Gerard W Ostheimer Syllabus

What's New in Obstetric Anesthesia in 2018

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#SOAPAM2019

During the SOAP Annual conference, the What's New in Obstetric Anesthesia Lecture presents novel and relevant publications from the preceding year. This Lecture was first given in 1975 and since 1995 has been named in honor of Gerard W Ostheimer. The 2019 Ostheimer Lecture and the enclosed accompanying Syllabus present articles published throughout the 2018 calendar year.

Objective: Readers will identify novel and updated areas of research related to maternal care during pregnancy, labor and the postpartum period. Significant themes in this Syllabus are maternal morbidity and mortality; spinal hypotension; and postpartum care.

Journal Selection: The highest impact journals in Obstetrics and Gynecology, Anesthesia, General Medicine, Critical Care, Pain and Healthcare Services were selected for monthly review of the Table of Contents (see List below) throughout 2018. Additional Journals were searched according to keywords "maternal" and "pregnancy" to identify relevant publications during 2018. Finally this search was supplemented using Obstetric Anesthesia Digest, Joanne Douglas's Monthly OB Division News, F1000, Twitter, and other media sources. Almost 1200 articles published in 2018 were downloaded and managed using Windows folders.

Manuscript Selection: Priority was given to Original Articles in high impact journals, particularly those that present a novel finding, impact clinical practice, represent a technical advance, an interesting hypothesis (F1000 recommendation classifications) or "grabbed my attention". Given the huge number of high quality Original Articles published in the highest ranking medical journals during 2018, the selection was a major challenge. Manuscripts selected are mostly Original Articles, plus Important Guidelines and must-read Review Articles. They are accompanied where available by Editorials, Practice Guidelines and Infographics. In some cases a related Supplementary Commentary from a prominent general medical journal is also presented. Studies are presented with design, dates, primary outcome, and for prospective studies, n=number of patients analyzed for the primary outcome. Hyperlinks to relevant webpages are in blue font.

Manuscript Topic Categories are listed in descending order according to the number of downloaded manuscripts: Maternal Morbidity & Mortality; Hypertensive Disorders of Pregnancy and Preeclampsia; Neonatal Outcomes; Cesarean Delivery; Delivery Outcomes; Hemorrhage and Hematological Disease; Postpartum Period; Infectious Diseases; Labor Analgesia; Cardiovascular Morbidity; Opioids and Cannabis; Placenta Accreta Spectrum; Spinal Hypotension; Venous Thromboembolism; Ultrasound in Obstetric Anesthesia; Simulation.

I am grateful to all the authors of the manuscripts published in 2018 that relate to Obstetric Anesthesia, to the care of women and their optimal passage through pregnancy, labor and the postpartum period. The time and effort invested by all authors in pursuit of better care for pregnant women and their babies is manifest and wonderful. I regret all the work that could not be included in this focused Syllabus and the accompanying Lecture, despite their novelty, impact and importance to our specialty.

Journals searched using Table of Contents (*denotes Journals searched according to Keywords "maternal"; "pregnancy")

ANESTHESIA: Anesthesiology; British Journal of Anaesthesia (BJA); Pain; Anaesthesia; Regional Anaesthesia and Pain Medicine; European Journal of Anaesthesiology
Anesthesia and Analgesia (A & A); International Journal of Obstetric Anesthesia (IJOA); Canadian Journal of Anesthesia (CJA); Clinical Journal of Pain; European Journal of Pain; Pain Medicine; Acta Anaesthesiologica Scandinavica; Current Opinion in Anesthesiology; Journal of Pain

OBSTETRICS and GYNECOLOGY: American Journal of Obstetrics and Gynecology; Obstetrics and Gynecology; British Journal of Obstetrics and Gynecology (BJOG); Acta Obstetrica et Gynecologica Scandinavica

GENERAL MEDICINE: New England Journal of Medicine (NEJM); The Lancet; Journal of the American Medical Association (JAMA); British Medical Journal; Annals of Internal Medicine*

CARDIAC: European Journal of Heart*; Journal of American College of Cardiology*; Hypertension; Circulation; Heart*; Stroke; Journal of the American Heart Association; JAMA Heart*

CRITICAL CARE: Critical Care Medicine*; Intensive Care Medicine*; Resuscitation; Critical Care*; Annals of Emergency Medicine*

PEDIATRICS: JAMA Pediatrics*; Pediatrics*; American Journal of Perinatology

PSYCHIATRY: American Journal of Psychiatry*

HEMATOLOGY: Blood; British Journal of Hematology; Transfusion

SIMULATION: Simulation in Healthcare; British Medical Journal Simulation; Advances in Simulation; British Medical Journal Quality and Safety; BMJ Simulation and Technology Enhanced Learning

OTHERS: The Cochrane Library; Lancet Global Health*; MMWR morbidity mortality weekly report; Journal of Clinical Epidemiology*

Pain journals searched by Sharon Orbach-Zinger; **Simulation** journals searched by Gill Abir

SYLLABUS TABLE OF CONTENTS

ABBREVIATIONS

ACOG American College of Obstetricians & Gynecologists
ADP accidental dural puncture
AFE amniotic fluid embolism
AGA appropriate for gestational age
AHI apnea hypopnea index
AMB automatic mandatory bolus
aOR adjusted Odds Ratio
ART assisted reproductive therapy
ASRA American Society of Regional Anesthesia & Pain Medicine
AUC area under the curve
bd twice daily
BMI body mass index
BP blood pressure
CBC complete blood count
CD cesarean delivery
CDC Center for Disease Control
CEI continuous epidural infusion
CI confidence intervals
CNS central nervous system
CO cardiac output
COX-2 cyclooxygenase-2
CTPA computerized tomography pulmonary angiogram
CPR cardiopulmonary resuscitation
CROWN Core Outcomes in Women's and Newborn Health
CSF cerebrospinal fluid
CSRD clinically significant respiratory depression
CVA cerebrovascular accident
CVD cardiovascular disease
CVS cardiovascular system
DB David Bogod
DIC disseminated intravascular coagulation
DTI decision-to-incision time
EBC Each Baby Counts
EBL estimated blood loss
EBP epidural blood patch
ECG electrocardiography
ECV external cephalic version
EPDS Edinburgh postpartum depression score
ESA European Society of Anaesthesiologists
ER emergency room
EV epidural volume
FHR fetal heart rate
FIGO International Federation of Gynecology & Obstetrics
FXI Factor XI
GA general anesthesia
HIE hypoxic ischemic encephalopathy
HR heart rate
ICU intensive care unit
IM intramuscular
IONV intraoperative nausea and vomiting
IR invasive radiology
IUGR intrauterine growth retardation
IV intravenous
LAST local anesthetic systemic toxicity
LMWH low molecular weight heparin
MD mean difference
MFMU Maternal-Fetal Medicine Units
MMR Maternal Mortality Review
MRI magnetic resonance imaging
NAP national audit project
NE neonatal encephalopathy
NICU neonatal intensive care unit
NPV negative predictive value
NSAID non-steroidal anti-inflammatory agent
od once daily
OR Odds Ratio
ORII operating-room-to-decision intervals
OSA obstructive sleep apnea
PAS placenta accreta spectrum
PCA patient controlled analgesia
PCEA patient controlled epidural analgesia
PDPH postdural puncture headache
PE pulmonary embolism
PIEB programmed intermittent epidural bolus
PIP percent change in pain
PlGF placental growth factor
POCUS point of care ultrasound
PPD postpartum depression
PPH postpartum hemorrhage
PPV positive predictive value
PTT partial thromboplastin time
QL quadratus lumborum
QST quatitive sensory testing
RCT randomized controlled trial
RD respiratory depression
ROC receiver operated characteristic
RCOG Royal College of Obstetricians & Gynaecologists
RD risk difference
ROSC return of spontaneous circulation
RR Relative risk
SBP systolic blood pressure
SD standard deviation
SEH spinal epidural hematoma
sFlt-1 soluble fms-like tyrosine kinase 1
SMFM Society of Maternal Fetal Medicine
SOB shortness of breath
SOMA Slow Off-rate Modified Aptamer
SPG sphenopalatine ganglion block
SQ subcutaneous
SSI surgical site infection
TAP transabdominus plane
TGCS Ten-Group Classification System
TPR total peripheral resistance
TXA tranexamic acid
UA umbilical artery
UFH unfractionated heparin
UK United Kingdom
US United States
VD vaginal delivery
VTE venous thromboembolism
WHO World Health Organization

MATERNAL MORTALITY

1.The California Pregnancy-Associated Mortality Review. Report from 2002-2007 Maternal Death Reviews. *Sacramento: California Department of Public Health, Maternal, Child and Adolescent Health Division* 2017, Spring 2018

California Maternal Mortality Review (2002-07)
Women presented in this maternal mortality review died during labor and up to 1 year postpartum in California (n>1000). According to data identified through the in-depth review, many maternal mortality cases would have been attributed to preeclampsia, if the death certificates were used to attribute cause of death. Clinical warning signs were ignored or recognized late, and institutions were not ready for obstetric emergencies. Although most women who died were considered "not low risk" meaning they had some comorbidities, the review committee considered that 41% of the deaths were potentially preventable. Examples of potentially preventable deaths included untreated hypertension, delayed recognition of PPH, and no VTE prophylaxis. Importantly, recognition of the rise in maternal death rates from 1999 led to strategies to tackle maternal deaths through investments in maternal public health care and toolkits. Subsequently a decline in maternal death rate was reported from 2008.

2.Illinois Maternal Morbidity and Mortality Report. *Illinois Department of Public Health*: October 2018

Illinois Maternal Mortality Review (2015)
Deaths related to pregnancy (n=37) and to violent causes (n=28) were reviewed in this first MMR from the State of Illinois. Advanced maternal age, higher BMI, high school education only, and Medicaid insurance were associated with higher likelihood of maternal death. The death certificate listed a cause of death that was considered by the review to be incorrect in 61% of cases. Therefore if only death certificates are used, the cause of death would be wrongly attributed. Need for a continuum of care throughout the antenatal and postpartum periods, non-fragmented care between the different providers and a high index of suspicion postpartum were emphasized.

3.McCaw-Binns AM, Campbell LV, Spence SS. **The evolving contribution of non-communicable diseases to maternal mortality in Jamaica, 1998-2015: a population-based study**. *BJOG* 2018, 125(10): 1254-1261

Jamaica Maternal Mortality Review (1998-2015)
Jamaica, a middle income country, has performed MMRs based upon the UK confidential enquiries since 1998. This report compared three periods: 1998-2003, 2004-9 and 2010-15, and found that maternal deaths are rising, mainly attributed to indirect disease such as cardiac comorbidity, while hypertensive disease of pregnancy is an important yet decreasing cause of maternal mortality in Jamaica. The report highlights the importance of surveillance for late deaths (up to 365 days after pregnancy) that revealed additional cases of maternal death that would otherwise be missed.

ACCOMPANIED BY EDITORIAL: Stokes MJ, Wilkinson JP. **The causes of maternal mortality are changing and preventable**. *BJOG* 2018, 125(10): 1262

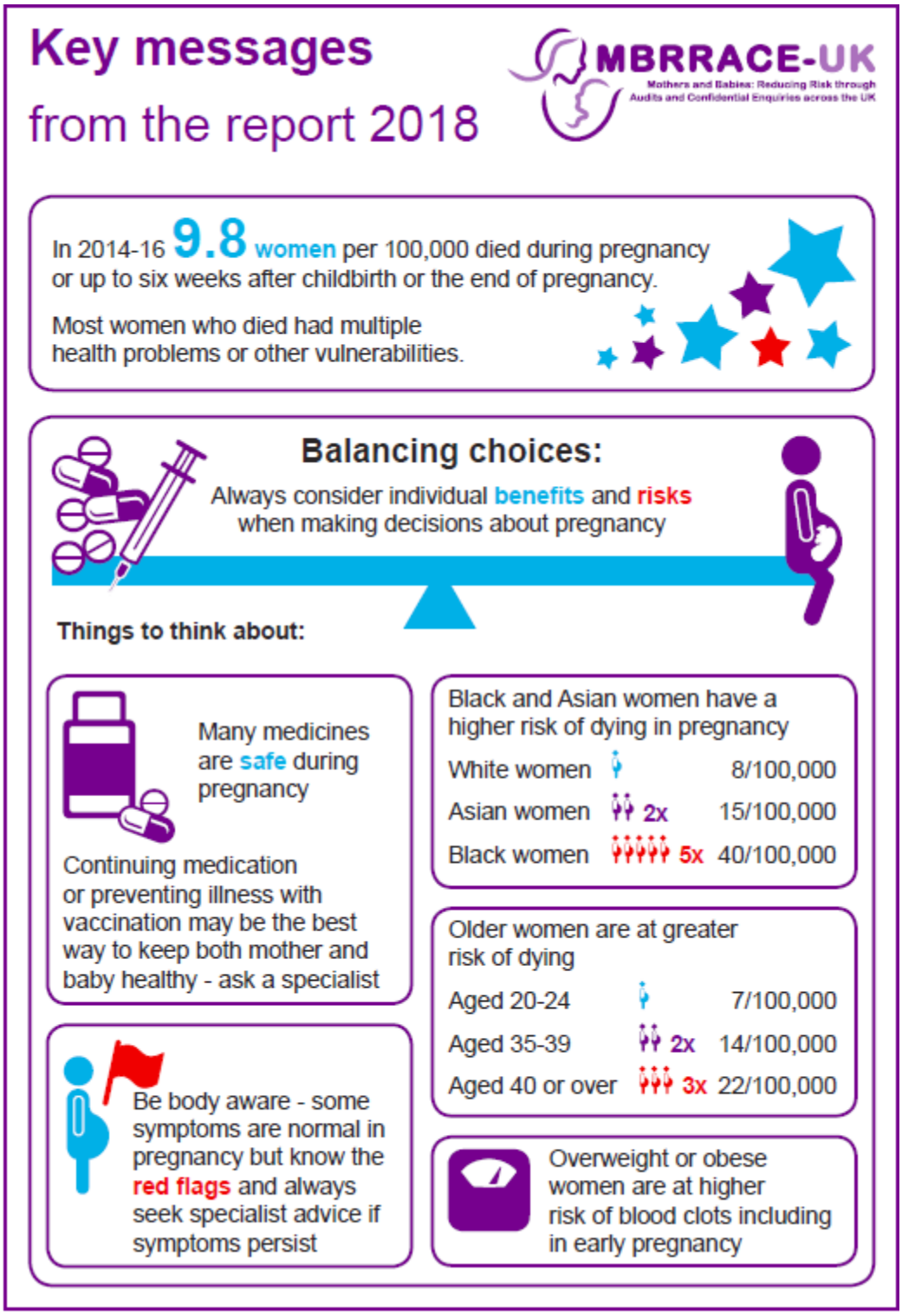
4.Pasha O, McClure EM, Saleem S, Tikmani SS, Lokangaka A, Tshefu A *et al.* **A prospective cause of death classification system for maternal deaths in low and middle-income countries: results from the Global Network Maternal Newborn Health Registry**. *BJOG* 2018, 125(9): 1137-1143

Prospective population based observational study (2014-16)
MMR (diagnostic autopsy) is the optimal method to assign cause of death (COD), yet this is challenging to perform. In 7 low-to middle income countries, COD for maternal death is recorded by the health worker (often untrained in clinical diagnosis). This COD was compared to an algorithm-COD applied by trained registry staff. The algorithm has 9 diagnostic options, and assigns COD according to clinical signs and symptoms. The highest level of agreement between health worker and the algorithm-COD was for hemorrhage and the lowest was for infection. 22 women had COD assigned as anemia by the health worker (not a WHO recognized COD). This study provides insight into the challenges to verify maternal COD.

ACCOMPANIED BY EDITORIAL: Mathai M. **To reduce maternal mortality, we must know and respond to women's personal stories.** *BJOG* 2018, 125(9): 1144

5.Knight M, Nair M, Tuffnell D, Kenyon S, Shakespeare J, Brocklehurst P, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. **Saving Lives, Improving Mothers' Care: Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2014–16**. *Oxford: National Perinatal Epidemiology Unit, University of Oxford, 2018*:

Maternal death rates from direct causes in the UK were unchanged in this MBBRACE report 2018. Cardiac disease remains the primary cause of death, and VTE was the second highest cause of maternal death (highest direct cause) up to 42 days postpartum. Suicide was the leading case of direct maternal death up to one year postpartum. Despite free health care available in the UK, ethnic disparities were highlighted in this report.



The anesthesiologist can impact mortality and morbidity outcomes

6.McQuaid E, Leffert LR, Bateman BT. **The role of the anesthesiologist in preventing severe maternal morbidity and mortality**. *Clin Obstet Gynecol* 2018, 61(2): 372-386

The role of the obstetric anesthesiologist in crises situations includes airway management, vascular access, blood product administration and transthoracic echocardiography. This excellent and clear review presents updates on difficult airway and pulmonary aspiration, and neuraxial complications including (headache, total spinal, intravascular local anesthesia injection, epidural hematoma, epidural abscess and meningitis.

Maternal Mortality: What Can **#OBAnes** Do?

CARDIOVASCULAR DISEASE

Quick Stats

- Leading cause of maternal death in the US
- Risk Factors for Mortality: Pre-existing disease, substance misuse, African American race
- 15% of presenting patients have no prior conditions

What Can We Do?

- Be an active member of the multidisciplinary team in the perinatal period
- Recognize and respond to symptoms
- Explore the utility of point of care TTE for this patient population

HEMORRHAGE

Quick Stats

- Defined as cumulative blood loss of at least 1000mL or blood loss accompanied by signs/symptoms or hypovolemia within 24 h following the birth process
- Mortality is often deemed preventable
- Structured based team response improves outcomes

What Can We Do?

- Design/implement a stage based hemorrhage plan with other disciplines
- Provide early and aggressive management
- Examine effectiveness of laboratory-guided transfusion for improved maternal outcome

HYPERTENSIVE DISORDERS

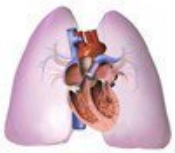
Quick Stats

- Sixth leading cause of maternal mortality
- Uncontrolled hypertension is the most important risk factor for stroke in patients with preeclampsia
- Hypertensive crisis and failed airways are more common in women with preeclampsia

What Can We Do?

- Consider developing a Severe Pre-eclampsia-Eclampsia Box with emergency medications
- Use neuraxial analgesia when possible
- Research pathophysiologic mechanisms of disorders and their physiologic effects

VENOUS THROMBOELMBOLISM



Quick Stats

- Cause specific mortality ratio has increased by 50% over the past 20 years
- DVT is 15 times more likely to occur in the postpartum period than in pregnancy
- Thromboprophylaxis is the most important modifiable strategy to reduce death

What Can We Do?

- Collaborate with care team to develop strategies for prophylaxis that do not impede the use of neuraxial analgesia/anesthesia
- Provide invasive monitoring and critical care support when needed
- Investigate the hematologic effects of anticoagulants in pregnancy and postpartum

ANESTHESIA RELATED

Quick Stats

- Most cases occur in cesarean deliveries
- Most airway disasters occur in the peri-extubation period and in the recovery unit
- Often deemed preventable: medication error, miscommunication, inadequate supervision, and inadequate monitoring as root causes

What Can We Do?

- Identify latent safety threats; participate in multidisciplinary performance improvements
- Ensure optimal communication between personnel by using techniques such as check backs and closed loop communication
- Evaluate monitoring strategies and decision tree algorithms for post-partum care

Abir G, Mhyre J. Maternal mortality and the role of the obstetric anesthesiologist. Best Pract Res Clin Anaesthesiol 2017;31:91–105.
McQuaid E, Leffert LR, Bateman BT. The Role of the Anesthesiologist in Preventing Severe Maternal Morbidity and Mortality. Clin Obstet Gynecol 2018.
Hameed AB, Lawton ES, McCain CL, et al. Pregnancy related cardiovascular deaths in California: beyond peripartum cardiomyopathy. Am J Obstet Gynecol 2015;213:379.e1e379.e10
ACOG. reVITALize obstetric data definitions. 2016 (23 December 2016). Available from: http://www.acog.org/About ACOG/ACOG Departments/Patient Safety and Quality Improvement/reVITALize Obstetric Data Definitions. [Accessed 3/15/2018]
Wilkinson H, Trustees and Medical Advisers. Saving mothers' lives. Reviewing maternal deaths to make motherhood safer: 2006 2008. BJOG 2011;118:1402 3 4.
Creanga AA, Berg CJ, Syverson C, et al. Pregnancy related mortality in the United States, 2006e2010. Obstet Gynecol 2015; 125:5e12.
Mhyre JM, Riesner MN, Polley LS, et al. A series of anesthesia related maternal deaths in Michigan, 1985e2003. Anesthesiology 2007;106:1096e104.

Infographic
@dkatz621

Amniotic fluid embolism

7.Bonnet MP, Zlotnik D, Saucedo M, Chassard D, Bouvier-Colle MH, Deneux-Tharaux C *et al.* **Maternal death due to amniotic fluid embolism: A national study in France**. *Anesth Analg* 2018, 126(1): 175-182

French Maternal Death Review (2007-11)
A review of 36 women with AFE comprising 1:10 maternal deaths in France, 0.95/100, 000 live births. SMFM diagnostic research criteria for AFE are hemodynamic/respiratory compromise, DIC, no fever, and within 30 mins of labor/placental delivery. Only 1/3 women exhibited all 4 SMFM criteria; 1 woman had autopsy consistent with AFE despite the cardiac arrest occurring 4 days postpartum. Collapse was the first sign of AFE in 50% of cases and occurred in all but one case. Importantly, although not an SMFM criteria to diagnose AFE, premonitory signs (neurological signs, fainting, and sense of doom) occurred in three-quarters of the women. This review demonstrates that AFE remains a clinical diagnosis.

