HATCH TECHNOLOGIES

Delivering Lifesaving Solutions for Newborns

VAYU Bubble CPAP

Device-Specific Use Training

PRESENTER

Dr. Audrey Chepkemoi

SUPPORTED BY

The Gates Foundation

HATCH TECHNOLOGIES

VAYU Bubble CPAP

Device-Specific Use Training

TOT Training Attendance Form

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Vayu CPAP Training Pre-test

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OVERVIEW

HATCH TECHNOLOGIES

What this training covers

01	**Introduction to CPAP**	Physiology, indications & complications
02	**VAYU bCPAP - Components & Assembly**	Setup, application & patient fitting
03	**VAYU bCPAP - Disassembly**	Safe teardown for reprocessing
04	**Monitoring the VAYU bCPAP System**	Device checks & patient monitoring
05	**Reprocessing & Disinfection**	Cleaning, disinfection & storage
06	**Pulse Oximeter**	Principles, use & infection control
07	**VAYU Oxygen Blender System**	Low-flow oxygen therapy device

SECTION 01

Introduction to CPAP

Physiology, indications, clinical use cases & complications

01

01

HATCH TECHNOLOGIES

Objectives

UNDERSTAND

- Define CPAP
- Understand the principle of bubble CPAP
- Overview of the clinical uses of VAYU CPAP

GAIN COMPETENCY FOR

1. Components of VAYU CPAP and interfaces
2. Setting up bubble – VAYU CPAP
3. Administering CPAP to newborn babies
4. Trouble shooting VAYU CPAP

ITEM 01 · INTRODUCTION

01

HATCH TECHNOLOGIES

Why CPAP?

CPAP is a non-invasive method of respiratory support that provides a constant distending pressure.

CPAP USE CONTRIBUTES TO

Reduced intubation rates

Reduced incidence of chronic lung disease

Improved survival

Even a single positive pressure breath can initiate biotrauma/baro/volutrauma. Intubation is a single major preventable factor contributing to BPD.

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CPAP: mimicking in utero breathing mechanics

- In utero the transpulmonary pressure of the fluid-filled developing lung is approximately 3–4 cm H_2O
- CPAP at 5 cm H_2O results in nasal pharyngeal distending pressure of approximately 2–3 cm H_2O
- CPAP provides some mechanical similarities to the lungs in the intrauterine environment
- It promotes lung growth/development and protection

Nasal Continuous Positive Airway Pressure (CPAP) for the Respiratory Care of the Newborn Infant. Robert M DiBlasi RRT-NPS, 2009.

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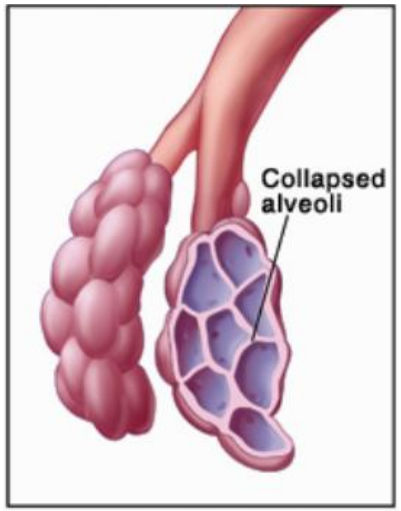
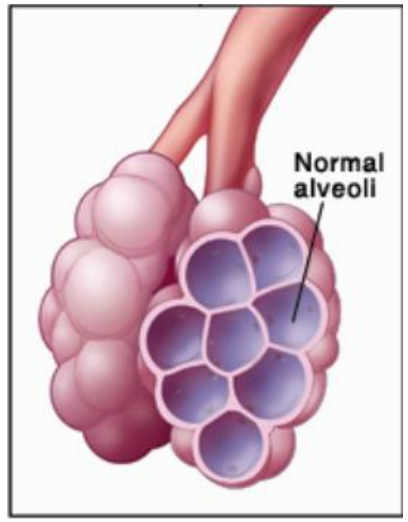
CPAP physiology

CPAP increases the FRC of the lungs and improves pulmonary artery oxygen.

1. By maintaining a constant positive pressure throughout the whole respiratory cycle
2. Prevents collapse of the alveoli at the end of expiration
3. Results in less energy needed to reopen alveoli and initiate a breath
4. **Decrease the total work of breathing**



Collapsed alveoli



Normal alveoli

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Benefits of nCPAP

Splints the upper airway

Reducing upper airway resistance

Establishes functional residual capacity (FRC)

Augments spontaneous breathing efforts

Stimulates lung growth & surfactant production

Preserves endogenous surfactant, decreases the need for surfactant administration

Decreases need for, and duration of, mechanical ventilation

01

HATCH TECHNOLOGIES

Indications & contraindications for nCPAP

INDICATIONS

Neonates with:

- Respiratory Distress Syndrome
- Apnea of prematurity with spontaneous respiratory effort
- Transient Tachypnea of the Newborn (TTN)
- Post-extubation respiratory support
- Meconium aspiration syndrome
- Persistent pulmonary hypertension of the newborn
- Pneumonia
- Weaning from mechanical ventilation

CONTRAINDICATIONS

nCPAP may not be appropriate for neonates with:

- Severe respiratory failure requiring mechanical ventilation
- Unstable cardiovascular status
- Severe apnea that requires frequent stimulation
- Some congenital abnormalities (e.g., diaphragmatic hernia, choanal atresia)
- No spontaneous respiration / gasping respiration

ITEM 01 · CLINICAL USE CASE

01

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VIDEO DEMO

Respiratory distress syndrome

SIGNS OF DISTRESS

- **Grunting**
- **See-saw breathing**
- **Subcostal retractions**

On the Vayu bCPAP System, the same baby breathes comfortably.

ITEM 01 · CLINICAL USE CASE

01

HATCH TECHNOLOGIES

Use case for the Vayu bCPAP System: Transport

Portable and functions without electricity — suitable for both intra-facility and inter-facility transport.

Ambulance transport — Philippines

Boat ambulance — Amazon, Brazil

WHY IT WORKS

The Vayu bCPAP System requires no electricity, making it suitable for both intra-facility transport (between units) and inter-facility transport (between hospitals and facilities).

ITEM 01 · CLINICAL USE CASE

01

HATCH TECHNOLOGIES

Use case: immediate Kangaroo Mother Care (iKMC)

Skin-to-skin KMC while on Vayu bCPAP therapy - Ethiopia

The Vayu bCPAP System is compatible with Kangaroo Mother Care (KMC), skin-to-skin contact between a neonate and their caregiver.

WHO strongly recommends initiating KMC as early as possible. It has been shown to improve:

- Temperature regulation, respiration & oxygen saturation
- Vital signs stability and weight gain
- While reducing infection rates and neonatal mortality

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Care of a neonate on CPAP

KEEP WARM

Keep warm and maintain neutral thermal environment

Reduce oxygen consumption

AIRWAY

Airway patency should be ensured

BREATHING

Specific management

Surfactant use and respiratory support (CPAP)

CIRCULATION

Feeds and nutrition

Initiation of early feeds & maintenance fluids

DRUGS & DATA

Close monitoring of vitals

Blood sugars, hypotension common in early RDS, antibiotics, caffeine citrate

Support parents and reduce parental stress as much as possible (Family centred care).

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HATCH TECHNOLOGIES

Timing of CPAP initiation

PROPHYLACTIC CPAP

< 32 weeks

- Initiated as soon as possible preferably in the delivery room
- Preterm with or without signs of respiratory distress
- Preterm with good cardiac activity and breathing spontaneously
- Intended to avoid mechanical ventilation

RESCUE CPAP

≥ 32 weeks

- Signs of respiratory distress with one or more of: tachypnoea (RR>60bpm), nasal flaring, grunting, sternal retraction, lower chest indrawing
- Initiated after failed trial of oxygen therapy for 15 minutes
- Neonate with increased work of breathing and SpO_2 < 90% on nasal prongs at 1 L/min

Nasal Continuous Positive Airway Pressure (CPAP) for the Respiratory Care of the Newborn Infant. Robert M DiBlasi RRT-NPS, 2009.

ITEM 01 · CLINICAL USE CASE

01

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Delivery room CPAP

Use case for the Vayu bCPAP System: L&D Ward and Maternal Theater

Increasingly used in the labor and delivery ward and maternal theater to provide early bCPAP treatment.

This is important because the neonate can then be transported to the newborn unit without interrupting treatment.

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HATCH TECHNOLOGIES

Settings

Use the national guidelines for your country. Generally:

INITIAL CPAP PRESSURE

5–6 cmH_2O

adjust based on clinical response

FIO_2

Lowest needed

target SpO_2 range: 90–95%

FLOW RATE

4–10 L/min

ensure bubbling in the pressure generator

BEFORE STARTING

- Perform baseline clinical assessment (HR, RR, oxygen requirement, chest retractions, nasal flaring, grunting)
- Ensure a good seal with the nasal interface to avoid leaks
- Use continuous pulse oximetry and monitor for signs of respiratory distress

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Increasing bCPAP treatment

BEFORE INCREASING — CHECK DOPES

- **D** **Disconnection -** Is the connection circuit complete and well secured?
- **O** **Obstruction -** Is there an obstruction – baby or tubing?
- **P** **Pneumothorax -** Is there a pneumothorax?
- **E** **Equipment failure -** Is the water bubbling?
- **S** **Secretion -** Does the baby need suctioning?

AFTER CHANGING TREATMENT

- Reassess the baby's immediate response and then every 15 min
- Increase PEEP by 1 cmH_2O to a max of 8 cmH_2O (before you get to 8 cmH_2O – consult a senior)
- Increase FiO_2 by 10–20%
- If the baby's condition has improved, reassess at 1 hour then 3-hourly
- If no improvement after initial increase – consult a senior early

Decision is based on need to increase the SpO_2 or reduce the work of breathing.

SCENARIO · BABY SEMA

01

HATCH TECHNOLOGIES

A term infant develops respiratory distress

BABY SEMA — 4 HRS OLD

A term infant born via C-section develops increased work of breathing: respiratory rate of 70 breaths/min and moderate retractions. Vayu CPAP is started at 5 cmH_2O, FiO_2 30%.

AFTER 30 MINUTES

The infant's work of breathing increases (RR 80/min, SpO_2 88% on 30% FiO_2).

How will you proceed with the management?

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HATCH TECHNOLOGIES

What to do

1	**Increase FiO_2 to 40%**	SpO_2 increased to 91%, but patient had increased WOB, RR 80/min
2	**Auscultate for bilateral air entry**	Incrementally increase pressure to 6 cmH_2O in 1 cmH_2O steps, monitoring for SpO_2, RR and work of breathing
3	**At 6 cmH_2O**	RR drops to 75/min, SpO_2 94% — still had increased WOB
4	**Check DOPES**	If okay, increase PEEP to 7 cmH_2O
5	**RR drops to 55/min, SpO_2 94%**	There was no work of breathing

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HATCH TECHNOLOGIES

Weaning CPAP

WEANING PROCESS

- Reducing the FiO2 before reducing the CPAP pressure. Weaning FiO2 by 10–20%
- Reduce CPAP pressure by 1–2 cmH_2O every 12–24 hours, down to 4–5 cmH_2O
- Once CPAP is at 4–5 cmH_2O and FiO2 ≤ 0.30, trial on nasal cannula

CRITERIA FOR WEANING

- Stable respiratory status for 24 hours
- Minimal oxygen requirement (FiO2 ≤ 0.3) and SpO2 90–95% for at least 6 hrs
- PEEP 4–5 cmH_2O for at least 6 hrs
- Decreasing signs of respiratory distress (normal RR, minimal retractions)

Monitoring post-weaning: Observe the baby closely after CPAP has been stopped. If work of breathing increases or oxygen saturations decrease, CPAP may need to be restarted.

ITEM 01 · INTRODUCTION

01

CPAP failure

SCENARIO CONTINUED — DAY 3 OF LIFE

Baby Sema's RR drops to 50/min, SpO_2 95%. No increased work of breathing for the last 6 hrs.

A diagnosis of CPAP failure is made on any baby who has been on CORRECTLY applied CPAP who continues to have:

- **Moderate to severe recessions and grunting**
- **SpO_2 < 90% at an FiO_2 of >60%**
- **Recurrent apneas even on a maximum CPAP pressure of 8 cmH_2O**

For CPAP failure, make sure you do DOPES, consider specialist review and referral for tertiary care.

CPAP leads to a 35% reduction in death and use of assisted ventilation, however, it can fail.

