# Children's Resuscitation Emergency Drug Dosage (CREDD)

## 2nd Edition

Sponsored by the Queensland Emergency Department
Strategic Advisory Panel (QEDSAP)

Clinical Excellence Queensland
Queensland Government

## Acknowledgement of country

We pay our respects to the Aboriginal and Torres Strait Islander ancestors and custodians of this land, their spirits and their legacy. The foundations laid by these ancestors—First Nations peoples—gives strength, inspiration and courage to current and future generations. We are committed to working towards a stronger and healthier Queensland community for Aboriginal and Torres Strait Islander and non-Aboriginal and Torres Strait Islander people.

*Children's Resuscitation Emergency Drug Dosage (CREDD)* 2nd Edition

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Cover artwork produced for Queensland Health by Gilimbaa. The motifs used represent the important network of people from Queensland communities and how they work together to empower Aboriginal and Torres Strait Islander Queenslanders to have long, healthy, productive lives.

For content enquiries or feedback email the CREDD team at CREDD@health.qld.gov.au

For distribution enquiries email the Simulation Training Optimising Resuscitation for Kids (STORK) at STORK@health.qld.gov.au

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This book has been designed as a cognitive aid to guide drug administration in paediatric emergency situations throughout Queensland. We recommend hospitals follow their usual practice for endorsement locally including presenting it to their local Medicines Advisory Committee (or equivalent) prior to use. It is designed to be used by staff with expertise and skills in the management of critically unwell children. We recommend staff become familiar with and receive training in the use of this book prior to using it. Whilst the information contained herein has gone through a vigorous checking and referencing process it is not a substitute for thinking and checking.

# Purpose

This book is a weight-based equipment and medication guide intended for use by clinicians managing critically unwell children during the initial stages of resuscitation. It contains information on the recommended dosing, preparation and delivery of drugs administered in a wide range of paediatric emergencies.

The aim of providing this information by weight is to reduce the cognitive burden at the time of resuscitation thereby limiting the potential for error and improving the speed of medication delivery.

The CREDD book has been developed by a multidisciplinary team of clinicians and pharmacists with emergency, paediatric, paediatric intensive care and retrieval expertise.

The preparation methods contained in this book use standardised concentrations to align with the international safety standards of drug preparation.

## Considerations

The CREDD book is not a substitute for clinically appropriate, carefully checked medication orders. It is designed to be used in conjunction with state and/or local resources which contain information on drug interactions, compatibilities, precautions and possible side effects.

Empiric antibiotic recommendations are beyond the scope of this book.

The dosing information contained in this book reflects the latest evidence at the time of print and is subject to change. Refer to *references* and the *rationale for consensus decisions* at the back of this book for further information.

The infusion recommendations align with the Queensland Children's Hospital, Paediatric Intensive Care medication safety drug profiles. We recommend using drug error reduction software (DERS) on all pumps. For sites without DERS software we have included mL/hr relating to dosing recommendations for that particular medication when prepared as instructed.

For online paediatric emergency resources including a digital version of CREDD and further paediatric resuscitation education by Simulation Training Optimising Resuscitation for Kids (STORK) visit the Queensland Paediatric Emergency Care page on the Children's Health Queensland website. Search "CHQ emergency care" or scan the code on the front cover with your phone's camera.

## Second edition changes

In response to valuable feedback we have made the following changes to the 2nd edition.

Inclusions:

- Weights 2.5 kg, 3.5 kg, 4.5 kg.
- New medication sections
  - Lignocaine 1% for pain associated with IO medication and fluid administration
  - Antiarrhythmic medications
  - Acute Behavioural disturbance medications
- Fluid recipe appendix.

Changes to existing sections:

- Midazolam IV 0.15 mg/kg – dose change
- Levetiracetam 60 mg/kg – dose range change
- Sodium Valproate 40 mg/kg – new medication
- Infusions
  - Narrowing of recommended rate range. Top dose capped at rate when a dose considered the upper end of usual adult dosing is reached. If clinically indicted, the dose can still be increasecd within the programmed DERS pumps soft and hard limits.
  - Fentanyl added to weights 2 - 9 kg
  - Morphine STRONG added to weights 26 kg - 70 kg
  - Midazolam STRONG added to weights 26 kg - 70 kg
  - Esmolol 2 - 70 kg – new medication
  - Amiodarone 2 - 70 kg – new medication
  - A change in the Alprostadil (Open Ductus Arteriosus) dose range 50 to 100 nanogram/kg/min 2 - 6 kgs

**When caring for critically unwell children call for HELP early**

If no paediatric critical care facility onsite, contact **Retrieval Services Queensland (RSQ) on 1300 799 127.**
If required, Paediatric Critical Care specialists can check dosing and guide clinicians through drug preparation.

