MINISTRY OF HEALTH EMERGENCY MEDICAL SERVICES ECHO

THE REPUBLIC OF UGANDA
MINISTRY OF HEALTH

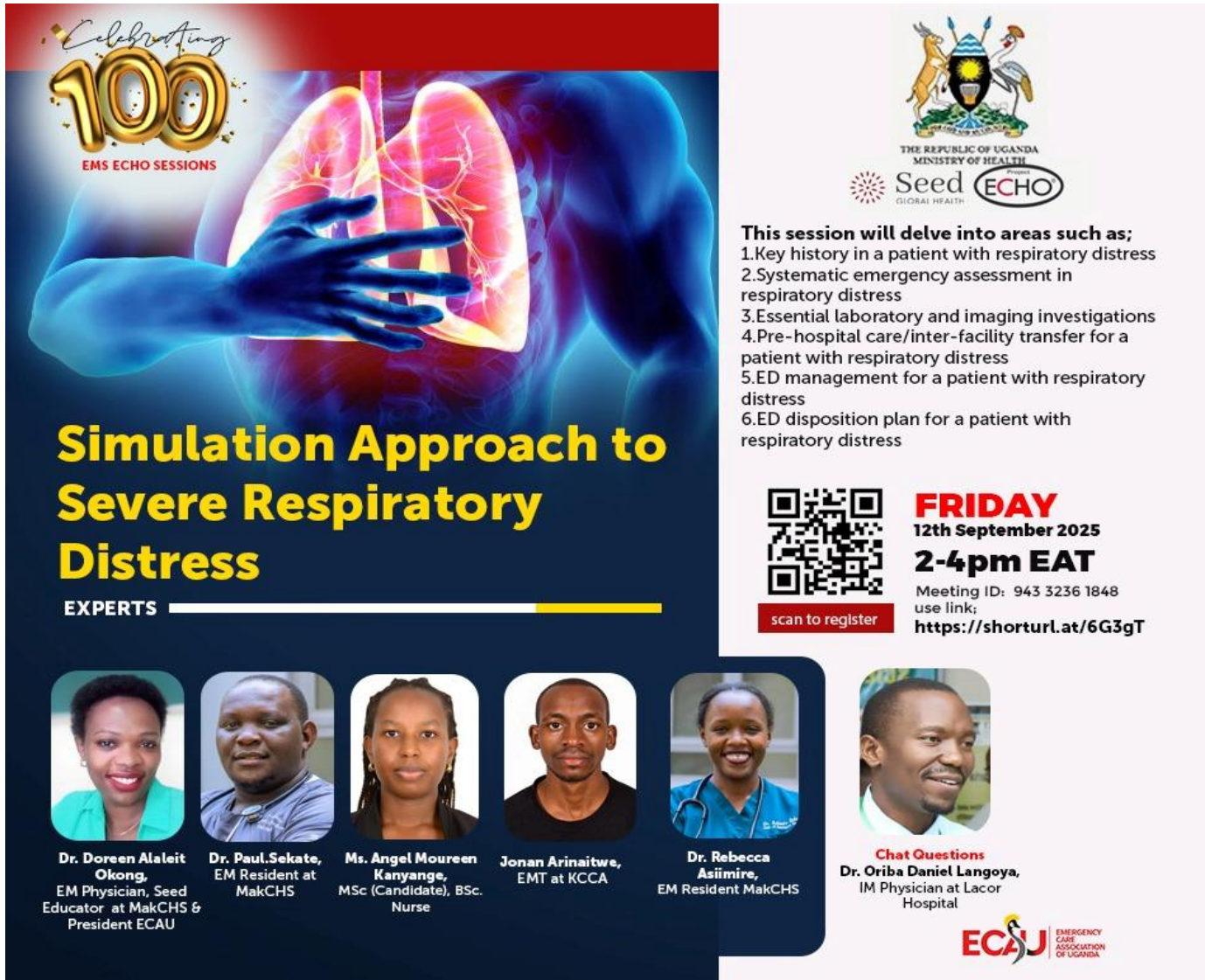
Seed GLOBAL HEALTH

Project ECHO®

Disclaimer

EMS ECHO training videos are for educational purposes and should not be used as the sole source of reference during patient care. Always refer to official guidelines and consult qualified professionals before applying any practices

EMS ECHO Session 100



Learning Objectives

- Recognise risk factors and presentation of severe RD
- Stabilise a critically ill patient with severe hypoxia and shock
- Different oxygen delivery modalities and their indications
- Timely decision-making for making when managing RD
- Demonstrate effective team communication and leadership during resuscitation.

