

Title:	Guidelines for Management of Severe and life-threatening Bronchiolitis Reference Number: PCCN2
Version:	Version 3
Supersedes:	Guidelines Management of Moderate to Severe Bronchiolitis (2016) version 2
Application:	Patients – Children only Recommended for use for the management of paediatric patients less than 24 months of age in district general hospitals in the North West and North Wales Paediatric Critical Care ODN with severe and life-threatening bronchiolitis for whom transfer to tertiary paediatric intensive care unit may be considered. Local ratification is also advised. Please follow appropriate local / national guidelines such as NICE for less severe cases.

Originated / Modified By: Designation:	Version 3 modified by: Eamonn Coleman, Paediatric Anaesthetic SCF, NWTS & Alder Hey Children’s Hospital Luke Winslow, Paediatric Anaesthetic CF, NWTS & Alder Hey Children’s Hospital Sam Ellis, ANP PICM, NWTS & Alder Hey Children’s Hospital Kate Parkins, PICM Consultant, NWTS Version 1 & 2 Originated / Modified By: Nayan Shetty, Consultant PICM, Alder Hey Children’s NHS Foundation Trust & NWTS Rajesh Phatak, Consultant PICM, Royal Manchester Children’s Hospital & NWTS
Reviewed by:	North West & North Wales Paediatric Critical Care Operational Delivery Network
Ratified by:	RMCH (Host Trust): - Paediatric Medicines Management Committee (MMC) - Paediatric Policies & Guidelines Committee
Date of Ratification:	08.04.22
Ratified by:	AHFT:CDEG (Clinical Development & Evaluation Group)
Date of Ratification:	06.06.2022

Planned Review Date:	3 years
Responsibility of:	Clinical lead North West & North Wales Paediatric Critical Care Network & NWTS guideline lead consultant and nurse

Issue / Circulation Date:	08.06.2022
Circulated by:	NWTS & North West & North Wales Paediatric Critical Care OD Network
Dissemination and Implementation:	Via network circulation lists
Date placed on NWTS website:	08.06.2022

Summary Amendments to version 3:	1) Clarification of risk groups 2) Revised escalation, stabilisation and de-escalation pathways 3) Clarification of discharge criteria 4) Updated references
Minor Amendment (If applicable) Notified To:	Not applicable
Date notified:	
EqIA Registration Number:	126/12

1. Detail of Procedural Document

Guidelines for Management of Severe or Life-Threatening Bronchiolitis in Children

This guideline is for use by staff working in the District General Hospitals of the North West (England) and North Wales region and NWTs team to use when caring for those UNDER 24 months of age with an severe or life-threatening bronchiolitis. It focuses on acute management and potential differential diagnosis that need to be considered.

This does not replace an acute referral to NWTs team for advice on management, but is designed to help both NWTs and the referring team throughout the acute stabilisation period.

Please follow local or NICE guidelines for management of less severe cases of bronchiolitis

2. Equality Impact Assessment

EqlA registration Number for RMCH:	126/12
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3. Consultation, Approval and Ratification Process

This guideline was developed with input from:

- North West (England) and North Wales Paediatric Transport Service (NWTs) - medical & nursing
- Representatives from the District General Hospitals within the North West (England) & North Wales Paediatric Critical Care operational delivery network; includes medical, nursing and AHP (paediatrics, anaesthetics, and emergency medicine teams)
- Representatives from both Paediatric Critical Care Units (Royal Manchester Children's Hospital and Alder Hey Children's Hospital) - medical and nursing

These guidelines were circulated amongst the North West and North Wales Paediatric Critical Care Network for comments on 25.08.21

All comments received have been reviewed and appropriate amendments incorporated.

These guidelines were signed off by the Network's Joint Clinical Leads

For ratification process for network guidelines see appendix 1.

4. Disclaimer

These clinical guidelines represent the views of the North West and North Wales Paediatric Critical Care Network and North West and North Wales Paediatric Transport Service, which were produced after careful consideration of available evidence in conjunction with clinical expertise and experience.

The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.

Clinical advice is always available 24/7 from NWTs on a case by case basis via the referral line: 08000 84 83 82

Please feel free to **contact NWTs (01925 853 550)** regarding these documents if there are any queries.

