Can We Reduce the Number of Low-Birth-Weight Babies? The Cuban Experience

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Abstract

Low-birth-weight (LBW) infants have a significantly greater mortality than other babies, not only within the neonatal period but also in infancy and early childhood. Babies are LBW either because they are preterm or they have experienced intrauterine growth retardation. Reducing the prevalence of LBW babies is important in reducing child and infant mortality. Risk factors for prematurity and intrauterine growth retardation are well established. Socioeconomic conditions and nutrition during pregnancy are two key factors. Interventions to reduce the prevalence of LBW infants in developed countries have usually been unsuccessful. A few studies in developing countries have, however, achieved positive results. Cuba has managed to reduce the prevalence of LBW infants and their model of healthcare in relation to achieving this is described. Key features of the Cuban healthcare system are that it is both free and universal, and additionally there is a strong emphasis on primary healthcare. It is likely that a similar approach in both developing countries and disadvantaged communities in developed countries

would reduce the prevalence of LBW babies. This would have a major impact in relation to reducing infant mortality rates.

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Introduction

Low birth weight (LBW) is defined by the World Health Organization (WHO) as a birth weight of <2.5 kg irrespective of gestational age [1]. This definition was agreed at the 29th World Health Assembly in 1976 [1]. LBW infants have a significantly greater mortality than other babies. Worldwide each year there are more than 20 million LBW infants born and they account for over 15% of all births. Over 95% of these births occur in developing countries. There are two main causes of LBW babies. These are preterm birth (before 37 weeks' gestational age) [1] and intrauterine growth retardation (IUGR). Both the WHO and UNICEF recognise the importance of reducing the number of LBW infants as an important contribution to the Millennium Development Goal for reducing child mortality.

The importance of birth weight is illustrated by recent data from the USA which looks at infant mortality rates

Table 1. Prevalence of LBW infants [1] and infant mortality rates [3] in several countries

Country	% LBW infants (2000)	Infant mortality rate ¹ (2005)
Finland	4	3
Canada	6	5
Cuba	6	5
UK	8	5
USA	8	7
Jamaica	9	17
Bangladesh	30	54
India	30	56

¹ Per 1,000 live births.

Table 2. Risk factors for LBW

	Prema- turity	IUGR
Society		
Poor socioeconomic conditions	+	+
Very young maternal age	+	+
Advanced maternal age	+	-
Lack/poor maternal education	+	+
Quality of antenatal care	+	+
Working long hours during pregnancy	+	-
Short inter-pregnancy interval	+	-
Single marital status	+	+
High altitudes	-	+
Nutrition		
Inadequate calorie intake	-	+
Low pre-pregnancy weight	+	+
Poor gestational weight gain	-	+
Nutritional deficiencies (iron, folate or zinc)	+	-
Maternal short stature	-	+
Mental health		
Stress and anxiety	+	-
Depression	?	-
Toxicology		
Cigarette smoking	+	+
Environmental toxins	+	+
Medical		
General morbidity, episodic illness	-	+
Hypertension	+	+
Infections	+	-
Inflammation	+	-
Multiple gestations	+	-
Previous preterm birth	+	-
Periodontal disease	?	-

(IMRs) in relation to a variety of factors [2]. The IMR is 25 times greater for LBW infants than for babies weighing ≥ 2.5 kg. For infants weighing < 1.5 kg, the IMR is 108 times greater. This is as expected as these are the highly preterm infants where survival rates are low. The American data does, however, also point out that the IMR for babies with a birth weight between 2.25 and 2.5 kg is almost 5 times greater than the IMR for babies weighing ≥ 2.5 kg [2].

Despite the fact that more than half the infants in the developing world are not weighed at birth, the WHO and UNICEF have developed methods to estimate the percentage of LBW infants born each year in most countries [1]. There is considerable variation between countries in the percentage of LBW babies and this is illustrated in table 1. Table 1 also shows data for the IMR, and it is clear that there is a strong correlation between the percentage of LBW births and the IMR [3]. Cuba, which is a poor country, has the same percentage of LBW infants as Canada, which is far richer. This review will look at the aetiology of LBW infants and the Cuban experience of reducing the number of LBW infants.

