

Simulation Package : Asthma

An open access resource for clinical educators



Optimus
BONUS



Optimus

BONUS

Bank Of iNdependently Useful Simulations

Part of the Children's Health Queensland 'Optimus' curriculum.

Optimus BONUS : Asthma

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An electronic version of this document is available at <https://www.childrens.health.qld.gov.au/research/education/queensland-paediatric-emergency-care-education/optimus-bonus/>

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Contents of this educational package:



Simulation

Recognise and manage life threatening asthma in a child



Further Reading

Podcasts and Blog Posts
Online Videos
Journal Articles

Fill out our participant survey
to receive a training certificate

(Select Optimus BONUS as course)



Section I: Scenario Demographics

| | |
|------------------------|---|
| Scenario Title: | Asthma |
| Date of Development: | 11/4/23 |
| Target Learning Group: | Multidisciplinary teams that look after paediatric patients |

Section II: Scenario Developers

| | |
|----------------------|--|
| Scenario Developers: | Dr Fiona Brown, Dr Ben Symon |
| Reviewed by : | Ms Tina Haffenden, Dr Ben Lawton, Ms Heidi Best |
| Acknowledgements: | Thanks to Miranda Otto and Leisa Bauer for their photographs |

Section III: Curriculum

| Learning Goals & Objectives | |
|-----------------------------|---|
| Educational Goal: | <ul style="list-style-type: none"> Recognise and manage acute life-threatening asthma |
| Skills Rehearsal: | <ul style="list-style-type: none"> Prescribe, prepare & administer an IV Magnesium and IV Aminophylline infusion Set up pressure support ventilation (HF vs NIV) |
| Systems Assessment: | <ul style="list-style-type: none"> Rehearse escalation of care and structured handover to seniors/retrieval Departmental access to clinical guidelines & prescribing resources for asthma BiPAP mask options |

Case Summary: Brief Summary of Case Progression and Major Events

Rawiri is an 8 year old boy who presented to ED 2 hours ago with acute asthma on background of URTI symptoms.

- He develops increasing respiratory compromise, does not respond to initial management with bronchodilators.
- He improves with intravenous therapy and pressure support ventilation but requires higher level care.

Section IV: Equipment and Staffing

| Scenario Cast | | | |
|--|---|---|---------------------------|
| Patient: | <input type="checkbox"/> Mannequin suitable to represent an 8 yr old boy | | |
| Clinical Expert: | Facilitator familiar with local asthma guidelines | | |
| Confed erate: | Senior clinician and/or retrieval services (PICU/RSQ) Parental presence (optional) | | |
| Required Monitors | | | |
| <input type="checkbox"/> 4 wave patient monitor | <input type="checkbox"/> Temp probe | | |
| <input type="checkbox"/> ECG leads | <input type="checkbox"/> NIBP cuff | | |
| <input type="checkbox"/> Pulse oximetry | | | |
| Required Equipment | | | |
| If running this simulation in situ, we suggest using your authentic equipment if approved by your department. This will help diagnose any actual equipment / availability / layout issues. | | | |
| <input type="checkbox"/> Airway Trolley | <input type="checkbox"/> Medication and Fluid chart - Med chart to include drugs to date | <input type="checkbox"/> Cannulation equipment | |
| <input type="checkbox"/> Stethoscope | <input type="checkbox"/> CREDD book | <input type="checkbox"/> Pathology results – VBG, CXR | |
| <input type="checkbox"/> HFNC | <input type="checkbox"/> Spacer/ nebuliser | | |
| <input type="checkbox"/> Ventilator | <input type="checkbox"/> Medications consistent with your asthma guideline - Salbutamol, Atrovent, MgSO ₄ , Hydrocortisone, Aminophylline, Adrenaline | <input type="checkbox"/> Paediatric BiPAP mask or Anaesthetic mask with associated equipment (see appendix 1) | |
| <input type="checkbox"/> CEWT chart | <input type="checkbox"/> Fluids and IV pole | | |
| Moulage | | | |
| Nil | | | |
| Approximate Timing | | | |
| Set-Up: | 10min | Prebrief : | 10 min |
| Scenario: | 15 min | Debriefing: | 20 min |
| Patient Profile and History | | | |
| Patient Name: Rawiri Tohu | | Age: 8 | Weight: 30kg |
| Gender: Male | | | |
| Chief Complaint: Exacerbation of asthma | | | |
| History of Presenting Illness: 2 day history of cough, coryzal symptoms and sore throat. Wheeze at home | | | |
| Past Medical History: | Asthma – 2 previous hospital admissions, no ICU | Medications: PRN | Immunisations: Up to date |
| Allergies: NKDA | | | |
| Social History: Lives with mum, dad and 2 younger brothers | | | |
| Family History: Father – History of childhood asthma, Mother – Eczema, hayfever Pacific Islander Background | | | |

