# An Update on Research Issues in the Assessment of Birth Settings: Workshop Summary

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# AN UPDATE ON RESEARCH ISSUES IN THE ASSESSMENT OF BIRTH SETTINGS

WORKSHOP SUMMARY

Leslie Pray, *Rapporteur*

Board on Children, Youth, and Families

INSTITUTE OF MEDICINE *AND*
NATIONAL RESEARCH COUNCIL
*OF THE NATIONAL ACADEMIES*

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[1]Institute of Medicine planning committees are solely responsible for organizing the workshop, identifying topics, and choosing speakers. The responsibility for the published workshop summary rests with the rapporteur and the institution.

# Reviewers

This workshop summary has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the institution in making its published workshop summary as sound as possible and to ensure that the summary meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the process. We wish to thank the following individuals for their review of this summary:

**Kimberly Gregory,** Cedars-Sinai Medical Center
**Amy J. Levi,** University of New Mexico, Albuquerque
**Dale Reisner,** Swedish Medical Center, Seattle
**Marla E. Salmon,** University of Washington

Although the reviewers listed above have provided many constructive comments and suggestions, they did not see the final draft of the workshop summary before its release. The review of this workshop summary was overseen by **Hugh H. Tilson,** University of North Carolina at Chapel Hill, School of Public Health. Appointed by the Institute of Medicine, he was responsible for making certain that an independent examination of this

summary was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this workshop summary rests entirely with the rapporteur and the institution.

# Contents

# 1

# Introduction[1]

More than 30 years ago, the Institute of Medicine (IOM) and the National Research Council (NRC) convened a committee to determine methodologies and research needed to evaluate childbirth settings in the United States. The committee members reported their findings and recommendations in a consensus report, *Research Issues in the Assessment of Birth Settings* (IOM and NRC, 1982). On March 6 and 7, 2013, in Washington, DC, the IOM convened a workshop to review updates to the 1982 report. The workshop presentations and discussions were intended to highlight research findings that advance our understanding of the effects of maternal care services in different birth settings on labor, clinical and other birth procedures, and birth outcomes. These settings include conventional hospital labor and delivery wards, birth centers, and home births. An additional objective was to identify datasets and relevant research literature that may inform a future ad hoc consensus study to address these concerns. The audience included health care providers, researchers, government officials, and other experts from midwifery, nursing, obstetric medicine, neonatal medicine, general practice medicine, public health, social science, and related fields, as well as consumer representatives. These participants represent the types of stakeholders that can be informed by this summary.

[1]The planning committee's role was limited to planning the workshop, and the workshop summary has been prepared by the workshop rapporteur as a factual summary of what occurred at the workshop. Statements, recommendations, and opinions expressed are those of individual presenters and participants, and are not necessarily endorsed or verified by the IOM or the NRC, and they should not be construed as reflecting any group consensus.

The information presented in this workshop summary reflects only what was spoken or visually presented (on slides) during the workshop. Although this workshop summary covers much ground, it should not be construed as a comprehensive review of the subject matter, nor should any of the information, opinions, or conclusions expressed in this workshop summary be construed as reflecting consensus on the part of the IOM, the NRC, the Board on Children, Youth, and Families, the workshop planning committee, or any other group. The purpose of the workshop was to engage in a dialogue about birth setting assessment and to identify and discuss relevant data and research, not to reach consensus on any issue or make recommendations. All of the opinions, interpretations, and suggestions for future research summarized in this document reflect the expressions of individual workshop participants.

Not only has a considerable amount of time passed since the 1982 assessment, but the issues themselves have evolved. The demographic and health trends of childbirth in the United States have changed; for example, while maternal mortality rates decreased over much of the 20th century, they have increased in recent years. Birth setting trends have changed, including a growing but still very small percentage of women choosing to deliver at home. More and different types of data are available now than were available in 1982; for example, the U.S. birth certificate was revised in 1989 to distinguish between home and birthing center births. Additionally, researchers are asking different questions than they did three decades ago, such as questions about how physical features of the birthing environment can impact health outcomes by affecting the stress response system.

As Patrick Simpson, M.P.H., of the W.K. Kellogg Foundation, Battle Creek, Michigan, expressed in his welcoming remarks, a better understanding of how birth settings and the care services offered in those settings impact maternal and birth outcomes can enhance the opportunity for vulnerable children to be born healthy. He raised several questions that he said need to be revisited in the context of research done since the 1982 report. What factors impact a woman's birth experience? What factors determine whether the birth setting is a stress-free environment? What is "safe"? Are hospital settings safer than freestanding birthing centers? What are the roles of physicians, nurse-midwives, doula, and other health care professionals? A better understanding of the science of birth settings will help to not only improve maternal and birth outcomes, but also build a future research agenda and allow research sponsors, like the W.K. Kellogg Foundation, to make more informed funding decisions.

In her introductory remarks, Isadora Hare, M.S.W., Maternal and Child Health Bureau (MCHB), Health Resources and Services Administration, echoed Simpson's sentiment about the role of a strong evidence base in improving the safety and quality of care and the health of both mothers

and babies. She emphasized the importance of a "life-course approach" to improving maternal and child health, that is, taking into consideration the preconception and postpartum periods as well as the intrapartum period and their impacts on maternal and neonatal health. Hare said that, currently, infant mortality in the United States is 6.61 per thousand live births, placing the United States 27th among industrialized nations. She remarked on the significant disparity among rates for African American, non-Hispanic black, and non-Hispanic white women, with the rate for African American women being double what it is for non-Hispanic white women. The majority of infant deaths occur during the neonatal period. On behalf of the MCHB, Hare expressed hope that the workshop deliberations will help the MCHB in its efforts to promote the safety and quality of care being provided to mothers and babies at the time of birth. The MCHB is involved with two major efforts to reduce infant mortality and maternal mortality and morbidity. First, the bureau is collaborating with states participating in the initiative, *A Collaborative Innovation Network* (ACIN), which currently involves 13 southern states but is expected to expand nationwide by the end of 2013. Its specific goals are to reduce elective delivery before 39 weeks, expand access to interconception care through Medicaid, increase smoking cessation among pregnant women, promote safe sleep, and expand perinatal regionalization. While the ACIN initiative remains a state-level initiative. MCHB is providing management and leadership. Second, MCHB is involved with the National Maternal Health Initiative to improve women's health across the life course and to improve the quality and safety of maternity care. The bureau is working closely with a number of public and private partners to strengthen surveillance, clinical guidelines, policies and practices in maternity care, and community-based models for improving access to prenatal and postpartum care.

In closing, Hare noted what she described as a "burgeoning" research base demonstrating the advantages of breastfeeding, not only for babies but also for women, and encouraged consideration of evidence on the impact of birth setting on breastfeeding.

## MAJOR WORKSHOP THEMES

The workshop discussion spanned a broad range of issues related to the effects of maternal care services in different birth settings on labor, clinical and other birth procedures, and birth outcomes, including historic and recent trends in childbirth and birth settings, assessment of risk in pregnancy, health outcomes associated with birth setting, workforce issues related to birth setting, data systems and measurement, and cost and reimbursement issues. The major themes that were raised by the participants during the workshop are highlighted in Box 1-1.

**BOX 1-1**
**Major Themes of Workshop Discussion**

- While much of the workshop discussion revolved around general differences between hospital, birthing center, and home birth settings, several workshop participants elaborated on the *variability within each setting* with respect to physical environment, care, and patient experience.
- Since 1982, researchers have gathered a great deal of data and information about birth setting trends, outcomes, and related issues. However, several participants opined that, while the lists of what has been learned are long, the list of *what still needs to be learned* is longer.
- Many participants elaborated on the importance of *vital statistic data* (e.g., U.S. birth certificate data) and the need to improve the quality of such data. While the gathering of information has improved since 1982, for example, with the distinction between home and birthing center births added to the U.S. birth certificate in 1989, the importance of accurate reporting is underappreciated.
- There was a great deal of discussion about *the risks and safety of birth*, with topics ranging from varying definitions of "low risk" to varying perceptions of risks and safety (i.e., different women have different perceptions of what is safe). In addition, there were discussions about the need for greater public and provider understanding of risk, including differences between absolute and relative risk.
- There were several calls for more *randomized controlled trials* of health outcomes among different types of birth settings; at the same time, the difficulty of conducting such studies (i.e., the difficulty of randomizing participants among birth settings) was recognized.
- There was much discussion about *birth outcomes* as related to the birth setting, with several presenters observing that the birth center and home birth settings have been associated with fewer interventions, fewer complications, high transfer rates, and an increased risk for neonatal mortality with home births. The latter finding was deemed controversial.
- While one of the purposes of birth setting research is to inform policy and practice, workshop participants considered how developing and implementing national standards will be difficult due to *state-level variation* in birth and birth setting trends, provider regulation and liability, and Medicaid coverage for maternal and neonatal care.
- Several workshop participants expressed concern about *choice of birth setting* and the need to better inform women about available options, and *disparity in access* to various birth settings and specific services. They suggested there is a need to increase access to a wider range of settings, services, and care providers and to opportunities for transfer from out-of-hospital settings to a hospital if the need should arrive.
- The lack of trust among different types of *care providers* was a prevailing theme, with many participants calling for the need to improve interprofessional education, communication, and interaction.

At the conclusion of the workshop, two presenters provided "big picture" overviews of the workshop discussion. Catherine Spong of the National Institute of Child Health and Human Development, Rockville, focused her overview on factors to consider when evaluating research on birth settings, especially research on health outcomes associated with different birth settings. She discussed selection bias (i.e., factors that influence a woman's decision to choose one birth setting over another), variation in outcome measures, variation in institutional policies, varying definitions of low risk, the focus on women at low obstetric risk, and other factors to consider when evaluating the evidence and its implications for policy and practice decision making.

Following Spong's presentation, Zsakeba Henderson of the Centers for Disease Control and Prevention, Atlanta, Georgia, provided an overview of key findings since 1982 and key knowledge gaps.

To set the stage for developing a future research agenda, Henderson also listed what she gathered to be the most important research needs based on the information and insights presented, discussed, and debated. Her list included the need for randomized controlled trials involving *all* birth settings (e.g., including all of the various types of hospital settings), the need for an examination of effective methods to transfer care from out-of-hospital settings into hospital settings, a cost assessment of birth settings, an evaluation of the experience of care in different settings, and several other types of studies.

Given that the purpose of birth setting research is to inform policy and practice, Henderson also identified important nonresearch, but research-related, steps to consider. They included improving the quality of birth certificate data, data on transfer to hospital care, and other types of data; developing risk-assessment tools for maternal mortality and morbidity; developing consistent policies for education, certification, and licensing of care providers; and other steps. Most importantly, and the most important take-home message of the workshop for Henderson, was the need to improve interprofessional education, communication, and interaction.

## ABOUT THIS REPORT

The organization of this report parallels the organization of the workshop. The workshop was organized into panels, with all but one panel focusing on one of a range of general topics: birth and birth setting trends and statistics (Chapter 2); assessment of risk in pregnancy (Chapter 3); health outcomes associated with birth setting (Chapter 4); workforce issues related to birth setting (Chapter 5); data systems and measurement (Chapter 6); and cost, value, and reimbursement issues (Chapter 7). For each of these general topic panels, the speaker presentations were followed by a discus-

sant whose task was to reflect on the information presented during that panel. Discussants highlighted key findings, identified gaps in the evidence base, contributed additional information, and offered personal observations about future research needs. At the end of each general topic panel, audience members were invited to comment or ask questions; summaries of those discussions are included at the end of each chapter.

An additional panel was included in the workshop agenda to allow three maternity care providers working in different birth settings to share their varying perspectives on future research needs. Chapter 8 summarizes the information and opinions presented during that panel.

Complete summaries of Catherine Spong and Zsakeba Henderson's concluding "big picture" overviews of the workshop discussion are included in Chapter 9.

Appendix A contains the agenda, Appendix B presents the biographical sketches of the moderators and speakers, and Appendix C identifies abbreviations and acronyms.

# 2

# Context and Background

Childbirth and birth setting trends in the United States have changed significantly over the past century. This chapter summarizes the Panel 1 workshop presentations that focused on demographic and health trends in childbirth in the United States; birth setting trends (i.e., who is giving birth where); and the essential role of U.S. birth certificate data in analyzing these trends. See Box 2-1 for a summary of key points made by individual speakers. This panel was moderated by Sherin Devaskar, M.D., University of California, Los Angeles. A summary of the panelists' discussion with the audience is included at the end of Chapter 3.

## HISTORICAL AND RECENT TRENDS IN CHILDBIRTH IN THE UNITED STATES[1]

Brady Hamilton described several key demographic and health trends in childbirth in the United States, both recent and historical. All of the data he described were based on information obtained from the birth certificates filed in the United States for each year.[2]

[1]This section summarizes information presented by Brady Hamilton, Ph.D., National Center for Health Statistics (NCHS), Reproductive Statistics Branch, Washington, DC.

[2]Data obtained from U.S. birth certificates are compiled in the National Vital Statistics System, a data-sharing system maintained by the Centers for Disease Control and Prevention's (CDC's) NCHS.

**BOX 2-1**
**Context and Background:**
**Key Points Made by Individual Speakers**

- Brady Hamilton noted that demographic trends among pregnant women in the United States have changed over the past few decades. For example, while the majority of births are to non-Hispanic white women, the number and percentage of births to groups other than non-Hispanic white women has been increasing.
- Hamilton presented some of the changes in health trends in the United States over the past few decades, such as the increasing rate of Cesarean deliveries between 1996 and 2009. However, the rate of Cesarean deliveries appears to have abated somewhat in the past few years.
- Marian MacDorman emphasized that birth setting trends have been changing as well. Most notably, the percent of out-of-hospital births has recently increased, by 36 percent since 2004, but still with only 1.2 percent of all births in the United States occurring outside of hospital settings. The increase in out-of-hospital birth rate is occurring much more quickly for non-Hispanic white women.
- MacDorman pointed out that risk factors associated with different birth settings have also been changing over time, with women in a home or birth center setting much less likely than women in hospital settings to deliver preterm and low-birth-weight infants. This trend suggests to MacDorman that selection of low-risk women as candidates for home and birth center births has improved over time.
- All of the trends described by Hamilton and MacDorman and summarized in this chapter are based on U.S. birth certificate data. In their opinion, U.S. birth certificate data are vital to gaining a better understanding of demographic and health trends among pregnant women and of birth setting trends.
- Nigel Paneth remarked that he was more impressed by how little things have changed over the past few decades than by how much they have changed. The most notable changes since 1982, in his opinion, are decreased birth rates but steady fertility rates, the older age of most mothers, a shift in the birth population (decrease in the percent of births among non-Hispanic white women), and increased interventions (especially Cesarean sections).

## Demographic Trends in Childbirth

The number of births in the United States has been generally rising over the last 9 decades, from 2.95 million in 1920 to 3.95 million in 2011 (see Figure 2-1). This overall increase has been punctuated by several periods of decline, including in the 1920s through the early 1930s, the 1960s through the early 1970s, the early 1990s, and over the past few years. The general rising trend is a product of the increasing size of the U.S. female population of reproductive age, changes in the composition of the reproductive age population, and changing fertility patterns.

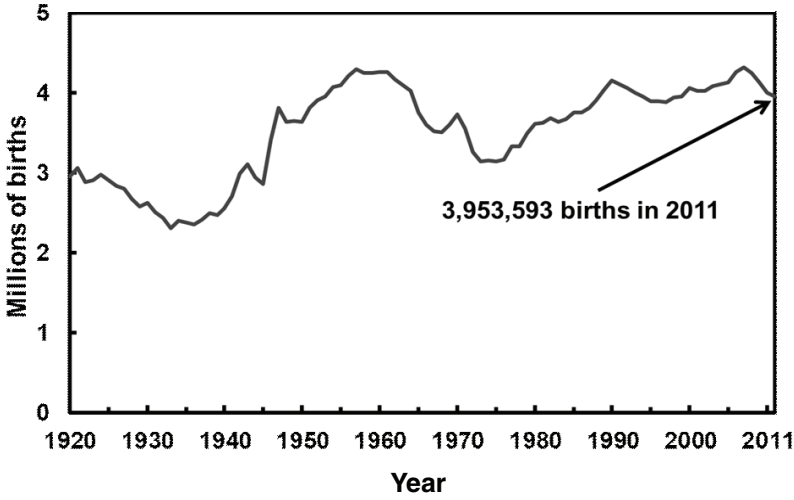



**FIGURE 2-1** The number of births per year in the United States, 1920-2011, final 1920-2010 and preliminary 2011.
NOTES: Beginning with 1959, trend lines are based on registered live births; trend lines for 1920-1958 are based on live births adjusted for underregistration.
SOURCE: Hamilton et al., 2012.

With respect to distribution of births by population group, in 2011 the majority of births were to non-Hispanic white women (2,150,926), followed by Hispanic women (912,290) and non-Hispanic black women (583,079). These three groups are also the largest race and Hispanic-origin groups in the United States by population size. Births to non-Hispanic American Indian or Alaska Native and to non-Hispanic Asian or Pacific Islander accounted for about 45,000 and 250,000 births, respectively, in 2011. The number and percentage of births to groups other than non-Hispanic whites has been increasing over the past few decades, as has the number and percentage of births to parents of different races. In 2010, slightly more than 2 percent of U.S. births were to women who reported more than one race (i.e., multiracial mothers).

As Hamilton noted, the number of births is a product of the size of the population, specifically the number of females of reproductive age, as well as fertility patterns. One way to assess fertility patterns is with fertility measures, such as total fertility rate, which estimates the number of births that a group of 1,000 women would have over their lifetimes based on the birth rates by age of mother in a given year. Fertility rate can also be expressed as the expected number of births per woman. Generally, the trend

in total fertility rate (not shown) has followed the trend in the number of births. However, the rate has been fairly level over the past three decades, ranging between 1.8 and 2.1 births per woman from 1980 to 2011. In 2011, the average number of expected births per woman differed markedly by race and ethnicity, with Hispanic women having the highest rate (2.2), and American Indian or Alaska Native women having the lowest rate (1.4).

Although overall fertility patterns have remained fairly stable over the past three decades, there have been some marked shifts in birth rates by age of mother. The most noticeable shift is a decline in rates for women under age 30 and a rise in rates for women over age 30. In 2011, 40 percent of U.S. births were to women age 30 and over, up from 20 percent in 1980. The age of first-time mothers has been increasing as well, from 21.4 in 1970 to 25.4 in 2010.

## Health Trends in Childbirth

Data from U.S. birth certificates can be used to assess not just demographic trends, but also health trends in childbirth. Hamilton described several of these trends, starting with the rate of Cesarean delivery, which increased from 1996 to 2009 (see Figure 2-2). However, the trend appears

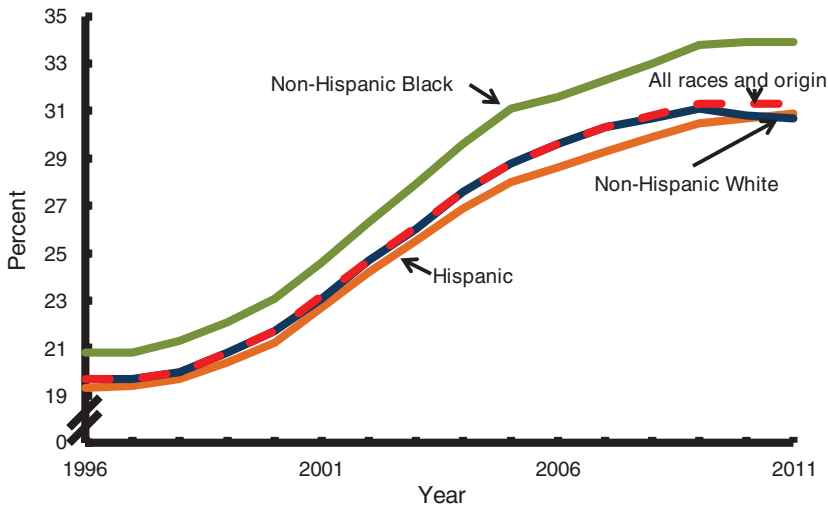



**FIGURE 2-2** Cesarean delivery rates in the United States, 1996-2011, by selected race and Hispanic origin (final 1996-2010, preliminary 2011).
NOTE: Singleton births only.
SOURCE: Hamilton et al., 2012.

to have abated, with the rate declining slightly from 2009 to 2010 and remaining unchanged from 2010 to 2011. Non-Hispanic black women are more likely than other women to have a Cesarean delivery. While Cesarean delivery rates increased for all age groups, Cesarean rates by age of mother have decreased slightly over the past couple of years but still remain well above what they were in 1996.

In addition to Cesarean delivery rates, another key health trend that can be assessed using U.S. birth certificate data is preterm births. Since 2006, preterm birth rates have declined significantly for infants in each of the three largest ethnic groups (i.e., Hispanic, non-Hispanic black, and non-Hispanic white). Despite the declines for all groups, disparities persist. In 2011, the preterm birth rate for non-Hispanic black infants was 60 percent higher than for non-Hispanic white infants.

Another significant health shift is in birth by gestational age. From 1990 to 2006, the overall distribution of gestational age shifted to earlier gestations, with the proportions of birth at 36 and 39 completed weeks increasing. From 2006 to 2011, gestational ages shifted to longer gestations, with more births occurring at 39 or more weeks and fewer births occurring at less than 39 weeks.

In more specific terms, the percentage of births at 37, 38, and 39 completed weeks of gestation increased from the 1990s through the mid-2000s, while the percentage of births at 40 completed weeks of gestation decreased. However, starting in 2006 and continuing to 2011, the percentage of births at 37 and 38 weeks decreased while the percentage of births at 39 weeks increased rapidly and the percentage of births at 40 weeks increased slightly.

With respect to trends in low birth weight, the percentage of infants born weighing less than 2,500 grams increased by more than 20 percent from the mid-1980s through 2006, but has declined slightly since then (down by 2 percent from 2006 to 2011). As with the preterm birth rate, low birth weight varies considerably by race and ethnicity. The rate for non-Hispanic black infants is the highest (11.46 in 2010) and more than two times higher than the lowest rate, which is for non-Hispanic white infants (5.22 in 2010).

Trends in weight gain during pregnancy have shifted as well, with the percentage of women gaining more than 40 pounds (i.e., more than the recommended amount of weight gain during pregnancy) increasing by more than 50 percent between 1990 and 2010 and the percentage of women gaining less than 16 pounds (i.e., less than the recommended amount of weight gain during pregnancy) nearly doubling over the same time period.

Gestational diabetes and gestational hypertension rates both vary significantly by race and ethnicity of mother. In 2010, the highest rate for gestational diabetes was among non-Hispanic Asian women (7.9 percent),

compared to 4.1 percent among non-Hispanic white women, 3.6 percent among non-Hispanic black women, and 4.4 percent among Hispanic women. Patterns are quite different for gestational hypertension. In 2010, non-Hispanic black women were more likely to have gestational hypertension (5.3 percent) than any other group (non-Hispanic white women, 4.6 percent; Hispanic women, 3.1 percent; and non-Hispanic Asian women, 2.3 percent).

Finally, both the number and the rate of twin births have been rising until very recently. The number of twin deliveries doubled from 68,339 to 137,217 between 1980 and 2009. In 2010, however, for the first time in several decades, both the number and the rate of twins declined slightly. The rate of twin births increased 76 percent from 1980 to 2009, rising by nearly 3 percent a year in the 1990s but by less than 1 percent per year in the mid-2000s. The rise of triple and higher-order births was even more dramatic, with the rate increasing by more than 400 percent during the same time period and peaking in 1998. Since peaking in 1998, both the rate and the number of triple and higher-order births has declined, with the lowest number since 1995 recorded in 2010 (5,503).

## Summary

In summary, there have been substantial increases in the number and percentage of births to groups other than non-Hispanic white women, particularly among Hispanic women, and to women age 30 and over. The percent of women gaining more than 40 pounds during pregnancy has also increased. While Cesarean delivery rates have increased over the past several decades, the rates have decreased slightly in recent years. Similarly, while low-birth-weight rates have increased over the past several decades, the rates have decreased slightly in recent years. But marked disparities in both rates among racial and ethnic groups persist. There has been a long and sustained decrease in preterm birth rates, although, again, with marked disparity. Finally, twin birth rates appear to have stabilized, while triple and higher-order birth rates are clearly declining.

In conclusion, Hamilton noted the several new items that will be added to the U.S. birth data files in 2013 (for the 2009, 2010, and 2011 data years): body mass index, tobacco use in 3 months prior to pregnancy (i.e., whether the mother quit prior to pregnancy), whether the mother received food through the Special Supplemental Nutrition Program for Women, Infants, and Children during pregnancy, whether pregnancy resulted from infertility therapy, infections present during pregnancy (e.g., *Chlamydia*), source of payment for the delivery (e.g., Medicaid), interval since last live birth, maternal morbidities (e.g., ruptured uterus), and infant breastfeeding.

## WHO ARE THE WOMEN GIVING BIRTH IN VARIOUS SETTINGS?[3]

Birthing patterns in the United States have changed significantly over the past century (MacDorman et al., 2012). In her presentation, Marian MacDorman described how. As with the demographic and health trends observed by Brady Hamilton, all of the patterns observed by MacDorman were based on data from all birth certificates filed in the United States each year and compiled by the National Vital Statistics System. Importantly, U.S. birth certificate data show only the number of births actually delivered in each location (e.g., home, birthing center, hospital), not where women intended to deliver (e.g., women who planned to deliver at home but were transported to a hospital).

### Place of Birth

In 1900, nearly all U.S. births occurred at home. By 1940, only 44 percent of U.S. births occurred outside a hospital. By 1969, only 1 percent of U.S. births occurred outside a hospital. The percent of out-of-hospital births has remained around 1 percent for several decades. In 1990 there were about 47,000 out-of-hospital births in the United States, a number that gradually declined to a low of about 35,500 in 2004.

Recently, the percent of out-of-hospital births has increased—by 36 percent since 2004—with just over 47,000 U.S. babies born outside of a hospital in 2010, representing 1.2 percent of the U.S. births (see Figure 2-3). Despite this substantial increase in out-of-hospital births, they still represent "a drop in the bucket" compared to the nearly 4 million in-hospital births in the United States each year.

Not until the 1989 revisions of the birth certificate was it possible to distinguish, for the first time, between types of out-of-hospital births, that is, whether the births occurred in homes or in birthing centers. As with total out-of-hospital births, both home and birthing center births declined gradually from 1990 to 2004 and then increased rapidly from 2004 to 2010. Home births increased by 41 percent from 2004 to 2010, with 10 percent of the increase occurring in the last year; birthing center births increased by 44 percent over the same time period, with 14 percent of the increase occurring in the last year. In 2010, there were 31,500 home births and 13,166 birthing center births in the United States. Among out-of-hospital births, 67 percent are home births, 28 percent occur in birthing centers, and 5 percent are identified as "other" (which has an unclear meaning).

U.S. birth certificate data indicate that 29 percent of out-of-hospital

[3]This section summarizes information presented by Marian MacDorman, Ph.D., NCHS, Reproductive Statistics Branch, Washington, DC.

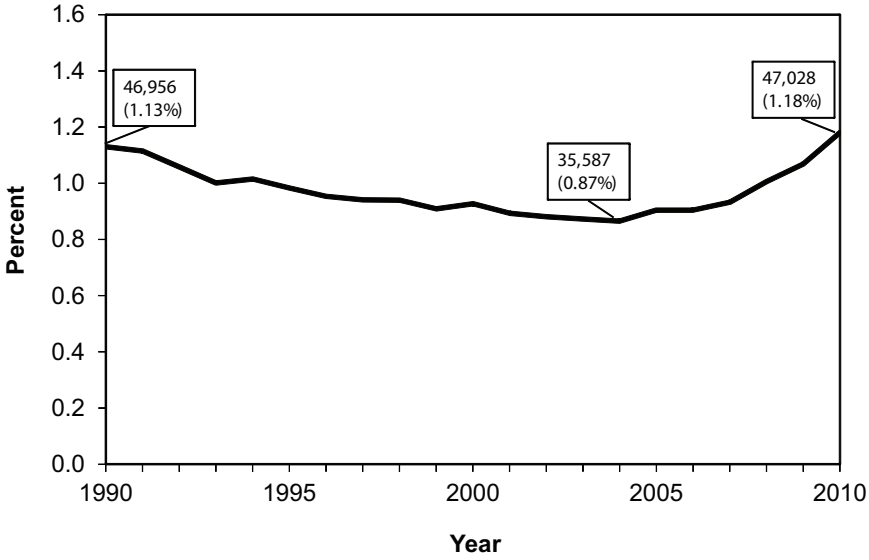



**FIGURE 2-3** Number and percent of out-of-hospital births in the United States, 1990-2010.
SOURCE: CDC, 2013.

births are delivered by certified nurse midwives (CNMs) or certified midwives (CMs), 41 percent by other midwives (including certified professional midwives, licensed midwives, and direct entry midwives), 6 percent by physicians, and 24 percent by "other" (e.g., emergency responders, family members).

Overall trends in out-of-hospital births disguise large variation by race and ethnicity. Even from 1990 to 2004, when overall out-of-hospital births were declining, out-of-hospital births for non-Hispanic white women increased by 5 percent (see Figure 2-4). Out-of-hospital births for all other race and ethnic groups declined during that period.

More recently, from 2004 to 2010, out-of-hospital births increased by 46 percent for non-Hispanic white women, from 1.2 percent to 1.75 percent of births. In 2010, for non-Hispanic white women, 1 out of every 57 births in the United States was an out-of-hospital birth. From 2004 to 2010, out-of-hospital births increased more slowly for other racial and ethnic groups such that, by 2010, the percent of out-of-hospital births was four times higher for non-Hispanic white women than for other racial and ethnic groups. About 90 percent of the total increase in out-of-hospital births from 2004 to 2010 was due to an increase among non-Hispanic white women.

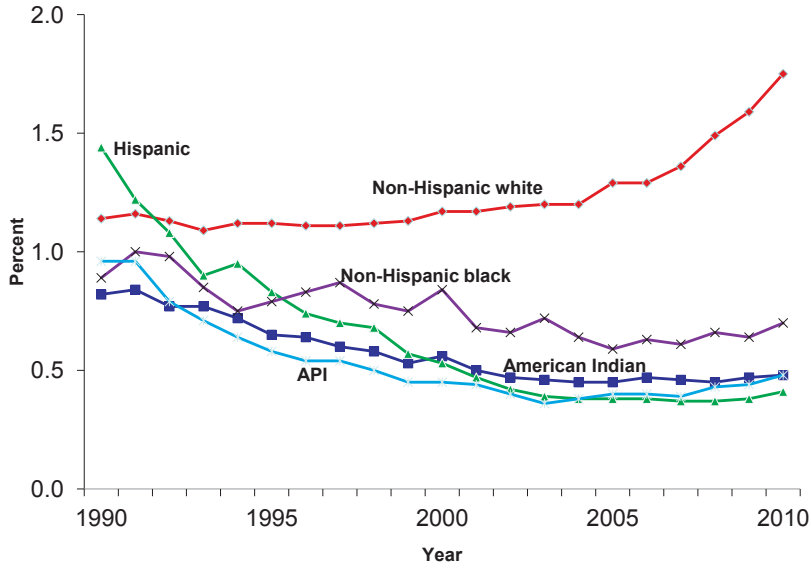



**FIGURE 2-4** Percent of out-of-hospital births in the United States by maternal race/ethnicity, 1990-2010.
NOTES: Non-Hispanic white, non-Hispanic black, and Hispanic data exclude New Hampshire in 1990-1992 and Oklahoma in 1990, as these states did not report Hispanic origin on their birth certificates for those years. API denotes Asian or Pacific Islander.
SOURCE: CDC, 2013.

### Characteristics and Risk Factors Associated with Birth Setting

MacDorman explained, "We know that only low-risk women should deliver outside of a hospital, but the precise definition of low risk remains controversial." In an effort to describe the risk status of home versus birth center versus hospital births, MacDorman examined trends in various characteristics and risk factors associated with the different birth settings. These included maternal age, parity, smoking history, marriage status, and select medical risk factors.

Based on 2010 data, with respect to maternal age, about 9 percent of hospital births are to teen mothers, compared to 2 to 3 percent of home and birthing center births. At the other end of the age spectrum, about 14 percent of hospital births are to women age 35 and older, compared to 15 percent of birth center and 21 percent of home births. The majority of births in all settings are to women between 20 and 34 years of age (76.5

percent of home births, 82.7 percent of birthing center births, 76.2 percent of hospital births).

Women having a home or birth center birth are less likely to be having their first birth and are more likely to have had three or more previous children. More specifically, 22.5 percent of women having a home birth are having their first child, 45.9 percent their second or third child, and 31.6 percent their fourth or greater child; 36.1 percent of women having a birth center birth are having their first child, 44.3 percent their second or third child, and 19.5 percent their fourth or greater child; and 40.6 percent of women having a hospital birth are having their first child, 48.0 percent their second or third child, and 11.4 percent their fourth or more child.

With respect to smoking, in 2010, 2 to 3 percent of women giving birth at home or in a birth center identify as smokers, compared to 9.3 percent of women giving birth in a hospital. With respect to marriage status, also in 2010, 14 to 15 percent of women giving birth at home or in a birth center are unmarried, compared to 41.1 percent of women with a hospital birth.

MacDorman reported 2010 trends for five select medical risk factors: preterm birth, low birth weight, multiple births, diabetes, and hypertension. Women with a home or birth center birth are much less likely to deliver preterm (5.4 percent for home births and 2.2 percent for birth center births, compared to 12.1 percent for hospital births) and to deliver low-birth-weight infants (3.9 percent for home births and 1.1 percent for birth center births, compared to 8.2 percent for hospital births). They are also much less likely to have multiple births (1.0 percent for home births and 0.3 percent for birth center births, compared to 3.5 percent for hospital births). The prevalences of diabetes and hypertension are also much lower among women delivering at home (1.1 percent for diabetes, 0.3 percent for hypertension) and in birth centers (1.1 for diabetes, 0.1 percent for hypertension) compared to hospitals (5.1 percent for diabetes, 1.4 percent for hypertension).

The lower rates of medical risk factors for out-of-hospital births suggest that appropriate risk selection of low-risk women as candidates for out-of-hospital births is occurring. However, the possibility that these differences reflect differences in risk factor reporting between out-of-hospital and hospital settings cannot be ruled out.

Another way to view risk factors is to examine changes over time. A comparison of 2004 and 2010 data reveals a decline in percent of home births to teens (3.9 percent in 2004, 2.2 percent in 2010) and to women age 35 and older (22.0 percent in 2004, 21.3 percent in 2010). The percent of home births to unmarried women also declined during this same time period (from 20.4 percent in 2004 to 14.9 percent in 2010), as did the percent of home births with live birth order of four or more (33.1 percent in 2004, compared to 31.6 percent in 2010). These same risk factors show

similar declines for birth center births, with 4.5 percent of birth center births to teens in 2004 dropping to 2.5 percent in 2010, 15.8 percent of birth center births to women age 35 and older in 2004 dropping to 14.8 percent in 2010, 16.0 percent of birth center births to unmarried women in 2004 dropping to 14.2 in 2010, and 22.8 percent of birth center births with live birth order of four or more in 2004 dropping to 19.5 percent in 2010.

With respect to the selected medical risk factors described previously, a comparison between 2004 and 2010 indicates declines for the percent of home births born preterm (7.1 percent in 2004, compared to 5.4 percent in 2010) and for the percent of home births with low birth weight (5.3 percent in 2004, compared to 3.9 percent in 2010), but not much change for the percent of home births that are multiple births (1.1 percent in 2004, 1.0 percent in 2010). For birth center births, a similar decline occurred with percent of births born preterm (2.7 percent in 2004, compared to 2.2 percent), but not for low birth weight (1.0 percent in 2004, 1.1 percent in 2010). As with home births, the percent of birth center births with multiple births also remained more or less the same (0.2 percent in 2004, 0.3 percent in 2010).

Changes in reporting of some items on the U.S. birth certificate, such as smoking, make it difficult to examine trends over time. Meanwhile, the observed declines in percent of births born preterm or with low birth weight suggest, again, that selection of low-risk women as candidates for home and birth center births has improved over time.

### Planning Status of Home Birth

Planning status of home birth is considered an important indicator of risk for home births. Studies suggest that most home births are planned home births and that unplanned home births usually result from an emergency situation or a woman not being able to get to the hospital in time. According to MacDorman, unplanned home births may be at a higher risk for poor birth outcomes, with the births taking place in environments unprepared for delivery.

In 2010, planning status of home birth was reported in 31 states and in the District of Columbia, representing 60 percent of U.S. births. Although the data are not completely representative of the U.S. population, they can suggest national trends. In 2010, 88 percent of home births were planned and 12 percent were unplanned. However, the percent of home births that were planned versus unplanned varied by care provider. Among home births delivered by physicians, very few were planned (36 percent), which MacDorman stated is "in keeping with the preference of most physicians to attend births in hospitals." In contrast, 98 to 99 percent of home births delivered by midwives (CNM/CM and other midwives) were planned.

Surprisingly, in MacDorman's view, 70 percent of home births delivered by what was identified as "other" on the birth certificate were reported to be planned home births. MacDorman proposed the 70 percent figure suggests that either some women are planning to deliver at home without a trained care provider or, more likely, that fathers are signing birth certificates in states where some types of midwives may not be licensed.

Planning status of home births varies considerably by race and ethnicity of the mother. Among non-Hispanic white women, 93 percent of home births in 2010 were planned. This is in contrast to non-Hispanic black women, among whom only 33 percent of home births were planned. For Hispanic and Native American women, 67 to 68 percent of home births in 2010 were planned; for Asian or Pacific Islander women, 75 percent of home births in 2010 were planned.

### Geographic Differences

Home birth trends vary geographically, with the percent of home births being higher in the Pacific Northwest and lowest in the South (see Figure 2-5). In 2010, more than 2 percent of total births in Oregon, Montana, and Vermont occurred at home, and between 1.5 and 2 percent of total births in Alaska, Idaho, Maine, Pennsylvania, Utah, Washington, and Wisconsin occurred at home. For 16 states, at least 1 percent of births occurred at home.

Another way to view the geographic variation in home birth trends is to examine how the 41 percent increase in home births that occurred nationwide between 2004 and 2010 played out at a state level (see Figure 2-6). Overall, 35 states experienced statistically significant increases in the percent of births that occurred at home, including 19 states where the percent of home births increased by 41 percent or more. The 2004-2010 increase was widespread and involved states from every region of the country. Vermont was the only state that showed a significant decline in the percent of home births between 2004 and 2010; despite the decline, Vermont remains one of the highest states for home births, with 2 percent of Vermont babies born at home in 2010.

Birth center births show similar geographic variation, with the highest percent of birth center births in Alaska (4.4 percent in 2010) and Idaho (2.1 percent) and with four additional states having 1 percent or more of their births occurring in birth centers (Montana, Oregon, Pennsylvania, Washington). In contrast, the percent of birth center births was less than 0.1 percent in 23 states. Six states had increases of 300 or more births occurring in birth centers between 2004 and 2010 (Florida, Oregon, Pennsylvania, South Carolina, Texas, and Washington), together accounting for more than three-fourths of the increase in birth center births in the United States during that time period. Some of the geographic variation in birth

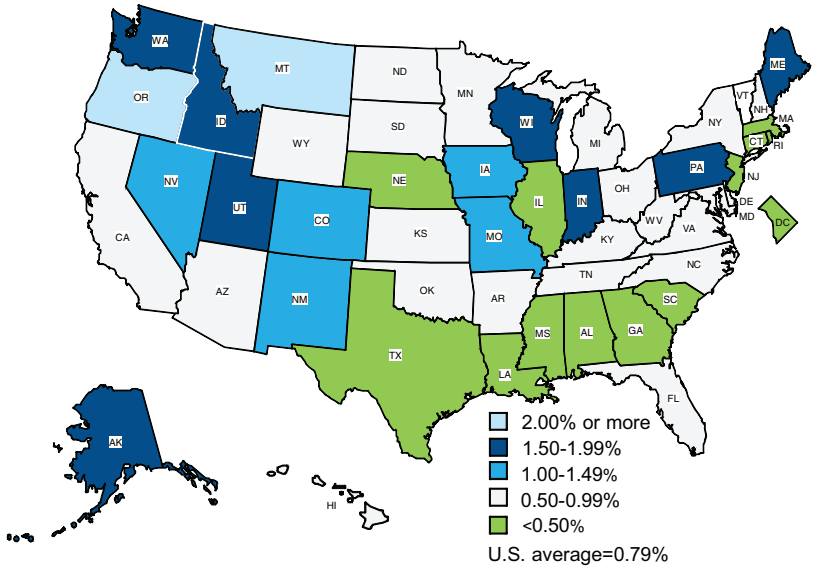



**FIGURE 2-5** Percentage of home births in the United States by state, 2010.
SOURCE: CDC, 2013.

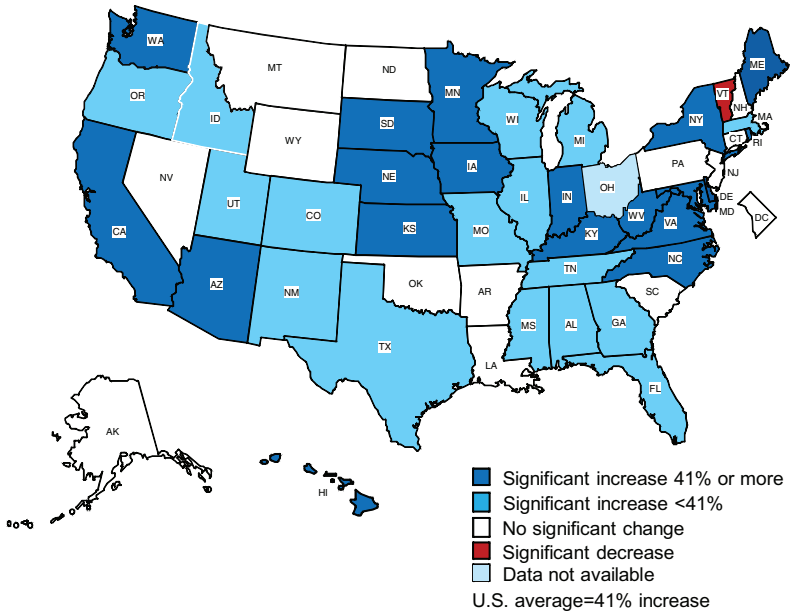



**FIGURE 2-6** Change in percentage of home births in the United States by state, 2004-2010.
SOURCE: CDC, 2013.

**BOX 2-2**
**Summary of Key Trends: Who Is Giving Birth Where?**

- After a gradual decline from 1990 to 2004, the percent of total out-of-hospital, home, and birthing center births increased rapidly from 2004 to 2010. The increase was widespread and involved states from every region of the country.
- In 2010, 1.2 percent of U.S. births were out-of-hospital births.
- Ninety percent of the increase in out-of-hospital births from 2004 to 2010 occurred among non-Hispanic white women.
- In 2010, 1 in 57 births to non-Hispanic white women were out-of-hospital births.
- In 2010, 88 percent of home births in 31 states and in the District of Columbia were planned. Among non-Hispanic white women, 93 percent were planned. In contrast, only 33 percent of home births were planned for non-Hispanic black women.
- In 2010, out-of-hospital births were more prevalent (>2.5 percent of births) in the Pacific Northwest, Alaska, and Pennsylvania and least prevalent in the South.
- In 2010, home and birthing center births had a lower risk profile than hospital births for a variety of risk factors, including teen births, nonmarital births, preterm or low-birth-weight babies, multiple births, maternal smoking, hypertension, and diabetes.
- Conversely, out-of-hospital births had higher percentages of older mothers and mothers having a fourth or higher-order birth, compared to hospital births.
- The risk profile for out-of-hospital births improved from 2004 to 2010, suggesting that appropriate risk selection of low-risk women is occurring and improving. However, the possibility that these differences reflect differences in risk factor reporting between out-of-hospital and hospital settings cannot be ruled out.

center births is due to geographic variation in access to birth centers. As of January 2013, 13 states did not have freestanding birth centers listed with the American Association of Birth Centers.

