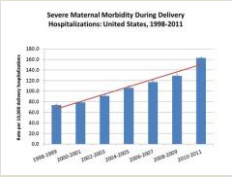
OBSTETRICAL BLEEDING – TRANSFUSION SERVICE SUPPORT

Baylor University Medical Center – Dallas, TX

Severe Maternal Morbidity in the US

http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/SevereMaternalMorbidity.html



Maternal morbidity
- Includes physical and psychologic conditions that result from or are aggravated by pregnancy and have an adverse effect on a woman's health.
- The most severe complications of pregnancy, generally referred to as severe maternal morbidity (**SMM**), affect more than 65,000 women in the United States every year.
- Based on recent trends, this burden has been steadily increasing.[1]

Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstet Gynecol*. 2012;120(5):1029-1036.

Why the rise in SMM?

- Rises in SMM are likely driven by a combination of factors including:
  - Increases in maternal age
  - Pre-pregnancy obesity
  - Pre-existing chronic medical condition
  - Cesarean delivery.
- The consequences of the increasing SMM prevalence include:
  - Higher health service use
  - Higher direct medical costs
  - Extended hospitalization stays
  - Long-term rehabilitation
- The review of SMM cases provides an opportunity to identify points of intervention for quality improvements in maternal care.
- Tracking SMM will help monitor the effectiveness of such interventions.

Blood transfusion was the most common indicator of SMM during 1998–2011.

For the most recent 2-year period (2010–2011), **blood transfusion** was a SMM indicator for 117 of 10,000 delivery hospitalization.

The 2nd–5th most frequent indicators of SMM during delivery hospitalizations were:

- **Disseminated intravascular coagulation** (32 per 10,000 delivery hospitalizations)
- **Heart failure during a procedure or surgery** (18 per 10,000 delivery hospitalizations)
- **Hysterectomy** (9 per 10,000 delivery hospitalizations)
- **Operations on the heart or pericardium** (7 per 10,000 delivery hospitalizations).

Table 1. Rates (Standard Errors) of Selected Severe Complications During Delivery Hospitalizations per 10,000 Delivery Hospitalizations: United States, 1998–2009 (n=49,346,974)