Severe disease: $FiO_2 > 0.5$ to maintain $SpO_2 > 92\%$, $\uparrow HR$, $\uparrow RR$, $\uparrow WOB$, frequent apnoeas ($> 2/hr$) but not needing BVM
Life-threatening disease: $SpO_2 < 88\%$ despite high flow oxygen / NIV, respiratory acidosis ($pH < 7.25$) despite CPAP / BiPAP, exhaustion, grunting, apnoea needing BVM or frequent with desaturations +/- bradycardia
Monitor Heart rate, RR, pulse oximetry. Paediatric Early Warning Scores.

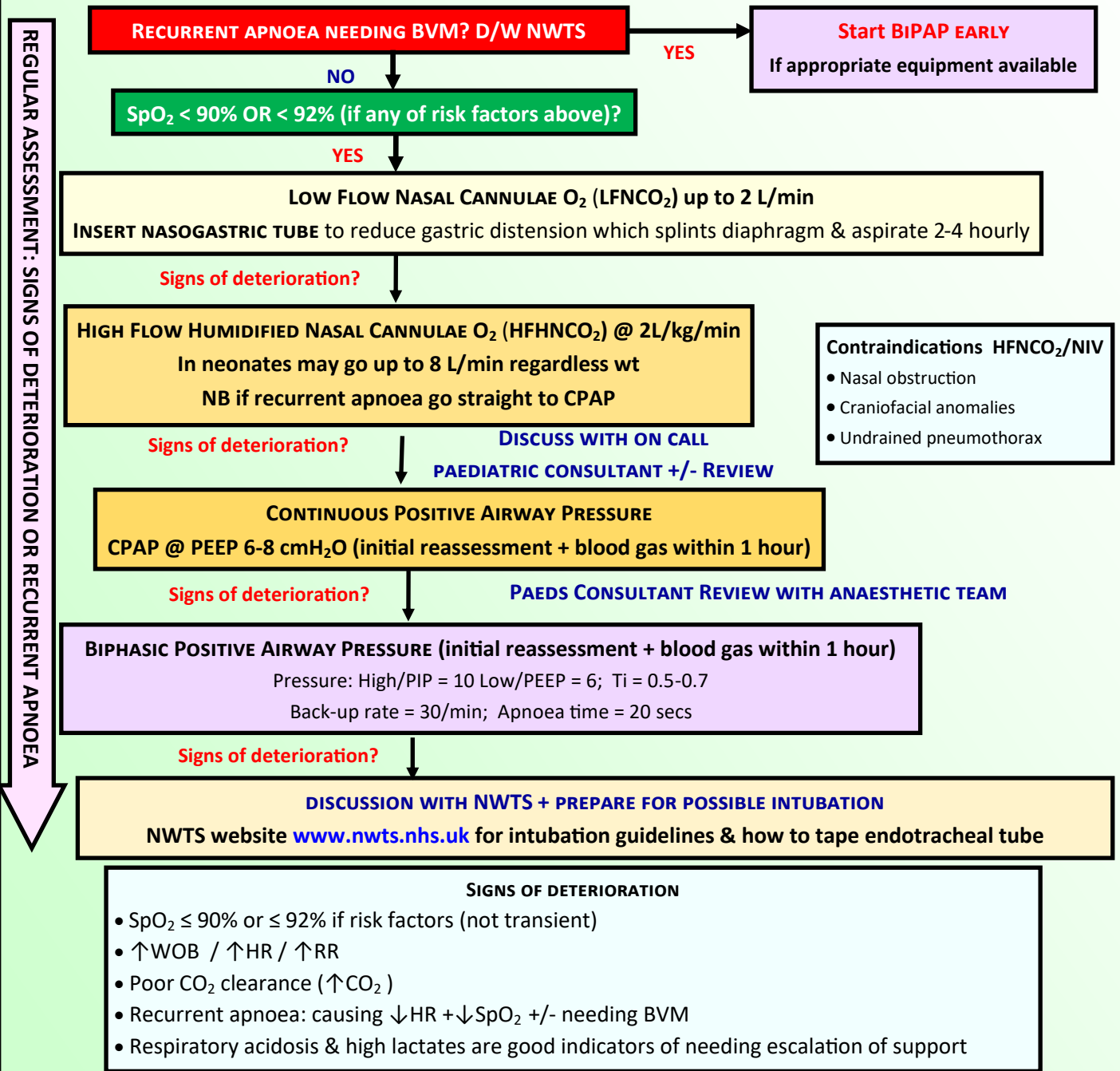
RISK FACTORS FOR SEVERE DISEASE:

- ◆ Less than 6 weeks CGA +/- less than weight 5 kg
- ◆ Prematurity (especially $< 32/40$)
- ◆ Chronic lung disease: especially if O_2 dependent

NB if any risk factors present aim for $SpO_2 > 92\%$

- ◆ Congenital heart disease & Cardiomyopathy
- ◆ Neuromuscular disorders
- ◆ Immune deficiency
- ◆ Trisomy 21

STRATEGY FOR ESCALATION OF CARE IN BRONCHIOLITIS



RECURRENT APNOEA'S:

- Transfuse PRC if $Hb < 100$ g/L. Keep $Hb \geq 100$ g/L to \downarrow apnoea frequency & severity, especially in ex-prem
- Consider Caffeine citrate 20mg/kg OR Aminophylline 5mg/kg IV loading dose. Limited evidence of benefit for either drug

Majority NIV CPAP / BiPAP machines used for those with bronchiolitis are designed for neonates.

Use appropriate size prongs/mask & check there is a good seal . Probably limited effectiveness for those ≥ 10 kg

OTHER MANAGEMENT OPTIONS TO PREVENT DETERIORATION

FEEDING / FLUIDS: Keep NBM if severe respiratory distress, $FiO_2 > 0.5$ or deteriorating
Start IV fluids 100 mL/kg/day; watch Na/fluid balance. If hyponatraemic restrict to 70 mL/kg/day (watch glucose)
Ideally use balanced crystalloid with glucose eg Plasmalyte 148 + 5% glucose. Avoid hypotonic intravenous fluids

POSITIONING: ELEVATE head of cot (45°) + change position 2-4 hourly eg supine, right or left side & prone positions
Prone: always place roll under pelvic & shoulder girdles to prevent diaphragm splinting.
Repositioning improves oxygenation & reduces risk of mucus plugging.
Use dummy & positioning to keep mouth closed & maintain PEEP

SUCTION: To clear blocked nose (0.9% saline drops +/- gentle nasopharyngeal suction). Review 2-4 hrly

CLUSTER CARES: eg turn, suction, change nappy 2-4 hourly. Aim: blood gases / medical review at same time

SEDATION: If non-pharmacological measures (eg swaddling, sucrose) don't work, consider chloral hydrate 10-15 mg/kg/dose NGT if struggling to achieve a "good seal" and compliance in agitated infant on NIV. If useful dose can be repeated 6-8 hourly. Avoid more frequent doses as risk of over-sedation in patient with an unprotected airway.

INDICATIONS FOR INTUBATION

- ◆ Failure (see page 3) to stabilise on NIV CPAP / BiPAP or HFHNC₂ for older infant / child
- ◆ Marked increased work of breathing (WOB), impending exhaustion
- ◆ Recurrent clinically significant apnoea's despite NIV ie \downarrow HR + \downarrow SpO₂ or depressed GCS
- ◆ \uparrow pCO₂ > 10 kPa with respiratory acidosis pH <7.25 despite non-invasive support (capillary gas)

INTUBATION—Print out Crashcall.com

See NWTS website www.nwts.nhs.uk for intubation guidelines & how to tape endotracheal tube

- ◆ Always use cuffed ETT (if possible): available from size 3.0 (microcuff) for those ≥ 3 kg
- ◆ Don't pre-cut ETT as this makes optimising ETT position and securing ETT much harder
- ◆ Don't forget to place an NGT & decompress the stomach prior to intubation if able

MANAGEMENT AFTER INTUBATION: DISCUSS WITH NWTS CONSULTANT

Initial Ventilation Strategy: aim for Tidal volume 5-8mL/kg; MAX 10 mL/kg with PEEP: 5 – 10 cmH₂O

