

Appendix. Details of Maternal Deaths Due to Sepsis

Patient Number	Case narrative	Time of presentation vital signs: HR, RR, BP, T, SpO ₂ (vital signs triggering MEWC ¹ are bolded)	Antibiotic choice at time of diagnosis. Appropriate for clinical situation?	Organism identified	Delay in appropriate antibiotic treatment or escalation of care?
1	Multiparous woman at term underwent an uncomplicated repeat CD. Complained of a cough during hospitalization. Last charted SpO ₂ was 93% on RA the day of delivery and was not repeated. CXR performed but not read prior to discharge was significant for bilateral patchy infiltrates. Given amoxicillin PO and was discharged. The day after discharge, patient presented severely hypoxic and was transferred to another hospital. She died 8 days later.	Remainder of vital signs not available from transferring hospital, 67% on RA	<ul style="list-style-type: none"> Ciprofloxacin <p>Neither amoxicillin or ciprofloxacin are adequate treatment for HCAP*</p>	Not identified	<p>Delay in appropriate antibiotic treatment: yes, patient SpO₂ and CXR should have been followed up and antibiotics for pneumonia should have been prescribed prior to discharge.</p> <p>Delay in escalation of care: yes, patient was cyanotic at admission, but was not transferred to a tertiary care center for over 10 hours.</p>
2	Multiparous woman presented with placental abruption and underwent repeat CD. Postoperative course complicated by ileus but ultimately discharged after a small bowel movement. Readmitted on POD #5 complaining of abdominal pain, distention, and unable to pass flatus. Large amount of free air was present under both diaphragms, but dismissed as thought to be due to	142 , 24, 145/72, 36.1°C, SpO ₂ not done	<ul style="list-style-type: none"> Cefoxitin Metronidazole Gentamicin <p>Inadequate treatment due to concern for bowel perforation, does</p>	<i>Bacteroides caccae</i>	Delay in appropriate antibiotic treatment: yes, patient had signs concerning for bowel perforation, but general surgery not consulted and antibiotics were not

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	recent CD. On POD #6, general surgery was consulted, antibiotics immediately started, and she was taken to the OR. Focal necrosis of the transverse colon was identified. Postoperatively, the patient was transferred to a medical/surgical floor. She had persistent oliguria overnight without physician evaluation for over 10 hours. During a routine vital sign check, she was found in cardiac arrest, resuscitated and died 3 days later.		not cover <i>Enterococcus</i>		started until the next day. Delay in escalation of care: yes, patient with known perforated viscus was severely oliguric overnight for over 10 hours without transfer to the ICU.
3	Multiparous woman during the 2 nd trimester with hyperemesis gravidarum on TPN with PICC line presented with a 2-day history of fever and shortness of breath. She was admitted to the antepartum floor and had increasing O ₂ requirements with no improvement in SpO ₂ . Within 12 hours of admission, she was severely acidotic with a lactate acid >10 mmol/L and went into cardiac arrest, was resuscitated and died 2 days later.	80, 40 , 108/60, 37.1°C, SpO ₂ not done Did not develop a fever during hospitalization	<ul style="list-style-type: none"> • Cefotetan Inadequate treatment given Central Line Associated Blood Stream Infection (CLABSI)	<i>Klebsiella</i> , Group D <i>Streptococcus</i> , <i>Enterobacter cloacae</i> and <i>Enterococcus faecalis</i>	Delay in appropriate antibiotic treatment: yes, although antibiotics were given at admission, appropriate antibiotics were not given until 7 hours after admission Delay in escalation of care: yes, patient was admitted tachypneic (greater >35 bpm), hypotensive at times, requiring oxygen without transfer to the ICU for 9 hours after admission.
4	Nulliparous woman during the 1 st trimester with an unknown blood dyscrasia, one-month history of vaginal bleeding, and severe thrombocytopenia (platelet count 26 x 10 ⁹ /L) was admitted to the ICU. She underwent a D&C on HD#2, and was transferred to the floor on HD#3. She was later	110, 24, 86/64 , 38.3°C, 93% on RA	<ul style="list-style-type: none"> • Ampicillin/ Sulbactam • Gentamicin Inadequate for clinical situation,	<i>Streptococcus pyogenes</i>	Delay in appropriate antibiotic treatment: yes, occurred due to the failure to give clindamycin. Delay in escalation of care: no, patient was

