Health Education England

Delivering oxygen therapies: Mitigating risks & understanding oxygen consumption

NB: please ensure you are familiar with your local Trust guidance related to fire, catastrophic oxygen failure and associated escalation processes

17th January 2021

NHS England and NHS Improvement

Overview

This resource was designed as a high-level document to highlight the risks of a catastrophic event relating to oxygen use, limited supplies and failure. The following topics are covered:

- Catastrophic oxygen failure and mitigating the risks
- Oxygen consumption and good housekeeping guidance
- Risk of fire and mitigating actions

This resource is designed for all clinical staff working in areas delivering oxygen therapies. This document does not present any original guidance, national and regional guidance has been collated where appropriate. All guidelines used are referenced and linked in the relevant sections.

Contents

Catastrophic Oxygen Failure

A sudden increase in the use of oxygen may lead to a failure of oxygen delivery and a low pressure in the oxygen supply framework. If unmanaged this has the potential to cause malfunction of ventilators and other oxygen delivery devices with catastrophic clinical consequences for patients who are oxygen and pressure support dependent.

Essential to ensure both judicious use and careful monitoring of oxygen used.

Two Key Principles:

1. The safe management of oxygen including monitoring of oxygen usage and escalation process where levels are nearing or exceeding target gas flow rate.
2. Good clinical housekeeping for patients requiring oxygen therapy.

Mitigating risk of catastrophic oxygen failure

NICE Clinical guide for the optimal use of oxygen therapy during the coronavirus pandemic (see here)

To support prioritisation of oxygen flow for the most severely ill patients in hospital

- Oxygen prescribing targets for all adults treated in NHS hospitals should be adjusted from the current range (of oxygen saturation 94% - 98%) to oxygen saturation 92% - 96% in the first instance.
- COVID-19 infection and non-COVID-19 conditions (for example stroke, myocardial infarction, trauma) in adults should use this SaO2 target.
- Evidence from clinical trials suggests that hyperoxia may be harmful and lower oxygen target ranges are safe.
- A target range of 90% - 94% may be considered if clinically appropriate by hospitals according to prevailing oxygen flow demands.

For further clinical guidance see: ***COVID-19: Guidance for the use of CPAP or NIV for patients in Acute Hypoxaemic Respiratory Failure associated with COVID-19 (see Appendix, p.13)***

Good oxygen housekeeping

- Daily review of oxygen saturation targets by clinicians (ensure documented)
- Oxygen usage should be reviewed on a regualr basis as part of board rounds and clinical handover
- Check oxygen delivery device/positioning/kinking etc.
- Medical/nursing handovers should highlight if any patients are on high flow O2 or 15L O2.
- Location of emergency O2 cylinders on each ward should be known.
- Oxygen flowmeters are turned off when not in use
- Oxygen is turned off when patients no longer require it
- Review all equipment being used in order to identify opportunities for less O2 hungry kit
- Every patient on oxygen therapy has oxygen prescribed (as for any medication)

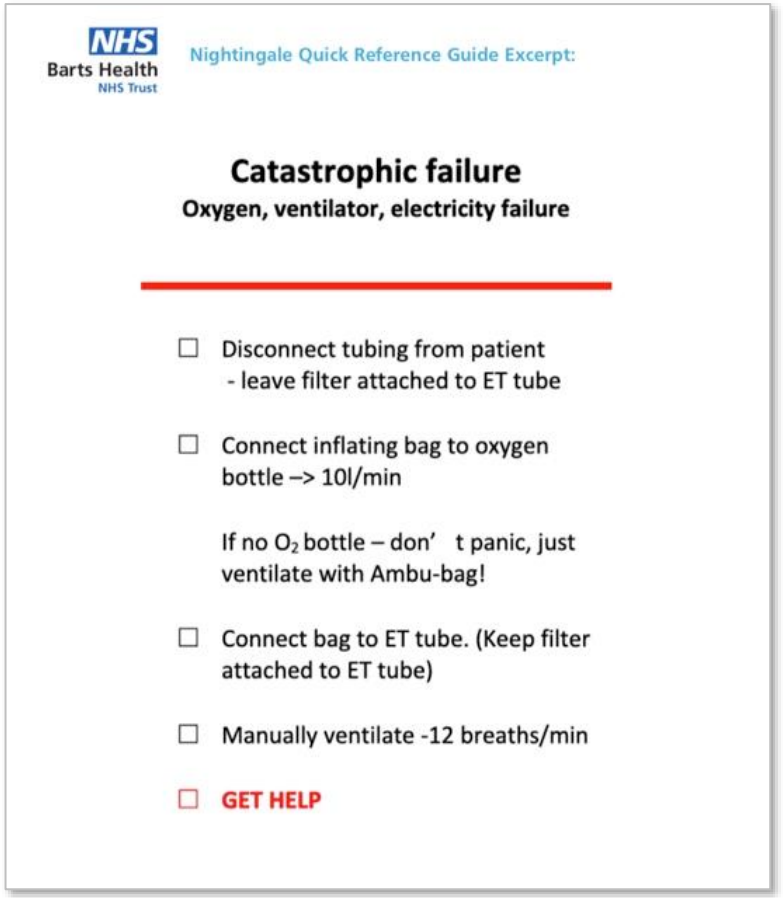
Oxygen and Ventilation Failure Critical Care Setting

2 lesson plans for educators are available via LTLC:

1. Oxygen and Ventilation Failure Green Lesson plan
   - 15 min lesson plan for healthcare workers with prior critical care experience
2. Breathing Amber Lesson plan
   - Part of a 60 min lesson plan for Registered Support Clinicians (RSC)

Learning Objectives

- State what to do in the event of mass (catastrophic) oxygen and ventilator failure
- List the steps to safely change from the ventilator circuit to a self-inflating bag (Ambubag) with HME/viral filter using an ETT clamp & connect oxygen cylinder to Ambubag
- Demonstrate how to safely hand ventilate a patient (rate & volume)
- Describe what it feels like when hand ventilation is ineffective & how to escalate to CC Nurse or Senior doctor


NHS Barts Health NHS Trust

Nightingale Quick Reference Guide Excerpt:

Catastrophic failure

Oxygen, ventilator, electricity failure

- ☐ Disconnect tubing from patient - leave filter attached to ET tube
- ☐ Connect inflating bag to oxygen bottle –> 10l/min

  If no O_2 bottle – don' t panic, just ventilate with Ambu-bag!
- ☐ Connect bag to ET tube. (Keep filter attached to ET tube)
- ☐ Manually ventilate -12 breaths/min
- ☐ GET HELP

Oxygen consumption (1/2)

The piped oxygen supply has a total capacity, each additional device drawing from the supply reduces the available capacity.

