

OBSTETRICS

Preventing Low Birthweight: 25 years, prenatal risk, and the failure to reinvent prenatal care

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In 2010, *Preventing Low Birthweight* celebrated its 25th anniversary. The report, one of the most influential policy statements ever issued regarding obstetric health care delivery, linked prenatal care to a reduction in low birthweight (LBW). Medicaid coverage for prenatal care services was subsequently expanded and resulted in increased prenatal care utilization. However, the rate of LBW failed to decrease. This well-intentioned expansion of prenatal care services did not change the structure of prenatal care. A single, standardized prenatal care model, largely ineffective in the prevention of LBW, was expanded to a heterogeneous group of patients with a variety of medical and psychosocial risk factors. Reinventing prenatal care as a flexible model, with content, frequency, and timing tailored to maternal and fetal risk, may improve adverse birth outcomes. Risk-appropriate prenatal care may improve the effectiveness of prenatal care for high-risk patients and the efficiency of prenatal care delivery for low-risk patients.

Key words: health care utilization, low birthweight, prenatal care, risk assessment

Last year marked the 25th anniversary of *Preventing Low Birthweight*, one of the most influential policy statements ever issued regarding obstetric health care delivery.¹ In the report, an Institute of Medicine (IOM) interdisciplinary committee addressed the dilemma of the low birthweight (LBW) infant, the most common cause of infant morbidity and mortality. Encompassing preterm birth and intrauterine growth restriction (IUGR), LBW (<2500 g) represents a major social and economic bur-

den. LBW infants are 3 times more likely to have neurodevelopmental deficits, are at significantly increased risk of having a prolonged illness, and are linked to two-thirds of all infant deaths.² Annual aggregate costs for the hospitalization of LBW infants approach \$6 billion, and currently represent almost one-half of all the costs for infant hospitalizations.³ The IOM Committee concluded, “the overwhelming weight of the evidence indicates that prenatal care reduces low birthweight”—unequivocally asserting a cause-and-effect relationship.¹

Following the IOM Committee’s 1985 recommendations, federal and state legislators quickly responded by funding a dramatic expansion of prenatal care services, largely for low-income pregnant women, a population at increased risk for adverse birth outcomes.⁴ Subsequently, Medicaid coverage for maternity care was expanded in an attempt to cover 14.6 million previously uninsured women, with the explicit intention of reducing the number of LBW infants.⁵ Unfortunately, despite this dramatic increase in coverage, no reduction in LBW has occurred. Rather, since the publication of *Preventing Low Birthweight*, the

rate of LBW infants has increased from 6.8% in 1983 to 8.2% of births in 2007.^{6,7}

A careful look at the story behind Medicaid expansions for pregnant women reveals a well-intentioned, but ultimately misguided effort to expand a health care model without appropriately revising its content. As differences in maternal and fetal risk continue to widen among patient groups, the need for a flexible prenatal care model that can be tailored to risk is clear from patient, provider, and health care system perspectives. However, during the last 25 years, policymakers have been less successful at expanding health care models that are risk appropriate than they have been at expanding one, universal model for all patients. To examine how the expansion of a flawed model contributed to the failure of prenatal care to reduce LBW, we take a detailed look at *Preventing Low Birthweight* and the major legislation and policy statements that followed.

Historical context of LBW

In the early 1980s, clinicians and policymakers noted unsettling changes in the incidence of LBW infants. Slowly but steadily declining since the mid 1960s, the rate of LBW plateaued at 6.8% from 1980 through 1983 (Figure 1).^{6,7} In addition, the 2:1, black-to-white ratio of LBW failed to narrow further. Although difficult to interpret in isolation, the rate of LBW in the United States in 1980 was greater than that of more than 10 other industrialized countries, including Canada, the United Kingdom, and Germany.¹

Therefore, the IOM Committee to Study the Prevention of Low Birthweight first convened in 1982 and for 3 years rigorously reviewed the available evidence regarding the etiology, impact, and cost of LBW.¹ They concluded that the expansion of prenatal care services was an efficient, cost-effective way to decrease the rate of LBW. Priority areas for future resource in-

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vestment were intended to improve insufficient Medicaid funding, a shortage of obstetric health care providers, and the lack of prenatal care services in low-socioeconomic communities. The IOM Committee estimated that, for every \$1.00 spent on prenatal care services, \$3.38 would be saved, due to the reduction in the incidence of LBW infants.¹ In essence, more prenatal care was clearly seen as the key to less LBW.

