetal growth restriction is due to maternal nutritional deficiencies, infections during pregnancy, abnormal placental function or fetal malformations. The various possibilities for classification of status of the newborn are shown in figure 1 which has weight on the y-axis and gestational age on the x-axis. Newborns who are at the expected weight whether preterm or at or after 37 weeks are referred to as appropriate for gestational age: these are above the dashed line in the figure. Newborns who are lower than the expected weight whether preterm or full term are referred to as SGA. LBW referring simply to being <2,500 g at birth includes some newborns who are preterm, some who are SGA and some who are both with the relative proportions in populations varying by setting and other factors. The classification of LBW does not include the newborns who weigh 2,500 g or more but are small for their gestational age. In figure 1, one can also identify the group of newborns who are full term and at least 2,500 g at birth. This group has been referred to as ‘term low birthweight’ which has been used in previous estimates related to fetal growth restriction due to limited data availability on gestational age and thus on the true prevalence of SGA births.
Small for Gestational Age Births

The Child Health Epidemiology Reference Group (CHERG) of the World Health Organization and UNICEF has undertaken analyses in the last decade of global levels and causes of child death, numbers of preterm births and stillbirths, prevalence and consequences of nutritional risk factors, and maternal, neonatal and child morbidity. In the last 2 years, a set of analyses has focused on prevalence of fetal growth restriction and its consequences [4–7]. These analyses have been published in research papers [5–7] and as part of a series of papers on maternal and child nutrition published in *The Lancet* in mid-2013 [4, 8–10]. Detailed methods are published in these papers. Briefly, SGA was defined as birthweight below the tenth percentile of a reference population for a given gestational age and sex [11]. The reference used for these analyses included more than 3 million nationally representative, multiethnic births in the United States in 1991. Preterm birth was considered to be delivery at less than 37 weeks.

In previous analyses, fetal growth restriction was indicated by LBW (<2,500 g) in babies who were full term because of what data were available [12]. This did not allow estimation of the full prevalence of fetal growth restriction (as indicated by SGA) that would include babies who were both preterm and SGA or who were SGA but weighed more than 2,500 g. In new analyses, it has been possible to do estimates of SGA that overcome these limitations and provide the
results for both term and preterm births [5, 6]. These estimates indicate that in 2010, 32.4 million babies were born SGA, 27% of all births in low- and middle-income countries [6]. About 20% of the preterm births in these countries were also SGA. India has not only the largest number of SGA births of any country, 12.8 million (uncertainty range 11.5–14.3 million), but an extremely high proportion of all births in India are SGA (46.9%) [6]. Figure 2 shows the estimated national prevalence of SGA births in low- and middle-income countries in 2010. The highest prevalences were in South Asia and the Sahelian countries of Africa.

As shown in figure 3, the prevalence of SGA, including both term and preterm births, is approximately double the prevalence of LBW in all the world regions. SGA is largely in babies born at term with only a small proportion of babies being both preterm and SGA.

**Implications for Programs and Research**

SGA is an important global problem with consequences for child survival and development, and an even more critical problem for countries in South Asia, especially India and some countries in Africa. Success in reducing neonatal and child mortality in these countries [13] may depend on addressing the problem of fetal growth restriction. Improved diets for pregnant women, as well as specific interventions, such as targeted balanced protein energy supplementation and multiple micronutrient supplementation in pregnancy, that are proven to reduce SGA should be implemented in ways to achieve high coverage in preg-
nant women who can benefit. Additional nutritional interventions, e.g. in adolescence and before conception, should be evaluated and implemented if effective.

As the evidence accumulates that poor fetal growth has both short-term consequences for survival and linear growth (i.e. stunting) and long-term adverse effects on cognitive and psychosocial development, adult stature and risk of adult metabolic diseases \[4, 14\], there must be more focus on programs and research to prevent it. However, recognizing that the prevention approaches may for some time remain only partially successful and that some of the determinants of poor fetal growth may take a generation to reduce, there is a parallel need for research on the mechanisms for these adverse fetal effects, how they may differ by the timing and type of nutritional insult during pregnancy and how the adverse effects of SGA can be mitigated after birth.

**Disclosure Statement**

Robert Black serves on the Boards of the Micronutrient Initiative, Vitamin Angels and the Child Health and Nutrition Research Initiative and the Nestle Creating Shared Value Advisory Committee.
References