- ◆ Ideally limit Peak Inspiratory Pressures < 30 cmH₂O (may need higher PIP)
 - ◆ Avoid rates > 30-40/min, to avoid gas trapping especially if wheezy
 - ◆ Set Inspired Time (T_i) 0.6-0.8 seconds. Aim for I:E ratio between 1:1 -1:2; OR 1:2-1:3 if wheezy (use slower rate)
 - ◆ Either appropriate sized Heat & Moisture Exchanger (HME) or active heated humidification via vent. circuit
 - ◆ Titrate FiO₂ as required to achieve SpO₂ > 92%. Tolerate permissive hypercarbia if pH > 7.15
 - ◆ Regular blood gases: 4-6 hourly (use capillary blood gases) with lactate
 - ◆ **Keep well sedated** during stabilisation: morphine +/- midazolam infusions plus boluses muscle relaxant
 - ◆ Usually settle on: morphine 20 microgram/kg/hr +/- midazolam 60-120 microgram/kg/hr + rocuronium 1 mg/kg
- Troubleshooting:** Check dead space in circuit & reduce if able
- ◆ **CXR** to visualise ETT tip (aim around T2 or midway between clavicles & carina) & check position NGT (aspirate air)
 - ◆ Check clinically & radiologically for pneumothorax or lobar collapse
 - ◆ **Suction** with saline lavage eg 0.9% sodium chloride 1-2 mL to relieve mucus plugging
Instil 0.9% NaCl, allow few breaths (either via ventilator or via bagging circuit) & then suction
 - ◆ Start **antibiotics:** 30-40% may have bacteria infection. Review need for antibiotics with culture results at 48 hrs.
 - ◆ Send blood & sputum cultures, & NPA for extended respiratory viral screen (including COVID PCR)
 - ◆ **Fluids/Feeding:** continue IV fluids at 100 mL/kg/day during stabilisation. Keep NBM if transfer within 4-6 hrs.
Aim for UO 1-2 mL/kg/hr. Watch blood glucose, biochemistry and fluid balance.
 - ◆ **Transfusion: Packed cells** only if Hb < 70 g/L in haemodynamically stable and easily oxygenated patient
Higher target threshold Hb 100 g/L for those haemodynamically unstable or in severe hypoxaemia or apnoea
may be used if patient deteriorating and may need intubation/ventilation

MANAGEMENT SEVERE BRONCHOSPASM IN THOSE UNDER 2 YEARS OLD

- ◆ Minimal evidence for benefit of nebulised salbutamol, ipratropium or hypertonic saline.
- ◆ Nebulised salbutamol or ipratropium is more likely to benefit older infant/child ie over 6-12 months; consider trial & review in this age group. NB if no improvement discontinue nebulisers
- ◆ **Consider** magnesium sulphate bolus IV +/- aminophylline bolus, then infusion—more likely to be effective
- ◆ IV salbutamol is unlikely to benefit this age group & may cause toxicity / harm (see NWTS asthma guideline)

POTENTIAL WEANING STRATEGY FROM OR BiPAP OR CPAP OR HFHNCO₂

NB NO GUIDELINE REPLACES CLINICAL JUDGEMENT

BIPHASIC POSITIVE AIRWAY PRESSURE STABLE FOR 24 HRS ON BiPAP + FiO₂ ≤ 50%

STABILITY CRITERIA—WEANING FROM BiPAP OR CPAP

SpO₂ > 90% (>92% if any risk criteria)

Good respiratory drive / no apnoea

Respiratory distress settled if ↑WOB previously a concern

Normal (or normalising) blood gas—pH, pCO₂ & lactate

Cardiovascularly stable and neurologically appropriate

Switch directly to Continuous Positive Airway Pressure (CPAP): start at 6-8 cmH₂O

CPAP once stable for 6-12 hours

Wean O₂ every hour

If SpO₂ > 95% reduce FiO₂ by 10% ie 50% to 40%

If SpO₂ = 90 - 95% reduce by 5% ie 50% to 45%

Wean PEEP when FiO₂ = 30-35% & stable for 4 hrs

STABILITY CRITERIA ON CPAP: PEEP = 4–6 cmH₂O + FiO₂ = 30-35% + SpO₂ > 90% for 4 hrs

