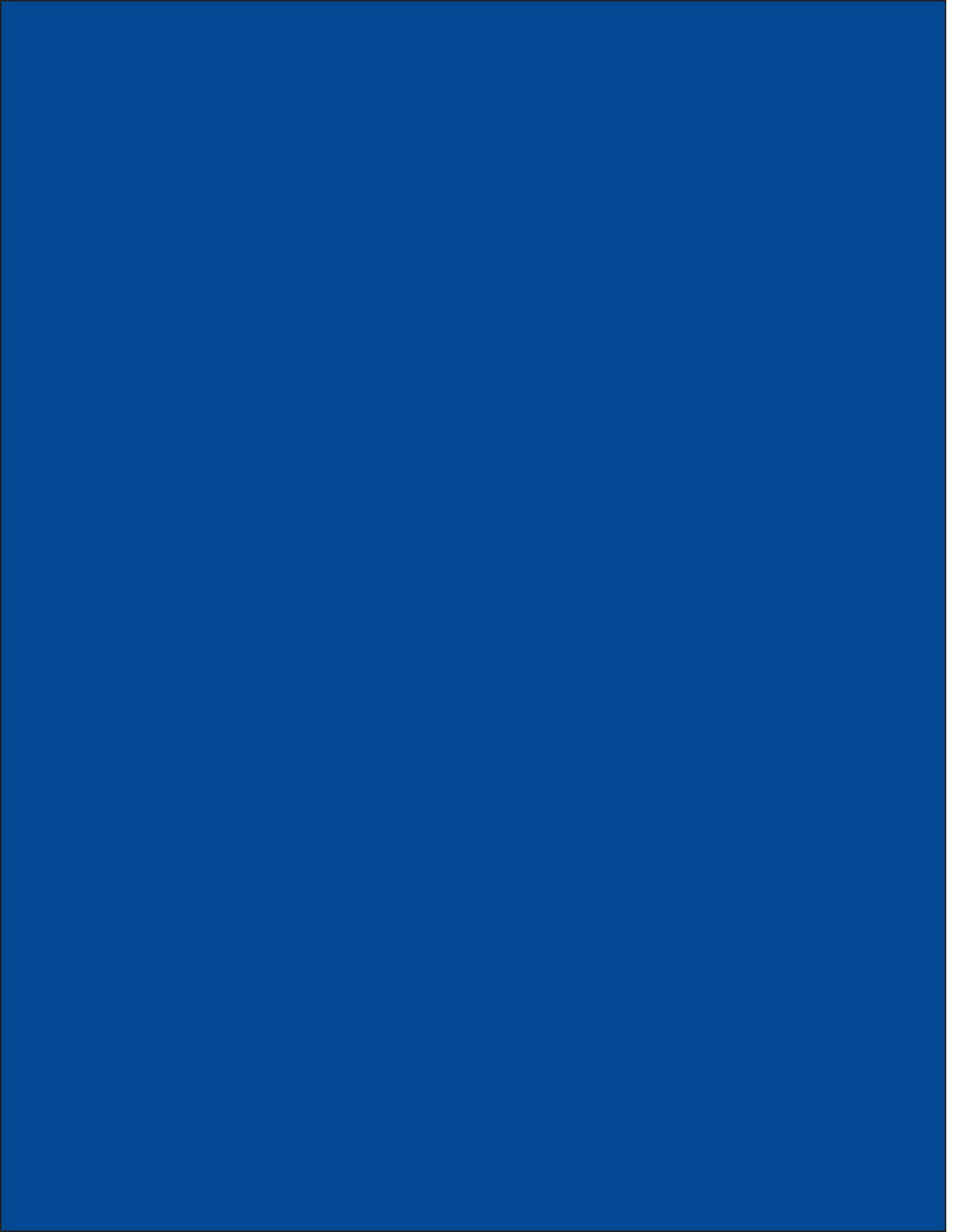




Evidence-Based Maternity Care: What It Is and What It Can Achieve

by Carol Sakala and Maureen P. Corry



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Childbirth Connection

Reforming States Group

Milbank Memorial Fund

Milbank Memorial Fund
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TABLE OF CONTENTS

List of Tables, Figures, and Sidebars	iv
Foreword	v
Acknowledgments	vii
Executive Summary	1
Introduction	7
Maternity Care in the U.S. Health Care System: Prominent Position, Large Expenditures, Troubling Performance	10
Evidence-Based Maternity Care: Effective Care with Least Harm	21
The Physiologic Foundation of Evidence-Based Maternity Care	25
Overused Interventions: Examples of Practices to Use Judiciously and with Careful Attention to Informed Consent	35
Underused Interventions: Examples of Practices to Use Whenever Possible and Appropriate	51
Challenges to Closing Evidence-Practice Gaps in Maternity Care in the United States	59
Policy Recommendations Developed in Collaboration with Members of the Reforming States Group	68
Appendix: Leading Resources and Tools for Evidence-Based Maternity Care	71
References	73
The Authors	110
Selected Publications of the Milbank Memorial Fund	112
Selected Publications of Childbirth Connection	114

LIST OF TABLES, FIGURES, AND SIDEBARS

TABLES

1	Leading Procedures Billed to Medicaid and Private Insurance Payers, United States, 2005	13
2	Performance on Selected Indicators of Maternal and Newborn Health, United States, Each State, and District of Columbia	18
3	Childbirth in U.S. Hospitals, 2005: <i>Listening to Mothers II</i> Survey	27
4	Intervention Rates for Low-Risk Women in the United States and among Births Attended by Certified Professional Midwives, 2000	29

FIGURES

1	Leading Major Diagnostic Categories by Number of Hospital Discharges, United States, 2005	10
2	Percentage of Pregnancy, Childbirth, and Puerperium and All-Condition Hospital Discharges by Payer, United States, 2005	11
3	Total Hospital Charges by Payer, United States, 2005	12
4	Average Facility Labor and Birth Charge by Site and Mode of Birth, United States, 2003–2005	15
5	Preterm Birth Rate and Low Birthweight Rate, United States, 1981–2006	16
6	Total Cesarean, Primary Cesarean, and Vaginal Birth after Cesarean (VBAC) Rates, United States, 1989–2006	42

SIDEBARS

What Is the “Gold Standard” for Knowledge about Effects of Maternity Care?	22
National U.S. Midwifery Credentials: Certified Nurse-Midwife, Certified Midwife, and Certified Professional Midwife	30
Diethylstilbestrol (DES) Clarifies Importance of Caution with Perinatal Exposures	33
Is the Most Resource-Intensive Care the Best Care?	45
The Evidence about Vaginal Birth after Cesarean (VBAC)	57

FOREWORD

Evidence-based maternity care uses the best available research on the safety and effectiveness of specific practices to help guide maternity care decisions and to facilitate optimal outcomes in mothers and newborns. Although the field of pregnancy and childbirth pioneered evidence-based practice, resulting in a wealth of clear guidance for evidence-based maternity care, there remains a widespread and continuing underuse of beneficial practices, overuse of harmful or ineffective practices, and uncertainty about effects of inadequately assessed practices.

In order to inform coverage and clinical policy decision making for maternity care, Childbirth Connection (CC), the Reforming States Group (RSG), and the Milbank Memorial Fund (MMF) collaborated to write, review, and publish this report. The report presents a discussion of current maternity care in the U.S. health care system and identifies key indicators that show the need for improvement. The report further summarizes results of the many systematic reviews that could be used to improve maternity care quality, identifies barriers to the use of evidence-based maternity care, and offers policy recommendations and other strategies that could lead to wider implementation of evidenced-based maternity care in the United States. These maternity care quality concerns and opportunities for improvement are not widely recognized at this time.

Organized in 1992, the RSG is a voluntary association of leaders in health policy in the legislative and executive branches of government, from all fifty states, Canada, England, Scotland, and Australia. The Milbank Memorial Fund is an endowed national foundation, established in 1905, that works with decision makers in the public and private sectors to carry out nonpartisan analysis, study, and research on significant issues in health policy. Established in 1918, Childbirth Connection (formerly Maternity Center Association) is a national not-for-profit voice for the needs and interests of childbearing families. Its mission is to improve the quality of maternity care through research, education, advocacy, and policy.

Many members of the RSG, as well as others knowledgeable in the field, reviewed successive drafts of this report. As a result of these reviews and the authors' subsequent revisions, we believe that the information in this report is timely and accurate. The matters that have been highlighted by the authors do not necessarily represent the policy preferences of all the members of the RSG or of the other individuals who reviewed drafts of this report.

We thank all who participated in this project.

Eileen Cody
Chair, Health Care and Wellness Committee
Washington House of Representatives
Co-Chair, Reforming States Group

Kevin Concannon
Former Director
Iowa Department of Human Services
Past Co-Chair, Reforming States Group

John Nilson
Member of the Legislative Assembly
Province of Saskatchewan
Co-Chair, Reforming States Group

Maureen P. Corry
Executive Director
Childbirth Connection

Carmen Hooker Odom
President
Milbank Memorial Fund

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distribution.

EXECUTIVE SUMMARY

SYNOPSIS

Effective maternity care with least harm is optimal for childbearing women and newborns. High-quality systematic reviews of the best available research provide the most trustworthy knowledge about beneficial and harmful effects of health interventions. A large, growing body of systematic reviews is available to help clarify effects of maternity practices, yet these valuable resources are grossly underutilized in policy, practice, education, and research in the United States. Practices that are disproved or appropriate for mothers and babies in limited circumstances are in wide use, and beneficial practices are underused. Rates of use of specific practices vary broadly across facilities, providers, and geographic areas, in large part because of differences in practice style and other extrinsic factors rather than differences in needs of women and newborns. These gaps between actual practice and lessons from the best evidence reveal tremendous opportunities to improve the structure, process, and outcomes of maternity care for women and babies and to obtain greater value for investments. This report points the way to achieving these gains for the large population of childbearing women and newborns and for those who pay for their care.

REPORT AIMS

This report has several aims:

- to position maternity care within the U.S. health care system and to identify key indicators that clarify the need for improvement
- to present a framework for identifying the best available research, based on the principle of effective care with least harm, and to apply the framework to maternity care
- to summarize results of many systematic reviews that could be used to improve maternity care quality, with a focus on opportunities to increase benefit and/or reduce harm for large segments of the population of childbearing women and newborns
- to identify barriers to wider implementation of evidence-based maternity care in the United States
- to identify policy and other strategies that, if adopted, could lead to wider implementation of evidence-based maternity care in the United States

REPORT AUDIENCES

This report is directed toward many stakeholder groups. It is a priority to communicate about these matters with policymakers who have legislative, executive, delivery system, purchasing, and other responsibilities for maternity care. Members of the Reforming States Group, a voluntary association of state-level health policymakers, have helped ensure that the strategies for quality improvement and other sections of this report can assist policymakers with efforts to improve maternity care. The report

is also directed to others who are involved with maternity care, including health professionals and health profession educators, hospital and health plan administrators, insurers, employers, researchers, childbearing women and their families, consumer advocates, and journalists.

MATERNITY CARE IN THE U.S. HEALTH CARE SYSTEM

Childbearing is a major life passage for over 4.3 million mothers, newborns, and families annually in the United States. Within the U.S. health care system, childbirth is the leading reason for hospitalization. About 23 percent of all individuals discharged from hospitals are mothers or newborns. The current style of maternity care is procedure-intensive, and six of the fifteen most commonly performed hospital procedures in the entire population are associated with childbirth. Cesarean section is the most common operating room procedure in the country. Only three reasons for outpatient visits involve more visits annually than maternity care (prenatal and postpartum visits combined): general medical examination, progress visit, and cough.

FINANCING MATERNITY CARE

Due to the large number of births per year and this technology-intensive style of care, hospital charges for birthing women and newborns far exceed those of any other condition. Costs of this care especially impact employers and private insurers, the primary payers for 51 percent of the births, and taxpayers and Medicaid programs, primary payers for 42 percent. “Mother’s pregnancy and delivery” is the most costly hospital condition for both Medicaid and private insurers, followed by “newborn infants.” These conditions are associated with 27 percent of hospital charges to Medicaid and 15 percent of hospital charges to private insurers.

Charges for childbirth vary considerably depending on the type and place of birth. The average hospital charge in 2005 ranged from about \$7,000 for an uncomplicated vaginal birth to about \$16,000 for a complicated cesarean section, and charges for newborn care, anesthesia services, and the maternity provider involved additional expense. By contrast, childbirth charges in a national survey of out-of-hospital birth centers were about one-quarter of the charges of uncomplicated vaginal birth in hospitals (\$1,624 in 2003, when the national average charge for uncomplicated vaginal birth in hospitals was \$6,239), in addition to charges for maternity provider services.

Actual payments tend to be lower than charges, but payment data are difficult to obtain. A recent analysis of a large database of payments for all maternity services (excluding newborn care) was weighted to reflect the national population of childbearing women with commercial insurance; the report concluded that average payments for cesarean births exceeded those for vaginal births by nearly 50 percent, adding several thousand dollars to insurers’ expenditures. Another recent analysis estimated that the average total prenatal and intrapartum expenditure for women with a code for “normal pregnancy and delivery” was \$7,564 (2004 dollars), with over three-quarters of the expense

concentrated in the hospital stay. Although the cost of prenatal care for Medicaid and privately insured women was similar, the hospital component of care for privately insured women was about \$2,000 more than the hospital component for women with Medicaid coverage.

PERFORMANCE OF THE U.S. MATERNITY CARE SYSTEM

Many performance indicators raise concern about U.S. maternity care. A mid-course review of national Healthy People 2010 objectives for the country found that we have been moving away from targets for many maternity objectives, including low birthweight and preterm birth measures, cerebral palsy, mental retardation, and cesarean measures. Changes in measurement make it difficult to understand trends in maternal mortality, which may be rising after stagnating with no improvement at the end of the past century. The national cesarean rate has increased annually from the mid-1990s and has reached a record level each successive year of the present century. Four percent of women lack access to insurance for childbirth, and a much larger proportion transitions from being uninsured to having insurance coverage during pregnancy. Rates of specific indicators vary widely across states. In comparison with white non-Hispanic and Hispanic mothers, black mothers experience a breadth and depth of disparity in maternity care delivery and outcomes. Cross-national comparisons from the World Health Organization and the Organisation for Economic Co-operation and Development clarify that many other nations are doing a better job with measures such as perinatal, neonatal, and maternal mortality, low birthweight, and cesarean rates. Nonetheless, per capita health expenditures for the United States far exceed those of all other nations. These outcomes, together with costly, procedure-intensive care, have been called the “perinatal paradox: doing more and accomplishing less.”

FRAMEWORK FOR EVIDENCE-BASED MATERNITY CARE

Evidence-based maternity care uses the best available research on the safety and effectiveness of specific practices to help guide maternity care decisions and to facilitate optimal outcomes in mothers and newborns. Various care paths that might be pursued in a specific situation can involve very different benefit/harm profiles. Evidence-based maternity care gives priority to effective care with least harm.

A rigorous, well-conducted systematic review of original studies yields the most trustworthy knowledge about beneficial and harmful effects of specific interventions. Randomized controlled trials are especially valuable original studies, but have some important limitations. Other types of study designs are often needed to help answer important questions. Many factors shape both views about suitable care and patterns of care, which often do not reflect the best current research. Thus, it is always important to ensure that policy and practice are in fact guided by the best available research. Informed decision making should consider safety and effectiveness as well as values and circumstances of individual women.

Although most childbearing women and newborns in the United States are healthy and at low risk for complications, national surveys reveal that essentially all women who give birth in U.S. hospitals experience high rates of interventions with risks of adverse effects. Optimal care avoids when possible interventions with increased risk for harm. This can be accomplished by supporting physiologic childbirth and the innate, hormonally driven processes that developed through human evolution to facilitate the period from the onset of labor through birth of the baby, the establishment of breastfeeding, and the development of attachment. With appropriate support and protection from interference, for example, laboring women can experience high levels of the endogenous pain-relieving opiate beta-endorphin and of endogenous oxytocin, which facilitates labor progress, initiates a pushing reflex, inhibits postpartum hemorrhage, and confers loving feelings. Large national prospective studies report that women receiving this type of care are much less likely to rely on pain medications, labor augmentation, forceps/vacuum extraction, episiotomy, cesarean section, and other interventions than similar women receiving usual care. Such physiologic care is also much less costly and thus provides outstanding value for those who pay for it. Burgeoning research on the developmental origins of health and disease clarifies that some early environmental and medical exposures are associated with adverse effects in childhood and in adulthood. Recognition of known harms and the possibility that many harms have not yet been clarified further underscores the importance of fostering optimal physiologic effects and limiting use of interventions whenever possible.

OVERUSED MATERNITY PRACTICES

Many maternity practices that were originally developed to address specific problems have come to be used liberally and even routinely in healthy women. Examples include labor induction, epidural analgesia, and cesarean section. These interventions are experienced by a large and growing proportion of childbearing women; are often used without consideration of alternatives; involve numerous co-interventions to monitor, prevent, or treat side effects; are associated with risk of maternal and newborn harm; and greatly increase costs. Mothers, babies, and purchasers would benefit from giving priority to effective, safer care paths and using risky interventions for well-supported indications only or when other measures are inadequate. The following practices would instead be consistent with the framework of this report: avoiding induction for convenience; using labor support, tubs, and other validated nonpharmacologic pain relief measures and stepping up to epidurals only if needed; and applying the many available measures for promoting labor progress before carrying out cesarean section for “failure to progress.” Such protocols would require considerable change in many settings, but would lead to a notable reduction in the use of more consequential procedures and an increase in cost savings. Available systematic reviews also do not support the routine use of other common maternity practices, including numerous prenatal tests and treatments, continuous electronic fetal monitoring, rupturing membranes during labor, and episiotomy.

UNDERUSED MATERNITY PRACTICES

Systematic reviews also clarify that many effective maternity practices with modest or no known adverse effects are underutilized. Greater fidelity in providing these forms of care would lead to improved outcomes for many mothers and babies. In pregnancy, such care includes prenatal vitamins, smoking cessation interventions, measures for preventing preterm birth, and hands-to-belly maneuvers to turn fetuses to a head-first position before birth. The many beneficial, underused practices around the time of birth include continuous labor support, numerous measures that increase comfort and facilitate labor progress, nonsupine positions for giving birth, delayed cord clamping, and early mother-baby skin-to-skin contact. Best available evidence also supports providing access to vaginal birth after cesarean (VBAC) for most women with a previous cesarean. Systematic reviews also identify many strategies for increasing both establishment and duration of breastfeeding and effective ways to treat postpartum depression.

BARRIERS TO EVIDENCE-BASED MATERNITY CARE

Efforts to increase access to evidence-based maternity care should address barriers to quality improvement. Barriers to evidence-based maternity care include the following:

- lack of a set of robust maternity performance measures with buy-in of key stakeholders to use them for measuring, reporting, rewarding, and improving performance
- perverse incentives of payment systems
- adverse effects of the malpractice system
- primary reliance on specialists for providing maternity care to a predominantly healthy, low-risk population
- limited reliance on best evidence in leading guidelines for maternity care
- loss of core childbearing knowledge and skills among health professionals
- limited attention to harms and iatrogenesis
- challenge of translating research into practice
- adverse effects of pressure from industry
- inadequate informed consent processes and women's lack of preparation for making informed decisions
- limitations of views put forth in media and popular discourse

Efforts to improve payment systems, the liability system, consumer decision making processes, and other factors that impact clinical decisions should identify best evidence and develop policies, programs, and processes that align these systems with optimal care.

POLICY AND OTHER STRATEGIES TO HELP ALIGN PRACTICE WITH EVIDENCE

Members of the Reforming States Group have worked with the authors of this report to identify the following priority strategies to increase provision of evidence-based maternity care:

- increase awareness about concerns with the present maternity care system and knowledge of evidence-based maternity care by educating and advising the range of stakeholders
- support research to further evidence-based maternity care
- reform the current reimbursement system to promote evidence-based maternity care and involve federal and state payers and private insurers
- require performance measurement, reporting, and improvement.

The report provides specific recommendations for operationalizing these strategies.

INTRODUCTION

This report addresses the scientific basis for maternity practice. It begins by positioning care for the large, distinctive population of childbearing women and newborns within the U.S. health care system and describing performance on several maternity care quality indicators. The report then provides a framework for understanding “evidence-based maternity care,” including the relationship between evidence about human physiology and evidence about specific maternity practices. Evidence-based maternity care uses best available evidence to identify and provide optimal maternity care, defined as *effective care with the least harm*. The report then identifies a series of practices that are overused, as they have an unfavorable benefit/harm profile and good evidence points to the availability of effective, safer, and less costly options for most women. The next section identifies underused practices that offer established benefit with little or no identified risk. Mothers and babies would benefit from judicious, more restrictive use of the overused practices and more extensive use of underused practices. The examples identify important opportunities for improving the quality of maternity care for large proportions of mothers and babies through provision of effective care with minimal harm. While a comprehensive, up-to-date overview of best maternity evidence is needed, such an overview is beyond the scope of this technical report. Final sections of the report describe some of the greatest challenges to reducing the evidence-practice gaps and identify policy and practice strategies that might be used to narrow the gaps.

The Committee on Quality of Health Care in America and the Institute of Medicine’s landmark 2001 report, *Crossing the Quality Chasm: A New Health System for the 21st Century*, outlined fundamental concerns with the quality of health care in the United States. The report identified six aims for improvement that have been widely adopted: health care should be safe, effective, patient-centered, timely, efficient, and equitable. A major theme of the report was the importance of providing care that is based on the best available scientific evidence. The report identified impediments to such care, including underuse of beneficial care, overuse of services unlikely to offer benefits, and illogical variation in care from provider to provider and place to place. The report found that these concerns have troubling implications for health outcomes and efficient use of resources.

As detailed in the following section, more than 4.3 million babies are born in the United States every year, a life passage with major consequences for mothers, newborns, and families. Within the health care system, childbirth is the leading reason for hospitalization, and charges for birthing women and newborns far exceed hospital charges for any other condition. Notably, a follow-up Institute of Medicine report, *Priority Areas for National Action: Transforming Health Care Quality*, identified pregnancy and childbirth as a national priority area for health care quality improvement (Adams, Corrigan, et al. 2003).

Maternity care has attributes that distinguish it from much other health care. The “Bridges to Health” model identified childbearing women and infants as one of eight population segments with distinct characteristics that must be addressed if the entire population is to achieve the Institute of Medicine’s aims for improvement (Lynn et al. 2007). Another contribution points to numerous similarities between maternity care and end-of-life care, in contrast to the delivery of health care for

many other conditions (Clark 2008). Distinctive attributes of care for childbearing families include the following:

- the challenge of caring for a primarily healthy population within acute care facilities that focus on treatment of pathology
- the difficulty of predicting how childbirth will unfold and the individual nature of the experience
- the importance of the continuous attentive presence of caregivers and loved ones
- the importance of respectful care of women and families—including clear communication, high-quality information, and control over decision making—and of their positive memories of the experience
- incentives arising from service bundling and global fee payment systems that encourage use of interventions and measures to hasten and control childbirth even though such care generally is not optimal for mothers and babies
- missed opportunities to prepare women to make informed decisions during their pregnancy and well before labor
- the challenge for women of making informed decisions about many crucial care matters while in labor and constraints on their choice at that time
- the great extent to which services could be calibrated to provide more appropriate care and to increase benefit and reduce harm and waste
- concerns about the severe impact of the malpractice system on maternity services
- exclusion of this clinical area from many established quality initiatives due to their focus, for example, on Medicare beneficiaries or chronic conditions

The evidence base for care during pregnancy and childbirth has been progressively developed and refined over several decades. Three comprehensive overviews of best evidence in the field were published in 1989: *Effective Care in Pregnancy and Childbirth* (Chalmers, Enkin, and Keirse 1989), *A Guide to Effective Care in Pregnancy and Childbirth* (Enkin, Keirse, and Chalmers 1989), and *Oxford Database of Perinatal Trials* (Chalmers 1989–92). Through updating and further development of these or successor products, along with the work of many other organizations, agencies, and individuals, a large, growing body of systematic reviews is available to guide maternity policy, practice, education, and research.

However, comparing current maternity care practice and performance in the United States to lessons from the best available research and to performance benchmarks reveals large gaps. Consistent with common patterns of innovation in medicine (McKinlay 1981), obstetric practices such as episiotomy (Graham 1997) and electronic fetal monitoring (Graham et al. 2004; Hoerst and Fairman 2000) were adopted prior to adequate evaluation. Implementation of best evidence has proven to be extremely difficult following adequate evaluation. Therefore, many practices that are

disproved or appropriate for mothers and babies only in limited circumstances are in wide use. Conversely, numerous beneficial practices are underused because they offer limited scope for economic gain, are less compatible with predominant medical values and practices, have only recently been favorably evaluated, or due to other reasons. Beyond average overall gaps between evidence and practice, use of specific maternity practices varies broadly across facilities, providers, and geographic areas. This is primarily due to differences in practice style and other extrinsic factors rather than differences in needs of mothers and newborns. These gaps between where we are and what we could achieve present opportunities to improve the structure, process, and outcomes of care for mothers and babies and to obtain greater value for investments.

The discussion of overused and underused practices focuses on some of the greatest opportunities for increasing benefit and/or reducing harm for large segments of the population of childbearing women and newborns. It is not intended to be a comprehensive review of the evidence about maternity care. The Appendix points to many excellent resources for a more comprehensive understanding of evidence-based maternity care. Most are freely available to those with Internet access. Despite the abundance of resources, there are important areas where systematic evidence is not presently available and adequate to guide practice, such as evidence about effective pre- and interconceptional care, care for childbearing teenagers, and interventions to prevent and treat alcohol abuse and depression in pregnancy.

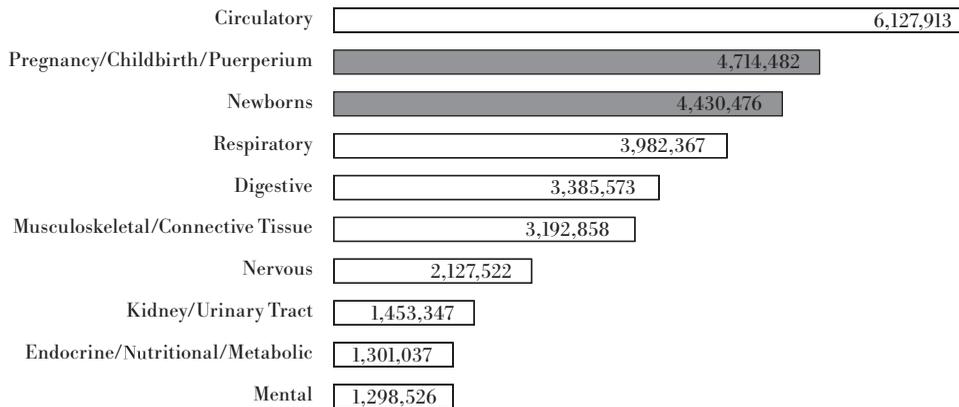
This report was developed to inform many stakeholder groups. It is a priority to communicate with policymakers who have legislative, executive, delivery system, purchasing, and other responsibilities about these matters. Sections on barriers to optimal care and on policy and other strategies for closing evidence-practice gaps are intended to assist policymakers with efforts to improve maternity care. The involvement of policymakers from the Reforming States Group has strengthened the entire report and these sections in particular. This report is also directed to many others who are involved with maternity care, including health professionals and health profession educators, hospital and health plan administrators, insurers, employers, researchers, childbearing women and their families, consumer advocates, and journalists.

**MATERNITY CARE IN THE U.S. HEALTH CARE SYSTEM:
PROMINENT POSITION, LARGE EXPENDITURES,
TROUBLING PERFORMANCE**

MATERNITY CARE LEADING REASON FOR HOSPITALIZATION/OFFICE VISITS

With over 4.3 million births every year, childbirth is the leading reason for hospitalization in the United States, exceeding such prevalent conditions as pneumonia, cancer, heart failure, bone fracture, and stroke (Kozak, DeFrances, and Hall 2006). Figure 1 lists leading major diagnostic categories by number of hospital discharges in 2005. Combined annual discharges for childbearing women and newborns greatly surpassed those for other major categories. In the 2005 Nationwide Inpatient Sample, 23 percent of all hospital discharges (9,144,958 among 39,163,834 total discharges) were for these two major diagnostic categories (Agency for Healthcare Research and Quality 2008).

FIGURE 1. LEADING MAJOR DIAGNOSTIC CATEGORIES BY NUMBER OF HOSPITAL DISCHARGES, UNITED STATES, 2005



Source: Agency for Healthcare Research and Quality 2008

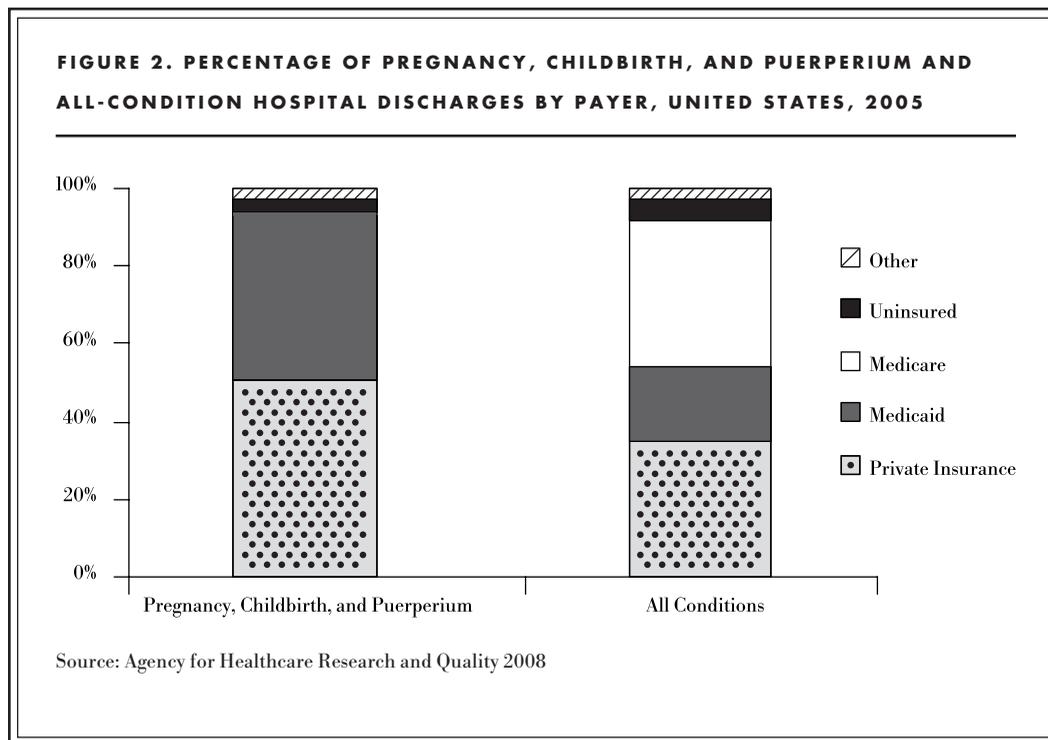
Maternity care is also a leading reason for ambulatory visits. Within the entire population in 2003–2004, maternity care (combined prenatal and postpartum visits) was the fourth most common reason for an outpatient visit, exceeded only by general medical examination, progress visit, and cough, and representing 2.8 percent of all outpatient visits (Hing 2007).

HOSPITAL CHARGES FOR CURRENT STYLE OF MATERNITY CARE HIGHEST OF ALL HOSPITAL CONDITIONS

Hospitalization is by far the largest component of health care costs, and hospital charges for the current style of childbirth are considerable. Combined hospital charges for birthing women (about

\$44 billion) and newborns (about \$35 billion) totaled \$79,277,733,843 and far exceeded charges for any other condition in 2005 (Agency for Healthcare Research and Quality 2008).

In 2005, private insurers paid for 51 percent of hospital stays for childbirth in the United States, and Medicaid paid for 42 percent of these stays, with variation in these proportions across states. These payers were responsible for markedly greater proportions of childbirth payments than for all conditions combined (Figure 2) (Agency for Healthcare Research and Quality 2008).



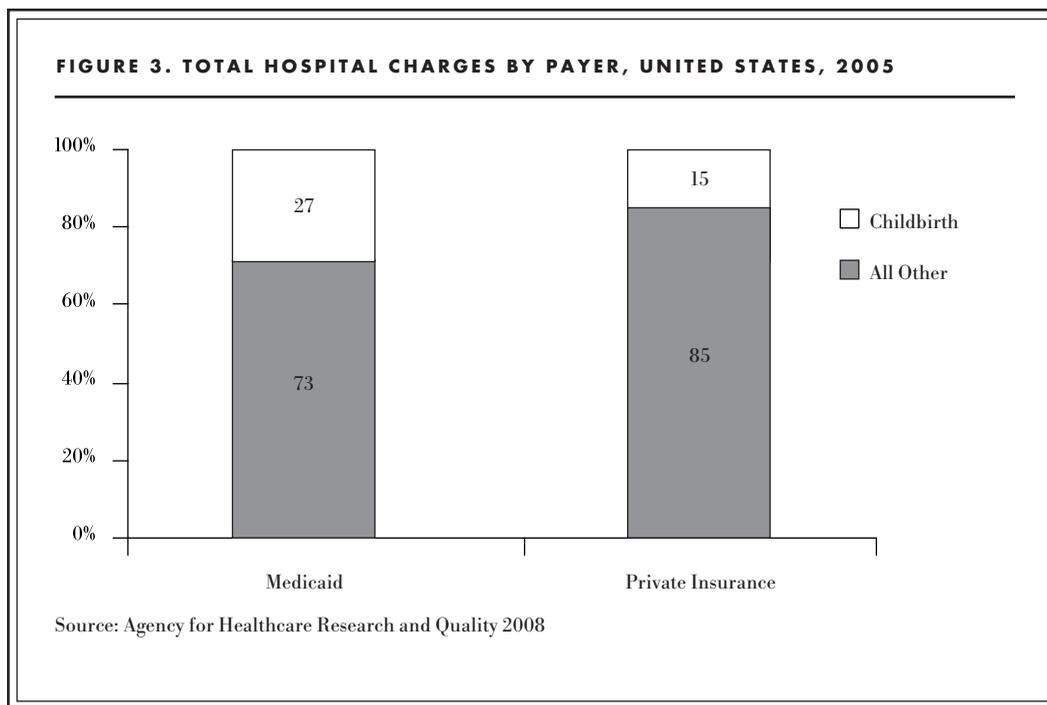
Thus, the financial toll of maternity care on private payers/employers and Medicaid/taxpayers is especially large. In 2005, fully 27 percent of hospital charges (or \$34,164,460,561) to Medicaid and 15 percent of hospital charges (or \$39,726,164,301) to private insurers were for birthing women and newborns (Figure 3). “Mother’s pregnancy and delivery” was the most expensive condition for both payers, followed by “newborn infants” (Andrews and Elixhauser 2007).

The procedure-intensity of these hospital stays helps to explain the level of expense. In 2005, 49 percent of all hospital procedures performed on all individuals aged eighteen to forty-four were obstetric procedures, and six of the fifteen most commonly performed hospital procedures in the entire population involved childbirth (Agency for Healthcare Research and Quality 2008):

- medical induction, manually assisted delivery, and other procedures to assist delivery (number 2)
- repair of current obstetric laceration (number 6)

- cesarean section (number 7)
- circumcision (number 8)
- fetal monitoring (number 13)
- artificial rupture of membranes (number 14)

Six of the ten most common procedures billed to Medicaid and to private insurers in 2005 were maternity related (Table 1). Cesarean section was the most common operating room procedure for Medicaid, for private payers, and for all payers combined (Agency for Healthcare Research and Quality 2008).