Box 2-2 provides a summary of key trends in childbirth.

## BIRTH SETTINGS: ANYTHING NEW SINCE '82?[4]

Nigel Paneth offered some perspective on the analyses of vital data presented by Brady Hamilton and Marian MacDorman. As the only representative of the Institute of Medicine (IOM)/National Research Council (NRC) committee responsible for authoring the 1982 report *Research*

[4]This section summarizes information presented by Nigel Paneth, M.D., M.P.H., Michigan State University, East Lansing, Michigan.

*Issues in the Assessment of Birth Settings* (IOM and NRC, 1982), Paneth also offered some perspective on what has been learned—and what remains to be learned—since then.

He opened by commenting on the significance of vital statistic data gathered from U.S. birth statistics, which all state vital registrars are required to submit to the NCHS. He described the data as an "extraordinary resource," one that must be maintained and sustained. Without such data, analyses such as those presented by Hamilton and MacDorman would not be possible. Yet, in Paneth's opinion, the public, including the medical public, is "woefully uneducated" about the value of vital data, with many people not even knowing what a birth certificate is. The amount of resources currently being dedicated to the maintenance and sustenance of U.S. birth certificate (and death certificate) data is inadequate, at both the state and national levels. He urged medical professionals to be more outspoken in their support of the need for keeping good birth certificate data, as well as other vital data.

### Key Changes Since 1982

Paneth identified several key changes since 1982:

- *Decreased birth rates, but steady fertility rates*.[5] While fertility rates have shifted to higher age brackets, overall fertility rates have declined only 6.4 percent since 1982 (from 67.3 to 63.2 percent).
- *Mothers are older*. Mothers age 20 to 24 years old were once the first-place age bracket, but dropped to second place in 1997 and third place in 2007. Today, 40 percent of mothers are over the age of 30, with a mean maternal age of 28.
- There has been a *shift in the birth population*, with the percent of births among non-Hispanic white women dropping from 80 percent in 1982 to 54 percent in 2011. Paneth described this is a "substantial demographic shift."
- *Births are characterized by increased interventions*, with Cesarean delivery rates now more than 30 percent, compared to 5 percent in 1972, and with interventions occurring earlier during gestation (such that the 39th week has replaced the 40th week as the modal gestational week, the week with the largest number of births). There has also been a significant increase in multiple births, which are associated with infertility treatments.

[5]Birth rate is defined as the number of children born in a year as a proportion of the total population. Fertility rate is defined as the number of children an average woman is likely to have during her reproductive years.

- *New information exists that was not available in 1982*. In 1982, one of the committee recommendations was related to the need to know who is born at a birthing center versus at home and whether the birth was planned as such. In 1989, the U.S. birth certificate was revised to distinguish between home and birthing center births. For 31 states and the District of Columbia, data have also been collected on planning status.

### Key Nonchanges Since 1982

Paneth expressed that he was more impressed by how little things have changed than by how much they have changed. He identified several key "nonchanges" since 1982:

- *The total number of births in the United States has remained fairly constant*, around 3.5 million to 4 million per year, even though the population size of the country has increased 35 percent from 232 million (in 1982) to 313 million. This trend does not reflect a decreased fertility rate, as fertility rate has not decreased much, but rather a decrease in the fraction of the population that are women of reproductive age (as boomers age out of fertility).
- *The percentage of out-of-hospital births has remained relatively steady*, around 1 percent, since 1969. However, since 2005, the percentage of out-of-hospital births among non-Hispanic white women has been increasing—to nearly 2 percent. Paneth described the choice of out-of-hospital births in a subset of the U.S. population as a "notable recent trend."
- *The diversity of birth settings—and variation in data being collected on the different U.S. birth certificates circulating—continues to make it difficult to make generalizable statements*. For example, "home" is anything someone defines as "home." Home settings range from places with easy ambulance access to five-story walk-ups where it is difficult to transport via ambulance. It is very difficult to know what "home" on a birth certificate means.

### A Closer Look at Out-of-Hospital Births

Reviewing some of the data that MacDorman reported, Paneth said that he was surprised that about two-thirds of out-of-hospital births are home births and about one-third birth center births (and about 5 percent "other"). He expected the proportion of birth center births to be greater, given the increased number of birth centers nationwide (about 200 to 250, compared to about 150 in 1982). He found it "striking" that nearly 90

percent of home births are planned, but that only about 30 percent of non-Hispanic black women's home births are planned.

Paneth suggested the increased premature rates among home births probably reflect the proportion of home births that are unintended or unplanned. He reflected that, generally and very encouragingly, both home births and birth center births involve mothers at generally lower risk of adverse outcomes of pregnancy (i.e., women who are predominantly non-Hispanic white, older, of higher parity, married, and nonsmoking).

Paneth concluded with an anecdotal story about a local birth center 4 miles from his home, in Okemos, Michigan. On their website, the birth center announced: "It with great sadness that we announce the closing of the birth center on September 30, 2012. We have been blessed to have attended over 700 births since 2003. It has been a great pleasure to work with our families and help them give birth in a safe, comfortable and supportive environment. Our belief in and support of women seeking natural childbirth in a setting of their choosing is unwavering. We are so sorry that our community will no longer have a birth center to serve those that want that option. Thank you so much for inviting us into your lives." According to a local newspaper, the *Lansing State Journal*, the birth center closed amid a legal battle with a couple whose newborn son died following a breech vaginal delivery. Unsure of the actual legal status, Paneth observed the end result: "the closing of a birth center and an option for mothers."

Paneth urged that vital data (from both birth and death certificates) be used to monitor planned out-of-hospital births and compare planned out-of-hospital births with hospital births in terms of risk factors for problem births (e.g., such as those presented by MacDorman), both neonatal and maternal mortality, and both neonatal morbidity (e.g., ventilation, transfer, and Apgar scores) and maternal morbidity (e.g., lacerations and transfusions).

He also urged surveillance for sentinel events. State programs already exist that identify maternal deaths and, in some locations, infant deaths. These programs should be expanded to identify and investigate individual events that should not be found in planned out-of-hospital deliveries (e.g., breech vaginal deliveries).

Finally, he urged an assessment of the cost-effectiveness, satisfaction, and benefits (e.g., rate of breastfeeding) of home and birth center deliveries among low-risk women compared to hospital deliveries among women at similar risk.

### The Challenge of Analyzing Mortality Data

Following Paneth's presentation, MacDorman commented on the challenge of analyzing mortality data and comparing out-of-hospital versus

hospital birth neonatal mortality given that the planning status of hospital births is unknown. For example, there are no data on the number or percentage of women who begin laboring at home but are transferred to hospitals because of complications. Compounding the challenge is variation in risk. Vital data do not provide enough information about risk. MacDorman expressed reluctance to analyze mortality data given the apples-to-oranges comparison involved when planning status and risk are unknown.

In response, Paneth stressed that vital data are only a starting point, but said, "I would not go so far as to say that because we cannot really fully answer, you should not answer at all." He suggested that analyzing *actual* deliveries provides at least a sense of what those rates are in the different settings and whether there are any unusual mortalities. While it may be difficult to select comparison groups for studies (e.g., women in different settings but with similar risk profiles), vital data on U.S. birth certificates nonetheless provide enough descriptive information such that unusual events that warrant further investigation, what Paneth calls "sentinel events," should stand out. He said, "Even without a denominator, their existence is of interest."

# 3

# Assessment of Risk in Pregnancy

Risk assessment in pregnancy helps to predict which women are most likely to experience adverse health events and enables providers to administer risk-appropriate perinatal care. While risk assessment and the challenge of defining "low risk" was a topic that was revisited several times during the course of the workshop, this chapter summarizes the Panel 2 workshop presentations which focused exclusively on the topic and included suggested topics for future research. See Box 3-1 for a summary of key points made by individual speakers. The panel was moderated by Benjamin Sachs, M.D., Tulane University, New Orleans, Louisiana. Also summarized here is the combined Panel 1 and 2 discussion with the audience (i.e., on topics covered both here and in Chapter 2).

## IDENTIFYING LOW-RISK PREGNANCIES[1]

The steady declines in maternal and neonatal mortality across the United States illustrated in Figure 3-1 are among the greatest public health achievements of the 20th century (CDC, 1999). The declines were driven by many technical and political changes, starting in 1933 when the first maternal and child morbidity and mortality reviews were convened. The shift from home to hospital births that occurred during the 1940s, coupled with the use of antibiotics and transfusions in the 1950s, drove further declines, bringing maternal mortality down to about 7 per 100,000 by 1982

[1]This section summarizes information presented by Kimberly Gregory, M.D., M.P.H., Cedars-Sinai, Los Angeles, California.

**BOX 3-1**
**Assessment of Risk in Pregnancy:**
**Key Points Made by Individual Speakers**

- Kimberly Gregory noted while the steady declines in maternal and neonatal mortality across the United States are among the greatest public health achievements of the 20th century, the maternal mortality rate has been increasing in recent years.
- Gregory emphasized the dynamic nature of low risk: the risk associated with childbirth can change at any point, often unexpectedly. She also emphasized the contextual nature of risk, for example with risks of both maternal and neonatal events being low in collaborative care situations where events are triaged appropriately.
- Gregory urged a greater focus on identifying conditions that call for different levels of care. Just as high-risk women need to be cared for in appropriate facilities with appropriate resources, the same may be true of low-risk women given that care of low-risk women in high-risk or high-intervention sites is associated with increased adverse events.
- Elizabeth Armstrong observed that numerous sociological and anthropological studies have identified control and safety as being especially important for the birth experience. However, control and safety have different meanings for different women. For some women, a technology-intensive birth in a hospital imparts a desired sense of control. For others, the same situation makes them feel out of control.
- Armstrong described contemporary American culture as a "risk society," one that views birth as a high-risk and dangerous endeavor. Some social scientists believe that the attempt to classify births into varying levels of risk itself emphasizes the pathology inherent in birth rather than the normal physiology of birth.
- As described by Kathryn Menard, the purpose of risk assessment is to predict which women are most likely to experience adverse events, to streamline resources to those who need them most, and to avoid unnecessary interventions.
- Identifying low obstetric risk is a difficult challenge. Menard elaborated on how low risk is defined differently by different researchers, making it difficult to compare outcomes across settings. She emphasized the need for more consistent and evidence-based criteria of low obstetric risk and called for a greater understanding of predictors of both neonatal and maternal complications to guide decisions about level of care and a better understanding of predictors that should prompt maternal transfer.

(from greater than 800 per 100,000 in 1900). However, more recently, based on data from the Maternal, Child and Adolescent Health Division of the California Department of Public Health, there is very clear evidence that the maternal mortality rate is increasing (see Figure 3-2). In the mid-

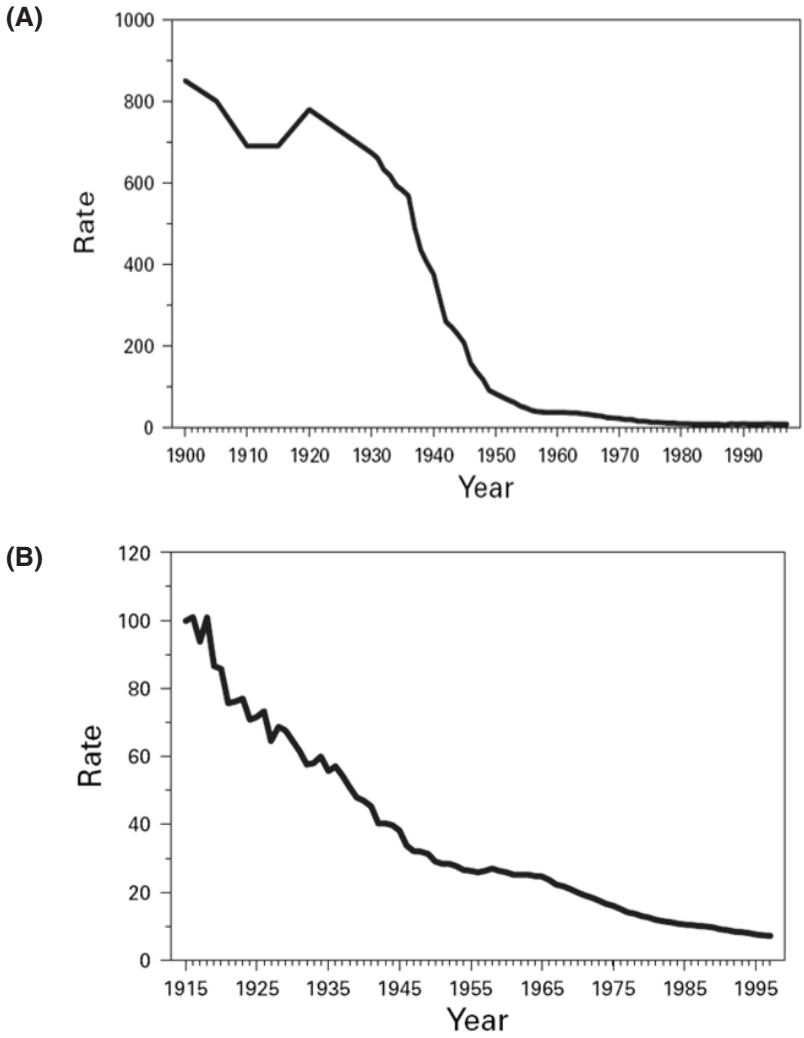



**FIGURE 3-1** (A) Maternal mortality rate per 100,000 live births by year, United States, 1900-1997. (B) Infant mortality rate per 1,000 live births by year, United States, 1915-1997.
SOURCE: CDC, 1999.

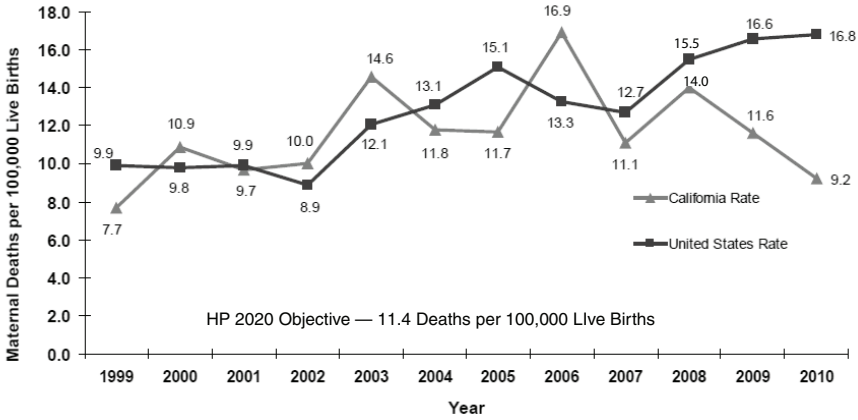



**FIGURE 3-2** Maternal mortality rate, California and the United States, 1999-2010.
NOTES: HP2020, Healthy People 2020; ICD, International Classification of Diseases. State of California, Department of Public Health, California Birth and Death Statistical Master Files, 1999-2010. Maternal mortality for California (deaths ≤42 days postpartum) was calculated using ICD-10 cause-of-death classification (codes A34, O00-O95, O98-O99) for 1999-2010. U.S. data and Healthy People 2020 Objective were calculated using the same methods. U.S. maternal mortality data are published by the National Center for Health Statistics (NCHS) through 2007 only. U.S. rates from 2008-2010 were calculated using NCHS Final Death Data (denominator) and Centers for Disease Control and Prevention Wonder Online Database (http://wonder.cdc.gov) for maternal deaths (numerator). Produced by California Department of Public Health, Center for Family Health, Maternal, Child and Adolescent Health Division, April 2013.
SOURCE: California Department of Public Health, 2013.

2000s, the national rate was about 13 deaths per 100,000. In California, it was about 16 per 100,000.

### What Is Low Risk?

Tasked to identify low-risk pregnancies, Kimberly Gregory began by searching the scientific literature, restricting her search to publications since 1996 and to developed countries. She searched using several combinations of terms: "low risk" and "pregnancy"; "risk assessment" and "pregnancy"; "levels of care" and "pregnancy"; and all of those same terms crossed with "midwives," "family practice," "birth centers," and "home births." Later, she updated her search to include maternal transfers. Gregory also considered discussions of low risk in consensus statements issued by representative

organizations and on the websites of the American Congress of Obstetricians and Gynecologists (ACOG), American College of Nurse-Midwives (ACNM), American Academy of Family Physicians (AAFP), and American Association of Birth Centers (AABC).

Gregory observed that the history of risk assessment in obstetrics began in 1929, in the United Kingdom (UK), when Dr. Janet Campbell implied, "the first requirement of a maternity service is effective supervision of the health of the woman during pregnancy" (Dowswell et al., 2010). Thereafter, the UK Ministry of Health set antepartum exams to begin at 16 weeks, to occur again at 24 and 28 weeks, and then to occur monthly to 36 weeks and weekly thereafter. Examiners were advised to check fundal height, fetal heart, and urine. It was advised that medical officers conduct the week 32 and 36 exams. These standards form the basis for current antenatal care, although additional screening interventions for identifying "high risk" have been added over time. Mead and Kornbrot (2004) defined the "standard primip"[2] eligible for midwifery care in the United Kingdom as a woman who is Caucasian, 20-34 years old, taller than 155 centimeters, with a singleton and vertex pregnancy greater than 37 weeks, with the delivery setting occurring as planned, and with no medical complications.

In the United States, identification of obstetric "low risk" is made more complicated than it is in the United Kingdom by questions such as, at low risk for what? Most risk-assessment models are for preterm birth, perinatal morbidity and mortality, Cesarean delivery, or vaginal birth after Cesarean or uterine rupture. No risk-assessment models, or tools, specifically address the risk of maternal morbidity and mortality. Because no such tools exist, and given that home and birth center births are supposed to be low risk, Gregory examined criteria used to identify candidates for home and birth center births as a means of identifying "low risk."

According to criteria posted on the Open Door Midwifery website,[3] in order to be a candidate for home birth, exam and laboratory tests must be within normal limits and show no evidence of chronic hypertension, epilepsy or seizure disorder, HIV infection, severe psychiatric disease, persistent anemia, diabetes, heart disease, kidney disease, endocrine disease, multiple gestation, or substance abuse.

According to the American Public Health Association (APHA) *Guidelines for Licensing and Regulating Birth Centers* (APHA, 1982), birth centers themselves should specify criteria for establishing risk status in their policy and procedure manuals and clearly delineate and annually review medical and social risk factors that exclude women from the low-risk antepartum group. Referencing several older papers (Aubry and Pennington,

[2]Primip is a woman who is having her first baby.

[3]See http://www.opendoormidwifery.com/criteria.html.

1973; Hobel et al., 1973, 1979; Lubic, 1980; March of Dimes, Committee on Perinatal Health, 1976; Sokol et al., 1977), the APHA guidelines identify some specific high-risk conditions: recurrent miscarriage, history of still birth, history of preterm birth hypertension, diabetes, cardiac disease, anemia or Rh disease, renal disease, thyroid disease, toxemia, macrosomic infant, multiparity, "multiple problems," systemic conditions like sarcoid or epilepsy, drug or alcohol use, and venereal disease. Gregory noted that the APHA guidelines emphasize continual evaluation through the prenatal, intrapartum, and postpartum periods. However, again, their focus is on perinatal risk, not maternal risk.

"High-risk" conditions are usually what Gregory described as a "sign of the times." That is, they change over time. For example, Aubry and Nesbitt (1969) included tuberculosis in their list of high-risk conditions, along with bacteriuria, uterine anomalies, and other conditions. Today, in addition to many of the same conditions listed elsewhere, the American Academy of Pediatrics (AAP)/ACOG *Guidelines for Perinatal Care*, 7th edition (AAP and ACOG, 2012), include some new conditions: prior deep vein thrombosis or pulmonary embolism, chronic anticoagulation, and family history of a genetic disorder. Like the 1982 APHA guidelines, the AAP and ACOG 2012 guidelines emphasize ongoing risk assessment. They also emphasize referral and consultation among institutions that provide different levels of care.

So what is "low risk"? "It is the opposite of high risk," Gregory said. She paraphrased Supreme Court Justice Potter Stewart: "I imply no criticism of . . . [the literature] which in those days was faced with the task of trying to define what may be undefinable. . . . I shall not today attempt further to define the kinds of material I understand to be embraced within that short hand description; concluding perhaps, I could never succeed in intelligibly doing so. But, I know it when I see it."

### Given Low Risk, What Happens to You?

Outcomes for low-risk mothers depend on where they deliver and who takes care of them. Villar et al. (2001) evaluated patterns of prenatal care and found no difference in risk of Cesarean, anemia, urinary tract infections, or postpartum hemorrhage between midwife, general practice, and obstetric care. They reported a trend toward lower preterm birth, less antepartum hemorrhage, and lower perinatal mortality with midwife and general practice care; significant decreases in pregnancy-induced hypertension (PIH) and eclampsia with midwife and general practice care; a significant increase in failure to diagnose malpresentation with midwife and general practice care; and a similar or higher satisfaction with midwife and general practice care.

Other studies have shown wide variation in care for healthy women, but more consistent care with complicated deliveries (Baruffi et al., 1984). Care is dictated by the structure, process, and culture where that care is being administered. For example, Gregory said evidence suggests that, for low-risk women, midwife-led care is better (i.e., results in fewer interventions) in freestanding or integrated birth centers where midwives have autonomy and where they are practicing in a small-scale setting. Midwives in integrated centers tend to incorporate the risk culture of the environment at large, such that midwives in units with high intervention rates perceive intrapartum risk to be greater and underestimate the likelihood to progress normally (Mead and Kornbrot, 2004). Gregory explained midwives in high-intervention environments are more likely to "risk out" a patient than are midwives working in low-intervention environments.

Approximately 20 percent of laboring women are transferred out of midwifery care, based on the Walsh and Devane (2012) and Hodnett et al. (2010) reviews. Lynch et al. (2005) reported an intrapartum transfer rate from hospitals without Cesarean delivery capabilities of 9.5 to 12 percent. Stapleton et al. (2013) reported that, of 18,084 women accepted for birth center care (of 22,403 who planned a birth center birth on entry to prenatal care), 13.7 percent (2,474) were transferred antenatally to a medical doctor for medical or obstetrical complications (primarily postdates, malpresentation, PIH, and nonreassuring fetal heart rate) and 0.2 percent (36) never presented to the birth center in labor. Thus, a total of 15,574 women planned and were considered eligible for birth center care at onset of labor. Of those, 4.5 percent transferred at the onset of labor but still prior to admission; another 12 percent (of those still on track for a birth center birth) were transferred intrapartum (e.g., because of arrest, nonreassuring fetal heart rate, diagnosis of breech, bleeding, PIH, cord prolapse, or seizure). Of note, less than 1 percent of the intrapartum transfers were emergency transfers, which Gregory interpreted to mean that there was plenty of time to make arrangements for getting the women safely to a nearby hospital. Also of note, 82 percent of the intrapartum transfers were for *nulliparous women*. Finally, another 2 percent (of those who actually delivered in the birth center) were transferred postpartum, primarily because of postpartum hypertension or postpartum hemorrhage. But again, only less than 0.5 percent of those transfers were emergency transfers, alluding to the fact that there was plenty of time to ensure that women were receiving appropriate levels of care. The researchers concluded that fetal and neonatal mortality rates among the birth center births were consistent with those of low-risk births reported elsewhere in other settings, including hospital births.

In her search for additional information to help guide the identification of obstetric low risk, Gregory identified Baskett and O'Connell (2009) as another relevant study. The researchers examined a 24-year period (1982-

2005) of maternal transfers for critical care from freestanding birth units. They identified 117 transfers out of 122,000 deliveries (so 1 in 1,000). Eighty percent of the transfers (95/117) were for intensive care unit (ICU) care and the other 20 percent (24/117) were for medical or surgical care not available at the obstetrics unit. Most transfers (101/117) were postpartum, the remainder (16/117) antepartum. Hemorrhage and hypertension accounted for 56.4 percent of indications for transfer. Overall mortality was fairly low (only 5 deaths out of 122,000 deliveries), with a death-to-morbidity ratio of 1 to 23.

In Gregory's opinion, available data and guidelines suggest that the 30-minute rule of "decision to incision" for emergency Cesarean delivery might not be good enough (Minkoff and Fridman, 2010). She suggested that there might be specific conditions under which care providers should be thinking in terms of "golden minutes." These include placenta previa/accreta, abruption, cord prolapse, and uterine rupture. She acknowledged, however, that, as Lagrew et al. (2006) pointed out, "most emergent Cesarean deliveries develop during labor in low-risk women and cannot be anticipated by prelabor factors" (p. 1638).

## Conclusion

In conclusion, Gregory defined low risk as singleton, term, vertex pregnancies, and the absence of any other medical or surgical conditions. Low risk is a dynamic condition, one subject to change over the course of the antepartum, intrapartum, and postpartum periods. The change can be acute and unexpected.

Low risk can also be defined regionally or locally within the context of collaborative care. Rates of neonatal and maternal adverse events are low if events are triaged appropriately with skilled clinicians. Recognizing that 39 percent of deliveries occur in hospitals where there are fewer than 500 deliveries per year, or fewer than approximately two deliveries per day, clearly not all hospitals can provide the same standard of care. While volume is usually associated with outcome, this is not true of midwifery care. Small-scale midwifery care is associated with better outcomes in terms of fewer interventions.

Gregory urged an evaluation of risk-appropriate care within the context of *both* risk (low risk versus high risk) and alternate birth settings. More data are needed regarding conditions that call for high-level care, such that high-risk women and/or conditions are cared for in appropriate facilities with appropriate resources. For example, what maternal conditions require delivery at Level III (specialty) or IV (regional site)? Low-risk women may also need to be cared for in appropriate facilities with appro-

priate resources, given that care of low-risk women in high-risk or high-intervention sites is associated with increased adverse events.

## SOCIOLOGICAL PERSPECTIVE ON RISK ASSESSMENT IN PREGNANCY[4]

Looking beyond historical trends in childbirth and who chooses which settings, Elizabeth Mitchell Armstrong examined factors that drive women's decisions about where to give birth. More specifically, what drives a woman's understanding of risk? She looked through three different "lenses" on, or frameworks, for understanding, risk: (1) cultural views of risk and birth, that is, the sociocultural perception of birth in contemporary American society; (2) women's perceptions, expectations, and experiences of birth and, in particular, the ways some women's assessments of risk differ from those of their providers; and (3) structural conditions that affect risk.

### Sociocultural Views of Risk and Birth in Contemporary American Society: The Notion of a "Risk Society"

Contemporary American culture views birth as a high-risk endeavor. The dominant cultural view of birth among medical professionals, as well as among laypersons, is that birth is inherently risky, even dangerous. Birth is depicted in popular movies like *Knocked Up* and in television shows like *Birth Story* as a chaotic, bloody affair involving lots of urgency, running around, and yelling. The model mood is one of panic. The birthing woman herself is depicted as irrational and out of control and the men around her as incompetent. Thus, birth is depicted in the media as a full-blown crisis, with vanishingly few planned home births depicted at all. In television and the movies, the only births occurring outside hospitals are precipitous ones; often, no one is in charge, and the birth resembles nothing so much as an unmitigated disaster. Also in the media, extreme pain is depicted as something with no other solution but drugs. Armstrong said, "No wonder women fear birth."

Yet, a historical perspective on childbirth suggests that birth should be less terrifying than in the past. Today, virtually all women and babies survive birth, with the birth of a child often an emotional high that many women and men report as being among the happiest of their lives.

How has American culture come to regard birth, a natural and intrinsic part of life and human society, with such trepidation, fear, and loathing? Armstrong suspects that the answer lies, in part, in a broader set of cultural

[4]This section summarizes information presented by Elizabeth Mitchell Armstrong, Ph.D., M.P.A., Princeton University, Princeton, New Jersey.

shifts that have transformed modern society and in the evolution of what Beck (1992, 1999) calls a "risk society." A risk society is one where the notion of risk overshadows all social life and where the identification and management of risk are the principle organizing forces. Beck (1999) argues that modern society has become a risk society "in the sense that it is increasingly occupied with debating, preventing, and managing the risks that it, itself, has produced" (Beck, 2006). As both Beck (1992, 1999) and Giddens (1999) argue, modern life is increasingly perceived in terms of danger and organized around the pursuit of safety. This increased awareness of risk has led to a pervasive sense of uncertainty and attempts to control the future.

Based on theories of risk articulated by Beck (1992, 1999) and Giddens (1999), Armstrong shared some insights that she deems relevant to risk assessment at birth. First, many of the risks being considered are what Beck calls "manufactured risks," that is, risks created by human intervention, as opposed to risks created by weather or other natural events. Second, the omnipresence of risk in modern society has led to the emergence of a collective risk consciousness and a prevailing ethos of risk avoidance. Beck notes that much of this is organized around "attempt[ing] to anticipate what cannot be anticipated" (Beck, 2006). Third, the relationship between risk and trust is inverse; that is, science and technological expertise have become more important in society and at the same time the public has lost trust in both the content and conduct of science. Fourth, as Beck (1999) contends, some social actors have greater authority than others to define risk.

It is this fourth phenomenon, that some social actors have greater authority than others to define risk that leads to what anthropologist Brigitte Jordan calls "authoritative knowledge" (Jordan, 1997; Jordan and Davis-Floyd, 1992). According to Armstrong, Jordan argues that in any particular domain of human life there may be several knowledge systems or ways of understanding the world. Some of these ways of understanding may carry greater weight than others, either because they explain the state of the world better or because they are associated with a stronger power base, or for both reasons. As one kind of knowledge begins to dominate, other knowledge systems are delegitimized and dismissed (Jordan, 1980, 1997). For example, in his description of the evolution of American medicine, Paul Starr (1982) points to the tremendous "cultural authority" accorded one form of medical practice, allopathic medicine, to the exclusion of other forms of medicine that flourished in the late 19th century. The important thing to keep in mind about authoritative knowledge, Armstrong explained, is that it is socially constructed. Yet, it is viewed as being a natural order, with many people failing to recognize the ways it is socially constituted. In the realm of birth, obstetrics embodies authoritative knowledge. As such, obstetrics crowds out other ways of knowing and other ways of birth, limiting women's awareness of alternative modes of birth.

When birth is viewed through this lens of a "risk society," it is easier to understand the climate of fear, not confidence, that surrounds American birth and how it is that we think of birth as dangerous. Contemporary organization of maternity care reflects our "risk society." According to Armstrong, Ray De Vries (2012) has noted that even our attempt to classify births into varying risk levels is itself a powerful reframing of birth, one that emphasizes the pathology inherent in birth, rather than the normal physiology of birth.

Another force shaping the way women perceive the risk of birth is the polarization (Declercq, 2012) in views of birth, which are often characterized as the medical versus midwifery models of birth. Different attributes are associated with the different models (e.g., pathology with the medical model, physiology with the midwifery model), with the two models often considered to be "diametrically opposed." In Armstrong's opinion, this polarization of views of birth not only obscures the fact that birth is a physiological process with the potential for pathology (i.e., it is not "either/or"), but also affects cultural perceptions of risk and structures the options available to women.

### Women's Views of Risk

Numerous sociological and anthropological studies of contemporary American childbirth demonstrate that women's experiences of birth are marked by a range of sometimes contradictory feelings. Women express fear while putting emphasis on being safe or feeling safe. Additionally, both women and their providers voice varying levels of trust and distrust in the female body. Finally, the desire for control is paramount in many discussions of birth. Armstrong identified control and safety as being particularly important.

Control can have different meanings and different implications. In a qualitative study of women's birth experiences, Namey and Lyerly (2010) documented the multiple meanings of control in the context of birth and concluded that control matters but its meaning varies widely among women and can have implications for their choice of birth setting. Armstrong said, for some women, technology-intensive birth in the hospital imparts a desired sense of control. But for other women, that same situation makes them feel out of control.

Safety too can have different meanings and different implications. The prevailing cultural view is that the hospital is the safe place to give birth. Indeed, in Armstrong's opinion, most women trust modern medical care to ensure safe births. Yet, studies show that many women who birth in hospitals end up very dissatisfied with their birth experiences (Declercq et al., 2002, 2006). The very high rate of routine interventions is part of why

they end up so dissatisfied. A desire for safety drives many women's choices to birth outside of a hospital. Precisely what historically sent women to the hospital to birth in the first place—a desire to avoid risks and to experience a safer birth—is what motivates some women to avoid the hospital for birth today. If women choose birth outside the hospital, it is not because they are reckless or heedless of risks. Rather it is because their understanding of risk and safety is very different.

A number of studies have assessed women's decision making around home birth and have identified a common set of themes (Boucher et al., 2009; De Vries, 2004; Klassen, 2001). Some women choose home birth for religious reasons (Klassen, 2001). Armstrong speculated that perhaps the higher rates of home births in Pennsylvania and Indiana, which were evident on one of the maps shown by MacDorman, reflect the Amish populations in those states. Yet, even among women for whom religious beliefs are a primary motivation for choosing home birth, many of those women report some of the same ideas about birth that other women who choose home births for nonreligious reasons report. That is, they perceive home as being a place where they can feel in control and where they will feel safe. In addition to feelings about control and safety, trust appears to be another determinant of home birth choice. Women who choose home births often report that they trust their body's ability to birth and that they have a deep level of trust with their care provider.

### The Role of Structure

Debates about home birth typically do not consider a structural perception of risk. Yet, in Armstrong's opinion, it is an important perspective to consider. That is, what systems support or impede women's decisions about birth settings? By examining systems of transport and transfers, one can begin to see the ways that institutional arrangements can actually increase risks for low-risk women delivering outside the typical setting. According to Armstrong, numerous studies, as well as court cases, have demonstrated "the trouble with transport" (Davis-Floyd, 2003). In Armstrong's opinion, that we have failed to develop a system of transport and transfer that protects women and babies from adverse outcomes is not just a failure of infrastructure. It is also morally fraught because of the deep polarizations that exist in thinking about birth (as physiology versus pathology) and because of deep levels of mistrust among provider communities. So not only do we lack the infrastructure for transport and transfer, we lack cultural consensus to develop that infrastructure and ensure its smooth functioning. Armstrong noted that in other societies where home birth is a viable option for women, most notably in the United Kingdom and in the Netherlands, systems have evolved for assessing risk and ensuring smooth transfer—thus

reducing risk and ensuring safety for women who choose to birth outside of the hospital.

### Areas for Future Social Science Research

In conclusion, Armstrong identified several areas where social scientists can contribute to gaining a better understanding of birth settings. First, they can help to achieve a better understanding of the notion of "good birth." What is a good birth? Where (setting) and how (under the care of which providers) can good births happen as often as possible? Second, they can help to achieve a better understanding of women's decision-making processes (e.g., where do expectations of birth come from?) and ways to foster trust between women and maternity care providers. Finally, they can explore ways to change the structural landscape around birth and develop high-functioning systems of transport and transfer.

## PRESENTATION ON ASSESSMENT OF RISK IN PREGNANCY[5]

By way of disclosure, Kathryn Menard began her talk by describing what she called her "vantage point." She is the mother of three children and maternal fetal medicine specialist and educator; she works in a perinatal regional center at the University of North Carolina at Chapel Hill where about 3,700 babies are delivered annually. The center has a "24-7" midwifery practice that is well integrated into the care plan such that women can transition seamlessly from the midwifery practice to the generalist or maternal-fetal medicine practice. Many of her complicated antepartum patients choose midwifery-style births, with intrapartum care provided under the direct supervision of midwives but with physician backing. She noted that there is a freestanding birth center in town, just a couple of miles away from the hospital.

### Why Assess Risk?

The purpose of risk assessment is to predict which women are most likely to experience adverse health events. The predictions can be used to streamline resources to those who need them most and avoid overuse of technology and intervention. Focusing resources on those who need them most and avoiding unnecessary interventions can lead to better care, better health, and lower cost.

When thinking about risk-appropriate perinatal care, it is important

[5]This section summarizes information presented by M. Kathryn Menard, M.D., M.P.H., University of North Carolina at Chapel Hill, North Carolina.

to consider the entire continuum of care: preconception/interconception care (i.e., identifying modifiable risk factors and emphasizing prevention), antepartum care, intrapartum care, and neonatal care. Menard focused her comments on intrapartum care (care of the mother during labor and delivery).

### Regionalization of Perinatal Care

Menard emphasized the role of regionalization within the context of perinatal care (care of the fetus or newborn from the 28th week of pregnancy through the 7th day postdelivery). In 1970, reports from Canada emphasized the importance of integrated systems that promote delivery of care to mothers and infants based on level of acuity; the reports showed that neonatal mortality was significantly lower in obstetrics facilities that had neonatal instensive care units (NICUs). In 1976, TIOP I (Toward Improving the Outcome of Pregnancy) described a model system for regionalized perinatal care that included definitions for varying levels of perinatal care based on both neonatal and maternal characteristics (March of Dimes, Committee on Perinatal Health, 1976). The early perinatal regional centers focused on education, dissemination of information, and referral resources and systems for maternal transport.

Evidence indicates that regionalization saves lives. For example, Lasswell et al. (2010) reported that infants smaller than 1,500 grams born at Level I or II hospitals had increased odds of death (38 percent versus 23 percent), compared to similarly sized infants born at Level III hospitals. Similarly, infants born at less than 32 weeks gestation in Level I or II hospitals had increased odds of death (15 percent versus 17 percent), again compared to similarly preterm infants born at Level III hospitals.

While the regionalization of systems, combined with advances in technology, has contributed to improvements in neonatal survival rates, there is not much information about other benefits of regionalized systems, including how regionalization impacts maternal mortality or morbidity. Nor is there much information about the potential harm of regionalization.

Early regionalization efforts emphasized both maternal and neonatal care. In 2012, the AAP issued a new policy statement regarding levels of perinatal care. The maternal characteristics that were included in the earlier policy statements (i.e., TIOP I) were removed, such that the policy statement contains no reference whatsoever to maternal care (Barfield et al., 2012). Likewise, the new *Guidelines for Perinatal Care*, 7th edition (AAP and ACOG, 2012), contains minimal reference to maternal care indicators. The current climate (2012) is also characterized by an emphasis on value-based health care, that is, an emphasis on increased quality at decreased

cost, an increased emphasis on patient-centered care, and greater recognition of a woman's right to choose her site of birth.

### What We Know About Neonatal Care in Different Settings

Menard remarked that while outcomes associated with different birth settings would be the topic of detailed presentations to follow, she wanted to provide a context for those talks (see Chapter 4 for a summary of that more detailed discussion). She mentioned the Wax et al. (2010) meta-analysis, which reported that planned home birth delivery of term babies is associated with less medical intervention but a two- to threefold increase in neonatal mortality. Data on delivery of term babies in freestanding birth centers is limited, so similar claims cannot be made. The Hodnett et al. (2012) Cochrane review reported that delivery of term babies in alternative hospital settings, that is, colocated midwifery units, are associated with higher rates of spontaneous vaginal delivery, more breastfeeding, more positive views of care, and no difference in either neonatal or maternal outcomes (all compared to conventional hospital settings). That review was based on 10 randomized controlled trials (N = 11,795). Finally, with respect to the delivery of term babies in a hospital setting, Menard mentioned Snowden et al. (2012), who reported that a higher delivery volume may be associated with lower neonatal morbidity. Very little is known about collaborative care models within the hospital environment and whether such models impact either neonatal or maternal outcomes.

### What We Know About Maternal Care in Different Settings

Because maternal mortality is an uncommon event, examining maternal mortality is like "looking at the tip of the iceberg," in Menard's opinion. And while severe maternal morbidity is an active area of conversation today, it is not measured in a consistent manner. Much of the conversation revolves around how to define and monitor severe maternal morbidity. Nor are factors that predict the need for a higher level of care well defined. The scientific basis for making those decisions is limited, with different predictors being used in different circumstances.

### "Low Obstetric Risk"

Different researchers define "low obstetric risk" differently. Menard gave four examples. First, in a randomized trial conducted in Australia (the COSMOS trial) on primary midwifery continuity care versus usual care within a tertiary care center, McLachlan et al. (2012) used these inclusion criteria: singleton, uncomplicated obstetric history (no stillbirth, neonatal

death, consecutive miscarriages, fetal death, preterm birth <32 weeks, isoimmunization, gestational diabetes), no current pregnancy complications (e.g., fetal anomaly), no precluding medical conditions (no cardiac disease, hypertension, diabetes, epilepsy, severe asthma, substance use, significant psychiatric disorder, BMI >35 or <17), and no prior Cesarean.

Second, in a randomized controlled trial of simulated home birth in the hospital (midwife-led care) versus usual care in the United Kingdom, MacVicar et al. (1993) used very different inclusion and exclusion criteria: nulliparous[6] and multiparous[7] women were included, but women with prior Cesareans were not; their definition of exclusionary maternal illness was more loosely defined ("no maternal illness such as diabetes, epilepsy, and renal disease"); and, while their definition of past obstetrical history was not as specific (no prior stillbirth, neonatal death, or small for gestational age), they included a history of elevated maternal serum alpha-fetoprotein.

Third, Bernitz et al. (2011) used yet another set of inclusion and exclusion criteria in their randomized controlled trial of three hospital levels in Norway. Their inclusion criteria were healthy, low-risk women without any disease known to influence pregnancy; singleton; cephalic; BMI <32; smokes <10 cigarettes/day; no prior operation on the uterus; and 36 weeks, 1 day to 41 weeks, 6 days gestation. Finally, a randomized controlled study in Ireland on midwifery care versus consultant-led care (Begley et al., 2011) used yet another entirely different set of exclusion criteria (e.g., BMI <18 or >29; smoking ≥20 cigarettes per day).

Menard emphasized the need for consistent and evidence-based criteria of "low obstetric risk" so that valid comparisons across settings can be made and our understanding of birth settings advanced.

### Research Needed to Describe "Risk"

In addition to developing uniform definitions of risk factors, several other research steps need to be taken in order to advance our understanding of risk. Menard called for a greater understanding of essential resources for each of the various birth settings, predictors of neonatal complications to guide decisions about level of neonatal care (i.e., predictors beyond the context of birth weight, which is how most current neonatal care criteria are based), predictors of maternal complications to guide decisions about level of maternal care, and predictors that should prompt maternal transport.

With respect to determining predictors of maternal care, Menard remarked that the concept of levels of maternal care (i.e., birth center versus Level 1 [basic] versus Level 2 [specialty] versus Level 3 [subspecialty] versus

[6]A woman who has never given birth.

[7]A woman who has given birth two or more times.

Level 4 [regional perinatal center]) is being developed and promoted as a strategy to expand regionalized perinatal care. Ideally, the strategy will be applied uniformly across all states so that surveillance can be standardized. But doing so, she opined, will require a complementary set of predictors of maternal complications to guide decisions about which level of care a woman should receive.

With respect to predictors that should prompt maternal transport, the question is, if a woman has a birth experience in a birth center or a facility with a lower level of care, what are the important signs and symptoms that indicate she should be moved to a higher level of care?

Menard identified several additional research topics that would help to define "risk": uniform definitions of maternal and neonatal morbidity; definitions of family perceptions and satisfaction with care; the role of the care provider and the role of continuity of care; the role of the care "system" and how to optimize that system (i.e., interprofessional working relationships, consultations, hand-offs, transfer of care); cultural issues, such as threshold for intervention in high-level facilities; and patient perception of risk and the influence of her perception of risk on birth outcomes and perception of care.

## DISCUSSION WITH THE AUDIENCE[8]

Following Menard's presentation, the workshop was opened to questions and comments by members of the audience. Topics addressed included international birth setting trends and risk guidelines; perception of risk among women entering pregnancy and how it varies depending on age, culture, and other factors; the large proportion of non-Hispanic black women who deliver unplanned out-of-hospital births; the increasing rate of home births in the United States; how economic factors drive birth setting decisions; the need for infrastructure in states without birth center regulations; and the challenge of transfer (legal and professional mistrust issues).