Continuous distending pressure (CDP) is associated with lower risk of treatment failure (typical RR 0.65, 95% CI 0.52 to 0.81; NNTB 5, 95% CI 4 to 10; six studies; 355 infants).

Ho JJ, Subramaniam P, Davis PG. Continuous distending pressure for respiratory distress in preterm infants. Cochrane Database Syst Rev 2015. • Wright CJ et al. Preventing CPAP Failure. Clin Perinatol. 2018;45(2):257-271.

Complications of nCPAP

Skin, nasal, lung, abdominal & oxygen therapy complications

01

HATCH TECHNOLOGIES

Skin & nasal complications

SKIN COMPLICATIONS

Constant pressure on nares, ears, head and forehead can lead to reduced skin integrity and injury causing pressure ulcers. First sign of skin breakdown is nasal erythema.

PREVENTION

- ✓ **Frequent observation**
- ✓ **Minimize points of contact**
- ✓ **Keep skin dry and clean**
- ✓ **Proper nasal prong and hat**

NASAL COMPLICATIONS

Frequency and severity of nasal trauma increases with lower gestational age. Most nasal trauma appears during the first days of nCPAP.

PREVENTION

- Maintain 2mm distance between columella and nasal prongs
- Ensure proper fitting and positioning of the whole interface

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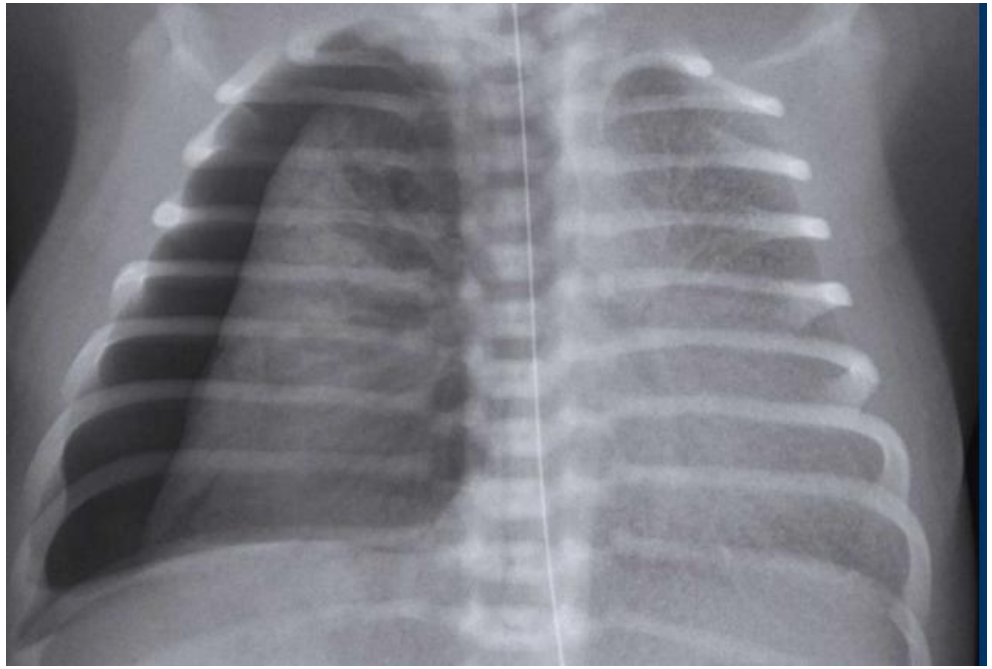
HATCH TECHNOLOGIES

Lung complications



PNEUMOTHORAX

CPAP increases risk of air leaks. Hyperinflation of lungs occurs due to high CPAP pressures.

Results in reduced cardiac output secondary to reduced venous return (signs of low cardiac output include low BP, reduced urine output, low saturations, temperature gradient, etc).

PREVENTION

Always check CPAP pressure. Do not exceed pressures of 8 cmH_2O.

01

HATCH TECHNOLOGIES

Abdominal complications

ABDOMINAL DISTENTION

- Excessive swallowed air
- Feeding intolerance and desaturation episodes

PREVENTION

- Insert an OGT
- Leave OGT open
- If OGT is used for feeding, close for 30 mins after feeding the baby then open OGT

01

HATCH TECHNOLOGIES

Oxygen therapy complications

HYPOXIA

SpO_2 85–89%

- Increases mortality
- Neurodevelopmental impairment
- NEC
- Free radicals that cannot be metabolized by immature antioxidant systems

HYPEROXIA

SpO_2 > 95%

- Chronic lung disease - BPD
- Eye Injury - ROP

PREVENTION

- Monitor SpO_2
- Aim for O_2 saturation of 90–95%
- Titrate the FiO_2 based on SpO_2

Walsh BK, Smallwood CD. Pediatric Oxygen Therapy: A Review and Update. Respir Care. 2017;62(6):645-661.

Questions?

End of Section 01 - Introduction to CPAP

SECTION 02

VAYU bCPAP System

Components, assembly & patient application

02

02

HATCH TECHNOLOGIES

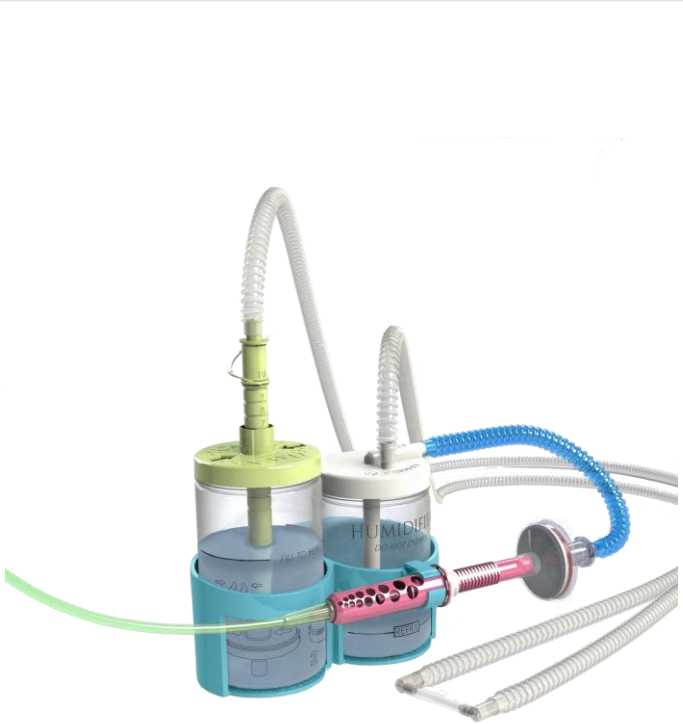
The Vayu bCPAP System provides:

Flow
To meet all the patient’s inspiratory needs

Blended Oxygen
To keep the patient’s oxygen saturations within optimal range

Pressure
To keep the patient’s airways and alveoli from collapsing

Humidification
To prevent drying out of the nasal pathways



02

Oxygen source

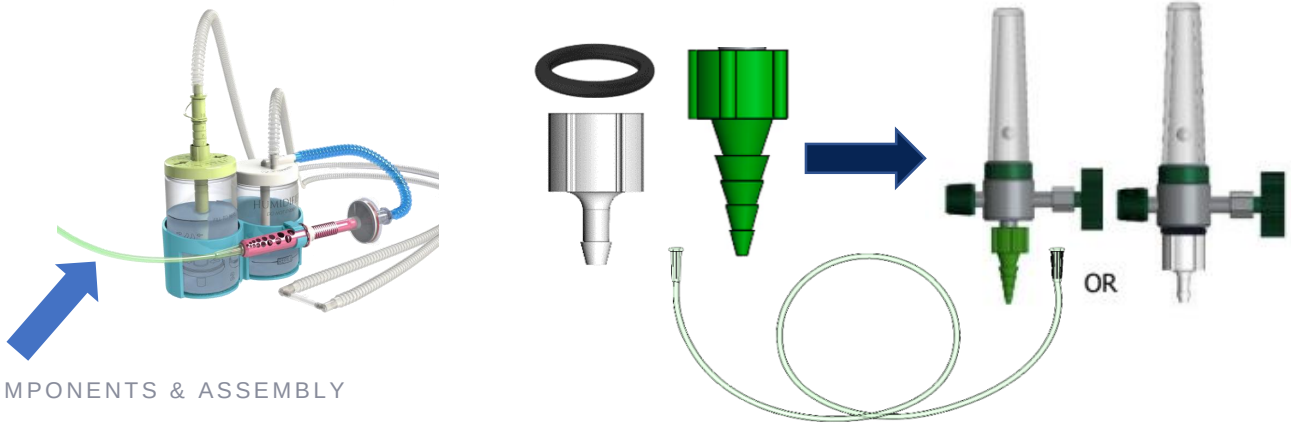
The Vayu bCPAP System only requires an oxygen source to function — no electricity or medical compressed air needed.

Wall Source

Oxygen Cylinder

Oxygen Concentrator

Oxygen Source Adaptors & Oxygen Tube



ADAPTORS & TUBE

Two oxygen source adapters: the green DISS and the white BSPP (includes an O-ring to prevent leaks).

Any external humidifier should be removed, the system has its own humidifier jar. The green oxygen tube connects the adapter to the Vayu blender.

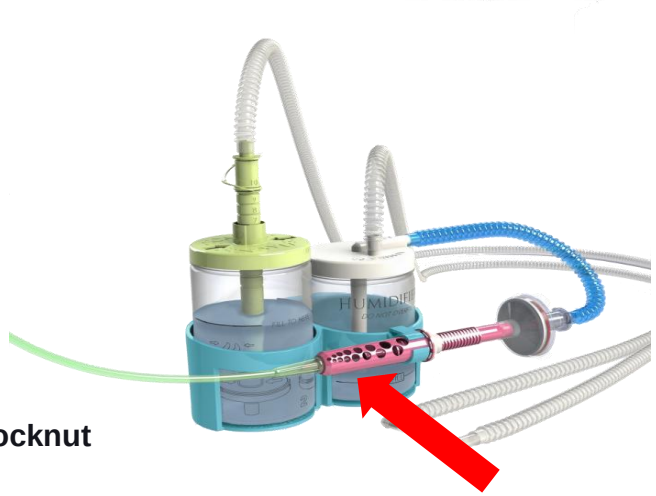
ITEM 02 · COMPONENTS

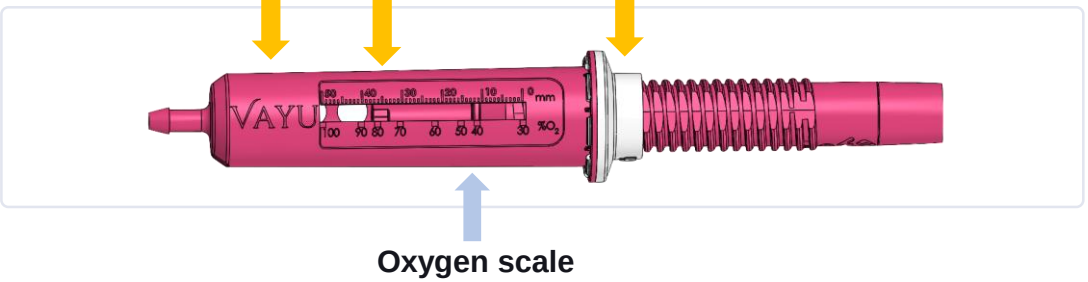
Vayu Blender

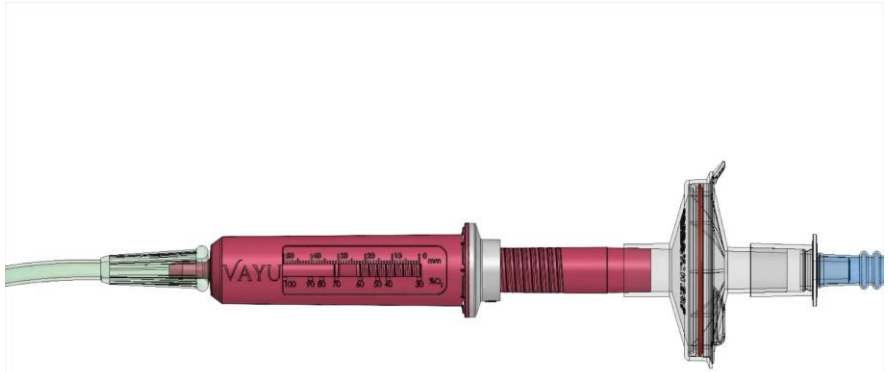
02

HATCH TECHNOLOGIES

VIDEO DEMO







The Vayu bCPAP System works without electricity or compressed air because of the Venturi blender, the device's most innovative part. It blends oxygen and ambient air to concentrations between 30–100%.