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	found unresponsive, resuscitated and died on HD#4.		should include clindamycin		admitted to the ICU and had appeared to recover before floor transfer.
5	Nulliparous woman during the 1 st trimester presented with vaginal bleeding from a suspected missed abortion and reported fever and rigors at home. She underwent a D&C. In the PACU, the patient was in DIC. Tachypnea and tachycardia worsened in the PACU, and she became profoundly hypotensive and went into cardiac arrest and was unable to be resuscitated and died.	135, 24, 70/45, 36.5°C, 98% on RA Did not develop a fever during hospitalization	<ul style="list-style-type: none"> • Ampicillin • Gentamicin • Clindamycin <p>Appropriate for the clinical situation</p>	Not identified	<p>Delay in appropriate antibiotic treatment: no, appropriate antibiotics were given.</p> <p>Delay in escalation of care: no, patient admitted with concern for bleeding and taken to the OR. Once infection was suspected was treated appropriately.</p>
6	Nulliparous woman during the 3 rd trimester with a history of bariatric surgery 4 years prior presented with epigastric and abdominal pain and coffee ground emesis. Pancreatitis was suspected, and she was admitted to the floor. No imaging or antibiotics were ordered. She became increasingly tachycardic, tachypneic and hypotensive and was transferred to ICU, intubated, and started on cefotetan. After 12 hours of no improvement, she underwent exploratory laparotomy, and CD. Bowel ischemia was identified and she underwent a right hemicolectomy. She died 2 days later.	87, 20, 128/77, 36.2°C, 96% on RA	<ul style="list-style-type: none"> • Cefotetan <p>Inadequate treatment for clinical situation</p>	<i>E. coli</i> in blood	<p>Delay of appropriate antibiotic treatment: yes, occurred due to treatment given not broad for intra-abdominal pathology.</p> <p>Delay in escalation of care: no, as patient condition worsened, she was transferred to the ICU.</p>
7	Multiparous woman at term presented for induction of labor and underwent an uncomplicated NSVD. Patient complained of a sore throat and cough. She had marked erythema and a throat culture was sent. Culture returned Group A <i>Streptococcus</i> , but she was discharged without antibiotics. She presented	115, 20, 113/70, 34.8°C, SpO ₂ not done Did not develop a fever during hospitalization	<ul style="list-style-type: none"> • Ampicillin/Sulbactam <p>Inadequate treatment for clinical situation,</p>	<i>Streptococcus pyogenes</i> in blood, <i>Klebsiella</i> in urine	Delay of appropriate antibiotics: yes, culture should have been followed up and treated.

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	on PPD #7 to a different hospital with abdominal pain and vaginal bleeding. She went into cardiac arrest 2 hours after arrival.		should have included clindamycin		Delay of escalation of care: yes, severely hypothermic patient with clinical presentation of endometritis was unstable. She was sent for imaging and coded.
8	Multiparous woman at term underwent an uncomplicated NSVD. PPD#20 presented to the ED with chronic subcutaneous drug abuse and shortness of breath. She was admitted to the ICU for sepsis and found to have endocarditis. She was taken to the OR for valve replacement and continued to have persistent endocarditis and had withdrawal of care.	142, 40, 117/70, 36.9°C, 83% on RA	<ul style="list-style-type: none"> Levofloxacin Metronidazole <p>Inadequate treatment, need <i>Staphylococcus aureus</i> coverage for drug use</p>	Methicillin-sensitive <i>S. aureus</i> in blood/sputum, <i>Enterobacter</i> in urine	<p>Delay of appropriate antibiotics: yes, antibiotic therapy not appropriate until transfer to the ICU hours later from the ER.</p> <p>Delay in escalation of care: no, admitted to the ICU at admission.</p>
9	Multiparous woman had a preterm CD due to eclampsia and ICU admission. She presented on PPD #28 with chest pain and SOB. She was treated for CAP, even though she was recently hospitalized in the ICU and had HCAP. She was on a telemetry floor and continued to decline and went into cardiac arrest. She was transferred to the ICU and arrested again and expired 3 days later.	161, 20, 110/77, 39.7°C, 95% on 2LNC	<ul style="list-style-type: none"> Ceftriaxone <p>Inadequate treatment, need coverage for HCAP, was recently intubated in ICU</p>	Methicillin-resistant <i>S. aureus</i>	<p>Delay in appropriate antibiotic treatment: yes, not given appropriate antibiotic therapy until admitted to telemetry service hours later.</p> <p>Delay in escalation of care: yes, was not done until she needed intubation. She had been tachypneic (>35bpm) and tachycardic (>150bpm) and</p>