Cardiac arrest in pregnancy

8.Zelop CM, Einav S, Mhyre JM, Lipman SS, Arafeh J, Shaw RE *et al.* **Characteristics and outcomes of maternal cardiac arrest: A descriptive analysis of Get with the guidelines data**. *Resuscitation* 2018, 132: 17-20

Quality improvement audit (2000-16)
This audit of a non-mandatory reporting system identified maternal cardiac arrests (n=462) among all in-hospital cardiac arrests in the US. Most arrests, 94%, were witnessed, 31% occurred in the delivery suite, and 32% occurred among women without preexisting conditions. Given the high proportion of witnessed arrests, a surprize finding was that the first identified rhythm was PEA in 51% of cases, and VF in only 7%. ROSC occurred in 74% but only 41% survived to hospital discharge.

9.Zelop CM, Einav S, Mhyre JM, Martin S. **Cardiac arrest during pregnancy: ongoing clinical conundrum**. *Am J Obstet Gynecol* 2018, 219(1): 52-61

This review summarizes etiologies and management of maternal cardiac arrest, with emphasis on modifications in pregnant women: multidisciplinary team, aortocaval compression relief by manual uterine displacement, smaller endotracheal tube, and early neonatal delivery (uterine evacuation) after 4-5 minutes of CPR for improved maternal survival after 20 weeks gestation. Finally the role of medical simulation to optimize management for this rare yet catastrophic event is discussed.

MATERNAL MORBIDITY and CO-MORBIDITIES

Rise in maternal morbidity

10.Fingar KR, Hambrick MM, Heslin KC, Moore JE. **Trends and disparities in delivery hospitalizations involving severe maternal morbidity, 2006-2015: Statistical Brief #243**. *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs* 2006

US Statistical Brief (2006-15)
According to the Healthcare Cost and Utilization Project (HCUP) Statistical Brief, severe maternal morbidity in the US from 2006-15 increased 45%. The most common morbidities were blood transfusion, DIC and hysterectomy. Severe morbidity was highest in women aged >40 years, however at all ages, Black mothers had a 115% higher rate of maternal morbidity and this did not change over time. This Statistical Brief corroborates the concerning rise of maternal morbidities and mortalities reported from other US data sources.

Obstetric triage in a low income country

11.Goodman DM, Srofenyoh EK, Ramaswamy R, Bryce F, Floyd L, Olufolabi A *et al.* **Addressing the third delay: implementing a novel obstetric triage system in Ghana**. *BMJ Glob Health* 2018, 3(2): e000623

Impact study (2012-15)
In Accra Ghana, institutional delivery was encouraged for pregnant women, through a government program supported by Kybele. On arrival to the referral hospital women waited in line on a bench, regardless of disease acuity. An obstetric triage system reduced waiting times for initial triage assessment from median (IQR) 40 min (15-100) to 5 min (2-6) ($p<0.001$) over the 5-year intervention. This enabled rapid triage to identify acute cases.

Cardiovascular disease in pregnancy

12.Owens A, Yang J, Nie L, Lima F, Avila C, Stergiopoulos K. **Neonatal and maternal outcomes in pregnant women with cardiac disease.** J Am Heart Assoc. 2018, 7: e009395

Population database (2000-14)
Outcomes for acquired cardiac disease of pregnancy are less well studied than adult congenital heart disease (ACHD). Pregnancies of women with (n=3871) versus without (n=2, 280, 173) cardiac disease were compared. Among women with cardiac disease, four categories of cardiac disease were presented: valvular heart disease (40%), ACHD (35%), cardiomyopathy (17%), and pulmonary hypertension (8%). The primary outcome, maternal major adverse cardiac events (MACE), occurred in 16% of women with cardiac disease and 0.4% without cardiac disease. Among the four cardiac disease categories, 46% of women with cardiomyopathy, 25% with pulmonary hypertension, 10.1% with valvular heart disease and 6.1% with ACHD had MACE.

13. Silversides C, Grewal J, Mason J, Sermer M, Kiess M, Rychel V *et al*. **Pregnancy outcomes in women with heart disease**. J Am Coll Cardiol 2018, 71(21): 2419-2430

Multi-center prospective observational study (1994-2014)
This study included n=1, 938 women with cardiac disease and pregnancies >20 weeks' gestation. The primary study outcome, adverse cardiac events, occurred in 16% of the women; the most common event being arrhythmias. Most cardiac events occurred antepartum. Arrhythmias were most frequently seen in the 2nd trimester, whereas heart failure was more frequent in the 3rd trimester and postpartum. Over the study period, the incidence of arrhythmias was unchanged, however pulmonary edema became less frequent, attributed to better care. The authors updated their risk index, CARPREG II, using a derivation and a validation set from the study cohort.

14.Regitz-Zagrosek V, Roos-Hesselink JW, Bauersachs J, Blomstrom-Lundqvist C, Cifkova R, De Bonis M *et al.* **2018 ESC Guidelines for the management of cardiovascular diseases during pregnancy**. *Eur Heart J* 2018, 39(34): 3165-3241

These guidelines discuss management of CVD during pregnancy. They are substantial, encompassing the description of the pathologies, the effects of pregnant physiology on CVD, and anesthesia considerations. Important sections presented include arrhythmias and their management, and the medication challenges of mechanical valves during pregnancy. VTE considerations are also discussed. Medications administered to these women are presented with the Level of evidence, specifying the updates since the previous 2011 guidelines. This is a well-referenced valuable resource and a supplementary "Ten Commandments" is provided.

ACCOMPANIED BY SUMMARY: Regitz-Zagrosek V. **'Ten Commandments' of the 2018 ESC Guidelines for the management of cardiovascular diseases during pregnancy**. *Eur Heart J* 2018, 39(35): 3269

Cardiovascular disease after pregnancy

15.Brouwers L, van der Meiden-van Roest AJ, Savelkoul C, Vogelvang TE, Lely AT, Franx A *et al.* **Recurrence of pre-eclampsia and the risk of future hypertension and cardiovascular disease: a systematic review and meta-analysis**. *BJOG* 2018, 125(13): 1642-1654
16.Abbasi J. **To Prevent Cardiovascular Disease, Pay Attention to Pregnancy Complications**. *JAMA* 2018, 320(17): 1741-1743

Systematic review and meta-analysis (22 studies) of the CVD risk for women who experienced pregnancies with recurrent preeclampsia versus women with only one pregnancy complicated by preeclampsia. After recurrent preeclampsia, the risk of heart failure was 3-fold higher, the risk of hypertension and ischemic heart disease was 2-3 fold higher, and the risk of CVA 2-fold higher. An Editorial in JAMA commented on the postpartum cardiac risk for women who had gestational hypertension and preeclampsia. Attention to postpartum cardiac morbidities is an important feature of the ACOG "fourth trimester" bulletin.

ACCOMPANIED BY EDITORIAL: Theilen LH. **Pre-eclampsia and cardiovascular risk: comparing apples with apples**. BJOG 2018, 125(13): 1655

ACCOMPANIED BY VIDEO ABSTRACT: https://vimeo.com/rcog/authorinsights15394

Anemia in pregnancy

17.Daru J, Zamora J, Fernandez-Felix BM, Vogel J, Oladapo OT, Morisaki N *et al.* **Risk of maternal mortality in women with severe anaemia during pregnancy and post partum: a multilevel analysis**. *Lancet Glob Health* 2018, 6(5): e548-e554
18.Pasricha S-R, Colman K, Centeno-Tablante E, Garcia-Casal M-N, Peña-Rosas J-P. **Revisiting WHO haemoglobin thresholds to define anaemia in clinical medicine and public health**. *The Lancet Haematology* 2018, 5(2): e60-e62

WHO multinational cross-sectional survey (2010-11)
Severe anemia may contribute to maternal morbidity and mortality, however among antenatal interventions, anemia management is not a priority. This survey was performed across 29 countries using a multistage cluster-sampling strategy detailed in the manuscript (n=12, 470). Women were more likely to die if suffering severe anemia (Hb<7g/dl), adjusted OR 2.36 95%CI 1.60 to 3.48. This relationship between death and severe anemia was strengthened when PPH was removed from the model, OR 4.58 95%CI 2.87 to 7.31. This paper highlights that antenatal anemia management should be a priority in pregnant women. A commentary in another *Lancet* journal discussed the need to update hemoglobin threshold definitions for anemia, because current thresholds (>11 = not anemic; <7 severe anemia) were coined over 50 years ago.

ACCOMPANIED BY EDITORIAL: Young MF. **Maternal anaemia and risk of mortality: a call for action**. *The Lancet Global Health* 2018, 6(5): e479-e480

Cancer in pregnancy

19.de Haan J, Verheecke M, Van Calsteren K, Van Calster B, Shmakov RG, Mhallem Gziri M *et al.* **Oncological management and obstetric and neonatal outcomes for women diagnosed with cancer during pregnancy: a 20-year international cohort study of 1170 patients**. *The Lancet Oncology* 2018, 19(3): 337-346

Multi-national registry (1996-2016)
This study describes obstetric, oncological and neonatal data from an international registry (16 countries, 37 centers) of pregnant women with cancer (n=1170); breast cancer was the most common malignancy. Treatment (chemotherapy and/or surgery) was administered to 67% of pregnant women. Platinum-based and taxane chemotherapy were associated with IUGR and NICU admission respectively. The frequency of fetal malformations was similar to that in the general population. Over the 20-year period chemotherapy was increasingly used during pregnancy for women with cancer, and the live-birth rate increased. Need for NICU admission appears to depend on the

malignancy type. Preterm birth decreased over the study period, attributed to decreased induced early labor. The accompanying Editorial highlights selection bias of women reported to the registry and that oncologic management guidelines cannot be construed from these data.

ACCOMPANIED BY EDITORIAL: Köhler C, Marnitz S. **Cancer in pregnancy: evidence, or still empiricism?** *The Lancet Oncology* 2018, 19(3): 272-274

Diagnosing sleep apnea in extremely obese pregnant women

20.Dominguez JE, Grotegut CA, Cooter M, Krystal AD, Habib AS. **Screening extremely obese pregnant women for obstructive sleep apnea**. *Am J Obstet Gynecol* 2018, 219(6): 613 e611-613 e610

Single-center prospective study (2015-17)
This study aimed to evaluate OSA screening questionnaires in extremely obese pregnant women (n=80). Women with BMI≥40kg/m^2 completed a home sleep test and AHI≥5 events per hour was considered as OSA. Nineteen (24%) extremely obese women had OSA diagnosed using the home sleep test. Questionnaires were not useful to screen for OSA in this extremely obese pregnant population, thus alternative screening strategies are required.

Thrombocytopenia <100, 000 is not gestational

21.Reese JA, Peck JD, Deschamps DR, McIntosh JJ, Knudtson EJ, Terrell DR *et al.* **Platelet counts during pregnancy**. *N Engl J Med* 2018, 379(1): 32-43

Single-center retrospective study (1999-2012)
The occurrence and severity of gestational thrombocytopenia are not known. Women with at least two CBC performed during pregnancy (n=7351) were identified: uncomplicated pregnancies (n=4568), pregnancy complications (n=2586) and preexisting diseases predisposing to thrombocytopenia (n=197). The women with uncomplicated pregnancies were further compared to non-pregnant patients (n=8885). The incidence of platelet count <100,000 per cubic millimeter at any period during pregnancy or labor was 1% in women with uncomplicated pregnancy, 2.3% in women with pregnancy complications, and 18.2% in women with preexisting thrombocytopenia. The incidence of platelet count <80,000 per cubic millimeter at any time during pregnancy or labor was 0.26% in women with uncomplicated pregnancy, 1.2% in women with pregnancy complications, and 9.65% in women with preexisting thrombocytopenia. In most women with uncomplicated pregnancies who had thrombocytopenia of <100,000, this chart review found an alternate reason for thrombocytopenia.

IVF and maternal morbidity

22.Cromi A, Marconi N, Casarin J, Cominotti S, Pinelli C, Riccardi M *et al.* **Maternal intra- and postpartum near-miss following assisted reproductive technology: a retrospective study**. *BJOG* 2018, 125(12): 1569-1578

Prospective cohort study (2005-16)
Women with ART (n=650) were compared to women without ART (22, 803). The frequencies of WHO-defined outcomes: potentially life threatening events; and near misses were significantly higher among women with ART, 27.1% versus 5.7% without; and 2.6 with ART versus 0.3% without respectively. Even after adjusting for confounders including maternal age, multiple gestation, parity and medical comorbidities, ART remained a significant contributor to these outcomes. There were many unknown confounders, however use of a prospective database allowed identification of conditions associated with the primary outcomes that cannot be identified in a population database using ICD-9 codes.

Fathers are involved too

23.Khandwala YS, Baker VL, Shaw GM, Stevenson DK, Lu Y, Eisenberg ML. **Association of paternal age with perinatal outcomes between 2007 and 2016 in the United States: population based cohort study**. *BMJ* 2018, 363: k4372

Retrospective population study (2007-16)
Advanced maternal age has reported associations with adverse maternal and neonatal outcomes. In a population of over 40 million births in the US, fathers aged 45 and older had a 14% increased likelihood that their offspring delivered preterm and the mother had an increased risk of gestational diabetes but not preeclampsia or eclampsia. Analyses were adjusted for the unsurprising collinearity between maternal and paternal age.

Anesthesiologists can impact maternal and neonatal outcomes

24.Lim G, Facco FL, Nathan N, Waters JH, Wong CA, Eltzschig HK. **A review of the impact of Obstetric Anesthesia on maternal and neonatal outcomes**. *Anesthesiology* 2018, 129(1): 192-215

This fantastic thoroughly referenced review updates the reader on labor analgesia and best practice in all areas of anesthesiology involved in the labor process, from labor outcomes, anesthesia interventions for ECV, aspiration risks, CD anesthesia, to postpartum pain and analgesic effects on the fetus, breastfeeding, and depression. The impact of anesthesiology practices on maternal morbidity and mortality are discussed. This is a highly recommended update for contemporary practice of Obstetric Anesthesia.

HYPERTENSIVE DISORDERS of PREGNANCY

International guidelines for hypertensive disorders in pregnancy

25.Brown MA, Magee LA, Kenny LC, Karumanchi SA, McCarthy FP, Saito S *et al.* **Hypertensive disorders of pregnancy: ISSHP classification, diagnosis, and management recommendations for international practice**. *Hypertension* 2018, 72(1): 24-43

Practice recommendations from the International Society for the Study of Hypertension in Pregnancy that summarize the latest clinical practice guidelines. A great repository of acknowledged information and a very useful source. There are several visual aids, including management of hypertensive crisis, classifications of hypertensive disorders of pregnancy and definitions of preeclampsia, and BP follow-up recommendations for postnatal care.

Hypertension treatment in pregnancy

26.Cleary KL, Siddiq Z, Ananth CV, Wright JD, Too G, D'Alton ME *et al.* **Use of antihypertensive medications during delivery hospitalizations complicated by preeclampsia**. *Obstet Gynecol* 2018, 131(3): 441-450

Insurance company database (2006-15)
High blood pressure should be treated during pregnancy to optimize maternal outcomes. The use of antihypertensives among women with preeclampsia (all severities) was investigated during delivery hospitalizations. Among 239,454 women with preeclampsia, 105,409 received an antihypertensive. The most important finding was a decrease in risk of pregnancy associated stroke, contemporaneous to increased antihypertensive use. The range of antihypertensive drugs used included labetalol (oral and IV), hydralazine, nifedipine, and multiple agents. The authors presume that the 2013 ACOG guidelines encouraged use of antihypertensives but noted that the changes predate these.

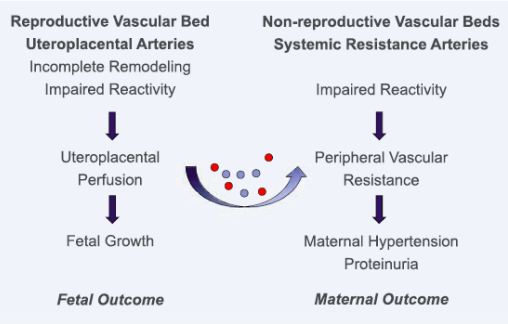
Postpartum stroke occurs among women without hypertensive disorders of pregnancy

27.Too G, Wen T, Boehme AK, Miller EC, Leffert LR, Attenello FJ *et al.* **Timing and Risk Factors of Postpartum Stroke**. *Obstet Gynecol* 2018, 131(1): 70-78

Population database (2013 & 2014, Jan–Oct)
This study identified 1, 505 readmissions within 60 days for postpartum stroke. Most readmissions occurred within 10 days. The risk of postpartum stroke readmission was 24/100, 000 deliveries. An important finding was that only 19% of postpartum strokes occurred in women with known pregnancy associated hypertension.

What's new in preeclampsia?

28.Editors. **Hypertension editors' picks: Preeclampsia, pregnancy, and hypertension.** *Hypertension* 2018, 72(1): e1-e18



The July 2018 issue of *Hypertension* was dedicated to pregnancy, blood pressure and preeclampsia. The issue summarized an array of original articles published in *Hypertension* since 2016 that include the diverse proposed mechanisms, management strategies, disease patterns, subsequent morbidities following pregnancy with preeclampsia, and the elusive hunt for a biomarker or algorithms to reliably predict preeclampsia. The different topics covered are illustrated in the infographic.

Can we predict preeclampsia?

29.Euliano TY, Michalopoulos K, Singh S, Gregg AR, Del Rio M, Vasilopoulos T *et al.* **Photoplethysmography and Heart Rate Variability for the Diagnosis of Preeclampsia**. *Anesth Analg* 2018, 126(3): 913-919

Single-center observational study (dates not reported)
This small study used changes seen in ECG and pulse oximetry waveforms to identify features that may be consistent with preeclampsia. Their model was derived from women with severe preeclampsia (n=37), women with hypertension (n=28) and normotensive women (n=43). Their proposed model had a PPV 0.993 and false-positive rate 0.101. Although no reliable predictor of hypertension and preeclampsia has yet been identified, this study could generate interesting future research and may be useful in lower resource settings.

30.Cerdeira AS, Agrawal S, Staff AC, Redman CW, Vatish M. **Angiogenic factors: potential to change clinical practice in pre-eclampsia?** *BJOG* 2018, 125(11): 1389-1395

This review article discusses angiogenic factors that may be used to predict preeclampsia and an angiogenic state. Measurable angiogenic biomarkers may enter maternal circulation, for example sFlt-1, PlGF, and soluble Endoglin. Clinical biochemistry panels measuring sFlt-1 and free PlGF can reliably exclude preeclampsia (specificity 99%), however positive predictive values are low. It is now 15 years after the

landmark paper (Karumanchi SA; 2003) that first outlined the relationship between the anti-angiogenic sFlt1 and the onset of preeclampsia. This huge leap in understanding has not yet changed clinical practice. This excellent review provides a clear and comprehensive review of the current status of these potential biomarkers in the detection, or prediction of preeclampsia.

ACCOMPANIED BY EDITORIAL: Karumanchi SA. **Angiogenic factors in pre-eclampsia: implications for clinical practice**. *BJOG* 2018, 125(11): 1396

Genetics and preeclampsia

31.Gray KJ, Kovacheva VP, Mirzakhani H, Bjonnes AC, Almoguera B, DeWan AT *et al.* **Gene-Centric Analysis of Preeclampsia Identifies Maternal Association at PLEKHG1**. *Hypertension* 2018, 72(2): 408-416

Multi-national gene-centric case-control study (dates not reported)
The genetic disposition for preeclampsia was investigated among women of European origin with preeclampsia (n=498) and normotensive women (n=1864) from 5 sites in the US. Genetic samples were genotyped according to known cardiovascular genes. One large gene locus, PLEHG1 was identified as a focus for future research. This may be of interest for researchers seeking a genetic predisposition to preeclampsia.

32.Gray KJ, Saxena R, Karumanchi SA. **Genetic predisposition to preeclampsia is conferred by fetal DNA variants near FLT1, a gene involved in the regulation of angiogenesis**. *Am J Obstet Gynecol* 2018, 218(2): 211-218

This review presents some genetic characteristics associated with preeclampsia, such as variants in the Flt-1 focus in the fetus. This is an excellent summary, and provides a good basis to understand future developments in the search for a genetic predisposition to preeclampsia.

Updates in genetics (back to medical school)

33.**ACOG technology assessment in Obstetrics and Gynecology No. 14: Modern Genetics in Obstetrics and Gynecology**. *Obstet Gynecol* 2018, 132(3): e143-e168

ACOG have provided this summary of modern genetics for clinicians caring for women. Although it is primarily intended as a tool to enable counselling and to understand updated concepts, this document explains genetic terminology and models that may relate to preeclampsia and other diseases, in a clear manner.

