Management of acute Bronchiolitis

For more detailed information, please read the complete guideline

MODERATE
Moderate recessions
Moderate increase in RR
FiO2 <0.5 to maintain SpO2 >92%
Brief apnoeas

SEVERE
Severe recessions, tachypnoea, tachycardia
FiO2 >0.5 to maintain SpO2 >92%
Frequent apnoea (bagging not required)

LIFE THREATENING
Exhaustion, grunting, marked recessions
Hypoxia (Spo2 <88%) despite on HFNC O2 or CPAP
Respiratory acidosis pH <7.25
Apnoeas with desaturation requiring bagging

1) Essential care considerations
PEWS chart. Record RR, apnoeas , recessions.
Minimal handling, use PPEs as appropriate (COVID +ve),
Assess risk factors for severe disease*

2) A+B: Ensure airway patency.
Gentle clearance of secretions if safe.
Consider naso/orogastric tube to prevent abdominal distension if on NIV.

3) Oxygen therapy: Target SpO2> 92%, unless CHD (seek advice from cardiology).
1: NC supplemental O2 in moderate cases
2: HFNC O2: 2L/kg/min if increased WOB
3: CPAP 7-8 cm of H20
Reassess HR, WOB and RR frequently.

4) Fluids & Nutrition: Continuous/small volume, frequent NG feeds in moderate cases. If NG not tolerated or in severe cases, start IV Fluids (0.9%NaCl+5%D) and restrict to 2/3rd maintenance.
Aim for Urine output 1-2ml/kg/hr.

5) Treat with **antibiotics** in suspected bacterial infection (compatible Chest X-ray and blood findings) and in life-threatening cases.

Frequent review and reassess for therapeutic end point
Continue current management.
Wean as feasible.
If deterioration at any point reassess and step up management

INVASIVE VENTILATION
- Urgent Anaesthetic review for I+V
- Discuss with PaNDR need for transfer
- Ensure NGT in situ - aspirate
- 2 points of IV access
- Use Ketamine + Rocuronium for induction of anaesthesia (Refer to PaNDR intubation checklist/ guidelines)
- Secure ETT
- Sedate and paralyse adequately.
- Post intubation chest X- ray

GENERAL VENTILATOR SETTINGS
Aim for Tidal Volume 5-7 ml/kg
PIP- 15, RR< 30, Ti- 0.7 – 1.0, I:E - 1:2
PEEP 6-10 cmH2O depending on oxygenation
Aim for SpO2 >92% and permissive hypercapnia and pH >7.25

***RISK FACTORS FOR SEVERE ILLNESS**
Age under 3 months
Prematurity (particularly <32 weeks)
Chronic lung disease
Congenital heart disease
Chronic neurological and neuromuscular conditions
Immunodeficiency
Trisomy 21

THERAPEUTIC END POINTS

SpO2 > 92% and ability to wean FiO2
pH > 7.25 on capillary gas
Minimal hypercarbia/Normocarbia
No respiratory acidosis
HR<99th Centile
Urine Output > 1ml/kg/hr
No Apnoeas
RR in normal range for Age / decreased WOB

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- McKiernan C, et al. High flow nasal cannula therapy in infants with bronchiolitis. J Pediatrics. 2010
- F A Hutchings et al. Heated humidified high-flow nasal cannula therapy in children. Arch of Disease in Childhood July 2015

Guidelines for the management of bronchiolitis

1 Scope

For use within the Paediatric and Neonatal Decision Support and Retrieval Service (PaNDR) for the East of England.

2 Purpose

To provide guidance on diagnosis and management of children presenting with bronchiolitis.

