

# Putting the “M” back in maternal-fetal medicine: A 5-year report card on a collaborative effort to address maternal morbidity and mortality in the United States



Mary E. D’Alton, MD; Alexander M. Friedman, MD, MPH; Peter S. Bernstein, MD, MPH; Haywood L. Brown, MD; William M. Callaghan, MD, MPH; Steven L. Clark, MD; William A. Grobman, MD, MBA; Sarah J. Kilpatrick, MD, PhD; Daniel F. O’Keeffe, MD; Douglas M. Montgomery, MD; Sindhu K. Srinivas, MD, MSCE; George D. Wendel, MD; Katharine D. Wenstrom, MD; Michael R. Foley, MD

**I**ncreasing severe maternal morbidity and mortality in the United States are well characterized. The Centers for Disease Control and Prevention have demonstrated continuous increases in maternal risk over recent decades,<sup>1–3</sup> with racial disparities among non-Hispanic black women an important contributing factor.<sup>4–6</sup> More than 50,000 women experienced severe maternal morbidity in 2014, with a mortality rate of 18.0 per 100,000.<sup>7,8</sup> Maternal risk for a range of complications including postpartum hemorrhage, severe preeclampsia, cardiovascular and noncardiovascular medical conditions, and peripartum hysterectomy has been stable or increased.<sup>1,6,9–12</sup> In 2012, the first “Putting the ‘M’ back in Maternal-Fetal Medicine” session was held at the Society for Maternal-Fetal Medicine’s (SMFM) Annual Meeting. With the realization that rising risk for severe maternal morbidity and mortality<sup>2,13–15</sup> required action, the “M in MFM”

The Centers for Disease Control and Prevention have demonstrated continuous increased risk for maternal mortality and severe morbidity with racial disparities among non-Hispanic black women an important contributing factor. More than 50,000 women experienced severe maternal morbidity in 2014, with a mortality rate of 18.0 per 100,000, higher than in many other developed countries. In 2012, the first “Putting the ‘M’ back in Maternal-Fetal Medicine” session was held at the Society for Maternal-Fetal Medicine’s (SMFM) Annual Meeting. With the realization that rising risk for severe maternal morbidity and mortality required action, the “M in MFM” meeting identified the following urgent needs: (i) to enhance education and training in maternal care for maternal-fetal medicine (MFM) fellows; (ii) to improve the medical care and management of pregnant women across the country; and (iii) to address critical research gaps in maternal medicine. Since that first meeting, a broad collaborative effort has made a number of major steps forward, including the proliferation of maternal mortality review committees, advances in research, increasing educational focus on maternal critical care, and development of comprehensive clinical strategies to reduce maternal risk. Five years later, the 2017 M in MFM meeting served as a “report card” looking back at progress made but also looking forward to what needs to be done over the next 5 years, given that too many mothers still experience preventable harm and adverse outcomes.

**Key words:** advanced cardiac life support, amniotic fluid embolism bundles, certification, clinical guidelines, intensive care unit, levels of maternal care, maternal hypertension, maternal safety, national surveillance program, postpartum hemorrhage, research, simulation, training, venous thromboembolism

From the Vagelos College of Physicians and Surgeons (Drs D’Alton and Friedman), Columbia University, New York, NY; Albert Einstein College of Medicine (Dr Bernstein), Yeshiva University, New York, NY; Morsani College of Medicine (Dr Brown), University of South Florida, Tampa, FL; Division of Reproductive Health (Dr Callaghan), Centers for Disease Control and Prevention, Atlanta, GA; Baylor College of Medicine (Dr Clark), Baylor University, Houston, TX; Feinberg School of Medicine (Dr Grobman), Northwestern University, Chicago, IL; Cedars-Sinai Medical Center (Dr Kilpatrick), Los Angeles, CA; The Society for Maternal-Fetal Medicine (Dr O’Keeffe), Phoenix, AZ; Kaiser Permanente Riverside Medical Center (Dr Montgomery), Riverside, CA; Perelman School of Medicine (Dr Srinivas), University of Pennsylvania, Philadelphia, PA; American Board of Obstetrics and Gynecology (Dr Wendel), Dallas, TX; Women and Infants Hospital (Dr Wenstrom), Brown University, Providence, RI; University of Arizona College of Medicine Phoenix at Banner University Medical Center Phoenix (Dr Foley), Phoenix, AZ.

