An Outbreak of Necrotising Enterocolitis of Unknown Aetiology in Newborns Admitted to a Neonatal Unit in Gauteng Province, March – August 2018

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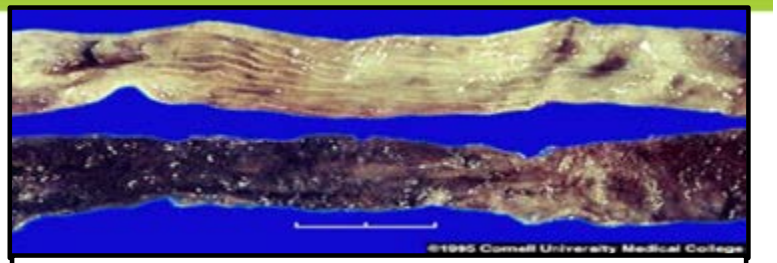
NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES
Division of the National Health Laboratory Service

Background



Normal (top) versus Necrotic section of bowel (bottom)

- Necrotizing enterocolitis (NEC)
  - Common and serious gastrointestinal disease among newborn babies, requiring emergency treatment
  - Is an acute inflammatory disease with a multifactorial and controversial aetiology
    - Attributable to both infective (bacteria, virus and fungi)
    - Non-infective factors (e.g. low birth weight, low gestational age, formula milk feeding, etc.)

Background

- National Institute for Communicable Diseases notified on 4 April 2018 by neonatal unit paediatrician
  - 12 premature babies diagnosed (on imaging) with NEC
  - All patients had low serum C-reactive protein levels and no diarrhoea
  - A viral aetiology was suspected but no testing was done

Aims and objectives

- Suspected NEC outbreak at neonatal unit investigated in order to:
  - Verify the diagnosis
  - Ascertain the existence of an NEC outbreak
  - Determine the possible causes and sources of NEC
  - Implement prevention and control measures in order to contain the outbreak
  - Make recommendations on prevention and control measures to prevent future outbreaks

Methodology

1. Study design

- **We conducted a cross-sectional study**
  - To describe the characteristics and possible source/causes of the outbreak

2. Case definition

  - Modified Bell's staging criteria for NEC and reported stages 2 & 3
  - Outbreak included cases with NEC onset from 01 March-29 Aug 2018, born and admitted at hospital's neonatal unit (ward 16B)

Methodology

3. Data sources

- **Retrospective baseline data**: Number of NEC cases diagnosed over the last year (Jan – Dec 2017) to March 2018, provided by hospital
- **Clinical and epidemiological data from 1 March to 29 August 2018**
  - From case-patient record reviews
  - Lab results obtained from the lab information system
- **Healthcare worker interviews, IPC audits, environmental health assessment**