### International Birth Setting Trends and Risk Guidelines

The audience raised two separate sets of issues related to birth setting assessment outside of the United States. First, it was suggested that there might be lessons to be learned from antepartum risk guidelines being used in the United Kingdom, including the fact that the guidelines were created by conducting a systematic review of the international evidence and reaching consensus among a stakeholder panel.

[8]This section summarizes the discussion that occurred at the end of Panels 1 and 2, immediately following Kathryn Menard's presentation.

Second, a remark was made about the increasing percentage of women in the Netherlands who are choosing hospital deliveries. Specifically, according to a workshop participant, the number of women in the Netherlands choosing hospital deliveries has increased from 23 to 38 percent over the past 20 years. The participant emphasized that this is very different than what is happening in the United States, where a growing percentage of women are seeking home deliveries. He also emphasized that the trend is occurring in a country, the Netherlands, with a long history of home births. "I want the record to show," he said, "that [in the Netherlands] it is considered a privilege to have a hospital birth." Elizabeth Armstrong agreed that, yes, more women in the Netherlands are seeking hospital births, but she warned that the reasons for the trends are complex and that the trend does not necessarily mean that women feel unsafe in home birth settings. Another participant who identified herself as being from the Netherlands agreed with Armstrong that the reasons for the increasing trend in hospital births are complex. They include demographic changes, that is, more older women entering pregnancy, as well as more primips; media portrayal of pregnancy as something to be feared; increased prenatal testing; and a diverse immigrant population, with varying cultural perceptions of pregnancy. She noted primary care in the Netherlands is midwife-led care, adding that the rate of home birth in the Netherlands is about 19 percent, with another 12 percent of women giving birth in a hospital but with their midwives and without attendance by obstetricians.

### Perception of Risk and How It Varies Depending on Age, Culture, and Other Factors

A participant suggested that perception of risk might be changing as the percentage of older women entering pregnancy increases. The implication was that older women are not as healthy as younger women and therefore may perceive pregnancy as a riskier experience than younger women do. Kathryn Menard agreed that women entering pregnancy are less healthy than in the past because they are older and suggested that perhaps the increasing maternal morbidity and mortality trends being observed in the United States are related to that demographic change. She emphasized the importance of maternal morbidity and mortality surveillance.

More generally on the issue of perception of risk, Nigel Paneth observed, "The question about risk is always: what can you control?" Centuries ago, losing a child in infancy was considered normal and unpreventable. Changes in infant (and maternal) mortality over time have changed what women consider as unpreventable, or uncontrollable. For example, the likelihood of a woman dying during pregnancy dropped 100-fold during the

20th century. Today, the risk of a woman dying during pregnancy is more controllable than it was in the past.

An audience member commented on the role of culture and how a woman's perception of risk might reflect her own place of birth. Armstrong replied that, while there has not been much research addressing the role of place of birth in perception of risk, women who have experienced other maternity care systems enter the U.S. system with a certain set of expectations. This is true even of primips who have not actually delivered themselves but nonetheless have an understanding of how birth works in the culture they come from.

Armstrong further observed that social disadvantage can also impact choice of birth setting. Some socially disadvantaged women, whether it is because of race or ethnicity, socioeconomic status, or immigrant status, perceive medicalized, high-technology hospital birth as being of a higher status and therefore more desirable than home birth. That perception is not necessarily related to risk or safety.

### Disparity in Outcomes Among Ethnicities

The panelists were asked why as many as 66 percent of home deliveries by non-Hispanic black women are unplanned and what research is needed to find the answer(s). Marian MacDorman clarified that the incidence of home births in general is much lower for non-Hispanic black women, perhaps because fewer non-Hispanic black women have access to care providers that allow that option, and that the proportion of unplanned home births is high but the absolute numbers are low. With respect to research, she emphasized the importance of directly asking women about their preferences and experiences. She also suggested promoting more services in areas and neighborhoods where non-Hispanic black women live and training more minority care providers.

Another audience member speculated that at least some of the large percentage of African American women who report on birth certificates that their home birth was "unplanned" reflects a growing preference in free birthing, which is birthing without the assistance of a care provider. She noted that free birthing is on the rise in places like Maryland where Medicaid provisions for home birth have been removed, and that many women who choose free birthing report "unplanned" on their birth certificates because they think it will draw less attention.

Paneth observed that the "big monster in the room" is not that 66 percent figure, rather the "huge health disparity between black and white infant mortality." That, in his opinion, is the greater research challenge. What is causing such extreme preterm birth among African American women? While many research teams are pursuing answers, the question remains.

### Why the Percentage of Home Births in the United States Is Increasing

The panelists were asked to reflect on why the percentage of home births in the United States is increasing. MacDorman replied that birth certificate data do not reveal why certain birth options are chosen, or not chosen. She referred to the large number of studies in the medical literature based on having directly asked women why they chose home births. Women who choose home births express desire for low-intervention physiologic births in environments where they feel comfortable and more in control over which interventions will be induced, and they express concern about the high rates of Cesarean delivery and other interventions in hospital settings.

Another audience member asked whether there might be a correlation between change in percentage of home births and increased access to licensed midwifery offering the option of transfer. That is, do states exhibiting greater increases in percentage of home births provide greater access to licensed midwifery offering the option of transfer? MacDorman agreed that the question would serve as an excellent topic for future research.

### Economic Factors Driving Birth Setting Choice

An audience member commented on the role of health insurance in birth setting choice and observed that a significant number of women who would choose to deliver outside of the hospital are not able to do so because their insurance will not cover out-of-hospital deliveries. The audience member also mentioned liability insurance and observed that in some states Medicaid will not cover a home birth midwife unless the midwife carries a level of liability insurance that most home birth midwives do not carry. Panelist MacDorman agreed that economic factors contribute to the complexity of the issue of choice. She remarked that studies have shown that the cost of a home birth is about one-third the cost of a hospital birth, but in fact home births cost women much more than hospital births if they are not covered by insurance.

### The Need for Infrastructure in States with Birth Center Regulations

In response to remarks made by Nigel Paneth about a birth center in Michigan closing after a breech delivery, an audience member commented on the fact that Michigan is one of the few states without licensure for free-standing birth centers. Breech deliveries are outside of the national standard for birth centers. The implication was that states without regulations, such as Michigan, need infrastructure to help avoid this type of problem.

### The Challenge of Transfer

A participant observed that transfer is legally fraught for liability reasons. For example, in Virginia, midwives are licensed and practice legally. Yet, some hospitals report each and every transfer to the state licensing board, which presents a real challenge for the midwives. She asked the panelists if any of their research points to a way forward. Armstrong added that the patchwork of state laws that govern who can attend births compounds the legal challenge. However, she cautioned that moving forward will require more than legal reform. Addressing the challenge of transfer will require a multipronged approach, one that also involves rebuilding trust among the different communities of care providers. She described the mistrust that currently exists among communities of care providers as "endemic and corrosive." MacDorman agreed that trust is a core issue.

Two other participants echoed concerns about liability and the important role that state legislation plays in either restricting or promoting collaboration during transfer. For example, malpractice carriers telling physicians that they cannot provide midwifery backup significantly restricts collaboration. The state of Washington has been very forward thinking in its requirement that insurers who provide malpractice insurance provide such insurance to midwives, thereby promoting collaboration.

# 4

# Birth Settings and Health Outcomes: State of the Science

Much of the research that has been conducted over the past three decades on birth settings in the United States has focused on health outcomes, including both maternal and neonatal health outcomes. Moderated by Holly Powell Kennedy, C.N.M., Ph.D., FACNM, FAAN, Yale University, New Haven, Connecticut, Panel 3 presenters discussed several major recent studies on birth settings and health outcomes conducted in the United States and elsewhere. This chapter summarizes those presentations and the panel discussion that followed. See Box 4-1 for a summary of key points made by individual speakers.

## COCHRANE REVIEW OF ALTERNATIVE VERSUS CONVENTIONAL INSTITUTIONAL SETTINGS FOR BIRTH[1]

The impetus for the Hodnett et al. (2012) Cochrane review on clinical birth settings was rooted in prevailing concerns about the technological focus on birth in hospital settings. These concerns, combined with studies demonstrating that the built physical environment can influence length of stay, development of complications, and patient satisfaction with care, pointed to birth settings as an important area of study.

Hodnett et al. (2012) identified three types of alternative hospital settings: (1) *"home-like," or bedroom-like, room, or rooms*, that exist either within the hospital labor ward or as separate units within the hospital; (2)

[1]This section summarizes information presented by Ellen Hodnett, R.N., Ph.D., FCAHS, University of Toronto, Toronto, Ontario, Canada.

**BOX 4-1**
**Birth Settings and Health Outcomes: State of the Science**
**Key Points Made by Individual Speakers**

- In a comparison of the effects of care in "alternative hospital settings" to care in a conventional labor room, the Hodnett et al. (2012) Cochrane review concluded that women randomized to alternative hospital settings were more likely to have no analgesia or anesthesia, spontaneous vaginal birth, and preference for the same setting next time; and less likely to have intrapartum oxytocin, epidural analgesia, Cesarean delivery, assisted vaginal birth, and episiotomy. They found no difference in postpartum hemorrhage, serious maternal morbidity or mortality, serious perinatal morbidity or mortality, 5-minute Apgar, admission to neonatal intensive care unit, or perinatal death.
- Jane Sandall reported the Birthplace in England Collaborative Group prospective cohort study showed a low incidence of adverse perinatal outcomes in all birth settings for low-risk women. While there were no differences in perinatal outcomes for nulliparous women between midwifery units and obstetric units or for multiparous women between any settings, there were significantly more adverse outcomes among nulliparous women in births planned at home compared with those planned in obstetric units. The researchers also reported fewer interventions among women planning births at home or in midwifery units compared to women planning births in obstetric units; and a higher percentage of nulliparous women transferred from either home or a midwifery unit to an obstetric unit, compared to multiparous women.
- Based on a growing collection of reports and studies on intrapartum care principles and processes, the "emerging mosaic" coming into view, in Carol Sakala's opinion, is that undisturbed, physiologic childbearing confers benefits to women and babies and that common intrapartum practices may have many consequential, sustained, and unintended consequences. Sakala observed that care in birthing centers and home births appears to be associated with fewer interventions and more favorable care practices. Birth center settings do not compromise any measured outcome and, in fact, favor several outcomes. While home births have been associated with lower rates of many maternal and neonatal morbidity measures, they have also been associated with an increased rate of neonatal mortality. Sakala noted that the latter finding is controversial.
- Esther Sternberg explored the growing body of evidence suggesting that a person's physical environment can influence health via the body's stress response system and expressed hope that a greater understanding of the brain-immune connection can help designers build healthier, safer birth environments that support both mental and physical health of the mother, fetus, and child. Sternberg called for more research on physiological outcome measures and suggested some methods that might be useful.
- Kristi Watterberg described planned home births as "the most emotional and least data-driven issue" that she has encountered in neonatology, with the possible exception of circumcision. In her opinion, data are limited by researchers from different backgrounds having different expectations of what they will find; splintered systems making it difficult to collect reliable and complete data; and the difficulty, or impossibility, of randomizing study participants in clinical trials.

*ambient rooms*, which were named as such because of their health-promoting aspects, such as nature scenes (either natural scenes that can be viewed through a window or artificially imposed scenes on the walls of the room), music, freedom to move, and mats and pillows instead of a labor bed, all of which are intended to promote feelings of control, freedom of movement, and calmness; and (3) the *Snoezelen room*, a type of room that is used more frequently for people with neurologic brain disorders and which is characterized by multiple sensory stimuli, such as fiberoptic lights, sounds, and aromatherapy. The review covered only care in alternative institutional birth settings; it did not cover home births.

The primary objective of the review was to evaluate effects of care in an alternative birth setting compared to care in a conventional labor room. The secondary objectives were to determine if effects vary based on certain characteristics, namely, (a) whether the alternative setting was staffed by the same or separate staff (i.e., conventional labor ward staff), (b) whether continuity of care was also part of the alternative setting, (c) location of the alternative setting (i.e., within the conventional labor and delivery ward, elsewhere in the hospital, or as a freestanding unit), and (d) type of room (i.e., bedroom-like, ambient, or Snoezelen).

## Methods

The authors searched the literature from around the world, regardless of language. As with nearly all Cochrane reviews, they sought only randomized controlled trials. Additionally, they analyzed only prespecified outcome measures (both primary and secondary outcome measures). All analyses were by intent to treat. They conducted independent assessments of the eligibility of trials based on methods used and risk of bias; they also conducted sensitivity analyses (e.g., removed weaker trials from the review to see if their removal affected the conclusions). The reviewers ended their search with a total of 10 randomized controlled trials involving 11,795 women.

Of the 10 trials, one trial provided no relevant data, that is, no data for any of the prespecified primary or secondary outcomes. Of the remaining nine, two were conducted in Canada, one in Ireland, one in Australia, one in Sweden, three in the United Kingdom, and one in Norway. One of the nine was a pilot randomized controlled trial (N = 60) of the ambient room setting; the other eight were randomized controlled trials of bedroom-like settings. The reviewers found no randomized controlled trials of either Snoezelen rooms or freestanding birth centers. The eight studies on bedroom-like settings varied in some of their characteristics. Five provided some antenatal care as well as intrapartum care, indicating some level of continuity, and three had separate staff in the alternative care setting, com-

pared to the hospital's conventional labor and delivery ward, with all three operating with continuity of care as their *modus operandi*.

All of the alternative study settings included in the review shared a common philosophy that labor and birth is a fundamentally normal experience, and all restricted use of technology during labor and birth. Generally, physicians were not involved in labor and birth in the alternative study settings unless needed. The settings were characterized by high transfer rates either before or during labor, with rates ranging from 29 percent in one study to up to 67 percent in another study.

## Results and Conclusions

Women randomized to alternative birth settings were *more likely* to have no analgesia or anesthesia (based on data from six trials, N = 8,953), spontaneous vaginal birth (based on data from eight trials, N = 11,202), and preference for same setting next time (based on data from two trials, N = 1,207); they were *less likely* to have intrapartum oxytocin (based on data from eight trials, N = 11,131), epidural analgesia (based on data from eight trials, N = 10,931), Cesarean birth (based on data from nine trials, N = 11,350), assisted vaginal birth (based on data from eight trials, N = 11,202), and episiotomy (based on data from eight trials, N = 11,055). The reviewers found no significant differences in postpartum hemorrhage (based on six trials, N = 10,712), serious maternal morbidity or mortality (based on four trials, N = 6,334), serious perinatal morbidity or mortality (based on five trials, N = 6,385), 5-minute Apgar (based on seven trials, N = 7,665), admission to neonatal intensive care unit (NICU) (based on seven trials, N = 10,798), or perinatal death (based on eight trials, N = 11,206).

The reviewers intended to use prespecified subgroup analyses as a way to determine whether the effects of care observed in alternative settings varied depending on certain characteristics of the trial. However, it was only possible to conduct one subgroup analysis, specifically, whether outcomes varied depending on whether the setting was staffed by the same individuals who staffed the hospital's conventional labor and delivery ward. The reason for conducting that particular subgroup analysis was the feeling that it was a lot to ask of midwives and nurses working in tertiary units to shift gears the next day and work in a birth setting where risks are lower and where care is based on a different philosophy. However, results of the subgroup analysis revealed that whether staff was the same or separate did not affect spontaneous vaginal birth or serious maternal or perinatal morbidity or mortality.

Hodnett et al. (2012) concluded that their results were consistent with other studies on the independent effects of hospital architecture on health outcomes. However, the benefits of an alternative setting may be overpow-

ered by institutional norms and policies. Hodnett emphasized that it is important to keep in mind that each of these settings is part of an institution and, as such, is subject to the same norms and policies, both stated and unstated, of that institution.

### Implications for Practice and Policy

The implications for practice are that pregnant women should be informed that alternative hospital birth settings are associated with lower rates of medical interventions during labor and birth and higher levels of satisfaction, without increasing risk either to themselves or to their babies.

The implications for policy are that decision makers who wish to decrease rates of medical interventions for women experiencing normal pregnancies should consider developing birthing units with policies and practices to support normal birth and labor. More evidence is needed to help decision makers make decisions about staffing models, organization of care, autonomy of the setting, and architectural features.

### Recommendations for Future Research

The authors identified several methodological recommendations for future research: measure and report serious perinatal morbidity as well as mortality, provide clear protocols for consultation and transfer of care, address potential confounding effects of continuity of caregiver (i.e., when trying to determine whether setting makes a difference), use evidence-based approaches to encourage high response rates to postal questionnaires, and include cost-effectiveness analyses.

With respect to areas of study, Hodnett et al. (2012) recommended several types of future studies: randomized controlled trials of freestanding birth centers; randomized controlled trials of alternative birth settings that are specifically designed to promote freedom of movement, feelings of calmness, and a sense of control; studies to determine optimal organizational models of birth center care; qualitative studies of impact of transfer on women, care providers, and decision-making processes regarding the need for intervention; and qualitative studies on the impact of competing philosophical, political, and administrative pressures on the operation of alternative settings.

Hodnett also argued that a shift in focus from trying to change providers' and women's behavior to altering the clinical environment for labor and birth is worthy of rigorous evaluation. Cesarean delivery rates for otherwise healthy childbearing women continue to increase, despite widespread efforts to encourage providers to adopt evidence-based practices.

Hodnett closed with two slides depicting a hospital labor room before

**FIGURE 4-1** Questioning the intention to promote feeling of calmness. Left: a bedroom-like hospital labor room as the laboring woman enters it. Right: The same room after the woman has been admitted to the labor room.
SOURCE: Fannin, 2003. Reprinted with permission from John Wiley and Sons.

and after admission of a woman in labor (see Figure 4-1). She said that many of these settings are now called family birth centers.

## BIRTHPLACE IN ENGLAND COLLABORATIVE GROUP STUDIES[2]

The Birthplace in England Collaborative Group is a team of midwives, obstetricians, health economists, epidemiologists, maternity service user organizations, and colleagues led by the National Perinatal Epidemiology Unit at the University of Oxford. The group has produced a series of reports and studies that can be viewed on the project website (http://www.npeu.ox.ac.uk/birthplace). After providing workshop participants with some statistics about deliveries in England, Jane Sandall described in detail one of these studies, a prospective cohort study on perinatal and maternal outcomes by planned place of birth (Brocklehurst et al., 2011).

### Having a Baby in England

About 680,000 babies are born in England every year, with the majority of women giving birth in the National Health Service (NHS) sector (i.e., England's public health system). Forty percent of deliveries are attended by obstetricians or other hospital doctors, 60 percent by midwives. Based on NHS maternity statistics, in 2010-2011, the majority of women (92

[2]This section summarizes information presented by Jane Sandall, Ph.D., M.Sc., B.Sc., RM, HV, RN, King's College London, United Kingdom.

percent) gave birth in an obstetric unit (177 obstetric units nationwide), 3 percent delivered at home, 3 percent gave birth in alongside midwife units colocated on the same site as an obstetric unit (53 such units nationwide), and 2 percent delivered in freestanding midwife units geographically separate from any obstetric unit (59 such units nationwide). Both alongside and freestanding midwife units are led by midwives who have clinical accountability for the women in their care. Sandall emphasized that the maternity care system in England is integrated, such that women can transfer from outside of an obstetric unit into an obstetric unit with her midwife. There are no barriers to transfer, according to Sandall. In 2012, there were 21,249 midwives (plus another 5,000 in training), 1,570 consulting obstetricians, and 2,635 registrars (obstetricians in training) practicing as NHS providers nationwide.

Current policy is that women should be provided choices for where to give birth and that those choices should be informed by evidence. However, there is a lack of accurate quantification of the risks associated with births planned in different settings. What evidence does exist has been difficult to interpret because actual place of birth has often been used to make inferences about planned place of birth. "It is absolutely crucial," Sandall stated, "to be able to look at outcomes by planned place of birth . . . and to use an intention-to-treat analysis." Thus, the Birthplace in England Collaborative Group was commissioned by the Department of Health to conduct such an analysis. Other studies conducted by the group include a mapping survey of NHS providers in England, a cost-effectiveness study, and case studies on how care is organized and delivered.

### A Prospective Cohort Study on Perinatal and Maternal Outcomes by Planned Place of Birth

The primary objective of the project's prospective cohort study was to compare intrapartum and early neonatal mortality and morbidity by planned place of birth (i.e., at the start of care of labor) and among women judged to be at "low risk" of complications according to current national clinical guidelines (Brocklehurst et al., 2011). Sandall explained that the national guidelines for identifying low-risk births also contain a set of indicators identifying women who should be advised to give birth in an obstetric unit. The guidelines do not use the word "allow." Rather, they state that women should be informed that the guidelines are based on a review of international evidence.

The sample population included all NHS trusts providing intrapartum care at home, all freestanding midwifery units, all alongside midwifery units, and a stratified random sample of 142 obstetric units. The sample totaled 64,538 eligible "low-risk" women, that is, women with a singleton,

term pregnancy (greater than or equal to 37 weeks). A power calculation based on a composite perinatal primary outcome measure indicated a need for 57,000 participants, a target that was more than achieved. Unplanned births were excluded from the analysis.

The comparison groups included planned place of birth at the start of care of labor for low-risk women at (a) home, (b) freestanding units, (c) alongside midwifery units, and (d) obstetric units. All comparisons were made with the obstetric unit, not because obstetric units were considered safer but because of the statistical power achieved by using that comparison. Analyses were adjusted for maternal age, ethnicity, and various sociodemographic characteristics; adjustments were made because women who chose to birth at home and in freestanding midwifery centers were more likely to be older, white, better educated, and living in less disadvantaged areas.

### Are There Differences Between Planned Birth Settings in Outcomes for the Baby?

The researchers found a higher-than-expected prevalence of complicating conditions recorded at the start of labor, but with marked differences among planned place of birth. Almost 20 percent of women in obstetric units had at least one complicating condition recorded at the start of care compared to 7 percent or fewer in each of the other settings. The complicating conditions included meconium stain, proteinuria, abnormal vaginal bleeding, and other phenomena. According to Sandall, these various complicating conditions probably arose because the system works so well, with women calling their midwives and being advised to go to an obstetric unit. Because the complicating conditions were unexpected, the researchers' planned analysis had not taken them into account. Thus, the investigators conducted additional analyses of outcomes that were restricted to women without complicating conditions at the start of care in labor.

Of the approximately 65,000 women who participated in the study, there were about 250 adverse perinatal outcomes. The outcome measure was a composite measure. Examining each outcome separately would not have provided enough statistical power to conduct an assessment. Of the 250 primary composite outcome events, 13 percent were intrapartum stillbirths or early neonatal deaths, 46 percent were neonatal encephalopathy, 30 percent meconium aspiration, and 12 percent shoulder injuries. The overall event rate was 4.3 adverse perinatal outcome events per 1,000 births. The rate was higher for nulliparous women (5.3 events per 1,000 births) than for multiparous women (3.1 events per 1,000 births).

There were no statistically significant differences in adverse perinatal outcome among the different planned places of birth. However, in a subgroup analysis by parity, there were significant differences. Among nul-

liparous women (nullips), there were significantly more adverse outcomes in births planned at home (9.3 per 1,000) compared with those planned in obstetric units (5.3 per 1,000). There were no significant differences for nullips who were planning to give birth in midwife units compared to those planning to give birth in obstetric units, and no significant differences for multiparous women (multips) among any of the four settings.

For the restricted sample of women without any complicating conditions at the start of labor, the effect for nullips who were planning to give birth at home was strengthened. Restricting the sample had no impact on results for the other settings.

In summary, for low-risk women, the incidence of adverse perinatal outcomes is low in all birth settings. For multiparous low-risk women, there are no differences in adverse perinatal outcomes among settings. For nulliparous women, the risk of an adverse perinatal outcome appears to be higher among women who plan to give birth at home compared to women planning to give birth in obstetric units.

### How Does Planned Birth in Different Settings Affect Intrapartum Interventions and Other Maternal Outcomes?

The researchers evaluated several secondary outcomes: mode of birth, maternal morbidity and mortality, and interventions during labor and birth (e.g., forceps delivery versus intrapartum Cesarean section versus "normal birth"). Normal birth was defined as birth without any of the following interventions: induction of labor, epidural or spinal analgesia, general anesthetic, forceps or ventouse, Cesarean section, or episiotomy (Maternity Care Working Party, 2007). In 2012, 47 percent of women who gave birth in the United Kingdom had what would be defined as a normal birth. The analysis of maternal outcomes by planned place of birth revealed that the Cesarean delivery rate for women planning to give birth in obstetric units was 11 percent, compared to 2 to 4 percent for women planning to give birth in one of the other settings. The pattern was similar for other interventions (forceps and syntocinon) although not quite as stark. The pattern was reversed for normal births, with a smaller percentage of women who plan to deliver in obstetric units having normal births compared to the other settings. For women with access to water or pain relief in labor, the discrepancy in rates for normal birth between the obstetric unit group and the other groups was greater.

### Conclusions of the Prospective Study

In sum, the Birthplace in England Collaborative Group (Brocklehurst et al., 2011) concluded that, for low-risk women, the incidence of adverse

perinatal outcomes is low in all birth settings (4.3 adverse perinatal outcome events per 1,000 births). For multiparous low-risk women, there are no differences in adverse perinatal outcomes among planned place of birth settings. For nulliparous women, the risk of an adverse perinatal outcome appears to be higher among women who plan to give birth at home compared to women who plan to give birth in obstetric units. There were no observed differences in risk among women who plan to give birth in freestanding or alongside units compared to women who plan to give birth in obstetric units.

Among maternal outcomes, all low-risk women planning births at home or in either freestanding or alongside midwifery units experienced fewer interventions than those planning births in obstetric units.

### How Often Are Women Who Plan Birth in Nonobstetric Settings Transferred During Labor or Immediately After the Birth?

A key concern with birth settings, in Sandall's opinion, is women who transfer. Overall, 21 to 26 percent of the prospective study participants transferred to obstetric units during labor or shortly after birth. A far higher percentage of nulliparous women transferred (36 to 45 percent), compared to multiparous women (9 to 12 percent). The most common reasons for transfer were failure to progress in the first and second stages and signs of fetal distress.

In addition to the prospective cohort study described above, the Birthplace in England Collaborative Group also conducted a qualitative study on women's experience of transfer (Rowe et al., 2012). The investigators observed that concerns around transfer distance meant that many women, especially women living in rural areas, did not feel they had any realistic choice of place of birth. They were concerned about the arrangements and the time and travel that transfer would require. Among those who transferred, most women were prepared for the unpredictability of childbirth and the possibility of transfer; however, some were not expecting transfer. Some women found transfer to be worrying, disempowering, or disappointing. Careful explanation of events by professionals had a positive effect on women and their partners' experiences (Rance et al., 2013).

### Economic Analysis

The economic analysis conducted by the Birthplace in England Collaborative Group was a bottom-up costing of all resources used for intrapartum care and during the immediate postnatal period after birth, including any higher-level care administered to either mothers or babies (Schroeder et al., 2012). Costs were allocated to planned places of birth. The research-

ers reported a cost per birth gradient with planned births in obstetric units being the most expensive (£1631), followed by planned births in alongside midwifery units (£1461), planned births in freestanding midwifery units (£1435), and planned births at home (£1067).

### Implications for Practice

Results of the various Birthplace in England Collaborative Group studies have several implications for practice. First, guidance to women on planned place of birth should be updated with more accurate information about maternal and perinatal outcomes and transfer rates. Second, variation in out-of-hours cover, training, experience, and support for midwives should be reduced (McCourt et al., 2012). Likewise, variation in transport arrangements for home birth provision needs to be improved. Third, the higher intervention rates and low normal births in obstetric units need to be addressed. Fourth, midwife-unit provision should be expanded. Sandall observed that expanding alongside, rather than freestanding, units seems to be the more popular option for logistical reasons. However, maternity services across the United Kingdom are being reconfigured, with many small obstetric units closing and being reconfigured into freestanding midwife units. Finally, results of the Birthplace in England Collaborative Group work call for an audit and review of intrapartum transfers and management.

Issues that the Birthplace project cannot address include health economics beyond intrapartum and postpartum care costs. The economic analysis was limited to a short time frame around birth. Also, it is not clear why, for women having their first baby, planned home births appear to be more risky than planned obstetric unit births.

### Implications for Further Research

Sandall listed several questions that the Birthplace group identified as priorities for future research:

- What aspects of clinical care and service delivery are associated with poorer intrapartum outcomes? Which are potentially modifiable?
- How can the frequency of interventions be reduced for low-risk women planning birth in obstetric units?
- To what extent do socially disadvantaged women have reduced access to choice of birth setting? What strategies might improve equity?
- How can the experience of intrapartum transfer be better managed and the experience improved for women and partners?

- How can ongoing assessment of complications and early detection and referral in late pregnancy and early labor be improved?
- Do models of care that provide continuity of care across settings improve the quality and safety of care?

## PROCESS OF CARE DURING CHILDBIRTH[3]

Carol Sakala addressed three questions related to the process of care during childbirth: (1) What intrapartum care principles and processes are optimal for healthy, lower-risk childbearing women and newborns?; (2) What settings most reliably implement these principles and processes?; and (3) What criteria should be used to assess intrapartum care within and across birth settings?

### What Intrapartum Care Principles and Processes Are Optimal for Healthy, Lower-Risk Childbearing Women and Newborns?

To answer this question, Sakala shared some insights from Childbirth Connection's consensus report, *2020 Vision for a High-Quality, High-Value Maternity Care System* (Carter et al., 2010, p. S8). The report was based on work done by a multistakeholder, multidisciplinary team of individuals who were provided with systematic reviews and other best evidence about the effects of different elements of the maternity system. The draft document was reviewed by all members of the organization's Transforming Maternity Care steering committee and all 10 co-chairs of the project's five stakeholder work groups. The final report describes several values and principles, including the six quality aims identified in the Institute of Medicine (IOM) 2001 report *Crossing the Quality Chasm: A New Health System for the 21st Century*, but adapted for maternity care. The report also emphasizes care processes that protect, promote, and support physiologic childbirth, and care that is evidence based. Also consistent with the IOM (2001) report, the Childbirth Connection report defines quality as "the degree to which maternity care services provided to individuals and populations increase the likelihood of optimal health outcomes and are consistent with current knowledge" (p. S8) and value as "the optimal cost to quality ratio in the delivery of maternity care services" (p. S8).

Sakala shared some excerpts from the report. First, with respect to a goal for care around the time of birth, "All maternity caregivers have knowledge and skills necessary to enhance the innate childbearing capacities of women. Each woman is attended in labor and birth in the manner

[3]This section summarizes information presented by Carol Sakala, Ph.D., M.S.P.H., Childbirth Connection, New York, New York.

that is most appropriate for her level of need and that of her baby and experiences only interventions that are medically indicated, supported by sound evidence of benefit, with least risk of harm compared with effective alternatives. Women and babies at high risk for complications for whom a higher level of specialized care is appropriate have specialty care available to them that adheres to the same basic values and principles" (p. S11).

With respect to the care system and settings for care around the time of birth, the *2020 Vision* report states: "A full range of safe birth settings is available and receives system-wide support, so that each woman is free to choose the setting that is most appropriate for her level of need and that of her fetus/baby and that best reflects her values, culture, and preferences. This choice can be made with confidence because each setting assures her a consistent standard of safe, effective, risk-appropriate care, within an integrated system that provides for coordinated consultation, collaboration, or transfer in either direction should her level of need or that of her baby change"(p. S13).

In addition to the 2020 report, Sakala also referred workshop attendees to a forthcoming commissioned report on the hormonal physiology of childbearing (Buckley, forthcoming). Based on a large body of evidence, that report states that, when protected, promoted, and supported, endogenous hormone systems optimize physiologic adaptation of women and fetuses and newborns from before the onset of labor through labor, birth, breastfeeding, and attachment. Benefits include helping with stress and labor pain, providing fetal neuroprotection in labor, preventing postpartum hemorrhage, and optimizing breastfeeding initiation. The report also presents available evidence, clarifying that common maternity care interventions can disrupt hormonal processes and interfere with these benefits.

Related to the Buckley report, Sakala described what she referred to as a "burgeoning literature" on the developmental origins of health and disease and how medical, nutritional, and environmental exposures during sensitive periods of rapid development can have lifelong consequences for immune, metabolic, neurologic, and other body systems (Csaba, 2008; Hyde et al., 2012; Newbold et al., 2006; Penders et al., 2006; van Nimwegen et al., 2011). These consequences include epigenetic effects. Studies showing multigenerational effects of DES (diethylstilbestrol) exposure are especially sobering, in Sakala's opinion (Newbold et al., 2006). Some of the studies demonstrate variation in effects by birth setting, with less intervention generally associated with fewer adverse consequences. Effects also vary by mode of birth and infant feeding, which themselves vary by birth setting. Mothers too may experience lasting or long-term effects of intrapartum care processes which often vary by setting (Buckley, forthcoming; Ip et al., 2007; Kim et al., 2010; Silver et al., 2006). The evidence is especially

impressive for Cesarean deliveries (lasting reproductive and gynecologic effects) and breastfeeding (long-term effects).

Sakala expressed her view that the appropriate focus of research about the effects of care processes should be the mother-baby dyad, rather than an exclusive focus on the effects on either the baby or the mother.

In conclusion, the "emerging mosaic" that is coming into view suggests that undisturbed, physiologic childbearing confers benefits to women and babies and that common intrapartum practices may have many consequential, sustained, and unintended consequences. Sakala urged exercise of the precautionary principle (Kriebel and Tickner, 2001; Tickner et al., 2003); that is, whenever possible, minimize deviation from what Sakala called "our mammalian heritage" and limit exposure to interventions that do not offer a clear benefit.

### What Settings Most Reliably Implement These Principles and Processes?

To answer this question, Sakala referred to the "Milbank report" on evidence-based maternity care (Sakala and Corry, 2008). The report was based on data from Childbirth Connection's Listening to Mothers II survey of women who gave birth in U.S. hospitals in 2005 and on systematic reviews of maternity practices experienced by a large proportion of women and newborns. The report identified many overused practices, including labor induction, epidural analgesia, Cesarean delivery, continuous electronic fetal monitoring (EFM), rupturing membranes, and episiotomies. Conversely, the report also identified numerous underused effective, beneficial, and noninvasive practices in U.S. hospital-based maternity care, including family physician maternity and midwifery care; smoking cessation interventions for pregnant women; external cephalic versions for breech presentation fetuses; vaginal births after Cesarean deliveries; continuous labor support; measures for comfort, pain, relief, and labor progress; nonsupine positions for giving birth; delayed cord clamping in term and preterm babies; early skin-to-skin contact; breastfeeding and interventions to support its initiation and duration; practices to foster women's satisfaction with childbirth experience; and interventions for postpartum depression.

Sakala emphasized that her intention was not to assess the weight of the evidence or derive precise estimates, but to identify studies that help to clarify whether there are differences in practice patterns across the various birth settings. First, she examined studies that compare care in hospitals versus birth centers. Fullerton and Severino (1992) conducted a secondary analysis of the first National Birth Center Study, comparing participants in that study with a group of women experiencing care in hospitals. Both groups had predominantly midwifery care, with no medical or obstetric risk factors (as defined by the investigators) and no prenatal or intrapartum

complications. All eight interventions and care practices examined favored birth centers: (1) external electronic fetal monitoring (7 percent in birth centers, compared to 50 percent in hospitals); (2) intravenous fluids (8 percent in birth centers, compared to 24 percent in hospitals); (3) artificial rupture of membranes (41 percent in birth centers, compared to 51 percent in hospitals); (4) more than four vaginal exams (44 percent in birth centers, compared to 53 percent in hospitals); (5) solid food during labor (15 percent in birth centers, compared to 11 percent in hospitals); (6) shower or bath during labor (40 percent in birth centers, compared to 24 percent in hospitals); (7) episiotomy (21 percent in birth centers, compared to 34 percent in hospitals); and (8) Cesarean section (4 percent in birth centers, compared to 10 percent in hospitals).

A second study, by Jackson et al. (2003), compared birth center women who had received midwifery care (N = 1,808) to women in hospitals who were eligible for birth center care (N = 1,149). Jackson et al. (2003) performed an intention-to-treat analysis; the investigators adjusted for race/ethnicity, parity, history of Cesarean delivery, age, marital status, country of origin, smoking, and height. All 11 interventions and care practices examined favored birth centers: (1) labor induction (8 percent in birth centers, compared to 15 percent in hospitals), (2) labor augmentation (16 percent in birth centers, compared to 27 percent in hospitals), (3) intravenous fluids (67 percent in birth centers, compared to 97 percent in hospitals), (4) artificial rupture of membranes (53 percent in birth centers, compared to 57 percent in hospitals), (5) continuous EFM (48 percent in birth centers, compared to 94 percent in hospitals), (6) walking in labor (75 percent in birth centers, compared to 67 percent in hospitals), (7) tub or shower in labor (37 percent in birth centers, compared to 3 percent in hospitals), (8) epidural analgesia (30 percent in birth centers, compared to 69 percent in hospitals), (9) episiotomy (13 percent in birth centers, compared to 38 percent in hospitals), (10) assisted delivery (8 percent in birth centers, compared to 18 percent in hospitals), and (11) Cesarean section (11 percent in birth centers, compared to 19 percent in hospitals).

With respect to outcome, the conservative style of care typical of a birth center setting did not result in any compromise of the measured outcomes and, in fact, favored several outcomes. Specifically, there was no difference in positive pressure ventilation, NICU admission, major complication composite measures, preterm birth or low birthweight, intrapartum maternal febrile morbidity, or maternal and newborn readmissions. Outcomes that favored birth centers included fetal heart abnormalities (11 percent in birth centers, compared to 19 percent in hospitals), spontaneous vaginal births (81 percent in birth centers, compared to 63 percent in hospitals), and maternal length of stay greater than 72 hours (10 percent in birth centers, compared to 16 percent in hospitals).

Sakala also pointed to the Birthplace in England study, noting that the odds ratio for the composite "normal birth" (with neither labor induction nor epidural/spinal analgesia, general anesthesia, forceps or vacuum extraction, Cesarean, or episiotomy) measure that Dr. Sandall had referenced in her presentation was 3.86 for freestanding midwifery units compared to obstetric units (Brocklehurst et al., 2011). For a recent summary of these and other studies on birth center versus hospital care, see Goer and Romano (2012).

With respect to care in a home setting, Sakala pointed to the Wax et al. (2010) meta-analysis. In a comparison of planned home births versus planned hospital births, Wax et al. (2010) identified several high-impact interventions that favored planned home births: epidural analgesia (9 percent in a home setting, compared to 23 percent in hospitals), electronic fetal heart rate monitoring (14 percent in a home setting, compared to 63 percent in hospitals), episiotomy (7 percent in a home setting, compared to 10 percent in hospitals), assisted delivery (4 percent in a home setting, compared to 10 percent in hospitals), and Cesarean section (5 percent in a home setting, compared to 9 percent in hospitals).

Additionally, the investigators identified several maternal morbidity outcomes that also favored planned home births: third- or fourth-degree laceration (1 percent in a home setting, compared to 3 percent in hospitals), infection (1 percent in a home setting, compared to 3 percent in hospitals), postpartum bleeding or hemorrhage (4.9 percent in a home setting, compared to 5 percent in hospitals), vaginal laceration (8 percent in a home setting, compared to 22 percent in hospitals), and retained placenta (1 percent in a home setting, compared to 2 percent in hospitals). In contrast, one maternal morbidity outcome, perineal laceration, favored hospital births (43 percent in a home setting, compared to 37 percent in hospitals). Another maternal morbidity outcome, cord prolapse, was no different between the two settings.

With respect to newborn morbidity outcomes, two favored planned home births: prematurity (1 percent in a home setting, compared to 5 percent in hospitals) and low birthweight (1 percent in a home setting, compared to 2 percent in hospitals). Two newborn morbidity outcomes showed no difference between the two settings: newborn ventilation and perinatal death. Two favored planned hospital births: total neonatal death (0.20 percent in a home setting, compared to 0.09 percent in hospitals) and nonanomalous neonatal death (0.15 percent in a home setting, compared to 0.04 percent in hospitals). The last finding—the greater percentage of neonatal deaths in home versus hospital settings—has been a very controversial finding. Sakala mentioned that a number of concerns have been discussed in the literature, including the inclusion of women with unplanned, high-risk

births in some of the studies in the meta-analysis. She pointed out that the absolute risk difference in neonatal deaths is small.

In addition to the results of Wax et al. (2010), Sakala referred to findings reported in the Birthplace in England national prospective cohort study (Brocklehurst et al., 2011), where the odds ratio for that study's "normal birth" measure was 4.47 for the births planned at home compared to births planned in obstetric units. For a recent summary of these and other studies on home versus hospital birth, see Goer and Romano (2012).

Sakala expressed concern that the United States does not have an integrated system, one characterized by licensure of all providers and routine electronic sharing of health records, care collaboration, performance measurement and reporting, and quality improvement initiatives.

### What Criteria Should Be Used to Assess Intrapartum Care Within and Across Birth Settings?

When assessing intrapartum care within and across birth settings, several outcomes of interest to women and families are often excluded from studies. These include quality of life, physical and emotional functioning and recovery, breastfeeding, adaptation to parenthood and family functioning, new-onset maternal morbidity, and payer and out-of-pocket cost of intrapartum care.

Sakala emphasized her belief in the importance of considering optimal outcomes (e.g., spontaneous vaginal birth, exclusive breastfeeding), as well as harms. Sakala indicated harms are generally understudied. Harms of interest with respect to assessing intrapartum care include effects of unneeded interventions; disruption of hormone systems (both short- and long-term effects); perinatal origins of disease and impact on immune, metabolic, and other systems; new-onset maternal morbidity; child morbidity; and mortality.

Additionally, Sakala emphasized the importance of assessing whether the policies, protocols, and systems in place are *promoting* physiologic childbearing. For example, do personnel have the skills and knowledge to support physiologic childbearing? Furthermore, do personnel *protect* physiologic childbearing by ensuring a quiet and private environment or by ensuring that mothers and babies are not disturbed by routine early separation? And, do personnel *support* physiologic childbearing by routinely promoting comfort and labor progress through rest, hydration, positioning, comfort measures, and encouragement?

Many studies of intrapartum care do not measure outcomes after hospital discharge or after the intrapartum period. Thus, very little is known about the longer-term effects of different settings (Teune et al., 2013). Although costly, research follow-up to at least 1 year would help fill what

is basically a "black box" in terms of what is known about long-term outcomes.

Additionally, according to Sakala, experience of care surveys (e.g., the Consumer Assessment of Healthcare Providers and Systems [CAHPS] hospital survey) are poorly suited to maternity care. She suggested, as an example, maternity CAHPS surveys are needed to measure the experiences of both mother and newborn across the various settings and with different types of care providers.

Finally, Sakala indicated the fact that many women have difficulty finding ready and willing "essential maternity care services" that should be routinely available. These include vaginal birth after Cesarean, external cephalic version, vaginal breech birth, vaginal twin birth, skillful judicious assisted delivery, measures to foster comfort and labor progress, and tubs and showers. Thus, in evaluations, questions should be asked whether any given setting provides essential maternal care services appropriate to its level of care and whether it supports women's informed choices.

### Summary Points

Sakala concluded with four summary points:

1. The precautionary principle is a prudent consideration when assessing processes of care during childbirth.
2. Hospitals are much more likely to provide the type of childbirth care needed by women and babies at higher risk or with significant established problems than that needed by most lower-risk childbearing families.
3. Care around the time of birth in birth centers and home births appears to be more closely aligned with needs of lower-risk childbearing families, but our broader health care system needs to better integrate and support these settings, and to hold all settings accountable.
4. Current research cannot answer many priority questions about the comparative effectiveness of childbirth care in birth settings. We need to expand the questions, measures, outcomes, and designs.