# How to use CREDD

Determine the weight of the child and find the respective pages for that weight in the book. If the exact weight is not known, it can be estimated (see *Table 1*).

Medications are grouped according to the condition in which they are used. Weights range from 2 to 70 kg in predefined increments. When the actual body weight is between a weight range, we recommend rounding up to the nearest kilogram.

Clinical judgement is needed for dose selection at the extremes of body weight for a given age.

Depending on the medication there is variability in the weight at which an adult medication dose is reached. Once adult dosing is reached all weights above this will reflect the adult dose.

## Equipment selection

Equipment sizing is determined by age.

As this book is a weight based guide, the listed size is based on the expected weight for each age. See *Table 1*.

When using a cuffed Endotracheal tube (ETT) we recommend the use of an ETT with a micro-cuff. These tubes are designed to seal at a lower cuff pressure with a more anatomically favourable design for paediatric patients.

| Age | Weight | Height | ETT micro-cuff size |
|---|---|---|---|
| Birth (term) | 3.5 kg | 50 cm | 3.0 |
| 1 month | 4 kg | 55 cm | 3.0 |
| 2 months | 5 kg | 58 cm | 3.0 |
| 3 months | 6 kg | 61 cm | 3.0 |
| 4 months | 7 kg | 63 cm | 3.0 |
| 6 months | 8 kg | 67 cm | 3.5 |
| 9 months | 9 kg | 72 cm | 3.5 |
| 1 year | 10 kg | 75 cm | 3.5 |
| 2 years | 12 kg | 87 cm | 4.0 |
| 3 years | 14 kg | 96 cm | 4.0 |
| 4 years | 16 kg | 103 cm | 4.5 |
| 5 years | 18 kg | 110 cm | 4.5 |
| 6 years | 20 kg | 115 cm | 5.0 |
| 7 years | 22 kg | 122 cm | 5.0 |
| 8 years | 25 kg | 127 cm | 5.5 |
| 9 years | 28 kg | 134 cm | 5.5 |
| 10 years | 30 kg | 139 cm | 6.0 |
| 11 years | 35 kg | 144 cm | 6.0 |
| 12 years | 40 kg | 150 cm | 6.0 or 7.0 |
| 13 years | 45 kg | 156 cm | 6.0 or 7.0 |
| 14 years | 50 kg | 162 cm | 7.0 |

**Table 1.** Average weight and height for age with ETT micro-cuff sizes

## Medication recommendations

Medication doses are expressed as the **recommended dose/kg** and the **dose** reflects the calculated dose for each weight.

Where a dosing range is displayed, the lower dose is provided in the dose column. Certain medications should be titrated to the desired effect. Careful judgement is needed when managing critically unwell children. A shocked child is particularly sensitive to the respiratory and cardio depressant effects of induction agents and analgesics. Titration of these drugs to effect with careful attention to correcting hypovolaemia and using vasoactive agents such as push dose pressor Adrenaline is recommended.

We have aimed to simplify medication administration, and comply with international medication safety standards, by guiding the user to prepare medications as standard concentrations, referred to as **final concentration**. This is familiar practice in most emergency departments. Where practical, and to minimise error the recommended practice is to draw up the entire contents of specific vials/ampoules and dilute according to the **preparation/dilution** instructions.

Unless otherwise indicated, the recommended diluent is Sodium Chloride 0.9%. The user is guided in preparing a **final concentration** of the drug and the **final volume to administer** the calculated dose.

Some medications do not require dilution; the preparation instructions for these state “Undiluted”.

When the recommended dose exceeds the contents of one vial, multiple vials may need to be drawn into the syringe to give the dose and **final volume to administer**.

The wording “consult” replaces the dose when a medication would not be recommended due to the age of the child.

The **administration** column provides guidance on medication delivery. Medications to be administered as a “push” should be given as rapidly as the vein and volume allows unless a time frame is specified. IV refers to both intravenous and intraosseous routes of administration.

When the dose of IV/IO medication to be administered has a volume of less than 1 mL and is required to be given over any time period between 30 seconds to 5 minutes. The exact dose can be drawn up in a 1 mL syringe then diluted to a total volume of 1 mL with a compatible fluid. This enables an exact dose to be given as specified.

Medications given over longer than five minutes should preferably be given as a short infusion. However, where this is not possible, the medication can be pushed by a staff member over the specified time frame.

