VOLUME 01

# Paediatric Infectious Disease Perspectives (PIPS) Volume 01

Providing the latest evidence articles and perspectives for paediatric infectious disease to improve patient outcomes.

## Infectious diseases continue to cause most deaths in infants and children [1]

## Table of Contents

# Incidence and Transmission of Respiratory Syncytial Virus in Urban and Rural South Africa, 2017-2018

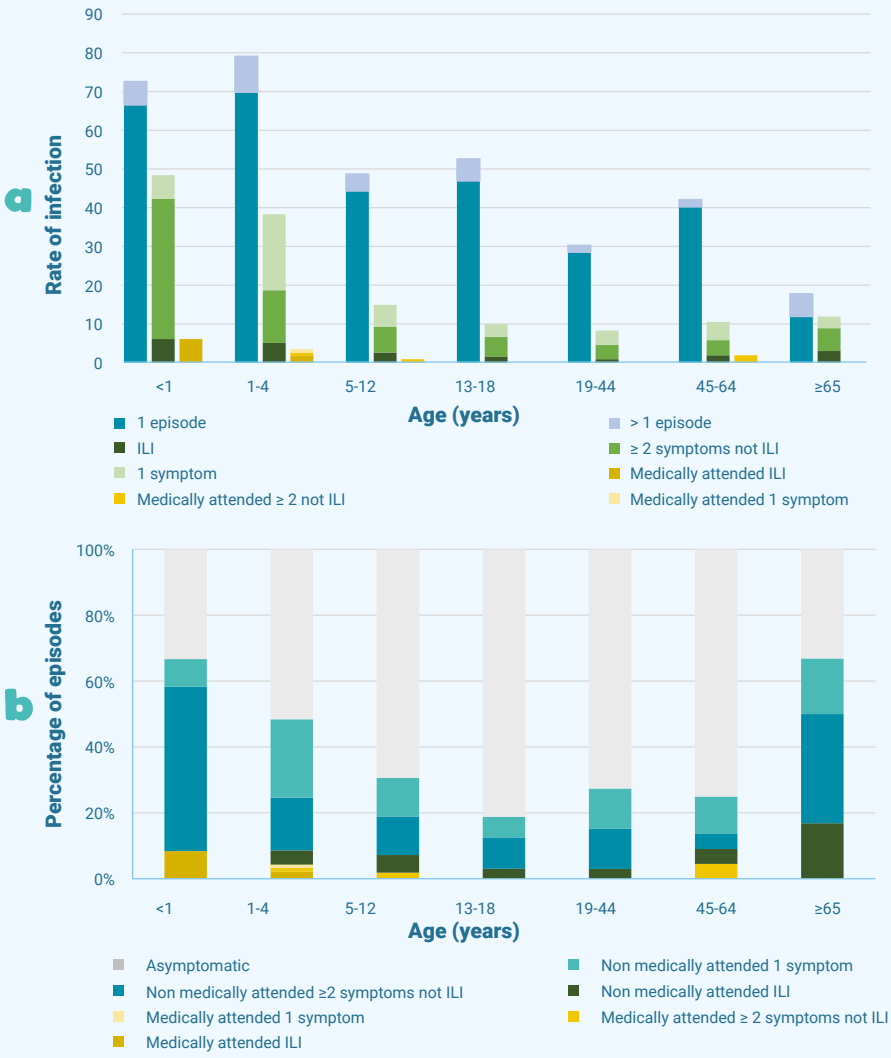
## What is Respiratory Syncytial Virus?

"Respiratory syncytial virus (RSV) is the **most common cause of bronchiolitis and lower respiratory tract infection (LRTI) among young children** and may cause severe illness in young infants. The RSV season in South Africa usually precedes the influenza season, average onset at the end of February." National Institute of Communicable Disease (NICD) 2024 [1]

## Figure 1

**Rates and symptomatic percentage of RSV infection and illness by age group at a rural and an urban site, South Africa, 2017-2018** [2]

**a** Rates of RSV infections and RSV-associated illness per 100 person-years and **b** percentage of episodes by symptom and medical attendance.




Adapted from Cohen *et al.*
ILI – influenza-like illness (fever and cough).

## Fast Facts Sheet [2]

The incidence of **RSV infection** in rural and urban South African households is **high** (>45 per 100 person-years).

- **10 %** of infected patients had a **repeat infection** in the same year.
- **1/3** of patients experienced **symptoms.**
- Incidence **highest** among children **<5 years**.