Maternity care thus plays a considerable role in escalating health care costs, which increasingly threaten the financial stability of families, employers, and federal and state budgets (Blumenthal 2006; Cowan and Hartman 2005).

GREAT VARIANCE IN CHARGES AND PAYMENTS BY TYPE AND PLACE OF BIRTH

In 2005, the national average hospital charge for childbirth ranged from about \$7,000 to nearly \$16,000, depending on whether the birth was vaginal or cesarean and, further, was coded as uncomplicated or complicated (Figure 4). A national 2003 survey puts hospital charges in further perspective. In eighty-six freestanding birth centers across the country, the average childbirth charge was about \$1,600, one-

TABLE 1. LEADING PROCEDURES BILLED TO MEDICAID AND PRIVATE INSURANCE PAYERS, UNITED STATES, 2005

Rank	Medicaid-Billed Procedure	Private Insurance-Billed Procedure
1	Medical induction, manually assisted delivery, and other procedures to assist delivery	Medical induction, manually assisted delivery, and other procedures to assist delivery
2	Cesarean section	Repair of current obstetric laceration
3	Repair of current obstetric laceration	Circumcision
4	Prophylactic vaccinations and inoculations	Cesarean section
5	Circumcision	Other therapeutic procedures
6	Fetal monitoring	Diagnostic cardiac catheterization, coronary arteriography
7	Artificial rupture of membranes	Blood transfusion
8	Other therapeutic procedures	Fetal monitoring
9	Other vascular catheterization, not heart	Artificial rupture of membranes
10	Blood transfusion	Other vascular catheterization, not heart

Source: Agency for Healthcare Research and Quality 2008

quarter of the hospital charge for uncomplicated vaginal birth that year (Figure 4). These figures do not include additional hospital-only charges for newborn care and additional anesthesia services charges for most hospital births, as well as maternity provider fees for all births. The National Birth Center Study of nearly twelve thousand women found excellent outcomes and very high levels of satisfaction with birth center care (Rooks et al. 1989; Rooks, Weatherby, and Ernst 1992a, 1992b, 1992c); this comparison suggests that the level of resource use in hospitals for uncomplicated vaginal births could be much lower. At present, less than 1 percent of childbearing women in the United States experience the style of care and efficient use of resources of freestanding birth centers (Martin et al. 2007).

Actual payments for medical services are generally somewhat lower than charges; however, payment data are often not publicly available. A recently reported analysis of a database of employer-sponsored health insurance attempted to measure comprehensive payments (rather than charges) for having a baby, including hospitalization, ambulatory visits, outpatient medications, laboratory services, and radiology/imaging services. Newborn care was not included, and elimination of outliers led to further underestimation of average payments. The database included about 1 percent of U.S.

births in 2004, and was weighted to reflect the national population of childbearing women covered by commercial insurance. The study found that actual payments were well below charges. It also found a large differential between vaginal and cesarean births, with average payments for cesarean births (\$10,958) exceeding average payments for vaginal births (\$7,737) by nearly 50 percent. The average vaginal-cesarean differential was \$2,090 for hospital payments and \$723 for payment of professional fees (Thomson Healthcare 2007).

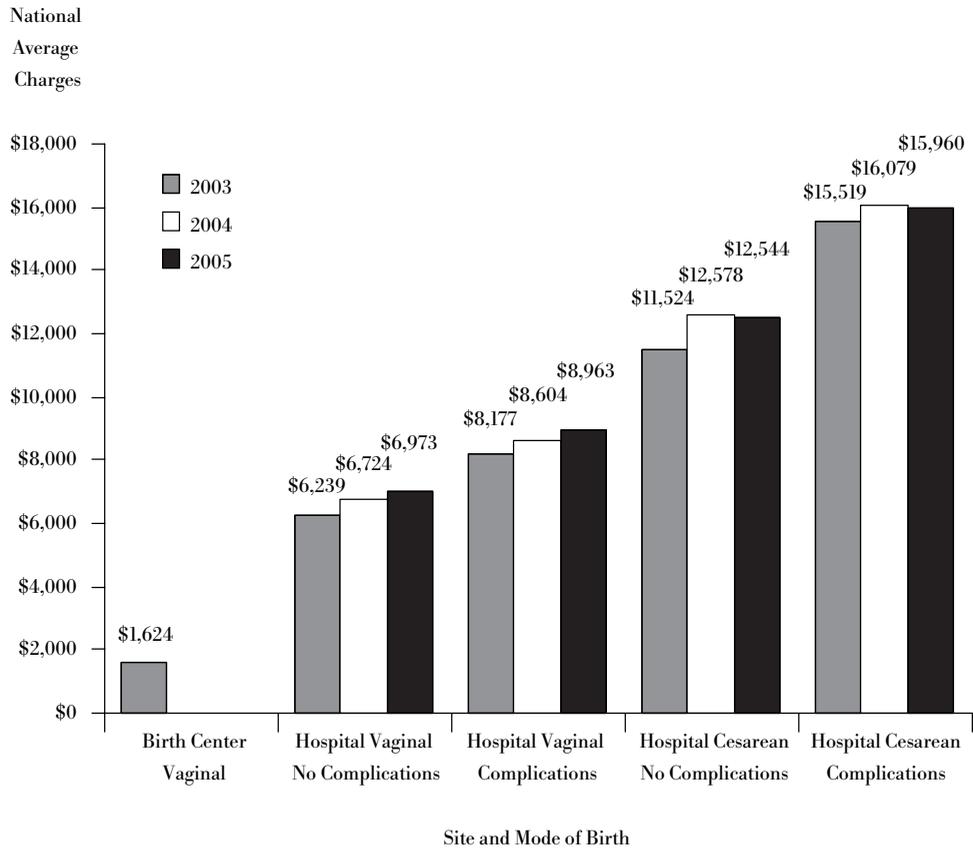
Another recent national analysis used federal Medical Expenditure Panel Survey results to estimate all prenatal and in-hospital childbirth expenditures in 2004 for women with a Clinical Classification Code of “normal pregnancy and delivery.” The analysis considered all sources of payment and included all professional services, hospital charges, prescription medications, and other expenses. Expenses associated with newborns appear to have been excluded. The analysis pooled and did not distinguish vaginal and cesarean births. Investigators estimated that combined average prenatal and childbirth costs were \$7,564, with delivery expenses (\$5,850) involving about five times the expense of prenatal care (\$1,159). Expenditures for privately insured women were higher than average (\$8,366 total, \$6,520 delivery), and expenditures for women with Medicaid coverage were lower than average (\$6,540 total, \$4,577 delivery), with differences concentrated in the childbirth component. Privately insured women paid about 8 percent of the expenses out of pocket, and Medicaid-insured women were responsible for about 1 percent of expenses (Machlin and Rohde 2007).

OVERALL PERFORMANCE A CONCERN AND MANY TRENDS HEADED IN WRONG DIRECTION

The U.S. Department of Health and Human Services established national Healthy People 2010 objectives for the first decade of this century. A midcourse review of progress found movement away from targets for low birthweight and very low birthweight, all preterm birth (live births before thirty-seven completed weeks of gestation), preterm births of thirty-two through thirty-six weeks of gestation, maternal labor and birth complications, initial (“primary”) and repeat cesareans in low-risk women, cerebral palsy, and mental retardation. Numerous other maternity-related goals had not reached 15 percent of their targets at midcourse, including perinatal mortality—the child mortality measure most closely associated with the quality of maternity care (U.S. Department of Health and Human Services 2006).

In the quarter-century from 1981 to 2006, the national rate of preterm birth increased by 36 percent, and the proportion of low birthweight babies increased by 22 percent (Figure 5) (Hamilton, Martin, and Ventura 2007; Martin et al. 2007). Following a steady decrease through most of the twentieth century, maternal mortality stagnated from 1982 to 1998. Changes in the measurement of maternal mortality in the United States in 1999 (implementation of *International Classification of Diseases*, Tenth Revision) and in 2003 (new pregnancy status question on U.S. standard certificate of death) make it difficult to compare the most recent years with the period through 1998. The national maternal mortality rate was 8/100,000 live births in 1998 and 13/100,000 live births in 2003 (Centers for Disease Control and Prevention 1998; Hoyert 2007; Miniño et al. 2007).

FIGURE 4. AVERAGE FACILITY LABOR AND BIRTH CHARGE BY SITE AND MODE OF BIRTH, UNITED STATES, 2003—2005



Sources: Agency for Healthcare Research and Quality 2008 (DRGs 370-373); National Association of Childbearing Centers 2004

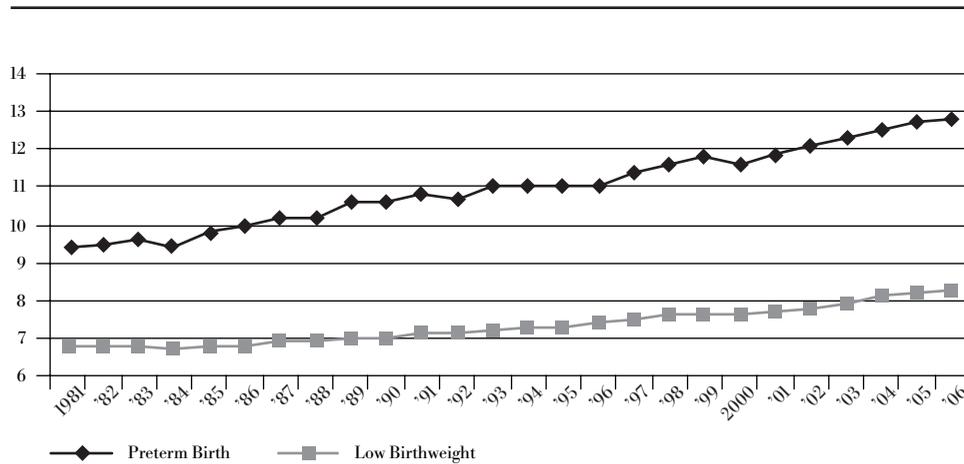
Notes: Figures in graph do not include additional anesthesia services charge associated with all cesarean and most vaginal births in hospitals, additional newborn care charge associated with all births in hospitals, and additional maternity provider charge associated with all births.

Payments of third-party payers typically reflect a discounting of charges.

Birth center figure is average charge reported by eighty-six out-of-hospital birth centers.

Comparable birth center figure will next be available for 2008.

FIGURE 5. PRETERM BIRTH RATE AND LOW BIRTHWEIGHT RATE, UNITED STATES, 1981–2006



Source: National Center for Health Statistics (Hamilton, Martin, and Ventura 2007; Martin et al. 2007)

Note: 2006 figures are preliminary.

Following a period of modest decline, the national cesarean rate rose by 50 percent from 1996 to 2006, setting a new record each year from 2000 onward. The repeat cesarean rate rose by 28 percent from 1996 to 2005, when 92 percent of mothers with a previous cesarean had a repeat cesarean. From 1990 to 2005, the proportion of medically induced labors rose by 135 percent, from 9.5 percent to 22.3 percent (Hamilton, Martin, and Ventura 2007; Martin et al. 2006; Martin et al. 2007). Moreover, validation studies suggest that these official rates—derived from aggregate birth certificates—identify just 45 percent to 61 percent of actual instances of induced labor (Lydon-Rochelle et al. 2005; Parrish et al. 1993; Piper et al. 1993; Yasmeeen et al. 2006). In just over ten years, from 1990 to 2002, with an increasing proportion of induced labors and planned cesarean sections, the most common gestational age among singleton births in the United States fell from forty to thirty-nine weeks (Davidoff et al. 2006), and current trends suggest continued foreshortening of gestational age.

In national surveys, women who gave birth in U.S. hospitals in 2005 reported high rates of numerous new-onset physical and mental health problems in the first two months after birth, with many problems persisting to six months or more postpartum (Declercq et al. 2008).

Table 2 clarifies that there is large variation in these performance indicators across states, including greater than sixfold for vaginal birth after cesarean and greater than threefold for labor induction.

In 2005, 4 percent of births were uninsured, an increase of 12 percent over the previous year (Agency for Healthcare Research and Quality 2008). Moreover, a much larger proportion of women lacks insurance prior to pregnancy than at the time of birth and transitions to insurance coverage during pregnancy. We were unable to find data describing conditions since 1999, when a study across nine states found that from 17 percent to 41 percent of childbearing women lacked insurance prior to pregnancy, with 1 percent to 4 percent remaining uninsured through to the time of birth. From 13 percent to 35 percent of mothers made the most common insurance status transition, from uninsured to Medicaid. Levels of prepregnancy uninsurance, continuous uninsurance, and transition from uninsurance to Medicaid were considerably higher for women with annual incomes below \$16,000 than for women with higher incomes (Adams, Gavin, et al. 2003). Current data, along with an understanding of the impact of insurance transitions in pregnancy on access to high-quality care and health outcomes, are needed. Uninsured childbearing women face bills for maternity services when they are adjusting physically and emotionally from pregnancy and childbirth and when their infants benefit from continuity of caregiver and breastfeeding.

When comparing experiences of childbearing women with private and public payment sources or across major race/ethnicity groupings, all segments of the population appear to experience problems with access to quality care. Where differences exist, there are greatest concerns about the quality of care received by black non-Hispanic women in comparison with both white non-Hispanic and Hispanic women (Sakala and Corry 2008). Similarly, black non-Hispanic mothers experience much higher rates of preterm birth, low birthweight, and fetal, perinatal, and maternal mortality than both other groupings (Martin et al. 2006). Moreover, the midcourse Healthy People 2010 review found that disparities for black non-Hispanic women were increasing for numerous indicators, including neonatal deaths, very low birthweight infants, mental retardation, and cerebral palsy (U.S. Department of Health and Human Services 2006).

Our national maternity care performance is also disappointing when compared with other nations. In *The World Health Report 2005: Make Every Mother and Child Count*, the World Health Organization identified twenty-nine nations with lower estimated maternal mortality rates than the United States (14/100,000 live births), thirty-five with lower early neonatal mortality rates (4/1,000 live births), and thirty-three with lower neonatal mortality rates (5/1,000 live births) in 2000 (2005). An analysis of maternal mortality rates for 2005 identified thirty-three countries with better performance than the United States (estimated at 11/100,000 live births, but perhaps as high as 21/100,000) (Hill et al. 2007). Among the thirty member nations of the Organisation for Economic Co-operation and Development (OECD), twenty-three reported a lower low birthweight rate than that of the United States (7.9 percent) for 2003, and six had higher rates. Fourteen OECD countries reported a lower perinatal mortality rate than that of the United States (6.9 percent) for 2003, and nine had higher rates. For the same year, nineteen members reported a lower cesarean rate than that of the United States (29.1 percent), and three reported higher rates (Organisation for Economic Co-operation and Development 2007).

TABLE 2. PERFORMANCE ON SELECTED INDICATORS OF MATERNAL AND NEWBORN HEALTH, UNITED STATES, EACH STATE, AND DISTRICT OF COLUMBIA

STATE	2003		2005				
	Births Covered by Medicaid ¹		Low Birthweight ²	Preterm Birth ²	Cesarean Section ²	Vaginal Birth after Cesarean (VBAC) ²	Induction of Labor ^{2,g}
	PERCENT	PERCENT	PERCENT OF LIVE BIRTHS	PERCENT OF LIVE BIRTHS	PERCENT OF LIVE BIRTHS	RATE PER 100 WOMEN WITH A PREVIOUS C-SECTION	PERCENT OF LIVE BIRTHS
United States	—^a		8.2	12.7	30.3	—^c	22.3
Alabama	46		10.7	16.7	31.8	5.9	30.5
Alaska	55		6.1	10.6	21.9	18.6	20.2
Arizona	50		6.9	13.2	24.7	6.0	18.9
Arkansas	52		8.9	13.4	31.5	6.0	26.5
California	45		6.9	10.7	30.7	5.5	11.0
Colorado	37		9.2	12.3	24.6	11.7	19.6
Connecticut	28		8.0	10.4	32.4	6.7	20.1
Delaware	41		9.5	14.0	30.0	10.3	25.3
District of Columbia	34		11.2	15.9	30.5	7.0	26.1
Florida	50		8.7	13.8	34.9	5.7 ^d	24.2
Georgia	50		9.5	13.6	30.5	5.8	23.8
Hawaii	27		8.2	12.2	25.6	12.4	12.1
Idaho	40		6.7	11.4	22.6	17.3 ^d	28.3
Illinois	40		8.5	13.1	28.8	9.5	25.2
Indiana	41		8.3	13.5	28.2	6.9	26.5
Iowa	28		7.2	11.8	26.7	8.4	27.0
Kansas	40		7.2	12.2	28.9	11.3 ^d	27.1
Kentucky	44		9.1	15.2	33.9	6.9 ^d	29.5
Louisiana	59		11.5	16.5	36.8	3.6	22.9
Maine	47		6.8	10.7	28.3	6.0	19.7
Maryland	34		9.1	13.3	31.1	9.8	22.4
Massachusetts	29		7.9	11.3	32.2	9.7	18.0
Michigan	35		8.3	12.5	28.8	8.3	18.7
Minnesota	37		6.5	10.7	25.3	10.6	21.2
Mississippi	60		11.8	18.8	35.1	3.8	20.1
Missouri	45		8.1	13.3	29.7	7.6	29.8
Montana	35		6.6	11.4	25.8	11.4	27.1
Nebraska	40		7.0	12.2	28.6	9.5 ^d	33.0
Nevada	32 ^b		8.3	13.9	31.0	4.9	19.4
New Hampshire	23		7.0	10.5	28.1	16.6 ^d	23.0
New Jersey	26 ^b		8.2	12.5	36.3	9.6	20.1
New Mexico	67 ^b		8.5	13.1	22.2	13.0	14.9
New York	40		8.3	12.1	31.5	10.8 ^{d,e}	21.4
North Carolina	48		9.2	13.7	29.3	8.9	19.8

TABLE 2. (CONTINUED)

STATE	2003		2005				
	Births Covered by Medicaid ¹		Low Birthweight ²	Preterm Birth ²	Cesarean Section ²	Vaginal Birth after Cesarean (VBAC) ²	Induction of Labor ^{2,g}
	PERCENT	PERCENT OF LIVE BIRTHS	PERCENT OF LIVE BIRTHS	PERCENT OF LIVE BIRTHS	RATE PER 100 WOMEN WITH A PREVIOUS C-SECTION	PERCENT OF LIVE BIRTHS	
North Dakota	30	6.4	11.5	26.4	10.3	29.3	
Ohio	32	8.7	13.0	28.1	8.9	30.4	
Oklahoma	50	8.0	13.1	32.5	2.8	27.6	
Oregon	43	6.1	10.2	27.6	10.3	26.9	
Pennsylvania	31	8.4	11.9	28.9	15.2 ^d	21.9	
Rhode Island	37	7.8	12.1	30.3	9.4	20.2	
South Carolina	55	10.2	15.6	32.7	10.0 ^d	31.8	
South Dakota	36	6.6	11.5	25.1	13.7	29.3	
Tennessee	46	9.5	14.7	31.1	11.1 ^d	32.6	
Texas	48	8.3	13.6	32.6	10.0 ^d	25.2	
Utah	30	6.8	11.4	21.6	18.2	35.3	
Vermont	48	6.2	9.0	25.9	— ^f	22.6	
Virginia	28	8.2	12.3	31.4	6.6	17.9	
Washington	46	6.1	10.6	27.8	13.2 ^d	22.2	
West Virginia	50	9.6	14.4	34.2	4.8	33.9	
Wisconsin	38	7.0	11.4	23.7	11.8	24.0	
Wyoming	46 ^b	8.6	13.1	24.6	8.0	25.3	

Notes:

^a U.S. rate not available for 2003.

^b Data from 2002; 2003 data is not available.

^c U.S. rate not available; the 2005 VBAC rate for thirty-seven states using unrevised birth certificates (69 percent of all births) was 7.9 percent, and for twelve states using revised certificates (31 percent of all births) was 10.1 percent. For more information, see www.marchofdimes.com/peristats/calc/dm.

^d Data are based on the 2003 revised birth certificate; VBAC rates calculated based on the 2003 revision are slightly higher and should not be compared to those based on the 1989 revision.

^e New York City did not use the 2003 revised birth certificate and was excluded from state data. To access data for NYC, visit www.marchofdimes.com/peristats.

^f Data not available due to midyear transition from the 1989 to 2003 revised birth certificate.

^g Validation studies and national surveys indicate that birth certificates underestimate actual rates of induced labor.

Sources:

¹ Data collected by the National Governors Association, 2006 and 2007.

² National Center for Health Statistics, 2005 final natality data.

Prepared by March of Dimes Perinatal Data Center, April 2008.

Although maternity-specific expenditure level data are not available across a large set of countries, the United States had by far the greatest overall health expenditure per capita across the thirty OECD countries in 2005, which was greater than twice the average expenditure of these nations. Similarly, the United States far exceeded all other OECD countries in health expenditure as a share of gross domestic product in 2005 (Organisation for Economic Co-operation and Development 2007).

These disappointing, often deteriorating outcomes in concert with procedure-intensive care and very large financial investments have been described as “the perinatal paradox: doing more and accomplishing less” (Rosenblatt 1989).

**EVIDENCE-BASED MATERNITY CARE: EFFECTIVE CARE
WITH LEAST HARM**

NOTE: REFERENCES TO SYSTEMATIC REVIEWS ARE IN ITALICS

“Evidence-based maternity care” uses the best available research on the safety and effectiveness of specific practices to help guide maternity care decisions and facilitate optimal outcomes in mothers and newborns. Various paths that might be pursued in a given situation often have very different benefit/harm profiles. *Evidence-based maternity care gives priority to care paths and practices that are effective and least invasive, with limited or no known harms whenever possible.* This framework is in the tradition enjoining practitioners to “first, do no harm” and consider undesirable consequences of good intentions.

The principle of effective care with least harm has two corollaries. First, practices with established or plausible adverse effects should be avoided when best available research identifies no clear anticipated benefit to justify their use. For example, mothers reported that a substantial proportion of labor inductions and cesarean sections in 2005 were carried out because of a caregiver’s judgment and concern about a large fetus (Declercq et al. 2006; *National Collaborating Centre for Women’s and Children’s Health 2008b*), but a series of rigorous reviews have found that best research does not support this as a valid indication for either procedure (*Chauhan, Grobman, et al. 2005; Coomarasamy et al. 2005; Pattinson and Farrell 1997; Rouse and Owen 1999*). An evidence-based framework also questions the wisdom of using interventions with a marginal expected benefit that is overshadowed by greater risk of established harm. Examples of such a situation include inducing labor by various means or hastening it with synthetic oxytocin for convenience and in the absence of a clear medical rationale (Grobman 2007; Simpson and Thorman 2005).

These principles for evidence-based maternity care are especially important in consideration of the sensitive perinatal development period, the potential for long-term beneficial and adverse health effects, and the large scope for uncertainty about unintended consequences of many possible exposures, as discussed in the following section. These principles are also guides for helping purchasers obtain good value.

To implement these principles and to help guide maternity care decisions, decision makers need access to the highest quality of evidence about the safety and effectiveness of specific procedures, medications, and other interventions. They should require rigorous research results demonstrating that the care provided has been shown to work, may thus be expected to offer genuine benefit, and is a wise choice when considering associated harms and alternatives.

Basic principles for determining what constitutes best available evidence are as follows:

- *Question common assumptions.* Maternity care practices based on the opinions of experts or the general public or on tradition are unreliable guides for decision making. These views and patterns of care have been shaped by many factors and often do not reflect the best current research. They may lead to inadequate care, poor outcomes, and wasted resources. It is important to demand to be shown the best evidence.
- *Know that many studies of interventions are unreliable guides for decision making.* Careful evaluation of the quality of research using “critical appraisal” skills is essential. Many studies are flawed or limited in scope and do not provide valid answers to key questions. One newly

reported study rarely offers the best, most definitive answer, and commercial interests influence many studies. It is important to ask what is already known about a particular question on the basis of the best available research, and what, if anything, a new study adds.

- *Look for the “gold standard.”* When available, well-designed and well-conducted systematic reviews of research should inform maternity care decisions. If systematic reviews are not available, well-designed and well-conducted studies with randomized controlled trial designs can provide the most valid answers to many questions. For many reasons, it may be important to consider other types of studies as well. (See sidebar titled “What is the ‘Gold Standard’ for Knowledge about Effects of Maternity Care?” for more about systematic reviews and original studies.)
- *Make informed decisions that consider evidence about safety and effectiveness and the values and circumstances of individual childbearing women.* When making maternity care decisions, it is crucial to consider the best available evidence as well as values, preferences, and individual circumstances of childbearing women who have been supported to understand this evidence. It is also important to consider the options within specific care settings, such as the skills of caregivers and available forms of care.
- *Beware of misleading claims.* With growing recognition of the value of evidence-based policy and practice, it is important to be wary of bandwagon slogans describing “evidence-based” products and services and of deeply flawed execution that may not in fact reflect these principles.

WHAT IS THE “GOLD STANDARD” FOR KNOWLEDGE ABOUT EFFECTS OF MATERNITY CARE?

A rigorous and transparent systematic review of original studies that has been conducted according to established guidelines and with discernment regarding both methodology and topic (Cochrane Methodology Register 2008; Moher et al. 2007; Sheikh et al. 2007) is a powerful tool for understanding the weight of the best available evidence. Such a review gives the most trustworthy knowledge about beneficial and harmful effects of specific health interventions. Systematic review procedures help limit investigator bias and error that can easily distort results of single studies and of more conventional and haphazard research reviews. A systematic review establishes the scope and other basic review parameters at the outset as a guide for conducting the review. It involves a thorough search for all the studies that meet explicit criteria for inclusion. Using criteria for assessing methodological rigor, researchers include only better quality studies in the review. When possible, researchers reach a conclusion by pooling data from the included studies using statistical techniques of

meta-analysis. Systematic reviews should be updated over time to incorporate new relevant high-quality research and to refine and strengthen the original analysis when possible. A recent Milbank Report describes the history, methodology, and uses of systematic reviews (Moynihan 2004), and another highlights the use of systematic reviews in policymaking (Sweet and Moynihan 2007).

The earliest systematic reviews were carried out more than twenty-five years ago to evaluate pregnancy and childbirth care. This pioneering work led to the formation of the Cochrane Collaboration to continue the pregnancy and childbirth research and to develop and update systematic reviews across all clinical and public health fields (Chalmers 1993). Many hundreds of systematic reviews are now available to guide maternity policy and practice from the highly regarded Cochrane Pregnancy and Childbirth Group and many other entities and individuals throughout the world. These invaluable tools for providing high-quality maternity care and obtaining good value have been grossly underutilized in the United States (see, for example, Chauhan et al. 2006).

Among individual studies, randomized controlled trials (or RCTs) can provide especially trustworthy results about many effects of specific interventions. In this type of research, participants are randomly assigned to receive one or another form of care. Those receiving usual care (or placebo treatment such as a sugar pill) are in the control group. Those receiving the type of care that is being studied are in the treatment or experimental group. Random assignment helps ensure that the groups being compared are truly similar and that any differences in outcomes are due to the treatment under study rather than some other difference between the groups.

RCTs are not the best study design for answering many important questions. For example, due to the great expense that would be required to enroll large numbers of participants and/or to follow participants over time, RCTs generally do not provide meaningful data about (1) less common but important outcomes (such as maternal mortality) and (2) outcomes that may occur far in the future (such as effects of cesarean section on mothers and babies in future pregnancies) or at earlier points when a high rate of follow-up may be difficult and expensive. Due to the expense, many pregnancy and childbirth RCTs do not collect any outcome data after postpartum hospital discharge—a serious limitation. For ethical reasons, it may not be possible to carry out RCTs (for example, researchers would not randomly assign babies to a non-breastfeeding group). RCTs can be misleading when they are not carried out according to plan. Notably, when large proportions of participants do not receive the care of the group to which they were assigned, the experience of the groups becomes more similar and RCTs lose power to detect true differences in effects. Thus, reports of “no difference” may be invalid

in the many RCTs where such group crossover occurred. Even if feasible and ethical, RCTs may not have been conducted to answer key questions. In general, we need to complement knowledge from RCTs with best options among other types of studies and carefully weigh the better studies (Jadad and Enkin 2007).

SHORT-TERM HEALTH BENEFITS OF PHYSIOLOGIC MATERNITY CARE

In addition to evidence about interventions, an evidence-based maternity care framework must take into account evidence about the biological foundation of childbearing: how mothers' and babies' bodies work, and work in concert, from prenatal through postpartum periods, to accomplish growth, development, the childbirth process, the establishment of breastfeeding, and attachment as the basis of the mother-child relationship and other relationships.

The authors of *A Guide to Effective Care in Pregnancy and Childbirth*, the highly regarded manual on evidence-based maternity care, gave priority to the biological foundation and accorded fundamental respect to mothers and babies when they described their framework for interpreting evidence on interventions:

We worked from two basic principles: first, that the only justification for practices that restrict a woman's autonomy, her freedom of choice, and her access to her baby, would be clear evidence that these restrictive practices do more good than harm; and second, that any interference with the natural process of pregnancy and childbirth should also be shown to do more good than harm. We believe that the onus of proof rests on those who advocate any intervention that interferes with either of these principles (p. 486 Enkin et al. 2000).

This report affirms these principles. With appropriate support and protection from external interference, childbearing women and their fetuses/newborns experience innate, mutually regulating, hormonally driven processes that have developed during human evolution. These processes facilitate the period from the onset of labor through birth of the baby and placenta, as well as the establishment and continuation of breastfeeding and the development of mother-baby attachment. Examples of steps along this path include the following (Buckley 2004a; Winberg 2005):

- the mother's elevated levels of beta-endorphin, an endogenous opiate that relieves pain and facilitates an altered state of consciousness, similar to experiences of endurance athletes
- the mother's rhythmic involuntary expulsion efforts shortly before birth (Ferguson's reflex)
- the unmedicated and undisturbed infant's drive to crawl on its mother's chest, self-attach to the breast, and begin suckling shortly after birth
- the mother's surge of oxytocin at the time of birth, which stimulates loving feelings and inhibits hemorrhage by contracting the uterus
- the continuing oxytocic effects with breastfeeding

When facilitated, these autonomic nervous system functions overwhelmingly succeed in conferring a cascade of physical, psychological, and social benefits for the mother-baby dyad (Buckley 2004a; Odent 2001; Winberg 2005). When caregivers recognize and give priority to these capacities, mothers and babies experience these benefits and avoid risk of known short- and long-term harms and as yet unknown harms of avoidable, medically unnecessary interventions. By mobilizing these capacities, caregivers also humanize childbirth, show respect to women and fetuses/newborns as agents of these processes, enable all involved parties to experience the remarkable competence of

birthing women and newborns, strengthen mother-baby bonds, and foster a uniquely fulfilling and empowering experience (Wagner 2001).

Many historic and contemporary reports and studies confirm that the physiologic approach to childbirth, which has most consistently been provided by midwives (*Brown and Grimes 1995; Hatem et al. in press; Kennedy and Shannon 2004; Waldenström and Turnbull 1998; Walsh and Downe 2004*), has succeeded remarkably well in achieving positive outcomes for mothers and babies in diverse contexts. These include situations that are often viewed as involving elevated risk, such as care for women in remote and inner-city settings and care among low-income and underserved populations (Raisler and Kennedy 2005; Ulrich 1990). In addition to such physiologic care, childbearing women and newborns benefit when deprivation, disease, inadvertent use of unsafe practices, or other adverse circumstances are minimized. In all contexts, a portion of childbearing women and newborns require and gain benefit from specialized skills and knowledge and obstetric interventions that effectively address specific problems. Access to consultation, referral, shared care, transferred care, and transport is an essential complement to physiologic care.

Unlike most recipients of health care in the United States, childbearing women and newborns are primarily healthy and benefit especially from care that maintains good health (Lynn et al. 2007). It is a challenge to provide an overall estimate of the portion of this population that can benefit from more specialized care and procedures that intervene in physiologic processes. The federal Healthy People 2010 initiative provides one widely used proxy measure, which identifies low-risk women as those who are giving birth at term (thirty-seven completed weeks of gestation or beyond) with a single infant in a head-first position (U.S. Department of Health and Human Services 2000). In 2003, 82.6 percent of childbearing women met these criteria (National Center for Health Statistics 2006). By this estimate, more intensive and invasive care is appropriate for about one mother in six.

Physiologic childbirth is within reach of the great majority of mothers and babies. However, this approach is poorly recognized and supported at present in the United States and other industrial nations. External, professional-directed management of childbirth in hospitals (Table 3) typically interferes with these mother- and baby-led capacities. Results in the table from the national *Listening to Mothers II* survey of women who gave birth in U.S. hospitals in 2005 clarify the extent of use of obstetric interventions in this primarily healthy population. A project of Childbirth Connection, this survey was conducted by Harris Interactive in January–February 2006 among 1,573 women across the United States. The methodology was designed to describe the survey’s target population of women aged eighteen through forty-five who gave birth to single babies in U.S. hospitals in 2005, with the baby still living at the time of the survey (a detailed appendix describes the methodology). The survey covered the time from before conception through the postpartum period. It included many items that are not available through other national data sources or appear to be undercounted in those sources; many validation studies (described in the survey’s report appendix) have found that birth certificates and hospital discharge records do not capture a large proportion of actual occurrences for many data items. *The Listening to Mothers II* survey is thus a unique resource for describing contemporary

experiences of childbearing women and newborns in the United States and for comparing care that is actually received with optimal care (Declercq et al. 2006).

TABLE 3. CHILDBIRTH IN U.S HOSPITALS, 2005: LISTENING TO MOTHERS II SURVEY

Medical Induction and Self-Induction

Any attempt to induce labor with drugs and/or techniques	50%
Professional attempted to induce labor	41%
Mother attempted to induce labor	22%
Labor was actually induced	39%
Professional's actions started labor	34%
Mother's actions started labor	4%

Fetal Monitoring (experienced labor)

Any electronic fetal monitoring (EFM)	94%
EFM continuously throughout labor	71%
EFM most of the time during labor	16%
Handheld device alone for monitoring	3%

Other Labor and Birth Interventions

Synthetic oxytocin to induce and/or speed labor	57%
Rupture of membranes to induce or speed labor	65%
Epidural or spinal analgesia	76%
Narcotic analgesia	22%
Intravenous drip	83%
Bladder catheter	56%

Restrictions

No mobility after well-established contractions (experienced labor)	76%
No oral fluids (experienced labor)	59%
No oral solids (experienced labor)	85%
Back-lying position for giving birth (vaginal births)	57%

Interventions at the Time of Birth (vaginal births)

Staff pressure on belly to move baby out	17%
Staff-directed pushing	75%
Episiotomy	25%

(continued)

TABLE 3. (CONTINUED)

Mode of Birth	
Total vaginal	68%
Vaginal, spontaneous	60%
Vaginal, vacuum extraction/forceps	7%
Vaginal birth after cesarean (VBAC)	2%
Total cesarean	32%
Primary (first-time) cesarean	16%
Repeat cesarean	16%
Hospital Practices That Can Interfere with Breastfeeding (mother intended to exclusively breastfeed at the end of pregnancy)	
Baby primarily with staff for routine care first hour after birth	39%
Mother given free formula samples/offers	66%
Baby given formula or water “supplement”	38%
Baby given pacifier	44%
Breastfeeding	
Intended exclusive breastfeeding at end of pregnancy	61%
Exclusively breastfeeding one week after birth	51%

Note: Percentage is for all mothers, unless specified in parentheses.