### Rounding rules

**Final volume to administer** is calculated according to the following rules:

- the volume has been rounded to two decimal places for medication doses which are below 1 mL (accurately draw up into a 1 mL syringe)
  e.g. Adenosine dose 0.4 mg = final volume of 0.13 mL
- single decimal place used for medication doses with volumes between 1 - 20 mL
  e.g. Levetiracetam 440 mg = final volume of 8.8 mL
- dosing rounded to the nearest mL for medication doses with a volume above 20 mL

“The underlying principle of CREDD is to provide a safe and practical guide for medication administration in pressured situations. For this reason, doses are rounded to a volume that is easy to draw up and administer. Ideally, we would like to apply a blanket rule for rounding doses however this is not always appropriate. In most cases, medications with volumes less than 1 mL are rounded to two decimal places and volumes over 1 mL to one decimal place. In some medications, the dose is reflected as the actual calculated dose and the final volume is rounded to a practical and safe volume to administer.”

# Administration

## Push and titratable medications

The recommended procedure for medications to be administered as a push is as follows:

1. Prepare the **final concentration** (Mothership) syringe **(A)**. Ensure it is clearly labelled as per institutional labelling standards.

2. Attach a fluid dispensing connector **(B)** or 3-way tap **(C)** to an appropriate sized **dose** syringe **(D)** that is clearly labelled.

3. Draw the exact dose **final volume to administer (D)** into the dosing syringe.

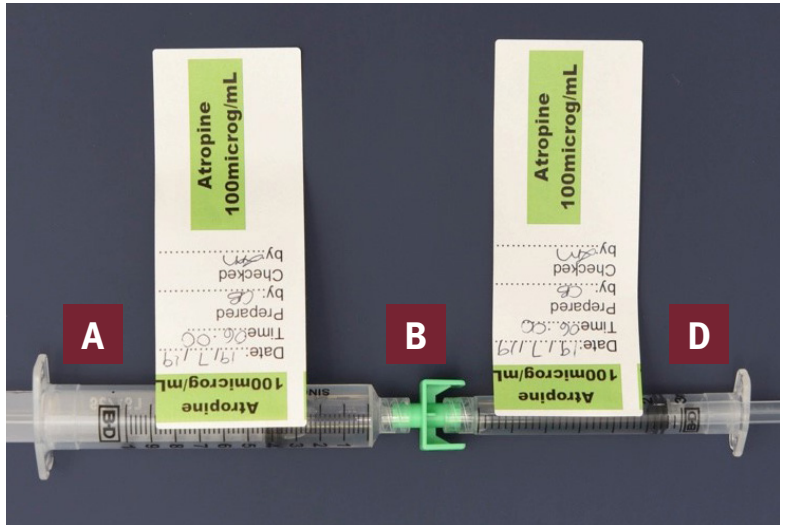


**Fig 1.** Final concentration syringe connected to the dose syringe using a fluid dispensing connector.

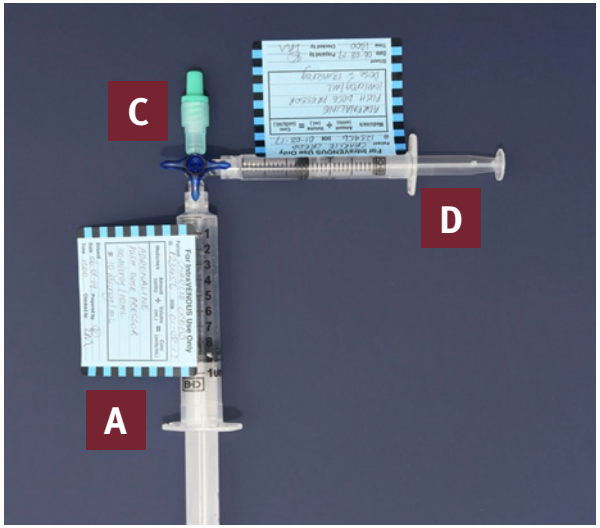


**Fig 2.** Final concentration syringe connected to the dose syringe using a 3-way tap.

## Short infusions and loading doses

Having prepared the final concentration, ensure only the exact volume to be infused is attached to the syringe pump by either:

- drawing up the **final volume to administer** into a different syringe of appropriate size.
- if **final volume to administer** less than 5 mL it is reasonable to dilute the dose up to a practical volume for the pump to infuse.
- or, if using the **final concentration** (Mothership) syringe, discard all excess solution so that the volume contained in the final concentration syringe is limited to the **final volume to administer**.

Administer the exact dose via an infusion pump over the specified time.

## **Infusions** (page 5 of each weight)

All infusion preparations are prepared to produce a standardised concentration in line with the Children's Health Queensland and CHQ Retrieval Service and international drug safety standards. Unless specified, all infusions are made up to a concentration which can be safely administered via a peripheral vein. Where a central vein is advised, this may be achieved by using a central vein or intraosseous access.