The Venturi effect: Pure oxygen enters through a narrow nozzle, creating a high-velocity jet that generates low pressure, drawing in ambient air (21% O_2). The larger the gap inside the blender, the more ambient air is pulled in — resulting in a lower oxygen concentration.

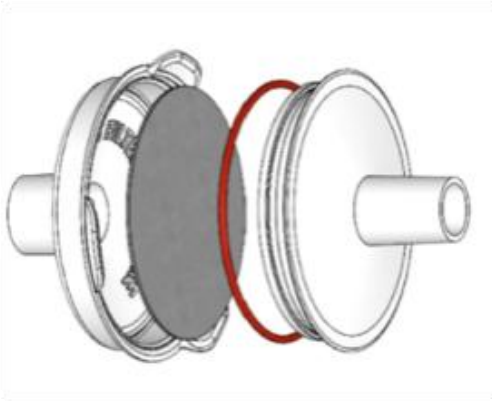
ITEM 02 · COMPONENTS

02

HATCH TECHNOLOGIES

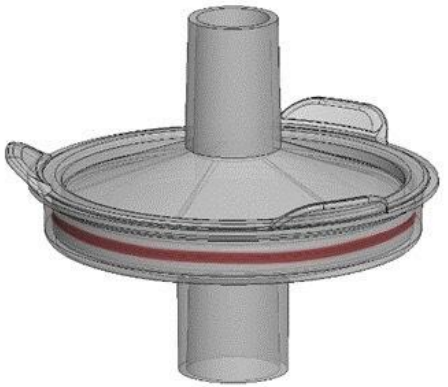
Filter & rotator

BACTERIAL VIRAL FILTER



Composed of 4 parts: two halves of the filter housing, an O-ring, and a filter disk. The disk is an electrostatic filter — it depends on electric charge, not pore size, so it cannot be replaced with cotton or gauze.

ROTATOR

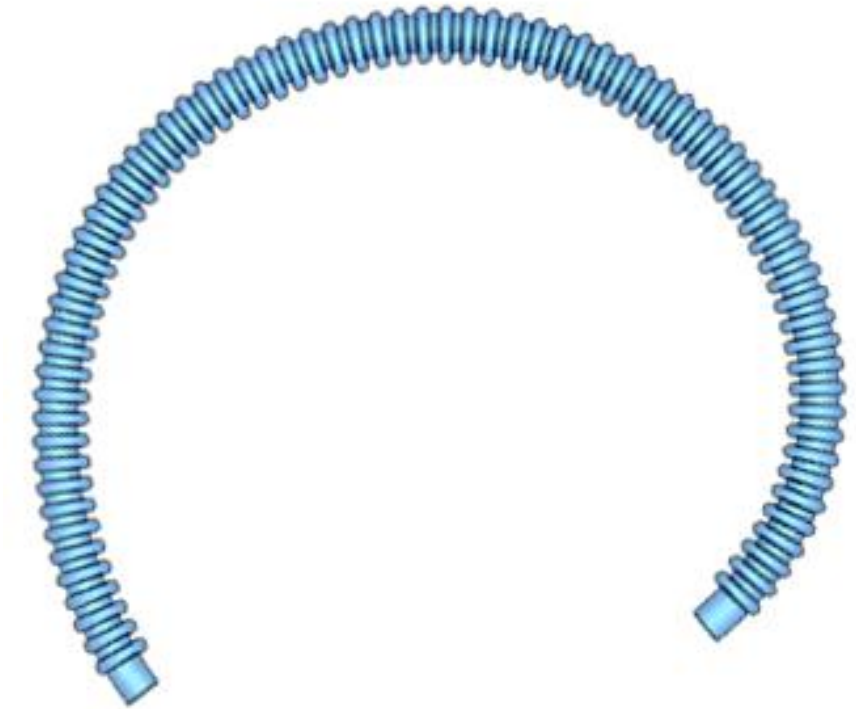


Filters out particulates, bacteria, or viruses that the patient should not breathe, before the gas continues through the humidifier tube.

02

HATCH TECHNOLOGIES

Humidifier tube & humidifier



CRITICAL

Fill with distilled/sterile water to the “fill to here” mark.

Connect the humidifier tube to the horizontal “INLET” port, and the breathing tube to the vertical “TO PATIENT” port.

Do not switch these connections, water could enter the breathing tube and reach the patient’s lungs.

After the rotator, a blue humidifier tube carries the gases to the humidifier jar.

KNOWLEDGE CHECK

02

HATCH TECHNOLOGIES

Quick check

1. How should the Vayu blender be placed, and why?

A. On the bed so that it is close to the patient

B. Next to the oxygen source so that it is able to provide oxygen optimally

C. Held by the blender clip so that the holes are not occluded, and oxygen can blend with the surrounding air

2. What type of water should be placed in the humidifier?

A. Clean water

B. Saline

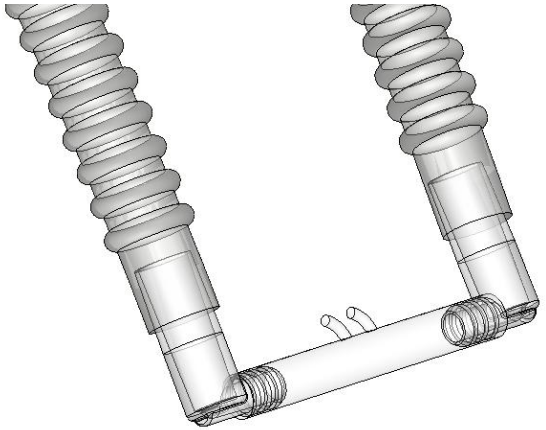
C. Sterile water

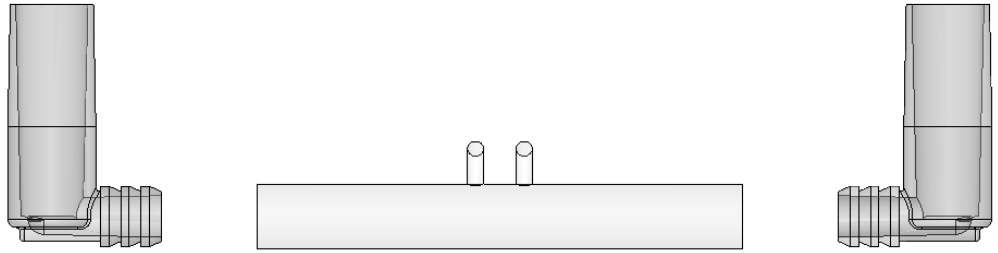
D. Any water

ITEM 02 · COMPONENTS

02

Breathing tubes & prongs





Gases flow from the humidifier through the inspiratory breathing tube, into the prongs, and out through the expiratory breathing tube. The inspiratory and expiratory tubes are identical, so they can be used interchangeably.

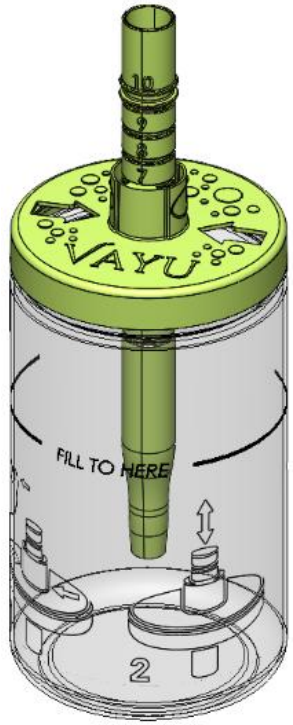
The package includes six nasal prong sizes. Ensure the prongs fully fill the nares without stretching or whitening the skin, each prong is marked with its size on the bottom surface.

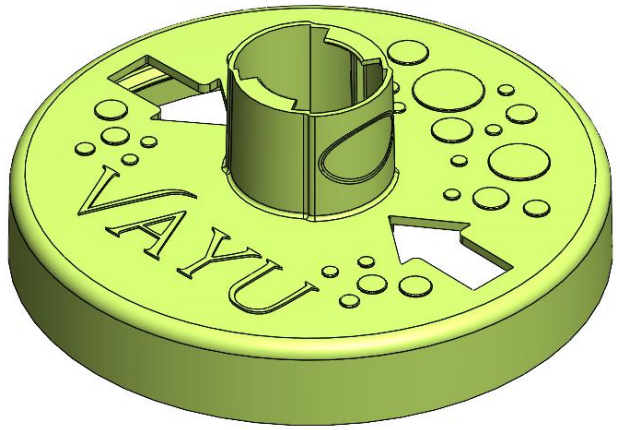
02

HATCH TECHNOLOGIES

Pressure generator

The gases exit the system through the green pressure generator, responsible for delivering the continuous pressure that keeps the patient's lungs open.





4–10 cmH_2O

The wand is marked with lines from 4 to 10 — the Vayu bCPAP System can generate pressures across this range depending on how deep the wand is submerged in water.

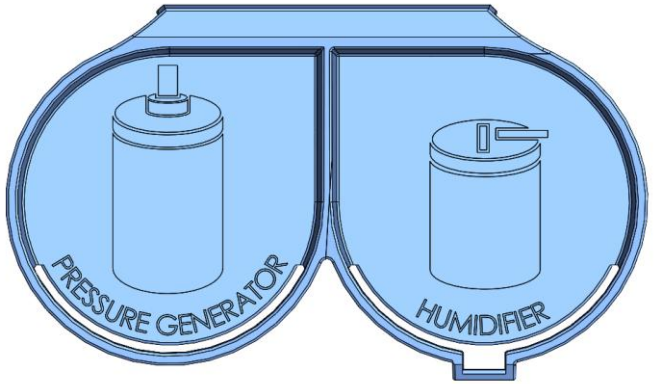
As gases try to escape through the wand, they're blocked by a column of water. Enough pressure must build to push the water down and release bubbles — like blowing bubbles into a drink with a straw. Use distilled/sterile water.

02

HATCH TECHNOLOGIES

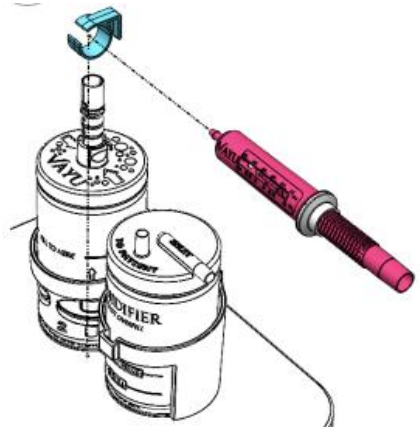
Bracket & blender clip

BRACKET



The jars are held together in a bracket. The base is labeled “HUMIDIFIER” on one side and “PRESSURE GENERATOR” on the other, with an opening for the blender clip.

BLENDER CLIP



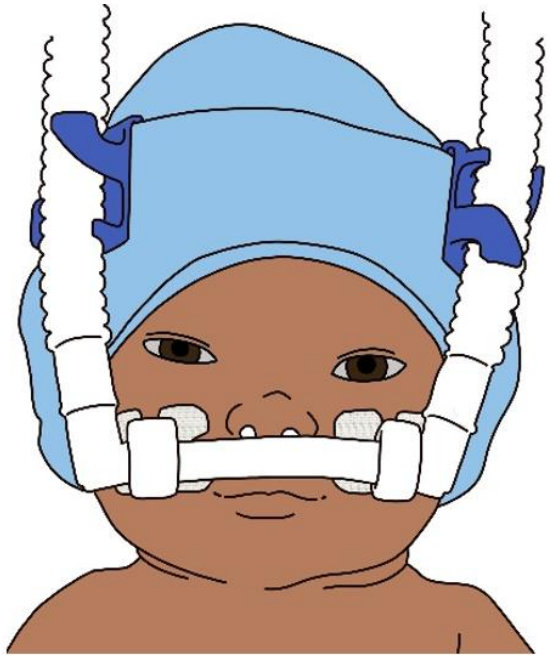
The blender slides into the blender clip, which then slides into the bracket, keeping the blender firmly in place, preventing the holes from being blocked, and stabilizing the entire system.

02

HATCH TECHNOLOGIES

Patient interface accessories

Accessories included with the device that help secure the patient interface.



Hats

Three sizes — small, medium, large — with weight suggestions on the package. Should fit the baby’s head firmly but not too tight.