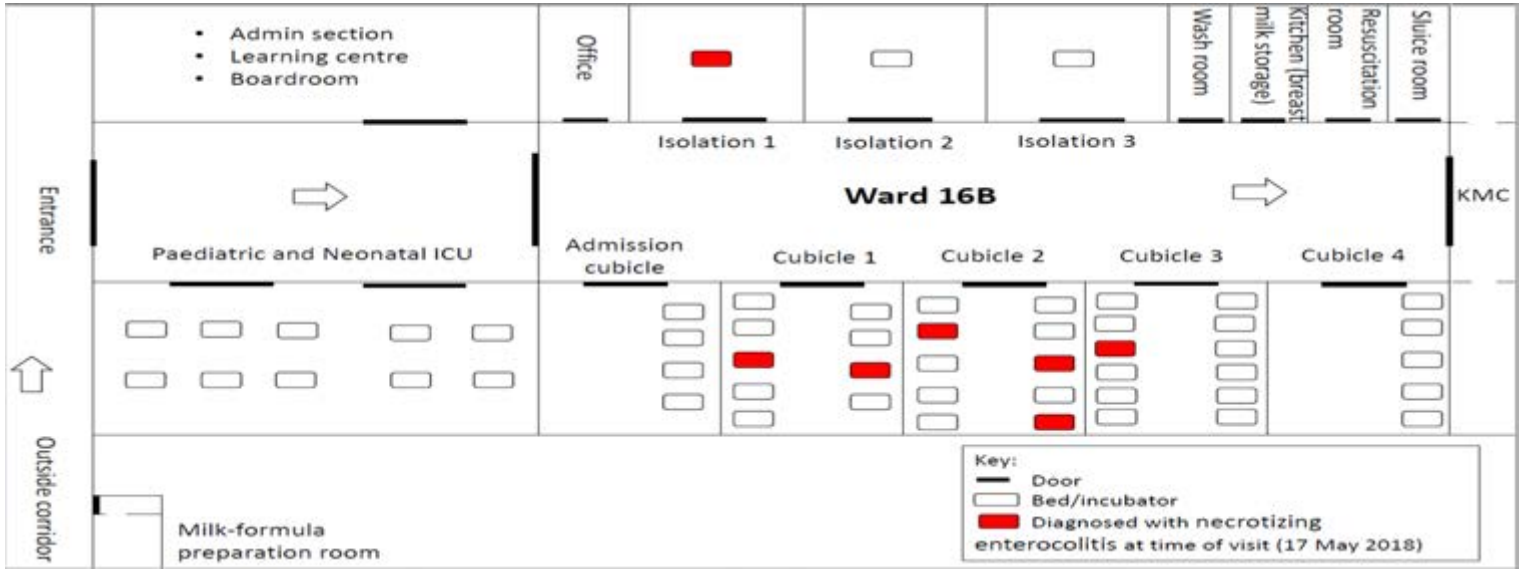
Methodology

4. Laboratory investigations

- **Clinical samples (blood and stool)** were collected
  - Blood and stool cultures testing at local NHLS laboratory
  - Stool enteric pathogen testing at NICD (Real-time PCR, FTD for bacteria, parasites, viruses, fungi)
- **Environmental samples** (surface swabs and milk)
  - Formula and breast milk samples tested at NHLS ICLS (bacteria)
  - Some milk and swabs samples tested at NICD

