

Bacteremia and Early Neonatal Mortality Among Kenyan Newborns in Health Facilities



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BACKGROUND AND OBJECTIVES

Neonatal mortality rates remain high in low-resource settings. We aimed to determine incidence and risk factors for bacteremia and early neonatal mortality among high-risk newborns in health facilities, to inform targeted treatment.

METHODS

- Prospective cohort study in government health facilities in Kisii and Homa Bay regions of rural western Kenya
- Caregivers screened for TB, HIV and malaria
- Sociodemographic and health history interview conducted



Inclusion criteria: 1+ intrapartum &/ or newborn feature

Intrapartum Factors	Neonatal Features <72 hrs old
<ul style="list-style-type: none"> Fever prior to delivery ($\geq 38^\circ\text{C}$) Tachycardia ($>100/\text{min}$) Uterine tenderness Chorioamnionitis Obstructed labor Prolonged rupture of membranes Foul smelling amniotic fluid/vaginal discharge Delivery <37 wks 	<ul style="list-style-type: none"> Difficulty feeding* Hypothermia ($<36.5^\circ\text{C}$) or Hyperthermia ($\geq 38.5^\circ\text{C}$)* Tachypnoea ($>60/\text{min}$)* Severe chest indrawing* History of convulsions* Movement only when stimulated/no movement* Apnea Jaundice 5 min Apgar ≤ 6

Exclusion Criteria: No maternal consent; Infant <1kg; > 96 hours old

* WHO Integrated Management of Childhood Illness severe disease in infants ≤ 59 days from Young Infants Clinical Signs Study (YICSS) criteria for possible severe bacterial infection (pSBI)

- Newborn physical exam and bacterial blood culture conducted
- Clinical data abstracted from patient files
- Follow-up 7 days post-enrollment

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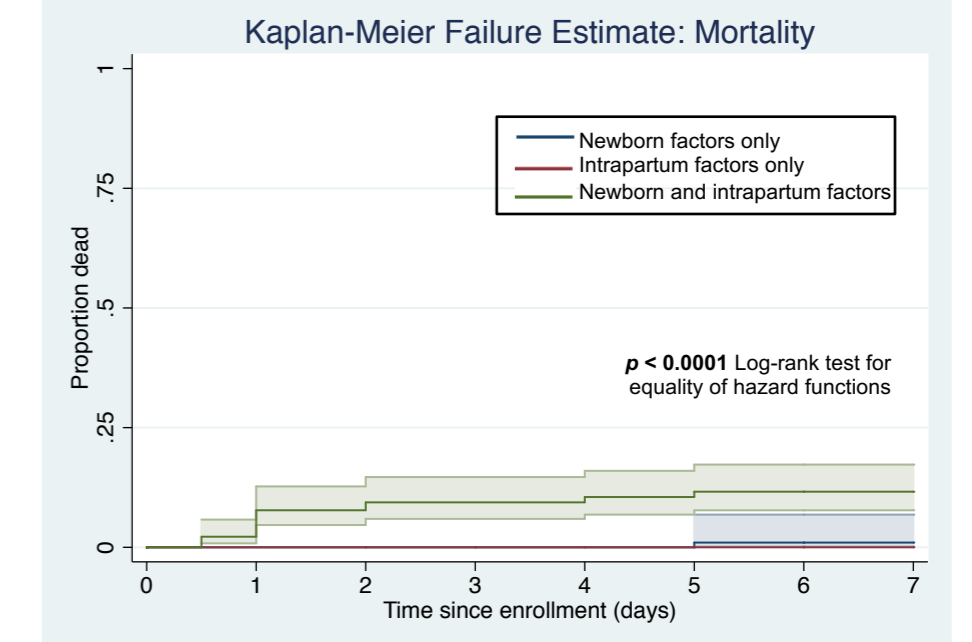
RESULTS

- 380 newborns enrolled; 378 followed to 7-days
- Prevalence of bacteremia with isolated pathogen: 1.6% (95% CI: 0.6% - 3.4%, n=6)
- Cumulative incidence of mortality within 7 days: 5.8% (95% CI: 3.7%-8.6%), n=22)
- No newborns with culture-confirmed bacteremia died
- 95% (n=21) of newborns who died had an intrapartum risk factor **and** a possible severe bacterial infection (pSBI) sign; no newborns with only an intrapartum risk factor died
- Overall, mortality risk with ≥ 2 pSBI signs 6-fold that with 0 or 1 sign (RR = 6.0, 95% CI: 2.1-17.4)

Characteristics of enrolled newborns	Freq. (%) or Median (IQR)
Enrollment site	
Kisii	238 (62.6)
Homa Bay	142 (37.4)
Mother completed primary education or less	197 (51.8)
Mother HIV +	57 (15.0)
Delivery in a health facility	368 (97.1)
Preterm (< 37 wks)	145 (40.1)
Low birthweight (<2500 g)	141 (37.1)
Cesarean delivery	141 (37.1)
Intrapartum antibiotics received	12 (3.2)
Male gender	222 (58.4)
Age at enrollment (hrs)	25 (13, 42)
Enrollment criteria	
Maternal/intrapartum factors only	97 (25.5)
Newborn clinical signs only	102 (26.8)
Newborn and intrapartum factors	181 (47.6)
Antibiotic exposure prior to blood draw	293 (77.1)

Organisms isolated from bacterial blood culture

Categorization	Isolate (Freq.) (%)
Definite pathogens	
Gram positive	<i>Enterococcus faecalis</i> (1) <i>Enterobacter aerogenes</i> (1)
Gram negative	<i>Escherichia coli</i> (2) <i>Klebsiella pneumoniae</i> (1) <i>Enterobacter cloacae</i> (1)
<i>Total</i>	6 (1.6)
Contaminants	Coagulase-negative <i>Staphylococcus</i> (19), <i>Bacillus spp.</i> (1), Yeast (1)
<i>Total</i>	21 (5.5)



Risk factors for 7-day mortality among high-risk newborns, Homa Bay

Factor	Cumulative incidence of mortality (95% CI) †	Relative Risk (95% CI) ‡
Birthweight < 2,500 g	21.4 (10.3, 36.8)	3.3 (1.3, 8.6)
Ever breastfed	5.9 (2.4, 11.7)	0.1 (0.1, 0.3)
Fast breathing	30.3 (15.6, 48.7)	4.7 (2.0, 11.4)
Severe chest indrawing	29.3 (12.6, 51.1)	3.4 (1.5, 8.1)
Difficulty feeding	27.3 (16.1, 41.0)	11.9 (2.8, 49.9)
Hypothermia	29.6 (13.8, 50.2)	4.8 (1.8, 12.8)
Hyperthermia	17.6 (3.8, 43.4)	2.9 (0.8, 10.4)
Movement only when stimulated	36.8 (16.3, 61.6)	4.5 (2.0, 10.5)
History of convulsions	33.3 (14.6, 57.0)	4.0 (1.7, 9.4)
Signs of pSBI		
≥ 2 YICSS criteria	27.3 (16.14, 41.0)	11.9 (2.8, 49.9)
0 or 1 YICSS criteria	2.3 (0.3, 8.1)	Ref.

† Binomial exact distribution ‡ Crude log-binomial regression. **Bold:** p -value < 0.05 from Fisher's Exact test.

CONCLUSION

- Intrapartum risk factors common among those with signs of pSBI, and may identify newborns for vigilant observation and/or early treatment.
- pSBI signs discriminate highest-risk newborns, even among a high-risk facility-based population.
- Blood culture may be uninformative in clinical management among newborns with high suspicion or risk of bacteremia in resource-constrained health facilities.

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