Simulation Scenario

- **Patient**: Mukasa John, 45/M, obese truck driver, known smoker, hypertensive, referral from Jinja RRH for advanced care

- **P/C:** Severe shortness of breath (DIB) progressively worsening over 3 days

- **Key History:**
  - Recent hospital admission for **pelvic fracture repair (1 week ago)** after a fall.
  - Discharged home; developed worsening dyspnea 3 days ago.
- No fever, no chest pain reported

Overview of Hypoxaemia

Dr. Oriba Dan Langoya, MBChB, MMED, FISPD

Assoc. Consultant Physician

Head of Department Internal Medicine

St. Mary's Hospital Lacor

Honorary Lecturer, Faculty of Medicine

Gulu University

Reminder: Respiratory Characteristic in Children & Adults

Children

- Rapid Respiration (30 – 55 per min)
- Abdominal breathing
- Irregular in rate & depth
- Chest wall is thin with little muscle
- Ribs 7 sternum easily seen
- Round thorax
- At risk for URIs
- Airways are short

Adults

- 16 – 24 B/Min
- Power of Muscle reduced
- Barrel or elliptical shaped thorax
- Lung Tissue less elastic
- Air way collapse more easily

Hypoxemia is common in many (childhood) illnesses

Hypoxemia = Low Oxygen level in the blood ; SpO2 <90% on pulse oximeter reading

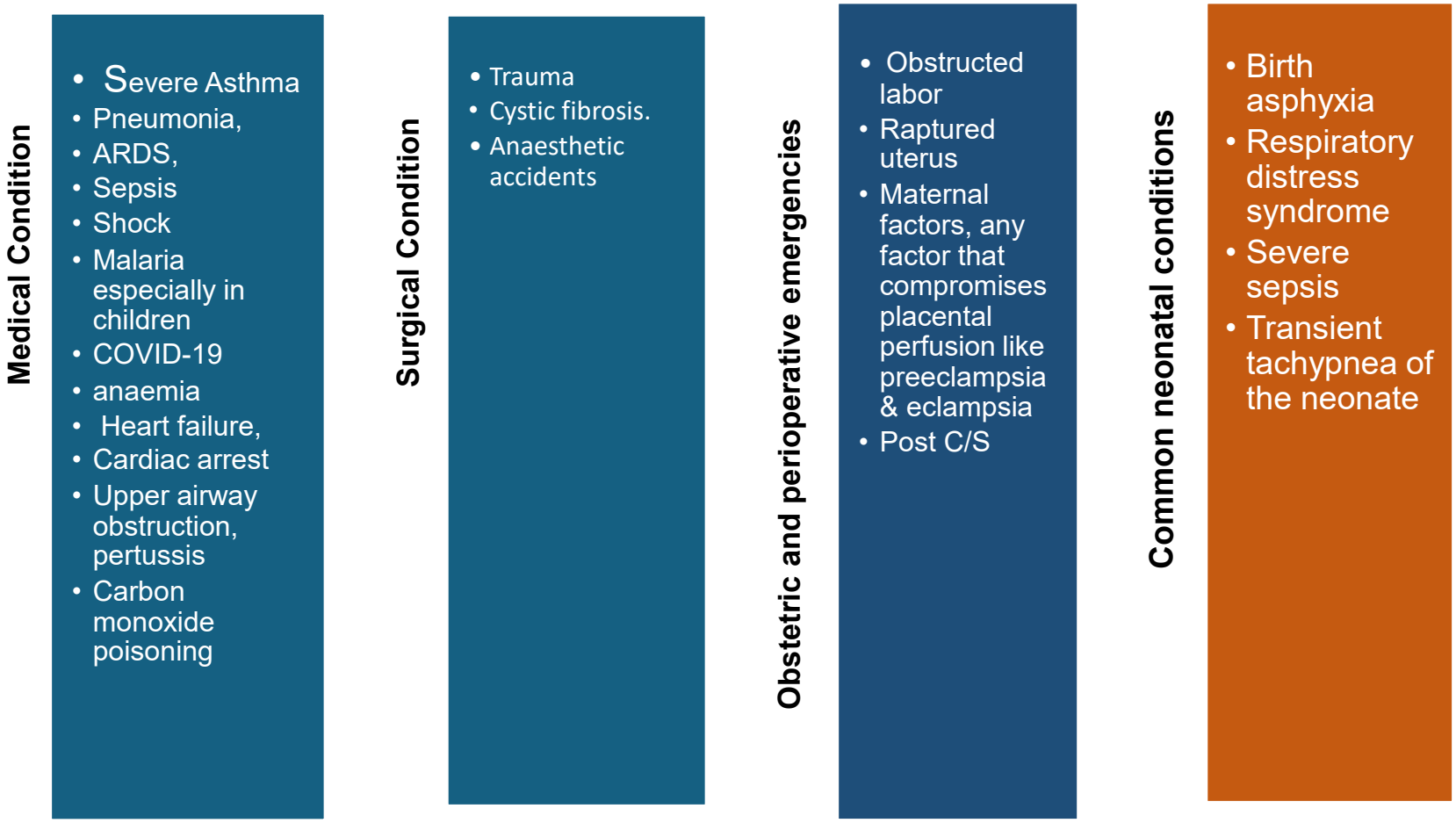
Common causes of Hypoxemia (Percent of hospital admissions showing hypoxemia)