RSV was estimated to cause **33 million** acute lower respiratory tract **infections** (ALRI) globally in 2019.

Among children **<5 years** of age, an estimated **3.6 million ALRI hospital admissions** and **>100,000 deaths**; approximately **2 %** of all-cause **deaths** in children aged 0–60 months.

Highest burden of disease (>97 %) occurs in **low- and middle-income countries** (LMIC) with three quarters medically unattended.

Incidence of RSV-associated ALRI is **greatest** among **infants** aged <6 months; an estimated 80 % of RSV-associated ALRI among children aged <5 years occurs in children aged 6 months to 4 years.

There is also a substantial burden of severe RSV among older adults.


# Study design and participants

A prospective cohort study, conducted in a **rural and an urban community** in South Africa from **2017 through 2018** over two seasons.

**1,116 participants in 225 households**. Each year nasopharyngeal swabs were collected twice a week for 10 months annually and tested for RSV using PCR.

## Methods

Households **randomly selected** at each site.

Study conducted in a **rural site** (in Mpumalanga Province, situated within a health and socio-demographic surveillance system) and an **urban community** (North West Province) in South Africa from 2017 through 2018.

**Households with >2 members** and where ≥80 % of members individually consented to participate were enrolled.

**Nasopharyngeal samples** were collected using nasopharyngeal nylon flocked swabs.

Samples were **tested** for RSV by real-time reverse transcription polymerase chain reaction **(rRT-PCR)** using the FTD Flu/RSV detection assay.

## Results

**32 % (359/1116) of individuals had ≥1 RSV infection;**

- **10 %** (37/359) had **repeat infection** during the same season,
- **33 %** (132/396) of infections were **symptomatic**,
- **2 %** (9/396) sought **medical care**.

Incidence was 47.2 infections/ 100 person-years and **highest in children <5 years** (78.3).

**75 %** (168/225) of households had at least **one person testing RSV-positive** each year.

Young **children** were more likely to **introduce RSV** into the households.

Most common **symptoms** reported were **cough** (80 %), **runny nose** (69 %) and **fever (15 %)**.

## Conclusions

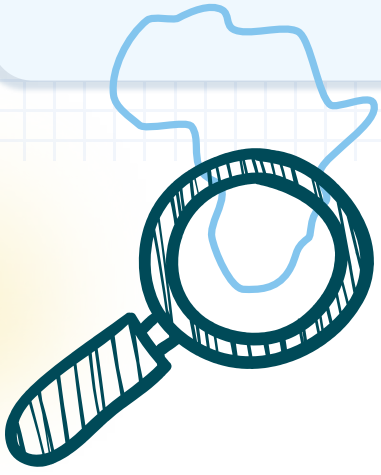
Overall **75 % of households** had at least one **positive RSV test**.

Future **studies should examine** whether **vaccines targeting children** aged <12 years could reduce community transmission.

Within two South African communities, RSV attack rate was high, and most infections asymptomatic.

**The study highlights the need for preventive strategies**.

Incidence was **highest among children** aged **<5 years** (exceeding 70 infections per 100 person-years); children **≤12 years** old accounted for **60 % of cases.**



References:

1. https://www.nicd.ac.za/start-of-the-respiratory-syncytial-virus-rsv-season-alert-to-clinicians/ last accessed 24th April 2024.
2. Cohen C , Kleynhans J, Moyes J, McMorrow M L, Treurnicht F K, Hellferscee O, *et al*. Incidence and transmission of respiratory syncytial virus in urban and rural South Africa, 2017-2018. *Nature Communications*.

# Hot topics in Paediatric Infectious Diseases in South Africa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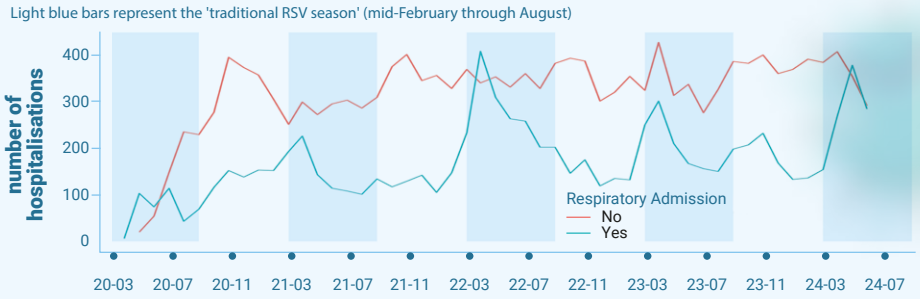
The **"hot topics"** mentioned here are a subset of the areas which require enquiry and a consolidated research focus if we are to approach the infant and child survival targets set by the Sustainable Development Goals. We each have our areas of interest and expertise.

