Mid Essex Hospital Services NHS Trust

OXYGEN ADMINISTRATION FOR CHILDREN AND YOUNG PEOPLE 0-16 YEARS	**Type: Clinical Guidelines** **Register No: 10102** **Status: Public**

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Related Trust Policies (to be read in conjunction with)	04071: Standard Infection Prevention Precautions Policies 04072: Hand Hygiene Policy 04090: Moving and Handling Policy 11046: Observation policy CYP 07051: Infant CPAP therapy 12017: Use of Emergency Oxygen in Adults 12028: High flow nasal cannula therapy (HNFC) – Optiflow TM for adults, adolescents and children more than 8 years

Document Review History:

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1.0	Caroline Fox	23rd September 2010
2.0	Andrea Stanley	11th February 2015
3.0	Mary Stebbins	14th June 2018

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1.0 Purpose

1.1 To ensure the safe administration of oxygen for paediatric patients, to achieve optimum tissue oxygenation as indicated by the target range of saturation prescribed on the prescription chart.

2.0 Scope

2.1 These guidelines set out the principles for administrating oxygen and the different routes available in children and young people (up to their 16th birthday).

2.2 These guidelines are for the use of all nursing and medical staff caring for children and young people within Mid Essex Hospitals NHS Trust.

3.0 Background

3.1 Children and young people requiring oxygen have varying needs. Different illnesses, diseases, percentage/flow rate of oxygen required, age groups and compliance of child may require different delivery modes and devices in administration of oxygen.

3.2 Oxygen Therapy is the administration of oxygen at concentrations greater than that in ambient air with the intent of treating or preventing the symptoms and manifestations of hypoxia.

3.3 Definition of Hypoxia -: reduction of oxygen supply to a tissue below physiological levels despite adequate perfusion of the tissue by blood.

3.4 Oxygen Therapy assists in reversing hypoxia by raising the concentration of inspired oxygen. Hypoxia will, however, only improve if respiratory effort or ventilation and tissue perfusion are adequate. If ventilation is inadequate or absent, assisting or completely taking over the patient's ventilation is essential to reverse hypoxia.

3.5 Concentration of oxygen required is dependent upon condition; inappropriate concentrations have potentially serious effects, leading to pulmonary epithelial damage (broncho-pulmonary dysplasia), convulsions and retinal damage (particularly in neonates).

4.0 Roles and Responsibilities

4.1 Managing Director

The Managing Director is responsible for ensuring that processes are in place and are working. This responsibility is delegated to the Medical Director and Chief Nurse.

4.2 Chief Medical Officer and Director of Nursing

The Chief Medical Officer and Director of Nursing are responsible for ensuring that systems are in place to support the implementation of this policy.

4.3 **Associate Directors of Nursing and Clinical Directors**

The Associate Directors of Nursing and Clinical Directors are responsible for ensuring that systems are in place to support the implementation of this policy.

4.4 **Medical and Nursing Staff**

All medical and nursing staff have a responsibility to ensure they understand this policy and act on its contents in an appropriate way.

5.0 Administration of Oxygen

5.1 Oxygen must be regarded as a medication and the use of oxygen must be documented and prescribed for each patient (BMJ publishing 2006)

5.2 Oxygen should be delivered at the lowest concentration possible and for the shortest time possible.

5.3 Oxygen flow should be titrated to maintain adequate oxygen saturation as indicated by transcutaneous pulse oximetry SpO2 (percentage saturation), as requested on drug chart, or appropriate arterial or venous blood gas values, or as requested in medical records.

5.4 Oxygen saturation should be recorded where possible prior to the administration of oxygen, however, if a pulse oximeter is not immediately available oxygen should not be with-held.

5.5 In an emergency 15 litres per minute of high flow oxygen via a reservoir mask may be given for short term management until child is stabilized, then wean to within prescribed target oxygen saturation range.

5.6 Target Oxygen saturation for prescribed oxygen:

- For infants and children: 94-98%
- For neonates if full term 95-98%
- If preterm - 90-96% - please adjust according to arterial PO2 values to avoid hyperoxia especially in babies with birth weight < 1500 grams

5.7 Non emergency oxygen therapy must be given in accordance with the prescribed range on the prescription chart.

6.0 Indications for Oxygen Therapy

6.1 Any individual with one or more of the following:

- Peri and post cardiac or respiratory arrest
- Hypoxia - diminished blood oxygen levels (oxygen saturation levels of <92%) or appropriate arterial or capillary blood gas values.
- Acute and chronic hypoxemia (PaO2 < 9kPa or 65mmHg, SaO2 < 92%)
- Signs and symptoms of shock

6.2 Despite a lack of supportive data, oxygen is also administered in the following conditions:

- Dyspnoea without hypoxemia
- Postoperatively, dependent on instruction from surgical team
- Treatment of pneumothorax

6.3 There remains a lack of consensus regarding fundamental issues in the delivery of oxygen therapy to children and young people, but principle differences from adult care must be taken into account in the care of children.

