

# CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) AND BPAP: TREATMENT INITIATION FOR LONG TERM HOME USE - CHW

## PROCEDURE <sup>®</sup>

### DOCUMENT SUMMARY/KEY POINTS

- Sleep disorders, such as Obstructive Sleep Apnoea (OSA) and Hypoventilation, can be treated by Continuous Positive Airway Pressure (CPAP) or bi-Positive Airway Pressure (BPAP) Ventilation<sup>1,10</sup>.
- Poor compliance with non-invasive ventilation impedes treatment of patients.
- Patients commencing CPAP/BPAP treatment in a hospital ward receive monitoring and support from CHW staff to facilitate therapy compliance.
- This CPAP/BPAP initiation protocol provides a procedural framework differentiating between patients commencing CPAP/BPAP in a clinical setting and patients commencing in Hospital in the Home (HITH)

#### **Abbreviations:**

**OSA** = obstructive sleep apnoea

**CPAP** = Continuous Positive Airway Pressure

**NIV** = non-invasive ventilation (ventilation delivered via a nasal mask)

**BPAP** = Pressure support with two pressure settings IPAP and EPAP

**IPAP** = inspiratory peak (or positive) airway pressure

**EPAP** = expiratory positive airway pressure

**PD** = Pressure determination

**RSS** = Respiratory Support Service (part of Sleep Medicine)

**Midline CPAP in Neonates**, refer to [Grace Centre for Newborn Care Respiratory Support in Neonates Practice Guideline](#).

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

<b>Approved by:</b>	SCHN Policy, Procedure and Guideline Committee	
<b>Date effective:</b>	5 <sup>th</sup> February 2024	<b>Review Period:</b> 3 years
<b>Team Leader</b>	Clinical Nurse Consultant	<b>Area/Dept:</b> Respiratory Medicine

## CHANGE SUMMARY

- Document due for mandatory review
- Child Life Therapy section added
- Removal of Turner initiations as these no longer occur.
- Updated all other sections
- Updated Reference section

## READ ACKNOWLEDGEMENT

- Training – In-services are provided on request by individual ward areas.
- Staff of the Respiratory Support Services and Sleep Unit who are involved in the process of initiating respiratory therapy for children, nursing staff caring for children on respiratory support should read and acknowledge that they understand the contents of this document.

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## 1 The Respiratory Support Service (Sleep Medicine Team)

The Respiratory Support Service (RSS) is a division of the Respiratory Department at The Children's Hospital at Westmead (CHW) which specialises in managing respiratory disorders that affect sleep and the management of respiratory support therapy.

The RSS team is a part of Sleep Medicine. The multi-disciplinary Sleep Team is composed of a Clinical Manager, Sleep and Respiratory Specialists, Sleep Fellow and Sleep Registrars, a Clinical Nurse Consultant (CNC), Clinical Nurse Specialist, Scientific Officers, Registered Nurses (RN), Sleep Technologists, Research Assistants and Child Life Therapists. Each member has a specific role to ensure complete therapy is provided to the patient.

## 2 What is Continuous Positive Airway Pressure [CPAP]?

**Nasal mask CPAP** is used for the treatment of upper airway obstruction in children. It is most often used as long-term management of obstructive sleep apnoea (OSA). Sometimes children have the therapy short term prior to more definitive surgery.

If left untreated, children with upper airway obstruction can develop serious complications including cardiac dysfunction and cognitive impairment. More mild abnormalities include ventricular dysfunction, diastolic hypertension, and behavioural and concentration disturbances very similar to Attention Deficit Hyperactivity Disorder (ADHD)<sup>2, 6</sup>. In their most severe form these complications progress to pulmonary hypertension and developmental delay.

**Non-invasive ventilation (NIV) or BPAP** refers to the delivery of ventilation through a nasal mask and this treatment is used for conditions that lead to hypoventilation during sleep, for example children with neuromuscular diseases who develop respiratory failure. These children tend to have more severe respiratory abnormalities than children being treated with CPAP.

If left untreated, children with sleep-associated hypoventilation may develop mild complications including morning headaches and poor daytime function. In their most severe form these children develop daytime hypoventilation and may present in fulminant respiratory failure with even minor respiratory infections that may be fatal. This can lead to frequent hospital admissions with a need for invasive ventilation in the Intensive Care Unit. Children who are established on BPAP in their homes often continue to use this therapy during acute respiratory infections and thus avoid admission to the ICU.