**What are your "hot topics" in the arena of childhood infections?**

## Figure 2

### General Paediatric Admissions to Chris Hani Baragwanath Academic Hospital: March 2020 - May 2024




Graph supplied by Prof Moore

## Expert Opinion
### David P. Moore

**23 May 2024**
I enjoy posing questions to the clinicians attending my ward rounds, encouraging them to come up with topics for research which may be conducted using the wealth of clinical cases available to us in our busy academic hospital. This is because a typical clinical round in an academic paediatric general ward in the South African public health sector serves as a barometer as to what types of infectious organisms are circulating in the community at large, and research is a means by which disease trends, aetiologies, treatment options and preventive strategies may be elucidated. On yesterday's round, **respiratory viruses** predominated, followed by presumed **severe bacterial sepsis**, and a case of suspected **tuberculosis**. Each of these speak to some of the "hot topics" in paediatric infectious diseases currently.

**We are in the midst of the respiratory syncytial virus** (RSV) epidemic, which typically begins in February each year and spans to August in South Africa. [1] The COVID-19 pandemic disrupted the circulation of respiratory viruses, including RSV, largely due to use of personal protective equipment and social distancing policies.

While no widely available, safe vaccine is available to prevent RSV in infants and children as yet, there are a number of vaccines under development, [2] and vaccines have been licensed for use in older adults in the United States and Europe. [3]

Vaccination of pregnant women has been shown to confer protection to their newborns against all-cause and RSV-associated hospitalisation. [4] **The effectiveness of antenatal RSV vaccination programmes** in reducing the burden of hospitalisation among infants up to the age of 6 months will be important to model ahead of incorporation of a maternal vaccination programme in low-middle income countries (LMIC).

**As lower respiratory tract infections** (LRTI) are the leading cause of morbidity and mortality in young children globally, guideline recommendations and clinician preference are for the use of antibiotic treatment in children hospitalised with pneumonia. We have recently shown that step-down to oral antibiotic therapy, rather than continuation of intravenous antibiotic to complete 5 days of therapy as recommended by the World Health Organization (WHO), is safe. [5]

Step-down to oral antibiotic therapy, **or targeted antibiotic therapy based on point-of-care biomarker responses** in children with LRTI, or other infectious disease syndromes, may assist in minimising the overuse of antibiotics in hospitalised children, thereby decreasing the rates of antibiotic resistant infections.

**Antimicrobial resistance** has been flagged as a threat to human health. Strategies to influence clinician behaviours in terms of optimisation of **infection prevention and control practice**, and to increase their awareness of more judicious utilisation of antimicrobials, are **urgently needed**.

Studies designed to sustainably impact on these aspects of clinical care may reverse the escalating trends in infections with **multi-drug resistant organisms** in our healthcare environments.

Detection and treatment of childhood tuberculosis is challenging, with only 71% (2.5 million) of the targeted 3.5 million children with tuberculosis accessing care worldwide from 2018 to 2022. [6] (*World Health Organization* 2023)

Roll-out of more accurate and easy to administer **diagnostic tests for childhood tuberculosis** is essential to close this treatment gap. These require cost-effectiveness assessments and validation in routine clinical practice. Algorithms for the detection of tuberculosis in children need to be validated and refined across geographic regions, and response to WHO-recommended short-course therapy [7] in programmatic settings needs to be assessed."


