University Hospitals of Leicester NHS Trust

Paediatric Intensive Care Unit

Pain, Agitation, Neuromuscular Blockade, Delirium & Early Mobility Guideline

Staff relevant to:	Medical and Nursing staff caring for children in the PICU
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Written by:	E Rizal, S Wheeler, P Kukreja, J Tong, J Vujcikova, R Joyce, J. Dukes, R. Pau, S. Mead, S. Bennett
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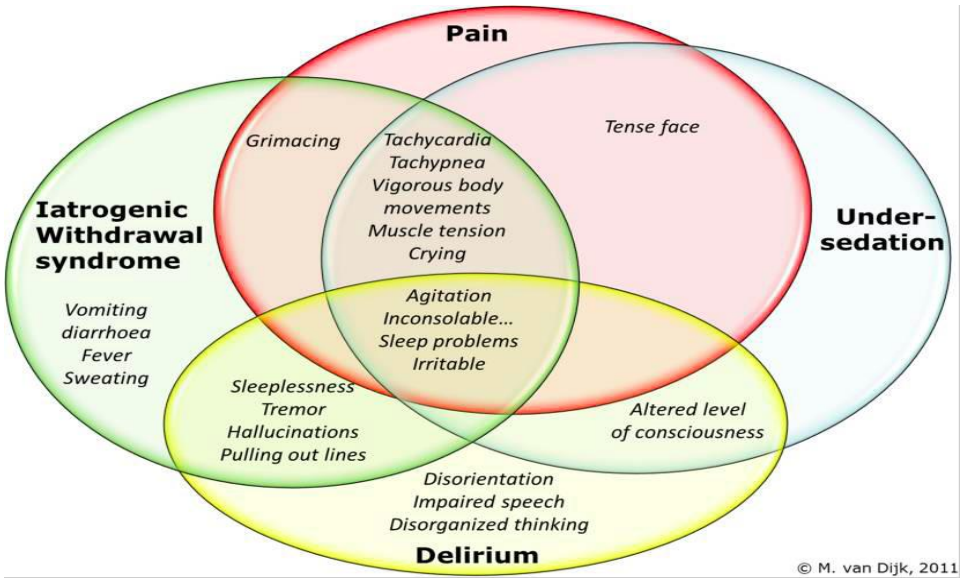
Related Guidelines and Policies:	
C39/2017	Application of Arm Splints
C116/2016	PICU Management of the Endotracheal Tube (ETT)
C150/2016	Clinical management on PICU following cardiac surgery
C3/2021	Inhalational Anaesthesia using the AnaConDA Device in PICU/CICU
C246/2016	Guideline for the care of children and young people (under 18 yrs) requiring Morphine, Fentanyl, Ketamine & Morphine Patient Controlled Analgesia (PCA), Nurse Controlled Analgesia (NCA) & continuous Morphine infusion
C7/2015	Guideline for the care of neonates, children and young people requiring epidural analgesia
Keywords:	Sedation, Analgesia, Pain, Agitation, Distress, Withdrawal, Morphine, Fentanyl, Midazolam, Alimemazine, Clonidine, Paracetamol, Ibuprofen, Ventilated, PICU, Early Mobility, Delirium, Rocuronium, SPACE Mission, PANDEM, AnaConDA, Chloral Hydrate

Contents

FLACCS & Wong-Baker FACES Pain assessment Tools



Instructions for Usage

Explain to the person that each face represents a person who has no pain (hurt), or some, or a lot of pain.

Face 0 doesn't hurt at all. Face 2 hurts just a little bit. Face 4 hurts a little bit more. Face 6 hurts even more. Face 8 hurt a whole lot. Face 10 hurts as much as you can imagine, although you don't have to be crying to have this worst pain.

Ask the person to choose the face that best depicts the pain they are experiencing.

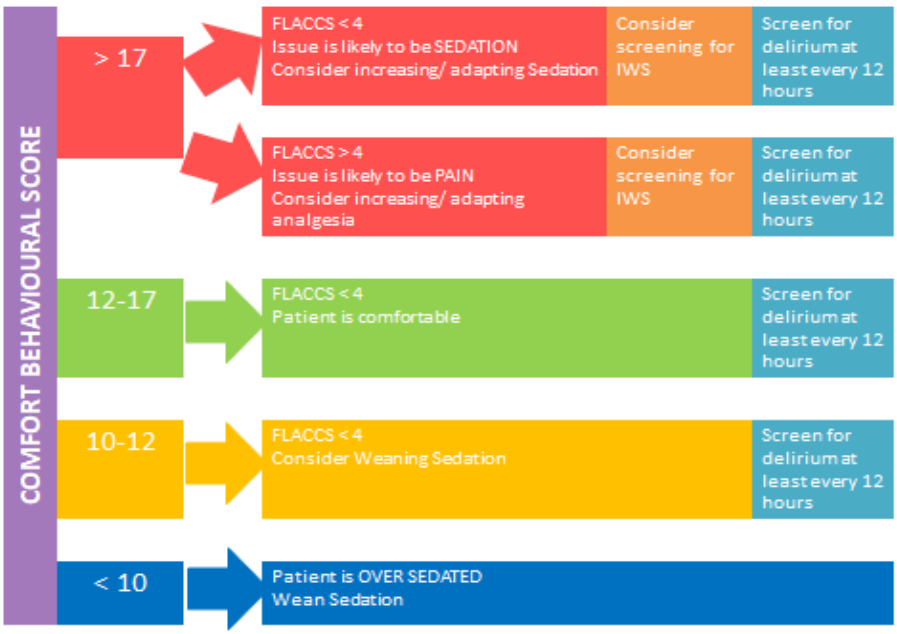
RESPONE	SCORE 0	SCORE 1	SCORE 2
FACE	No particular expression or smile	Occasional grimace or frown, withdrawn, uninterested	Frequent, constant quivering chin, clenched jaw
LEGS	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
ACTIVITY	Lying quietly, normal position, moves easily	Squirming, shifting, back and forth, tense	Arched, rigid or jerking
CRY	No Cry (awake or asleep)	Moans, whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
CONSOLABILITY	Content, relaxed	Reassured by occasional touch, hug or being talked to-distractible	Difficult to console or comfort