- Assessment process - difficulty to obtain arterial blood samples
- Clinical conditions in infancy are exclusive although overlaps exist in adolescents
- Prognosis in infancy usually positive - children often require oxygen therapy for limited periods
- Many children require long term oxygen therapy overnight only, this differs from the 15 hours forming the adult long term therapy definition
- Low flow equipment is sometimes required
- Supervision from parent/carer essential

7.0 Long Term Oxygen Therapy (LTOT)

7.1 Long term oxygen therapy is the provision of continuous oxygen therapy for patients with chronic hypoxaemia, requirements vary between 24 hour dependency and dependency during periods of sleep. Principal aim is to improve symptoms and prevent harm from chronic hypoxaemia.

7.2 Any child likely to require LTOT for longer than 3 weeks should be considered for domiciliary oxygen.

7.3 Patient groups potentially affected by chronic hypoxaemia include:

- Chronic lung disease
- Congenital heart disease with pulmonary hypertension
- Pulmonary hypertension secondary to respiratory disease
- Interstitial lung disease
- Obliterative bronchiolitis
- Cystic fibrosis and other causes of severe bronchiectasis
- Obstructive sleep apnoea and other sleep related disorders
- Palliative care for symptom relief

7.4 If a child is on long term oxygen therapy the frequency of observations and monitoring can be adjusted in line with the clinical condition following assessment and evaluation.

8.0 Assessment of Patient

8.1 Baseline Assessment

- Wherever possible a set of baseline observations should always be obtained including CEWT score
- This should be documented appropriately on relevant trust paperwork

8.2 **Continuous Assessment of Child**

8.2.1 Regular clinical assessment, observations and CEWT (Children's Early Warning Tool) score should be an integral part of care, enabling the detection of changes in the child's condition.

8.2.2 Children requiring oxygen therapy should receive at least hourly observations and have continuous saturation monitoring.

8.2.3 Effort of breathing should be assessed including:

- Respiratory rate
- Use of accessory muscles
- Presence of wheeze
- Presence of stridor
- Grunting and/or nasal flaring
- Change in colour (cyanosis)
- Capillary refill
- Level of consciousness (AVPU)

8.2.4 Fluid balance should be closely monitored alongside the above

8.2.5 If Oxygen Requirements Increase
- Continue to monitor child and increase frequency of observations
- Inform nurse in charge and medical team as necessary

9.0 Safety Considerations

9.1 Ensure that adequate education re: safety of oxygen therapy, handling of portable cylinders is established

9.2 Oxygen should not be delivered in the vicinity of any naked flames.

9.3 Moving and handling of large oxygen cylinder must be carried out in accordance with guideline 04090 (Moving and Handling).

9.4 **Flow meters**

9.4.1 The correct flow meter must be used at all times.

9.4.2 Air flowmeters must be removed once not in use.

9.4.3 When a low flow oxygen meter is used a high flow oxygen meter should be available with the appropriate mask and connected on a second outlet in case of an emergency.

9.4.4 Low flow meters must be removed when not in use.

10.0 Documentation

10.1 Oxygen therapy must be prescribed as target level of oxygen saturation on prescription chart.

10.2 Oxygen flow rate in litres or percentage of oxygen delivered must be recorded on the observation chart.

10.3 As a minimum SaO2, respiratory rate, heart rate, capillary refill time, AVPU and CEWT score should be documented hourly and BP daily. The frequency should be adjusted as the child's clinical condition dictates.

10.4 Children Early Warning Tool score to be recorded with vital sign measurement

11.0 Choice of Equipment and Method used for the Delivery of Oxygen

11.1 Equipment is chosen to take into consideration the need and requirements of the patient. High concentration oxygen is usually delivered via incubator, humidified high flow nasal cannula (Optiflow/Airvo 2) or face mask. For concentrations below 50%, oxygen can be delivered via low flow nasal cannula, high flow nasal cannula Optiflow/Airvo 2) or a simple face mask.