Aetiology

There is considerable overlap between risk factors for prematurity and risk factors for IUGR. Poverty is associated with an increased risk for an LBW birth [4]. This is probably associated with a variety of factors. These include poor nutrition, an increased prevalence of cigarette smoking and drug abuse, alongside a very young maternal age and an inadequate education in relation to pregnancy and poor diet. The most systematic review of the determinants of LBW is the extensive study by Kramer [5] that was published 20 years ago. Kramer identified the following risk factors for (i) the early onset of labour and subsequent birth of a preterm infant and (ii) for IUGR and subsequent birth of an LBW baby: poor socioeconomic conditions; low weight prior to pregnancy; very young maternal age; lack of/poor maternal education, and cigarette smoking. He also established that the following were risk factors for IUGR: poor calorie intake; general morbidity, episodic illness during pregnancy; poor weight gain during pregnancy, and short stature.

Subsequent research has confirmed many of the risk factors identified by Kramer and also confirmed some of the possible risk factors previously identified (table 2). These studies have looked at both society issues such as poor maternal socioeconomic status [6] and low levels of

maternal education [7] as well as medical issues such as maternal hypertension, placenta previa and placental abruption [8–11]. The importance of antenatal care has been highlighted in an American study which suggested that women who received no antenatal care had an almost 4 times greater risk of delivering an LBW baby [12].

Air pollution appears to be associated with both IUGR and prematurity [13]. A systematic review of the literature suggests that there is a link between polycyclic aromatic hydrocarbons and IUGR, but the timing of exposure and precise identification of the relevant pollutants has not yet been established [14].

Interventions

Despite the fact that the aetiology of LBW babies has been known for over 20 years, interventions in many countries have usually been unsuccessful in both reducing IUGR and preventing preterm births. A systematic review of 126 trials evaluating 36 prenatal interventions to prevent or treat IUGR identified only three interventions which had been shown to be beneficial [15]. These included (1) the cessation of smoking, (2) nutritional supplementation during pregnancy, and (3) the treatment of malaria during pregnancy. It is important to recognise that although only three interventions had been shown to be beneficial, this did not mean that the other 33 interventions are definitely not of benefit. Many of the trials had inadequate sample sizes or were poorly randomised. The authors identified supplementation with zinc, folate and magnesium as areas that required further research. They also commented that combinations of several interventions may be of benefit. The same group did a systematic review of nutritional and antimicrobial interventions to prevent preterm births [16]. They identified that the treatment of asymptomatic bacteriuria during pregnancy reduced the incidence of both preterm birth and delivery of an LBW infant.

In contrast, a trial in rural Gambia demonstrated that nutritional supplementation during pregnancy in mothers at risk resulted in a mean increase in birth weight of 136 g [17]. This small increase in mean birth weight reduced the prevalence of LBW infants from 17 to 11.1%. This small study also reported a substantial reduction in the prevalence of still births and in early neonatal mortality [17]. It is important to recognise that several studies have documented a small increase in birth weight in disadvantaged communities [18]. It has been suggested that an increase of 100 g in the mean birth weight may be as-

Table 3. LBW births in Cuba [23]

Year	LBW births	Live births, %
1978	15,115	10.4
1980	13,178	9.7
1985	14,693	8.2
1990	14,260	7.6
1995	11,737	7.9
2000	8,814	6.1
2005	6,574	5.4

sociated with a 30–50% reduction in neonatal mortality [18]. It has also been suggested that to counter the effects of socioeconomic deprivation, interventions during pregnancy alone are insufficient and that interventions need to be introduced prior to conception [19, 20].

Two recent studies of multivitamin supplementation during pregnancy have shown a positive effect. A study of over 8,000 pregnant women in Tanzania showed a significant reduction in the incidence of LBW infants from 9.4 to 7.8% [21]. A study of over 30,000 pregnant women in Indonesia showed a significant reduction in early infant mortality and a trend towards reduction in the incidence of LBW infants [22].