Hat Clips

Slide down onto the hat brim and are used to secure the breathing tubes.

Mustache / Cheek Daisies

Skin-safe tape on one side, Velcro attachment on the other. The tape secures onto the philtrum or cheeks; the Velcro attaches to the soft loop fasteners.

Soft Loop Fasteners

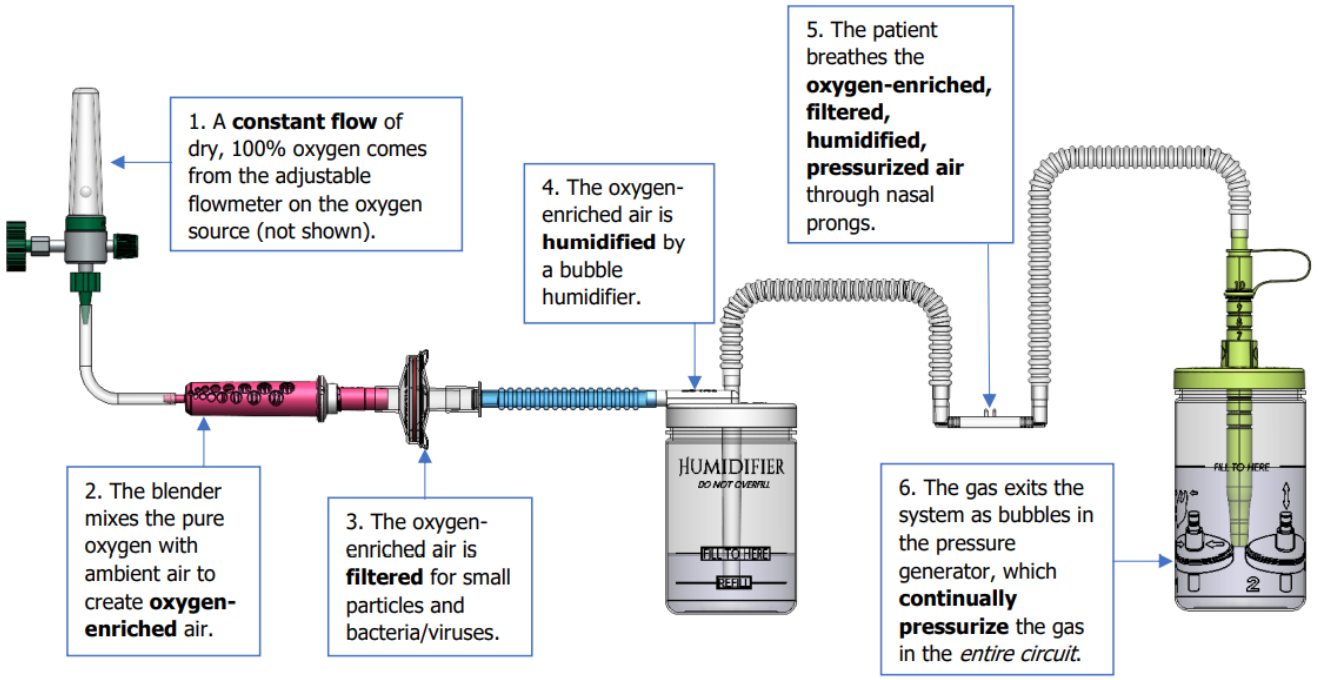
Wrapped around the prongs to secure the prongs to the mustache or cheek daisies.

02

HATCH TECHNOLOGIES

Assembly of the Vayu bCPAP System

*Vayu bubble CPAP provides patients a **constant flow** of air that is **oxygen-enriched, filtered, humidified, and pressurized.***



Vayu Bubble CPAP System Instructions for Use: VAYU GLOBAL HEALTH INNOVATIONS, 22 Welgate Road, Medford, MA 02155

WHY HUMIDIFICATION MATTERS

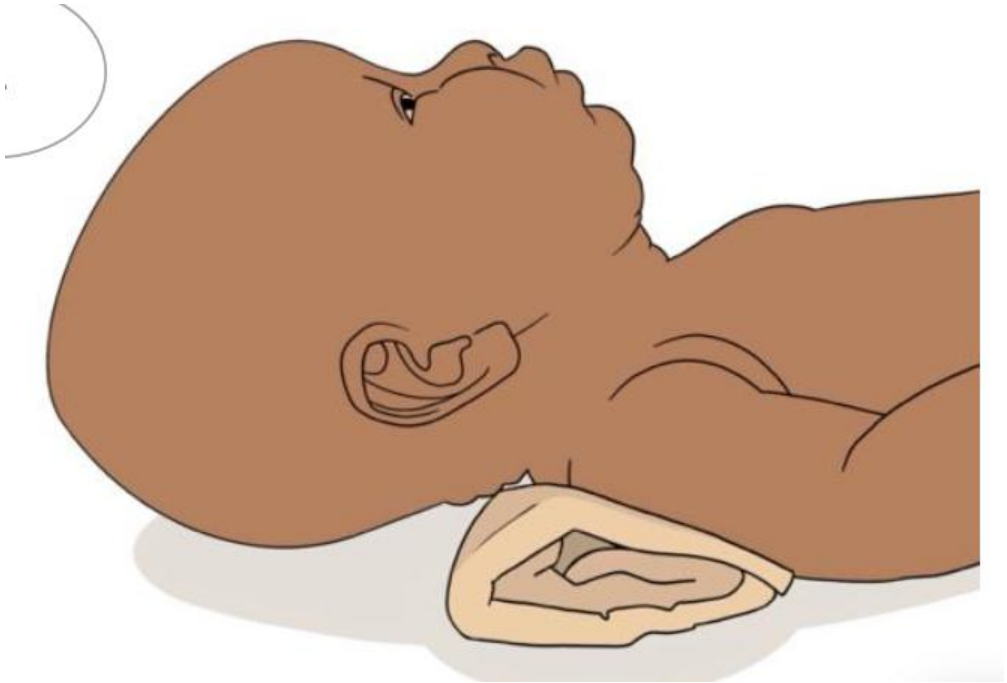
Humidification is critical for reducing thick, viscous airway secretions and avoiding mucous plugging that narrows or blocks airways.

The water column in the pressure generator bottle acts as a resistor to generate CPAP.

02

HATCH TECHNOLOGIES

Preparing the baby



BEFORE PLACING THE NASAL PRONGS

- Elevate the head of the bed or place a rolled cotton towel under the neck/shoulder
- Ensure the airway is clear — suction if there are secretions; insert OGT
- Lubricate the nostrils (1 drop of normal saline per nostril, using a 2cc syringe)
- Turn on the O_2

02

HATCH TECHNOLOGIES

Application of the Vayu CPAP to the baby

1. Place the selected hat onto the patient's head, ensuring it goes all the way to the back
2. Peel the back of the selected mustache and apply it on the philtrum
3. Peel the back of 2 soft loop fasteners and attach to both ends of the nasal prongs, forming a loop
4. Set the oxygen flow at 4 L/min before gently placing the prongs into the patient's nares

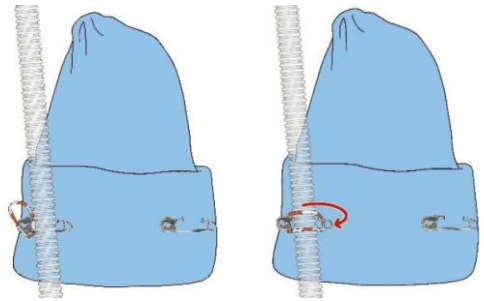
DO NOT insert prongs without turning on the oxygen flow.

02

HATCH TECHNOLOGIES

Secure tubing to the hat

Hat Size	Patient Weight Range
Small	<1,500g
Medium	1,500g- 3,000g
Large	> 3,000g



1. Select hat by weight. 2. Fasten a safety pin on each side through all fabric layers. 3. Place hat, hold tubing over the pin. 4. Stretch a rubber band over the tubing and hook onto both ends of the safety pin.

A WELL-FITTING HAT WILL:

Assist with achieving an effective seal by reducing movement of the prongs/interface, improving CPAP delivery.

Prevent nasal injury and skin injury.

02

HATCH TECHNOLOGIES

VIDEO DEMO

Video on the Components & assembly of Vayu CPAP

02

HATCH TECHNOLOGIES

VIDEO DEMO

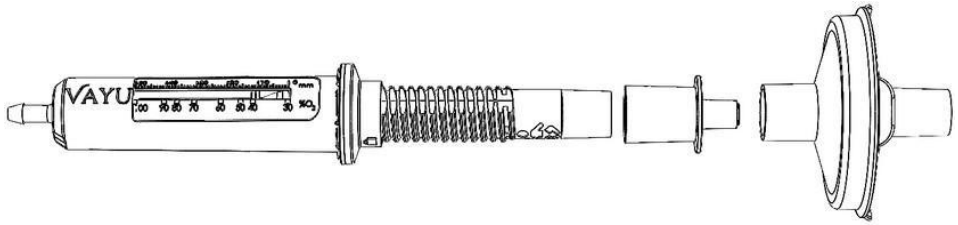
Continuous bubbling

KNOWLEDGE CHECK

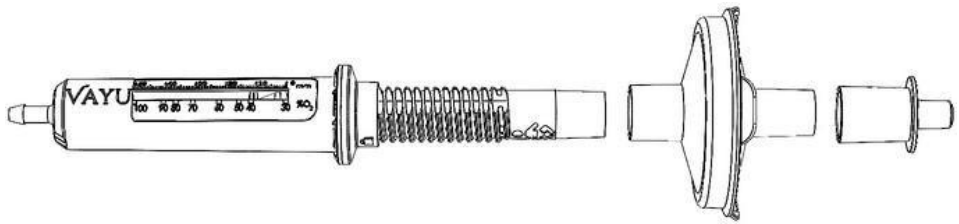
HATCH TECHNOLOGIES

Which photo represents the correct set up?

A



B



Answer: B. The rotator should come after the filter, not before.

KNOWLEDGE CHECK

Does this photo represent the correct setup of the Vayu bCPAP System?

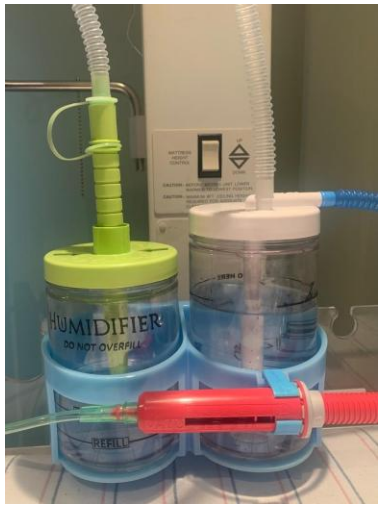
Answer: Yes. Oxygen tube to blender nozzle; blender fixed by the clip with holes unblocked; filter, rotator, then humidifier tube to the humidifier “INLET” port; breathing tubes to the “TO PATIENT” port and pressure generator connector.

KNOWLEDGE CHECK

02

Which of these photos represents the correct set up?

A



B

Answer: B. Ensure lids are on their respective jars and jars are correctly placed in the warmer bracket.

KNOWLEDGE CHECK

Quick check

3. How do you select the right nasal prong size?

- A. Check weight ranges on the packaging
- **B. Check weight ranges on the packaging and check fit in the nares**
- C. Check weight ranges on the packaging and check height of the patient

4. When should the oxygen source be turned on?

- A. After completing device assembly and the nasal prongs are placed in the nares
- **B. After completing device assembly but before placing the nasal prongs in the nares**

5. Which sign indicates a successful leak test?

- **A. Continuous bubbling in the pressure generator**
- B. Continuous bubbling in the humidifier
- C. Intermittent bubbling in the pressure generator
- D. Chest rise of the patient

SECTION 03

03

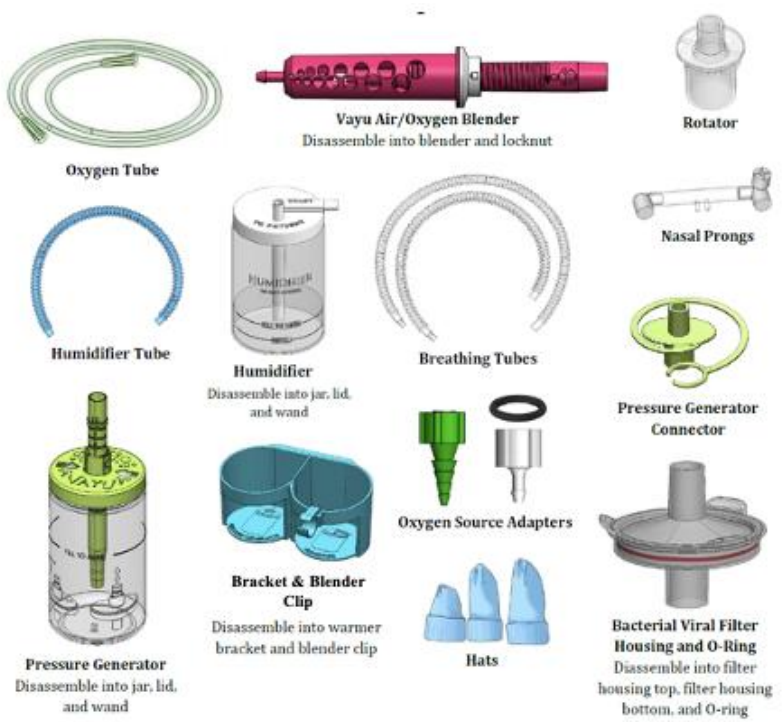
Disassembly of the Vayu bCPAP System

Safe teardown for reprocessing between patients

03

Have all the components

A visual reminder of the individual Vayu bCPAP System components that need to be disassembled.