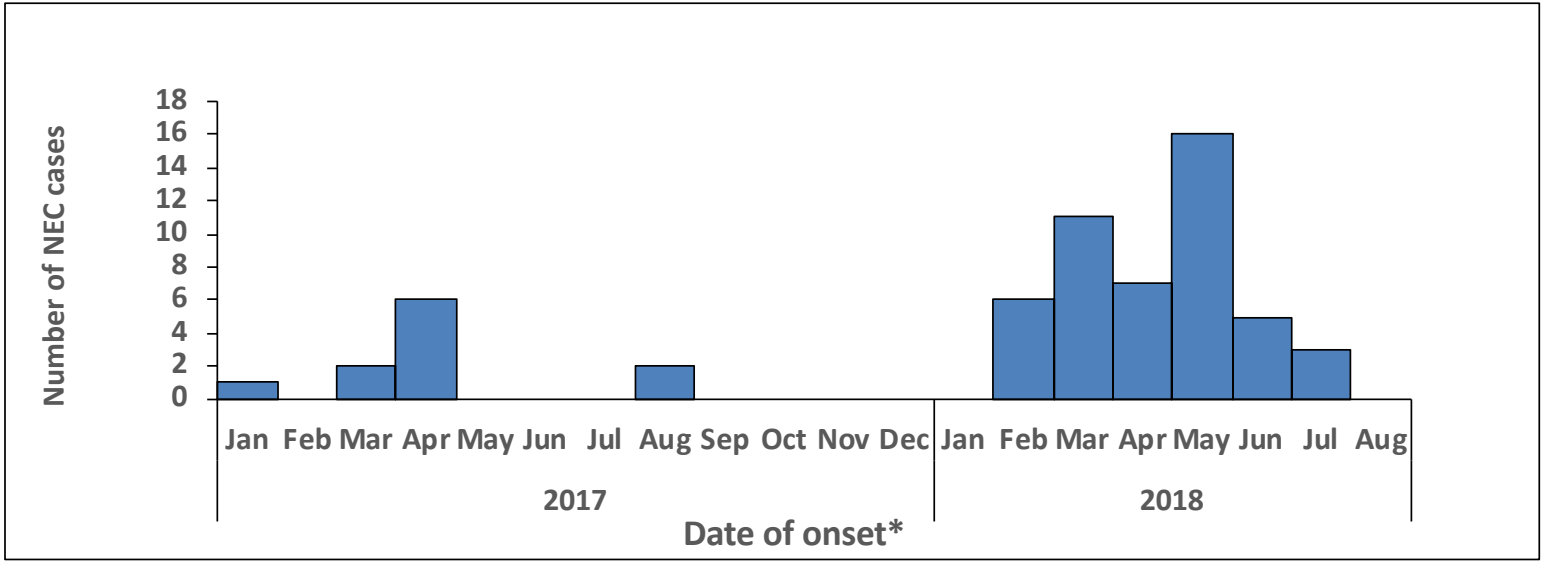
Findings

Neonatal unit map - 17 May 2018



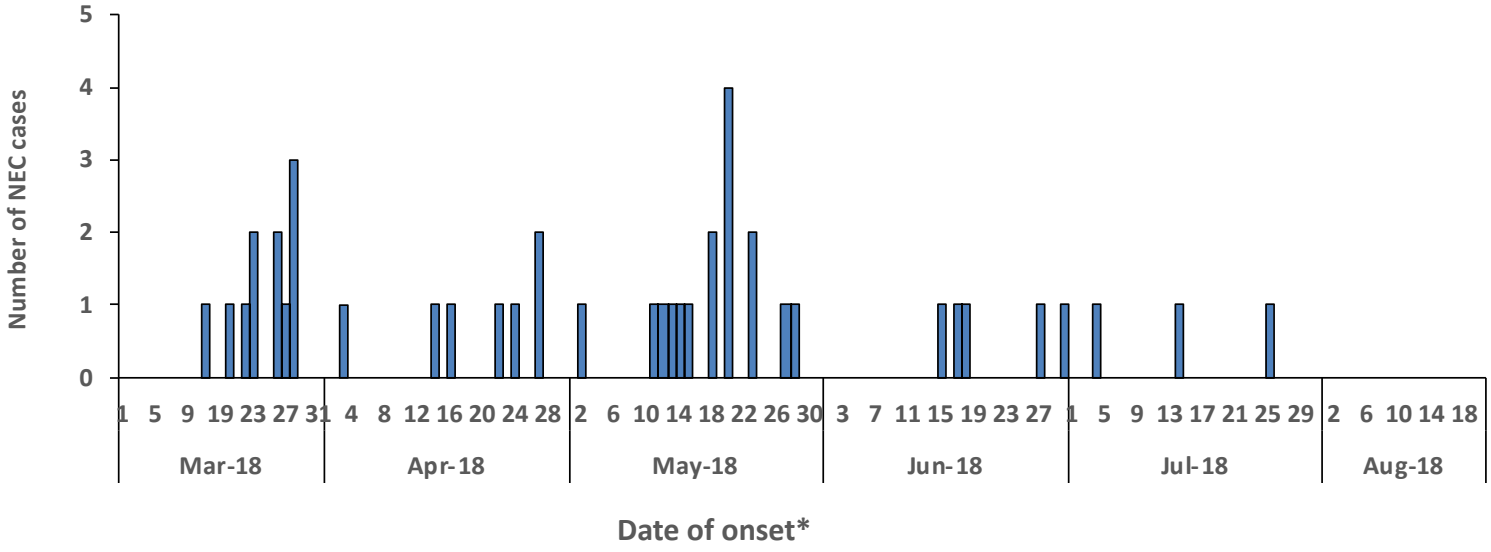
Findings

Epidemic curve showing number of NEC cases by month of disease onset, ward 16B, Jan-Dec 2017/Jan-Aug 2018



Findings

Epidemic curve showing number of NEC cases by date of disease onset, Ward 16B, March – Aug 2018

