

# Sepse u těhotné

## z pohledu anesteziologa a intenzivisty



**JAN BLÁHA**

Klinika anesteziologie, resuscitace a intenzivní medicíny  
1. lékařská fakulta Univerzity Karlovy v Praze  
Všeobecná fakultní nemocnice v Praze

[jan.blaha@vfn.cz](mailto:jan.blaha@vfn.cz)

# Surviving Sepsis Campaign



*The Intensive Connection*



Society of  
Critical Care Medicine  
The Intensive Care Professionals

## Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012

R. Phillip Dellinger, MD<sup>1</sup>; Mitchell M. Levy, MD<sup>2</sup>; Andrew Rhodes, MB BS<sup>3</sup>; Djillali Annane, MD<sup>4</sup>; Herwig Gerlach, MD, PhD<sup>5</sup>; Steven M. Opal, MD<sup>6</sup>; Jonathan E. Sevransky, MD<sup>7</sup>; Charles L. Sprung, MD<sup>8</sup>; Ivor S. Douglas, MD<sup>9</sup>; Roman Jaeschke, MD<sup>10</sup>; Tiffany M. Osborn, MD, MPH<sup>11</sup>; Mark E. Nunnally, MD<sup>12</sup>; Sean R. Townsend, MD<sup>13</sup>; Konrad Reinhart, MD<sup>14</sup>; Ruth M. Kleinpell, PhD, RN-CS<sup>15</sup>; Derek C. Angus, MD, MPH<sup>16</sup>; Clifford S. Deutschman, MD, MS<sup>17</sup>; Flavia R. Machado, MD, PhD<sup>18</sup>; Gordon D. Rubenfeld, MD<sup>19</sup>; Steven A. Webb, MB BS, PhD<sup>20</sup>; Richard J. Beale, MB BS<sup>21</sup>; Jean-Louis Vincent, MD, PhD<sup>22</sup>; Rui Moreno, MD, PhD<sup>23</sup>; and the Surviving Sepsis Campaign Guidelines Committee including the Pediatric Subgroup\*

Crit Care Med 2013; 41:580-637  
Intensive Care Med. 2013 Feb;39(2):165-228.

## Impact of the Surviving Sepsis Campaign protocols on hospital length of stay and mortality in septic shock patients: Results of a three-year follow-up quasi-experimental study\*

Álvaro Castellanos-Ortega, MD, PhD; Borja Suberviola, MD; Luis A. García-Astudillo, MD; María S. Holanda, MD; Fernando Ortiz, MD; Javier Llorca, MD, PhD; Miguel Delgado-Rodríguez, MD, MPH, PhD

Crit Care Med 2010; 38:1036 -1043

Table 2. Comparison between the historical and the intervention groups

	Historical Group, n = 96 (20%)	Intervention Group, n = 384 (80%)	<i>p</i>
Time from severe sepsis presentation to ICU admission, hr	11.7 ± 13.5	9.2 ± 14.4	<.001
Compliance with 6-hr resuscitation bundle, n (%)			
Serum lactate measured	15 (15.6)	288 (75.0)	<.001
Blood cultures before antibiotics	36 (37.5)	210 (56.7)	.003
Early broad-spectrum antibiotics	47 (49.0)	220 (57.3)	.168
Intravenous fluids delivered	57 (59.4)	322 (83.9)	.037
Mean arterial pressure ≥65 mm Hg achieved	71 (74.0)	257 (66.9)	.187
Central venous pressure ≥8 mm Hg achieved	68 (70.8)	288 (75.0)	.435
Central venous oxygen saturation ≥70% achieved	53 (55.2)	215 (56.0)	.909
Outcome measurements			
Hospital mortality, n (%)	55 (57.3)	144 (37.5)	.001
Standardized mortality ratio	1.05 ± 0.18	0.75 ± 0.13	.139
ICU mortality, n (%)	51 (53.1)	117 (30.5)	<.001
Hospital LOS for all patients, days	26.5 ± 23.9	30.6 ± 33.2	.435
ICU LOS for all patients, days	9.9 ± 9.3	9.1 ± 10.4	.235
Hospital LOS for survivors, days	41.0 ± 26.3	36.2 ± 34.8	.043
ICU LOS for survivors, days	11.0 ± 9.5	8.4 ± 9.8	.004

## Surviving Sepsis Campaign • International Guidelines for Management of Severe Sepsis and Septic Shock

### SPONSORING ORGANIZATIONS:

American Association of Critical-Care Nurses  
 American College of Chest Physicians  
 American College of Emergency Physicians  
 American Thoracic Society  
 Asia Pacific Association of Critical Care Medicine  
 Australian and New Zealand Intensive Care Society  
 Brazilian Society of Critical Care  
 Canadian Critical Care Society  
 Chinese Society of Critical Care Medicine  
 Chinese Society of Critical Care Medicine-China Medical Association  
 Emirates Intensive Care Society  
 European Respiratory Society  
 European Society of Clinical Microbiology and Infectious Diseases  
 European Society of Intensive Care Medicine  
 European Society of Pediatric and Neonatal Intensive Care  
 Infectious Diseases Society of America  
 Indian Society of Critical Care Medicine  
 International Pan Arabian Critical Care Medicine Society  
 Japanese Association for Acute Medicine  
 Japanese Society of Intensive Care Medicine  
 Pediatric Acute Lung Injury and Sepsis Investigators  
 Society for Academic Emergency Medicine  
 Society of Critical Care Medicine  
 Society of Hospital Medicine  
 Surgical Infection Society  
 World Federation of Critical Care Nurses  
 World Federation of Pediatric Intensive and Critical Care Societies  
 World Federation of Societies of Intensive and Critical Care Medicine  
 Participation and endorsement:  
 The German Sepsis Society  
 Latin American Sepsis Institute

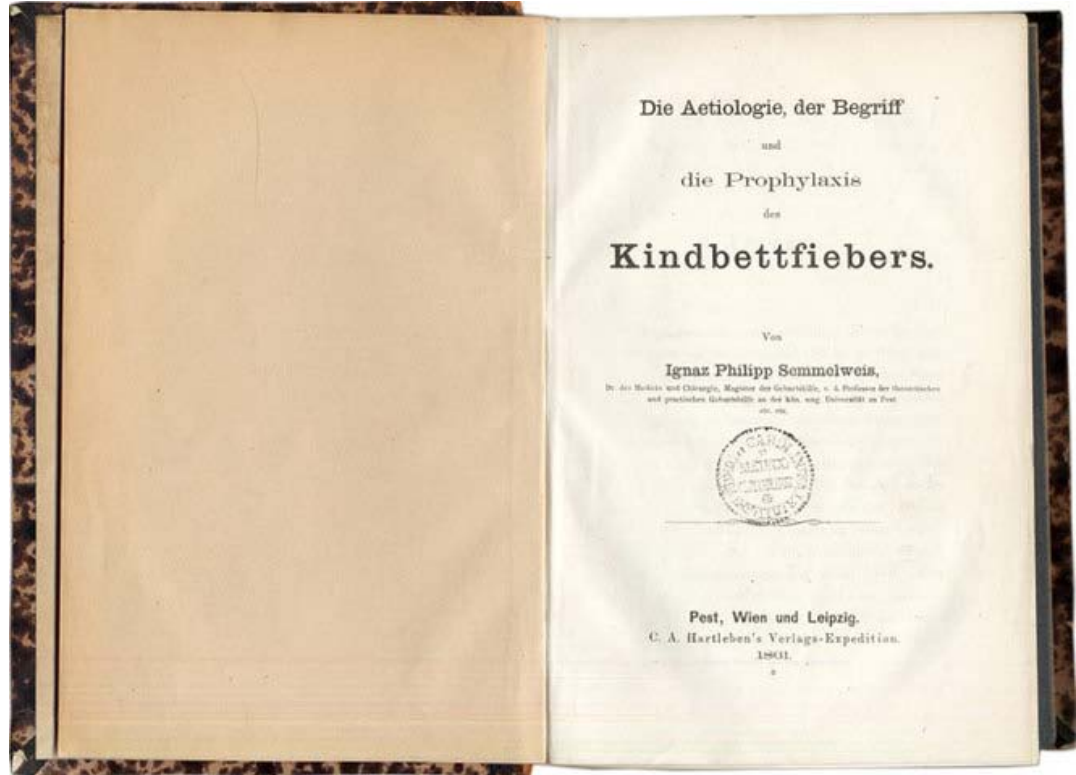
Sepsis v těhotenství  
 Verze: 1.2.

Česká gynekologická a porodnická společnost ČLS JEP  
 Česká společnost intenzivní medicíny ČLS JEP  
 Česká společnost anesteziologie, resuscitace a intenzivní medicíny ČLS JEP  
 Česká společnost nemocniční epidemiologie a hygieny ČLS JEP ?  
 Společnost pro epidemiologii a mikrobiologii ČLS JEP ?  
 Česká společnost infekčního lékařství ČLS JEP ?  
 Česká neonatologická společnost ČLS JEP ?