## EFFECT OF BUILT ENVIRONMENT ON THE NEUROENDOCRINE IMMUNE AXIS AND HEALTH: IMPLICATIONS FOR DESIGN OF HOSPITAL BIRTHING ENVIRONMENTS[4]

Can a place make you well or sick? The answer is "yes," according to Esther Sternberg. How does physical environment affect health? Sternberg explained that the answer lies within a field of science related to the mind-body, or brain-immune, connections (Sternberg, 2009).

The brain regulates the immune system in many ways; the immune system, in turn, sends signals to the brain (Sternberg, 2006). The brain's hypothalamic-pituitary-adrenal axis regulates the immune system via anti-inflammatory glucocorticoids released by the adrenal glands. Additionally, the brain regulates the immune system at the regional level via the sympathetic nervous system and innervation of the spleen, lymph nodes, and thymus. Finally, the peripheral nervous system regulates immunity at sites of inflammation. The parasympathetic nervous system also plays a role.

Basically, when stressed, or when someone perceives stress, the brain's hormonal stress response turns on and releases corticotropin-releasing hormone from the hypothalamus, adrenocorticotropic hormone from the pituitary gland, and glucocorticoids from the adrenals. At the same time, the sympathetic nervous system is activated and releases norepinephrine from adrenergic nerves and adrenaline from the adrenal medulla. Together, these constitute the physiologic stress response: feeling anxious, sweating, feeling your heart beating fast, urgency to defecate, etc.

Generally, the stress response is what Sternberg called a "good thing." By focusing one's attention on being vigilant and getting out of danger, the stress response can be life saving. But when activated for too long or in the wrong circumstances, as in chronic stress, the stress response can create problems. The total load of stress on the body is known as "allostatic load" (McEwen, 2007). It is that heavy load of stress which can cause illness.

There is a wealth of information on the association between chronic stress and numerous stress-related diseases and conditions: increased severity and frequency of viral infections (Cohen et al., 1991; Glaser and Kiecolt-Glaser, 2005), decreased vaccine take rate (Glaser and Kiecolt-Glaser, 2005), prolonged wound healing (Glaser and Kiecolt-Glaser, 2005), accelerated cancer growth (Armaiz-Pena et al., 2009), and accelerated chromosomal aging (Epel et al., 2004). Of these, prolonged wound healing in particular has great implications for birthing. In a study on chronically stressed caregivers of Alzheimer's patients, Kiecolt-Glaser and colleagues (1995) measured healing time for skin biopsies. In subjects who had re-

[4]This section summarizes information presented by Esther M. Sternberg, M.D., Arizona Center for Integrative Medicine, Tucson, Arizona. Andria Pizzato, Doctor of Nursing Practice graduate student, contributed to the background research for the presentation.

ceived biopsy wounds, 50 percent of nonstressed individuals were fully healed in 6 weeks, while only 15 percent of caregivers were healed. All of the healthy nonstressed controls were healed by 8 weeks, compared to only 85 percent of caregivers.

There is substantial literature in the field of integrative medicine demonstrating that mind-body interventions can reduce perceived stress and the impact of the stress response on the immune system (Benedetti et al., 2003; Davidson et al., 2003; Kjaer et al., 2002; Lutz et al., 2008; Newberg et al., 2003; Peng et al., 2004; Pollo et al., 2003). These interventions include meditation, exercise, breathing, yoga, tai chi, prayer, and placebo (a belief that something will heal). Numerous studies have shown that these interventions reduce the neuroendocrine (hypothalamic-pituitary-adrenal axis) and adrenergic stress responses, activate the parasympathetic relaxation response, activate brain opioid pathways and dopamine reward pathways, and enhance the immune response. These studies have used a variety of measures, including brain imaging (positron emission tomography, functional magnetic resonance imaging), heart rate variability (reflecting autonomic—adrenergic sympathetic and cholinergic parasympathetic—responses), neuroendocrine responses (salivary cortisol), and antibody response to vaccine (Benedetti et al., 2003; Davidson et al., 2003; Kjaer et al., 2002; Lutz et al., 2008; Newberg et al., 2003; Peng et al., 2004; Pollo et al., 2003).

### Can Place Affect the Stress Response System?

According to Sternberg, although more data need to be gathered, evidence collected thus far suggests that the physical environment can either foster or reduce the stress response. Elements of place that trigger the stress response include noise, crowding, light (either too much or too little), odors, mazes, and novelty (unfamiliarity).

A study on recovery of surgery (Ulrich, 1984) launched the field of evidence-based design. Ulrich (1984) showed that patients recovering from gallbladder surgery, all of whom were cared for by the same staff, recovered differently depending on the view from their hospital room. Patients in rooms with views of trees had shorter hospitalizations (by approximately 1 day), fewer analgesic medications, and fewer negative nurse notes than patients with views of brick walls. The findings from Ulrich (1984) have been reproduced many times in multiple settings (e.g., patients with various forms of depression left the hospital 2 to 4 days sooner if their rooms were on the sunny side of the ward [Beauchemin and Hays, 1998; Benedetti et al., 2001]).

According to Sternberg, this suggests that elements that improve both mental and physical health should be incorporated into our hospitals, in-

cluding in our birthing units. What kinds of physical environment changes could be introduced into these settings to reduce the stress response? She imagined spaces for contemplation, meditation, and prayer; green spaces with gardens or views of nature; spaces for social support, which is hugely important for coping with stress; areas for exercise; and areas for activities that engage the senses (e.g., art, music).

The Pebble Project (Center for Health Design, 2013), a project started by the Center for Health Design in San Francisco, California, involved measuring health outcomes associated with the physical changes caused by retrofitting various types of hospital units (e.g., intensive care units, pediatric units, cancer units, and regular wards). For example, the Clarian Health Partners Methodist Hospital in Indianapolis, Indiana, merged critical care and step-down units[5] in an effort to reduce complications associated with transfer of critical care patients from critical care units to step-down units; the Pebble Project reported that the merging of the units resulted in 90 percent fewer patient transfers, fewer medical errors, and greater satisfaction (Voelker, 2001). Sternberg reported that when the Center for Health Design collated findings from participating hospitals they found fewer patient falls, fewer medical errors, fewer hospital infections, and a reduction in pain medication use among patients in the retrofitted units. She said they also found less nursing turnover and greater staff and patient satisfaction (Ulrich et al., 2004, 2008). Moreover, Berry et al. (2004) calculated that it would have cost an additional $12 million up front to build a "fable" hospital with all of the physical features associated with improved health outcomes but that the cost would be recouped in the first year of operation, due to savings from improved health outcomes.

Based on a literature search on the effects of birthing environment on stress and health outcomes, Sternberg observed that most of the evidence is subjective (e.g., subjective scale scores, interviews) (Burges Watson et al., 2007; Diette et al., 2003; Dijkstra et al., 2008; Duncan, 2011; Fink et al., 2011; Foureur et al., 2010; Hauck et al., 2008; Hodnett et al., 2012; Lohr and Pearson-Mims, 2000; Park and Mattson, 2009; Raanaas et al., 2012; Stichler, 2007; Tse et al., 2002; Vincent et al., 2010; Walch et al., 2005). The evidence suggests that women who deliver in alternative birth environments experience decreased perceived stress, decreased emotional distress and anxiety, decreased fatigue, increased pain threshold and tolerance, increased patient satisfaction, improved physical and mental wellness, and improved patient safety. For example, the Snoezelen room, an alternative birth environment that creates not just visual cues but also other sensory cues such as aroma and sound, has been associated with increased distrac-

[5]Intermediate care between a critical care unit and a regular inpatient room.

tion from pain, increased relaxation, increased comfort, increased safety, and increased maternal satisfaction.

In terms of objectively measured physiological effects, some studies have associated alternative birth environments with decreased labor time, decreased need for epidurals, decreased length of stay, decreased systolic blood pressure, decreased sensory pain, decreased analgesic use, and decreased pain medication cost (Burges Watson et al., 2007; Diette et al., 2003; Dijkstra et al., 2008; Duncan, 2011; Fink et al., 2011; Foureur et al., 2010; Hauck et al., 2008; Hodnett et al., 2012; Lohr and Pearson-Mims, 2000; Park and Mattson, 2009; Raanaas et al., 2012; Stichler, 2007; Tse et al., 2002; Vincent et al., 2010; Walch et al., 2005). Sternberg observed that pain medication is a fairly easy way to gauge in an objective manner the effect of an environment on an individual.

Sternberg recommended more research on physiological outcome measures at psychological, physiological, and molecular levels. She encouraged noninvasive research methodologies and highlighted two case studies that exemplify the type of noninvasive research needed. First, Thayer et al. (2010) compared office workers who worked in old versus new office space using salivary cortisol and heart rate variability as outcome measures. Both outcome measures were sensitive enough to detect physiological changes associated with working in an old versus new office space. Heart-rate variability, which provides an indication of the balance between the parasympathetic relaxation and sympathetic stress responses, was higher in workers in the new office space. Such was the case even at night after the workers went home. Higher heart-rate variability is associated with a healthier rhythm; the parasympathetic relaxation response slows the heart and increases variability between beats. Among the same subjects, workers in the new office space had a lower salivary cortisol response. So both components of the stress response indicated an effect of the built environment. Sternberg noted that, interestingly, the subjects' subjective reports of stress showed no statistical difference in the old and new office space.

In a second study, Marques-Deak et al. (2006) used sweat patches to measure immune biomarkers associated with stress. In a proof-of-principle study, Cizza et al. (2008) used the sweat patches to detect patterns of biomarkers associated with major depressive disorder and found elevated proinflammatory cytokines; elevated neuropeptide Y, reflecting adrenergic nervous system activation; elevated pain neuropeptides; and decreased levels of vasoactive intestinal polypeptide, which reflects parasympathetic nervous system activity. This pattern of a proinflammatory state and a shift toward the adrenergic stress response and away from the parasympathetic relaxation response is consistent with the expected pathophysiology seen in major depressive disorder. Levels of biomarkers also correlated closely with Hamilton Depression and Hamilton Anxiety scores in these women consid-

ered to be clinically in remission. This indicates that such patterns of sweat biomarkers could be useful for detecting health status of individuals noninvasively. New methods to collect and detect sweat analytes are currently being developed (Jia et al., 2012). Sternberg indicated that in combination these studies indicate that new noninvasive methods are becoming available that could be used in any birth environment to ensure the health and safety of mother and fetus with minimal intrusiveness to the birthing experience.

In conclusion, Sternberg reiterated that a greater understanding of the brain-immune connection can help designers build healthier, safer birth environments that support both mental and physical health in the mother, fetus, and child.

## BIRTH SETTINGS AND HEALTH OUTCOMES: STATE OF THE SCIENCE[6]

Kristi Watterberg, a member of the American Academy of Pediatrics (AAP) Committee on Fetus and Newborn and lead author on the AAP policy statement on planned home birth, reflected on the four Panel 3 presentations. Before summarizing what she perceived as the key messages of each presentation, she remarked that, with the possible exception of circumcision, planned home births may be the most emotional and least data-driven issue that she has encountered in neonatology. The emotional nature of the issue seems at least partly due to conflict over control of the process. Who does it belong to? Who is in charge of it? Who needs to help and how? It is also driven in part by perceptions of beneficence versus autonomy. Who knows best? On what basis do they know best? And finally, it is driven by opinions of relative value. That is, what is important to one individual may not be as important to someone else.

With respect to why the data are so limited and flawed, Watterberg suggested several reasons. First, what one looks for may determine what one finds. Researchers approach problems from different backgrounds and with different expectations of what they will find. Related to this is the reality that many people have strongly held opinions regarding the value of interventions and outcomes, leading to a lack of equipoise. Second, it is difficult to gather reliable and complete data from the type of splintered systems that exist in the United States. Third, most of the existing structures are conflicting, not cooperative, with limited options for birth centers, great isolation of home birth providers, and highly variable credentialing among care providers. Finally, and arguably most challenging, it is often difficult or impossible to randomize study participants. Watterberg said,

[6]This section summarizes information presented by Kristi L. Watterberg, M.D., University of New Mexico School of Medicine, Albuquerque, New Mexico.

"You can't pull a card and randomize a woman to home birth." Without randomization, populations are different in unknowable ways. While it may be possible to adjust for some factors, such as socioeconomic status or maternal education or parity, there will always be other unknowable but significant factors.

### Reflections on Hodnett's Presentation

In the Cochrane review that Hodnett summarized in her presentation (Hodnett et al., 2012), only one alternative birth setting considered by the reviewers had been studied in randomized controlled trials: the bedroom-like setting within or alongside a standard obstetrical unit. Results from the trials demonstrated less intervention and fewer maternal complications associated with the bedroom-like setting, but a high transfer rate (29 to 67 percent). There was no difference in perinatal death rate.

Watterberg noted Hodnett's emphasis on the difference between the place and the environment of a planned birth. For example, a woman may be giving birth in a hospital (the place), but the environment of that hospital can be anything from accommodating and friendly to sterile and difficult. This distinction is particularly important in Watterberg's opinion because the vast majority of women give birth in a hospital setting. Thus, as much attention needs to be focused on the hospital setting as is focused on other settings. Watterberg also noted Hodnett's suggestion that the focus on changing individual behaviors should be shifted to changing the environment.

### Reflections on Sandall's Presentation

The Birthplace in England study (Brocklehurst et al., 2011) that Sandall summarized in her presentation was focused on four settings: home births, freestanding midwifery units, alongside midwifery units, and hospital-based obstetric units. The three non-hospital-based obstetric units were associated with decreased obstetrical interventions and increased normal (nonintervention) births compared to hospital-based obstetric units, but high transfer rates (21 to 26 percent overall, 36 to 45 percent among primiparous women). Home births were associated with increased risk for a composite adverse neonatal outcome (death, neonatal encephalopathy, meconium aspiration, or shoulder injury) for first pregnancies.

Watterberg's "take-away" message from Sandall's presentation was that not all "low-risk" pregnancies are the same. In addition to the need to develop a good way to identify low risk, Watterberg also called for an examination of the higher intervention rates and lower normal birth rates in hospital settings. Again, she emphasized the difference between place and

environment. Giving birth in a hospital should not mean that a woman has to experience a higher intervention rate.

### Reflections on Sakala's Presentation

Sakala's definition of quality (i.e., quality of care during childbirth) was the following: "The degree to which . . . care services increase the likelihood of optimal health outcomes and are consistent with current knowledge." Watterberg emphasized the "consistent with current knowledge" component of the definition. She said, "We have almost no knowledge that is really very helpful." Many unanswered questions remain regarding optimum principles and practices, which settings best implement those, and which criteria should be used to assess care across settings.

Watterberg noted Sakala's emphasis of the precautionary principle: "Minimize deviation from mammalian heritage and exposure to interventions that do not offer a clear benefit." In Watterberg's opinion, the precautionary principle is very similar to the physician's "first, do no harm" principle.

Another noteworthy theme of Sakala's presentation, in Watterberg's opinion, is that, while there may be different ideas about how to move forward, a common goal is an integrated system that provides for coordinated consultation, collaboration, and transfer.

### Reflections on Sternberg's Presentation

Sternberg's main themes, in Watterberg's view, were that there are clear biochemical effects of stress on the neuroendocrine immune axis and health and specific effects of birthing environments on stress, health, and pain outcomes. Sternberg's presentation raised this question for Watterberg: Is childbirth a unique situation such that experience of pain might have positive, as well as negative, hormonal effects? In Watterberg's opinion, this is something worth keeping in mind when introducing interventions that change hormones.

### Common Themes

A common theme among the four presentations, in Watterberg's opinion, was that alternative birth settings are associated with fewer interventions and high transfer rates and that home deliveries are associated with an increased neonatal risk. Regarding the last trend, several studies suggest that home birth is associated with increased neonatal mortality. Wax et al. (2010) concluded that home births are associated with a two- to threefold increase in neonatal mortality, although the absolute incidence

is low. Watterberg explained that the Wax et al. (2010) meta-analysis was based on a set of heterogeneous studies conducted in different countries, in different time periods, and using different methodologies. However, she pointed to two other studies which she considered more compelling than Wax et al. (2010). First, Malloy (2010) used birth and death certificate data to compare midwife-attended home births to hospital births in the United States and reported greater neonatal mortality rates in homes compared to hospitals (0.05 percent), both for births attended by nurse midwives (0.10 percent) and for those attended by other midwives (0.18 percent). And in a third study, Symon and colleagues (2009) compared independent midwife-attended births to NHS births in the United Kingdom and reported greater perinatal mortality in the independent midwife-attended births, although there was no difference in perinatal mortality if high-risk cases were excluded.

The question for Watterberg is, why are these alternative settings associated with increased neonatal mortality? She said that the answer is unclear. She asked: Is there a difference in caregiver education or training or a difference in the equipment available? Are high-risk pregnancies inappropriately being delivered at home? Is the problem because of the time required for transport? Is there an inescapable, unavoidable problem with emergencies that occur far from a hospital? Or is it a system failure (because there is no system in the United States)? In a relatively small study of home births in British Columbia, Canada, where a unified system is in place, with registered midwives mandated to offer home or hospital care depending on very specific safety criteria, home births were associated with fewer interventions and no increase in baby morbidity or mortality (perinatal death was 0.35 per 1,000 in planned home births with midwives, compared to 0.57 per 1,000 in hospital births with midwives and 0.64 per 1,000 in hospital births with medical doctors) (Janssen et al., 2009).

Watterberg emphasized the many gaps in research on outcomes associated with variation in birth settings. Pain control is just one example. In a Cochrane review on pain management for women in labor, Jones et al. (2012) wrote: "A major challenge in compiling this overview . . . has been the variation in use of different process and outcome measures in different trials, particularly assessment of pain and its relief, and effects on the neonate after birth . . . despite concerns for 30 years or more about the effects of maternal opioid administration during labour on subsequent neonatal behaviour and its influence on breastfeeding, only two out of 57 trials of opioids reported breastfeeding as an outcome" (p. 2). Another pain-control measure, epidural analgesia, was administered to 61 percent of all singleton births in the United States in 2008 (22 to 78 percent, depending on state) according to birth certificate data (Osterman and Martin, 2011). Although epidural analgesia does relieve pain (ACOG, 2004), it also increases ma-

ternal fever, hypotension, length of second stage, assisted vaginal delivery, Cesarean section for fetal distress, and urinary retention (Anim-Somuah et al., 2011).

The challenge with assessing interventions is that no two individuals are alike. What might be good for one woman might not be good for another. There is tremendous variability in risk and the implications of risk not just for the mother (e.g., successful breastfeeding as a maternal outcome), but also for the baby, including the baby's long-term health (i.e., longer-term health outcomes related to the development origins of health and disease). Watterberg concluded by echoing Sakala's thoughts on the precautionary principle and the importance of distinguishing between what is known, what is incompletely known, and what is completely unknown.

## DISCUSSION WITH THE AUDIENCE[7]

Following Watterberg's presentation, workshop attendees were invited to comment or ask questions of the Session 3 panelists. Topics covered included the Wax et al. (2010) meta-analysis; the need for a patient perspective on birth setting research needs; the Birthplace in England study discussed by Sandall and whether any follow-up analyses are being conducted; the importance of conducting research that will help to improve outcomes for high-risk, as well as for low-risk, pregnancies; variation in midwife education; the need for research on the relative costs of deliveries in different settings; and the need for research on long-term outcomes.

### Concerns About the Wax et al. (2010) Meta-Analysis

A workshop attendee expressed concern over the central place the Wax et al. (2010) meta-analysis occupied in the dialogue, given limitations of a key study included in that analysis (i.e., Pang et al., 2002). According to the attendee, Pang et al.'s (2002) study on home births in Washington State was flawed in several ways, most importantly by the lack of a subgroup analysis of home births attended by licensed midwives or certified nurse midwives. The attendee asked, "Why are we still talking about this study? When we are looking at the safety of home birth, what can we do to remove these studies from the dialogue and move forward?" Watterberg responded by describing the controversy that ensued when the Wax et al. (2010) meta-analysis was published and how the journal editors recruited an independent group of researchers to reanalyze the data. The independent group of reviewers ended up with the same results. Watterberg indicated

[7]This section summarizes the workshop discussion that took place at the conclusion of Panel 3.

that it is part of the literature and cannot be removed. She believes other studies will come along and either confirm the Wax et al. (2010) findings or disagree with them.

### Calls for a Patient Perspective on Research Needed

There was concern expressed about the lack of a patient panel at the workshop, especially given the subjective nature of the perceived risk of childbirth and the relative risks associated with the different settings. An audience member remarked that "optimal childbirth" means different things to different women. For some, it means making it through childbirth without a ton of pain. For those women, pain relief is very important. One participant remarked that the workshop represented a missed opportunity to let patients express their thoughts on what research they think is important.

### Questions About the Birthplace in England Studies

When asked whether any follow-up analyses to the Birthplace in England study were under way, Sandall mentioned examination of variation in service organizations and its impact on maternal outcomes; the relationship between intrapartum transfer and adverse outcomes; outcomes among high-risk women; and staffing (e.g., how different midwife units are configured and how those configurations impact women's experiences). She clarified that the observed increased rate of adverse outcomes among planned home births reported in the Birthplace in England Collaborative Group study (Brocklehurst et al., 2011) was among nullips only. There was no significant difference in the rate of adverse outcomes among multips. She emphasized the importance of not disseminating the message that home birth is unsafe for all women and remembering that the overall adverse outcome rate was low.

There was another question about the cost analyses conducted by Schroeder et al. (2012) and concern that the analysis did not include the hidden costs of home births (e.g., cost of transport, lifetime costs of caring for infants who experience lasting adverse health outcomes). Sandall agreed that long-term costs associated with lasting adverse health outcomes could be modeled. However, the focus of the Birthplace in England project was on short-term outcomes and costs. Another participant remarked that all birth settings have hidden costs and that home births have many hidden cost savings as well (i.e., savings accrued by not intervening with a Cesarean delivery, epidural, vacuum extraction, etc.); she encouraged a study on the relative costs, including hidden costs, associated with different birth settings.

### The Importance of Research That Will Help to Improve Outcomes for High-Risk Pregnancies

One participant cautioned that most of the focus of research on birth settings is on low-risk women and that a research agenda is needed for high-risk women as well. The participant encouraged researchers to think about how lessons learned about low-risk women can help to improve outcomes for higher-risk women.

### Variation in Midwife Education and Training

There was a question about variation in midwife education and training, specifically whether there are differences between UK and U.S. midwife education and training. Sandall replied that all UK and U.S. midwife education and training programs strive for International Confederation of Midwives (ICM) competency standards. In the United Kingdom, certified midwives must achieve nationally approved competencies. "Of course," she said, "even with a national system like that, you have variation between different training providers." Post-training experience and skill development vary as well, such that women working in community-based practices inevitably develop specialist skills associated with working in those practices whereas women working in high-risk settings develop a separate set of specialist skills.

Several members of the audience contributed to a discussion on three types of U.S. midwife education and training: certified nurse midwives (CNMs), certified professional midwives (CPMs), and certified midwives (CMs). CNMs and CMs attend education programs accredited by the American Commission of Midwifery Education, which is recognized by the U.S. Department of Education. They are certified by the American Midwife Certification Board upon passing a national certification exam and before they can apply for state licensure. CNMs and CMs are educated on performing births in all settings. In a recent analysis of educational programs for midwives, the American College of Nurse Midwives found that its criteria for national certification meet ICM standards. The major difference between the two credentials is whether they are registered nurses (CNMs) or enter midwifery without nursing (CMs). One participant said, "For all intents and purposes, at the midwifery level, they are identical midwives." A master's degree is required for all current CNM and CM graduates.

CPMs are certified through the North American Registry of Midwives (NARM). CPMs enter the profession through an educational program accredited by the Midwifery Education Accreditation Commission or through a Portfolio Evaluation Process assessed by NARM. CPMs must pass a national hands-on skills exam and a national written exam before receiving

the certification. Once certified, the CPM can apply for state licensure in 27 states where it is recognized. CPMs do not have an educational degree requirement, but some hold advanced degrees.

### The Need for Long-Term Research

Some concern was expressed about the lack of research on long-term outcomes. Most studies do not examine outcomes that occur after discharge from care. Thus, it is not clear how interventions impact long-term health for either the women or her child. Sakala replied that, although long-term research is expensive, ignorance is even more expensive. "I don't think we can afford not to look at these questions," she said.

# 5

# Workforce Issues

Workforce issues extend beyond "who does what" questions to questions about who is allowed to do what, who gets to do what with whom, who makes it on to the team, and who takes responsibility (or has responsibility "shoved" on them) when something goes wrong. Although workforce issues emerged as topics of discussion in various contexts throughout the course of the workshop, Panel 4 was designed to focus exclusively on these and related questions and to identify future research needs. This chapter describes the information presented and discussions that occurred during the workforce issues panel. See Box 5-1 for a summary of key points made by individual speakers. The panel was moderated by Thomas C. Ricketts, Ph.D., M.P.H., University of North Carolina at Chapel Hill.

## EDUCATION, REGULATION, AND MANAGEMENT OF HEALTH CARE PROFESSIONALS IN BIRTH SETTINGS[1]

Catherine Dower provided an overview of the U.S. birth setting workforce, including its changing supply and demand, varying educational backgrounds of different types of care providers, varying regulations for different types of providers, the role of care teams, and future research needs.

[1]This section summarizes information presented by Catherine Dower, J.D., University of California, San Francisco.

**BOX 5-1**
**Workforce Issues**
**Key Points Made by Individual Speakers**

- Catherine Dower noted that many different types of health care professionals are involved in the care of birthing mothers and their babies, with obstetricians comprising the largest sector of the workforce and midwives the second largest sector.
- According to Dower, the impact of teams of birth setting professionals working together is unknown, and researchers still do not know how to define or measure teams.
- While education and training among obstetricians and the different types of midwives varies, all professions are challenged by insufficient interprofessional education and a lack of awareness about what people in other professions can do. In Dower's opinion, much of the mistrust, or distrust, that exists among different types of perinatal care professionals stems from the lack of interprofessional education.
- According to Debra Bingham, registered nurses (RNs) have played an increasingly important role in birth settings because of the many intervention and outcome changes that have occurred over the past few decades, most notably dramatic increases in Cesarean deliveries, severe maternal morbidity, and women receiving blood transfusions during hospital birth admissions.
- Bingham stated that there has been significant recent growth in the number of births attended by midwives. It is unclear whether and how demand for midwives or other professionals would change if women were fully informed about all of their birth setting options.
- While nurse staffing and nurse education have been shown to affect patient outcomes, Bingham stressed that little is known about perinatal RN staffing patterns, the qualifications of perinatal nurses who provide care to women and newborns, and how those patterns and qualification impact outcomes.
- Susan Stapleton observed that the list of what is unknown about the maternity care workforce is much longer than the list of what is known.

## Workforce Supply and Demand

Physicians comprise the largest segment of U.S. health care professionals working in birth settings, with an estimated 50,000 obstetricians nationwide. Dower warned, however, that the numbers she was presenting were "squishy," saying that every time she reports a number, there are many ways to qualify that information. For example, not all obstetricians work in labor and delivery. Nonetheless, they do comprise the largest sector of birth setting professionals. Second to physicians are midwives, which are composed primarily of four groups: (1) CNMs, with an estimated 13,000 to 18,500 nationwide (Dower suspected that the number was closer to 13,000, with many of the 18,500 estimated by the Health Resources and Services

Administration inactive); (2) CPMs, with an estimated 2,000 nationwide; (3) licensed midwives (LMs), with an estimated 750 to 2,000 nationwide; and (4) CMs, with fewer than 100 nationwide. Additional health care professionals working in birth settings include doctors of osteopathy (DOs), family practice medical doctors (MDs), anesthesiologists, nurses, doulas, hospital staff, paramedics, and interpreters. Dower said, "There are a lot of people who are peripherally and directly involved in the care of birthing moms and their babies."

All of the different professions involved with the care of birthing moms and their babies have increased in size in recent years, although to varying degrees. For example, the number of obstetricians has increased nearly 20 percent over the past 15 years, outpacing population growth. Dower emphasized that, although not all obstetricians are involved with labor and delivery, the fact that growth of the obstetrician supply is outpacing population growth is an important trend to recognize. The CPM supply is also growing at a very quick rate, at about 10 percent per year over the past 3 years, again outpacing population growth. However, with CPMs, the "N" is very small (again, only about 2,000 nationwide), so a 10 percent growth rate does not translate into a significantly larger number of CPMs practicing.

Dower noted that there has also been significant growth in the number of births attended by midwives, from about 6 percent 10 years ago to 8 to 10 percent in 2009 (8 percent for total births, 12 percent for vaginal births).

With respect to diversity, the birth setting workforce tends to be very heavily female dominated, particularly among the CNMs and CPMs, with neither race nor ethnicity reflecting the general population.

Collecting workforce supply numbers is a challenging task. The data are difficult to find. Dower had to contact colleagues from multiple organizations and, as she said, "pull all those pieces together." Not only are the data difficult to collect, but they are not standardized, making it very difficult to compare estimates across the various health professions.

In terms of workforce demand, there has been a fairly steady and predictable need for birth setting professionals. The predictability stems from the predictability of the number of babies born per year. However, according to Dower, there is unknown demand with respect to choices that women would make if they were fully informed about all their birth setting options. It is also not clear how demand will change in response to changes resulting from the Affordable Care Act, changes in the economy (i.e., cost is an issue not just for consumers, but also for health care providers), changes in delivery technology, shifts in consumer choice (e.g., when consumers are provided with additional information), and changing public health concerns. An example of a changing public health concern is the growth of antibiotic resistance (or superbugs) in hospitals. Currently,

Dower said labor and delivery is the highest revenue source for hospitals. She suggested that even just a couple of high-profile antibiotic-resistant bacterial outbreaks could create a significant reduction in consumer demand for hospital-based labor and delivery.

### Education

Education, training, model of care, and practice location vary among the different birth setting professions. MDs are trained via a very academic program (i.e., a bachelor's program and then medical school), followed by residency and board certification; their training and practice are based on a medicine model of care; and they train and practice primarily in hospitals. CNMs are initially trained via a bachelor's or registered nurse (RN) program, followed by master's or doctoral degrees; their advanced training and practice are based on a midwifery model of care; and they practice primarily in hospitals. CPMs are trained via either an apprenticeship or an accredited educational program, with CPM apprenticeships (the most popular track) not requiring any formal education and the education track including anything from certificates to doctoral degrees; their training and practice are based on a midwifery model of care; and they work primarily in homes and birth centers. CMs are educated and trained much like CNMs in a midwifery model, but without having a prior nursing background; CMs must complete at least a bachelor's degree plus master's to receive certification.

Dower emphasized that all four professions—MDs, CNMs, CPMs, and CMs—share some of the same challenges. These include finding sites for clinical training, particularly sites outside of hospital settings; providing interprofessional education; providing evidence-based preparation (i.e., entering evidence into the curricula and training professionals based on that evidence); and training professionals to work in a changing health care environment (i.e., the environment that most people work in today looks little like it did when people were trained 15, 20, or 30 years ago). Dower emphasized the challenge of interprofessional education, an issue where much of her current work is focused. Because they do not train together, many people do not know what people in other professions can do. Much of the mistrust, or distrust, that exists among different types of perinatal care professionals is rooted in the lack of interprofessional education.

### Workforce Regulation

As with education and training, regulation too varies among the various birth setting professionals. MDs and DOs have the same full scope of

practice; they can provide any care to anyone in any health care setting. Moreover, their scope of practice is standardized among all 50 states, which is not the case for midwives (or any of the other professions involved with labor and delivery). While CNMs are recognized and can practice legally in all 50 states, they can practice independently in only 20 states. State variation in CNM scope of practice stems, in part, from different definitions and compromises over terms like "collaboration" and "supervision" in legislation. With respect to the other types of midwives, only about half of the states recognize CPMs, only half recognize LMs (and they are not necessarily the same states that recognize CPMs), and only five states authorize CMs to practice.

Scope-of-practice laws for all health professions involved with labor and delivery are state based and politically driven, according to Dower, resulting in significant state variability and some disconnects between competence and authority. In some places, people are authorized to provide more care than they can competently provide, while in other places people are not allowed to provide care that they can competently provide. In Dower's opinion, scope-of-practice "turf battles" exacerbate the problem. Not only do people from different professions not know how to communicate with each other or work together, but they are taught from a very early stage of their professional development to think of people in other professions as competitors or opponents.

### Management: The Challenge of Defining "The Team"

A team of birth setting professionals can include obstetricians, nurse midwives, midwives, doulas, and any of the many other professionals involved with labor and delivery. But it is still not clear how to put a team together in any given setting in the most effective way. Again, part of the challenge is that people from different professions are not trained to work together as teams. Thus, the impact of real teamwork is unknown. It is not clear how many of each type of provider are needed in each care setting; how real team care impacts provision of care and patient outcomes; how real teamwork impacts educational programs; and how real teamwork impacts cost. "We don't know how to define or measure teams yet," Dower said.

### Still to Learn

There is still much to learn about the birth setting workforce. Dower identified several key needs. First are accurate, comparable supply numbers so that researchers can compare the different professions. Second, it is not clear how to measure demand. People do not have a fully informed range

of choices available to them; thus, it is not clear how many people would choose different providers in different settings. Third, the costs of various workforce and staffing models are unknown. Dower remarked that such costs have been only barely touched on in some of the research featured at the workshop, which in her opinion is the best research in the field conducted thus far. Finally, there is much more still to learn about the impact of technology, policy changes, consumer choice, and innovative financing on workforce needs, education, regulation, or management. For example, many systems are joining together to work collaboratively (e.g., birthing centers and hospitals). What will the impacts of that collaboration be on care?

## PERINATAL RN STAFFING IN BIRTH SETTINGS[2]

Representing the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), Debra Bingham spoke about the importance of measuring and tracking perinatal RN staffing, what is known about trends in perinatal RN staffing, and the need for more research on perinatal RN staffing. AWHONN is the standard-bearer organization for more than 350,000 women's health, obstetric, and neonatal nurses in the United States. The organization advocates for key health care and nursing professional issues, develops and disseminates evidence-based nursing practice resources, and serves as an international nursing leader.

### Trends in Perinatal RN Staffing

There is considerable variation in the volume of births and the type of registered nurse staffing present in hospital settings where women give birth. In 2008, 79 percent of the 3,265 U.S. hospitals with obstetric services reported fewer than 2,000 annual births despite the fact that nearly half of all births occur in only 15 percent of U.S. hospitals (Simpson, 2011). Not every hospital in the United States has an in-house physician or midwife. Bingham herself has worked in hospital units where there are no physicians or midwives in house, only nurses.

AWHONN issued updated guidelines for perinatal RN nurse staffing (AWHONN, 2010), but not without controversy. The guidelines, which represent an update from 1983 guidelines, were issued because of the many intervention and outcome changes that have occurred since 1983 and the need for more intensive nursing care as a result of those changes. Most notably, between 1983 and 2008, there was a 100 percent increase

[2]This section summarizes information presented by Debra Bingham, Dr.P.H., RN, LCCE, Association of Women's Health, Obstetric and Neonatal Nurses, Washington, DC.

in Cesarean deliveries, from 16.5 percent to 33 percent. From 1998-1999 to 2008-2009, severe maternal morbidity increased by 75 percent and the number of women receiving a blood transfusion during a hospital birth admission increased by 184 percent (Callaghan et al., 2012). Technology is also changing. A comparison of the electronic health record for a nonpregnant patient and the electronic health record of a pregnant patient illustrates the much more complicated flow of records associated with pregnancy. In theory, integration of electronic health records should save nurses time. Bingham observed that this is not the case. The flow of outpatient and inpatient records is especially slow, with the necessary records not always available to clinical teams.

The AWHONN staffing guidelines are applicable to all settings. They are based on the type of patient and care needed, not where care is being provided. While RN maternity nurses are essential frontline clinicians in hospital-based perinatal units, where multiple types of care are provided (from emergency triage and evaluation to psychiatric care), birthing centers have various types of staffing models which can include RNs, licensed practical nurses (LPNs), or nurses' aides. Home births do not usually employ RN care. Bingham noted that it is not clear whether women giving birth in nonhospital birth settings by non-RNs are missing important nursing interventions.

### Research on Perinatal RN Staffing and Outcomes

"Unfortunately," Bingham said, "there has been very limited curiosity in the effect of nursing staff on birth settings and birth outcomes." There have been only a few studies, including one on the impact of nursing staff ratios on survival and outcomes for low-birth-weight and preterm infants (Hamilton et al., 2007) and one on oxygen-related outcomes in premature newborns (Sink et al., 2011). However, more than two decades of studies linking RN staffing and RN competencies to improved outcomes in intensive care and medical surgical settings suggest that similar types of outcomes could be expected in a perinatal population. For example, Needleman et al. (2002) linked greater hours of RN staffing to decreased length of stay and lower rates of urinary tract infections, upper gastrointestinal bleeding, shock or cardiac arrest, pneumonia, and failure to rescue. Of these, Bingham pointed to urinary tract infections, length of stay, and failure to rescue as being most relevant to a perinatal population. As another example, Kane et al. (2007) linked RN staffing to hospital-acquired pneumonia, unplanned extubation, respiratory failure, cardiac arrest in intensive care units, and failure to rescue after a postsurgical complication. Of these, Bingham pointed to the last as being most relevant to a perinatal population.

Another study of relevance to birth settings, in Bingham's opinion, is Needleman and colleagues' 2011 study on care transitions, with higher-than-typical rates of patient admissions, discharges, and transfers during a shift being associated with increased mortality. The association is an indication of the important time and attention needed by RNs to ensure effective coordination of care for patients at critical transition periods. Bingham has witnessed transitions involving women transferring into the hospital setting from a home birth not going as smoothly as they should. She said, "I think there's a very important role for understanding those transitions and making them more effective." Based on the premise that the core, or essence, of nursing work is caring relationships, AWHONN is currently conducting a study on the effect of nurse staffing on a range of nurse-sensitive processes and outcomes and is developing nursing care quality measures (AWHONN, 2013).

Bingham commented briefly on community-based models of care and how randomized controlled trials have shown that Nurse-Family Partnership[3] programs have improved the "maternal life course." More specifically, they have demonstrated improved choices in health and education, such as decreased perinatal cigarette smoking and improved spacing of children. Finally, she noted that other countries have found that improving perinatal outcomes requires increased surveillance and response to early warning signs (Singh et al., 2012). She urged paying more attention not just to surveillance but also to team mobilization. Maternity nurses play a key role in team mobilization, given that other care team members are not in the hospital 24 hours per day, 7 days per week, as nurses are.

## AWHONN Data Collaborative

To fill gaps in data and to help better understand perinatal RN staffing patterns in the United States, AWHONN formed a data collaborative covering more than 170 hospitals, with approximately 23,000 nurses who work at those hospitals, and about 413,000 births, based on 2010 and 2011 annual birth volumes. The data are not generalizable (hospitals pay to participate), but it is the largest database to date on RN perinatal staffing patterns. Participating hospitals are divided into five groupings based on birth volume: <1,000; 1,000 to 1,999; 2,000 to 2,999; 3,000 to 3,999; and 4,000+ births.

For every participating hospital, AWHONN researchers have examined 32 different care situations to determine whether the AWHONN guidelines for perinatal RN staffing are being met. Bingham commented only on

[3]For information on the Nurse-Family Partnership, visit http://www.nursefamilypartnership.org.

situations related to intrapartum care. These data indicate that situations involving oxytocin or women who choose no pharmacologic or anesthetic pain management are most likely to not meet AWHONN RN staffing guidelines. As expected, these data also showed that more experienced RNs receive fewer orientation hours. Among new hires, hours of orientation range from 216 (first quartile) to 1,872 (maximum), with a mean of 388. Similarly, there is considerable variation among the number of RNs per 1,000 births among the five groupings of hospitals, ranging from 6.6 to 82, with a mean of 29.79. While there are some outliers, most of the hospitals within a single grouping fall within a fairly narrow range, although there is considerable variation among groupings. Finally, these data show considerable variation in how many nurses hold bachelor's degrees, with some hospitals reporting 0 percent and others as much as 92 percent, with an average of 52 percent. More research is needed on how level of education impacts perinatal outcomes.

### Summary of Key Points

In summary, nurse staffing and nurses' education have been shown to affect patient outcomes, and the number of interventions performed and patient population characteristics have been shown to affect nurse staffing. However, there are limited data on perinatal staffing patterns and on the qualifications of perinatal nurses who provide care to women and newborns in the United States.

Based on these summary points, Bingham highlighted four recommendations made in a previous Institute of Medicine (IOM) report, *The Future of Nursing: Leading Change, Advancing Health* (2011). First, nurses should practice to the full extent of their education and training. Second, nurses should achieve higher levels of education and training through an improved education system that promotes seamless academic progression. Third, nurses should be full partners with physicians and other health professionals in redesigning health care in the United States. Bingham remarked that nurses "didn't even really make it" into the 1982 birth setting assessment report (IOM and NRC, 1982). Although there are more nurses than physicians in the United States, their participation on health care redesign committees is usually only token representation; rarely are nurses in leadership positions on those committees. Fourth, effective workforce planning and policy making require better data collection and an improved information infrastructure. Bingham pointed to several specific outcomes where better data are needed on the effect of RN staffing levels and RN competence: failure to rescue, severe maternal morbidity, labor support, breastfeeding support, transitions of care and transports, and outpatient and community care.

In conclusion, Bingham emphasized two key points: the importance of measuring and tracking perinatal RN staffing patterns and the need for more perinatal nurse staffing research for all types of birth settings.

## RESEARCH ISSUES IN THE ASSESSMENT OF BIRTH SETTINGS: WORKFORCE ISSUES[4]

Based on data presented during this panel, as well as some evidence presented during earlier presentations, Susan Stapleton offered some thoughts on "what we know" versus "what we need to know." She observed, "One of the things I'm learning as I'm sitting in the room today is that the list of what we don't know is growing significantly longer than the list of what we know."

### Workforce Issues: What We Know

Stapleton observed the following:

- The level of acuity of hospital-based intrapartum care has increased partly as a result of higher rates of labor induction and Cesarean delivery.
- Some perinatal outcomes are worsening and have worsened over the past couple of decades.
- Competent and educated nurses improve patient outcomes. Stapleton wondered what the impact would be on perinatal outcomes if all obstetrical nurses in the United States were midwives.
- Midwife-attended out-of-hospital births have increased. (It is unclear whether and how this trend is being driven by access to such services.)
- Transitions from one setting to another or from one provider to another are associated with increased adverse outcomes; hand-offs require a high level of care and coordination.
- The need to expand and fully utilize the women's health provider workforce is becoming more urgent as the age of the current provider workforce increases.
- Evidence suggests that collaborative teams of maternity care providers improve outcomes and may lower costs.
- The current education system for maternity care providers tends to reinforce barriers to working collaboratively and is disparate in terms of resources devoted to different groups of providers.

[4]This section summarizes information presented by Susan R. Stapleton, D.N.P., CNM, FACNM, Commission for the Accreditation of Birth Centers, Miami, Florida.