Severe Pneumonia (13%)	Severe malaria (3-5%)	Sepsis
Bronchiolitis	Asthma (up to 43%)	Neonatal conditions
Obstetric emergencies	Perioperative emergencies	Trauma

Note: Percentage refers to the percent of hospital admissions showing hypoxemia
Sources: S Junge et Al. The spectrum of hypoxaemia in children admitted to hospital in The Gambia, West Africa;
Duke T et al. - The prevalence of hypoxemia among ill children in developing countries. Burden of hypoxaemia in children with moderate and severe acute asthma is about 43% (Nantanda et.al 2013)

Summary of Conditions leading to Hypoxemia by field of medical specialty

- Hypoxemia = low oxygen in the arterial blood is SpO2 <90% on pulse oximetry reading.

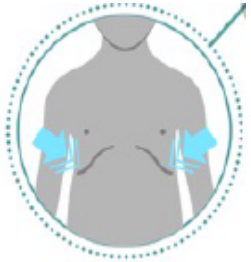


Clinical signs alone are not enough to detect hypoxemia

Clinical signs that are <u>specific</u>, but miss a lot of cases of hypoxemia

- Blue coloring of tongue or gums (central cyanosis)
- Grunting or head nodding with every breath (SRD)
- Nasal flaring (SRD)

Clinical signs that are sometimes, but not always a sign for hypoxemia



- Severe lower chest wall indrawing
- Tachypnea
- Depressed conscious state
- Inability to drink or feed (when due to respiratory illness)