Infusions are grouped according to the purpose of use. The user is guided in **preparation** instructions to produce a standardised **final concentration** of drug made up in a 50 mL syringe. The **recommended dose/kg** range is stated in appropriate units (e.g. units/kg/min or units/kg/hr). The final rate range reflecting this dose range is given in millilitres (mL) per hour. This is to assist sites without smart pumps and drug error reduction software.

Some infusions have small volumes and low rates which can result in delays in the medication reaching the patient. We recommend the infusion line is connected as close as possible to the patient IV and commenced at a rate which ensures the medication reaches the patient quickly. The patient should be observed continuously, and the infusion titrated to effect.

Higher concentration solutions options are offered in larger children, to minimise the need for infusion changes.

# References

Provided below are the references to support the recommendations outlined in this book. Refer to the glossary below for further details on the references.

**Table 2.** References to support medication recommendations

| Drug | Indication | Dose | Dilution and final concentration | Max dose/adult dose | Administration | References |
|---|---|---|---|---|---|---|
| Adrenaline | Anaphylaxis | 10 microg/kg. Auto-injector under 20 kg use 150 microg over 20 kg use 300 microg | 1:1000 = 1000 microg/mL | 0.5 mg | IM | Ascia, AMHc, APLS, ANZCOR |
| Adrenaline | Upper airway obstruction | 5 mg | 5 mLs of 1:1000 | 5 mg | Nebuliser | Ascia, eTG |
| Adrenaline | Cardiac arrest | 10 microg/kg | 1:10,000 = 100 microg/mL | 1 mg | IV | ANZCOR, APLS |
| D/C Shock | Cardiac arrest shockable rhythm | PAD selection size dependant on make of machine | | Dependant on model Biphasic 150 - 200J Monophasic 360J | | ANZCOR, APLS |
| AmiODAROne | Shock resistant VT/VF | 5 mg/kg | Glucose 5% final concentration 10 mg/mL | 300mg Adult dose from 60 kg | IV | ANZCOR APLS |
| Fluid Bolus | Hypovolaemia | 10 mL/kg | Sodium Chloride 0.9% | | | ANZCOR, APLS |
| Fluid Bolus | Hypovolaemia | 20 mL/kg | Sodium Chloride 0.9% | | IV | ANZCOR, APLS |
| Glucose 10% | Hypoglycaemia | 2 mL/kg | Glucose 10% | 150 mL repeat to effect | IV | APLS |
| Adenosine 1st | SVT | 0.1 mg/kg | Undiluted | 6 mg | IV | ANZCOR, APLS |
| Adenosine 2nd | SVT | 0.2 mg/kg | Undiluted | 12 mg | IV | ANZCOR, APLS, AMH |
| Adenosine 3rd | SVT | 0.3 mg/kg | Undiluted | 12 mg from 40 kg | IV | ANZCOR, APLS, AMH |
| Synchronised cardioversion | | 1 - 2 J/kg | | Adult 50 J 100 J 200 J | | APLS, ANZCOR |
| Atropine | Bradycardia | 20 microg/kg | Dilute to 100 microg/mL | 600 microg | IV | APLS, ANZCOR, AMH |
| Push Dose Pressor | Intermittent administration of small doses of vasopressors for hypotension particularly associated with Intubation. Useful as a temporizing bridge to inotrope infusion commencing. Below 40 kg Adrenaline is preferred over Metaraminol. | | | | | Ross et al 2018, Scott Weingart 2017 |
| Adrenaline | Hypotension | 1 microg/kg | 10 microg/mL | 50 microg at 50 kg | Push in 1 mL aliquots if multiple doses needed start infusion | Ross et al 2018, Scott Weingart 2017 |
| Metaraminol | Hypotension | 10 microg/kg | 500 microg/mL | Max 0.5 mg per dose Use over 12 years | Max 1 mL boluses repeated up to 5 mg | BNFc |
| Fentanyl | Sedation | 2 - 5 microg/kg | 10 microg/mL | 100 microg | Titrate to effect | AMH |
| Ketamine | Sedation | 1 - 2 mg/kg | 10 mg/mL | 200 mg | Titrate to effect | AMHc |
| PropOFOl | Sedation | 2 - 3 mg/kg | 10 mg/mL | | Titrate to effect | AMHc, BNFc |
| Midazolam | Sedation/seizure | 0.15 mg/kg | 1 mg/mL | 10 mg | IV | AMHc |
| Rocuronium | Muscle relaxation | 1.2 mg/kg | 10 mg/mL | | IV | QCH, Shann |
| Suxamethonium | Muscle relaxation | 2 mg/kg | 10 mg/mL | 150 mg | IV | QCH |

