

NeoSep1: a study to determine the ranking of existing and new antibiotics combinations to treat newborn babies who are in hospital with severe sepsis

Submission date 17/01/2022	Recruitment status Recruiting	<input checked="" type="checkbox"/> Prospectively registered <input checked="" type="checkbox"/> Protocol
Registration date 24/02/2022	Overall study status Ongoing	<input checked="" type="checkbox"/> Statistical analysis plan <input checked="" type="checkbox"/> Results
Last Edited 28/08/2025	Condition category Infections and Infestations	<input type="checkbox"/> Individual participant data

Plain English summary of protocol

Background and study aims

At present, babies who are admitted to hospital with sepsis are treated with medicines called “antibiotics”. In many countries, these antibiotics are those recommended by the World Health Organisation (WHO). Other countries use different antibiotics based on local policies but unfortunately, these are not always easily available. The use of different antibiotics also varies from baby to baby and between countries and hospitals.

More and more infections are being caused by bacteria that are “resistant” to commonly used antibiotics; this means these antibiotics will not kill the bacteria and therefore will not cure the infection. These bacteria are often called multidrug-resistant, as they are not killed by most antibiotics. We need to find new ways of treating these infections, and using combinations of existing antibiotics is one possibility. Fosfomycin, flomoxef, and amikacin are three antibiotics that could be combined into different two-drug regimens. Another option is to give stronger antibiotics at the start of treatment. The problem with doing this is that not all babies will need these stronger antibiotics, and the more we use them, the more resistance will develop to these antibiotics. So using them in lots of babies now, who don’t all need them, may mean that in the future we will not be able to use them in any babies who might need them.

The NeoSep1 study will test how well giving fosfomycin and amikacin, OR flomoxef and amikacin OR fosfomycin and flomoxef works to treat babies 28 days old or younger who are in hospital with severe sepsis. It will also test how well these new combinations work compared to other antibiotics or combinations of antibiotics that are currently used globally. We have worked out the right doses of fosfomycin, amikacin and flomoxef to use in an earlier part of this study by measuring levels of these drugs in babies’ blood.

Who can participate?

Over 3,000 babies aged 28 days old or younger who are in hospital with severe sepsis will be included in Part 1 and 2 of the NeoSep1 study. Participants will be recruited from all over the

world, and in particular from low and middle-income countries such as South Africa, Kenya, and other countries in Africa and South East Asia.

What does the study involve?

The study will be divided into two parts: Part 1 and Part 2.

Part 1 will measure the level of fosfomycin, amikacin, and flomoxef in the baby's blood; this is called a pharmacokinetic study or PK study. Each baby will get one of the three new combinations of antibiotics: fosfomycin and amikacin, flomoxef and amikacin, or fosfomycin and flomoxef. We will study 20 babies in each group, one after the other. We will use doses recommended in other studies. The information collected for Part 1 will confirm how much fosfomycin and/or flomoxef we should use in the next part of the study. We will also collect data on any side effects. Babies in Part 1 will be followed up for 28 days.

In Part 2 of the study, we will check how well these three combinations, as well as other antibiotics that are used routinely to treat sepsis in newborn babies, treat bacterial infections, and stop babies from dying.

Babies will generally get these antibiotics for about 7-10 days (their "firstline" treatment). If a baby's condition gets worse during this time, or doesn't get better as would be expected, doctors will be able to give them different antibiotics (also known as "second-line" treatment) to see if they do better with different antibiotics. Which specific second-line antibiotics each baby gets will also be chosen at random from a set of combinations that doctors would use after each first-line treatment. Babies will get different second-line antibiotic treatments to those they already had as first-line. Babies will be followed up for 90 days, with a visit or telephone call 28 and 90 days after the baby entered the study to see if the baby is still doing well.

What are the possible benefits and risks of participating?

Participating in this study may not directly benefit the babies taking part, but the information we get from the study will help us work out the best available treatment combinations to treat babies with sepsis in the future. While in hospital, babies taking part in the study will be reviewed daily by the study clinicians and nurses, together with the regular hospital staff.

Where is the study run from?