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Corresponding author: Mary D’Alton, MD. [MD511@cumc.columbia.edu](mailto:MD511@cumc.columbia.edu)

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meeting identified the following urgent needs: (i) to enhance education and training in maternal care for maternal-fetal medicine (MFM) fellows; (ii) to improve medical care and management of pregnant women; and (iii) to address critical research gaps in maternal medicine.<sup>16</sup> Five years later, the 2017 M in MFM meeting served as a “report card,” looking back at progress made and also looking forward to what needs to be done over the next 5 years, given that too many mothers still experience preventable harm and adverse outcomes.

Progress on M in MFM initiatives has occurred within a broad collaborative effort dedicated to improving maternal care that includes the American Congress of Obstetricians and Gynecologists (ACOG), the American Board of Obstetrics and Gynecology (ABOG), SMFM, the National Partnership for Maternal Safety (NPMS) under the Council on Patient Safety in Women’s Health Care, the Centers for Disease Control and Prevention (CDC), the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD), the Alliance for Innovation on Maternal Health, and other organizations. Leaders in these organizations participated in the creation of this “report card.” In addition to reviewing progress on the original recommendations from “Putting the ‘M’ back in maternal-fetal medicine,”<sup>16</sup> this report card also focuses on an important new development: stepwise and coordinated progress toward improving maternal death reviews nationwide in the United States. Systematic maternal death reviews have been an invaluable resource in understanding risk and improving maternal safety in the United Kingdom;<sup>15</sup> a similar approach in United States will be critical in improving care.

## Education

Five major educational recommendations were developed from the 2012 M in MFM meeting: (i) MFM fellows should complete mandatory rotations on labor and delivery (L&D) and in an intensive care unit (ICU); (ii) MFM fellowships should use simulations and case-based

learning to enhance education in maternal medicine; (iii) MFM should have active certification in advanced cardiac life support (ACLS); (iv) MFM fellows should undergo a yearly in-service examination similar to that administered to residents by the Council on Resident Education in Obstetrics and Gynecology; (v) MFM fellows should receive training in leadership skills via formal leadership courses as well as participation in hospital-level quality assurance committees and quality initiative projects.

## Completed

### *Mandatory L&D and ICU training*

Prior to the initial M in MFM meeting, fellowship requirements were 12 months of clinical rotations without a requirement for L&D or ICU rotations. ABOG has subsequently modified the MFM fellowship to include 15 months of clinical rotations including 2 months of L&D/inpatient services and a 1-month ICU rotation.<sup>16</sup> Per communication with ABOG, prior to this change, the L&D training among fellowship programs varied in structure, education, supervision, timing, and duration. In some programs, the L&D experience was unstructured and service-oriented, consisting simply of night and weekend call. All programs had to develop structured rotations with newly defined educational L&D objectives and advanced responsibilities for fellows. There has been a subsequent increase in interest in maternal care, with 11 MFM physicians now certified in critical care. Many centers are pursuing the addition of a critical care fellowship as an adjunct to maternal-fetal medicine training. For the M in MFM meeting, 1 year of MFM thesis data were reviewed: approximately 45% of MFM fellowship theses are on maternal health topics. Per communication with ABOG, going forward data on MFM theses will be tracked.