11.2 Considering oxygen requirement and potential for tolerability of the child, delivery methods must be decided and potential methods of delivery are listed below.

11.3 The selection of an appropriate oxygen delivery device must take into account, clinical condition, the patient's size, needs and therapeutic goals:

- High Flow Nasal Cannula Oxygen (Optiflow/Airvo 2)
- Face masks
- Non re-breathe mask with reservoir bag
- Humidified oxygen
- Wafting
- Via nebulisation
- Tracheostomy
- Low Flow Nasal Cannula
- Via a ventilation Circuit
- Nasal CPAP

11.4 **High Flow Nasal Cannula Oxygen therapy: Optiflow for CYP**

Optiflow is a non-invasive oxygen delivery device which warms and humidifies high flow blended oxygen. Inspired oxygen between 21-100% is delivered to the patient via specifically designed Optiflow nasal or tracheostomy interfaces. Refer to the Optiflow for children and young people guideline in appendix 2 for details on use.

11.5 **Face Mask**

11.5.1 Masks are supplied in two sizes: child and adult. Children do not always tolerate face masks but it is important to ensure that the correct sized mask is used to ensure a good fit, enabling optimum oxygen delivery. It is not appropriate to use this type of mask for infants and small children.

11.6 **Simple Oxygen Mask (Variable flow masks)**

11.6.1 Vents in the mask allow for the dilution of oxygen. High concentrations of oxygen can be safely administered. If low concentration of oxygen (below 4 litres) required then there is a risk of a carbon dioxide build up. Minimum flow should be 5 litres to avoid re-breathing of carbon dioxide.

11.6.2 Variable flow rate oxygen mask

Flow Rate	5 litres	6 litres	8 litres
O2 concentration	35%	40%	50%

11.7 **Non re-breathe mask with reservoir bag**

Used for emergency situations due to a large reservoir that allows oxygen only to be breathed in by the child. This prevents the inhalation of mixed gases. The approximate oxygen received is 85%. To achieve this, the supply of oxygen should be 15 litres per minute which causes the bag to inflate and fill. Oxygen cannot be humidified but this device should only be used short term.

11.8 **Humidified oxygen**

11.8.1 This can be delivered via high flow nasal cannula (Optiflow/Airvo 2). Humidified oxygen should be utilised when high percentages of oxygen are required for prolonged periods i.e. greater than 6 hours and in those with chronic respiratory illness to prevent drying of the mucosa and secretions.

11.8.2 Low flow nasal cannula oxygen does not need to be humidified

11.9 **Wafting**

When conventional delivery methods are not tolerated, wafting of oxygen via a face mask has been shown to deliver concentrations of 30% - 40% with 10 litres oxygen per minute, to an area of 35 x 32cms from top of the mask. Wafting via green oxygen tubing has been assessed as appropriate for short term use only, i.e., whilst feeding. A standard paediatric oxygen mask placed on the chest can give significant oxygen therapy with minimal distress to the patient.

11.10 **Via nebuliser**

If the child is oxygen dependant nebulisers should be delivered via oxygen and not air.

11.11 **Tracheostomy**

Oxygen can be delivered via a tracheostomy mask, Swedish nose or via a tracheostomy adaptor used on the Optiflow system. Type of device used will take into account the child's individual needs.

11.12 **Low Flow Nasal Cannula**

- Nasal cannula is useful for infants who are obligatory nose breathers or for older children
- who require low flow oxygen (< 2 litre/min).
- Can be used for long-term oxygen use, whilst allowing the child to vocalise and eat.
- The concentration is often not controlled resulting in a low inspiratory oxygen concentration.
- The use of nasal cannula can in the sensitive child produce dermatitis and mucosal drying.
- The nasal cannula should occupy less than half the space in the nasal passage.
- Low flow rates of up to 2 litres per minute can be given comfortably due to inadequate humidification. Approximately 28% oxygen is received when 2 litres. Nasal cannula oxygen does not need to be humidified.

11.13 **Via a ventilation circuit**

Accurate measurement of inspired oxygen is difficult and pulse oximetry must be maintained. Oxygen can be delivered at various points throughout the ventilation circuit.

11.14 **Via an Ayres T piece – open ended bag**

Used frequently by anaesthetists and experience gives a reliable impression of the state of the lungs. This technique allows manual application of PEEP (Positive End-Expiratory Pressure). It is completely reliant on an effective oxygen source.