0	1	2	3	4	5	6	7	8	9	10
No Pain		Mild Pain		Moderate Pain				Severe Pain		

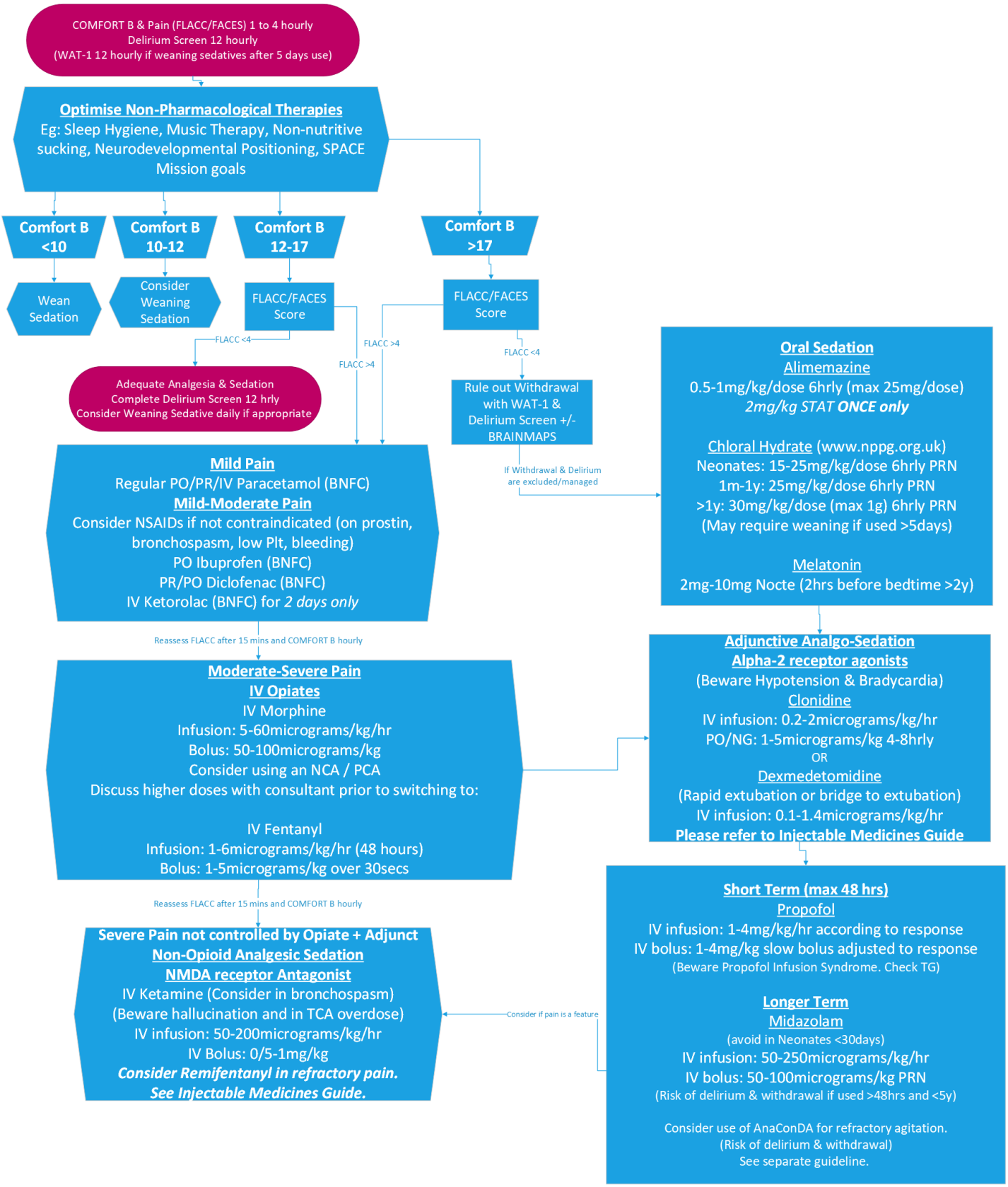
(Merkel et al. 1997)

Comfort score table

COMFORT Behavioural score		TIME																		
ALERTNESS	Deeply asleep	1																		
	Lightly asleep	2																		
	Drowsy	3																		
	Awake & alert	4																		
	Awake & hyper-alert	5																		
CALM/AGITATION	Calm	1																		
	Slightly anxious	2																		
	Anxious	3																		
	Very anxious	4																		
	Panicky	5																		
RESPIRATORY RESPONSE (Mechanically ventilated patients only)	No spontaneous respiration	1																		
	Spontaneous & ventilator respiration	2																		
	Restless or resistance to ventilator	3																		
	Actively breathes against ventilator or coughs	4																		
	Fights ventilator	5																		
RESPIRATORY RESPONSE (Spontaneously breathing patients only)	Quiet breathing, no crying	1																		
	Occasional sobbing/ moaning	2																		
	Whining	3																		
	Crying	4																		
	Screaming or shrieking	5																		
PHYSICAL MOVEMENT	No movement	1																		
	Occasional movements <3	2																		
	Frequent movements (> 3)	3																		
	Vigorous movements limited to extremities	4																		
	Vigorous movements include torso & head	5																		
MUSCLE TONE	Muscles totally relaxed; no muscle tone	1																		
	Reduced muscle tone; less than normal	2																		
	Normal muscle tone	3																		
	↑ muscle tone & flexion of fingers & toes	4																		
	Extreme muscle rigidity & flexion of fingers & toes	5																		
FACIAL TENSION	Facial muscles totally relaxed	1																		
	Normal facial tone	2																		
	Tension evident in some muscles	3																		
	Tension evident throughout muscles	4																		
	Facial muscles contorted & grimacing	5																		
COMFORT SCORE																				
FLACC SCORE																				
SIGN																				



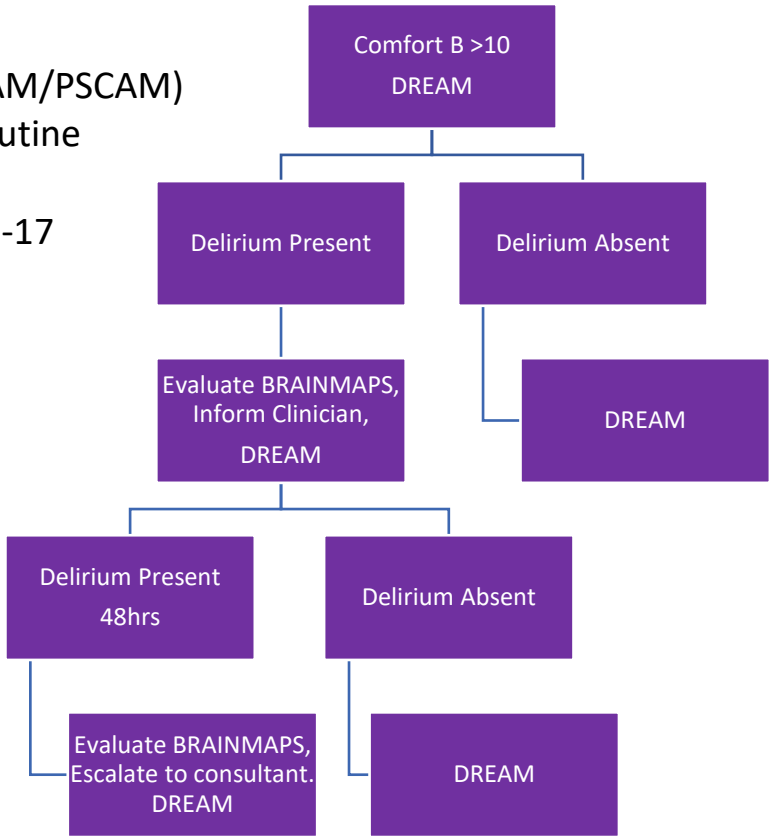
1. Summary of Management of Pain and Agitation in PICU



2. Summary of Management of Paediatric Critical Care Delirium

Delirium Prevention - DREAM

D – Delirium Score Twice Daily (PCAM/PSCAM)
R – Review Drug Chart. Set daily Routine
E – Early Extubation
A – Analgesia, WAT-1, Comfort B 12-17
M – Mobilise with SPACE MISSION.



Evaluation of Delirium – BRAINMAPS

	Assess	Evaluate & Treat
B	Bring Oxygen	Anaemia, Hypoxaemia, Low pCO2
R	Remove Deliriogenic Drugs	Anticholinergics, Sedatives
A	Analgesia, Sedation & Iatrogenic Withdrawal	FLACC & Comfort B in target range.
I	Infection & Inflammation	FBC, CRP, PCT, Cultures. Treat infection
N	New Organ Dysfunction	CNS, CVS, Respiratory, Liver, Renal, Endocrine
M	Metabolic Disturbances	Urea & Electrolytes, Blood gas – correct acidosis/alkalosis
A	Atmosphere	Conducive lighting, reduce noise, encourage parental presence
P	Positive touch	Encourage positive touch and neurodevelopmental techniques to alleviate distress. Cluster cares.
S	Space Mission	Engage in early sensory and physical activity.

3. Withdrawal assessment tool v.1

WITHDRAWAL ASSESSMENT TOOL VERSION 1 (WAT – 1)

Patient Identifier													
	Date:												
	Time:												
Information from patient record, previous 12 hours													
Any loose/watery stools	No = 0 Yes = 1												
Any vomiting, retching, gagging	No = 0 Yes = 1												
Temperature > 37.8 °C	No = 0 Yes = 1												
2 minute pre-stimulus observation													
State	SBS[1] ≤ 0 or asleep/awake calm = 0 SBS[1] ≥ +1 or awake distressed = 1												
Tremor	None/mild = 0 Moderate/severe = 1												
Any sweating	No = 0 Yes = 1												
Uncoordinated/repetitive movement	None/mild = 0 Moderate/severe = 1												
Yawning or sneezing	None or 1 = 0 >2 = 1												
1 minute stimulus observation													
Startle to touch	None/mild = 0 Moderate/severe = 1												
Muscle tone	Normal = 0 Increased = 1												
Post-stimulus recovery													
Time to gain calm state (SBS[1] ≤ 0)	< 2 minutes = 0 2 - 5 minutes = 1 > 5 minutes = 2												
Total Score (0-12)													

WITHDRAWAL ASSESSMENT TOOL (WAT – 1) INSTRUCTIONS

- Start WAT-1 scoring from the **first day of weaning** in patients who have received opioids +/or benzodiazepines by infusion or regular dosing for prolonged periods (e.g., > 5 days). Continue twice daily scoring until 72 hours after the last dose.
- The Withdrawal Assessment Tool (WAT-1) should be completed along with the SBS[1] at least once per 12 hour shift (e.g., at 08:00 and 20:00 ± 2 hours). The progressive stimulus used in the SBS[1] assessment provides a standard stimulus for observing signs of withdrawal.