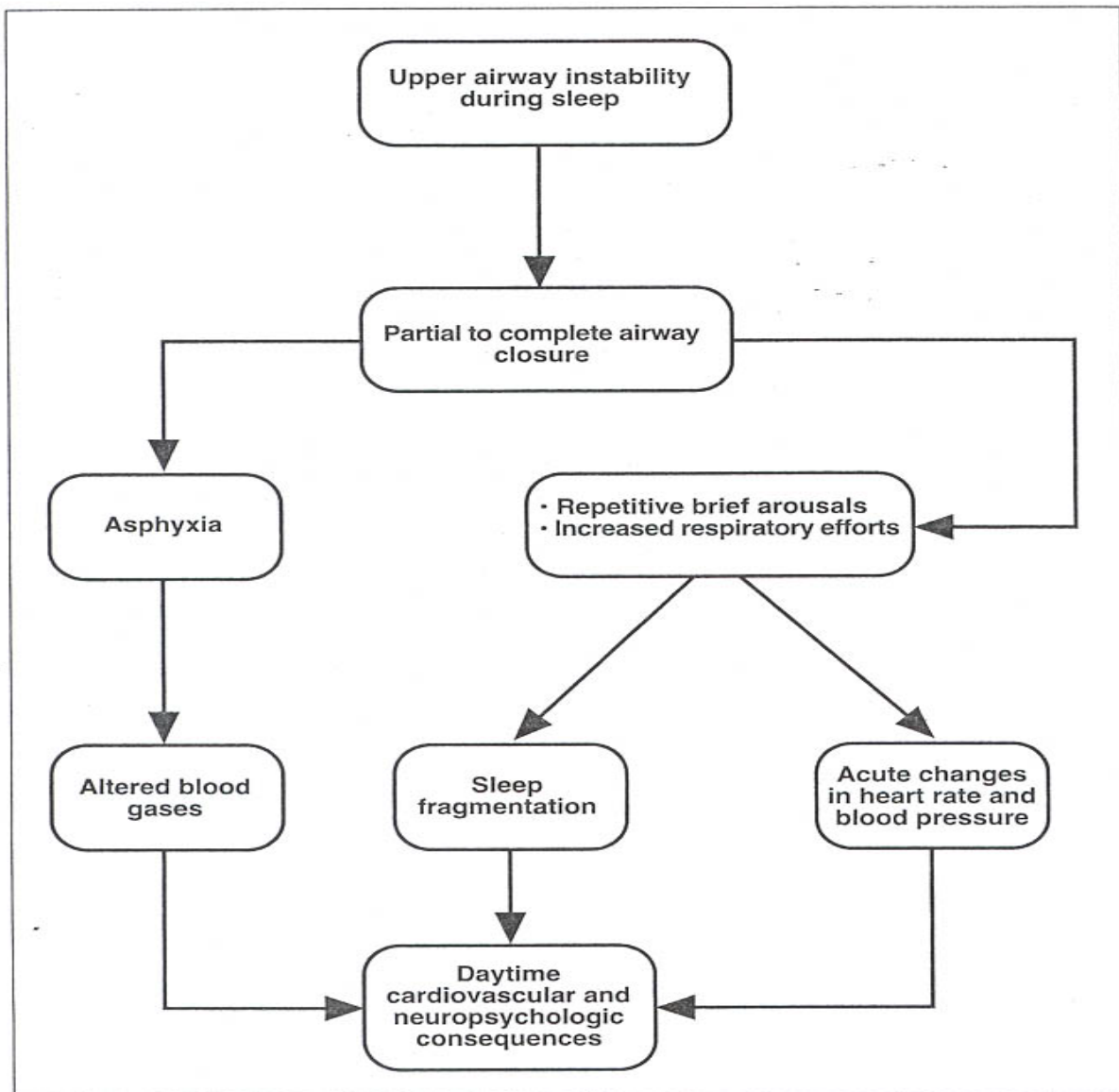
When children are being established on treatment with CPAP or BPAP for sleep disordered breathing they require vigilant monitoring over the first few nights. At this stage of acclimatisation to the treatment it is very important to ensure compliance if tolerance of the CPAP or BPAP treatment is to be obtained over the long term<sup>3, 11, 19</sup>

This policy is to be used to guide the procedure of admission and course of CPAP/BPAP initiation for patients within the Hospital.