References:
1. **Staadegaard, L., S. Caini, S. Wangchuk, B. Thapa, W. A. F. de Almeida, F. C. de Carvalho, R. A. Fasce**, *et al.* 2021. "Defining the seasonality of respiratory syncytial virus around the world: National and subnational surveillance data from 12 countries." Journal Article. *Influenza Other Respir Viruses* 15 (6): 732–41. https://doi.org/10.1111/irv.12885.
2. **Verwey, C., and S. A. Madhi.** 2023. "Review and Update of Active and Passive Immunization Against Respiratory Syncytial Virus." Journal Article. *BioDrugs* 37 (3): 295–309. https://doi.org/10.1007/s40259-023-00596-4.
3. **Venkatesan, Priya. 2023.** "First RSV vaccine approvals." Journal Article. Lancet Microbe 4 (8): e577. https://doi.org/10.1016/S2666-5247(23)00195-7.
4. **Kampmann, B., S. A. Madhi, I. Munjal, E. A. F. Simões, B. A. Pahud, C. Llapur, J. Baker**, *et al.* 2023. "Bivalent Prefusion F Vaccine in Pregnancy to Prevent RSV Illness in Infants." Journal Article. *N Engl J Med* 388 (16): 1451–64. https://doi.org/10.1056/NEJMoa2216480.
5. **Musiime, Victor, and The PediCAP Trial Team. 2024.** "Early oral step-down to amoxicillin is safe and effective for children hospitalised with severe community-acquired pneumonia: the PediCAP trial." In. ESCMID Global 2024, Barcelona, Spain. https://projectpedicap.org/wp-content/uploads/2024/05/PediCAP-results-@ESCMID-2024_Barcelona_27-30-Apr-24_v0.4.pdf
6. **World Health Organization. 2023.** Global Tuberculosis Report 2023. Online Report. Geneva, Switzerland: World Health Organization. https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2023.
7. **Turkova, A., G. H. Wills, E. Wobudeya, C. Chabala, M. Palmer, A. Kinikar, S. Hissar**, *et al.* 2022. "Shorter Treatment for Nonsevere Tuberculosis in African and Indian Children." Journal Article. *N Engl J Med* 386 (10): 911–22. https://doi.org/10.1056/NEJMoa2104535.

# Causes of Death Among Infants and Children in the Child Health and Mortality Prevention Surveillance (CHAMPS) Network [1]

## Study Background [1]

Despite the number of deaths of younger children decreasing worldwide, in 2019 an estimated 5.3 million deaths occurred. 2.8 million (53 %) deaths were recorded in children less than 5 years of age. [1]

**Understanding the causes of death in children under five is crucial for improving global child health outcomes.** [1]

**Traditional methods of mortality surveillance often lack accuracy, particularly in low-income countries.** [1]

Image source: freepik.com

**53%**

**of deaths in children less than <5 years** [1]



## Study Purpose [1]

To describe and identify underlying, intermediate, and immediate the **causes of childhood mortality across seven surveillance sites in sub-Saharan Africa and South Asia.** [1]

## Study Design [1]

**Data of deceased children aged 1 to 59 months** was extrapolated from the Child Health and Mortality Prevention Surveillance (CHAMPS) Network (for the period December 3, 2016, to December 3, 2020). [1]

The cross-sectional study utilised minimally invasive tissue sampling **(MITS)** alongside **histopatho-logic analysis, microbiological diagnostics, clinical data, and verbal autopsies** for cause of death determination. ***N* = 632.** [1]

## Endpoints [1]

The primary endpoint was the identification of the underlying, intermediate, and immediate **causes of death** among the enrolled children. [1]

The CHAMPS network is a collaborative effort of more than 135 global partners, including ongoing engagement with National Public Health Institutes, governments, incountry organizations, universities, and program office staff from the Emory Global Health Institute, the International Association of National Public Health Institutes, Public Health Informatics at the Task Force for Global Health, Deloitte and the United States Centers for Disease Control and Prevention. [2]

**CHAMPS sites are located in Sub-Saharan Africa and South Asia. These regions account for approximately 82 percent of the world's under-five deaths each year.** [2]

- champshealth.org

CHAMPS

# Results [1]

The study analysed data from **632 deceased children**.

## The six most common underlying causes of death were:

**104**
**malnutrition**
(16,5 %)

**75**
**HIV**
(11,9 %)

**71**
**malaria**
(11,2 %)

**64**
**congenital birth defects**
(10,1 %)

**53**
**lower respiratory tract infections**
(8,4 %)

**46**
**diarrheal diseases**
(7,2 %)

## Most dominant immediate causes: [1]

1. **sepsis** (191 [36.7 %])
2. **LRTI** (129 [24.8 %])

An **infection** was present in 86.9 % of the cases. [1]

## Contributing pathogens to infectious deaths: [1]

***Klebsiella pneumoniae***
(155 of 549 infectious deaths [28.2 %]; 127 [81.9 %] considered nosocomial)

***Plasmodium falciparum***
(122 of 549 [22.2 %])

***Streptococcus pneumoniae***
(109 of 549 [19.9 %]).

**Cytomegalovirus**
(57 [10.4 %])

***Acinetobacter baumannii***
(39 [7.1 %]; 35 of 39 [89.7 %] considered nosocomial), also played important roles.

Potentially, 494/632 deaths (78.2%) were **preventable** and 26/632 deaths (4.1%) **preventable under certain conditions**. [1]

