

CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) AND BPAP: TREATMENT INITIATION - CHW

PROCEDURE[®]

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^{1,10}.
- 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 either Care By Parent setting or CAPAC

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

Midline CPAP in Neonates, refer to Grace Centre for Newborn Care practice guideline:

<http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2009-0042.pdf>

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.

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This Policy/Procedure may be varied, withdrawn or replaced at any time. Compliance with this Policy/Procedure is mandatory.

CHANGE SUMMARY

Section 3.1.3 added – Speech Pathology Assessment

Section 4.3.1 updated to reflect introduction of SPOC across NSW Health

Section 6.0 updated – Hire of equipment

Addition of flow chart to inform of current process of initiation of therapy

READ ACKNOWLEDGEMENT

- Training – In-services are provided on request by individual ward areas.
- Staff of 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.

This document reflects what are currently regarded as safe practice. However, as in any clinical situation there may be factors that 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.

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1 The Respiratory Support Service (RSS)

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

The RSS is a multi-disciplinary team and is composed of a Clinical Manager, Sleep and Respiratory Specialists, Respiratory Registrars, a Respiratory Support Clinical Nurse Consultant (CNC), a Scientific Officer, Registered Nurses (RN), Sleep Technologists and Research Assistants. 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 may be used as long term management of obstructive sleep apnoea (OSA) or short term prior to more definitive surgery, or if surgery has not resolved their condition.

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)^{2, 6}. 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^{3, 11}.

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^{1, 4, 5}. The majority 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.