Condition	1998–1999	2000–2001	2002–2003	2004–2005	2006–2007	2008–2009	P*	% Increase
Acute renal failure	2.29 (0.16)	1.99 (0.12)	2.61 (0.14)	2.77 (0.16)	3.33 (0.17)	4.52 (0.14)	<.05	97.26
Cardiac arrest or ventricular fibrillation	0.51 (0.06)	0.46 (0.05)	0.49 (0.06)	0.66 (0.06)	0.68 (0.06)	0.63 (0.06)	.14	22.89
Heart failure during procedure or surgery	11.12 (0.50)	9.25 (0.64)	10.17 (0.54)	10.66 (0.66)	9.77 (0.50)	9.92 (0.54)	.48	−10.75
Shock	1.50 (0.10)	1.30 (0.10)	1.52 (0.10)	1.86 (0.12)	2.16 (0.12)	3.01 (0.14)	<.05	100.66
Sepsis	3.14 (0.20)	2.45 (0.18)	2.68 (0.16)	2.57 (0.15)	2.77 (0.15)	3.08 (0.17)	.80	−1.96
Disseminated intravascular coagulation	9.20 (0.31)	8.08 (0.34)	9.61 (0.36)	9.97 (0.52)	11.09 (0.52)	12.46 (0.72)	<.05	35.46
Amniotic fluid embolism	0.40 (0.05)	0.50 (0.05)	0.48 (0.05)	0.44 (0.05)	0.35 (0.05)	0.36 (0.05)	.17	−8.88
Thrombotic embolism	0.81 (0.09)	1.07 (0.09)	1.29 (0.10)	1.39 (0.10)	1.49 (0.10)	1.39 (0.09)	<.05	71.81
Puerperal cerebrovascular disorders	1.98 (0.13)	1.79 (0.11)	2.01 (0.13)	2.12 (0.12)	2.08 (0.12)	1.69 (0.10)	.95	−12.75
Severe anesthesia complications	1.91 (0.14)	1.41 (0.11)	1.43 (0.11)	1.08 (0.09)	1.11 (0.08)	0.74 (0.06)	<.05	−61.27
Pulmonary edema	2.11 (0.16)	2.01 (0.15)	1.61 (0.15)	1.80 (0.20)	1.49 (0.13)	1.44 (0.12)	<.05	−31.76
Adult respiratory distress syndrome	3.56 (0.18)	3.39 (0.17)	3.93 (0.19)	4.49 (0.18)	4.90 (0.21)	6.24 (0.32)	<.05	75.41
Acute myocardial infarction	0.11 (0.03)	0.20 (0.03)	0.18 (0.03)	0.24 (0.04)	0.22 (0.04)	0.20 (0.04)	.17	79.35
Eclampsia	6.34 (0.29)	5.92 (0.28)	5.79 (0.35)	6.01 (0.37)	5.19 (0.21)	4.80 (0.18)	.06	−24.31
Blood transfusion	34.04 (1.47)	42.59 (1.75)	55.07 (2.82)	71.05 (2.86)	84.03 (2.36)	96.38 (2.84)	<.05	183.15
Ventilation	4.73 (0.19)	4.75 (0.20)	5.36 (0.22)	5.71 (0.23)	5.59 (0.21)	6.32 (0.28)	<.05	33.55
Hysterectomy	7.56 (0.28)	7.41 (0.28)	7.76 (0.29)	8.14 (0.30)	8.27 (0.30)	9.31 (0.36)	<.05	23.73
Sickle cell anemia with crisis†	0.92 (0.10)	0.72 (0.09)	0.73 (0.08)	0.91 (0.12)	0.86 (0.10)	0.58 (0.07)	.48	−36.45
Intracranial injuries†	0.13 (0.03)	0.12 (0.03)	0.17 (0.04)	0.19 (0.04)	0.10 (0.02)	0.09 (0.02)	.28	−33.37
Internal injuries of thorax, abdomen, and pelvis†	0.64 (0.07)	0.52 (0.06)	0.73 (0.07)	0.78 (0.08)	0.68 (0.07)	0.55 (0.07)	.75	−14.10
Aneurysm†	0.02 (0.01)	0.04 (0.02)	0.04 (0.01)	0.08 (0.02)	0.09 (0.02)	0.06 (0.02)	.07	194.73
Operations on heart and pericardium†	2.63 (0.13)	1.53 (0.72)	3.26 (0.13)	3.98 (0.15)	4.44 (0.32)	4.60 (0.18)	<.05	74.96
Cardio monitoring†	2.26 (0.26)	3.47 (1.08)	2.09 (0.68)	2.48 (0.09)	1.21 (0.42)	0.93 (0.08)	.11	−58.80
Temporary tracheostomy†	0.22 (0.04)	0.21 (0.04)	0.21 (0.04)	0.21 (0.04)	0.21 (0.04)	0.26 (0.04)	.73	19.75
Conversion of cardiac rhythm†	0.53 (0.06)	0.52 (0.06)	0.58 (0.06)	0.59 (0.06)	0.63 (0.06)	0.63 (0.06)	<.05	18.25
At least one complication	73.82 (1.63)	78.59 (1.86)	91.24 (2.23)	106.33 (1.74)	116.06 (2.93)	129.08 (3.34)	<.05	74.86
In-hospital mortality	1.05 (0.09)	0.75 (0.07)	0.86 (0.08)	0.78 (0.07)	0.88 (0.06)	0.66 (0.06)	.18	−37.45

* Cuzick nonparametric test-for-trend across ordered groups was used to assess the statistical significance of changes over time.
† Conditions and procedures identified based on review of coded discharge abstracts where discharge status was listed as died during hospitalization.

Blood transfusion rates during delivery have increased **183%** since 1998

Table 2. Rates (Standard Errors) of Selected Severe Complications During Postpartum Hospitalizations per 10,000 Delivery Hospitalizations: United States, 1998–2009 (N=738,124)