| Drug | Indication | Dose | Dilution and final concentration | Max dose/adult dose | Administration | References |
|---|---|---|---|---|---|---|
| Vecuronium | Muscle relaxation | 0.1 mg/kg | 1 mg/mL | 10 mg | IV | AMH, Shann |
| Sugammadex | Rocuronium reversal | 16 mg/kg | 100 mg/mL | | IV | AMH, Shann |
| Flumazenil | Benzodiazepine reversal | 5 microg/kg | 100 microg/mL | Max single dose 200 microg can go up to total dose 2 mg | IV | AMHc, BNFc |
| Naloxone | Opioid reversal | 10 microg/kg | 400 microg/mL | 400 microg | IV/IM | AMH, QCH |
| Dexamethasone | Severe croup | 0.3 mg/kg | 4 mg/mL | 12 mg | IV/IM | CHQ |
| Magnesium Sulfate | Asthma<br>Polymorphic VT | 0.2 mmol/kg | 0.2 mmol/mL | 10 mmol | IV | AMHc, QCH, PIG |
| Hydrocortisone | Adrenal crisis, Asthma | 4 mg/kg | 50 mg/mL | 200 mg | IV | AMHc, CHQ |
| Methylprednisolone | Asthma | 1 mg/kg | 40 mg/mL | 60 mg | IV | CHQ |
| Salbutamol | Asthma load | 0.1 mg/kg | 0.1 mg/mL | 5 mg | IV | CHQ |
| Aminophylline | Asthma load | 5 mg/kg | 5 mg/mL | 500 mg | IV | CHQ |
| Midazolam | Seizure | 0.2 mg/kg | 5 mg/mL | 10 mg | IM | AMHc |
| Midazolam | Seizure | 0.3 mg/kg | 5 mg/mL | 10 mg | Nasal/buccal | AMHc |
| Phenytoin | Status epilepticus | 20 mg/kg | 10 mg/mL | 1500 mg | IV | AMHc, APLS |
| Phenobarbital | Status epilepticus | 20 mg/kg | 20 mg/mL | 1000 mg | IV | AMHc, APLS, BNFc |
| Levetiracetam | Status epilepticus | 60 mg/kg | 50 mg/mL | 4.5 g | IV | Lyttle et al 2019 |
| Sodium Valporate | Status epilepticus | 40 mg/kg | 40 mg/mL | 3 g | IV | CHQ, AMHC |
| Mannitol 20% | Raised ICP | 0.5 g/kg | 0.2 g/mL | | IV | CHQ, BNFc |
| Sodium Chloride 3% | Raised ICP | 3 mL/kg | 0.5 mmol/mL | 150 mL | IV | CHQ |
| Potassium Chloride | Hypokalaemia | 0.3 mmol/kg | 0.1 mmol/mL premixed bag | 20 mmol/hr | IV | CHQ |
| Calcium Gluconate | Hypocalcaemia,<br>Hyperkalaemia | 0.11 mmol/Kg | 0.2 mmol/mL | 4.5 mmol 20 mL 10% | IV | BNFc |
| Salbutamol Nebs | Hyperkalaemia | 2.5 mg under 6 years<br>5 mg over 6 years | | | Neb | RCH |
| Frusemide | | 1 mg/kg | 1 mg/mL | | IV | AMHc, BNFc |
| Sodium bicarbonate 8.4% | Hyperkalaemia | 1 mmol/kg | 1 mmol/mL | | IV | BNFc, RCH |
| Resonium A | Hyperkalaemia | 0.25 g/kg | Dilution chosen for ease of administration | | PO/PR | BNFc |
| Blood | Blood loss<br>Anaemia | 10 mL/kg | As clinically indicated. Blood loss 10 - 20 mL/kg and reassess. Elective transfusion equation child under 20 kg. mL = weight (kg) x desired Hb rise g/L (desired Hb g/L–Actual Hb g/L) x 0.5 10 mL/kg usually = 2 g/L rise | | | APLS, ANZCOR |
| Tranexamic acid | Large blood loss | 15 mg/kg | 10 mg/mL | 1000 mg | IV | AMHc |
| Fentanyl | Analgesia | 1.5 microg/kg | 50 microg/mL | 100 microg | IN | AMH |
| Fentanyl | Analgesia | 0.1-1 microg/kg | 10 microg/mL | 100 microg | IV | AMH |
| Morphine | Analgesia | 0.05-0.1 mg/kg | 1 mg/kg | 10 mg | IV | AMH |