Obtain information from the patient's record. (This can be done before or after the stimulation):

- ✓ Any **loose or watery stools** documented in the past 12 hours score as a 1. Score a 0 if none noted.
- ✓ Score 1 if any **vomiting, spontaneous retching or gagging** were documented in the past 12 hours; score 0 if none were noted.
- ✓ Score 1 if the modal (most frequently appearing) documented **temperature was greater than 37.8 °C** in the past 12 hours; score 0 if this was not the case.

2 minute pre-stimulus observation:

- ✓ **State:** Score 1 if awake and distress (SBS[1] ≥ +1) observed during the 2 minutes prior to stimulus; score 0 if asleep or awake and calm/cooperative (SBS[1] ≤ 0).
- ✓ **Tremor:** Score 1 if moderate to severe tremor observed during the 2 minutes prior to stimulus; score 0 if no tremor (or only minor, intermittent tremor).
- ✓ **Sweating:** Score 1 if any sweating during the 2 minutes prior to stimulus; score 0 if no sweating noted.
- ✓ **Uncoordinated/repetitive movements:** Score 1 if moderate to severe uncoordinated or repetitive movements such as head turning, leg or arm flailing or torso arching observed during the 2 minutes prior to stimulus; score 0 if no (or only mild) uncoordinated or repetitive movements.
- ✓ **Yawning or sneezing:** Score 1 if more than 1 yawn or sneeze observed during the 2 minutes prior to stimulus; score 0 if 0 to 1 yawn or sneeze.

1 minute stimulus observation:

- ✓ **Startle to touch:** Score 1 if moderate to severe startle occurs when touched during stimulus; score 0 if none (or mild).
- ✓ **Muscle tone:** Score 1 if tone increased during the stimulus; score 0 if normal.

Post-stimulus recovery:

- ✓ **Time to gain calm state (SBS[1] ≤ 0):** Score 2 if it takes greater than 5 minutes following stimulus; score 1 if achieved within 2 to 5 minutes; score 0 if achieved in less than 2 minutes.

Sum the 11 numbers in the column for the total WAT-1 score (0-12).

Reprinted with permission from: Franck LS, Harris S, Soetenga D, Amling J, Curley M. The withdrawal assessment tool (WAT-1): Measuring iatrogenic withdrawal symptoms in pediatric critical care. Pediatr Crit Care Med 2008;9(6):573-580.

[1]Curley et al. State behavioral scale: A sedation assessment instrument for infants and young children supported on mechanical ventilation. Pediatr Crit Care Med 2006;7(2):107-114.

4. State Behavioral Scale (SBS)

Score as patient's response to voice then gentle touch then noxious stimuli (planned endotracheal suctioning or <5 seconds of nail bed pressure)

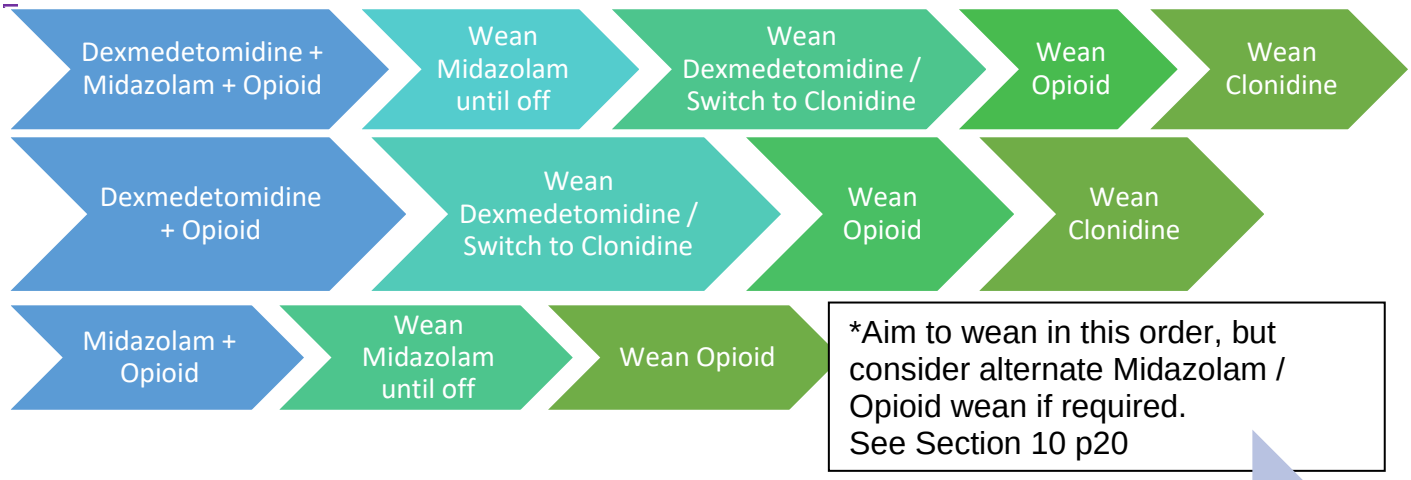
Score	Description	Definition
−3	Unresponsive	No spontaneous respiratory effort No cough or coughs only with suctioning No response to noxious stimuli Unable to pay attention to care provider Does not distress with any procedure (including noxious) Does not move
−2	Responsive to noxious stimuli	Spontaneous yet supported breathing Coughs with suctioning/repositioning Responds to noxious stimuli Unable to pay attention to care provider Will distress with a noxious procedure Does not move/occasional movement of extremities or shifting of position
−1	Responsive to gentle touch or voice	Spontaneous but ineffective nonsupported breaths Coughs with suctioning/repositioning Responds to touch/voice Able to pay attention but drifts off after stimulation Distresses with procedures Able to calm with comforting touch or voice when stimulus removed Occasional movement of extremities or shifting of position
0	Awake and able to calm	Spontaneous and effective breathing Coughs when repositioned/Occasional spontaneous cough Responds to voice/No external stimulus is required to elicit response Spontaneously pays attention to care provider Distresses with procedures Able to calm with comforting touch or voice when stimulus removed Occasional movement of extremities or shifting of position/increased movement (restless, squirming)
+1	Restless and difficult to calm	Spontaneous effective breathing/Having difficulty breathing with ventilator Occasional spontaneous cough Responds to voice/No external stimulus is required to elicit response Drifts off/Spontaneously pays attention to care provider Intermittently unsafe Does not consistently calm despite 5 minute attempt/unable to console Increased movement (restless, squirming)
+2	Agitated	May have difficulty breathing with ventilator Coughing spontaneously No external stimulus required to elicit response Spontaneously pays attention to care provider Unsafe (biting ETT, pulling at lines, cannot be left alone) Unable to console Increased movement (restless, squirming or thrashing side-to-side, kicking legs)

Curley MA, Harris SK, Fraser KA, Johnson RA, Arnold JH. State Behavioral Scale: a sedation assessment instrument for infants and young children supported on mechanical ventilation. Pediatr Crit Care Med. 2006 Mar;7(2):107-14. doi: 10.1097/01.PCC.0000200955.40962.38. PMID: 16446601; PMCID: PMC1626525.