### Workforce Issues: What We Need to Know

Based on evidence presented during this panel and earlier in the workshop, Stapleton identified several key gaps in knowledge regarding the maternity care workforce:

- How does nurse staffing affect quality, safety, and cost of hospital-based perinatal care? Most studies on nurse staffing have been conducted in nonperinatal settings; are the patterns observed in those settings the same as those in perinatal settings?
- What is the impact of "missed nursing care" on perinatal outcomes, including breastfeeding measures (breastfeeding success and duration)? That is, what is the impact on breastfeeding when perinatal nurses do not have time to provide support and teach women what they need to know to ensure breastfeeding success?
- How will changes in electronic health record technology impact workforce training needs and demands? Will such changes demand more or fewer providers?
- What will be the impact of patient engagement and shared decision-making models on workforce training and staffing needs? How can the mother and childbearing family be included as an integral part of the perinatal team?
- How does care being provided in the various birth settings differ? How do those differences contribute to the outcomes being observed?
- What are the cost and outcome implications for new models of care that rely on perinatal teams providing collaborative care (e.g., the types of models mentioned by Catherine Dower)? For example, how will providers be trained? What will the costs be?
- What provider ratios are optimal for full utilization of the workforce and for high-value care? For example, are more doctors needed? Are more midwives needed? Are more doulas needed? Stapleton remarked that very little is known about optimal ratios for these different types of providers.
- Is the current workforce being utilized to the full extent of its education, training, and scope of practice? Data presented by Catherine Dower indicate that the answer to this question is "no." What are the barriers and incentives?
- What new team members can be added to the perinatal team (besides the mother and childbearing family) to improve outcomes and decrease cost? There may be other providers who are less expensive to educate and train and whose contributions can significantly improve outcomes in ways not well understood right now.

- What professional education model(s) will best prepare perinatal care providers to function as part of collaborative teams? Stapleton reiterated Dower's remarks about training providers to work collaboratively before patterns of communication are established. What changes in graduate education funding are needed to develop these models?
- What are the "best practices" to develop and maintain competency of perinatal teams in responding to the need for transfer from one setting to another? What do we know about these hand-offs? How can hand-offs be conducted smoothly and seamlessly? What characteristics of transfer make for the best outcomes? What communication patterns among providers make for the best outcomes, and what role does the childbearing family play in those patterns?
- What are the best collaborative-based models, both within the United States and elsewhere, and how can they be replicated?
- What institutional support and incentives are needed (i.e., in terms of regulation, liability reform, payment reform, and professional education) to support collaborative practice models at the health care system level?

## DISCUSSION WITH THE AUDIENCE[5]

Following the panel discussion on workforce research issues, the floor was opened to comments and questions from the audience. Workshop attendees touched on a range of research topics: collaborative care and teamwork, single-room maternity care, home births and nursing, pain relief and nurse staffing, rural maternity care, workforce diversity, and national trends.

### Collaborative Care and Teamwork

Much of the discussion during the question-and-answer period focused on collaborative care and teamwork. A member of the audience suggested that the state of California might be a good place to test various models of collaborative care, given its history of research on health professions and the large number of different types of professionals providing maternity care (e.g., physicians, CNMs, and CPMs). Moreover, the state has a diverse geography, with dense urban areas and sparsely populated areas. A variety of conditions could be examined (e.g., different ratios of providers) and their impact on care assessed.

[5]This section summarizes the discussion that occurred at the end of Panel 4, immediately following Stapleton's presentation.

Another member of the audience commented on the difficulty that many certified professional midwives face when seeking physicians to sign collaborative agreements so that the midwives can provide care to Medicaid patients. Many of these midwives are midwives of color, serving women of color. The implication was that if collaborative relationships could be fostered, outcomes among women of color might improve.

There was some discussion around the cost of collaboration. One participant expressed concern that having multiple providers present during every birth is not economically sustainable. He noted that collaborative models being applied in countries where midwife-driven births are more prevalent (e.g., England, France) than in the United States are very different than the U.S. model. Catherine Dower clarified that her earlier comments about teamwork did not imply that all team members would be present at all times, rather that each would contribute at a different time during pregnancy. She agreed that there are some good alternative collaborative models out there that should be examined (i.e., alternatives to the physician-centric team leader model), including models with midwives as team leaders and other professionals being called upon as necessary during labor and delivery. Different groups are examining these alternative models, including physicians, for various reasons. Some are trying to improve quality of care, while others are trying to save money. Still others are trying to improve staffing satisfaction.

In addition to encouraging the consideration of non-physician-centric team leader models, Dower also encouraged thinking of teams "more expansively." She envisioned teams composed of a variety of professionals, from midwives and doulas to mental health professionals and community health workers, each being called on at a different point during the pregnancy—teamwork that involves "many more touches with the health care system, but much shorter touches."

### Single-Room Maternity Care

There was a suggestion that more research be done on single-room maternity care and its impact on safety, cost, patient satisfaction, and other outcomes. Not unlike the merged step-down units mentioned earlier in the workshop by Esther Sternberg, single-room maternity units staffed by cross-trained nurses (i.e., with staff not divided between labor and delivery) might be a way to ensure that all women have one-on-one continuous support while avoiding problems caused by the "peaks and valleys of workload" (e.g., high cost because of the large number of nurses on staff even during times when demand is low).

### Home Births and Nursing

There was a question about what the potential role of RNs in home birth settings and what RNs would do that midwives attending home births are not already doing. Debra Bingham replied that it is a difficult question to answer because so little is known about how RNs spend their time in hospital settings and, thus, whether there is care that they are providing that is not being provided in home birth settings. Likewise, it is unclear whether there are things being done in hospital settings that should not be replicated in a home birth setting. Another audience member asserted that evidence-based nursing care is already being provided in the home birth setting and that, in fact, nursing students would become much better nurses if they were to spend some time in those settings during their training. She predicted that the role of the RN in a home setting would be "doing the old-fashioned nursing many of us were brought up on—being there for women, getting to know women well, providing the kind of continuous emotional and physical support that nurses taking care of IV drips and post-op Cesarean mothers don't have time to do." Yet another audience member agreed that much can be learned by attending a home birth and suggested that the type of birth that happens more often at home, that is, a birth facilitated by a woman's own capacity, can also occur in a hospital setting; the challenge is in preparing all providers to facilitate that type of experience.

### Pain Relief and Nursing

An audience member expressed concern about the impact of overuse of oxytocin on nursing staff, that is, the "heavy burden of oxytocin." The recommended patient-staffing ratio for pharmaceutically induced pain relief administration is one-to-one. Another audience member asked whether obstetric nurses are trained to treat pain differently than other types of nurses. Specifically, is the threshold of no pain a goal for all nurses, not just obstetric nurses? Bingham stated that more data are needed to assess whether nurses are being adequately trained in nonpharmacological methods of labor support.

### Rural Maternity Care

A question was asked about rural maternity care and whether any of the panelists had any thoughts on maternity care in settings where care is typically provided by generalists (e.g., many Indian Health Service sites do not have dedicated obstetrical nurses). Bingham replied that AWHONN's data collaborative includes hospitals with fewer than 500 births per year and that AWHONN RN staffing guidelines apply to all settings, not just

high-volume hospital settings. She added that models are available for conducting staff orientations in sites without in-house expertise.

### Maternity Care Workforce Diversity

There was a comment about the lack of diversity in the maternity care workforce and a question about whether any initiatives were under way to add diversity. Dower agreed that, while gender representation in medicine and, to a lesser extent, nursing, is improving, racial and ethnic diversity is still very poorly represented in the maternity care workforce. While the issue is on several organizations' "radar screens," she was unaware of any research being conducted to determine why or initiatives under way to change the situation for maternity care workforce specifically.

### A Need for National Trend Data

It was mentioned that the seven midwifery organizations in the United States responsible for accreditation and certification are currently working together to resolve confusion around the numbers of the various professionals who provide maternal care and the need to gain a better understanding of those trends at a national level.

# 6

# Data Systems and Measurement

A major overarching theme of the workshop discussion was the need for more data to help move the birth setting research agenda forward and to help inform decision making and ways that those data could be collected or, in some cases, are already being collected. Much of this discussion occurred during Panel 5. Moderated by Diane Rowley, M.D., M.P.H., University of North Carolina at Chapel Hill, Panel 5 speakers elaborated on specific examples of how birth data are being collected, analyzed, interpreted, and used to inform decision making, and the challenges and limitations of birth setting data. This chapter summarizes their presentations and the discussion that followed. Box 6-1 summarizes key points made by individual speakers.

## THE USE OF DATA FOR DECISION MAKING: BIRTH SETTING[1]

William Barth's presentation was focused on one professional organization's use of data for decision making, that is, the American Congress of Obstetricians and Gynecologists' (ACOG's) use of birth setting data to articulate its planned home birth committee opinion (ACOG, 2011). He also discussed the limitations of existing datasets and described what he thought constituted the "ideal" dataset. Before Barth spoke, he listed some disclosures: He is an obstetrician whose salary is supported by the number

[1]This section summarizes information presented by William H. Barth, Jr., M.D., Massachusetts General Hospital, Boston, Massachusetts.

**BOX 6-1**
**Data Systems and Measurement**
**Key Points Made by Individual Speakers**

- William Barth observed most data informing the birth setting dialogue have been observational and retrospective, with no randomized controlled trials of sufficient size on home births.
- How available data are used to inform decision making depends on who is making the decision, with different people valuing outcomes differently and using the same data in different ways. Barth described how the American Congress of Obstetricians and Gynecologists (ACOG) used data from the controversial Wax et al. (2010) meta-analysis to articulate its planned home birth committee opinion (ACOG, 2011).
- Caitlin Cross-Barnet described how Strong Start, a Center for Medicare and Medicaid Innovation (CMMI) initiative, is collecting data on three different models of prenatal care. While the focus is on preterm births, CMMI is collecting data on a range of other outcomes as well. Many birth setting researchers face challenges such as variation in data availability, state-level variation in Medicaid coverage, and inconsistent recording of data on U.S. birth certificates.
- Elliott Main and William Barth each elaborated on several additional data and measurement challenges, such as statistical issues resulting from small sample sizes. For example, given that the total number of home births in the United States per year is 27,000, having sufficient statistical power to detect differences in an outcome like perinatal mortality, which is typically 1 to 2 per 1,000, is very difficult.

of in-hospital deliveries he attends;[2] he is a fellow of ACOG, past Chair of the ACOG Committee on Obstetric Practice and primary author of the planned home birth committee opinion (ACOG, 2011), and medical director for a large hospital-based midwifery service in Boston.

### ACOG Use of Data for Decision Making

Barth described ACOG's use of data in its home birth setting committee opinion decision making as a "dance," one similar to the "dance of legislation" described by Eric Redman in his now classic 1973 book on legislation that led to creation of the National Health Service Corps (Redman, 1973).

The ACOG dance started with a policy statement on home births in the United States issued by the ACOG executive board. The statement contained a couple of what Barth called "lightning rods," namely, "ACOG strongly opposes home births" and "ACOG does not support programs or

[2]At the time of the workshop.

individuals that advocate for or who provide home births." The reasoning behind its positioning on home birth was the lack of available data to inform the issue, according to Barth. That policy statement fueled the 6th edition of the American Academy of Pediatrics (AAP) and ACOG *Guidelines for Perinatal Care* (AAP and ACOG, 2007), which stated, "The hospital, including a birthing center within a hospital complex, or freestanding birthing centers that meet the standards of the [AAAHC, JC, AABC][3] provide the safest setting for labor, delivery, and the postpartum period." The 6th edition guidelines also stated, "Until such data are available, home births are not encouraged."

Also setting the stage for the dance was a controversial study by Pang and colleagues (2002), a retrospective cohort study conducted in Washington State that relied on birth certificate data as its sole data source.

With respect to where births were being delivered when the ACOG dance began, Barth said 24,970 home births were reported in 2006. Assuming that about two-thirds of those home births were planned, about 1 of every 263 births delivered that year was a planned home birth.

As more data were collected, Barth said, "the tides began to change." Several studies appeared showing that neonatal deaths and other newborn outcomes associated with planned home births are no different than those associated with hospital births. These include a retrospective cohort study conducted in Sweden and based on data collected from the Swedish medical birth register and from follow-up phone calls (Lindgren et al., 2008); a retrospective cohort study conducted in the Netherlands and based on three different linked national perinatal databases (de Jonge et al., 2009); a retrospective cohort study conducted in British Columbia and based on provincial perinatal database registry data (Janssen et al., 2009); and a retrospective cohort study conducted in Ontario, Canada, and based on the Ministry of Health midwifery care database (Hutton et al., 2009). In addition to the relatively similar newborn outcomes in planned home birth versus hospital settings, another common theme of these studies was a decreased rate of interventions among planned home births compared to hospital births.

Also contributing to the landscape of the ACOG dance were the different views on home births being advocated by different organizations. Some organizations, like the Royal College of Midwives and the Royal College of Obstetricians and Gynaecologists, supported home births, while others, like the Royal Australian and New Zealand College of Obstetricians and Gynaecologists, did not endorse home births.

The process for formulating an ACOG committee opinion is long. It

[3]AAAHC, Accreditation Association for Ambulatory Health Care; JC, Joint Commission; AABC, American Association of Birth Centers.

begins when a subject is proposed. Subjects can be proposed by individual members of the committee or may result from correspondence received by the College from concerned members of the public, public representatives or elected officials, or others. When proposed, the committee decides whether the subject is worth pursuing. If so, a primary author is assigned and a professional literature search conducted. Under the leadership of the primary author, a first draft of the committee opinion is drafted within 6 to 12 months. The first draft is discussed by the committee, which is composed of ACOG Fellows and staff, as well as representatives of the AAP, American Academy of Family Physicians, American College of Nurse-Midwives, Eunice Kennedy Shriver National Institute of Child Health and Human Development, Centers for Disease Control and Prevention, and Society for Maternal-Fetal Medicine. Committee comments are assembled by ACOG staff and presented back to the primary author, who revises the draft. The revised draft is reviewed by the committee 6 months later. If it clears the committee, the draft is sent to a clinical document review panel that examines the draft for internal consistency (i.e., consistency with other ACOG policy statements). Once cleared by the clinical document review panel, the draft is sent to the ACOG executive committee. The final draft is published in *Obstetrics and Gynecology* and a press release issued online. Barth noted that, very importantly, unlike an ACOG policy statement, an ACOG committee opinion has a lifetime. That is, it is regularly reviewed and changed if new data and science warrant a change. Barth described it as a "living document."

It was during this long process that the Wax et al. (2010) meta-analysis was published. Drawing the most attention in Wax et al. (2010) was the twofold increase in neonatal deaths and almost threefold increase in non-anomalous deaths among planned home births compared to hospital births. Barth remarked that even his standing there saying that it is "threefold," when the actual odds ratio is 2.87 triggers an emotional reaction in many people. "It's such an emotionally charged subject," he said. "That's an understatement." Barth pointed out that what sometimes "gets lost" in discussions of the meta-analysis are its findings indicating dramatic reductions in interventions among planned home births compared to hospital births.

The response was dramatic in what Barth called the "wake of the meta-analysis," with many letters to editors in various journals, not just in the *American Journal of Obstetrics and Gynecology* (where the article was published), but also in *The Lancet* and *BMJ*, as well as in popular blogs and in many non-peer-reviewed but well-read websites. The editors of the *American Journal of Obstetrics and Gynecology* published a number of the letters they received. They also took the very unusual step of reconvening a panel of experts in meta-analysis, all of whom were maternal-fetal medicine specialists. The independent review panel derived slightly different results

but concluded that there was no difference in the direction of the point estimate of the pooled odds ratio or in the overall statistical significance of the results. The panel recommended that the journal publish online full summary graphs for each outcome that was assessed in the study and that there was no need for retraction of the article.

Thus, the ACOG committee on obstetric practice went forward with its committee opinion on planned home births and included in its opinion a statement on the twofold to threefold increased risk of neonatal death among planned home births when compared with planned hospital births. Barth emphasized that the committee opinion is the opinion of an organization, not the opinion of an individual, and that the emphasis on the increased risk of neonatal death among planned home births is an organizational opinion. Still, it is a "lightning rod."

The new committee opinion, including its remarks on the neonatal death risk associated with planned home births, fed into the seventh edition of the ACOG *Guidelines for Perinatal Care* (AAP and ACOG, 2012).

Barth offered some personal observations on the ACOG Committee Opinion 476: Planned Home Birth (ACOG, 2011). First, he noted the rigorous review process. It is much more rigorous than standard peer review, in his opinion. Second, it is written from a U.S. perspective. Data from outside the United States were used cautiously. Third, the opinion was carefully worded to minimize ambiguity and avoid overstatement. Fourth, he reiterated that it is an opinion only. Finally, there is great regional variation in health care infrastructure, with driving times to hospitals with maternity centers varying from less than 15 minutes to over an hour. The opinion may not apply in some regions.

Barth mentioned that the course of events left him "a little bit whipsawed." The words of his friend, Jeffrey Ecker, M.D., calmed him: "No one can force someone to have a hospital birth. . . . No one can force providers to support home birth or interpret data differently than they do."

### Data That Have Been Used to Inform the Literature on Birth Setting

Data informing the literature on birth setting have been almost exclusively observational and mostly retrospective. In any observational study, comparison groups are inevitably different. Some of those differences are known, but others are not. There has been only one randomized controlled trial on home births, and it accrued only 11 patients.

Available data include state-reported birth certificate data (i.e., the 2003 U.S. standard certificate of live birth), registry data (e.g., National Birth Center Study data [American Association of Birth Centers], Midwives Alliance's Statistics Project [MANAstats]), datasets compiled for individual reports, and payer data.

From Barth's perspective, features of an ideal dataset, that is, the type of dataset he would want to have in hand if he were to attend a meeting to resolve the issue of home birth, include ascertainment (i.e., intended place of delivery); selection criteria (i.e., appropriateness of candidacy for home birth); type of attendant (i.e., education, certification, licensure); integration of the health system (i.e., whether transport agreements were in place, geography of the health system, and indication for transport); standardized definitions for outcomes; single electronic records per person; mandatory, audited, and enforced reporting of data; and public availability for downloading and analysis.

Currently, 36 states, plus the District of Columbia, Puerto Rico, and Northern Marianas, use the U.S. standard certificate of live birth. In addition, 32 states use the U.S. standard report of fetal death (Personal communication, Marion MacDorman, National Center for Health Statistics [NCHS]). ACOG has been pushing for adoption of the U.S. standard certificate of live birth for about 10 years and wrote model legislation in 2009 that was distributed to all states for public comment. The college has been pushing for it in every issue of *Guidelines for Perinatal Care*. There is reason for optimism, with the National Association for Public Health Statistics and Information Systems and NCHS agreement meaning that all states should be using the certificate by January 2014.

Importantly, in Barth's opinion, there are some things that the 2003 U.S. standard certificate of live birth does not do. It does not capture planned home births transferred to hospitals. So for women whose deliveries occur in hospitals, there is no indication whether the delivery was planned as such, nor does it capture reason for transfer or distinguish among different routes to midwifery (i.e., certified professional midwife [CPM] versus licensed midwife versus other). Likewise with the 2003 U.S. standard report of fetal death: there is important information that it does not capture, including planned home births transferred to hospitals, type of midwife provider, and location of intrapartum fetal death (i.e., home or hospital). All of these missing items are "within our range to tweak," Barth said.

MANAstats provides another example of the limitations of available data being used to inform the birth setting dialogue. Enrollment in MANAstats is voluntary, with participation rates among providers at only about 20 to 30 percent for CPMs and 17 percent for certified nurse midwives (CNMs) and certified midwives (CMs). Efforts are under way to encourage or mandate reporting by providers, as are efforts to ensure data quality (through the use of a "data doula"). Individual patients must consent to participate, with fewer than 3 percent declining, yet about 8 percent of participants withdraw from reporting before finishing their registered event. Despite these participation limitations, outcomes based on

MANAstats data, such as those reported by Johnson and Daviss (2005), are similar to outcomes being reported in other types of studies.

Provider participation is also a challenge for birth center data (e.g., Stapleton et al., 2013), with only 41 percent of birth centers being members of the AABC and only 78 percent of AABC members participating in its online registry.

Other data sources include various national perinatal data collection efforts (e.g., efforts by the University Health Consortium and National Perinatal Information Center), states' perinatal reporting beyond birth certificates (e.g., the California Maternal Quality Care Collaborative), payer or system datasets (e.g., Kaiser, Department of Defense), and fledgling efforts by professional organizations such as the Women's Health Registry Alliance.

### Use of Data for Decision Making

Unfortunately, there have been no randomized controlled trials of sufficient size to inform the birth setting dialogue. The only science at our disposal right now is imperfect case series and cohort studies. Available data are limited by ascertainment problems (i.e., ascertainment of intended birth setting); lack of knowledge about provider education, training, certification, and licensure; nonstandard selection criteria; nonuniform definitions of outcomes; and tremendous regional variation in health system infrastructure. Also, ultimately, the data are limited by the lack of a uniform platform for adequately comparing birth settings. For home births, the MANAstats platform is probably the leading platform. For birth center births, it is probably the AABC. But for spanning across all birth settings, the 2003 U.S. standard certificate of live birth is the "best shot," in Barth's opinion. He encouraged all states to adopt the certificate and encouraged slight modifications to help inform the discussion on birth settings (e.g., address intention, etc.). Meanwhile, how data are used for decision making depends on who is making the decision, with use of the same data varying and outcomes being valued differently. Patients, providers, payers, government agencies, and other interested parties each have their own perspective and values.

## STRONG START: APPROACHES TO DATA COLLECTION AND EVALUATION[4]

Strong Start, a Center for Medicare and Medicaid Innovation (CMMI) initiative, has two components. The first, Strong Start I, is a nationwide public awareness effort to improve the health of moms and babies by en-

[4]This section summarizes information presented by Caitlin Cross-Barnet, Ph.D., Center for Medicare and Medicaid Innovation, Baltimore, Maryland.

couraging mothers and practitioners to let labor begin on its own. Strong Start I is campaigning in partnership with the March of Dimes and ACOG to reduce early elective deliveries. According to Caitlin Cross-Barnet, many women are confused by the emphasis on remaining pregnant for 39 weeks. That is, for many women, when 39 weeks hit, they think, "Now I can have my induction." While the primary goal is to reduce the incidence of early scheduled inductions and other elective deliveries (i.e., Cesareans), especially those that occur before 39 weeks, Strong Start I is pushing the idea that, for pregnancies with no medical indication, labor should begin on its own.

### Strong Start II

The goal of the second program component, Strong Start II, is to reduce the incidence of preterm birth among high-risk Medicaid beneficiaries. Merely being on Medicaid is not enough to be considered high risk, even though poverty is a risk factor for preterm birth. The focus of the program is on women at highest risk for preterm birth based on geographic, demographic, physical, and psychosocial risk factors. Specifically, the program uses Institute of Medicine (IOM) criteria for high risk (IOM, 2007).

Four different approaches to enhanced prenatal care are being evaluated. One of the approaches is being evaluated through the Maternal, Infant, and Early Childhood Home Visiting program, a Health Resources and Services Administration project with a mandate from the Affordable Care Act to measure home visiting. Strong Start is looking at a component of the Mother and Infant Home Visiting Program Evaluation (MIHOPE). Specifically, MIHOPE-Strong Start (MIHOPE-SS) measures home visiting associated with the Nurse Family Partnership and Healthy Families America programs. Strong Start II provides funds for MIHOPE-SS and consults with the program regularly but is not managing the program. The other three approaches are being evaluated through CMMI. They include (1) care through birth centers, (2) group prenatal care (e.g., CenteringPregnancy™), and (3) maternity care homes (i.e., medical care homes for pregnant women). At the time of award, Strong Start II had a total of 27 awardees serving more than 80,000 women at 182 sites in 32 states. The program serves many geographic regions, both urban and rural, with sites ranging from federally qualified health centers in extremely poor rural areas to sites in the middle of Washington, DC. The level and type of risk for preterm birth varies among and within states, as well as among and within practices. The demographic composition of intervention participants also varies among states and regions.

Cross-Barnet described the different types of providers across the three

different care models. (1) Women delivering in *maternity care homes* may see a number of different service providers through care coordination. These may include social workers, lactation consultants, nutritionists, obstetricians, midwives, and nurses. The primary prenatal care provider may or may not be the one who attends the delivery. (2) Facilitators of *centering/group care programs* have varying qualifications. They include obstetricians, registered nurses, CNMs, and nurse practitioners. The programs are often facilitated by a medical provider and a more lay-oriented individual, with the facilitators (and the peer group) staying consistent throughout prenatal care. However, the facilitators may or may not attend the actual deliveries. Often a woman meets her delivery practitioner for the first time only when she enters the birth setting. (3) In *birth centers*, prenatal care providers are usually midwives, and the prenatal care providers usually attend the delivery. However, the midwife in attendance may not necessarily be one that a woman has seen much throughout prenatal care.

As with providers, birth settings vary among the three different care models. (1) *Maternity care homes* have no requirements for birth setting, although the birth setting is almost always a hospital. The hospital setting may or may not be affiliated with the care provider setting, so some women may receive care in a maternity care home and then delivery in a facility not directly affiliated with that home. (2) Likewise with *centering/group care*: there is no requirement for birth setting. But again, it is usually a hospital. And again, the care provided prior to delivery may or may not be provided in a setting affiliated with the actual birth setting. A woman may make her own birth arrangements. (3) All *birth center* awardees are freestanding birth centers where women are almost always receiving care in the same facility where they give birth and with familiar practitioners.

The focus of CMMI is on value-based medicine, that is, medicine that produces better care and better health at lower cost. With respect to lowering cost, while preventing preterm births obviously reduces neonatal costs, Strong Start II is also evaluating cost beyond the early postpartum period by following women and their babies for 1 full year. With respect to better health, the program is examining both maternal and infant health, again through the first year of the baby's life. So even though the initiative is focused on preterm birth (i.e., reducing the incidence of preterm birth), it is also examining longer-term outcomes.

Preterm birth is being measured by gestational age and birth weight. Cross-Barnet noted that gestational age can be a "very fuzzy" measurement, which is why birth weight is also being measured. Currently, ACOG's preferred mode of measurement of gestational age is a first-trimester ultrasound (before 20 weeks). But for women who enter prenatal care later during their pregnancy, gestational age is often estimated based on the woman's last menstrual period (LMP). In addition to preterm birth, care costs are

being evaluated for pregnancy, delivery, and the postpartum period through 60 days (and up to a year if Medicaid eligibility continues). The expectation is that, with the Affordable Care Act, more mothers will be eligible for Medicaid through that first full year of the baby's life and, thus, more mothers will be followed through Strong Start II for longer.

Other outcomes being measured include length of stay for delivery; neonatal intensive care unit (NICU) admission and length of stay; unplanned maternal ICU admission; frequency of ongoing prenatal care; timing of prenatal care (i.e., when a woman enters care), with differences expected based on the type of care (e.g., centering/group care standards are that a woman enters care before 18 weeks, while the birth center standard of care is 20 weeks); appropriate use of antenatal steroids; whether the delivery is vaginal or Cesarean and, if vaginal, whether it is operative or not (i.e., involves use of forceps, vacuum extraction, etc.); elective deliveries prior to 39 weeks (as well as medically indicated deliveries prior to 39 weeks); appropriately timed postpartum care for the mother (e.g., care for postpartum depression, breastfeeding success, future planning); and patient experience of care (i.e., at intake, at the third trimester, and at the postpartum visit).

### Evaluation of Awardees

Variation in data availability and program design complicate the evaluation process. For example, there is a large amount of variation in maternity care home measures, with some groups focused on patient care coordination, but others not. Also, care enhancements offered vary (or are similar) both across and within care models. For example, peer counseling might be offered by both birth centers and maternity care homes. The same is true of birth centers and group prenatal care. In order to capture as much of this variation as possible, Strong Start II is using a multipronged evaluation approach. Cross-Barnet described approaches under consideration.

First, the evaluators may conduct a baseline comparison using a contemporaneous comparison group and based onsite visits, interviews, and state Medicaid and vital records data. An issue with this approach is that baseline is not necessarily standard obstetrical care (e.g., a woman visits her obstetrician for a 10-minute visit, etc.), with that care suddenly replaced by another type of care (e.g., birth center or centering/group care) when the Strong Start intervention begins. The notion of a standard level of care is complicated by variation in state Medicaid coverage. Cross-Barnet emphasized that even though Medicaid has a large federal component, it also has a large state component, with states making many individual decisions about what Medicaid will cover. Strong Start pays only for enhanced care provisions not covered by state Medicaid. For example, CPMs are covered by Medicaid in some states, but not in other states. In addition to this

state-level variation in "standard" of care, while birth centers are already operating as birth centers and while many centering/group care and maternity care home sites are already operating as such, some sites that are just starting up have no baseline of any kind. Without a baseline, a baseline comparison cannot be made.

In addition to baseline comparisons, another evaluation approach being considered is analysis of state-linked data. State-linked data are vital records data (e.g., birth and death certificate data) that some states link to Medicaid beneficiaries. Strong Start evaluators compare the vital record data to information provided on Medicaid claims. However, there is tremendous state-level variation in the type of data being linked. Some, but not all, states link Medicaid records of both mothers and their infants, whereas other states link only portions of records. States link records for varying reasons. Some do it to set insurance rates, others to screen for eligibility (i.e., they link them only when someone requests Medicaid and their birth certificate needs to be verified for eligibility), and still others link data to study a particular issue and only for a certain period of time. Some states have no data links at all. Cross-Barnet mentioned data linking in Washington State as an exemplary model of state-linked data.

State-linked data might actually be enough to evaluate Strong Start II sites, if the medical portion of the U.S. certificate of live birth was always filled out completely. However, it is often not complete. Although gestational age and birth weight are usually recorded relatively accurately, many other fields are not consistently recorded. These include risk factors of relevance to preterm births (e.g., having a prior preterm birth), place of birth, and birth attendant. About half of all states do not routinely record place of birth, and 11 states do not routinely record the name and title of the birth attendant. Also, "other midwife" has multiple meanings. For example, CPMs are licensed only in some states.

Another challenge with state-linked data is that, again, Medicaid coverage is largely determined by states and therefore varies among states. The federal government mandates that Medicaid cover all pregnant women up through 133 percent of the poverty line, but states have the option of covering women who have higher incomes than that. Some states cover women with significantly higher incomes, while others do not. Thus, the range or depth of poverty that women on Medicaid are experiencing varies from state to state. Medicaid coverage also varies by immigration status, with some states covering prenatal care for immigrants who do not have legal status while other states do not (although those other states cover the birth, because technically the birth is for the baby). There is no way to know from Medicaid claims if women received prenatal care through non-Medicaid means. Additionally, Medicaid coverage of services varies from state to state, with some states covering *centering/group* care and

others not. Similarly, there is significant variation in provider coverage, as Medicaid covers only providers who are licensed in their state and not all types of providers are licensed in all states (e.g., CPMs). Even in states that do license a particular type of provider, the liability insurance requirements might be so astronomical that the providers are unable to practice.

Additional challenges to state-linked data include the lag time for state submission of claims data to the Centers for Medicare & Medicaid Services; inaccuracy of claims codes (e.g., in states where vaginal and Cesarean deliveries receive the same reimbursement, there may not be much attention directed to which code is being used on a claims form); and global billing (i.e., a set fee is paid for all prenatal care and birth services), which makes it difficult to know how many prenatal visits there were and to associate prenatal visits with outcomes.

A third approach that is being considered to evaluate the different Strong Start service models is via comparison groups. Some awardees offer Strong Start service models only to some, not all, patients, because of the large number of eligible patients. In those cases, people who are eligible but do not receive services can be compared with people who are eligible and who do receive services. Or, some communities may be large enough that they have other sites that are serving high-risk Medicaid women but not through Strong Start; those sites could be compared to Strong Start sites.

Regardless of the approach used to evaluate the different Strong Start service models, care model bias poses a challenge. That is, do women enroll in certain Strong Start sites because they are seeking a particular type of care? For example, is there a particular type of woman that chooses a birth center as opposed to a group care facility? If so, does seeking a particular type of care compromise valid comparisons among care models? Can nontraditional care serve women with the same risk profiles as those in traditional care? For example, is it acceptable to care for a woman with preeclampsia, gestational diabetes, and a prior preterm birth at a birth center as opposed to a maternity care home? Are the same risk profiles distributed equally among the three interventions? Finally, Cross-Barnet asked, is seeking traditional care a bias? Many people think of seeking birth center care as being a bias. Conversely, she said there are plenty of women who would never give birth outside a hospital. It is unclear how much "true choice" really exists. People seek particular types of care for multiple reasons, including insurance coverage, availability, transportation or child care concerns, and other issues.

In addition to the combination of evaluation strategies being used to evaluate sites, Strong Start II is considering how to use state data judiciously, given its limitations; relying on standardized measurement tools (e.g., tools that are consistent across all sites); and conducting considerable qualitative inquiry into the patient and caregiver experience.

## DATA SYSTEMS AND MEASUREMENT: FORMAL DISCUSSION[5]

At the end of the Session 5 panel, Elliott Main was invited to reflect on data systems and measurement issues. Main commented on the "big data" handled by the California Maternal Quality Care Collaborative, with California home to more than 500,000 births annually, some years as many as 550,000 births, and with the collaborative responsible for evaluating the quality of maternity care in more than 280 hospitals and other settings. He and his colleagues deal with both administrative data and merged clinical datasets. In addition to his work with the collaborative, Main directly supervises quality for 20 Sutter Health birthing facilities, including 2 for which the majority of births are delivered by midwives. He also provides outpatient consultations for several hundred northern California maternity providers, including midwives at freestanding birthing facilities. He stated that he had no financial disclosures.

### Challenges to Evaluating Birth Setting Data

Main discussed several challenges to evaluating birth setting data that earlier presenters had mentioned: limitations of vital records, denominator and numerator size issues, power limitations, comparison issues, and identification of high risk factors.

#### *Limitations of Vital Records*

The U.S. standard certificate of live birth is limited by its lack of information on intended place of birth. Without that information, it does not capture planned births transferred to hospitals. This is a critical issue as the "transferred" group has a much higher risk of serious morbidity, at least based on what Main and colleagues have observed in northern California. Not only does the birth certificate not capture transfer from home, on-screen instructions for filling it out indicate that information being collected on transfers is for intrafacility transfers (e.g., hospital to hospital, birthing facility to hospital) and not for transfers from home to hospital. In a sense, Main opined, it is a difficult question to ask because mothers come to a hospital from home regardless of whether they intended to deliver at home or not.

In Main's opinion, even the suggested revised U.S. birth certificate has a number of potentials for error and will take several years for new or added fields to be accurately completed on a widespread basis. "Minor"

[5]This section summarizes information presented by Elliott Main, M.D., California Maternal Quality Care Collaborative, Stanford, California.

fields on the birth certificate are least likely to be completely accurate, with many birth certificate clerks not very adept at asking or completing those questions. Generally, there has been little attention directed toward birth certificate quality in the United States. Main noted that a large birth certificate data quality project is being started in California.

*Denominator and Numerator Issues*

With respect to denominator issues, many outcomes are reported in small numbers. For example, perinatal mortality is typically 1 to 2 per 1,000. To identify a difference between 1 per 1,000 and 2 per 1,000, the recommended sample size is 23,500 per arm. Given that the total number of home births in the United States is 27,000 per year, having sufficient statistical power to detect differences is very difficult.

The same small numbers (e.g., 1 to 2 neonatal deaths per 1,000) create numerator issues as well. For example, there would be only 10 to 20 cases in a sample size of 10,000, with misattribution or nonreporting of even a few cases leading to significant differences in calculated rates. Ensuring a highly accurate numerator requires ongoing extensive focus on the data elements, which in turn requires extensive money and time. Even then, accuracy is not guaranteed. Based on a number of published studies that have analyzed the accuracy of U.S. birth certificate data, some fields of data are highly accurate: birth date and time, birth weight, parity, plurality, maternal demographics (e.g., race and ethnicity), and method of delivery. Other fields of data are acceptable, but not perfect, for example clinical estimate of gestational age (i.e., not the LMP estimate). Unfortunately, in Main's opinion, many of the fields of data used for risk adjustment are those that are known to be poorly collected and represented: pregnancy complications, labor and delivery complications, neonatal complications, and NICU admission. There is a place on the birth certificate for information about neonatal complications and NICU admission to be recorded, but most of that information is not known when the certificate is filled out (usually within hours of birth). Recording pregnancy or labor and delivery complications is sometimes beyond what a birth certificate clerk is best at doing. However, when information on these various poorly collected fields is recorded, it is usually accurate. The poor collection of these data makes it difficult to risk-adjust for medical factors based solely on birth certificate data.

Main used a study by Snowden et al. (2013) comparing three different ways of analyzing hospital versus planned home birth data from Oregon to illustrate denominator and numerator data limitation issues. The researchers compared 3 years of data, from 2008 to 2010. One of the comparisons was between planned home birth data and "typical" hospital birth data,

which included all near-term births; the second comparison was between planned home birth data and hospital data excluding facility transfers (with the intention of excluding intended home births, although they likely did not); and the third comparison was between planned home birth data and hospital birth data, excluding births that did not meet Oregon eligibility criteria for home births. The state of Oregon's eligibility criteria are based on a series of exclusionary factors (e.g., under 35 weeks, no preeclampsia, etc.).

The Snowden et al. (2013) analysis involved only 2,736 home births, with 7 neonatal deaths, which amounts to a 0.26 percent neonatal death rate, similar to that for total hospital births. However, when compared to hospital births that met the Oregon criteria for home births, the actual home birth neonatal death rate was three times higher than the hospital rate. A different numerator, even just one or two fewer or more deaths, could have changed the rate significantly. Another approach would be to increase the denominator, and many have recommended combining data from multiple states (or even national data), but that can be misleading because of variation in home birth attendant certifications, guidelines, and cultures and traditions. But, as Snowden et al. (2013) illustrate, single-state data collected even over several years, in a state with one of the highest rates of home births, still provides an inadequate denominator (even several years of data collection yielded a sample size smaller than 3,000) and unstable numerators (again, just a couple fewer or more deaths would change percentages significantly).

Snowden et al.'s (2013) study also serves as a good example of the limitations of birth certificate coding. It is unclear whether home births, hospital births, or both were undercoded for maternal complications. Likewise, it is unclear whether birth certificate data really capture intended home births that end up in the hospital. Although Oregon changed its birth certificate question about intended home birth in 2012, it remains to be seen how that change is going to roll out and how the question will be completed in the hospital.

Birth certificates can provide large denominator numbers; all births in the United States are recorded, although more robust sources of data, like linked datasets that contain information on medical conditions, are needed for risk-adjustment denominators. Main expressed uncertainty about how to manage the numerator issue. "I don't have a good answer for that," he said.

### *Comparison Issues*

With respect to comparison issues, Main asked, "If we cannot randomize, how can we make the groups comparable?" The question is relevant to all birth settings. There needs to be some control for medical and de-

mographic factors, as well as control for commitment to the program (i.e., commitment to home versus hospital versus birth center) and commitment to one's end goal (e.g., value of vaginal birth).

*Identifying High Risk*

Main described the IOM list of risk factors, upon which Strong Start is based, as a "grab bag" (IOM, 2007). According to Main, the list includes everything that has ever been reported as being associated with preterm birth, but most of these do not put the fetus at risk for late stillbirth or neonatal mortality. Some of the factors listed are higher risk than others, for example having had a prior preterm birth and race/ethnicity; likewise with multiple gestations, which in Main's opinion should be considered separately and not even included in the risk analysis (see last paragraph on this page). With respect to placental abnormalities, some are high risk, others not, according to Main. With respect to the use of marijuana and other illicit drugs, the drug of concern with respect to preterm birth is methamphetamine, not marijuana. In sum, some risk factors are more important than others.

Also, for some risk factors, the issue is one of gradations, not a dichotomous yes or no. For example, transient hypertension poses a different risk than a history of hypertension, as does mild versus severe hypertension (i.e., women with mild hypertension not being medicated versus women with severe hypertension taking one or two medications). Obesity is another factor that needs to be considered in terms of gradations. Obesity is defined as a body mass index (BMI) greater than 30. Half of U.S. women have a BMI of at least 30, but few have a BMI greater than 50, which Main said is probably where the risk is. The same problem exists with anemia, which can range from a hematocrit of 20 to 34 percent, with very different risk profiles for women at different points along that spectrum. Likewise with maternal age, the risk associated with a maternal age of 30 to 35 years is very different than the risk associated with a maternal age of 45. In sum, Main said, "The plea here is that risk adjustment needs a lot of work." He suggested simplifying it through the use of fewer factors, and simultaneously complicating it by considering gradations and interactions.

The dominant factor for successful labor outcome in any risk adjustment is parity. This is true across most typically analyzed labor outcomes (e.g., Cesarean birth rates, labor length, labor pain, physiological birth rates, and successful birthing center or home births). Nulliparous women have much higher rates of all adverse outcomes, regardless of birth setting. It is much harder to find increased risks among low-risk multiparous women. Again, this is true across settings.

### Limitations of Data Sources

Main identified two required data sources: vital records and patient discharge diagnosis (PDD) datasets. Challenges with vital records data include continuing issues with attribution and accuracy. Also, vital records are not a good source for data on comorbidities and complications. PDD datasets, on the other hand, are actually a pretty good source for data on comorbidities and complications and are easily linkable to vital records. Main remarked that California routinely links PDD datasets and vital records. However, while PDDs are submitted by every hospital to a central state agency, they are not collected for home births or freestanding birth center births.

Voluntary data sources include registries and research datasets. Registries are not universal and are nonstandard. Plus, their voluntary nature raises questions about missing cases. Main applauded those who are conducting quality assessments of registry datasets, which he said "has to be done." The challenge with research datasets is that they are expensive. Because of the expense and time involved, it is difficult to collect sufficiently large numbers (for the denominator).

### Understanding Small Risks

Main explained that many patients or families have a difficult time understanding small risks, and, importantly, different people interpret them differently. For example, in prenatal diagnosis, where this has been studied extensively, some families are unwilling to take a 1-in-10,000 risk for a baby with Down syndrome, while others are very happy taking a 1-in-150 or even 1-in-50 risk. These varying assessments of risk affect how risks among the different birth settings are interpreted. There is no objective or external standard. It is a personal choice.

Related to the issue of varying risk perceptions, Main offered what he described as his "editorial" on what is driving the increase in home births in the United States. Based on his talks with women in northern California, he thinks the increase in home births is being driven by a fear of overmedicalization of birth with too many interventions. Main said Cesarean delivery rates have increased by 50 percent in the past decade and vaginal birth after Cesarean (VBAC) rates have markedly decreased. He mentioned the "near disappearance of VBACs in many hospitals," saying, "women have fewer choices in hospitals, and so they are looking for alternatives."

### Variation in Outcomes Among Hospitals

With respect to the 98 percent of births occurring in hospitals, Main emphasized that not all hospitals are the same. For example, California

hospitals show significant geographic variation in median hospital Cesarean rates (both nulliparous term singleton vertex Cesarean [NTSV CS] rates and total term Cesarean rates). The median NTSV CS rate in his region (in northern California) is down around 21 percent, but the median rate in Los Angeles is over 30 percent. The national target for NTSV CS rates is 23.9 percent. As another example, the California Maternal Data Center is a statewide data center that links birth certificate data provided by the state (every 45 days) and hospital-supplied PDD or International Classification of Diseases, 9th revision (ICD-9) codes. The data are linked "on the fly," with 99.8 percent completion, and used to calculate a series of data quality measures (e.g., missing or inconsistent delivery method) and clinical quality measures (e.g., elective delivery under 39 weeks). Facilities can use the results to compare themselves to the state, a region, or other hospitals. NTSV CS rates range from 15 percent in some hospitals to 40 percent or more in others. Main observed that, just as there has been much discussion (during the workshop) about not lumping midwives together (in analyses), hospitals should not be lumped either.

Main concluded by asking what he said was a rhetorical question: Given the variation that exists, is there an opportunity to pay based on outcomes? Is maternity care an opportunity for value-based purchasing?

## DISCUSSION WITH THE AUDIENCE[6]

Workshop attendees addressed several issues during the discussion with Session 5 panelists, including how patients perceive risk and how providers discuss risk with their patients, numerator and denominator issues, issues related to the lack of data on intended place of birth, other miscellaneous data issues, language used to discuss birth setting research, and a woman's choice of birth setting.

### Patient Perspective of Risk and Provider-Patient Risk Communication

An audience member remarked that much of the workshop discussion on risk was "highly categorical," but that risk is a continuous variable for patients. He said that patients are not evaluating whether they are at low or high risk. Rather, they are evaluating the likelihood that certain things will happen to them. That is, patients are evaluating "whether [they] are a numerator." They are also evaluating the impact of those events on their families.