The brain and the placenta

34.Ciampa E, Li Y, Dillon S, Lecarpentier E, Sorabella L, Libermann TA *et al.* **Cerebrospinal fluid protein changes in preeclampsia**. *Hypertension* 2018, 72(1): 219-226

Single-center prospective observational study (dates not reported)
Data were obtained from CSF in 14 preeclamptic and 14 control women at the time of spinal anesthesia for CD. None of the women had eclampsia. The study used SOMAscan, a proteomic test capable of capturing >1300 proteins from a biological sample for quantitative analysis at a wide range of concentrations. Data are presented as heat maps. Disregarding the huge number of proteins and the small number of subjects, this novel study presents a possible window into the CNS manifestations of preeclampsia. In current clinical practice we lack access to the CSF until performing neuraxial block for CD or labor analgesia, thus limiting the time-window for access to CSF.

ACCOMPANIED BY EDITORIAL: Staff AC, Dechend R. **Preeclampsia: What does the brain tell us? Can we blame the eclampsia risk on a malperfused placenta?** *Hypertension* 2018, 72(1): 65-67

Phenotypes of hypertensive disorders of pregnancy

35.Ferrazzi E, Stampalija T, Monasta L, Di Martino D, Vonck S, Gyselaers W. **Maternal hemodynamics: a method to classify hypertensive disorders of pregnancy**. *Am J Obstet Gynecol* 2018, 218(1): 124 e121-124 e111

Single-center cohort study (secondary analysis) (2009-13)
Maternal CO is typically decreased in early-onset preeclampsia and often associated with poor placentation and IUGR. Conversely in late-onset preeclampsia, CO is typically higher. Women with new onset hypertension (>20 weeks pregnancy) were investigated using bioimpedance cardiac output measurements in the standing position. Hypertensive women were classified according to AGA (n=142) and IUGR (n=41), and a normotensive group (n=33) acted as controls. The primary study outcome was maternal hemodynamics according to AGA and IUGR phenotypes. CO was significantly reduced and TPR was significantly higher for women with IUGR versus AGA, while BP was similar. The authors speculate that women with AGA and IUGR have different hemodynamics; the former having low CO and high TPR while the latter have the opposite. The different phenotypes may require different management strategies.

36.McLaughlin K, Scholten RR, Kingdom JC, Floras JS, Parker JD. **Should maternal hemodynamics guide antihypertensive therapy in preeclampsia?** *Hypertension* 2018, 71(4): 550-556

Not all preeclampsia has the same phenotype. This review discusses the rationale for hemodynamic guided management for women with preeclampsia according to different phenotypes: high TPR/low CO and low TPR/high CO. Some evidence for this differentiation in management strategies is presented, although further research in this area of preeclampsia management according to phenotype is required.

VENOUS THROMBOEMBOLISM

Diagnostic paradigm for pulmonary embolus

37.Righini M, Robert-Ebadi H, Elias A, Sanchez O, Le Moigne E, Schmidt J *et al.* **Diagnosis of pulmonary embolism during pregnancy: A multicenter prospective management outcome study**. *Ann Intern Med* 2018, 169(11): 766-773

Multicenter European multinational prospective study (2008-16)
Validated models to diagnose PE have excluded pregnant women, therefore specific and sensitive tests to confirm PE in pregnancy are lacking. D-dimer is not currently recommended to diagnose PE due to unreliability in pregnant women. This study screened all pregnant women (n=395) with acute onset or worsening SOB/chest pain of unknown cause, for suspected PE. A pre-test probability (low/intermediate or high) was assigned using the Geneva score– not validated in pregnancy. Women with a low/intermediate pre-test probability and negative D-dimer (<500 mcg/L) were defined as negative for PE, were excluded from further testing, and did not receive anticoagulant therapy. Women with high pretest probability or positive D-dimer (≥500 mcg/L) underwent sequential tests for PE. Bilateral compression leg ultrasound was the first test performed, and if negative, a CTPA was performed, and if inconclusive a lung V/Q scan was performed. The primary outcome, VTE risk for women with low pretest probability for PE, was 0.0% (95%CI 0.0% to 1.0%). The authors suggest starting with the Geneva score and D-dimer test for women identified with clinical suspicion for PE, to eliminate women without PE. High risk women should undergo sequential diagnostic tests for PE. This study is notable for the use of D-dimer in pregnancy to exclude women with clinical suspicion for PE. Future research should evaluate standardized combinations of clinical patterns with sequential tests to reliably exclude or diagnose PE.

ACCOMPANIED BY EDITORIAL: Valente AM, Economy KE. **Diagnosing pulmonary embolism during pregnancy: Which test is best?** *Ann Intern Med* 2018, 169(11): 810-811

SOAP consensus statement for venous thromboembolism prophylaxis

38.Leffert L, Butwick A, Carvalho B, Arendt K, Bates SM, Friedman A *et al.* **The Society for Obstetric Anesthesia and Perinatology Consensus Statement on the anesthetic management of pregnant and postpartum women receiving thromboprophylaxis or higher dose anticoagulants**. *Anesth Analg* 2018, 126(3): 928-944

Venous thromboembolism in pregnancy

39.**ACOG Practice Bulletin No. 196: Thromboembolism in pregnancy**. *Obstet Gynecol* 2018, 132(1): e1-e17
ACOG Practice Bulletin No.196: **Thromboembolism in pregnancy: Correction.** *Obstet Gynecol* 2018,132(4):1068

Use of LWMH for VTE prophylaxis is increasingly used for pregnant women. These SOAP guidelines emphasize early assessment of women receiving VTE prophylaxis to enable timely decisions regarding neuraxial block for labor and delivery. Prophylactic doses (≤40 mg od or 30 mg bd) should be stopped 12 hours prior to performing a block; therapeutic doses require a 24 hour stopping period. A 4-6 hour waiting period is recommended after UFH 5000 U SQ bd (previously there was no waiting period). Risk assessment according to 36 experts' opinions of clinical scenarios are presented in the guidelines. Over 75% would perform neuraxial block within 6 hours of UFH 5000U SQ dose, but barely 10% would perform labor epidural within 10 hours of 60 mg od LMWH heparin dose.

ACCOMPANIED BY EDITORIAL: Banayan JM, Scavone BM, Mhyre JM. **Consensus statement on pregnant women receiving thromboprophylaxis: An essential tool to guide our management**. *Anesth Analg* 2018, 126(3): 754-756

40.Horlocker TT, Vandermeuelen E, Kopp SL, Gogarten W, Leffert LR, Benzon HT. **Regional anesthesia in the patient receiving antithrombotic or thrombolytic therapy: American Society of Regional Anesthesia and Pain Medicine evidence-based guidelines (Fourth Edition)**. *Reg Anesth Pain Med* 2018, 43(3): 263-309

These revised guidelines present anticoagulants and management considerations for regional and neuraxial blocks. The guidelines report the very low risk of SEH in the obstetric population; the increased use of VTE prophylaxis; and the protective effect of hypercoagulability in pregnancy. Section 15.2 specifically states that the risk of general anesthesia required in light of the ASRA guidelines may be higher than potential risks of SEH. Thus ASRA guidelines may be modified by clinical necessity to enable neuraxial block in the obstetric population.

41.Ducloy-Bouthors AS, Baldini A, Abdul-Kadir R, Nizard J, for the ESA VTE Guildeines Taskforce. **European guidelines on perioperative venous thromboembolism prophylaxis: Surgery during pregnancy and the immediate postpartum period**. *Eur J Anaesthesiol* 2018, 35(2): 130-133
42.Afshari A, Ageno W, Ahmed A, Duranteau J, Faraoni D, Kozek-Langenecker S *et al.* **European Guidelines on perioperative venous thromboembolism prophylaxis: Executive summary**. *Eur J Anaesthesiol* 2018, 35(2): 77-83

This document is one of ten guidelines for VTE prophylaxis revised in 2018 by the ESA. This guideline focuses on recommendations for women undergoing surgery during and after pregnancy. The ESA recommend that all women undergoing non-obstetric surgery during pregnancy receive VTE prophylaxis until fully mobile (Grade 1C). They recommend that all women undergoing CD (except low risk women undergoing elective CD) receive VTE prophylaxis (duration depends on risk), Grade 2C evidence. 2015 RCOG guidelines recommend that women without VTE history and 2 minor risk factors be *considered* for prophylaxis; and 2018 ACOG guidelines recommend surveillance for low risk women.

ANAPHYLAXIS in PREGNANCY

43.McCall SJ, Bunch KJ, Brocklehurst P, D'Arcy R, Hinshaw K, Kurinczuk JJ *et al.* **The incidence, characteristics, management and outcomes of anaphylaxis in pregnancy: a population-based descriptive study**. *BJOG* 2018, 125(8): 965-971
44. **Overdiagnosis of penicillin allergy leads to costly, inappropriate treatment.** *JAMA* 2018, 320(18): 1846-1848

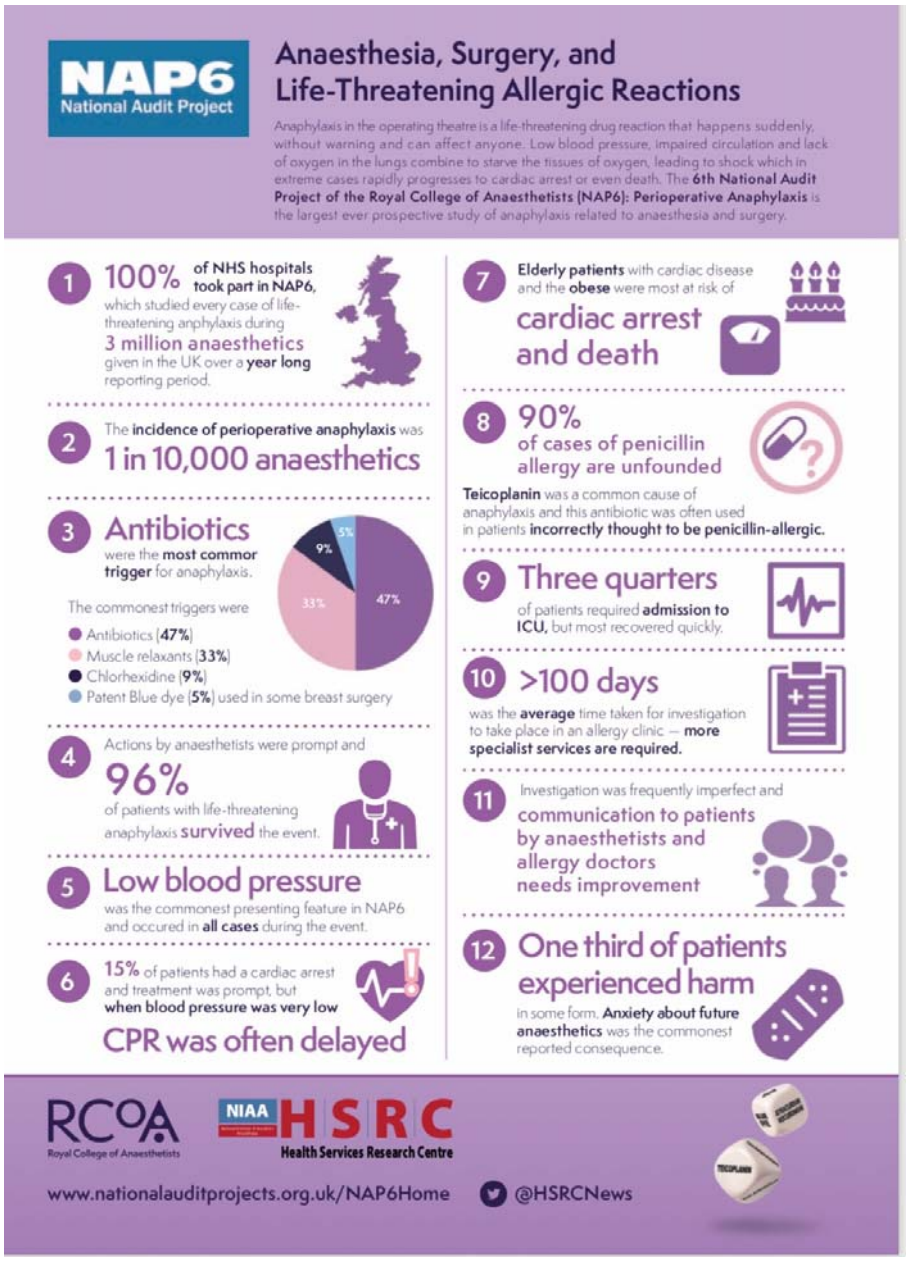
Population-based study (2012-15)
Using a reporting system (UKOSS), 37 cases of anaphylaxis among pregnant women were identified. Ten women had reported penicillin allergy, and 12 women had a reaction to the antibiotic given during the CD. Two of the anaphylaxis cases related to antibiotics were in women with known penicillin allergy. An opinion piece in JAMA reported that 10% of patients are labelled as penicillin allergic but the vast majority are actually not allergic. Since alternatives to penicillin are associated with higher SSI rates, this issue is becoming increasingly important. However, obstetric anesthesiologists may hesitate to test whether a woman is truly penicillin allergic at the time of a CD given the risk of anaphylaxis.

ACCOMPANIED BY EDITORIAL: Eschenbach DA. Obstetricians' awareness associated with better outcomes. *BJOG* 2018, 125(8): 972

No obstetric anaphylaxis cases attributed to antibiotics in the NAP-6 audit

45.Harper NJN, Cook TM, Garcez T, Farmer L, Floss K, Marinho S *et al.* **Anaesthesia, surgery, and life-threatening allergic reactions: epidemiology and clinical features of perioperative anaphylaxis in the 6th National Audit Project (NAP6)**. *Br J Anaesth* 2018, 121(1): 159-171

National audit project (2016)
Chapter 20 of this UK audit of anaphylaxis during surgery specifically discusses obstetric patients and reports a rate of 1.6 per 100, 000 maternities. Among the eight obstetric cases with severe anaphylaxis, six occurred during CD and of the four cases with an identified trigger, none were caused by antibiotics. Although antibiotics were the most frequent cause of anaphylaxis in the NAP-6 report, 90% of the suspected cases of penicillin anaphylaxis were unfounded once testing was done.



INFECTION and ANTIBIOTICS

Infection and antibiotics for cesarean delivery

46.**ACOG Practice Bulletin No. 199: Use of prophylactic antibiotics in labor and delivery**. *Obstet Gynecol* 2018, 132(3): e103-e119

This bulletin outlines recommended antibiotic prophylaxis (not treatment) for laboring women. All women undergoing CD should receive optimally a first generation cephalosporin (1G up to 80 kg, 2G up to 120 and 3G >120 kg) within 60 mins prior to skin incision, and azithromycin should be added to standard regimen if CD is urgent. Women with known penicillin allergy should receive clindamycin plus aminoglycoside.

47.Kawakita T, Huang CC, Landy HJ. **Choice of prophylactic antibiotics and surgical site infections after cesarean delivery**. *Obstet Gynecol* 2018, 132(4): 948-955

Single-center retrospective study (2012-17)
Antibiotics have enabled a reduction in wound complications. Women who received first generation cephalosporin (n=6163) were compared to women who received non-cephalosporin (n=421) antibiotics for CD. Use of non-cephalosporin antibiotics was associated with increased odds of SSI. In addition, use of non-ACOG recommended alternative to cephalosporins further increased the odds of SSI. Women who are penicillin allergic should be thoroughly queried, as use of a non-beta-lactam alternative antibiotic is associated with increased SSI rates.

48.Hermanides J, Lemkes BA, Prins JM, Hollmann MW, Terreehorst I. **Presumed beta-lactam allergy and cross-reactivity in the operating theater: A practical approach**. *Anesthesiology* 2018, 129(2): 335-342

This review summarizes the differences between beta-lactams and the most commonly used alternatives. Cephalosporins have a cross-reactivity with penicillin of around 5.5%. Concerns of anaphylaxis leads to administration of non beta-lactam alternatives such as clindamycin, potentially leading to SSI and Clostridium Difficile. A suggested algorithm is presented in the manuscript for anesthesiologists faced with a patient with suspected or known penicillin sensitivity, and in most cases cefazolin may be administered.

Rise of Clostridium Difficile in obstetric patients

49.Ruiter-Ligeti J, Vincent S, Czuzoj-Shulman N, Abenhaim HA. **Risk factors, incidence, and morbidity associated with obstetric Clostridium Difficile infection**. *Obstet Gynecol* 2018, 131(2): 387-391

Population database (1999-2013)
Antibiotics are administered in labor and delivery to decrease infections, however they may increase the risk of Clostridium Difficile. All women with a birth registered in the NIS with an ICD-9 code for Clostridium difficile were identified (n=2757) and compared to women without a recorded Clostridium Difficile code. The frequency of Clostridium Difficile has increased over the past 15 years among pregnant women.

Vaginal antiseptic preparation prior to cesarean delivery

50.Haas DM, Morgan S, Contreras K, Enders S. **Vaginal preparation with antiseptic solution before cesarean section for preventing postoperative infections**. *Cochrane Database Syst Rev* 2018, 7: CD007892

This updated Cochrane review included 11 trials that evaluated whether vaginal cleaning was associated with lower post-CD infectious morbidity (n=3403). The stronger evidence in this updated review show that vaginal cleansing with antiseptic solutions prior to CD likely reduces the incidence of endometritis. This effect seems to be greater in women who undergo CD after ruptured membranes in labor. Currently neither chlorhexidine nor iodine appear to have superiority.

NEONATAL OUTCOMES

Are maternal medications safe for the fetus?

51.Berard A, Sheehy O, Girard S, Zhao JP, Bernatsky S. **Risk of preterm birth following late pregnancy exposure to NSAIDs or COX-2 inhibitors**. *Pain* 2018, 159(5): 948-955

Population database (1998-2009)
This Canadian cohort study investigated the relationship between premature births, and NSAID and COX-2 inhibitor exposure in the 3 months prior delivery. 156, 531 pregnancies were analyzed: 448 (0.3%) women received NSAIDS/COX-2; naproxen n=215, ibuprofen n=129 were the most frequent. 11, 087 (7%) pregnancies had premature birth; 51 (11%) in the NSAID/COX-2 exposed versus 11, 036 (7%) unexposed pregnancies. After adjustment for confounders (social factors, comorbidities, maternal autoimmune disease), only COX-2 inhibitor use during late pregnancy was associated with a 2-fold increased risk of prematurity, especially celecoxib (OR 3.18, 95% CI 1.64-6.15).

52.Huybrechts KF, Hernandez-Diaz S, Straub L, Gray KJ, Zhu Y, Patorno E *et al.* **Association of maternal first-trimester ondansetron use with cardiac malformations and oral clefts in offspring**. *JAMA* 2018, 320(23): 2429-2437

Population database (2000-12)
Ondansetron may be used in pregnancy, and evidence regarding potential congenital malformations is contradictory. Among 1, 816, 414 pregnant women, 88, 467, 4.9% were exposed to ondansetron in the first trimester and the risk of congenital malformations per 10, 000 births were compared to unexposed pregnancies. The risks for cardiac malformations were similar for exposed and unexposed women. A small increased risk of oral clefts, corresponding to 5 additional cases per 10, 000 exposed births, was noted.

ACCOMPANIED BY EDITORIAL: Haas DM. **Helping pregnant women and clinicians understand the risk of ondansetron for nausea and vomiting during pregnancy**. *JAMA* 2018, 320(23): 2425-2426

53.**ACOG Practice Bulletin No. 189: Nausea And vomiting of pregnancy**. *Obstet Gynecol* 2018, 131(1): e15-e30

This ACOG Bulletin presents effective pharmacologic therapies including ondansetron, phenothiazines for nausea and vomiting during pregnancy. Use of antiemetics seems to be increasing in pregnant women. Insufficient data exist regarding the safety of ondansetron, and women should consider use before 10 weeks only if essential. Ginger is a useful non-pharmacological option.

54.Bateman BT, Heide-Jorgensen U, Einarsdottir K, Engeland A, Furu K, Gissler M *et al.* **Beta-blocker use in pregnancy and the risk for congenital malformations: An international cohort study**. *Ann Intern Med* 2018, 169(10): 665-673

Population databases (Nordic cohort 1996-2010; US cohort 2000-10)
This population database investigated a Nordic and a US cohort, to examine associations between first-trimester β -blocker use and neonatal outcomes including cardiac defects, oral clefts and CNS malformations 1 year after birth. Hypertensive pregnancies with β -blocker exposure versus no antihypertensive drug exposure were examined in the first trimester. A total of 682 (19%) in the Nordic and 1668 (11%) in the US cohort were exposed to β -blockers during pregnancy. The pooled adjusted relative risk (RR) and risk difference (RD) per 1000 persons exposed associated with β-blockers were 1.07 (95% CI, 0.89 to 1.30) and 3.0 (CI, -6.6 to 12.6), respectively, for any major malformation. This suggests that the RR increase for congenital malformations is more modest than previous studies suggested. The accompanying Editorial reiterates that β -blockers should be used in pregnancy as maternal health is vital to fetal health, and untreated hypertension can cause fetal abnormalities.