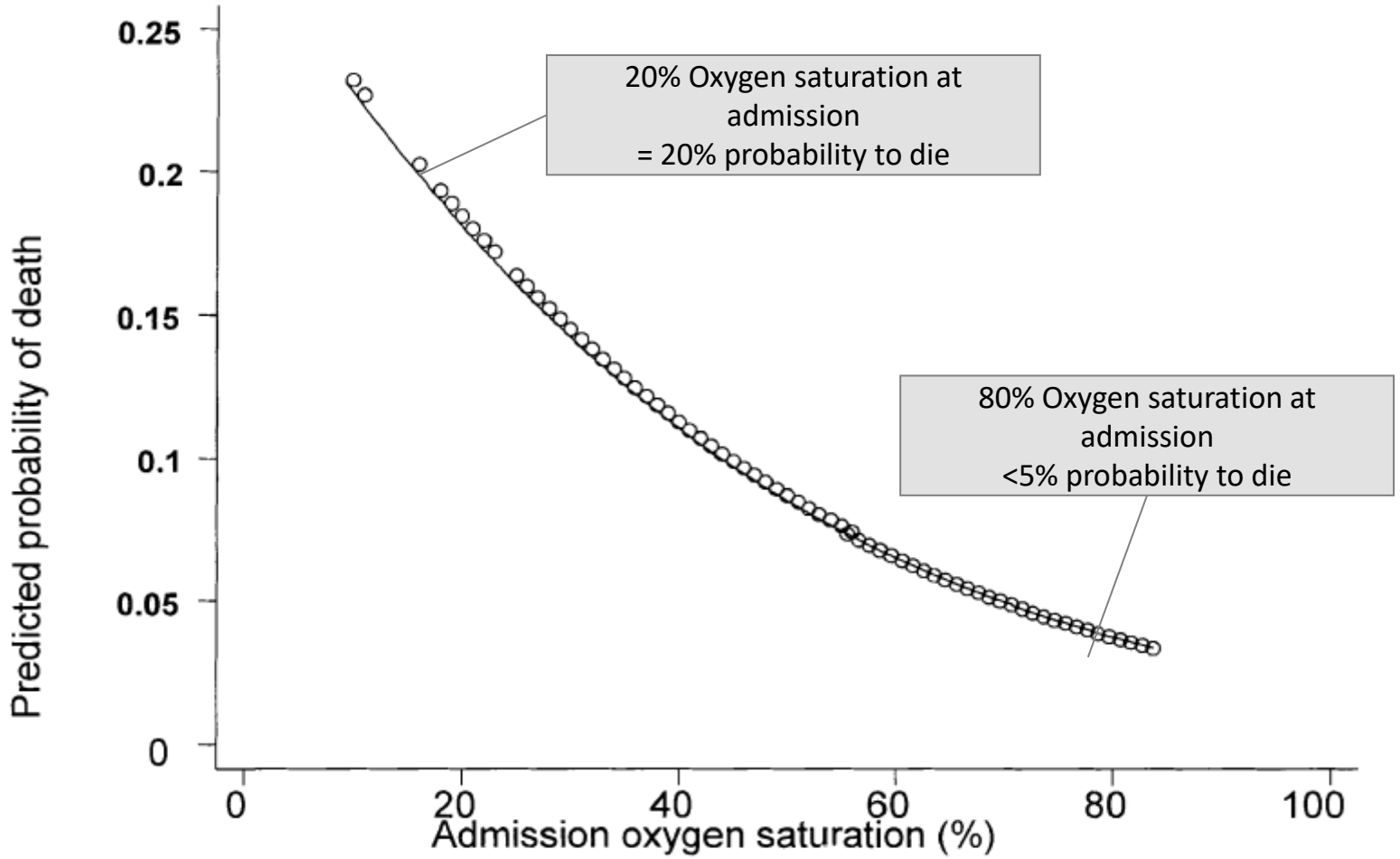
Clinical signs are often insufficient to detect hypoxemia, especially in neonates and very young children

Diagnosing Hypoxemia

	Clinical Signs	Blood Gas Analysis	Pulse Oximetry
Description	Clinical examination to identify both signs that may be indicative of low oxygen in blood	Direct measurement of the partial pressure of oxygen (PaO_2) and carbon dioxide in blood and also blood pH and concentrations of the main electrolytes.	Measures the percentage of oxygenated haemoglobin in arterial blood (SpO_2).
Pros/Cons	• Non-invasive + • Misses some cases of hypoxemia —	• Highly accurate • Invasive – • Expensive • Highly skills dependent	• Accurate + • Non-invasive + • Depends on equipment functionality & availability Depends on the szkills—

All health workers should be able to identify the clinical signs as indicative of severe illness in children. However, reliance on clinical signs alone commonly results in misdiagnosis of hypoxaemia in children with normal oxygen saturation or failure to detect hypoxaemia in others.