Risk: overwhelm the supply = Result: catastrophic oxygen failure

- Each Trust/ward will have its own procedures in the case of failure – ensure you know your plan!
- **High flow** oxygen therapies are the greatest concern
- Low flow oxygen therapies are less of a concern, but still place a demand on the overall supply.
    - Useful guide for helping estimate consumption

Escalate

- Oxygen capacity is closely monitored at Trusts and whilst it is not everyone's individual responsibilities to worry about oxygen supplies, it's good to have a basic understanding. If you are concerned escalate your concerns to the nurse in charge.

Know the plan!

- Ensure you are implementing “oxygen good housekeeping” in your unit**. See embedded CAS Alert**
- Ensure you know your Trust’s catastrophic oxygen failure plan.

HIGH FLOW O_2 Therapies – indicative consumptions

		Flow (L/min)						
		30	35	40	45	50	55	60
Fi02 (%)	30	3.4	4.0	4.6	5.1	5.7	6.3	6.8
	40	7.2	8.4	9.6	10.8	12.0	13.2	14.4
	50	11.0	12.8	14.7	16.5	18.4	20.2	22.0
	60	14.8	17.3	19.7	22.2	24.7	27.2	29.6
	70	18.6	21.7	24.8	27.9	31.0	34.1	37.2
	80	22.4	26.1	29.9	33.6	37.3	41.1	44.8
	90	26.2	30.6	34.9	39.3	43.7	48.0	52.4
	100	30	35	40	45	50	55	60

Table showing the relationship between flow and oxygen consumption for different levels of support (FiO2) for Airvo/Optiflow .

Useful app for looking at O2 consumption from Airvo 2 HFNO (Google play; Apple)

See appendix 1 (pg 11) for ranges used in clinical studies.

Oxygen consumption (2/2)

Non-invasive oxygen therapies

- There are a range of non-invasive ventilation devices with variable oxygen entrainment efficiency.
- Not all devices are appropriate for use in all clinical situations.
- The table below highlights where devices could be used and gives a relative 'efficiency' score for them (based on their oxygen consumption). Find the full document here.
- A detailed test report can be found here.

Device	Use for Covid-19 CPAP with high oxygen requirement? YES/ NO	Use for Covid-19 weaning from ventilation YES/ NO	Type-2 Respiratory failure or OSA/OHV YES/ NO	Efficient with oxygen consumption (1) Efficient - (3) Less Efficient	If entraining oxygen via green tubing into the machine or circuit (devices vary) at 15L/Min, and machine set at CPAP 10cmH_2O, what FiO_2 can be achieved?
Breas VIVO 1	NO	NO	YES*	-	-
Breas VIVO 2	NO	NO	YES	2	56
Breas VIVO 3	NO	NO	YES	2	62
NIPPY 4 +	NO	YES	YES	2	59
Breas VIVO 65	YES**	YES	YES	2	61
ResMed Lumis 150	NO	NO	YES	1	81
Philips Trilogy 202	YES	YES	YES	1	71
Philips Trilogy EVO	YES***	YES	YES	1	72
Lowenstein Prismavent-50c	NO	YES	YES	3	48
UCL Ventura	YES	NO	NO	3	-****

Note that mask leak may lead to automatic flow compensation requiring significant (up to 100l/min) rises in oxygen flow rates.

** With Dual Limb Circuit

*** With oxygen blending module (OBM)

**** For a patient on 10cmH20 CPAP and FiO2 0.6, flow rate will vary with respiratory demand between approximately 17 and 50 litres/min

Flow meters

Conventional oxygen flowmeters used in acute care can typically deliver a measured flow of oxygen up to 15 litres per minute (lpm). However, it is possible to increase the flow beyond the measured maximum of 15lpm by continuing to open the valve. In this way much larger flows can be achieved and may not be intended. These flows can far exceed the flows that can be delivered by a conventional face mask and can result in significant wastage – which in turn can also contribute to the risk of increasing ambient oxygen levels (pg8).

Venturi

Red: 40% FiO2, flow rate 10LPM

Green: 60% FiO2, flow rate 15LPM

Fire risk

All open circuit oxygen devices, such as CPAP, have the potential to leak oxygen into the atmosphere. This is intensified by high flow open circuits, such as HFNCO.

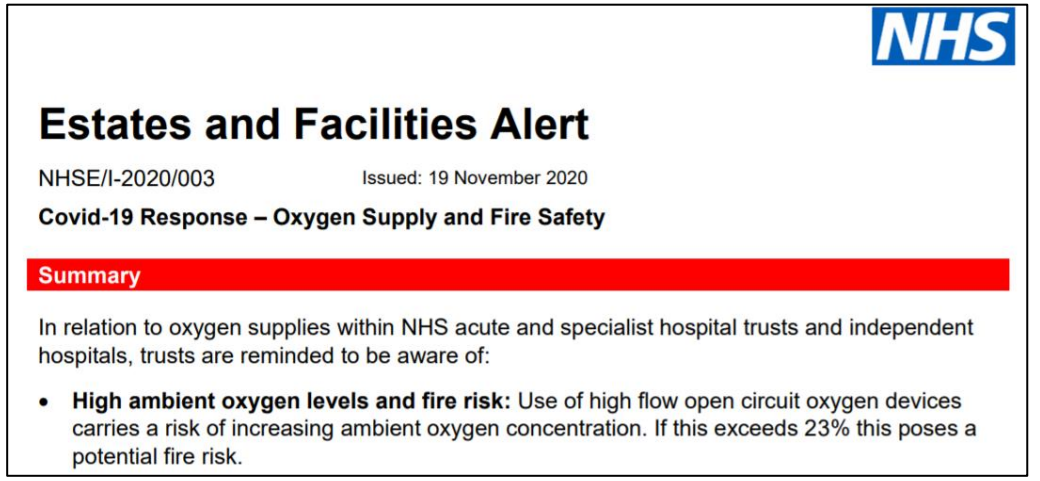
The Risk

- Increased ambient oxygen levels pose a significant fire risk.
- Some sources of ignition that do not ignite at 21% oxygen become flammable at 23% oxygen levels.
- Fires burn significantly faster and more intensely with even a very small increase in oxygen concentrations.