RR within normal range for age (or condition)

No significant recession, tolerating time off CPAP during cares (up to 15 mins)

Consider switching to HFHNCO₂ or directly to LFNCO₂

HFHNCO₂ once infant stable for 6 hours

Wean FiO₂ until FiO₂ < 30%

Then reduce flow gradually to 1 L/kg/min

Once stable for 6 hours switch to LFNCO₂

LFNCO₂ once infant stable for 6 hours

Wean every hour that SpO₂ > 90% if stable

REGULAR ASSESSMENT: check stable/improving observations/PEWS plus regular blood gases as appropriate

If fails go back onto previous step/plan and review with senior paediatrician

FEEDING / FLUIDS

Usually opt for maintenance fluids 100 mL/kg/day unless hyponatraemic

If hyponatraemic fluid restrict to 70% maintenance ie 70 mL/kg/day

Offer comfort feeds via NGT as patient is starting to improve / stabilise

Start with small amount and check it is tolerated eg 2-5 mL/hour

When starting feeds there is a risk of splinting the diaphragm and vomiting, especially if on non-invasive support (BiPAP or CPAP). Therefore, avoid giving larger amounts with longer time interval between feeds

Initially give all feeds via NGT: gradually increase up to full feeds 100 mL/kg/day 2-3 hourly feeds

As tolerated and infant stable / improving switch to part oral +/- NGT top-up

Fluid balance: always keep an accurate in/out fluid chart when on any respiratory support, especially if any concerns eg hyponatraemia, AKI. Aim for urine output 1-2 mL/kg/hr (calculate every 4-6 hrs)

WHEN INTUBATED AND VENTILATED

IF TRANSFER IS DELAYED (keep in regular contact with NWTS):

FEEDS: Only consider enteral feeds once stable & lactate < 2 mmol/L. Start NG feeds 2-5 mL/hr. Gradually increase up to full feeds 100 mL/kg/day 2-3 hourly feeds.

Avoid feeds if transfer pending in next 4-6 hours.

Midazolam may be swapped for chloral hydrate 25 mg/kg/dose 3-6 hourly via NGT once stable and feeds started, but always d/w NWTS

SUGGESTED DISCHARGE HOME CRITERIA FOLLOWING ADMISSION FOR BRONCHIOLITIS

Consider discharge when observed and stable over previous 6-8 hours

SpO₂ > 90% in air (> 92% if any risk factors present see page 3)

Respiratory rate: less than 60 /min (under 1 year); < 50 /min (over 1 year)

Heart rate < 150 /min

Not requiring suction

Apyrexial

Taking 100 mL/kg/day enteral feeds

Breast feeds not lasting more than 25 minutes plus no maternal concerns re feed volume

Infants > 6 months and tolerating solids: aim approx. 600 mL/day

Regular wet nappies

Assess whether parents need further support via social services, health visitor or hospital at home

Check parents understand when to seek medical review

REGISTRAR REVIEW PRIOR TO DISCHARGE HOME

NB parent information leaflets re Bronchiolitis are available via:

<https://what0-18.nhs.uk/application/files/5215/1024/3272/>

[CS45385_NHS_Bronchiolitis_Advice_Sheet_Oct_17.pdf](https://what0-18.nhs.uk/application/files/5215/1024/3272/CS45385_NHS_Bronchiolitis_Advice_Sheet_Oct_17.pdf)