ACCOMPANIED BY EDITORIAL: Ray JG. **To beta or not to beta? Very likely OK to beta**. *Ann Intern Med* 2018, 169(10): 718

Effects of anesthesia agents on the developing brain: monkey business

55.Raper J, De Biasio JC, Murphy KL, Alvarado MC, Baxter MG. **Persistent alteration in behavioural reactivity to a mild social stressor in rhesus monkeys repeatedly exposed to sevoflurane in infancy**. *Br J Anaesth* 2018, 120(4): 761-767
56.Jevtovic-Todorovic V. **Exposure of developing brain to general anesthesia: what is the animal evidence?** *Anesthesiology* 2018, 128(4): 832-839)

Observational study in primates
Parents may be concerned about the effects of anesthetics on their young children, given the strong evidence in rats of apoptosis and in primates of behavioral disturbances. Monkeys exposed to 3 sevoflurane anesthetics were compared to monkeys separated 3 times from their mother at 2 week intervals from aged 7 days. After 1-2 years monkeys exposed to sevoflurane exhibited similar characteristics except for subtle behavioral changes. The results of the "GAS study" (due in 2019) may establish whether short anesthetic exposure at a young age is safe in young children regarding long term behavioral outcomes.

ACCOMPANIED BY EDITORIAL: Vutskits L, Sneyd JR. **Quest for new drugs: a way to solve anaesthesia neurotoxicity?** *Br J Anaesth* 2018, 120(4): 619-621

Stillbirth subsequent pregnancy outcomes

57.Gravensteen IK, Jacobsen EM, Sandset PM, Helgadottir LB, Radestad I, Sandvik L *et al.* **Healthcare utilisation, induced labour and caesarean section in the pregnancy after stillbirth: a prospective study**. *BJOG* 2018, 125(2): 202-210

Nationwide population cohort study (1999-2008)
Women after stillbirth (n=174), and 2 reference groups: women after live-birth (n=362) and women nulliparous at the birth (n=365) were investigated for healthcare utilization, induced labor and CD. Women after stillbirth had more antenatal visits, ultrasound scans and hospital admissions. Induced labor and CD were more frequent among women after a previous stillbirth. Fear of childbirth was also a significant concern for women after stillbirth. Anesthesiologists have an opportunity to support women during this sensitive time of delivery after a previous stillbirth.

ACCOMPANIED BY EDITORIAL: Silver RM, Siassakos D,Dudley DJ. **Pregnancy after stillbirth: anxiety and a whole lot more.** *BJOG* 2018, 125(2): 211

Fetal cardiotocography does not predict poor neonatal outcomes

58.Frey HA, Liu X, Lynch CD, Musindi W, Samuels P, Rood KM *et al.* **An evaluation of fetal heart rate characteristics associated with neonatal encephalopathy: a case-control study**. *BJOG* 2018, 125(11): 1480-1487

Retrospective case-control study (2006-15)

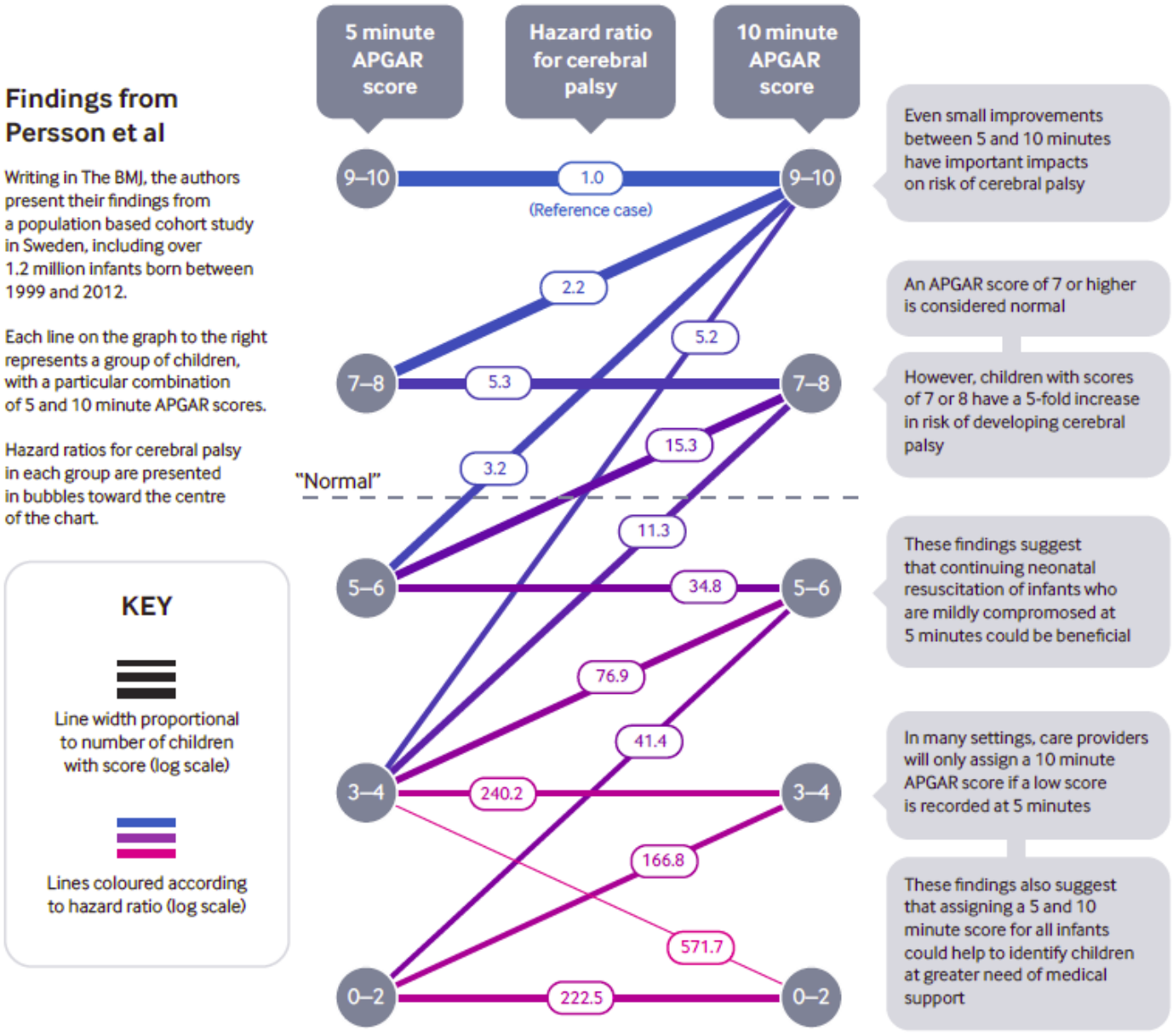
Continuous FHR monitoring tracings during the 30 mins prior to delivery were classified as Category I, II and III according to ACOG guidelines. Newborns with NE (n= 109) were compared to normal newborns (n=233). The primary outcome was aOR, 95% CI for the presence of specific FHR categories and characteristics. Category 1 tracings overall occurred in 42% with NE vs 81% normal newborns; Category 2 occurred in 54% with NE vs 19% in normal newborns and Category 3 occurred in 4% with NE versus no normal newborns. Prior to delivery, most tracings were Category 2, regardless of whether NE was diagnosed or not, however Category 3 tracings appear pathologic. This reinforces prior understandings that Category 3 tracings are relatively rare yet may predict poor outcomes, while the more frequent Category 2 tracings cannot reliably predict poor neonatal outcomes.

ACCOMPANIED BY EDITORIAL: Steer PJ. **Continuous electronic fetal heart rate monitoring in labour is a screening test, not a diagnostic test**. *BJOG* 2018, 125(11): 1488

<u>Can the Apgar score predict cerebral palsy and epilepsy?</u>

59.Persson M, Razaz N, Tedroff K, Joseph KS, Cnattingius S. **Five and 10 minute Apgar scores and risks of cerebral palsy and epilepsy: population based cohort study in Sweden**. *BMJ* 2018, 360: k207

Multi-center population study (1999-2012)
This Swedish study hypothesized that Apgar scores at 5 and 10 minutes may be associated with cerebral palsy and epilepsy diagnosed up to 16 years after birth. Among 213, 470 "non-malformed" live infants born, 1221 had cerebral palsy and 975 had epilepsy. The aOR for cerebral palsy increased steadily as the Apgar scored decreased compared with children with a 5-minute Apgar score of 10. This association was stronger for Apgar scores at 10 -minutes for the outcome cerebral palsy. These associations were also noted, albeit less pronounced, for epilepsy. Lower Apgar score at 10 minutes confers higher risks of cerebral palsy and epilepsy than lower 5 minute Apgar scores.



OBSTETRIC HEMORRHAGE

Uterotonics for a non-cooled environment

60.Widmer M, Piaggio G, Nguyen TMH, Osoti A, Owa OO, Misra S *et al.* **Heat-stable Carbetocin versus oxytocin to prevent hemorrhage after vaginal birth**. *N Engl J Med* 2018, 379(8): 743-752

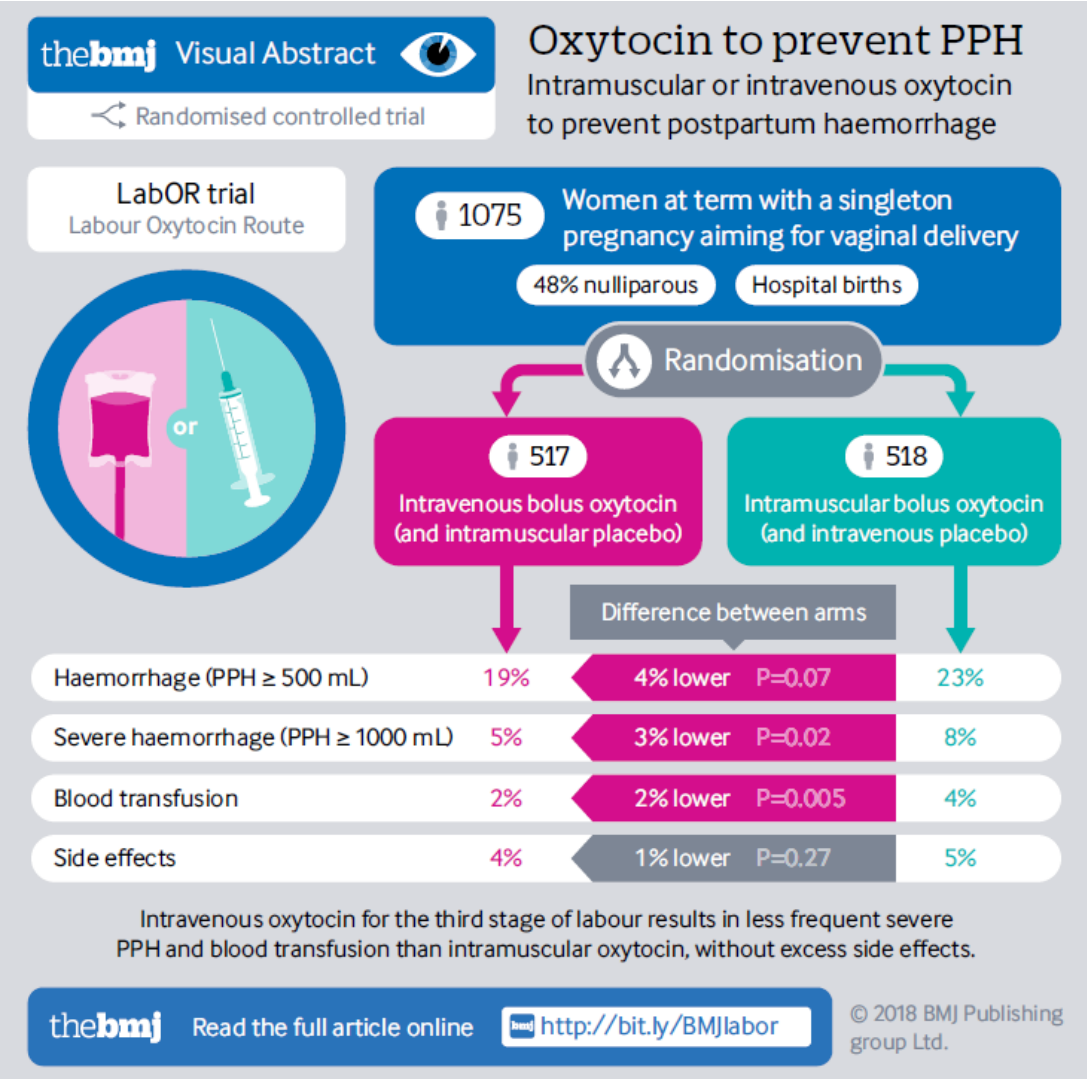
Multi-national non-inferiority randomized controlled trial (2015-18)
Heat-stable carbetocin does not require cold-storage and is currently not included in the WHO PPH prevention guidelines. In 10 countries, women were randomized to receive IM oxytocin 10 units (n=14, 768) vs 100 mcg heat-stable carbetocin (n=14, 771). There were two primary outcomes. The first primary outcome, PPH ≥500 mL measured using a collecting drape and/or additional uterotonic adminstered, occurred in 14.4% with oxytocin versus 14.5% for carbetocin, RR 1.01, 95% CI 0.95 to 1.06. The second primary outcome, EBL ≥1000mL, was nonsignificant yet close to non-inferiority.

ACCOMPANIED BY EDITORIAL: Shakur-Still H, Roberts I. **Finding better ways to prevent postpartum hemorrhage.** *N Engl J Med* 2018, 379(8): 790-792

Uterotonics: Is there an advantage to intramuscular oxytocin?

61.Adnan N, Conlan-Trant R, McCormick C, Boland F, Murphy DJ. **Intramuscular versus intravenous oxytocin to prevent postpartum haemorrhage at vaginal delivery: randomised controlled trial**. *BMJ* 2018, 362: k3546

Single-center randomized controlled trial (2016-17)
After VD, oxytocin can be adminstered IV (recommended by WHO) or IM (recommended by RCOG). Women received 10 units oxytocin immediately after delivery either IV slowly (n=517) over 1 minute or IM in the thigh (n=518). The primary outcome, PPH ≥500 mL measured using a collecting bag, was 18.8% for IV oxytocin vs. 23.2% for IM oxytocin; not statistically significant. Secondary outcomes were significant: severe PPH (≥1000 mL) 4.6% vs. 8.1% and blood transfusion 1.5% vs 4.4% for IV versus IM oxytocin respectively. The side effects were not more frequent with IV administration. 10 units IV oxytocin should be adminstered with care, particulary in women with hemodynamic compromise.



Mythbuster: Third-stage tranexamic acid prophylaxis is not beneficial for all women undergoing vaginal delivery

62.Sentilhes L, Winer N, Azria E, Senat MV, Le Ray C, Vardon D *et al.* **Tranexamic acid for the prevention of blood loss after vaginal delivery**. *N Engl J Med* 2018, 379(8): 731-742

Multi-center randomized controlled trial (2015-16)
TXA may be useful to prevent PPH after VD. Women received 1G IV TXA (n=1461) or placebo (n=1473) 2-minutes after term VD. The primary outcome, PPH≥500 mL measured using a collecting bag, occurred in 8.1% after TXA and 9.8% after placebo, RR 0.83 95% CI 0.68 to 10.1. TXA is not currently recommended for PPH prophylaxis for VD. However, this study included all women after VD, not just those at high-risk for PPH, and further trials are required for the high risk population.

ACCOMPANIED BY EDITORIAL: Shakur-Still H, Roberts I. **Finding better ways to prevent postpartum hemorrhage.** *N Engl J Med* 2018, 379(8): 790-792

Tranexamic acid for postpartum hemorrhage management is safe and seems effective

63.Gayet-Ageron A, Prieto-Merino D, Ker K, Shakur H, Ageron F-X, Roberts I *et al.* **Effect of treatment delay on the effectiveness and safety of antifibrinolytics in acute severe haemorrhage: a meta-analysis of individual patient-level data from 40, 138 bleeding patients**. *The Lancet* 2018, 391(10116): 125-132

This meta-analysis of 40, 138 bleeding patients evaluated two large RCTs where TXA was administered versus placebo. One study randomized women with PPH, the WOMAN trial (n=20, 011) and the other randomized bleeding trauma patients, the CRASH-2 trial (n= 20, 127). For PPH, TXA administration should not be delayed and should be given as soon as the diagnosis is made; delays were associated with more bleeding, and TXA was not associated with vascular occlusive events in the meta-analysis.

ACCOMPANIED BY EDITORIAL: Dries DJ. **Tranexamic acid: is it about time?** *The Lancet* 2018, 391(10116): 97-98

Increased oxytocin requirements following labor

64.Foley A, Gunter A, Nunes KJ, Shahul S, Scavone BM. **Patients undergoing cesarean delivery after exposure to oxytocin during labor require higher postpartum oxytocin doses**. *Anesth Analg* 2018, 126(3): 920-924

Single-center retrospective study (2015, Jan-Sept)
Among women undergoing CD, women who received oxytocin during labor (n=140) were compared to women without pre-CD oxytocin (n=262). The primary study outcome was maximum infusion rate of oxytocin administered during the third stage and the immediate postpartum period. The maximum infusion dose was selected according to the response to initial oxytocin dose. Women who received oxytocin prior to CD required higher doses of oxytocin more frequently (64%) than women who did not receive pre-CD oxytocin (40%), $p<0.0001$.

Definitions of postpartum hemorrhage

65.Borovac-Pinheiro A, Pacagnella RC, Cecatti JG, Miller S, El Ayadi AM, Souza JP *et al.* **Postpartum hemorrhage: new insights for definition and diagnosis**. *Am J Obstet Gynecol* 2018, 219(2): 162-168

This review highlights that there are several definitions for PPH and vital sign changes associated with PPH, according to 5 major international organizations including FIGO, ACOG, and RCOG. Estimating bleeding volume alone overlooks the clinical condition. Visual estimation delays diagnosis of PPH. The shock index (HR divided by SBP) may improve early identification of women with hypovolemia, and is the focus of some attention in obstetric care.

Intrauterine balloon tamponade should be in the postpartum hemorrhage algorithm

66.Revert M, Rozenberg P, Cottenet J, Quantin C. **Intrauterine balloon tamponade for severe postpartum hemorrhage**. *Obstet Gynecol* 2018, 131(1): 143-149

Retrospective multicenter study (2011-12)
This French study compared two PPH protocols used in two different networks during the same time period. The PPH protocol in one network (n=10 centers) recommended intrauterine balloon tamponade insertion after uterotonic administration, manual removal of placenta and examination/management of delivery trauma, and prior to invasive radiology/other surgical procedures in the management of continuous PPH. The PPH protocol in the other network (n=9) did not mention intrauterine balloon tamponade in the management algorithm. The primary outcome was rate of invasive procedures to manage PPH. The rate of PPH in the balloon using network was 4.5%, and in the other network was 4.1%. The primary outcome was significantly lower in the network recommending intrauterine balloon tamponade. After adjustment, this difference was only significant for women undergoing VD.

High body mass index may not be an important factor in postpartum hemorrhage

67.Butwick AJ, Abreo A, Bateman BT, Lee HC, El-Sayed YY, Stephansson O *et al.* **Effect of maternal body mass index on postpartum hemorrhage**. *Anesthesiology* 2018, 128(4): 774-783

Population database (2008-12)

Previous studies suggested a relationship between BMI and PPH. Pre-pregnancy maternal BMI categories and the relationship with PPH were investigated in a cohort of deliveries in California (n=2,176,673). The rate of PPH was 2.8%, and maternal obesity appeared to have only a modest effect on hemorrhage risk.

Race may be an important factor in postpartum hemorrhage

68.Gyamfi-Bannerman C, Srinivas SK, Wright JD, Goffman D, Siddiq Z, D'Alton ME *et al.* **Postpartum hemorrhage outcomes and race**. *Am J Obstet Gynecol* 2018, 219(2): 185 e181-185 e110

Population database (2012-14)
Race and the association with maternal morbidities associated with PPH were investigated. The primary outcome was maternal morbidity according to 21 CDC maternal morbidity definitions (including shock, stroke, heart failure) and transfusion among women with PPH. The PPH rate was 3.2% among more than 11 million deliveries. Black women were at higher risk for severe morbidity and mortality associated with PPH.

Shock index and lactate can be useful to identify need for massive transfusion

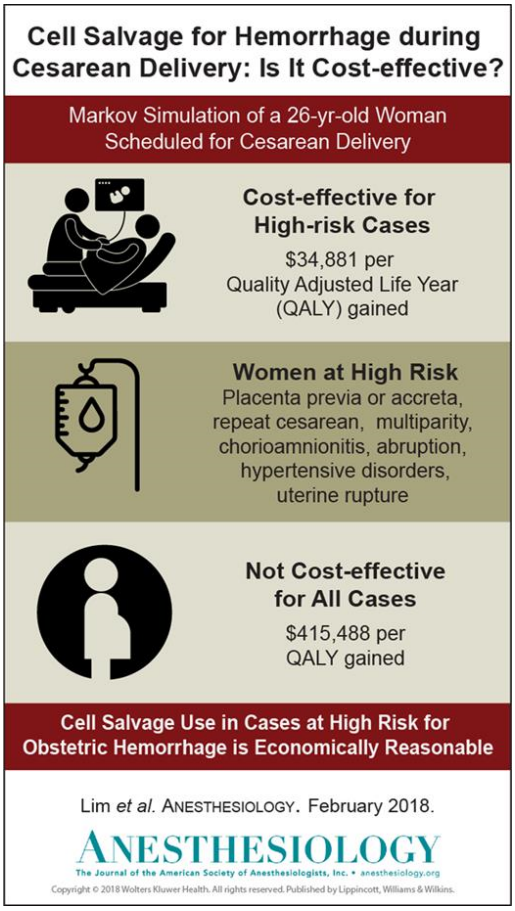
69.Sohn CH, Kim YJ, Seo DW, Won HS, Shim JY, Lim KS *et al.* **Blood lactate concentration and shock index associated with massive transfusion in emergency department patients with primary postpartum haemorrhage**. *Br J Anaesth* 2018, 121(2): 378-383

Single-center retrospective analysis (2004–2015)
Blood lactate >2 mM is a marker of compromised tissue perfusion. Women with PPH who had a blood lactate measurement (n=302) were studied. The primary outcome, massive blood transfusion (dichotomous outcome) >10 units of packed red blood cells within 24 hours of PPH, occurred in 101 women. Median lactate values for all women, regardless of massive blood transfusion were higher than 2 mM, however for women who received massive blood transfusion they were 4.5 mM. Two variables were associated with massive blood transfusion requirement: lactate, OR 1.56, 95% 1.31-1.87) and shock index, OR 10.25 95%CI 3.69 to 28.45. As seen in other populations, high lactate is associated with compromised tissue perfusion. The shock index (HR divided by SBP), used in trauma to identify unstable patients has utility in obstetric hemorrhage and should be investigated further.