Covid: Romania hospital blaze kills at least 10 infected patients

14 November

Coronavirus pandemic



Estates and Facilities Alert

NHSE/I-2020/003 Issued: 19 November 2020

Covid-19 Response – Oxygen Supply and Fire Safety

Summary

In relation to oxygen supplies within NHS acute and specialist hospital trusts and independent hospitals, trusts are reminded to be aware of:

- **High ambient oxygen levels and fire risk:** Use of high flow open circuit oxygen devices carries a risk of increasing ambient oxygen concentration. If this exceeds 23% this poses a potential fire risk.

Mitigating the risk

1 Check

Check the ambient oxygen levels

- Trusts have been asked to regularly check ambient oxygen levels in areas with high levels of delivery of oxygen therapies.
- This should **never** exceed 23%.
- Ensure you know the escalation plan in case high ambient oxygen levels are detected.

2 Remove

Remove sources of ignition

- E-cigarettes, matches, electronic devices that are not needed at the bedside.
- Ensure clutter/waste is minimised.
- Do not use oil-based emollients or alcohol-based sanitiser on patients who are on oxygen or on yourself if you are close to them. Allow alcohol to evaporate a safe distance away first. All skin protectants and any emollients with white soft paraffin are flammable and must not contaminate oxygen equipment/valves.

3 Ventilate

Ensure good room ventilation and safe management of oxygen cylinders

- Where there is no mechanical ventilation system, windows should be kept open on wards and in side rooms to provide natural air flow and to safely dilute the oxygen level
- In a fire oxygen cylinders can explode, ensure they are suitably and safely stored in ward areas

4 Know

Know the plan!

- Ensure that you are familiar with your fire escalation plan – this is likely to have been reviewed in light of Covid-19.
- Ensure you are up to date with your mandatory fire training.
- Know the location of oxygen isolation points, Area Valve Service Units (AVSU) and the area served. These will indicate type of gas affected
- Know the location of medical gas indicator panels and how to respond following your local Trust plan.

References

Page	Document	Link
4	Clinical guide for the optimal use of oxygen therapy during the coronavirus pandemic	https://www.nice.org.uk/Media/Default/About/COVID-19/Specialty-guides/specialty-guide-oxygen-therapy.pdf
4, 6	Good Oxygen Housekeeping: Hospital Level Review	https://static1.squarespace.com/static/5e6613a1dc75b87df82b78e1/t/600ee828b92191007ecf9ae0/1611589672735/Hospital+level+checklist+for+oxygen+consumption+04012020.pdf
5	LTLC site – multiple training materials	https://www.e-lfh.org.uk/programmes/london-transformation-and-learning-collaborative-ltlc/
5	Oxygen and Ventilation Failure Green Lesson Plan NH	http://portal.e-lfh.org.uk/Component/Details/679575
5	Breathing Amber Lesson Plan	http://portal.e-lfh.org.uk/Component/Details/679535
6, 7	Safe use of oxygen in high demand inpatient settings	https://static1.squarespace.com/static/5e6613a1dc75b87df82b78e1/t/600ee8484955200b5b37a670/1611589705000/Quick+guide+to+NIV+devices.pdf
7	NIV/CPAP DEVICES REVIEW Provisional testing report to 16th July 2020	https://static1.squarespace.com/static/5e6613a1dc75b87df82b78e1/t/600ee74b9dfc5a5337fc01cd/1611589452322/Brompton+guide+to+NIV+devices.pdf
12	Range of flow ranges used in clinical studies for Optiflow HFNCO Therapy	https://www.fphcare.com/en-gb/hospital/adult-respiratory/optiflow/frequently-asked-questions/#q_protocol

Appendix:

1. Range of flow ranges used in clinical studies for Optiflow Therapy *(p.12)*
2. CPAP/NIV in COVID19 patients v1.01 *(p.13)*

Appendix 1: Range of flow ranges used in clinical studies for Optiflow HFNCO Therapy

Summary of range of flows used in clinical studies for Optiflow HF Therapy (F&P clinical studies)					
	Study	Clinical situation	Mean flow	Starting flow	Flow range
			L/min		
Respiratory distress	Mace et al, 2019	Acute hypoxemic respiratory failure (pneumonia)	50		
	Hernandez et al, Oct 2016	Extubated patients at high risk of reintubation	50		
	Hernandez et al, April 2016	extubated patients at low risk of reintubation	~30		
	Bell et al, 2015	Acute undifferentiated shortness of breath in the ED		50	
	Frat et al, 2015	Acute hypoxemic respiratory failure (pre-intubation)		50	~38-58
	Stephan et al, 2015	Hypoxemic patients post cardiothoracic surgery		50	
	Peters et al, 2013	Do not intubate patient with hypoxemic respiratory distress	~43		30-60
	Sztrymf et al, 2011	acute respiratory failure		~48	~40-57
	Parke et al, 2011	mild-to-moderate hypoxemic respiratory failure		35	
	Corley et al, 2011	Post cardiac surgery		35	35-50
Chronic	Storgaard et al, 2018	COPD		20	
	Nagate et al, 2018	COPD	~29		
	Cirio et al, 2016	stable severe COPD patients	60		55-60
	Rea et al, 2010	COPD and/or bronchiectasis			20-25

https://www.fphcare.com/en-gb/hospital/adult-respiratory/optiflow/frequently-asked-questions/#q_protocol

NHS England and NHS Improvement (London)

Respiratory & Critical Care Networks

COVID-19: Guidance for the use of CPAP or NIV for patients in Acute Hypoxaemic Respiratory Failure associated with COVID-19

Disclaimer: The evidence regarding the optimal use of respiratory support in patients with COVID-19 is rapidly emerging given limited experience of CPAP use with COVID Acute Respiratory Failure. This document is based on the available evidence at the time and will be continuously reviewed to ensure alignment with the evolving data.