## MEZIOBOROVÝ DOPORUČENÝ POSTUP

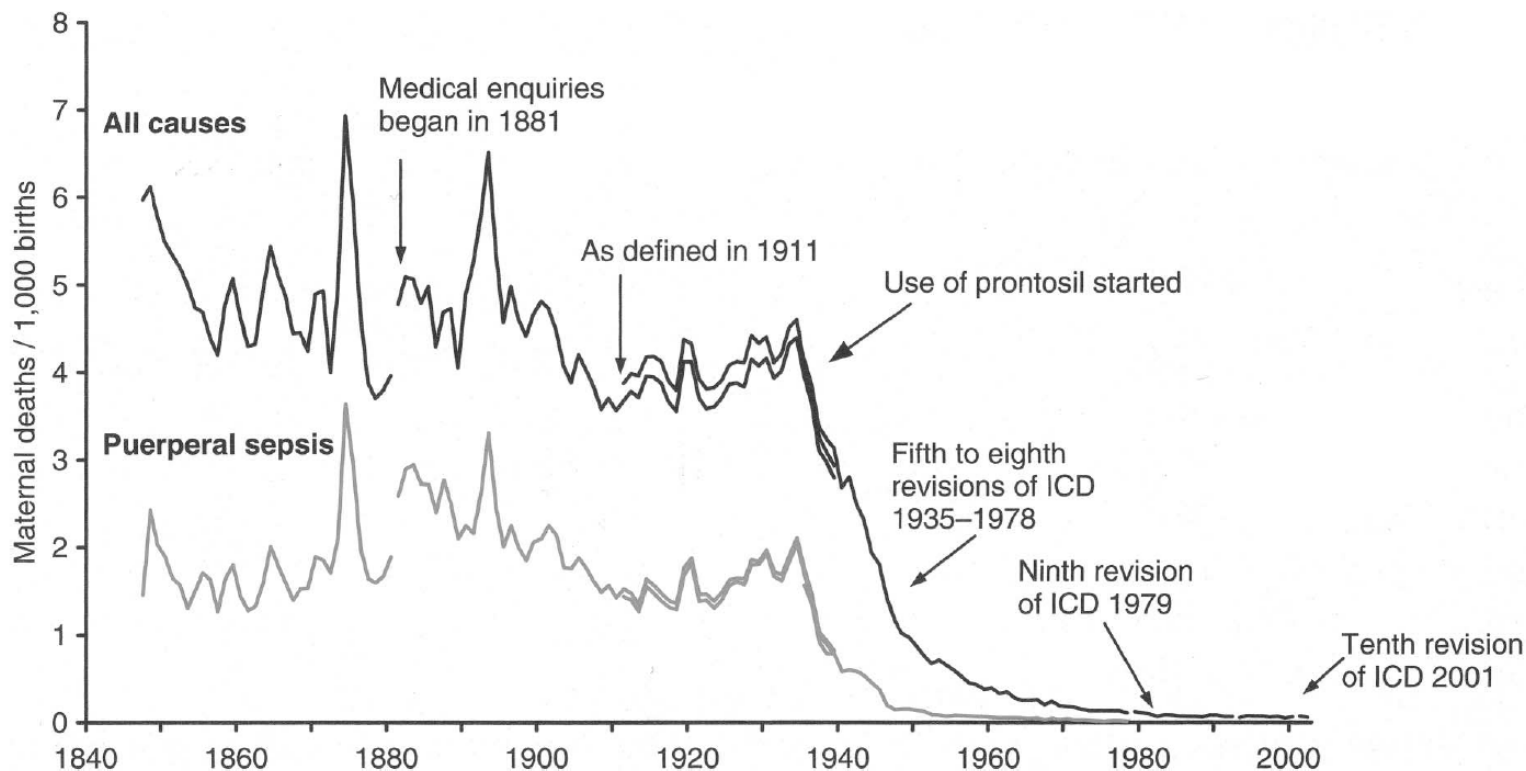
### DIAGNOSTIKA A LÉČBA SEPSE V SOUVISLOSTI S TĚHOTENSTVÍM

Adámková Václava  
 Balík Martin  
 Bláha Jan  
 Černý Vladimír  
 Kolář Milan  
 Melichar Jan  
 Pařízek Antonín  
 Plavka Richard



# Puerperal sepsis in the 21st century: progress, new challenges and the situation worldwide

Bigna S Buddeberg, Wynne Aveling



**Figure 1** Maternal mortality in England and Wales, 1840–2000. Source: General Register Office, OPCS and ONS mortality statistics. Birth counts, tables A10.1.1–A10.1.4. ICD, International Classification of Diseases; ONS, Office for National Statistics; OPCS, Office of Population Censuses and Surveys.

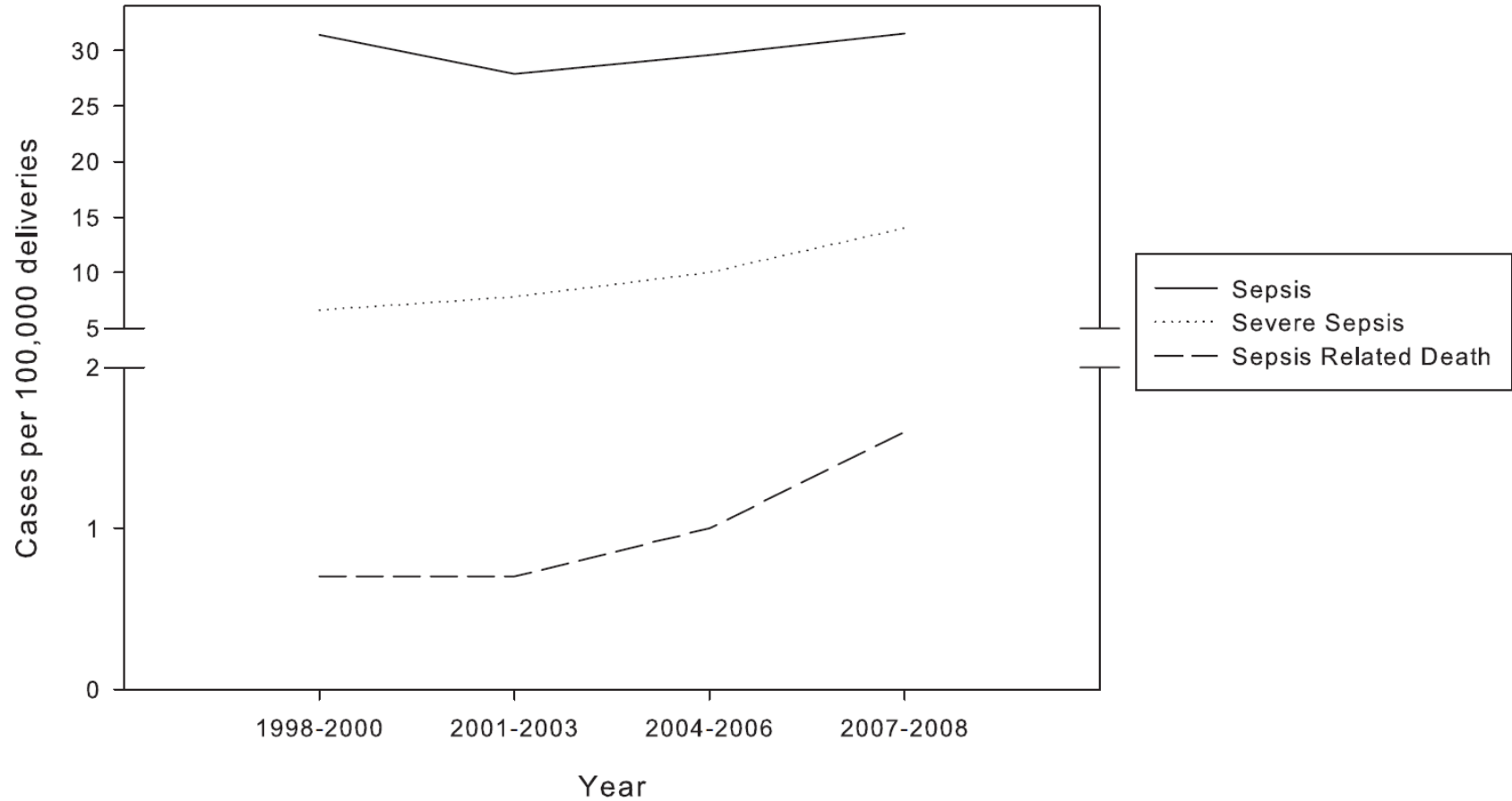
**Table 1.4.** Numbers and rates of leading causes of maternal deaths: UK 1985–2008