### *Simulation and case-based learning*

Given that maternal deaths occur rarely and many life-threatening maternal conditions are low prevalence, simulation and case-based learning represent

an important means of preparing MFM providers to manage life-threatening severe morbidity scenarios.<sup>17–19</sup> Obstetric simulation training may result in improved interdisciplinary teamwork and better patient outcomes with fewer medical and communication errors.<sup>20</sup> Simulation for maternal cardiac arrest has resulted in improved knowledge, confidence, and competence in management of this life-threatening clinical scenario.<sup>21,22</sup> The annual Critical Care in Obstetrics—An Innovative and Integrated Model for Learning the Essentials course is held separately from SMFM’s annual conference. ABOG was intimately involved in creation of this multi-day training course; ABOG worked to identify the 20 most important topics in maternal medicine and critical care obstetrics to reduce maternal morbidity and mortality. Since 2014, a total of 1791 obstetrician-gynecologists have taken the course. The program includes online lectures, case studies, simulation sessions, as well as a 3-day onsite course with in-person simulation, virtual reality, and skill development focused on developing obstetric critical care skills. Resident attendance at the Annual Critical Care in Obstetrics course is particularly important in maternal care education, given that the majority of obstetric providers in the United States are not MFM specialists.

### *In-service examinations*

After careful review, it was determined by ABOG that, given the sample of test takers, the development of in-service examinations was not psychometrically feasible for MFM fellows.

### *Active ACLS certification*

Because many obstetrics and gynecology residencies require ACLS training, MFM fellows often arrive at fellowship with this certification. Many programs now require maintenance of certification during fellowship.

### *Expanded leadership training*

To address leadership gaps in MFM, over the last 5 years the Society for Maternal-Fetal Medicine has sponsored the SMFM Academy for Leadership and

Development. Two 3-day on-site courses in Denver, Colorado, with additional facilitated dialogues during the 6 interceding months focus on leadership imperatives including strength-based leadership, crucial conversations and accountability, and change management. This important skill development helps to focus efforts in leading change, especially as it relates to reducing maternal morbidity and mortality. Maternal care improvements require MFM-led implementation of hospital-level care initiatives, inter-hospital collaboration, and communication with hospital and hospital system leadership; leadership training was a gap identified by SMFM members.

### Clinical

The original M in MFM meeting developed 5 specific recommendations for improving maternal clinical care on a national basis: (i) development of a national, stratified system for levels of maternal care with high-risk patients triaged to centers with appropriate resources and expertise; (ii) creation of guidelines and bundles to prevent and to manage the leading causes of severe maternal morbidity and mortality; (iii) increasing departmental and divisional support for MFM subspecialists focusing on maternal care, including facilitating academic advancement for MFM inpatient directorships; (iv) improving maternal care reimbursement and billing coding for maternal care; and (v) creating models for comprehensive care for mothers at high risk secondary to acute or chronic comorbid conditions.

### Completed

#### *Levels of maternal care*

The Obstetric Care Consensus on Levels of Maternal Care, developed by ACOG and SMFM, provides uniform designations for levels of maternal care, standardized definitions, quality guidelines, and nomenclature for each level of maternal care, and recommendations for equitable geographic distribution of full-service maternal care facilities and systems to improve maternal safety and outcomes across the United States. For

each level of care, the document makes recommendations for staffing, center capabilities, and where patients with specific risk factors should deliver.<sup>23</sup> The Obstetric Care Consensus document is supported and endorsed by leading anesthesia, pediatric, and nursing societies.

### In progress

#### *Guidelines and bundles*

The National Partnership for Maternal Safety under the Council on Patient Safety in Women's Health Care, representing all major women's healthcare professional organizations, has published bundles on obstetric hemorrhage, severe hypertension, thromboembolism, and racial and ethnic disparities, leading causes of severe maternal morbidity and mortality.<sup>24–27</sup>