Global Antibiotic Research & Development Partnership (Switzerland)

When is the study starting and how long is it expected to run for?

From August 2022 to December 2028

Who is funding the study?

Global Antibiotic Research & Development Partnership (Switzerland)

Who is the main contact?

Sally Ellis

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Contact information

Type(s)

Public

Contact name

Ms Nathalie Khavessian

Contact details

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Type(s)

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Additional identifiers

Clinical Trials Information System (CTIS)

Nil known

ClinicalTrials.gov (NCT)

Nil known

Protocol serial number

v1.0

Study information

Scientific Title

An open-label randomised controlled trial comparing novel combination and existing antibiotic regimens for the empiric treatment of neonatal sepsis with a run-in confirmatory pharmacokinetic phase (NeoSep1)

Acronym

NeoSep1

Study objectives

Part 1:

Recommended doses of fosfomycin and floxomef, in combinations to be studied in Part 2, will provide adequate drug levels in neonates with sepsis.

Part 2:

Mortality in hospitalised neonates with sepsis can be reduced by choosing a top-ranked antibiotic regimen compared with the WHO recommended empiric antibiotic regimens for neonatal sepsis and other currently used regimens.

Ethics approval required

Old ethics approval format

Ethics approval(s)

1. Approved 31/08/2022, Stellenbosch University Health Research Ethics Committee (Stellenbosch University, Private Bag X1, Matieland, 7602, Stellenbosch, South Africa; +27 021 938 9075; blanchep@sun.ac.za), ref: M22/05/007
2. Approved 15/08/2022, University of the Witwatersrand Human Research Ethics Committee (Medical) (Suite 189, Private Bag x2600, Houghton 2041, South Africa; +27 11 274 9200; HREC-Medical.ResearchOffice@wits.ac.za), ref: 220509B
3. Approved 27/07/2022, Research Ethics Committee of Kenya Medical Research Institute (Scientific and Ethics Review Unit, P.O Box 54840 00200 off Mbagathi Road, Nairobi, Kenya; +254 0717 719 477; seru@kemri.org), ref: KEMRI/RES/7/3/1
4. Approved 02/08/2022, South African Health Products Regulatory Authority (SAHPRA) (Building A, Loftus Park, 2nd Floor, Kirkness Rd, Arcadia 0083, South Africa; +27 012 501 0413; enquiries@sahpra.org.za), ref: 20220614
5. Approved 21/12/2022, Pharmacy and Poisons Board (PPB) (Lenana Road, P.O. Box 27663-00506, Nairobi, Kenya; +254 709 770 100; info@pharmacyboardkenya.org), ref: PPB/ECCT/22/08/03/2022(335)

Study design

Phase III/IV/pragmatic public health multicentre Personalized Randomized Controlled Trial (PRACTical) incorporating a Sequential Multiple Assignment Randomised Trial (SMART) design

Primary study design

Interventional

Study type(s)

Treatment

Health condition(s) or problem(s) studied

Neonatal sepsis

Interventions

Randomisation:

Treatment allocation (Part 1 only): Run-in sequential treatment cohort:

1. Fosfomycin and amikacin

2. Flomoxef and amikacin
3. Flomoxef and fosfomycin

Randomisation (Part 2 only): The main empiric treatment trial (Part 2) will use a novel tailored randomised controlled trial (PRACTical) design, in which each neonate is randomised to pre-defined first-line regimens that are considered clinically acceptable for that specific site and neonatal sub-population. The design will also incorporate a Sequential Multiple Assignment Randomised Trial (SMART) design to allow randomisation to second-line treatment where indicated. For the second randomisation, personalised randomisation lists will be determined by the neonate's first randomised regimen and what is clinically appropriate for that specific site.