3 Definitions

RSV – Respiratory Syncytial Virus
PICU – Paediatric Intensive Care Unit
SIADH – Syndrome if Inappropriate Antidiuretic Hormone Secretion
CPAP – Continuous Positive Airway Pressure
BiPAP – Bi-level Positive Airway Pressure
TAPVC – Total Anomalous Pulmonary Venous Connection
PAPVC – Partial Anomalous Pulmonary Venous Connection
AS – Aortic Stenosis
CLD – Chronic Lung Disease

4 Key Points

- Bronchiolitis is a clinical diagnosis
- No investigations should be routinely performed
- Management includes supporting feeding and oxygenation as required
- No medication should be routinely administered

5 Introduction

- Bronchiolitis is an acute viral lower respiratory tract infection, caused by RSV affecting younger children (<24 months of age) and most commonly in the first year of life, peaking between 3 and 6 months.
- It is a clinical diagnosis, based on typical history and examination.
- Bronchiolitis typically begins with coryzal illness followed by onset of one or more of:
  - Persistent cough
  - Tachypnoea
  - Chest retractions
  - Widespread crackles or wheeze
- Young infants with this disease (<6 weeks of age) may present with apnoeas without other clinical signs.
- Peak severity is usually at around day two to three of the illness with resolution over 7–10 days
- Usually self-limiting, often requiring no treatment or interventions.
- Even in cases where child needs PICU admission, outcomes are good in the vast majority of cases.

6 Aetiology

- Viral
  - RSV: the most frequent – 75%
  - Others (10-20%): Metapneumovirus, Adenovirus, Parainfluenza, Influenza, Enterovirus, Rhinovirus, Bocavirus
- Bacterial
  - Mycoplasma pneumoniae, Chlamydia (uncommon)

Other non-respiratory ways of presentation:
Apnoea (central or obstructive), encephalitis, myocarditis, arrhythmias, SIADH.

7 Risk Factors For More Serious Illness

- **Age under 3 months**
- **Premature birth, particularly under 32 weeks**
- **Chronic lung disease**
- **Congenital heart disease**
- **Chronic neurological and neuromuscular conditions**
- **Immunodeficiency**
- **Trisomy 21**

Infants with any of these risk factors are more likely to deteriorate rapidly and require escalation of care.
Consider hospital admission, even if presenting early in the illness, even with mild symptoms.

8 Assessment Of Severity

This table is meant to provide guidance in order to stratify severity. The more symptoms & signs the infants have in the mod-severe categories, the more likely they are to develop life-threatening disease.

	MILD	MODERATE	SEVERE	LIFE THREATENING
Behaviour	Normal	Some / intermittent irritability	Increasing irritability and / or lethargy Fatigue	Altered consciousness
Respiratory rate (RR)	Normal–mild tachypnoea	Increased RR	Severe tachypnoea, Tachycardia	Respiratory acidosis (pH < 7.2) despite CPAP/ BiPAP
Use of accessory muscles	Nil to mild chest wall retraction	Moderate chest wall retractions Suprasternal retraction Nasal flaring	Marked chest wall retractions Marked suprasternal retraction Marked nasal flaring	Exhaustion, grunting, marked respiratory distress
O2 requirement/ SpO2	SPO2 >92% (in room air)	FiO2 < 0.5 to maintain saturations >92%	FiO2 < 0.5 to maintain saturations >92%	Hypoxia (saturations < 88% despite maximum deliverable oxygen)
Apnoeic episodes	None	May have brief apnoea	Increasingly frequent or prolonged apnoea (No bagging required)	Apnoeas with frequent desaturations and requiring bagging.
Feeding	Normal	May have difficulty with feeding or reduced feeding	Reluctant or unable to feed	

9 Differential Diagnoses

- Tachypnoea with new chest x-ray changes - Bacterial bronchopneumonia, Aspiration secondary to reflux, TAPVC or PAPVC.
- Isolated tachypnoea / recessions—Underlying airway abnormalities/ tracheo-bronchomalacia.
- Tachypnoea + Poor perfusion + Murmur — Cardiac disorders (Coarctation / Critical AS).
- Apnoea—Pertussis, NAI, sepsis, metabolic disorders.
- Older children— Foreign body inhalation, Asthma, Anaphylaxis, CLD.
- Bronchiolitis may precipitate heart failure in some children with congenital heart disease (just as any other infection or inflammatory pathology would).
- Sepsis

10 Investigations

In most children with bronchiolitis no investigations are required.
Investigations should only be undertaken in children who are at the severe end of the bronchiolitis spectrum/ when there is deterioration or diagnostic uncertainty (e.g. cardiac murmur with signs of congestive cardiac failure).