### 3 Obstructive Sleep Apnoea (OSA)

Obstructive Sleep Apnoea (OSA) is characterised by obstruction of the upper airways resulting in episodes of ineffective breathing efforts during sleep (recurrent episodes of hypopnea and apnoea). The main symptom of OSA is snoring, resulting from limited airflow. Episodes of partial or complete airway occlusion cause oxygen desaturation, carbon dioxide retention and disturbed sleep. Clinically, this manifests as loud snoring. Other consequences of sleep disordered breathing are demonstrated in [Figure 1](#).

In children, the estimated prevalence of snoring is 3 to 12 percent and of OSA is 1 to 4 percent<sup>1, 4, 5</sup>. Many of these children have mild symptoms, and many outgrow the condition. The most common cause of OSA is adenotonsillar hypertrophy, although children with other conditions such as craniofacial abnormalities and skeletal or neuromuscular disease may be at increased risk of the disease.



**Figure 1: Consequences Sleep Disordered breathing.**

## 3.1 Treatment options

### 3.1.1 CPAP

CPAP devices generate airflow continuously at a positive pressure to the airway through a nasal or face mask. In children, CPAP is used to treat moderate to severe OSA, most often in addition to ENT surgery. The most common surgery is Adenotonsillectomy. CPAP is commonly used during sleep only. The increased pressure acts as a splint to prevent collapse of the airway, aiming to restore normal sleep. This reduces both immediate and long-term symptoms by improving ventilation during sleep<sup>7, 8</sup>.

CPAP pressure is measured in “centimetres of water” (cmH<sub>2</sub>O).

Points to remember:

1. CPAP is not ventilation but a respiratory support mechanism.
2. CPAP does not have a back up respiratory rate.
3. The lowest pressure that is considered therapeutic is 4cm.
4. The pressure setting is set accordingly to the child's severity of airway obstruction.
5. If O<sub>2</sub> is required, then this is a change in the clinical presentation and must be reported to the medical registrar or on call sleep consultant.

### 3.1.2 BPAP Ventilation

BPAP Positive Airway Pressure differs from CPAP in that it delivers both an inspiratory pressure and a lower expiratory pressure. This device assists ventilation during sleep and is most often used for diseases where ventilation is compromised during sleep (nocturnal hypoventilation); acute respiratory failure where the patient is either not breathing enough or breathing effort is not strong enough.

#### Terms used in BPAP.

**Mode** - basic setting for device 'S' or 'ST'

**IPAP** - Inspiratory positive airway pressure - helps expand the lungs on inspiration.

**EPAP** - Expiratory positive pressure - air pressure delivered on expiration. A lower pressure – keeps the lungs slightly expanded and stops the lungs collapsing on expiration.