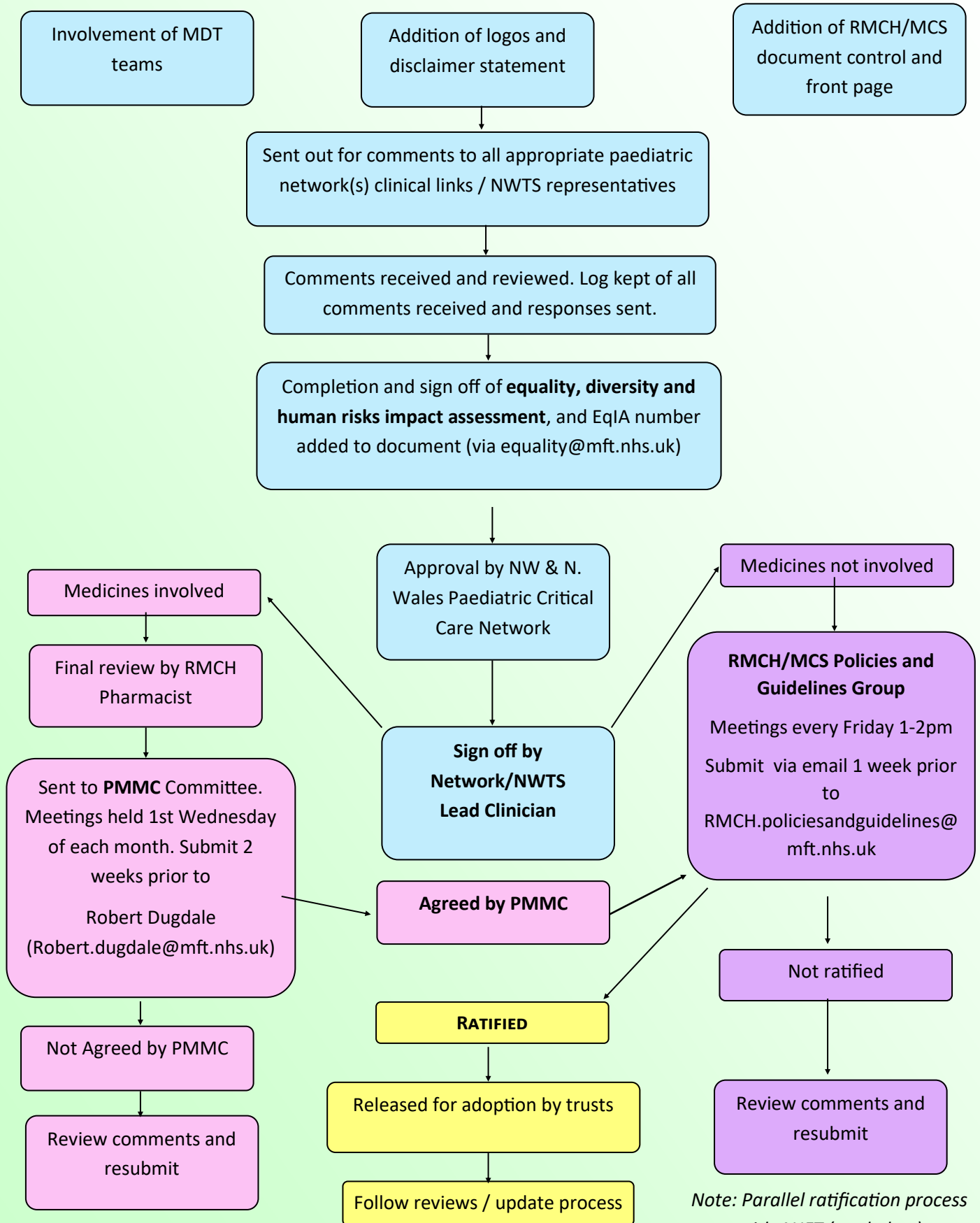
OR

<https://www.clinicalguidelines.scot.nhs.uk/parent-and-carer-information/bronchiolitis>

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- Bronchiolitis Guidelines** Alder Hey Children's NHS Foundation Trust 2019
- Other regional transport teams' Bronchiolitis guidelines:**
- | | |
|-----------|------------|
| SORT 2018 | STRS 2018 |
| CATS 2020 | WATCH 2021 |

Ratification of Guidelines with Host Organisation (MFT)