Patient Ready for Sedation Wean

(Comfort-B <17, FLACCS <4, WAT-1 <3) **Convert to enteral ASAP**

*



*Aim to wean in this order, but consider alternate Midazolam / Opioid wean if required.
See Section 10 p20

Dexmedetomidine	If >0.7mcg/kg/hr, wean by 0.1mcg/kg/hr 6-8hrly until dose = 0.7mcg/kg/hr.	Then commence Clonidine 2mcg/kg 4-6hrly.	Stop Dexmedetomidine after 12-24hrs of Clonidine.

Weaning IV Midazolam or IV Morphine according to length of infusion

If < 5days	•Stop Infusion •Monitor WAT-1 for 48hrs
If 5-9 days	•Reduce by 50% of original dose daily to stop. •Monitor WAT-1 until off for 48hrs
If 10-14 days	•Reduce by 20% of original dose daily (can do 10% 12hrly) •Alternate Opioid and Benzodiazepine wean •Monitor WAT-1 until off for 48hrs
If > 14days	•Reduce by 10% of original dose daily •Alternate Opioid and Benzodizepine wean •Monitor WAT-1 until off for 48hrs

If WAT-1 >3

- Review FLACCS & Delirium Screen. Adopt Non-pharmacological strategies
- Give 1st Rescue Dose (Morphine 50mcg/kg OR Midazolam 50mcg/kg)
- Reassess WAT-1 in 1 hr
- If resolved, continue weaning as above.

WAT-1 >3 for 2nd time in 24hrs

- Review FLACCS & Delirium Screen. Adopt Non-pharmacological strategies
- Give 2nd Rescue Dose of Morphine OR Midazolam
- Hold wean for 24hrs
- Review WAT-1 12hrly
- Resume wean as per above if WAT-1 allows.
- If not, slow wean.

WAT-1 >3 for 3rd time in 24hrs

- Review FLACCS & Delirium Screen. Adopt Non-pharmacological strategies
- Give 3rd Rescue Dose of Morphine OR Midazolam.
- Revert to previously effective dose.
- Consider adding adjunctive medication.
- Review WAT-1 12 hrly.
- Resume wean 24hrly if scores allow.
- If not, slow wean.

Converting to IV to Enteral

Ymg Diazepam = X mg Midazolam in 24hrs
12
Prescribe Y mg 6 hrly (max 10mg/dose)

MIDAZOLAM

1. Halve IV Midazolam at 1st dose of Diazepam.
2. Then STOP at 2nd dose.
3. Wean daily by 20% of original dose until Dose = 0.05mg/kg/dose QDS
4. Then wean frequency daily as tolerated.

MORPHINE SULPHATE

Commence conversion if tolerated when
IV Dose </= 10mcg/kg/hr
1mg IV = 3mg PO
Once converted to **ORAL MORPHINE SOLUTION**

1. Wean from 4hrly -> 6hrly
2. Then wean dose by 20% of original dose daily to a minimum of **200microgams per dose**.
3. Consider weaning to 8hrly or PRN.

6hrly Dose
= Total IV Morphine x 3
4
Max
200micrograms/kg/dose

4hrly Dose
= Total IV Morphine x 3
6
Max
200micrograms/kg/dose

FENTANYL

1microgram/kg/hr Fentanyl = 25microgram/kg/hr Morphine

a. In acute pain, relative potency of Fentanyl to Morphine is 1:100.
b. In chronic use (where weaning is required), the potency is thought to be 1:25-50.
c. When changing between opioids, the tolerance to the 'new' opioid is not thought to be the same, hence the 'new' opioid dose should be reduced by 25-50%.
d. First convert Fentanyl -> IV Morphine by multiplying by 25. In some cases a lower conversion can be tried by multiplying by 10.
e. Then, convert from IV Morphine to PO Morphine as per above.

5. Introduction

Infants, children and young people admitted to the paediatric intensive care unit (PICU) experience pain, anxiety, agitation and fear as a consequence of the care they are receiving. This is exacerbated by factors including the PICU environment, unfamiliar staff and routines, high intensity light and noise, fever/environmental temperature, surgical/PICU procedures, monitoring, positioning and physical movement.

Pain and agitation stimulate stress responses and increases metabolic and oxygen demand. Pain has also been shown to lead to permanent structural and functional changes in the developing brain.

PICU interventions carry a risk of causing acquired complications (PACs) including critical care delirium, critical illness polyneuropathy and iatrogenic withdrawal syndrome which can present with symptoms and signs that overlap with inadequate analgesia and under/over-sedation. It is therefore pertinent that all these aspects are considered when managing the physical and psychological comfort of the child and family.

Agitated, scared or delirious children on PICU are at significant risk of harm due to unplanned removal of vital monitoring and therapeutic devices. Whilst sedation can be helpful in facilitating nursing care and reducing recall of unpleasant situations, it is important to recognise that over-sedation adversely impacts patient outcomes in terms of their survivorship, and has a negative impact on the quality of their sleep.

The 2022 Society of Critical Medicine Clinical Practice Guidelines on Prevention and Management of Pain, Agitation, Neuromuscular Blockage, and Delirium in Critically Ill Pediatric Patients with consideration of the ICU Environment and Early Mobility (PANDEM) was published with 44 recommendations that will be included within this guideline.

This guideline now amalgamates and incorporates the “Monitoring and management of withdrawal symptoms” guideline as well as the “Paediatric Critical Care Delirium Guideline”

The Early Mobility initiative in UHL is unique in that it incorporates Sensory and Physical Activity, under the reference of SPACE Mission.

6. Scope

This guideline is intended to help guide doctors, advanced clinical practitioners, nurses, play specialists, physiotherapists and other staff in caring for infants, children and young people being cared for in the paediatric intensive care unit (PICU).

Most of these patients will be ventilated for critical illness or for recovery following surgery.

This guideline does not cover new born and infants being cared for in the special care baby unit (SCBU) or neonatal intensive care unit (NICU).

7. Key Points

Continuous assessment is key with the following validated each of these aspects.

I. Children who are muscle-relaxed cannot be assessed accurately with regards to pain, comfort and delirium. Clinical assessment of physiological parameters will need to be reviewed; and muscle relaxant ceased to make a true assessment of this.

II. Adequate analgesia should be provided to all infants, children and young people in PICU regardless of the need for sedation. FLACC scores should be used to monitor pain in non-verbal children. Verbal or developmentally able children should have their pain assessed using a validated tool – eg: Wong-Baker faces. This should be carried out 4 hourly in combination with COMFORT B scores.

III. COMFORT B scores (for sedation) should be carried out a minimum of 4 hourly on ALL patients from admission to discharge. This frequency should be increased to hourly if the score is out of target, or in event of acute change; until the target (usually 12-17) is achieved and maintained.

IV. PSCAM/PCAM (for delirium screening) should be completed a minimum of 12 hourly on ALL patients from admission to discharge when the COMFORT B is 10 or above.
V. WAT-1 scores should be used for surveillance of iatrogenic withdrawal syndrome with one baseline assessment prior to weaning followed by a minimum of 12 hourly assessment at 6am and 6pm from the first day of weaning opioids +/- Benzodiazepines +/- Dexmedetomidine if a patient has had prolonged use (typically but not necessarily >5 days)

Optimise non-pharmacological or adjunctive interventions including music therapy, neurodevelopmental positioning or non-nutritive sucking to maximise comfort and analgesia.
Optimise simple analgesics early e.g. paracetamol / ibuprofen as per analgesic ladder. First-line analgesia for moderate to severe pain in PICU remains to be opioids.
Patient-controlled analgesia (PCA) devices should be considered for older children and nurse-controlled analgesia (NCA) for younger patients. (Please refer to Paediatric Pain Nursing Team if commenced.)
Early use of enteral sedative and analgesia agents is recommended to encourage and facilitate protocolised weaning practise and rehabilitation of patients.
Along with optimisation of the PICU environment, early sensory and mobility activity in PICU has the potential to minimise the effects of immobility in critically ill patients. A standardised protocol that outlines readiness criteria, contraindications and developmentally appropriate mobility activities and goals, guided by the multi-disciplinary team including family is suggested.
The multi-pronged approach to managing critically ill infants, children and young people aims to improve survivorship and decrease length of stay in PICU, given the overall low rate of mortality.

