

KIDS COUNT Indicator Brief

Preventing Low Birthweight

July 2009

The Annie E. Casey Foundation

701 St. Paul Street
Baltimore, MD 21202

www.aecf.org
www.kidscount.org

Produced for the Annie E. Casey Foundation by Rima Shore, Ph.D. & Barbara Shore, M.A.

KIDS COUNT Indicator Brief Preventing Low Birthweight

Despite decades of research and prevention efforts, low birthweight (less than 2,500 grams, or 5 lbs., 8 ozs.) remains a major public health challenge. Preterm birth (before 37 weeks of gestation) is by far the most common reason for low birthweight (LBW), and trendlines for LBW tend to parallel those for preterm birth. Since 1990, the U.S. low-birthweight rate has increased by 19 percent, and the preterm birth rate has risen by 21 percent. From 2005 to 2006, the percentage of LBW births increased from 8.2 to 8.3 percent; the rate of preterm births increased from 12.7 percent to 12.8 percent (Hamilton, Martin & Ventura, 2007).

The percentage of infants born at *very* low birthweights (under 750 grams, or 1 lb., 10.5 ozs.) has also been on the rise. After steadily increasing since the 1980s, the rate of very-low-birthweight births held steady from 2005 to 2006 (Martin et al., 2009). This represents scant progress, considering that babies born at very low birthweights face the most severe risks and are the most likely not to survive their first year. The increase in such births in recent years has been cited as the major reason for the plateau in the United States' infant mortality rate since 2000. The leveling off of this rate—after two decades of improvement—has prompted concern among researchers and policy makers (Levi, Cimons & Johnson, 2008; Mathews & MacDorman, 2008).

Many factors have contributed to the increase in the rate of LBW births, including a relatively high rate of multiple births, which was about three percent in 2005 (Mathews & MacDorman, 2008); wider availability of sophisticated medical technologies that help very-low-birthweight babies survive; and a trend toward delayed childbearing that makes complications resulting in preterm births and LBW more likely (Tough et al., 2002). However, these changes do not account for all of the increase in LBW, nor do they explain persistent disparities for different racial and ethnic groups.

More research is needed to illuminate how the many factors affecting LBW interact, because for every clear finding, there are numerous unanswered questions (Conde-Agudelo, Rosas-Bermudez & Kafury-Goeta, 2006). For example, while delayed childbearing has been linked with a greater likelihood of LBW births, the increase in very-low-birthweight births occurs primarily among mothers aged 20 to 34, the peak childbearing years (Mathews & MacDorman, 2008). While multiple births certainly are a factor, most of the rise in very LBW births has occurred among babies born in single deliveries.

The rising rate of low-birthweight births in the United States is a vexing and persistent medical and social problem—but not an unsolvable one. There is growing consensus that the complex issues surrounding LBW and preterm births call for a broad strategy, one that addresses a wide range of risk factors. Just-in-time solutions—those introduced during pregnancy—are not sufficient. Preventing LBW requires a lifespan approach to the health of women and men, one that takes full account of socioeconomic and environmental as well as medical issues and incorporates powerful public education campaigns (Johnson et al., 2006).

This *KIDS COUNT Indicator Brief* describes five strategies that are essential to any plan aimed at reducing the rate of LBW births:

- **Expand access to medical and dental services, taking a lifespan approach to health care**
- **Focus intensively on smoking prevention and cessation**
- **Ensure that pregnant women get adequate nutrition**
- **Address demographic, social, and environmental risk factors**
- **Support sustained research on the causes of LBW.**

- **Expand access to medical and dental services, taking a lifespan approach to health care**

Researchers have long known that women who have access to adequate health services before, during, and after childbirth have better outcomes and healthier children (Levi, Cimon & Johnson, 2008). In recent years, they have made strides in linking specific medical and dental conditions with increased risk for LBW, but have had less success in harnessing this knowledge to improve birth outcomes, especially for racial and ethnic groups disproportionately affected by LBW. More research is needed to improve treatment of specific risk factors. At the same time, there is growing consensus that health care strategies focusing on pregnancy cannot compensate for a lifetime of disadvantage or compromised health. Broader, more sustained efforts are needed.

Take a lifespan approach to combating LBW. Women who have chronic health problems, such as obesity, type-2 diabetes, and cardiovascular disease, are more likely to have LBW babies (Arya et al, 2006). In 2002, 50 percent of women of childbearing age were overweight or obese; 9 percent had diabetes; 3 percent had cardiac disease; and 3 percent were hypertensive (Johnson et al, 2006). Recently, researchers have identified other diseases that affect birth weight. Case in point: inflammatory bowel disease (including Crohn's disease and ulcerative colitis) typically has an onset during the peak reproductive years, and, according to a recent study, doubles women's odds of having LBW babies (Cornish et al., 2007). In short, chronic conditions affect significant percentages of women during their childbearing years. In contrast, treatable medical conditions that arise during pregnancy affect only a small proportion of women. Therefore, as many researchers have observed, efforts to improve birth outcomes need to emphasize women's health over the long term rather than focusing narrowly on prenatal care (Reichman, 2005).