**BPM** - back up respiratory rate – Breaths per Minute

**Rise time** – how quickly the change is made from EPAP to IPAP when child inspires.

**i-Time** – Time taken for inspiration with each breath.

**“S”** = spontaneous and uses IPAP and EPAP only

**“S/T”** = IPAP and EPAP and allows a back up rate to be set.

**AVAPS** – Average volume assured pressure support – Hybrid of volume and pressure support ventilation.

### 3.1.3 *Speech Pathology Assessment*

- Infants and children who require respiratory support are vulnerable during oral feeding due to the need to coordinated suck: swallow: breathe for suck feeding or swallow: respiration for eating and cup drinking. They are at risk of aspiration and developing feeding aversions due to airway compromise because of their underlying respiratory difficulties <sup>13</sup>.
- Infants under 6 months of age who are commencing or who have already commenced pressure support require a feeding assessment by the Speech Pathologist during admission. The purpose is to assess the infant's feeding readiness, oral and pharyngeal phase skills, ability to protect their airway during swallowing and the infant's cues for sustaining oral feeding or otherwise <sup>14</sup>.
- Children over 6 months of age may require an assessment if they have elevated risk for aspiration due to structural airway and/or neurodevelopmental comorbidities or clinical signs of aspiration or feeding difficulties.
- To be considered ready for oral feeding assessment, patients should be able to tolerate a minimum of 45-60 minutes off their pressure support without an increase in work of breathing before suck feeding can be offered. In addition to feeding/swallowing difficulties inherent to their underlying respiratory disease, the pressure support itself increases aspiration risk due to stenting open the airway, misdirecting the bolus and continuous flow which may altering sensation <sup>16</sup>.
- Information obtained from the speech pathology assessment will be used to guide the team in decision-making around suitable methods of feeding infants, whether oral or non-oral. A Videofluoroscopic Swallow Study (AKA Modified Barium Swallow) may be required as part of the speech pathology assessment to more fully determine the risk and pathophysiology of aspiration during oral feeding, especially if this is suspected by the teams caring for the infant.
- Patients assessed as safe for feeding via methods that bypass the oral route (e.g., nasogastric/gastrostomy) may receive feeds while pressure support is in use. These patients will require speech pathology input to maintain and facilitate their development of skills to enable the patient to transition to oral feeding in the future if appropriate. It may be appropriate to offer these infants a dummy coated in milk to suck on during feeds and for settling, however fluid should not be presented from a syringe directly into the infant's mouth.

### 3.1.4 *Child Life Therapy Assessment and Intervention*

- The Child Life Therapist role is to perform a stress potential assessment and provide individualised support to families to help patients develop compliance and cope with CPAP initiation.
- Patients with elective admission are triaged. For patients and families who are assessed to benefit from pre-admission preparation and support, the Child Life Therapist will provide a phone consultation proceeded with emailing electronic resources.



- The Child Life Therapist will action referrals for patients with non-elective admissions and/or mask fitting appointments.
- Once admitted, the Child Life Therapist will offer sessions to encourage patients to practice wearing CPAP mask using scaffolded strategies such as education, distraction, play and desensitisation. The primary carer is encouraged and expected to consistently implement recommended strategies to maximise compliance with CPAP initiation.
- The Child Life Therapists' recommended plan and strategies for CPAP initiation overnight provides guidance to the nursing staff and families. Ongoing assessment regarding patients' progress is shared with the team to inform decision making as needed.

## 4 Compliance with non-invasive ventilation therapy

There is a risk of poor compliance with non-invasive ventilation therapy due to limited cooperation with the primary caregiver and/or challenges experienced by the child <sup>10, 11 17</sup>

### 4.1 Observation and parental support

Support to the primary caregiver and the patient maximises compliance with therapy <sup>17</sup>. A multiple night hospital admission provides the opportunity to determine optimal treatment pressure and effective interventions to improve compliance of Continuous Positive Airway Pressure (CPAP) and BPAP treatment.

### 4.2 Mask training

Appropriate mask fitting is essential.

Prior to admission for initiation of CPAP or BPAP, ideally there is a period of home training, where the child wears their mask in 10–20-minute blocks to allow him/her to get used to the feel of the mask.

This also allows the child to associate the mask with bedtime.

The Child Life Therapist is often used in the mask fitting and training to optimise normalisation and compliance and reduce risk of associated distress.

The child will be booked to attend a mask fitting clinic in the sleep unit to get an appropriately sized mask. The family will pay a mask fee to purchase a mask. If the child requires further masks, the family will be required to privately purchase a mask. A member of the sleep team will provide the family with information on purchasing a mask.

Once the child is compliant with the mask, the child will have a 3-night admission, either in hospital or through HITH to commence therapy.

#### 4.2.1 Fitting the mask

- Ensure the headgear sits at the nape of the neck.
- The headgear must sit firmly on the head; in some cases, alterations to the headgear may be required.



- The cushion does not cover the eyes.
- The cushion can sit on the upper lip but is not to cover the mouth or nostrils.

Do not strap the headgear too tightly as this may induce pressure sores and skin breakdown. The soft material of the masks provides a seal against the face when the pressure is delivered through it to the nose.

### 4.3 Oxygen Saturation (SpO<sub>2</sub>) Monitoring

Pulse oximeters detect the change in transmission of light across the capillary bed, usually in the finger. Other sites include the foot or toe. Consideration to sensor positioning may influence clinical interpretation of the pulse oximeter readings<sup>12</sup>. The sensor is placed on the nail with the light source against the finger pulp. The photo-detector identifies oxyhaemoglobin and partially bound oxyhaemoglobin. By comparing the difference in light transmission through the “arterialised” capillary bed and the non pulsatile venous bed the oximeter can calculate the haemoglobin saturation, known as the “functional saturation”<sup>9</sup>.