The IOM Committee's report on improving prenatal care resulted immediately in a series of legislative initiatives that significantly expanded Medicaid eligibility during pregnancy. The Omnibus Reconciliation Act of 1986 (Public Law 99-509) was the first to allow all states to cover pregnant women with incomes $\leq 100\%$ of the federal poverty level.⁸ This was followed by Omnibus Reconciliation Act of 1989 that required states to cover pregnant women $\leq 133\%$ of the federal poverty level.⁹ Whereas 17% of pregnant women were covered by Medicaid in 1985, by 1998, that number had risen to 35%.¹⁰

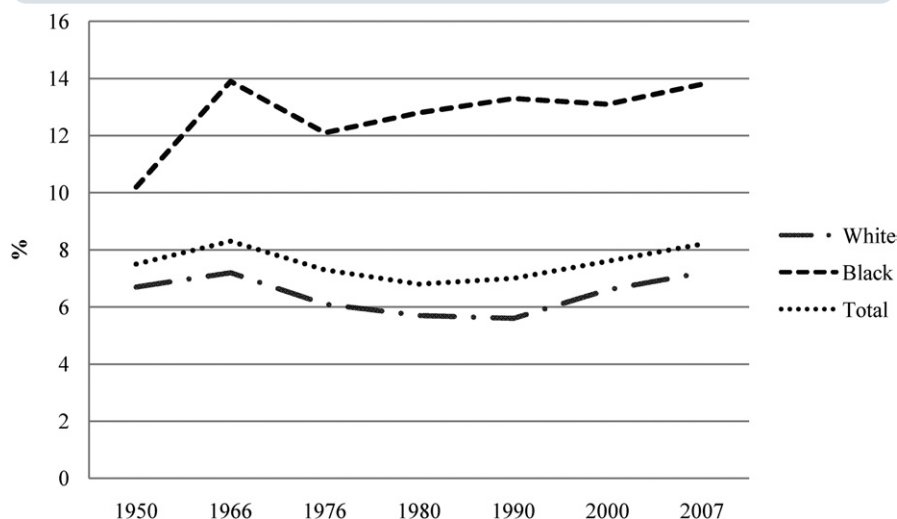
In other words, the IOM report clearly influenced policy. In 1985, first-trimester prenatal care utilization stood at 76.2%; by 2007, it had risen to 82.0% (Figure 2).^{11,12} First-trimester prenatal care utilization also increased among African American women, the patient population with the highest rate of LBW. Compared with 61.5% in 1985 by 2007, 75.0% of African American women received first-trimester prenatal care.

Despite dramatic increases in prenatal care utilization, the rate of LBW did not fall. Gains in prenatal care utilization rates were merely process measures, as the rate of LBW infants rose from 6.8% of births in 1983 to 8.2% of births in 2007.^{6,7} The increase has been shared among both Caucasian and African American women (Figure 1).

Reasons for a disconnect

The pronounced disconnect between the expansion of prenatal care and trends in LBW can largely be traced to the ways in which the IOM Committee to Study the Prevention of Low Birthweight drew its conclusions. The conclusions reached in *Preventing Low Birthweight* were largely

FIGURE 1
Rate of low birthweight in United States, 1950 through 2007



Reproduced from Centers for Disease Control and Prevention, National Center for Health Statistics.^{6,7}
Krans. *Preventing Low Birthweight and the failure to reinvent prenatal care. Am J Obstet Gynecol* 2012.

based on the secondary analyses of large vital statistics databases, as well as limited prenatal care program evaluations.¹ Although large vital statistics datasets offer the obvious advantage of large sample sizes for evaluations of adverse birth outcomes, they also have significant limitations. Most databases record the number of prenatal visits, but without regard to the content, quality, or context of a visit with a health care provider, thus failing to account for a qualitative evaluation of the education, counseling, and social support that is often provided through continuity of care and provider-patient relationships.