Section V : Scripts

Scenario commences with handover from treating nurse

Can you review Rawiri? I'm worried he's deteriorating despite a full burst of salbutamol.

Rawiri is an 8 year old boy who presented to ED 2 hours ago with asthma. He has a 2 day history of URTI symptoms. He needed 2 hrly salbutamol at home today, so his parents have brought him to ED as per his wheeze plan.

On arrival he was given a burst of salbutamol (3 x 12 puffs of salbutamol) and oral prednisolone 2mg/kg. It has been 30 minutes after his last salbutamol dose but he seems to be getting worse.

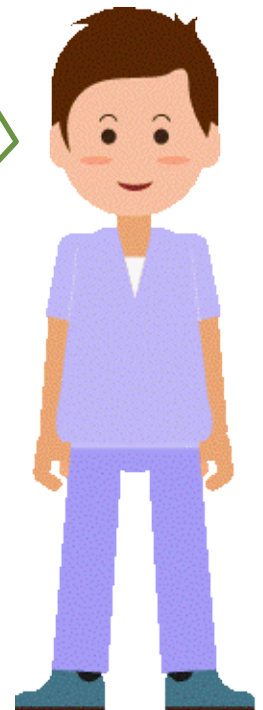
His resp rate is 40, he has moderate work of breathing and oxygen saturations are now 90% in room air. He looks tired and exhausted and his air entry is decreasing.

If asked for further information on Rawiri 's background:

History of asthma, managed by GP

Only regular medications – PRN Salbutamol. No preventer medication (weaned off last winter)

- Has had exacerbations of asthma previously, only requiring salbutamol and prednisolone. No MgSO₄, No oxygen requirement, No PICU admission.
- NKDA
- Immunisations up to date
- Islander descent



Scripts Continued

Script for parent



If asked about Rawiri's history, you are concerned about his illness and have never seen him working this hard before. It is clear to you that he is severely unwell and you are appropriately concerned but you trust the healthcare team looking after him & are calm.

- Rawiri is 8 and has been doing pretty well with his asthma the last 12 months. He's been unwell for a couple of days with flu like symptoms and started to go downhill this afternoon.
- He had a fair amount of trouble in his preschool years and needed a couple of admissions, but lately he's been pretty good and under advice of his GP you were trialling being off his preventer for the last 3 months.
- There is a family history of asthma, nobody smokes at home, and his immunisations are up to date.
- He's never needed ICU or HDU before. He hasn't had interval symptoms the last few months.

Scenario State 1

State 1 : Structured assessment and initiation of treatment

| Patient State | Patient Status | Learner Actions, Modifiers & Triggers to Move to Next State | |
|---|---|---|--|
| Rhythm: Sinus HR: 145 BP: 100/50 Cap refill 2.5 seconds RR: 40 [shallow] O₂ SAT: 89% on air, 93% if O ₂ applied T: 37.6 AVPU = V, fatigued | Severe work of breathing Air entry is decreased Bilateral expiratory wheeze with prolonged expiratory phase Speaking only in single words, looks tired | Initiate asthma treatment consistent with expectations of your service. eg: <ul style="list-style-type: none"> • Attach additional monitoring • ABCDE assessment • Apply oxygen – titrate sats to 93% • Ipratropium burst • Continuous salbutamol • Consider IV access • Early call for help • Venous gas | Simulation aims to steer participants towards realising Rawiri is very sick and needs aggressive management, but not so severe that they rush to intubation. Initial treatment provides no clinical improvement |