- Blood gas
- Nasopharyngeal aspirate (viral and bacterial)
- Blood cultures
- Chest x-ray (CXR)
- Urine culture (in case of persistent high fever)
- COVID 19 swab

11 Management Of Mild Disease

- Fit for discharge with "safety netting"
- Minimal respiratory distress
- Respiratory rate within normal range for age.
- SpO2 > 92%
- Feeding >50% of requirements
- No risk factors and >3/12 age
- Parents happy for discharge and no significant social concerns.

12 Management Of Moderate Disease

Management principles on ward / HDU:

- Supplemental O2 to maintain oxygen saturations >92% unless congenital heart disease (seek advice)
- Apnoea monitoring if required (history, <2 months)
- Minimal handling, reduce blood gases.
- Suction nasal secretions if obstructed with mucus.
- In failed oxygen therapy start non-invasive respiratory support by humidified high flow nasal cannula at 2 L/kg/min or CPAP 5-6cm H2O. Reassess frequently.
- Continuous or small volume, frequent nasogastric feeds if possible.
- Reduce enteral fluid intake to 50ml/kg/day (risk of fluid overload/hyponatraemia/seizures)
- If IV fluid required-must be isotonic (e.g. 0.9% sodium chloride with 5% glucose). If acidotic to consider balanced salt solutions.
- Consider requesting a chest physiotherapy assessment in children who have relevant comorbidities (for example spinal muscular atrophy, severe tracheomalacia) when there may be additional difficulty clearing secretions.

13 Management Of Severe and Life-threatening Bronchiolitis

Initial management:

- Ensure airway patency.
- Ensure nose not blocked with secretions (0.9% saline +/- gentle suction may be needed).
- Give oxygen to achieve SaO2>92% (preferably humidified)
- Monitor for apnoeas (especially if age <6 weeks).
- Consider naso/orogastric tube to prevent abdominal distension. Leave on free drainage and actively decompress if on NIV.
- Keep NBM if severe respiratory distress or FiO2> 0.5 (in patients anticipated to need intubation). Restrict intravenous fluids to 2/3rd maintenance, choice of fluid depending on trust policy. BEWARE OF SIADH.
- Aim for urine output 1 – 2ml/kg/h. If not, may be dehydrated and need more fluid (consider a fluid bolus of balanced solutions [10 – 20ml/kg] if acidotic or if haemodynamically unstable).
- Antibiotics should be started if strong evidence of bacterial infection or if severe disease.
- Chest physiotherapy assessment in relevant patients.

Respiratory support
NON-INVASIVE VENTILATION:

- Consider HFNC (high flow nasal cannula oxygen) and/or CPAP for respiratory support in case of worsening respiratory distress
- Evidence suggests that CPAP of 7 to 8 cm H_2O is optimal
- If HFNC is used, use 2 L/kg/min as gas flow rate (for infants <12kg, weight banded for >12kg)

Consider early anaesthetic review for intubation if:

- Exhausted, increased work of breathing.
- Recurrent, persistent/prolonged apnoeas.
- Reduced conscious level.
- Worsening hypoxaemia (SpO2 <91% with FiO2 >60%).
- Worsening hypercarbia and respiratory acidaemia despite medical treatment

Intubation
Life threatening bronchiolitis often requires direct intubation and ventilation.
Refer to PaNDR intubation checklist and guideline.

- Optimise pre-oxygenation.
- Decompress stomach by nasogastric tube aspiration.
- Fluid bolus and resuscitation drugs available.
- 2 point IV access
- Choose appropriate endotracheal tube (ETT) to minimise leak.
- Ensure end tidal ($ETCO_2$) monitoring available.
- Consider modified rapid sequence induction with Ketamine (bronchodilator activity) and Rocuronium (see Intubation guideline for dosing)
- Cuffed ETT is preferred and do not cut ETT tube.
- Post intubation CXR
- Refer to RCPCH guidelines for managing children with bronchiolitis during COVID 19.