Dosing:

Dosing will depend on the treatment regimen given at enrolment (part 1) or randomisation (part 2). The following provides a summary on the proposed dosing

1. Amikacin: 15 mg/kg total daily dose for sepsis; 15 mg/kg total daily dose for suspected /confirmed meningitis
2. Ampicillin/amoxicillin: 100-150 mg/kg total daily dose for sepsis; 200-400 mg/kg total daily dose for suspected/confirmed meningitis; 2-3 divided doses per day
3. Benzylpenicillin: 100,000-200,000 IU/kg total daily dose for sepsis; 100,000-200,000 IU/kg total daily dose for suspected/confirmed meningitis; 2-4 divided doses per day
4. Cefotaxime: 100-150 mg/kg total daily dose for sepsis; 150-200mg/kg total daily dose for suspected/confirmed meningitis; 2-3 divided doses per day
5. Ceftazidime: 100-150 mg/kg total daily dose for sepsis; 100-150 mg/kg total daily dose for suspected/confirmed meningitis; 3 divided doses per day
6. Ceftriaxone: 80-100 mg/kg total daily dose for sepsis; 80-100 mg/kg total daily dose for suspected/confirmed meningitis; 1-2 divided doses per day
7. Cloxacillin: 100-150 mg/kg total daily dose for sepsis; 100-150 mg/kg total daily dose for suspected/confirmed meningitis; 2-3 divided doses per day
8. Flomoxef: 120-150 mg/kg total daily dose for sepsis; 120-150 mg/kg total daily dose for suspected/confirmed meningitis; 2-3 divided doses per day
9. Fosfomycin: 200-300 mg/kg total daily dose for sepsis; 200-300 mg/kg total daily dose for suspected/confirmed meningitis; 2 divided doses per day
10. Gentamicin: 5-7 mg/kg total daily dose for sepsis; 5-7 mg/kg total daily dose for suspected /confirmed meningitis; 1 divided doses per day
11. Meropenem: 60 mg/kg total daily dose for sepsis; 80-120 mg/kg total daily dose for suspected/confirmed meningitis; 3 divided doses per day
12. Piperacillin/tazobactam: 240-300 mg/kg (piperacillin) total daily dose for sepsis total daily dose for suspected/confirmed meningitis; 3-4 divided doses per day

Treatment:

Part 1: Planned duration of treatment at enrolment for culture-negative is to Day 7 \pm 2 days, for culture-positive is to Day 10 [-3,+4 days] if there is no switch. If antibiotics are switched, the total planned duration of antibiotic treatment including first and second-line treatment is 14 \pm 7 days depending on the baby's condition.

Part 2: Planned duration of treatment at enrolment for culture-negative is Day 7 \pm 2 days, for culture-positive is Day 10 [-3,+4] days if there is no switch. If antibiotics are switched the total duration of antibiotic treatment including first and second-line treatment is 14 \pm 7 days depending on the baby's condition.

Assessments:

Assessments (Part 1): PK assessment on Day 1 and Day 5; Clinical assessment on Day 1, Day 5, Day 7, Day 14, and Day 28

Assessments (Part 2): Clinical assessments on Day 3, Day 7, Day 14, Day 28, and Day 90

Intervention Type

Drug

Phase

Phase III/IV

Drug/device/biological/vaccine name(s)

Ampicillin* and gentamicin, cefotaxime or ceftriaxone, fosfomycin and amikacin, fosfomycin and flomoxef, flomoxef and amikacin, ceftazidime and amikacin, piperacillin/tazobactam and amikacin, meropenem *or benzylpenicillin or cloxacillin or flucloxacillin or amoxicillin

Primary outcome(s)

Part 1:

1. PK parameters derived for fosfomycin and flomoxef using the population PK model using Day 1 PK samples taken at 5 min, 30 min, and 4 h post-treatment or 15 min, 1 h, and 6 h post-treatment from the population:

1.1. Clearance (CL)

1.2. Central volume of distribution (V)

1.3. Postnatal maturation function parameters: fraction of size and scaled clearance at birth (Fm) and the rate of postnatal maturation of clearance (Km)

Part 2:

1. 28-day mortality measured from patient records at 28 days

Key secondary outcome(s)

Current secondary outcome measures as of 19/02/2025:

Part 1:

1. PK parameters derived for fosfomycin and flomoxef using the population PK model using PK samples taken on Day 1 and Day 5:

1.1. Maximum plasma concentration (C_{max})

1.2. Time to C_{max} (T_{max})

1.3. Apparent terminal elimination half-life (t_{1/2})

1.4. Area under the plasma concentration-time curve from 0 to last observed time point (AUC_{0–last})

1.5. Area Under the Curve to infinity (AUC_(0–∞))

1.6. Volume of distribution at steady state (V_{ss})

2. Potential PK/PD relationships using PK and PD samples taken on Day 1 and Day 5:

2.1. Free drug AUC ratio to Minimum Inhibitory Concentration (MIC) (fosfomycin)

2.2. Fraction of time for free concentration above MIC (flomoxef)

3. Safety measured using the following:

3.1. Incidence of Grade 3/4 adverse events (AEs) based on the International Neonatal Consortium Neonatal Adverse Event Severity Scale (NAESS) measured from patient records between baseline and 28 days

3.2. Incidence of AEs of any grade related to antibiotics measured from patient records

throughout the study

3.3. Modification of antibiotics for adverse reactions measured from patient records throughout the study

Part 2:

1. Efficacy:

1.1. Clinical status, assessed daily after randomisation through to the earlier of discharge from a trial site or Day 28 using a clinical recovery score based on data from the NeoOBS observational study

1.2. Additional systemic antibiotics beyond the first randomised treatment through Day 28

1.3. Additional systemic antibiotics beyond the first randomised and second (for failure) treatment through Day 28

1.4. Length of stay during the index hospitalisation

1.5. Systemic antibiotic exposure (days on antibiotics) during the index hospitalisation

1.6. 90-day mortality

1.7. Change in C-reactive protein to Day 3 and 7 from baseline

1.8. Re-admission by Day 90 (all-cause)

2. Safety:

2.1. Grade 3/4 adverse events (AEs) graded using a combined low and middle income country (LMIC) relevant adapted Division of AIDS (DAIDS) and International Neonatal Consortium Neonatal Adverse Event Severity Scale (NAESS) through Day 28

2.2. Adverse events of any grade related to antibiotics through Day 28

2.3. Modification (including discontinuation) of antibiotics for adverse reactions through Day 28

2.4. Neurodevelopment as assessed by the WHO Global Scale for Early Development (GSED) package at Day 28 and Day 90

Note: Serious Adverse Events will be collected for pharmacovigilance and analysed descriptively but they are not trial outcome measures because the severity of illness of the population means that they will likely commonly be related to the underlying condition.

Previous secondary outcome measures:

Part 1:

1. PK parameters derived for fosfomycin and flomoxef using the population PK model using PK samples taken on Day 1 and Day 5:

1.1. Maximum plasma concentration (C_{max})

1.2. Time to C_{max} (T_{max})

1.3. Apparent terminal elimination half-life (t_{1/2})

1.4. Area under the plasma concentration-time curve from 0 to last observed time point (AUC_{0–last})

1.5. Area Under the Curve to infinity (AUC_(0–∞))

1.6. Volume of distribution at steady state (V_{ss})

2. Potential PK/PD relationships using PK and PD samples taken on Day 1 and Day 5:

2.1. Free drug AUC ratio to Minimum Inhibitory Concentration (MIC) (fosfomycin)

2.2. Fraction of time for free concentration above MIC (flomoxef)

3. Safety measured using the following:

3.1. Incidence of Grade 3/4 adverse events (AEs) based on the International Neonatal Consortium Neonatal Adverse Event Severity Scale (NAESS) measured from patient records between baseline and 28 days

3.2. Incidence of AEs of any grade related to antibiotics measured from patient records

throughout the study

3.3. Modification of antibiotics for adverse reactions measured from patient records throughout the study

Part 2:

1. Efficacy measured using the following:

1.1. Clinical status measured using a clinical recovery score based on data from the NeoOBS observational study (NeoSep Recovery Score) at 3, 7, 14, and 28 days after randomisation

1.2. Clinically appropriate need for additional antibiotics beyond the first randomised treatment measured from patient records between the first randomised treatment and the end of the study

1.3. Clinically appropriate need for additional antibiotics beyond the first randomised and second (for failure) treatment measured from patient records between the second randomised treatment and the end of the study

1.4. Cure, defined as clinical improvement and no need for further antibiotic treatment for the original sepsis episode, measured using clinical assessment at the test of cure (TOC) visit (Day 14 \pm 3 days after randomisation)