Source: Declercq et al. 2006

As shown in Table 3, labor is literally *pushed* by routine or common measures applied to this primarily healthy population—measures including labor induction, labor augmentation, staff-directed maternal pushing, and forceful pressure applied by staff on women’s abdomens at the time of birth. Labor is also frequently *pulled* by interventions such as vacuum extraction/forceps, cesarean section, pulling on the cord to hasten birth of the placenta, and separation of babies from mothers after birth. About one-half of the items in Table 3 were experienced by a majority of women despite the overall healthy status of this population. These and other common interventions disrupt and preclude the physiologic capacities of the childbirth process (Buckley 2004b; Odent 2001) and incur a cascade of secondary interventions used to monitor, prevent, and treat the side effects of the initial interventions (Brody and Thompson 1981). As one intervention justifies or increases the likelihood of using others, the cumulative effect is to create a distorted understanding of childbirth as a time when things are likely to go wrong and intensive medical management is required (Mold and Stein 1986).

By learning from those with the skills and knowledge to enhance the innate physiologic capacities of the childbearing process, we can refrain from exposing mothers and babies to the harm and expense of avoidable interventions and use medical interventions appropriately, as needed. Table 4 compares rates of several interventions among a national group of low-risk women receiving usual care with those in a large prospective study of American women who gave birth with certified professional midwives (CPMs) in 2000 (Johnson and Daviss 2005). The usual care group is composed of all women who met Healthy People 2010 criteria for low-risk laboring woman. The contrast in experiences is striking, with national rates of intervention among low-risk women with usual care from two to sixteen times as great as the midwifery study rates. Notably, both the CPM study and an earlier large prospective U.S. study of low-risk women who also received physiologic care (Rooks et al. 1989) reported a cesarean section rate of 4 percent. By contrast, the low-risk mothers with usual care in 2000 were five times as likely to experience this procedure.

Infrequent use of interventions and other conditions of the CPM study were not associated with increased risk for study participants when compared with low-risk women giving birth in usual care hospital settings (Johnson and Daviss 2005). The low CPM study rates of intervention are benchmarks for what the majority of childbearing women and babies who are in good health might achieve.

TABLE 4. INTERVENTION RATES FOR LOW-RISK WOMEN IN THE UNITED STATES AND AMONG BIRTHS ATTENDED BY CERTIFIED PROFESSIONAL MIDWIVES, 2000

Intervention	Low-Risk, U.S.* (n = 3,360,868)	Certified Professional Midwives (n = 5,418)
Electronic fetal monitoring	84%	10%
Intravenous drip	not reported	8%
Epidural analgesia	not reported	5%
Artificial rupture of membranes	not reported	5%
Episiotomy	33%	2%
Forceps	2%	1%
Vacuum extraction	5%	1%
Cesarean	19%	4%

* Met Healthy People 2010 criteria for low-risk laboring woman.

Source: Johnson and Daviss 2005

(See the sidebar titled “National U.S. Midwifery Credentials” to learn more about the relatively new CPM credential and the other two national midwifery credentials: certified nurse-midwife and certified midwife.)

Just as mothers and babies have much to gain by forgoing avoidable drugs, surgery, and other consequential procedures (as detailed in the following subsection), so can purchasers obtain exceptional value by using scientific evidence to provide effective care with least harm. Figure 4 contrasts the average charge for physiologic care in eighty-six freestanding birth centers across the United States with national average hospital charges for childbirth. In the best case, for uncomplicated vaginal birth, hospital charges were on average four times as high as birth center charges in 2003. Hospital charges were more than nine times as high as birth center charges when the pregnancy ended with a complicated cesarean. With wider application of care that facilitates physiologic processes, it is reasonable to expect that a notable proportion of births could shift from

NATIONAL U.S. MIDWIFERY CREDENTIALS: CERTIFIED NURSE-MIDWIFE, CERTIFIED MIDWIFE, AND CERTIFIED PROFESSIONAL MIDWIFE

The style of care typically provided by midwives is well-suited to needs of childbearing women, including healthy women who anticipate an uncomplicated birth. Many midwives give priority to providing women with good information, involving them in decision making, offering flexible and responsive care, supporting physiologic processes, and avoiding unnecessary interventions. The accrediting body of the National Organization for Competency Assurance accredits three midwifery credentials in the United States.

Certified nurse-midwives (CNMs) are well-established maternity professionals in the United States. Educated in the two disciplines of nursing and midwifery, they provide prenatal, childbirth, postpartum, and well-woman care. CNMs are licensed to practice in all states and covered by a wide variety of insurance programs. Certified Midwives (CMs) are equivalent in training and practice to CNMs but do not have a nursing credential. This newer path to the midwifery profession is recognized in several states. CNMs and CMs practice in all settings and primarily attend hospital births (American College of Nurse-Midwives 2005). Another newer credential, the certified professional midwife (CPM), indicates a midwife who is educated to provide pregnancy, birth, and postpartum care for women who give birth in out-of-hospital birth centers or at home. The number of CPMs has grown rapidly in recent years. Nearly one-half of states license CPMs, and efforts are under way to extend licensure to all states. A new issue brief provides additional background information about CPMs (North American Registry of Midwives et al. 2008).

complicated to uncomplicated status and from cesarean to vaginal birth, with considerable benefit for those who receive and pay for care.

LONG-TERM HEALTH BENEFITS OF PHYSIOLOGIC MATERNITY CARE

It is critical to retain a long-term, life-course focus when planning and providing care for babies and mothers. A vast body of research is accumulating about lifelong implications for babies of the medical, physical, and social environment from conception through pregnancy and birth and into the postpartum period. This early period includes windows of heightened sensitivity for fostering many dimensions of optimal human development or generating harm. Many papers review specific topics within this work on the “developmental origins of health and disease” (see, for example Csaba 2007; Davis and Sandman 2006; Gluckman and Hanson 2006; Gluckman et al. 2005; Grandjean and Landrigan 2006; Heindel 2006; *Horta et al. 2007*; *Ip et al. 2007*; Johns, Jauniaux, and Burton 2006; Lewis, Poore, and Godfrey 2006; Olsen 2000; and Tchernitchin et al. 1999). Alterations in genes, cells, and tissues can have mutagenic, teratogenic, carcinogenic, and other adverse effects. Many health problems that manifest in later childhood or adulthood appear to have origins in this much earlier period, following impairment of immune, neurobehavioral, reproductive, metabolic, cardiovascular, and other functions. Due to delay or failure to recognize effects or to establish associations with early exposures, the concept of “silent epidemics” has been proposed as an extension of areas of current knowledge (Grandjean and Landrigan 2006). Collectively, this work suggests the importance of rigorous assessment of possible long-term effects of perinatal exposures. Given current uncertainty, it would be prudent to avoid needless exposures. (The sidebar titled “Diethylstilbestrol (DES) Clarifies Importance of Caution with Perinatal Exposures” provides an example of one of the most carefully and longest documented perinatal exposures, diethylstilbestrol, or DES.)

Growing evidence also suggests that maternity practices can have a long-term positive or negative impact on maternal well-being—for example, whether mothers use medication such as DES during pregnancy, have a cesarean, or breastfeed (*Ip et al. 2007*; Kennare et al. 2007; Labbok 2001; Lauver, Nelles, and Hanson 2005; Silver et al. 2006). It is a priority to understand longer-term effects of maternity interventions on mothers as well, and to consider this knowledge during decision making processes.

In addition to environmental exposures and aspects of pregnant and breastfeeding women’s nutritional status, accumulating evidence finds that medical interventions used during childbirth may be associated with long-term harms (Odent 2006). These results and other possible impacts warrant further research and assessment in systematic reviews to strengthen our knowledge about long-term effects of widely experienced exposures during apparently sensitive windows of time in the perinatal period. A new narrative review describes research to date to understand mechanisms and effects of medical and environmental exposures in the perinatal period and to distinguish perinatal exposures from teratogenic exposures during early gestation (Csaba 2007; see also Tchernitchin et

al. 1999). The implication, which is consistent with the framework of this report, is that interventions should only be used when there is a well-supported clinical rationale for doing so. Further, decision making processes should take into account known harms and recognize the potential for harms that have not yet been established or well-publicized. Studies that point to potential adverse developmental consequences of intrapartum interventions consistent with the growing understanding of the developmental origins of health and disease include the following:

- Babies exposed to antibiotics during the birth process were more likely than unexposed babies to experience persistent wheezing measured at age six to seven years (Rusconi et al. 2007).
- In comparison with healthy term newborns delivered by planned cesarean, healthy term newborns who experienced labor had improved survival of white blood cells that destroy microorganisms (neutrophils) in their cord blood and better neutrophil function; this suggests that labor may be immunologically beneficial to normal newborns and may help explain excess neonatal morbidity and mortality with planned cesareans (Molloy et al. 2004).
- The initial colonization of the newborn intestine persists over a long period and has a pivotal effect on long-term health (Bedford Russell and Murch 2006; Glasgow et al. 2005; Grolund et al. 1999), and babies who experienced cesarean section, failure to breastfeed, intrapartum antibiotics, or hospital birth were less likely to have early colonization with beneficial bacteria than those who were, respectively, born vaginally, breastfed, not given antibiotics, or born at home (Penders et al. 2006).
- Cesarean section is associated with numerous adverse future harms in women, including abdominal adhesion formation and chronic pelvic pain (Almeida et al. 2002; Lyell et al. 2005; Morales, Gordon, and Bates Jr. 2007) and in mothers and babies in future pregnancies, including placenta previa, placenta accreta, placental abruption, uterine rupture, hysterectomy, small size for gestational age, low birthweight, preterm birth, stillbirth, and neonatal intensive care unit admission (Getahun et al. 2006; Kennare et al. 2007; Taylor et al. 2005). Serious maternal morbidity increases progressively as the number of previous cesareans increases (Nisenblat et al. 2006; Silver et al. 2006).
- In contrast with unmedicated babies, babies whose mothers received epidurals and/or systemic opioids during labor exhibited reduced breast-seeking and breastfeeding behaviors, were less likely to breastfeed within 150 minutes of birth, and cried more; from 90 percent to 100 percent of the unmedicated newborns exhibited all six measured breastfeeding behaviors (Ransjö-Arvidson et al. 2001). Numerous childbirth interventions decrease the likelihood of establishing breastfeeding (Forster and McLachlan 2007; Moore, Anderson, and Bergman 2007; Smith 2007), which confers many short- and long-term benefits to babies and mothers (American Academy of Pediatrics 2005; Horta et al. 2007; Ip et al. 2007; Lobbok 2001; Lobbok, Clark, and Goldman 2004).
- Adults who met diagnostic criteria for drug addiction were about five times as likely as sibling controls to have received three or more doses of opioid and barbiturate drugs within ten hours

before birth (Nyberg, Buka, and Lipsitt 2000). When controlling for numerous potential confounders, researchers concluded that the association between pain medications and adult addiction appeared to have a dose-response effect and was not found with drugs administered more than ten hours before birth (Jacobson et al. 1990).

- After adjusting for numerous potential confounders, researchers found that men who committed suicide by violent means were about five times as likely as sibling controls to have experienced multiple trauma at birth (identified as events likely to cause pain to the baby). A sensitive window for effects (“imprinting”) is postulated as the mechanism (Jacobson and Bygdeman 1998).

Tables 3 and 4 clarify the degree to which mothers and babies are experiencing many of these practices as well as the potential for reducing use of many interventions. In view of known and suspected adverse effects of such perinatal exposures, as well as much uncertainty about unintended effects, it would be wise to learn more about these relationships; to studiously avoid maternity interventions that do not offer clear, compelling, and well-supported benefits; and to give priority to effective practices that promote, protect, and support physiologic labor.

DIETHYLSTILBESTROL (DES) CLARIFIES IMPORTANCE OF CAUTION WITH PERINATAL EXPOSURES

From 1947 to 1985, diethylstilbestrol, or DES, was administered to millions of women in the United States and elsewhere with the belief that it would prevent miscarriage. It was given to women with established problems and to healthy women as a “preventive” measure. Early advocates did not carry out controlled trials to establish efficacy, and health professionals continued to prescribe DES for two decades after it was shown to be ineffective in preventing miscarriage. Exposure of pregnant U.S. women and their offspring ceased in 1971 when the U.S. Food and Drug Administration withdrew approval several months after researchers linked intrauterine DES exposure to a rare form of vaginal cancer in teens and young women. Had a cluster of women with this cancer not been treated at Massachusetts General Hospital, where Harvard University clinicians had conducted early DES experiments, and had the origins of their illness not been investigated and associated with DES by researchers there, we might not know about the harmful nature of this medical measure today (Ibarreta and Swan 2001). We might instead be experiencing these effects as an unrecognized “silent epidemic” (Grandjean and Landrigan 2006).

Researchers have now investigated the harmful effects of DES for several decades. This evidence has emerged as an important cautionary example of the range and duration of adverse effects that are possible with perinatal exposures. DES mothers have increased

risk of developing breast cancer. Exposed during prenatal development, DES daughters have increased risk for vaginal and breast cancer, various reproductive tract abnormalities, endometriosis, spontaneous abortion, infertility, preterm births and other pregnancy complications, and immune disorders. DES sons are also at increased risk for a range of reproductive tract abnormalities. Implications for DES sons and daughters in later life are not yet known. Initial research now suggests that harm extends to the generation of DES grandchildren, which has been established as genetic and epigenetic effects in mice (Brouwers et al. 2007; Felix et al. 2007; Ibarreta and Swan 2001; Lauver, Nelles, and Hanson 2005; Newbold 2004; Newbold, Padilla-Banks, and Jefferson 2006; Tchernitchin et al. 1999).

This cautionary story about just one among a vast range of perinatal exposures that are or have been widely used shows that medical treatments and other exposures, including presumed advances from the most prestigious medical institutions, can cause widespread, long-term harm and may adversely impact evolutionary biology (Csaba 2007).

**OVERUSED INTERVENTIONS: EXAMPLES OF PRACTICES
TO USE JUDICIOUSLY AND WITH CAREFUL ATTENTION
TO INFORMED CONSENT**

NOTE: REFERENCES TO SYSTEMATIC REVIEWS ARE IN ITALICS

Many maternity practices originally developed to address specific problems have come to be used liberally and even routinely in healthy women (Simpson and Thorman 2005). This overuse exposes many mothers and babies to risk of harm with marginal medical benefit or none at all. This section presents evidence regarding several of these interventions and applies the principles articulated in preceding sections. Greatest attention is given to labor induction, epidural analgesia, and cesarean section, which have all increased considerably in use over the past decade in the United States. These interventions are experienced by a large proportion of childbearing women; are often applied without consideration of alternatives; involve numerous co-interventions to monitor, prevent, or treat side effects; are associated with risk of maternal and newborn harm; and greatly increase costs. As clarified in the following subsections, there are many signs that a notable proportion of use involves casual application with marginal medical benefit or none at all.

It is challenging for childbearing women to recognize that structure and process of care affect outcome; to gain access to full, high-quality information and learn about benefits and harms of common and consequential labor interventions, and of alternative measures; and to clarify their preferences, set goals, and make plans for achieving their goals. Women need opportunities to become informed about these matters and to weigh options well before labor, in addition to consistent, rigorous adherence to informed consent processes during labor. Due to personal values and preferences, women may exercise their right to informed choice and prefer a care path involving greater likelihood of harm than other possible paths. It is inappropriate, however, for clinicians, administrators, and other professionals to recommend, encourage, or give priority to use of care practices with increased risk of harm to mothers and newborns because the path is more convenient, efficient, or lucrative for professional work. Further, it is essential to improve the liability system and enable health professionals to make clinical decisions free of pressure to reduce their risk of legal liability.

LABOR INDUCTION

Labor induction is the use of drugs and/or techniques to cause labor to start, as opposed to waiting for labor to begin on its own through a complex interplay of maternal and fetal factors (Liao, Buhimschi, and Norwitz 2005). Many putative indications are used to justify labor induction, and many agents and techniques are used to carry it out.

In considering this increasingly used intervention, it is important to distinguish labor that is in fact induced from unsuccessful attempts to bring on labor (as not all attempts cause labor to begin), and to distinguish women's attempts to self-induce from efforts of health professionals. The national *Listening to Mothers II* survey sheds light on these facets of labor induction among women who gave birth in U.S. hospitals in 2005 (Declercq et al. 2006). It is an important source of information because birth certificates only include one item about induction, that is, whether labor was actually brought on by any medical intervention. In addition, as referenced earlier, validation studies have

found that a large proportion of cases of induced labor is not in fact recorded on birth certificates. Still, the undercounted rate of medically induced labor derived from birth certificates increased by 135 percent from 1990, when it was 9.5 percent, to 2005, when it reached 22.3 percent of all women giving birth (Martin et al. 2007).

Reflecting increasingly casual professional and social attitudes toward intervening in the process of childbirth, 22 percent of *Listening to Mothers II* participants indicated that they had themselves tried to start their labor. Of these, 21 percent—or 4 percent of all of the mothers—reported actually inducing labor. Leading methods used for trying to bring on labor were walking/exercise (82 percent), sexual intercourse (71 percent), and nipple stimulation (41 percent). The most common reason was fully elective—the desire to end the pregnancy (58 percent of attempts to self-induce), followed by a desire to avoid a medical induction (33 percent), interest in controlling the timing (15 percent), and their provider’s concerns about a large baby (10 percent) (sum of percentages exceeds 100 as the mothers were asked to identify all methods and reasons that applied) (Declercq et al. 2006).

Fully 41 percent of *Listening to Mothers II* participants reported that a health professional tried to induce their labor, with 84 percent of those—34 percent of all women—reporting that the attempt did in fact start labor. Combining self- and medical induction, 50 percent of all women were exposed to induction agents and/or techniques, and 39 percent of all labors were started by external means without waiting for labor to start on its own (Declercq et al. 2006).

Combining induced labor with cesareans that were carried out before the onset of labor, a majority of mothers (52 percent) experienced elective delivery rather than spontaneous onset of labor (Sakala 2006a), resulting in a social foreshortening of the length of human gestation. The most common gestational age at birth among single babies shifted from forty to thirty-nine weeks between 1992 and 2002 (Davidoff et al. 2006). This shift in the duration of gestation appears to be continuing despite evidence for progressive fetal development of vital organs such as the brain and lungs after thirty-seven completed weeks of gestation (Kinney 2006; Morrison, Rennie, and Milton 1995; Stutchfield, Whitaker, and Russell 2005; Zanardo et al. 2004), the current definition of full term.

We were unable to find any published study or professional statement identifying any absolute indication for inducing labor. *Listening to Mothers II* survey mothers who experienced medical attempts to induce labor revealed the most common reason(s) for use of this intervention. They reported a caregiver’s concern that the baby was overdue (25 percent of women whose caregivers tried to induce labor), a maternal health problem that called for quick delivery (19 percent), mother’s desire to end the pregnancy (19 percent), and a caregiver’s concern about the size of the baby (17 percent). Less common reasons included concern about infection with ruptured (broken) membranes (9 percent), concern about baby’s health (9 percent), mother’s interest in controlling timing (8 percent), and mother’s interest in giving birth with a specific provider (8 percent) (Declercq et al. 2006). As with self-inductions, many women reported use of this intervention with no expectation of a medical benefit.

Most *Listening to Mothers II* participants who experienced attempted medical induction were exposed to two or more methods of induction. Synthetic oxytocin was most commonly used (by

80 percent of this group), followed by breaking of membranes (49 percent), sweeping or stripping membranes loose (33 percent), and some form of prostaglandin applied near the cervix (24 percent). Forty-five percent of this group experienced both synthetic oxytocin and rupture of membranes (Declercq et al. 2006).

Wide practice variation in rates of induced labor appears to be unrelated to needs of mothers or babies. For example, an analysis of over thirty-one thousand births in 1998–1999 in sixteen hospitals in upstate New York found that 21 percent of all births were induced, and that there was no apparent reason for 25 percent of those. Rates of induction varied about fourfold across hospitals (from 10 percent to 39 percent) and about sevenfold across providers in hospitals (from 7 percent to 48 percent). There was even greater variation in the proportion that appeared to have no medical rationale across hospitals (from 12 percent to 55 percent) and across providers in hospitals (from 3 percent to 76 percent). The variation could not be explained by risk status of the women or other investigated factors (Glantz 2003).

Eleven percent of all *Listening to Mothers II* participants reported experiencing pressure from a health professional to undergo labor induction. Those who reported pressure were more likely to experience attempts to induce labor than those who did not report pressure (Declercq et al. 2006).

The large prospective CPM 2000 study of low-risk American women who received care with a focus on enhancing the physiology of childbirth suggests a benchmark labor induction rate that might be achieved for the majority of childbearing women who are at low risk at the end of pregnancy. In this population of 5,418 births in 2000, 9.6 percent experienced attempts to induce labor (Johnson and Daviss 2005), in contrast to the equivalent figure of 50 percent of *Listening to Mothers II* participants.

What do we lose when we forgo spontaneous labor and instead expose mothers and babies to induction agents and techniques and shorter gestation without sound evidence that the health benefits outweigh harms? Several examples and other possible impacts suggest that this question warrants further research and assessment in systematic reviews to improve knowledge about the impact of forgoing labor, foreshortening gestational age, and exposing mothers and babies to induction agents and techniques. Studies point to the importance of improving knowledge of potential effects, including the following:

- Synthetic oxytocin, which is widely used to induce labor, interferes with the functioning of a woman's own oxytocin receptors (Phaneuf et al. 2000). This may adversely affect other important functions of a mother's natural oxytocin release, such as reducing postpartum hemorrhage and contributing to attachment and the establishment of breastfeeding (Buckley 2004b).
- Prenatal methods for estimating gestational age are imprecise and have a margin of error of up to \pm two weeks (Engle 2006), so elective labor induction will in many cases lead to delivery at an earlier gestational age than intended.
- Evolving understanding of normal fetal brain development has identified major changes continuing through forty-one weeks of gestation; for example, over one-third of brain volume

increase takes place in the final six to eight weeks, and a five-fold increase in white matter volume occurs from thirty-five to forty-one weeks gestation. There is uncertainty about how extrauterine brain development compares to intrauterine development during similar time periods from conception (Kinney 2006).

- Induction appears to increase the likelihood of cesarean in first-time mothers, when the cervix is not ready for labor and at earlier gestational ages (Kaufman, Bailit, and Grobman 2002).

In the national *Listening to Mothers II* survey, childbearing women in the United States expressed a strong desire to know about all or most potential complications of labor induction before deciding to have one, yet their demonstrated knowledge of labor induction complications was quite poor, whether they had one or not (Declercq et al. 2006). This identifies the need for improved education and informed consent processes.

Induction for convenience or for a medical indication that is not supported by clear evidence may be expected to offer minimal benefit at best. It is important to identify any harm that may be associated with the extensive use of elective induction, and a systematic review of effects of elective induction is being completed. A recent narrative review (Grobman 2007) identified concerns with elective induction, including increased likelihood of the following:

- fetal monitoring
- epidural analgesia
- cesarean section in first-time mothers
- cesarean section when the cervix is not ready for labor
- assisted delivery (vacuum extraction or forceps)
- postpartum hemorrhage and transfusion
- longer intrapartum period and longer postpartum stay
- costs (with increases in multiple cost centers)

Given such concerns, it is important to avoid exposure of mothers and babies and costs to payers of labor induction that lacks a clear medical benefit. In addition to inductions for convenience, a major area for improving practice in the United States is with respect to those that are initiated for a suspected large baby (macrosomia). Best current evidence identifies no benefits for mothers and babies when labor is induced for suspected fetal macrosomia (*National Collaborating Centre for Women's and Children's Health 2008b; Sanchez-Ramos, Bernstein, and Kaunitz 2002*) and limitations of leading methods for estimating fetal size (*Chauhan, Grobman, et al. 2005; Coomarasamy et al. 2005; Dudley 2004; Pattinson and Farrell 1997*).

Economic analyses find that induction increases costs associated with childbirth. The costs are especially high for first-time as opposed to experienced mothers, when carried out at earlier gestational ages, and when a woman's cervix does not show signs of readiness for labor. One estimate of the extra cost associated with induction of one hundred thousand first-time mothers with a cervix that did not have clinical signs of readiness for labor at thirty-nine weeks was \$91,000,000 (Kaufman, Bailit, and Grobman 2002), an average of \$910 per woman. Another analysis reported that induction

added an average of 11 percent to the cost of childbirth among low-risk women (Tracy and Tracy 2003). By implementing a program to reduce inappropriate elective labor induction at eleven hospitals, a health care system estimated that the average total maternal and newborn variable cost decreased by \$300 (The Commonwealth Fund 2004).

In sum, an evidence-based framework does not support elective nonmedical induction or induction for a medical rationale that is not supported by strong evidence, as these expose mothers and babies to risk without clear health benefit. Such practices are unlikely to be in the best interests of mothers and babies and increase the cost of maternity services. From a clinical perspective, the preferred alternative is “watchful waiting” for the spontaneous onset of labor and readiness to intervene should a clear justification arise. The strategies identified in the section of this report on policy recommendations might be used to address overuse.

EPIDURAL ANALGESIA

Epidural analgesia, a regional form of pain medication administered into the epidural space of the spinal cord, is the most effective form of pain relief commonly available for use during labor. The rate of use of epidurals during labor has rapidly increased in recent years, and 76 percent of participants in the national *Listening to Mothers II* survey experienced epidural analgesia or the spinal variant in 2005 (Declercq et al. 2006).

The effectiveness of this method of pain relief comes at a cost. Labor epidurals alter the physiology of labor and increase risk for numerous adverse effects. Undesirable maternal effects include immobility, voiding difficulty, sedation, fever, hypotension, itching, longer length of the pushing phase of labor, and serious perineal tears. Undesirable fetal/newborn risks include rapid fetal heart rate, hyperbilirubinemia, increased workup for sepsis and administration of antibiotics (due to fever in mothers), and poorer performance on newborn assessment scales (*Leighton and Halpern 2002; Lieberman and O’Donoghue 2002; Mayberry, Clemmens, and De 2002*). The spinal variant of this regional analgesia method is associated with increased likelihood of bradycardia, or abnormally low heart rate, in the fetus (*Mardirossoff et al. 2002*). Under some conditions—when initiated early in labor or when used with low- as opposed to high-dose synthetic oxytocin—epidural appears to be associated with increased likelihood of cesarean section (*Klein 2006; Kotaska, Klein, and Liston 2006*).

Numerous co-interventions, which may further alter the course of labor and have their own side effects, are used to monitor, prevent, and treat unintended consequences of the epidural. Continuous electronic fetal monitoring, intravenous infusions, and frequent blood pressure monitoring are standard precautions with epidural analgesia that would otherwise be unnecessary in healthy women. Women with an epidural are also more likely to experience bladder catheterization, synthetic oxytocin, medication for hypotension, vacuum extraction or forceps, and episiotomy. The original and cascading interventions transform normal labor into a technology-intensive experience.

Many laboring women welcome the pain relief of epidural analgesia, but they do not appear to be well-informed about the side effects. Although childbearing women in the United States overwhelmingly want to be informed of complications of epidurals before deciding to have one (Declercq et al. 2006), their demonstrated knowledge of epidural complications in a national survey was poor, whether they used this method or not (Declercq et al. 2002). This identifies the need for improved education and informed consent processes.

Due to costs of purchasing, operating, maintaining, and providing this package of interventions, epidurals substantially increase costs of childbirth. In one analysis, epidural was associated with as much as a 32 percent increase in the cost of care among low-risk first-time mothers and a 36 percent increase in cost among low-risk experienced mothers (Tracy and Tracy 2003).

Both pharmacologic and nonpharmacologic alternatives to epidurals are available. Although systemic opioids and self-administered nitrous oxide gas both provide less complete pain relief than epidural analgesia, most women who used them rated them in a national survey as very or somewhat helpful for pain relief (Declercq et al. 2002). Both methods have less adverse impact on the course of labor and on mothers. Opioids have the established and undesirable residual side effect of sedation, which can result in depressed newborns; when nitrous oxide is discontinued, the effects appear to cease immediately (Bricker and Lavender 2002; Kronberg and Thompson 2005; Rosen 2002). Twenty-two percent of *Listening to Mothers II* participants used narcotics, and 3 percent used nitrous oxide in 2005 (Declercq et al. 2006).

Many *Listening to Mothers II* survey participants gave favorable ratings to a broad range of drug-free pain relief methods (Declercq et al. 2006). Some of the most favorably rated, however, were underutilized (due to lack of access and of high-quality information and other reasons):

- tubs—very or somewhat helpful according to 91 percent who used them, but used by just 6 percent
- use of hot or cold objects—very or somewhat helpful: 81 percent, but used by just 6 percent
- showers—very or somewhat helpful: 78 percent, but used by just 4 percent
- birthing balls—very or somewhat helpful: 67 percent, but used by just 7 percent

Systematic reviews of drug-free measures, including hypnosis (Cyna, McAuliffe, and Andrew 2004), immersion in water (Cluett et al. 2002; Simkin and O'Hara 2002), acupuncture (Lee and Ernst 2004), and other methods (Simkin and O'Hara 2002), have found that these measures are helpful for many women, are associated with decreased use of medications, and appear to have excellent safety profiles. In addition, access to a companion who is present exclusively to provide continuous support throughout labor is associated with substantially decreased use of pain medication and increased satisfaction with the childbirth experience in comparison with usual care, and has no known adverse effects (Hodnett et al. 2007; Simkin and O'Hara 2002). A classic study to understand factors that are associated with women's experience of labor pain found that women's degree of confidence in their ability to handle labor was most important and had a bigger impact than such matters as their childbirth preparation, fear of pain, cervical dilation, and frequency of uterine contractions (Lowe 1989).

Labor support from a trained doula or other companion and many drug-free techniques and comfort measures appear to enhance normal labor physiology rather than disrupting it, which contributes to optimal outcomes (Simkin and Ancheta 2005). Many measures for increased comfort can be used in combination—for example, labor support and hydrotherapy. In contrast to narcotics and epidurals, all can be readily discontinued with little or no residual effect if inadequate, and others can readily be tried.

The evidence-based framework in this report suggests that optimal outcomes in mothers and babies and best value for payers would result from using safer, less invasive physiology-enhancing methods for comfort and labor pain relief as first-line care for most women, and using more consequential methods if women find that a series of simpler ones have been inadequate. First-line epidural analgesia would be optimal in selective situations, such as the small proportion of women with extreme fear of labor pain. Such a strategy would elevate appreciated and effective but underused pain relief methods and lead to more conservative use of narcotics and epidurals. It would require that women and health professionals clearly understand the pros and cons of the leading pharmacologic and nonpharmacologic methods of pain relief, that women have opportunities well before labor and again during labor to learn about and discuss these matters, that health professionals are educated to provide a range of methods, and that women have access to these methods and are supported in their decisions about pain relief.

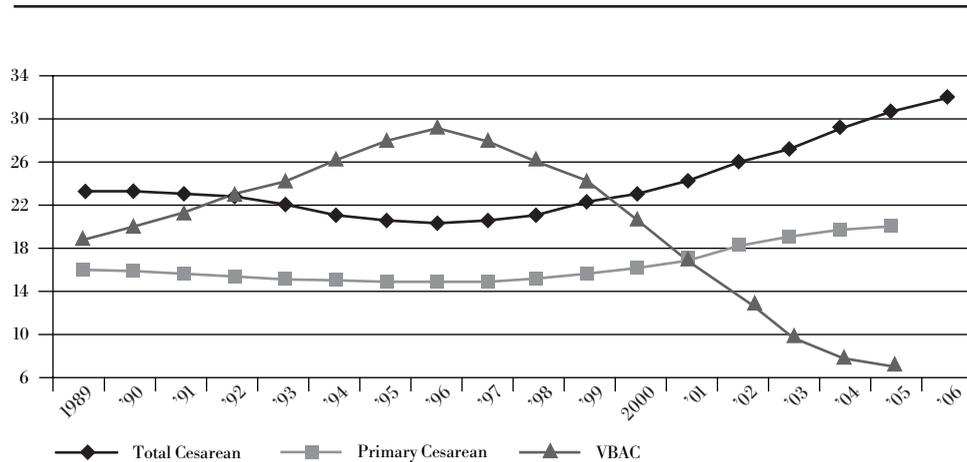
CESAREAN SECTION

Delivery by cesarean section is a clearly beneficial and even life-saving procedure for mother and/or baby in selected circumstances. Absolute indications for cesarean section include prolapsed umbilical cord (cord precedes the baby's head through birth passage), placenta previa (placenta has grown over the opening of the cervix), placental abruption (placenta has separated from uterus before birth of baby), and persistent transverse lie (fetus is fixed in a horizontal position).

The absolute indications for cesarean section apply to a small proportion of births, yet rates of cesarean section are steadily increasing in the United States and many areas of the world (Betrán et al. 2007). Figure 6 illustrates recent U.S. trends for the overall cesarean rate, the first-time or “primary” cesarean rate, and the rate of vaginal birth among women with a previous cesarean (vaginal birth after cesarean, or VBAC, rate). When first measured nationally in 1965, the U.S. cesarean rate was 4.5 percent (Taffel, Placek, and Liss 1987). Since 1996, it has risen steadily from 20.7 percent to the provisional 2006 rate of 31.1 percent, a 50 percent increase (Hamilton, Martin, and Ventura 2007). A new record level has been reached every year in the present century, and the trend is for continued increase. In 2008 an estimated one mother in three is giving birth by cesarean in the United States. This reflects both a steady rise in primary cesareans and a sharp 72 percent decline in vaginal births among women with a past cesarean, from 28 percent in 1996 to 8 percent in 2005 (Martin et al. 2007).

Contrary to recent trends, national Healthy People 2010 objectives call for a substantial decrease in the cesarean rate and an increase in the rate of vaginal birth after cesarean from 2000 to 2010 (U.S.

FIGURE 6. TOTAL CESAREAN, PRIMARY CESAREAN, AND VAGINAL BIRTH AFTER CESAREAN (VBAC) RATES, UNITED STATES, 1989–2006



Source: National Center for Health Statistics (Hamilton, Martin, and Ventura 2007; Martin et al. 2006; Martin et al. 2007)

Note: For comparability, 2004 and 2005 primary cesarean and VBAC rates are limited to thirty-seven jurisdictions with unrevised birth certificates, encompassing 69 percent of 2005 births; 2006 total cesarean rate is preliminary.

Department of Health and Human Services 2000). Recent analyses substantiate the World Health Organization’s recommendation that optimal national cesarean rates are in the range of 5 percent to 10 percent of all births and that rates above 15 percent are likely to do more harm than good (Althabe and Belizán 2006). Participants in two large prospective studies of American women experienced cesarean rates that were compatible with this recommendation: both low-risk populations experienced cesarean rates of 4 percent and no observed increase in harms through use of care that enhanced physiologic labor (Johnson and Daviss 2005; Rooks et al. 1989).

What is lost with unnecessary deviation from physiologic labor through planned prelabor cesareans or cesareans initiated during labor? Several examples and other possible effects suggest that this question warrants further research and assessment in systematic reviews to strengthen our knowledge about the impact of forgoing labor, deliberately foreshortening gestational age, and/or exposing mothers and babies to cesarean section. Studies point to the importance of improving knowledge of potential effects, including the following:

- When babies do not experience labor, they fail to benefit from physiologic changes that precede spontaneous onset of labor to help clear fluid from their lungs, and from further clearance during the process of labor, which appear to protect against serious breathing problems in newborns with the sudden transition to extrauterine life (Jain and Eaton 2006).
- Following the sterile intrauterine environment, passage through the vagina increases the likelihood that the newborn intestines will be colonized with beneficial bacteria and reduces colonization with harmful bacteria, in comparison with cesarean delivery (Penders et al. 2006); initial colonization influenced by mode of birth endures over time (Bedford Russell and Murch 2006; Grolund et al. 1999) and may help to explain the association of cesarean birth with asthma and allergy (Renz-Polster et al. 2005; Salam et al. 2006).
- As methods of estimating fetal gestational age are imprecise (Engle 2006), planned cesareans may inadvertently lead to iatrogenic prematurity. In Florida, between 1995 and 2003, 50 percent of the increase in the preterm birth rate among single births was associated with increasing numbers of cesarean births. Further examination of the relationship between cesarean birth and late preterm birth (thirty-four to thirty-six weeks of gestation) among births of single babies to Florida women with low documented medical risk revealed that cesarean without labor (suggesting planned cesarean) was associated with a 53 percent increase in the estimated risk of a late preterm birth, while cesarean with labor was not associated with increased risk of late preterm birth (women with a previous cesarean and with fourteen potential risk factors for cesarean were excluded) (Goodman, Sappenfield, and Thompson 2007), which may help explain why the recent increase in preterm birth has been concentrated in the late preterm weeks (Russell et al. 2007).
- In comparison with vaginal or intended vaginal birth, delivery by elective cesarean is consistently associated with increased risk of respiratory morbidity in near-term newborns and full-term newborns (Hansen et al. 2007).