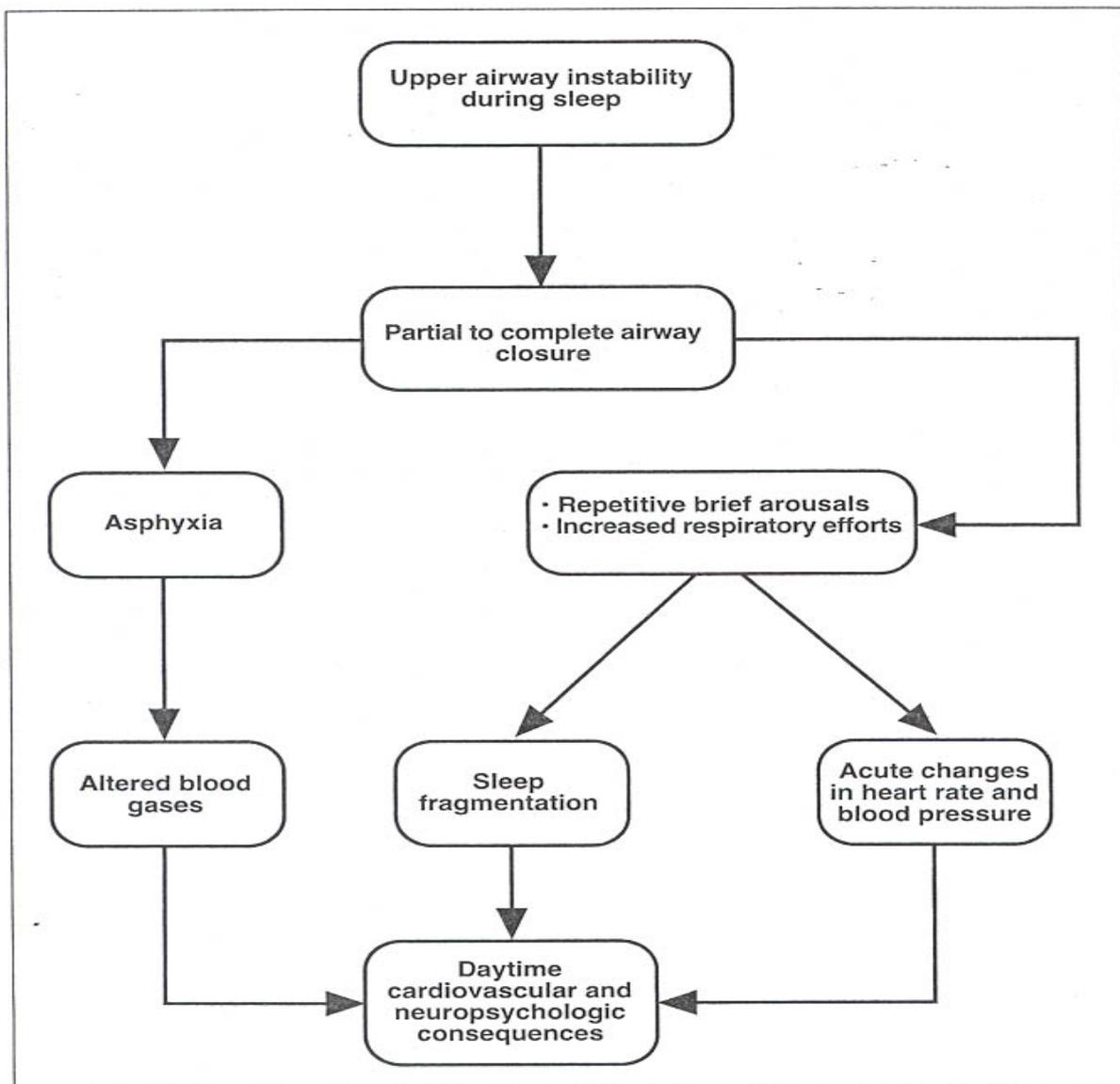


Figure 1: Consequences Sleep Disordered breathing.

3.1 Treatment of OSA

Children with OSA who require adenotonsillectomy may be treated pre-operatively with Continuous Positive Airway Pressure (CPAP). They may also require CPAP for a period of time following surgery.

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, either before and/or after surgery for adenotonsillectomy or for long term management of OSA related to other medical conditions. It is commonly used during sleep only. The increased pressure acts as a splint and prevents collapse of the airway, aiming to restore normal sleep. This reduces both immediate and long term symptoms by improving ventilation during sleep^{7, 8}.

CPAP pressure is measured in "centimetres of water" (cmH₂O).

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 O₂ 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.

3.1.3 Speech Pathology Assessment

- 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 oral motor and swallowing skills and the infant's capacity for sustaining oral feeding or otherwise.
- 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 modified barium swallow may be required as part of the speech pathology assessment to more fully determine the risk of aspiration during oral feeding, especially if this is suspected by the teams caring for the infant. Patients assessed as safe to feed orally, should be off their pressure support while they are feeding.
- 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.

4 Compliance with non-invasive ventilation therapy

There is a risk of poor compliance with non-invasive ventilation therapy due to poor cooperation with the primary caregiver and/or behavioural problems by the child^{10, 11}.

4.1 Observation and parental support

Support to the primary caregiver and the patient maximises compliance with therapy. 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 for compliance from the child.

Prior to admission for initiation of CPAP or BPAP, home training commences, with the child wearing the 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.

Play therapy is often used in the mask fitting and training.

The child will be booked to attend a mask fitting clinic in the sleep unit to get an appropriate sized mask. The family will pay a mask fee to loan the mask. If the child requires further masks, the family will be required to privately purchase a mask. The CNC / Scientific officer 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 hospital or CAPAC admission 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.

4.3 Oxygen Saturation (SpO₂) Monitoring

Pulse oximeters detect the change in transmission of light across the capillary bed, usually in the finger. Other sites include the foot, toe and ear lobe. Consideration to sensor positioning may influence clinical interpretation of the pulse oximeter readings¹². 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”⁹.

4.3.1 Monitoring

- Continuous (overnight) whilst on CPAP or BPAP.
- Alarms are preset – high 100%, low 85% (unless otherwise specified).
- Hourly recording of oxygen saturation readings, respiratory rate and patients pulse rate MUST be documented.
- Alterations to calling criteria may be required to be documented on the SPOC charts
- 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 Turner Care by Parent (TCBP)

5.1.1 Criteria

For patients admitted to Turner Care By Parent (TCBP):

- Patients > 12 months of age.
- Patients who are medically stable.
- Other suitable patients to be determined by the Respiratory consultant.
- 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.
- 1 Bed per week is available for CPAP initiation. The Sleep Unit Manager co-ordinates the bookings with the Manager and ward clerk from TCBP

5.1.2 Process

The Respiratory Support Service Scientific Officer liaises with the Manager of the Sleep Unit to co-ordinate suitable dates for admission into TCBP.

Patients are admitted for three consecutive nights in TCBP. During this time the patient will have trolley studies and venous blood gases (VBG) to determine the appropriate pressure.

5.1.3 Monitoring

Hourly observations and mask adherence are conducted and documented by the Sleep Unit staff.

If a PD study is practicable, the patient will be discharged from TCBP following their second night stay to the Sleep Unit, and undergo a sleep study.

If a PD study is not practicable, the patient will be reviewed again by the consultants for appropriate course of action.

5.2 For patients admitted to a ward

5.2.1 Criteria

For patients admitted to wards other than TCBP:

- Patient is medically complex.
- All Infants < 1yr old
- All BPAP initiations
- Patients determined by their admitting consultant as unsuitable for TCBP.
- 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.

5.2.2 Process

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

5.2.3 Monitoring

Hourly observations and mask adherence are conducted and documented on the [CPAP & BPAP Checklist 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 at:

<http://chw.schn.health.nsw.gov.au/o/documents/policies/procedures/2007-8044.pdf>

5.2.4 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.