These bundles represent a selection of existing guidelines and recommendations in a form that aids implementation and consistency of practice for individual centers, with the goal of improving prevention, recognition, and management of life-threatening medical and obstetric conditions. Examples of care improvement supported by these bundles include optimizing thromboembolism prophylaxis, improving recognition and management of obstetric hemorrhage, and timely treatment of severe hypertension. In addition, ACOG and SMFM have created specific management recommendations for high-risk conditions such as placenta accrete,<sup>28</sup> and SMFM has focused on the role of reducing disparities in improving overall maternal outcomes.<sup>29,30</sup> Facilitating statewide bundle implementation is 1 of the priorities of the Alliance for Innovation on Maternal Health (AIM) that has partnered with professional societies, industry, and governmental organizations to improve maternal care. The Safe Motherhood Initiative in New York State has facilitated statewide implementation of thromboembolism, obstetric hemorrhage, and hypertension bundles.<sup>31</sup> Implementation of the hemorrhage bundle has led to decreased risk for severe morbidity in California.<sup>32</sup> Adoption of parallel recommendations for management of hypertension has led to decreased risk for eclampsia and severe morbidity.<sup>33</sup>

*Quality assessment of severe maternal morbidity.* Transfusion of 4 or more units of blood products, admission to an intensive care unit, or both were developed at the M in MFM meeting as simple measures of severe maternal morbidity to prompt case reviews within all hospitals that deliver obstetric care.<sup>34</sup> To aid in guidance of severe maternal morbidity case reviews, recommendations have been developed for a standardized interdisciplinary approach to identifying systems and professional and facility factors with the goal of improving hospital-level safety. Included are recommendations on committee organization, the review process, medical record abstraction and assessment, review culture, data management, review timing, and review confidentiality. An accompanying structured severe maternal morbidity abstraction and assessment form to aid in morbidity reviews is available for download at: <http://safehealthcareforeverywoman.org/>.<sup>35,36</sup>

Uniform diagnostic criteria for amniotic fluid embolism have been developed to aid in diagnosis of this condition.<sup>37</sup> Similar to what is done by our colleagues in neonatology, severe morbidity should be tracked on large-scale, systematic bases by state and regional maternal quality care collaboratives.

*Career support and academic advancement for maternal-care–focused MFM subspecialists.* Supporting maternal care–focused MFM subspecialists is a substantial challenge, despite clear clinical needs. Although states with a high density of MFM specialists generally have lower mortality rates, several states with high MFM density have high mortality rates, suggesting that some MFM specialists may not be providing maternal-focused care.<sup>38</sup> A significant proportion of generalist obstetricians express dissatisfaction in the availability and/or the limited scope of practice of MFM specialists. Data from a recent MFM workforce survey found that only 47.5% of MFMs working full-time take in-house call in hospitals providing higher-acuity maternal care (Level III or IV centers).<sup>39</sup> Encouraging and

supporting MFM specialists who focus on maternal care will continue to be an urgent priority, given national needs.

*Improving reimbursement for maternal care.* Coding courses have shown great benefit in obtaining improved reimbursement for maternal care. Providers and billing staff may attend SMFM coding courses specifically for MFM coders and physicians. Departmental leadership may encourage providers and billing staff to attend these courses and billing staff to optimize coding for maternal reimbursement.

*Models of comprehensive maternal care.* Comprehensive maternal care centers, modeled on prenatal diagnosis/fetal referral centers (Level IV Regional Perinatal Health Care Centers) are evolving. As an example, the Mothers Center at Columbia University serves as a quaternary referral center for maternal high-risk diagnoses such as maternal cardiac disease, placenta accreta, and other major medical, surgical, and obstetric conditions. Care is coordinated with maternal-care–focused MFM providers and medical and surgical subspecialists with expertise in obstetric patients in the same clinical space; in this model, the quaternary maternal center can serve as a resource to both community providers and other academic centers.