8. Non-pharmacological interventions

Address any correctable environmental and or physical factor causing stress, pain or discomfort alongside pharmacological management. This can be achieved by:

- Sympathetic care from staff and family. Family presence is a valuable tool in providing comfort to children and infants.
- Providing conducive and appropriate lighting and noise levels.
- Promotion of sleep and day–night orientation
- Relaxation, distraction and music therapy.
- Implementing a daily routine for activity AND rest. Use Play and Music therapy (inc. bubble tubes and fibre-optic lights) and SPACE Mission, but ensure there is undisrupted quiet time also.
- Use neuro-developmental positioning techniques including swaddling and non-nutritive sucking in infants
- Addressing feeding and hydration needs wherever possible
- Address essential cares e.g. mouth & eye care, body wash

Note that sleep quality is often worsened due to increased doses of sedative and hypnotic medications paradoxically with the (well-meaning) intention of improving the subjective assessment of sedation and sleep.

9. Pain Assessment and Management

Patients who cannot communicate (and not muscle relaxed) should be assessed for the presence of pain-related behaviours and physiological indicators of pain. Those whom are able to communicate should be assessed using a validated pain scoring tool such as the Wong-Baker Faces tool.
Pain assessment (FLACC scale) should be done 1 – 4 hourly in combination with COMFORT B scores. Where patients are muscle relaxed, carers must remain vigilant to physiological observations that may indicate pain, and attempt assessment on cessation of muscle relaxant therapy. See section 7.
Titrate analgesia, using the analgesia ladder to the desired levels of effect for safety and comfort.

If a patient requires more than 3 bolus doses of Morphine within 1 hour, consider increasing the infusion dose by 20%.
Monitor for withdrawal symptoms following prolonged use of opioids - typically > 5 days (but may be shorter).

10. Sedation Assessment and Management

Sedation assessment (COMFORT-B scores) should be done on ALL patients (who are not muscle relaxed), minimum of 4 hourly, from the point of admission to discharge from PICU.

I. If any changes are made, this should be done hourly until a steady state is reached within target.

COMFORT B scores should be correlated with simultaneous FLACC scores.
Target COMFORT B scores are 12-17. Sedation therapy should be discussed on all patients to establish this remains the case.
If the COMFORT B score is >/= 10, consideration must be made to carry out Delirium Screening.
Consider weaning sedation if COMFORT-B <12.

If Comfort B score > 17 & FLACC > / = 4

- Give a Morphine bolus 50 – 100 micrograms/kg IV (max 5 mg) and review COMFORT B and FLACC score in 15 minutes.
- Repeat Morphine bolus if FLACC score still >4 still not in range twice more, reviewing FLACC score every 15 min and COMFORT B hourly.
- Increase Morphine infusion rate by 10-20% if FLACC score still not in target range after 3 bolus doses.

If Comfort B score > 17 & FLACC < 4

- Move to next step on sedation ladder.
- Repeat COMFORT B score hourly until achieving target.
- If cardiovascularly stable, give Midazolam bolus 50-100microgram/kg.
- Discuss with PICU consultant if Comfort B score still not in target range.

Patient about to have an unintended extubation:

- Call for help and bolus 100 micrograms/kg of Morphine +/- Midazolam if child is cardiovascularly stable and increase the background rate by 20%.

Over sedation: Comfort B < 12

- Decrease sedation by 20% if the Comfort B score is still < 12 after 1 hour.

11. Neuromuscular Blockade

Infants, children and young people in PICU may require neuromuscular blockade when they are critically unstable, or may have a post-operative recommendation for muscle relaxation.
It is important to note that it is very difficult to objectively assess pain and sedation (COMFORT B and FLACC scores cannot be done) when a patient is muscle-relaxed. Thus it is important to achieve adequate levels of analgesia and sedation prior to administration and commencement of a neuromuscular blocking agent.
Beware of the use of continuous muscle-relaxants in the context of multi-organ failure.
Where possible, continuous muscle relaxant infusion should be paused each day at 9am, to make an assessment of sedation, analgesia and delirium if possible. Prolonged immobility in intensive care increases the risk of critical care myopathy and other PICU acquired complications.
Passive eyelid closure and eye lubrication for prevention of corneal abrasions in critically ill paediatric patients receiving muscle relaxation is recommended.

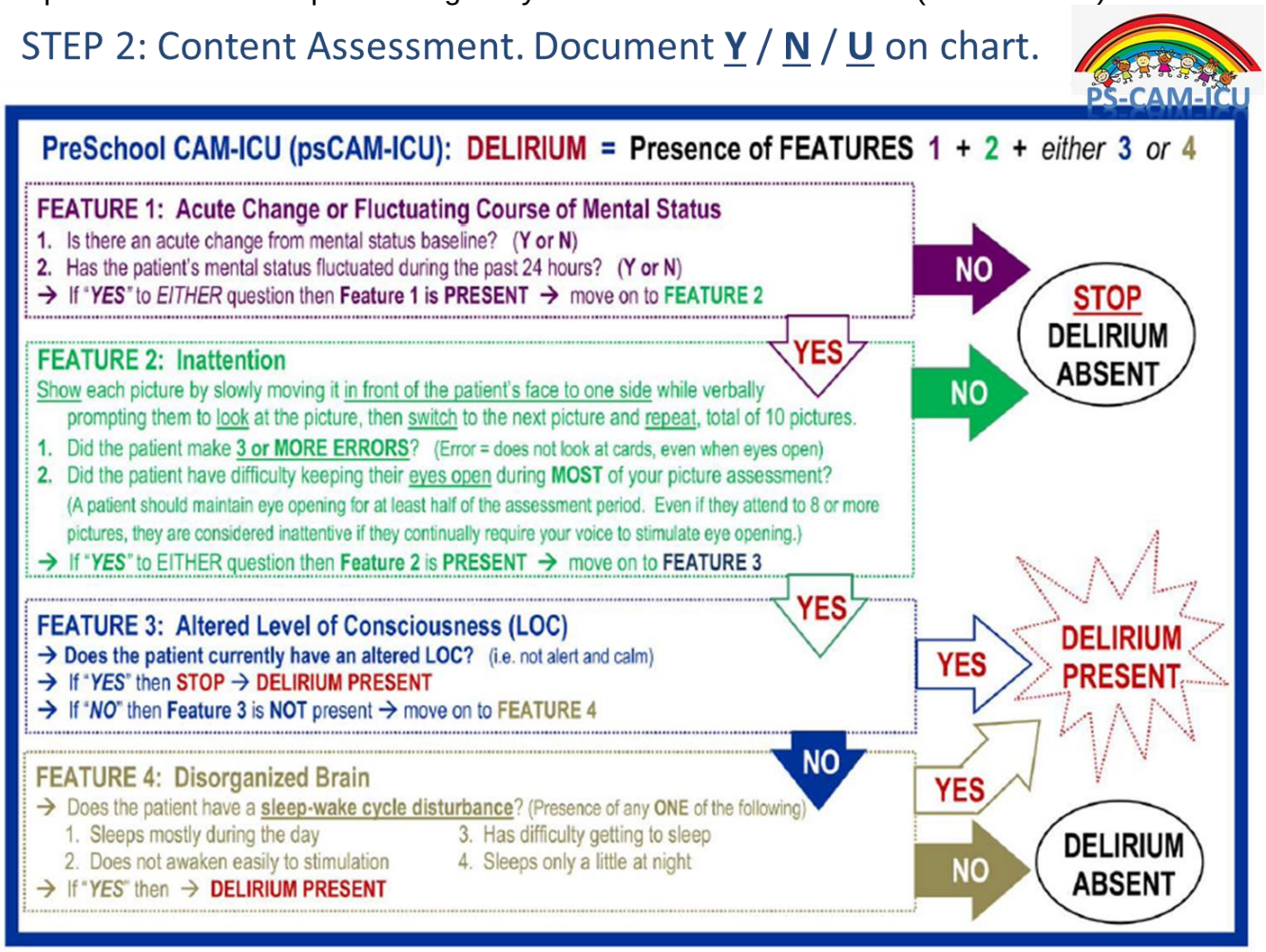
A train-of-four monitor can be used along with clinical assessment to determine the depth of neuromuscular blockade.