Version 1.0 Review Date: 24/02/2021

Publication Date: 10/01/2020 Contact: england.londoncagsupport@nhs.net

If this guidance is seen after the review date above, please contact england.londoncagsupport@nhs.net for the latest version.

Summary

Healthcare services are facing unprecedented pressure at this time and this guidance relating to the use of CPAP/ HFNO and NIV therapy for COVID-19 positive patients in the context of the pandemic. In conditions of extreme surge and demand, it may not be possible to deliver workforce and estate requirements as set out in the national British Thoracic Society (BTS) guidance[1], which is considered optimal practice. However, adoption of BTS guidance should be resumed as soon as activity levels permit. Intensive Care Society Guidance (Section 5)[2], regarding saturation aims have been reflected within this document.

A network approach is recommended to support a consistent approach to utilisation of CPAP/HFNO2. To facilitate the development of this guidance[3], a London Clinical Reference Group was convened representing respiratory, acute and intensive care medicine, to share emerging evidence and expertise. A list of contributors is included within Appendix 1. Appendix 2 and 3 includes previously issued NHS England and NHS Improvement (London) guidance reflecting the learning from wave 1.

The guidance is adapted from the following three publications:

East of England Guidance:	*British Thoracic Society Guidance:*	*Intensive Care Society Guidance:*
Adobe Acrobat Document	Adobe Acrobat Document	Adobe Acrobat Document

Guidance for the management of hypoxaemic respiratory failure due to COVID-19

Guidance for the management of hypoxaemic respiratory failure due to COVID-19

AREA	Acute NIV*/CPAP areas/ patient management should be supported by the following : a) Continuous pulse oximetry. b) Continuous ECG monitoring should be available for patients with a clinical indication (e.g. pulse rate > 120 bpm, dysrhythmia). c) Point of care blood gas analyser accessible to the NIV/CPAP area. d) Oxygen delivery cascade systems should be assessed for the number of patients who can be supported within a given area. e) Hospitals should have regular review of their VIE capacity f) 24/7 immediate available medical cover and rapid access to critical care support or other interventions.
LEADERSHIP	There should be 24/7 consultant cover for patients in receipt of CPAP and a designated clinical lead to coordinate the delivery of NIV/CPAP. A designated lead nurse and physiotherapist should provide support to the areas providing CPAP/NIV. Close collaboration between clinicians working in acute medicine, respiratory medicine and critical care is required. Decision to undertake CPAP/NIV/HFNO should be a senior decision maker (see flow diagrams and associated document). Assessment should be at a minimum at 6 hours and 2 x day plus with MDT discussion at day 1, 3 and 5.
STAFFING	In non-surge situation, adherence to national recommendations as a minimum and adapt according to patient acuity and local circumstances (e.g. impact of PPE, side-rooms). FICM[4] and BTS[1] recommend a 1:2 to 1:4 nursing model, (provision for 1:2 care for acutely unwell patients). It is recognized that in the present pandemic the ratio of 1:2 is not achievable. Unstable patients should be referred to critical care.
EQUIPMENT	All ventilators used to deliver acute NIV/CPAP should be designed for this purpose. There should be sufficient quantity of masks and ventilators to meet the expected demand for NIV/CPAP. It should be noted that home NIV machines often have alarms set as off as the default setting. Teams must ensure alarms are set appropriately and checked at each shift. Appropriate training for the use equipment used and patient management should be ensured.
SERVICE CAPACITY	Services should consider staffing provision, skill mix and appropriate clinical leadership when patients are being cared for in various sites within the hospital N.B. Consideration should be given regarding the potential increased fire risk where patients are cohorted on high flow oxygen devices as a result of ambient oxygen levels rising with increased delivery capacity. Appropriate measurements should be taken and recorded to ascertain the risk and need for subsequent mitigations.
GOVERNANCE	The NIV/CPAP service should have: a) A locally developed acute NIV/CPAP protocol agreed between critical care and respiratory medicine colleagues. b) A process of continuous audit. NIV/CPAP data outside critical care is not submitted to ICNARC but logging/tracking of patients treated with NIV/CPAP should be undertaken at Trust level and reviewed. c) A robust morbidity and mortality (M&M) process, including rapid case note review of inpatient deaths of patients treated with (or considered for) acute NIV/CPAP) and ensuring shared learning between acute medicine, critical care and respiratory medicine.

** for patients with chronic respiratory conditions associated with chronically raised CO2*

Initiation of CPAP or NIV and or referral to Critical Care

Initiation of CPAP or NIV and or referral to Critical Care	
Establish a treatment escalation plan:	Establish suitable treatment bundle: thromboprophylaxis, Dexamethasone, Remdesivir, regular repositioning/semi-proning, hydration, nutrition, antibiotics if indicated. Ensure a Treatment Escalation Plan (TEP) i.e. Coordinate my Care (CMC) is completed to include, amongst other interventions the ceiling of respiratory support. Senior review should include setting saturation aims, review of physiology and laboratory parameters to determine if the patient is improving / not deteriorating / deteriorating. Deteriorating patients should be urgently considered for CPAP and referred to critical care if in line with their treatment pathway.
Consider CPAP:	If there is increasing FiO2 requirement (40-60%) despite awake proning/repositioning, increased work of breathing, deteriorating general status – please refer to ICS guidelines "Clinical guide for the management of critical care for adults with COVID-19 during the Coronavirus pandemic"[2]. Appropriate CPAP devices should be used accounting for training and oxygen flows – turbine design may be preferred in constrained oxygen scenarios.
Consider NIV:	As above, plus chronic respiratory condition associated with chronically raised CO2 +/- acute acidaemic hypercapnic respiratory failure.
Consider HFNO:	HFNO should only be prescribed following critical care consultant or equivalent review and patients monitored through critical care outreach and included in MDT review processes as described. HFNO can be considered for breaks from CPAP to prevent pressure ulcers, or during mealtimes albeit other modalities may be suitable. Oxygen that is not being used must be switched off. Mealtimes should be staggered, as should nebuliser administration to decrease oxygen demand. Nebulisers should not be used with concurrent application of HFNO.
Research:	Consider enrollment into appropriate research trials
Cautions:	A 3 l/min oxygen reduction in 200 patients represents a quarter of the total capacity of a standard VIEs of 2500 l/min and thus is a significant benefit in terms of a hospitals oxygen resilience. The use of high flow devices such as Optiflow HFNO, as well as some CPAP devices have significant oxygen flow requirements. Leaks from CPAP/NIV devices can result in significant oxygen wastage and all devices should be switched off when not in use. Oxygen audits and good housekeeping relating to equipment chosen, saturation aims, meal-times, nebulizer times and measurement of ambient 02 should be daily occurrences.