Cause of death	Rates per 100 000 maternities							
	1985–87	1988–90	1991–93	1994–96	1997–99	2000–02	2003–05	2006–08
<b>Direct deaths</b>								
Sepsis	0.40	0.72	0.65	0.73	0.85	0.65	0.85	<b>1.13</b>
Pre-eclampsia and eclampsia	1.19	1.14	0.86	0.91	0.75	0.70	0.85	<b>0.83</b>
Thrombosis and thromboembolism	1.41	1.40	1.51	2.18	1.65	1.50	1.94	<b>0.79</b>
Amniotic fluid embolism	0.40	0.47	0.43	0.77	0.38	0.25	0.80	<b>0.57</b>
Early pregnancy deaths*	0.71	1.02	0.73	0.68	0.80	0.75	0.66	<b>0.48</b>
Ectopic	0.48	0.64	0.39	0.55	0.61	0.55	0.47	<b>0.26</b>
Spontaneous miscarriage	0.18	0.25	0.13	0.09	0.09	0.05	0.05	<b>0.22</b>
Legal termination	0.04	0.13	0.22	0.05	0.09	0.15	0.09	<b>0.00</b>
Other	0.00	0.00	0.09	0.00	0.00	0.00	0.05	<b>0.00</b>
Haemorrhage	0.44	0.93	0.65	0.55	0.33	0.85	0.66	<b>0.39</b>
Anaesthesia	0.26	0.17	0.35	0.05	0.14	0.30	0.28	<b>0.31</b>
Other <i>Direct</i>	1.19	0.72	0.60	0.32	0.33	0.40	0.19	<b>0.17</b>
Genital tract trauma	0.26	0.13	0.17	0.23	0.09	0.05	0.14	<b>0.00</b>
Fatty liver	0.26	0.21	0.09	0.09	0.19	0.15	0.05	<b>0.13</b>
Other causes	0.66	0.38	0.35	0.00	0.05	0.20	0.00	<b>0.04</b>
<b>All Direct</b>	<b>6.13</b>	<b>6.14</b>	<b>5.53</b>	<b>6.10</b>	<b>4.99</b>	<b>5.31</b>	<b>6.24</b>	<b>4.67</b>
<b>Indirect</b>								
Cardiac disease	1.01	0.76	1.60	1.77	1.65	2.20	2.27	<b>2.31</b>
<i>Indirect</i> neurological conditions	0.84	1.27	1.08	2.14	1.60	2.00	1.75	<b>1.57</b>
Psychiatric causes	–	–	–	0.41	0.71	0.80	0.85	<b>0.57</b>
<i>Indirect</i> malignancies	–	–	–	–	0.52	0.25	0.47	<b>0.13</b>
Other <i>Indirect</i> causes	1.90	1.91	1.64	1.77	1.93	2.50	2.37	<b>2.14</b>
<b>All Indirect</b>	<b>3.70</b>	<b>3.94</b>	<b>4.32</b>	<b>6.10</b>	<b>6.40</b>	<b>7.76</b>	<b>7.71</b>	<b>6.59</b>
<b>Coincidental</b>	<b>1.15</b>	<b>1.65</b>	<b>1.99</b>	<b>1.64</b>	<b>1.37</b>	<b>1.80</b>	<b>2.60</b>	<b>2.18</b>

2011 Centre for Maternal and Child Enquiries (CMACE), BJOG 118 (Suppl. 1), e12–e21

## Maternal Severe Sepsis in the United States

**Figure 1.** Temporal trends for maternal sepsis, severe sepsis, and sepsis-related death during hospitalization for delivery during 1998 to 2008 in the United States.





While the overall frequency of sepsis was stable across the study period ( $P = 0.95$ ), acquiring severe sepsis increased 10% per year, sepsis-related death also increased 10% per year.

Sepsis complicated 1:3333 deliveries

severe sepsis complicated 1:10,823 deliveries,

and sepsis-related death complicated 1:105,384 deliveries

Bauer et al. Anesthesia & Analgesia 2013; 117(4):944-950

**Tab. 8.43** Hlavní příčiny mateřských úmrtí v České republice v průběhu let 1991–2010 (Petr Velebil, ÚPMD, 2012)

hemoragie	cca 23 %
trombózy a embolie	cca 20 %
kardiovaskulární komplikace	cca 16 %
absolutní počet úmrtí	cca 10 za rok
maternal mortality ratio	cca 10

Hájek et al. Porodnictví: 3., zcela přepracované a doplněné vydání (2014)

### MATERNAL MORTALITY: CAUSES (676 deaths during 2006-09)

Post-partum haemorrhage	<b>19.38 %</b>	Hepatic	<b>2.8 %</b>
Hypertensive disorders	<b>12 %</b>	Thromboembolism	<b>2.2 %</b>
Sepsis	<b>8 %</b>	Neurological	<b>2.2 %</b>
Heart diseases	<b>6.8 %</b>	Renal problems	<b>1.3 %</b>
Amniotic fluid embolism	<b>6.3 %</b>	Anaesthetic complications	<b>1.3 %</b>
Suicides	<b>2.8 %</b>		

Sources: KFOG, DHS

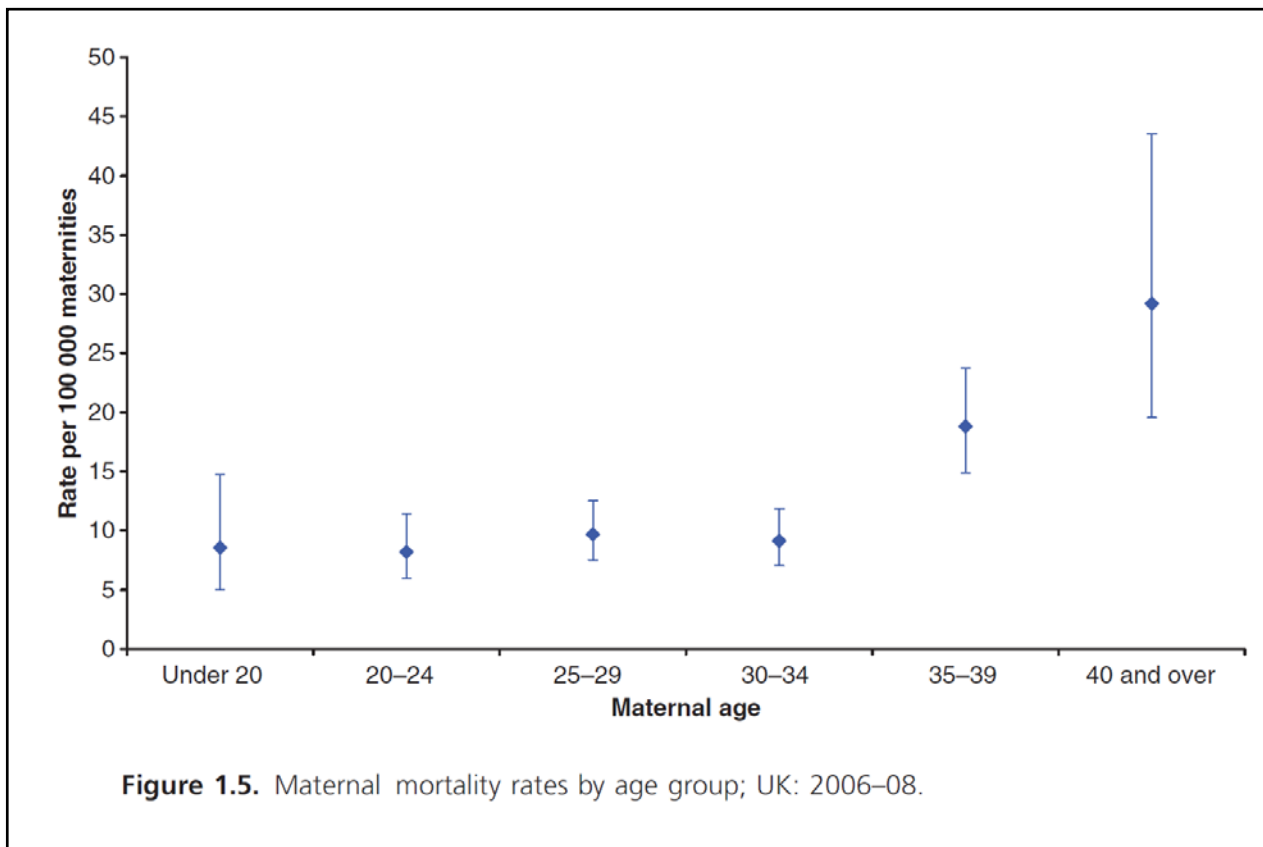
Thiruvananthapuram, January 7, 2013

- Porodnická mortalita v souvislosti se sepsí stoupá a očekává se její vzestup i nadále, přestože
  - používáme moderní postupy
  - zlepšuje se akutní péče
  - máme široké spektrum ATB
  - ...

## PROČ RIZIKO ROSTE?

Protože porodnictví se mění!

- demografické změny těhotných žen
  - rodičky jsou starší, častěji obézní a s DM, ...
  - častěji komplikace těhotenství (poruchy placentace, ...)
- změny v porodnické praxi
  - invazivní diagnostické a terapeutické techniky, ...



The Eighth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom, 2011.

## TĚHOTENSTVÍ JE JINÝ STAV

- vyšší „zranitelnost“ rodičky
  - příznaky a symptomy jsou často méně vyjádřené
  - progrese sepse je často mnohem rychlejší
  - rychlý rozvoj komplikací
- 
- vede k předčasnému porodu
  - infekce plodu

## ZMĚNY V TĚHOTENSTVÍ

- hyperdynamická cirkulace
- zvýšení srdečního výdeje (+40%)
- redukováná SVR
- již bazálně zvýšená zátěž myokardu
  
- zvýšená ventilace = mírná respirační alkalóza kompenzovaná mírnou metabolickou acidózou
- snížení kompenzačních možností při rozvoji acidózy při sepsi
  
- snížený sérový albumin - ovlivnění koloidně-osmotického tlaku (náchylnost k plicnímu edému)