12. Paediatric Critical Care Delirium

Critical Care Delirium is an acute brain/organ dysfunction that is defined by the DSM V Criteria as:-
Acute and fluctuating mental status
Inattention
Acutely altered level of consciousness and or disorganised thinking systems.
It can manifest as hypoactive, hyperactive and mixed. The presence of critical care delirium in PICU increases morbidity and mortality of patients. Therefore it is important that it is prevented, recognised and managed appropriately.
In UHL, the validated tool for critical care delirium screening is the Paediatric Confusion Assessment Method for the ICU (PCAM-ICU) and Pre-school Confusion Assessment Method for the ICU (PSCAM-ICU).
All patients admitted to PICU should be screened twice daily from admission through to discharge. This is a PICANET daily data entry requirement.
STEP 1: AROUSAL ASSESSMENT – COMFORT B (see above)
Delirium Screening can only proceed when COMFORT-B >10 but preferably between 12 and 17. It can be performed more often if there is a change in behaviour or mental status.

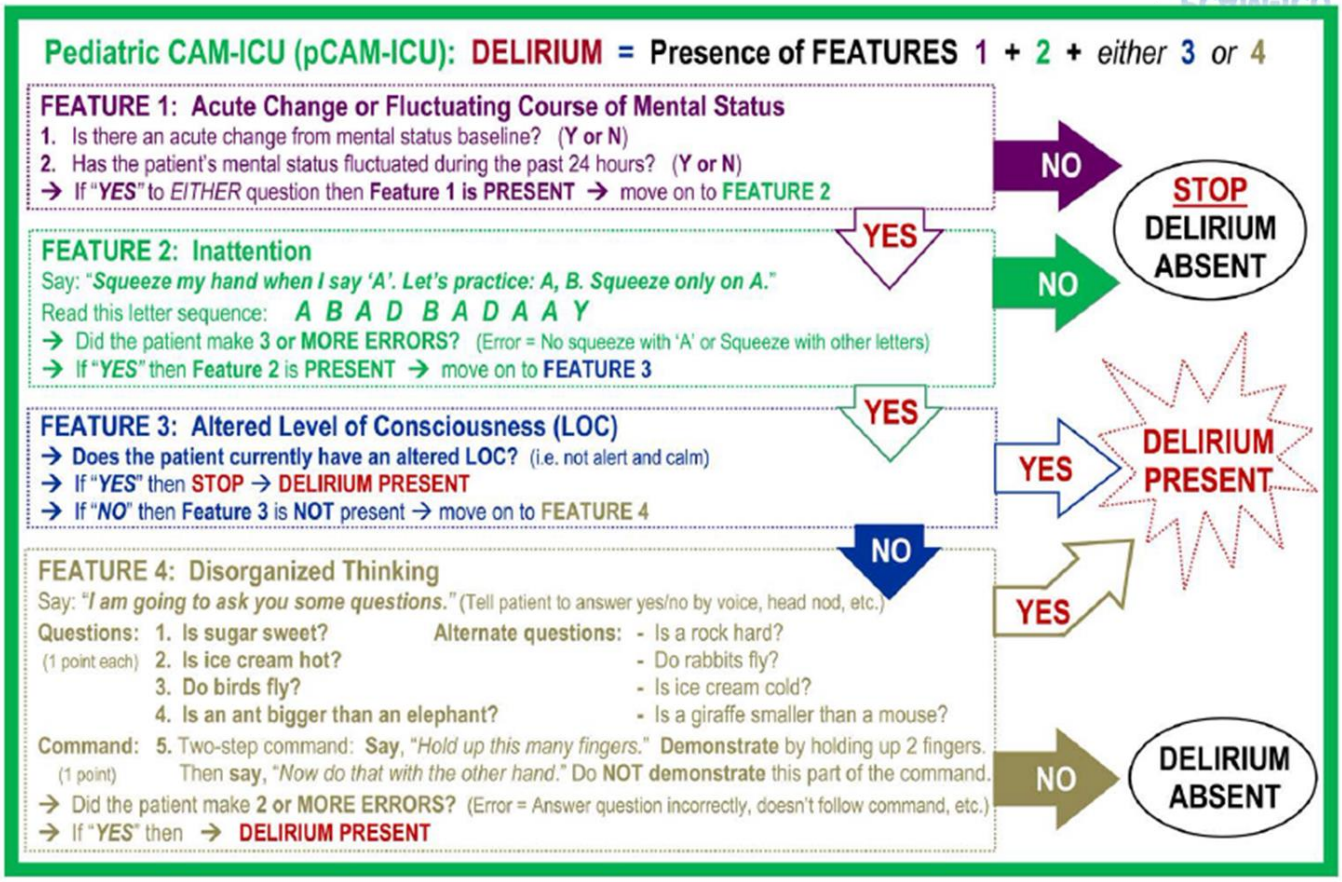
STEP 2: Content Assessment

For patients with developmental age <5y – use PreSchool CAM-ICU (PSCAM-ICU)



For patients with developmental age >5y, use the Paediatric CAM-ICU (PCAM-ICU)

STEP 2: Content Assessment. Document **Y** / **N** / **U** on chart.



If delirium is identified as being present, the following steps should be taken:-

- Escalate and inform medical staff
- Evaluate "BRAINMAPS" (see pg 6)

Continue to use the "DREAM" prevention strategy. (see pg 6)

If delirium persists >48hours, escalate to consultant. Persevere with non-pharmacological therapies and BRAINMAPS recommendations. The course of delirium is often fluctuating and improvements may not be seen for at least 24-48hours after implementation of strategy.
If hyperactive delirium is persistently causing significant risk to the patient's safety and haemodynamic stability in spite of optimised non-pharmacological therapies consultants may consider the use of pharmacological therapies.

Pharmacological therapies in critical care delirium

Pharmacotherapy in paediatric delirium is not evidence-based. The mainstay of management recommended is optimisation of non-pharmacological therapies – as per BRAINMAPS.

Consideration of the use of anti-psychotics to manage hyperactive delirium should be a consultant-led decision on a strict case-by-case basis. It is pertinent that a discussion with senior pharmacist and potentially CAMHS consultant is had, to ensure all other options are considered.

In adult studies, the use of Haloperidol, Ziprasidone vs placebo did not affect duration of delirium, mortality, ventilator time or length of stay. (Mind NEJM c379 ePub Oct 20). An adult study looking at the efficacy and safety of Quetiapine in critically ill patients with delirium found that vs placebo and PRN Haloperidol, the average time in delirium was 36 hours vs 120 hours (p= 0.006). (Devlin JW et al. Crit Care Med 2010 PMID19915454) But there was no difference in ICU length of stay. In-hospital mortality was 11% vs 17% but p =1.
A review article published in 2020 on the use of antipsychotic use in prevention and treatment of ICU delirium in paediatric patients concluded that in 13 reports including 131 patients receiving Haloperidol and 125 patients receiving Olanzepine, efficacy was reported – however this was often in absence of the use a validated delirium tool. (https://doi.org/10.5863/1551-6776-25.2.81)
A letter published in the Intensive Care Medical journal in 2014 recorded that a "considerable proportion of critically ill children with paediatric delirium developed adverse events with Haloperidol".

If the decision is made to use an **atypical anti-psychotic** following consultation with Pharmacy and CAMHS, the advice would be to **prescribe the lowest recommended dosage as per BNFC**. **Baseline ECG and calculated QTc must be documented and routine electrolytes measured prior to commencement.**
Patients should be observed for sensitivity and side effects accordingly. If used for a prolonged period, these medications can also cause iatrogenic withdrawal, therefore reduction in dose and frequency should be carried out in a step-wise fashion.

See for an example of de-prescribing in adult patients: **Antipsychotic de-prescribing in adults with dementia**

13. Withdrawal Assessment

Iatrogenic Withdrawal Syndrome (IWS) is a common side effect of prolonged sedation in critically ill patients. They manifest when an opioid or benzodiazepine is withdrawn after prolonged use (usually >5days, but can be >48hrs).