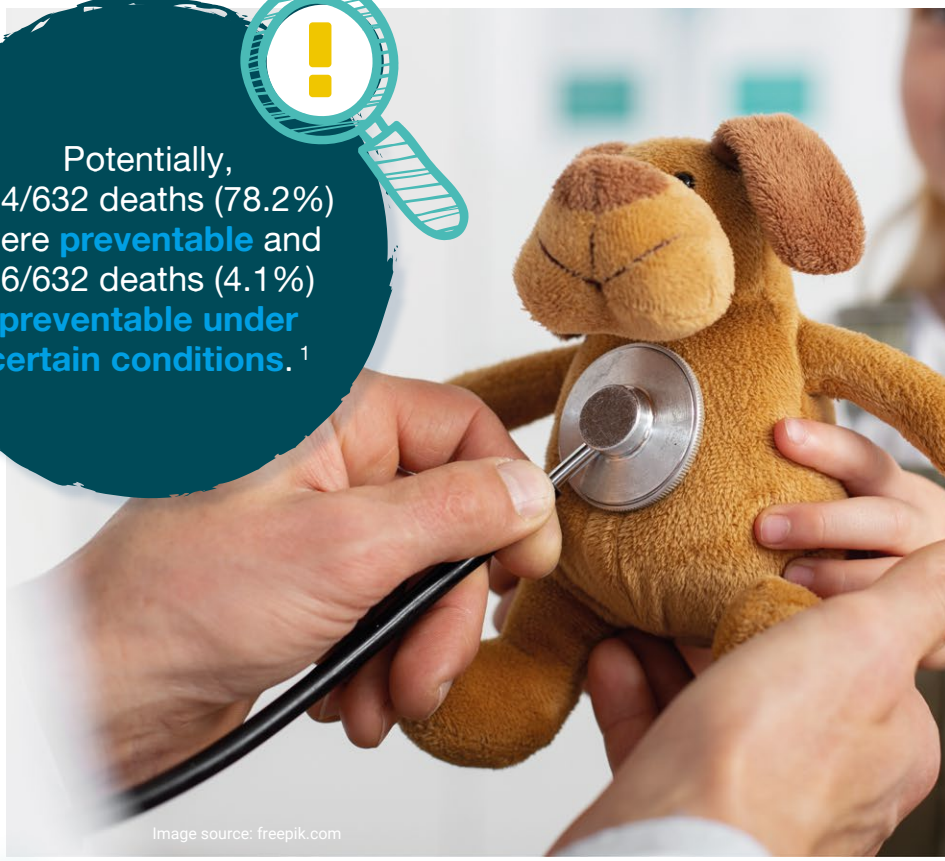


Image source: freepik.com

# Conclusions [1]

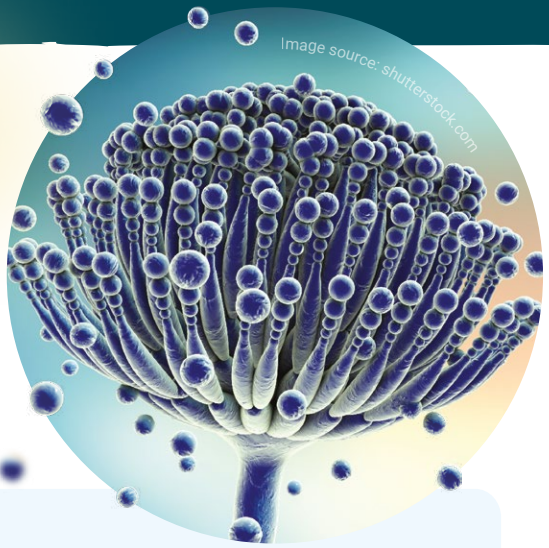
The **CHAMPS** Network approach using MITS provides **valuable insights** into the causes of childhood mortality. The study highlights **infectious diseases** continue to cause **most deaths in infants and children**, often in conjunction with **malnutrition**. [1]

It provides the significant **opportunities for action to prevent deaths** and improve child survival through healthcare interventions and strategies to address maternal health risks. [1]

The significant mortality caused by ***S pneumoniae*** and ***H influenzae*** indicates gaps in protection against severe disease on account of ***vaccination coverage***, disease caused by nonvaccine sero-types, or the high prevalence of underlying conditions reducing vaccine effectiveness, such as malnutrition. [1]


References:
1. **Bassat Q, Blau D.M, Ogbuanu I U, Samura S, Kaluma E, Bassey I-A**, *et al*. Causes of Death Among Infants and Children in the Child Health and Mortality Prevention Surveillance (CHAMPS) Network. *JAMA Network Open*. 2023;6(7):e2322494
2. www.champshealth.org. Last accessed 20 May 2024.