Cuban Experience

The percentage of LBW births in Cuba is lower than both in neighbouring countries such as Jamaica and far richer countries such as the UK and USA. The percentage of LBW births in Cuba has consistently fallen over the last 30 years (table 3) [23]. The worldwide incidence of LBW births in developing countries over the last decade has remained relatively constant (24% in 1990 and 23% in 2000) [1]. Cuba has an excellent healthcare system and, in particular, has a primary healthcare system which is the envy of many countries.

The primary healthcare system is based around the family doctor who is located in a small primary care centre (consultorio) where there is also a nurse [24]. Both the nurse and family doctor live either at the primary care centre or nearby. Each family doctor and nurse provide medical care for between 120 and 160 families. The family doctor and nurse see individual patients at least twice a year for a routine check-up. One check-up occurs within the primary care clinic and the other at the patient's home.

Table 4. Prevalence of LBW births at two different times (1990 [29] and 2000 [1])

	1990 (UNICEF 1996 report)	2000
Finland	4	4
Cuba	9	5
UK	7	8
USA	7	8
Jamaica	11	9
Bangladesh	50	30
India	33	30

The primary care health team are aware of each patient's medical and social problems. This system results in the early identification of patients with social problems that may adversely affect their health. It allows health professionals to give appropriate advice to women who are likely to become pregnant prior to conception. Within the primary care system there is a strong emphasis on the importance of nutrition for women during pregnancy and while breastfeeding. Such a system provides excellent internatal care which has been identified as probably being more important than antenatal care [19].

During pregnancy, each woman receives 12 check-ups. If it is a low-risk pregnancy, then the woman will be seen each month by the family doctor who will check her weight and blood pressure alongside a physical examination appropriate for the stage of the pregnancy. For pregnancies where there is a higher risk, the family doctor will liaise with appropriate specialists such as obstetricians, dieticians, and psychologists and ensure that the pregnant woman is seen by both the family doctor and appropriate specialists as frequently as is required.

For women with major social problems (including teenage pregnancies) the Cuban healthcare system has established maternity homes. These are buildings that offer free food and accommodation for pregnant women from 20 weeks' gestation. A doctor, midwife and nurse provide medical care during the day and the women are provided with healthy meals and advice regarding nutrition and breastfeeding. In a country where there is an acute shortage of housing and young adults often live with their parents, teenagers who are pregnant welcome the opportunity of living with other teenagers who are also pregnant. Mothers who are expecting twins are also offered the opportunity of staying in the maternity home from 20 weeks' gestation, and in a society where women are still expected to do all domestic chores this offer is

usually accepted as it gives the pregnant woman the opportunity of resting.

Cuba also has an excellent education system with free and universal education for all children between the ages of 6 and 16 years. This ensures that all women receive education, which is an important factor in reducing the risk of a LBW baby. Cuba has a 100% literacy rate [25] and has attained the two Millennium Development Goals that relate to education (ensuring all boys and girls complete a full course of primary schooling and the elimination of gender disparity in primary and secondary education) [26].

Cuba is a poor country (currently ranked as 120th worldwide). There is increasing recognition that poverty and poor socioeconomic conditions are relative and not absolute. Countries with higher levels of income inequality, such as the USA and UK, have higher rates of LBW babies than countries with lower levels of income inequality [27]. The relationship between income inequality and health and nutrition is complex. It is highly likely that the impact of income inequality is multifactorial and relevant factors include access to healthcare, education, mental health problems and diet [28]. The prevalence of LBW infants has actually increased in both the UK and USA (table 4), whereas it has decreased or remained static in countries such as Finland, which have lower levels of income inequality [1, 29]. Cuba has less income inequality than many other countries and this is probably a contributory factor to its low LBW rate. Cuba also has a national subsidy on essential foods which helps to reduce malnutrition.

Conclusions

Reducing the number of LBW infants that are born worldwide is essential if the Millennium Development Goals are to be achieved. Lessons can be learnt from Cuba in reducing the rate of LBW infants. A free and universal healthcare system with an emphasis on primary healthcare is probably the major factor. Alongside this, targeted nutrition and education in women who are of child-bearing age are likely to have a significant impact. Political measures such as reducing poverty and income inequalities are also likely to significantly reduce both the number of LBW infants and child mortality. Finally, one needs to recognise that a small increase in mean birth weight within disadvantaged communities can have a significant impact on both neonatal and infant mortality.

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