Signs and Symptoms of IWS

CNS irritability: poor sleep pattern, tremor, convulsions, irritability, hallucinations, dilated pupils
GI disturbance: vomiting, diarrhoea, abdominal pain, gagging
Autonomic disturbance: sweating, fever, yawning, hiccups, chills, increased secretions, tachycardia, tachypnoea, hypertension
The Withdrawal Assesment Tool-1 (WAT-1) should be used for the assessment of IWS due to opioid or benzodiazepine withdrawal in critically ill paediatric patients.
There is no current validated screening tool to assess for withdrawal from Alpha2 agonists; but the WAT-1 tool should be used as an adjunct to noting associated symptoms such as unexplained hypertension or tachycardia on cessation/weaning.
It is important to identify the cause of IWS:-

Opioid-related IWS should be treated with opioid replacement.
Benzodiazepine-related IWS should be treated with a benzodiazepine.
Alpha2 agonist-related IWS should be treated with IV and/or enteral alpha2 agonist.

Risk of IWS can be minimised by:

- Reducing total exposure of opioids and benzodiazepines. This can be achieved by optimising non-pharmacological interventions and considering the use of adjunctive non-opioid analgesia and alpha2-agonists if appropriate.
- Setting appropriate COMFORT-B targets and reviewing medication charts daily; identifying early, when sedatives and analgesia can be reduced in step-wise decrements.

- Early use of conversion of IV to enteral drugs where appropriate:-
  IV Morphine -> PO Oral Morphine Sulphate Solution
  IV Midazolam -> PO Diazepam
  IV Dexmedetomidine -> PO Clonidine

WAT-1 scoring instructions

- Start WAT-1 scoring from the first day of weaning in patients who have received opioids +/or benzodiazepines by infusion or regular dosing for prolonged periods *(usually, but not exclusively >5days).*
- Continue twice daily (in UHL - **6am and 6pm**) scoring until 72 hours post the last dose of opioid/benzodiazepine. *The assessment requires an observation of the patient for the previous 12 hours.*
- A total **score of 3 or more indicates iatrogenic withdrawal syndrome**.

14. Weaning of medications

Patients requiring opioids / benzodiazepines for less than 5 days do not require weaning UNLESS very high doses were used OR they are demonstrating signs of withdrawal when reducing/stopping medicines.

Suggested order of drugs to wean and conversion calculations:
This will need to be tailored according to the patient's clinical situation – wean sedatives first if there is an ongoing requirement for analgesia.

1. Ketamine

a) Although Ketamine is not associated with producing abstinence syndrome, there are reports of patients developing tolerance and requiring increasing dosage to achieve the same effect. Therefore it should be reduced quickly over a few hours.

2. Benzodiazepines

a) Convert to enteral formulation as early as possible.
   Conversion of IV Midazolam to Diazepam-
   - For 6 hrly dosing, divide Total (mg) of Midazolam by 12, up to max 10mg/dose.
   - Start Diazepam (PO/PR/IV).
   - At First Dose of Diazepam - Reduce IV Midazolam by 50%
   - At Second Dose of Diazepam – Cease IV Midazolam infusion

b) Wean the dose 24-48hrly by 20% until it is 0.05mg/kg/dose 6hrly, completing WAT-1 scores twice daily.

c) Then wean the interval from 6hrly to 8hrly to 12hrly at 24-48hrly intervals as tolerated, and then to stop. Weaning may need to be slowed further if there are signs of IWS.

3. Opioids

Opioids should be weaned if used at high doses OR for more than 5 days.

a) Weaning IV Morphine Infusion based on time of administration
   1. <5 days: Stop
   2. 5-9 days: Wean by 50% of original dose in first 24 hours, then wean by 50% of that dose, then stop
   3. 10-14 days: Wean by 20% of original dose every 24 hours
   4. 14 days : Wean by 10% of original dose every 24hrs

b) IV Morphine to PO Morphine

IV to PO Morphine potency approximately 1:3

1. Commence conversion when infusion is </= 10microgram/kg/hr and tolerating enteral feeds.

   Conversion of IV Morphine to PO Oral Morphine Sulphate Solution

   a) For 6hrly dosing, multiply Total (micrograms) IV morphine in 24 hrs by 0.75 (max dose 200micrograms/kg)
   b) For 4 hrly dosing, multiply Total (micrograms) IV morphine in 24 hrs by 0.5 (max dose 200micrograms/kg)

2. Wean 24-48hrly as tolerated by the patient. Consider alternating with a sedative.
3. Wean frequency from 4hrly to 6hrly.
4. Then wean the dose of PO Morphine by 20% each time to a minimum of 200microgams per dose. Consider weaning to 8hrly or PRN.

c) IV Fentanyl to PO Morphine

In acute pain, relative potency of Fentanyl to Morphine is 1:100.
In chronic use (where weaning is required), the potency is thought to be 1:25-50.
When changing between opioids, the tolerance to the 'new' opioid is not thought to be the same, hence the 'new' opioid dose should be reduced by 25-50%.

Conversion of IV Fentanyl to PO Morphine Sulphate Solution

a) First, convert from IV Fentanyl infusion dose to IV Morphine by multiplying x 25
   ie: 1microgram/kg/hr Fentanyl = 25microgram/kg/hr Morphine
b) Convert from IV Morphine to PO Morphine as per above.

4. Chloral Hydrate

a) Weaning should be considered if patients have required regular dosing of Chloral Hydrate for more than 5 days AND they are not being commenced on Diazepam as a part of sedative weaning.

1. To wean Chloral Hydrate:
   a) Reduce the frequency (ie 6hrly to 8 or 12hrly)
   b) If Chloral Hydrate is being stopped, it should be prescribed PRN for the initial few days whilst appropriate doses of opioids and benzodiazepines are being titrated.

5. Alimemazine

a) Alimemazine should be ceased when clinically appropriate.
b) Consider PRN Alimemazine if felt to be required.

6. Dexmedetomidine

a) Dexmedetomidine has rapid onset and offset of action with a terminal elimination half-life of approximately 2 hours, increasing to over 4 hours after an eight-hour infusion. It has a large volume of distribution in children and is 94% protein bound. Clearance of dexmedetomidine matures with age, reaching maturation at around 1 year and is also reduced by 27% after cardiac surgery. Withdrawal syndrome can occur after prolonged use of Dexmedetomidine (approximately 4 days at 1microgram/kg/hr). Symptoms tend to occur in the latter part of weaning or after cessation[40].
b) A review in 2022 found that there is no specific recommendation or guidance for the weaning of Dexmedetomidine.
c) UHL local policy suggests:-

1. Wean by 0.1micrograms/kg/hr 6-8hrly until dose = 0.7micrograms/kg/hr
2. Then commence Clonidine PO 2micrograms/kg 4-6hrly.
3. Stop Dexmedetomidine 12-24hrs after commencing Clonidine.
4. Wean Clonidine as per below

7. Clonidine

a) Continuing Clonidine into the withdrawal period can help to reduce the incidence of IWS in majority of patients. The dose should remain the same until opioids and or benzodiazepines are weaned off, or increased if IWS are present.
b) IV Clonidine will require step-wise weaning if administered for >5days. Monitor for withdrawal in these circumstances.
    1. If administered for >10days
        a) Reduce dose by 25% of original dose every 24 hours.
    2. If administered for 5-10days
        a) Reduce dose by 50% every 24 hours. (Should stop over 48hrs)
        b) Convert IV Clonidine to PO Clonidine once able to tolerate.
        1microgram IV Clonidine = 1microgram PO Clonidine.
    3. Commence PO Clonidine at 2-3micrograms/kg/dose 4-6hrly (max 5micrograms/kg/dose)
    4. Wean daily by 1microgram/kg/dose 6hrly
    5. Then wean the frequency daily to stop.

Monitor blood pressure 6 hourly whilst weaning Clonidine as it is an anti-hypertensive. Rebound hypertension is not necessarily a sign of iatrogenic withdrawal. If BP increases by 50% from the previous 24 hours, consider slowing the rate of weaning down, and reinstate the previous dose, and then start weaning again after 24hrs.