1.5. Length of stay during the index hospitalisation measured from patient records between hospital admission and discharge

1.6. Systemic antibiotic exposure (days on antibiotics) during the index hospitalisation measured from patient records between hospital admission and discharge

1.7. 90-day mortality measured from patient records at 90 days

1.8. Change in C-reactive protein at baseline, 3, and 7 days (selected sites based on availability)

2. Safety measured using the following:

2.1. Incidence of Grade 3/4 adverse events (AEs) based on the International Neonatal Consortium Neonatal Adverse Event Severity Scale (NAESS) measured from patient records between baseline and 28 days

2.2. Incidence of AEs of any grade related to antibiotics measured from patient records throughout the study

2.3. Modification of antibiotics for adverse reactions measured from patient records throughout the study

Completion date

31/12/2028

Eligibility

Key inclusion criteria

Current inclusion criteria as of 19/02/2025:

1. Currently admitted to hospital

2. Aged \leq 28 days (post-natal age)

3. Weight \geq 1000g

4. Clinical diagnosis of a new episode of sepsis with two or more of the following clinical signs together with planned treatment with IV antibiotics

a. Abnormal temperature ($<35.5^{\circ}\text{C}$ Or $\geq 38^{\circ}\text{C}$)

b. Chest indrawing or increase in oxygen requirement or increase of respiratory support

c. Abdominal distension

d. Difficulty in feeding or feeding intolerance

e. Evidence of shock including cold peripheries

f. Lethargy, or reduced or no spontaneous movement

- g. Cyanosis
- h. Abnormal heart rate (bradycardia <80 bpm; tachycardia >180 bpm)
- i. Convulsions
- j. Irritability

For making the diagnosis of significant sepsis, the neonate should have no alternative primary explanation for these criteria (such as Hypoxic Ischaemic Encephalopathy, hypothermia, hypoglycemia, prematurity etc)

5. At moderate to high risk of death from this episode of sepsis, based on a neonatal sepsis severity score (NeoSep Severity Score). This was adapted from the WHO pSBI based scores for the hospital setting and developed using baseline clinical information and subsequent mortality from the NeoOBS study; specifically, a NeoSep Severity Score of 5 or higher at presentation for this episode of sepsis (which may be before formal screening)

6. Can receive all potential treatment options on the relevant randomisation list for this neonate at their site, ensuring randomisation is possible (see country-specific appendices)

7. IV antibiotics about to be started OR not received more than 24 hours of IV antibiotics for this episode of neonatal sepsis at the point of randomisation

Parent/guardian willing and able to provide consent (written or, if their neonate is severely ill, verbal consent which must be confirmed by written consent as soon as possible and wherever possible within 48 hours after the first trial specific procedure). Verbal consent allows for administration of first-line antibiotics at no or minimal delay

Previous inclusion criteria:

1. Currently admitted to hospital
2. Aged ≤ 28 days (post-natal age)
3. Weight >1000 g
4. Clinical diagnosis of a new episode of sepsis together with planned treatment with IV antibiotics
5. At moderate to high risk of death from this episode of sepsis, based on a neonatal sepsis severity score (NeoSep Severity Score) developed using baseline clinical information and subsequent mortality from the NeoOBS study; specifically, a baseline assessment NeoSep Severity Score of 4 or higher
6. Can receive at least 2 of the potential treatment options, ensuring randomisation is possible (Part 2 only)
7. IV antibiotics about to be started or not received >24 h of IV antibiotics for this episode of neonatal sepsis at the point of randomisation
8. Parent/guardian willing and able to provide consent (written or, if their baby is severely ill, verbal consent confirmed by written consent as soon as possible). Verbal consent allows for the administration of first-line antibiotics at no or minimal delay.