State 2 : Poor response to initial treatment and escalation of care

| | | | |
|--|--|---|--|
| Rhythm: Sinus HR: 145 BP: 100/50 Cap refill 2.5 seconds RR: 40 [shallow] O₂ SAT: 95% on continuous oxygen driven salbutamol T: 37.6 AVPU = V, fatigued | Mild agitation with mask/nebs on face, pushing medical staff away. Appears fatigued, only speaking in words Ongoing wheeze with decreased air entry. Moderate work of breathing. | <ul style="list-style-type: none"> • Initiate IV Magnesium Sulfate (0.2mmol/kg dose over 20 mins) • IV steroid – hydrocortisone 4mg/kg • Consider respiratory support strategies | Facilitator actions <ul style="list-style-type: none"> - Provide investigation results as required (VBG, CXR) - Prompt use of cognitive aids |
|--|--|---|--|

State 3 : Consideration of respiratory support and IV asthma therapy

Rhythm: Sinus
HR: 120
BP: 98/48
Cap refill 2.5 seconds
RR: 28 [shallow]
O₂ SAT: 93% on continuous oxygen driven salbutamol
T: 37.8
AVPU = V, fatigued

Remains conscious and making meaningful eye contact, but very fatigued and working hard.

Quiet wheeze with decreased air entry.

- Initiate IV asthma therapy (aminophylline or salbutamol) and set up equipment for respiratory support.
- Consider respiratory support strategies – HFNC vs NIV depending on resources of hospital.
- Refer patient to appropriate critical care service

Minimal response to initial treatment should guide participants considering their next steps to support patient's respiration and fatigue, e.g. High Flow, CPAP or BiPap.

Our goal in this scenario is not to teach healthcare teams to rush to intubating an asthmatic child, given the risks of air trapping and difficult ventilation.



Hello, I'm from the Retrieval service. How can I help?

(Listen to phone call and provide supportive advice)

Advise to treat severe asthma as per your service's recommendation, e.g:

- Clarify gas results
- Advise High Flow Nasal Prongs started at 2L/kg and if deteriorates further may need BiPAP.
- Suggest aminophylline infusion 150mg load over 30 minutes, followed by salbutamol infusion if no improvement.
- Confirm IV steroid given, e.g. 4mg/kg hydrocortisone

Close conversation with confirmation of retrieval team activation & that you will touch base in 45 minutes to see whether infusions have helped.