Treatment

Initiation of CPAP or NIV and/or referral to Critical Care

"An SpO2 target of 90-93% is acceptable in patients with visible continuous pulse oximetry in an appropriately monitored care environment with trained staff to monitor for clinical deterioration".[2]

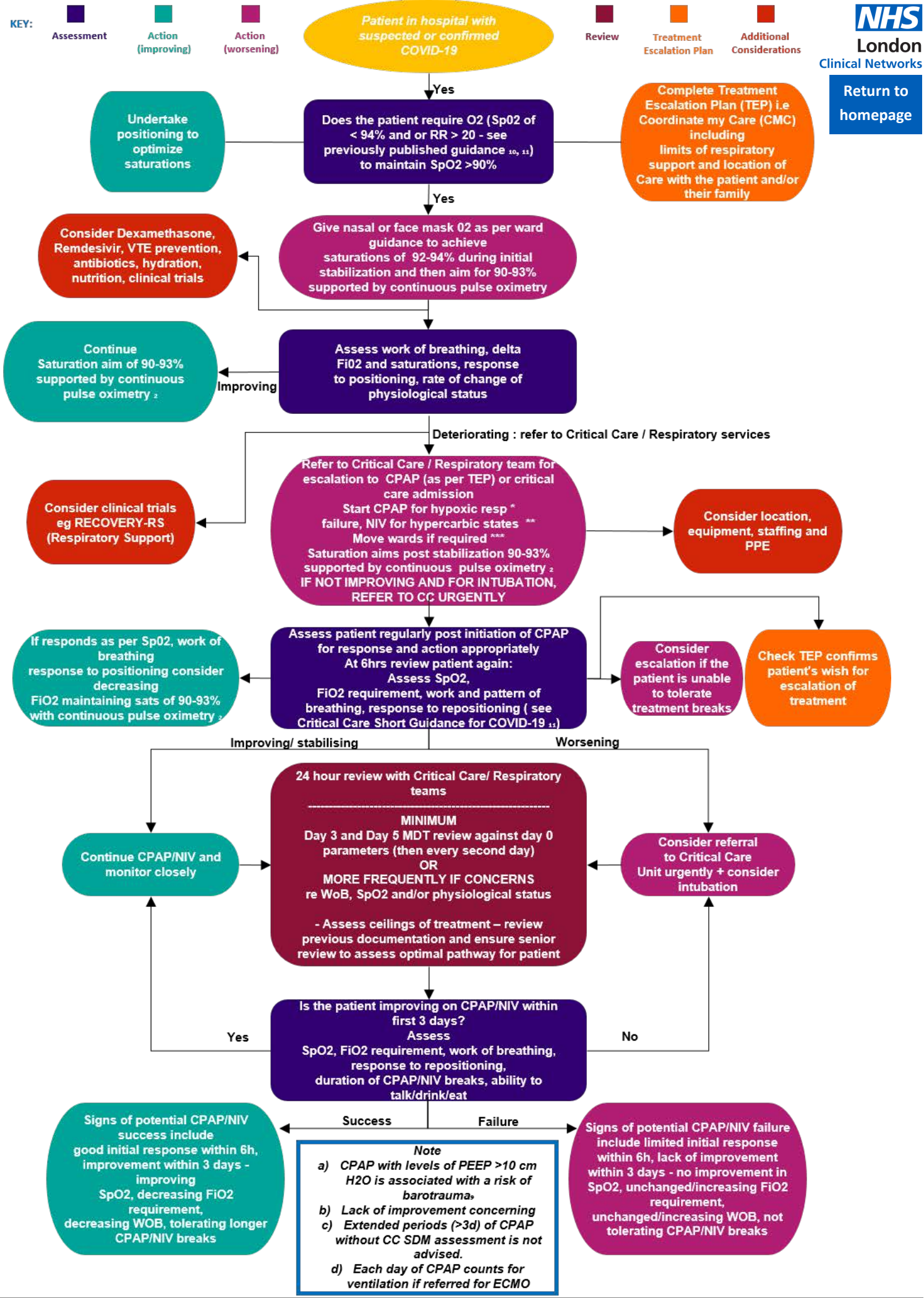
Appropriate Infection Control Precautions:	PPE appropriate for AGP for all staff. Ideally non-vented mask (ensure circuit appropriate for mask), antimicrobial filter, good humidification. Please refer to the BTS[1] Public Health England and NHS England and Improvement Guidelines [5, 6]
Location/ staffing:	Treatment should be delivered in areas that have been designated as appropriate within the hospital surge plan. Surge plans should include nurse deployment, CPAP/NIV training strategies, and task-based competencies across the multi professional team. Close liaison between Respiratory and Critical Care teams is a key factor to optimize care.
Awake proning and positioning:	This can be helpful for patients for patients at all stages of their clinical course – face mask oxygen, CPAP and full ventilation. (Appendix 4). Further guidance relating to prone positioning has been published by the ICS [7].
Cautions:	There may be some situations where HFNO is required or identified as the most suitable method where available. It is critical that patients are not given HFNO without appropriate critical care review. Oxygen saturations should be continuously monitored with regular checks and alarms enabled on the saturation monitor and the CPAP device. It is critical that saturations are kept within strict target ranges and any early signs of deterioration should be reviewed urgently. Regular reviews of saturation aims and down titrating of FiO2 should take place if appropriate. HFHO2 and CPAP should be avoided if the patient's TEP suggests that this is not appropriate.