[6]This section summarizes the panel discussion with the audience that occurred at the end of Session 5.

There was a question about how data are being discussed in provider-patient relationships. William Barth replied that the issue is, at least partly, a numeracy issue. As a provider, he counsels patients very differently based on what he perceives as their appreciation of numeracy. For example, he would counsel a software engineer differently than he would counsel a patient from Somalia who has been in the United States for only 4 months and is frightened during the visit. For many people, describing the risk of neonatal death as less than 1 percent is not alarming; but describing it as threefold higher at home than in a hospital dramatically changes the context of the conversation. As a provider, he has to not only read the patient without necessarily knowing anything about that patient, but also check his own personal biases. He remarked that, although nondirective counseling is "the big issue today," it is hard not to have an opinion about a risk and to not advise a person based on that opinion.

### Numerator and Denominator Issues

The discussion of risk led into some further discussion of the Wax et al. (2010) study, concerns about which had been addressed in an earlier question-and-answer period. Marian MacDorman commented on the focus on neonatal mortality risks reported in that study. In MacDorman's opinion, perinatal mortality risk is a better measure of risk. Measures of perinatal mortality risk combine both late fetal deaths and early infant (neonatal) deaths. In contrast, neonatal mortality only measures the risk of death from live birth through 27 days of age. The denominator of the perinatal mortality risk estimate reported by Wax et al. (2010) was on the order of 331,000, compared to only 12,000 for the neonatal mortality risk. She described the neonatal mortality risk estimation as a "very underpowered analysis." That study reported no increase in perinatal mortality among home births. MacDorman said, "So the whole [controversy] about neonatal mortality was sort of misguided." She also commented on the fact that, while some studies included in the Wax et al. (2010) meta-analysis reported a slightly higher relative risk in neonatal mortality among planned home births, none reported high absolute risks. She expressed concern that the notion of absolute risk is "underutilized." William Barth explained that the difference in the denominators resulted from a decision to include neonatal mortality data only for those studies that extended out to 28 days. He emphasized that the authors of the ACOG committee opinion on planned home births tried to be very careful with their words by differentiating between relative and absolute risk. That is, the opinion reads along the lines of, "Although the absolute risks are low, there may be an increase in the risk of neonatal death" Barth quoted a colleague (Michael F. Greene, M.D.), who said, "Risk, like beauty, is in the eye of the beholder." He explained that dif-

ferent people will value different outcomes and risks differently and "our charge is to convey what we do know based on the imperfect information that's out there."

### Lack of Data on Intended Place of Birth

An audience member lauded efforts to add intended place of birth to all birth certificates. However, if the goal of doing so is to better understand the factors involved in out-of-hospital births that need to be moved into the medical system, it is not enough to know the intended place of birth. One also needs to know whether a care provider was involved in the transfer decision making. According to the commenter, there has been an increase in unassisted out-of-hospital births. Some women choose that. Others do not have any licensed provider in their area to help with a home birth. It is important to know whether it was a friend, neighbor, or qualified provider who made the risk assessment that led to the transfer of care. She urged those who are making efforts to add intended place of birth to all birth certificates to also consider adding that information as well. MacDorman responded that, while there may be some minor tweaking with the U.S. certificate of live birth in another 5 years or so to improve data on specific items, there is no plan in place for a global revision. She suggested writing a letter to the NCHS. However, she cautioned, "It's pretty hard to change the birth certificate." She described Oregon's question on their birth certificate about whether hospital births were planned to be hospital births or not as a "big improvement."

### Other Miscellaneous Data Issues

There were a couple of remarks made on various other miscellaneous data issues. First, Cross-Barnet clarified that Strong Start collects data only for birth centers, maternity care homes, and centering/group care. The program does not collect data for home births, even though Medicaid pays for home births in some states. Second, the issue of voluntary versus mandatory data reporting was brought up. The North American Registry of Midwives is currently taking steps with the Midwives Alliance of North America to combine efforts toward mandatory data collection from all CPMs in 2015.

### Language Used to Discuss Birth Setting Research

An audience member observed that much of the workshop discussion seemed to pit the promotion of women's voices and evidence-based health care against each other. She said, "Those two things are not mutually exclusive or even contradictory." She also observed that referring to hospital

births as "traditional" and home births as "nontraditional" does not help the discussion. Up until very recently, hospital births were not a traditional way to give birth. Nor does using the word "versus," as in "hospital births versus home births" help the discussion. Another workshop participant suggested that "standard" be used instead of "traditional."

### A Woman's Choice of Birth Setting

A comment was made in response to one of William Barth's quotes. Specifically, he had quoted his friend Jeffrey Ecker, M.D.: "No one can force someone to have a hospital birth." The commenter said, "Someone can and someone has." She referred to the state, often acting at the behest of obstetricians, with women who prefer to give birth at home being forced to deliver in hospitals. She pointed to the Laura Pemberton case in Florida as an example. The commenter asserted that women have also been forced to have Cesarean deliveries that they did not consent to. Barth clarified that he was quoting his friend. He said, "What we should say is, 'no one should be forced to have a hospital birth.'"

# 7

# Costs, Values, and Reimbursement Issues Associated with Various Birth Settings

At several times during the course of the workshop discussion, participants commented on the need to consider the economic drivers of decision making around birth settings. While perceived health risks clearly impact both patient and provider decision making, so too do cost, value, and reimbursement issues. Moderated by Jeannette Rogowski, Ph.D., University of Medicine and Dentistry of New Jersey, Piscataway, New Jersey, Panel 6 participants considered some of these issues. This chapter summarizes the information that was presented and discussed in that panel. Box 7-1 summarizes key points made by individual speakers.

## REIMBURSEMENT ISSUES AND PAYMENT INNOVATION[1]

The Center for Medicare and Medicaid Innovation (CMMI), also known as "the Innovation Center," was mandated by the Affordable Care Act and appropriated $10 billion for testing new payment models. Its purpose is to find new ways to leverage different approaches to paying for care through providers, health systems, hospitals, and states, with the ultimate goal of improving quality, improving outcomes, and reducing total cost of care. While the Centers for Medicare & Medicaid Services (CMS) have long employed demonstration projects, CMMI provides a unique opportunity to "scale up" to the national-level models that demonstrate reductions in cost and no change in quality, or improvement in quality and no change

[1]This section summarizes information presented by William Shrank, M.D., M.S.H.S., Center for Medicare and Medicaid Innovation, Baltimore, Maryland.

**BOX 7-1**
**Costs, Values, and Reimbursement Issues Associated with Various Birth Settings**
**Key Points Made by Individual Speakers**

- Medicaid is a major payer for births in the United States, paying for approximately 40 percent of all births nationwide. Medicaid also pays for many poor birth outcomes. To sustain itself, Medicaid is seeking ways to reduce costs. William Shrank discussed the wide range of new payment models being tested by the Center for Medicare and Medicaid Innovation (CMMI), also known as "the Innovation Center." Many of these models impact perinatal care.
- After a decades-long history of state laws, regulations, and policies enacted or implemented to foster collaboration between midwives and physicians, Laurie Cawthon suggested that Washington State serves as a model for varied birth settings. She presented results from an unpublished study based on Medicaid claim and U.S. birth certificate data comparing expenditures between hospital, home, and birth center births. Expenditures for out-of-hospital births are consistently lower than for hospital births.
- While Medicaid interest in perinatal care is high, involving Medicaid in perinatal research is challenging. Kathleen Nolan identified several key challenges: data collection; state-level variation in Medicaid coverage; and the unknown impact of the shifting Medicaid landscape on pregnancy coverage.

in cost. The U.S. Department of Health and Human Services secretary has the authority to expand successful models through rule making, not legislation, leading to rapid implementation.

William Shrank described programs announced by CMMI to date (as of the time of the workshop). He stated that the Center was still in its infancy, having been established just 2 years ago, but that already it has announced a large agenda of new programs. He noted at the outset that he would describe each program's relevancy to childbirth care but emphasized that the goal is to think more broadly about "the changing incentives, the changing environment, the changing platform and what that means for all of us as we strive to improve the quality and reduce the cost of care for the patients that we serve."

The programs announced thus far by CMMI are grouped into several categories:

- Coordinated Care
  - Coordinated care is a central theme of the Affordable Care Act and was written directly into the CMMI statute, that is, that CMMI should emphasize new programs that attempt to im-

prove care coordination for the beneficiaries being served. There are two types of coordinated care programs: Accountable Care Organizations (ACOs), which include the Pioneer ACO Model and the Advance Payment ACO Model; and the Primary Care/Medical Home models, which are patient-centered models that emphasize and realign incentives for primary care physicians.

- Right Care
  - Right care programs are focused on improving incentives to optimize outcomes and reduce costs for providers who are delivering acute care services. For example, the Bundled Payment for Care Improvement model is a bundling of hospital services to help realign incentives for hospitals to deliver higher-quality, lower-cost care.
- Innovation Infrastructure
  - CMMI is investing in infrastructure to help train the next generation of leaders of health reform innovation. The programs include the Innovation Advisors Program and Healthcare Innovation Challenge.
- State/Medicaid/Duals
  - CMMI has announced several activities at the state level that focus on ways to better allocate funding and align incentives.
- Preventive Care
  - Preventive care models include the Million Hearts Campaign and Strong Start.

## Coordinated Care

### *Pioneer ACO Model*

Shrank described several of the Coordinated Care models, beginning with the Pioneer ACO Model, which he observed has received significant media coverage. The goal of this initiative is to test the transition from a shared-savings payment model to a population-based payment model. In a broader sense, the goal is to transition to a health system that provides the full range of care for the beneficiaries it serves—a system that is responsible for all patient care and accountable for the total cost of care. Such a model requires that management of patient care be considered very broadly, by finding ways to reduce waste, improve coordination, improve health outcomes, and reduce downstream costs. Pioneer ACOs are reimbursed through rewards for delivering higher-quality, lower-cost care. A number of quality indicators serve as specific targets for higher remuneration. If the ACOs are able to provide higher-quality, lower-cost care to their beneficiaries and thereby reduce the total cost of care, CMS

will share the savings with them. The financial incentive is a strong incentive for perinatal care.

Shrank emphasized the importance of understanding what the evidence indicates is the best way to target, communicate, and work with patients and deliver them to the childbirth site that best meets their needs and preferences and delivers the best outcome at the lowest cost.

### *Advance Payment Model*

According to Shrank, Pioneer ACOs are more advanced than other health systems with respect to already being well on their way to providing coordinating care. Advance payment programs, on the other hand, are generally rural ACOs that may not even have a main hospital or the other pieces required to deliver the full range of care. To help these models advance, CMS provides them with up-front capital to help recruit and otherwise invest in building the necessary infrastructure.

### *Comprehensive Primary Care Initiative (CPCi)*

CPCi is committed to studying how to improve the role of the primary care doctor and delivery of care to patients by empowering doctors with opportunities to make more decisions and with resources for building the infrastructure needed to deliver comprehensive care. CPCi is a multipayer initiative, with all payers investing in comprehensive primary care and with Medicare paying approximately $20 per beneficiary per month to improve care coordination. On the front end, Shrank explained, the initiative helps physicians invest in delivering higher-quality and more efficient primary care, for example by hiring a nurse practitioner to help people with diabetes better manage their blood sugars or by hiring a pharmacist to help patients better adhere to their medications or understand drug side effects. On the back end, the initiative is a shared savings model.

In Shrank's opinion, the CPCi model is an incentive for primary care physicians to think on a more "global" level about prevention and to deliver primary care in a holistic, coordinated way. The hope is that following patients more closely will reduce the total number of office visits (e.g., by handling issues via better management or over the phone or through e-mail), thereby reducing total cost of care. Medicare will pay a large portion of the difference.

With respect to relevancy to perinatal care, Shrank observed that such a model, whereby the primary care physician is accountable for care of the entire patient, would present opportunities for primary care physicians to play a role in facilitating early and appropriate obstetrician/gynecologist participation.

## Right Care Initiatives

The Innovation Center is testing three right care initiatives: Partnership for Patients, Community-Based Care Transitions, and Bundled Payment for Care Improvement.

### *Partnership for Patients*

The Partnership for Patients model is slightly different than the Innovation Center's other models, which are generally focused on a specific new payment for doctors, health systems, or hospitals. It is a national campaign to promote healthier, safer care in hospitals, with very aggressive goals to reduce preventable hospital-acquired conditions and reduce readmissions. At the time of this workshop, nearly 4,000 hospitals, or about 75 to 80 percent of all U.S. hospitals, had signed the pledge to participate. The program's main goal is to test and share approaches to improving the safety of care, which ultimately will lead to cost reduction. Shrank described the model as a "learning collaborative." He observed that, with respect to perinatal care, there are a number of ways that the safety and cost of obstetric care could be improved, for example through the use of checklists.

### *Community-Based Care Transition Program (CCTP)*

The Innovation Center has invested $500 million in CCTP to date (at the time of the workshop), through which community-based organizations play a unique role in helping transition patients from a hospital to a home or other outpatient setting. Shrank observed that there is likely a unique opportunity for CCTP to improve perinatal care, particularly during that time of transition when new parents take their baby home from the hospital for the first time. Shrank said, "Everyone says . . . 'I didn't get the handbook.' . . . There's unquestionably a unique opportunity here to help new parents at that time of transition to maintain the safety."

### *Bundled Payments for Care Improvement*

The Bundled Payments for Care Improvement model is one of the Innovation Center's largest models. Historically, at least over the past 20 years, CMS has bundled the cost of a hospital stay, but with providers billing CMS as much as possible (i.e., for multiple referrals, etc.). The Bundled Payments for Care Improvement model is based on bundling for the entire care episode, so not just for the inpatient phase of care but also for the post-acute care period. The goal is to ensure that hospitals have incentive to bill CMS not as much as they can, but only for what is appropriate.

If, in so doing, a hospital is able to reduce the cost of care, it will receive a share of the savings. Hospitals are also rewarded for providing higher-quality care. That is, if patients are readmitted within 30, 60, or 90 days, the hospitals have to pay. Shrank explained, "There is a whole new level of accountability for [hospitals] to make sure that when those patients are sent home, they are sent home with a good plan." Currently (i.e., at the time of the workshop), none of the program bundles are focused exclusively on childbirth. However, Shrank said that the program was announced only very recently and that it would likely evolve in the years to come.

### State/Medicaid/Duals

The Innovation Center has announced many programs aimed at reducing spending on dually eligible patients (i.e., patients eligible for both Medicare and Medicaid) by coordinating payments. Shrank observed that, as states try to innovate and transform the models that they use to pay for care within their states, it would be short sighted not to include childbirth as an important target, given that such a large amount of Medicaid spending is focused on childbirth and perinatal care.

### *Conclusion*

In conclusion, Shrank emphasized that efforts at the Innovation Center are aimed at the whole continuum of care. Whether the focus is on primary care physicians, hospitals, health systems, or the state, all of its efforts are aimed at realigning incentives to reward providers for delivering higher-quality and lower-cost care and improving health outcomes. Perinatal care is an important component of almost all of the delivery transformation models being tested by CMMI.

## ASSESSING COSTS OF BIRTHS IN VARIED SETTINGS[2]

Before reporting on the costs of births in varied settings in Washington State, Laurie Cawthon provided some "quick facts" on the births themselves. In 2011, about 87,000 births were reported in the state of Washington, 3.1 percent of which occurred at homes or in birthing centers. Like the United States overall, out-of-hospital births have been increasing in Washington State. From 2004 to 2011, the number of home births nearly doubled, with the proportion of home births increasing from 1.1 to 1.9 percent of total births. From 2000 to 2011, the number of births in free-

[2]This section summarizes information presented by Laurie Cawthon, M.D., M.P.H., Washington State Department of Social and Health Services, Olympia, Washington.

standing birthing centers also nearly doubled, with the proportion of such births increasing from 0.7 to 1.2 percent of total births.

Cawthon said Medicaid covers 50 percent of total Washington births, with Washington being 1 of about 11 states with Medicaid reimbursement for direct entry midwives. In many ways, she suggested, Washington is a model for varied birth settings, with many state laws, regulations, and policies enacted or implemented over the past 30 years and with collaboration between midwives and physicians.

In 1989, the state faced a crisis in maternity care access. While midwives were welcomed to the ranks of prenatal care providers, at that time Medicaid did not reimburse for home births attended by any provider type. Out-of-hospital births remained a contentious issue throughout the 1990s. The Washington State Department of Social and Health Services Planned Home Births report, *Planned Home Births: Outcomes Among Medicaid Women in Washington State* (Cawthon, 1996), received sharp criticism. Not until 2001 did the state Medicaid agency begin reimbursing for planned home births. Vaginal births after Cesarean deliveries, multiple gestation, and breech births that occurred in home settings were excluded from Medicaid reimbursement.

### Analysis of Medicaid Expenditures

Cawthon described results from an intent-to-treat analysis (unpublished data) based on the premise that pregnant women who sought prenatal care from licensed midwives were planning, or at least considering, out-of-hospital births. The cornerstone of the analytical methods used by Cawthon and colleagues at the Washington State Department of Social and Health Services was individual record linkage of Medicaid claims and vital records. They used attendant-at-birth and birth-place-type items from the birth certificate to identify birth attendant licensure or specialty (medical doctor/doctor of osteopathy, hospital administrator, certified nurse midwife [CNM]/certified midwife, other midwife, other) and place of birth (hospital, freestanding birth center, home birth, clinic or doctor's office, other); they independently verified provider credentials using licensure data provided by the state.

They classified providers of out-of-hospital births into three mutually exclusively categories based on the typical location of where their deliveries occurred: home birth providers (providers who delivered at least 75 percent home births), birthing center providers (providers who delivered at least 75 percent birthing center births), and providers mixed (providers who delivered babies in both settings). Data collected from 2010 to 2012 showed home birth providers included 72 licensed midwives (LMs) and 8 CNMs; birthing center providers included 16 LMs and 1 CNM; providers mixed

included 33 LMs and 5 CNMs. For all out-of-hospital births, there were a total of 121 LMs and 14 CNMs. Cawthon noted that, in 2011, there were 1,674 home births and 1,006 birthing center births in Washington State.

The researchers identified prenatal care providers using Medicaid claim codes and assigned the women who they cared for into one of six categories: perinatologists (N = 3,544), all other Medicaid (N = 105,785), home birth providers (N = 598), birth center providers (N = 642), providers mixed (N = 911), and CNMs at hospitals (N = 16,653).

Cawthon presented data for both achieved birth and intended place of birth. The difference is illustrated by the fact that, for example, although 598 women received prenatal care from a provider identified as a home birth provider, only 410 (68 percent) actually achieved a home birth. Data for those who intended a home birth and those who achieved a home birth were analyzed separately.

Expenditure data based on Medicaid claim data were computed for both the achieved birth and the intended place of birth groups. The researchers collected Medicaid expenditure data from all Medicaid claims between 270 days prior to delivery and the second postpartum month.

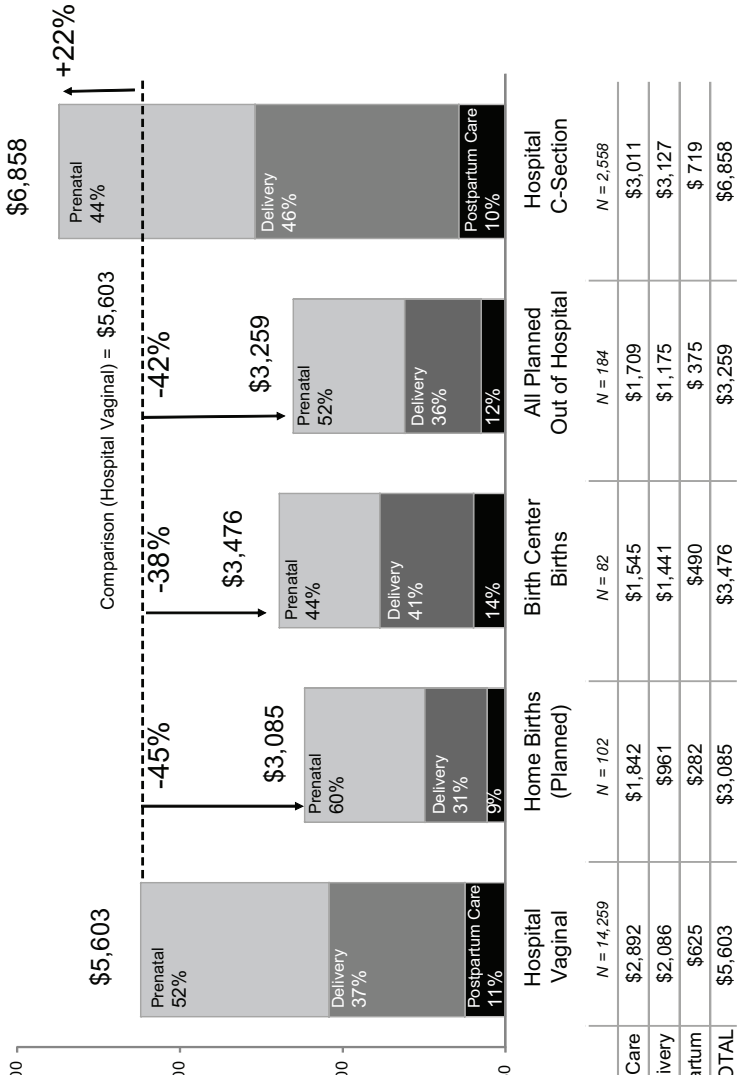
### Results of Achieved Birthplace Analysis

See Figure 7-1 for a breakdown of the expenditure results for low-risk women who gave birth in the various locations. The "all planned out of hospital" group is the sum of the home birth and birth center groups.

The researchers used birth certificate criteria to identify low-risk women. Specifically, they identified low-risk births as singletons that were delivered at term (37 to 41 weeks), and no indication of risk factors (based on check boxes on the birth certificate).

In Cawthon's opinion, what is remarkable about the results depicted in Figure 7-1 is that, despite the very small denominators, expenditures for the various out-of-hospital birth groups are actually quite consistent and consistently lower ($3,085 for planned home births, $3,476 for birth center births, $3,259 for all planned out-of-hospital births) than those for the hospital birth groups ($5,603 for hospital vaginal births, $6,858 for hospital Cesarean deliveries). With respect to comparison groups, Cawthon said that they "struggled" to find appropriate comparison groups. Because no Cesarean deliveries occur at home, they decided the appropriate comparison group was vaginal births in the hospital. But they also examined hospital Cesarean deliveries. The data are fee-for-service data only. Washington has a large managed care component to their Medicaid program; this type of analysis does not work well for that type of managed care data due to the leveling of expenditures.

When all births, not just low-risk births, are included in the analysis,




| | Hospital Vaginal | Home Births (Planned) | Birth Center Births | All Planned Out of Hospital | Hospital C-Section |
|---|---|---|---|---|---|
| | *N = 14,259* | *N = 102* | *N = 82* | *N = 184* | *N = 2,558* |
| Prenatal Care | $2,892 | $1,842 | $1,545 | $1,709 | $3,011 |
| Delivery | $2,086 | $961 | $1,441 | $1,175 | $3,127 |
| Postpartum | $625 | $282 | $490 | $ 375 | $ 719 |
| TOTAL | $5,603 | $3,085 | $3,476 | $3,259 | $6,858 |

**FIGURE 7-1** Average Medicaid expenditures for achieved birth place type in Washington State, 2010-2012, with only low-risk births included.
SOURCE: Cawthon, 2013.

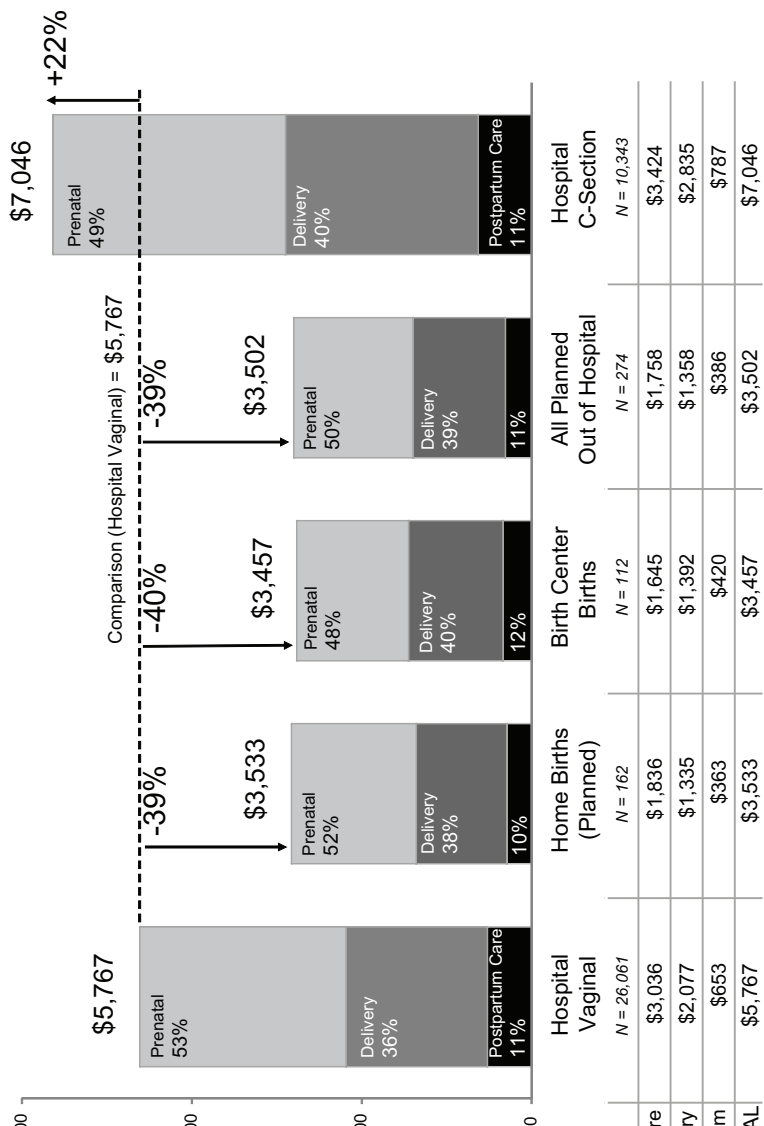
the pattern is remarkably similar, Cawthon observed (see Figure 7-2). Also remarkable, in her opinion, is how small the added expenditure is when all births are included. The average expenditure for the hospital vaginal delivery group, the smallest group, was $5,767, representing only an incremental difference (compared to $5,603 for low-risk births); for the hospital Cesarean deliveries group, it was $7,046, again representing only an incremental difference (compared to $6,858 for low-risk births).

### Results of Intent-to-Treat Analysis

Cawthon and colleagues used different comparison groups for the intent-to-treat analysis (see Figure 7-3). Because they also tracked CNMs who delivered primarily in hospitals, they decided that a better comparison group than all hospital deliveries would be hospital deliveries for which women received prenatal care from a CNM ("hospital CNM"). Because this was an intent-to-treat analysis, Cesarean deliveries could have occurred in any group. The direct cost of Cesarean deliveries was included in overall expenditures. The researchers used the same definition of low risk that they used in the previous analysis. Cawthon observed that, remarkably, the costs were comparable to those computed in the first analysis: $5,412 for the hospital CNM group, $3,873 for the planned home birth group, $3,641 for birth center births, $3,691 for the mixed provider group, $3,748 for the all planned out-of-hospital group, and $5,792 for the "hospital other" group.

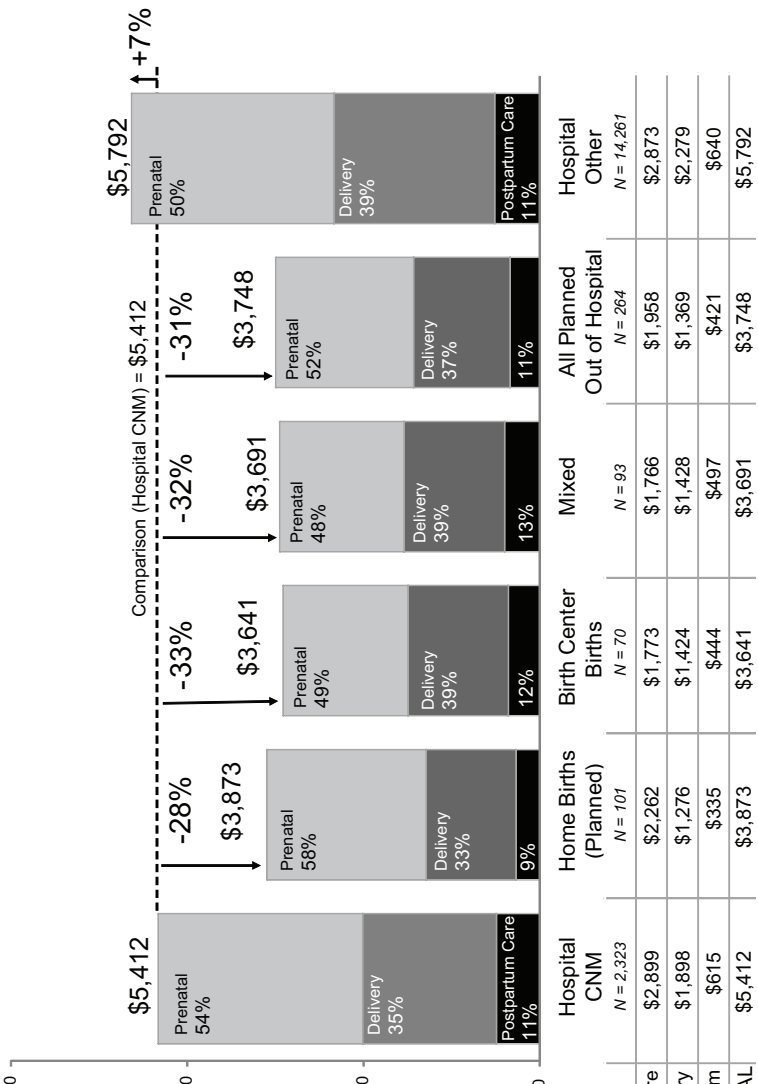
When they removed the low-risk constraint and examined all births, there was a slight shift in the pattern although, overall, not a great increase in Medicaid expenditures (see Figure 7-4). For the hospital CNM cases, average expenditure increased from $5,412 to $6,039. For the "hospital other" group, average expenditure increased from $5,792 to $6,309. For the birth center births group, savings (compared to the hospital CNM group) are exactly the same: a 33 percent in overall expenditures. For the planned home birth group, savings are not as great. Cawthon said that she was unsure as to why.

Cesarean delivery rates for the intent-to-treat groups show a dramatic reduction among the out-of-hospital groups compared to the "hospital all" group, for which the rate was 27.9 percent. The Cesarean delivery rate for home births was 9.4 percent; for birthing center births, 11.4 percent; for mixed providers, 12.2 percent; for all out-of-hospital births, 11.6 percent; for hospital CNM, 20.2 percent; and for hospital births with no CNM prenatal care, 29.4 percent. Cawthon remarked on the noteworthiness of the reduction in Cesarean delivery rates among hospital births to women who received prenatal care from a CNM compared to women who did not receive CNM prenatal care. In Cawthon's opinion, the benefits of lower Cesarean delivery rates are not limited to reduced direct and immediate costs.



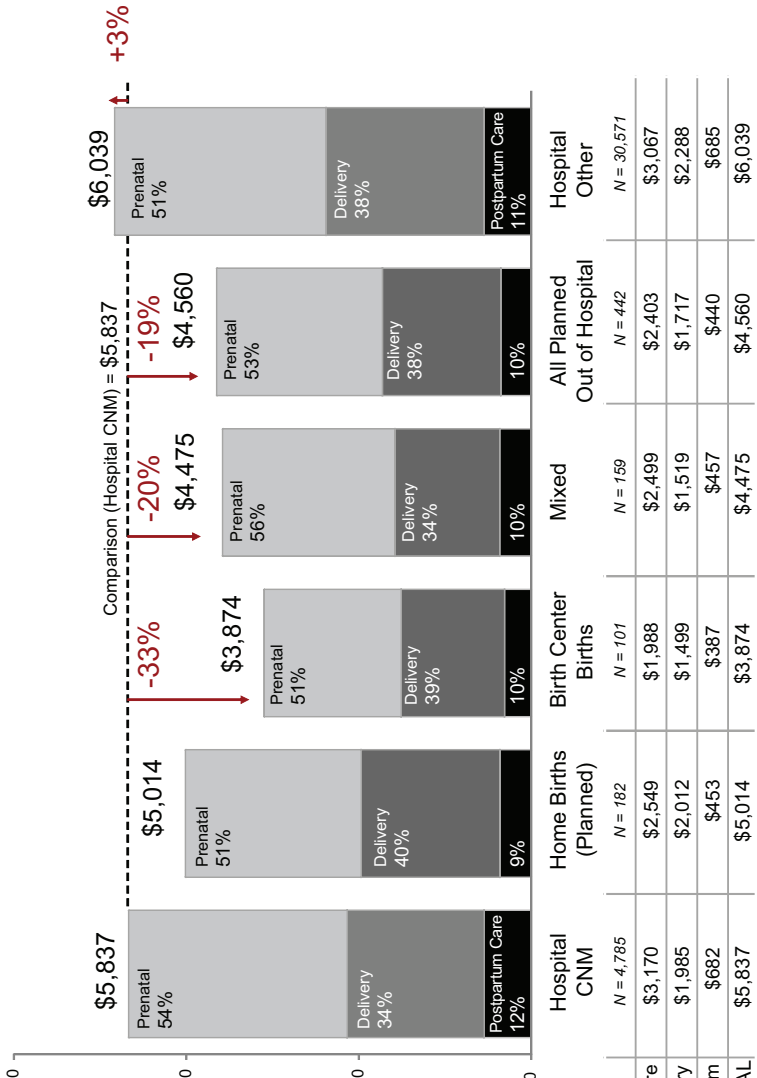

| | Hospital Vaginal | Home Births (Planned) | Birth Center Births | All Planned Out of Hospital | Hospital C-Section |
|---|---|---|---|---|---|
| | *N = 26,061* | *N = 162* | *N = 112* | *N = 274* | *N = 10,343* |
| Prenatal Care | $3,036 | $1,836 | $1,645 | $1,758 | $3,424 |
| Delivery | $2,077 | $1,335 | $1,392 | $1,358 | $2,835 |
| Postpartum | $653 | $363 | $420 | $386 | $787 |
| TOTAL | $5,767 | $3,533 | $3,457 | $3,502 | $7,046 |

**FIGURE 7-2** Average Medicaid expenditures for achieved birth place type in Washington State, 2010-2012, with all births included.
SOURCE: Cawthon, 2013.




| | Hospital CNM N = 2,323 | Home Births (Planned) N = 101 | Birth Center Births N = 70 | Mixed N = 93 | All Planned Out of Hospital N = 264 | Hospital Other N = 14,261 |
|---|---|---|---|---|---|---|
| Prenatal Care | $2,899 | $2,262 | $1,773 | $1,766 | $1,958 | $2,873 |
| Delivery | $1,898 | $1,276 | $1,424 | $1,428 | $1,369 | $2,279 |
| Postpartum | $615 | $335 | $444 | $497 | $421 | $640 |
| TOTAL | $5,412 | $3,873 | $3,641 | $3,691 | $3,748 | $5,792 |

**FIGURE 7-3** Average Medicaid expenditures for intent-to-treat births in Washington State, 2010-2012, with only low-risk births included.
SOURCE: Cawthon, 2013.




| | Hospital CNM | Home Births (Planned) | Birth Center Births | Mixed | All Planned Out of Hospital | Hospital Other |
|---|---|---|---|---|---|---|
| | *N = 4,785* | *N = 182* | *N = 101* | *N = 159* | *N = 442* | *N = 30,571* |
| Prenatal Care | $3,170 | $2,549 | $1,988 | $2,499 | $2,403 | $3,067 |
| Delivery | $1,985 | $2,012 | $1,499 | $1,519 | $1,717 | $2,288 |
| Postpartum | $682 | $453 | $387 | $457 | $440 | $685 |
| TOTAL | $5,837 | $5,014 | $3,874 | $4,475 | $4,560 | $6,039 |

**FIGURE 7-4** Average Medicaid expenditures for intent-to-treat births in Washington State, 2010-2012, with all births included.
SOURCE: Cawthon, 2013.

### Limitations of Analyses

These analyses have several limitations. For example, the analysis did not reveal which aspects of delivery accounted for the lower Cesarean delivery rates or whether in some cases outcomes would have been better if Cesarean deliveries had been performed. There are several ways that the assessment of the costs of birth in varied settings can be improved. Cawthon encouraged other states with linked Medicaid claims and vital record data and with Medicaid reimbursement for out-of-hospital births to conduct similar analyses. By extending the analysis to other states, sample sizes and denominators would increase and some statistical power issues could be resolved. Also by extending the analysis to other states, it might be possible to study different models of care and reimbursement and describe other insurance issues.

Additionally, Cawthon encouraged more sophisticated types of analysis. For example, she and her colleagues did not adjust for risk factors other than by excluding high-risk women and by excluding a single outlier (based on infant medical care cost). The use of medical record review data or a detailed analysis of claims data could be used to identify the timing of the transfer of care and emergency transport expenses. Finally, to gain a broader perspective on cost of care, Cawthon suggested examining, in addition to expenditure data, costs of birth outcomes that are not recorded in immediate and direct Medicaid expenditures.

## COST, VALUE, AND REIMBURSEMENT ISSUES: THE MEDICAID PERSPECTIVE[3]

Kathleen Nolan was invited to share her thoughts on issues raised by William Shrank and Laurie Cawthon. She emphasized that Medicaid is a major payer for births in the United States, paying for approximately 40 percent of all births nationwide. Medicaid also pays for many poor birth outcomes. Nolan observed that it has been generally accepted that Medicaid cannot be sustained in the future without efforts at cost containment and greater care coordination. Thus, as Shrank described previously, there is a great deal of work being done at the state level on delivery system and payment reform. Notably, a number of multipayer initiatives are under way. While long-term care is the most costly set of services in Medicaid, it does not have "a lot of resonance" with private payers, according to Nolan. Perinatal care, on the other hand, is an area where multipayer initiatives, with Medicaid involvement, might be especially applicable. Nolan

[3]This section summarizes information presented by Kathleen Nolan, M.P.H., National Association of Medicaid Directors, Washington, DC.

also noted the large number of mothers in managed care, which has some potential pluses with respect to the role that Medicaid can play. For all of these reasons, Nolan said, "Medicaid is a great opportunity to move this agenda forward."

While Medicaid interest in perinatal care is "high," involving Medicaid also represents a challenge. First are data collection issues, which Nolan observed that many other workshop speakers had already addressed. Compounding the data collection challenges are the many health and environmental challenges to leveraging the Medicaid population. Many women enrolled in Medicaid are in poor health. Also, they are more likely to be poor and have fewer resources in their lives, not just in health care, and to live in unsafe neighborhoods where midwives might not want to travel. Additionally, it is not uncommon for Medicaid women who are pregnant to not show up for perinatal care until late in their pregnancy.

Another challenge is that pregnancy coverage may be shifting in the future. Currently, Nolan reported, states must cover pregnant women with incomes up to 133 percent of poverty. About 20 states cover pregnant women with incomes at or above 185 percent of poverty. Although the Affordable Care Act froze these eligibility levels from 2009 to the present, in 2014 states can either raise or lower (not below 133 percent of poverty) their eligibility income criteria. The future consequences of this are unclear. It might mean that women will be circling in and out of Medicaid, with what Nolan described as a "lot of churn" among pregnant women. Not only will there be a lot of churn, but it will vary from state to state.

Nolan emphasized state variation in Medicaid coverage and in other important features of health care oversight. It is not just eligibility levels that vary, but all of the other components of Medicaid. In addition to Medicaid state-level variation, health facilities oversight and regulation vary as well, likewise with professional regulation and community norms. Such substantial state-level variation makes establishing a national agenda for a perinatal care delivery system and payment reform very difficult.

In summary, Nolan reiterated three key challenges: (1) data collection challenges, (2) state variability, and (3) the shifting Medicaid landscape. In her opinion, the temptation is to say that Medicaid should cover home birth. But Medicaid covering home birth does not mean that "all of the other pieces will be there in place for that to move forward." Mandating coverage for home birth nationwide could be detrimental, as it could fail to recognize the different state environments and preparedness for this kind of shift. Nolan encouraged the sharing of best practices and moving forward collaboratively.

## DISCUSSION WITH THE AUDIENCE[4]

At the end of Panel 6, members of the audience were invited to comment on issues raised or ask questions of the panelists. Topics covered included the need to improve outcomes in hospital settings, the dominant role of physicians in the U.S. health care system, the challenge of decreasing costs in a for-profit system, the challenge of measuring actual cost of care, payment reform and perinatal care, "supervision" language used by Medicaid, and Medicaid reimbursement for midwives.

### Improving Outcomes in Hospital Settings

A member of the audience observed that the focus of the workshop discussion should be on improving the quality of all birth settings, not just home birth settings. Many steps could be taken now to improve outcomes in hospital settings, based on the evidence. Another audience member agreed and asked whether and how Medicaid payment incentives were being altered to encourage and maximize "normal physiologic birth" in hospitals. Kathleen Nolan replied that numerous initiatives are under way to accomplish that goal. She mentioned William Shrank's descriptions of the many Innovation Center initiatives aimed at increasing accountability and value-based purchasing. She reiterated her opinion that, rather than simply saying, "there needs to be more home birth," discussing ways to improve quality and improve value is the more salient conversation and would attract more interest from Medicaid. She cautioned, however, that Medicaid "can't always be the only lever." She suggested that multipayer initiatives present more opportunities for forward movement.

### Dominant Role of Physicians in the U.S. Health Care System

An audience member expressed concern about the dominant role of physicians within the U.S. health care system, whether it be in hospitals, health insurance companies, malpractice insurance companies, or elsewhere, and the way that the American Medical Association has nurtured that role by discouraging support of nonphysician providers. She encouraged those who are thinking about ways to help the system function better to think beyond the realm of "just physicians." Caitlin Cross-Barnet responded that the CMMI has been examining midlevel providers. For example, two of the Strong Start initiative models, the birth center model and the centering/group care model, focus on non-physician-based care. She cautioned, how-

[4]This section summarizes the discussion that took place at the conclusion of Panel 6, immediately following Nolan's presentation.

ever, that midwifery does not always save the system money. In some states, midwives are reimbursed at the same level as physicians. But if midwives are reimbursed at a lower rate, then it does save money.

### The Challenge of Decreasing Costs in a For-Profit System

A member of the audience asked how the "inherent conflict" of decreasing costs in a for-profit system can be resolved. Two panelists commented. Cross-Barnet commented on Medicare's success in delivering more economically efficient health care and providing results compared to other health care delivery models. She wondered why there is not a broader public embrace of the program, given its success. Kathleen Nolan mentioned that there have been some conversations on this very issue, specifically the value purchasing conversation that CMMI and others are having. The value purchasing conversation in Medicaid is similar to the one in Medicare, and focused on payment alignment and incentives for quality, rather than whether it is a for-profit or nonprofit model.

### The Challenge of Measuring Actual Cost of Care

A comment was made that measuring actual cost of care would yield a more accurate measure of care delivery than billable charges and Medicaid reimbursements. The commenter also challenged researchers to consider cost to the patient, not just cost to the government or to health care organizations. Nolan responded that measuring actual cost of care in hospitals is challenging but that growing interest in value purchasing has increased the desire to understand those costs. She noted that a couple of states have tried to take a closer look at actual cost of hospital care.