Another type of evidence used in *Preventing Low Birthweight* was evaluations of prenatal care programs.¹ Those prenatal care programs were designed to target a specific patient population already known to be at risk for poor pregnancy outcomes. Unrandomized and with limited sample sizes, these studies largely came from health maintenance organizations, prematurity prevention projects, and maternal and child health programs. They demonstrated that selected high-risk women enrolled in enhanced prenatal care programs delivered fewer LBW infants.¹³⁻¹⁵

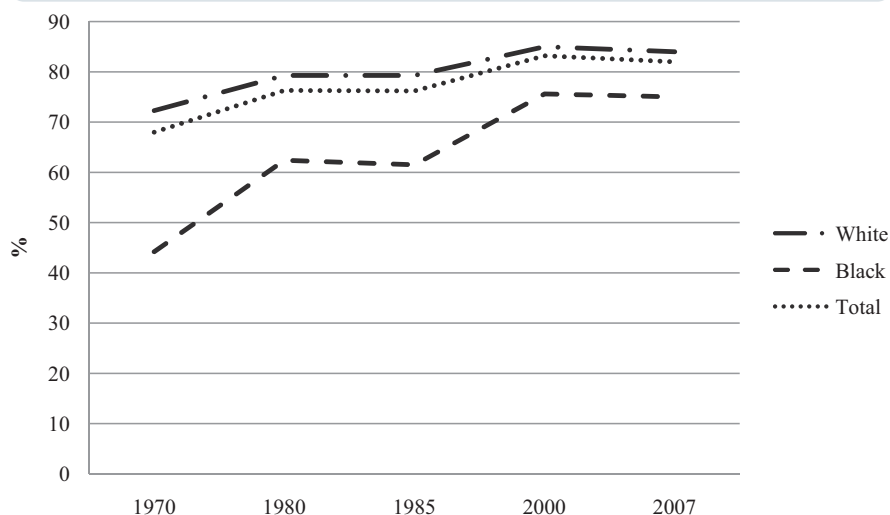
Importantly, although some interpreted their conclusions as causal, the IOM Committee explicitly articulated

the inherent limitations of their data prior to discussing the positive association between prenatal care and LBW.¹ They noted the inherent difficulty in evaluating the efficacy of prenatal care without the ability to test a true experimental model. Selection bias, the lack of qualitative assessments, the difficulty in controlling for confounding, and problems with the validity of data sources were reviewed in detail as limitations that plague the analyses of prenatal care. Yet, these methodological caveats were largely ignored in the policy write-ups and roll-out that followed the IOM Committee's report.

Differences of opinion

The past decades have seen numerous program evaluations of the Medicaid expansion effort. Rigorous program evaluations have been unable to consistently or conclusively link increased prenatal care utilization rates with a decrease in the rate of LBW. For example, Dubay and colleagues¹⁶ evaluated national natality files comparing obstetrical outcomes between 1980 through 1986 and 1986 through 1993, the period spanning the Medicaid prenatal care expansion effort. Their results indicated that, despite substantial increases in the rates of early prenatal care utilization among African

FIGURE 2
First-trimester prenatal care utilization
in United States, 1970 through 2007



Reproduced from Centers for Disease Control and Prevention, National Center for Health Statistics.^{11,12}
 Krans. *Preventing Low Birthweight and the failure to reinvent prenatal care. Am J Obstet Gynecol* 2012.

American women, there was still an increase in the rate of LBW.