#### 4.3.1 Monitoring

- Continuous (overnight) whilst on CPAP or BPAP.
- Alarms are preset – high 100%, low 95% (unless otherwise specified).
- Hourly recording of oxygen saturation readings, respiratory rate and patients pulse rate MUST be documented.
- Skin integrity must be checked a minimum of 4<sup>th</sup> hourly and documented.
- Alterations to calling criteria may be required to be documented on the “Between the Flag” (BTF) charts<sup>15</sup>
- If you have concerns regarding the patient, page the Medical Team Registrar on-call.

#### 4.3.2 Clinical application

- Probe sites should be changed at least every two hours.
- The device does not need to be calibrated.
- Sources of error.
  - Poor positioning of the probe.
  - Nail polish must be removed as signal strength can be reduced.
  - Excessive motion and strong incidental light can cause an effect and give erroneous signals.
  - Abnormal haemoglobin and anaemia can affect the accuracy of the measurements.

#### 4.3.3 Infection control

No special precautions are necessary when using the equipment at the bedside, although standard universal precautions apply.

## 5 Non-invasive ventilation initiation protocol

### 5.1 For patients admitted to a ward

#### 5.1.1 Criteria

For patients admitted to wards:

- Patient is medically complex.
- All Infants < 1yr old
- All BiPAP initiations
- Admission of multiple patients will be determined by the Sleep consultants and the Respiratory Support team at regular clinical meetings. Factors such as priority, medical condition, staff availability and workload etc will be taken into consideration when determining date and ward for admission.

#### 5.1.2 Process

The physician completes an electronic admissions form requesting admission to an appropriate ward area. Patients are admitted for around three consecutive nights into the ward.

#### 5.1.3 Monitoring

Hourly observations and mask adherence are conducted and documented on the Between the Flags observation chart by ward staff. A trolley study and venous blood gas (VBG) will be attended during this admission to determine appropriate pressure.

The patient will be reviewed, and the consultant will determine the best course of action. The procedure for trolley studies can be found in [Sleep Screening Trolley Study – CHW](#).

#### 5.1.4 Placement of the unit

The machine is to be placed on the bedside table, sitting approx 30cms away from the wall to prevent overheating at the back of the unit. The device should be placed at a height lower than the patients head to prevent water flow through the tubing to the child's mask.

It is not recommended that the machine is placed on the floor, as the air drawn into the machine may contain particulate matter, reducing the quality of the air breathed in and the life of the filters.

### 5.2 For CPAP Patients initiated through HITH

For patients that are initiated on CPAP through HITH, please refer to the separate document CPAP initiation in the home: [Continuous Positive Airway Pressure \(CPAP\) Initiation in the Home - HITH Patient Management Practice Guideline](#).

#### 5.2.1 Criteria

In addition to the criteria listed in the '*CPAP Initiation in the Home – HiTH Patient Management*' policy, the patient's cognitive ability should be assessed to ensure that they are

able to engage in the mask fitting and education process. This will allow HiTH nursing staff to address some of the difficulties in tolerance to CPAP with the parent and directly with the child during home visits.<sup>18</sup>

### 5.3 Apnoea Monitoring

When patients are under the age of 6 months and require respiratory support, they are usually sent home on an apnoea monitor to use during sleep only. This is to alert the parents if the infant experiences any heart or breathing problems whilst wearing the mask during sleep. Education and training on this device is provided by the Scientific Officers in the sleep service. The device is loaned through the Appliance Centre. The apnoea monitor is set to alarm for the following reasons:

- Central apnoea lasting 20 seconds or longer.
- Bradycardia <80bpm – The alarm for this is lowered to 70bpm when the patient is 2 months old, and then to 60bpm when the patient is 4 months old.
- Tachycardia >230bpm will remain the same throughout the monitoring process.