Expand access to preconception counseling and care. Since 1996, progress toward improving birth outcomes, including low birthweight, have slowed, in part, due to inconsistent, insufficient efforts to detect and treat health conditions and risk factors *before* pregnancy (Johnson et al, 2006; Atrash et al, 2006). According to the Center for Disease Control and Prevention, preconception counseling and care for women and men is a crucial element in any plan to reduce the LBW rate.

Ensure that all expectant mothers have access to research-based prenatal care. Prenatal care cannot overcome years of compromised health, but regular care during pregnancy is nevertheless extremely important. A significant proportion of pregnant women do not begin prenatal care until the third trimester. The percentage varies widely in different states. In 2005, it ranged from 3.1 in New Hampshire to 11.1 in Texas (KIDS COUNT Data Center, 2009). It is hard to measure the benefits of prenatal care since ethical concerns prevent researchers from

conducting random control studies—the kind that divide subjects into “treatment” and “non-treatment” groups. Moreover, researchers have found it difficult to document the effects of prenatal programs due to variations in content, implementation, or participation (Reichman, 2005). However, researchers can observe what happens when changes in health insurance policies or the closure of clinics affect access to prenatal care for large groups of women. Such studies indicate that birthweights can be affected (Sontheimer et al, 2008; Reichman, 2005).

While more research on the impact of prenatal care is needed, it remains a crucial element in a broader strategy to improve birth outcomes. Providers can identify and treat chronic conditions that affect birthweight. In some cases, they may be able to make recommendations aimed specifically at preventing LBW or preterm births. For example, there is evidence that taking calcium supplements can help to reduce preterm birth rates and the incidence of LBW, especially in women at risk for hypertensive disorders (Bull, Mulvihill & Quigley, 2003). During prenatal examinations, health providers can identify specific conditions, such as an abnormal uterus or cervix that can increase the mother’s risk of having a LBW baby. Prenatal care can also link women with services aimed at curbing smoking and improving nutrition (Dickinson, 2004; Ramakrishnan, 2004).

Universal health care is a key to improving birth outcomes. Health care strategies geared exclusively to pregnant women, or even to women of childbearing age, are not sufficient (Levi, Cimons & Johnson, 2008). High priority must be given to covering all pregnant women since women who lack health insurance are less likely to seek and obtain prenatal care. In particular, efforts to expand health insurance access and enrollment need to focus intensively on those women who are least likely to be covered, including African Americans and Hispanics, women living in poverty, high school dropouts, and young adults (ages 18 to 24).

Expand access to dental care. Physicians have long known that infections can increase women’s odds of having preterm and LBW babies. This includes not only infections of the urogenital tract, such as bacterial vaginosis, but also more distant infections that can be carried in the blood stream to the placenta. In this way, tooth decay and gum disease can affect birthweight. Such dental problems affect more than 80 percent of women aged 20 to 39 years (Johnson, 2006), and affect blacks more than whites (Currie, 2005). While further study is needed, it is increasingly clear that regular dental care is crucial not only for good overall health, but also for good birth outcomes (Johnson, 2006; Sacco et al, 2008).

Expand access to mental health services aimed at reducing stress. Scientists are beginning to learn more about the connections between mental health and birth outcomes. For example, studies have linked depression during the second trimester of pregnancy with slower fetal growth. Some groups are especially at risk. For example, high levels of depression have been found among low-income pregnant women. Both depression and anxiety may be related to psychological stress, which can affect the mother’s and baby’s health directly (by affecting neuroendocrine functioning and the immune system) or indirectly (by influencing behaviors such as smoking or drinking) (Hobel & Culhane, 2003; Hoffman & Hatch, 2000; Chomitz & Cheung, 1995). Stress can also affect an expectant mother’s appetite or caloric utilization, leading to a lower gestational weight gain.

- **Focus intensively on smoking prevention and cessation**

Cigarette smoking during pregnancy is the single most important known cause of low birthweight. Even after controlling for other factors, researchers find that smokers are nearly twice as likely to deliver a low-birthweight baby as non-smokers (Child Trends, 2004; Chomitz, Cheung & Lieberman, 1995). The good news is that the percentage of births to mothers who smoked during pregnancy declined over the last decade, and was down to 10.7 percent in 2005 (KIDS COUNT Data Center, 2009). However, more must be done. Smoking prevention and cessation efforts continue to be crucial to reducing the LBW rate.