| Drug | Indication | Dose | Dilution and final concentration | Max dose/adult dose | Administration | References |
|---|---|---|---|---|---|---|
| Lignocaine 1% | Analgesia for **IO** infusions | 0.5 mg/kg | 10 mg/mL | 40 mg initial<br>20 mg subsequent<br>MAX 60 mg | IO follow dose with 1 mL Sodium Choride 0.9% flush over 2 min. Dwell for 1 min. Rapid flush 5 mL. Half original dose can be repeated as above | QAS, PCCM |
| AmiODAROne (load) | Antiarrhythmic | 5 mg | Glucose 5%<br>2 mg/mL | 300 mg | Use 0.22 micron<br>Filter load over 4 hours = 20 - 25 microg/kg/min | ANZCOR, AMHc, PIG |
| Esmolol (load) | Beta blocker SVT | 0.25 - 0.5 mg/kg | Undiluted | 500 microg | Push over 1 - 2 min | AMHc, BNFc, PIG |
| Esmolol (infusion) | Beta blocker | 50 - 300 microg/kg/min | Undiluted | 500 microg/kg/min | Titrate in 25 - 50 microg/min increments | AMHc, PIG |
| Verapamil | SVT | 0.1 MG/KG | 1 mg/mL | 10 mg | Infuse over 5 - 10 min | AMHc, BNFc, PIG, AID |
| Diazepam | Behavioural disturbance | 0.2 mg/kg | 1 mg/mL | 10 mg | PO | QHG, RCH |
| Lorazepam | Behavioural disturbance | ‹ 40 kg 0.5 - 1 mg<br>› 40 kg 1 - 2 mg | | 2 mg | PO<br>Dose banding | CHQ, RCH |
| Olanzapine | Behavioural disturbance | ‹ 40 kg 2.5 - 5 mg<br>› 40 kg 5 - 10 mg | | 10 mg | PO<br>Dose banding | QHG, CHQ |
| Risperidone | Behavioural disturbance | 0.02 - 0.04 mg/kg | | 2 mg | PO<br>Dose banding | QHG, RCH |
| Droperidol | Behavioural disturbance | 0.1 - 0.2 mg/kg | Undiluted 2.5 mg/mL | 10 mg | IM | QHG, CHQ |
| Olanzapine IM | Behavioural disturbance | 0.2 mg/kg<br>‹ 40 kg 2.5 - 5 mg<br>› 40 kg 5 - 10 mg | | 10 mg | IM<br>Dose banding | CHQ, RCH |
| Benztropine | Dystonic reaction | 0.02 mg/kg | Undiluted 1 mg/mL | 1 mg | IM/IV | CHQ, AMHc |

**Table 3.** References to support equipment recommendations

| Equipment | Recommendation | Reference |
|---|---|---|
| ETT | Tube sizes are calculated according to age. As this is a weight based book we have used 50$^{th}$ centile weights for age from AMH to determine weights at which tube size and depth of insertion change | APLS |
| ETT cuffed | Calculated as Age/4 + 3.5 for children 1 year or older. ETT with average weight for age represented | APLS, Micro cuff ETT www.halyardhealth.co.uk |
| ETT uncuffed | Calculated as Age/4 + 4.0 for children 1 year or older. ETT with average weight for age represented | APLS |
| Depth at lips | Calculated as Age/2 + 12 for children 1 year or older. Newborn 8 cm, 6 months 10 cm, 1 year 12 cm | APLS |
| Depth at nose | Calculated as Age/2 + 15 for children 1 year or older. Newborn 10 cm, 6 months 13 cm, 1 year 14 cm | APLS |
| LMA size | Under 5 kg = 1, 6 - 10 kg = 1.5, 11 - 20 kg = 2, 21 - 30 kg = 2.5, 31 - 50 kg = 3, 51 - 70 kg = 4 | ANZCOR |
| IDC and Nasogastric tube | 2 x uncuffed ETT | Standard practice |
| Intercostal catheter | 4 x uncuffed ETT | Standard practice |