Although many health professionals, journalists, and others have proposed that the rising cesarean rate is largely a consequence of women's requests for planned cesarean without a medical rationale, surveys of mothers themselves find that this phenomenon is very limited (Declercq et al. 2006; Kingdon, Baker, and Lavender 2006; McCourt et al. 2007). Similarly, increased genuine need for cesarean in the population of childbearing women—associated, for example, with more multiple births and childbearing among older women who are more likely to have chronic medical conditions—appears to play a limited role in recent trends, as the cesarean rate is rising for all classes of women, at all levels of risk, including those with no indicated risk at all. The increase reflects changing professional standards, with growing casual acceptance of cesarean surgery, lowered thresholds for applying traditional indications, and the appearance of new and unsupported justifications such as “baby seems large” (Declercq, Menacker, and MacDorman 2006; Declercq et al. 2006). Consistent with this supply-side interpretation, fully 25 percent of *Listening to Mothers II*

participants who had both primary and repeat cesareans reported having experienced pressure from a health professional to have a cesarean (Declercq et al. 2006). This style of professional practice is efficient and lucrative for professionals and hospitals (Sakala 2006a) and is widely viewed as reducing risk for malpractice claims and suits (Lockwood 2004). There is considerable practice variation in the use of cesarean, and higher rates are associated with inappropriate use in healthy women (see sidebar “Is the Most Resource-Intensive Care the Best Care?”).

As major surgery, cesarean section has potential for great harm when overused. Most comparisons of effects of cesarean and vaginal birth are based on single studies, focus on a small set of outcomes, and fail to bring into view the full range of effects that are relevant to decision making. A systematic review that aimed to identify all known harms that differ in likelihood by mode of birth found a large inventory of differences that strongly favored vaginal birth (Sakala 2006b). A booklet to help women become informed about these matters is based on the review and describes the full range of outcomes (summarized in the following paragraphs) and the added likelihood of experiencing them when having a cesarean or, in several cases, a vaginal birth; it has been endorsed by over thirty organizations and is freely available online (*Childbirth Connection 2006*).

Short-term harms to mothers that were more likely with cesarean section included

- maternal death
- emergency hysterectomy
- blood clots and stroke
- surgical injury
- longer hospitalization and more likely rehospitalization
- infection
- poor birth experience
- less early contact with babies
- intense and prolonged postpartum pain
- poor overall mental health and self-esteem
- poor overall functioning

Possibly due to postsurgical adhesion formation, cesarean mothers were also more likely to experience the longer-term problems of chronic pelvic pain and bowel obstruction. The review found that cesarean born babies were more likely than vaginally born babies to experience

- respiratory problems
- surgical injuries
- failure to establish breastfeeding
- asthma in childhood and adulthood

The review also identified many adverse effects impacting a woman’s future reproductive life and mothers and babies in future pregnancies, including greater likelihood of

- involuntary infertility
- reduced fertility due to decreased desire to have more children

IS THE MOST RESOURCE-INTENSIVE CARE THE BEST CARE?

John Wennberg and colleagues at Dartmouth Medical School have for several decades examined the problem of wide variation in medical practice—for example, differences in rates of performing a procedure across physicians, hospitals, or geographic areas—that cannot be explained by needs and preferences of the people receiving care. Such variation reflects differences in professional practice styles and other nonclinical factors. Baicker and colleagues recently extended this analysis to cesarean section. Using U.S. linked birth-death data from 1995 through 1998, with an overall cesarean rate of 20.6 percent, they found that risk-adjusted cesarean rates varied by more than fourfold across the largest U.S. counties. Medical need explained some variation, but nonmedical factors such as provider and health system supply, malpractice pressure, and practice style appeared to account for most of the variation. Areas with higher rates were associated with more inappropriate care and use of surgery in healthier women. Highest rates were not associated with lower maternal or neonatal mortality but were associated with increases in morbidity and costs (Baicker, Buckles, and Chandra 2006).

As cesarean birth poses greater risk than vaginal birth for many short-term and longer-term adverse effects in mothers, babies, and outcomes of future pregnancies (*Childbirth Connection 2006*), and the cesarean rate has risen by about 50 percent since the period of Baicker and colleagues' analysis, its implications are more troubling at present. An analysis of nearly one-quarter million births in 124 facilities in 2004 found variation of 200 to 300 percent in primary cesarean rates within regions and concluded that “a pattern of almost random decision making” exists for use of this invasive procedure (Clark et al. 2007).

The relationship between poor quality and most expensive and intensive care has been consistently reported in many U.S. contexts, including a large national evaluation of nearly one million Medicare beneficiaries. Although high cost was associated with more visits, hospitalizations, tests, and procedures, the researchers found no evidence of better quality, better access to care, better satisfaction, or better health outcomes. Rather, highest-cost care was associated with less effective care, compromised access, poorer satisfaction for several measures, and a slightly increased risk of death (Fisher et al. 2003a, 2003b). Similar results have been reported with system-wide changes in care within the Veterans Health Administration (Ashton et al. 2003) and with health plan analysis of proprietary data (Schaeffer and McMurtry 2005).

- cesarean scar ectopic pregnancy
- placenta previa
- placenta accreta
- placental abruption
- uterine rupture
- hemorrhage
- low birthweight
- preterm birth
- stillbirth
- maternal death

The likelihood of many of these conditions was found to increase as the number of previous cesareans increased (*Childbirth Connection 2006; Sakala 2006b*).

A scarred uterus appears to be less likely to provide a hospitable environment for the developing fetus than an unscarred uterus and may contribute to placental insufficiency (Smith, Pell, and Bobbie 2003). Many women with an interest in vaginal birth after cesarean (VBAC) are unable to find a health provider or hospital willing to support this choice (Declercq et al. 2006), and many are thus forced to accept the risks associated with repeated cesareans. (See sidebar titled “The Evidence about Vaginal Birth after Cesarean (VBAC)” in the following section.)

The review that aimed to identify the full range of harms that differ in likelihood by mode of birth identified several maternal outcomes that favored cesarean section: increased perineal pain, urinary incontinence, and anal incontinence (*Sakala 2006b*). Research does not yet exist to clarify the degree to which these conditions, which generally are mild and abate in the months after birth, are associated with vaginal birth per se or with the common use of practices that increase the likelihood of injury, such as episiotomy, staff-directed pushing, supine birthing position, and staff-applied abdominal pressure to push babies out (Albers and Borders 2007). A single outcome in babies favored cesarean section, brachial plexus shoulder nerve injury, which is primarily transient and occasionally permanent in limiting use of the affected arm (*Childbirth Connection 2006; Sakala 2006b*). By one estimate, one permanent brachial plexus injury occurs in ten thousand vaginal births (Chauhan, Rose, et al. 2005).

A series of recent studies has confirmed this broad range of excess risk associated with cesarean section even when conducted under optimal conditions for limiting harm in healthy, low-risk women without medical or obstetric conditions having planned, nonurgent cesareans (Declercq et al. 2007; Hansen et al. 2007; Kolas et al. 2006; Liu et al. 2007; MacDorman et al. 2008; Tracy, Tracy, and Sullivan 2007). In continuing reports of large studies, downstream adverse reproductive effects were more likely in women with a history of cesarean than in women who had vaginal births (Kennare et al. 2007; Silver et al. 2006), and repeat cesareans were associated with significant cumulative abdominal adhesion formation and adverse reproductive effects (Morales, Gordon, and Bates Jr. 2007; Nisenblatt et al. 2006).

Although childbearing women in the United States expressed in a national survey a strong desire to know about complications of cesarean section before deciding to have one, their demonstrated knowledge of cesarean complications was quite poor, whether they had one or not (Declercq et al. 2006), pointing to the need for improved education and informed consent processes.

As shown in Figure 4, the average hospital charge for an uncomplicated cesarean is almost twice as high as the average hospital charge for an uncomplicated vaginal birth. The average charge for an uncomplicated cesarean is about seven times the average charge for a physiologic vaginal birth, as carried out in out-of-hospital birth centers across the country. Most expensive of all are hospital charges for cesareans with complications, which averaged \$15,960 in 2005. These figures do not include charges for anesthesia services and newborn care services in hospitals and maternity provider services for all births. The substantial cesarean-vaginal differential was also found in a systematic review of individual economic analyses (Henderson et al. 2001). Most studies in the latter were based on charge data from the United States. The differential was also found in a new analysis of payments from a commercial database of privately insured women (Thomson Healthcare 2007). The analyses are limited to the initial hospitalization period and exclude rehospitalization and other subsequent medical costs, as well as indirect costs of recovery from surgery to the woman and her family.

Adjusting the Thomson Healthcare (2007) figures for national health expenditure inflation rates of 6.5 percent in 2005 and 6.7 percent in 2006 (Centers for Medicare and Medicaid Services 2008), and applying them to the 31.1 percent cesarean rate in 2006, we estimated 39 percent of all payments for childbearing women were for women with cesareans. If, by contrast, the U.S. cesarean rate had been 15 percent in 2006, an estimated point at which harms begin to exceed benefits (Althabe and Belizán 2006), just 20 percent of payments for mothers' care would have been devoted to women with cesareans, with a net reduction in expenses of more than \$2.5 billion.

As over nine out of ten births following a previous cesarean are repeat cesareans at this time in the United States, the cost of the initial cesarean is magnified over time. Capital costs to reconfigure facilities for more planned births and surgical births with longer lengths of stay increase overall expense and generate pressure to sustain this level of revenue and style of practice involving high rates of surgery and weekday deliveries.

In addition to the strategies described in the section on policy recommendations, the following strategies are associated with reduced likelihood of cesarean section:

- in clinical settings, multifaceted interventions, including audit and feedback, were effective in reducing cesarean rates (Chaillet and Dumont 2007), for example, a hospital program combining stringent requirements for a second opinion, objective criteria for the most common indications, review of all cesareans, and reporting of rates of individual physicians providing childbirth services (Myers and Gleicher 1988)
- for pregnant women, providing access to and seeking settings and caregivers with conservative practice styles and low overall rates of cesarean section (Kennedy and Shannon 2004; Reime et al. 2004)

- for women in labor, working with caregivers to delay going to the hospital until labor is well established (Jackson et al. 2003; Klein et al. 2004)
- for women in labor, having a companion (such as a doula, friend, or family member) who is not a member of the hospital staff and is present during labor exclusively to provide continuous support (Hodnett et al. 2007)
- for maternity care providers, retaining and applying skills to facilitate vaginal birth, including a broad range of strategies that foster progress and comfort during labor (Simkin 2002; Simkin and Ancheta 2005), manually turning babies that are not in a head-first position (Collaris and Oei 2004; Hofmeyr and Kulier 1996), skillful vaginal breech birth (Hofmeyr and Hannah 2003), skillful vaginal twin birth (Hogle et al. 2003), and vaginal birth after cesarean (Guise, Berlin, et al. 2004; Guise, McDonagh, et al. 2004; Mozurkewich and Hutton 2000; National Collaborating Centre for Women's and Children's Health 2004)
- in facilities, avoiding whenever possible interventions that can increase the likelihood of cesarean section, including continuous electronic fetal monitoring (Alfirevic, Devane, and Gyte 2006), labor induction (especially in first-time mothers with an “unfavorable” cervix (Kaufman, Bailit, and Grobman 2002), and early epidural (Klein 2006)
- in facilities, limiting cesarean section to clearly established indications and addressing inappropriate use of unsupported indications, such as “large baby” (Chauhan, Grobman, et al. 2005; Coomarasamy et al. 2005; Pattinson and Farrell 1997; Rouse and Owen 1999), twin birth, preterm birth, and babies that are small for gestational age (Hogle et al. 2003; National Collaborating Centre for Women's and Children's Health 2004)

BRIEF NOTES ABOUT SOME OTHER OVERUSED MATERNITY INTERVENTIONS

Continuous Electronic Fetal Monitoring

It is important during labor to periodically monitor the fetal heart rate as a way to check on the baby's well-being. Electronic fetal monitoring (EFM) is the predominant means of doing this in the United States. Ninety-four percent of women who experienced labor in U.S. hospitals in 2005 reported using EFM, and among those, 93 percent were monitored either continuously (76 percent) or for most of the time (17 percent) during labor. Just 3 percent were monitored using a handheld device alone (Declercq et al. 2006).

A recently updated systematic review pooling studies that compared continuous EFM with intermittent EFM monitoring found that continuous EFM did not reduce the likelihood of perinatal death or cerebral palsy, but increased the likelihood of cesarean section and vaginal birth assisted with vacuum extraction or forceps. Other adverse effects of continuous EFM were impairment of mobility, increased discomfort, and focus on the machine rather than the woman. The sole advantage documented of continuous EFM was a slight reduction in newborn seizures, with

no known long-term impact on babies. The rarity of this event would require 661 women to be continuously monitored to avert one seizure. Similar results were found for lower-risk and higher-risk subgroups (*Alfirevic, Devane, and Gyte 2006*). Although expected benefits for continuous EFM have been disproven, the practice has become the standard of care. Intermittent monitoring with various devices is more consistent with an evidence-based maternity care framework.

Two systematic reviews have also assessed the impact of a baseline period of fetal monitoring shortly after hospital admission with the machine used for continuous monitoring. The most recent review found no benefit for newborns and increased likelihood of both cesarean section and assisted delivery among low-risk women experiencing such baseline monitoring (*Gourounti and Sandall 2007*). The earlier review reported a nonsignificant trend toward cesarean and assisted delivery; increased likelihood of use of epidural analgesia, continuous EFM, and fetal blood sampling; and no newborn benefit in randomized controlled trials of low-risk women experiencing the baseline test; and other types of studies were difficult to interpret (*Blix et al. 2005*). Both reviews concluded that there is no support for using this admission test with low-risk women.

Rupturing Membranes

Breaking the membranes containing the fetus, amniotic fluid, and umbilical cord with a tool similar to a crochet hook (amniotomy) is a common procedure for inducing labor and—after labor has begun—for hastening labor. Forty-seven percent of *Listening to Mothers II* participants reported that their caregivers had ruptured their membranes after labor had begun (*Declercq et al. 2006*). A recent systematic review concludes that there is no evidence of shorter labor, increased maternal satisfaction, or improved newborn outcomes with amniotomy after the start of spontaneous labor, whether the labor is progressing well or is prolonged. The researchers found a possible increase in cesarean section with this procedure and identified concerns about adverse effects on the fetal heart rate and the serious problem of umbilical cord prolapse and compression (*Smyth, Alldred, and Markham 2007*).

Episiotomy

Episiotomy is a cut made to enlarge the vaginal opening just before birth. Although the rate of use has declined in recent years, 25 percent of women with vaginal births continued to experience this intervention in 2005 (*Declercq et al. 2006*).

A recent systematic review reaffirmed longstanding evidence: the routine or liberal use of this practice does not confer benefits and rather exposes women to risk of harm. Depending on circumstances, the literature reviewed found that routine episiotomy was associated with an increase in the following conditions: perineal injury, need for stitches, experience of pain and tenderness, healing period, likelihood of leaking stool or gas, and pain with intercourse (*Hartmann et al. 2005*). The review authors recommended that with judicious use, the rate of episiotomy could be below 15 percent of all vaginal

births in the United States. Benchmark episiotomy rates of 2 percent or less have recently been reported in large studies of American women with physiologic care (Albers et al. 2005; Johnson and Daviss 2005).

Certain Prenatal Care Practices

The United Kingdom's National Institute for Health and Clinical Excellence carries out systematic reviews and develops guidelines for clinical practice. A broad, in-depth report that was updated in 2008 and not limited to studies from the United Kingdom concluded that the following practices should *not* be included in prenatal care, as they have either been disproven or there is inadequate evidence to support their use (*National Collaborating Centre for Women's and Children's Health 2008a*):

- routine iron supplementation
- routine ultrasound after twenty-four weeks
- routine fetal movement counting
- routine chlamydia screening
- routine hepatitis C screening
- routine toxoplasmosis screening
- routine bacterial vaginosis screening
- routine preterm labor screening
- routine ultrasound to estimate fetal size if large baby is suspected
- routine vaginal examination to assess gestational age, predict preterm birth, or estimate a tight passage during birth

**UNDERUSED INTERVENTIONS: EXAMPLES OF PRACTICES
TO USE WHENEVER POSSIBLE AND APPROPRIATE**

NOTE: REFERENCES TO SYSTEMATIC REVIEWS ARE IN ITALICS

This section highlights effective, noninvasive forms of care with modest or no known adverse effects and low plausibility of serious unknown harms. They are suitable for routine use. It is reasonable to anticipate that greater fidelity in providing these forms of care to childbearing women and newborns would lead to considerable improvement in outcomes. The inventory here is not meant to be exhaustive but rather illustrative of the broad range of generally safe, effective interventions that are underused, could offer benefits to a large segment of the childbearing population, and should be more widely available. In selecting these examples, we have also given preference to measures that can prevent problems (primary prevention) and measures that can help resolve problems (secondary prevention).

MIDWIVES AND FAMILY PHYSICIANS

In the United States, midwives are the lead maternity caregivers for 8 percent to 9 percent of women during pregnancy and childbirth (Declercq et al. 2006). Of the three national midwifery credentials, certified nurse-midwives (CNMs) are regulated in all states, certified midwives (CMs) are regulated in several states, and certified professional midwives (CPMs) are regulated in about one-half of the states, with efforts under way to develop legislation in the remaining states.

Several systematic reviews have summarized the evidence for midwifery care relative to physician-led or shared care. A meta-analysis of fifteen studies of care by CNMs in U.S. settings found that when differences in process and outcome were identified, they favored CNMs with the exception of increased likelihood of spontaneous perineal tears, primarily smaller first-degree tears, compatible with considerably reduced rates of episiotomy (a second-degree incision) in CNM groups. Other pooled differences in studies that controlled for risk status of mothers included less use of analgesia, anesthesia, intravenous fluids, electronic fetal monitoring, artificially ruptured membranes, and forceps; greater likelihood of spontaneous vaginal birth; and reduced low birthweight in midwifery groups (*Brown and Grimes 1995*). A systematic review comparing midwifery care in freestanding birth centers to obstetrician-led care in hospitals found that differences favored the midwifery groups, including reduced likelihood of episiotomy and cesarean section (*Walsh and Downe 2004*). Another systematic review compared midwifery-led care from prenatal through postpartum periods in a diversity of delivery settings with usual care in the locality of the study. Differences favored women who received midwifery care, who were less likely to experience labor induction, labor augmentation, electronic fetal monitoring, pain medications, assisted vaginal birth, and episiotomy, and were more likely to be satisfied with all phases of their care (*Waldenström and Turnbull 1998*). A Cochrane review comparing midwifery-led care to other models will be published in 2008 and further contribute to this body of reviews (*Hatem et al. in press*).

Family physicians are the lead maternity caregivers in the United States for about 6 percent to 7 percent of childbearing women (Declercq et al. 2006). Many studies compare the safety and effectiveness of family physicians to other maternity caregivers, primarily obstetricians, yet we were unable to find a systematic review of this literature. The most recent narrative review (Klein 1993)

preceded a number of studies of this question and found consistent results across more than twenty-five reports; when differences in process and outcomes were identified in mothers at low and mixed risk, they favored family physicians over specialized care. Family physicians routinely provide pre- and interconceptional care, offer continuity of care, care for all family members, and increase access in rural settings (Klein 1993). Updated and systematic reviews of family physician maternity care are urgently needed to provide rigorous guidance about maternity care workforce issues.

A systematic review comparing provision of prenatal care led by midwives and/or general practitioners and by obstetricians found that the differences in outcome favored midwives and general practitioners, who were associated with reduced likelihood of pregnancy-induced hypertension and preeclampsia, greater satisfaction, and lower costs (*Khan-Neelofur, Gülmezoglu, and Villar 1998*).

PRENATAL MULTIVITAMINS FOR PREVENTING CONGENITAL ANOMALIES

A systematic review summarized results of studies that evaluated whether prenatal folic acid–fortified multivitamins were protective against congenital anomalies. Use of the multivitamin supplements was consistently protective against neural tube defects, cardiovascular defects, and limb defects. For other outcomes examined, either no effects were shown or effects were only shown in weaker quality study designs (*Goh et al. 2006*).

SMOKING CESSATION INTERVENTIONS FOR PREGNANT WOMEN

Short- and longer-term hazards of smoking in pregnancy are well established (*Castles et al. 1999; Pattenden et al. 2006*). Smoking cessation programs for pregnant women have been shown to reduce smoking and prematurity and to increase birthweight (*Lumley et al. 2004*). The following interventions appear to be effective in reducing smoking in pregnant women: advice from caregivers, group sessions, and behavioral therapy with self-help manuals. Smoking cessation interventions are more effective in pregnant than nonpregnant participants (*Law and Tang 1995*).

GINGER FOR NAUSEA AND VOMITING IN PREGNANCY

A growing body of evidence finds ginger (*Zingiber officinale*) to be helpful for nausea and vomiting in pregnancy, and no side effects have been identified to date (*Borrelli et al. 2005; National Collaborating Centre for Women’s and Children’s Health 2008a*).

INTERVENTIONS FOR PREVENTING PRETERM BIRTH

Most assessments of interventions to prevent prematurity have failed to identify effective measures. In addition to smoking cessation programs for pregnant women, noted above (*Lumley et al. 2004*), the

following measures are associated with reductions in preterm birth: having a birth to conception interval of eighteen to fifty-nine months versus less than eighteen months or more than fifty-nine months (*Conde-Agudelo, Rosas-Bermúdez, and Kafury-Goeta 2006*) and use of progesterone in women at increased risk of preterm birth (*Dodd et al. 2006; Mackenzie et al. 2006; Sanchez-Ramos, Kaunitz, and Delke 2005*).

It is also important to avoid iatrogenic prematurity, as a result of labor induction or planned cesarean before the thirty-seventh completed week of pregnancy, if there is no evidence-based indication to justify ending the pregnancy prematurely (Fuchs and Wapner 2006), and to recognize that prenatal methods for estimating gestational age have a margin of error up to \pm two weeks (Engle 2006).

If results of an initial promising randomized controlled trial are confirmed in further studies, the CenteringPregnancy[®] model of group prenatal care may prove to be a crucial tool for prematurity prevention. In this model, groups of eight to twelve women/couples/teens meet during pregnancy and in the early postpartum period with facilitators for discussion, sharing, learning, and health assessment. The trial found a 33 percent reduction in risk of prematurity with group prenatal care, in comparison with usual prenatal care, and stronger effects among black mothers (Ickovics et al. 2007). Because a cesarean in a previous pregnancy has been associated with preterm birth in a subsequent pregnancy (Kennare et al. 2007; Smith, Pell, and Bobbie 2003; Taylor et al. 2005), judicious use of cesarean section may help reduce prematurity over time.

EXTERNAL VERSION TO TURN BREECH BABIES AT END OF PREGNANCY

Using hands-to-belly maneuvers to try to turn babies to a head-first position (external version) at the end of pregnancy succeeds in doing so in many instances and reduces the likelihood of cesarean section (*Hofmeyr and Kulier 1996*). Best available studies on the safety of this procedure indicate a low likelihood of adverse effects (*Collaris and Oei 2004; Nassar et al. 2006*).

PRACTICES TO FOSTER WOMEN'S SATISFACTION WITH THEIR CHILDBIRTH EXPERIENCE

A systematic review examining factors that are most consistently associated with women's satisfaction with the childbirth experience found that four conditions overrode the many other factors that have been examined: amount of support from caregivers, involvement in decision making, quality of mother-caregiver relationship, and having high expectations for the childbirth experience or experiences that exceeded those expectations (*Hodnett 2002*).

CONTINUOUS LABOR SUPPORT

The continual presence of a labor companion who has an exclusive focus on providing emotional support, comfort, and information has been found to offer important benefits to laboring women,

in comparison with usual care. A friend, family member, or doula can assist women in this way. Benefits include reduced likelihood of the following interventions/conditions: pain medications, cesarean section, assisted delivery with vacuum extraction or forceps, and dissatisfaction with the childbirth experience. Such support also increased the likelihood of spontaneous vaginal birth. Benefits were not found or were weaker when support was provided by a member of the hospital staff. No adverse effects were identified with the continual presence of a labor companion (*Hodnett et al. 2007; Simkin and O'Hara 2002*). A book is available to guide a partner, friend, or relative who might wish to take on this role (*Simkin 2008*).

MEASURES TO RELIEVE PAIN, BRING COMFORT, AND/OR PROMOTE PROGRESS DURING LABOR

Fourteen percent of *Listening to Mothers II* survey participants gave birth without the use of pain medications (*Declercq et al. 2006*). Systematic reviews have concluded that many women find several noninvasive methods of pain relief helpful during labor, including immersion in water (*Cluett et al. 2002; Simkin and O'Hara 2002*), hypnosis (*Cyna, McAuliffe, and Andrew 2004*), acupuncture (*Lee and Ernst 2004*), and intradermal sterile water injections for low back pain (*Huntley, Coon, and Ernst 2004; Simkin and O'Hara 2002*). The acupuncture and hypnosis reviews are each based on several initial consistent studies. Initial evidence also suggests that a hands-and-knees position helps reduce pain among women with “posterior” babies (forward-facing position that is less common, more painful, and associated with more difficult labor) (*Hunter, Hofmeyr, and Kulier 2007*). The reviews found that these measures increase comfort for many women, are associated with decreased use of medications, and appear to have excellent safety profiles. *Simkin and Bolding* provide an overview of the evidence on many nonpharmacologic methods of labor pain relief (2004). As noted above, the continuous presence of a supportive labor companion also reduces the likelihood of using pain medications (*Hodnett et al. 2007*).

DELAYED AND SPONTANEOUS PUSHING

Very frequently, hospital staff coach women to push their babies out and direct them in forceful, sustained pushing as soon as a cervical dilation of ten centimeters is documented. Twenty-eight percent of *Listening to Mothers II* survey participants who gave birth vaginally pushed exclusively with staff calling out, 47 percent pushed with staff calling out and their body's own sensations, and 21 percent relied solely on their own pushing reflexes (*Declercq et al. 2006*). Women with epidural analgesia who delay pushing for some period of time (from up to one hour to up to three hours in studies included in the review) have the opportunity for spontaneous descent of the baby, spontaneous rotation of the baby's head through the pelvic passage, and onset of the involuntary pushing reflex; and the women are more likely to have a spontaneous vaginal birth with neither assisted delivery (vacuum extraction or forceps) nor cesarean section (*Brancato, Church, and Stone 2008; Roberts et al. 2004*). In women without epidural analgesia, staff-directed pushing does not appear to confer presumed benefits (such as shorter labor and improved

fetal status) and rather appears to increase the likelihood of late fetal heart decelerations and the frequency and severity of perineal trauma in mothers (*Bosomworth and Bettany-Saltikov 2006*).

NONSUPINE POSITIONS FOR GIVING BIRTH

Most women who give birth vaginally in the United States lie on their backs while pushing their babies out (Declercq et al. 2006). However, in studies of women without epidurals, upright and side-lying positions are associated with less severe pain for mothers, less use of episiotomy, less use of vacuum extraction or forceps, fewer heartbeat abnormalities in babies, and a shorter pushing phase of labor (*Gupta, Hofmeyr, and Smyth 2004*). In two small studies of women with epidural analgesia, the pushing phase was shortened and there was a nonsignificant trend for reduced assisted and cesarean delivery with upright positions (*Roberts et al. 2005*). Larger studies are needed to clarify the value of upright positions in women with epidurals.

DELAYED CORD CLAMPING IN FULL-TERM AND PRETERM NEWBORNS

Immediate cord clamping is standard procedure in U.S. hospitals at present. However, in term newborns, delaying cord clamping for a minimum of two minutes was associated with improved hematologic status, iron status, and iron stores, as well as reduced anemia, with benefits measured from two to six months after birth (*Hutton and Hassan 2007*). Delayed clamping also offers benefits to preterm babies (*Rabe, Reynolds, and Diaz-Rossello 2004; Rabe, Reynolds, and Diaz-Rossello 2008*).

EARLY SKIN-TO-SKIN CONTACT

Thirty-nine percent of *Listening to Mothers II* survey participants reported that their baby was primarily with staff for routine care during the first hour after birth (Declercq et al. 2006). Skin-to-skin contact between mothers and babies right after birth and during the first twenty-four hours postpartum, in comparison with usual hospital care, was associated with improved performance on measures of breastfeeding status and duration, improved newborn temperature regulation, reduced newborn crying, and more affectionate maternal behaviors, with some evidence of long-term effects, and no evidence of harm (*Moore, Anderson, and Bergman 2007*; see also Winberg 2005).

BREASTFEEDING AND INTERVENTIONS TO PROMOTE ITS INITIATION AND DURATION

Best current evidence suggests that exclusive breastfeeding for at least six months provides optimal nourishment for infants (*Kramer and Kakuma 2004*); benefits of breastfeeding for the baby extend into and beyond childhood; and mothers experience long-term benefits from breastfeeding as well

(Horta et al. 2007; Ip et al. 2007). As they neared the end of pregnancy, 61 percent of *Listening to Mothers II* survey participants intended to exclusively breastfeed, yet just 51 percent were doing so a week after the birth, a missed opportunity for about four hundred thousand mother-infant pairs annually in the United States. Among mothers who had given birth at least seven months before taking the survey, 27 percent met the international standard of exclusive breastfeeding for at least six months (Declercq et al. 2006).

Focused individual or group education sessions (which may include skills training, provision of equipment, and/or discussion) increased initiation and short- but not long-term duration of breastfeeding. One-to-one in-person or telephone support increased short- and longer-term duration (but not initiation) (Dyson, McCormick, and Renfrew 2005; Guise et al. 2003) and initiation among low-income women (Fairbank et al. 2000). Lay, professional, or combined support was effective in extending duration in settings where initiation and duration were low (Britton et al. 2007). Effective interventions tended to span the prenatal period or both prenatal and postpartum periods and to offer face-to-face information, guidance, and support. Intensive interventions combining group and individual sessions and/or home visits over time were associated with increased duration (de Oliveira, Camacho, and Tedstone 2001). WIC (Women, Infants, and Children) programs were effective in increasing breastfeeding (Fairbank et al. 2000). (See also Shealy et al. 2005.)

The Baby-Friendly Hospital Initiative, promoted by the World Health Organization and the United Nations Children's Fund, is effective in increasing rates of breastfeeding. However, in June 2008, just sixty-four hospitals and birth centers in the United States were designated as "Baby-Friendly" (BFHI USA 2008). Elements of this ten-step program include early postpartum skin-to-skin contact, rooming in, "demand" feeding, avoiding commercial discharge packs, and avoiding formula or water supplementation (Demott et al. 2006; Guise et al. 2003; U.S. Government Accountability Office 2006; see also Merewood et al. 2005; World Health Organization 1998).

As cesarean section is associated with decreased initiation of breastfeeding (DiMatteo et al. 1996), judicious use of cesarean section can play a role in increasing breastfeeding. Mixed messages of support for breastfeeding and for formula, and brief nonintensive interventions are not successful in increasing breastfeeding (de Oliveira, Camacho, and Tedstone 2001).

INTERVENTIONS TO REDUCE NEWBORN PROCEDURE PAIN

Blood sampling and other routine and less common procedures can be painful to newborns. Infants who were breastfed during these procedures, in comparison with swaddling, pacifiers, and other measures, had better scores on several measures of pain experience (Shah, Aliwalas, and Shah 2007). Babies with blood drawn from veins similarly appeared to experience less pain than babies with blood drawn by heel lance (Shah and Ohlsson 2007).

PSYCHOSOCIAL AND PSYCHOLOGICAL INTERVENTIONS FOR POSTPARTUM DEPRESSION

Due to concerns about adverse effects of maternal medications on breastfed children, effective nonpharmacologic treatments for postpartum depression are of special interest for postpartum women. Best current evidence suggests that both psychosocial interventions (such as peer support and nondirective counseling) and psychological interventions (such as cognitive behavioral therapy and interpersonal psychotherapy) reduce the likelihood of depressive symptoms among new mothers with depression (Dennis and Hodnett 2007). A second review confirms the effectiveness of psychological interventions (Lumley, Austin, and Mitchell 2004). The reviews found that one mother was helped for every two to four who received these interventions.

THE EVIDENCE ABOUT VAGINAL BIRTH AFTER CESAREAN (VBAC)

As shown in Figure 6, the proportion of women with a previous cesarean who gave birth vaginally rose steadily leading up to 1996 but has sharply declined since that time. Access to VBAC has fallen off sharply in recent years (Roberts et al. 2007), and more than nine out of ten women with previous cesareans now have repeat cesareans. Forty-five percent of *Listening to Mothers II* survey participants would have liked the option of VBAC in 2005, but most of those women did not have this option, primarily due to an unwilling caregiver (45 percent) or hospital (23 percent) (Declercq et al. 2006). Best evidence can provide clarifying guidance about mode of birth after cesarean for the large population of childbearing women with at least one previous cesarean—annually in the United States, about a half million women, and rising.

In considering the options of repeat cesarean or VBAC, the focus has been on the possibility that the scar could give way during labor (uterine rupture) among VBAC mothers, requiring an immediate cesarean and possibly leading to serious problems for the mother and/or baby. A systematic review that examined outcomes related to uterine rupture in the present pregnancy concluded that about 370 women would need to have a repeat cesarean to prevent one symptomatic uterine rupture, and over 7,100 women would need to have a repeat cesarean to prevent the death of one baby from this situation. The review found that the likelihood a mother would have an emergency hysterectomy or would die did not differ between VBAC and repeat cesarean (Guise, Berlin, et al. 2004; Guise, McDonagh, et al. 2004; see also Landon et al. 2004). A subsequent report from the prestigious National Institute of Child Health and Human Development Maternal–Fetal Medicine Units Network clarified that multiple prior cesareans were not associated with increased risk of uterine rupture in women planning vaginal birth after cesarean in comparison with those with a single prior

cesarean. The research identified several modifiable risk factors that were associated with increased risk of uterine rupture in women who labored after a previous cesarean: labor induction, labor augmentation with synthetic oxytocin, and an interval of twenty-four or fewer months since previous cesarean (Landon et al. 2006).