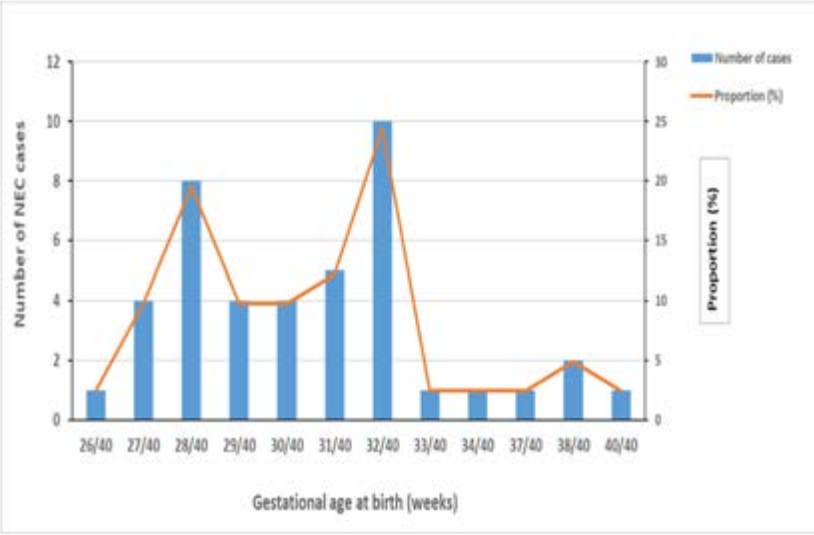


Findings

- A total number of 42 cases reported (as of 29 August 2018)
  - 38 (90.5%) premature and four (9.5%) full-term babies
  - **Birth weight:** 79% (33) were <1500 g, 21% >1500 g
  - HIV exposure history was known in 64.3% (n=27) cases
    - **HIV exposed:** 40.7% (n=11) cases
    - **HIV unexposed:** 59.3% cases

Findings

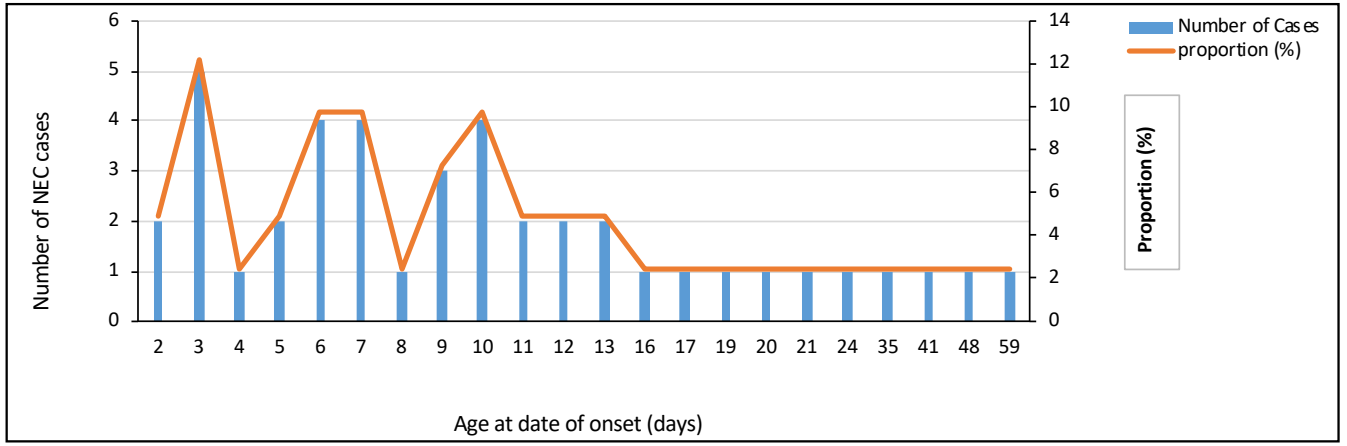
Gestational age of NEC cases at birth, March – August 2018



- The gestational age (GA) at birth ranged from 26 to 40 weeks (median: 32; IQR: 29-35)
  - 24% of cases born at 32 weeks GA.
  - 20% born at 28 weeks GA

Findings

Age distribution of NEC cases, March – August 2018.



- Age ranged from 2 to 59 days (median: 13; IQR: 7-21)
- Children under 1-month old accounted for 90.5% of the cases (n = 38),
- 9.5% (n =4) were cases aged between 1 – 2 months old

Findings

Clinical staging of the cases, March – August 2018

NEC Stage	Number of cases	Proportion (%)
NEC IIA	22	52.4
NEC IIB	9	21.4
NEC IIIA	3	7.1
NEC IIIB	8	19
Total	42	100

The cases were definite NEC stage IIA-B (mildly to moderately ill) and stage IIIA-B (severely ill). Most cases were NEC stage II (~74%)

Findings

Outcomes for NEC cases, March – August 2018

Outcome	Number of cases (%)
Died	9 (21.4)
Discharged	28 (66.7)
Transferred	4 (9.5)
Still admitted*	1 (2.4)
Total	42 (100%)

***Still admitted for other premature-related medical conditions by 29 August 2018**

Findings

Type of feeding for NEC cases, March – August 2018

Feeding type	Number of cases (%)
Breast milk (EBM/DEBM)	14 (33.3)
Mixed feeding	13 (31)
Formula milk	11 (26.2)
Unknown	4 (9.5)
Total	42 (100%)