Heighten public awareness of the risks of smoking during pregnancy. Anti-smoking campaigns should stress the impact of smoking on birth outcomes and children's health. Such campaigns need to take full account of local trends, cultures, and concerns. Rates of births to mothers who smoke during pregnancy vary widely among states, and in 2005 were highest in Kentucky (26.1 percent). Interestingly, the state where expectant mothers are least likely to get timely prenatal care, Texas, is also the state where pregnant women are least likely to smoke (KIDS COUNT Data Center, 2009). This finding suggests that cultural factors and local concerns powerfully influence mothers' behaviors and must be taken fully into account in the design and delivery of smoking cessation messages and programs.

Discourage girls and young women from starting to smoke. This is a crucial challenge because research shows that people who do not start smoking when they are teens are unlikely to start smoking later in life. The rate of adolescent smoking has dropped over the last decade but remains as high as or higher than adult smoking rates. On average, more than one in five high school students (22 percent) smoked cigarettes in 2003. Among white students, girls (27 percent) were more likely to smoke than boys (23 percent). Among black and Hispanic students, more boys smoked. Promising prevention strategies include education, restriction of advertising to young people, reduced access, increased cigarette taxes, and restricted smoking in public places (Centers for disease Control and Prevention, 2004b).

Help women stop smoking before they become pregnant, or as early as possible during pregnancy. All of the evidence suggests that helping women quit smoking can lower the LBW rate. However, even with intensive behavioral interventions, only one in five smokers successfully controls the habit during pregnancy. Efforts that begin before conception can take advantage of medications that reduce nicotine withdrawal symptoms but may not be safe for pregnant smokers (Johnson, 2006). While early cessation is the ultimate goal, pregnant women need to understand that it is worthwhile to quit or cut down at any stage. According to American Cancer Society research, women who quit smoking prior to being pregnant or during the first three or four months of pregnancy lower their risk of having a low birthweight to the same level as women who never smoked (American Cancer Society, 2003). According to a report by the Surgeon General, women who quit cigarette smoking at almost any point during pregnancy have lower rates of LBW babies (U.S. Department of Health and Human Services, 2004).

Develop smoking cessation programs that take into account the special needs of women. Many experts stress that programs need to take into account barriers that may be particularly steep for women smokers, including a greater likelihood of depression and concerns about

weight control. For pregnant women, smoking cessation interventions are most effective when they are provided by trained personnel using materials addressing the specific concerns of expectant mothers. Research shows that such programs reduce the prevalence of LBW births for women who stop smoking before pregnancy and result in higher birthweights when expectant mothers quit during pregnancy. Such programs are especially important in places where women are most likely to smoke during pregnancy. Follow-up is important, since many women resume smoking after giving birth. This may affect the health of this and other children, as well as affect subsequent pregnancies.

Provide training in smoking cessation to reproductive health workers. Training in smoking cessation needs to become an integral part of the education of physicians and other reproductive health workers.

Ensure that health insurance covers smoking cessation. Smoking-cessation programs should be part of every public and private health insurance package. While most employers and health plans typically have not covered the cost of smoking-cessation programs, there is evidence of some progress in this arena. In 2005, Medicare began footing the bill for some antismoking interventions and, with the publication of research showing the financial benefits of such programs, private employers have begun to add them to their list of covered expenses (Wall Street Journal, 2005).

- **Ensure that pregnant women get adequate nutrition**

A mother's nutrition has a crucial impact on her child's later health. There is a direct link between a mother's pre-pregnancy weight and the weight of her child; there is also a connection between weight gain during pregnancy and the infant's birthweight. That being said, there is growing awareness that a lifespan approach to nutrition is a key to improving birth outcomes. Researchers have found that when a poorly nourished woman becomes pregnant, even intensive interventions (such as high-protein diets or intensive regimens of vitamin and mineral supplements) may not be enough to reduce her odds of having a LBW baby (Goldenbert & Culhane, 2007).

Build nutrition counseling into preconception and prenatal care. Expectant mothers need to eat a balanced diet; health care providers generally recommend that a woman of normal weight gain 25 to 35 pounds. Women who gain less than 22 pounds are two to three times more likely to have a LBW baby than women who gain at least that amount (Dickinson, 2004). Consuming 400 micrograms of folic acid before conception and during the early months of pregnancy is also recommended (March of Dimes, 2008).