# Invasive Fungal Infections in a Paediatric Intensive Care Unit in a Low-to middle-income Country




## The rise of fungal pathogens and infections (invasive fungal infections – IFDs) is becoming a major public health entity worldwide.

The **most vulnerable** individuals are those with **existing health conditions or compromised immune** systems, including those with chronic lung disease, a history of tuberculosis (TB), HIV, cancer, and diabetes mellitus.

Additionally, **critically ill** patients in an intensive care unit **(ICU)**, individuals undergoing **invasive medical procedures** and receiving broad-spectrum **antibiotics**, and those taking **immune-suppressing medications are also at a higher risk**. [1] *WHO Fungal Priority Pathogen List, 2023*

**Infectious diseases** are among the **top causes of mortality** and a leading cause of **disability** worldwide.

**Drug-resistant bacterial infections** are estimated to **directly cause 1.27 million deaths** and to **contribute to** approximately **4.95 million deaths every year**, with the greatest burden in resource-limited settings.

The **diagnosis and treatment** of IFDs are **challenged by limited access to quality diagnostics and treatment** as well as **emergence of antifungal resistance** in many settings. [1] *WHO 2023.*

### Figure 3

### WHO fungal priority pathogens list

**Critical Priority Group**

- *Cryptococcus neoformans*
- *Candida auris*
- *Aspergillus fumigatus*
- *Candida albicans*

**High Priority Group**

- *Nakaseomyces glabrata* (*Candida glabrata*)
- *Histoplasma* spp.
- Eumycetoma causative agents
- Mucorales
- *Fusarium* spp.
- *Candida tropicalis*
- *Candida parapsilosis*

**Medium Priority Group**

- *Scedosporium* spp.
- *Cryptococcus gattii*
- *Lomentospora prolificans*
- *Talaromyces marneffei*
- *Coccidioides* spp.
- *Pneumocystis jirovecii*
- *Pichia kudriavzeveii* (*Candida krusei*)
- *Paracoccidioides* spp.

Adapted from www.who.int
**Abbreviations: WHO** - World Health Organisation, **spp.** - species

# Study Background

**Invasive fungal infections (IFIs) pose a significant threat to critically ill children**, particularly in **low-to-middle-income countries** (LMICs) where resource constraints and limited diagnostic capabilities can hinder early diagnosis and management.This study investigates the **most common cause** of healthcare-associated infections and outcomes of IFIs in a paediatric intensive care unit (PICU) setting.

Image source: shutterstock.com

# Study Purpose

**The primary aim** of the study was to determine the **prevalence of IFIs, types of fungal pathogens** involved in children admitted to the PICU and to offer a basis for the efficient prevention and treatment of IFIs.

# Methods

**A retrospective study conducted in children <12 years of age, over a two-year period.**

Children were **categorised according to pre-defined microbiology criteria**, if they had a positive culture from blood or other sterile sites.

Data gathered included **demographics, invasive procedures, length of stay and mortality.**

***N = 1042.***
All children had received **prior antibiotic therapy** and had **urinary catheterisation**, whilst **97.2% had invasive ventilation** with endotracheal tubes.

**Two-thirds** (63.4%) had **central catheters** in place and **almost half** (44.4%) had previous **surgery**.

# Results

- **Patients admitted – 1 042.**
- 56.8 % (***N = 592***) were **male**.
- **Median length of stay was 18 days** (mean ± SE 18.6±8.9) for IFI vs **7.3 days for children** with a bacterial infection.
- **IFI** was identified in **35 cases per 1 000** admissions, with **77.7 % < 1 year of age**.
- **In-hospital mortality** for IFI was **36%** compared with 16% for all admissions.
- Findings confirmed that **colonisation was more prevalent than IFI**.

***Candida***
was the **predominant fungal pathogen** identified in the PICU

***C. albicans***
accounted for **36.1% of all invasive isolates**

***C. glabrata***
is more **prevalent in surgical patients** or those with a central venous line;

***C. tropicalis***
is more common among patients with **malignant disease or neutropenia;**

***C. parapsilosis***
is frequently seen among **infants or those on parenteral nutrition.**

**Invasive fungal infections are associated with an overall mortality of 11%.**

Image source: commons.wikimedia.org / microbenotes.com

# Conclusions

- **Early appropriate therapy** of IFI is imperative with **high-performance antifungal drugs**.
- **IFIs** are **more common with indwelling invasive devices** (especially in young children).
- The dominance of ***Candida*** and specifically ***C. albicans*** in PICU
- **IFIs are common among infants**, these patients have a **higher mortality rate** and **prolonged hospital stay**.