EBM: Expressed breast milk. **DEBM:** Donated EBM

Findings

Blood cultures performed for 36 cases (86%)

Blood culture results	Number of cases (%)
No growth	17 (47.2%)
Coagulase-negative *Staphylococcus*	9 (25.0%
Candida albicans	4 (11.1%)
Acinetobacter baumannii	1 (2.8%)
Candida parapsilosis	1 (2.8%)
Klebsiella pneumoniae	1 (2.8%)
Staphylococcus aureus	1 (2.8%)
Klebsiella pneumoniae and *Staphylococcus aureus*	1 (2.8%)
Escherichia coli	1 (2.8%)

- No specific pathogen isolated.

Findings

- **Stool samples** were collected for 19/42 cases (45%)
  - **Enteric bacteria were tested in 12 cases (12/19, 63%)**
    - **9 (75%) stool cultures were negative**
      - For any of the bacteria tested: *Salmonella, Shigella, Campylobacter, Listeria, Vibrio cholerae, enterohaemorrhagic Escherichia coli, Clostridium perfringens, Bacillus cereus, Vibrio* spp, *Staphylococcus aureus, or Yersinia enterocolitica*
    - 3 (25%) stool samples rejected: not tested
  - **Enteric viruses were tested in 10 cases (10/19, 53%)**
    - **All 10 were negative** for rotavirus, astrovirus, sapovirus, norovirus and adenovirus.

Findings

- **Environmental sample testing:**
  - 50 milk samples (n = 48 formula; n = 2 EBM) collected & tested
    - Milk contamination found in 39 (78%) samples (n = 38 formula; n = 1 EBM)
      - *Bacillus* species/*Streptococcus* species isolated
        - » In both mixed and dry powder milk (opened and unopened containers)
  - All surface swabs were negative

Findings

IPC audits, HCW interviews (n=25), environmental health assessment

- Highlighted sub-optimal IPC practices
  - By both HCW, mothers, cleaners and students
- Overcrowding: of babies and due to students on rotation
- Staff shortages: only 1 nurse per cubicle
- Shortage of equipment: cubicles sharing equipment
- Poor monitoring: IPC championship

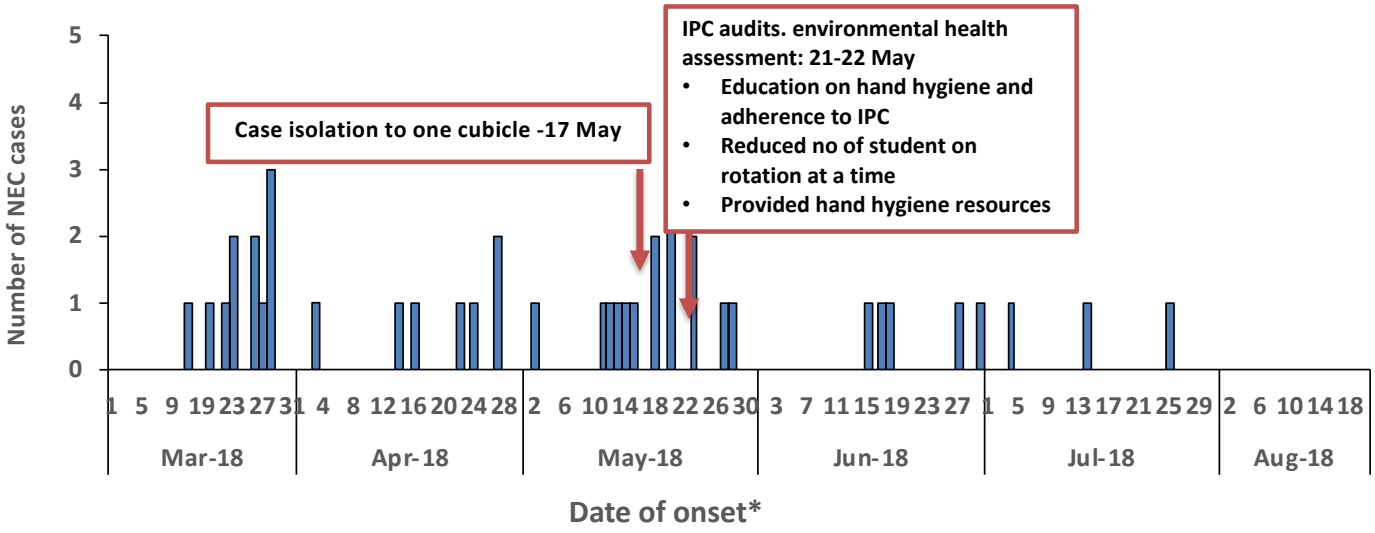
Discussion and limitations

- No specific pathogen identified as possible cause of NEC
  - Several pathogens were isolated from blood culture,
  - No enteric pathogen isolated in stool samples
    - Results should be interpreted with caution as **antibiotic treatment was initiated when samples were collected**