Hypoxemia increases the risk of death

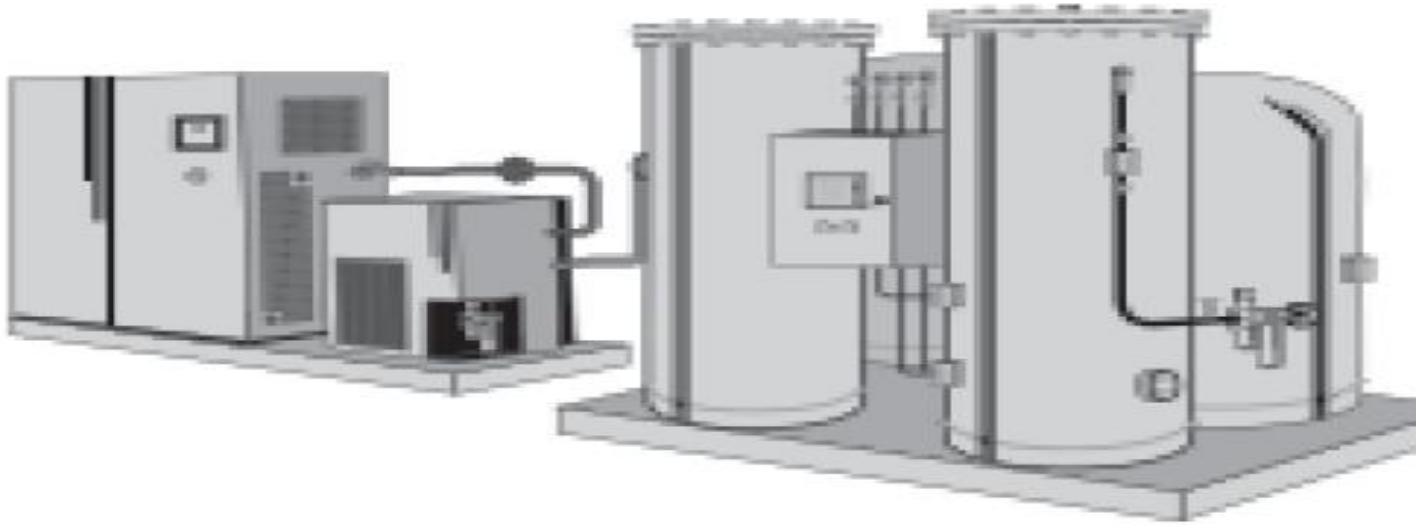


Hypoxemia can be treated by timely and adequate oxygen administration to the patient

Source: Int J Tuberc Lung Dis 2001; 5:5

Oxygen therapy

How is oxygen produced at regional referral hospitals

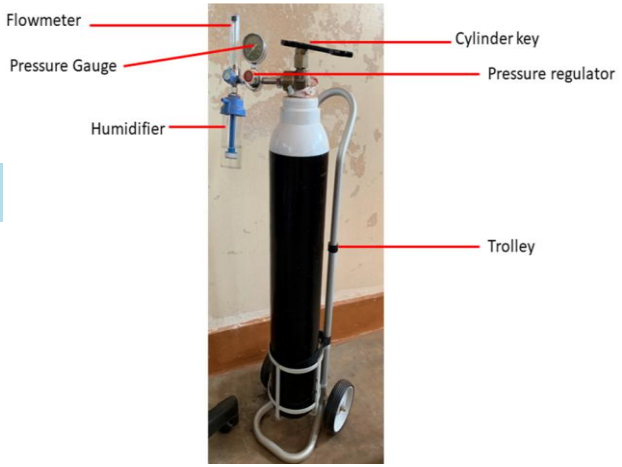


- Almost all RRHs have the same type of oxygen plant that uses pressure swing adsorption (PSA) technology
- The RRH plant serves as the oxygen source for the RRH and all lower-level health facilities within the region
- Oxygen from a PSA plant can either be:
  - piped directly to bedside terminal units within patient areas or,
  - be used to refill cylinders for oxygen distribution
- Requires a reliable source of power