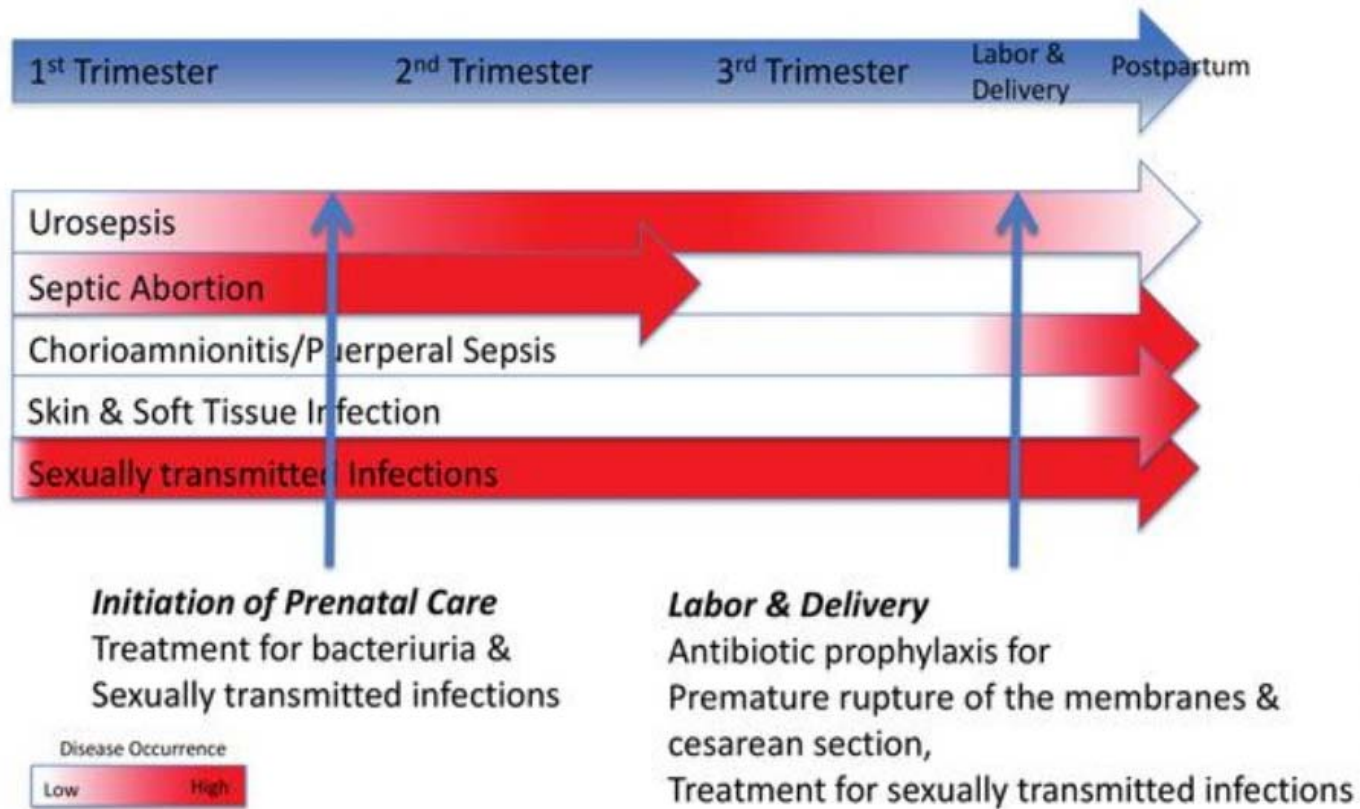
## ZMĚNY V TĚHOTENSTVÍ

- dilatace ureterů (relaxace hladkého svalstva)
- + tlak těhotné dělohy

= vysoké riziko pyurie a vzniku pyalonefritidy



## Narrowing Priority Pathogens/Syndromes to Actionable Targets: Opportunities for Bundled Interventions



## PŘÍZNAKY A SYMPTOMY SEPSE

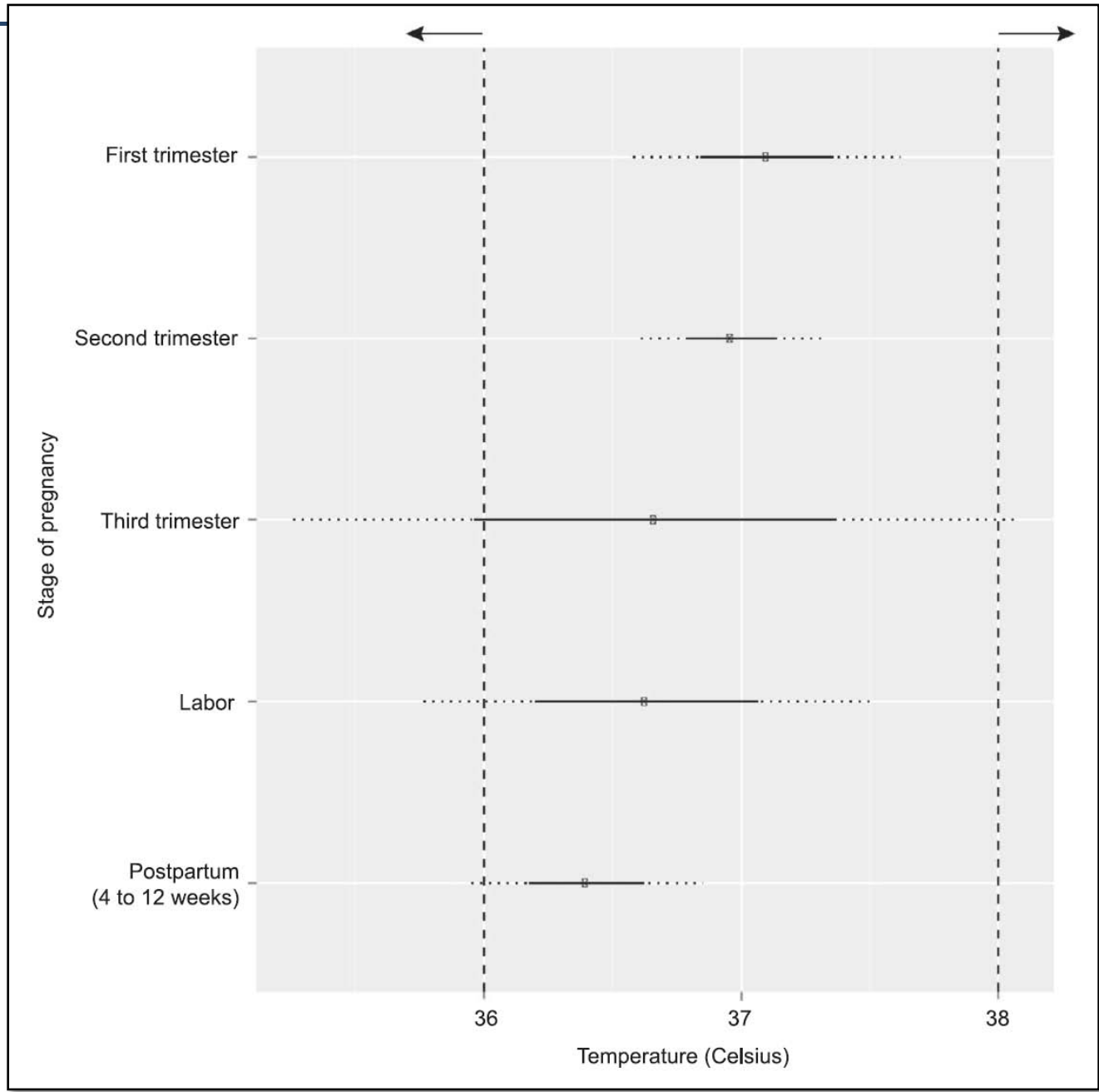
- **Horečka**  $>38^{\circ}\text{C}$
- **Hypotermie**  $<36^{\circ}\text{C}$
- **Perzistující tachykardie**  $>90/\text{min}$
- **Tachypnoe**  $>20/\text{min}$
- **Leukocytóza**  $>12 \cdot 10^9/\text{l}$  nebo  $<4 \cdot 10^9/\text{l}$
  
- **Průjem** a/nebo **zvracení**
- **Bolesti v podbřišku**
- **Abnormální ozvy plodu**

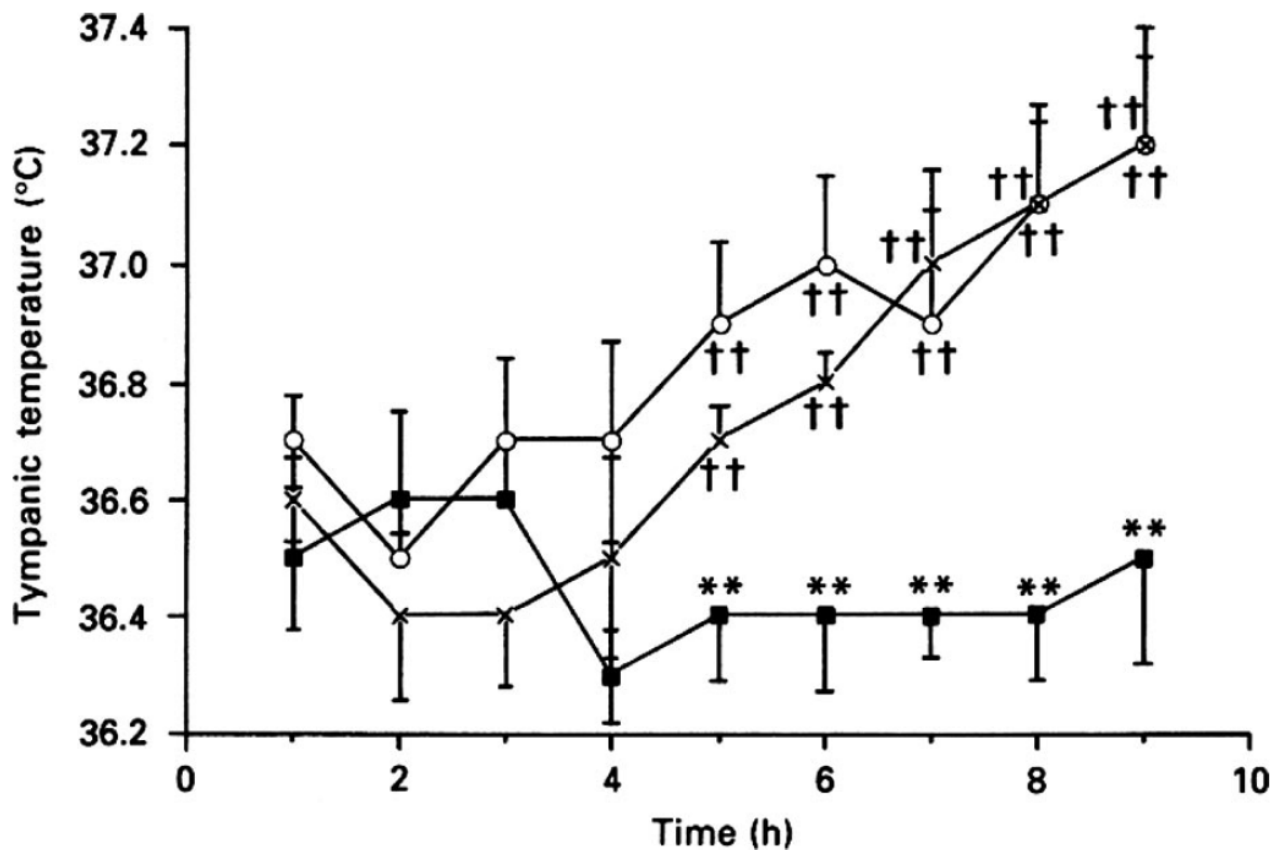
**Fig. 2.** Normal temperature variation during pregnancy and postpartum. Mean is indicated by the center of each forest plot, 1 standard deviation (SD) is indicated by a solid line, and a dotted line indicates 2 SDs from the mean. Vertical dotted lines indicate systemic inflammatory response syndrome criteria for each parameter. Bauer. SIRS Criteria in Pregnancy. Obstet Gynecol 2014.