Discussion and limitations

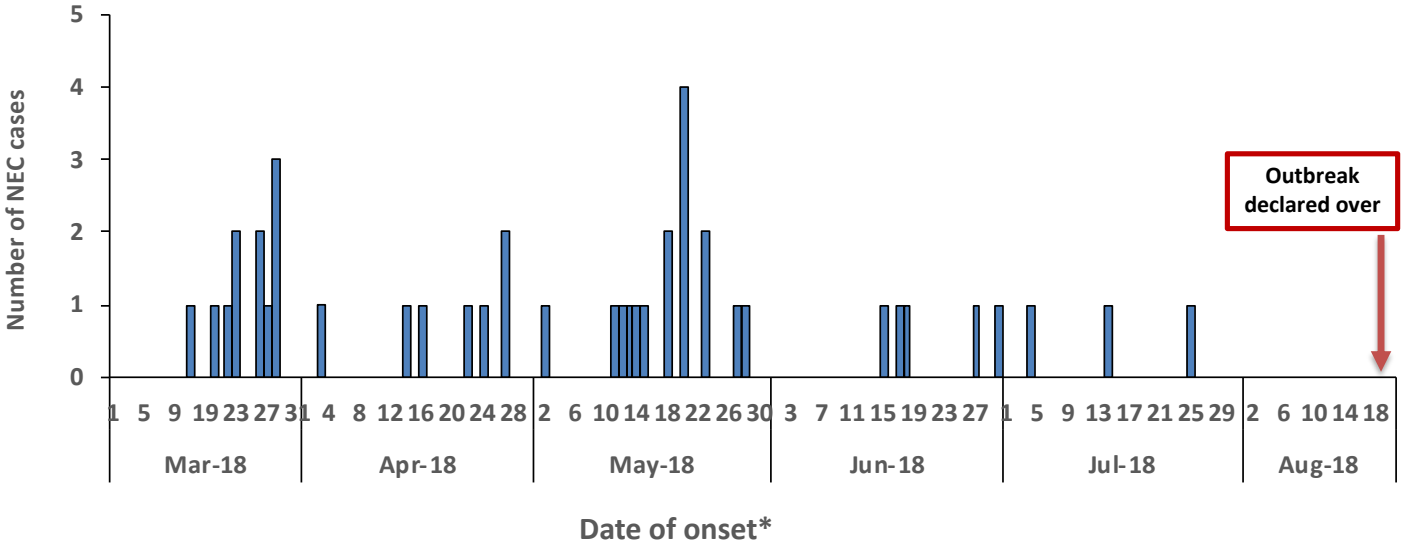
- Isolation of *Bacillus* and *Streptococcus* spp in formula milk and one EBM may indicate possible contamination
- Risk factors such as HIV exposure and underlying medical conditions not well recorded

Discussion and conclusions



- The decline of cases since June could be attributed to the interventions measures implemented

Discussion and conclusions



- Outbreak was declared over as case numbers have returned to baseline level

Recommendations

- We recommended:
  - Heightened surveillance to detect and report outbreaks
  - Education and strict adherence to IPC practices
    - Hand hygiene and case isolation
  - Clinical sample collection before treatment initiation

Recommendations

- We further recommend in the long term to
  - Address long-standing problems
    - Overcrowding: More patients admitted than beds available
    - Staff shortages: Patient to professional nurse ratios
    - Shortage and sharing of equipment
- Outbreak created research opportunities
  - Further analytical studies (e.g. a case control study) might be necessary to further understand the NEC risk factors

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- Local academic hospital neonatal unit team and management
- EHP at local academic hospital
- NHLS HJH microbiology lab
- NHLS Wits ICLS

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THANK YOU

Infant with necrotizing enterocolitis.