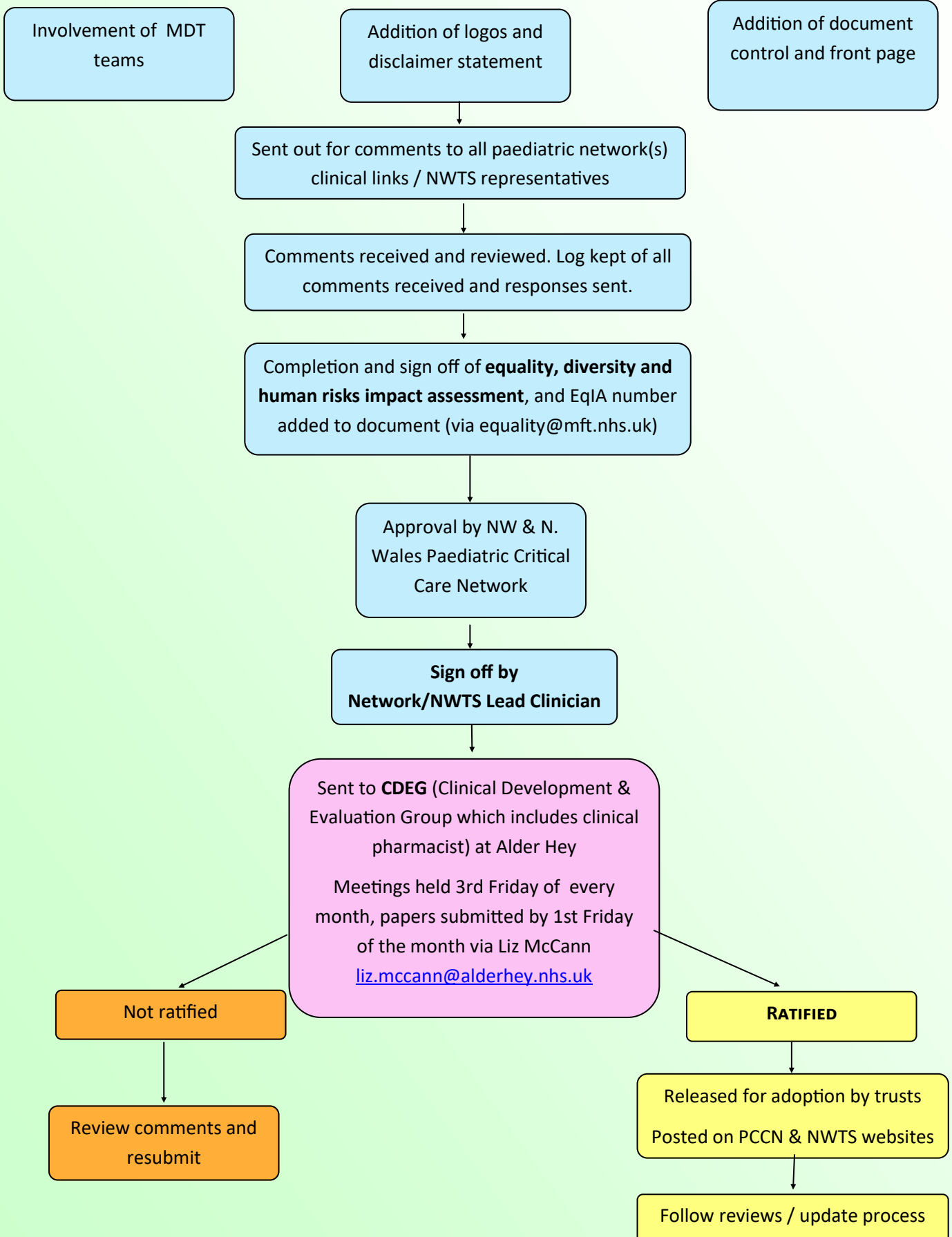


Note: Parallel ratification process with AHFT (see below)

Appendix 2 continued



Ratification of Guidelines with Alder Hey



Resources

www.crashcall.net - for intubation drugs / sedation regime

Contact numbers:

NWTS (North West & North Wales Paediatric Transport Service) referral line: 08000 84 83 82

NWTS enquiries / office: 01925 853 550

Regional Paediatric Intensive Care Unit Alder Hey Children's Hospital 0151 252 5241

Regional Paediatric Intensive Care Unit Royal Manchester Children's Hospital 0161 701 8000

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Please visit NWTS website for the most up to date version of this guideline: www.nwts.nhs.uk