11.15 **Bag valve mask**

Comes in three sizes: 250mls, 500mls and 1500mls. The smallest one is ineffective even at birth. Two smallest bags have a pressure limiting valve set at 4.41 kPa (45 cm H_20) to protect the lungs from barotrauma (Damage caused to tissues by a change in pressure inside and outside the body). The reservoir bag enables the delivery of oxygen concentrations up to 98%. Without the reservoir bag it is not possible to supply more than 50% oxygen.

11.16 **Nasal CPAP** (refer to guideline 07051)

12.0 Positioning Of Oxygen Devices

12.1 Selection of a device is made at the start of therapy, after careful assessment of need and patient characteristics. The change from one type of device to another is based on a change in the patient's condition, patient preference, or ability to use a specific device. Oxygen therapy should be administered continuously unless the need has been shown to be associated only with specific situations e.g. exercise, feeding, or other stress.

12.2 **Nasal Cannula**: Position the tips of the cannula in the patient's nose so that the tips angle down within the nostril. Overlong tubing is uncomfortable, which may make the patient reject nasal cannula. Sore nasal mucosa can result from pressure or friction of tubing that is too long. Place tubing around the ears and under the chin. Educate patient and/or family re prevention of pressure areas on the back of the ear enabling optimum comfort for the patient. Infants and small children will need the tubing secured in place with tape.

12.3 **Face Masks:** Gently place mask over the patient's face, position the strap behind the head or the loops over the ears then carefully pull both ends through the front of the mask until secure. This ensures a comfortable fit and delivery of prescribed oxygen is maintained. Check that strap is not across ears and if necessary insert padding between the strap and head, to prevent irritation.

13.0 Staff Training

13.1 Staff responsible for delivery of oxygen should have demonstrated knowledge and skills related to:

- Oxygen delivery systems, including portable and piped and their limitations
- Assembly, care and use of oxygen delivery systems
- Identify and check the correct outlet is in use and remove flow meter/pipes when air not in use
- Performance of the necessary subjective and objective assessments in order to determine effectiveness of oxygen therapy
- Clinical assessment skills to recommend changes in oxygen therapy
- Provision of comprehension patient and lay care giver instruction

13.2 All medical and nursing staff to ensure that their knowledge, competencies and skills are up to date and in line with roles and responsibilities outlined above.

13.3 During the induction process, all junior medical and nursing staff will receive instruction on current policies and guidelines.

13.4 Medical and nursing staff will be kept up to date with teaching, ongoing case presentations and learning from outcomes.

13.5 Ongoing discussion as necessary will take place at all relevant operational and directorate meetings.

14.0 Equality and Diversity

14.1 Mid Essex Hospitals is committed to the provision of a service that is fair, accessible and meets the needs of all individuals.

14.2 An Equality Impact Assessment is attached to the policy at appendix 2

15.0 Infection Prevention

15.1 All staff should follow Trust guidelines on infection control by ensuring that they effectively decontaminate their hands between each patient.

16.0 Monitoring compliance with policy requirements

16.1 Any instances of non-compliance with this policy should be recorded on a risk event form in accordance with the Incident Policy.

16.2 The documentation audit will assess compliance of these guidelines.

17.0 Implementation and Communication

17.1 The policy will be uploaded on the Trust Intranet site and will be communicated to staff via staff focus.

17.2 The policy will be circulated to the Clinical Lead for paediatrics and Lead Nurse for children & young people for dissemination.

18.0 References

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Appendix 1

Selection of most appropriate method of delivery

Device	Approximate maximum FiO2	Can be humidified	Approximated age range	Comments
Nasal Cannula	30% (variable)	No	Any	Should not be humidified.
Simple face mask	35-50% High concentrations can be delivered safely	No	Any	Flow rate below 4 litres can potentially result in carbon dioxide retention. Minimum flow should be 5 litres to avoid re-breathing of carbon dioxide. Prolonged periods of high percentage oxygen should be humidified.
Non re-breathe face mask	85% 10-15 L required	No	12 months+	For use in emergency.
'Wafting'	21-40% 10 L required	Yes	Any	Conventional methods recommended if tolerated.
Optiflow	21-100%	Yes	Any	
Incubator	21-70%	Yes	Pre-term to newborn infant. (N>B> Consider size and weight of infant)	

Appendix 2

Optiflow for Children & Young People Guideline

1.0 Purpose

1.1 Used in conjunction with the oxygen administration guideline for children 0-16 years, the use of Optiflow in the paediatric patient can be undertaken safely.