Sustain programs that offer nutritional support to low-income expectant mothers and infants. Designed by the U.S. Department of Agriculture for low-income families at nutritional risk, the WIC program (the Special Supplemental Food Program for Women, Infants and Children) combines nutritional education with vouchers for certain foods. On balance, most studies of the WIC program have shown modest success in reducing the rate of LBW and preterm births. One study found that WIC enrollment reduces participants' probability of giving birth to a low-birthweight infant by 29 percent, and their probability of giving birth to a very-low-birthweight infant by more than half (Bitler & Currie, 2005). In addition to offering

nutritional supplementation and monitoring adequate weight gain during pregnancy, the program aids in smoking cessation and refers women for prenatal care.

Ensure that food stamps are available to all eligible individuals. Researchers say that one-third of low-income families who qualify for food stamps experienced food insecurity in 2005 (Nord et al., 2005). Many Americans who remain eligible for food stamps are not making use of them. Barriers to participation include lack of information about eligibility, administrative problems, or lack of funding. States can improve the situation by reaching out to those who are eligible for food stamps and streamlining procedures for enrolling and receiving benefits.

- **Address social and demographic risk factors**

Work toward breaking the LBW cycle. Recent research has shown that LBW is often perpetuated from one generation to the next. An infant whose mother was a LBW baby is four times more likely to have a low birthweight; the likelihood is six times greater in the case of an LBW father. This finding makes it easier to identify parents at risk of having an LBW baby (Conley & Bennett, 2000). It also suggests that a key to preventing LBW births is to break this cycle—and that will require a better understanding of it. A recent study found that intergenerational transmission of low birthweight is stronger for mothers who live in high-poverty zip codes. This suggests a complex relationship between genetic and environmental factors (Currie & Moretti, 2007).

Some researchers are studying the potential of education to break the LBW cycle. Maternal education has long been considered a key factor in infant health. Generally speaking, women with more years of education give birth to fewer children and engage in fewer behaviors that undermine their own health or place their pregnancies at risk (Martin et al., 2009). Overall, mothers with high school diplomas (and to an even greater degree, those with at least some college credits) have less probability of giving birth to LBW babies than mothers with less education (Reichman, 2005). However, this trend does not hold within all ethnic/racial subgroups. For example, among African American and American Indian/Alaskan Native mothers, more years of education does not appear to lower the risk of LBW births (Nepomnyaschi, 2009). More research and more nuanced strategies are needed.

It appears that biological health at infancy, through its impact on overall development, affects education and eventual socioeconomic status—which in turn increase the risk of LBW and poor infant health. Providing educational support to LBW babies from the start may be one way to interrupt this vicious cycle.

Raise awareness of the links between racial segregation and LBW. By studying LBW rates in urban neighborhoods, researchers have learned that the risk of LBW for African American mothers is significantly higher in more segregated than in less segregated areas. Some blame the environmental risks associated with inner-city living, such as exposure to environmental toxins, substandard housing, increased risk of infection, decreased availability of high quality medical care, the generally poorer quality of food and the higher prices of groceries. Poverty alone cannot explain the high rate of LBW births in highly segregated areas. For African American families in these neighborhoods, an increase in income does not lower the incidence of LBW (Aber &

Bennett, 1997). Public health officials and other decision makers need to factor into their deliberations the probability that stress related to isolation from mainstream society can, in and of itself, increase the risk of LBW.

Increase social supports for mothers at high risk of having LBW babies. LBW mothers are 27 percent less likely to be married than mothers of normal weight, full-term babies (Ellen, 2000). The reasons for this are not entirely clear. On the one hand, single mothers may be at higher risk simply because they have fewer economic resources. On the other hand, stress due to an unwanted pregnancy or a lack of adequate social supports may be a factor. It is well known, for example, that socially isolated individuals generally have poorer health outcomes than members of a loving family or close-knit community (Singer & Ryff, 2001). It has also been suggested that single mothers, especially teenagers (for whom the probability of LBW is 34 percent higher than for older mothers) are more likely to ignore or deny a pregnancy, thus receiving little or no prenatal care (Conley & Bennett, 2000).

Promote responsible fatherhood and support fragile families. Familial ties can enhance pregnancy outcomes, including birthweight. A review of more than 200 studies shows that social support from the baby's father or other family members predicted better outcomes, especially higher birthweight. Mothers with more familial support were less likely to smoke, drink alcohol, or use drugs; had more timely prenatal care; and had less stress (Singer & Ryff 2001). On the other hand, troubled relationships, especially when they lead to violence, are associated with poor birth outcomes. Pregnant women who are victims of intimate partner violence are more likely to have a preterm or LBW baby. They experience higher rates of stress, are more likely to smoke or use other drugs during pregnancy, are less likely to obtain prenatal care, and have an increase in infectious complications (Chambliss, 2008). A better understanding is needed of how these factors interact.