Cell saver is safe and cost-effective for high risk cases

70.Lim G, Melnyk V, Facco FL, Waters JH, Smith KJ. **Cost-effectiveness analysis of intraoperative cell salvage for obstetric hemorrhage**. *Anesthesiology* 2018, 128(2): 328-337

This cost-effectiveness model investigated use of cell salvage for three categories: all women undergoing CD, women undergoing CD with high risk of hemorrhage, and no cell saver use. Use of cell salvage is cost effecive for women undergoing CD who are at high risk of hemorrhage.



Basics of blood product compatibility

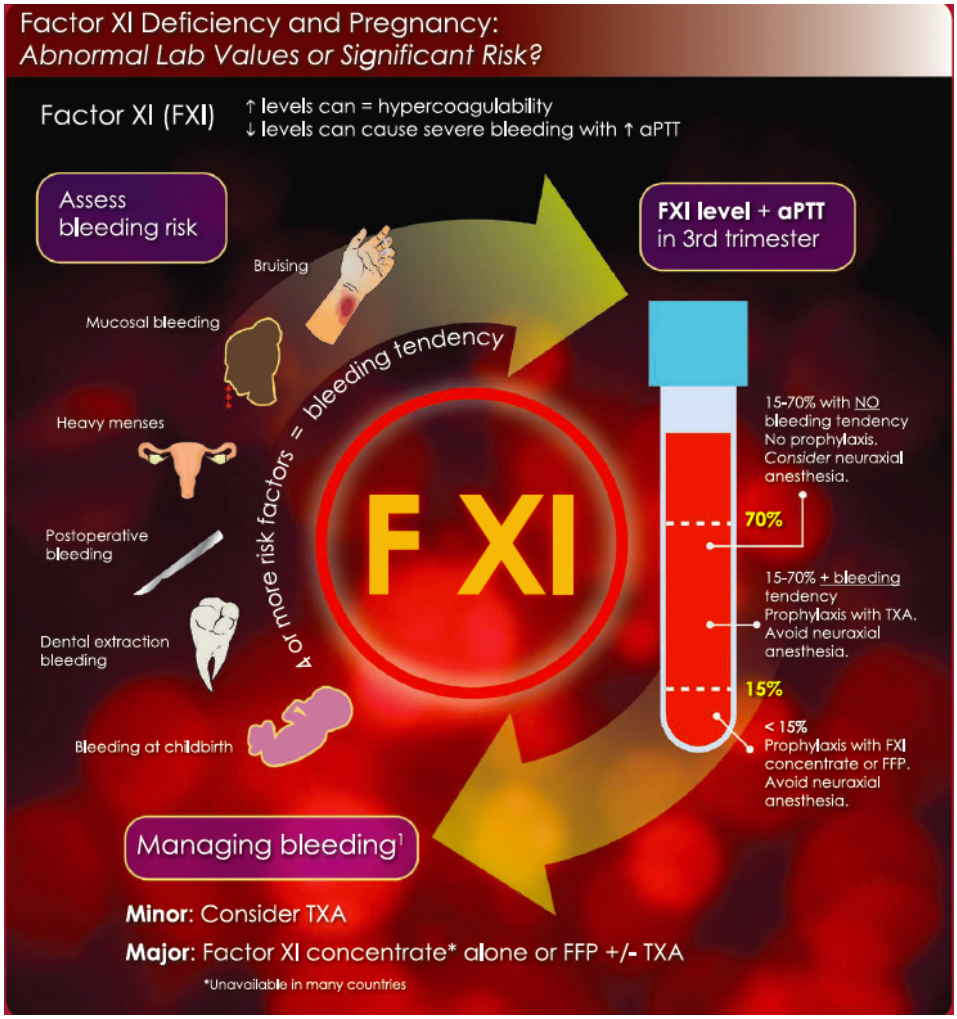
71.Yazer MH, Waters JH, Spinella PC, Cap CA, Fahie CRL, Sr., Gourdine E *et al.* **Use of uncrossmatched erythrocytes in emergency bleeding situations**. *Anesthesiology* 2018, 128(3): 650-656

This clear and relevant review presents updated information about blood bank activities, and tests performed to identify compatible red blood cells. The relatively rare risks of administering uncrossmatched red blood cells are discussed.

Factor XI and labor anesthesia

72.Shander A, Friedman T, Palleschi G, Shore-Lesserson L. **The evolving dilemma of Factor XI in pregnancy: Suggestions for management**. *Anesth Analg* 2018, 126(6): 2032-2037

The authors of this case report and review suggest that women with a known non-bleeding Factor XI deficiency phenotype with Factor XI levels between 15-70% may be considered for neuraxial block. However those with a bleeding or an unknown phenotype and levels below 70% should avoid neuraxial block. Factor XI deficiency is more common than previously thought; homozygotes have levels <15% and heterozygotes have 25-70% or normal values. Importantly, genotype does not predict phenotype thus the bleeding risk may be unknown. Often FXI is discovered after abnormal incidental finding of elevated PTT. Treatment involves TXA, Factor XI concentrate if available and FFP.



CESAREAN DELIVERY

Spinal hypotension

73.Campbell JP, Stocks GM. **Management of hypotension with vasopressors at caesarean section under spinal anaesthesia - have we found the Holy Grail of obstetric anaesthesia?** *Anaesthesia* 2018, 73(1): 3-6

Anesthesiologists have an opportunity to make a direct impact on patient care, as illustrated by this quote from the Editorial accompanying three papers in the January 2018 volume of *Anaesthesia*. "If we were to choose one thing in our obstetric anaesthetic careers which has revolutionized our practice, it would be the introduction of phenylephrine infusions to prevent hypotension during CD under spinal anaesthesia."

74.Kinsella SM, Carvalho B, Dyer RA, Fernando R, McDonnell N, Mercier FJ *et al.* **International consensus statement on the management of hypotension with vasopressors during caesarean section under spinal anaesthesia**. *Anaesthesia* 2018, 73(1): 71-92

This international consensus statement provides a complete update of why and how to prevent hypotension among women undergoing CD with spinal anesthesia. Recommendations for best practice include using phenylephrine rather than ephedrine, administered as prophylaxis rather than therapeutic bolus; with colloid preload or crystalloid co-load and left uterine displacement. The aim is maintenance of SBP≥90% following accurate pre-spinal anesthesia assessment and avoiding <80% baseline measures. No single tactic can predict spinal hypotension; women with pre-eclampsia and women undergoing intrapartum CD experience less spinal hypotension, and women with cardiac disease require individual assessments. The accompanying Editorial asserts that the single-most practice changing element is use of phenylephrine infusions to prevent spinal hypotension.

ACCOMPANIED BY EDITORIAL: Campbell JP, Stocks GM. Management of hypotension with **vasopressors** at caesarean section under spinal **anaesthesia** - have we found the **Holy Grail** of obstetric **anaesthesia**? *Anaesthesia* 2018, 73(1): 3-6

Is spinal hypotension anticipatable?

75.Zieleskiewicz L, Noel A, Duclos G, Haddam M, Delmas A, Bechis C *et al.* **Can point-of-care ultrasound predict spinal hypotension during caesarean section? A prospective observational study**. *Anaesthesia* 2018, 73(1): 15-22

Single-center prospective observational study (2015-6)
Preoperative echocardiography was performed prior to spinal anesthesia for CD (n=40). Using ROC curves, the AUC for the primary outcome, change in velocity time interval (VTI) for supine followed by legs-elevated position, was 0.8 (0.6-0.9) with a PPV 70% and NPV 85%. The authors suggest that assessing the VTI in the two positions can predict spinal hypotension. Future use may be limited as it is not an easily replicable measurement.

ACCOMPANIED BY EDITORIAL: Campbell JP, Stocks GM. **Management of hypotension with vasopressors at caesarean section under spinal anaesthesia - have we found the Holy Grail of obstetric anaesthesia?** *Anaesthesia* 2018, 73(1): 3-6

76.Dyer RA, Emmanuel A, Adams SC, Lombard CJ, Arcache MJ, Vorster A *et al.* **A randomised comparison of bolus phenylephrine and ephedrine for the management of spinal hypotension in patients with severe preeclampsia and fetal compromise**. *Int J Obstet Anesth* 2018, 33: 23-31

Single-center randomized controlled trial (2011-13)
Typically preeclampsia is associated with less spinal hypotension. Phenylephrine is associated with higher umbilical artery pH than ephedrine in healthy women undergoing spinal for CD. Women with severe preeclampsia undergoing CD for non-reassuring heart rate who experienced hypotension after a small fluid bolus were randomized to receive therapeutic boluses of phenylephrine (n=31) versus ephedrine (n=29). The primary outcome, between group comparison of UA base excess, showed mean(SD) UA base excess of -4.9 (3.7) with phenylephrine versus -6.0 (4.6) with ephedrine, a non-significant difference. In women with preeclampsia undergoing CD with a compromised fetus, both phenylephrine and ephedrine can be used to treat spinal hypotension. In the discussion, the authors expounded the particulars of obtaining informed consent in this emergency situation.

77.Higgins N, Fitzgerald PC, van Dyk D, Dyer RA, Rodriguez N, McCarthy RJ *et al.* **The effect of prophylactic phenylephrine and ephedrine infusions on umbilical artery blood pH in women with preeclampsia undergoing cesarean delivery with spinal anesthesia: A randomized, double-blind trial**. *Anesth Analg* 2018, 126(6): 1999-2006

Single-center randomized controlled trial (2006-14)
Prophylactic vasopressor infusions are recommended to avoid spinal hypotension, however these studies were performed in non-preeclamptic women. Women with preeclampsia (mild/severe features) undergoing CD were randomized to receive prophylactic phenylephrine 100 mcg/mL (n=54) versus ephedrine 8mg/mL (n=54); a relative potency 80:1, initiated immediately after spinal anesthesia injection. The primary outcome, UA pH ratio for phenylephrine:ephedrine, was 1.002 (95% CI 0.997 to 1.007). In contrast to studies in non-preeclamptic women, phenylephrine prophylaxis did not confer advantages for fetal acid-base status compared to ephedrine.

Prophylactic vasopressors in preeclampsia

78.Dyer RA, Daniels A, Vorster A, Emmanuel A, Arcache MJ, Schulein S *et al.* **Maternal cardiac output response to colloid preload and vasopressor therapy during spinal anaesthesia for caesarean section in patients with severe pre-eclampsia: a randomised, controlled trial**. *Anaesthesia* 2018, 73(1): 23-31

Single-center randomized controlled trial (2011-13)
Women with preeclampsia or imminent eclampsia symptoms undergoing CD under spinal anesthesia were monitored using non-invasive CO monitor to measure changes in cardiac parameters in response to spinal anesthesia hypotension and the effects of vasopressors. For all 42 enrolled women, increases were noted for CO and HR. Only 20 women experienced hypotension despite the colloid preload and they were randomized to receive phenylephrine bolus (n=10) versus ephedrine (n=10). The primary outcome, mean difference % in cardiac output change following pre-delivery vasopressor administration, was greater in women receiving phenylephrine, corresponding to more effective reversal of maternal hemodynamic changes.

ACCOMPANIED BY EDITORIAL: Campbell JP, Stocks GM. **Management of hypotension with vasopressors at caesarean section under spinal anaesthesia - have we found the Holy Grail of obstetric anaesthesia?** ***Anaesthesia*** **2018, 73(1): 3-6**

Automated prophylactic administration

79.Sng BL, Du W, Lee MX, Ithnin F, Mathur D, Leong WL *et al.* **Comparison of double intravenous vasopressor automated system using nexfin versus manual vasopressor bolus administration for maintenance of haemodynamic stability during spinal anaesthesia for caesarean delivery: A randomised double-blind controlled trial**. *Eur J Anaesthesiol* 2018, 35(5): 390-397

Single-center randomized controlled trial (2013-16)
Women were randomized to receive vasopressor boluses administered by an automated device (DIVA) according to maternal hemodynamics (n=117) versus physician administered vasopressor boluses (n=113). The primary outcome, incidence of maternal hypotension, was measured by continuous non-invasive arterial pressure monitor, and occurred in 39% in the DIVA group versus 58% in the physician administered bolus group, p=0.008.

Prophylactic vasopressors in obesity

80.George RB, McKeen DM, Dominguez JE, Allen TK, Doyle PA, Habib AS. **A randomized trial of phenylephrine infusion versus bolus dosing for nausea and vomiting during Cesarean delivery in obese women**. *Can J Anaesth* 2018, 65(3): 254-262

Multi-center randomized controlled trial (2011-14)
Spinal hypotension studies usually exclude obese woman and do not consider nausea and vomiting as the primary outcome. The primary outcome, incidence of IONV, was investigated in obese women (>35 kg/m^2) randomized to receive therapeutic phenylephrine bolus (n=79) versus prophylactic infusion (n=81). Significantly more women receiving bolus (75%) had IONV than women receiving infusion (46%), RR 0.61 95%CI 0.47-0.08. As expected, there was less hypotension in the infusion group, although in both groups rate of spinal hypotension were unexpectedly higher than in previous similar studies.

ACCOMPANIED BY AN EDITORIAL: Ngan Kee WD. **Preventing hypotension-induced nausea and vomiting during spinal anesthesia for Cesarean delivery in obese parturients: a small solution for a big problem**? *Can J Anaesth* 2018, 65(3): 235-238

Noradrenaline prophylaxis

81.Ngan Kee WD, Lee SWY, Ng FF, Khaw KS. **Prophylactic norepinephrine infusion for preventing hypotension during spinal anesthesia for cesarean delivery**. *Anesth Analg* 2018, 126(6): 1989-1994

Single-center randomized controlled trial (2014-16)
Healthy women undergoing elective CD were randomized to receive either prophylactic norepinephrine 5mcg/mL infusion started at 30mL/hour (n=43) versus 5mcg/mL bolus of therapeutic norepinephrine (n=37) according to a BP protocol. The primary outcome, incidence of BP<80% baseline, occurred in 17% receiving prophylaxis and 66% receiving therapeutic norepinephrine, p<0.001. Prophylactic norepinephrine infusion was associated with less hypotension than treatment. An accompanying Editorial discussed the advantage of norepinephrine due to reduced incidence of bradycardia, and suggests that further investigations of this diluted solution (relative to ICU doses) be undertaken, while acknowledging the reticence currently to use noradrenaline in routine clinical practice.

ACCOMPANIED BY EDITORIAL: Vallejo MC, Zakowski MI. **Old ways do not open new doors: Norepinephrine for first-line treatment of spinal hypotension**. *Anesth Analg* 2018, 126(6): 1809-1811

Believe the patient when she complains of pain during cesarean delivery

82.McCombe K, Bogod DG. **Learning from the Law. A review of 21 years of litigation for pain during caesarean section**. *Anaesthesia* 2018, 73(2): 223-230

This narrative review summarizes obstetric anesthesia negligence cases (n=367) where the author (DB) acted as either defense or plaintiff. Major themes are consent, communication with the patient, testing the block before allowing the surgeon to proceed, and most importantly believing the patient when she says she is in pain. The case vignettes are must-reads.

Does anesthesia mode impact outcomes for Category-1 cesarean delivery?

83.Palmer E, Ciechanowicz S, Reeve A, Harris S, Wong DJN, Sultan P. **Operating room-to-incision interval and neonatal outcome in emergency caesarean section: a retrospective 5-year cohort study**. *Anaesthesia* 2018, 73(7): 825-831

Single-center retrospective study (2010-14)
As opposed to decision-to-delivery time (DTI), operating-room-to-decision intervals (ORII) focus on pure anesthesia time (without decision and transfer times to the OR). This study aimed to determine the effect of the category of CD urgency on the ORII (n=9634 women). ORII median was shortest for Category 1 CD (median=11 mins) and longer for Category 2 (median=21 mins), Category 3 (median=28 mins) and Category 4 (median=33 mins). The effect of anesthesia mode on neonatal outcomes was assessed for Category 1 (most urgent) CD (n=667 women). ORII according to anesthesia mode was: GA=6 mins; epidural top-up=11 mins; spinal=13 mins; CSE=24 mins. Despite shortest ORII, GA was associated with the lowest 5 minute Apgar scores in Category 1 CD. This study collaborates previous findings that faster DTI does not improve neonatal outcome.

Cesarean delivery speed does not improve neonatal outcomes

84.Grobman WA, Bailit J, Sandoval G, Reddy UM, Wapner RJ, Varner MW *et al.* **The association of decision-to-incision time for cesarean delivery with maternal and neonatal outcomes**. *Am J Perinatol* 2018, 35(3): 247-253

Secondary analysis of prospectively collected data (2008-2011)
Women with term singleton non-anomalous cephalic presentation without prior CD who intended to labor in MFMU network hospitals were assessed (n=3482). Maternal composite was PPH, EBL>1000mL, blood transfusion, endometritis, wound infection/separation, operative injury, hysterectomy. Neonatal composite was pH<7. 5-min Apgar<5, HIE, seizures, death. CDs were grouped according to DTI ≤15, 16-30, >30 mins. Among women who had CD for arrest of labor, the neonatal composite morbidity was less frequent after *longer* DTI. For women with fetal indication CD, neonatal composite morbidity was more frequent after *shorter* DTI. There was no demonstrable association between DTI and maternal and neonatal outcomes. Given that desire to shorten the DTI may create pressure to perform GA, it would be interesting to investigate anesthesia mode for these cases.

Anesthesia impacts neonatal outcomes

85.Royal College of Obstetricians and Gynaecologists. **Each Baby Counts: Themed report on anaesthetic care, including lessons identified from Each Baby Counts babies born 2015 to 2017**.

The Neonatal Mortality and Severe Morbidity Review, Each Baby Counts (EBC) was launched in the United Kingdom in 2014 by the Royal College of Obstetricians and Gynaecologists. This 2018 EBC report focused on anesthesia care aspects of 49 newborns who either died or had severe intrapartum brain injury during 2015-2017. The report highlights the need to convey to the anesthesiologist the urgency of CD; that decisions about transfer to the operating room should be made with the anesthesiologist and re-assessed on entering the operating room; that handovers between anesthesiologists will maintain situational awareness. Labor epidurals should be reviewed periodically for efficacy; women's safety should be prioritized over haste to deliver the baby; difficult intubation guidelines should be available; and training levels assured. Anesthesiologists were involved in only 41% of the hospital review boards and the report highlights that all review boards should include an anesthesiologist.

Cesarean delivery rate: too high for some yet too low for others

86.Wiklund I, Malalat AM, Cheung NF, Cadee F. **Lancet. Appropriate use of caesarean section globally requires a different approach**. *Lancet* 2018, 392(10155): 1288-1289
87.**Lancet. Stemming the global caesarean section epidemic**. *Lancet* 2018, 392(10155): 1279
88.Occhi GM, de Lamare Franco Netto T, Neri MA, Rodrigues EAB, de Lourdes Vierira Fernandes A. **Lancet. Strategic measures to reduce the caesarean section rate in Brazil**. *Lancet* 2018, 392(10155): 1290-1291

Series introduction: Optimization of the CD rate is key. Women who require this life saving surgery may be unable to receive it, while unneccsary CDs are being performed in other centers or countries, with detrimental maternal and neonatal consequences. This 3-part series plus Editorials intends to generate debate and research, and presents limitations of current knowledge about optimizing the CD rate.

89.Visser GH, Ayres-de-Campos D, Barnea ER, de Bernis L, Di Renzo GC, Vidarte MFE *et al.* **FIGO position paper: how to stop the caesarean section epidemic**. *Lancet* 2018, 392(10155): 1286-1287

The FIGO position paper is a call to action for governments to unify fees for VD and CD, oblige publication of instituitional CD rates, use the Robson TGCS system to categorize the reasons for CD, and to invest financially in care, logistics and staff and their training. The paper calls for low income countries to address limited access to timely CD and train skilled birth assistants for VD.

90.Boerma T, Ronsmans C, Melesse DY, Barros AJD, Barros FC, Juan L *et al.* **Global epidemiology of use of and disparities in caesarean sections**. *The Lancet* 2018, 392(10155): 1341-1348

Series Part 1: This manuscript discusses disparities of CD availability and optimization of the CD rate among different countries. Although many countries have a CD rate above the WHO recommended 15%, particularly among wealthier women and those with private insurance, in low and middle income countries women and their newborns may suffer morbidity and mortality as CD is not readily available.