Treatment Review

Treatment Review

Patients should be closely monitored when on CPAP/NIV

6 hours after CPAP/NIV initiation:	Continue if positive response (improved oxygenation, decreased work of breathing). However, change in RR appears a poor discriminator of CPAP success (often little change initially). Consider intubation if progressive decline / no improvement with increased work of breathing persisting, during the first 6 hours.
At treatment breaks:	Consider escalation if patient unable to tolerate breaks from CPAP/NIV. Expect use > 16 hours/day first few days. Predictors of CPAP failure include elevated inflammatory markers, BNP. Consider CT-PA for those not improving / deteriorating
24-hour MDT review:	A minimum of daily consultant reviews should be ensured for all patients on CPAP/ HFNO/NIV with 2 x day review by senior clinician. Consider escalation if an initial positive oxygenation response to awake proning is lost, if FiO2 requirements are climbing, or work of breathing worsening. Ensure continued delivery of treatment bundle. Consider escalation if generalised decline or significant worsening in physiological and laboratory markers; consider CT-PA if concern to diagnosis of pulmonary embolic disease.
MDT reviews against day 0 parameters:	Set time points to review progress to twice daily. Formal review of markers of oxygenation, treatment response, imaging and bloods (CPAP failure more likely if inflammatory and coagulopathy markers high on admission and show a worsening trend). Formal consideration of referral to ICU at day 3 and 5 MDTs if no improvement, alongside referral as needed for deterioration. If persisting with CPAP at day 3, a TEP for 'not for intubation' or full early escalation should be discussed/reviewed with critical care. Continuous CPAP for 7 days will likely make a patient ineligible for ECMO. There is variable opinion as to the level of barotrauma that may be caused by CPAP, but all consider it a variable risk, alongside disease process impact. In view of this patients must have senior CC/ resp MDT review at Day 1, 3 and 5 at a minimum.
Consider failure of CPAP/NIV:	At any stage if there is deterioration or failure to improve consider escalation to critical care for intubation or other interventions. Critical care colleagues may consider escalation to ECMO service if within referral criteria.
Markers of CPAP success:	Good initial response, able to take breaks from CPAP without immediate decompensation, improving clinical trend. In a small series, average CPAP duration was 6 days +/- 3.5 (i.e. avoid stopping too early, do not prolong indefinitely, and wean inspired oxygen appropriately).
Cautions:	The above timeframes are intended as a guide to support the delivery of high-quality care. However, clinical judgement is key and a patient's condition will likely require further review outside of these intervals.



* HFNO should only be instituted following review with senior CC colleague and or resp consultant and should be reviewed daily with CC

** Equipment choice should be guided by training and low oxygen supply requirement

*** High volume oxygen wards should monitor ambient oxygen levels

N.B. This flowchart is to be viewed alongside the main guidance which is due for review 24/02/2021.

Appendix Navigation

Appendix One: Pan-London Knowledge-Sharing and Learning Forum Attendees

Name	Role	Organisation
Ana de Ramon	Respiratory Consultant	Frimley Health NHS Foundation Trust
Andrew Jones	Intensive Care Consultant	Guy's & St Thomas' NHS Foundation Trust
Prof Andrew Menzies-Gow	Deputy Medical Director, Respiratory Consultant	Royal Brompton & Harefield NHS Foundation Trust
Prof Andrew Rhodes	Consultant Intensivist	St George's University Hospitals NHS Foundation Trust
Chris Meadows	Critical Care Consultant	Guy's & St Thomas' NHS Foundation Trust
Clare Ross	Respiratory Consultant & Pleural Lead	Imperial College Healthcare NHS Trust
David Adeboyeku	Respiratory Consultant	London North West University Healthcare NHS Trust
David Howell	Clinical Director & Consultant Intensivist	University College London Hospitals NHS Foundation Trust
Prof Ganesh Suntharalingam	President of the Intensive Care Society & Clinical Lead	London North West University Healthcare NHS Trust
Gary Davies	Respiratory Consultant	Chelsea and Westminster Hospital Foundation Trust
Prof Geoff Bellingan	Medical Director & Intensive Care Consultant	University College London Hospitals NHS Foundation Trust
Gubby Ayida	Medical Director & Consultant Obstetrician and Gynaecologist	The Hillingdon Hospitals NHS Foundation Trust
James Goldring	Respiratory Consultant & Lead for Pleural disease	Royal Free London NHS Foundation Trust
Jeremy Cordingley	Consultant Intensivist	Barts Health NHS Trust
Joel Meyer	Critical Care Consultant	Guy's & St Thomas' NHS Foundation Trust
Prof Julian Redhead (Co-Chair)	Medical Director & Consultant in Emergency Medicine	Imperial College Healthcare NHS Trust
Lucy Baker	Respiratory Consultant	Lewisham and Greenwich NHS Trust
Lucy Nelson	Senior Clinical Project Manager	NHS England & Improvement (London)
Malti Varshney	Director, Clinical Networks and Senate	NHS England & Improvement (London)
Marcela Vizcaychipi	Consultant Anaesthetist	Chelsea and Westminster Hospital Foundation Trust
Mark Faulkner	Clinical Development Manager for Critical Care	London Ambulance Service NHS Trust