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					requiring a 100% NRB for multiple hours.
10	Nulliparous woman during the 2 nd trimester with sickle cell disease presented in sickle cell crisis. HD#1 developed a fever and was started on cefazolin. Over the next 24 hours developed tachypnea with respiratory distress and was intubated and transferred to ICU. She went into cardiac arrest, and resuscitation was unsuccessful.	90, 18, 36.4°C, 126/89, SpO ₂ 100% on RA	<ul style="list-style-type: none"> • Cefazolin <p>Inadequate treatment-Sickle cell patients need broad coverage and are at risk for infections with atypical bacteria</p>	<i>Salmonella Group D</i> (Kauffman-White Serotype; modern taxonomic classification not available)	<p>Delay in appropriate antibiotics: yes, cefazolin not given for 12 hours after admission, appropriate antibiotics not given for >24 hours after admission.</p> <p>Delay in escalation of care: Unable to determine based on clinical information available.</p>
11	Multiparous woman at term underwent an uncomplicated NSVD. She presented PPD #10 with SOB and neck pain. She was tachycardic and tachypneic. 38.6°C in the ED, but antibiotics were not ordered until 7 hours after arrival. She was transferred to the ICU. She was found to have ascites and underwent exploratory laparotomy, D&C. Purulent fluid was noted in the abdomen without bowel perforation. She was recovering from sepsis and transferred to the floor. She was found unresponsive and unable to be resuscitated.	142, 60 , 146/50, 37.1°C, SpO ₂ 99% on RA	<ul style="list-style-type: none"> • Vancomycin • Clindamycin • Gentamicin <p>Indeterminate based on available clinical information</p>	<i>Bacteroides fragilis</i> in blood	<p>Delay in appropriate antibiotic treatment: Unable to determine appropriate antibiotic treatment based on available information.</p> <p>Delay in escalation of care: yes, escalation of care did not occur for 8 hours despite tachypnea (>35bpm).</p>
12	Multiparous woman at term underwent uncomplicated NSVD. She presented PPD #15 with hypoxia and SOB and found to have multi lobar pneumonia. She was intubated for respiratory distress and hypoxia. 3 days later had neurologic	119, 24, 126/92, 36.3°C, 70% on RA	<ul style="list-style-type: none"> • Ceftriaxone • Azithromycin <p>Inadequate treatment given</p>	<i>S. pneumoniae</i>	Delay in appropriate antibiotic administration: yes, occurred due to HCAP coverage should have been given.

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	signs and found to have herniation and resultant brain death.		risk of HCAP from recent admission		Delay in escalation of care: no, patient intubated and admitted to ICU upon admission.
13	Unknown parity during the 1 st trimester presented to the ER complaining of fever/nausea/vomiting and was sent home. She presented the next day tachycardic, tachypneic, and hypotensive. She was transferred to a tertiary care center. En route suffered cardiac arrest and died.	Missing	Unable to determine antibiotic type	Not identified	Unable to be determined based on available information
14	Supermorbidity obese nulliparous woman during the 1 st trimester with suspected ectopic pregnancy underwent an unsuccessful operative laparoscopy due to inability to insufflate. On POD#1, the patient complained of abdominal pain. Further imaging was ordered. She became increasingly tachycardic and tachypneic. Progress notes stated concern for bowel perforation but no antibiotics were ordered. The patient decompensated further and underwent an exploratory laparotomy and a sigmoid perforation was identified. She died 2 days later.	n/a, sepsis occurred later in hospitalization	<ul style="list-style-type: none"> • Ampicillin/ Sulbactam • Metronidazole <p>Appropriate for clinical situation</p>	<i>E. coli</i> , <i>Fusobacterium necrophorum</i> , <i>Bacteroides uniformis</i> and <i>Prevotella melaninogenica</i>	Delay in appropriate antibiotic treatment and escalation of care: yes, although documented in the chart the concern for perforated viscus, not given antibiotics or transferred to the ICU for 8 hours, and not taken to the OR for 12 hours
15	Multiparous woman during the 3 rd trimester with a history of cocaine use presented with abdominal pain and placental abruption. She underwent cesarean delivery due to malpresentation. Within the first 24 hours, Tmax 40.5°C. Patient became tachycardic, hypotensive, and hypothermic and was transferred to the ICU. An IM consultant noted positive blood cultures and started broad spectrum antibiotics. Died 2 days later.	n/a, sepsis occurred later in hospitalization	<ul style="list-style-type: none"> • Cefazolin • Ciprofloxacin • Metronidazole <p>Inadequate treatment for infection after abdominal surgery, does not cover Enterococci</p>	<i>Streptococcus pyogenes</i> in blood	<p>Delay of appropriate antibiotics: yes, not given appropriate antibiotic therapy until blood cultures returned positive the next day.</p> <p>Delay in escalation of care: yes, once fever spiked, only vital</p>