References:

1. World Health Organisation (WHO) fungal priority pathogens list to guide research, development and public health action 2023.
2. **Hlophe ST, Jeena P M, Mahabeer Y, Ajayi O R, Govender N P, Ogunsakin R E, Masekela R**. Invasive fungal infections in a paediatric intensive care unit in a low-to middle-income country. *Afr J Thoracic Crit Care Med* 2022;28(3):104-108

# Antimicrobial Resistance in Enterobacterales Infections Among Children in sub-Saharan Africa: a Systematic Review and Meta-analysis

## Study Background

**Sub-Saharan Africa** (SSA) faces a significant **burden of antimicrobial resistance** (AMR), particularly among children. It has been estimated that sub-Saharan Africa (SSA) has the **world's highest incidence of deaths due to antimicrobial resistance** (AMR). **Enterobacterales are common** bacteria causing infections **in children**, and **increasing resistance** to antibiotics used for treatment is a growing concern.


## Methods

The researchers searched medical databases for **studies published between 2005 and 2022** that investigated **AMR patterns in Enterobacterales** causing infections in **children aged 0-18 years in SSA**.

Researchers excluded studies that **lacked clear documentation** of how they tested antibiotic susceptibility.

**Additionally, studies with very few results** (less than 10) for a specific bacteria **were excluded** to avoid basing conclusions on limited data.

To further **ensure data quality, two independent authors** reviewed and evaluated the remaining studies. The **main focus** of the analysis was to determine the **percentage of Enterobacterales bacteria resistant to antibiotics** commonly used to treat children's infections.


## Results

**1111 records were screened**, 122 relevant studies included providing data on more than 30,000 blood, urine and stool isolates.

**The analysis revealed high proportions of resistance to commonly used antibiotics** for treating Enterobacterales infections in children across sub-Saharan Africa.

### Here are some key findings:

***Escherichia coli*** and ***Klebsiella* spp. were the predominant** species, both presenting high proportions of resistance to third-generation cephalosporins, especially in blood cultures.

***E. coli***, a common Enterobacterales species, **showed high resistance** to ampicillin (around 92.5%) and gentamicin (over 42 %).

**Gentamicin resistance was also prevalent in *Klebsiella* spp.** (over 77 %).

**These antibiotics** are often used empirically **for initial treatment of infectious** syndromes in children.

## Conclusions

The study highlights a **critical issue of high AMR in Enterobacterales causing infections among children in sub-Saharan Africa.** This resistance poses a challenge for effective treatment, potentially leading to poorer outcomes.

### The findings emphasise the need for:

Improved **local surveillance of AMR patterns** to inform clinical practice guidelines.

**Development of strategies** to curb the emergence and spread of AMR in this region.

**Urgent need to strengthen local-level capacities** in microbiological analysis in SSA to support antimicrobial stewardship measures.

**Strengthening infection prevention and control** in healthcare services would dramatically improve patients' outcomes in the region.


Reference:

**Morgane Kowalski, Basilice Minka Obama, Gaud Catho, Juan Emmanuel Dewez, Arnaud Merglen, Micaela Ruef, Diego O. Andrey, Nasreen Hassoun-Kheir,Marlieke E. A. de Kraker, Christophe Combescure, Stephane Emonet, Annick Galetto-Lacour, and Noémie Wagner.** Antimicrobial resistance in Enterobacterales infections among children in sub-Saharan Africa: a systematic review and meta-analysis. *eClinicalMedicine* 2024;70: 102512

# Multiple Choice Questions for CPD points

Submit your answers on www.medicalnewsletters.com


Image source: freepik.com

**Questions 1 to 4 refers to article:**

## "Incidence and transmission of respiratory syncytial virus in urban and rural South Africa, 2017-2018"

**1. What was the primary focus of the study by Cohen *et al*. regarding RSV in South African households?**

a) To develop a vaccine against RSV
b) To compare RSV infection rates between urban and rural areas only
c) To describe the incidence (frequency) and transmission patterns of RSV infection
d) To assess the effectiveness of different medications for treating RSV

**2. According to the study, what age group had the highest RSV infection rate?**

a) Adults over 65 years old
b) Children between 1-4 years old
c) Children under 5 years old
d) All age groups had similar rates