In 1995, Kevin Fiscella¹⁷ conducted a detailed review of prenatal care programs seeking to determine if there was any evidence for causality between prenatal care and adverse birth outcomes. After evaluating temporal relationships, biologic plausibility, consistency, and alternative explanations, Fiscella¹⁷ concluded that “current evidence does not satisfy the criteria necessary to establish that prenatal care definitively improves birth outcomes.” This evaluation was followed by a review commissioned by the Agency for Healthcare Research and Quality by Lu and colleagues.¹⁸ After evaluating >25 interventions performed during prenatal care visits, including fundal height measurements, third-trimester ultrasounds, and cervical examinations designed to either detect or prevent an adverse birth outcome, the authors concluded that “even in the most generous interpretations of the evidence, prenatal care interventions might realistically reduce rates of preterm delivery by less than 10%.” These and other evaluations of prenatal care programs, content, and interventions have similarly concluded that there is no definitive cause-

and-effect relationship between prenatal care and adverse birth outcomes.¹⁹⁻²²

Reinventing prenatal care

The irony is that the authors of *Preventing Low Birthweight* also called for revising prenatal care content in ways that would redefine prenatal care. Instead of universal and standardized care, the IOM Committee recognized the need to have a prenatal care system that incorporated an assessment of maternal and fetal risk to “manage a wider variety of patient problems and risk factors.”¹ Women at greatest risk for delivering a LBW infant are African American, poor, often have psychosocial risk factors, including chronic stress, and are also more likely to be uninsured.²³ Recognizing this, the IOM Committee suggested that women newly enrolled in Medicaid prenatal care services “may require more frequent visits and more specialized care than more affluent, low-risk women.”¹ Conversely, women at low-risk for adverse maternal and fetal outcomes would attend a decreased frequency of visits, ultimately resulting in a flexible, risk-appropriate model of prenatal care.

In response to the IOM Committee’s call for a comprehensive risk assessment

process that would redefine the timing, frequency, and content of prenatal care, the US Public Health Service convened the Expert Panel on the Content of Prenatal Care in 1986.²⁴ In their publication, *Caring for Our Future: The Content of Prenatal Care*, the expert panel articulated the first series of evidence-based guidelines on prenatal care content, timing, and frequency. As part of these guidelines, the panel emphasized the importance of (1) early and continuing risk assessment, (2) health promotion, and (3) medical and psychosocial interventions and follow-up. Their objective was to stratify women into high- and low-risk categories, so that providers could tailor prenatal care content, timing, and frequency to an individual patient’s risk factors. The expert panel indicated that women with medical and psychosocial risk factors would require more frequent and more intensive prenatal care visits, involvement from case and social workers, as well as additional outreach services. In contrast, low-risk women would follow a reduced-frequency schedule consisting of 9 visits for nulliparous patients and 7 visits for multiparous patients, in addition to childbirth classes and telephone contacts for a 41-week gestation. This revision shifted the emphasis of the traditional prenatal care schedule to the first trimester and stressed “the value and importance of prenatal care in terms of content and objectives, in contrast to the concept of simply counting visits.”²⁴

The prenatal care road not taken

Many women in the United States continue to receive the same model of prenatal care as they received in 1985, without a significant adjustment in prenatal care frequency, timing, and content based on risk. “Intensive” prenatal care use, defined as use >1 SD above the mean, increased from 18.4% in 1981 to 28.8% in 1995.²⁵ Although factors associated with a greater likelihood of intensive use included high-risk predictors, such as multiple gestation and maternal age >35 years, intensive use among low-risk women also increased steadily each year. In 2004, 30% of women received at least ≥2 prenatal care visits than were recommended by the American College

of Obstetricians and Gynecologists (ACOG), regardless of risk status.²⁶ This increase in overutilization represents a 50% increase in “superadequate” prenatal care since 1985 and was consistent across all age and race/ethnicity groups. Finally, in an evaluation of the adoption of a low-risk prenatal care model, only 17% of providers reported using a reduced-frequency schedule for their low-risk patients. This poor compliance is concerning when >71% of providers also admitted that they believed that they could give effective prenatal care to their low-risk patients by using a reduced-frequency model.²⁷

Overutilization for low-risk patients has profound implications for access to care and costs. The average health care expenditure for each woman utilizing prenatal care services and inpatient delivery is approximately \$7600 (in 2004 US dollars), and more frequent visits directly translates into increases in total antenatal costs.²⁸ Most insurance providers, including Medicaid, reimburse all prenatal care expenses with a standard, global fee. As a result, excessive visits that are not medically indicated for low-risk patients have the potential to drain valuable health care resources and reduce access for high-risk women who might benefit from high-intensity services.