Condition	1998–1999	2000–2001	2002–2003	2004–2005	2006–2007	2008–2009	P*	% Increase
Acute renal failure	0.48 (0.06)	0.72 (0.08)	1.02 (0.10)	1.13 (0.11)	1.53 (0.12)	2.17 (0.11)	<.05	351.11
Cardiac arrest or ventricular fibrillation	0.12 (0.03)	0.17 (0.03)	0.22 (0.04)	0.17 (0.03)	0.18 (0.04)	0.41 (0.07)	.08	244.85
Heart failure during procedure or surgery	0.98 (0.08)	1.10 (0.09)	1.34 (0.10)	1.39 (0.11)	1.58 (0.10)	1.86 (0.14)	<.05	89.53
Shock	0.40 (0.05)	0.60 (0.07)	0.75 (0.07)	0.86 (0.08)	1.02 (0.08)	1.40 (0.16)	<.05	250.06
Sepsis	1.42 (0.10)	1.42 (0.10)	1.86 (0.12)	2.38 (0.13)	2.69 (0.14)	3.53 (0.21)	<.05	148.81
Disseminated intravascular coagulation	1.19 (0.11)	1.27 (0.13)	1.68 (0.13)	1.91 (0.13)	1.73 (0.12)	2.18 (0.18)	<.05	82.87
Thrombotic embolism	1.33 (0.11)	1.35 (0.10)	2.29 (0.13)	2.64 (0.14)	2.88 (0.15)	3.57 (0.19)	<.05	168.63
Puerperal cerebrovascular disorders	1.51 (0.12)	1.94 (0.13)	2.28 (0.15)	2.46 (0.14)	2.37 (0.14)	3.13 (0.22)	<.05	107.45
Severe anesthesia complications	0.30 (0.05)	0.18 (0.03)	0.20 (0.04)	0.18 (0.04)	0.22 (0.04)	0.25 (0.05)	.95	-17.80
Pulmonary edema	0.42 (0.06)	0.42 (0.05)	0.49 (0.06)	0.49 (0.06)	0.43 (0.06)	0.58 (0.08)	.08	38.34
Adult respiratory distress syndrome	1.07 (0.10)	1.35 (0.11)	1.71 (0.12)	2.00 (0.13)	2.45 (0.15)	3.01 (0.18)	<.05	181.74
Acute myocardial infarction	0.18 (0.03)	0.28 (0.05)	0.32 (0.05)	0.33 (0.05)	0.40 (0.05)	0.42 (0.06)	<.05	131.24
Eclampsia	1.76 (0.12)	2.01 (0.12)	2.28 (0.14)	2.70 (0.16)	2.69 (0.14)	2.90 (0.18)	<.05	64.52
Blood transfusion	3.48 (0.21)	4.67 (0.26)	6.22 (0.29)	7.82 (0.31)	8.74 (0.36)	9.89 (0.38)	<.05	184.32
Ventilation	1.19 (0.11)	1.42 (0.11)	1.81 (0.14)	2.04 (0.15)	2.14 (0.15)	2.57 (0.18)	<.05	116.33
Hysterectomy	0.88 (0.08)	0.89 (0.08)	1.10 (0.09)	1.16 (0.09)	1.04 (0.08)	1.19 (0.11)	.06	35.74
Sickle cell anemia with crisis	0.09 (0.03)	0.10 (0.02)	0.13 (0.03)	0.34 (0.06)	0.33 (0.06)	0.40 (0.11)	<.05	345.10
Intracranial injuries	0.08 (0.02)	0.04 (0.02)	0.08 (0.02)	0.13 (0.03)	0.08 (0.02)	0.08 (0.03)	.45	5.26
Internal injuries of thorax, abdomen, and pelvis	0.21 (0.04)	0.13 (0.03)	0.16 (0.03)	0.28 (0.05)	0.18 (0.03)	0.15 (0.03)	.85	-28.39
Aneurysm	0.03 (0.01)	0.04 (0.02)	0.01 (0.01)	0.03 (0.01)	0.03 (0.01)	0.06 (0.03)	.46	88.47
Operations on heart and pericardium	0.80 (0.08)	1.17 (0.11)	1.64 (0.12)	1.83 (0.15)	1.96 (0.13)	2.47 (0.15)	<.05	209.01
Cardio monitoring	0.53 (0.07)	0.48 (0.07)	0.38 (0.05)	0.43(0.07)	0.48 (0.08)	0.31 (0.06)	.12	-40.76
Temporary tracheostomy	0.09 (0.03)	0.12 (0.03)	0.10 (0.02)	0.21 (0.04)	0.23 (0.04)	0.24 (0.05)	<.05	164.65
Conversion of cardiac rhythm	0.06 (0.02)	0.08 (0.02)	0.13 (0.03)	0.13 (0.03)	0.12 (0.03)	0.30 (0.06)	.07	407.25
At least one complication	13.59 (0.42)	15.42 (0.46)	19.54 (0.56)	22.61 (0.61)	24.45 (0.63)	29.03 (0.68)	<.05	113.60
In-hospital mortality	0.26 (0.04)	0.24 (0.04)	0.29 (0.05)	0.30 (0.05)	0.32 (0.04)	0.43 (0.06)	<.05	66.10

* Cuzick nonparametric test-for-trend across ordered groups was used to assess the statistical significance of changes over time.

Blood transfusion rates during postpartum hospitalization have increased **184%** since 1998.