Appendix One: Pan-London Knowledge-Sharing and Learning Forum Attendees

Name	Role	Organisation
Marlies Ostermann	Consultant Intensivist	Guy's & St Thomas' NHS Foundation Trust
Prof Mark Mason	Medical Director & Consultant Cardiologist	Royal Brompton & Harefield NHS Foundation Trust
Martin Kuper	Medical Director and Deputy Chief Executive	London North West University Healthcare NHS Trust
Meera Kamalanathan	Respiratory Consultant	Lewisham and Greenwich NHS Trust
Prof Mervyn Singer	Clinical Professor Intensive Care Medicine	University College London Hospitals NHS Foundation Trust
Michael Slattery		
Mick Jennings	Intensive Care Consultant	Lewisham and Greenwich NHS Trust
Prof Mike Roberts	Managing Director for UCLPartners Academic Health Science System &Respiratory Consultant,	UCL Partners
Moerida Belton	Respiratory Consultant	Lewisham and Greenwich NHS Trust
Nicholas Hart,	Clinical and Academic Director, Respiratory Consultant	Guy's & St Thomas' NHS Foundation Trust
Nirav Shah	Respiratory Consultant	Lewisham and Greenwich NHS Trust
Paramita Palchaudhuri	Respiratory Consultant	Lewisham and Greenwich NHS Trust
Peter Sherren	Intensive Care Medicine and Anaesthesia Consultant	Guy's & St Thomas' NHS Foundation Trust
Rachel Tennant	Clinical Lead & Consultant Respiratory Medicine	London North West University Healthcare NHS Trust
Rajesh Banka	Respiratory Consultant	Croydon Health Services NHS Trust
Prof Richard Beale	Consultant Intensivist	Guy's & St Thomas' NHS Foundation Trust
Richard Breeze	Clinical Director & Consultant Intensivist and Anaesthetist	Lewisham and Greenwich NHS Trust
Ritchie Sama	Consultant Anaesthetist	The Hillingdon Hospitals NHS Foundation Trust
Roger Chinn	Consultant Radiologist	Chelsea and Westminster Hospital Foundation Trust

Appendix One: Pan-London Knowledge-Sharing and Learning Forum Attendees

Name	Role	Organisation
Ronan Astin	Consultant Respiratory Medicine	University College London Hospitals NHS Foundation Trust
Salina Harvey-Porter	AIR Service Lead	Kingston Hospital NHS Foundation Trust
Sara Lock	Respiratory Consultant	Whittington Health NHS Trust
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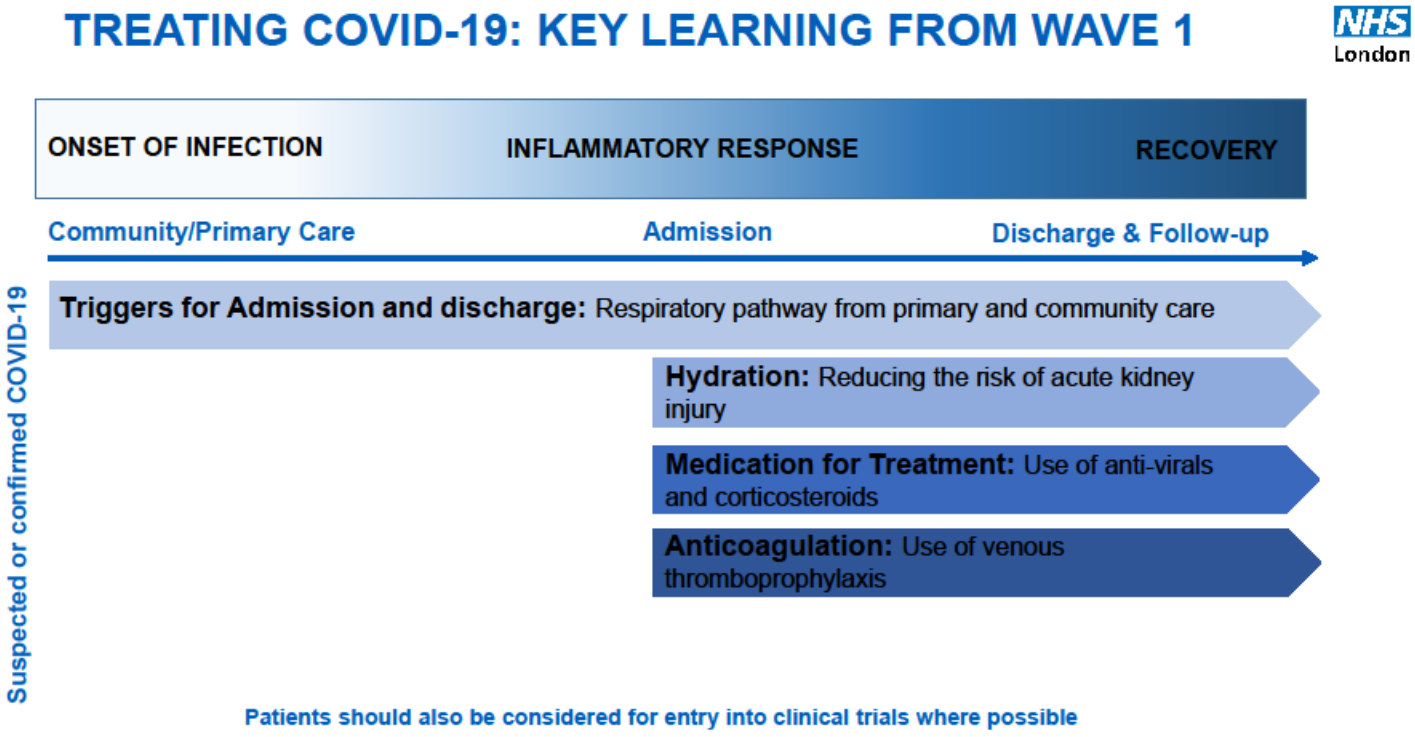
Appendix 2: Treating COVID-19: Learning from Wave 1