*Emerging concepts.* Innovation in healthcare delivery will play an essential role in reducing maternal risk, as patient needs are often not one-size-fits-all. For example, compared to presenting for office blood pressure checks, patient engagement of outpatient follow-up for hypertensive diseases of pregnancy may be improved by remote patient monitoring that allows patients to monitor blood pressure at home, to have their measurements digitally logged through a tablet, and then to have providers automatically notified of abnormal parameters. Given that cardiac and noncardiac medical conditions are now the leading causes of maternal death, use of innovative technological interventions to

improve patient engagement and to monitor high-risk conditions may represent opportunities to reduce major sources of maternal risk.<sup>40</sup> Aligning with initiatives to improve engagement with women in the postpartum period, remote patient monitoring along with structured “virtual visits” may represent a means of improving care for both high-risk and low-risk patients.

### Critical Research Gaps

The 2012 M in MFM meeting identified 7 critical research gaps related to maternal care including the following: (i) the need for a standardized definition of significant maternal morbidity and “near misses”; (ii) the need for risk prediction models for severe morbidity and mortality, including maternal early warning systems to avert adverse outcomes; (iii) guidance on delivery timing to optimize maternal and neonatal outcomes, including management of placenta accrete; (iv) economic analyses demonstrating cost savings associated with improved maternal care; (v) research on effectiveness of maternal care training and education; (vi) research on long-term outcomes after an adverse pregnancy; and, as discussed in the section below, (vii) national surveillance of maternal mortality and morbidity. Addressing these knowledge gaps is a top priority of the NICHD.

### Research supported by the NICHD

The Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) supports a broad range of maternal health research. Recent key topics in this area have included advanced maternal age as it relates to maternal risk, health services, and systems of care in obstetrics, maternal comorbidities, depression, preeclampsia and hypertension, HIV, labor and delivery complications, obstetrics pharmacology, environmental exposures, gestational diabetes, obesity, and placental complications. From 2011 to 2016, maternal-focused NICHD research has increased from approximately \$129 million to \$138 million annually. At the request of the NICHD,

the National Institutes of Health (NIH) agreed to add a maternal health category to NIH-wide reporting which commenced in 2017. This new category was designed to enable better tracking of “maternal health” research at the National Institutes of Health.

Of the 7 critical research gaps in maternal health identified in 2013, NICHD has supported work to address each of these areas, with examples for each highlighted in [Supplementary Table 1](#). In addition to specific researcher-initiated grants, NICHD supports major initiatives and programs such as the National Survey of Family Growth, the Population Dynamics Research Infrastructure Program, the Maternal-Fetal Medicine Units Network, the Global Network for Women’s and Children’s Health, the Obstetric-Fetal Pharmacology Units Network, and the Consortium on Safe Labor.<sup>37,41–60</sup>

To simplify data sharing with the research community, NICHD has developed and launched the Data and Specimen Hub (DASH; <https://dash.nichd.nih.gov/>). This is a centralized resource for researchers to store and access data from NICHD-funded research studies to use for secondary analyses. In addition, NICHD supports the Biospecimen Repository Access and Data Sharing (BRADS) site, a repository of epidemiologic studies and clinical trials (<https://brads.nichd.nih.gov/>).

### National Surveillance

The CDC’s Pregnancy Mortality Surveillance System (PMSS) has been tracking maternal deaths in the United States since 1986. This system relies on death certificates for women thought to have died during or within 1 year of pregnancy, as well as linked birth and/or fetal death certificates shared voluntarily from the Divisions of Vital Statistics from the 50 states and the District of Columbia (<https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html>). When information on these records is viewed with a clinical eye, causes of death can be ascribed in a more nuanced fashion than when using conventional International Classification of Disease coding. However,