03

Disposable components

Should be discarded after each patient — they cannot be reprocessed or reused between patients.

- **Filter Disk**
- **Soft Loop Fasteners**
- **Moustache**
- **Rubber Bands**
- **Safety Pins**

03

HATCH TECHNOLOGIES

VIDEO DEMO

Oxygen tubing

✕ DO NOT

✓ DO

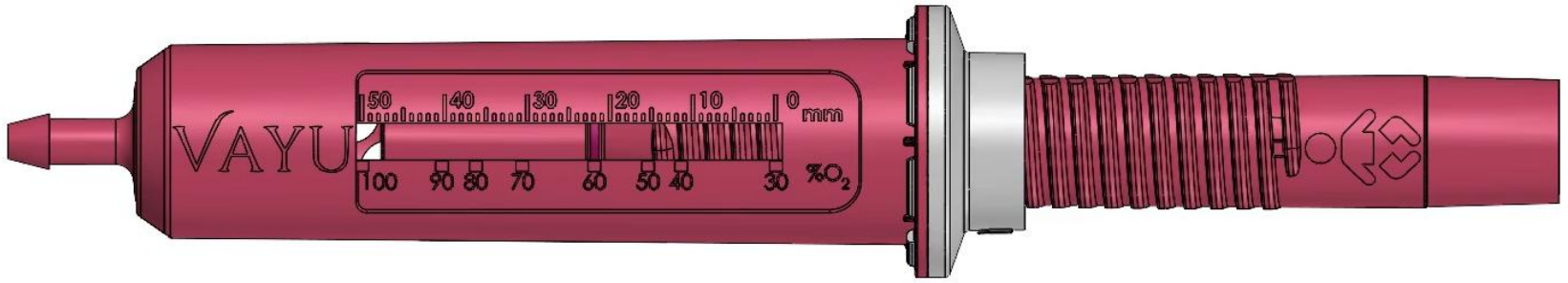
Apply horizontal force to remove the tubing. Wrap your hand around the tubing for a better grip and pull outward with a slight wiggle — be careful not to break the blender nozzle.

03

HATCH TECHNOLOGIES

VIDEO DEMO

Vayu Air / Oxygen Blender



Disassemble the blender into its subcomponents: blender and locknut. Completely unscrew the locknut to remove it, then adjust the blender to 40% oxygen so disinfectant can reach both ends. Do not put the locknut back on at this stage.

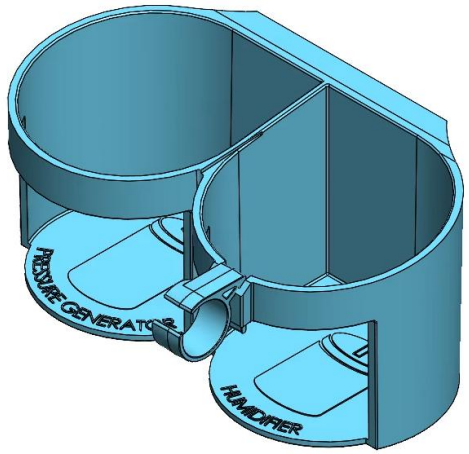
ITEM 03 · DISASSEMBLY

03

HATCH TECHNOLOGIES

VIDEO DEMO

Bracket & Blender Clip



Disassemble the bracket into its subcomponents: bracket and blender clip. Remove the blender clip from the bracket, sliding it upward.

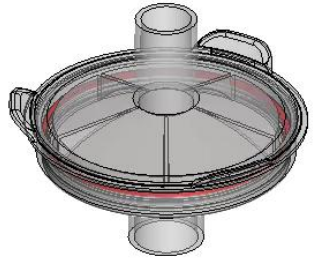
ITEM 03 · DISASSEMBLY

03

HATCH TECHNOLOGIES

Bacterial viral filter housing & O-ring

VIDEO DEMO



Disassemble into: filter housing, O-ring, filter disk.

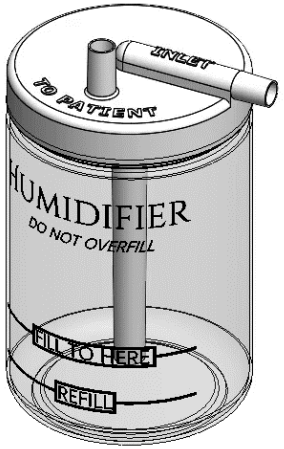
Separate the two halves of the filter housing by gently pulling on each tab. Hold at the tube openings to separate completely. Dispose of the filter disk and remove the O-ring.

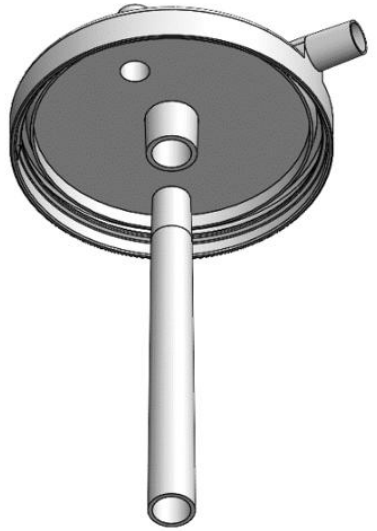
03

HATCH TECHNOLOGIES

Humidifier

VIDEO DEMO





Disassemble into: jar, lid, wand. Unscrew the humidifier lid from the jar and empty it, then detach the wand from the lid.

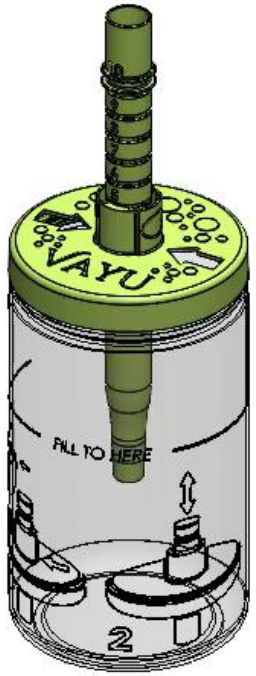
ITEM 03 · DISASSEMBLY

03

HATCH TECHNOLOGIES

Pressure generator

VIDEO DEMO



Disassemble into: jar, lid, wand.

Remove the pressure generator connector. Separate the wand completely from the lid by pinching the collar on the lid and pulling the wand up and out. Then unscrew the lid from the jar and empty it.

Practice Session

End of Section 03 - Disassembly of the Vayu bCPAP System

04

SECTION 04

Monitoring the VAYU bCPAP System

Device checks and patient monitoring after application

04

HATCH TECHNOLOGIES

Monitoring

Every 15 min, then hourly, then 3-hourly monitoring of vital signs — RR, HR, SpO_2, temperature.

PATIENT MONITORING

- Work of breathing
- Nasal blockage (instill normal saline)
- Abdominal distension
- Chest auscultation — assess air entry
- Position of the prongs
- Nasal septum intact

DEVICE MONITORING

- Tubing not kinked
- Hat snuggly fit
- Correct water level
- Ensure oxygen flow
- Ensure there is bubbling
- Humidifier is filled
- Correct blender setting

04

HATCH TECHNOLOGIES

Documentation of the monitoring

Use country-specific charts — example below.

Patient Name:	**Date of Birth:** dd / mm / yyyy **Birth Weight:** ____ g
Day of life:	**Today's Date:** dd / mm / yyyy **Current Weight:** ____ g
Diagnosis:	
Indications for CPAP:	

Patients on CPAP must be monitored VERY closely!!
- Assess patient ***1 hour*** after starting CPAP or making any setting changes
- Assess patient ***every 6 hours*** if stable on CPAP settings

CPAP ASSESSMENTS

Goals: RR < 60, SpO2 > 90%, Improved Respiratory Distress

Date & Time	Current CPAP Settings					RR	HR	SpO2	Temp	Signs of Respiratory Distress			Abd Dist	OGT	Suction/ saline drops	Changes Made	Signature
	Water Level	Total Flow	O2 Flow	Bubbling	Prongs in place / Check hat					Grunting	Nasal Flaring	Recessions (mild, mod, severe)					

04

HATCH TECHNOLOGIES

Vayu bCPAP System - Monitoring

DEVICE MONITORING

1

Refill humidifier

Every 6–8 hours

2

Refill pressure generator

3

Replace water in jars

Every 24 hours

4

Replace filter disk

Every 24h or if discolored

PATIENT MONITORING

5

Continuous bubbling

6

Oxygen saturation & WOB

7

Weaning assessment

8

Preventing nasal injuries

The numbering does not reflect a chronological order or level of importance, each step is reviewed individually in the following slides.

04

HATCH TECHNOLOGIES

Refill humidifier

Refill before water drops below the “REFILL” line, typically every 6 to 8 hours.

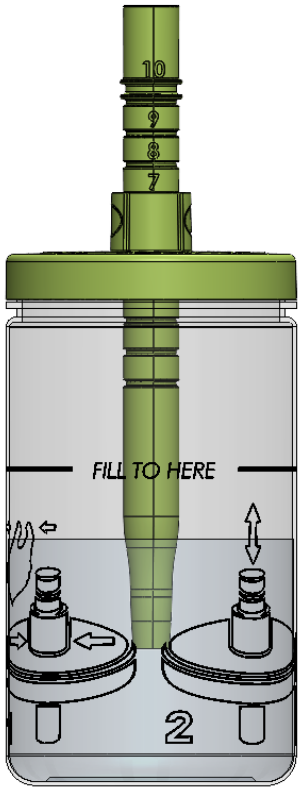
Use sterile water.

Do not overfill above the “FILL TO HERE” line, this will interfere with the resistance of the system.

Opening the humidifier lid creates a leak in the system, remove the nasal prongs from the nares before doing so, to avoid suffocating the patient.

04

Refill pressure generator



Refill when water drops below the “FILL TO HERE” line.

Use clean water.

The pressure the patient receives is determined by the depth of the wand submerged in water the wand is calibrated to this line. Underfilling delivers less pressure than indicated; overfilling delivers more.

Tip: use the holes at the top of the pressure generator to refill with a syringe. If opening the lid, remove the nasal prongs first.

04

HATCH TECHNOLOGIES

Replace water in jars

Completely replace the water in both jars after 24 hours to prevent bacterial growth.

Humidifier Jar

Fill with sterile water. Do not add vinegar, it can cause irritation.

Pressure Generator Jar

Fill with clean water. You may add 2 tablespoons (30mL) of vinegar, optional, not mandatory.

Remove the nasal prongs from the nares before opening the lids, to avoid suffocating the patient.

04

HATCH TECHNOLOGIES

Replace filter disks

VIDEO DEMO

Replace the filter disk:

- **Every 24 hours (or sooner if it becomes discolored)**
- **AND after each patient**

Remove the nasal prongs from the patient’s nares first (to avoid suffocation), swap the filter, then place the prongs back. Check the pressure generator for continuous bubbling before proceeding.

04

HATCH TECHNOLOGIES

VIDEO DEMO

Continuous bubbling

Always check for continuous bubbling! If not seen, the patient may not be receiving enough flow.

Continuous Bubbling

Normal — no leaks, sufficient flow.

Intermittent Bubbling

Small leak, or flow not high enough. Check for leaks first, then increase flow.

Vigorous Bubbling

Looks like boiling water — flow is too high. Turn it down at the source.

04

HATCH TECHNOLOGIES

Work of breathing

Adjust the pressure depending on the work of breathing.