15. SPACE MISSION

All patients in PICU should be screened daily and allocated a “Patient Category” based on the inclusion criteria detailed on the SPACE Mission reference guide.
This category must be identified on the “SPACE Mission Goal Sheet” by circling the image of the category, and a target set from the suggested activity goals documented. This can also be documented on the nursing observation chart.
Parental and family involvement in planning and carrying out the activities and personal cares should be encouraged where appropriate.
Prior to out-of-bed activities being carried out, staff are expected to complete a documented risk assessment (sticker or written note) to ensure that tubes, drains and lines are secure; and that observations and monitoring are maintained during the activity. Appropriate numbers and members of staff/carers should be considered.
In the event of patient deterioration during activities, staff are expected to return patients to their bed and seek necessary help to assess and manage the deterioration. This should be clearly documented in the patient notes, and a Datix completed for any adverse incidences eg: unplanned extubation relating to mobilisation.

16. Drug Glossary

See flow charts for an overview of analgesia and sedation in PICU.

Category	Drug	Dose	Notes **Refer to BNFC for full cautions**	Weaning considerations
Simple Analgesia	Paracetamol	As per BNFC	Prefer PO > IV > PR NB IV dose & frequency is lower	N/A
NSAID	Ibuprofen	As per BNFC	Caution in renal disease, coagulation defects, those on anti-coagulants/anti-platelets. May exacerbate IBD, potential for uncontrolled hypertension	N/A
NSAID	Diclofenac	As per BNFC		N/A
NSAID	Ketorolac IV	As per BNFC Used for 2 days max.		N/A
Opioid	Morphine	Bolus: 50-100micrograms/kg Continuous infusion: 5-60micrograms/kg/hr	Usual prescribed & administered bolus dose is 50micrograms/kg. This can be given twice if required	Wean according to length of infusion. Convert to enteral when tolerated </=10microgram/kg/hr
Opioid	Fentanyl	Infusion: 1-6micrograms/kg/hr (48 hours) Bolus: 1-5micrograms/kg over 30secs	If used for 9 days -> 100% Withdrawal	Prolonged elimination half life if prolonged use! Convert to IV Morphine first.
Alpha 2 agonist	Clonidine	IV infusion: 0.2-2micrograms/kg/hr PO/NG: 1-5micrograms/kg 4-8hrly		Convert to PO Clonidine once on 0.5micrograms/kg/hr. The dose IV = PO.
Alpha 2 agonist	Dexmedetomidine	Ref: Injectable Medicines Policy Dose Ranges: Newborn CGA 28-37/40: 0- 0.8 microgram/kg/hour Term infants < 14 days: 0.2-0.6 (max 1.4) micrograms/kg/hr Term infants >14days: 0.4 to 0.7 (max 1.4) micrograms/kg/hour	Reduce dose in Renal/ Hepatic Impairment. CI in Advanced Heart block, uncontrolled hypotension, acute cerebrovascular conditions	Wean if used >72hrs Convert to PO Clonidine when 0.7micrograms/kg/hr
Anti-histamine	Alimemazine	0.5-1mg/kg/dose 6hrly (max 25mg/dose)	Extrapyramidal side effects including dystonia & dyskinesia. Can	

			cause insomnia and agitation. Can cause arrhythmia. Avoid in renal and hepatic failure	
Sedative	Chloral Hydrate	Neonates: 15-25mg/kg/dose 6hrly PRN 1m-1y: 25mg/kg/dose 6hrly PRN >1y: 30mg/kg/dose (max 1g) 6hrly PRN (May require weaning if used >5days)	Hypotension, bradycardia arrhythmias, hepatotoxicity, hyperbilirubinaemia, withdrawal and paradoxical reactions	Rapidly absorbed. Peak effects at 30-60mins. Metabolized by alcohol dehydrogenase to trichloroethanol.
	Melatonin	2-10mg Nocte usually for age >2y	Give 2 hours before bedtime, with other sleep hygiene methods.	
	Propofol	IV infusion: 1-4mg/kg/hr according to response IV bolus: 1-4mg/kg slow bolus adjusted to response	Beware Propofol Infusion Syndrome. Check TG	
	Midazolam	IV infusion: 50-250micrograms/kg/hr IV bolus: 50-100micrograms/kg PRN	avoid in Neonates <30days Risk of delirium & withdrawal if used >48hrs and <5y	Problems with tolerance and withdrawal syndrome: Incidence ~ 17 - 30% with total dose of > 60 mg/kg (200 micrograms/kg/hr Infusion for 12.5 days) T1/2 lengthens with use, so when used for several days it will have prolonged sedation on discontinuation, also sits in tissues, plastic tubing of circuits etc; reduced efficacy in infants.
NMDA receptor antagonist	Ketamine	IV infusion: <u>Neonates:</u> 480 – 800micrograms/kg/hr <u>Paediatric:</u> 600-2700micrograms/kg/hr IV Bolus: 0.5-2mg/kg	Consider in bronchospasm. Beware hallucination and in TCA overdose	Rapid Wean over few hours

17. Other Analgesia & Sedation Options

The following options should be considered and discussed with the PICU consultant when pain and or sedation management for a patient is problematic:

- Local / Regional anaesthesia
- Local and regional anaesthetic techniques should be considered where appropriate, e.g. epidural anaesthesia for abdominal surgery, regional nerve blocks for limb pain.
- Discuss with an anaesthetic colleague or a member of the pain service.
- A patient-controlled analgesia device may be useful in older children.

Remifentanil

Remifentanil is a very short acting and potent opioid and is ideal for use during short stimulating procedures such as physiotherapy or chest drain removal.

Due to its very short half-life, it may be useful in situations where frequent neurological assessment is needed as it can be paused/stopped, allowing the child to quickly gain a window of awareness/consciousness for assessment.

Remifentanil is metabolised by non-specific blood and tissue esterases (and unlike other opioids is not metabolised in the liver) and therefore may be useful in situations where hepatic impairment is a concern.

Due to its very short half-life, a child returning from theatre on a remifentanil infusion will rapidly experience severe pain if an alternative analgesia is not adequately established before weaning remifentanil. Discuss transition with a consultant.

All ages

6 – 20 micrograms/kg/hour (0.1-0.33micrograms/kg/min)

Max 120 micrograms/kg/hour.

Caution: Avoid IV bolus remifentanil in PICU due to risk of severe hypotension.

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19. Education and Training

This guideline will be circulated to all staff on the PICU clinical practice group mailing list to raise awareness. It will be available to download from PAGL on Insite.
This guideline will be presented in QUICKA-PIC meetings as required, with support and guidance provided by senior clinical staff and PICU pharmacists.
Education and training for nursing staff will be carried out by the nursing education team. Junior doctors will be made aware of this guideline at induction, with support and guidance provided by senior clinical staff and PICU pharmacists.

20. Monitoring Compliance

What will be measured to monitor compliance	Method of Assessment	Frequency	Monitoring Lead	Reporting
Guideline Algorithm followed	Audit	As necessary	PICU CPM	PICU CPM
Unplanned extubation rate	Datix Audit	As necessary	PICU CPM	PICU CPM
Unplanned line removal rate	Datix Audit	As necessary	PICU CPM	PICU CPM
Critical Care Delirium Screening Compliance Rate	PICANet Audit	Annually		
SPACE Mission Goal setting & completion	Audit	Monthly		

21. Keywords

Alimemazine, Benzodiazepines, Chloral hydrate, Clonidine, Comfort score, Content assessment, Dexmedetomidine, Ketamine, Opioids, Pain assessment, State behavioural scale, Withdrawal

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The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.
As part of its development, this policy/guideline and its impact on equality have been reviewed and no detriment was identified.

CONTACT AND REVIEW DETAILS			
Guideline Lead (Name and Title) Eldilla Rizal PICU Consultant S Wheeler PICU Pharmacist		**Executive Lead** Chief Medical Officer	
Review Record			
Date	**version**	**Reviewed by**	**Description of change (if any)**
Jun 2019	**2**	J Tong	

January 2024	**3**	Eldilla Rizal PICU Consultant S Wheeler PICU Pharmacist UHL PICU/CICU Clinical practice group UHL Children's Quality & Safety Board	**Complete re-write and re-title**