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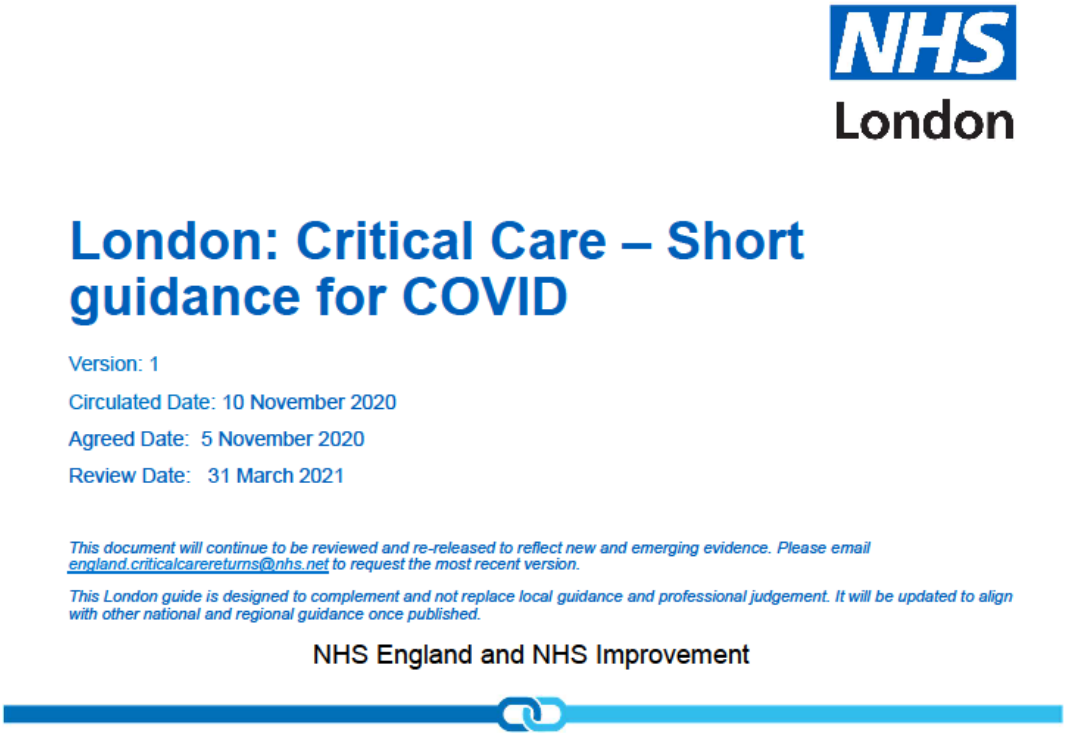
Appendix 3: Learning from Wave 1 - Critical Care – Short guidance for COVID

Please note: There are some modified recommendations to the "London: Critical Care—Short guidance for COVID-19" published in November 2020, particularly with regards to saturation aims. Please refer to the flowchart (page 7) within the above guidance for saturations aims.



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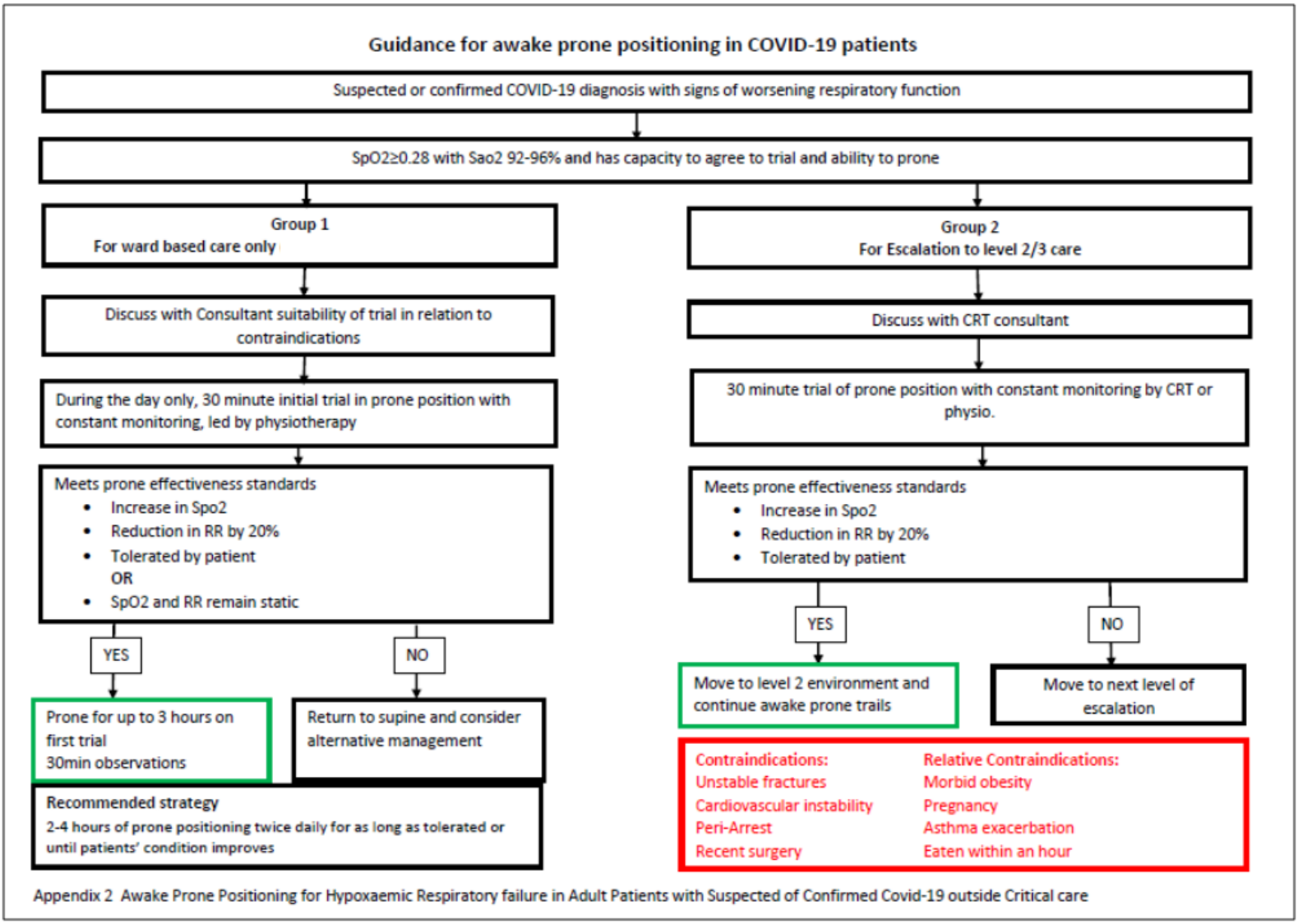
Appendix 4: Awake Prone Positioning for Hypoxaemic Respiratory Failure in Adult Patients with Suspected or Confirmed COVID-19



Appendix 2 Awake Prone Positioning for Hypoxaemic Respiratory failure in Adult Patients with Suspected of Confirmed Covid-19 outside Critical care

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