Monitor continuously throughout bCPAP therapy, more closely right after initiation, until target saturation and reduced work of breathing are achieved.

Distress increasing? Increase pressure by submerging the wand further into the water.

Improving? Decrease the pressure and continue to monitor closely.

After adjusting the pressure, make sure there is continuous bubbling, adjust flow if not.

04

HATCH TECHNOLOGIES

Oxygen saturation

Note: the FiO_2 is determined by the scale on the blender and is not dependent on flow.

- Always ensure saturation is within normal range. If hypoxic or hyperoxic, increase or decrease the blender setting respectively.
- After changing the blender setting, ensure there is continuous bubbling and adjust flow if not.
- Even at 10 LPM flow, if the blender is set to 30% oxygen, it will still deliver 30% oxygen — flow does not change FiO_2.

CPAP failure is commonly defined as requiring >60% oxygen and >7 cmH_2O pressure — consider escalating care.

IMPORTANT

Always check the pressure gauge

If nearing empty, the Vayu bCPAP System will not function properly!

Check the pressure gauge on the oxygen cylinder before initially connecting the system, and frequently during use.

A stable, reliable oxygen source is fundamental for the proper functioning of the device, replace the cylinder when low.

04

HATCH TECHNOLOGIES

Assess & adjust

A visual summary of the three parameters to keep an eye on.

ASSESS

Bubbling

↓ adjust

Flow

Any problem with bubbling should prompt a check for leaks and a flow adjustment.

ASSESS

Work of Breathing

↓ adjust

Pressure

The patient's work of breathing should primarily draw attention to the pressure in the pressure generator.

ASSESS

Saturation

↓ adjust

FiO_2

Oxygen saturation is mostly affected by the FiO_2, but can also be affected by pressure.

Always readjust flow for continuous bubbling! Always refer back to the respiratory distress scores.

04

HATCH TECHNOLOGIES

Weaning assessment

Always check for readiness-to-wean criteria. Always follow your local guidelines.

Timely Weaning

Reduced hospital-acquired infections and hospital waste.

Optimal Outcomes

Maintain the patient on bCPAP as long as necessary for optimal outcomes.

04

HATCH TECHNOLOGIES

Nasal injury prevention

Perform inspections every 3 to 4 hours:

- **Ensure the skin around the nose is dry**
- **Apply ointment around the nares**
- **Massage the nose gently**
- **Suction (only when necessary)**
- **Ensure 2–3mm between bridge and septum**

ITEM 04 · MONITORING

04

HATCH TECHNOLOGIES

Vayu bCPAP System - Monitoring

DEVICE MONITORING

1

Refill humidifier

Every 6–8 hours

2

Refill pressure generator

3

Replace water in jars

Every 24 hours

4

Replace filter disk

Every 24h or if discolored

PATIENT MONITORING

5

Continuous bubbling

6

Oxygen saturation & WOB

7

Weaning assessment

8

Preventing nasal injuries

The numbering does not reflect a chronological order or level of importance, each step is reviewed individually in the following slides.

KNOWLEDGE CHECK

Quick check

1. What does continuous bubbling in the pressure generator mainly indicate?

- **A** The patient is getting high enough flow of breathing gases
- **B** The Vayu bCPAP System is set to the correct pressure
- **C** The oxygen is being blended
- **D** There is a leak in the system

2. How often should the filter disk be replaced?

- **A** Every 24 hours
- **B** If it gets discolored
- **C** After every patient
- **D** All of the above

KNOWLEDGE CHECK

04

Quick check

3. When should the humidifier be refilled?

- **A** Before the water level drops to the refill line
- **B** When the jar is empty
- **C** Every 12 hours
- **D** Every 24 hours

4. When should the pressure generator be refilled?

- **A** When the jar is empty
- **B** When the jar is half empty
- **C** When the water drops below the fill line

KNOWLEDGE CHECK

Quick check

5. How often should the water in the humidifier and pressure generator be replaced?

A Every 8 hours

B Every 12 hours

C Every 24 hours

D Every 48 hours

05

SECTION 05

Reprocessing & Disinfection

Cleaning, disinfecting and storing the VAYU devices between patients

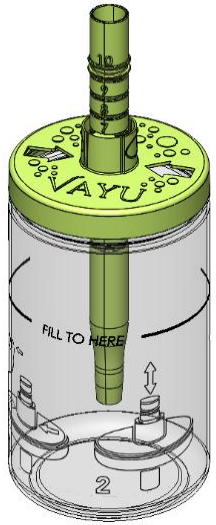
05

HATCH TECHNOLOGIES

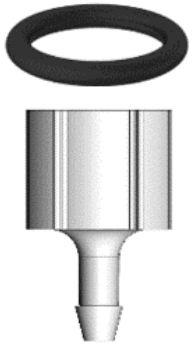
Reusable components - Vayu bCPAP System

Components that can be reused for the entire life span of the device.

Humidifier



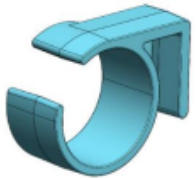
Pressure Generator



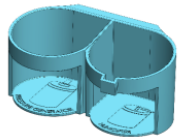
Rotator

Blender

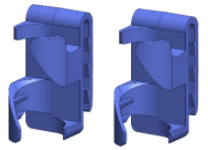
Filter Housing



Blender Clip



Bracket



Hat Clips

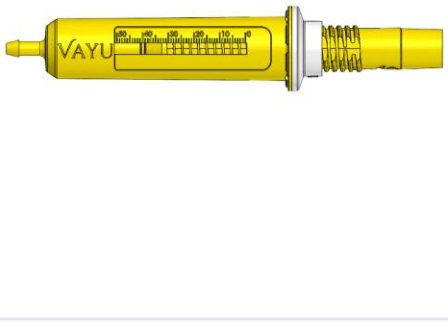
Also includes: Pressure Generator Connector.

05

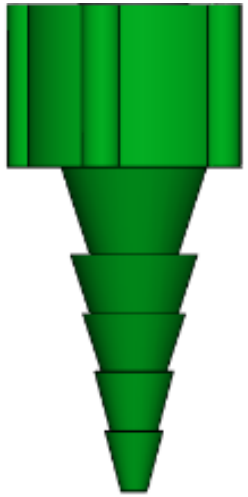
HATCH TECHNOLOGIES

Reusable components - Vayu Oxygen Blender System

All parts of the Oxygen Blender System are reusable for the entire life span of the device.



Oxygen Blender



Nozzle

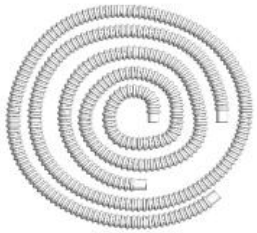
Connector

O-Ring

05

Prongs and tubes - limited reusability

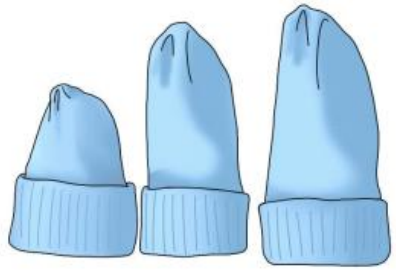
Can be reprocessed for a limited number of cycles - check for any stiffness or cracks before patient use.


Breathing Tubes

Oxygen Tube

Humidifier Tube

Nasal Prongs

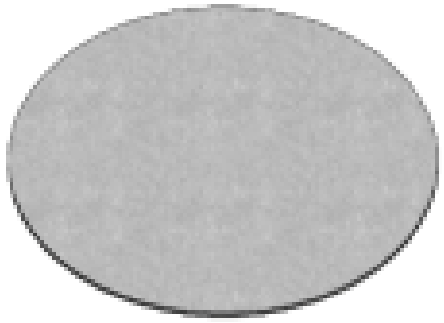


Hats can be laundered like other hospital linen and reused a limited number of times until they start wearing down.

05

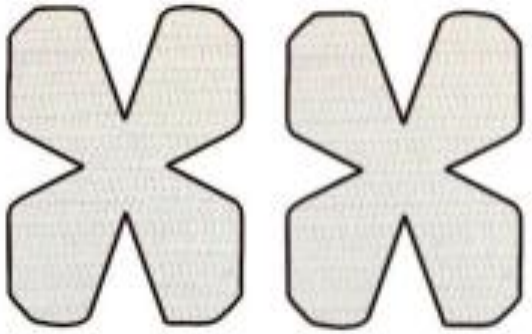
Disposable components

Should be discarded after each patient - they cannot be reprocessed or reused.



Filter Disk

Soft Loop Fasteners



Cheek Daisies

05

HATCH TECHNOLOGIES

Reprocessing steps for Vayu devices

1

Prepare after Use

Wipe off gross soiling; disassemble into subcomponents

2

Soak

Soak in clean water until ready to reprocess

3

Clean

Scrub with a soft-bristled brush; use enzymatic detergent or dish soap

4

Rinse & Dry

Rinse all components; air dry or wipe dry with gauze

5

High-Level Disinfection

Soak in disinfectant; do not autoclave, boil or steam sterilize

6

Rinse & Dry

Rinse three times in large volumes of water; air dry or wipe dry

7

Store

Store the pre-assembled device in a clean container, out of direct sunlight

Disinfection options: 0.55% OPA solution (20 min, preferred) • 0.5% chlorine solution (10 min) • 2.5–3.5% glutaraldehyde solution (40 min)

05

HATCH TECHNOLOGIES

VIDEO DEMO

Prepare after use & soak

STEP 1 - PREPARE AFTER USE

Empty the jars, remove any gross soiling, then fully disassemble the device into its components and subcomponents.

STEP 2 - SOAK

Soak all components in clear water after use until you are ready to reprocess the device — this prevents drying of secretions.

05

HATCH TECHNOLOGIES

VIDEO DEMO

Clean — scrub

Clean with enzymatic detergent or dish soap. Use a soft-bristled brush or sponge. Scrub more diligently if using dish soap.

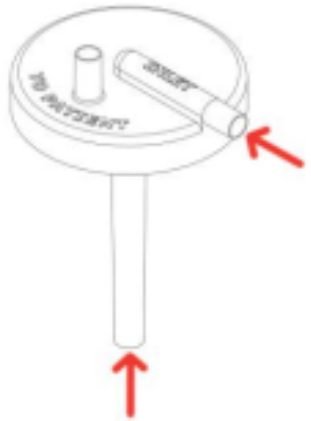
05

HATCH TECHNOLOGIES

VIDEO DEMO

Clean — brush lumens

Do not forget to brush the lumens!!



Select a soft-bristled brush slightly larger in diameter than the lumen being brushed, so all inner surfaces are reached. The blender has two different lumens — both must be brushed.

05

HATCH TECHNOLOGIES

VIDEO DEMO

Clean — flush lumens

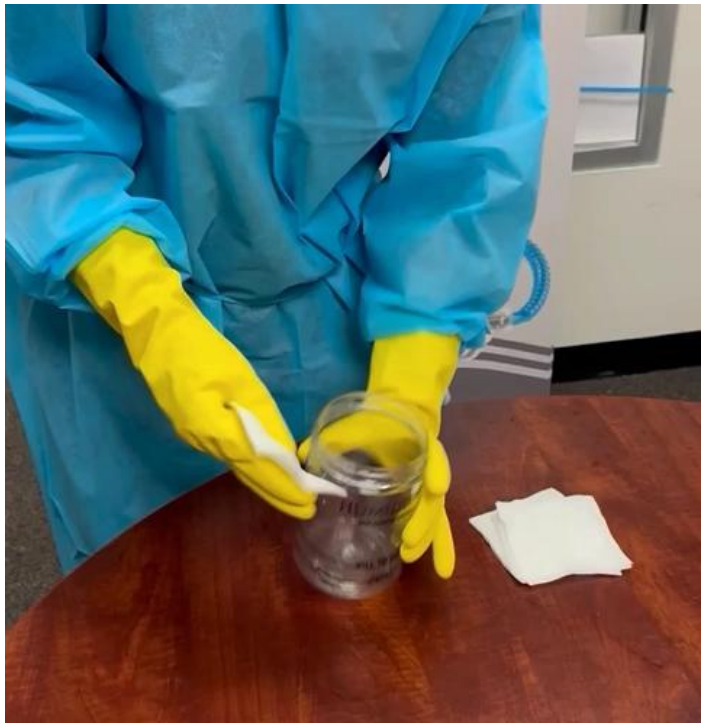
You should also flush the lumens with the detergent. Flushing involves using a syringe to push the fluid through the lumen.