Discussions about how women with a previous cesarean might give birth generally fail to consider the many outcomes that differ in likelihood between vaginal birth and repeat cesarean but are not related to the possibility of uterine rupture in the index pregnancy. As discussed in the previous section, these strongly favor vaginal birth and include a broad range of shorter- and longer-term adverse effects of cesarean section in mothers and babies, as well as increased risks of cesareans for mothers and babies in future pregnancies. Many future reproductive risks increase as the number of previous cesareans grows. Two large additional studies from the Maternal-Fetal Medicine Units Network depict a striking contrast between repeat cesarean and VBAC/repeat VBAC paths. The following conditions/procedures increased as the number of cesareans grew: placenta accreta, cystotomy, bowel injury, ureteral injury, ileus, need for postoperative ventilation, intensive care unit admission, hysterectomy, blood transfusion requiring four or more units, duration of operative time, and duration of hospital stay (Silver et al. 2006). By contrast, as the number of VBACs grew, the likelihood of VBAC success increased and the likelihood of the following conditions/procedures decreased: uterine rupture, scar separation, surgical complications, transfusion, and endometritis. The investigators found no increase in newborn morbidity or mortality with increasing VBAC (Mercer et al. 2008).

The failure to offer access to VBAC to many eligible women in many settings inevitably involves a high and growing level of iatrogenic harm and excess costs that are playing out over time. About 36 percent of U.S. mothers have given birth three or more times, and 38 percent of mothers aged twenty-five to forty-four reported having had an unwanted or mistimed birth (Chandra et al. 2005). As many women will have additional children, future childbearing is difficult to predict, and hazards increase as the number of previous cesareans grows, it would be wise for women without a clear and compelling need for cesarean section in the present pregnancy to avoid the extra risks of surgery and to get off the repeat cesarean track.

**CHALLENGES TO CLOSING EVIDENCE-PRACTICE GAPS
IN MATERNITY CARE IN THE UNITED STATES**
NOTE: REFERENCES TO SYSTEMATIC REVIEWS ARE IN ITALICS

Two recent systematic reviews about the effectiveness of strategies for improving the quality of maternity care found consistent evidence that interventions identifying and addressing barriers to improvement are effective in improving care (*Chaillet and Dumont 2007; Chaillet et al. 2006*). This section summarizes some of the leading factors that are contributing to the usual patterns of maternity care described in this report.

LACK OF A NATIONAL STANDARDIZED SET OF MATERNITY PERFORMANCE MEASURES

Various entities have independently developed quality measures to assess the performance of health professionals, facilities, or health plans that provide maternity care (Agency for Healthcare Research and Quality 2007). However, to date, a full, national standardized set of perinatal measures has not been available to assess and report performance and reward good performance. The National Quality Forum (NQF) is currently working with measure developers, prospective measure users, and other stakeholders to develop a robust, standardized set of NQF-endorsed perinatal measures and to identify gaps in available perinatal measures. When this initial measure set is endorsed in 2008, it will be vital to ensure that it is widely used to assess maternity care performance, with adequate technical assistance and other support for facilitating and assessing this process. Further, it will be important to publicly report performance and to help consumers and purchasers use this information to make informed decisions about choosing and purchasing services. Purchasers may also elect to reward good performance. The information can also help those who deliver maternity care to improve practice. Finally, it will be important for measure developers to design, evaluate, and submit to NQF measures to fill important gaps and for NQF to incorporate the best new maternity measures into its perinatal measure set and refine existing measures on the basis of their performance (Sakala in press).

A PAYMENT SYSTEM THAT INCURS PERVERSE INCENTIVES

The present system of payment for maternity care provides strong incentives for inappropriate care of healthy childbearing women. Recent market pressures, such as tightened reimbursement from payers and costly malpractice insurance premiums, appear to be driving providers to respond more directly to unintended payment system incentives than they did in the past (Ginsburg and Grossman 2005). Many practitioners who do not respond directly to financial interests will nonetheless be influenced by resulting shifts in the standard of care.

In the United States, maternity providers are paid a fixed global fee for a bundle of services. The fee schedule code and size of payment are based on the portion of prenatal, labor and birth, and postpartum services the caregiver has provided and the type of birth the patient had. Some fee schedules pay the same amount for vaginal and cesarean birth, while many pay more for cesarean. In one recent analysis, employer-sponsored insurance paid providers an additional \$723 on average

for cesarean births in comparison with vaginal births in 2004 (Thomson Healthcare 2007). Extra payments for cesarean birth provide an incentive for this procedure.

In addition to the size of the payment, providers must consider the time and effort involved in obtaining a payment. This effort affects their availability for providing other reimbursable hospital and office services, for meeting the needs of others in their practice, and for balancing their work and personal lives. A planned cesarean offers the advantages of predictable scheduling and a short time commitment, along with a higher average fee. A vaginal birth that begins on its own involves no control of timing and often means that another provider who is on call will collect the payment for the birth, which is generally much larger than the prenatal and postpartum components. This provides an incentive for induced labor or planned cesarean that is coordinated with a provider's hospital schedule. Many obstetric interventions may help providers who care for women in labor move on more quickly to provide care and reimbursable services to other patients or gain time for their personal lives. These include practices that are believed to hasten and compress the length of labor (such as augmentation with synthetic oxytocin, ruptured membranes, and staff-directed pushing) as well as converting in labor from vaginal to cesarean birth.

Hospitals can benefit from use of interventions to control birth as well. Scheduled inductions and cesareans can help plan for nurse staffing. Nursing staff may especially appreciate weekday hours, and hospitals may find it easier and less expensive to hire nurses for those shifts. Quicker turnover of delivery rooms or an even briefer period in an operating room can reduce staff time required for a given birth and free up the space for a new mother. A recent study estimated that employer-sponsored insurance paid hospitals an additional \$2,090 for cesarean births in comparison with vaginal births in 2004 (Thomson Healthcare 2007). Cesarean birth involves extra days in the hospital and more intensive care, and further analysis is needed to understand whether the larger payments provide an incentive for cesarean birth. In other clinical areas, hospital admissions for surgical procedures have been found to be much more profitable than admissions for medical procedures (Ginsburg and Grossman 2005).

Charting of birth by time of day, day of week, and holiday versus non-holiday shows that birth in the United States takes place disproportionately during non-holiday weekday hours (Goodman 2007; Peltier 2007). While some of this variation reflects scheduling for appropriate inductions and cesareans, a very large proportion of these procedures is discretionary, with troubling implications for the welfare of mothers and babies and the cost of maternity care.

Thus, the present reimbursement system involves strong *disincentives* for support of physiologic childbirth. Providers and hospitals who give optimal care to women can pay a price in the amount of reimbursement they receive for their considerable effort, in their ability to obtain payments for other services, and/or in their ability to control personal and personnel time. The current payment system provides disincentives to limit use of induction, cesarean section, and other labor and birth interventions, and disincentives to offer women patient support for their own efforts, capacities, and time frames. Those who provide optimal care do not get extra monetary rewards and are thus

penalized for such high-quality service and for the benefit to purchasers of more appropriate use of costly interventions. Those who maintain such high standards may have difficulty remaining in competitive markets.

We were unable to find data on the appropriateness of use of neonatal intensive care unit (NICU) services for healthier newborns and on NICU use due to problems that might have been avoided, such as respiratory problems in babies with avoidable planned cesareans. If NICUs are functioning as profitable hospital service lines with incentives for inappropriate care, this may involve avoidable exposure to tests and treatments, disruption of family life at this important time, and expense for costly care. It is a priority to better understand the role of financial incentives in patterns of newborn hospital care.

MALPRACTICE CONCERNS

A full examination of the negative impact of the present liability environment on maternity care and options for addressing the adverse effects is needed at this time. Key points are noted here. First, the liability system continues to uphold current standards of care and use of professional experts without regard to lessons from the best scientific research (Massie 2004; Peters 2000). This is a troubling disincentive for the provision of evidence-based maternity care. It is a priority to identify ways to align legal incentives with care that is consistent with the best scientific research.

Second, leading allegations in obstetric claims involve infant neurologic injury or stillbirth/neonatal death (Wilson and Strunk 2007). Fear of high-cost awards to compensate families of children with disabilities appears to generate some undesirable defensive behavior. Many of these awards do not in fact involve the legal malpractice standard of negligent injury, and rather reflect a willingness of involved parties to help families in need. Other mechanisms are needed for this purpose.

Third, population-based studies that led to recognition of the high level of medical error in the United States and to the Institute of Medicine's landmark *To Err Is Human* report (Kohn et al. 2000) clarified that maternity care does involve a notable amount of negligent injury of newborns and especially of mothers (Brennan et al. 1991; Thomas et al. 2000). More recently, an adverse event rate of at least 2.1 percent and possibly as high as 5.4 percent was reported for a teaching hospital obstetrics unit (Forster et al. 2006). The present malpractice system is not doing a good job of providing incentives to limit this injury or to compensate those who experience it.

Fourth, implementing a culture of safety and quality and more cooperative methods for responding to concerns about error and injury may go a long way toward giving health personnel and families who receive care increased confidence about the care that is delivered and may help limit adverse effects of the liability system (Pearlman 2006; Sage 2003; Schoenbaum and Bovbjerg 2004).

Fifth, care by midwives and in birth centers is often well-suited to childbearing women and can provide excellent value to purchasers. However, midwives and birth centers face some special challenges in the present liability environment. For example, a large payout within their smaller pools

can lead to a major increase in the size of premiums, making it unaffordable to remain in the market with professional liability insurance. Moreover, the trend has been for conventional commercial insurers to be replaced by malpractice insurance providers that are owned by or closely allied with physicians and hospitals. The new carriers may have limited commitment to ensuring that midwives and birth centers are able to remain in the market. Further, policies of some physicians interfere with provision of back-up services to midwives. Also, due to their commitment to a conservative practice style, midwives and birth centers may be unwilling to intensify use of procedures to increase volume of services and reimbursement in response to the pressure of high premiums. Also, such procedures may be beyond their scope of practice. Although this focus on avoiding unwarranted services is desirable from the perspective of quality care, it further limits the ability of midwives and birth centers to remain in the market. Finally, maternity providers who have the relatively new certified professional midwife credential may have difficulty finding access to liability insurance products.

SPECIALIST ORIENTATION CARE TYPICAL FOR HEALTHY, LOW-RISK MOTHERS AND BABIES

Although most pregnant women in the United States are healthy and at low risk for complications, pathology- and surgery-oriented obstetric specialists are the lead caregivers for about 79 percent of women during both pregnancy and labor (Declercq et al. 2006). The predominant orientation of this specialty is external management of childbirth, as opposed to facilitation of physiologic processes (Reime et al. 2004). Among developed nations, only the United States and Canada rely to this degree on specialists rather than midwives to provide care to healthy birthing women (Wagner 1998).

A cluster analysis in British Columbia helped clarify variation in attitudes within and across the main types of maternity caregivers. The analysis associated 79 percent of obstetricians and 16 percent of family physicians with the obstetric attitude cluster, 21 percent of obstetricians and 58 percent of family physicians with the family physician cluster, and 26 percent of family physicians and 100 percent of midwives with the midwife cluster (Reime et al. 2004). A study of practice style across the three groups in Washington State controlled for biological and demographic differences in the women receiving care. Investigators found pronounced differences in care provided by certified nurse-midwives (fewer interventions) and both types of physicians. There were more modest differences between obstetricians and family physicians (the latter had lower epidural rates and more women who used no pain medication) (Rosenblatt et al. 1997).

Midwives are more likely to have skills that support physiologic processes in healthy women and newborns, to value such supportive care, and to make judicious and conservative use of interventions (*Brown and Grimes 1995; Cragin and Kennedy 2006; Hatem et al. in press; Kennedy and Shannon 2004; Waldenström and Turnbull 1998; Walsh and Downe 2004*). Nationally, risk-adjusted outcomes of care by certified nurse-midwives caring for women with single vaginal births at thirty-five to forty-three weeks of gestation demonstrated better outcomes than physician caregivers with respect to low

birthweight and neonatal and infant mortality, which may reflect well-documented differences in practice style (MacDorman and Singh 1998; see also Raisler and Kennedy 2005). Yet midwives are vulnerable to marginalization and experience obstacles that benefit powerful interests at the expense of the health care system and the best interests of women and babies (Goodman 2007). They are the lead caregivers for just 8 to 9 percent of U.S. mothers during pregnancy and childbirth (Declercq et al. 2006). In the United States, certified nurse-midwives (CNMs), certified midwives (CMs), and certified professional midwives (CPMs) have passed certification exams of entities accredited by the accrediting body of the National Organization for Competency Assurance and met the criteria of the International Confederation of Midwives for the definition of a midwife. Projected cost savings from shifting to a system of care with midwives as primary caregivers for most U.S. birthing women are considerable (Wagner 1998).

In the United States, family physicians (FPs) are important providers of maternity care, with a disproportionate provision of maternity services in many geographic areas. About 28 percent of FPs provide some type of maternity care, and 20 percent attend births in hospitals, while about 73 percent of all FPs accept Medicaid beneficiaries (American Academy of Family Physicians 2007). They bring to maternity services the value of a primary care orientation and of care provided to entire families, with continuity through the life course. Overall, the practice style of family physicians falls between obstetricians and midwives (Reime et al. 2004). Family physicians are the lead pregnancy caregivers for just about 8 percent of women and the birth attendant about 7 percent of the time in the United States (Declercq et al. 2006). The most recent review comparing the process and outcomes of maternity care provided by family physicians and by obstetricians found that differences favor family physicians (Klein 1993).

CURRENT MATERNITY PRACTICE GUIDELINES EXCESSIVELY RELIANT ON OPINION

A recent analysis of American College of Obstetricians and Gynecologists (ACOG) obstetrical practice bulletins published from June 1998 through December 2004 reported that a small proportion of the recommendations in the bulletins met high standards of evidence. Just 23 percent of obstetrics recommendations were Level A (“based on good and consistent scientific evidence”), whereas 35 percent were Level B (“based on limited or inconsistent scientific evidence”) and fully 42 percent were Level C (“based primarily on consensus and expert opinion”). Among references cited for the obstetric and gynecologic bulletins that were assessed, just 1 percent were for systematic reviews from the *Cochrane Database of Systematic Reviews*, and 3 percent were for meta-analyses (Chauhan et al. 2006), collectively representing a minute proportion of the large, growing inventory of available systematic reviews and meta-analyses on maternal, newborn, and women’s health topics.

Within evidence-based medicine, expert opinion that is not based on critical appraisal of research is viewed as the lowest and least valid level of evidence, and a systematic review of the most

rigorous primary studies is considered optimal research, offering the most valid results (Centre for Evidence-Based Medicine 2001; Eden et al. 2008).

Some current ACOG guidelines have lowered or removed the bar for use of consequential interventions, in comparison with previous versions. For example, current guidance on labor induction accepts “psychosocial indications” (American College of Obstetricians and Gynecologists 1999), and current guidance on slow or stalled labor progress (dystocia) has removed previous explicit criteria for diagnosing dystocia before turning to a cesarean (American College of Obstetricians and Gynecologists 2003). Despite the weak foundation of guidelines from the leading U.S. obstetric professional society, the recommendations influence professional practice. To reduce risk of legal liability, providers may experience pressure to practice according to recommendations without good scientific support.

LACK/LOSS OF PROFESSIONAL CORE KNOWLEDGE/SKILLS FOR OPTIMAL CHILDBIRTH

Support for physiologic labor is the safest care for healthy women experiencing normal labor. This is also the most economical care for purchasers of maternity services. Most midwifery education programs offer an opportunity to observe physiologic childbirth and to learn about and become competent in supporting innate capacities of women and their fetuses/newborns. However, given current standards of practice (Table 3), many physicians may have limited opportunities to observe and support physiologic childbirth during their education and beyond. Adequate knowledge about appropriate choice and timing of interventions is a special concern, including knowing whether and when to intervene in nonurgent matters, how to do so safely without imposing needless harm, and when more invasive interventions are truly of value.

Instead of relying on a breadth of core childbirth skills and knowledge, first-line care often involves use of interventions such as synthetic oxytocin (used by 57 percent of mothers in the *Listening to Mothers II* survey), epidural analgesia (76 percent), and cesarean section (32 percent) (Declercq et al. 2006; Gawande 2006; Savage 2007). A related concern is the proposition that a scheduled cesarean is a good way to preserve pelvic floor function (O’Boyle, Davis, and Calhoun 2002), when caregivers could instead emphasize safer vaginal birth practices that limit episiotomy, forceful pushing, “fundal pressure” on the mother’s abdomen, back-lying positions for giving birth, and other practices that are prevalent (Declercq et al. 2006) and increase risk for pelvic floor injury (Albers and Borders 2007; Bosomworth and Bettany-Saltikov 2006; Gupta, Hofmeyr, and Smyth 2004; Hartmann et al. 2005).

Despite lengthy and expensive health professional education programs, recently educated practitioners may have limited opportunity to acquire and maintain core skills, including those needed for the following:

- facilitation of labor progress and provision of comfort measures and pain coping skills through patient, individualized care that might involve emotional support; use of positioning and movement; guarding energy reserves; a private and calm environment; use of heat, cold, pressure,

- and/or warm water; and so forth as appropriate and helpful to a laboring woman (Simkin 2002; Simkin and Ancheta 2005; Simkin and Bolding 2004)
- skillful, judicious assisted delivery (vacuum extraction and forceps) (Spencer, Murphy, and Bewley 2006)
- external version to manually turn babies to a head-first position (Spencer, Murphy, and Bewley 2006)
- vaginal breech birth (American College of Obstetricians and Gynecologists 2006; Lavin Jr., Eaton, and Hopkins 2000; Queenan 2004; Spencer, Murphy, and Bewley 2006)
- vaginal twin birth (Spencer, Murphy, and Bewley 2006)
- support for breastfeeding (Freed et al. 1995; Philipp, Merewood, and O'Brien 2001)

HARMS AND IATROGENESIS OFTEN NOT ADEQUATELY UNDERSTOOD/CONSIDERED

Despite heightened concerns about the potential for harm during sensitive developmental periods (as discussed earlier in the Physiologic Foundation section) and women's interest in knowledge of harms of interventions (Declercq et al. 2006), adverse effects are often underemphasized in medicine. An optimism bias prevails (Chalmers and Matthews 2006), and many evidence sources focus primarily or exclusively on benefits, while comprehensive high-quality data on harms are often unavailable. In primary studies, harms are less likely than benefits to be studied at all, in enough participants, or over a long enough period; adequately measured; reported when studied; and well-referenced in articles (Chan et al. 2004; Ioannidis et al. 2004). The biases persist in systematic reviews due to this professional ethos and the deficiencies of the primary studies (McIntosh, Woolacott, and Bagnall 2004; Papanikolaou and Ioannidis 2004). Randomized controlled trial evaluations of interventions and systematic reviews limited to RCTs are unlikely to be able to measure serious but rare outcomes or effects that may manifest when study participation has ended. Liberal use of maternity interventions with limited caution about harms reflects these pervasive patterns and values.

KNOWLEDGE TRANSFER AND APPLICATION CHALLENGING

It is a challenge to stay abreast of and interpret the vast and ever-growing body of research on pregnancy and childbirth. As the initial work to systematically appraise best research was carried out in this field, there are far more Cochrane reviews for this clinical area than any other, in addition to a large number of pregnancy and childbirth systematic reviews from other sources. Busy professionals need support to keep up with best pregnancy and childbirth evidence.

Even with access to lessons from the best available research, it is often difficult to move beyond established beliefs and routines and put evidence into practice without reconfiguring education, practice settings, and policies. Nonetheless, a growing body of systematic reviews identifies effective strategies for health practice quality improvement (see Appendix), and the National Institutes of Health have identified translational research as a priority.

PRESSURE FROM INDUSTRY

Industry pressure compromises maternity care. Drugs, devices, and other products with commercial value are more likely to be evaluated, adopted into practice, and promoted than simpler measures with little or no commercial value. One of the most striking examples in maternity care is the commercial value of formula, in contrast to breast milk, which is optimal for nearly all babies. Before and after giving birth, many women receive numerous formula samples/offers, and the formula industry influences policies and practices in hospital maternity units. As a result, even women who wish to exclusively breastfeed experience numerous hospital practices that disrupt breastfeeding, such as the distribution of formula “supplements” and promotional materials (Declercq et al. 2006; Kaufman and Lee 2007).

INFORMED CONSENT PROCESSES OFTEN INADEQUATE

Studies of decision making in maternity settings consistently raise concerns about the adequacy of informed consent processes (e.g., Akkad et al. 2004; Dixon-Woods et al. 2006; O’Cathain et al. 2002; Turnbull et al. 1999). Among women who experienced episiotomy in U.S. hospitals in 2005, just 18 percent reported having had a say about the procedure (Declercq et al. 2006). In recent national surveys, virtually all women expressed the wish to know all or most of the complications of labor induction, epidural, and cesarean before deciding to undergo these respective procedures, but mothers had poor knowledge of their actual side effects, whether they had experienced the specific intervention or not (Declercq et al. 2002; Declercq et al. 2006).

In many if not most jurisdictions in the United States, the legal standard of informed consent has shifted from what a health professional believes a person should understand about offered care to what a reasonable patient would want to know (American College of Obstetricians and Gynecologists 2005). Improved consumer education and informed consent processes are needed to ensure that women have the information they desire and that informed consent processes meet evolving legal standards.

Adequate informed consent processes for labor and birth interventions are especially difficult to achieve while women are experiencing the challenges of labor. At that time, women have limited options for obtaining second opinions, gathering further information, and making other care arrangements. On the other hand, pregnant women have many months to prepare and would benefit from access to high-quality information and decision support relating to labor and birth well before labor. Informed choice requires access to a range of options, good understanding of best evidence about benefits and harms of offered care and of alternatives, and solid support for the choices women make.

MEDIA DEPICTION OF THE CHILDBIRTH EXPERIENCE OFTEN LIMITED

It is difficult for journalists, the general public, and childbearing women themselves to understand the nature, extent, and causes of the evidence-practice gaps in maternity care. Increasingly, there is little

other frame of reference for all stakeholder groups than the pattern of care summarized in Table 3. The *Listening to Mothers II* survey found that far more pregnant women were exposed to the childbirth experience through often sensational TV shows than through the didactic and interactive process of childbirth education provided by trained educators (Declercq et al. 2006).

INCREASED HARM/EXPENSE AND MORE ENTRENCHED PROBLEMS TO RESULT IF POLICY INTERVENTION DELAYED

Millions of mothers, newborns, and families cannot wait for a delayed response and would benefit from timely improvement of maternity care. In addition, improving the quality of maternity care is critical to avoiding more deeply entrenched problems.

First, as described in this section, loss of skills and knowledge among maternity professionals is a serious concern. Younger professionals have fewer core skills for supporting childbearing women than those nearing retirement (American College of Obstetricians and Gynecologists 2006; Gawande 2006). It is a priority to stem these skill losses, to benefit from those professionals who have retained these essential skills, and to ensure that the large investment in the education of health professionals results in caregivers who are prepared to provide appropriate care.

Second, as standards of maternity care and the culture of maternity care shift (Simpson and Thorman 2005), fewer and fewer professionals, administrators, policymakers, journalists, and women themselves have a frame of reference for what is appropriate care, and it is becoming difficult for all stakeholder groups to know what care is possible and optimal and to provide and seek such care.

Finally, altering the present course can head off unintended downstream consequences. The rising rate of first-time cesareans and the increasing trend for repeat cesareans have health risk implications that will play out over a long period of time, and more so in an environment where repeat cesarean is the norm and many women who desire VBAC do not have this option. With growing use of labor induction and cesarean section, hospital maternity units are reconfiguring to accommodate more surgeries, more labor and birth services scheduled during weekday hours, and more postpartum beds due to longer postsurgical lengths of stay. Supplier-induced demand is likely to be a formidable force after hospitals make these costly capital investments and become dependent upon the increased revenue from cesarean as opposed to vaginal birth, face pressure to receive a return on their investments, and shape practice through new facility designs.

Members of the Reforming States Group worked together with the authors of this report to identify the following policy recommendations and strategies to increase the provision of evidence-based maternity care.

Evidence-based health care methodologies were developed within the field of pregnancy and childbirth over a quarter century ago. Despite a strong and continually refined knowledge base, contemporary maternity care in the United States involves considerable overuse of harmful or ineffective practices (e.g., episiotomy, cesarean section, early separation of mothers and babies) and underuse of beneficial practices (e.g., smoking cessation programs in pregnancy, continuous support during childbirth). Further, many important research questions have not been adequately investigated, including questions about the potential for longer-term unintended consequences of numerous widely used maternity interventions in both children and women.

Maternity care decisions should be guided by the best available evidence and the principle of effective care with least harm, as well as the informed preferences of women and their families, rather than by unsupported beliefs about appropriate care, convenience, liability pressure, or other extrinsic factors. Subject to the availability of resources, policymakers can use educational, research, fiscal, and performance measurement strategies to encourage the health system to provide, and women to seek, evidence-based maternity care.

Malpractice concerns are a troubling disincentive for the provision of evidence-based maternity care. The medical liability system continues to drive standards of care and use of professional experts without regard to lessons from the best scientific research. An example of this paradox is the legal system's prevailing assertion that continuous electronic fetal monitoring (EFM) is a standard of care for all deliveries despite the available wealth of evidence identifying intermittent monitoring as preferable. More research and fruitful discussions among all stakeholders need to occur to better align the legal system with best available evidence.

To foster increased provision of evidence-based maternity care, we recommend the following:

1. Increasing the knowledge and use of evidence-based maternity care by educating and advising a wide range of stakeholders. These stakeholders include state and federal policymakers in legislative and executive branches, health professionals and health profession educators, hospital and health plan administrators, insurers, employers, researchers, childbearing women and their families, consumer advocates, and journalists.
 - Distribute this report to the multiple stakeholders.
 - Carry out public health education campaigns in support of evidence-based maternity care.
 - Create model professional education programs with evidence-based maternity care curricula and practicum experiences at public colleges and universities. Support medical students, family medicine and obstetric residents, and nursing and midwifery students with interdisciplinary training involving maternity care providers such as midwives, nurses, lactation consultants, perinatologists, and obstetricians.

- Support the development, provision, and updating of independent sources of high-quality evidence-based education and decision support materials in accessible formats for childbearing women.
 - Develop clinical practice guidelines that promote evidence-based maternity care and reflect the principle of effective maternity care with least harm to guide health professionals and institutional and organizational policies.
2. Supporting research to further evidence-based maternity care.
- Investigate available studies on the impact of the liability system on maternity care, and identify ways to strengthen that system and limit unintended effects.
 - Prioritize research needs for evidence-based maternity care and the principle of effective maternity care with least harm, and close continuing gaps in knowledge. Give careful attention to possible harms of interventions. Improve knowledge of longer-term effects in children and women, in recognition of the significance of maternity care to the developmental origins of health and disease. Identify pre- and interconceptional opportunities to improve maternity outcomes.
 - Include comparison groups of women with physiologic care to clarify relative benefits and harms of maternity interventions whenever appropriate.
 - Apply research results to the domains of education, payment and financing, and quality measurement.
3. Reforming the current reimbursement system to promote evidence-based maternity care and extending payment reform to all payers, including private insurers.
- Support a comprehensive, high-level exploration of ways to align the payment and financing system with the principle of effective care with least harm, including support for physiologic childbirth in healthy women. Involve leading experts on health care payment and financing, advocates for childbearing women and families, and other stakeholders in this work. Mechanisms to consider include reducing payment for overused services; increasing payment for underused services, including support for physiologic childbirth; rewarding high-performing providers and facilities; and providing incentives for women to select high-performing providers and facilities.
 - Modify distribution of Medicaid graduate medical education funds to incentivize medical schools and residency programs to develop and utilize curricula for evidence-based maternity care.
 - Encourage the federal government to implement and evaluate demonstrations of the most promising ways to align payment and financing with evidence-based maternity care.
 - Address the need to retain and expand the supply of family physicians who include maternity care in their scope of practice (most crucial in rural and underserved areas) through financial incentives and/or funding of dedicated programs to provide loan repayment support, early career mentoring, and locums physicians offering relief and support.

- Foster broad access to safe, effective midwifery care by setting adequate Medicaid and Medicare reimbursement rates for certified nurse-midwives, certified midwives, and certified professional midwives.
 - Apply successful mechanisms broadly throughout the nation, with leadership from the Centers for Medicare and Medicaid Services, state Medicaid programs, and other purchasers of maternity services, including large employers.
4. Requiring performance measurement, reporting, and improvement.
- Develop a national standardized evidence-based set of maternity performance measures and fill gaps in available measures to address current patterns of overuse, underuse, and unjustified practice variation.
 - Support the establishment and implementation of statewide or regional maternity care quality improvement collaboratives and develop statewide or regional database/reporting systems that provide useful information to the public about the performance of maternity professionals and facilities, and also provide practitioners with information about their performance. Use performance measurement to identify disparities and to initiate focused quality improvement.
 - Incorporate maternity care performance measures into Medicaid quality improvement activities, including Medicaid managed care contracts. Encourage private insurers to adopt and incorporate similar performance measures.
 - Set aggressive goals for maternity care quality improvement in public agency contracts for Medicaid clients, public employees, and others.

These recommendations reflect the need to increase the public’s awareness of evidence-based maternity care practices, to support further research in this area, and to develop a reimbursement system and performance measures that promote evidence-based care. Implementing these recommendations has the potential to greatly increase access to evidence-based maternity care in the United States and to provide excellent value for purchasers of maternity services.

**APPENDIX: LEADING RESOURCES AND TOOLS FOR
EVIDENCE-BASED MATERNITY CARE**

**NOTE: AN ASTERISK INDICATES THAT THE RESOURCES ARE AVAILABLE
WITHOUT CHARGE OR SUBSCRIPTION**

Agency for Healthcare Research and Quality, Evidence-based Practice Program*
<http://www.ahrq.gov/clinic/epcix.htm> (accessed June 13, 2008).

BMJ Clinical Evidence, updated monthly
<http://www.clinicalevidence.com> (accessed June 13, 2008).

Childbirth Connection: *What Every Pregnant Woman Needs to Know about Cesarean Section**
<http://www.childbirthconnection.org/cesareanbooklet/> (accessed June 25, 2008).

Childbirth Connection website: For Women section*
<http://www.childbirthconnection.org/home.asp?Visitor=Woman> (accessed June 13, 2008).

Cochrane Central Register of Controlled Trials, updated quarterly
<http://www.thecochranelibrary.com> (accessed June 13, 2008).

Cochrane Database of Systematic Reviews, updated quarterly
provides free access to detailed abstracts and plain language summaries for all reviews
<http://www.thecochranelibrary.com> (accessed June 13, 2008).

Current Resources for Evidence-Based Practice, updated quarterly*
<http://www.childbirthconnection.org/article.asp?ClickedLink=199&ck=10268&area=2>
(accessed June 13, 2008).

Database of Abstracts of Reviews of Effects (DARE), updated monthly*
<http://www.crd.york.ac.uk/crdweb/> (accessed August 13, 2008).

Evidence-Based Maternity Care Resource Directory*
covers systematic reviews about effective professional practice and organization of care, reports that summarize this body of work, reports about maternity quality improvement initiatives and many other topics
<http://www.childbirthconnection.org/article.asp?ClickedLink=184&ck=10263&area=2>
(accessed June 13, 2008).

Family Medicine Obstetrics, 3rd edition (Ratcliffe, S.D., ed.). Amsterdam: Elsevier Health Sciences, 2008.
http://www.elsevier.com/wps/find/bookdescription.cws_home/713090/description#description
(accessed June 13, 2008).

A Guide to Effective Care in Pregnancy and Childbirth, 3rd edition (Enkin, M., M.J.N.C. Keirse, J. Neilson, C. Crowther, L. Duley, E. Hodnett, and J. Hofmeyr eds). Oxford: Oxford University Press, 2000.*
<http://www.childbirthconnection.org/article.asp?ClickedLink=194&ck=10218&area=2>
(accessed June 13, 2008).

Listening to Mothers Surveys*

These survey questionnaires may be adapted to help states, health plans, hospitals, and other entities better understand the childbearing experiences of their constituents and to develop policies and programs to improve care for specific populations. The questionnaires, full survey reports (with appendices detailing the study methodology and summarizing validation studies of birth certificate and hospital discharge data), and other related documents are available at <http://www.childbirthconnection.org/listeningtomothers/> (accessed June 13, 2008).

National Institute for Health and Clinical Excellence*
<http://www.nice.org.uk/> (accessed June 13, 2008).

National Institutes of Health, PubMed meta-analysis search function*
<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?CMD=Limits&DB=pubmed> (accessed June 13, 2008).

REFERENCES

NOTE: AN ASTERISK INDICATES THAT THE CITATION IS TO A SYSTEMATIC REVIEW

- Adams, E.K., N.I. Gavin, A. Handler, W. Manning, and C. Raskind-Hood. 2003. Transitions in Insurance Coverage from before Pregnancy through Delivery in Nine States, 1996–1999. *Health Affairs* 22(1):219–29. doi:10.1377/hlthaff.22.1.219. Available at <http://dx.doi.org/10.1377/hlthaff.22.1.219> (accessed January 29, 2008).
- Adams, K., J.M. Corrigan, Committee on Identifying Priority Areas for Quality Improvement, Board on Health Care Services, and Institute of Medicine. 2003. *Priority Areas for National Action: Transforming Health Care Quality*. Washington, DC: the National Academies Press. Available at http://www.nap.edu/catalog.php?record_id=10593 (accessed February 12, 2008).
- Agency for Healthcare Research and Quality. 2007. *National Quality Measures Clearinghouse. Disease/Condition Results: Pregnancy Complications*. Available at <http://www.qualitymeasures.ahrq.gov/browse/browsemode.aspx?node=22020&type=1&view=all> (accessed February 22, 2008).
- Agency for Healthcare Research and Quality. 2008. *HCUPnet, Healthcare Cost and Utilization Project*. Rockville, MD: AHRQ. Available at: <http://hcupnet.ahrq.gov/> (accessed February 22, 2008).
- Akkad, A., C. Jackson, S. Kenyon, M. Dixon-Woods, N. Taub, and M. Habiba. 2004. Informed Consent for Elective and Emergency Surgery: Questionnaire Study. *BJOG* 111(10):1133–38. doi:10.1111/j.1471-0528.2004.00240.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.2004.00240.x> (accessed November 20, 2007).
- Albers, L.L., and N. Borders. 2007. Minimizing Genital Tract Trauma and Related Pain Following Spontaneous Vaginal Birth. *Journal of Midwifery & Women's Health* 52(3):246–53. doi:10.1016/j.jmwh.2006.12.008. Available at <http://dx.doi.org/10.1016/j.jmwh.2006.12.008> (accessed November 20, 2007).
- Albers, L.L., K.D. Sedler, E.J. Bedrick, D. Teaf, and P. Peralta. 2005. Midwifery Care Measures in the Second Stage of Labor and Reduction of Genital Tract Trauma at Birth: A Randomized Trial. *Journal of Midwifery & Women's Health* 50(5):365–72. doi:10.1016/j.jmwh.2005.05.012. Available at <http://dx.doi.org/10.1016/j.jmwh.2005.05.012> (accessed November 21, 2007).
- *Alfirevic, Z., D. Devane, and G.M.L. Cyte. 2006. Continuous Cardiotocography (CTG) as a Form of Electronic Fetal Monitoring (EFM) for Fetal Assessment during Labour. *Cochrane Database of Systematic Reviews*, Issue 3. Art. No.: CD006066. doi:10.1002/14651858.CD006066. Available at <http://dx.doi.org/10.1002/14651858.CD006066> (accessed November 21, 2007).