The future of prenatal care

The future of prenatal care continues to be *Preventing Low Birthweight's* unfulfilled vision of a flexible, risk-appropriate prenatal care system. ACOG, the World Health Organization (WHO), and the Institute for Clinical Systems Improvement (ICSI) all recommend a comprehensive risk assessment at the first obstetric visit, noting that the frequency of follow-up visits should be determined by “the individual needs of the woman and an assessment of her risks.”²⁹⁻³¹ However, although a comprehensive risk assessment process is clinically intuitive, our ability to accurately define, assess, and address maternal and fetal risk is challenging.

Defining risk

Risk can be divided into 3 broad categories: medical risk (maternal medical comor-

bidities, such as chronic hypertension, antepartum pregnancy complications, such as gestational diabetes, and a history of pregnancy complications, such as preterm birth), psychosocial risk (chronic maternal stress, lack of social support, substance abuse, and psychiatric diagnoses), and low-risk (the absence of medical and psychosocial risk).²⁴ Patients with medical and psychosocial risk factors, collectively referred to as “high risk,” are at increased risk of adverse birth outcomes, such as LBW, and often require more frequent health care visits and consume the majority of health care resources in obstetrics.

Assessing risk

Although the positive association between medical and psychosocial risk factors and LBW in observational, epidemiologic, and retrospective data have helped define and categorize risk, our ability to accurately predict which individual patients will have adverse birth outcomes has only recently gained traction. The first risk assessment tool to predict preterm birth and LBW was developed by Emile Papiernik in the late 1960s, but had limited predictive power.^{32,33} As ultrasound, laboratory evaluations, microbiologic tests, and other diagnostic tools became more sophisticated, a wide variety of risk assessment tools and scoring systems subsequently emerged.^{34,35} Unfortunately, none of these tools have been able to predict the delivery of a LBW infant with enough sensitivity and specificity to support additional screening for preterm birth beyond a comprehensive history, physical, and laboratory evaluation.³⁶

Although an accurate screening tool for the general population remains elusive, transvaginal cervical length sonography and the fetal fibronectin test have improved positive predictive values and high negative predictive values for preterm birth in symptomatic women.³⁷⁻³⁹ The improved sensitivity and specificity of these tests has helped patients with negative results avoid unnecessary testing, intervention, and antepartum hospitalization. In addition to preterm birth risk, significant advances have been made in predicting IUGR with the use of uterine artery Doppler velocimetry.⁴⁰ In

pilot data, a first-trimester elevated uterine artery mean resistance index has been significantly associated with subsequent IUGR.⁴¹ These and other emerging risk assessment tools have the potential to create a risk scoring system with unprecedented predictive value for preterm birth and LBW.

Addressing risk

As the assessment of maternal and fetal risk improves, the ability to address identified risk factors through tailored, risk-appropriate prenatal care is also showing greater promise. Traditionally, pregnancies complicated by medical and psychosocial risk factors often receive additional, individual prenatal care visits with their provider supplemented by consultations with perinatologists, neonatologists, and medical subspecialists for testing, monitoring, medication administration, and counseling. Although frequent, individual visits with providers are often necessary, alternative models of prenatal care tailored to risk have also been designed and evaluated. In particular, home visitation, case management, telemedicine, and group prenatal care for women with high-risk pregnancies and reduced-frequency schedules for women with low-risk pregnancies offer particular promise.⁴²⁻⁴⁷