05

HATCH TECHNOLOGIES

VIDEO DEMO

Rinse and dry



Rinse the components with clean water and dry them. Flush lumens with water using the same technique shown previously.

05

HATCH TECHNOLOGIES

High-level disinfection

Use a cold liquid high-level disinfectant:

0.55%

OPA Solution

Soak for 20 minutes (recommended)

0.5%

Chlorine Solution

Soak for 10 minutes

2.5–3.5%

Glutaraldehyde

Soak for 40 minutes

Flush each lumen with disinfectant at least 3 times, then fully immerse all components, making sure all lumens are completely filled.

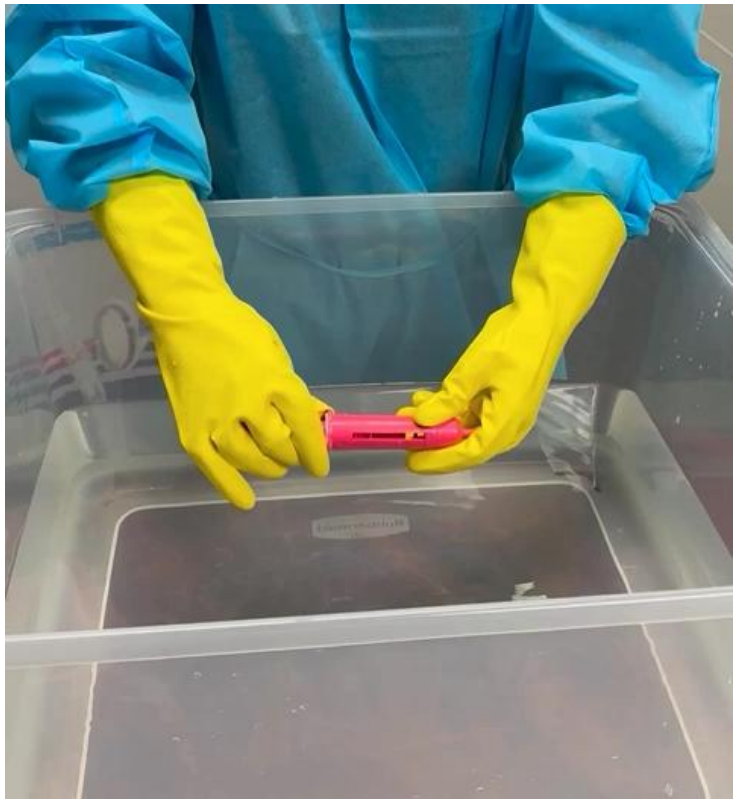
Do not autoclave, boil or steam sterilize - this can cause the plastic components to melt.

05

HATCH TECHNOLOGIES

VIDEO DEMO

Rinse and dry



Flush lumens 3 times with high volumes of water to remove disinfectant residues. Ensure all components are fully dry before storing.

HATCH TECHNOLOGIES

Store

Inspect All Components

Discard any degraded components - loss of seal, clouding that interferes with utility, or cracks.

Reassemble

Store the device in its pre-assembled form, as described in the assembly section of the training.

Store Safely

Store in a clean container out of direct sunlight. Only place liquids in the jars immediately before use.

05

HATCH TECHNOLOGIES

Reprocessing steps for Vayu devices

1

Prepare after Use

Wipe off gross soiling; disassemble into subcomponents

2

Soak

Soak in clean water until ready to reprocess

3

Clean

Scrub with a soft-bristled brush; use enzymatic detergent or dish soap

4

Rinse & Dry

Rinse all components; air dry or wipe dry with gauze

5

High-Level Disinfection

Soak in disinfectant; do not autoclave, boil or steam sterilize

6

Rinse & Dry

Rinse three times in large volumes of water; air dry or wipe dry

7

Store

Store the pre-assembled device in a clean container, out of direct sunlight

Disinfection options: 0.55% OPA solution (20 min, preferred) • 0.5% chlorine solution (10 min) • 2.5–3.5% glutaraldehyde solution (40 min)

06

SECTION 06

Pulse Oximeter

Principles, correct use & infection control

06

HATCH TECHNOLOGIES

How to detect hypoxaemia

1. Clinical Signs

Nasal flaring, central cyanosis, grunting with every breath, intercostal and sternal retraction, severe lower chest wall indrawing, respiratory rate ≥ 70/min.

2. Blood Gas Analysis

Measures the arterial oxygen saturation (SaO_2), blood pH, PaO_2, PCO_2, HCO_3, and the concentrations of the main electrolytes.

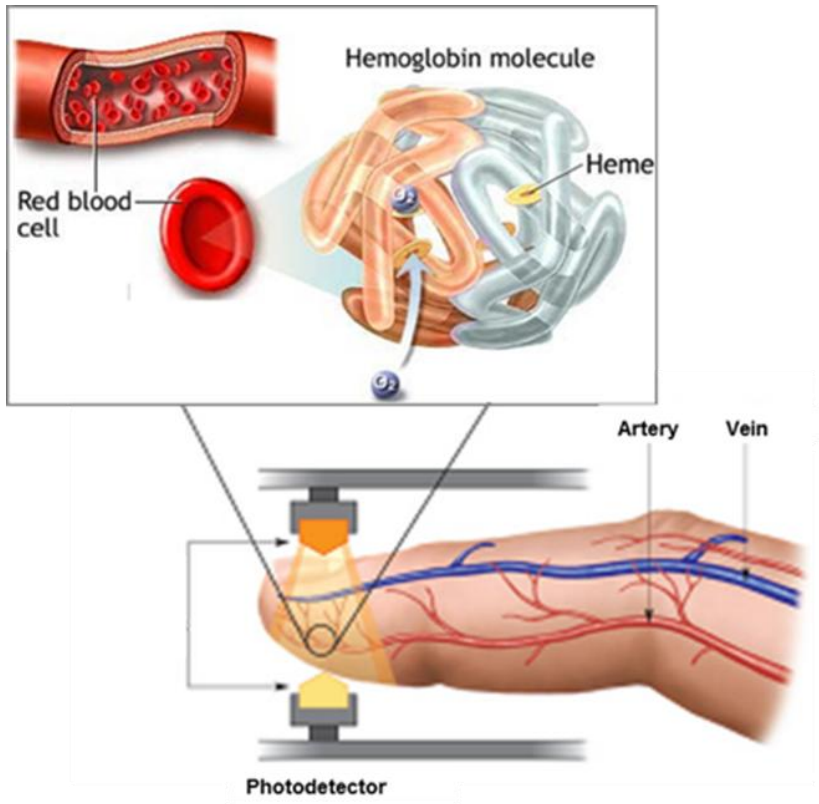
3. Pulse Oximetry

Non-invasive, painless method for detecting hypoxaemia. Measures the % of oxygenated haemoglobin in arterial blood (SpO_2) and pulse rate. Also necessary for oxygen therapy monitoring.

06

HATCH TECHNOLOGIES

How does a pulse oximeter work?



1. The sensor is made of small LEDs — red (660 nm) and infrared light (940 nm) — opposite a photodetector.

2. Oxygenated hemoglobin absorbs more infrared light and allows more red light to pass through.

3. Deoxygenated hemoglobin absorbs more red light and allows more infrared light to pass through.

4. Light from the LEDs passes through tissues and is converted to an electronic signal by the photodetector.

5. This signal (ratio of absorption/oxygenation) is amplified and processed, and depicted as SpO_2 and pulse rate on the monitor.

It is usually used on a translucent part of the patient's body (dorsal foot and palmar surface).

06

HATCH TECHNOLOGIES

Devices used for pulse oximetry

NOT RECOMMENDED FOR NEWBORNS

Fingertip Pulse Oximeter

Cardiac Monitor

RECOMMENDED FOR NEWBORNS

Neonatal Probe

06

HATCH TECHNOLOGIES

Components & the neonatal probe

Ideal for neonates. A wide variety exists, each manufacturer has different specifications.

NEONATAL PROBE

- Ideal for newborns, finger or toe is too small to attach a clip
- Flexible bands, or sensors held on by a small wrap; wrapped around the palm or foot
- Extra care on neonatal skin, which is thin and sensitive
- Reposition every 3 hours if affixed for continuous monitoring

06

HATCH TECHNOLOGIES

How to prepare a pulse oximeter for use

SETUP

- Perform hand hygiene
- Check that you have the machine and a pulse oximeter with a neonatal probe
- Check that the machine battery/dry cells are well placed
- Clean the pulse oximeter probe thoroughly using a 70% alcohol-soaked cotton swab and let it dry
- Check that the pulse oximeter settings are in neonatal mode

SET ALARM LIMITS

SpO_2

Lower limit 89%, upper limit 96%

Heart Rate

Lower limit 99 bpm, upper limit 181 bpm

Set display variables as recommended by the manufacturer. Ensure date and time are set correctly.

06

HATCH TECHNOLOGIES

Preparing and using a pulse oximeter

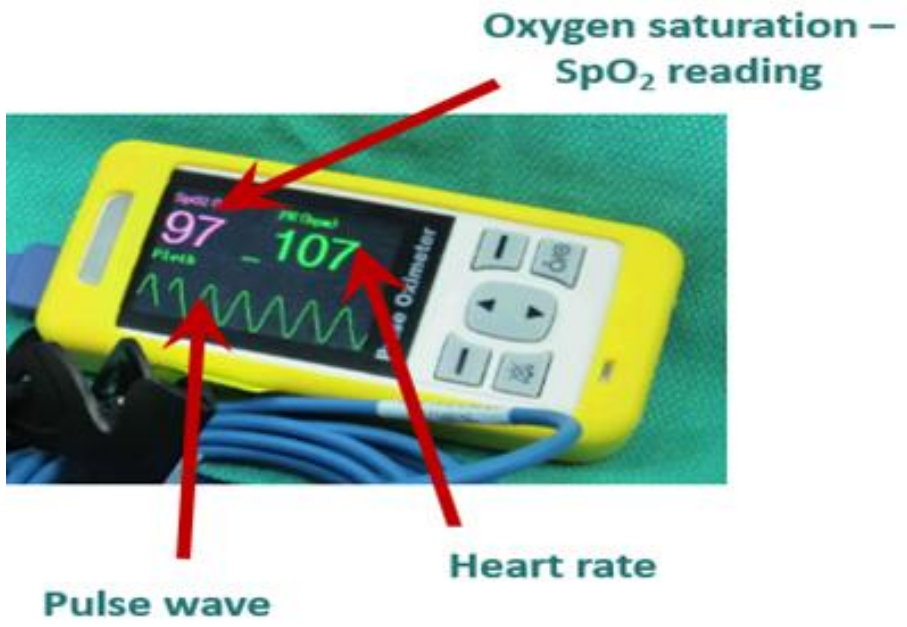
1. Connect the probe
2. Turn the oximeter on
3. Check for the red light on the sensor
4. Correctly attach and secure the probe on the selected side
5. Position the baby in a comfortable position away from excessive lighting
6. Choose an assessment site which is warm, well perfused and with minimal movement (foot or wrist)
7. Wrap and snuggly secure the probe on the assessment site — ensure the light source and sensor line up

Observe IPC (infection prevention & control) throughout.

06

HATCH TECHNOLOGIES

Using a pulse oximeter



Allow the trace to establish

Give the baby's pulse trace time to stabilize.

Read the display

Oxygen saturation, wave form and heart rate on the display screen.

Confirm accuracy

Manually assess the pulse rate and compare with what is displayed on the pulse oximeter.