91.Sandall J, Tribe RM, Avery L, Mola G, Visser GHA, Homer CSE *et al.* **Short-term and long-term effects of caesarean section on the health of women and children**. *The Lancet* 2018, 392(10155): 1349-1357

Series Part 2: This manuscript discusses the increased maternal mortality and morbidity consequences of CD, and higher risks in subsequent pregnancies. The short and long term effects on newborn health are reviewed.

92.Betrán AP, Temmerman M, Kingdon C, Mohiddin A, Opiyo N, Torloni MR *et al.* **Interventions to reduce unnecessary caesarean sections in healthy women and babies**. *The Lancet* 2018, 392(10155): 1358-1368

Series Part 3: This manuscript discusses interventions such as TOLAC guidelines, active labor management, and ECV, that may decrease CD rates. Educational strategies that may decrease CD rates are discussed. Litigation concerns may increase CD rates and no single strategy may decrease the CD rate. The solutions will be complex, and further research is required. The Robson TGCS is presented as one strategy to compare use of CD within and between countries.

Reducing the cesarean delivery rate in China

93.Liang J, Mu Y, Li X, Tang W, Wang Y, Liu Z *et al.* **Relaxation of the one child policy and trends in caesarean section rates and birth outcomes in China between 2012 and 2016: observational study of nearly seven million health facility births**. *BMJ* 2018, 360: k817

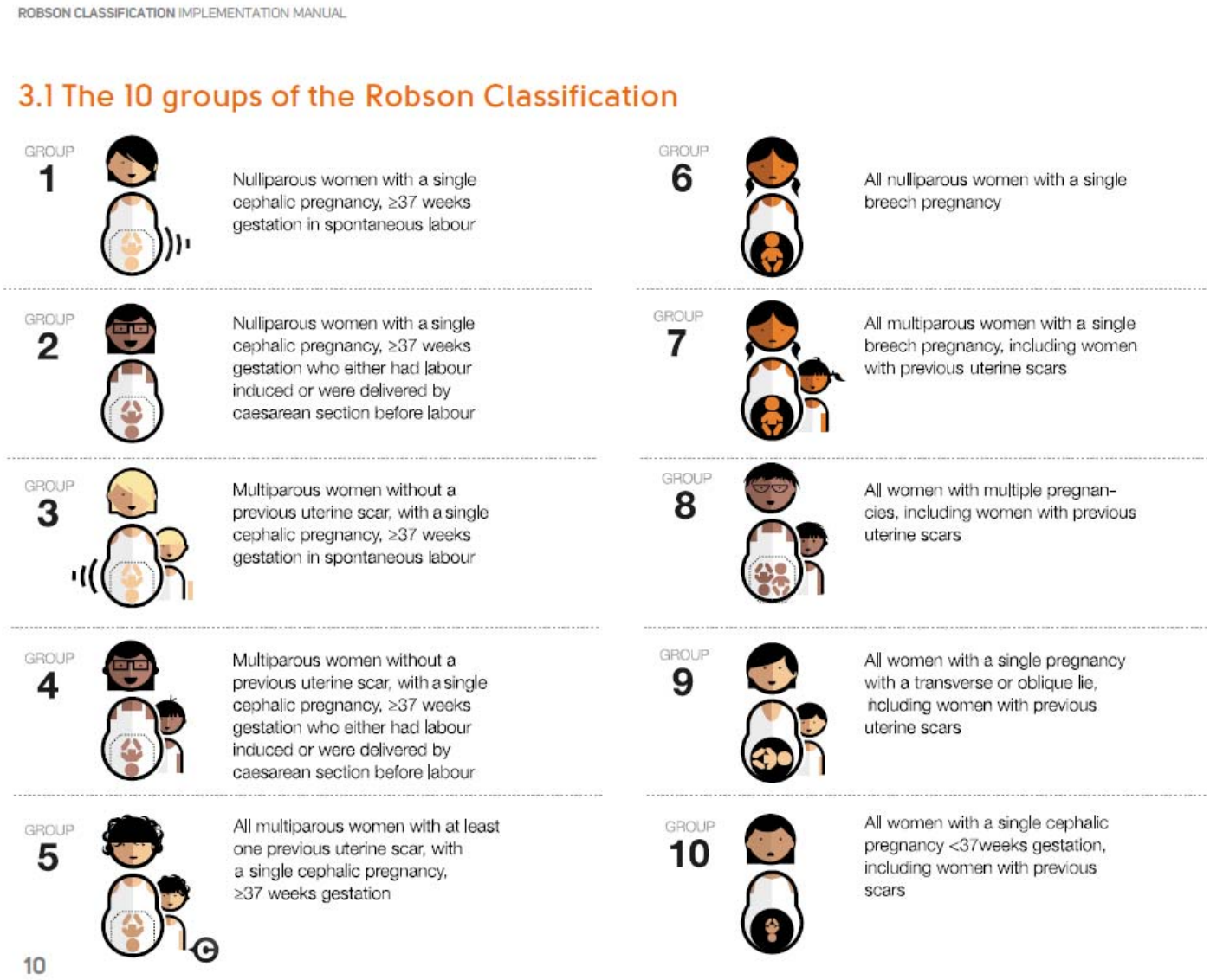
National Maternal Near Miss Surveillance System (2012-16)
Among almost 7 million deliveries in 441 Chinese hospitals, the Robson classification was used to identify trends in CD over time. CD rates declined between 2012 and 2016, from 45% to 41%. Relaxation of the one child policy increased the number of multiparas (34% to 47%). The decrease in CD rates was greatest in hospitals with a high CD rate. The biggest decline was seen among nulliparas with cephalic singleton pregnancy (>37 weeks) and multiparas without a uterine scar. The highest CD rates were seen among women with a prior uterine scar (91%). The authors suggest that increasing multiparous deliveries amplified the decline noted in the CD rate. Government intervention including updated guidelines, training, together with a focus on the high CD rate hospitals, may have impacted the decline in CD rates.

Classifying labor using the Robson Ten Group Classification System

94.Hehir MP, Ananth CV, Siddiq Z, Flood K, Friedman AM, D'Alton ME. **Cesarean delivery in the United States 2005 through 2014: a population-based analysis using the Robson 10-Group Classification System**. *Am J Obstet Gynecol* 2018, 219(1): 105 e101-105 e111

Population database (2005-14)
All 27, 044, 217 deliveries meeting inclusion criteria in the US were categorized according to the Robson TGCS. There are ten possible classification groups for women who undergo CD (see infographic) Robson 10-Group Classification Implementation Manual. In the US during this study period the CD rate was 32%. Most CDs were performed for Group 5 women (singleton term multiparas); 90% of women with previous CD had repeat CD; and 90% of women with breech presentation had CD. Obstetric units can use the TGCS to analyze their contributing categories to the CD rate. For example centers performing more CD for women with prior CD and ECV can focus on these areas where the CD rate may be reduced. Limitations of this TGCS include lack of CD indications.

ACCOMPANIED BY EDITORIAL: Robson MS. The 10-Group Classification System-a new way of thinking. *Am J Obstet Gynecol* 2018, 219(1): 1-4



External cephalic version is not widely performed

95.Son M, Roy A, Grobman WA, Miller ES. **Association between attempted external cephalic version and perinatal morbidity and mortality**. *Obstet Gynecol* 2018, 132(2): 365-370
96.**ACOG Committee Opinion No. 745: Mode of term singleton breech delivery**. *Obstet Gynecol* 2018, 132(2): e60-e63

Single-center retrospective study (2006-16)
Women with breech presentation who underwent an ECV attempt (n=1263, 31%) were compared to women without ECV attempt (n=2854, 69%). The primary outcome, neonatal outcome composite, occurred among 3% of all women, regardless of ECV performance. However the CD rate was significantly lower among women who had ECV. The revised 2018 ACOG bulletin affirms that all eligible women should undergo ECV, in facilities able to perform CD.

Impact of too many cesarean deliveries: Placenta accreta spectrum

97.**Placenta Accreta Spectrum. Obstetric Care Consensus No. 7. American College of Obstetricians and Gynecologists**. *Obstet Gynecol* 2018, 132: e259-275

This PAS SMFM document is accompanied by an Obstetric Consensus Statement from the ACOG. It presents diagnosis, and management strategies for PAS. Anesthesia and other multidisciplinary team members need to be alerted early before the 34-36 week planned delivery.

Conservative management of placenta accreta spectrum

98.Sentilhes L, Kayem G, Chandraharan E, Palacios-Jaraquemada J, Jauniaux E, Diagnosis FPA *et al.* **FIGO consensus guidelines on placenta accreta spectrum disorders: Conservative management**. *Int J Gynaecol Obstet* 2018, 140(3): 291-298

Conservative management for PAS is discussed in the new FIGO international guidelines. Cesarean hysterectomy is one strategy to manage PAS, however conservative management may be selected to avoid cesarean hysterectomy. In contrast to cases of CD without PAS, where removal of the placenta is recommended, the placenta should not be pulled out with force when PAS is suspected as this may result in major hemorrhage. However gentle efforts may be used if during surgery PAS is not seen despite pre-surgery suspicion.

Endovascular balloon prophylaxis for placenta accreta spectrum

99.Shahin Y, Pang CL. **Endovascular interventional modalities for haemorrhage control in abnormal placental implantation deliveries: a systematic review and meta-analysis**. *Eur Radiol* 2018, 28(7): 2713-2726

Systemic review and meta-analysis (69 studies) of endovascular management for hemorrhage in women with PAS. Most were case reports/reviews or retrospective studies, and only 1 was an RCT. Endovascular prophylactic balloon occlusion was placed for (n=1395) 77% of the women in the studies: internal or common iliac arteries, infra-renal abdominal aorta, or uterine artery. In the 14 studies comparing endovascular procedure versus no endovascular procedure for blood loss, endovascular procedures significantly reduced blood loss (MD—893 mL, 95% CI -1389 to -397 ml, p<0.001). In the 11 studies that compared the two methods for number of units of packed red blood cells, endovascular procedures were associated with fewer transfused units, (MD -1.54 units, 95% CI -2.27 to 0.81 units, p<0.001). Although this is thought-provoking and lends support to an argument for IR to manage PAS cases, the meta-analysis did not address confounders such as depth of placental invasion and urgency of surgery, and most of the studies to date are of low quality with small numbers.

Anesthesia for placenta accreta spectrum

100.Markley JC, Farber MK, Perlman NC, Carusi DA. **Neuraxial anesthesia during cesarean delivery for placenta previa with suspected morbidly adherent placenta: A retrospective analysis**. *Anesth Analg* 2018, 127(4): 930-938

Single-center retrospective study (1997-2015)
Neuraxial anesthesia was the primary anesthesia choice for 122/129 women undergoing non-emergency CD for suspected PAS; 16% of these had Mallampati score ≥3. Twenty (16%) women required conversion to GA, 5 prior to skin incision; 15 during surgery and 7 of these during active resuscitation; 3 conversions to neuraxial anesthesia were difficult to intubate. This group reported good experience selecting neuraxial anesthesia for their population, however emphasize their advanced resources and that use of neuraxial anesthesia may not be suitable for other environments.

ACCOMPANIED BY EDITORIAL: Beilin Y. **Maternal hemorrhage- regional versus general anesthesia: Does it really matter?** *Anesth Analg* 2018, 127(4): 805-807

POSTOPERATIVE ANALGESIA

Respiratory depression with neuraxial morphine is rare

101.Sharawi N, Carvalho B, Habib AS, Blake L, Mhyre JM, Sultan P. **A systematic review evaluating neuraxial morphine and diamorphine-associated respiratory depression after cesarean delivery**. *Anesth Analg* 2018, 127(6): 1385-1395

Systematic review (no date restrictions)

Clinically significant respiratory depression (CSRD) was defined as RD that the authors considered to be clinically relevant. CSRD was sought among studies that reported administration of neuraxial morphine or diamorphine for postpartum CD pain. Among 75 manuscripts, 16 cases of CSRD were identified, a rate of 8.67 per 10, 000 95%CI 4.20-15.16) cases. The doses of opioids varied, and only 2 women with CSRD received contemporaneous low dose (150 mcg) neuraxial morphine.

Quadratus lumborum block for post-cesarean delivery analgesia

102.Krohg A, Ullensvang K, Rosseland LA, Langesaeter E, Sauter AR. **The analgesic effect of ultrasound-guided quadratus lumborum block after cesarean delivery: A randomized clinical trial**. *Anesth Analg* 2018, 126(2): 559-565

Single-center randomized controlled trial (2014-15)
After CD performed under intrathecal isobaric bupivacaine 10mg without neuraxial morphine, women received either US guided bilateral QL block with ropivacaine (n=20) 30 mL 0.2% versus bilateral placebo saline injection (n=20). The primary outcome, cumulative ketobemidone (an opioid) consumption, was significantly reduced after ropivacaine QL block: ratio of means 0.60, 95% CI 0.3 to 0.97, p=0.04 when administered as part of a multimodal analgesia strategy.

Keep it low: local anesthesia doses for transabdominus plane block

103.Ng SC, Habib AS, Sodha S, Carvalho B, Sultan P. **High-dose versus low-dose local anaesthetic for transversus abdominis plane block post-Caesarean delivery analgesia: a meta-analysis**. *Br J Anaesth* 2018, 120(2): 252-263

This meta-analysis (n=14 studies) examined women who received TAP block (n=389) with high dose (≥50 mg) or low dose (<50 mg bupivacaine equivalents per block side) local anesthetics versus controls who did not receive TAP block (n=381) for post CD pain. The primary outcome, 24 hour post CD morphine equivalent consumption, was reported in 8 studies. Consumption was significantly lower both the high and low dose TAP groups versus control. Thus a benefit of high TAP block was not shown, and likely should be avoided as it may be associated with LAST.

LABOR and DELIVERY OUTCOMES

Elective term induction versus expectant management

104.Grobman WA, Rice MM, Reddy UM, Tita ATN, Silver RM, Mallett G *et al.* **Labor induction versus expectant management in low-risk nulliparous women**. *N Engl J Med* 2018, 379(6): 513-523

Multi-center randomized controlled trial (2014-17)
Nulliparas in 41 MFMU network centers were randomized to term induction at 39^{+0} to 39^{+4} (n=3059) vs. expectant management (n=3037). Primary outcome, neonatal outcome composite (respiratory support, Apgar ≤3 at 5mins, HIE, seizure, infection, meconium aspiration syndrome, birth trauma) or perinatal death, occurred in 4.3% of neonates in the induction group vs 5.4% in the expectant group (p=0.049) – a priori significance required was 0.046. Other neonatal outcomes were also similar. CD rates was an a priori chief secondary outcome, and was significantly decreased in the term induction group 18.6% vs 22.2%, RR 0.84; 95% CI 0.76 to 0.93, p<0.0001. Term induction was also associated with lower frequency of hypertensive disorders of pregnancy. The accompanying Editorial highlighted the high refusal rate for study enrollment, lower maternal age and unrepresentative racial and ethnic characteristics of the study groups compared to other studies. ACOG responded that elective term induction is a reasonable option for healthy normal nulliparous pregnancies after confirmed 39^{+0} weeks' gestation. This may require logistical overhauls in labor and delivery to enable more elective term inductions.

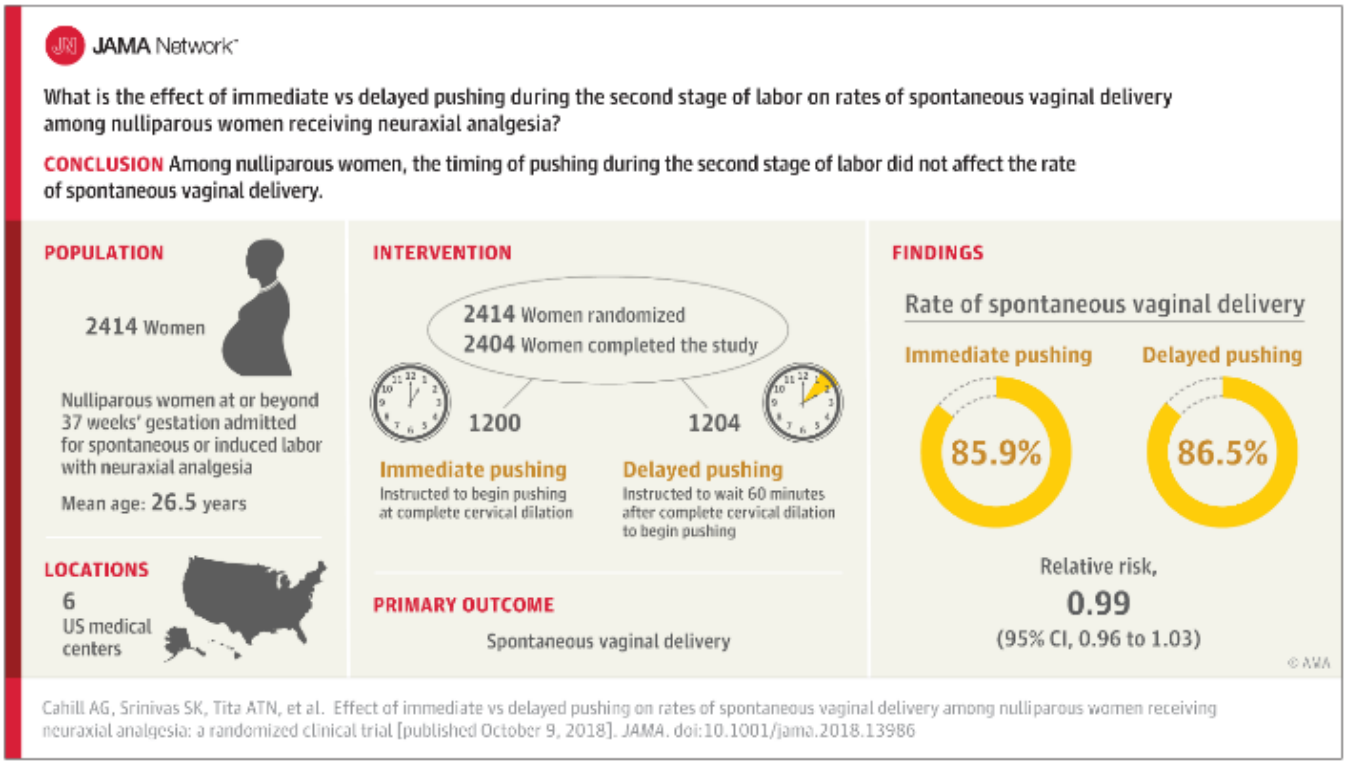
ACCOMPANIED BY EDITORIAL: Greene MF. **Choices in managing full-term pregnancy**. *N Engl J Med* 2018, 379(6): 580-581
ACCOMPANIED BY SMFM STATEMENT **on elective induction of labor in low-risk nulliparous women at term: the ARRIVE trial.** Am J Obstet Gynecol Published August 8, 2018 and endorsed by ACOG
ACCOMPANIED BY Practice Advisory: **Clinical guidance for integration of the findings of The ARRIVE Trial: Labor induction versus expectant management in low-risk nulliparous women**
ACCOMPANIED BY Media Statement: **Leaders in Obstetric Care respond to the published results of the ARRIVE trial published by ACOG and SMFM**. August 8, 2018

Can nulliparas with an epidural push immediately in second stage?

105.Cahill AG, Srinivas SK, Tita ATN, Caughey AB, Richter HE, Gregory WT *et al.* **Effect of immediate vs delayed pushing on rates of spontaneous vaginal delivery among nulliparous women receiving neuraxial analgesia: A randomized clinical trial**. *JAMA* 2018, 320(14): 1444-1454

Multi-center randomized controlled trial (2014-17)
The primary study aim was spontaneous vaginal delivery rate for women randomized at the diagnosis of second stage to immediate (n=1200) versus delayed pushing (n=1204). The study was terminated at 75% of planned enrollment due to futility (similar rates of vaginal delivery in both groups: 86% immediate and 87% delayed pushing). Delayed pushing was associated with an increased rate of PPH, (a pre-specified secondary outcome) 27% for immediate versus 48% for delayed pushing.

ACCOMPANIED BY EDITORIAL: Sperling JD, Gossett DR. **Immediate vs delayed pushing during the second stage of labor**. *JAMA* 2018, 320(14): 1439-1440
WITHDRAWN: ACOG Practice Advisory- Immediate vs. delayed pushing in nulliparous women receiving neuraxial analgesia



106.Korb D, Deneux-Tharaux C, Seco A, Goffinet F, Schmitz T, for the JUmeaux MODe d'Accouchement (JUMODA) study group and the Groupe de Recherche en Obstétrique et Gynécologie. **Risk of severe acute maternal morbidity according to planned mode of delivery in twin pregnancies**. *Obstet Gynecol* 2018, 132(3): 647-655

Multi-center prospective observational study (2015-15)
This was a planned secondary analysis comparing planned CD (n=3062) versus planned VD (n=5062) for twin pregnancies with the presenting twin in cephalic presentation. The primary outcome was a *maternal composite* of intrapartum morbidity (death, PPH, transfusion, artery embolization, vascular ligation, uterine compression suture, hysterectomy, PE, stroke/TIA, severe organ dysfunction, thrombocytopenia, other emergency surgery, and ICU admission). Perineal lacerations were not included in the composite. The primary outcome occurred in 6.1% undergoing CD and 5.4 undergoing VD (RR 1.13%, 95% CI 0.94 to 1.35). The authors conclude that given the similar delivery outcomes for CD versus VD for twin pregnancies, both for neonatal (previous study) and maternal morbidities (current study), VD is preferred due to lower long term maternal morbidities.