### Payment Reform and Perinatal Care

An audience member commented on the growing number of organizations considering the use of bundled payments. She asked the panelists to comment on the use of bundled payments in perinatal care. Cross-Barnet replied that some prenatal care is already being bundled, with a set fee for prenatal care plus birth delivery; but that it is unclear how the bundling is impacting quality of care. Nolan added that there is plentiful opportunity in perinatal care to share best practices and find the best approach and then incorporate that approach into ongoing initiatives in payment reform.

### "Supervision" Language Used by Medicaid

A member of the audience commented on the inability of a certain home birth services organization staffed by certified nurse-midwives to provide Medicaid care to their clients because of the "supervisory" language used in the Medicaid application. Specifically, the application required that a supervisory physician be present. She asked whether there is any federal-standard application that replaces "supervision" language with "collaboration" language. Nolan responded that there is no federal standard for use of "supervisory" language. Use of that language varies state by state, with respect to both practice laws and state Medicaid programs, and the two are not necessarily aligned (e.g., even though a state's licensure laws might not require supervision, its Medicaid program might).

### Medicaid Reimbursement for Midwives

A member of the audience clarified that there is a federal mandate that all state Medicaid programs reimburse nurse-midwives, regardless of where those births occur (at home, in a birth center, or in a hospital). Cross-Barnet added that Medicaid is mandated to pay for licensed midwifery care, that is, any midwife who is licensed in her or his state, but that other factors, like malpractice insurance, may restrict the care that licensed midwives are actually able to provide. To further clarify, Medicaid only reimburses midwives for care in certain settings, so while they do have to provide licensed midwives with reimbursement, they do not necessarily have to pay for home birth, though some states do.

# 8

# Perspective from Providers

At several times during the course of the workshop, presented evidence was interpreted differently by different types of providers. Panel 6 provided an opportunity for three care providers working in different settings to share their thoughts on research issues related to birth setting assessment and to help identify future research needs. The three speakers were a medical doctor (MD) from a hospital (Frank Chervenak), a certified nurse midwife (CNM) from a freestanding birth center (Karen Pelote), and a certified professional midwife (CPM) who attends home births in private practice (Brynne Potter). This chapter summarizes their presentations and the brief discussion that followed. As is true throughout this workshop summary, the perspectives summarized here reflect the perspectives of the individual presenters, not the perspectives of the planning committee, the Institute of Medicine or the National Research Council, or any other group. The panel was moderated by Ellen Hodnett, R.N., Ph.D., University of Toronto, Ontario, Canada. Box 8-1 summarizes key points made by individual speakers.

**BOX 8-1**
**Perspective from Providers**
**Key Points Made by Individual Speakers**

- Frank Chervenak discussed results of an unpublished analysis he and colleagues performed on U.S. Centers for Disease Control and Prevention data suggesting that depressed 5-minute Apgar scores, stillbirths, and neonatal seizures occur at greater rates in home settings than in hospital settings. He suggested that hospitals should do what is necessary to ensure safety and to consider creating alternative environments.
- Karen Pelote described typical experiences of women who choose to deliver in birth centers. She discussed safety and transfer results from the 2013 American Association of Birth Centers (AABC) Uniform Data Set (UDS) outcomes study (Stapleton et al., 2013) and called for more research on the psychosocial, cost, and other benefits of birth center care.
- Brynne Potter noted the significant disagreement among experts around some of the outcomes reported in published literature. She discussed the safety of home birth from an absolute risk perspective and identified several areas of research that would help to make home birth as safe as possible: access to qualified care providers with appropriate equipment, appropriate risk assessment, communication and collaboration, integrated transfer of data, quality improvement measures, and access to licensure and reimbursement.

## NEONATAL OUTCOMES IN RELATION TO BIRTH LOCATION: ETHICAL IMPLICATIONS FOR CLINICAL PRACTICE AND RESEARCH[1]

After encouraging workshop participants to read two papers that he and his colleagues wrote (Chervenak et al., 2011, 2013a), Frank Chervenak highlighted two key points from earlier workshop presentations: (1) The public is insufficiently educated in the importance of maintaining vital data. (2) Centers for Disease Control and Prevention (CDC) birth certificate data are important when considering U.S. births. He remarked, "I think the best database we have today is CDC data."

Chervenak discussed results from an analysis based on 2007-2010 CDC data (Chervenak et al., 2013b [unpublished data]). The analysis was designed to address two questions: (1) Are there differences between hospital and home births, using Apgar scores and seizures as prognostic

[1]This section summarizes information presented by Frank Chervenak, M.D., Weill Cornell Medical College, New York, New York.

data for future outcome? (2) If there are differences between hospital and home births, are they due to location or attendants? What are their ethical implications for clinical practice and research?

Only term births greater than 2,500 grams were included in the analysis, bringing the size of the CDC database down (i.e., the database covering all U.S. births from 2007 to 2010) from more than 16 million births to about 14 million births. This included more than 100,000 home births, 67,000 of which were home births delivered by midwives.

All home births showed a threefold increase in depressed 5-minute Apgar scores (i.e., scores of 0 to 6), compared to hospital births. Midwife-attended home births, which Chervenak and colleagues considered an acceptable measure of intended home births, showed a twofold increase in depressed 5-minute Apgar scores, compared to hospital births. Five-minute Apgar scores of 4 to 6 and 0 to 3 showed the same twofold increase among midwife-attended home births, compared to hospital births. Five-minute Apgar scores of 0 (i.e., stillbirths) showed an 18-fold increase among midwife-attended home births, compared to hospital births. Depressed 5-minute Apgar scores for midwife-attended home births were different for CNM-attended births and other midwife-attended births, but both groups had more depressed scores than hospital births. Chervenak interpreted these results as evidence that location, not attendant, determines outcome.

Data for neonatal seizures showed even more dramatic differences, with a fivefold increase among midwife-attended home births compared to hospital births. Among all midwife-attended births, only 6 percent occurred at home, but 25 percent of neonatal seizures that occurred with midwife-attended births occurred at home.

In sum, Chervenak said that, regardless of which of the three outcomes one examines, all were significantly increased among midwife-attended home births compared to hospital births: a twofold increase for depressed 5-minute Apgar scores, an 18-fold increase for stillbirths, and a fivefold increase for neonatal seizures.

Ideally, Chervenak said, he and his colleagues would also include in their analysis long-term follow-up data. But even gathering these short-term outcome data was a "Herculean task," he said. While they may not be as valuable as long-term follow-up outcomes, depressed 5-minute Apgar scores are still a very valuable outcome, in Chervenak's opinion. Depressed 5-minute Apgar scores have been associated with neurological disability, death, cerebral palsy, respiratory distress, hypoxic ischemic encephalopathy, and childhood cancer. Likewise with neonatal seizures, which have been associated with cerebral palsy, hypoxic ischemic encephalopathy, neurologic sequelae, and neurodevelopmental sequelae.

Based on the same CDC database, Chervenak observed that about half of hospital births had at least one risk factor and about 15 percent

of home births had a least one risk factor. The risk factors included prior preterm birth, tobacco use, diabetes, prior poor outcome, hypertension, prior Cesarean, breech presentation, or less than 11 pound weight gain. In his opinion, 15 percent is too high.

One observation that raised questions for Chervenak was that *average* 5-minute Apgar scores were higher for midwife-attended births compared to hospital births. He asked, "How could this be happening, given the lower Apgar scores that I just reported?" He explained that the greater number of Apgar scores of 10 for home births accounted for the greater average Apgar scores, even though the rate of depressed Apgar scores at 5 minutes was higher for home births. In the hospital, regardless of whether the attendant was a midwife or physician, about 3.7 percent of Apgar scores were reported as scores of 10. At home, 40 percent of CNMs and 57 percent of other midwives reported Apgar scores of 10. Chervenak suggested that this difference be studied. He said, "Either something very good is happening, or people are not assigning Apgar scores correctly."

Chervenak indicated, in his view, one of the themes of this workshop was the need to encourage collaboration and trust. For him, the underpinning of trust is respect, and the underpinning of respect is truth. He encouraged the correct assignment of Apgar scores.

Chervenak emphasized that the observed differences between midwife-attended home births and hospital births were due to location, not attendant. He said, "An obstetrician or physician can deliver an infant no better than a midwife, maybe worse. It is due to the location. Hospital births prevent these outcomes." Based on this evidence, Chervenak asserted, "Physicians and other health care professionals should discourage home birth." He encouraged hospitals to do what is necessary to ensure safety (e.g., see Grünebaum et al., 2011) and to consider creating alternative birthing environments.

## RESEARCH ISSUES PERTAINING TO BIRTH CENTERS: A PROVIDER'S PERSPECTIVE[2]

Karen Pelote began by disclosing that she is the mother of six children, two of whom were born in a hospital under obstetric care, two in a birth center, and the last two (twins) in a hospital under osteopathy care. She attended the workshop to give her perspective as a provider at a birth center. Pelote noted that there are 248 birth centers that are licensed across 41 states. She indicated that the majority of birth center primary providers are CNMs, with the remaining providers consisting of a combination of

[2]This section summarizes information presented by Karen Pelote, M.S.N., CNM, Community of Hope, Family Health and Birth Center, Washington, DC.

different groupings of licensed midwives, CPMs, and CNMs. Pelote currently practices at the Community of Hope Family Health and Birth Center (FHBC), the only freestanding birth center in Washington, DC.

Midwifery means "with women." Midwives involved in modern health care research are always aware that there are real people and real families behind all the numbers and statistics. In that spirit, Pelote shared two stories that reflect clients' experiences at FHBC. Each story was made up of the experiences of several of their patients. The first story was about a 17-year-old woman named "Sally" who visited the birth center with her grandmother. Sally was very nervous. She did not speak much nor did she share much information. But she did agree to attend group prenatal care. Over time, as the group progressed, she began to open up. The second story was about "Jane," a 34-year-old pregnant woman who transferred care to the birth center after she realized that her obstetrician did not appreciate what she was trying to achieve in her birth plan. She too agreed to attend the biweekly prenatal group care.

Group is an integral part of prenatal care at FHBC, according to Pelote. The groups are dynamic and diverse, with clients and their partners representing a variety of socioeconomic statuses. The emphasis is on education (prenatal, intrapartum, and postpartum), including care of the newborn and the benefits of breastfeeding. The two women, though very different, participated in the same group, where they shared their experiences and answered each other's questions.

When Sally came in for labor, she delivered normally and had an uncomplicated birth at the birth center. She went home 4 hours after delivery and received a home visit the next day. Jane came in for labor about a week later. She too had a natural labor and birth, went home soon afterward, and received a home visit the next day. The two women, although very culturally different, had similar outcomes.

Both Sally and Jane, like 99 percent of the women who deliver at FHBC, chose to breastfeed. Pelote noted that the FHBC rate for breastfeeding initiation is 84 percent, compared to the U.S. rate of 54 percent. The FHBC rate for exclusive breastfeeding at 6 months is nearly three times that of the U.S. rate.

When Jane first told her family that she would be transferring to a birth center from her obstetrician, her family was very concerned. She shared with them some safety statistics to alleviate their skepticism. Specifically, the 2013 American Association of Birth Centers (AABC) Uniform Data Set (UDS) outcomes study results showed that 84 percent of women who start care at a birth center deliver at the birth center, with 93 percent having vaginal deliveries regardless of the actual birth setting (Stapleton et al., 2013). The neonatal mortality rate is low, and there were no incidences of maternal mortality.

In Pelote's opinion, birth centers provide a unique opportunity to change people's lives—not just their present lives, but their future lives as well. Both Sally and Jane developed a new sense of confidence from having had a birth center birth. Sally realized that she was more capable than she could be. She said, "I made this baby, I delivered this baby, and now I am feeding this baby all by myself." She brought her baby in for regular check-ups and felt comfortable calling her provider with issues or concerns instead of going to the emergency department. Jane expressed that the care she received at the birth center was personalized and that it felt like a family. She said, "Instead of feeling like my pregnancy was a medical condition, I feel like it was an awesome, natural event." Jane's family was impressed that she was back home in 4 hours after delivery, since both of her parents had expected her to end up with a Cesarean delivery. Pelote said that, as midwives, she and her colleagues feel like these statements reflecting how women feel about the birth center are fact. In actuality, there are no studies on the psychosocial benefits of birth center births.

With respect to cost, the decision to deliver at FHBC saved each woman about $8,000. Currently, only about 1.9 percent of pregnant women in the United States deliver at birth centers. Changing that number to just 10 percent would save approximately $2.6 billion annually, according to Pelote's estimate. Not only do birth center deliveries save money, but they also educate women to care for their bodies in the long term.

Sally, because of her African American race, had an increased chance of having a Cesarean delivery, a low-birth-weight baby, and no breastfeeding. Also, the maternal death rate among African American pregnant women is more than 10 times what it should be. Sally represents a very small percentage of African Americans who choose birth center deliveries. At the FHBC, 32 percent of births are to African American women. But only 5 percent of women who participated in the 2013 AABC UDS study were African American (Stapleton et al., 2013). The low participation rate raises questions about why African American women do not choose birth centers, even though birth centers are easily accessible and have excellent outcomes. Pelote believes that a greater understanding of the barriers to care for African American women and why they do not choose birth centers would help to improve outcomes for African American women.

The 2013 AABC UDS study showed a 12 percent referral rate to hospitals among women admitted to birth centers for labor and fewer than 1 percent of the women required emergency transfer during labor (Stapleton et al., 2013). Pelote relayed a story about a recent experience with a patient at FHBC who was committed to a birth center birth and was doing beautifully up until she reached nine and a half centimeters and her water broke. Pelote said that the woman had the "thickest, darkest meconium" that Pelote had ever seen. She and her colleagues discussed the situation

and decided to transfer the woman to a hospital. It was not an emergency situation. It was a decision. Above all else, the woman's contractions slowed to almost nothing during the transport. The woman labored beautifully. She had a spontaneous birth with no complications and was able to go home the next day with her 9-pound baby. The woman later wrote a letter to Pelote: "Because of all we have learned from our laboring and breastfeeding classes at the birth center, we felt prepared for labor and the first weeks at home with a new baby. We could not have asked for a better birth experience. We really value the people and the services of the Family Health and Birth Center." Pelote said, "That is how transfers should be." The hospital standard may be receptive of transfers, but based on her experience, that is not always the case. In cases where it is not, patients suffer.

Pelote identified five topics in birth center care worthy of future investigation:

1. Clinical issues. Pelote suggested that more clinical research is needed to reduce transfer rates. She identified premature rupture of membranes, prolonged labor, and obesity as specific research areas worthy of funding.
2. The benefits of group prenatal care.
3. The psychological benefits of birth center care.
4. Cost and reimbursement issues.
5. Disparity.

In conclusion, Pelote asserted that every woman, regardless of socioeconomic, racial, or educational background, should have the opportunity to be informed about the benefits of birth centers and should be able to make the best decision for her health and the health of the baby. Birth centers have been shown to be safe, effective, and economical. Pelote expects that future research will also demonstrate their psychological benefits. She ended, "Birth centers cannot remain the best kept secret in health care today."

## PROVIDER PERSPECTIVES: MIDWIVES AND HOME BIRTH[3]

Brynne Potter reflected on what she observed had already been "handled very well and respectfully in this setting [for the most part]": that home birth providers are marginalized and not integrated into the system. She acknowledged that integrating home birth providers into the system will be disruptive; whether that is a "good" or "bad" thing depends on

[3]This section summarizes information presented by Brynne Potter, CPM, Private Practice, Charlottesville, Virginia.

one's perspective. She considered home birth in the United States a racial issue, with disparity in access and choice about where to give birth, and a political issue, with significant disagreement and mistrust among experts around some of the outcomes reported in published research. The media is also impacted when a professional association takes a position based on a controversial study and, for example, the *New York Times* draws conclusions about causal relationships extrapolated from but not demonstrated (e.g., as happened when the *New York Times* reported on the Wax et al. [2010] association between low intervention and higher neonatal deaths). Feeding into the politics of home birth is state variation in CPM legislation. CPMs legally practice in 27 states. In almost all the other states, licensure legislation is being either introduced or planned or licensure or advocacy being organized.

Women choose home births for a range of reasons (Blix, 2011; Boucher et al., 2009; Hendrix et al., 2010; Hildingsson et al., 2003, 2010; Jackson et al., 2012; Lindgren and Erlandsson, 2010; Symon et al., 2010). The overriding theme, according to Potter, is safety, control, and comfort. She quoted some clients' reasons for choosing home birth: "Comfortable setting—we can make decisions without pressure from staff." "I want to feel safe and comfortable. I have confidence in myself to have a natural birth. I like the one-on-one attention I will receive using a midwife." "I think that I will be able to relax in a home setting and not feel pressured by time constraints." In Potter's opinion, these sentiments are consistent with research results.

Potter mentioned the Olsen and Clausen (2012) Cochrane review and the questions its conclusions raise about autonomy. Potter questioned how high does absolute risk need to be to limit women's choices for birth setting? Currently, women's choices are limited based on an assumption around relative risk.

Potter remarked that once established that home birth is safe from an absolute risk perspective, the next question is: how can it be made safer? Potter identified several areas of research on home birth safety that will help to make home birth as safe as possible: access to qualified care providers with appropriate equipment, appropriate risk assessment, communication and collaboration, integrated transfer of data, quality improvement measures, and access to licensure and reimbursement.

With respect to research on risk assessment, Potter suggested that the question be reframed as "Is it safe?" rather than "How risky is it?" Questions about risk assume that risk can be reduced to zero. Questions about safety are based on level of acceptable risk, which varies (e.g., acceptable risk for a patient may be different than acceptable risk for a provider). Potter also emphasized the importance of considering the risks associated with other locations when access to one location is limited because of risk.

For example, with respect to women with limited access to hospital vaginal births after Cesarean deliveries, Potter said that she would "love, as a home birth provider, to not have those women coming to me, to ask me for that option, because they have nowhere else to go."

Potter emphasized the importance of mutual respect during transports. Her practice in Charlottesville, Virginia, does not have a collaborative relationship with the University of Virginia, but they do share an accepted understanding that women are going to choose home births. With transports, physicians greet women with an understanding that a hospital delivery was not the intention and an acknowledgment of the expertise of the midwives. Engaging midwives in the process improves quality of care and patient satisfaction. Also important during intrapartum transport is data integration (i.e., home birth, birth center, and hospital data) and the ability to access the right data in a timely manner.

The ethics of maternity care, including issues around birth setting choice, shared decision making, and patient autonomy, are complex (Plante, 2009). Especially in light of the Affordable Care Act, preference-sensitive care and its application to maternity care will be a critical issue to address while moving forward.

Potter urged more focus on race disparity and encouraged greater consideration of community-based health workers and their role in maternity care. For example, Kozhimannil et al. (2013) reported lower Cesarean delivery rates among doula-supported births, compared to national rates for Medicaid patients. She also urged more focus on rural care and improving the safety of maternity care for rural women (Grzybowski et al., 2007; Klein et al., 2009; Kornelsen and Grzybowski, 2005; Kornelsen et al., 2011).

Potter concluded with a discussion of the concept of "home birth–like." For her, home birth–like means woman-centered, family friendly (engaging whoever the woman identifies as family), and community based. It is a feeling that is hard to replicate. Putting gingham curtains on the wall does not necessarily make a room feel home-like. Additionally, the entire course of pregnancy needs to be engaged, with recognition that pregnancy and birth are unified and that making the birth setting home-like requires accommodating social, emotional, physical, cultural, and spiritual needs. Most importantly, a home birth–like environment is resolute for undisturbed, physiologic birth. There is a range of factors that can disturb physiologic birth, all of which need to be addressed in order to make a hospital setting more home-like (ACNM et al., 2012). Potter encouraged more research on the impact of these disruptive factors on epigenetics and the mother-baby dyad.

Potter closed with a photo that she feels has clinical significance. She shared the photo because she felt many hospital providers are unaware of

what home births are like. The photo depicts a woman who just delivered a physiologic birth. She is upright, with no provider nearby, holding her baby. She spent the last 30 minutes of the second stage of labor in a position that she found most comfortable; she was on her knees, bent over a mattress, making sounds, moving her body. After she pushed the baby out, in about three good pushes, she picked the baby up and brought him to her chest. All Potter could do was step back and witness what was an undisturbed physiologic birth.

## DISCUSSION WITH THE AUDIENCE[4]

After Potter's presentation, there was a brief discussion between the panelists and audience on the following topics: the risk of labor and the need for standardization in out-of-hospital settings; the need for hospitals to be more supportive of undisturbed physiologic childbirth; the need for a paradigm shift to evidence-based care; questions about data presented by Frank Chervenak; and ways to make home births safer.

### The Risk of Labor and the Need for Standardization in Out-of-Hospital Settings

Even at the lowest possible level of risk, for example, some of the low-risk deliveries reported in the United Kingdom, labor is, Nigel Paneth said, "one of the most dangerous things that we encounter as human beings." He called for recognition of this reality—there are risks with labor that need to be addressed. In his opinion, slightly higher levels of low Apgar scores or the occasional extra seizure in out-of-hospital births might be acceptable as a trade-off for benefits. At the same time, advocates of out-of-hospital births are obligated to define their "universe" and apply standards of quality improvement (e.g., accreditation) such that their universe becomes "normative" in society. Just as medicine controls itself through its policies and standards, the out-of-hospital delivery movement needs to control the quality of planned home deliveries, in his opinion.

### The Need for Hospitals to Be More Supportive of Undisturbed Physiologic Childbirth

A member of the audience asked the panelists what can be done to help hospitals become more supportive of undisturbed physiologic childbirth. She speculated that the increase in home births and out-of-hospital births

[4]This section summarizes some discussion that took place at the end of Panel 7, immediately following Potter's presentation.

more generally is partly a backlash to what is happening in hospitals today. Specifically, she asked, what can be done to support in-hospital birth centers or measures that will increase opportunities for in-hospital normal physiologic births? Frank Chervenak agreed that much of the out-of-hospital delivery movement is the result of failure of the obstetric profession to provide compassionate care. He mentioned the in-hospital birthing center at Roosevelt Hospital in New York City as an example of a setting that serves as an opportunity for in-hospital physiologic births. Debra Bingham explained that the Roosevelt Hospital birthing center provides evidence-based care. She suggested a paradigm shift; that is, regardless of where a woman chooses to have a baby, the standard of care should be evidence-based care. Additionally, in her opinion, providers are not always aware of their biases, with politics often overlaying whatever system has been set up in a particular location. At the Roosevelt Hospital, midwives are recognized as equal partners in the system.

Brynne Potter added that not only are women who have undisturbed physiologic births unencumbered, but so too are home birth providers. She suggested examining and trying to remove liabilities and other "encumbrances" that make it difficult for hospital physicians to provide home birth–like care.

### Questions About Data Presented by Frank Chervenak

Marian MacDorman pointed out that the neonatal seizure variable that Chervenak presented encompasses more than neonatal seizures. It also includes other neurological disorders. "So it is more than just seizures," she said. Moreover, it is one of the items on the U.S. birth certificate that is considered to be very poorly reported. With respect to the 5-minute Apgar scores reported by Chervenak, MacDorman wondered how well lower Apgar scores were reported, given the poor reporting of higher Apgar scores. MacDorman mentioned her own unpublished 2009 data, which linked birth and death certificate data on infant mortality by place of birth and provider. Cautioning that the data are not risk-adjusted and that they reflect absolute risks only, she reported a birthing center infant mortality rate of 2 per 1,000 and a midwife-delivered home birth infant mortality rate of 3 per 1,000. These numbers are "very low," in MacDorman's opinion. She suggested that the risks associated with home births may not be "as dire" as reflected in Chervenak's presentation.

### Making Home Births Safer

MacDorman asked the question, "Even if it is a little more risky for home births, what do you do about that?" Rather than preventing home

births, why not make them safer? She suggested licensing midwives, standardizing training, providing support, and integrating home health care into the health care system such that the same measures of quality are used in both home and hospital settings.

# 9

# Workshop Reflections: Moving the Research Agenda Forward

To conclude the workshop, Catherine Spong and Zsakeba Henderson were invited to reflect on the evidence presented and highlight topics or methodology issues to consider for future research. This chapter summarizes their reflections. As a reminder, the intention of the workshop was not to reach consensus or make recommendations. The suggestions summarized here reflect only the personal observations and thoughts of two individual participants. Box 9-1 summarizes key points made by the two speakers. Also included in this chapter is a summary of closing remarks by Maxine Hayes and Ruth Lubic.

## CONSIDERATIONS WHEN EVALUATING STUDIES ON BIRTH SETTINGS[1]

Catherine Spong offered some suggestions to help interpret the literature that was presented over the course of the 1.5-day workshop, particularly with respect to information presented on health outcomes (as summarized in Chapter 4), and to help plan a future birth settings research agenda. She noted that some of the issues she identified were issues in 1982 as well (IOM and NRC, 1982).

[1]This section summarizes information presented by Catherine Spong, M.D., National Institute of Child Health and Human Development, Rockville, Maryland.

**BOX 9-1**
**Workshop Reflections: Moving the Research Agenda Forward**
**Key Points Made by Individual Speakers**

- Catherine Spong identified several factors to keep in mind when evaluating the evidence presented at this workshop, especially the evidence on outcomes among different birth settings. These factors include: how outcomes are driven by the institutional norms and policies of a birth setting, regardless of type of birth setting; caregiver staffing and roles; types of patients studied; selection bias; and outcomes measured (e.g., is a 5-minute Apgar score enough?).
- Spong emphasized the need for more research on long-term outcomes, on women at increased risk, and on neural-immune connections in obstetric populations.
- Spong also stressed the importance of recognizing the limitations of available data and the limitations of generalizing research findings.
- Zsabeka Henderson noted there are many knowledge gaps still remaining, even though several additional birth setting data sources have become available since the 1982 Institute of Medicine (IOM) and National Research Council (NRC) report. In particular, birth certificate data do not capture planned home births transferred to hospitals or intended place of birth for either hospital or birth center births; very large datasets are needed to detect differences in perinatal mortality; and there is no uniform data platform to adequately compare birth settings.
- Henderson identified several key research needs discussed by workshop participants that could serve as a starting point for a future research agenda. These research needs range from evaluation of outcomes across birth settings to research on access to care in various birth settings.
- So that research can inform policy and practice, Henderson also identified several nonresearch gaps that need to be addressed. Most importantly, in Henderson's opinion, and the most important take-home message of the workshop for her, is the need to improve interprofessional education, communication, and interaction.

### Alternative Versus Conventional Settings

An important conclusion and major message for Spong from Ellen Hodnett's presentation on alternative hospital settings versus conventional hospital settings was that alternative settings impact, and in many cases reduce, interventions.

Spong identified several factors to keep in mind when evaluating the evidence that Hodnett presented and other similar evidence: how outcomes are driven by the institutional norms and policies of the birth setting, regardless of type of birth setting; caregiver staffing and roles, including what types of caregivers are present and the timing of their care (e.g., Are caregivers present for only 8 hours at a time, or did they stay for 24-36

hours?); and the types of patients studied (e.g., the type of patient interested in one setting might be different than the type of patient interested in another setting).

### UK Collaborative Group Studies

A key point for Spong from Jane Sandalls's presentation on the UK Collaborative Group Studies was that low-risk women have very rare adverse perinatal outcomes. Other important messages were that women in their first pregnancy have higher risks than women who have had a prior successful pregnancy and that interventions occur more often in hospital settings.

In Spong's opinion, factors to consider when evaluating the results from these and other similar studies include choice of birth setting, patient bias, and caregiver staffing and roles.

### Process of Care

Spong said that a major component from Carol Sakala's presentation on process of care was that the overall goal is fewer interventions.

Factors to consider when evaluating the evidence presented by Sakala and other similar evidence include institutional polices (e.g., the goal may be fewer interventions, but if there is a policy in place that all patients must receive a particular intervention, then all patients will receive it regardless of whether they need it), caregiver staffing and roles, selection bias, and outcomes measured (e.g., is a 5-minute Apgar score enough?).

### Effect of the Built Environment

A significant point for Spong from Esther Sternberg's presentation was that environment affects health, with both neuroendocrine and physiologic responses to what is happening in the environment impacting both mental and physical health.

An important factor to consider when evaluating the research presented by Sternberg and other similar research is that much of the data are from nonobstetrical populations. It is unclear how applicable the results are to obstetrical populations.

### Considerations

Spong identified several overarching factors to keep in mind when evaluating the evidence from these studies on birth settings and health outcomes, indeed when evaluating the evidence from any of the research described during the workshop or when planning future research:

- When evaluating any study, it is important to keep selection bias in mind. For example, women who plan home births typically have lower obstetrical risk and a later gestational age, desire fewer interventions, and prefer a specific care model.
- When interpreting cohort and historical studies, it is important to consider not just selection bias but also variation in outcomes measured and institutional policies.
- The availability of some obstetrical services is limited in some settings for certain types of conditions (e.g., vaginal birth after Cesarean deliveries), which can drive a woman's decision to have her birth in one setting versus another.
- It is difficult to conduct randomized controlled trials in birth setting research; thus, few such studies have been done.
- Different studies define "low risk" differently. Even slight differences in how "low risk" is defined can impact how results are interpreted. Likewise with "normal."
- Timing of delivery decision can impact how results are interpreted (e.g., whether it is decided in the first trimester versus the third trimester).
- Most studies report on short-term outcomes, for example Apgar scores, mortality, and hospital discharge. The field needs long-term outcomes. For example, how well does the child do in kindergarten? How well adjusted is the adolescent? How does birth setting impact the mother's reproductive and gynecologic health?
- Most studies involve women at low obstetric risk. The implications of those study results for women at increased risk are unknown. Yet, some women at increased risk might want to have a home birth. Because they have not been included in most studies, those decisions need to be made very carefully.
- Understanding neural-immune connections in obstetric populations will be critical to moving the field forward.

Overriding all of these factors to consider when evaluating studies on birth settings is the importance of taking into account the limitations of available data. It will also be important to recognize the limitations of generalizing research findings. For example, again, it is unclear whether and how findings from studies conducted with low-risk women can be generalized to higher-risk women. Spong concluded, "There are many unanswered questions . . . there is much work to be done."

## REFLECTIONS ON WORKSHOP AND FUTURE RESEARCH NEEDS[2]

*Learning without reflection is waste. Reflection without learning is dangerous.*

—Confucius

Zsakeba Henderson remarked that while many of the research plans made in 1982 remain incomplete (IOM and NRC, 1982), some progress has been made. The present time represents a unique opportunity to build on this progress and chart out a new research agenda. Her remarks were based on the presentations and discussions throughout the workshop.

### Childbirth Trends and Statistics: What Has Been Learned?

The landscape of births in the United States has changed significantly over the past 30 years, with the risk profile of women giving birth being very different now than it was then. Specifically, there have been substantial increases in births to women who are older (30 years and older); there are more births to women of Hispanic ethnicity; and more women are gaining more weight (greater than 40 pounds) during pregnancy.

Data also show that Cesarean deliveries in the United States, although they have risen significantly, nearly 60 percent from 1996 to 2009, have steadied in the past few years. There has even been a small decline, from 32.9 to 32.8 percent. Other successes include substantial decreases in low-birth-weight rate and the number and rate of triplet and higher-order multiple births.

Since 1900, the birthplace for most children born in the United States has shifted from the home to the hospital, with the rate of out-of-hospital births remaining fairly steady for decades until recently. The percentage of births outside the hospital increased rapidly from 2004 to 2010, mostly among non-Hispanic white women. Despite this recent rapid increase, the actual number of births outside the hospital is still very small, with only 1.2 percent of births in 2010. More out-of-hospital births occur among older, multiparous women with lower risk profiles. In 2010, 67 percent of out-of-hospital births were home births, and 28 percent were birthing center births. The majority of out-of-hospital births are planned (88 percent in 2010).

[2]This section summarizes information presented by Zsakeba Henderson, M.D., Centers for Disease Control and Prevention, Atlanta, Georgia.

### Childbirth Trends and Statistics: Knowledge Gaps

Although more is known about where women are giving birth, Henderson observed that we still do not really have a good sense of national trends for intended place of delivery. Many states do not report the planning status of home birth, with only 31 states and the District of Columbia doing so, amounting to about 60 percent of U.S. births; and different states are at varying stages of implementing the revised birth certificate (although, by 2014, all states should be implementing it).

Nor do we have a good sense of trends in transfers from alternative settings to hospitals. It is not always possible to determine transfers from the birth certificate, as such reporting is not required in all states. One state, Oregon, was mentioned during the workshop as having added transfers from home to a hospital setting on their birth certificate. Henderson expressed hope that more states would do the same, given the likelihood that the U.S. Standard Certificate of Live Birth will not be revised again in the near future.

Yet another gap in our knowledge about childbirth trends and statistics stems from limiting reporting of birth attendants. Part of the problem is that those data are not being captured; another part of the problem is that states vary in terms of licensure and in terms of who is able to attend a birth.

### Assessment of Risk in Pregnancy: What Has Been Learned?

Risk assessment in pregnancy is a very complex task. There is no clear definition of "low risk," with different studies defining low risk in different ways. Moreover, risk is dynamic and subject to change. Additionally, risk to the mother must be balanced with risk to the fetus. More important than the actual risks, as presented during the workshop, is that risk perception varies between providers and patients, with providers and patients placing different values on different risks. Cultural views, women's views, and structural conditions can also affect risk perception.

These challenges aside, Henderson remarked that overall absolute risk of adverse events in all birth settings is low.

### Assessment of Risk in Pregnancy: Knowledge Gaps

Improved risk assessment in pregnancy will require uniform definitions of outcomes. Henderson noted there have been several efforts to develop these uniform definitions. Also needed are risk-assessment tools for maternal morbidity and mortality. Considerable attention has been focused on neonatal risk and levels of care, but not on maternal risk and levels of care.

Specifically, consistent "low-risk" criteria for maternal risk are needed, as are descriptors for maternal resources and levels of maternal care. Other gaps include incomplete knowledge about predictors of neonatal and maternal complications and incomplete knowledge about predictive triggers for elevation of care or transport.

More information is needed on the role of providers and the care system in contributing to risk. Henderson described her impression of the workshop participants when she first walked into the room: she knew who was a midwife and who was a physician, not based on appearance, but based on conversations. The dialogues were separate. She said, "There is a definite need for improvements in the interprofessional working relationships."

Finally, Henderson observed that workshop participants had repeatedly mentioned that one of the reasons women are choosing home births is their perception of the risks associated with interventions. More work needs to be done on patient perception of care and thresholds for intervention in high-level care facilities.

### Birth Settings and Health Outcomes: What Has Been Learned?

Alternative birth settings have been associated with less intervention, fewer complications, high transfer rates in some instances, and no differences in perinatal death rates. However, in one study, home, freestanding, and "alongside" midwifery units were associated with decreased obstetrical interventions, transfer rates of more than 20 percent, and increased neonatal risks for first pregnancies with home births (Brocklehurst et al., 2011). Another study, albeit controversial, also associated home births with increased neonatal mortality (Wax et al., 2010).

Researchers have also learned more about the process of care and that it does impact health outcomes, and that the built environment impacts neural-immune connections and health. Henderson noted that the last finding is true of any setting and encouraged more research on how environment affects patients and patient outcomes.

### Birth Settings and Health Outcomes: Knowledge Gaps

Although much has been learned over the past 30 years about birth settings and health outcomes, there is still a great deal left to learn. In Henderson's opinion, the field needs an evaluation of all birth settings, comparing women of equal risk across all settings. Henderson noted how workshop participants had highlighted the fact that there have been no randomized controlled trials of freestanding birth centers. And the one meta-analysis of home births relied on only one randomized controlled trial (Wax et al., 2010), with the remainder being observational studies. Henderson

remarked that although randomized controlled trials are considered the gold standard, it is difficult to randomize patients across all birth settings. Moreover, not all birth settings within the same category are the same. That is, not everyone's home is the same; nor are all birthing centers the same. A comparison of health outcomes across birth settings is "definitely a gap . . . that needs more attention," Henderson said.

Additionally, the field needs studies with consistent process and outcome measures. It is very difficult to compare studies when the methodologies and outcome measures are so different. Examples of research areas needing this kind of work include assessment of pain relief, effects of pain management on neonates, effects of successful breastfeeding, and physiologic and biochemical measures.

The field needs more studies on longer-term outcomes, that is, outcomes beyond the immediate neonatal period. Because of its implications for future health, also needed is more research on the developmental origins of health and disease. Lastly, the field needs more research on the optimal process of care.

### Workforce Issues: What Has Been Learned?

Recognizing that discussion of workforce research needs was limited by who was present at the workshop (i.e., midwives, nurses, physicians) and that there are other members of the team not represented, Henderson identified some of what has been learned over the past 30 years about the workforce. Researchers have learned that supply trends are variable by profession; that the number of births to attendants is shifting, with increasing numbers of midwife-attended births both in and out of hospital settings; that there is state variability in who is licensed to do what; and that certain staffing models, including competent nursing staff and collaborative teams of care, contribute to improved patient outcomes.

### Workforce Issues: Knowledge Gaps

Gaps in knowledge include the role of education and certification in quality of care; ideal staffing models to optimize care quality (i.e., composition of collaborative teams, provider ratios); impact of "missed nursing care" in out-of-hospital settings; how nurse staffing affects quality, safety, and cost of hospital-based care; and the impact of technology on workforce training needs and demand. With respect to ideal staffing models, Henderson noted that things are done very differently in the United Kingdom, where midwife-attended and doctor-attended births do not necessarily have labor and delivery nurses on their care teams.

### Data Systems and Measurement: What Has Been Learned?

Since the 1982 IOM and NRC report, several additional data sources have become available to inform outcomes of birth settings: the 2003 U.S. Standard Certificate of Live Birth, linked birth certificate datasets (i.e., with discharge and Medicaid data), registries (e.g., Midwives Alliance of North America Stats, American Association of Birth Centers Uniform Data Set), data from payers, data from state and regional perinatal quality collaboratives, and data from professional organizations.

Additionally, the Center for Medicare and Medicaid Innovation (CMMI) Strong Start Initiative represents another opportunity to gain more information on outcomes, in particular outcomes related to preterm birth and the cost of care.

### Data Systems and Measurement: Knowledge Gaps

While more types of data are available now than in 1982 (IOM and NRC, 1982), workshop participants identified several limitations to the data being collected: birth certificate data do not capture planned home births transferred to hospitals, intended place of birth is not captured on the birth certificate for either hospital or birth center births, very large numbers are needed to detect differences in perinatal mortality (i.e., there have been no randomized controlled trials of sufficient size), and there is no uniform data platform to adequately compare birth settings.

### Cost, Value, and Reimbursement Issues: What Has Been Learned?

Considerable emphasis was placed during the workshop discussion on Medicaid, and "rightly so," according to Henderson. Medicaid is the payer for 40 percent of U.S. births. CMMI is realigning incentives to reward providers for lower-cost, high-quality care. However, those incentives do not really help in situations where care is not covered by Medicaid—some states do not cover home births. State-to-state variability in coverage limits the ability to create a national agenda around this issue.

Some data were presented on the cost of care, with Washington State Medicaid expenditures for hospital-based Cesarean and vaginal deliveries being higher than for birth center and home births. More data are needed from other states and on a national level.

### Cost, Value, and Reimbursement Issues: Knowledge Gaps

Gaps in knowledge include the lack of data from Medicaid managed care organizations, incomplete cost-comparison data (i.e., such data

may not include all costs associated with each birth setting), and lack of national-level cost data (i.e., because of state variability in reimbursement and state variability in linkage of Medicaid claims to vital records data).

### Future Research Needs

Henderson identified several key research needs discussed by workshop participants that serve as a starting point for a future research agenda:

- Randomized controlled trials to evaluate outcomes in freestanding birth centers, outcomes in other birth settings (e.g., Snoezelen rooms, ambient rooms), and the impact of interventions in the hospital setting in terms of poor outcomes for patients. Henderson highlighted the need to consider all settings in these randomized controlled trials and not just focus on any one setting.
- An evaluation of organizational models of care across all settings.
- An examination of effective methods to transition care from out-of-hospital settings to the hospital.
- An examination of the impact of transfer on women and on care providers.
- A determination of predictors of neonatal and maternal complications.
- An evaluation of the potential unintended impact of intrapartum care processes.
- A cost assessment of birth settings.
- A cost-effective analysis of birth settings.
- Research on access to care in various birth settings (i.e., what is available to women in various communities throughout the United States?).
- An evaluation of continuity of caregiver.
- An evaluation of the experience of maternity care in various settings.
- Research on the effect of the environment on neural-endocrine-immune interactions and physiologic responses.

Henderson stated the purpose of research is to inform policy and practice, and in order to best inform policy and practice, there are other nonresearch gaps that need to be addressed as well. Workshop participants touched on several of these. Henderson emphasized the importance of maintaining and supporting the National Vital Statistics System. She reiterated what others had said about many providers not really understanding the importance of the data being collected on birth and death certificates (e.g., how those data are used). The quality of those data needs to be

improved, likewise with the quality of data on transfer to hospital care. Although transfer data are not something that can be immediately added to the National Standard Certificate of Live Birth, it is something that can be discussed and lobbied in preparation for future revisions.

Another important nonresearch, but research-related, area is the need for measurement and reporting of perinatal morbidity and mortality for all settings. It could take the form of either passive or active surveillance, or state-based review committees. Such a system is needed for all settings, not just the hospital setting. Additionally, there are needs for development of clear protocols for consultation and transfer of care; development of risk-assessment tools for maternal morbidity and mortality; and development of consistent policies for education, certification, and licensing of care providers. Related to the need for consistent policies around licensing is the need to address cost and reimbursement issues for care provided in out-of-hospital settings.

Most importantly, in Henderson's opinion, and the most important take-home message of the workshop for her, is the need to improve interprofessional education, communication, and interaction.

## CLOSING REMARKS

There were several comments over the course of the 1.5-day workshop related to the reality that substantial gaps in knowledge remain even after more than three decades of research following the IOM and NRC (1982) research recommendations. In her closing remarks, Maxine Hayes, M.D., M.P.H., Washington State Department of Health, Olympia, Washington, reflected that there is more incentive and motivation today than there was following publication of the 1982 IOM and NRC report to move the research agenda forward. Moreover, more information about birth settings is available now than was available 30 years ago.

Hayes invited Dr. Ruth Lubic, a certified nurse midwife with a storied career, to offer some additional closing remarks. Lubic encouraged redefining "perinatal" to include conception, or even preconception, through the third year of life. "We are talking about families," she said. "We are not talking about silos." She remarked that birth centers have in fact been trying to conduct randomized controlled trials, but it is difficult to randomize women among birth settings. Finally, she called for more funding to do these studies, noting that most out-of-hospital care providers do not have access to the same funds that support hospital care providers (e.g., university funds).

In Hayes' opinion, there are many ways that the information discussed at the workshop and summarized in this report can be used to move the research agenda, noting that the workshop does not provide recommenda-

tions but a statement of facts. It may be that an IOM committee is formed to examine in more detail a certain element, or that the Kellogg Foundation, the sponsor of this meeting, may want to fund a certain activity related to the information communicated here. Hayes urged states, in collaboration with federal agencies, to review their state-level policies, given the many components of obstetric care, even in hospitals, that could be improved. She also called for greater collaboration among the professions. More broadly, she stated that the unnecessary medicalization of birth has created fears about a natural process and that the whole culture of birth needs to be changed. Finally, she emphasized the importance of considering long-term outcomes and how what happens during the perinatal period impacts child health and learning.