## PŘÍZNAKY SEPSE

Horečka >38°C

Hypotermie <36°C





**Figure 1.** Tympanic membrane temperature in laboring women self-selecting different types of analgesia. Patients receiving epidural bupivacaine with fentanyl (open circles) or epidural bupivacaine only (crosses) experienced a gradual increase in temperature averaging 0.07°C/hour with no difference between groups. Patients receiving IV nalbuphine (■) had no temperature change during labor. \*\* $P < 0.01$  for difference between opioid and epidural groups. †† $P < 0.01$  for difference between baseline (pre-epidural) temperature. Reprinted with permission from Camann et al.<sup>4</sup>

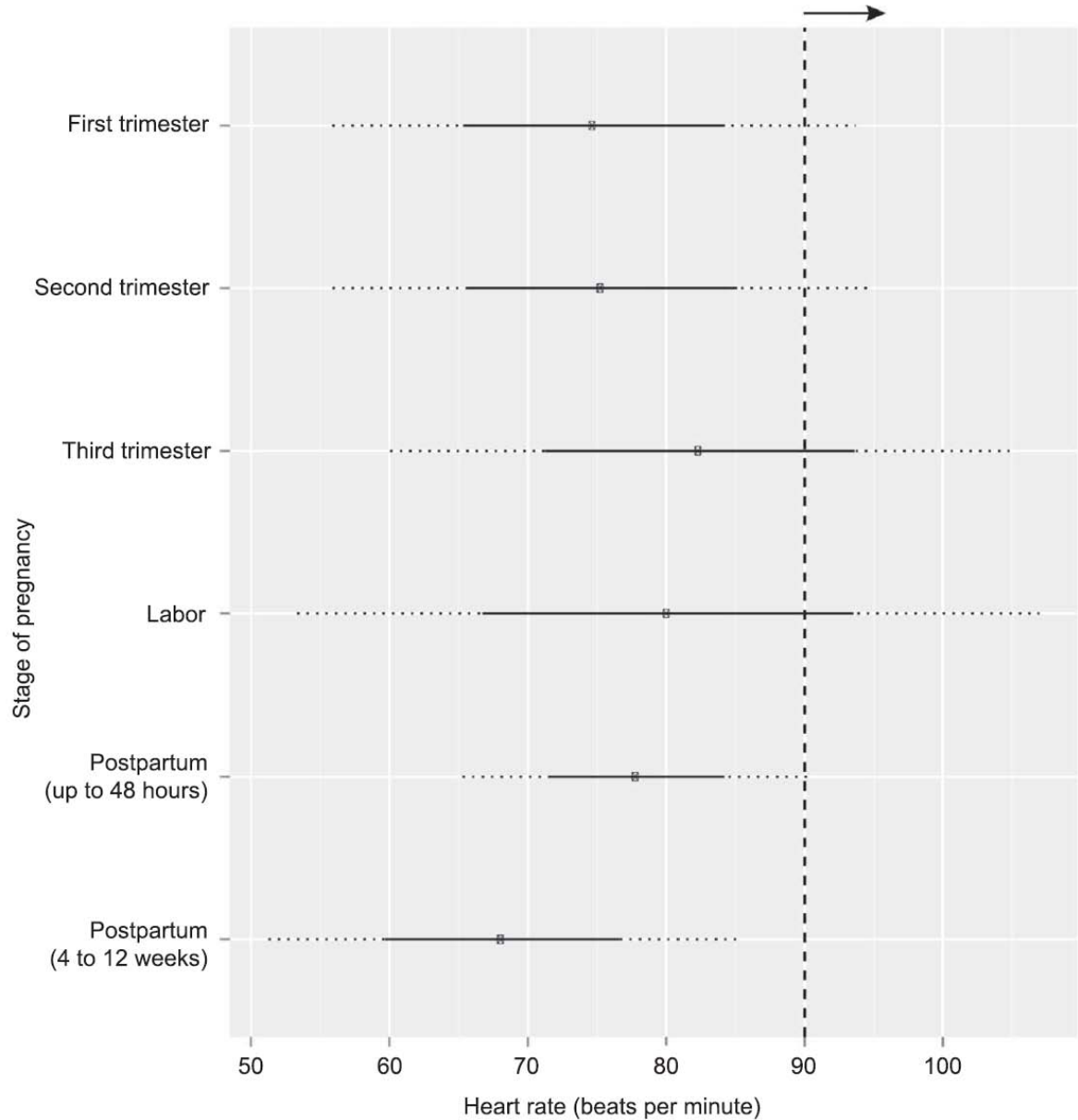
Anesth Analg 2010;111:1467-75

**Fig. 4.** Normal heart rate variation during pregnancy and postpartum. Mean is indicated by the *center* of each forest plot, 1 standard deviation (SD) is indicated by a *solid line*, and a *dotted line* indicates 2 SDs from the mean. *Vertical dotted lines* indicate systemic inflammatory response syndrome criteria for each parameter.

Bauer. *SIRS Criteria in Pregnancy.* *Obstet Gynecol* 2014.

## PŘÍZNAKY SEPSE

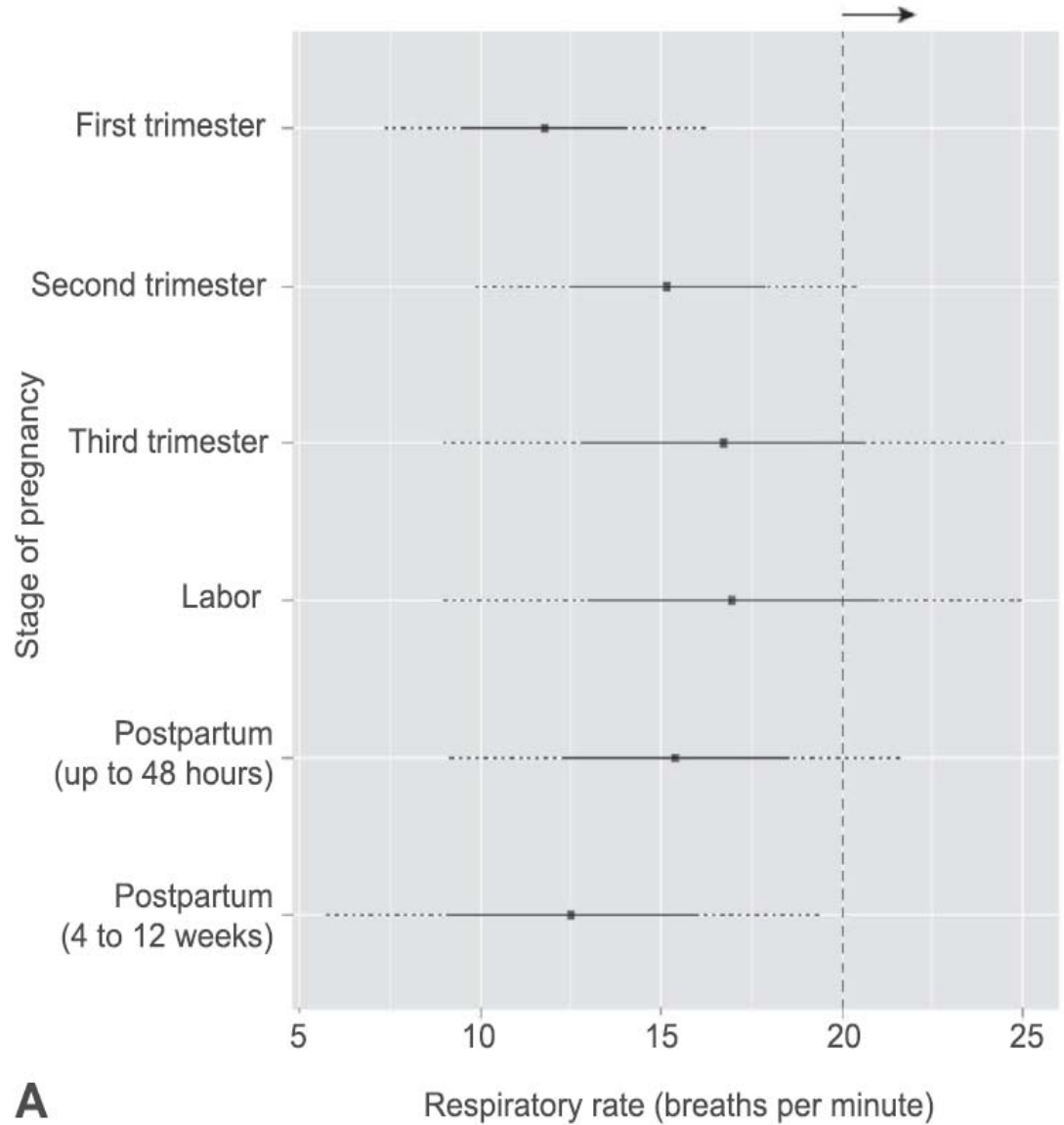
Tachykardie >90/min



**Fig. 3.** Normal respiratory rate variation during pregnancy and postpartum. Mean is indicated by the *center* of each forest plot, 1 standard deviation (SD) is indicated by a *solid line*, and a *dotted line* indicates 2 SDs from the mean.