- **Support and publicize research on the causes of LBW**

Despite decades of research, scientists do not understand all of the reasons that babies are born too early or too small. A better understanding of LBW—including its high prevalence in certain inner-city neighborhoods—remains an urgent priority. .

The need for additional research is crucial, but should not keep policymakers from publicizing today's best understandings and spreading best practices. While many question marks remain, enough is known to warrant near-term health care reform as well as sustained public education efforts. Surveys show that despite past efforts, most Americans are not aware of how the choices they make over many years (regarding smoking, drinking, nutrition, health check-ups, dental hygiene, and other behaviors) may influence their reproductive health and childbearing (Johnson et al., 2006).

Support sustained research into the causes of LBW. Elucidating the causes of low birthweight has proven to be a difficult public health challenge. Researchers have linked low birthweight with a variety of factors, including poor prenatal nutrition, smoking during pregnancy, low maternal pre-pregnancy weight, low maternal weight gain, teen pregnancy, single motherhood, socioeconomic status, and race. However, the meaning of these associations remains murky, and it is unclear whether these factors influence birthweight directly or indirectly.

For every clear finding, there are numerous unanswered questions. For example, researchers say that delayed childbearing has played a role in rising rates of LBW births in recent decades. On average, women in the U.S. are waiting longer to have children and are therefore more likely to have complications that result in both preterm delivery and LBW (Tough et al, 2002). But the increase in very-low-birthweight births occurs primarily among mothers aged 20 to 34, the peak childbearing years (Mathews & MacDorman, 2008). More research is needed to illuminate how the many factors that affect LBW interact (Conde-Agudelo, Rosas-Bermudez & Kafury-Goeta, 2006).

The rise in very-low-birthweight births in recent years is especially vexing. Multiple births contribute to this phenomenon: in 2005, about three percent of births in the U.S. were multiple births (Mathews & MacDorman, 2008). However, most of the rise in very-low-birthweight births has occurred among babies born in single deliveries. The rise may reflect, in part, more aggressive medical interventions and better management of high-risk pregnancies, resulting in the survival of more preterm infants. The last decade has witnessed significant technological innovation, including improvements in fetal imaging and diagnosis. At the same time, the rate of caesarean deliveries has risen sharply over the last decade, reaching 31.1 percent of all births in 2006 (Martin et al., 2009). However, these changes do not account for all of the increase in LBW, nor do they explain persistent disparities for different racial and ethnic groups.

Expand understanding of the impact of social and economic factors. Social and economic factors are even harder to pin down. Women living in poverty are far more likely than more affluent women to have LBW and/or preterm babies, even when known biological or medical risk factors are taken into account. Researchers are not certain why low socioeconomic status per se increases the risk for LBW. Nor is it clear why social programs for low-income people have had limited success in alleviating the problem. While Medicaid may have contributed to the decline in low-birthweight births that occurred in the late sixties and early seventies, expanded eligibility for Medicaid in the eighties had only a negligible effect on birth outcomes. Among women receiving public assistance, a modest reduction in LBW has been noted only for those who had known medical risk factors, such as a previous history of pregnancy complications, preterm delivery, or a preexisting medical condition such as diabetes or hypertension. Other high-risk groups (for example, teenage mothers, unmarried women, or African American women) did not appear to benefit (Hughes & Simpson, 1995). Increasingly, researchers are developing complex models to explore the relationships among multiple factors.

Support research into racial and ethnic variations in LBW and preterm rates. The National Institutes of Health have long considered “unraveling the underlying reasons for ethnic variations in LBW and preterm delivery” to be one of the most pressing public health challenges (2001). The gap between birth outcomes for black and white babies is particularly troubling. In 2006, the LBW rate for non-Hispanic black newborns (14.0 percent) was nearly twice the rate for non-Hispanic white infants (7.3 percent), and exceeded the LBW rate of any other reported racial or ethnic group, even when maternal age was taken into account. At almost all educational levels, socioeconomic strata, and age categories, black women are twice as likely as white women to have LBW babies. Black women were also more likely than white women to have preterm infants (18.5 vs. 11.7 percent), and to deliver by cesarean (33.1 vs. 31.3 percent). The gap

between black and white newborns is widest at the lowest birthweight ranges—those associated with the greatest health risks and poorest developmental outcomes (Martin et al., 2009).

Disparities in the birthweights of black and white newborns have been documented for more than four decades. They are so large and persistent that they have been shown to contribute to racial disparities in children's school readiness and may account for three to four percent of the racial gap in IQ scores (Reichman, 2005). Early intervention programs, especially those that combine hospital-based intervention with home visits and preschool placement, have been shown to improve cognitive and behavioral outcomes among children born at low birthweights and can help to narrow these gaps (McCormick et al., 2006).