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# A

# Workshop Agenda

**RESEARCH ISSUES IN THE ASSESSMENT OF BIRTH SETTINGS: A WORKSHOP**

**March 6-7, 2013**
**The National Academies Keck Center**
**500 Fifth Street, NW, Room 100**
**Washington, DC**

*DAY 1*

**9:00 a.m.** **Welcoming Remarks**
*Maxine Hayes, Washington State Department of Health*
*Workshop Moderator and Planning Committee Chair*

**9:05** **Perspectives from the Sponsor**
*Patrick S. Simpson, W.K. Kellogg Foundation*

**9:15** **Perspectives from the Maternal, Child, and Health Bureau**
*Isadora Hare, Division of Healthy Start and Perinatal Services*
*Maternal, Child, and Health Bureau*

**9:20** **Panel 1—Context and Background**
*Moderator: Sherin Devaskar, University of California, Los Angeles*

**Historical and Recent Trends in Childbirth in the United States**
*Brady Hamilton, Reproductive Branch, National Center for Health Statistics*

**Who Are the Women Giving Birth in Various Settings?**
*Marian MacDorman, Reproductive Branch, National Center for Health Statistics*

**Discussant**
*Nigel Paneth, Michigan State University*

**10:25** **Break**

**10:40** **Panel 2—Assessment of Risk in Pregnancy**
*Moderator: Benjamin Sachs, Tulane University*

**Identifying Low Risk Pregnancies**
*Kimberly D. Gregory, Cedars-Sinai*

**A Sociological Perspective on Risk Assessment in Pregnancy**
*Elizabeth Armstrong, Princeton University*

**Discussant**
*M. Kathryn Menard, University of North Carolina at Chapel Hill*

**11:45** **Panels 1 and 2 Discussion**

**12:15 p.m.** **Lunch**

**1:15** **Panel 3—Birth Settings and Health Outcomes: State of the Science**
*Moderator: Holly Powell Kennedy, Yale University*

**Cochrane Review: Alternative Versus Conventional Institutional Settings for Birth**
*Ellen Hodnett, University of Toronto*

**Birthplace in England Collaborative Group Studies**
*Jane Sandall, King's College, London*

**Process of Care During Childbirth**
*Carol Sakala, Childbirth Connection*

**Effect of Built Environment on Health Outcomes**
*Esther M. Sternberg, Arizona Center for Integrative Medicine*

**Discussant**
*Kristi L. Watterberg, University of New Mexico Hospital*

**2:55** **Break**

**3:10** **Panel Discussion**

**3:40** **Panel 4—Workforce Issues**
*Moderator: Thomas C. Ricketts, University of North Carolina at Chapel Hill*

**Education, Regulation, and Management of Health Care Professionals in Birth Settings**
*Catherine Dower, University of California, San Francisco*

**Staffing in Birth Settings**
*Debra Bingham, Association of Women's Health, Obstetric and Neonatal Nurses*

**Discussant**
*Susan R. Stapleton, Commission for the Accreditation of Birth Centers*

**4:40** **Panel Discussion**

**5:00** **Adjourn for the Day**
*Maxine Hayes*

*DAY 2*

**9:00 a.m.** **Welcome**
*Maxine Hayes*

**9:10** **Panel 5—Data Systems and Measurement**
*Moderator: Diane Rowley, University of North Carolina at Chapel Hill*

**Use of Data for Decision Making**
*William Barth, Massachusetts General Hospital*

**CMS Strong Start Study—Approach to Data Collection and Evaluation**
*Caitlin Cross-Barnet, Center for Medicare and Medicaid Innovation*

**Discussant**
*Elliot Main, California Maternity Quality Care Collaborative*

**10:10** **Panel Discussion**

**10:30** **Break**

**10:40** **Panel 6—Costs, Value, and Reimbursement Issues Associated with Various Birth Settings**
*Moderator: Jeannette Rogowski, University of Medicine and Dentistry of New Jersey*

**Reimbursement Issues and Payment Innovation**
*William Shrank, Center for Medicare and Medicaid Innovation*

**Assessing Costs of Births in Varied Settings—State Example**
*Laurie Cawthon, Washington State Department of Social and Health Services*

**Discussant**
*Kathleen Nolan, National Association of Medicaid Directors*

**11:40** **Panel Discussion**

**12:00 p.m.** **Lunch**

**1:00** **Panel 7: Discussion—Perspectives from Providers**
*Moderator: Ellen Hodnett, University of Toronto*

*Frank A. Chervenak, New York Weill Cornell Medical Center*
*Karen Pelote, Family Health and Birth Center*
*Brynne Potter, Private Practice Maternity*

**2:00** **Considerations When Evaluating Studies on Birth Settings**
*Catherine Spong, Pregnancy and Perinatology Branch National Institute of Child Health and Human Development*

**2:20** **Reflections on Workshop and Future Research Needs**
*Zsakeba Henderson, Division of Reproductive Health Centers for Disease Control and Prevention*

**2:40** **Conclusion and Adjourn**
*Maxine Hayes*

# B

# Moderator and Speaker Biographical Sketches

**Elizabeth M. Armstrong, Ph.D., M.P.A.,** is an Associate Professor in the Department of Sociology with joint affiliations in the Woodrow Wilson School and the Office of Population Research. Her research interests include public health, the history and sociology of medicine, risk in obstetrics, and medical ethics. She is currently conducting research on diseases and agenda-setting, and on fetal personhood and the evolution of obstetrical practice and ethics. She is the author or co-author of articles in *Health Affairs*, *Social Science and Medicine*, *Journal of Marriage and the Family*, *International Family Planning Perspectives*, and *Studies in Family Planning* and is the author of *Conceiving Risk, Bearing Responsibility: Fetal Alcohol Syndrome and the Diagnosis of Moral Disorder* (Johns Hopkins University Press, 2003). She was a Robert Wood Johnson Foundation (RWJF) Scholar in Health Policy Research at the University of Michigan from 1998 to 2000.

**William H. Barth, Jr., M.D.,** is Chief of the Division of Maternal-Fetal Medicine, Vincent Obstetrics and Gynecology Service at Massachusetts General Hospital and Associate Professor of Obstetrics, Gynecology, and Reproductive Biology at Harvard Medical School. He is a past Chair of the Committee on Obstetric Practice at the American College of Obstetricians and Gynecologists. Before retiring as a Colonel in the United States Air Force in 2005, he served as Department Chair at Wilford Hall Medical Center, as Chief Consultant to the Surgeon General for Maternal-Fetal Medicine, and as Commander of the 407th Expeditionary Medical Group in Iraq. He is an oral board examiner for the American Board of Obstetrics and Gynecology in both general obstetrics and gynecology and maternal-

fetal medicine. His clinical practice and interests are in the areas of preterm birth, cervical insufficiency, multiple gestations, and intrapartum obstetrics.

**Debra Bingham, Dr.P.H., R.N., LCCE,** is the Vice President of Research, Education, and Publications for the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN). Debra has more than 30 years' experience in Maternal Child Health Nursing, a master's degree in perinatal nursing from Columbia University, and a doctorate in Public Health from the University of North Carolina at Chapel Hill. Most of Dr. Bingham's career has been spent working in hospital leadership positions at the front lines of health care. She has held the positions of Director of Maternal Child Health Nursing for two union hospitals in New York City and Manager of a large referral Neonatal Intensive Care Unit in New York City, a stand-alone birthing center in a small community hospital, and a fetal evaluation unit. Dr. Bingham has expertise in Quality Improvement (QI) and implementation science. She has led numerous QI inter-disciplinary initiatives, co-developed measures of clinical quality that are endorsed by the National Quality Forum, and is an author of articles in peer reviewed journals and of implementation toolkits. Dr. Bingham was the first Executive Director of the California Maternal Quality Care Collaborative where she helped form the California Pregnancy-Associated Mortality Review (CA-PAMR) committee, provided committee administrative oversight, helped devise the review methodology, performed data analysis, and served on the CA-PAMR committee.

**Laurie Cawthon, M.D., M.P.H.,** is a Public Health Epidemiologist in the Division of Research and Data Analysis (RDA), Washington State Department of Social and Health Services. She conducts research and program evaluation studies about the health and welfare of women and children in Washington state, with a focus on those receiving publicly funded medical services. her specific areas of interest include maternity care and birth outcomes, health disparities, unintended pregnancy and family planning, early intervention, and chemical dependency during pregnancy. She has 20-plus years of experience in study design, data linkage, analysis, and operationalizing health measures with administrative data. She plays an active role on the Agency for Healthcare Research and Quality–funded Center of Excellence on Quality of Care Measures for Children with Complex Needs (PI: Mangione-Smith). Dr. Cawthon is committed to improving the quality of data used to evaluate health care services, and to improving medical care through multi-faceted quality improvement strategies. Prior to joining RDA, Dr. Cawthon worked in medical research in a variety of settings for more than 12 years. She received her M.D. and training in Public Health and Preventive Medicine from Oregon Health and Science University in

1982 and 1989, respectively. She completed her M.P.H. degree in Health Services Administration (Maternal and Child Health Data Analytic track) at the University of Washington in 1993.

**Frank A. Chervenak, M.D.,** currently serves as the Given Foundation Professor and Chairman of the Department of Obstetrics and Gynecology, as well as Obstetrician and Gynecologist-in-Chief and the Director of Maternal Fetal Medicine at the New York Presbyterian Hospital, Weill Medical College of Cornell University. Previous appointments include Associate Professor of Obstetrics and Gynecology and Director of Obstetric Ultrasound and Ethics at New York Hospital-Cornell Medical Center, Director of Maternal Fetal Medicine and Director of Obstetrics, Vice Chairman of the Department of Obstetrics and Gynecology, and Chairman and Obstetrician and Gynecologist-in-Chief. He received his B.S. degree from the Pennsylvania State University and his M.D. from Thomas Jefferson University. Dr. Chervenak served his internship in Internal Medicine at New York Medical College, residency in Obstetrics and Gynecology at New York Medical College in St. Luke's Roosevelt Hospital Center, and a fellowship in Maternal Fetal Medicine at Yale University School of Medicine. He was Assistant Professor of Obstetrics and Gynecology at Mt. Sinai Medical Center, where he was also Director of Perinatal Research and received the Dr. Solomon Silver Award for application of advances in research to the practice of Clinical Medicine. He received his Master in Medical Management degree from Carnegie Mellon University in 2002 and earned fellowship status from the American College of Physician Executives in 2008. Dr. Chervenak has published more than 260 papers in peer review literature and has co-authored or co-edited 28 textbooks. Research interests include ultrasound and ethics in obstetrics and gynecology and physician leadership. Currently, Dr. Chervenak serves as President of the International Society of the Fetus as a Patient, Vice-president of the International Academy of Perinatal Medicine, and Co-director of The Ian Donald Inter-University School of Medicine and Ultrasound. He serves on the March of Dimes Bioethics Committee and Prematurity Research Advisory Committee. He has been named a member of the Institute of Medicine (IOM) of the National Academies. Dr. Chervenak has been awarded honorary doctorates from universities around the world, as well as being an honorary member of many international societies. He has been admitted as a fellow ad eundem of the Royal College of Obstetricians and Gynecologists of Great Britain.

**Caitlin Cross-Barnet, Ph.D.,** is a Social Science Research Analyst at the Center for Medicare and Medicaid Innovation (CMMI) and an Associate at the Johns Hopkins Bloomberg School of Public Health. After a career as an English teacher, Dr. Cross-Barnet earned a Ph.D. in sociology from

Johns Hopkins University. Her research centers around poverty, social inequalities, and families, with a particular emphasis on mothers with young children. She conducted the qualitative evaluation of the Maryland WIC breastfeeding peer counseling program and currently serves on the board of the Maryland Breastfeeding Coalition. At CMMI, she conducts research on maternal-child health and coordinates the evaluation of the Strong Start for Mothers and Newborns initiative, which is an initiative to test models of care to prevent preterm birth in the high risk Medicaid population.

**Sherin U. Devaskar, M.D.,** is professor of pediatrics and executive chair of the Department of Pediatrics, David Geffen School of Medicine at the University of California, Los Angeles (UCLA). Dr. Devaskar's research focuses on the long-term outcome of premature and growth-restricted babies, the nutrition they receive while in the womb and soon after birth, and the propensity of these babies to develop adult-onset conditions, including obesity, diabetes, hypertension, and Alzheimer's disease. She is a member of the National Advisory Child Health and Human Development Council at the National Institutes of Health and was chair of the National Institute of Child Health and Human Development Maternal and Child Health Committee and member of the NIH-Human and Embryology Study Section. She also served as president of the Mid-West Society for Pediatric Research. Dr. Devaskar has a particular interest in academic development and serves on multiple UCLA, national, and international committees. She served as president of the American Pediatric Society and chair of the Program Committee for the Pediatric Academic Societies, and the American Pediatric Society Council. She was a member of the Perinatal-Neonatal Subsection of the American Board of Pediatrics. Dr. Devaskar served as the editor in chief of the *Pediatric Research* journal and is the editorial board member of the *American Journal of Physiology—Endocrinology and Metabolism*. She received an M.D. from the University of Madras Medical College.

**Catherine Dower, J.D.,** is an Associate Director at the University of California, San Franciso, Center for the Health Professions where for more than 15 years she has led health professions' research and policy efforts. At the Center, she directs the national Innovative Workforce Models in Health Care project and co-directs the Health Workforce Tracking Collaborative, which assesses health care workforce challenges including maldistribution, shortages and scopes of practice. She has also directed studies on midwifery in the United States, emerging professions, health care personnel in the military, allied health professions and new practice models in primary care and medical specialties. She co-directed the Pew Health Professions Commission's national Taskforce on Health Care Workforce Regulation and was a principal author of its reports on health professions regulation. She

served on the Committee of the RWJF Initiative on the Future of Nursing at the IOM and on the National Commission for Certifying Agencies. She received her undergraduate and law degrees from the University of California, Berkeley, and is licensed to practice law in the state of California.

**Kimberly D. Gregory, M.D., M.P.H.,** is Vice Chair of Women's Healthcare Quality and Performance Improvement at Cedars-Sinai. She has been affiliated with the Medical Center since 1992. Dr. Gregory is also a Professor at the David Geffen School of Medicine at UCLA in the Department of Obstetrics and Gynecology and the UCLA Fielding School of Public Health, Department of Community Health Sciences. Board-certified in obstetrics and gynecology and maternal-fetal medicine, Dr. Gregory has received grants to investigate her research interests in measuring maternal health care quality, developing maternal quality indicators, patient safety, obstetrical healthcare utilization, cesarean section rates and appropriateness, and complications of labor and delivery, such as maternal mortality and other morbidities such as uterine rupture and shoulder dystocia. Dr. Gregory has written articles for numerous peer-reviewed publications, such as the *American Journal of Public Health*, *Obstetrics & Gynecology*, and the *American Journal of Obstetrics and Gynecology*. She is a member of several professional organizations, including the National Medical Association, American College of Obstetricians and Gynecologists (ACOG), and the Society of Maternal Fetal Medicine. Dr. Gregory has served or been appointed to various leadership positions including but not limited to the U.S. Public Health Services Prevention Task Force, the IOM Committee on Preventive Services for Women, the Board of Directors for the Society of Maternal Fetal Medicine, regional Section Chair ACOG, and numerous health and public policy committees at both the state and national level including California Department Health Services Maternal Quality of Care Collaborative (CMQCC) Maternal Mortality Review, the Maternal Quality Indicator Working Group, and the American Medical Association Physician Consortium Performance Indicator Work Group, and the National Quality Forum. Dr. Gregory received her bachelor's degree from UCLA and her medical degree from Charles Drew University School of Medicine and Science. She completed her internship and residency in Obstetrics and Gynecology at Beth Israel Hospital in Boston and her fellowship in Maternal-Fetal Medicine at Los Angeles County + University of Southern California Medical Center. Dr. Gregory received her M.P.H. from Harvard School of Public Health.

**Brady E. Hamilton, Ph.D.,** is a statistician (demographer) in the Reproductive Statistics Branch at National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC). He is part of a team

responsible for the production and analysis of NCHS' national dataset of births and has authored reports on an extensive number of fertility-related topics, including childbearing patterns by maternal age, sex ratio at birth, delayed childbearing, and cohort fertility patterns.

**Isadora Hare, M.S.W., LCSW,** is the Perinatal Health Specialist in the Maternal and Child Health Bureau, Health Resources and Services Administration (HRSA), where she has worked for the last 13 years. Since 2008 she has been the project officer for the HRSA comprehensive resource kit *The Business Case for Breastfeeding: Steps for Creating a Breastfeeding-Friendly Worksite,* and provided oversight for a 3-year training and technical assistance project in 30 states to equip state breastfeeding coalitions and Healthy Start sites to introduce the kit to businesses. Subsequently, she was part of the Steering Committee for the *Surgeon General's Call to Action to Support Breastfeeding*. She has also worked on perinatal issues such as perinatal mental health problems and community-based doula programs in rural areas, and worked for many years for the National Association of Social Workers and the American Psychological Association. An M.S.W. graduate from South Africa, she is a member of the National Association of Social Workers Foundation's Social Work Pioneers and has served on the Board of Social Work Examiners for the state of Maryland. She has more than 40 publications and has made numerous presentations on social policy and children's health issues both across the United States and internationally, including several at conferences of the International Federation of Social Workers.

**Maxine Hayes, M.D., M.P.H.,** is the state health officer for the Washington State Department of Health. A native of Jackson, Mississippi, she has resided in Washington State for nearly 30 years. As the state's top public health doctor, her role includes advising the governor and the secretary of health on issues ranging from health promotion and chronic disease prevention to emergency response. A board certified pediatrician with a master's in public health, her passion and main interest is assuring every child has a healthy start in life. Dr. Hayes is considered one of our nation's top maternal child health experts and is the recipient of many awards and honors for her work in this field. She is a clinical professor of pediatrics at the University of Washington School of Medicine, member of the faculty at the University of Washington School of Public Health, fellow of the American Academy of Pediatrics, and member of the IOM.

**Zsakeba Henderson, M.D.,** is a Medical Officer in the Maternal and Infant Health Branch in the Division of Reproductive Health at the CDC. She is an obstetrician-gynecologist and leads the Division's activities in support of

state-based perinatal quality improvement collaboratives, which currently provides support to statewide collaboratives in California, New York, and Ohio. In this position she also provides clinical input into the development of the research agenda for the Maternal and Infant Health Branch, including activities in preterm birth, breastfeeding, and pregnancy-related mortality. She also serves as the Division's Liaison to the American College of Obstetricians and Gynecologists Committee on Health Care for Underserved Women, and a breastfeeding advocate and educator for the Georgia Chapter of the American Academy of Pediatrics. Dr. Henderson received her B.S. degree in biochemistry from Oakwood University in Huntsville, Alabama, and her medical degree from Harvard Medical School in Boston, Massachusetts. She then completed her internship and residency at Brigham and Women's Hospital/Massachusetts General Hospital Integrated Residency Program in Obstetrics and Gynecology, also in Boston. She subsequently entered the Epidemic Intelligence Service at the CDC, where she worked in the Division of STD Prevention in the Health Services Research and Evaluation Branch. Her interests include prevention of preterm birth, perinatal care quality improvement, and the role of the obstetrician-gynecologist in promoting and supporting breastfeeding.

**Ellen Hodnett, R.N., Ph.D., FCAHS,** is a full professor in the Lawrence S. Bloomberg Faculty of Nursing at the University of Toronto. Dr. Hodnett's research program focuses on rigorous evaluations of forms of care for childbearing women and on the effects of the health care environment on health outcomes. She was an editor for the Pregnancy and Childbirth Group of the Cochrane Collaboration, and a member of the Scientific and Technical Advisory Group of the World Health Organization (WHO) Maternal and Reproductive Health Research Program. Dr. Hodnett is a fellow of the Canadian Academy of Health Sciences. She received a Ph.D. in medical science from the University of Toronto.

**Holly Powell Kennedy, Ph.D., CNM, FACNM, FAAN,** is the current President of the American College of Nurse-Midwives and is the inaugural Helen Varney Professor of Midwifery at Yale University School of Nursing. Her research includes numerous studies exploring specific maternity care models and their relationship to health outcomes. She completed a clinical trial of Centering Pregnancy, a group model of prenatal care, in two military settings. She is on the faculty of King's College London where she was a Fulbright Distinguished Scholar during 2008 studying the National Health Service (NHS) efforts to decrease the national cesarean rate, specifically examining place of birth and models of care. She received her midwifery education from the Frontier School of Midwifery & Family Nursing, her master's degree from the Medical College of Georgia as a family nurse

practitioner, and her doctoral degree from the University of Rhode Island. She is a retired Colonel in the U.S. Army Reserve. She has practiced in numerous settings, including rural health, community and tertiary hospitals, and in academic practices.

**Marian MacDorman, Ph.D.,** is a senior statistician and researcher in the Reproductive Statistics Branch at the NCHS, CDC. Her research interests include home and out-of-hospital birth, cesarean section, induction of labor, preterm birth, infant, fetal and perinatal mortality, race and ethnic differences, and international comparisons.

**Elliott Main, M.D.,** has been the Director of the California Maternal Quality Care Collaborative since its formation in 2005 and has chaired the California Maternal Mortality Review Committee since its inception in 2006. Dr. Main currently serves on multiple national committees on Maternal Quality Measurement including National Quality Forum, ACOG, American Medical Association–convened Physician Consortium for Performance Improvement and the Joint Commission. He also co-chairs the national ACOG and NCHS project-"reVITALize" to standardize maternity definitions for quality measurement and birth certificates. He has co-authored two national Maternity Quality Improvement Toolkits on Obstetric Hemorrhage and Elective Delivery Less than 39 Weeks Gestation. Dr. Main is a Clinical Professor of Obstetrics and Gynecology both at the University of California, San Francisco, and at Stanford University. He has authored numerous peer reviewed articles and textbook chapters focused on medical complications in pregnancy, quality measurement in maternity care, and maternal mortality. Since 1998, he has been the Chairman of the Department of Obstetrics and Gynecology of California Pacific Medical Center in San Francisco. Over the past 10 years he has also chaired Obstetric Quality for Sutter Health's 20 hospitals and led quality improvement projects.

**M. Kathryn Menard, M.D., M.P.H.,** is UpJohn Distinguished Professor of Obstetrics and Gynecology, Vice Chair for Obstetrics and Director of the Division of Maternal Fetal Medicine at the University of North Carolina's School of Medicine, appointed in 2006. Dr. Menard completed her residency training in Obstetrics and Gynecology at the Hospital of the University of Pennsylvania before pursuing fellowship at the University of North Carolina (UNC) at Chapel Hill. She was the first OB/GYN at UNC to be selected as an RWJF Clinical Scholar. While a fellow and RWJF Clinical Scholar she completed a master's degree in public health, focusing on clinical epidemiology, preconception health, and fetal and infant mortality review. After completing fellowship training, she served on faculty at the Medical University of South Carolina (MUSC). Dr. Menard was a consultant to the

SC Department of Health and was instrumental in strengthening the system for perinatal regionalization in the state, to ensure risk appropriate care for mothers and neonates. Dr. Menard's interest in health systems and service efficiency led her to serve for 4 years as MUSC's Chief Medical Officer and Associate Dean for faculty practice prior to returning to UNC in 2006. Dr. Menard is recognized for her inclusive leadership style with an unusual ability to bring diverse perspectives together, promote collaboration, and find synergy. She serves on the Executive Committee of the Society for Maternal Fetal Medicine as the immediate past president. She provides the clinical leadership for development and implementation of North Carolina's Pregnancy Medical Home initiative, a program designed to provide comprehensive, coordinated maternity care for pregnant Medicaid recipients. She is a co-lead for Maternal Child Health Bureau's Collaborative Innovation Network (COIN) to reduce infant mortality through strengthening regionalization, including an emphasis on risk appropriate maternal care. She is also co-chair of the ACOG's ReVITALize initiative to develop and help gain adoption of standardized clinical data definitions in obstetrics. She serves an examiner for the American Board of Obstetrics and Gynecology (ABOG).

**Kathleen Nolan, M.P.H.,** joined the staff of the National Association of Medicaid Directors (NAMD) within 6 months of that organization's launch. At NAMD, Ms. Nolan manages a growing portfolio of state technical assistance on a range of policy and programmatic issues relevant to Medicaid directors. Prior to NAMD, Ms. Nolan worked for 7 years as Director of the Health Division in the National Governors Association's Center for Best Practices. As Division Director, Ms. Nolan led efforts to support implementation of best practices on health care issues facing states, including health care reform, Medicaid, health information technology, and public health programs. Ms. Nolan also held health policy positions with the Association of State and Territorial Health Officials and the IOM. Before moving to Washington, Ms. Nolan served as a Program Specialist in the Colorado Department of Public Health and Environment. Kathleen received her M.P.H. from the George Washington University, and her B.A. in psychology from Carleton College in Northfield, Minnesota.

**Nigel Paneth, M.D., M.P.H.,** is a pediatrician and perinatal and child health epidemiologist with a particular interest in the causes and prevention of childhood neurodevelopmental handicap, especially cerebral palsy. After training in pediatrics at the Albert Einstein College of Medicine in New York City from 1972 to 1976, and receiving his M.P.H. in epidemiology from Columbia University in 1978, he began his academic career at Columbia in 1978 with a joint appointment in Epidemiology and Pediatrics centered in the newly established Sergievsky Center, a research unit created

to examine the etiology of epilepsy and other brain disorders. There he conducted studies of the relationship of perinatal medical care to patterns of fetal and infant mortality, particularly in premature infants. Dr. Paneth came to the College of Human Medicine at Michigan State University in 1989 to develop a Program in Epidemiology. The program became a department in 1997, with Dr. Paneth serving from 1997 to 2002 as its first chair. He also served as Associate Dean for Research of the College from 2000 to 2006. From 1996 to 1999, Dr. Paneth led an AHRQ-funded international study of low-birth-weight outcomes (Canada, Germany, Holland, Jamaica, and the United States). Dr. Paneth currently serves as principal investigator of the Michigan Alliance for the National Children Study (NCS), a consortium of Michigan institutions (Michigan State University, the University of Michigan, Wayne State University, the Henry Ford Health Center, and the Michigan Department of Community Health) that will conduct the NCS in the five Michigan counties that are among 105 NCS locations around the nation.

**Karen Pelote, M.S.N., CNM,** offers the perfect blend of experience and passion to the Family Health and Birth Center in Washington, DC, as the Clinical Manager. Her education at the University of Maryland for both Bachelors of Science in Nursing and Certified Nurse Midwife (CNM) as well as her nearly two decades of as a labor and delivery nurse and 7 years as a CNM have prepared her well. As a former staff member at Washington Hospital Center, she developed lasting relationships which will advance the partnership between the hospital and the birth center. She understands the most important things to the families who place their faith and trust in her and her staff. They count on getting the best advice and care possible because every decision that they bring to the Birth Center can have a profound impact for a lifetime. A dedicated mother of 6 children, she has experienced births in both hospitals and birth centers. She strives every day to make the clinic a place where others can be cared for with excellence and compassion. Her mission is to grow Community of Hope's Family Health and Birth Center in its reputation for providing quality and caring health services to the entire Washington, DC community, including many who are often overlooked in the area of specialized women's health care services.

**Brynne Potter, CPM,** has worked in the field of midwifery since 1991 and has attended home births as a primary midwife for more than 10 years. She is also a member of the North American Registry of Midwives (NARM) Board of Directors, the credentialing agency that oversees the Certified Professional Midwife (CPM) credential through setting of standards for testing, accountability, and recertification. She is a member of the U.S.-Midwifery Education Regulation and Association (U.S.-MERA) workgroup, an effort

to align professional strategies for education and regulation of U.S. midwives. She served as a member of the Steering Committee for the Midwives and Mothers in Action Campaign, a coalition effort to pass federal recognition of the CPM. She was a midwife delegate to the Home Birth Consensus Summit (HBCS) in 2011 and is the Chair of the Legislation and Regulation Task Force of the HBCS. She is co-author on a paper in draft that describes the demographic, education, and practice characteristics of CPMs in the United States in 2011. In 2010, she founded Private Practice, an award-winning, patient-centered technology platform for charting and communication utilized by more than 20 percent of out of hospital providers in the United States. She was one of a few electronic health record vendors to participate as a delegate at the 2012 ACOG-sponsored Revitalize conference on Maternity Data Definitions. She also presented Private Practice's patient engagement and data integration features at the IOM-sponsored Health Data Initiative Forum as one of the top Health Information Technology Innovations of 2012.

**Thomas C. Ricketts, Ph.D., M.P.H.,** is professor of health policy and administration at the School of Global Public Health, professor of social medicine in the School of Medicine, and deputy director of the Cecil G. Sheps Center for Health Research at UNC at Chapel Hill. He is currently a commissioner of the National Health Care Workforce Commission. From 2001 to 2010, Dr. Ricketts chaired the Scientific Advisory Committee for the United Health Foundation's America's Health Rankings. In 2008 he was appointed to the Secretary of Veterans' Affairs Rural Advisory Committee. He works with the American College of Surgeons Health Policy Research Institute focusing on the future supply of surgeons and access to surgical care. Dr. Ricketts served as editor of the *North Carolina Medical Journal* from 2006 until 2012, having previously served as editor of the *Journal of Rural Health* from 1990 until 1996. He received an M.P.H. and Ph.D. from UNC at Chapel Hill where he was a Morehead Scholar.

**Jeannette A. Rogowski, Ph.D.,** is university professor in health economics in the Department of Health Systems and Policy at the University of Medicine and Dentistry of New Jersey School of Public Health. She is also a research associate of the National Bureau of Economic Research. Dr. Rogowski has extensive experience studying the economics of the health care system. She has published numerous peer-reviewed articles on health care use and expenditures by vulnerable populations, health insurance, and health care financing issues. Her published work has appeared in leading professional journals such as the *Journal of the American Medical Association*, *Pediatrics*, the *Journal of Health Economics*, and *Health Services Research*. She has served on numerous national advisory committees, including the

IOM Committee on Understanding Premature Birth and Assuring Healthy Outcomes and the National Advisory Committee for the RWJF Investigator Awards in Health Policy. She received a Ph.D. in economics from the Massachusetts Institute of Technology.

**Diane L. Rowley, M.D., M.P.H.,** is a professor of the practice of public health in the Department of Maternal and Child Health, Gillings School of Global Public Health at UNC at Chapel Hill. Dr. Rowley has a history of addressing health disparities in maternal and child health—first as a leader of key programs at the CDC and later as the director of the Research Center in Health Disparities at Morehouse College. Her current work is with existing community-based organizations and women in the community to develop a workgroup that will generate a strategy for delivering interconceptional care. The workgroup combines the results of EDIC (Eliminating Disparities in Interconceptional Care) with community knowledge of the local health care delivery system and community assets into a model for intervening on the underlying social factors that inhibit participation in interconceptional care. Her work uses community participatory research methods to test the model. She received an M.D. from Meharry Medical College and an M.P.H. from the Harvard School of Public Health.

**Benjamin P. Sachs, M.D., B.S., DPH, FACOG,** is professor of obstetrics and gynecology at Tulane University. Dr. Sachs served as senior vice president and dean of the School of Medicine at Tulane University from 2007 to July 2013. Before joining Tulane in November 2007, Dr. Sachs held several senior administrative positions at Harvard Medical School and the Beth Israel Deaconess Medical Center (BIDMC), including chief of the Department of Obstetrics and Gynecology; Harold H. Rosenfield professor of obstetrics, gynecology, and reproductive biology; and president of the BIDMC Physician Organization, an organization of 1,500 physicians for three terms. While at Harvard, Dr. Sachs helped create the research team that discovered the probable cause of preeclampsia, one of the leading causes of maternal and infant mortality and morbidity worldwide. The team also developed a new diagnostic test that is currently being evaluated in the United States and internationally by WHO. This research has been widely published, including in the *Journal of the American Medical Association*, the *New England Journal of Medicine*, the *Journal of Clinical Investigation*, *Nature Medicine*, and the *New Yorker*. Known internationally for his work in improving patient care and reducing medical errors, Dr. Sachs' team at BIDMC received the John M. Eisenberg Patient Safety and Quality award from the National Quality Forum and the Joint Commission in 2007. He received a bachelor of medicine/bachelor of surgery degree from St. Mary's

Hospital Medical School (now known as Imperial College London) and the Diploma of Public Health degree from the University of Toronto. Dr. Sachs is a Fellow of ACOG.

**Carol Sakala, Ph.D., M.S.P.H.,** is director of programs at Childbirth Connection, which works to improve the quality and value of maternity care through consumer engagement and health system transformation. She works across the continuum of clinical effectiveness activities, including primary data research, systematic reviews, performance measurement, clinical practice guidelines, and consumer decision aids. Dr. Sakala is the lead author of the Milbank Report *Evidence-Based Maternity Care: What It Is and What It Can Achieve* and of a forthcoming report on *Maternity Care and Liability*. She is a co-investigator of the continuing series of national Listening to Mothers surveys. Engaging stakeholders from across the health care system, Dr. Sakala helped create two direction-setting consensus reports: "2020 Vision for a High-Quality, High-Value Maternity Care System" and "Blueprint for Action." Her current work focuses on implementing priority Blueprint recommendations within Childbirth Connection's Transforming Maternity Care project to improve the system that provides maternity care to the nation's women, newborns, and families. She was a Pew Health Policy Fellow at Boston University, which awarded her doctorate, and she received an M.S.P.H. degree from the University of Utah.

**Jane Sandall, Ph.D., M.Sc., B.Sc., RM, HV, RN,** is Professor of Social Science and Women's Health in the Division of Women's Health, King's College, London. She leads the Maternal Health Services and Policy Research Group, has a clinical background in Midwifery and is a trained Social Scientist. She is Associate Editor of Midwifery and Adjunct Professor University of Technology, Sydney and of the University of Iceland. She has led a work programme in the *National Institute for Health Research* (*NIHR*) *King's Patient Safety and Service Quality Research Centre*, which looked at (a) the exploration of the management of escalation of care in medical and maternity settings, and the implementation of rapid response systems; (b) compared measures of organisational and safety culture with quality of care in perinatal care; and (c) the contribution of women and families to patient safety. Her research programme on the organization and delivery of maternal health care includes cohort and qualitative case studies on the organisation, delivery and outcome of birth in different settings (Birthplace in England Research Programme), the efficient use of the maternity workforce and the implications for safety and quality in maternity care in England, and Cochrane Reviews on Midwife-led care and antenatal preparation. Her research has been funded by the Economic

and Social Research Council, Medical Research Council, Wellcome Trust, NIHR, and a range of charitable sources. Research findings have informed the UK government commission on Nursing and Midwifery, House of Commons Health Committee on Inequalities, NHS London, and U.S., Brazilian, and Australian reviews of maternity services.

**William Shrank, M.D., M.S.H.S.,** is the Director of Rapid-Cycle Evaluation at the Center for Medicare and Medicaid Innovation at the Centers for Medicare & Medicaid Services (CMS). He leads the evaluation of all payment and health-system delivery reform programs supported by the Innovation Center as well as all congressionally mandated demonstration programs. He developed the rapid-cycle strategy to promote continuous quality improvement and rapid spread of effective programs while maintaining scientific rigor. He also oversees the intramural research enterprise for CMS. Dr. Shrank is serving as part-time faculty in the Division of Pharmacoepidemiology and Pharmacoeconomics at Brigham and Women's Hospital (BWH). At BWH, Dr. Shrank's research is focused on evaluating quality in pharmacologic care, enhancing adherence to chronic medications, and improving prescription drug labels. He was the founder and principal investigator of the CVS Caremark Harvard Partnership for Improving Medication Adherence, a multi-disciplinary research initiative to improve how patients take medication, as well as the Pharmacy Care Research Institute, also funded by CVS Caremark. He received a career development award from the National Heart, Lung, and Blood Institute of the National Institutes of Health to evaluate interventions to improve rational prescribing in cardiovascular disease, and a Pioneer Award from the RWJF to study the effect of labeling on medication use. He has published more than 100 articles in the peer-reviewed literature focusing on prescription drug use. Dr. Shrank serves or has served on national advisory committees for the FDA, CMS, HHS, AHRQ, the Society of General Internal Medicine, the American College of Physicians Foundation, and the U.S. Pharmacopeia. He attended Brown University, received his M.D. from Cornell University, and did his residency training in Internal Medicine at Georgetown University. He served on the clinical faculty in General Internal Medicine at University of Colorado Health Sciences Center before finishing a health services research fellowship at UCLA, Rand, and the West Los Angeles VA Hospital where he earned an M.S. in Health Services from UCLA. Until 2011, he practiced general internal medicine at BWH.

**Patrick Simpson, M.P.H.,** is a program officer at the W.K. Kellogg Foundation in Battle Creek, Michigan. As a member of the Food, Health, and Well-Being team, Patrick serves as a convener, collaborator, and catalyst, responsible for nurturing opportunities for affecting positive systemic change

in communities, and executing programming efforts aligned with the foundation's mission. He focuses on funding opportunities that enable the foundation to make progress in ensuring that all children can grow and thrive by having love, good parenting, high-quality food, physical activity, interaction with nature and access to healthcare. Prior to joining the Foundation in 2010, Patrick spent nearly 15 years with CityMatCH in Omaha, Nebraska, an organization focusing on maternal and child health needs in U.S. urban areas. He held positions including executive director (2007-2010); director of operations (2002-2007); program and policy manager (1998-2002); and project coordinator, policy and research (1996-1998). Since 2007, he has also been an instructor of child health policy at the University of Nebraska Medical Center, Department of Pediatrics. He holds a bachelor's degree in biology from University of Nebraska-Omaha and a master's in public health from the University of Alabama at Birmingham. The W.K. Kellogg Foundation, established in 1930, supports children, families, and communities as they strengthen and create conditions that propel vulnerable children to achieve success as individuals and as contributors to the larger community and society. Grants are concentrated in the United States, southern Africa, Latin America, and the Caribbean.

**Catherine Spong, M.D.,** is the Director, Division of Extramural Research at the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), NIH, a position she was appointed to in September 2012. Prior to this she was the Chief of the Pregnancy and Perinatology Branch at the Eunice Kennedy Shriver NICHD, NIH, a position she held since January 2001. Dr. Spong oversees the Institute's extramural research programs and manages scientific activities in maternal and child health, family health and well-being, and medical rehabilitation. The Institute's extramural research activities include more than 3,100 projects and involve 130 staff members. In addition to serving as the NICHD Director's principal advisor on extramural scientific and policy issues, Dr. Spong will be the Executive Secretary of the National Advisory Child Health and Human Development Council. Dr. Spong received B.A.s in biology and chemistry and her M.D. from the University of Missouri-Kansas City medical School's Six Year Medical Program in 1991. Her research interests focus on maternal and child health, emphasizing prematurity and fetal complications. In her position as Program Scientist for the NICHD Maternal Fetal Medicine Units Network, a network of 14 sites in the United States that performs clinical trials in high-risk pregnancies and for the Management of Myelomeningocele Study, the maternal-fetal surgery trial on the management of Myelomeningocele, Dr. Spong oversaw many advances that resulted in changes in clinical practice. In addition, Dr. Spong is interested in the de-

veloping fetus and neuroprotective agents to prevent fetal injury for which she is the holder of several patents.

**Susan Rutledge Stapleton, D.N.P., CNM, FACNM,** founded the Reading Birth & Women's Center in Reading, Pennsylvania, and was director of that practice for 25 years, attending births in a freestanding birth center, the hospital and mothers' homes. She is President of the Commission for the Accreditation of Birth Centers, the national accrediting body for birth centers in the United States. She is also Chair of the Research Committee of the American Association of Birth Centers (AABC), and headed the task force to develop the online AABC Perinatal Data Registry. She was primary investigator for a recently published multicenter, prospective study of the midwifery-led collaborative model of maternity care in U.S. birth centers.

**Esther M. Sternberg, M.D.,** is a major force in mind-body-stress-wellness and environment inter-relationships. Author of best-selling *Healing Spaces: The Science of Place and Well-Being* (2009) and *The Balance Within: The Science Connecting Health and Emotions* (2000), creator and host of PBS television's The Science of Healing, Dr. Sternberg is recognized by the National Library of Medicine as 1 of 300 women physicians who changed the face of medicine, and by NIH as Anita B. Roberts "Distinguished Women Scientists at NIH" lecturer. In 2011 Trinity College, Dublin awarded her a Doctorate Honoris Causa (Honorary Doctorate) in Medicine for her contributions to medicine, on the occasion of the 300th Anniversary of the founding of Trinity College School of Medicine. Currently Research Director for the Arizona Center for Integrative Medicine at the University of Arizona, at Tucson, Dr. Sternberg was previously Section Chief of Neuroendocrine Immunology and Behavior at the National Institute of Mental Health (NIMH); Director of the Integrative Neural Immune Program, NIMH/NIH; and Co-Chair of the NIH Intramural Program on Research on Women's Health.

**Kristi Watterberg, M.D.,** is a Professor of Pediatrics at the University of New Mexico (UNM). She served as Chief of the Division of Neonatology from 2006 to 2011, and is now the Director of the UNM Signature Program in Child Health Research. Dr. Watterberg completed her Pediatric and Neonatology training at UNM in 1985 and served on the UNM faculty until 1988. Subsequently, she was a faculty member at the Hershey Medical Center of The Pennsylvania State University, returning to UNM in 2000. Her primary research interests are adrenal function in the fetus and newborn infant and the pathogenesis and prevention of bronchopulmonary dysplasia (BPD). Pursuing these interests, Dr. Watterberg has received federal funding for observational and interventional studies exploring the re-

lationships between prenatal and postnatal inflammation, adrenal function and the development of BPD. In 2001, she received funding from NICHD for a multicenter trial entitled, *Prophylaxis of early adrenal insufficiency to prevent BPD*. Dr. Watterberg is the Principal Investigator at New Mexico for the NICHD Neonatal Research Network, which has multiple ongoing observational and interventional studies. She was a member of the Committee on Fetus and Newborn of the American Academy of Pediatrics from 2006 to 2012, and was lead author for the committee statements on the use of postnatal steroids to prevent or treat BPD (published) and planned home birth (in process). Dr. Watterberg is an author on more than 60 peer-reviewed publications, serves on NIH peer review panels, and is a member of the Society for Pediatric Research and the American Pediatric Society.

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# Abbreviations and Acronyms

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| AABC | American Association of Birth Centers |
| AAFP | American Academy of Family Physicians |
| AAP | American Academy of Pediatrics |
| ACIN | A Collaborative Innovation Network |
| ACNM | American College of Nurse-Midwives |
| ACO | Accountable Care Organizations |
| ACOG | American Congress of Obstetricians and Gynecologists |
| APHA | American Public Health Association |
| AWHONN | Association of Women's Health Obstetric and Neonatal Nurses |
| BMI | body mass index |
| CAHPS | Consumer Assessment of Healthcare Providers and Systems |
| CCTP | Community-based Care Transitions Program |
| CDC | Centers for Disease Control and Prevention |
| CM | certified midwife |
| CMMI | Center for Medicare & Medicaid Innovation |
| CMS | Centers for Medicare & Medicaid Services |
| CNM | certified nurse midwife |
| CPCi | Comprehensive Primary Care initiative |
| CPM | certified professional midwife |
| DO | doctor of osteopathic medicine |
| EFM | electronic fetal monitoring |

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| FHBC | Family Health and Birth Center |
| HRSA | Health Resources and Services Administration |
| ICD-9 | International Statistical Classification of Diseases-9th revision |
| ICM | International Confederation of Midwives |
| ICU | intensive care unit |
| IOM | Institute of Medicine |
| LM | licensed midwife |
| LMP | last menstrual period |
| LPN | licensed practical nurse |
| MCHB | Maternal and Child Health Bureau |
| MD | medical doctor |
| MIHOPE | Mother and Infant Home Visiting Program Evaluation |
| MIHOPE-SS | Mother and Infant Home Visiting Program Evaluation-Strong Start |
| NARM | North American Registry of Midwives |
| NCHS | National Center for Health Statistics |
| NHS | National Health Service |
| NICHD | National Institute of Child Health and Human Development |
| NICU | neonatal intensive care unit |
| NRC | National Research Council |
| NTSV CS | nulliparous term singleton vertex Cesarean section |
| OB/GYN | obstetrics and gynecology |
| PDD | patient discharge diagnosis |
| PIH | pregnancy induced hypertension |
| RN | registered nurse |
| TIOP | Toward Improving the Outcome of Pregnancy |
| UK | United Kingdom |
| VBAC | vaginal birth after cesarean |