2.0 Background

2.1 Optiflow is a non-invasive oxygen delivery device which warms and humidifies high flow blended oxygen. Inspired oxygen between 21-100% is delivered to the patient via specifically designed Optiflow nasal or tracheostomy interfaces.

2.2 The warmth and high humidity mean that very high nasal flows from 2 – 60L/min can be tolerated without adverse side effects and patient discomfort.

2.3 It allows delivery of a prescribed FiO_2 with reduced air entrainment and dilution. Optiflow/Airvo 2 may act as a bridge between low flow oxygen and nasal CPAP.

3.0 Benefits include:

Infant / Child	Clinician
More comfortable and tolerable than other respiratory therapies	May reduce the requirement for CPAP
Receives a more accurate level of oxygen	May reduce the need for intubation
Reduces the work of breathing	Easy to set up and maintain
Can enjoy greater interaction with parents and clinicians	More control and flexibility with delivery of a fraction of inspired oxygen (FiO2)
More likely to receive an uninterrupted oxygen flow	Easier holding of the infant
Less risk of upper airway trauma	Sedation may be reduced due to a more comfortable infant/child
Easier feeding/drinking/vocalising	May reduce length of stay

4.0 Indications

- Moderate / severe Respiratory distress from bronchiolitis or pneumonia
- Hypersensitive lung pathology e.g. asthmatics, bronchospasm
- Oxygen requirement of >30% or >2L/min via nasal prongs
- Oxygen requirement of >50% or 8L/min for more than 4 hours
- Respiratory support post extubation and mechanical intubation
- Respiratory support to children with neuromuscular disease.
- An alternative to CPAP or non-invasive ventilation

- Patients who may benefit from humidity/assistance with clearing secretions
- Oxygen delivery for tracheostomy's. Humidified air/oxygen prevents thickening of secretions, to help prevent blocking of tube
- Poor tolerance of face mask where the ability to eat, drink and vocalise is impaired.

5.0 Contraindications

- Blocked nasal passages / coanal atresia
- Presence of suspected basal skull fracture
- Maxillofacial trauma
- Any contraindications to CPAP

6.0 Potential Complications:

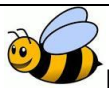
- Gastric distension
- Nasal Trauma
- Blocked nasal prongs due to secretions
- Pneumothorax

7.0 Clinical considerations

7.1 Nasal cannula

7.2 The size of nasal cannula used is dependent on the size of the patient's nares. The tip of the nasal cannula should fit into the nares and **must not** occlude any more than 50% of the space. The guidance below indicates the size of nasal cannula available and the approximate age and weight range for each of the different cannulas available.

Nasal Cannula sizes

	 Neonatal OPT 314	 Infant OPT 316	 Paediatric OPT 318	 Small adult OPT842
Maximum Flow rate	**8L/min**	**20L/min**	**25L/min**	**50L/min**
Appropriate age range	**27 weeks- 6 months**	**37 weeks – 3.5yrs**	**2 year – 8yrs**	**Over 8yrs**
Approximate Weight Ranges	**1-8kg**	**3-15kg**	**12- 22kg**	**Over 22 kg**

7.3 Flow rate

7.4 The minimum recommended starting flow rate for infants and children < 6 years is 5L/min. As a rough guide a maximum flow rate of 2L/kg/min can be used. In most cases a starting flow rate of 8-10 L/min will achieve the desired effect.

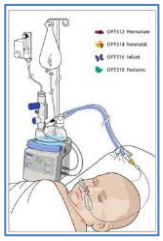
7.5 For children and young people > 8 years the minimum recommended starting flow rate is 10L/min. As a rough guide flow rates can be calculated as 0.5L/kg/min. For adults the

recommended starting flow rate is 35L/min. For older adolescents this option may need to be followed.

7.6 The maximum recommended flow rate for each individual cannula is listed in the table above and is written on the packaging.