Management after intubation.
Lung protective strategy should be applied for ventilation

- Limit Peak Inspiratory Pressures (aim < 30 cm H20)
- Aim for Tidal volume 5-7ml/kg
- Use PEEP (6 – 10 cmH20 depending on oxygenation).
- Avoid rates > 30, may lead to gas trapping (recommended inspiratory time 0.7 to 1.0 sec)
- I:E ratio start with 1:2 (may need 1:1 in severe illness)
- Aim for saturations > 92% and permissive hypercapnia and pH > 7.25.
- Sedation and paralysis for maintaining ventilation (refer to PaNDR drug calculator for dosing guidelines)
- Beware of progressive hyperinflation and gas trapping presenting as low minute volume and rising pCO2. May have to disconnect from ventilator and perform manual decompression of chest**.**

14 Transport Consideration

- Keep patient adequately sedated and muscle relaxed with appropriate hemodynamic monitoring
- ETCO2 is mandatory during transport
- If having problems with clearing CO2, minimise dead space
- Troubleshooting difficulties on ventilator- **DOPES**
  - **D**isplaced ETT-check ETCO2 and exact length of tube
  - **O**bstruction- suction ETT and check passes to end of ETT
  - **P**neumothorax-clinical examination- can be difficult to exclude if chest hyper-expanded due to air trapping
  - **E**quipment- check ventilator settings including O2, tubing disconnection.
  - **S**tomach- Ensure decompressed with nasogastric tube

    Assess DOPES first, CXR if problem not resolved

15 Weaning

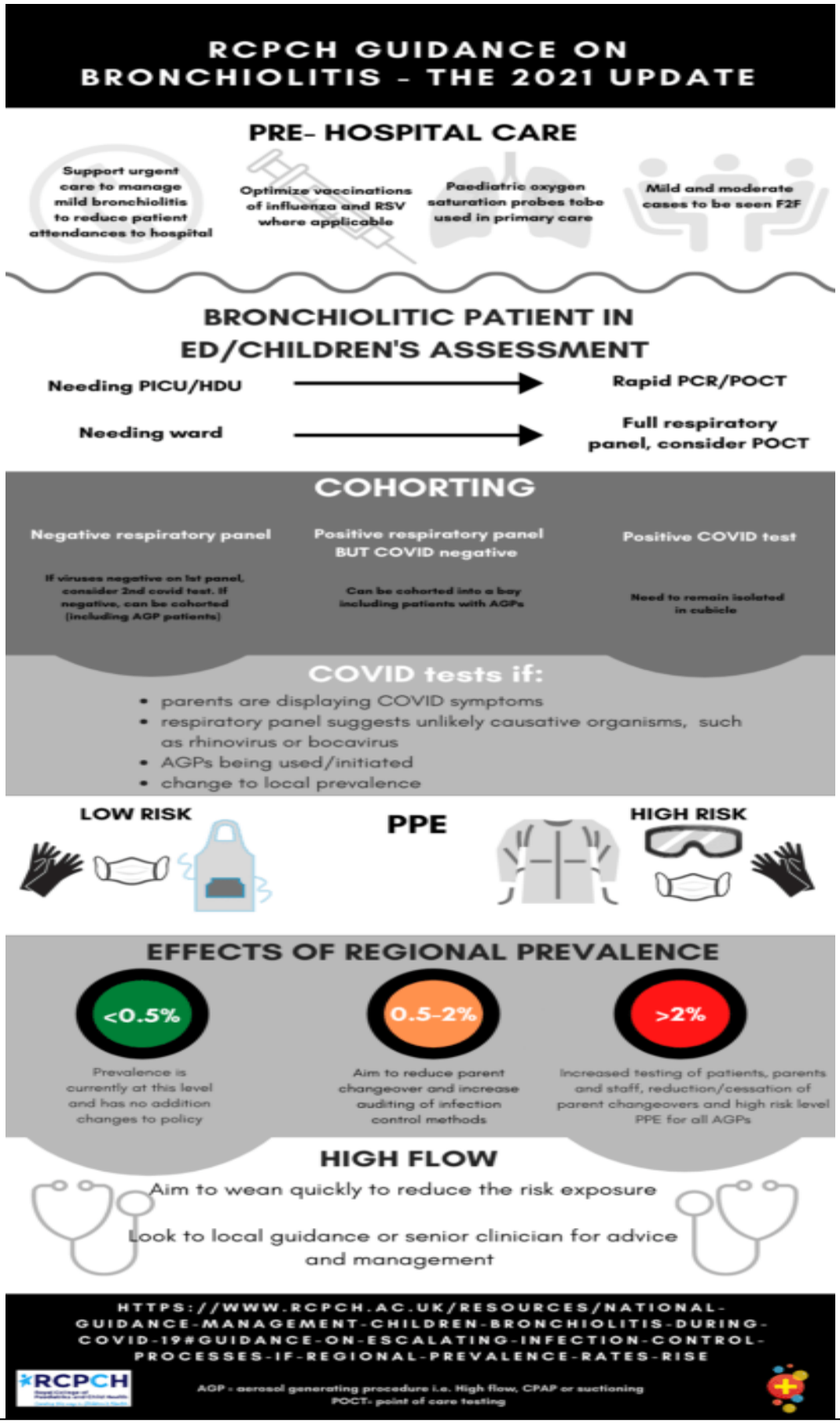
Relative Indications For De-Escalating Care