- Almeida, E.C.S., A.A. Nogueira, F.J. Candido dos Reis, and J.C. Rosa e Silva. 2002. Cesarean Section as a Cause of Chronic Pelvic Pain. *International Journal of Gynecology & Obstetrics* 79(2):101–4. doi:10.1016/S0020-7292(02)00227-8. Available at [http://dx.doi.org/10.1016/S0020-7292\(02\)00227-8](http://dx.doi.org/10.1016/S0020-7292(02)00227-8) (accessed November 21, 2007).
- Althabe, F., and J.M. Belizán. 2006. Caesarean Section: The Paradox. *The Lancet* 368(9546):1472–73. doi:10.1016/S0140-6736(06)69616-5. Available at [http://dx.doi.org/10.1016/S0140-6736\(06\)69616-5](http://dx.doi.org/10.1016/S0140-6736(06)69616-5) (accessed November 21, 2007).
- American Academy of Family Physicians. 2007. Facts about Family Medicine. Leawood, KS: American Academy of Family Physicians. Available at <http://www.aafp.org/online/en/home/aboutus/specialty/facts.html> (accessed November 21, 2007).
- American Academy of Pediatrics. 2005. Breastfeeding and the Use of Human Milk (Policy Statement). *Pediatrics* 115(2):496–506. doi:10.1542/peds.2004-2491. Available at <http://dx.doi.org/doi:10.1542/peds.2004-2491> (accessed November 21, 2007).
- American College of Nurse-Midwives. 2005. Become a Midwife. Available at http://acnm.org/become_midwife.cfm (accessed August 7, 2008).
- American College of Obstetricians and Gynecologists. 1999. ACOG Practice Bulletin Number 10, November: Induction of Labor. Available at http://www.medem.com/MedLB/article_detailb.cfm?article_ID=ZZZA9WKKUJC&sub_cat=2005 (accessed June 25, 2008).
- American College of Obstetricians and Gynecologists. 2003. ACOG Practice Bulletin Number 49, December: Dystocia and Augmentation of Labor. *Obstetrics & Gynecology* 102(6):1445–54. doi: doi:10.1016/j.obstetgynecol.2003.10.011. Available at <http://dx.doi.org/doi:10.1016/j.obstetgynecol.2003.10.011> (accessed June 26, 2008).
- American College of Obstetricians and Gynecologists. 2005. *Professional Liability and Risk Management: An Essential Guide for Obstetrician-Gynecologists*. Washington, DC: American College of Obstetricians and Gynecologists. Available at http://www.acog.org/bookstore/Professional_Liability_and_Risk_Management_Guide_P504.cfm (accessed February 13, 2008).
- American College of Obstetricians and Gynecologists. 2006. ACOG Committee Opinion No. 340: Mode of Term Singleton Breech Delivery. *Obstetrics & Gynecology* 108(1):235–37. Available at <http://www.greenjournal.org/content/voll08/issue1/> (accessed November 21, 2007).

Andrews, R.M., and A. Elixhauser. 2007. *The National Hospital Bill: Growth Trends and 2005 Update on the Most Expensive Conditions by Payer*. Statistical Brief 42. Healthcare Cost and Utilization Project (HCUP), December. Rockville, MD: Agency for Healthcare Research and Quality. Available at <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb42.jsp> (accessed January 29, 2008).

Ashton, C.M., J. Soucek, N.J. Petersen, T.J. Menke, T.C. Collins, K.W. Kizer, S.M. Wright, and N.P. Wray. 2003. Hospital Use and Survival among Veterans Affairs Beneficiaries. *The New England Journal of Medicine* 349(17):1637–46. doi:10.1056/NEJMsa003299. Available at <http://dx.doi.org/10.1056/NEJMsa003299> (accessed November 21, 2007).

Baicker, K., K.S. Buckles, and A. Chandra. 2006. Geographic Variation in the Appropriate Use of Cesarean Delivery. *Health Affairs* 25(5):w355–w367. doi:10.1377/hlthaff.25.w355. Available at <http://dx.doi.org/10.1377/hlthaff.25.w355> (accessed November 21, 2007).

Bedford Russell, A.R., and S.H. Murch. 2006. Could Peripartum Antibiotics Have Delayed Health Consequences for the Infant? *BJOG* 113(7):758–65. doi:10.1111/j.1471-0528.2006.00952.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.2006.00952.x> (accessed November 21, 2007).

Betrán, A.P., M. Meriardi, J.A. Lauer, W. Bing-Shun, J. Thomas, P. Van Look, and M. Wagner. 2007. Rates of Caesarean Section: Analysis of Global, Regional and National Estimates. *Paediatric and Perinatal Epidemiology* 21(2):98–113. doi:10.1111/j.1365-3016.2007.00786.x. Available at <http://dx.doi.org/10.1111/j.1365-3016.2007.00786.x> (accessed November 21, 2007).

BFHI USA. 2008. 64 US Baby-Friendly Hospitals and Birth Centers as of June 2008. Available at <http://www.babyfriendlyusa.org/eng/03.html> (accessed June 25, 2008).

*Blix, E., L.M. Reinar, A. Klovning, and P. Øian. 2005. Prognostic Value of the Labour Admission Test and Its Effectiveness Compared with Auscultation Only: A Systematic Review. *BJOG* 112(12):1595–1604. doi:10.1111/j.1471-0528.2005.00766.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.2005.00766.x> (accessed November 21, 2007).

Blumenthal, D. 2006. Employer-Sponsored Insurance—Riding the Health Care Tiger. *The New England Journal of Medicine* 355(2):195–202. doi:10.1056/NEJMhpr060704. Available at <http://dx.doi.org/10.1056/NEJMhpr060704> (accessed November 21, 2007).

- *Borrelli, F., R. Capasso, G. Aviello, M.H. Pittler, and A.A. Izzo. 2005. Effectiveness and Safety of Ginger in the Treatment of Pregnancy-Induced Nausea and Vomiting. *Obstetrics & Gynecology* 105(4):849–56. Available at <http://www.greenjournal.org/content/voll105/issue4/> (accessed November 21, 2007).
- *Bosomworth, A., and J. Bettany-Saltikov. 2006. Just Take a Deep Breath. A Review to Compare the Effects of Spontaneous versus Directed Valsalva Pushing in the Second Stage of Labour on Maternal and Fetal Wellbeing. *MIDIRS Midwifery Digest* 16:157–66. Available at <http://www.midirs.org/midirs/midwebl.nsf/services?openform> (accessed February 25, 2008).
- *Brancato, R.M., S. Church, and P.W. Stone. 2008. A Meta-Analysis of Passive Descent Versus Immediate Pushing in Nulliparous Women with Epidural Analgesia in the Second Stage of Labor. *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 37(1):4–12. Available at <http://www.blackwell-synergy.com/toc/jogn/37/1> (accessed January 29, 2008).
- Brennan, T.A., L.L. Leape, N.M. Laird, L. Hebert, A.R. Localio, A.G. Lawthers, J.P. Newhouse, P.C. Weiler, and H.H. Hiatt. 1991. Incidence of Adverse Events and Negligence in Hospitalized Patients. Results of the Harvard Medical Practice Study I. *The New England Journal of Medicine* 324(6):370–76. Abstract available at <http://content.nejm.org/cgi/content/abstract/324/6/370> (accessed November 21, 2007).
- *Bricker, L., and T. Lavender. 2002. Parenteral Opioids for Labor Pain Relief: A Systematic Review. *American Journal of Obstetrics & Gynecology* 186(5):S94–S109. Available at <http://www.ajog.org/article/PIIS0002937802701853/abstract> (accessed November 26, 2007).
- *Britton, C., F.M. McCormick, M.J. Renfrew, A. Wade, and S.E. King. 2007. Support for Breastfeeding Mothers. *Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD001141. doi:10.1002/14651858.CD001141.pub3. Available at <http://dx.doi.org/10.1002/14651858.CD001141.pub3> (accessed November 26, 2007).
- Brody, H., and J.R. Thompson. 1981. The Maximin Strategy in Modern Obstetrics. *The Journal of Family Practice* 12(6):977–86. Abstract available at <http://www.ncbi.nlm.nih.gov/pubmed/7014759> (accessed February 13, 2008).
- Brouwers, M.M., W.F.J. Feitz, L.A.J. Roelofs, L.A.L.M. Kiemeny, R.P.E. de Gier, and N. Roeleveld. 2007. Risk Factors for Hypospadias. *European Journal of Pediatrics* 166(7):671–78. doi:10.1007/s00431-006-0304-z. Available at <http://dx.doi.org/10.1007/s00431-006-0304-z> (accessed November 26, 2007).

*Brown, S.A., and D.E. Grimes. 1995. A Meta-Analysis of Nurse Practitioners and Nurse Midwives in Primary Care. *Nursing Research* 44(6):332–39. doi:10.1097/00006199-199511000-00003. Available at <http://dx.doi.org/10.1097/00006199-199511000-00003> (accessed November 26, 2007).

Buckley, S.J. 2004a. Undisturbed Birth: Nature’s Hormonal Blueprint for Safety, Ease and Ecstasy. *MIDIRS Midwifery Digest* 14:203–9. Available at <http://www.midirs.org/midirs/midweb1.nsf/services?openform> (accessed February 25, 2008).

Buckley, S.J. 2004b. What Disturbs Birth? *MIDIRS Midwifery Digest* 14:353–59. Available at <http://www.midirs.org/midirs/midweb1.nsf/services?openform> (accessed February 25, 2008).

*Castles, A., E.K. Adams, C.L. Melvin, C. Kelsch, and M.L. Boulton. 1999. Effects of Smoking during Pregnancy: Five Meta-Analyses. *American Journal of Preventive Medicine* 16(3):208–15. doi:10.1016/S0749-3797(98)00089-0. Available at [http://dx.doi.org/10.1016/S0749-3797\(98\)00089-0](http://dx.doi.org/10.1016/S0749-3797(98)00089-0) (accessed November 27, 2007).

Centers for Disease Control and Prevention. 1998. Maternal Mortality—United States, 1982–1996. *Morbidity and Mortality Weekly Report* 47(34):705–7. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/00054602.htm> (accessed February 22, 2008).

Centers for Medicare and Medicaid Services. 2008. *National Health Expenditure Data*. Available at: http://www.cms.hhs.gov/NationalHealthExpendData/01_Overview.asp#TopOfPage (accessed June 2, 2008).

Centre for Evidence-Based Medicine. 2001. *Oxford Centre for Evidence-Based Medicine Levels of Evidence*. Available at <http://www.cebm.net/index.aspx?o=1025> (accessed February 21, 2008).

*Chaillet, N., E. Dubé, M. Dugas, F. Audibert, C. Tourigny, W.D. Fraser, and A. Dumont. 2006. Evidence-Based Strategies for Implementing Guidelines in Obstetrics: A Systematic Review. *Obstetrics & Gynecology* 108(5):1234–45. Available at <http://www.greenjournal.org/content/vol108/issue5/> (accessed January 28, 2008).

*Chaillet, N., and A. Dumont. 2007. Evidence-Based Strategies for Reducing Cesarean Section Rates: A Meta-Analysis. *Birth* 34(1):53–64. doi:10.1111/j.1523-536X.2006.00146.x. Available at <http://dx.doi.org/10.1111/j.1523-536X.2006.00146.x> (accessed January 29, 2007).

Chalmers, I., ed. 1989–92. *Oxford Database of Perinatal Trials*. Oxford: Oxford University Press.

Chalmers, I. 1993. The Cochrane Collaboration: Preparing, Maintaining, and Disseminating Systematic Reviews of the Effects of Health Care. *Annals of the New York Academy of Sciences* 703(1):156–65. doi:10.1111/j.1749-6632.1993.tb26345.x. Available at <http://dx.doi.org/10.1111/j.1749-6632.1993.tb26345.x> (accessed January 29, 2008).

Chalmers, I., M. Enkin, and M.J.N.C. Keirse. 1989. *Effective Care in Pregnancy and Childbirth*, 2 vols. Oxford: Oxford University Press. Available at http://www.amazon.com/Effective-Pregnancy-Childbirth-medicalpublications/dp/0192615580/ref=sr_1_3?ie=UTF8&s=books&qid=1202922966&sr=8-3 (accessed February 13, 2008).

Chalmers, I., and R. Matthews. 2006. What Are the Implications of Optimism Bias in Clinical Research? *The Lancet* 367(9509):449–50. doi:10.1016/S0140-6736(06)68153-1. Available at [http://dx.doi.org/10.1016/S0140-6736\(06\)68153-1](http://dx.doi.org/10.1016/S0140-6736(06)68153-1) (accessed January 29, 2007).

Chan, A.W., A. Hróbjartsson, M.T. Haahr, P.C. Gøtzsche, and D.G. Altman. 2004. Empirical Evidence for Selective Reporting of Outcomes in Randomized Trials: Comparison of Protocols to Published Articles. *JAMA* 291(20):2457–65. doi:10.1001/jama.291.20.2457. Available at <http://dx.doi.org/10.1001/jama.291.20.2457> (accessed January 29, 2008).

Chandra, A., G.M. Martinez, W.D. Mosher, J.C. Abma, and J. Jones. 2005. Fertility, Family Planning, and Reproductive Health of U.S. Women: Data from the 2002 National Survey of Family Growth. National Center for Health Statistics. *Vital and Health Statistics* 23(25). Available at http://www.cdc.gov/nchs/products/pubs/pubd/series/sr23/pre-1/sr23_25.htm (accessed January 29, 2008).

Chauhan, S.P., V. Berghella, M. Sanderson, E.F. Magann, and J.C. Morrison. 2006. American College of Obstetricians and Gynecologists Practice Bulletins: An Overview. *American Journal of Obstetrics & Gynecology* 194(6):1564–72. doi:10.1016/j.ajog.2006.03.001. Available at <http://dx.doi.org/10.1016/j.ajog.2006.03.001> (accessed January 29, 2007).

*Chauhan, S.P., W.A. Grobman, R.A. Gherman, V.B. Chauhan, G. Chang, E.F. Magann, and N.W. Hendrix. 2005. Suspicion and Treatment of the Macrosomic Fetus: A Review. *American Journal of Obstetrics & Gynecology* 193(2):332–46. doi:10.1016/j.ajog.2004.12.020. Available at <http://dx.doi.org/10.1016/j.ajog.2004.12.020> (accessed January 29, 2008).

Chauhan, S.P., C.H. Rose, R.B. Gherman, E.F. Magann, M.W. Holland, and J.C. Morrison. 2005. Brachial Plexus Injury: A 23-Year Experience from a Tertiary Center. *American Journal of Obstetrics & Gynecology* 192(6):1795–1800. doi:10.1016/j.ajog.2004.12.060. Available at <http://dx.doi.org/10.1016/j.ajog.2004.12.060> (accessed January 29, 2008).

*Childbirth Connection. 2006. *What Every Pregnant Woman Needs to Know about Cesarean Section*, 2nd revised edition. New York: Childbirth Connection. Available at <http://www.childbirthconnection.org/cesareanbooklet/> (accessed January 30, 2008).

Clark, S.L., M.A. Belfort, G.D.V. Hankins, J.A. Meyers, and F.M. Houser. 2007. Variation in the Rates of Operative Delivery in the United States. *American Journal of Obstetrics & Gynecology* 196(6):526 e1–526.e5. Available at <http://journals.elsevierhealth.com/periodicals/ymob/home> (accessed January 30, 2008).

Clark, W.D. 2008. Pregnancy Care: An Apprenticeship for Palliative Care? *Journal of the American Board of Family Medicine* 21(1):63–65. doi:10.3122/jabfm.2008.01.070099. Available at <http://dx.doi.org/10.3122/jabfm.2008.01.070099> (accessed January 30, 2008).

*Cluett, E.R., V.C. Nikodem, R.E. McCandlish, and E.E. Burns. 2002. Immersion in Water in Pregnancy, Labour and Birth. *Cochrane Database of Systematic Reviews*, Issue 2. Art. No.: CD000111. doi:10.1002/14651858.CD000111.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD000111.pub2> (accessed January 30, 2008).

Cochrane Methodology Register. 2008. *In The Cochrane Library*, Issue 2. Chichester: Wiley, updated quarterly. Available at <http://www.thecochranelibrary.com> (accessed June 2, 2008).

*Collaris, R.J., and S.G. Oei. 2004. External Cephalic Version: A Safe Procedure? A Systematic Review of Version-Related Risks. *Acta Obstetrica et Gynecologica Scandinavica* 83(6):511–18. doi:10.1111/j.0001-6349.2004.00347.x. Available at <http://dx.doi.org/10.1111/j.0001-6349.2004.00347.x> (accessed January 31, 2008).

Committee on Quality of Health Care in America, and Institute of Medicine. 2001. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academies Press. Available at http://www.nap.edu/catalog.php?record_id=10027 (accessed February 13, 2008).

The Commonwealth Fund. 2004. Reducing Inappropriate Induction of Labor: Case Study of Intermountain Health Care. New York: The Commonwealth Fund. Available at http://www.commonwealthfund.org/innovations/innovations_show.htm?doc_id=250148 (accessed January 31, 2008).

*Conde-Agudelo, A., A. Rosas-Bermúdez, and A.C. Kafury-Goeta. 2006. Birth Spacing and Risk of Adverse Perinatal Outcomes: A Meta-Analysis. *JAMA* 295(15):1809–23. doi:10.1001/jama.295.15.1809. Available at <http://dx.doi.org/10.1001/jama.295.15.1809> (accessed January 31, 2008).

*Coomarasamy, A., M. Connock, J. Thornton, and K.S. Khan. 2005. Accuracy of Ultrasound Biometry in the Prediction of Macrosomia: A Systematic Quantitative Review. *BJOG* 112(11):1461–66. doi:10.1111/j.1471-0528.2005.00702.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.2005.00702.x> (accessed January 31, 2008).

Cowan, C.A., and M.B. Hartman. 2005. Financing Health Care: Businesses, Households, and Governments, 1987–2003. *Health Care Financing Review* 1(2):1–26, web exclusive. Available at <http://www.cms.hhs.gov/NationalHealthExpendData/downloads/bhg-article-04.pdf> (accessed January 31, 2008).

Cragin, L., and H.P. Kennedy. 2006. Linking Obstetric and Midwifery Practice with Optimal Outcomes. *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 35(6):779–85. doi:10.1111/j.1552-6909.2006.00106.x. Available at <http://www.blackwellsynergy.com/doi/abs/10.1111/j.1552-6909.2006.00106.x> (accessed January 31, 2008).

Csaba, G. 2007. Hormonal Imprinting: Phylogeny, Ontogeny, Diseases and Possible Role in Present-Day Human Evolution. *Cell Biochemistry & Function* 26(1):1–10. Available at <http://dx.doi.org/10.1002/cbf.1412> (accessed January 31, 2008).

*Cyna, A.M., G.L. McAuliffe, and M.I. Andrew. 2004. Hypnosis for Pain Relief in Labour and Childbirth: A Systematic Review. *British Journal of Anaesthesia* 93(4):505–11. doi:10.1093/bja/aeh225. Available at <http://dx.doi.org/10.1093/bja/aeh225> (accessed January 31, 2008).

Davidoff, M.J., T. Dias, K. Damus, R. Russell, V.R. Bettegowda, S. Dolan, R.H. Schwarz, N.S. Green, and J. Petrini. 2006. Changes in the Gestational Age Distribution among U.S. Singleton Births: Impact on Rates of Late Preterm Birth, 1992 to 2002. *Seminars in Perinatology* 30(1):8–15. doi:10.1053/j.semperi.2006.01.009. Available at <http://dx.doi.org/10.1053/j.semperi.2006.01.009> (accessed January 31, 2008).

Davis, E.P., and C.A. Sandman. 2006. Prenatal Exposure to Stress and Stress Hormones Influences Child Development. *Infants & Young Children* 19(3):246–59. Available at <http://www.iycjournal.com/pt/re/iyc/toc.00001163-200607000-00000.htm;jsessionid=Hz8hf1Mr9rt12w13gSJrsYp8T8Z693yclpv2WNtJRmgYgCqT42vw!-1108188142!181195628!8091!-1> (accessed January 31, 2008).

Declercq, E., M. Barger, H.J. Cabral, S.R. Evans, M. Kotelchuck, C. Simon, J. Weiss, and L.J. Heffner. 2007. Maternal Outcomes Associated with Planned Primary Cesarean Births Compared with Planned Vaginal Births. *Obstetrics & Gynecology* 109(3):669–77. Available at <http://www.greenjournal.org/content/vol109/issue3/> (accessed January 31, 2008).

Declercq, E., F. Menacker, and M. MacDorman. 2006. Maternal Risk Profiles and the Primary Cesarean Rate in the United States, 1991–2002. *American Journal of Public Health* 96(5):867–72. doi:10.2105/AJPH.2004.052381. Available at <http://dx.doi.org/10.2105/AJPH.2004.052381> (accessed January 31, 2008).

Declercq, E.R., C. Sakala, M.P. Corry, and S. Applebaum. 2006. *Listening to Mothers II: Report of the Second National Survey of Women's Childbearing Experiences*. New York: Childbirth Connection. Available at <http://www.childbirthconnection.org/listeningtomothers/> (accessed January 31, 2008).

Declercq, E.R., C. Sakala, M.P. Corry, and S. Applebaum. 2008. *New Mothers Speak Out: National Survey Results Highlight Women's Postpartum Experiences*. New York: Childbirth Connection. Available at <http://www.childbirthconnection.org/newmothersspeakout/> (accessed August 6, 2008).

Declercq, E.R., C. Sakala, M.P. Corry, S. Applebaum, and P. Risher. 2002. *Listening to Mothers: Report of the First National U.S. Survey of Women's Childbearing Experiences*. New York: Maternity Center Association. Available at: <http://www.childbirthconnection.org/listeningtomothers/> (accessed January 31, 2008).

*Demott, K., D. Bick, R. Norman, G. Ritchie, N. Turnbull, C. Adams, C. Barry, et al. 2006. *Clinical Guidelines and Evidence Review for Post Natal Care: Routine Post Natal Care of Recently Delivered Women and Their Babies*. London: National Collaborating Centre for Primary Care and Royal College of General Practitioners. Available at <http://www.nice.org.uk/nicemedia/pdf/CG037fullguideline.pdf> (accessed January 31, 2008).

*Dennis, C.-L., and E. Hodnett. 2007. Psychosocial and Psychological Interventions for Treating Postpartum Depression. *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD006116. doi:10.1002/14651858.CD006116.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD006116.pub2> (accessed January 31, 2008).

- *de Oliveira, M.I., L.A. Camacho, and A.E. Tedstone. 2001. Extending Breastfeeding Duration through Primary Care: A Systematic Review of Prenatal and Postnatal Interventions. *Journal of Human Lactation* 17(4):326–43. doi:10.1177/089033440101700407. Available at <http://dx.doi.org/10.1177/089033440101700407> (accessed January 31, 2008).
- *DiMatteo, M.R., S.C. Morton, H.S. Lepper, T.M. Damush, M.F. Carney, M. Pearson, and K.L. Kahn. 1996. Cesarean Childbirth and Psychosocial Outcomes: A Meta-Analysis. *Health Psychology* 15(4):303–14. doi:10.1037/0278-6133.15.4.303. Available at <http://dx.doi.org/10.1037/0278-6133.15.4.303> (accessed January 31, 2008).
- Dixon-Woods, M., S.J. Williams, C.J. Jackson, A. Akkad, S. Kenyon, and M. Habiba. 2006. Why Do Women Consent to Surgery, Even When They Do Not Want To? An Interactionist and Bourdieusian Analysis. *Social Science & Medicine* 62(11):2742–53. doi:10.1016/j.socscimed.2005.11.006. Available at <http://dx.doi.org/10.1016/j.socscimed.2005.11.006> (accessed January 31, 2008).
- *Dodd, J.M., V. Flenady, R. Cincotta, and C.A. Crowther. 2006. Prenatal Administration of Progesterone for Preventing Preterm Birth. *Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD004947. doi:10.1002/14651858.CD004947.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD004947.pub2> (accessed January 31, 2008).
- *Dudley, N.J. 2004. A Systematic Review of the Ultrasound Estimation of Fetal Weight. *Ultrasound in Obstetrics and Gynecology* 25(1):80–89. doi:10.1002/uog.1751. Available at <http://dx.doi.org/10.1002/uog.1751> (accessed January 31, 2008).
- *Dyson, L., F. McCormick, and M.J. Renfrew. 2005. Interventions for Promoting the Initiation of Breastfeeding. *Cochrane Database of Systematic Reviews*, Issue 2. Art. No.: CD001688. doi:10.1002/14651858.CD001688.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD001688.pub2> (accessed January 31, 2008).
- Eden, J., B. Wheatley, B. McNeil, H. Sox, Committee on Reviewing Evidence to Identify Highly Effective Clinical Services, Board on Health Care Services (HCS), and Institute of Medicine. 2008. *Knowing What Works in Health Care: A Roadmap for the Nation*. Washington, DC: National Academies Press. Available at http://www.nap.edu/catalog.php?record_id=12038 (accessed June 26, 2008).
- Engle, W.A. 2006. A Recommendation for the Definition of “Late Preterm” (Near-Term) and the Birth Weight–Gestational Age Classification System. *Seminars in Perinatology* 30(1):2–7. doi:10.1053/j.semperi.2006.01.007. Available at <http://dx.doi.org/10.1053/j.semperi.2006.01.007> (accessed January 31, 2008).

Enkin, M., M.J.N.C. Keirse, and I. Chalmers. 1989. *A Guide to Effective Care in Pregnancy and Childbirth*. Oxford: Oxford University Press.

Enkin, M., M.J.N.C. Keirse, J. Neilson, C. Crowther, L. Duley, E. Hodnett, and J. Hofmeyr. 2000. *A Guide to Effective Care in Pregnancy and Childbirth*, 3rd ed. Oxford: Oxford University Press. Available at <http://www.childbirthconnection.org/article.asp?ClickedLink=194&ck=10218&area=2> (accessed January 31, 2008).

*Fairbank, L., S. O'Meara, M.J. Renfrew, M. Woolridge, A.J. Sowden, and D. Lister-Sharp. 2000. A Systematic Review to Evaluate the Effectiveness of Interventions to Promote the Initiation of Breastfeeding. *Health Technology Assessment* 4(25):1-171. Available at <http://www.nchta.org/execsumm/summ425.shtml> (accessed January 31, 2008).

Felix, J.F., R.P.M. Steegers-Theunissen, H.E.K. de Walle, A. de Klein, C.P. Torfs, and D. Tibboel. 2007. Esophageal Atresia and Tracheoesophageal Fistula in Children of Women Exposed to Diethylstilbestrol in Utero. *American Journal of Obstetrics & Gynecology* 197(1):38.e1-38.e5. Available at <http://download.journals.elsevierhealth.com/pdfs/journals/0002-9378/PIIS0002937807002736.pdf> (accessed January 31, 2008).

Fisher, E.S., D.E. Wennberg, T.A. Stukel, D.J. Gottlieb, F.L. Lucas, and É.L. Pinder. 2003a. The Implications of Regional Variations in Medicare Spending. Part 1: The Content, Quality, and Accessibility of Care. *Annals of Internal Medicine* 138(4):273-87. Available at <http://www.annals.org/content/vol138/issue4/> (accessed February 8, 2008).

Fisher, E.S., D.E. Wennberg, T.A. Stukel, D.J. Gottlieb, F.L. Lucas, and É.L. Pinder. 2003b. The Implications of Regional Variations in Medicare Spending. Part 2: Health Outcomes and Satisfaction with Care. *Annals of Internal Medicine* 138(4):288-98. Available at <http://www.annals.org/content/vol138/issue4/> (accessed February 8, 2008).

Forster, A.J., I. Fung, S. Caughey, L. Oppenheimer, C. Beach, K.G. Shojania, and C. van Walraven. 2006. Adverse Events Detected by Clinical Surveillance on an Obstetric Service. *Obstetrics & Gynecology* 108(5):1073-83. Available at <http://www.greenjournal.org/content/vol108/issue5/> (accessed February 8, 2008).

Forster, D.A., and H.L. McLachlan. 2007. Breastfeeding Initiation and Birth Setting Practices: A Review of the Literature. *Journal of Midwifery & Women's Health* 52(3):273-80. doi:10.1016/j.jmwh.2006.12.016. Available at <http://dx.doi.org/10.1016/j.jmwh.2006.12.016> (accessed February 8, 2008).

Freed, G.L., S.J. Clark, J. Sorenson, J.A. Lohr, R. Cefalo, and P. Curtis. 1995. National Assessment of Physicians' Breast-Feeding Knowledge, Attitudes, Training, and Experience. *JAMA* 273(6):472–76. doi:10.1001/jama.273.6.472. Available at <http://dx.doi.org/10.1001/jama.273.6.472> (accessed February 8, 2008).

Fuchs, K., and R. Wapner. 2006. Elective Cesarean Section and Induction and Their Impact on Late Preterm Births. *Clinics in Perinatology* 33(4):793–801. doi:10.1016/j.clp.2006.09.010. Available at <http://dx.doi.org/10.1016/j.clp.2006.09.010> (accessed February 8, 2008).

Gawande, A. 2006. The Score: How Childbirth Went Industrial. *The New Yorker* 82(32):59ff. Available at http://www.newyorker.com/archive/2006/10/09/061009fa_fact (accessed February 8, 2008).

Cetahun, D., Y. Oyelese, H.M. Salihu, and C.V. Ananth. 2006. Previous Cesarean Delivery and Risks of Placenta Previa and Placental Abruption. *Obstetrics & Gynecology* 107(4):771–78. Available at <http://www.greenjournal.org/content/vol107/issue4/> (accessed February 8, 2008).

Ginsburg, P.B., and J.M. Grossman. 2005. When the Price Isn't Right: How Inadvertent Payment Incentives Drive Medical Care. *Health Affairs* (web exclusive). Available at <http://content.healthaffairs.org/webexclusives/index.dtl?year=2005> (accessed February 8, 2008).

Glantz, J.C. 2003. Labor Induction Rate Variation in Upstate New York: What Is the Difference? *Birth* 30(3):168–74. doi:10.1046/j.1523-536X.2003.00241.x. Available at <http://dx.doi.org/10.1046/j.1523-536X.2003.00241.x> (accessed February 8, 2008).

Glasgow, T.S., P.C. Young, J. Wallin, C. Kwok, G. Stoddard, S. Firth, M. Samore, and C.L. Byington. 2005. Association of Intrapartum Antibiotic Exposure and Late-Onset Serious Bacterial Infections in Infants. *Pediatrics* 116(3):696–702. doi:10.1542/peds.2004-2421. Available at <http://dx.doi.org/10.1542/peds.2004-2421> (accessed February 11, 2008).

Gluckman, P., and M. Hanson, eds. 2006. *Developmental Origins of Health and Disease*. Cambridge: Cambridge University Press. Available at <http://www.cambridge.org/catalogue/catalogue.asp?isbn=9780521847438> (accessed February 25, 2008).

Gluckman, P.D., M.A. Hanson, S.M.B. Morton, and C.S. Pinal. 2005. Life-Long Echoes—A Critical Analysis of the Developmental Origins of Adult Disease Model. *Biology of the Neonate* 87(2):127–39. doi:10.1159/000082311. Available at <http://dx.doi.org/10.1159/000082311> (accessed February 11, 2008).

- *Goh, Y.I., E. Bollano, T.R. Einarson, and G. Koren. 2006. Prenatal Multivitamin Supplementation and Rates of Congenital Anomalies: A Meta-Analysis. *Journal of Obstetrics and Gynaecology Canada* 28(August):680–89. Available at http://www.sogc.org/jogc/backIssue_e.aspx?id=31 (accessed February 11, 2008).
- Goodman, D., W. Sappenfield, and D. Thompson. 2007. Preterm Birth and Intrapartum Intervention in Florida: What Is the Connection? March of Dimes Florida Chapter Preterm Birth Summit. Tampa: University of South Florida College of Public Health, November 17.
- Goodman, S. 2007. Piercing the Veil: The Marginalization of Midwives in the United States. *Social Science & Medicine* 65(3):610–21. Available at <http://dx.doi.org/10.1016/j.socscimed.2007.03.052> (accessed February 11, 2008).
- *Gourounti, K., and J. Sandall. 2007. Admission Cardiotocography versus Intermittent Auscultation of Fetal Heart Rate: Effects on Neonatal Apgar Score, on the Rate of Caesarean Sections and on the Rate of Instrumental Delivery—A Systematic Review. *International Journal of Nursing Studies* 44(6):1029–35. doi:10.1016/j.ijnurstu.2006.06.002. Available at <http://dx.doi.org/10.1016/j.ijnurstu.2006.06.002> (accessed February 11, 2008).
- Graham, I.D. 1997. *Episiotomy: Challenging Obstetric Interventions*. Oxford: Blackwell Science. Available at <http://www.amazon.com/Episiotomy-Challenging-Interventions-Ian-Graham/dp/0632041455> (accessed February 19, 2008).
- Graham, I.D., J. Logan, B. Davies, and C. Nimrod. 2004. Changing the Use of Electronic Fetal Monitoring and Labor Support: A Case Study of Barriers and Facilitators. *Birth* 31(4):293–301. doi:10.1111/j.0730-7659.2004.00322.x. Available at <http://dx.doi.org/10.1111/j.0730-7659.2004.00322.x> (accessed February 11, 2008).
- Grandjean, P., and P.J. Landrigan. 2006. Developmental Neurotoxicity of Industrial Chemicals. *The Lancet* 368(9553):2167–78. doi:10.1016/S0140-6736(06)69665-7. Available at [http://dx.doi.org/10.1016/S0140-6736\(06\)69665-7](http://dx.doi.org/10.1016/S0140-6736(06)69665-7) (accessed February 11, 2008).
- Grobman, W.A. 2007. Elective Induction: When? Ever? *Clinical Obstetrics and Gynecology* 50(2):537–46. doi:10.1097/GRF.0b013e31804bdec4. Available at <http://dx.doi.org/10.1097/GRF.0b013e31804bdec4> (accessed February 11, 2008).

Grolund, M.-M., O.-P. Lehtonen, E. Eerola, and P. Kero. 1999. Fecal Microflora in Healthy Infants Born by Different Methods of Delivery: Permanent Changes in Intestinal Flora after Cesarean Delivery. *Journal of Pediatric Gastroenterology and Nutrition* 28(1):19–25. doi:10.1097/00005176-199901000-00007. Available at <http://dx.doi.org/10.1097/00005176-199901000-00007> (accessed February 11, 2008).

*Guise J.-M., M. Berlin, M. McDonagh, P. Osterweil, B. Chan, and M. Helfand. 2004. Safety of Vaginal Birth after Cesarean: A Systematic Review. *Obstetrics & Gynecology* 103(3):420–29. Available at <http://www.greenjournal.org/content/vol103/issue3/> (accessed February 11, 2008).

*Guise J.-M., M.S. McDonagh, P. Osterweil, P. Nygren, B.K.S. Chan, and M. Helfand. 2004. Systematic Review of the Incidence and Consequences of Uterine Rupture in Women with Previous Caesarean Section. *BMJ* 329(7456):19–25. doi:10.1136/bmj.329.7456.19. Available at <http://dx.doi.org/10.1136/bmj.329.7456.19> (accessed February 11, 2008).

*Guise, J.-M., V. Palda, C. Westhoff, B.K.S. Chan, M. Helfand, and T.A. Lieu. 2003. The Effectiveness of Primary Care-Based Interventions to Promote Breastfeeding: Systematic Evidence Review and Meta-Analysis for the US Preventive Services Task Force. *Annals of Family Medicine* 1(2):70–78. doi:10.1370/afm.56. Available at <http://dx.doi.org/10.1370/afm.56> (accessed February 11, 2008).

*Gupta, J.K., G.J. Hofmeyr, and R. Smyth. 2004. Position in the Second Stage of Labour for Women without Epidural Anaesthesia. *Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD002006. doi:10.1002/14651858.CD002006.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD002006.pub2> (accessed February 11, 2008).

Hamilton, B.E., J.A. Martin, and S.J. Ventura. 2007. Births: Preliminary Data for 2006. *National Vital Statistics Reports* 56(7). Hyattsville, MD: National Center for Health Statistics. Available at http://www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56_07.pdf (accessed February 11, 2008).