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					signs charted for 8 hours were temperature, vital signs had deteriorated in the meantime.
16	Multiparous woman at term with a pregnancy complicated by stillbirth and no prenatal care presented in labor and underwent a NSVD. She had an uncomplicated postpartum course and was discharged. She presented 17 days later complaining of abdominal pain. Physical exam was negative, but no further workup or vital signs were documented. She died at home 10 days later of Group A <i>Streptococcus</i> infection.	n/a, DOA	n/a	<i>Streptococcus pyogenes</i>	Unable to be determined based on available information
17	Multiparous woman presented to the ER on PPD #8 after a VAVD with a low-grade fever and diagnosed with a UTI and given IM ceftriaxone and PO cephalixin. PPD#14 was found unresponsive at home and DOA. Retained products of conception were identified on maternal autopsy.	n/a DOA	n/a	Not identified	Unable to be determined based on available information
18	Nulliparous woman during the 2 nd trimester underwent D&E with 2-day cervical preparation at an outpatient clinic and complained of heavy vaginal bleeding later that day after discharge. She was found unresponsive at home and presented DOA at the hospital. Autopsy demonstrated uterine infarction and systemic bacterial infection.	n/a DOA	n/a	Not identified	Unable to be determined based on available information
19	Multiparous woman at term underwent uncomplicated NSVD. Patient was found unresponsive on PPD #5. DOA upon arrival to hospital. She had reportedly been complaining of	n/a DOA	n/a	Not identified	Unable to be determined based on available information

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	abdominal pain. Autopsy significant for liters of pus in the abdominal cavity. No RPOC.				
20	Nulliparous woman at term underwent uncomplicated NSVD. Hospitalization was only significant for a temperature of 37.9°C the morning of discharge. Discharged on PPD#2. On PPD#3, patient was found in cardiac arrest at home, and was DOA upon arrival to the hospital. Per the family, she had cold symptoms, chest congestion, and a fever earlier in the day.	n/a DOA	n/a	Not identified	Unable to be determined based on available information
21	Multiparous woman during the 2 nd trimester was found DOA at home. Postmortem blood cultures positive for group B <i>Streptococcus</i> .	n/a DOA	n/a	Group B <i>Streptococcus</i> on postmortem blood cultures	Unable to be determined based on available information
22	Multiparous woman at term was found dead at home. Autopsy significant for acute bronchoalveolar pneumonia.	n/a DOA	n/a	Not identified	Unable to be determined based on available information

Abbreviations: MEWC= maternal early warning criteria, CD=cesarean delivery, HCAP=healthcare-associated pneumonia, POD=postoperative day, CLABSI=central line associated blood stream infection, PPD= postpartum day, DOA=dead on arrival, RPOC=retained products of conception, CAP=community acquired pneumonia.

*According to American Thoracic Society/Infectious Diseases Society of America guidelines, HCAP includes any patient who was hospitalized in an acute care hospital for two or more days within 90 days of the infection; resided in a nursing home or long-term care facility; received recent intravenous antibiotic therapy, chemotherapy, or wound care within the past 30 days of the current infection; or attended a hospital or hemodialysis clinic.²

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