- Ability to wean FiO_2 and maintain SPO_2 >92%.
- No apnoeas.
- Respiratory rate in normal for age/ decreased WOB.
- Minimal hypercarbia/ respiratory acidosis.
- Decreased irritability.
- Normocarbia / no respiratory acidosis.

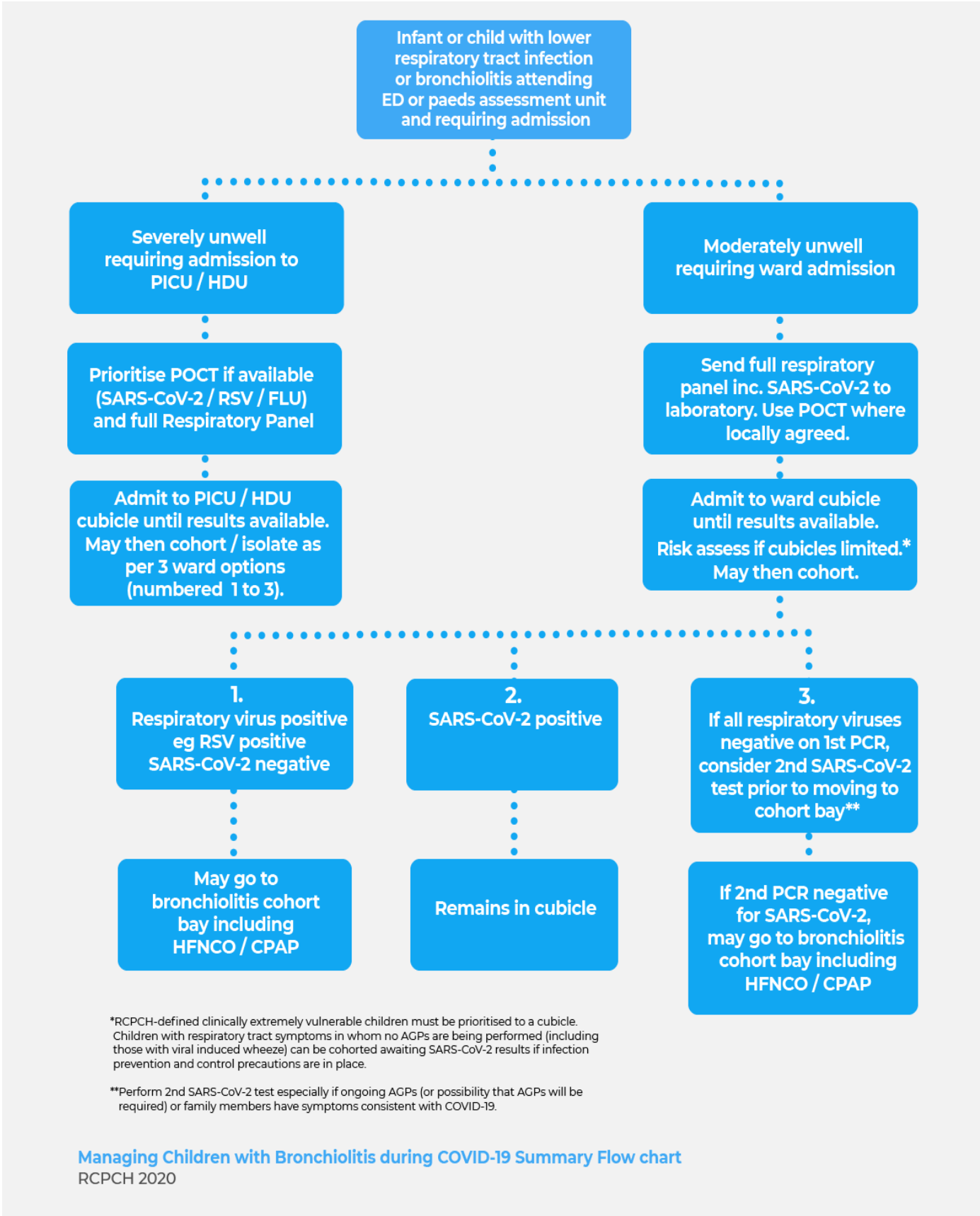
Weaning HFNCO

Patient weight	Starting flow rate	Weaning flow rate
<12kg	2l/min/kg	1l/min/kg
13-15 kg	30l/min	15l/min
16-30kg	35l/min	18l/min
31-50kg	40l/min	20l/min
>50kg	50l/min	25l/min

Appendix 1: RCPCH 2021 update guideline



Appendix 2: RCPCH 2020 guideline



Managing Children with Bronchiolitis during COVID-19 Summary Flow chart
RCPCH 2020

16 Monitoring compliance with and the effectiveness of this document

Note: It is not necessary to reproduce the questions below in the document but it is crucial that all the listed topics are covered. The questions and responses are for guidance only.

See appendix 3 (an extract from the developing Trust documents policy) for notes on how to complete this section.

17 References

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18 Associated documents

- PaNDR intubation checklist and guidelines
- ARDS – ventilation guideline

Equality and diversity statement

This document complies with the Cambridge University Hospitals NHS Foundation Trust service equality and diversity statement.

Disclaimer

It is **your** responsibility to check against the electronic library that this printed out copy is the most recent issue of this document.

Document management:

Approval:	September 2022 PaNDR Governance		
JDTC approval:	N/A		
Owning department:	Paediatric & Neonatal Decision Support and Retrieval Service		
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File name:	PaNDR Bronchiolitis Guideline		
Supersedes:	N/A		
Version number:	1	Review date:	September 2022
Local reference:		Document ID:	

Appendix 3: Monitoring compliance and effectiveness

Set out below are the issues which **must** be addressed when drawing up the monitoring section of a Trust document. It is important that a suitable process is chosen, one which will be followed through in practice and is appropriate for the document in question.