<u>Pelvic floor disorders after vaginal delivery</u>

107.Blomquist JL, Munoz A, Carroll M, Handa VL. **Association of delivery mode with pelvic floor disorders after childbirth**. *JAMA* 2018, 320(23): 2438-2447

Prospective longitudinal cohort study (2008-13)
Postpartum women, CD (n=778) and VD (n= 565) were followed up for nine years annually, 5-10 years after the first delivery. The primary outcome, incidence of pelvic floor disorders, was highest among women after operative VD and lowest after CD. Stress urinary incontinence had a peak hazard rate within 5 years of delivery and pelvic organ prolapse peak hazard was >20 years after delivery. As efforts are undertaken to decrease the CD rate, women will also need to know the potential disadvantages of VD, and it is unclear the impact this information will have on their decisions.

<u>A call for fixed set of outcomes for perineal research</u>

108.Pergialiotis V, Durnea C, Elfituri A, Duffy J, Doumouchtsis SK, International Collaboration for Harmonising Outcomes R *et al.* **Do we need a core outcome set for childbirth perineal trauma research? A systematic review of outcome reporting in randomised trials evaluating the management of childbirth trauma**. *BJOG* 2018, 125(12): 1522-1531

This systematic <u>review</u> identified reported outcomes for studies of perineal lacerations. Among 48 RCTs (n=20, 308 women), there were 77 different reported outcomes. Pain, wound healing, and anorectal dysfunction were the most frequently reported. This study adds to the Core Outcomes in Women's and Newborn Health (CROWN) initiative initiated by *BJOG* to standardize outcomes in women's health research. The notion of a fixed set of outcomes for specific research questions such as "maternal outcomes" and "neonatal outcomes" is being pursued and could advance research clinical investigations and improve the quality of meta-analyses.

ACCOMPANIED BY VIDEO ABSTRACT: https://vimeo.com/279818668

109.Peralta F, Bavaro JB. **Severe perineal lacerations after vaginal delivery: are they an anesthesiologist's problem?** *Curr Opin Anaesthesiol* 2018, 31(3): 258-261

This fresh review discusses perineal injury and its impact on depression and function after labor. Effective labor analgesia may decrease the incidence of perineal injury. Neuraxial analgesia for labor does not appear to predispose to perineal injuries and may possibly be protective. Pain is a significant concern and is insufficiently addressed.

LABOR ANALGESIA

Epidurals may not be uniformly available in the United States

110.Butwick AJ, Bentley J, Wong CA, Snowden JM, Sun E, Guo N. **United States state-level variation in the use of neuraxial analgesia during labor for pregnant women**. *JAMA Netw Open* 2018, 1(8): e186567

Population database (2015)
Date were taken from birth certificates (contain labor and delivery details) for all states in the United States except Connecticut. The final analysis included n=2, 262, 950 women. The study aimed to investigate if there were statewide variations in neuraxial analgesia. Statewide variations in epidural use were wide; however were not related to patient factors or anesthesia workforce levels. Overall, 73% received neuraxial analgesia; highest rates in Nevada 80% and lowest in Maine, 37%. Unmeasured effects, for example service availability and patient preferences may explain these differences.

Proactive management for epidurals that need re-siting

111.Sng BL, Tan M, Yeoh CJ, Han NR, Sultana R, Assam PN *et al.* **Incidence and risk factors for epidural re-siting in parturients with breakthrough pain during labour epidural analgesia: a cohort study**. *Int J Obstet Anesth* 2018, 34: 28-36

Single-center retrospective study (2012-3)
Details for 10, 170 women receiving neuraxial analgesia for labor were retrieved. The primary outcome, epidural catheter re-siting, occurred in 86 (0.85%). The most significant factor associated with likelihood for epidural re-siting was breakthrough pain, aOR 21.31, 95%CI 12.56 to 36.15. The authors state that optimum strategies for identification and management of inadequate labor epidural catheters require further investigation.

Low rate of spinal epidural hematoma at low platelet counts

112.Levy N, Goren O, Cattan A, Weiniger CF, Matot I. **Neuraxial block for delivery among women with low platelet counts: a retrospective analysis**. *Int J Obstet Anesth* 2018, 35: 4-9

Single-center retrospective study (2011-14)
The primary outcome of this study was the rate of neuraxial block in women (n=471) according to platelet range. 23/59 women with platelets ≤49, 000 received neuraxial block. No women had SEH or other complications. Adding these data to previous publications, the authors calculated the 95% CI for risk of SEH at platelet levels 50-69, 000/mcg/L is 0 to 0.26 and at platelet levels 0 to 49, 000/mcg/L is 0 to 9.

Programmed intermittent boluses for labor analgesia

113.Sng BL, Zeng Y, de Souza NNA, Leong WL, Oh TT, Siddiqui FJ *et al.* **Automated mandatory bolus versus basal infusion for maintenance of epidural analgesia in labour**. *Cochrane Database Syst Rev* 2018, 5: CD011344

Original Cochrane review of 12 RCTs (n=1121) that compared AMB versus BI for maintenance of labor epidural analgesia. Breakthrough pain likelihood was significantly reduced using AMB, RR (0.60; 95% CI 0.39 to 0.92). There was no difference in CD rates.

114.Zakus P, Arzola C, Bittencourt R, Downey K, Ye XY, Carvalho JC. **Determination of the optimal programmed intermittent epidural bolus volume of bupivacaine 0.0625% with fentanyl 2 mug.ml(-1) at a fixed interval of forty minutes: a biased coin up-and-down sequential allocation trial**. *Anaesthesia* 2018, 73(4): 459-465

Prospective double blind dose finding study (2016-17)
The optimum PIEB volume with retained efficacy (EV_{90}) was sought in a center where 40 min was found to be the optimum lock out time for PIEB boluses. After epidural catheter placement, two boluses (6mL) of bupivacaine 0.125% + fentanyl 3.3 mcg/mL were administered. Maintenance was bupivacaine 0.0625% + fentanyl 2 mcg/mL, 250 mL/hour. First PIEB dose was given at 60min after initiation of epidural, and subsequent boluses were given every 40 mins. Primary outcome was use of PCEA/additional boluses during the 6 hours after epidural placement or until full dilatation. Using Dixon Mood up-down method, the first enrolled woman had PIEB bolus 7mL, and if unsuccessful the next patient received 8mL; the maximum bolus volume was 12 mL. For women (n = 63) receiving this mixture at 40 min timed boluses, the estimated EV_{90} (95%CI) was 11.0 (10.0 to 11.7 mL) and a volume below 10 mL was ineffective.

115.Lange EMS, Wong CA, Fitzgerald PC, Davila WF, Rao S, McCarthy RJ *et al.* **Effect of epidural infusion bolus delivery rate on the duration of labor analgesia: A randomized clinical trial**. *Anesthesiology* 2018, 128(4): 745-753

Single-center randomized controlled trial (2015-17)

Following a CSE bolus, labor epidural analgesia was maintained using PIEB (10mL bolus every 60 mins in addition to self-administered boluses of 5mL every 10 mins, maximum 3 per hour). Women were randomized to receive slow rate PIEB bolus, 100mL/hr (n=108) versus high rate PIEB bolus, 300mL/hr (n=102). The primary study outcome, proportion of women requiring physician boluses for breakthrough pain, was similar in both groups; 41% receiving slow rate versus 36% receiving high rate. In this study setting, using CSE followed by PIEB 10mL boluses, either PIEB bolus delivery rate can be used.

116.Bullingham A, Liang S, Edmonds E, Mathur S, Sharma S. **Continuous epidural infusion vs programmed intermittent epidural bolus for labour analgesia: a prospective, controlled, before-and-after cohort study of labour outcomes**. *Br J Anaesth* 2018, 121(2): 432-437

Single-center impact of practice change study (2015-15).
This center transitioned from CEI (n=188) to PIEB+PCEA (n=236) for labor analgesia. The primary outcome, any motor weakness, occurred in 21.8% with CEI vs 1% with PIEB+PCEA; this significant difference remained when nulliparas and multiparas where examined separately. As opposed to an RCT with inclusion/exclusion criteria, limited bias and blinding, data from all women who received at least 10mL of study solution were assessed in this study, presenting evidence of the general clinical application of PIEB+PCEA.

Remifentanil labor analgesia

117.Wilson MJA, MacArthur C, Hewitt CA, Handley K, Gao F, Beeson L *et al.* **Intravenous remifentanil patient-controlled analgesia versus intramuscular pethidine for pain relief in labour (RESPITE): an open-label, multicentre, randomised controlled trial**. *Lancet* 2018, 392(10148): 662-672

Multi-center non-blinded randomized controlled trial (2014-16)
Pethidine (meperidine) is widely used in the UK. Healthy women in established labor (regular painful contractions regardless of cervical dilatation) in 14 UK units received IM 100 mg pethidine (n=199) versus IV remifentanil 40 mcg 1 to 2 mins PCA (n=201). The primary outcome, receiving an epidural, occurred for 19% of women with remifentanil PCA vs 41% with pethidine. Once randomized and prior to drug administration, 14/201 (7%) women did not receive remifentanil (none requested epidural) and 45/199 (33%) did not receive pethidine (22 requested epidural). Cervical dilatation at treatment initiation, duration and doses of study drugs were not reported. The study was non-blinded and 22 women refused pethidine, suggesting women a priori considered this an inferior treatment. Remifentanil was associated with more frequent occurrence of low oxygen saturation, and need for supplementary oxygen, corroborating previous studies showing hypoxemia and need for 1:1 nurse: patient ratios that many units may be unable to provide.

Postdural puncture headache

118.Rana K, Jenkins S, Rana M. **Insertion of an intrathecal catheter following a recognised accidental dural puncture reduces the need for an epidural blood patch in parturients: an Australian retrospective study**. *Int J Obstet Anesth* 2018, 36: 11-16

Single-center retrospective study (2009-15)
Among women with ADP and or PDPH, 94 had recognized ADP after epidural and 70% had intrathecal catheter placed. Although the incidence of PDPH was not different between women with versus without intrathecal catheter, 33% with intrathecal catheter required EBP versus 68% without intrathecal catheter, RR 2.04, 95%CI 1.33 to 3.12.

Is sphenopalatine ganglion block a replacement for epidural blood patch?

119.Cohen S, Levin D, Mellender S, Zhao R, Patel P, Grubb W *et al.* **Topical sphenopalatine ganglion block compared with epidural blood patch for postdural puncture headache management in postpartum patients: A retrospective review**. *Reg Anesth Pain Med* 2018, 43(8): 880-884

Single-center retrospective study (1997-2014)
All patients had history and symptoms consistent with PDPH. SPG (n=42) was compared with EBP (n=39). The rationale for treatment selection was not reported although headache intensity was similar in both groups. Fewer patients returned to the ER after SBP (zero) than after EBP (23.1%), OR 0.04, 95%CI 0.002 to 0.67). SPG was associated with greater frequency of headache relief 30 and 60 minutes after treatment; headache relief was similarly good after 24 hours beyond treatment. The number of women who required EBP after SPG was not reported. Lack of randomization introduces the possibility for biased patient selection. Further investigations are required to elucidate the efficacy of SPG: a less-invasive therapeutic strategy for women with PDPH.

Labor epidurals can be performed in the presence of a tattoo

120.Zipori Y, Jakobi P, Solt I, Abecassis P. **The need for an epidural "window of opportunity" in pregnant women with a lumbar tattoo**. *Int J Obstet Anesth* 2018, 33: 53-56

This review discussed recommendations for performing neuraxial block in women with a tattoo. Epidural analgesia should be avoided in the unlikely situation that the tattoo is fresh (<2 weeks old). If possible injection through the tattoo should be avoided. Importantly this review supports not withholding neuraxial block when a tattoo is present.

Neuraxial anesthesia for women with Chiari malformation

121.Waters JFR, O'Neal MA, Pilato M, Waters S, Larkin JC, Waters JH. **Management of anesthesia and delivery in women with Chiari I malformations**. *Obstet Gynecol* 2018, 132(5): 1180-1184

Retrospective case series (2010-15)
Among 63 women (95 deliveries) with Chiari I malformation, 44 had CD and 51 VD. Neuraxial block was performed for 62 deliveries with no untoward effects. Chiari I malformations are not uncommon, and the authors suggest that women with asymptomatic Chiari I or headaches alone, may deliver according to obstetric indications whereas those with hydrocephalus/ papilledema are high risk. As this was a retrospective study on selected data, it is unclear if practice will change in other centers.

POSTPARTUM PAIN

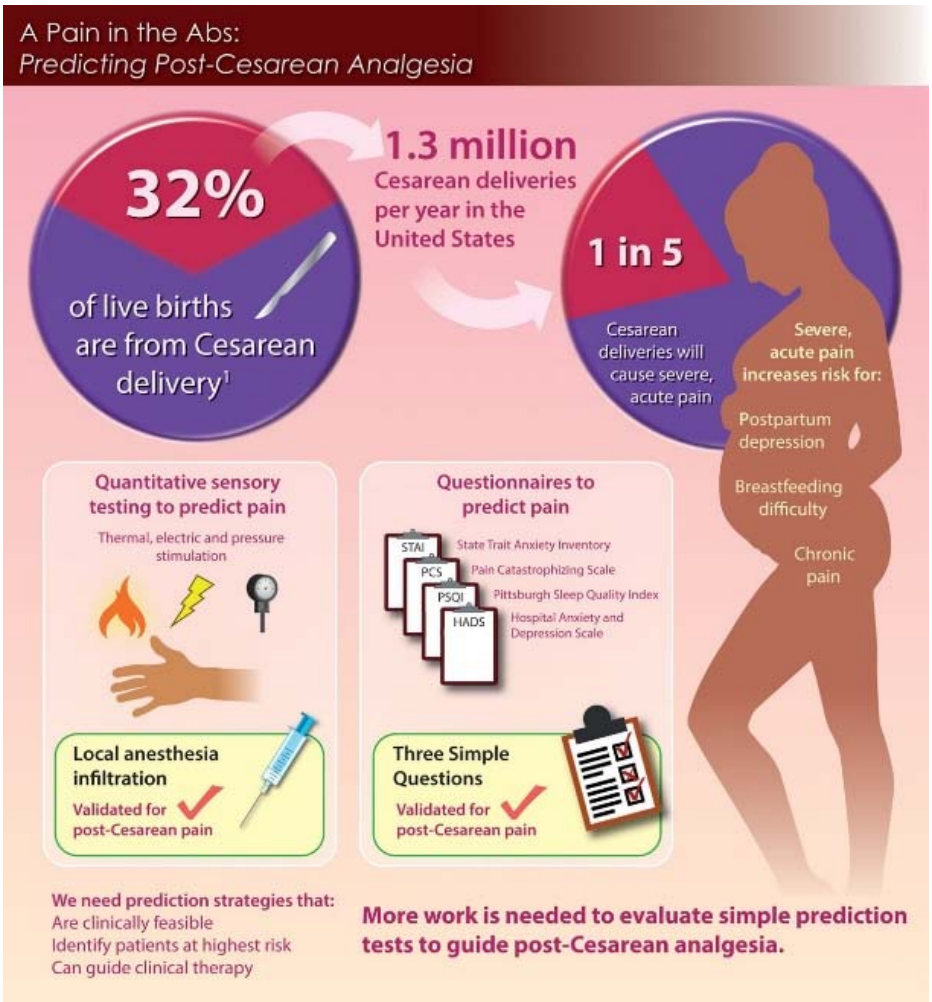
122.**ACOG Committee Opinion No. 742: Postpartum pain management**. *Obstet Gynecol* 2018, 132(1): e35-e43

ACOG published a postpartum pain management committee opinion. Wide variations in pain intensity and experience are recognized, after both VD and CD. Multi-modal analgesia is recommended, and opioids should be reserved for severe pain. Codeine containing agents are not recommended.

Predicting postpartum pain

123.Gamez BH, Habib AS. **Predicting severity of acute pain after cesarean delivery: A narrative review**. *Anesth Analg* 2018, 126(5): 1606-1614

This narrative review identified 13 studies that described methods to predict acute post CD pain. Five studies used QST, 1 used hyperalgesia, 4 used questionnaires and 2 used combined QST and questionnaires including state-trait anxiety inventory and pain catastrophizing scale. The authors concluded that clinically applicable tools are lacking and the best predictive tools currently for postpartum pain are either pain levels following local anesthesia injection prior to the spinal for CD, or 3-simple questions about anxiety and pain.



Induced labor and higher pain on postpartum day 1 predicts prolonged postpartum pain and opioid use

124.Komatsu R, Carvalho B, Flood P. **Prediction of outliers in pain, analgesia requirement, and recovery of function after childbirth: a prospective observational cohort study**. *Br J Anaesth* 2018, 121(2): 417-426

Prospective observational cohort study (secondary analysis) (2014-16)
Nulliparas were enrolled before labor onset or after epidural, and contacted daily starting postpartum day 1 until there were five pain- and opioid-free recovery days (n=134). From 3 months, for women still in pain, calls were made weekly. Women were asked about site-specific pain (depending on VD or CD). A total of 3343 daily phone-calls were made. The primary outcome, number of days until the composite outcome of opioid and pain free recovery, was median (range) 21 (3 to 85) days. Induced labor and higher postpartum day 1 pain scores predicted longer pain duration and need for opioids. After CD, the standard discharge prescription was 30 opioid pills and some women were discharged with opioids after VD. An accompanying Editorial surveyed anesthesiologists in 13 non-US countries: discharge opioids are not prescribed after VD except in the US, and discharge opioids are prescribed regularly only in Canada the US and South Africa after CD.

ACCOMPANIED BY AN EDITORIAL: Wong CA, Girard T. U**ndertreated or overtreated? Opioids for postdelivery analgesia.** *Br J Anaesth* 2018, 121(2): 339-342

125.**Morbidity and Mortality Weekly Report: Opioid Use Disorder Documented at Delivery Hospitalization — United States, 1999–2014**. https://www.cdc.gov/mmwr/volumes/67/wr/mm6731a1.htm. Opioid Use Disorder Documented at Delivery Hospitalization — United States, 1999–2014. Morbidity and Mortality Weekly Report
This report presents opioid use disorder per state per 1, 000 delivery hospitalizations annually from 1999 to 2014. Across the US, rates of opioid use disorder more than quadrupled among delivery hospitalizations, in some states more than others; Vermont, West Virginia, New Mexico and Maine have seen the greatest rise.

Opioids use among women undergoing vaginal delivery

126.Badreldin N, Grobman WA, Yee LM. **Inpatient opioid use after vaginal delivery**. *Am J Obstet Gynecol* 2018, 219(6): 608 e601-608 e607

Single-center case-control study (2015-16)
Women rarely need opioid analgesia after VD and in this center, a specific postpartum order is required to administer opioids after VD. In-hospital postpartum prescriptions for opioid naive women after VD (n=9038) were investigated. NSAIDS were prescribed for 97% of women, acetaminophen for 26% and opioids for 25%. Factors associated with opioid use included high BMI, and delivery complications (such as perineal tear, PPH). 20% of women with normal non-complicated VD received an opioid postpartum. Higher number of acetaminophen (aOR 0.81, 95% CI 0.77 to 0.85) and NSAIDS (aOR 0.92, 95% CI 0.87 to 0.96) doses and more senior practitioner prescribing (OR 0.46, 95% CI 0.29-0.73) were associated with lower likelihood of in-hospital opioid prescription after VD.

127.Prabhu M, Garry EM, Hernandez-Diaz S, MacDonald SC, Huybrechts KF, Bateman BT. **Frequency of opioid dispensing after vaginal delivery**. *Obstet Gynecol* 2018, 132(2): 459-465

Population database (2003-15)
Using an insurance claims database across the US and Puerto Rico, all women with VD (n=1,345,244) were identified. Within 1 week of discharge, 28.5% (95%CI 28.4 to 28.6) filled an opioid prescription; and geographic location accounted for the strongest risk difference. Women on benzodiazepines or antidepressants also had higher likelihood to fill opioid prescriptions, as did women after tubal ligations, operative VD and with perineal tears. Less than 1/5 women who filled opioid prescriptions had tubal ligations, perineal tears, operative VD. Codeine was the prescribed opioid in 15% of cases despite the FDA warning about potential neonatal RD. The reasons for opioid prescriptions were not reported.

Marijuana use in pregnancy and breastfeeding

128.Dickson B, Mansfield C, Guiahi M, Allshouse AA, Borgelt LM, Sheeder J *et al.* **Recommendations from cannabis dispensaries about first-trimester cannabis use**. *Obstet Gynecol* 2018, 131(6): 1031-1038

Statewide Cross-sectional study (2017 Jun-Jul)
400 Colorado cannabis dispensaries were asked whether they recommended cannabis products to a mystery caller "first trimester pregnant woman" to treat her nausea and vomiting. Most (69%) of the dispensaries recommended cannabis products to the caller. This is concerning given the insufficient safety data about use of marijuana for pregnant and breastfeeding women, and the increased state legalization in the US.

129. Ryan SA, Ammerman SD, O'Connor ME; Committee on substance use and prevention: Section on breastfeeding. **Marijuana use during pregnancy and breastfeeding: Implications for neonatal and childhood outcomes.** *Pediatrics* 2018, 142(3): e20181889.
ERRATUM published Aug 28.

This clinical guidance report published by the American Academy of Pediatrics presents epidemiological data regarding increased marijuana use among pregnant and breastfeeding women, and current knowledge of the effects of marijuana on fetal development.