Vertical dotted lines indicate systemic inflammatory response syndrome criteria for each parameter.

Bauer. SIRS Criteria in Pregnancy. *Obstet Gynecol* 2014.



## PŘÍZNAKY SEPSE

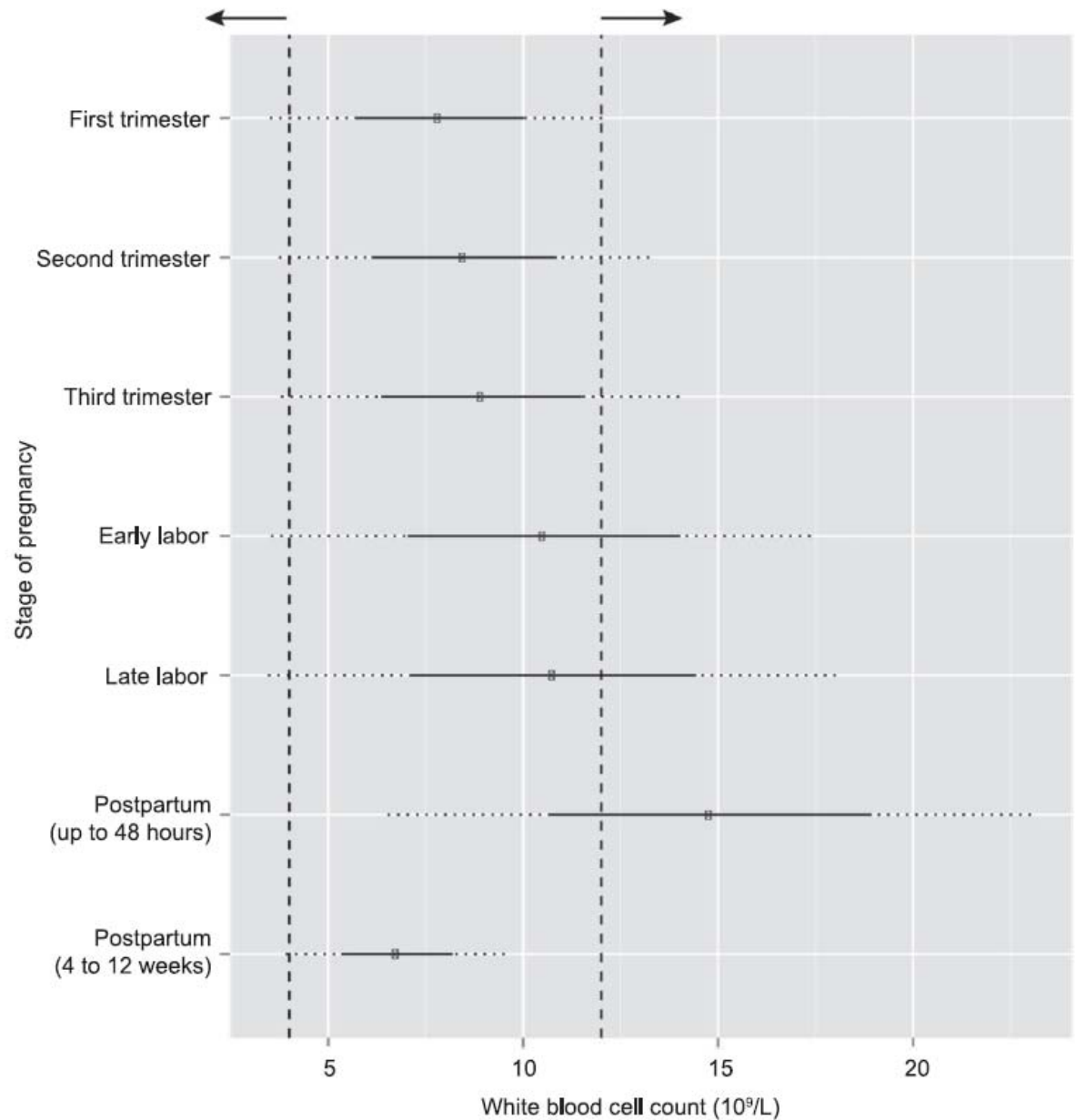
Tachypnoe >20/min

**A**

**Fig. 5.** Normal white blood cell count variation during pregnancy and postpartum. Mean is indicated by the *center* of each forest plot, 1 standard deviation (SD) is indicated by a *solid line*, and a *dotted line* indicates 2 SDs from the mean. *Vertical dotted lines* indicate systemic inflammatory response syndrome criteria for each parameter. *Bauer. SIRS Criteria in Pregnancy. Obstet Gynecol 2014.*

## PŘÍZNAKY SEPSE

Leukocytóza  $>12 \cdot 10^9/l$



## **Objective measures used in the diagnosis of sepsis in pregnancy**

- **Temperature**  $<36^{\circ}\text{C}$  or  $>38.3^{\circ}\text{C}$
- **Heart rate**  $> 100$  bpm
- **Respiratory rate**  $>24$ /minute
- **Acutely altered mental state**
- **Wbc**  $>20$  or  $<4 \times 10^9$ /l
- **Hyperglycaemia in the absence of (known) diabetes**

These parameters probably apply to pregnancy AFTER the first 20 weeks and up until the immediate postnatal period. **Under 20 weeks and more than 48 hours after delivery, it is probably safer to use the non-pregnant values, especially if the woman reports feeling unwell.**



# Maternal Deaths Due to Sepsis in the State of Michigan, 1999–2006

Melissa E. Bauer, DO, Robert P. Lorenz, MD, Samuel T. Bauer, MD, Krishna Rao, MD, MS, and Frank W.J. Anderson, MD, MPH

(*Obstet Gynecol* 2015;126:747–52)

**Table 2.** Specific Maternal Early Warning Criteria and Temperature Findings of Patients Who Presented to the Hospital With Sepsis

Patient No.	Maternal Early Warning Criteria* Triggered	Heart Rate Higher Than 120 bpm	Respiratory Rate Higher Than 30 Breaths/Min	Systolic Blood Pressure Lower Than 90 mm Hg	Spo <sub>2</sub> Less Than 95% on Room Air	Temperature Higher Than 38°C
1	+	NA	NA	NA	+	–
2	+	+	–	–	NA	–
3	+	–	+	–	NA	–
4	+	–	–	+	+	+
5	+	+	–	+	–	–
6	–	–	–	–	–	–
7	–	–	–	–	NA	–
8	+	+	+	–	+	–
9	+	+	–	–	+	+
10	–	–	–	–	–	–
11	+	+	+	–	–	–
12	+	–	–	–	+	–

bpm, beats per minute; NA, not available.

\* Maternal Early Warning Criteria are the following: systolic blood pressure lower than 90 or higher than 160 mm Hg, diastolic blood pressure higher than 100 mm Hg, heart rate lower than 50 or higher than 120 bpm, respiratory rate lower than 10 or higher than 30 breaths per minute, oxygen saturation on room air, at sea level, less than 95%, oliguria less than 35 mL per hour for 2 hours or longer, maternal agitation, confusion, or unresponsiveness; patient with preeclampsia reporting a nonremitting headache or shortness of breath.<sup>11</sup>

† Not part of the Maternal Early Warning Criteria.

*Original Research*

## **Maternal Deaths Due to Sepsis in the State of Michigan, 1999–2006**

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*(Obstet Gynecol 2015;126:747–52)*

Delays of care were found in the majority of patients.

Initial antibiotics with inadequate coverage based on the clinical situation were identified in 11 of 15 (73%) patients who received hospital care for sepsis;

Only 2 of 15 (13%) patients received appropriate initial antibiotics.

*Original Research*

## **Maternal Deaths Due to Sepsis in the State of Michigan, 1999–2006**

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*(Obstet Gynecol 2015;126:747–52)*

Of patients who presented to the hospital for care,  
delay of escalation of care was found in 53% (8/15)



Royal College of  
Obstetricians &  
Gynaecologists

## Bacterial Sepsis following Pregnancy

Green-top Guideline No. 64b  
April 2012



Sepsis v těhotenství  
Verze: 1.2.