Note: It is not necessary to reproduce the questions below in the document but it is crucial that all the listed topics are covered. The questions and responses are for guidance only.

1. **What are the key standards of the document that will be monitored?**
   This should include the standards laid down in the document or any key performance indicators (KPIs), such as indicated by the NHS Litigation Authority or any other relevant external bodies (as appropriate).
2. **How will these standards or KPIs be monitored?**
   Consider what will be done in practice to monitor what is described in the document. The following is a list of suggestions which may be useful:
   - a formal audit (internal or external)
   - quarterly spot checks
   - review of reported incidents
   - inspections
   - risk assessments or risk reviews
   - patient/staff surveys
   - complaints monitoring
   - sickness/ absenteeism levels
   - training records.

   An example of a KPI might be that '85% of all patient complaints are resolved within 14 days' or that '95% of patients surveyed are happy with the service received.' The KPI will vary according to the practice area and document type.
3. **Who will be responsible for conducting the monitoring?**
   Please state in the document, for each type of monitoring listed, whether it is an individual (no names needed, just the job title) or a group or committee who will be responsible.
4. **How frequently will the standards or KPIs be assessed?**
   Please state how often the monitoring will take place: eg daily, weekly, monthly, quarterly, annually or by spot checks.
5. **Who will review the results of the monitoring?**
   Please state who will be responsible for looking at the results of the monitoring; identifying any shortfalls which come to light, and most importantly, what will be done to address any shortfall.
6. **Responsibility for implementation of any actions needed**.
   Once actions have been identified as a result of (5) above, whose responsibility will it be to ensure any actions are followed through? Will it be an individual or a committee or group? – please state which. Please also state how the results of any implementation will be recorded or evidenced.