In conclusion, we present an overview of trends in severe maternal morbidity, update previous reports, and propose a new standard for monitoring severe maternal morbidity that remains open to emerging issues in obstetrical care and management. Our findings suggest a substantial increase in severe complications for delivery and postpartum hospitalizations from 1998–1999 to 2008–2009, particularly as indicated by the growing rates for blood transfusions, acute renal failure, shock, acute myocardial infarction, respiratory distress syndrome, aneurysms, and cardiac surgery during delivery hospitalizations.

What are diagnoses associated with obstetrical bleeding?

- Placenta previa
- Placenta accreta
- Placenta increta
- Placenta percreta
- Uterine rupture
- Placental abruption
- Complication that can present in any obstetrical case
  - Disseminated intravascular coagulopathy (DIC)

Classes of Hemorrhage

- Class 1
  - <900cc
  - Minimal symptoms
- Class 2
  - 1200-1500cc
  - Tachycardia, tachypnea
- Class 3
  - 1800-2100cc
  - Overt Hypotension, cold, clammy skin
- Class 4
  - 2400cc
  - Shock, absent BP

How to manage the patient?

- When diagnosed in advance of delivery, careful planning provides the best management.
- Extended antepartum hospital stay
  - *Continuous type and screen, should the patient go to delivery rapidly.*
  - *Every 3 days, new sample, new type and screen – requires coordination with nursing.*
- Delivery date is planned.
  - Patient is prepared for possible hemorrhage.
    - *May go to interventional radiology*
    - *Prophylactic hypogastric artery balloon catheters placed, so that the vessel can be controlled if massive bleeding occurs.*
  - *Cesarean section. Immediate hysterectomy, may be necessary. Bladder may be involved.*
    - *Perform section in the routine OR, not in the Delivery Room*
    - *Perform case close to the blood bank or have coolers in the room with many blood products.*

An Experienced Multidisciplinary Team

- Obstetrics
- Gynecologic Oncology
- Urology
- Vascular Surgery
- Interventional Radiology
- Anesthesia
- Critical Care
- Transfusion Medicine
- Coagulation Laboratory

Blood Products

- May just need a few urgent red cells.
- If hemorrhage is massive, massive transfusion protocol should be utilized.
- BUMC originally had a unique MTP for obstetrics. Smaller number of red cells and plasma.
  - Caused confusion as to which the MD wanted.
    - Standard MTP?
    - OB MTP?
  - Went to one MTP
- MTP can only be ordered with a phone call – no electronic ordering

Blood Products - MTP

- 1st MTP
  - 5 red cells, 4 plasma, 1 platelet
- 2nd MTP
  - 5 red cells, 4 plasma
- 3rd MTP
  - 5 red cells, 4 plasma, 1 platelet, pool of 10 cryo

At any time, the team can order off the protocol, i.e., if the fibrinogen is very low and cryo is needed sooner.

Must Have Rapid Coagulation Testing Capabilities

- Transfusion is often initiated before testing is complete.
- Obstetrical hemorrhage often has a significant component of enhanced fibrinolysis.
- Availability of rapid hemostasis profile, DIC panel
  - Fibrinogen
  - Hematocrit
  - Platelet count
  - PT INR
  - aPTT
  - Thrombin clot time
  - Fibrin split product
  - D Dimer
- Thromboelastograph (TEG) is also useful in management of obstetrical bleeding, especially to detect increased fibrinolysis.

SOPs and Training Specific to Obstetrical Bleeding

- All orders for type and screen and/or blood products on an OB patient are considered stat, regardless of priority entered by the ordering provider.
- Rapid response to MTP orders and emergency release orders (verbal)
- Rapid preparation of pooled cryo
- Recognition of "cry for help" from L/D. Prompt with the right questions. Nursing staff may not know how to express what is needed.
- Work with antepartum, Labor and Delivery leadership to understand the patient management plans.
- Support with necessary planning and coordination.
- Talk with your colleagues in the coagulation section. Check on results so product orders can be anticipated.

Transfusion Medicine Involvement and Real Time Monitoring of Transfusion Practices is Vital!!

Improper transfusion technique linked to Michigan maternal hemorrhage deaths

By: MICHELE G. SULLIVAN, Family Practice News Digital Network

May 16, 2016

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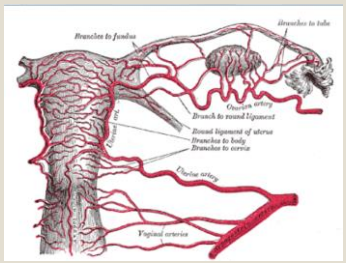
WASHINGTON – Half of the pregnancy-associated hemorrhage deaths in Michigan were deemed preventable, and most of those occurred in women who received no fresh frozen plasma during their transfusion.

Questions? Discussion…



Hypogastric Artery