Česká gynekologická a porodnická společnost ČLS JEP  
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### MEZIOBOROVÝ DOPORUČENÝ POSTUP

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Plavka Richard

### 3.1.1.

Doporučujeme vypracování vlastního formalizovaného protokolu / standardu pro včasný záchyt pacientek se známkami sepse a definování procesu péče po aktivaci systému včasného varování na konkrétním pracovišti(1)<sup>§</sup>

Poznámka: Důležité je zavedení tzv. rapid response system (RRS, systém časného varování), kdy k aktivaci systému může dojít už na podnět středního zdravotnického personálu. Smyslem systému „časného varování“ je zabránit u pacientů časové prodlevě zahájení léčby. Časová prodleva zhoršuje klinický výsledek exponenciálně.

### 3.2.1.

Doporučení: Jakákoliv významná změna zdravotního stavu / fyziologických funkcí nevysvětlitelná jinou příčinou by měla být považována za známku možného rozvoje sepse do doby jejího vyloučení. (1<sup>§</sup>)

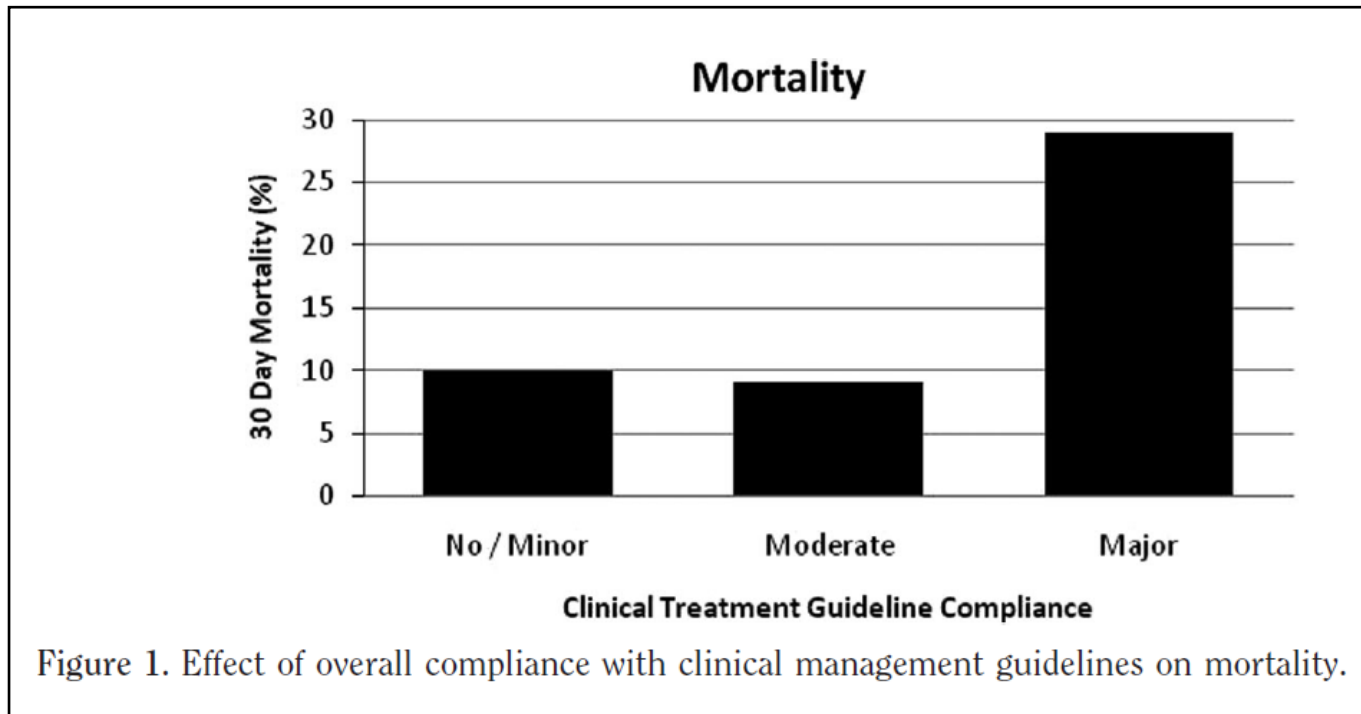


Figure 1. Effect of overall compliance with clinical management guidelines on mortality.

Rice et al. Crit Care Med 2012; 40:778-86



# Modified Early Obstetric Warning Score Call-Out-Cascade

## MEOWS $\leq 2$

Continue current treatment plan

## MEOWS = 3

Inform Coordinator or Senior Midwife  
Repeat observations  
Senior midwife to review  
Consider medical review

## MEOWS $\geq 4$

(Or 3 in any parameter)

Inform Coordinator or Senior Midwife  
Contact Obstetric SHO to review  
If SHO unable to attend within 30 minutes:  
Contact Obstetric Registrar, or  
Contact Obstetric Senior Registrar

## MEOWS $\geq 6$

Inform Coordinator or Senior Midwife  
Urgent medical review needed  
Contact Obstetric Registrar and Senior Registrar  
Contact Anaesthetic Registrar  
If doctors unavailable contact:  
Consultant Obstetrician on call  
4<sup>th</sup> On Anaesthetist  
Consider Critical Care Outreach referral

## Bleep Numbers:

Obstetric SHO – 0901  
Obstetric Registrar – 0902  
Obstetric Senior Registrar – 0903  
Obstetric Anaesthetist – 0011  
4<sup>th</sup> On Anaesthetist – Switchboard  
Critical Care Outreach Team - 0805

## Think:

Airway  
Breathing  
Circulation  
Left lateral tilt if pregnant  
Increase frequency of observations  
Record Oxygen saturations  
Urinalysis  
Fetal monitoring

## Consider:

Signs of SIRS or suspected sepsis?

→ Refer to Sepsis Bundle

O<sub>2</sub> therapy  
IV access  
Fluid resuscitation  
Urinary catheter  
Analgesia  
Bloods: FBC, U&E, LFT  
X-match  
Blood glucose  
ABG  
Septic screen  
12 lead ECG  
Transfer to CDS or Critical Care

If patient deteriorates, fails to respond to treatment or MEOWS increases by 2 points or more:

### Do not delay, seek expert help

Contact Consultant Obstetrician on call  
Contact duty Consultant Anaesthetist

**In an emergency call 2222 and state "Obstetric Emergency"**

Norfolk and Norwich University Hospitals   
NHS Foundation Trust

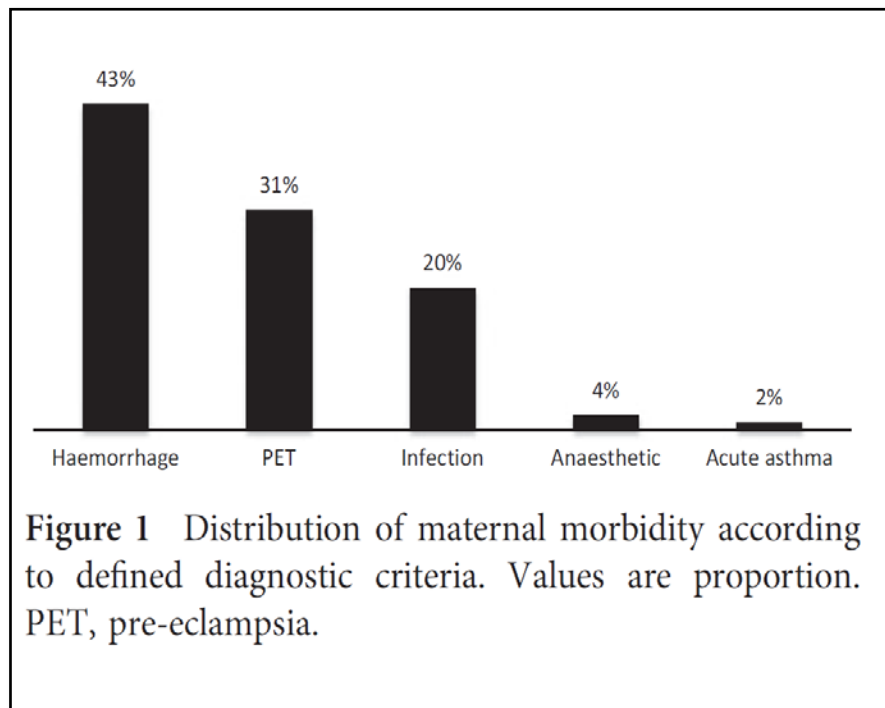
Date of issue: August 2014  
Guideline Ref No: MID33 v.4/AO13 v.4



# A validation study of the CEMACH recommended modified early obstetric warning system (MEOWS)\*

S. Singh,<sup>1</sup> A. McGlennan,<sup>2</sup> A. England<sup>2</sup> and R. Simons<sup>2</sup>

*1 Consultant Anaesthetist, Barnet Hospital, Herts, UK. 2 Consultant Anaesthetist, Royal Free Hospital, London, UK*



**Table 3.** Risk of developing morbidity in the presence of an abnormal parameter. Values are relative risk (95% CI).

Parameter	Relative risk of morbidity	p value
Heart rate > 100 beats.min <sup>-1</sup>	7.0 (4.9–10.1)	0.0001
Diastolic BP > 90 mmHg	6.6 (4.7–9.4)	0.0001
Systolic BP > 150 mmHg	5.4 (3.8–7.8)	0.0001
Respiratory rate > 22 breaths.min <sup>-1</sup>	4.8 (2.9–8.0)	0.0001
Temperature > 38 °C	3.4 (2.0–5.6)	0.0003
Systolic BP < 90 mmHg	2.4 (1.5–3.7)	0.0013
Oxygen saturation < 95%	1.3 (0.2–7.9)	0.56
Pain score 2–3	2.7 (0.8–8.4)	0.17
Responds to voice, pain or unresponsive	0.0	1.0

Singh S et al. Anaesthesia 2012; 67: 12–8

## A validation study of the CEMACH recommended modified early obstetric warning system (MEOWS)\*

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The MEOWS was 89% sensitive, 79% specific,  
with a positive predictive value 39% and a negative predictive value of 98%.