Participant type(s)

Patient

Healthy volunteers allowed

No

Age group

Neonate

Upper age limit

28 days

Sex

All

Key exclusion criteria

Current exclusion criteria as of 19/02/2025:

1. A known serious, non-infective co-morbidity anticipated to cause death within this admission (including major congenital abnormalities anticipated to cause death within this admission other than prematurity, e.g. known large ventricular septal defect)
 2. Previously enrolled in this trial
 3. Current participation in any other clinical study of an Investigational Medicinal Product (IMP) that is a systemic drug, unless it has received prior approval by the NeoSep1 Trial Management Group (TMG)
 4. Known contraindication to any of the trial antibiotics on the randomisation list for the relevant neonatal sub-population in that site
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Previous exclusion criteria as of 19/02/2025:

1. A serious, non-infective co-morbidity including major congenital abnormalities (other than prematurity), anticipated to cause death within this admission
2. Previously enrolled in this trial
3. Current participation in any other clinical study of an Investigational Medicinal Product (IMP) that is a systemic drug, unless it has received prior approval by the NeoSep1 Trial Management Group (TMG)
4. Known contraindication to any of the trial antibiotics on the randomisation list for the relevant neonatal sub-population in that site

Date of first enrolment

07/03/2023

Date of final enrolment

30/06/2028

Locations**Countries of recruitment**

Bangladesh

Ghana

India

Kenya

Pakistan

South Africa

Uganda

Viet Nam

Study participating centre
Tygerberg Children's Hospital
University of Stellenbosch
Francie Van Zijl Avenue
Parow
Western Cape
Cape Town
South Africa
7505

Study participating centre
Chris Hani Baragwanath Academic Hospital
26 Chris Hani Rd
Diepkloof
319-lq
Johannesburg
South Africa
1860

Study participating centre
KEMRI/Wellcome Trust Research Programme
PO Box 230-80108
Kilifi
Kenya
-

Study participating centre
Kumasi Centre for Collaborative Research in Tropical Medicine
Kumasi
Ghana
-

Study participating centre
Mbagathi Hospital
Nairobi

Kenya

-

Study participating centre

Coast General Teaching and Referral Hospital

Mombasa

Kenya

-

Study participating centre

Kawempe National Referral Hospital

Kampala

Uganda

-

Study participating centre

Mulago Specialised Women and Neonatal Hospital

Kampala

Uganda

-

Study participating centre

Child Health Research Foundation

Dhaka

Bangladesh

-

Study participating centre

Sir Salimullah Medical College Hospital

Bangladesh

-

Study participating centre

Lokmanya Tilak Municipal College and General Hospital

Mumbai

India

-

Study participating centre

Pt B D Sharma PGIMS

Rohtak

India

-

Study participating centre

The Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER)

Puducherry

India

-

Study participating centre

Tunku Azizah Kuala Lumpur Hospital

Kuala Lumpur

Malaysia

-

Study participating centre

The Aga Khan University Hospital (AKUH)

Karachi

Pakistan

-

Study participating centre

Vietnam National Children's Hospital

Hanoi

Viet Nam

-

Sponsor information

Organisation

Global Antibiotic Research & Development Partnership

ROR

<https://ror.org/0284j4180>

Funder(s)

Funder type
Charity

Funder Name
Global Antibiotic Research & Development Partnership

Results and Publications

Individual participant data (IPD) sharing plan
The contact details for data release requests are Sally Ellis, Childrens Antibiotics Project Leader (+41 22 9077612, sellis@gardp.org). The data sharing policy will be summarised in the study protocol. We intend to make the protocol available via the registry in due course, providing clarification on the details of individual participant data (IPD) sharing.

IPD sharing plan summary
Available on request

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Other files	Protocol Appendix 1 version 1.0	20/06/2024	19/02/2025	No	No
Other files	Protocol Appendix 2 version 1.0	20/06/2024	19/02/2025	No	No
Other files	Protocol Appendix 3 version 1.0	20/06/2024	19/02/2025	No	No
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes
Poster results	Part 1 results	30/04/2024	10/06/2024	No	No
Protocol file	version 1.0	04/04/2022	12/04/2023	No	No
Protocol file	version 3.0	03/10/2024	19/02/2025	No	No
Statistical Analysis Plan	Part 1 version 1.0	08/06/2023	29/05/2024	No	No
Statistical Analysis Plan	Part 2 version 1.0	30/01/2025	19/02/2025	No	No