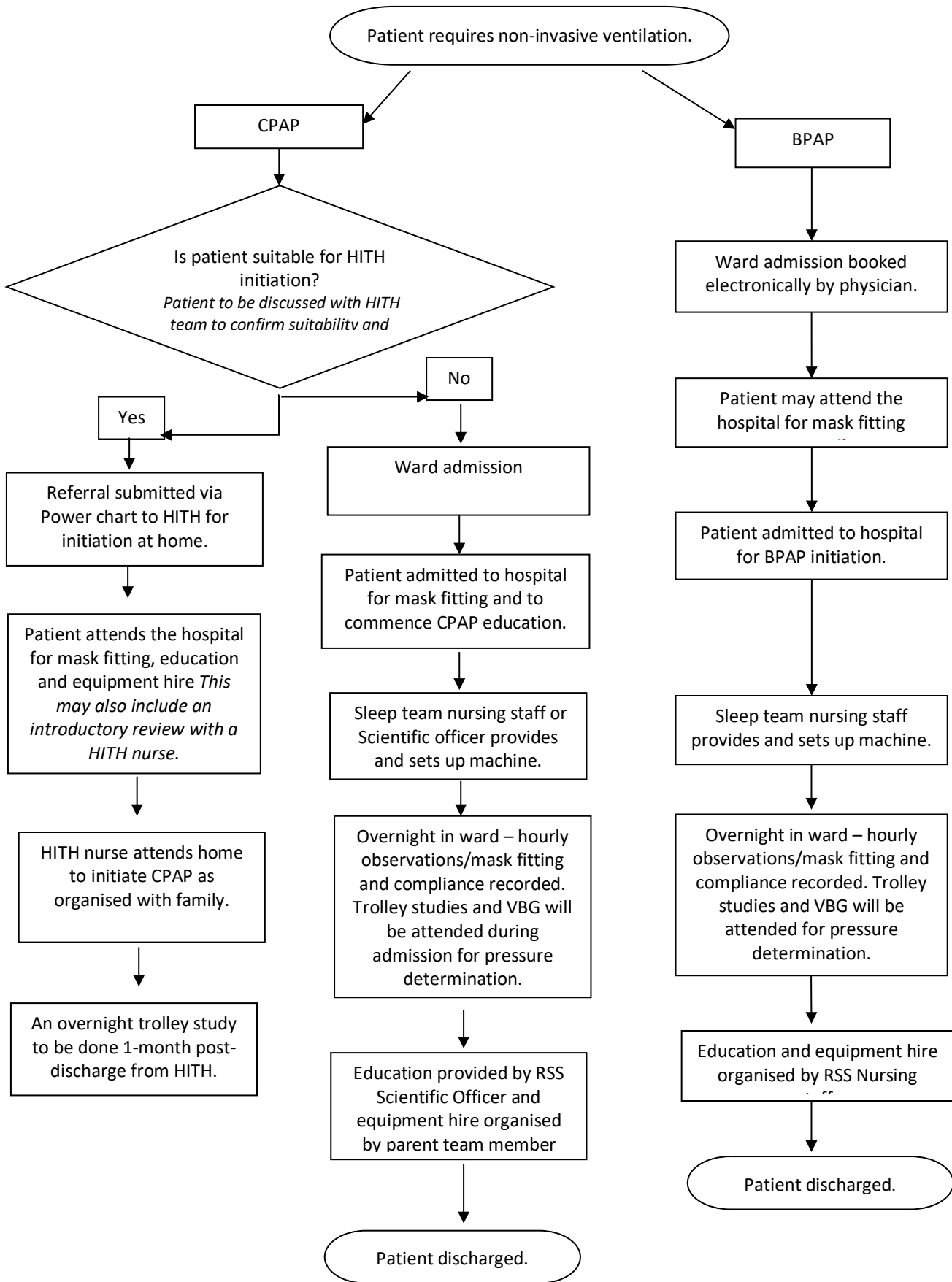
Downloads are done monthly for patients, and the data is sent to the Sleep Consultant for review. Monitoring is usually undertaken until the patient is 6 months of age or can be for shorter or longer duration at the discretion of the Sleep Consultant especially if the child was premature.

## 6 Hire of equipment

The CPAP/BPAP machine is the property of The Children's Hospital at Westmead. BiPAP can be rented through the hospital but It is required that all patients hire a CPAP machine from an external company. Your RSS Team member will organise the hire of equipment with the family.

There is a mask fee (payable to the cashier) that enables the family to use a CHW mask. Families of children who require long term support will need to purchase any replacement masks from external companies.

**Flow chart of processes around CPAP/BPAP initiation**



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