information on death certificates is likely more accurate for certain types of deaths than others (eg, postpartum hemorrhage vs pre-existing chronic disease), and the quality of documentation may vary significantly by state (eg, availability of records linked to birth certificates). Both under-ascertainment and false-positive results are a concern when surveillance is based solely on vital records.<sup>61,62</sup> Furthermore, the certificate itself can rarely provide any insight into the personal or medical circumstances surrounding the death. Hence, state and regional maternal mortality review (MMR) committees are likely able to provide more particulate and accurate data based on death identification from multiple sources, and these committees are well positioned to ascertain causality based on in-depth reviews of obstetric care and circumstances of death. If surveillance and review are done for the purpose of effecting change and preventing future events, it is the process information that must be understood to inform improvement. This information can be gleaned only from in-depth review. Although currently an aspirational idea, it is conceivable that systematic maternal death reviews on the state level across the United States could begin to approach the Confidential Enquiries into Maternal Deaths in the United Kingdom. As of 2013, a total of 18 states and 1 city had active MMR committees; as of today, the SMFM estimates that 36 states have MMR committees, with 9 states planning or starting up committees.

In supporting federal legislation to advance the national proliferation of MMR committees, SMFM was a key partner in a coalition of national organizations including ACOG, the Association of Maternal and Child Health Programs, the March of Dimes, the Preeclampsia Foundation, and others that advocated successfully for Congress to double funding for the CDC's efforts to support MMR committees. SMFM members participated in (i) grassroots efforts to encourage Congress for this support, and (ii) multiple direct education efforts with policymakers in the form of Congressional briefings, testimony, and hearings. HR 1318, the Preventing Maternal Deaths Act, a bill that

SMFM endorsed, advocated for, and hosted, and for which the SMFM co-sponsored Congressional briefings and on which it submitted testimony to Congress, was signed into law in December 2018. This legislation authorizes the CDC to provide assistance to states in setting up MMR committees and ensuring standardized review and data collection processes. SMFM endorsed several state efforts to create new or improve established MMR committees, and many MFMs serve as chairs of MMR committees in their states. In addition, the M in MFM initiative facilitated SMFM's dialogue with the CDC to provide a role for SMFM in supporting MMR committees. In the new 2019 Congressional session, SMFM plans to support the reintroduction of other bills addressing disparities, expanding Medicaid for postpartum women, authorizing the AIM program (for which SMFM sits on the executive team), and providing support for perinatal quality collaboratives.

In addition to the formation of MMR committees in most states, the quality of reviews may be improving as well. Via the Alliance for Innovation on Maternal Health (AIM), approaches and "lessons learned" from mortality reviews may be broadly disseminated. The CDC is currently facilitating efforts on suggested data standards for reporting from individual MMR committees as well as providing expertise on maternal death data abstraction, informant interviews, and committee processes. The Association of Maternal Child Health Programs in partnership with the CDC Foundation and the CDC Division of Reproductive Health has recently developed a Web-based resource, Review to Action (<http://www.reviewtoaction.org/about-us>). This effort aims to provide technical assistance to new review committees, to connect existing committees with new and veteran committees, and to raise awareness of the critical roles that such reviews can play in eliminating preventable deaths. The ultimate goal of improving maternal mortality surveillance in the United States is for every maternal death to undergo a high-quality death review.

## Conclusion

Since the first "M in MFM" meeting 5 years ago, major educational, research, and clinical strides have been made to improve maternal safety by a broad collaborative effort. Critical care and labor floor rotations are now required during MFM fellowship training. Critical care teaching has been provided to more than 1700 obstetrician-gynecologists and maternal fetal medicine specialists. The NICHD has supported more than 0.5 billion dollars in maternal research. Academic, industry, state, and federal leadership have developed a number of major safety initiatives to improve maternal care.