**3. The study suggests that individuals with which of the following characteristics were more likely to transmit RSV to others in the household?**

a) Those who were under 12 years old and had no symptoms
b) Those who were over 65 years old and experienced a fever
c) Those who received a flu shot in the previous month
d) Those who did not live in close quarters with other household members

**4. Based on the study findings, which statement is most likely true regarding future RSV prevention strategies?**

a) Targeting elderly individuals for vaccination would be the most effective approach.
b) Focusing solely on improving hygiene practices in households may not be sufficient.
c) Investigating vaccines for children under 12 years old could be a promising avenue.
d) Development of RSV treatment medications should be prioritized over vaccines.

**Questions 5 to 8 refers to article:**

## "Causes of Death Among Infants and Children in the Child Health and Mortality Prevention Surveillance (CHAMPS) Network"

**5. Which age group did the CHAMPS Network study focus on?**

a) Infants under 1 year old only
b) Children under 5 years old only
c) Infants and children under 18 years old
d) All ages

**6. What was the primary endpoint (goal) of the study by Bassat *et al*.?**

a) To compare MITS with traditional methods for cause of death determination.
b) To identify the most common causes of hospitalization in children.
c) To determine the underlying, intermediate, and immediate causes of death in enrolled children.
d) To assess the effectiveness of different treatment strategies for childhood illnesses.

**7. According to the study, what was a significant underlying cause of death in neonates (newborn infants)?**

a) Birth defects unrelated to maternal health
b) Prematurity and low birth weight (LBW)
c) Childhood vaccinations
d) Nutritional deficiencies

**8. The study's findings suggest that which of the following interventions could potentially reduce child mortality?**

a) Implementing widespread childhood drug screenings
b) Focusing solely on treating childhood malnutrition
c) Improving access to basic healthcare and addressing maternal health risks
d) Encouraging later childbearing ages for mothers

# Multiple Choice Questions for CPD points

Submit your answers on
www.medicalnewsletters.com

**Questions 9 to 12 refers to article:**

## "Invasive fungal infections in a paediatric intensive care unit in a low-to middle-income country"

**9. The study by S.T. Hlophe focused on IFIs in critically ill children admitted to a:**

a) O General paediatric ward
b) O Neonatal intensive care unit (NICU)
c) O Paediatric intensive care unit (PICU)
d) O Emergency department

**10. Which diagnostic method was most likely used to confirm IFIs in this study?**

a) O Chest X-ray
b) O Physical examination only
c) O Positive culture from blood or sterile sites
d) O Patient interviews about symptoms

**11. According to the study, what was the most common fungal pathogen isolated from children with IFIs?**

a) O *Aspergillus fumigatus*
b) O *Candida* species
c) O *Mucorales* spp.
d) O *Scedosporium* spp.

**12. The high mortality rate associated with IFIs in this study highlights the importance of:**

a) O Implementing stricter hospital visitation policies
b) O Focusing solely on treatment with powerful antifungal medications
c) O Early diagnosis and development of preventive measures for high-risk patients
d) O Discontinuing the use of invasive medical devices in PICUs

**Questions 13 to 16 refers to article:**

## "Antimicrobial resistance in Enterobacterales infections among children in sub-Saharan Africa: a systematic review and meta-analysis"

**13. What was the main design used in this study by Morgane Kowalski to assess AMR in Enterobacterales infections?**

a) O A large-scale clinical trial testing a new antibiotic
b) O A single hospital study comparing different treatment regimens
c) O A systematic review and meta-analysis of existing research
d) O Case studies of children with severe Enterobacterales infections

**14. The study focused on AMR patterns in Enterobacterales isolated from children with infections in:**

a) O All age groups
b) O Infants under 1 year old only
c) O Children under 5 years old only
d) O Adolescents aged 10-18 years old

**15. Which of the following findings about AMR in Enterobacterales is MOST LIKELY reported in the study?**

a) O High resistance to antibiotics rarely used for treating children
b) O Low prevalence of AMR compared to developed countries
c) O No significant difference in resistance patterns between urban and rural areas
d) O High resistance to commonly used antibiotics for treating Enterobacterales infections in children

**16. Based on the study's findings, what is a potential consequence of high AMR in Enterobacterales infections?**

a) O Reduced effectiveness of childhood vaccination programs
b) O Development of new and more powerful antibiotics
c) O Increased need for hospitalization in children with infections
d) O Lower risk of contracting other childhood illnesses

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