06

HATCH TECHNOLOGIES

Oxygen saturation reading interpretation - pulse wave

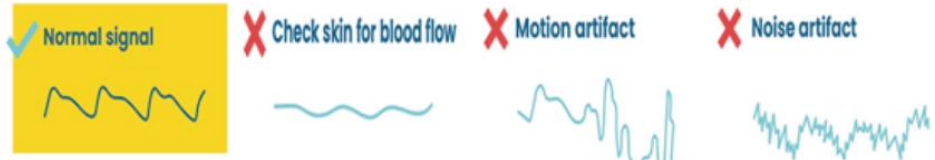
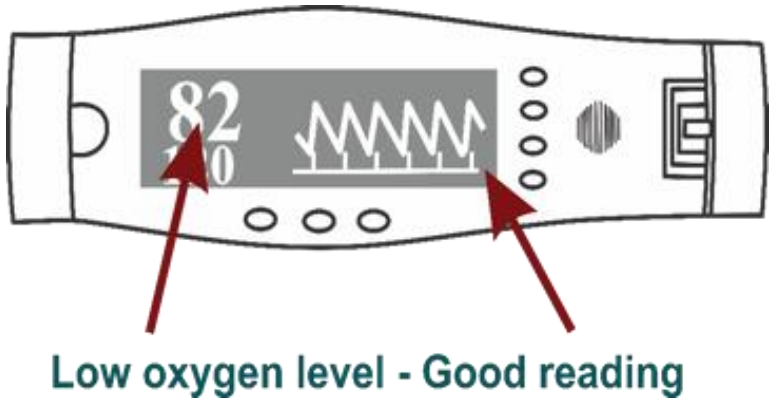
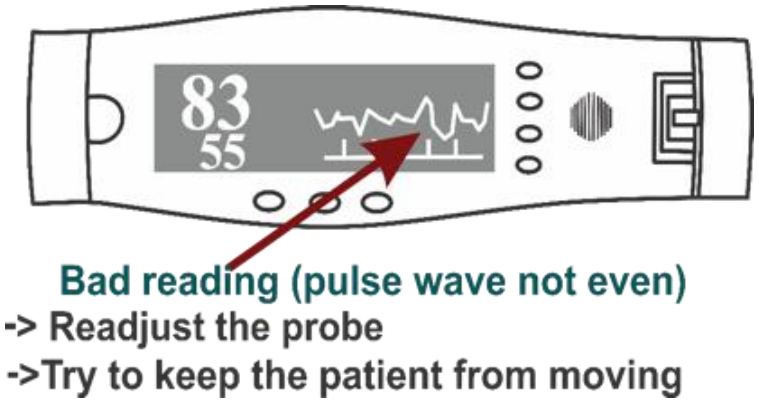


Fig 2.6.6b Pulse Oximeter Signal Tracings





Low oxygen level - Good reading

Bad reading - readjust the probe / keep patient from moving

06

HATCH TECHNOLOGIES

What conditions give inaccurate readings?

- Severe hypotension or anemia
- Venous congestion of the limbs
- Exposure to intense external light energy (as in phototherapy)
- Hypothermia
- Patient movement
- Carbon monoxide poisoning
- Tissue injury at probe site

Tissue injury may occur at the measuring site as a result of probe misuse (e.g., pressure sores from prolonged application).

ITEM 06 · PULSE OXIMETER

06

HATCH TECHNOLOGIES

Infection prevention & control practice

For pulse oximeter and probe · WHO Checklists-4, 2022

AIM	To ensure cleanliness of the pulse oximeter.
IPC REQUIREMENTS	Alcohol swabs, damp cloth & soapy water
FREQUENCY	Whenever you see any type of dirt on the pulse oximeter, and before using on any patient

KEY PRACTICES

- Always wash hands or sanitize before and after monitoring each patient
- Turn off the oximeter before cleaning
- Use alcohol swabs (70% isopropyl alcohol) to clean the oximeter, except the probe sensor
- Probe sensors should be cleaned with a clean damp cloth
- Avoid soaking equipment, autoclaving, and using chlorine — chlorine will corrode and destroy the device

06

HATCH TECHNOLOGIES

Handling a pulse oximeter

Incorrect

Ensure connectors are correctly aligned before inserting into the oximeter.

Correct

Never pull the probe from the machine by pulling the cable - grasp the connector firmly.

Loose Coil

Loosely coil the probe cable for storage or transport - tight coils can damage the wires.

07

SECTION 07

VAYU Oxygen Blender System

Low-flow oxygen therapy for neonates

ITEM 07 · OXYGEN BLENDER

07

Vayu Oxygen Blender System

System that delivers low-flow oxygen therapy, indicated for use in neonates.

Delivers flows of 0.5 – 1 LPM at adjustable oxygen concentrations.

07

HATCH TECHNOLOGIES

What is low flow oxygen therapy?

Controlled & Continuous

Administration of a controlled and continuous flow of oxygen.

Below Peak Inspiratory Flow

Flow is less than the patient's peak inspiratory flow.

Nasal Cannula

Usually administered using a nasal cannula.

Mild Hypoxemia

Indicated for mild hypoxemia with mild respiratory distress.

Source: https://www.who.int/publications/i/item/9789241549554

07

HATCH TECHNOLOGIES

Oxygen toxicity

Pure oxygen is toxic to humans, and it is especially dangerous to neonates.

Lungs

Can harm the lungs, leading to bronchopulmonary dysplasia.

Eyes

Can cause retinopathy of prematurity.

Brain

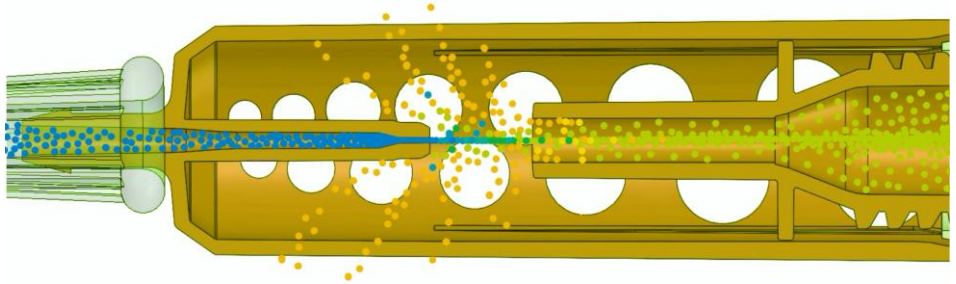
In severe cases, can even lead to brain damage.

07

HATCH TECHNOLOGIES

VIDEO DEMO

Oxygen blending



Achieved by the Vayu blender. Allows you to optimize tissue oxygenation while minimizing oxygen toxicity, by titrating the oxygen concentration.

07

HATCH TECHNOLOGIES

Target saturation

> 88%

Maintain an oxygen saturation of above 88%, using the lowest oxygen concentration possible.

Treatment with low-flow oxygen therapy is monitored using pulse oximetry.

07

HATCH TECHNOLOGIES

WHO recommendations: humidification in low flow

No need for humidification per WHO guidelines when using standard flowrates.

RECOMMENDATIONS ON HUMIDIFICATION

	RECOMMENDATION	QUALITY OF EVIDENCE
1.	When oxygen is delivered at a standard flow rate (0.5–1 L/min for a neonate, 1–2 L/min for an infant, 1–4 L/min for an older child) through a nasal catheter or nasal prongs, humidification is not necessary	Strong recommendation (*low-quality evidence*)
2.	When oxygen is delivered at a higher-than-standard flow rate (> 4 L/min) through a nasal catheter or nasal prongs, humidification is necessary.	Strong recommendation (*low-quality evidence*)

Source: https://www.who.int/publications/i/item/9789241549554

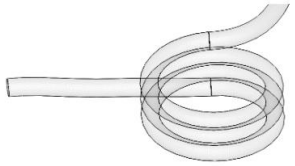
07

HATCH TECHNOLOGIES

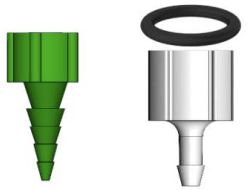
Components

Fully disassemble the Vayu Oxygen Blender System into its individual components.

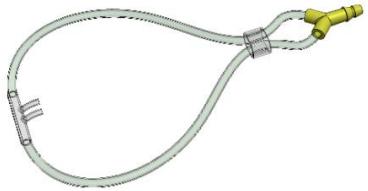
Connectors



Patient Tubing

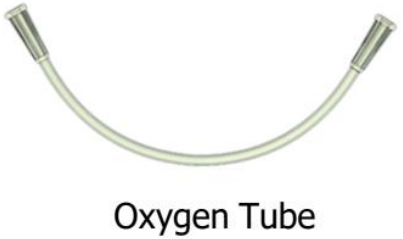


Oxygen Source Adapters



Nasal Cannula

Blender



Oxygen Tube

ITEM 07 · OXYGEN BLENDER

07

HATCH TECHNOLOGIES

VIDEO DEMO

Disassembly of the Vayu Oxygen Blender System

✕ DO NOT

✓ DO

OXYGEN TUBING

Apply horizontal force to remove the tubing — be careful not to break the blender nozzle.

VAYU AIR / OXYGEN BLENDER

Disassemble into subcomponents: blender, locknut. Unscrew the locknut and adjust the blender to 10mm on the scale.

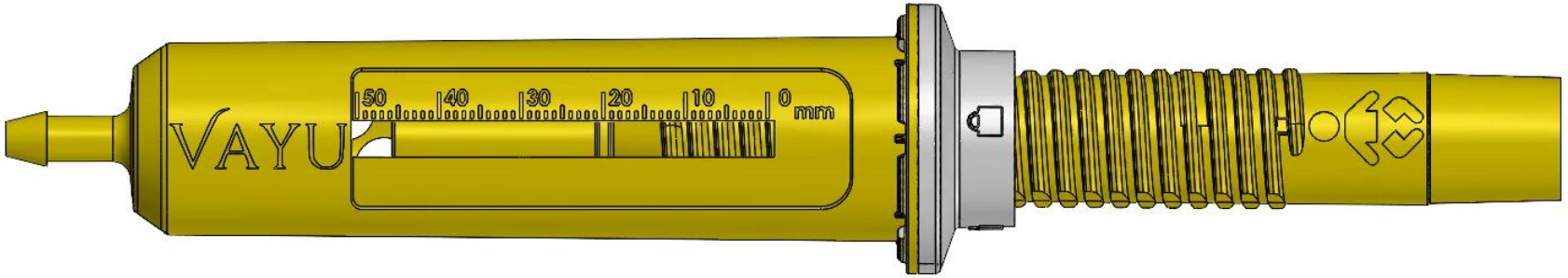
07

HATCH TECHNOLOGIES

VIDEO DEMO

Vayu Air / Oxygen Blender

Disassemble the blender into its subcomponents: blender, locknut.



07

HATCH TECHNOLOGIES

VIDEO DEMO

Monitoring the Vayu Oxygen Blender System

Vayu Bubble CPAP

Use During Treatment

VAYU

HATCH TECHNOLOGIES

Vayu Bubble CPAP

Use During Treatment

End of Training Program

Introduction to CPAP • Components & Assembly • Disassembly • Monitoring • Reprocessing • Pulse Oximeter • Oxygen Blender System

Vayu CPAP Training Post-test

bitly

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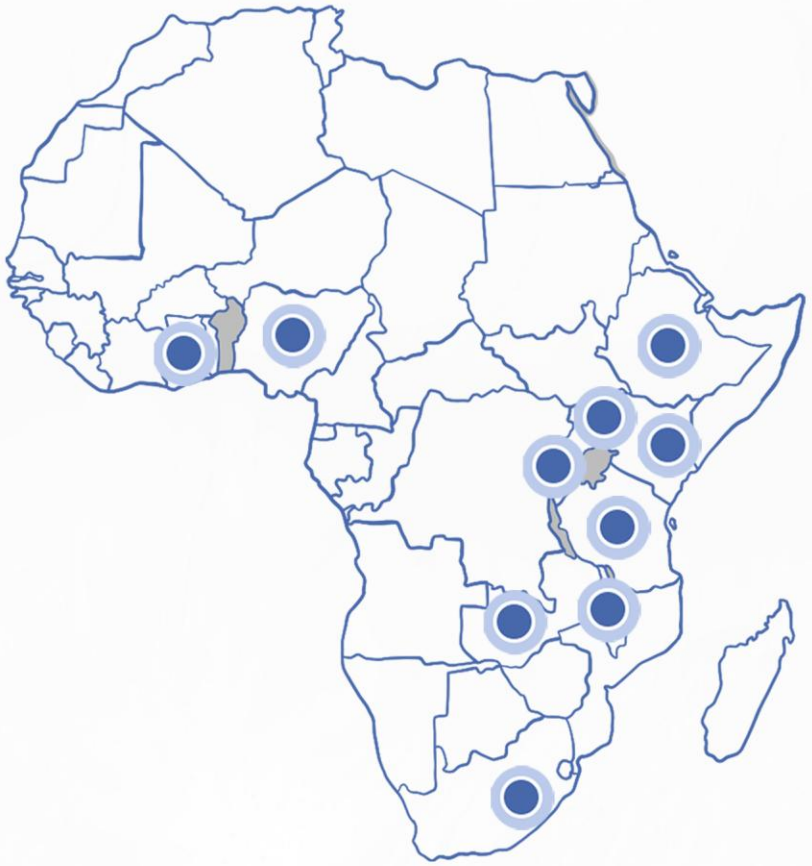

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