Singh S et al. Anaesthesia 2012; 67: 12-8

# Maternal Deaths Due to Sepsis in the State of Michigan, 1999–2006

Melissa E. Bauer, DO, Robert P. Lorenz, MD, Samuel T. Bauer, MD, Krishna Rao, MD, MS, and Frank W.J. Anderson, MD, MPH

(*Obstet Gynecol* 2015;126:747–52)

**Table 2.** Specific Maternal Early Warning Criteria and Temperature Findings of Patients Who Presented to the Hospital With Sepsis

Patient No.	Maternal Early Warning Criteria* Triggered	Heart Rate Higher Than 120 bpm	Respiratory Rate Higher Than 30 Breaths/Min	Systolic Blood Pressure Lower Than 90 mm Hg	Spo <sub>2</sub> Less Than 95% on Room Air	Temperature Higher Than 38°C
1	+	NA	NA	NA	+	–
2	+	+	–	–	NA	–
3	+	–	+	–	NA	–
4	+	–	–	+	+	+
5	+	+	–	+	–	–
6	–	–	–	–	–	–
7	–	–	–	–	NA	–
8	+	+	+	–	+	–
9	+	+	–	–	+	+
10	–	–	–	–	–	–
11	+	+	+	–	–	–
12	+	–	–	–	+	–

bpm, beats per minute; NA, not available.

\* Maternal Early Warning Criteria are the following: systolic blood pressure lower than 90 or higher than 160 mm Hg, diastolic blood pressure higher than 100 mm Hg, heart rate lower than 50 or higher than 120 bpm, respiratory rate lower than 10 or higher than 30 breaths per minute, oxygen saturation on room air, at sea level, less than 95%, oliguria less than 35 mL per hour for 2 hours or longer, maternal agitation, confusion, or unresponsiveness; patient with preeclampsia reporting a nonremitting headache or shortness of breath.<sup>11</sup>

† Not part of the Maternal Early Warning Criteria.

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2	+	+	–	–	NA	–
3	+	–	+	–	NA	–
4	+	–	–	+	+	+
5	+	+	–	+	–	–
6	–	–	–	–	–	–
7	–	–	–	–	NA	–
8	+	+	+	–	+	–
9	+	+	–	–	+	+
10	–	–	–	–	–	–
11	+	+	+	–	–	–
12	+	–	–	–	+	–

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## Obstetric Sepsis / Severe Sepsis Screening Tool

Does the woman have 2 Signs and Symptoms of Infection?

Temperature $<36$ or $>38$ °C	Respiratory rate $> 20$ bpm
Heart rate $>100$ bpm (AN & Intrapartum) $> 90$ bpm (PN)	Acutely altered mental state
WCC $>12$ or $<4 \times 10^9/l$ (higher threshold in labour)	Hyperglycaemia (Blood sugar $>7.7$ ) in the absence of diabetes

If YES

Does the woman have a history or signs of a new infection or infective source ?

Prolonged ruptured membranes or offensive liquor	Breast redness and / or tenderness / mastitis
Unexplained fetal tachycardia in the absence of a maternal tachycardia	Fetal demise
Recent delivery / offensive lochia	Cough / sputum / chest pain
Catheter or Dysuria	Abdominal pain distension/diarrhoea
Line infection	Cellulitis/wound infection/septic arthritis
Headache with neck stiffness	Other
Endocarditis	

If Yes the woman has **SEPSIS**

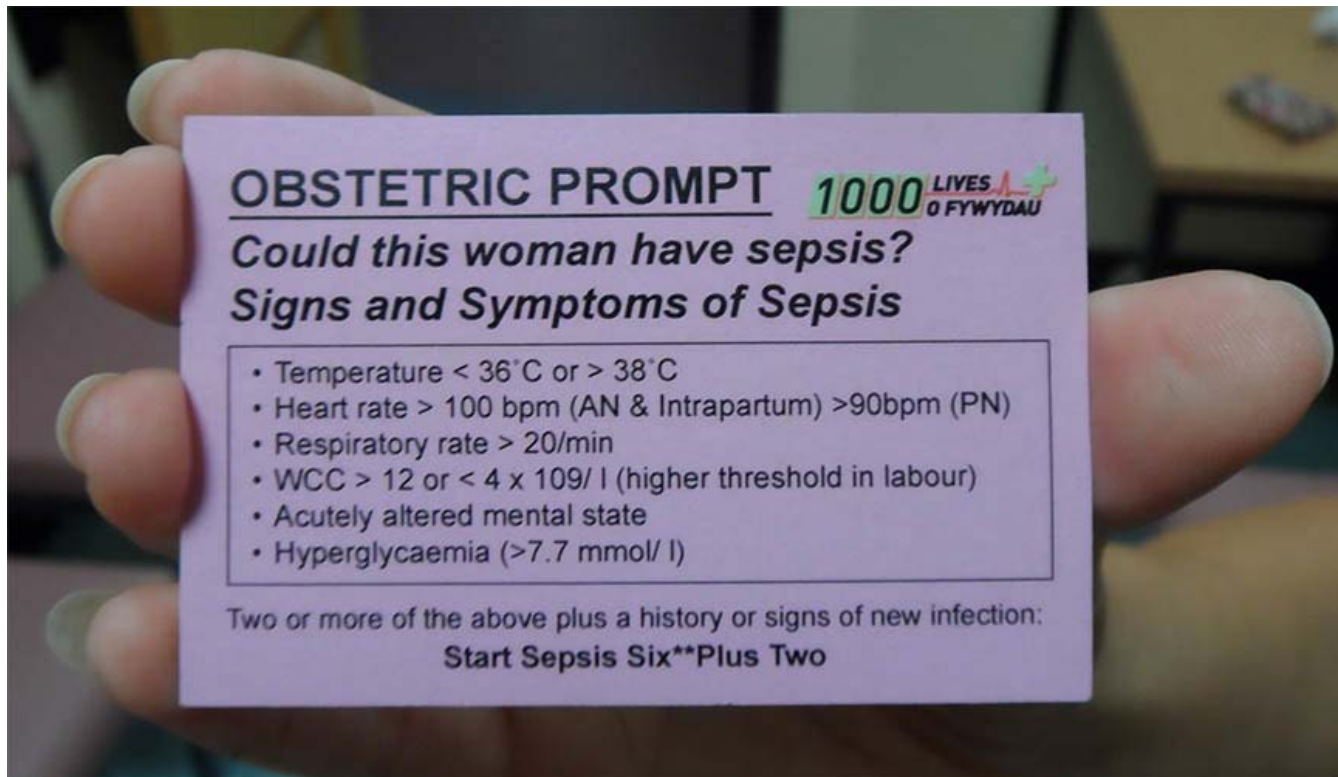
Does the woman have any signs of organ dysfunction ?

SBP $< 90$ or MAP $<70$ mmHg	Lactate $> 2$ mmols/l
Urine output $<0.5$ ml/kg/hr for 2 hours	New need for Oxygen to keep SaO <sub>2</sub> $>90\%$
Platelets $< 100 \times 10^9/l$	INR $> 1.5$ or aPTT $> 60$ s
Creatinine rise of $> 44.2$ mmol/l or level of $>177$ mmol/l	Bilirubin $> 70\mu$ mol/l

NO

YES

<p style="text-align: center;">If NO, treat for SEPSIS:</p> <p style="text-align: center;"><b><u>Start Sepsis Six**Plus Two</u></b></p> <ul style="list-style-type: none"> <li>Oxygen</li> <li>Blood cultures</li> <li>Lactate</li> <li>IV antibiotics</li> <li>Fluid therapy</li> <li>Fluid balance and catheter</li> </ul> <p style="text-align: center;">**Consideration of delivery &amp; VTE prophylaxis</p>	<p style="text-align: center;">If YES, the woman has SEVERE SEPSIS:</p> <p style="text-align: center;"><b><u>Start Sepsis Six**Plus Two</u></b></p> <ul style="list-style-type: none"> <li>Start the clock.....</li> <li>Refer the woman to Critical Care.</li> <li>Give IV Antibiotics within 1 hour</li> <li>Start with Stat Dose</li> </ul>
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It is helpful to remember the advice from CMACE 2006 - 2008; “*Be aware of sepsis – beware of sepsis.*”<sup>1</sup>

## Key Points

- Sepsis can lead to rapid deterioration and death in pregnant women
- Always suspect sepsis in all sick pregnant women until proven otherwise
- Use of a Modified Early Warning Scoring chart is recommended for all pregnant women in hospital
- Start broad spectrum antibiotics as early as possible
- Involve Obstetric, Gynaecology, Microbiological and Critical Care teams early

Cormack. Anaesthesia Tutorial of The Week 235, 8th August 2011

**MEDICAL CERTIFICATE OF DEATH**

16 DATE OF DEATH

*July* *27*, 191*2*  
(Month) (Day) (Year)

17 I HEREBY CERTIFY that I attended deceased from  
*July 15*, 191*2*, to *July 22*, 191*2*,  
that I last saw her alive on *July 22*, 191*2*,  
and that death occurred, on the date stated above, at \_\_\_\_\_ m.

The CAUSE OF DEATH\* was as follows:  
*Pericardial Peritonitis*

[jan.blaha@vfn.cz](mailto:jan.blaha@vfn.cz)