8.0 Equipment

8.1 Optiflow Junior



- Optiflow high and low flow meter pole; oxygen/air blender with Fisher-Paykel MR850 heated humidifier
- 1 litre bag of sterile water
- Fisher-Paykel circuit (including chamber)
- Green oxygen tubing
- Optiflow nasal cannula (Neonatal, Infant, Paediatric)

8.2 Airvo 2 Junior (< 6 years)

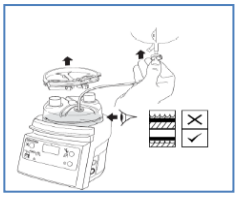
- Airvo 2 unit with high flow meter pole
- 1 litre bag sterile water
- Fisher-Paykel circuit (including chamber)
- Green oxygen tubing
- Optiflow nasal cannula (Neonatal, Infant, Paediatric)

8.3 Airvo 2 (> 6 years – adult)

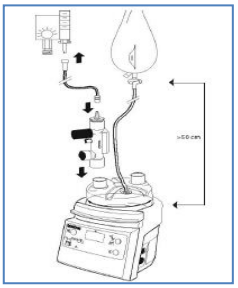
- Airvo 2 unit with high *flow meter pole*
- 1 litre bag sterile water
- Fisher-Paykel circuit (including chamber)
- Green oxygen tubing
- Optiflow nasal cannula (Small Adult)

8.4 The respiratory circuit and water chamber are single patient use and are to be changed every 7 days. These items should be disposed of at the end of therapy.

9.0 Procedure for setting up Optiflow Junior

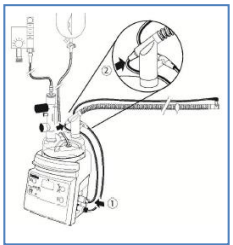


- Insert the humidification chamber to humidifier heater. Connect sterile water bag to chamber (auto filling) and check water level reaches the line on the chamber.



- Connect the circuit: Attach the pressure manifold to one of the outlets on the humidifier chamber and connect to the high flow meter with the green oxygen tubing.

- Attach the inspiratory limb of the circuit to the second outlet on the humidifier chamber. Connect the temperature probe and heater wire adaptor into the humidifier and then into the circuit



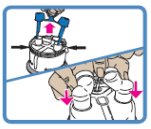
- Connect air and oxygen hoses to the wall supply. Plug in and switch on the humidifier and ensure it is on invasive

mode. Turn on the flow and allow the humidifier to warm up to 35-37 C. This will take approximately 10-15 minutes.

- Attach the circuit to the nasal cannula. Set required flow rate (as above). Set oxygen concentration as prescribed. Place nasal prongs in patient's nostrils and secure in place.

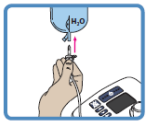
10.0 Procedure for setting up Airvo 2

- Fit the adaptor over the two vertical ports on the humidification chamber and push on fully then clip the water supply tube into position.

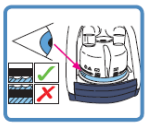


- Insert the chamber onto the humidifier heater section of the Airvo 2 unit by pushing down the finger guard and sliding into position until it clicks into place.

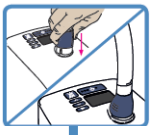
- **Connect sterile water bag.** Chamber will fill automatically. Ensure water bag is not allowed to run out to ensure continual humidification.



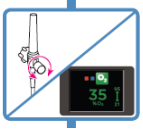
- Check that water flows into the chamber and is maintained below the line. If water level rises above the fill line, replace the chamber immediately.



- Connect the appropriate heated breathing tubing to the outlet on the top of the Airvo 2 unit. Push the sleeve down to lock.



- Connect oxygen hose to wall supply. This is only required for high flows. Connect green oxygen tubing to the oxygen outlet on the Airvo 2 unit. When using lower flow rates connect the green tubing to the wall oxygen flow meter to titrate oxygen requirement. When using higher flow rates connect the green tubing to the high flow meter on the pole to titrate oxygen requirements.



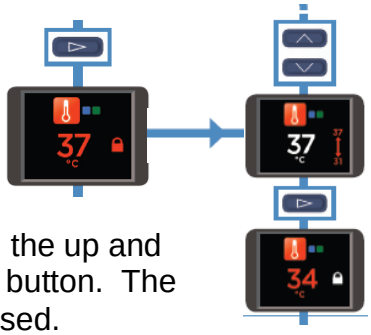
- Plug in and switch the Airvo 2 unit on.

- **Check the disinfection symbol is green.** Do not use the Airvo 2 on a new patient if the orange light appears. A swirl symbol remains while the Airvo 2 warms up.

- The Airvo 2 has a junior and standard (adult) mode. To move between the two modes press and hold the play (mode) button for 5 seconds. In junior mode a butterfly and bird will be displayed on the screen.

- **Configure target settings.** The dew-point temperature, flow rate and oxygen % will be displayed on the summary screen. To move between the settings press the play button to display each one separately.