Racial and ethnic variations in birthweight cannot be explained by differences in multiple births, nor are they attributable to economic factors alone. To be sure, many black women experience economic disadvantage; but American Indians, who also have high rates of poverty, have a relatively low incidence of LBW (although a high incidence of infant mortality). Moreover, studies have found little difference in birthweight distribution among African American infants by income. In fact, differences in LBW rates between black and white infants are even wider at the upper end of the socioeconomic spectrum than at the lower (AHRQ, 2004; Hughes & Simpson, 1995).

Nor do explanations emphasizing minority status tell the whole story. Rates of LBW births vary markedly among women of different ancestral origins: those of Cuban or Mexican descent, for example, have lower rates of LBW babies than women of Puerto Rican descent. Moreover, for virtually every racial and ethnic group, immigrants have better birth outcomes than mothers born in the U.S. More research is needed on the impact on birthweight of such factors as parents' culture, diet, lifestyle, occupation, and levels of stress (Reichman, 2005).

Expand understanding of environmental factors. Where a woman lives affects her odds of having a low-birthweight baby. Rates of LBW vary by state, city, and even by zip code. Increasingly, researchers are looking at neighborhood factors (such as access to health care, racial segregation, and exposure to environmental toxins) that may pose health risks above and beyond those associated with individual poverty. One study conducted in Chicago in 1990 found that the mother's neighborhood accounted for as much as 30 percent of the difference in birthweight between babies born to non-Hispanic blacks and whites. More research is needed to determine the relationship between individual risk factors (such as mothers' health status, education level, or behaviors) and neighborhood effects (social, economic, or physical characteristics) (Reichman, 2005).

Support research on the genetic traits and biological pathways that lead to LBW births. Even in cases where connections can be confidently drawn (such as the link between an expectant mother's eating or smoking habits and her newborn's weight), the biological pathways that lead from cause to effect may not be clear. For example, researchers need a better understanding of why some women who smoke during pregnancy have LBW infants while others do not. Recent breakthroughs in understandings of the human genome offer a new lens through which to view such questions. Two examples: A 2002 study suggested that cigarette smoke is more likely to cause LBW in women who have certain genetic traits—two genes that

are missing or inactive (Wang et al., 2002). A more recent study reported strong evidence for a major gene on chromosome 6q that influences variation in birthweight of infants born in the U.S. to mothers of Mexican and European heritage (Arya et al., 2006). Such findings may help researchers identify and help expectant parents at highest risk of having LBW babies.

Increase understanding of paternal factors that influence birthweight. A growing body of research suggests that paternal factors may affect birth outcomes, including birthweight. A man's pre-conception behaviors and environmental exposures can affect his seminal fluid; cause genetic mutations or abnormalities; or affect the way that his genetic contribution is expressed or passed on. More research is needed on the possible effects of paternal drinking and smoking on birthweight. Environmental factors require study as well. Research suggests when fathers' jobs expose them to pesticides, solvents, and lead, their newborns are at greater risk of preterm delivery, growth retardation, and low birthweight. This may play a role in birthweight disparities among racial and ethnic groups, since in the U.S., employed black men are nearly twice as likely as employed white men to work as operators, fabricators, and laborers, giving them a greater likelihood of exposure to toxic substances on the job (Reichman, 2005).

Shed light on other factors that appear to influence birthweight. Recently published studies raise questions and suggest possible new directions for research. Why do women with intellectual disabilities or self-reported learning disabilities seem to be at greater risk of having LBW babies (McConnell, Mayes & Llewellyn, 2008)? Why are pregnancies conceived following in vitro fertilization more likely to lead to preterm and LBW births, even among singleton births (Allen et al, 2008)?

Factor new research findings into program design. A clearer understanding of the causes of LBW could significantly strengthen intervention efforts. Recent research is shedding light on the genetic dimensions of low birthweight. If low maternal weight gain is really a marker for poverty, as many researchers have assumed, then nutrition supplementation programs can only address the problem's symptoms, not its underlying cause. By the same token, if the high rate of LBW among African Americans has less to do with poverty and more to do with psychological stress stemming from racial discrimination and isolation from mainstream society, then intervention strategies that treat race merely as a proxy for socioeconomic status also miss the mark. For all of these reasons, more and better studies, with sophisticated research designs, are a key to lowering the LBW rate.

Our nation's high LBW birth rate requires urgent attention because it takes such a great human and social toll. Babies born at low birthweights—particularly those born at very low birthweights—enter the world at risk for lifelong physical, cognitive and behavioral disabilities. While many of the medical and developmental challenges can be reversed over time with timely, research-based intervention, a small percentage of babies face major challenges from intellectual disability, cerebral palsy, and impairments in lung function, sight and hearing. Others, who may have escaped major physical consequences, are nevertheless at greater risk for long-term cognitive problems that can have a profound impact on school performance. In addition, research consistently shows that as birthweight decreases, the chance of developing more—and more serious—disabilities increases. Finally, lowering the LBW rate can help to improve Americans'

overall health and relieve the increasing burdens it places on educational institutions, social services, families and individuals.