Oxygen Supply: Equipment

Pulse oximeter

Oxygen cylinder

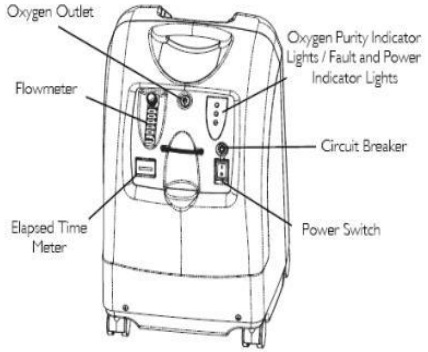


Oxygen delivery device

Basic:

Advanced:

Oxygen concentrator



Considerations for oxygen capacity at your health facility:

- Oxygen supply and demand
- Available cylinder size
- Back-up generator to power PSA plant and concentrators
- Refill schedule (buffer stock)

Slide courtesy of CHAI

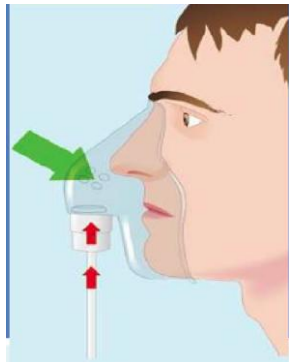
Titrate oxygen: use appropriate dose and delivery device

Nasal cannula

O_2 1–5 L/min

FiO_2
25-40%

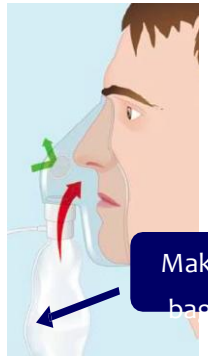
Face mask



O_2 6–10 L/min

FiO_2
40-60%

Face mask with reservoir bag



O_2 10–15 L/min

FiO_2
60-95%

High flow nasal cannula

↑ Aerosol Risk!

Up to O_2 60 L/min

FiO_2
up to 100%

Mechanical ventilation

↑ Aerosol Risk!

FiO_2
up to 100%

In children < 5 years, oxygen should be delivered by nasal cannula

Age of child	Maximal oxygen flow rates
Neonates	0.5–1.0 L/min by nasal cannula
Infants	1–2 L/min by nasal cannula
Pre-school aged	1–4 L/min by nasal cannula
School-aged	1–6 L/min by nasal cannula

- FiO_2 is determined by:
  - (i) flow rate; (ii) nasal diameter and (iii) body weight
  - In infants up to 10 kg:
    - 0.5 L/min = 35%
    - 1 L/min = 45%
    - 2 L/min = 55%
- Compliance with oxygen therapy may require assistance from nursing staff and family members

High flow nasal cannula (HFNC) oxygenation in COVID-19 pneumonia

- Nasally delivered
- Can deliver 100% oxygen FiO_2 but requires a high level of oxygen flow (up to 60 liters per minute)
- Requires active heat and humidification to keep airways from drying out
- Tolerated well and likely helps avoid mechanical ventilation for many COVID-19 patients

Selected patients must be awake, cooperative, haemodynamically stable, without urgent need for intubation

Slide details courtesy of STAR

What is the role of invasive mechanical ventilation (IMV) in the management of Severe Hypoxemia

- Delivered via a breathing (endotracheal) tube in sedated patients
- Can deliver 100% oxygen, and provides pressure in addition to oxygen
- Wide range of flow requirement (~15 liters per minute)
- May be best/only option for the sickest patients

Cummings MJ et al.. Lancet. 19 May 2020

QUESTIONS & ANSWERS

Updates

- Follow us on x(former twitter): https://x.com/seedug_learning
- Watch previous episodes via: https://youtube.com/@seedglobaltrainings?si=ArZhRGSjsxT-ujFO
- Find previous sessions' resources via: https://seedtraininghub.com
- Post-Session survey: https://s.zoom.us/m/bPFbmaIDD


THE REPUBLIC OF UGANDA
MINISTRY OF HEALTH
Seed GLOBAL HEALTH
Project ECHO
Celebrating
100
EMS ECHO SESSIONS
This, 12th September 2025, EMS ECHO marks 100 consecutive biweekly sessions—advancing emergency care in Uganda and beyond, thanks to our community's unwavering support.
ECSJ EMERGENCY CARE ASSOCIATION OF UGANDA