# Glossary

| | |
|---|---|
| **AMH** | *Australian Medicines Handbook July 2019*, amhonline.amh.net.au |
| **AMHc** | *Australian Medicines Handbook Children's Dosing Companion* July 2019, childrens.amh.net.au |
| **ANZCOR** | Australian Resuscitation Council, *Australian New Zealand Resuscitation Council (ANZCOR) Guidelines*; January 2016 resus.org.au/ guidelines/anzcor-guidelines |
| **ASCIA** | Australasian Society of Clinical Immunology and Allergy, July 2019, www.allergy.org.au |
| **APLS** | Australian Paediatric Life Support Australia; August 2017 www.apls.org.au |
| **BNFc** | *British National Formulary for Children* July 2019, www.medicinescomplete.com/#/browse/bnfc |
| **CHQ** | Children's Health Queensland Hospital and Health Service *Queensland Paediatric Guidelines*, August 2019, www.childrens.health.qld.gov.au/chq/health-professionals/qpec-statewide-guidelines |
| **eTG** | *Therapeutic guidelines*, June 2019, tgldcdp.tg.org.au/etgAccess |
| **Lyttle, M. et al 2019** | Levetiracetam versus phenytoin for second-line treatment of paediatric convulsive status epilepticus (EcLiPSE): a multicentre, open-label, randomised trial. The Lancet, 2019;393:2125-2134, www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)30724-X/fulltext |
| **PCCM** | *Primary Clinical Care Manual - 10th edition Section 8: Paediatrics,* www.publications.qld.gov.au/dataset/primary-clinical-care-manual-10th-edition |
| **PIG** | *Paediatric Injectable Guidelines* 2019 July 2019, pig.rch.org.au/monographs |
| **QAS** | *Queensland ambulance service field reference guide* |
| **QCH** | *Queensland Children's Hospital Paediatric Emergency Drug Preparation Guide* |
| **QHG** | Queensland health guideline *Acute behavioural disturbance in Emergency Departments,* www.health.qld.gov.au/__data/assets/pdf_file/0031/629491/qh-gdl-438.pdf |
| **Shann 2017** | Shann: F 2017 Drug Doses, Reservoir, Victoria |
| **RCH** | The Royal Children's Hospital Melbourne *Royal Children's Hospital Clinical Guidelines* www.rch.org.au/home |
| **Ross et al 2018** | Physiologic response to pre-arrest bolus dilute epinephrine in the pediatric intensive care unit. Resuscitation, 2018, Volume 126, 137-142 |
| **Scott Weingart 2017** | emcrit.org/emcrit/push-dose-pressor-update |

# Rationale for consensus decisions

**Anaphylaxis**
Throughout the book, we have recommended in a health care facility where 1 mg/mL (1 in 1000) Adrenaline is available to administer the exact 10 microg/kg IM dose for anaphylaxis. If 1 mg/mL is not available an autoinjector should be used. For children 7.5-20 kg use the 150 microg (0.15 mg) autoinjector and children weighing above 20 kg use the 300 microg (0.3 mg) autoinjector.

The risk of anaphylaxis is quite low in young children weighing less than 7.5 kg. If Adrenaline is needed for anaphylaxis in a child weighing less that 7.5 kg and if 1 mg/mL Adrenaline is not available the risk of administering a 'fixed' overdose via a 0.15 mg autoinjector device is considered to be lower than the risk of not administering any Adrenaline.

**Mini-Jets**
Due to unreliable availability we have opted to prepare most commonly used resuscitation drugs e.g. Adrenaline and Atropine instead of using mini-jets.

**Metaraminol**
We have recommended the use of a pre-prepared diluted solution of Metaraminol 5 mg/10 mL = 500 microg/mL available through central pharmacy. This is to minimise the steps that would be involved in preparing the medication from the 10 mg/mL vial.

**Intravenous Salbutamol**
The current evidence to support the Salbutamol IV bolus and infusion dosing is limited and practice varies considerably throughout Australia[1]. The dosages contained in this book align with the current *Queensland Paediatric Asthma Guideline*. The bolus dose is significantly higher than the current practice in Europe[2] which is informed by the *British National Formulary for Children* (BNFc) and that recommended in the *Australian Medicines Handbook* (AMH) and the *Australian Medicines Handbook Children's Dosing Companion* (AMHc). The CREDD authors opted to align with the *Queensland Paediatric Asthma Guideline* on the basis that salbutamol toxicity seems to be well tolerated by children.[3] If IV salbutamol is clinically indicated and there are significant concerns regarding Salbutamol toxicity it may be preferable to omit the load and commence the infusion starting at the upper rate range.

**Phenytoin**
Product information advises Phenytoin should be administered at a maximum concentration of 10 mg/mL. The user is guided in diluting whole vials to a final concentration of 10 mg/mL. For doses above 500 mg (50 mL) we have guided the user to prepare 100 mL of the 10 mg/mL solution by diluting 20 mL (1000 mg) in a 100 mL 0.9% sodium chloride mini-bag. The dose can then be taken from this 100 mL.

We have chosen a maximum loading dose of Phenytoin of 1 g. This reflects the initial loading dose that would be administered to an adult. If further Phenytoin above 1 g is needed, the additional dose can be prepared as per instructions for that additional dose.

**Morphine**
Morphine is available in a variety of concentrations. To standardise preparation instructions, we have recommended using the readily available 10 mg/mL preparation to produce the final concentration of 1 mg/mL. If an alternate concentration of morphine is used it will be necessary to change the diluent volume to produce a final concentration of 1 mg/mL.