References

- Aber, L.J., Bennett, G. et al. 1997. *The effects of poverty on child health and development. American Review of Public Health* 18: 463-83.
- Agency for Healthcare Research and Quality. 2004. Children's health: Studies examine hospital mortality rates and long-term outcomes of very low birthweight babies. Agency for Healthcare Research and Quality. Accessed at: <http://www.ahrq.gov/research/may04/0504RA10.htm>.
- Allen, C., Bowdin, S., Harrison, R.F., et al. 2008. Pregnancy and perinatal outcomes after assisted reproduction: a comparative study.
- American Cancer Society. 2003. *Cigarette smoking*. American Cancer Society. Accessed at: http://www.cancer.org/docroot/PED/content/PED_10_2X_Cigarette_Smoking_and_Cancer.asp.
- Annie E. Casey Foundation 2008. *The right start for America's newborns*. Baltimore, MD. Accessed at www.kidscount.org/datacenter/rightstart.jsp.
- Arya, R., Demerath, E., Jenkinson, C.P. et al. 2006. A quantitative trait locus (QTL) on chromosome 6q influences birth weight in two independent family studies. *Human Molecular Genetics* 115(10):1569-79.
- Atrash, H.K., Johnson, K., Adams, M., et. al. 2006. Time to act on missed opportunities to improve perinatal outcomes: Preconception care. *Maternal Child Health Journal*.
- Bitler, M.P. & Currie, J. 2005. Does WIC Work? The Effects of WIC on pregnancy and birth outcomes. *Journal of Policy Analysis and Management*, 24(1):73-91.
- Bull, J., Mulvihill, C. & Quickley, R. 2003. *Prevention of low birth weight: Assessing the effectiveness of smoking cessation and nutritional interventions: Evidence briefing*. London.
- Chambliss, L.R. 2008. Intimate partner violence and its implications for pregnancy. *Clinical Obstetrics and Gynecology* 51(2):385-97.
- Chomitz, V. R., Cheung, L. W. Y., & Lieberman, E. 1995. The role of lifestyle in preventing low birthweight. *The Future of Children* 5(1), Spring.
- Conde-Agudelo, A., Rosas-Bermudez, A. & Kafury-Goeta, A.C. 2006. Birth spacing and risk of adverse perinatal outcomes: A meta-analysis. *JAMA* 295:1809-1823.
- Conley, D., & Bennett, N. 2000. Is biology destiny? Birthweight and life chances. *American Sociological Review* 65:458-67.
- Cornish, J. Tan, E, Teare, J. et al. 2007. A meta-analysis on the influence of inflammatory bowel disease on pregnancy. *Gut*, 56:830-837.

Currie, J. 2005. Health disparities and gaps in school readiness. *Future of children* 15(1):117-138, Spring.

Currie, J. & Moretti, E. 2007. Biology as destiny? Short- and long-run determinants of intergenerational transmission of birth weight. *Journal of Labor Economics* 25(2).

Dickinson, E. 2004. *Preventing Low Birth Weight*. Erlanger Hospital Tennessee. www.erlanger.org<http://www.erlanger.org/>, Fall.

Ellen, I. G. 2000. Is segregation bad for your health? The case of low birth weight. *Brookings-Wharton Papers on Urban Affairs*: 203-29.

Goldenberg, R.L. & Culhane, J.F. 2007. Low birth weight in the United States. *American Journal of Clinical Nutrition*. 85(suppl):584S-90S.

Hamilton, B.E., Martin, J.A. & Ventura, J. 2007. *Births: Preliminary data for 2006*. National Center for Health Statistics, *National Vital Statistics Reports* 56(7):1-18, December.

Health Development Agency. Centers for Disease Control and Prevention. 2004. Cigarette smoking among adults—United States, 2002. *MMWR Morbidity and Mortality Weekly Report*, 53(20) 427-431. Available online at www.Centers for Disease Control and Prevention.gov/mmwr/preview/mmwrhtml/mm532012.htm<http://www.Centers for Disease Control and Prevention.gov/mmwr/preview/mmwrhtml/mm532012.htm>.

Hobel, C. & Culhane, J. 2003. *Role of psychosocial and nutritional stress on poor pregnancy outcome*. The American Society for Nutritional Sciences. 133:1709S-1717S.