130.Raymond BL, Kook BT, Richardson MG. **The opioid epidemic and pregnancy: implications for anesthetic care**. *Curr Opin Anaesthesiol* 2018, 31(3): 243-250

The huge burden of opioid use among pregnant women is presented in this review. Maternal and fetal effects of exposure are discussed. Replacement strategies (methadone, buprenorphine) and management of opioid tolerant mothers for postpartum pain are presented.

POSTPARTUM CARE

131.**ACOG Committee Opinion No. 736: Optimizing postpartum care**. *Obstet Gynecol* 2018, 131(5): e140-e150
132.Murray Horwitz ME, Molina RL, Snowden JM. **Postpartum care in the United States - new policies for a new paradigm**. *N Engl J Med* 2018, 379(18): 1691-1693

In the postpartum period, women should be in contact with *their* provider within 3 weeks. ACOG recognizes that many women do not attend the 6 week postpartum visit and that PPD occurs in approximately 10% of postpartum women. Postpartum complications are discussed, including bowel and bladder incontinence, along with educational tools and strategies. Care of the newborn, substance use/abuse, intimate-partner violence are other presented topics. All topics have counselling tools for questions, care, and resources the provider may use in consultation with postpartum women. A NEJM editorial discussed the importance of these care recommendations in the US where maternity leave is relatively short, and social inequalities impact optimum postpartum care.

ACCOMPANIED BY:
ACOG Postpartum ToolKit

Postpartum depression

133.**ACOG Committee Opinion No. 757: Screening for perinatal depression**. *Obstet Gynecol* 2018, 132(5): e208-e212

ACOG recommend that all postpartum women be screened using a validated tool at least once during the postpartum period, and that women with risk factors be closely monitored, given that 10% of postpartum women meet criteria for major depressive disorders.

Postpartum depression and labor analgesia

134.Orbach-Zinger S, Landau R, Harousch AB, Ovad O, Caspi L, Kornilov E *et al.* **The relationship between women's intention to request a labor epidural analgesia, actually delivering with labor epidural analgesia, and postpartum depression at 6 Weeks: A prospective observational study**. *Anesth Analg* 2018, 126(5): 1590-1597

Single-center prospective longitudinal study (2015-6)
PPD may be associated with painful labor. Among 1326 laboring women, 1058 women received epidural and 439 did not; 328 women wanted/did not receive epidural analgesia. The primary study outcome, PPD at 6 weeks for women who wanted/did not receive epidural analgesia versus the other women, was measured by Edinburgh postnatal depression score (≥10), and was similar for both groups, relative risk difference 1.8%, 95%CI -3% to 7%. However unmet expectations was a risk factor PPD (whether women delivered with epidural/did not want or wanted/did not receive).

ACCOMPANIED BY EDITORIAL: Toledo P, Miller ES, Wisner KL. **Looking beyond the pain: Can effective labor analgesia prevent the development of postpartum depression**? *Anesth Analg* 2018, 126(5): 1448-1450

135.Lim G, Farrell LM, Facco FL, Gold MS, Wasan AD. **Labor analgesia as a predictor for reduced postpartum depression scores: A retrospective observational study**. *Anesth Analg* 2018, 126(5): 1598-1605

Single-center retrospective and observational study (2015)
Women who received epidural analgesia and had pain scores assessed before and after epidural placement were investigated (n=201). The percent change in pain (PIP) was calculated (difference between baseline and subsequent pain scores over time). A positive score reflects good analgesia and a negative score the opposite. The primary outcome, PIP relationship with Edinburgh PPD scores (EPDS) measured at 6 weeks postpartum, was positive in simple linear regression, r=0.025, p=0.002. In a stepwise model including PIP, anxiety/depression history, perineal tears, antepartum anemia, pain scores accounted for 6.6% of the EPDS scores. According to these data, good labor analgesia is associated with reduced frequency of PPD.

ACCOMPANIED BY EDITORIAL: Toledo P, Miller ES, Wisner KL. **Looking beyond the pain: Can effective labor analgesia prevent the development of postpartum depression**? *Anesth Analg* 2018, 126(5): 1448-1450

ULTRASOUND IN OBSTETRIC ANESTHESIA

Ultrasound and the airway in preeclampsia

136.Ahuja P, Jain D, Bhardwaj N, Jain K, Gainder S, Kang M. **Airway changes following labor and delivery in preeclamptic parturients: a prospective case control study**. *Int J Obstet Anesth* 2018, 33: 17-22

Case control study (2014-15)
Physical and ultrasound assessments of the airway of preeclamptic women (n=25) and normal women (n=25) were performed before active labor, at 1 hour and 24-48 hours postpartum. The primary outcome, Mallampati score, worsened in both groups over time. Furthermore, ultrasound airway measurements worsened during labor in both groups. Development of airway edema during labor has been previously reported, however application of ultrasound is novel. Ultrasound skills to assess the airway can be useful to identify changes, and also to identify landmarks if surgical airway is needed.

Models for gastric ultrasound

137.Roukhomovsky M, Zieleskiewicz L, Diaz A, Guibaud L, Chaumoitre K, Desgranges FP *et al.* **Ultrasound examination of the antrum to predict gastric content volume in the third trimester of pregnancy as assessed by MRI: A prospective cohort study**. *Eur J Anaesthesiol* 2018, 35(5): 379-389

Single-center prospective observational study (2015-16)
Gastric antral ultrasound was compared to MRI measurements, to build a mathematical model for predicting gastric volumes in third trimester among non-fasted pregnant women (n=34). It was assumed the correlation between ultrasound and MRI would be high >0.75. The median antral CSA and MRI measure were strongly correlated, 0.76. Ultrasound to measure antral CSA appears reliable in non-fasted non-laboring women in the third trimester.

138.Arzola C, Perlas A, Siddiqui NT, Downey K, Ye XY, Carvalho JCA. **Gastric ultrasound in the third trimester of pregnancy: a randomised controlled trial to develop a predictive model of volume assessment**. *Anaesthesia* 2018, 73(3): 295-303

Single-center randomized controlled trial (2014-16)
Gastric antral ultrasound was performed to build a predictive model in non-laboring third trimester fasted women (n=60). Gastric ultrasound was performed before and after ingestion of clear fluids (fluid volumes were assigned randomly). The primary outcome, correlation between ingested fluid volume and ultrasound measures, was significant in the semi-recumbent position, Spearman rank correlation 0.7, $p<0.0001$. The authors report that ultrasound measures correlated well with ingested volumes and that measurements are best performed in the semi-recumbent position.

ACCOMPANIED BY EDITORIAL: Kinsella SM. **The 'full stomach': full time for sloppy terminology?** *Anaesthesia* 2018, 73(10): 1189-1190

139.Perlas A, Arzola C,Van de Putte P. **Point-of-care gastric ultrasound and aspiration risk assessment: a narrative review**. *Can J Anaesth* 2018, 65(4): 437-448

This is a complete update and review of gastric ultrasound in general and explains the measurement techniques and interpretations of the volumes measured.

Finding the window for ultrasound diagnosis during cardio-pulmonary resuscitation

140.Clattenburg EJ, Wroe P, Brown S, Gardner K, Losonczy L, Singh A *et al.* **Point-of-care ultrasound use in patients with cardiac arrest is associated prolonged cardiopulmonary resuscitation pauses: A prospective cohort study**. *Resuscitation* 2018, 122: 65-68

Single-center prospective study (2016-17)
Video recordings were collected of cardiac arrests managed in the ER and they were reviewed for the primary outcome, CPR pauses when POCUS was performed versus pauses when POCUS was not performed. Among 24 cardiac arrests evaluated, POCUS caused 17 second CPR pauses versus 11 second CPR pauses when POCUS was not performed. POCUS can uncover reversible causes of arrest such as pulmonary embolus, and hypovolemia, thus potentially directing therapies in maternal cardiac arrest, yet optimal resuscitation is achieved with minimal CPR interruptions. The authors suggest implementing a timer strategy to minimize CPR pauses when POCUS is performed during management of cardiac arrest.

141.Zieleskiewicz L, Bouvet L, Einav S, Duclos G, Leone M. **Diagnostic point-of-care ultrasound: applications in obstetric anaesthetic management**. *Anaesthesia* 2018, 73(10): 1265-1279

This is a lovely review of point of care ultrasound in obstetric practice. Important uses of ultrasound include airway assessments, diagnosis of shortness of breath in a pregnant patient, and intravenous fluid management and shock.

ACCOMPANIED BY EDITORIAL: Kinsella SM. **The 'full stomach': full time for sloppy terminology?** *Anaesthesia* 2018, 73(10): 1189-1190

DISPARITIES IN CARE

Racial disparities and adverse maternal outcomes

142.Grobman WA, Parker CB, Willinger M, Wing DA, Silver RM, Wapner RJ *et al.* **Racial disparities in adverse pregnancy outcomes and psychosocial stress**. *Obstet Gynecol* 2018, 131(2): 328-335

Multi-center prospective registry (2010-14)
This secondary analysis of a nulliparous registry investigated frequencies of preterm birth, hypertensive disease of pregnancy and SGA births in a population of 9, 470 women recruited in 8 US centers: 60% non-Hispanic white, 14% non-Hispanic black, 17% Hispanic, 4% Asian and 5% other. Non-Hispanic black women were most likely to experience these adverse pregnancy outcomes, and there was no relationship to psychosocial factors such as stress, racism and social support.

Impact of hospital closures or understaffing

143.Kozhimannil KB, Hung P, Henning-Smith C, Casey MM, Prasad S. **Association between loss of hospital-based obstetric services and birth outcomes in rural counties in the United States**. *JAMA* 2018, 319(12): 1239-1247

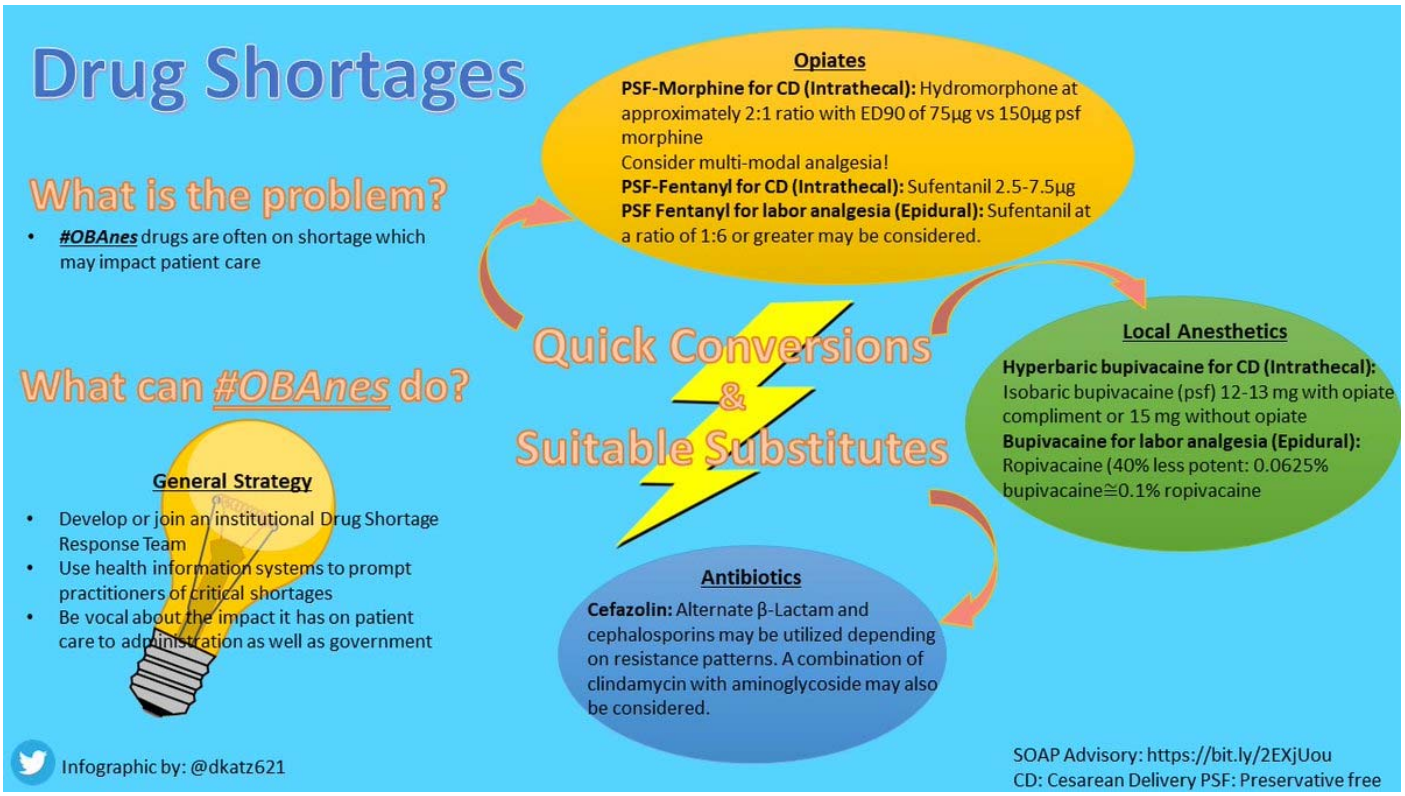
Population database (2004-14)
This study investigated availability of hospital obstetric services for almost 5 million deliveries births among women living in rural US rural counties with hospital obstetric services in 2004. Closure of hospital obstetric services was a concern. The primary study outcome measures were non-hospital delivery, delivery in hospitals without obstetric services, and preterm delivery. Loss of hospital obstetric services since 2004 resulted in increased risk of delivery in hospitals without obstetric services and of preterm delivery. The authors politely suggested some updates in hospital planning strategies.

144.Lonnee HA, Madzimbamuto F, Erlandsen ORM, Vassenden A, Chikumba E, Dimba R *et al.* **Anesthesia for cesarean delivery: A cross-sectional survey of provincial, district, and Mission hospitals in Zimbabwe**. *Anesth Analg* 2018, 126(6): 2056-2064

Cross-sectional survey (2015, Sept to Oct)
Using a structured WFSA/WHO survey, non-urban anesthesia providers in Zimbabwe were interviewed about logistics and practices. Most anesthesia providers were not physicians, 19% had no formal training and only one was a physician anesthesiologist. Most CDs were performed under spinal anesthesia.

DRUG SHORTAGES

145.**https://soap.org/2018-bupivacaine-shortage-statement.pdf**. SOAP statement on drug shortages



SIMULATION IN OBSTETRICS

146.Satin AJ. **Simulation in Obstetrics**. *Obstet Gynecol* 2018, 132(1): 199-209

The various simulation based programs reported in the field of obstetrics are reviewed along with a basic summary and update.

LOCAL ANESTHETIC SYSTEMIC TOXICITY

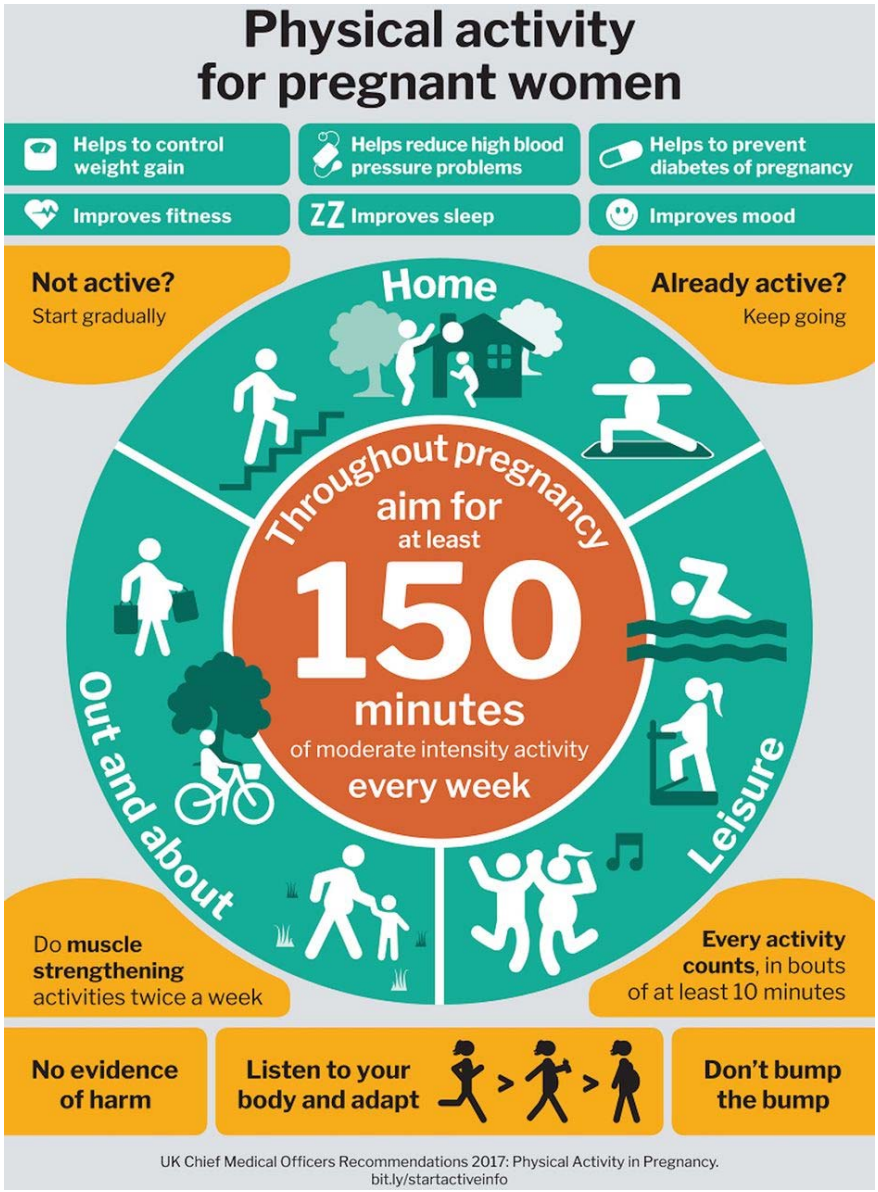
147.Neal JM, Barrington MJ, Fettiplace MR, Gitman M, Memtsoudis SG, Morwald EE *et al.* **The Third American Society of Regional Anesthesia and Pain Medicine Practice Advisory on Local Anesthetic Systemic Toxicity: Executive Summary 2017**. *Reg Anesth Pain Med* 2018, 43(2): 113-123

This practice advisory reports that LAST may be less frequent than previously reported. One third of patients present with CNS and CVS symptoms; presentation may be atypical and delayed up to an hour. If in doubt of the diagnosis, intralipid should be given.

EXERCISE DURING PREGNANCY

It's safe to exercise in pregnancy

148.Bo K, Artal R, Barakat R, Brown WJ, Davies GAL, Dooley M *et al.* **Exercise and pregnancy in recreational and elite athletes: 2016/2017 evidence summary from the IOC expert group meeting, Lausanne. Part 5. Recommendations for health professionals and active women**. *Br J Sports Med* 2018, 52(17): 1080-1085



This 5 part series reviews the impact of sport participation for recreational and elite pregnant athletes. Exercise is permitted unless there are extreme health concerns e.g. CHD, placenta previa, anemia among others. Hyperthermia in the first trimester, and aortocaval compression later on in pregnancy should be avoided. High altitude exercise should be avoided if not acclimatized. Guidelines suggest that during training the VO_{2max} (maximum rate of oxygen consumption) should not exceed >90% although this is not a proven recommendation. Exercise may reduce the risk of diabetes and PPD, but elite athletes appear to have similar risks of low back pain, girdle pain, pelvic floor pain and perineal tears as the non-athlete population.

POINT of VIEW

Reporting research: lessons for authors and reviewers

149.Adams AD, Benner RS, Riggs TW, Chescheir NC. **Use of the STROBE checklist to evaluate the reporting quality of observational research in obstetrics**. *Obstet Gynecol* 2018, 132(2): 507-512

Cross-sectional study (2008-2016)
This study assessed observational studies submitted to *Obstetrics and Gynecology* for adherence to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) items. Published observational studies complied with items 82% of the time, and 78% for critical items (e.g. objectives, study size, data analysis, and number of participants). Authors are required to complete the STROBE statement yet neglect to include some items in the manuscript. Editors and reviewers need to verify inclusion of these items.

Pregnant women often excluded from studies

150.Heyrana K, Byers HM, Stratton P. **Increasing the participation of pregnant women in clinical trials**. *JAMA* 2018, 320(20): 2077-2078

Due to exclusion of pregnant women in many studies, 80% of pregnant women are prescribed drugs that were not tested in this population. The barriers to enrollment of pregnant women such as the ethical committee designation of pregnant women as "vulnerable"; need to show direct benefit to the study population; and legal aspects, are discussed in this Commentary.

WHAT'S NEW in OBSTETRIC ANESTHESIA

The 2017 Gerard W Ostheimer Lecture summarized publications from the year 2016 and was presented by Dr B.T. Bateman in two publications (Epub) in 2018.

151.Bateman BT. **What's new in Obstetric Anesthesia: a focus on maternal morbidity and mortality**. *Int J Obstet Anesth* 2019, 37: 68-72

152.Bateman BT. **What is new in Obstetric Anesthesia: The 2017 Gerard W. Ostheimer Lecture**. *Anesth Analg* 2019, 128(1): 123-127