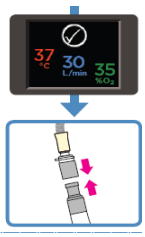
- **Set dew-point temperature.** In junior mode the temperature is set to 34C. In standard (adult) mode the temperature can be adjusted to 31-37C. To change the temperature, press the play button to display the temperature screen. To unlock the screen press the arrow keys simultaneously for 3 seconds. The temperature can then be altered using the up and down arrow keys. To lock the screen, press the play button. The screen will lock automatically if this operation is not used.



- **Set required flow rate**. To change flow rate press the play button to display the flow screen. To unlock the screen press the arrow keys simultaneously. The flow rate can then be altered using the up and down arrow keys. To lock the screen, press the play button. The screen will lock automatically if this operation is not used.

- **Set oxygen concentration as prescribed.** To titrate the oxygen % increase and decrease the flow of oxygen via the oxygen flow meter. The % of oxygen delivered to the patient will be displayed on the screen. N.B. Changing the flow setting will also have an impact on the oxygen setting.

- **Connect patient.** Place nasal prongs in patient's nostrils and secure in place. Connect patient interface to heated breathing tube. Airvo 2 is ready for use when the tick is shown in the summary screen.



11.0 Alarms

11.1 The Airvo 2 has visual and auditory alarms to warn about interruptions to treatment.

11.2 For temporary relief from audible alarms press the mute button. This will deactivate the alarm for approximately 2 minutes. The auditory alarms can be reactivated by pressing the mute button again.

11.3 Trouble shooting Airvo 2 Equipment

Message	Meaning	Affects delivery of:	Delays
Fault (E###)	**The unit has detected an internal fault and has shut itself down.** Switch the unit off and then restart. If problem persists, not the fault code and contact Fisher & Paykel Healthcare representative.	Oxygen humidity	< 5 seconds

Check tube	**The unit cannot detect the heated breathing tube.** Check that the heated breathing tube is not damaged and that it is plugged in correctly. If the problem persists, then change the heated breathing tube.	Oxygen humidity	< 5 seconds
Check for leaks	**The unit has detected a leak in the system.** The most likely cause is that the water chamber has been removed or has not been pushed in correctly. Check that the heated breathing tube is not damaged and that it is plugged in correctly. Check that the nasal interface is fitted. A leak alarm will be generated if an adult circuit and cannula are used in junior mode. Check that the filter is fitted.	Oxygen humidity	< 5 seconds
Check for blockages	**The unit has detected a blockage in the system.** Check the heated breathing tube or patient interface for blockage. Check the air filter and filter holder for blockage. Check whether the unit should be in junior mode. An alarm will be generated if a junior circuit and cannula are used in adult mode. The junior mode should be activated.	Oxygen humidity	< 10 seconds
O2 too low	**The measured oxygen level has fallen below the allowed limit (21`%).** Check that the oxygen source is still correctly connected. Adjust the level of oxygen from the oxygen source as necessary	Oxygen	< 20 seconds
O2 too high	**The measured oxygen level has exceeded the allowed limit (95%).** Adjust the level of oxygen from the oxygen source as necessary.	Oxygen	< 20 seconds
Cannot reach target flow	**The unit cannot reach the target flow setting.** Check the heated breathing tube or patient interface for blockage. Check whether the target flow setting is too high for the patient interface being used. The unit will choose appropriate new target settings. You will be prompted for acknowledgements. The oxygen concentration delivered to the patient can be affected by changes to the flow setting. Adjust the level of oxygen from the oxygen source as necessary.	Oxygen	10 +/- 1 minutes
Check water	**The chamber has run out of water.** When a chamber runs dry, the chamber float may be damaged. Replace the chamber and water bag. (Twenty seconds after the chamber is removed, the "check for leaks" alarm is activated. When the chamber is replaced, the unit enters Warm-up Mode and resumes normal operation). To ensure continual humidification, always ensure that the water chamber and/or water bag are not allowed to run out of water.	Humidity	Flows above 20L/min: < 20 minutes Flows of and below 20L/min: < 40 minutes
Cannot reach target temperature	**The unit cannot reach the target temperature setting.** You will be prompted for acknowledgement. The most likely cause for this is that the unit is operating at a high flow rate in low ambient conditions. Consider decreasing the target flow setting. The oxygen concentration delivered to the patient can be affected by changes to the flow setting. Adjust the level of oxygen from the oxygen source as necessary.	Humidity	30 +/- 3 minutes
Check operating conditions	**The unit has detected that it is operating in unsuitable ambient conditions.** Do not use the device when ambient temperature is less than 10 C. Do not use the device when the ambient temperature is greater than 30 C. This alarm may be	Humidity	60 +/- 6 seconds

	caused by a sudden change in ambient conditions (e.g. storing the unit in a cold place then using it in a warm place). Leave the unit running for 30 minutes. Switch the unit off and then restart.		
(Power out)	**The unit has been disconnected from the mains power supply.** No visual alarm. The auditory alarm will sound for 120 seconds.	Oxygen, Humidity	< 5 seconds