*Hansen, A.K., K. Wisborg, N. Uldbjerg, and T.B. Henriksen. 2007. Elective Caesarean Section and Respiratory Morbidity in the Term and Near-Term Neonate. *Acta Obstetrica et Gynecologica Scandinavica* 86(4):389–94. doi:10.1080/00016340601159256. Available at <http://dx.doi.org/10.1080/00016340601159256> (accessed February 11, 2008).

*Hartmann, K., M. Viswanathan, R. Palmieri, G. Gartlehner, J. Thorp, and K.N. Lohr. 2005. Outcomes of Routine Episiotomy: A Systematic Review. *JAMA* 293(17):2141–48. doi:10.1001/jama.293.17.2141. Available at <http://dx.doi.org/10.1001/jama.293.17.2141> (accessed February 11, 2008).

*Hatem, M., J. Sandall, D. Devane, H. Soltani, and S. Gates. In press. Midwife-Led Versus Other Models of Care for Childbearing Women. *Cochrane Database of Systematic Reviews*.

Heindel, J.J. 2006. Role of Exposure to Environmental Chemicals in the Developmental Basis of Reproductive Disease and Dysfunction. *Seminars in Reproductive Medicine* 24(3):168–77. Available at <http://www.thieme-connect.com/ejournals/toc/srm/5313> (accessed February 11, 2008).

*Henderson, J., R. McCandlish, L. Kumiega, and S. Petrou. 2001. Systematic Review of Economic Aspects of Alternative Modes of Delivery. *British Journal of Obstetrics and Gynaecology* 108(2):149–57. doi:10.1016/S0306-5456(00)00044-9. Available at [http://dx.doi.org/10.1016/S0306-5456\(00\)00044-9](http://dx.doi.org/10.1016/S0306-5456(00)00044-9) (accessed February 11, 2008).

Hill, K., K. Thomas, C. AbouZahr, N. Walker, L. Say, M. Inoue, and E. Suzuki, on behalf of the Maternal Mortality Working Group. 2007. Estimates of Maternal Mortality Worldwide between 1990 and 2005: An Assessment of Available Data. *The Lancet* 370(9595):1311–19. doi:10.1016/S0140-6736(07)61572-4. Available at [http://dx.doi.org/10.1016/S0140-6736\(07\)61572-4](http://dx.doi.org/10.1016/S0140-6736(07)61572-4) (accessed February 11, 2008).

Hing, E.S. 2007. Personal communication, January 9.

*Hodnett, E.D. 2002. Pain and Women’s Satisfaction with the Experience of Childbirth: A Systematic Review. *American Journal of Obstetrics & Gynecology* 186(5, suppl. 1):S160–72. doi: 10.1016/S0002-9378(02)70189-0. Available at [http://dx.doi.org/10.1016/S0002-9378\(02\)70189-0](http://dx.doi.org/10.1016/S0002-9378(02)70189-0) (accessed February 11, 2008).

*Hodnett, E.D, S. Gates, G.J. Hofmeyr, and C. Sakala. 2007. Continuous Support for Women during Childbirth. *Cochrane Database of Systematic Reviews*, Issue 3. Art. No.: CD003766. doi: 10.1002/14651858.CD003766.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD003766.pub2> (accessed February 11, 2008).

Hoerst, B.J., and J. Fairman. 2000. Social and Professional Influences of the Technology of Electronic Fetal Monitoring on Obstetrical Nursing. *Western Journal of Nursing Research* 22(4):475–91. doi:10.1177/01939450022044539. Available at <http://dx.doi.org/10.1177/01939450022044539> (accessed February 11, 2008).

*Hofmeyr, G.J., and M.E. Hannah. 2003. Planned Caesarean Section for Term Breech Delivery. *Cochrane Database of Systematic Reviews*, Issue 2. Art. No.: CD000166. doi:10.1002/14651858.CD000166. Available at <http://dx.doi.org/10.1002/14651858.CD000166> (accessed February 12, 2008).

- *Hofmeyr, G.J., and R. Kulier. 1996. External Cephalic Version for Breech Presentation at Term. *Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD000083. doi:10.1002/14651858.CD000083. Available at <http://dx.doi.org/10.1002/14651858.CD000083> (accessed February 12, 2008).
- *Hogle, K.L., E.K. Hutton, K.A. McBrien, J.F.R. Barrett, and M.E. Hannah. 2003. Cesarean Delivery for Twins: A Systematic Review and Meta-Analysis. *American Journal of Obstetrics & Gynecology* 188(1):220–27. doi:10.1067/mob.2003.64. Available at <http://dx.doi.org/10.1067/mob.2003.64> (accessed February 12, 2008).
- *Horta, B.L., R. Bahl, J.C. Martines, and C.G. Victora. 2007. *Evidence on the Long-Term Effects of Breastfeeding: Systematic Reviews and Meta-Analyses*. Geneva: World Health Organization. Available at http://whqlibdoc.who.int/publications/2007/9789241595230_eng.pdf (accessed February 12, 2008).
- Hoyert, D.L. 2007. Maternal Mortality and Related Concepts. National Center for Health Statistics. *Vital and Health Statistics* 3(33). Available at http://www.cdc.gov/nchs/data/series/sr_03/sr03_033.pdf (accessed February 12, 2008).
- *Hunter, S., G.J. Hofmeyr, and R. Kulier. 2007. Hands and Knees Posture in Late Pregnancy or Labour for Fetal Malposition (Lateral or Posterior). *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001063. doi:10.1002/14651858.CD001063.pub3. Available at <http://dx.doi.org/10.1002/14651858.CD001063.pub3> (accessed February 12, 2008).
- *Huntley, A.L., J.T. Coon, and E. Ernst. 2004. Complementary and Alternative Medicine for Labor Pain: A Systematic Review. *American Journal of Obstetrics & Gynecology* 191(1):36–44. doi:10.1016/j.ajog.2003.12.008. Available at <http://dx.doi.org/10.1016/j.ajog.2003.12.008> (accessed February 12, 2008).
- *Hutton, E.K., and E.S. Hassan. 2007. Late vs Early Clamping of the Umbilical Cord in Full-Term Neonates: Systematic Review and Meta-Analysis of Controlled Trials. *JAMA* 297(11):1241–52. doi:10.1001/jama.297.11.1241. Available at <http://dx.doi.org/10.1001/jama.297.11.1241> (accessed February 11, 2008).
- Ibarreta, D., and S.H. Swan. 2001. The DES Story: Long-Term Consequences of Prenatal Exposure. In *Late Lessons from Early Warnings: The Precautionary Principle 1869–2000*, edited by P. Harremoës, D. Gee, M. MacGarvin, A. Stirling, J. Keys, B. Wynne, and S.G. Vaz, 84–92. Copenhagen: European Environment Agency. Available at: http://reports.eea.europa.eu/environmental_issue_report_2001_22/en (accessed February 12, 2008).

- Ickovics, J.R., T.S. Kershaw, C. Westdahl, U. Magriples, Z. Massey, H. Reynolds, and S.S. Rising. 2007. Group Prenatal Care and Perinatal Outcomes: A Randomized Controlled Trial. *Obstetrics & Gynecology* 110(2):330–39. Available at <http://www.greenjournal.org/content/vol110/issue2/> (accessed February 12, 2008).
- Ioannidis, J.P.A., S.J.W. Evans, P.C. Gøtzsche, R.T. O’Neill, D.G. Altman, K. Schulz, and D. Moher for the CONSORT Group. 2004. Better Reporting of Harms in Randomized Trials: An Extension of the CONSORT Statement. *Annals of Internal Medicine* 141(10):781–88. Available at <http://www.annals.org/content/vol141/issue10/> (accessed February 12, 2008).
- *Ip, S., M. Chung, G. Raman, P. Chew, N. Magula, D. DeVine, T. Trikalinos, and J. Lau. 2007. *Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries*. Evidence Report/Technology Assessment No. 153. (Prepared by Tufts–New England Medical Center Evidence-Based Practice Center, under Contract No. 290-02-0022). AHRQ Publication No. 07-E007. Rockville, MD: Agency for Healthcare Research and Quality. Available at <http://www.ahrq.gov/downloads/pub/evidence/pdf/brfout/brfout.pdf> (accessed February 12, 2008).
- Jackson, D.J., J.M. Lang, J. Ecker, W.H. Swartz, and T. Heeren. 2003. Impact of Collaborative Management and Early Admission in Labor on Method of Delivery. *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 32(2):147–57. doi:10.1177/0884217503252045. Available at <http://dx.doi.org/10.1177/0884217503252045> (accessed February 12, 2008).
- Jacobson, B., and M. Bygdeman. 1998. Obstetric Care and Proneness of Offspring to Suicide as Adults: Case-Control Study. *BMJ* 317(7169):1346–49. Available at <http://www.bmj.com/content/vol317/issue7169/index.dtl> (accessed February 12, 2008).
- Jacobson, B., K. Nyberg, L. Grönbladh, G. Eklund, M. Bygdeman, and U. Rydberg. 1990. Opiate Addiction in Adult Offspring through Possible Imprinting after Obstetric Treatment. *BMJ* 301(6760):1067–70. Available at <http://www.pubmedcentral.nih.gov/tocrender.fcgi?iid=137475> (accessed February 12, 2008).
- Jadad, A.R., and M.W. Enkin. 2007. *Randomized Controlled Trials: Questions, Answers and Musings*, 2nd ed. Malden, MA: Blackwell Publishing. Available at <http://www.blackwellpublishing.com/book.asp?ref=9781405132664> (accessed February 19, 2008).
- Jain, L., and D.C. Eaton. 2006. Physiology of Fetal Lung Fluid Clearance and the Effect of Labor. *Seminars in Perinatology* 30(1):34–43. doi:10.1053/j.semperi.2006.01.006. Available at <http://dx.doi.org/10.1053/j.semperi.2006.01.006> (accessed February 12, 2008).

Johns, J., E. Jauniaux, and G. Burton. 2006. Factors Affecting the Early Embryonic Environment. *Reviews in Gynaecological and Perinatal Practice* 6(3-4):199-210. doi:10.1016/j.rigapp.2006.05.004. Available at <http://dx.doi.org/10.1016/j.rigapp.2006.05.004> (accessed February 12, 2008).

Johnson, K.C., and B.-A. Daviss. 2005. Outcomes of Planned Home Births with Certified Professional Midwives: Large Prospective Study in North America. *BMJ* 330(7505):1416. doi:10.1136/bmj.330.7505.1416. Available at <http://dx.doi.org/10.1136/bmj.330.7505.1416> (accessed February 12, 2008).

Kaufman, K.E., J.L. Bailit, and W. Grobman. 2002. Elective Induction: An Analysis of Economic and Health Consequences. *American Journal of Obstetrics & Gynecology* 187(4):858-63. doi:10.1067/mob.2002.127147. Available at <http://dx.doi.org/10.1067/mob.2002.127147> (accessed February 19, 2008).

Kaufman, M., and C. Lee. 2007. HHS Toned Down Breast-Feeding Ads. *Washington Post* August 31. Available at <http://www.washingtonpost.com/wp-dyn/content/article/2007/08/30/AR2007083002198.html> (accessed February 19, 2008).

Kennare, R., G. Tucker, A. Heard, and A. Chan. 2007. Risks of Adverse Outcomes in the Next Birth after a First Cesarean Delivery. *Obstetrics & Gynecology* 109(2):270-76. Available at <http://www.greenjournal.org/content/voll09/issue2/> (accessed February 19, 2008).

Kennedy, H.P., and M.T. Shannon. 2004. Keeping Birth Normal: Research Findings on Midwifery Care during Childbirth. *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 33(5):554-60. doi:10.1177/0884217504268971. Available at <http://dx.doi.org/10.1177/0884217504268971> (accessed February 19, 2008).

*Khan-Neelofur, D., M. Gülmezoglu, and J. Villar. 1998. Who Should Provide Routine Antenatal Care for Low-Risk Women, and How Often? A Systematic Review of Randomised Controlled Trials. *Paediatric and Perinatal Epidemiology* 12(suppl. 2):7-26. doi:10.1046/j.1365-3016.12.s2.6.x. Available at <http://dx.doi.org/10.1046/j.1365-3016.12.s2.6.x> (accessed February 19, 2008).

*Kingdon, C., L. Baker, and T. Lavender. 2006. Systematic Review of Nulliparous Women's Views of Planned Cesarean Birth: The Missing Component in the Debate about a Term Cephalic Trial. *Birth* 33(3):229-37. doi:10.1111/j.1523-536X.2006.00108.x. Available at <http://dx.doi.org/10.1111/j.1523-536X.2006.00108.x> (accessed February 19, 2008).

Kinney, H.C. 2006. The Near-Term (Late Preterm) Human Brain and Risk for Periventricular Leukomalacia: A Review. *Seminars in Perinatology* 30(2):81–88. doi:10.1053/j.semperi.2006.02.006. Available at <http://dx.doi.org/10.1053/j.semperi.2006.02.006> (accessed February 19, 2008).

Klein, M. 1993. The Effectiveness of Family Practice Maternity Care: A Cross-Cultural and Environmental View. *Primary Care* 20(3):523–36. Abstract available at <http://www.ncbi.nlm.nih.gov/pubmed/8378449> (accessed February 19, 2008).

*Klein, M.C. 2006. Does Epidural Analgesia Increase Rate of Cesarean Section? *Canadian Family Physician* 52(4):419–21. Available at <http://www.cfpc.ca/cfp/2006/Apr/vol52-apr-editorials-2.asp> (accessed February 19, 2008).

Klein, M.C., A. Kelly, J. Kaczorowski, and S. Grzybowski. 2004. The Effect of Family Physician Timing of Maternal Admission on Procedures in Labour and Maternal and Infant Morbidity. *Journal of Obstetrics and Gynaecology Canada* 26(7):641–45. Abstract available at <http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&uid=15248933&cmd=showdetailview&indexed=google> (accessed February 19, 2008).

Kohn, L.T., J.M. Corrigan, M.S. Donaldson, Committee on Quality of Health Care in America, and Institute of Medicine. 2000. *To Err Is Human: Building a Safer Health System*. Washington, DC: National Academy Press. Available at http://www.nap.edu/catalog.php?record_id=9728 (accessed February 12, 2008).

Kolas, T., O.D. Saugstad, A.K. Daltveit, S.T. Nilsen, and P. Oian. 2006. Planned Cesarean versus Planned Vaginal Delivery at Term: Comparison of Newborn Infant Outcomes. *American Journal of Obstetrics & Gynecology* 195(6):1538–43. doi:10.1016/j.ajog.2006.05.005. Available at <http://dx.doi.org/10.1016/j.ajog.2006.05.005> (accessed February 19, 2008).

*Kotaska, A.J., M.C. Klein, and R.M. Liston. 2006. Epidural Analgesia Associated with Low-Dose Oxytocin Augmentation Increases Cesarean Births: A Critical Look at the External Validity of Randomized Trials. *American Journal of Obstetrics & Gynecology* 194(3):809–14. doi:10.1016/j.ajog.2005.09.014. Available at <http://dx.doi.org/10.1016/j.ajog.2005.09.014> (accessed February 19, 2008).

Kozak, L.J., C.J. DeFrances, and M.J. Hall. 2006. National Hospital Discharge Survey: 2004 Annual Summary with Detailed Diagnosis and Procedure Data. National Center for Health Statistics. *Vital and Health Statistics* 13(162). Available at http://www.cdc.gov/nchs/data/series/sr_13/sr13_162.pdf (accessed February 19, 2008).

*Kramer, M.S., and R. Kakuma. 2004. The Optimal Duration of Exclusive Breastfeeding: A Systematic Review. *Advances in Experimental Medicine and Biology* 554:63–77. Abstract available at <http://www.ncbi.nlm.nih.gov/pubmed/15384567> (accessed February 19, 2008).

*Kronberg, J.E., and D.E.A. Thompson. 2005. Is Nitrous Oxide an Effective Analgesic for Labor? A Qualitative Systematic Review. In *Evidence-Based Obstetric Anesthesia*, edited by S.H. Halpern and M.J. Douglas, 38–55. Malden, MA: Blackwell Publishing. doi:10.1002/9780470988343.ch5. Available at <http://dx.doi.org/10.1002/9780470988343.ch5> (accessed February 19, 2008).

Labbok, M.H. 2001. Effects of Breastfeeding on the Mother. *Pediatric Clinics of North America* 48(1):143–58. doi:10.1016/S0031-3955(05)70290-X. Available at [http://dx.doi.org/10.1016/S0031-3955\(05\)70290-X](http://dx.doi.org/10.1016/S0031-3955(05)70290-X) (accessed February 19, 2008).

Labbok, M.H., D. Clark, and A.S. Goldman. 2004. Breastfeeding: Maintaining an Irreplaceable Immunological Resource. *Nature Reviews: Immunology* 4(7):565–72. doi:10.1038/nri1393. Available at <http://dx.doi.org/10.1038/nri1393> (accessed February 19, 2008).

Landon, M.B., J.C. Hauth, K.J. Leveno, C.Y. Spong, S. Leindecker, M.W. Varner, A.H. Moawad et al. for the National Institute of Child Health and Human Development Maternal–Fetal Medicine Units Network. 2004. Maternal and Perinatal Outcomes Associated with a Trial of Labor after Prior Cesarean Delivery. *The New England Journal of Medicine* 351(25):2581–89. Available at <http://content.nejm.org/cgi/content/full/351/25/2581> (accessed August 13, 2008).

Landon, M.B., C.Y. Spong, E. Thom, J.C. Hauth, S.L. Bloom, M.W. Varner, A.H. Moawad, et al. for the National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. 2006. Risk of Uterine Rupture with a Trial of Labor in Women with Multiple and Single Prior Cesarean Delivery. *Obstetrics & Gynecology* 108(1):12–20. Available at <http://www.greenjournal.org/content/vol108/issue1/> (accessed June 27, 2008).

Lauver, D., K.K. Nelles, and K. Hanson. 2005. The Health Effects of Diethylstilbestrol Revisited. *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 34(4):494–99. doi:10.1177/0884217505278293. Available at <http://dx.doi.org/10.1177/0884217505278293> (accessed February 19, 2008).

Lavin Jr., J.P., J. Eaton, and M. Hopkins. 2000. Teaching Vaginal Breech Delivery and External Cephalic Version: A Survey of Faculty Attitudes. *The Journal of Reproductive Medicine* 45(10):808–12. Available at http://www.reproductivemedicine.com/toc/auto_toc.php?month=October&year=2000 (accessed February 19, 2008).

*Law, M., and J.L. Tang. 1995. An Analysis of the Effectiveness of Interventions Intended to Help People Stop Smoking. *Archives of Internal Medicine* 155(18):1933–41. doi:10.1001/archinte.155.18.1933. Available at <http://dx.doi.org/10.1001/archinte.155.18.1933> (accessed February 19, 2008).

*Lee, H., and E. Ernst. 2004. Acupuncture for Labor Pain Management: A Systematic Review. *American Journal of Obstetrics & Gynecology* 191(5):1573–79. doi:10.1016/j.ajog.2004.05.027. Available at <http://dx.doi.org/10.1016/j.ajog.2004.05.027> (accessed February 19, 2008).

*Leighton, B.L., and S.H. Halpern. 2002. The Effects of Epidural Analgesia on Labor, Maternal, and Neonatal Outcomes: A Systematic Review. *American Journal of Obstetrics & Gynecology* 186(5):S69–S77. Available at [http://www.ajog.org/article/S0002-9378\(02\)70182-8/abstract](http://www.ajog.org/article/S0002-9378(02)70182-8/abstract) (accessed February 19, 2008).

Lewis, R.M., K.R. Poore, and K.M. Godfrey. 2006. The Role of the Placenta in the Developmental Origins of Health and Disease: Implications for Practice. *Reviews in Gynaecological and Perinatal Practice* 6(1–2):70–79. doi:10.1016/j.rigapp.2005.12.001. Available at <http://dx.doi.org/10.1016/j.rigapp.2005.12.001> (accessed February 19, 2008).

Liao, J.B., C.S. Buhimschi, and E.R. Norwitz. 2005. Normal Labor: Mechanism and Duration. *Obstetrics and Gynecology Clinics of North America* 32(2):145–64. doi:10.1016/j.ogc.2005.01.001. Available at <http://dx.doi.org/10.1016/j.ogc.2005.01.001> (accessed February 19, 2008).

*Lieberman, E., and C. O’Donoghue. 2002. Unintended Effects of Epidural Analgesia during Labor: A Systematic Review. *American Journal of Obstetrics & Gynecology* 186(5):S31–S68. Available at [http://www.ajog.org/article/S0002-9378\(02\)70181-6/abstract](http://www.ajog.org/article/S0002-9378(02)70181-6/abstract) (accessed February 19, 2008).

Liu, S., R.M. Liston, K.S. Joseph, M. Heaman, R. Sauve, and M.S. Kramer, for the Maternal Health Study Group of the Canadian Perinatal Surveillance System. 2007. Maternal Mortality and Severe Morbidity Associated with Low-Risk Planned Cesarean Delivery versus Planned Vaginal Delivery at Term. *CMAJ* 176(4):455–60. doi:10.1503/cmaj.060870. Available at <http://dx.doi.org/10.1503/cmaj.060870> (accessed February 19, 2008).

Lockwood, C.J. 2004. Editorial: Why the CD Rate Is on the Rise (Part 1). *Contemporary Ob/Gyn* 49:8. Available at <http://www.modernmedicine.com/modernmedicine/article/articleDetail.jsp?id=127145> (accessed February 20, 2008).

Lowe, N.K. 1989. Explaining the Pain of Active Labor: The Importance of Maternal Confidence. *Research in Nursing & Health* 12(4):237–45. doi:10.1002/nur.4770120406. Available at <http://dx.doi.org/10.1002/nur.4770120406> (accessed February 20, 2008).

- *Lumley, J., M.-P. Austin, and C. Mitchell. 2004. Intervening to Reduce Depression after Birth: A Systematic Review of the Randomized Trials. *International Journal of Technology Assessment in Health Care* 20(2):128–44. doi:10.1017/S0266462304000911. Available at <http://dx.doi.org/10.1017/S0266462304000911> (accessed February 20, 2008).
- *Lumley, J., S.S. Oliver, C. Chamberlain, and L. Oakley. 2004. Interventions for Promoting Smoking Cessation during Pregnancy. *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001055. doi:10.1002/14651858.CD001055.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD001055.pub2> (accessed February 20, 2008).
- Lydon-Rochelle, M.T., V.L. Holt, J.C. Nelson, V. Cárdenas, C. Gardella, T.R. Easterling, and W.M. Callaghan. 2005. Accuracy of Reporting Maternal In-Hospital Diagnoses and Intrapartum Procedures in Washington State Linked Birth Records. *Paediatric and Perinatal Epidemiology* 19(6):460–71. doi:10.1111/j.1365-3016.2005.00682.x. Available at <http://dx.doi.org/10.1111/j.1365-3016.2005.00682.x> (accessed February 20, 2008).
- Lyell, D.J., A.B. Caughey, E. Hu, and K. Daniels. 2005. Peritoneal Closure at Primary Cesarean Delivery and Adhesions. *Obstetrics & Gynecology* 106(2):275–80. Available at <http://www.greenjournal.org/content/vol106/issue2/> (accessed February 20, 2008).
- Lynn, J., B.M. Straube, K.M. Bell, S.F. Jencks, and R.T. Kambic. 2007. Using Population Segmentation to Provide Better Health Care for All: The “Bridges to Health” Model. *The Milbank Quarterly* 85(2):185–208. doi:10.1111/j.1468-0009.2007.00483.x. Available at <http://dx.doi.org/10.1111/j.1468-0009.2007.00483.x> (accessed February 20, 2008).
- MacDorman, M.F., E. Declercq, F. Menacker, and M.H. Malloy. 2008. Neonatal Mortality for Primary Cesarean and Vaginal Births to Low-Risk Women: Application of an “Intention-to-Treat” Model. *Birth* 35(1):3–8. doi:10.1111/j.1523-536X.2007.00205.x. Available at <http://dx.doi.org/10.1111/j.1523-536X.2007.00205.x> (accessed June 2, 2008).
- MacDorman, M.F., and G.K. Singh. 1998. Midwifery Care, Social and Medical Risk Factors, and Birth Outcomes in the USA. *Journal of Epidemiology and Community Health* 52(5):310–17. Available at <http://jech.bmj.com/content/vol52/issue5/> (accessed February 20, 2008).
- Machlin, S.R., and F. Rohde. 2007. *Health Care Expenditures for Uncomplicated Pregnancies*. Research Findings No. 27. Rockville, MD: Agency for Healthcare Research and Quality. Available at http://www.meps.ahrq.gov/mepsweb/data_files/publications/rf27/rf27.pdf (accessed February 20, 2008).

- *Mackenzie, R., M. Walker, A. Armson, and M.E. Hannah. 2006. Progesterone for the Prevention of Preterm Birth among Women at Increased Risk: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *American Journal of Obstetrics & Gynecology* 194(5):1234–42. doi:10.1016/j.ajog.2005.06.049. Available at <http://dx.doi.org/10.1016/j.ajog.2005.06.049> (accessed February 20, 2008).
- *Mardirosoff, C., L. Dumont, M. Boulvain, and M.R. Tramer. 2002. Fetal Bradycardia due to Intrathecal Opioids for Labour Analgesia: A Systematic Review. *BJOG* 109(3):274–81. doi:10.1111/j.1471-0528.2002.01380.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.2002.01380.x> (accessed February 20, 2008).
- Martin, J.A., B.E. Hamilton, P.D. Sutton, S.J. Ventura, F. Menacker, and S. Kirmeyer. 2006. Births: Final Data for 2004. *National Vital Statistics Reports* 55(1). Hyattsville, MD: National Center for Health Statistics. Available at http://www.cdc.gov/nchs/data/nvsr/nvsr55/nvsr55_01.pdf (accessed February 20, 2008).
- Martin, J.A., B.E. Hamilton, P.D. Sutton, S.J. Ventura, F. Menacker, S. Kirmeyer, and M.L. Munson. 2007. Births: Final Data for 2005. *National Vital Statistics Reports* 56(6). Hyattsville, MD: National Center for Health Statistics. Available at http://www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56_06.pdf (accessed February 20, 2008).
- Massie, A.M. 2004. In Defense of the Professional Standard of Care: A Response to Carter Williams on “Evidence-Based Medicine.” *Washington and Lee Law Review* 61(1):535–52. Available at <http://law.wlu.edu/lawreview/page.asp?pageid=128> (accessed February 20, 2008).
- *Mayberry, L.J., D. Clemmens, and A. De. 2002. Epidural Analgesia Side Effects, Co-Interventions, and Care of Women during Childbirth: A Systematic Review. *American Journal of Obstetrics & Gynecology* 186(5):S81–S93. Available at [http://www.ajog.org/article/S0002-9378\(02\)70184-1/abstract?issue_key=S0002-9378%2805%29X7121-6&issue_preview=no&search_preview=no&select2=no&select2=no&start=&startPage=](http://www.ajog.org/article/S0002-9378(02)70184-1/abstract?issue_key=S0002-9378%2805%29X7121-6&issue_preview=no&search_preview=no&select2=no&select2=no&start=&startPage=) (accessed February 21, 2008).
- McCourt, C., J. Weaver, H. Statham, S. Beake, J. Gamble, and D.K. Creedy. 2007. Elective Cesarean Section and Decision Making: A Critical Review of the Literature. *Birth* 34(1):65–79. doi:10.1111/j.1523-536X.2006.00147.x. Available at <http://dx.doi.org/10.1111/j.1523-536X.2006.00147.x> (accessed February 21, 2008).

- McIntosh, H.M., N.F. Woolacott, and A.-M. Bagnall. 2004. Assessing Harmful Effects in Systematic Reviews. *BMC Medical Research Methodology* 4:19. doi:10.1186/1471-2288-4-19. Available at <http://dx.doi.org/10.1186/1471-2288-4-19> (accessed February 21, 2008).
- McKinlay, J.B. 1981. From “Promising Report” to “Standard Procedure”: Seven Stages in the Career of a Medical Innovation. *The Milbank Memorial Fund Quarterly* 59(3):374–411. doi:10.2307/3349685. Available at <http://dx.doi.org/10.2307/3349685> (accessed February 21, 2008).
- Mercer, B.M., S. Gilbert, M.B. Landon, C.Y. Spong, K.J. Leveno, D.J. Rouse, M.W. Varner, et al. for the National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. 2008. Labor Outcomes with Increasing Number of Prior Vaginal Births after Cesarean Delivery. *Obstetrics & Gynecology* 111(2, part 1):285–91. Available at <http://www.greenjournal.org/content/vol111/issue2/> (accessed June 2, 2008).
- Merewood, A., S.D. Mehta, L.B. Chamberlain, B.L. Philipp, and H. Bauchner. 2005. Breastfeeding Rates in US Baby-Friendly Hospitals: Results of a National Survey. *Pediatrics* 116(3):628–34. doi:10.1542/peds.2004-1636. Available at <http://dx.doi.org/10.1542/peds.2004-1636> (accessed February 21, 2008).
- Miniño, A.M., M.P. Heron, S.L. Murphy, and K.D. Kochanek. 2007. *Deaths: Final Data for 2004. National Vital Statistics Reports* 55(19). Hyattsville, MD: National Center for Health Statistics. Available at http://www.cdc.gov/nchs/data/nvsr/nvsr55/nvsr55_19.pdf (accessed February 21, 2008).
- Moher, D., J. Tetzlaff, A.C. Tricco, M. Sampson, and D.G. Altman. 2007. Epidemiology and Reporting Characteristics of Systematic Reviews. *PLoS Medicine* 4(3):e78. doi:10.1371/journal.pmed.0040078. Available at <http://dx.doi.org/10.1371/journal.pmed.0040078> (accessed February 21, 2008).
- Mold, J.W., and H.F. Stein. 1986. The Cascade Effect in the Clinical Care of Patients. *The New England Journal of Medicine* 314(8):512–14.
- Molloy, E.J., A.J. O’Neill, J.J. Grantham, M. Sheridan-Pereira, J.M. Fitzpatrick, D.W. Webb, and R.W.G. Watson. 2004. Labor Promotes Neonatal Neutrophil Survival and Lipopolysaccharide Responsiveness. *Pediatric Research* 56(1):99–103. Available at <http://www.pedresearch.org/pt/re/pedresearch/fulltext.00006450-200407000-00017.htm;jsessionid=H91J4XqPvq1kft3SQvHd1SjGjrQ9v42ZnrzGMGGLFfGNj3c5Qn9Q!-1428189930!181195629!8091!-1> (accessed February 21, 2008).

*Moore, E.R., G.C. Anderson, and N. Bergman. 2007. Early Skin-to-Skin Contact for Mothers and Their Healthy Newborn Infants. *Cochrane Database of Systematic Reviews*, Issue 3. Art. No.: CD003519. doi:10.1002/14651858.CD003519.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD003519.pub2> (accessed February 21, 2008).

Morales, K.J., M.C. Gordon, and G.W. Bates Jr. 2007. Postcesarean Delivery Adhesions Associated with Delayed Delivery of Infant. *American Journal of Obstetrics & Gynecology* 196(5): 461.e1–461.e6. Available at [http://www.ajog.org/article/S0002-9378\(06\)02434-3/abstract](http://www.ajog.org/article/S0002-9378(06)02434-3/abstract) (accessed February 21, 2008).

Morrison, J.J., J.M. Rennie, and P.J. Milton. 1995. Neonatal Respiratory Morbidity and Mode of Delivery at Term: Influence of Timing of Elective Caesarean Section. *BJOG* 102(2):101–6. doi:10.1111/j.1471-0528.1995.tb09060.x. Available at <http://dx.doi.org/doi:10.1111/j.1471-0528.1995.tb09060.x> (accessed February 21, 2008).

Moynihan, R. 2004. *Evaluating Health Services: A Reporter Covers the Science of Research Synthesis*. New York: Milbank Memorial Fund. Available at <http://www.milbank.org/reports/2004Moynihan/040330Moynihan.html> (accessed February 21, 2008).

*Mozurkewich, E.L., and E.K. Hutton. 2000. Elective Repeat Cesarean Delivery versus Trial of Labor: A Meta-Analysis of the Literature from 1989 to 1999. *American Journal of Obstetrics & Gynecology* 183(5):1187–97. doi:10.1067/mob.2000.108890. Available at <http://dx.doi.org/10.1067/mob.2000.108890> (accessed February 21, 2008).

Myers, S.A., and N. Gleicher. 1988. A Successful Program to Lower Cesarean-Section Rates. *The New England Journal of Medicine* 319(23):1511–16. Abstract available at <http://content.nejm.org/cgi/content/abstract/319/23/1511> (accessed February 21, 2008).

*Nassar, N., C.L. Roberts, A. Barratt, J.C. Bell, E.C. Olive, and B. Peat. 2006. Systematic Review of Adverse Outcomes of External Cephalic Version and Persisting Breech Presentation at Term. *Paediatric and Perinatal Epidemiology* 20(2):163–71. doi:10.1111/j.1365-3016.2006.00702.x. Available at <http://dx.doi.org/10.1111/j.1365-3016.2006.00702.x> (accessed February 21, 2008).

National Association of Childbearing Centers. 2004. *NACC Survey Report of Birth Experience*. Perkiomenville, PA: NACC.

National Center for Health Statistics. 2006. 2003 Natality Data Set. SETS 2.0, Rev. 805. *Vital and Health Statistics*. CD-ROM Series 21, Number 17, May.

*National Collaborating Centre for Women's and Children's Health. 2008a. *Antenatal Care: Routine Care for the Healthy Pregnant Woman*, 2nd ed. London: RCOG Press. Available at <http://www.nice.org.uk/guidance/index.jsp?action=byID&o=11947> (accessed June 2, 2008).

*National Collaborating Centre for Women's and Children's Health. 2008b. *Induction of Labour*, 2nd ed. London: RCOG Press. Available at <http://www.nice.org.uk/Guidance/CG70/Guidance/pdf/English> (accessed August 7, 2008).

*National Collaborating Centre for Women's and Children's Health. 2004. *Caesarean Section* (Clinical Guideline 13). London: RCOG Press. Available at <http://www.nice.org.uk/nicemedia/pdf/CG013fullguideline.pdf> (accessed February 22, 2008).

Newbold, R.R. 2004. Lessons Learned from Perinatal Exposure to Diethylstilbestrol. *Toxicology and Applied Pharmacology* 199(2):142–50. doi:10.1016/j.taap.2003.11.033. Available at <http://dx.doi.org/10.1016/j.taap.2003.11.033> (accessed February 21, 2008).

Newbold, R.R., E. Padilla-Banks, and W.N. Jefferson. 2006. Adverse Effects of the Model Environmental Estrogen Diethylstilbestrol Are Transmitted to Subsequent Generations. *Endocrinology* 147:S11–S17. doi:10.1210/en.2005-1164. Available at <http://dx.doi.org/10.1210/en.2005-1164> (accessed February 21, 2008).

Nisenblat, V., S. Barak, O.B. Griness, S. Degani, G. Ohel, and R. Gonen. 2006. Maternal Complications Associated with Multiple Cesarean Deliveries. *Obstetrics & Gynecology* 108(1):21–26. Available at <http://www.greenjournal.org/content/vol108/issue1/> (accessed February 21, 2008).

North American Registry of Midwives, Midwifery Education Accreditation Council, National Association of Certified Professional Midwives, and Midwives Alliance of North America. 2008. *Certified Professional Midwives in the United States: An Issue Brief*. June. Available at <http://www.nacpm.org/cpm-issue-brief.html> (accessed August 5, 2008).