High-risk pregnancies can be extremely stressful for expectant mothers and their partners, as they navigate frequent prenatal care visits, extra and often recurring testing and interventions, as well as increased counseling and education. Home visitation, case management programs, and telemedicine initiatives have provided enhanced, intensive prenatal care services remotely, often with lower costs, and have successfully reduced LBW and preterm birth in high-risk populations.⁴²⁻⁴⁴ The South Carolina Partners for Preterm Birth Prevention designed a case management program that included a comprehensive risk assessment, a toll-free telephone line for patient questions, and case management services for women at high risk for preterm birth and resulted in a significant reduction in the rate of preterm birth <28 weeks.⁴⁵

Group prenatal care has emerged as an alternative prenatal care model adept at

addressing psychosocial risk factors, such as a lack of social support. Health care providers frustrated with the traditional, individual model of prenatal care developed group prenatal care in the 1970s.⁴⁸ Specifically designed to facilitate mutual support, insight development, and problem-solving skills, group prenatal care has been effective at reducing LBW and preterm birth, especially for women at high psychosocial risk.^{46,47} In addition to improved birth outcomes, as compared to receiving individual care, women randomized to group prenatal care had significantly better psychosocial outcomes, prenatal care knowledge, and satisfaction with prenatal care.

Although effective in low-risk and high psychosocial risk populations, group prenatal care has not been evaluated in women with medical risk factors. Patients with chronic diseases, such as diabetes mellitus, chronic hypertension, and systemic lupus erythematosus, face unique challenges in the management of their disease during pregnancy and often require increased social support, counseling, and attention from health care providers. Group prenatal care's unique ability to provide patients with peer and social support from patients facing similar challenges has the potential to improve medication compliance, provide effective disease education, and improve maternal and neonatal outcomes in women with medical risk factors.

At the other end of the maternal risk spectrum, reduced-frequency schedules for low-risk women have demonstrated equivalent maternal and fetal outcomes when compared to traditional models. In a randomized controlled trial of the reduced-frequency schedule recommended by the expert panel, there were no significant differences in preterm birth, LBW, cesarean section, or preeclampsia in women enrolled in the reduced-frequency schedule.⁴⁹ Additional analyses have confirmed these results and have also demonstrated no significant difference in satisfaction with the prenatal care experience in women enrolled in reduced-frequency schedules.^{50,51} As a result of these evaluations, reduced-frequency schedules for low-risk women have been endorsed by several prominent health policy organiza-

tions including ACOG, WHO, and ICSI.²⁹⁻³¹

Conclusions

Preventing Low Birthweight challenged the obstetric community to reinvent prenatal care as a targeted intervention—a flexible model where content, frequency, and timing were tailored to maternal and fetal risk status. Instead, efforts to apply the report's findings led to expanded but undifferentiated coverage for pregnant women. Universal prenatal care, largely ineffective in the prevention of LBW, was extended to a heterogeneous group of patients with a variety of medical and psychosocial risk factors. This well-intentioned, but ultimately inefficient and ineffectual, policy meant that the IOM Committee's calls to revise the prenatal care model and deliver risk-appropriate care were overshadowed by the comparatively easy solution of giving more of the same care to all patients.

Importantly, the expansion of prenatal care services to thousands of uninsured women was not without value. Expanded prenatal care provides women with important screening, testing, monitoring, education, and counseling that are necessary for healthy maternal and fetal outcomes. Prenatal care is an effective vehicle to deliver necessary obstetric services.

The challenge that remains, as articulated a generation ago by the experts who wrote *Preventing Low Birthweight*, is to transform prenatal care from a universal vehicle to a risk-appropriate intervention. The past few decades have seen differences in risk and adverse birth outcomes continue to widen among patient groups. Given our collective need to work in a world of finite resources, tailoring prenatal care utilization to maternal and fetal risk factors may improve the effectiveness of prenatal care for high-risk patients and the efficiency of prenatal care delivery to low-risk patients. ■

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