12.0 Monitoring response to Optiflow Therapy

12.1 Monitor patient's vital signs and CEWT score regularly paying close attention to respiratory rate, oxygen saturations, signs of respiratory distress and increased work of breathing

12.2 Assess child's response to therapy 30 minutes after commencing Optiflow. At this point flows can be increased if required. However, if patient is not responding to initial settings inform medical staff.

12.3 Re-assessment should occur at 1 hour following an increase in flow.

12.4 Within 2 hours it should be possible to see clinical stabilisation.

12.5 The FiO2 should be titrated to a target oxygen saturation of 94-98% unless otherwise specified. Oxygen should be reduced to ensure the minimal amount is delivered to meet the child's target saturation.

12.6 A patient requiring $FiO_2 > 0.5$ or who has rapid deterioration of oxygen saturation and/or marked increased in work of breathing should have a senior medical review. A blood gas analysis and/or chest xray should be considered

13.0 On-going Nursing Care

13.1 All children receiving Optiflow should have their vital signs and CEWT score assessed regularly to detect early signs of respiratory deterioration.

13.2 Ensure nasal prongs are clean and patent at all times. Use gentle suction to the nares as required to keep nares clear of secretions. Regularly check the position of the nasal prongs.

13.3 Check humidifier water level hourly and ensure sterile water bag does not run dry.

13.4 Check and record the humidifier temperature, flow and oxygen percentage hourly.

13.0 Weaning from Optiflow

13.1 When the child's clinical condition is improving it is recommended that the FiO2 be weaned to 0.3 or below prior to reducing the flow rate.

13.2 In infants and small children reduce the flow to 5L/min and in adolescents and young adults reduce the flow to 10L/min. Optiflow can be discontinued when the patient is able to tolerate lower flows. A low flow oxygen nasal cannula can then be used if the patient still has an oxygen requirement or oxygen therapy discontinued.

14.0 Cleaning and disinfection between patients

14.1 Switch off the unit and unplug from the power socket. Remove the single use heated breathing circuit and humidifier chamber and dispose of in clinical waste.

14.2 Clean the right hand port and the top port (outlet elbow) with a solution of warm water and mild detergent ensuring that the inside of the tube is clean from both ends. Do not clean the left hand chamber port as this will cause damage to the unit.

14.3 Wipe the outside surfaces of the unit with an alcohol wipe. Let it air dry.

14.4 Connect the red disinfection tubing and start the disinfection process immediately after cleaning by switching the unit on. The disinfection process takes 55 minutes after which the unit can be switched off.

14.5 The Airvo 2 can now be used on a new patient. Leave the red tubing attached to the unit to indicate that the disinfection process has taken place.

Appendix 3

Equality Impact Assessment (EIA)

Title of document: Oxygen Administration for Children & Young People 0-16 years

Equality or human rights concern. ***(see guidance notes below)***	**Does this item have any differential impact on the equality groups listed? Brief description of impact.**	**How is this impact being addressed?**
Gender	None	
Race and ethnicity	Patients and/or parents may require translation services.	Trust uses The Big Word for translation services.
Disability	Access to children's wards, emergency dept and OP clinics. Patients and/or parents with cognitive or sensory impairment may have difficulty with understanding information.	All facilities meet building standards. Hospital Liaison Specialist LD Nurse will support these patients and their families with LD
Religion, faith and belief	None	
Sexual orientation	None	
Age	Children may have difficulty in understanding procedures. Ensure the views of all children and young people are considered.	Hospital Play Specialist and parents/carers will support these children.
Transgender people	None	
Social class	Those patients with limited vocabulary or reading skills may have difficulty accessing and understanding patient information. Access to services and information may be affected by financial constraints.	Authors are directed to use short sentences, everyday language, and avoid the use of jargon. Information on transport and reimbursement of costs is available.
Carers .	Issues relating to race, ethnicity and disability may apply.	As above

Date of assessment: March 2018

Names of Assessor (s): Mary Stebbens