Nyberg, K., S.L. Buka, and L.P. Lipsitt. 2000. Perinatal Medication as a Potential Risk Factor for Adult Drug Abuse in a North American Cohort. *Epidemiology* 11(6):715–16. doi:10.1097/00001648-200011000-00018. Available at <http://dx.doi.org/10.1097/00001648-200011000-00018> (accessed February 21, 2008).

- O'Boyle, A.L., G.D. Davis, and B.C. Calhoun. 2002. Informed Consent and Birth: Protecting the Pelvic Floor and Ourselves. *American Journal of Obstetrics & Gynecology* 187(4):981–83. doi:10.1067/mob.2002.128085. Available at <http://dx.doi.org/10.1067/mob.2002.128085> (accessed February 21, 2008).
- O'Cathain, A., K. Thomas, S.J. Walters, J. Nicholl, and M. Kirkham. 2002. Women's Perceptions of Informed Choice in Maternity Care. *Midwifery* 18(2):136–44. doi:10.1054/midw.2002.0301. Available at <http://dx.doi.org/10.1054/midw.2002.0301> (accessed February 21, 2008).
- Odent, M. 2001. New Reasons and New Ways to Study Birth Physiology. *International Journal of Gynecology and Obstetrics* 75(suppl. 1):S39–S45. doi:10.1016/S0020-7292(01)00512-4. Available at [http://dx.doi.org/10.1016/S0020-7292\(01\)00512-4](http://dx.doi.org/10.1016/S0020-7292(01)00512-4) (accessed February 21, 2008).
- Odent, M. 2006. The Long Term Consequences of How We Are Born. *Journal of Prenatal & Perinatal Psychology & Health* 21(2):179–201. Available at <http://apt.allenpress.com/perlserv/?request=get-abstract&doi=10.1043%2F1097-8003%282006%29021%5B0179%3ATLTCOH%5D2.0.CO%3B2> (accessed June 27, 2008).
- Olsen, J. 2000. Prenatal Exposures and Long Term Health Effects. *Epidemiologic Reviews* 22(1):76–81. Available at <http://epirev.oxfordjournals.org/content/vol22/issue1/index.dtl> (accessed February 21, 2008).
- Organisation for Economic Co-operation and Development. 2007. *OECD Health Data 2007*. Paris: Organisation for Economic Co-operation and Development. Available at <http://www.ecosante.org/oecd.htm> (accessed February 21, 2008).
- Papanikolaou, P.N., and J.P.A. Ioannidis. 2004. Availability of Large-Scale Evidence on Specific Harms from Systematic Review of Randomized Trials. *The American Journal of Medicine* 117(8):582–89. doi:10.1016/j.amjmed.2004.04.026. Available at <http://dx.doi.org/10.1016/j.amjmed.2004.04.026> (accessed February 21, 2008).
- Parrish, K.M., V.L. Holt, F.A. Connell, B. Williams, and J.P. LoGerfo. 1993. Variations in the Accuracy of Obstetric Procedures and Diagnoses on Birth Records in Washington State, 1989. *American Journal of Epidemiology* 138(2):119–27. Available at <http://aje.oxfordjournals.org/content/vol138/issue2/index.dtl> (accessed February 21, 2008).

Pattenden, S., T. Antova, M. Neuberger, B. Nikiforov, M. De Sario, L. Grize, J. Heinrich, F. Hrubá, et al. 2006. Parental Smoking and Children's Respiratory Health: Independent Effects of Prenatal and Postnatal Exposure. *Tobacco Control* 15:294–301. doi:10.1136/tc.2005.015065. Available at <http://dx.doi.org/10.1136/tc.2005.015065> (accessed February 21, 2008).

*Pattinson, R.C., and E. Farrell. 1997. Pelvimetry for Fetal Cephalic Presentations at or near Term. *Cochrane Database of Systematic Reviews*, Issue 2. Art. No.: CD000161. doi:10.1002/14651858.CD000161. Available at <http://dx.doi.org/10.1002/14651858.CD000161> (accessed February 21, 2008),

Pearlman, M.D. 2006. Patient Safety in Obstetrics and Gynecology: An Agenda for the Future. *Obstetrics & Gynecology* 108(5):1266–71. Available at <http://www.greenjournal.org/content/vol108/issue5/> (accessed February 21, 2008).

Peltier, J. 2007. Births by Day of the Year. Available at: <http://peltiertech.com/Excel/Commentary/BirthsByDayOfYear.html> (accessed February 21, 2008).

Penders, J., C. Thijs, C. Vink, F.F. Stelma, B. Snijders, I. Kummeling, P.A. Van den Brandt, and E.E. Stobberingh. 2006. Factors Influencing the Composition of the Intestinal Microbiota in Early Infancy. *Pediatrics* 118(2):511–21. doi:10.1542/peds.2005-2824. Available at <http://dx.doi.org/10.1542/peds.2005-2824> (accessed February 21, 2008).

Peters, P.G. 2000. The Quiet Demise of Deference to Custom: Malpractice Law at the Millennium. *Washington and Lee Law Review* 57:163–205.

Phaneuf, S. B. Rodriguez Linares, R.L. TambyRaja, I.Z. MacKenzie, and A. Lopez Bernal. 2000. Loss of Myometrial Oxytocin Receptors during Oxytocin-Induced and Oxytocin-Augmented Labour. *Journal of Reproduction and Fertility* 120:91–97. doi:10.1530/jrf.0.1200091. Available at <http://dx.doi.org/10.1530/jrf.0.1200091> (accessed February 21, 2008).

Philipp, B.L., A. Merewood, and S. O'Brien. 2001. Physicians and Breastfeeding Promotion in the United States: A Call for Action. *Pediatrics* 107(3):584–87. doi:10.1542/peds.107.3.584. Available at <http://dx.doi.org/10.1542/peds.107.3.584> (accessed February 22, 2008).

Piper, J.M., E.F. Mitchel Jr, M. Snowden, C. Hall, M. Adams, and P. Taylor. 1993. Validation of 1989 Tennessee Birth Certificates Using Maternal and Newborn Hospital Records. *American Journal of Epidemiology* 137(7):758–68. Available at <http://aje.oxfordjournals.org/content/vol137/issue7/index.dtl> (accessed February 22, 2008).

Queenan, J.T. 2004. Teaching Infrequently Used Skills: Vaginal Breech Delivery. *Obstetrics & Gynecology* 103(3):405–6. Available at <http://www.greenjournal.org/content/vol103/issue3/> (accessed February 22, 2008).

*Rabe, H., G. Reynolds, and J. Diaz-Rossello. 2004. Early versus Delayed Umbilical Cord Clamping in Preterm Infants. *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD003248. doi:10.1002/14651858.CD003248.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD003248.pub2> (accessed February 22, 2008).

*Rabe, H., G. Reynolds, and J. Diaz-Rossello. 2008. A Systematic Review and Meta-Analysis of a Brief Delay in Clamping the Umbilical Cord of Preterm Infants. *Neonatology* 93(2):138–44. doi:10.1159/000108764. Available at <http://dx.doi.org/10.1159/000108764> (accessed February 22, 2008).

Raisler, J., and H. Kennedy. 2005. Midwifery Care of Poor and Vulnerable Women, 1925–2003. *Journal of Midwifery & Women's Health* 50(2):113–21. doi:10.1016/j.jmwh.2004.12.010. Available at <http://dx.doi.org/10.1016/j.jmwh.2004.12.010> (accessed February 22, 2008).

Ransjö-Arvidson, A.-B., A.-S. Matthiesen, G. Lilja, E. Nissen, A.-M. Widström, and K. Uvnäs-Moberg. 2001. Maternal Analgesia during Labor Disturbs Newborn Behavior: Effects on Breastfeeding, Temperature, and Crying. *Birth* 28(1):5–12. doi:10.1046/j.1523-536x.2001.00005.x. Available at <http://dx.doi.org/10.1046/j.1523-536x.2001.00005.x> (accessed February 22, 2008).

Reime, B., M.C. Klein, A. Kelly, N. Duxbury, L. Saxell, R. Liston, F.J.P.M. Prompers, R.S.W. Entjes, and V. Wong. 2004. Do Maternity Care Provider Groups Have Different Attitudes towards Birth? *BJOG* 111(12):1388–93. doi:10.1111/j.1471-0528.2004.00338.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.2004.00338.x> (accessed February 22, 2008).

Renz-Polster, H., M.R. David, A.S. Buist, W.M. Vollmer, E.A. O'Connor, E.A. Frazier, and M.A. Wall. 2005. Caesarean Section Delivery and the Risk of Allergic Disorders in Childhood. *Clinical & Experimental Allergy* 35(11):1466–72. doi:10.1111/j.1365-2222.2005.02356.x. Available at <http://dx.doi.org/10.1111/j.1365-2222.2005.02356.x> (accessed February 22, 2008).

*Roberts, C.L., C.S. Algert, C.A. Cameron, and S. Torvaldsen. 2005. A Meta-Analysis of Upright Positions in the Second Stage to Reduce Instrumental Deliveries in Women with Epidural Analgesia. *Acta Obstetrica et Gynecologica Scandinavica* 84(8):794–98. doi:10.1111/j.0001-6349.2005.00786.x. Available at <http://dx.doi.org/10.1111/j.0001-6349.2005.00786.x> (accessed February 22, 2008).

*Roberts, C.L., S. Torvaldsen, C.A. Cameron, and E. Olive. 2004. Delayed versus Early Pushing in Women with Epidural Analgesia: A Systematic Review and Meta-Analysis. *BJOG* 111(12):1333–40. doi:10.1111/j.1471-0528.2004.00282.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.2004.00282.x> (accessed February 22, 2008).

Roberts, R.G., M. Deutchman, V.J. King, G.E. Fryer, and T.J. Miyoshi. 2007. Changing Policies on Vaginal Birth after Cesarean: Impact on Access. *Birth* 34(4):316–22. doi:10.1111/j.1523-536X.2007.00190.x. Available at <http://dx.doi.org/10.1111/j.1523-536X.2007.00190.x> (accessed June 2, 2008).

Rooks, J.P., N.L. Weatherby, and E.K.M. Ernst. 1992a. The National Birth Center Study Part I—Methodology and Prenatal Care and Referrals. *Journal of Nurse-Midwifery* 37(4):222–53. doi:10.1016/0091-2182(92)90128-P. Available at [http://dx.doi.org/10.1016/0091-2182\(92\)90128-P](http://dx.doi.org/10.1016/0091-2182(92)90128-P) (accessed February 22, 2008).

Rooks, J.P., N.L. Weatherby, and E.K.M. Ernst. 1992b. The National Birth Center Study Part II—Intrapartum and Immediate Postpartum and Neonatal Care. *Journal of Nurse-Midwifery* 37(5):301–30. doi:10.1016/0091-2182(92)90239-Y. Available at [http://dx.doi.org/10.1016/0091-2182\(92\)90239-Y](http://dx.doi.org/10.1016/0091-2182(92)90239-Y) (accessed February 22, 2008).

Rooks, J.P., N.L. Weatherby, and E.K.M. Ernst. 1992c. The National Birth Center Study Part III—Intrapartum and Immediate Postpartum and Neonatal Complications and Transfers, Postpartum and Neonatal Care, Outcomes, and Client Satisfaction. *Journal of Nurse-Midwifery* 37(6):361–97. doi:10.1016/0091-2182(92)90122-J. Available at [http://dx.doi.org/10.1016/0091-2182\(92\)90122-J](http://dx.doi.org/10.1016/0091-2182(92)90122-J) (accessed February 22, 2008).

Rooks, J.P., N.L. Weatherby, E.K. Ernst, S. Stapleton, D. Rosen, and A. Rosenfield. 1989. Outcomes of Care in Birth Centers: The National Birth Center Study. *The New England Journal of Medicine* 321(26):1804–11. Abstract available at <http://content.nejm.org/cgi/content/abstract/321/26/1804> (accessed February 22, 2008).

*Rosen, M.A. 2002. Nitrous Oxide for Relief of Labor Pain: A Systematic Review. *American Journal of Obstetrics & Gynecology* 186(5):S110–S126. Available at [http://www.ajog.org/article/S0002-9378\(02\)70186-5/abstract?issue_key=S0002-9378%2805%29X7121-6&issue_preview=no&search_preview=no&select2=no&select2=no&start=&startPage=](http://www.ajog.org/article/S0002-9378(02)70186-5/abstract?issue_key=S0002-9378%2805%29X7121-6&issue_preview=no&search_preview=no&select2=no&select2=no&start=&startPage=) (accessed February 22, 2008).

Rosenblatt, R.A. The Perinatal Paradox: Doing More and Accomplishing Less. *Health Affairs* 1989 8(3):158–68. doi:10.1377/hlthaff.8.3.158. Available at <http://dx.doi.org/10.1377/hlthaff.8.3.158> (accessed February 22, 2008).

Rosenblatt, R.A., S.A. Dobie, L.C. Hart, R. Schneeweiss, D. Gould, T.R. Raine, T.J. Benedetti, M.J. Pirani, and E.B. Perrin. 1997. Interspecialty Differences in the Obstetric Care of Low-Risk Women. *American Journal of Public Health* 87(3):344–51. Available at <http://www.ajph.org/content/vol87/issue3/> (accessed February 22, 2008).

*Rouse, D.J., and J. Owen. 1999. Prophylactic Cesarean Delivery for Fetal Macrosomia Diagnosed by Means of Ultrasonography—A Faustian Bargain? *American Journal of Obstetrics & Gynecology* 181(2):332–38. doi:10.1016/S0002-9378(99)70557-0. Available at [http://dx.doi.org/10.1016/S0002-9378\(99\)70557-0](http://dx.doi.org/10.1016/S0002-9378(99)70557-0) (accessed February 22, 2008).

Rusconi, F., C. Galassi, F. Forastiere, M. Bellasio, M. De Sario, G. Ciccone, L. Brunetti, et al. 2007. Maternal Complications and Procedures in Pregnancy and at Birth and Wheezing Phenotypes in Children. *American Journal of Respiratory and Critical Care Medicine* 175:16–21. doi:10.1164/rccm.200512-1978OC. Available at <http://dx.doi.org/10.1164/rccm.200512-1978OC> (accessed February 22, 2008).

Russell, R.B., N.S. Green, C.A., Steiner, S. Meikle, J.L. Howse, K. Poschman, T. Dias, L. Potetz, M.J. Davidoff, K. Damus, and J.R. Petrini. 2007. Cost of Hospitalization for Preterm and Low Birth Weight Infants in the United States. *Pediatrics* 120(1):e1–e9. doi:10.1542/peds.2006-2386. Available at <http://dx.doi.org/10.1542/peds.2006-2386> (accessed February 22, 2008).

Sage, W.M. 2003. Medical Liability and Patient Safety. *Health Affairs* 22(4):26–36. doi:10.1377/hlthaff.22.4.26. Available at <http://dx.doi.org/10.1377/hlthaff.22.4.26> (accessed February 22, 2008).

Sakala, C. 2006a. Carol Sakala's Letter from North America: An Uncontrolled Experiment: Elective Delivery Predominates in the United States. *Birth* 33(4):332–35. doi:10.1111/j.1523-536X.2006.00131.x. Available at <http://dx.doi.org/10.1111/j.1523-536X.2006.00131.x> (accessed February 22, 2008).

*Sakala, C. 2006b. *Vaginal or Cesarean Birth: A Systematic Review to Determine What Is at Stake for Mothers and Babies*. New York: Childbirth Connection. Available at <http://www.childbirthconnection.org/article.asp?ck=10271&ClickedLink=200&area=2> (accessed February 22, 2008).

Sakala, C. In press. Letter from North America; Measuring Maternity Care Performance in the United States: The Way Forward. *Birth*.

Sakala, C., and M.P. Corry. 2008. Achieving the Institute of Medicine's Six Aims for Improvement in Maternity Care. *Women's Health Issues* 18(2):75-78. doi:10.1016/j.whi.2007.12.001. Available at <http://dx.doi.org/doi:10.1016/j.whi.2007.12.001> (accessed June 2, 2008).

Salam, M.T., H.C. Margolis, R. McConnell, J.A. McGregor, E.L. Avol, and F.D. Gilliland. 2006. Mode of Delivery Is Associated with Asthma and Allergy Occurrences in Children. *Annals of Epidemiology* 16(5):341–46. doi:10.1016/j.annepidem.2005.06.054. Available at <http://dx.doi.org/10.1016/j.annepidem.2005.06.054> (accessed February 22, 2008).

*Sanchez-Ramos, L., S. Bernstein, and A.M. Kaunitz. 2002. Expectant Management versus Labor Induction for Suspected Fetal Macrosomia: A Systematic Review. *Obstetrics & Gynecology* 100(5):997–1002. doi:10.1016/S0029-7844(02)02321-9. Available at [http://dx.doi.org/10.1016/S0029-7844\(02\)02321-9](http://dx.doi.org/10.1016/S0029-7844(02)02321-9) (accessed February 22, 2008).

*Sanchez-Ramos, L., A.M. Kaunitz, and I. Delke. 2005. Progestational Agents to Prevent Preterm Birth: A Meta-Analysis of Randomized Controlled Trials. *Obstetrics & Gynecology* 105(2):273–79. Available at <http://www.greenjournal.org/content/vol105/issue2/> (accessed February 22, 2008).

Savage, W. 2007. The Rising Caesarean Section Rate: A Loss of Obstetric Skill? *Journal of Obstetrics and Gynaecology* 27(4):339–46. doi:10.1080/01443610701337916. Available at <http://dx.doi.org/10.1080/01443610701337916> (accessed February 22, 2008).

Schaeffer, L.D., and D.E. McMurtry. 2005. Variation in Medical Care: Time for Action. *Health Affairs* (web exclusive). Available at <http://content.healthaffairs.org/cgi/content/abstract/hlthaff.w5.552> (accessed February 22, 2008).

Schoenbaum, S.C., and R.R. Bovbjerg. 2004. Malpractice Reform Must Include Steps to Prevent Medical Injury. *Annals of Internal Medicine* 140(1):51–53. Available at <http://www.annals.org/content/voll40/issue1/> (accessed February 22, 2008).

*Shah, P.S., L. Aliwalas, and V. Shah. 2007. Breastfeeding or Breastmilk to Alleviate Procedural Pain in Neonates: A Systematic Review. *Breastfeeding Medicine* 2(2):74–82. doi:10.1089/bfm.2006.003. Available at <http://dx.doi.org/10.1089/bfm.2006.0031> (accessed February 22, 2008).

*Shah, V., and A. Ohlsson. 2007. Venepuncture versus Heel Lance for Blood Sampling in Term Neonates. *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD001452. doi:10.1002/14651858.CD001452.pub3. Available at <http://dx.doi.org/10.1002/14651858.CD001452.pub3> (accessed February 22, 2008).

- Shealy, K.R., R. Li, S. Benton-Davis, and L.M. Grummer-Strawn. 2005. *The CDC Guide to Breastfeeding Interventions*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. Available at http://www.cdc.gov/breastfeeding/pdf/breastfeeding_interventions.pdf (accessed February 22, 2008).
- Sheikh, L., S. Johnston, S. Thangaratinam, M.D. Kilby, and K.S. Khan. 2007. A Review of the Methodological Features of Systematic Reviews in Maternal Medicine. *BMC Medicine* 5:10. doi:10.1186/1741-7015-5-10. Available at <http://dx.doi.org/10.1186/1741-7015-5-10> (accessed February 22, 2008).
- Silver, R.M., M.B. Landon, D.J. Rouse, K.J. Leveno, C.Y. Spong, E.A. Thom, A.H. Moawad, et al. for the National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. 2006. Maternal Morbidity Associated with Multiple Repeat Cesarean Deliveries. *Obstetrics & Gynecology* 107(6):1226–32. Available at <http://www.greenjournal.org/content/vol107/issue6/> (accessed February 22, 2008).
- Simkin, P. 2002. Supportive Care during Labor: A Guide for Busy Nurses. *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 31(6):721–32. doi:10.1177/0884217502239208. Available at <http://www.blackwellsynergy.com/doi/abs/10.1177/0884217502239208> (accessed February 22, 2008).
- Simkin, P. 2008. *The Birth Partner: A Complete Guide to Childbirth for Dads, Doulas, and All Other Labor Companions*, 3rd ed. Boston: Harvard Common Press. Available at http://www.amazon.com/Birth-Partner-Third-ChildbirthCompanions/dp/1558323570/ref=pd_bbs_sr_1?ie=UTF8&s=books&qid=1209008300&sr=1-1 (accessed June 2, 2008).
- Simkin, P., and R. Ancheta. 2005. *The Labor Progress Handbook*, 2nd ed. Oxford: Blackwell Publishing. Available at <http://www.blackwellpublishing.com/book.asp?ref=9781405122177&site=1> (accessed February 22, 2008).
- Simkin, P., and A. Bolding. 2004. Update on Nonpharmacologic Approaches to Relieve Labor Pain and Prevent Suffering. *Journal of Midwifery & Women's Health* 49(6):489–504. Available at [http://www.jmwh.com/article/S1526-9523\(04\)00355-1/abstract](http://www.jmwh.com/article/S1526-9523(04)00355-1/abstract) (accessed February 22, 2008).
- *Simkin, P.P., and M.A. O'Hara. 2002. Nonpharmacologic Relief of Pain during Labor: Systematic Reviews of Five Methods. *American Journal of Obstetrics & Gynecology* 186(5, suppl. 1):S131–S159. doi:10.1016/S0002-9378(02)70188-9. Available at [http://dx.doi.org/10.1016/S0002-9378\(02\)70188-9](http://dx.doi.org/10.1016/S0002-9378(02)70188-9) (accessed February 22, 2008).

Simpson, K.R., and K.E. Thorman. 2005. Obstetric “Conveniences”: Elective Induction of Labor, Cesarean Birth on Demand, and Other Potentially Unnecessary Interventions. *The Journal of Perinatal & Neonatal Nursing* 19(2):134–44. Available at <http://www.jpnnjournal.com/pt/re/jpnn/toc.00005237-200504000-00000.htm;jsessionid=H1LJ7zf13yhglFg7MZ1sRt2hTBGc9RV5Bq1Gqnc5rvrDxnbdB2rN!-1933273752!181195629!8091!-1> (accessed February 22, 2008).

Smith, G.C.S., J.P. Pell, and R. Bobbie. 2003. Caesarean Section and Risk of Unexplained Stillbirth in Subsequent Pregnancy. *The Lancet* 362(9398):1779–84. doi:10.1016/S0140-6736(03)14896-9. Available at [http://dx.doi.org/10.1016/S0140-6736\(03\)14896-9](http://dx.doi.org/10.1016/S0140-6736(03)14896-9) (accessed February 22, 2008).

Smith, L.J. 2007. Impact of Birthing Practices on the Breastfeeding Dyad. *Journal of Midwifery & Women’s Health* 52(6):621–30. doi:10.1016/j.jmwh.2007.07.019. Available at <http://dx.doi.org/10.1016/j.jmwh.2007.07.019> (accessed February 22, 2008).

*Smyth, R.M.D., S.K. Alldred, and C. Markham. 2007. Amniotomy for Shortening Spontaneous Labour. *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD006167. doi:10.1002/14651858.CD006167.pub2. Available at <http://dx.doi.org/10.1002/14651858.CD006167.pub2> (accessed February 22, 2008).

Spencer, C., D. Murphy, and S. Bewley. 2006. Caesarean Delivery in the Second Stage of Labour. *BMJ* 333(7569):613–14. doi:10.1136/bmj.38971.466979.DE. Available at <http://dx.doi.org/10.1136/bmj.38971.466979.DE> (accessed February 22, 2008).

Stutchfield, P., R. Whitaker, and I. Russell, for the Antenatal Steroids for Term Elective Caesarean Section (ASTECS) Research Team. 2005. Antenatal Betamethasone and Incidence of Neonatal Respiratory Distress after Elective Caesarean Section: Pragmatic Randomised Trial. *BMJ* 331(7518):662. doi:10.1136/bmj.38547.416493.06. Available at <http://dx.doi.org/10.1136/bmj.38547.416493.06> (accessed February 22, 2008).

Sweet, M., and R. Moynihan. 2007. *Improving Population Health: The Uses of Systematic Reviews*. New York: Milbank Memorial Fund in collaboration with the Centers for Disease Control and Prevention. Available at <http://www.milbank.org/reports/0712populationhealth/0712populationhealth.html> (accessed February 22, 2008).

Taffel, S.M., P.J. Placek, and T. Liss. 1987. Trends in the United States Cesarean Section Rate and Reasons for the 1980–85 Rise. *American Journal of Public Health* 77(8):955–59. Available at <http://www.ajph.org/content/vol77/issue8/> (accessed February 22, 2008).

Taylor, L.K., J.M. Simpson, C.L. Roberts, E.C. Olive, and D.J. Henderson-Smart. 2005. Risk of Complications in a Second Pregnancy Following Caesarean Section in the First Pregnancy: A Population-Based Study. *The Medical Journal of Australia* 183(10):515–19. Available at http://www.mja.com.au/public/issues/183_10_211105/contents_211105.html (accessed February 22, 2008).

Tchernitchin, A.N., N.N. Tchernitchin, M.A. Mena, C. Unda, and J. Soto. 1999. Imprinting: Perinatal Exposures Cause the Development of Diseases during the Adult Age. *Acta Biologica Hungarica* 50(4):425–40. Abstract available at <http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&uid=10735177&cmd=showdetailview&indexed=google> (accessed February 22, 2008).

Thomas, E.J., D.M. Studdert, H.R. Burstin, E.J. Orav, T. Zeena, E.J. Williams, K.M. Howard, P.C. Weiler, and T.A. Brennan. 2000. Incidence and Types of Adverse Events and Negligent Care in Utah and Colorado. *Medical Care* 38(3):261–71. doi:10.1097/00005650-200003000-00003. Available at <http://dx.doi.org/10.1097/00005650-200003000-00003> (accessed February 22, 2008).

Thomson Healthcare. 2007. *The Healthcare Costs of Having a Baby*. Santa Barbara, CA: Thomson Healthcare. Available at <http://www.kff.org/womenshealth/upload/whp061207othc.pdf> (accessed February 22, 2008).

Tracy, S.K., and M.B. Tracy. 2003. Costing the Cascade: Estimating the Cost of Increased Obstetric Intervention in Childbirth Using Population Data. *BJOG* 110(8):717–24. doi:10.1111/j.1471-0528.2003.02045.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.2003.02045.x> (accessed February 22, 2008).

Tracy, S.K., M.B. Tracy, and E. Sullivan. 2007. Admission of Term Infants to Neonatal Intensive Care: A Population-Based Study. *Birth* 34(4):301–7. doi:10.1111/j.1523-536X.2007.00188.x. Available at <http://dx.doi.org/10.1111/j.1523-536X.2007.00188.x> (accessed June 2, 2008).

Turnbull, D.A., C. Wilkinson, A. Yaser, V. Carty, J.M. Svigos, and J.S. Robinson. 1999. Women's Role and Satisfaction in the Decision to Have a Caesarean Section. *The Medical Journal of Australia* 170(12):580–83. Available at <http://www.mja.com.au/public/issues/contents170.html#21June> (accessed February 22, 2008).

Ulrich, L.T. 1990. *A Midwife's Tale: The Life of Martha Ballard, Based on Her Diary, 1785–1812*. New York: Alfred A. Knopf. Available at http://www.amazon.com/MidwivesTale-Laurel-Thatcher-Ulrich/dp/0394568443/ref=ed_oe_h (accessed February 22, 2008).

U.S. Department of Health and Human Services. 2000. *Healthy People 2010*, 2nd ed. With Understanding and Improving Health and Objectives for Improving Health. 2 vols. Washington, DC: U.S. Government Printing Office. Available at: <http://www.healthypeople.gov/document/> (accessed February 22, 2008).

U.S. Department of Health and Human Services. 2006. *Healthy People 2010 Midcourse Review*. Washington, DC: U.S. Government Printing Office. Available at <http://www.healthypeople.gov/data/midcourse/> (accessed February 22, 2008).

*U.S. Government Accountability Office. 2006. *Breastfeeding: Some Strategies Used to Market Infant Formula May Discourage Breastfeeding; State Contracts Should Better Protect against Misuse of WIC Name*. Washington, DC: GAO. Available at <http://www.gao.gov/new.items/d06282.pdf> (accessed February 22, 2008).

Wagner, M. 1998. Midwifery in the Industrialized World. *Journal of the Society of Obstetricians and Gynaecologists of Canada* 20:1225–34. Available at http://www.asac.ab.ca/BI_fall99/midwifery.html (accessed February 22, 2008).

Wagner, M. 2001. Fish Can't See Water: The Need to Humanize Birth. *International Journal of Gynecology & Obstetrics* 75(suppl. 1):S25–S37. doi:10.1016/S0020-7292(01)00519-7. Available at [http://dx.doi.org/10.1016/S0020-7292\(01\)00519-7](http://dx.doi.org/10.1016/S0020-7292(01)00519-7) (accessed February 22, 2008).

*Waldenström, U, and D. Turnbull. 1998. A Systematic Review Comparing Continuity of Midwifery Care with Standard Maternity Services. *BJOG* 105(11):1160–70. doi:10.1111/j.1471-0528.1998.tb09969.x. Available at <http://dx.doi.org/10.1111/j.1471-0528.1998.tb09969.x> (accessed February 25, 2008).

*Walsh, D, and S.M. Downe. 2004. Outcomes of Free-Standing, Midwife-Led Birth Centers: A Structured Review. *Birth* 31(3):222–29. Available at <http://dx.doi.org/10.1111/j.0730-7659.2004.00309.x> (accessed February 25, 2008).

Wilson, N., A.L. Strunk. 2007. Overview of the 2006 ACOG Survey on Professional Liability. *ACOG Clinical Review* 12(1):1, 13–16.

Winberg J. 2005. Mother and Newborn Baby: Mutual Regulation of Physiology and Behavior—A Selective Review. *Developmental Psychobiology* 47(3):217–29. doi:10.1002/dev.20094. Available at <http://dx.doi.org/10.1002/dev.20094> (accessed February 21, 2008).

World Health Organization. 1998. *Evidence for the Ten Steps to Successful Breastfeeding*. Geneva: WHO. Available at <http://www.who.int/bookorders/anglais/detart1.jsp?sesslan=1&codlan=1&codcol=93&codcch=142> (accessed February 25, 2008).

World Health Organization. 2005. *The World Health Report 2005: Make Every Mother and Child Count*. Geneva: WHO Press. Available at <http://www.who.int/whr/2005/en/index.html> (accessed February 25, 2008).

Yasmeen, S., P.S. Romano, M.E. Schembri, J.M. Keyzer, and W.M. Gilbert. 2006. Accuracy of Obstetric Diagnoses and Procedures in Hospital Discharge Data. *American Journal of Obstetrics & Gynecology* 194(4):992–1001. doi:10.1016/j.ajog.2005.08.058. Available at <http://dx.doi.org/10.1016/j.ajog.2005.08.058> (accessed February 25, 2008).

Zanardo, V., K.A. Simbi, S. Vedovato, and D. Trevisanuto. 2004. The Influence of Timing of Elective Cesarean Section on Neonatal Resuscitation Risk. *Pediatric Critical Care Medicine* 5(6):566–70. doi:10.1097/01.PCC.0000144702.16107.24. Available at <http://dx.doi.org/10.1097/01.PCC.0000144702.16107.24> (accessed February 25, 2008).

THE AUTHORS

Maureen P. Corry, MPH, is Executive Director and **Carol Sakala**, PhD, MSPH, is Director of Programs of Childbirth Connection, a not-for-profit organization that has made significant contributions to maternity care quality in the United States for ninety years. Founded in 1918 as Maternity Center Association, the organization has been based continuously in New York City. Its mission is to improve the quality of maternity care through research, education, advocacy, and policy.

Together, Corry and Sakala have conceived, planned, and led the implementation of Childbirth Connection's long-term national program to promote evidence-based maternity care, which was established in 1999. The program works with policymakers, health professionals, childbearing women, and journalists to close gaps between current practice and practice supported by best evidence. The authors are active in helping stakeholders understand and apply best evidence that is ready for implementation, commissioning systematic reviews and other appropriate research to fill gaps in evidence, and carrying out research on selected priority topics. The award-winning Childbirth Connection website (<http://www.childbirthconnection.org>) is an important vehicle for this work.

Under the authors' leadership, the organization commissioned leading investigators to prepare systematic and narrative reviews to clarify best evidence about the nature and management of labor pain. The resulting papers were presented and discussed at a multidisciplinary invitational symposium jointly sponsored with the New York Academy of Medicine and then peer-reviewed and published in the *American Journal of Obstetrics & Gynecology* (May 2002).

The authors are co-investigators of the landmark *Listening to Mothers* surveys. The initial survey (2002) marked the first time that women in the United States were polled at the national level about their maternity experiences and assessment of those experiences. *Listening to Mothers II*, covering continuing and new topic areas, was carried out and reported in 2006, and a follow-up survey with the same mothers was reported in 2008 in *New Mothers Speak Out: National Survey Results Highlight Women's Postpartum Experiences*. Harris Interactive conducted all three surveys, which enable a new level of understanding of the maternity experience in the United States.

Through the authors' leadership, Childbirth Connection carried out the only systematic review to identify the full range of harms that differ in likelihood by mode of birth, and then developed and issued a decision tool for women that summarized the review's findings. The consumer booklet *What Every Pregnant Woman Needs to Know about Cesarean Section* (revised edition 2006) has been endorsed by over thirty organizations.

At present, the authors focus especially on health policy and are active in the National Quality Forum, the Consumer-Purchaser Disclosure Project of the National Partnership for Women and Families, and Consumers United for Evidence-Based Healthcare. They are also planning Childbirth Connection's ninetieth anniversary symposium, *Transforming Maternity Care: A High Value Proposition*, which will be held in April 2009 and will bring together stakeholders from across the health care system to develop a blueprint for action to improve the quality of maternity care in the United States.

Carol Sakala has twenty-five years of experience as a researcher, educator, advocate, and policy analyst, with a continuous focus on maternity care quality improvement. From 2003 through

2007, she contributed a quarterly column, Current Resources for Evidence-Based Practice, for simultaneous publication in *Journal of Obstetric, Gynecologic, & Neonatal Nursing* and *Journal of Midwifery & Women's Health*. She has served for many years as Consumer Coordinator for North America of the Cochrane Pregnancy and Childbirth Group's Consumer Panel and also referees draft systematic reviews as a Panel member. She is a co-author of the influential Cochrane Review "Continuous Support for Women during Childbirth," prepares an annual Letter from North America for the journal *Birth*, and is the author of numerous other publications. She serves on the Steering Committee of the Guidelines International Network's Working Group on Patient and Public Involvement. She was a Pew Health Policy Fellow at Boston University, which awarded her doctorate in health policy in 1993.

Maureen Corry has thirty years of experience as a researcher, educator, advocate, and policy analyst focusing on maternal and infant health promotion and maternity care quality improvement. She has served as a board member of several national maternal and child health organizations and is currently Vice Chair of the Consumer Council of the National Quality Forum (NQF). She co-chaired NQF's National Voluntary Consensus Standards for Perinatal Care Steering Committee, which developed a national set of standardized performance measures for care at the end of pregnancy and during the intrapartum period. She referees systematic reviews under development for the Cochrane Pregnancy and Childbirth Group, is the author of numerous articles and consumer education resources, and is a frequent speaker at professional meetings. She received her MPH in 1991 from Yale School of Medicine in health services administration.

In their personal lives, both authors have experienced two pregnancies and births. Sakala is the mother of a teenaged daughter and son, and Corry is the mother of adult sons with families of their own.

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Childbirth Connection
281 Park Avenue South, 5th Floor
New York, NY 10010
(212) 777-5000
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