**Infusions**
In the 2nd edition of CREDD there have been changes made to the rate and volume ranges of a number of infusions.

The 1st edition reflects soft limits of DERS software for each medication. At times this allows for the maximum adult dose to be exceeded. Whilst this may be appropriate in some circumstances, we have chosen to narrow these ranges to avoid exceeding usual adult dose. The unit/kg/time at the top of the recommended rate range reflects this dose cap. The CREDD team do not recommend adjusting the current DERS pump hard and soft max limits.

Medications affected and usual upper dose limits for adult infusions are below:
- Adrenaline (Epinephrine) 20 microg/min
- Noradrenaline (Norepinephrine) 20 microg/min
- Fentanyl 150 microg/hr
- Ketamine 100 mg/hr
- Propofol 150 mg/hr
- Vecuronium 10 mg/hr

[1] Babl FE, Sheriff N, Borland M, Acworth J, Neutze J et al. Paediatric acute asthma management in Australia and New Zealand: practice patterns in the context of clinical practice guidelines. Arch Dis Child 2008; 93:307–312.

[2] 2019 BTS/SIGN: British guideline on the management of asthma: A national clinical guideline. Revised June 2019 https://www.brit-thoracic.org.uk/quality-improvement/guidelines/asthma/

[3] Starkey ES, Mulla H, Sammons HM, Pandya HC. Intravenous salbutamol for childhood asthma: evidence-based medicine? Arch Dis Child 2014; 99:873–877.

# Authors and acknowledgements

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# fluid recipes

# Fluid recipes

| Fluid ordered | Available as premade bag | Starting fluid | | | Additive | | Final volume after mixing |
|---|---|---|---|---|---|---|---|
| | | | Volume required | Volume to remove and discard | | Volume to add | |
| Sodium Chloride 0.9% with Glucose 5% | Use premade bag | | | | | | 1000 mL |
| Sodium Chloride 0.9% with Glucose 5% | If premade bag is not available | Sodium Chloride 0.9% | 1000 mL | 100 mL | Glucose 50% | 100 mL | 1000 mL |
| Sodium Chloride 0.9% with Glucose 10% | **No** | Sodium Chloride 0.9% with 5% Glucose | 1000 mL | 100 mL | Glucose 50% | 100 mL | 1000 mL |
| Sodium Chloride 0.9% with Glucose 10% | If premade not available | Sodium Chloride 0.9% | 1000 mL | 200 mL | Glucose 50% | 200 mL | 1000 mL |
| Sodium Chloride 0.9% with Glucose 12.5% | **No** | Sodium Chloride 0.9% | 1000 mL | 250 mL | Glucose 50% | 250 mL | 1000 mL |
| Sodium Chloride 0.9% with Glucose 5% and Potassium Chloride 20 mmol/L | Use premade bag | | | | | | 1000 mL |
| Sodium Chloride 0.9% with Glucose 5% and Potassium Chloride 20 mmol/L | If premade bag is not available | Sodium Chloride 0.9% with Potassium Chloride 20 mmol | 1000 mL | 100 mL | Glucose 50% | 100 mL | 1000 mL |
| Sodium Chloride 0.9% with Glucose 10% and Potassium Chloride 20 mmol/L | **No** | Sodium Chloride 0.9% with Glucose 5% and Potassium Chloride 20 mmol/L | 1000 mL | 100 mL | Glucose 50% | 100 mL | 1000 mL |
| Sodium Chloride 0.9% with Glucose 10% and Potassium Chloride 20 mmol/L | **No** | Sodium Chloride 0.9% with Potassium Chloride 20 mmol | 1000 mL | 200 mL | Glucose 50% | 200 mL | 1000 mL |
| Sodium Chloride 0.9% with Glucose 5% and Potassium Chloride 40 mmol/L | **No** | Sodium Chloride 0.9% with Potassium Chloride 40 mmol/L | 1000 mL | 100 mL | Glucose 50% | 100 mL | 1000 mL |
| Sodium Chloride 0.9% with Glucose 10% and Potassium Chloride 40 mmol/L | **No** | Sodium Chloride 0.9% with Potassium Chloride 40 mmol/L | 1000 mL | 200 mL | Glucose 50% | 200 mL | 1000 mL |

Please be aware than when preparing fluids of different glucose concentrations in potassium containing base fluids, the removal of the required amount of the starting fluid will also result in removal of potassium. This reduces the concentration of potassium in the final product. When removing 100mL of solution, potassium concentration is reduced by 10%. When removing 200 mL of solution, potassium concentration is reduced by 20%.


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