Hoffman, S., & Hatch, M. 2000. Depressive symptomology during pregnancy: evidence for an association with decreased fetal growth in pregnancies of lower social class women. *Health Psychology* 19(6): 535-43.

Hughes, D., & Simpson, L. 1995. The role of social change in preventing low birth weight. *The Future of Children* 5(1), Spring.

Johnson, K., Posner, S.F., Biermann, J. et al., 2006. *Recommendations to improve preconception health and health care – United States. A report of the Center for Disease Control and Prevention/ATSDR Preconception Care Work Group and the Select Panel on Preconception Care*. Centers for Disease Control & Prevention, April.

Levi, J., Cimon, M. & Johnson, K. 2008. *Healthy women, healthy babies*. Washington, D.C.: Trust for America's Health.

KIDS COUNT Data Center. 2009. Accessed at <http://datacenter.kidscount.org>.

Martin, J.A., Hamilton, B.E., Sutton, P.D., Ventura, S.J., Menacker, F., Kirmeyer, S. & Mathews, T.J. 2009. Births: Final data for 2006. *National Vital Statistics Reports*, 57(7):1-102.

Mathews, T.J., MacDorman, M.F. 2008. Infant mortality statistics from the 2005 period linked birth/infant death data set. *National Vital Statistics Reports* 57(2), July 30. Accessed at: http://www.cdc.gov/nchs/data/nvsr/nvsr57/nvsr57_02.pdf.

March of Dimes. 2008. Take folic acid before you're pregnant. Accessed at http://www.marchofdimes.com/pnhec/173_769.asp.

McConnell, D., Mayes, R. & Llewellyn, G. 2008. Women with intellectual disability at risk of adverse pregnancy and birth outcomes. *Journal of Intellectual Disability Research* 52(6):529-535, June.

McCormick, M.C., Brooks-Gunn, J., Buka, S.L. et al. 2006. Early intervention in low birth weight premature infants: Results at 18 years of age for the Infant Health and Development Program. *Pediatrics*, 117(3):771-780.

National Institutes of Health. 2001. Low birth weight in minority populations www.grants.nih.gov/grants/guide/PAfiles<http://www.grants.nih.gov/grants/guide/PAfiles>.

Nepomnyaschy, L. 2009. Socioeconomic gradients in infant health across race and ethnicity. *Maternal and Child Health Journal*, published online June 26.

Nord, M., Andrews, M. & Carlson, S. 2005. Household food security in the United States, 2005. U.S. department of Agriculture Economic Research Report 29.

Ramakrishnan, U. 2004. Nutrition and low birth weight: from research to practice. *American Journal of Clinical Nutrition* 79(1):17-21 (January 2004).

Reichman, N. 2005. Low Birth Weight and School Readiness in *The Future of Children* 15(1), Spring.

Sacco, G., Carmagnola, D., Abati, S. et al. 2008. Periodontal disease and preterm birth relationship: a review of the literature. *Minerva Stomatologica* 57(5)233-46, 246-50.

Singer, B.H. & Ryff, C.D., eds. 2001. *New horizons in health: An integrative approach*. Washington, DC: National Academy Press.

Sontheimer, D., Halverson, L.W., Bell, L., Ellis, M. & Bunting, P.W. 2008. Impact of discontinued obstetrical services in rural Missouri: 1990-2002. *Journal of Rural Health* 24(1): 96-98.

Tough, S.C., Newburn-Cook, C., Johnson, D.W. et al. 2002. Delayed childbearing and its impact on population rate changes in lower birth weight, multiple birth, and preterm delivery. *Pediatrics* 109:399-403.

U.S. Department of Health and Human Services. 2004. *The health consequences of smoking: A report of the Surgeon General—2004*. Centers for Disease Control and Prevention, Office on Smoking and Health. Atlanta, Georgia: DHHS.

Wall Street Journal. 2005. Case Grows to Cover Quitting. April 26, 2005, p. D1.

Wang, X. et al. 2002. Maternal cigarette smoking, metabolic gene polymorphism, and infant birth weight. *Journal of the American Medical Association*, 287(2), January 9.

Online resources

American Academy of Pediatrics

www.aap.org

American College of Obstetricians and Gynecologists

www.acog.org

Centers for Disease Control and Prevention (CENTERS FOR DISEASE CONTROL AND PREVENTION) Office on Smoking and Health

www.CentersforDiseaseControlandPrevention.gov/health/smoking.htm

March of Dimes Birth Defects Foundation

www.marchofdimes.com

National Center for Education in Maternal and Child Health

www.ncemch.org

Promising Practices Network on Children, Families and Communities

www.promisingpractices.net

Trust for America's Health

www.healthyamericans.org

(202) 223-9870

U.S. Public Health Service's Office on Women's Health

www.4woman.gov/owh