To successfully reduce maternal mortality in the United States, these achievements will have to be sustained and built upon over the coming years. Models of maternal care will need to be developed to manage risk from cardiovascular and noncardiovascular medical conditions that are now the leading causes of maternal mortality. Although a number of major initiatives to improve maternal safety on the hospital level have been developed—from criteria and strategies for severe morbidity review to bundles for thromboembolism, hemorrhage, and hypertension—implementation across the more than 3000 hospitals in the United States that provide obstetric services—in short, developing national maternal safety standards—represents a formidable challenge.<sup>63</sup> Supporting maternal-fetal medicine specialists focused on maternal safety in the setting of differential and unfavorable reimbursement relative to prenatal diagnosis and ultrasound necessitates commitment from departmental and hospital leadership. Creating a true national surveillance system that is able to critically evaluate safety gaps and to disseminate lessons learned and recommendations for care improvement will rely on states developing expertise in performing high-quality death reviews. ■

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**SUPPLEMENTARY TABLE 1****Examples of NICHD-funded research on maternal outcomes**

## National surveillance

MacDorman MF, Declercq E, Cabral H, Morton C. Recent increases in the U.S. maternal mortality rate: disentangling trends from measurement issues. *Obstet Gynecol* 2016;128:447-55.

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Wallace ME, Hoyert D, Williams C, Mendola P. Pregnancy-associated homicide and suicide in 37 US states with enhanced pregnancy surveillance. *Am J Obstet Gynecol* 2016;215:364.

## Severe morbidity

Clark SL, Romero R, Dildy GA, et al. Proposed diagnostic criteria for the case definition of amniotic fluid embolism in research studies. *Am J Obstet Gynecol* 2016;215:408-12.

Grobman WA, Bailit JL, Rice MM, et al. Frequency of and factors associated with severe maternal morbidity. *Obstet Gynecol* 2014;123:804-10.

Belfort MA, Saade GR, Thom E, et al. A randomized trial of intrapartum fetal ECG ST-segment analysis. *N Engl J Med* 2015;373:632-41.

Reddy UM, Rice MM, Grobman WA, et al. Serious maternal complications after early preterm delivery (24-33 weeks' gestation). *Am J Obstet Gynecol* 2015;213:538.

## Risk prediction

Coviello EM, Grantz KL, Huang CC, Kelly TE, Landy HJ. Risk factors for retained placenta. *Am J Obstet Gynecol* 2015;213:864.

Downes KL, Hinkle SN, Sjaarda LA, Albert PS, Grantz KL. Previous prelabor or intrapartum cesarean delivery and risk of placenta previa. *Am J Obstet Gynecol* 2015;212:669.

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Arkema EV, Palmsten K, Sjowall C, Svenungsson E, Salmon JE, Simard JF. What to expect when expecting with systemic lupus erythematosus (SLE): a population-based study of maternal and fetal outcomes in SLE and pre-SLE. *Arthritis Care Res (Hoboken)* 2016;68:988-94.

McCall-Hosenfeld JS, Phiri K, Schaefer E, Zhu J, Kjerulff K. Trajectories of depressive symptoms Throughout the peri- and postpartum period: results from the First Baby Study. *J Womens Health (Larchmt)* 2016;25:1112-21.

Lannon SM, Guthrie KA, Vanderhoeven JP, Gammill HS. Uterine rupture risk after periviable cesarean delivery. *Obstet Gynecol* 2015;125:1095-100.

## Optimal delivery timing

Frolova AI, Stout MJ, Tuuli MG, Lopez JD, Macones GA, Cahill AG. Duration of the third stage of labor and risk of postpartum hemorrhage. *Obstet Gynecol* 2016;127:951-6.

Kawakita T, Reddy UM, Iqbal SN, et al. Duration of oxytocin and rupture of the membranes before diagnosing a failed induction of labor. *Obstet Gynecol* 2016;128:373-80.

Grobman WA, Bailit J, Lai Y, et al. Association of the duration of active pushing with obstetric outcomes. *Obstet Gynecol* 2016;127:667-73.

## Long-term outcomes

Williams K, Sassler S, Addo F, Frech A. First-birth timing, marital history, and women's health at midlife. *J Health Soc Behav* 2015;56:514-33.

Cirillo PM, Cohn BA. Pregnancy complications and cardiovascular disease death: 50-year follow-up of the Child Health and Development Studies pregnancy cohort. *Circulation* 2015;132:1234-42.

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