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.

5.3 For CPAP Patients initiated through CAPAC

For patients that initiated on CPAP through CAPAC refer to CPAP initiation in the home: CAPAC Patient Management Practice Guideline:

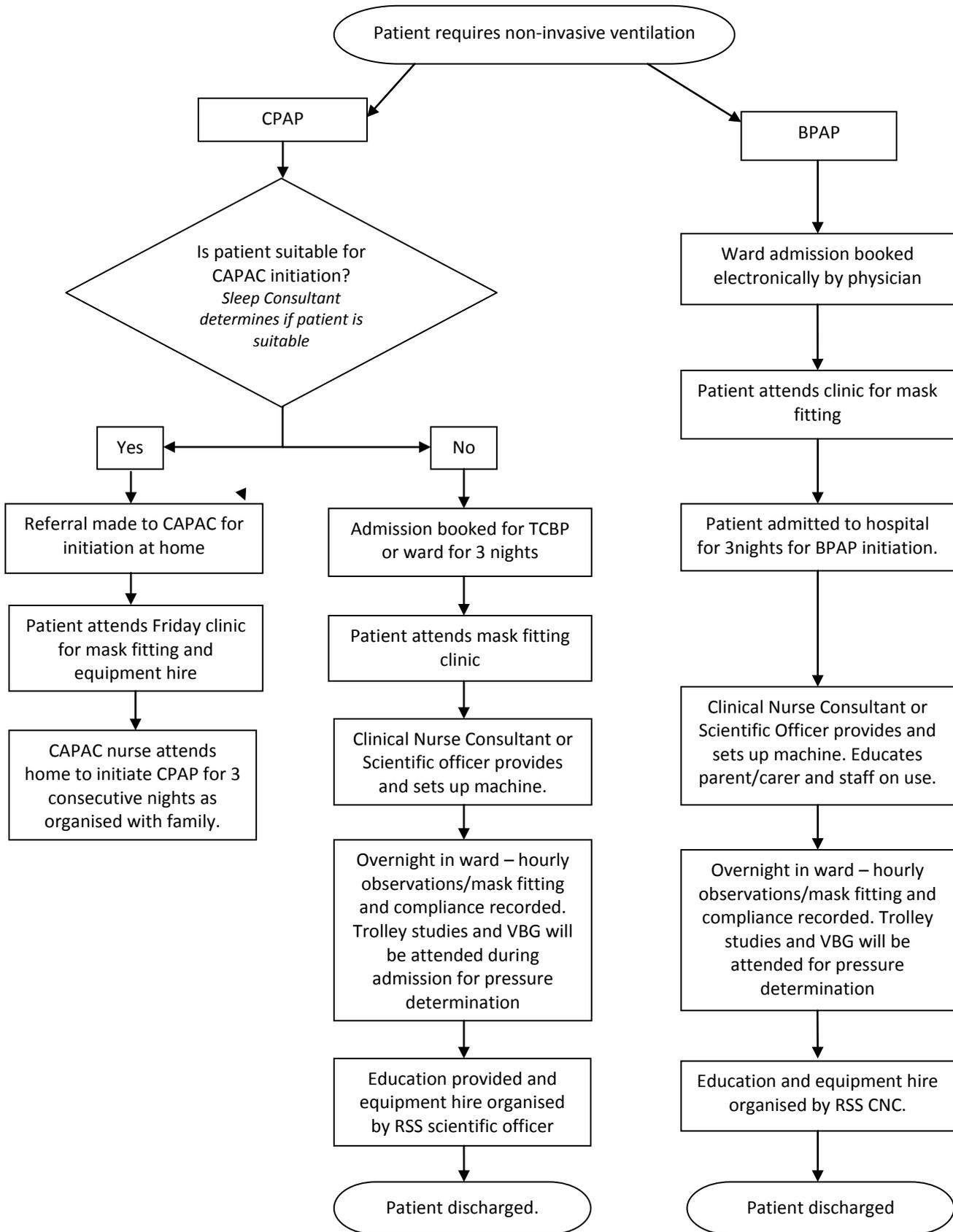
<http://chw.schn.health.nsw.gov.au/o/documents/policies/guidelines/2011-0007.pdf>

6 Hire of equipment

The CPAP/BPAP machine is the property of The Children's Hospital at Westmead. It is required that all patients hire a machine from an external company. The RSS Scientific Officer or Clinical Nurse Consultant 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 for a 3 month period while they purchase their own mask for the child. If the child is waiting for adenotonsillectomy, the family will not need to purchase a mask until after the surgery if the child requires CPAP for long term use.

7 Flow chart of processes around CPAP/BPAP initiation.



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