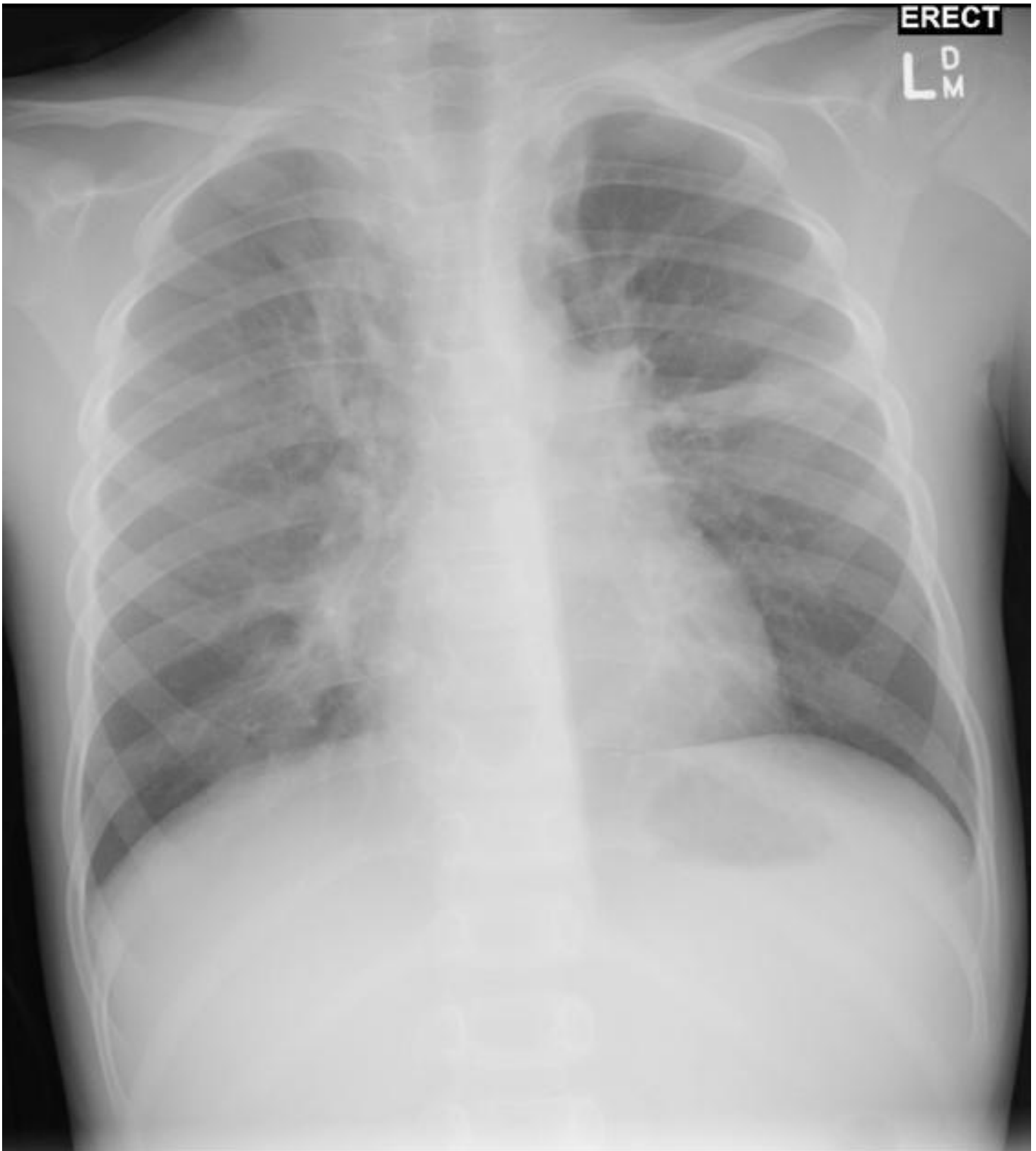
If contacted back with concerns not improving or if learning outcome is to start NIV:

- Advise BiPAP settings 15/5 - (IPAP – 15 cm H₂O, EPAP- 5 cm H₂O)
- If no BiPAP mask for kids, a Face Mask for BVM/Quantiflex can be attached to the ventilator as an alternative and strapped or held on

End scenario once learning objectives achieved. Advised patient stabilising and looking less fatigued.

Section VII: Supporting Documents, Laboratory Results, & Multimedia

| | Results | Units | Normal Range |
|----------------------------------|---------|--------|--------------------|
| pH | 7.29 | | 7.32 – 7.42 |
| pCO₂ | 58 | mmHg | 41 - 51 |
| pO₂ | 42 | mmHg | 25 - 40 |
| O₂ Saturations | 51 | % | 40 - 70 |
| Bicarb | 20 | mmol/L | 22 - 33 |
| BE | -7 | mmol/L | -3 - +3 |
| HCT | 0.48 | | 0.3 - 0.42 |
| Hb | 128 | g/L | 105 - 135 |
| Na⁺ | 138 | mmol/L | 135 - 145 |
| K⁺ | 3.5 | mmol/L | 3.2 - 4.5 |
| Ca⁺⁺ (ionised) | 1.65 | mmol/L | 1.15 – 1.35 |
| Glucose | 5.5 | mmol/L | 3.0 – 7.8 |
| Lactate | 2.5 | mmol/L | 0.7 – 2.5 |



Source: training T, Asthma. Case study, Radiopaedia.org (Accessed on 05 May 2023) <https://doi.org/10.53347/rID-17996>

Section VIII: Debriefing Guide

Objectives

| | |
|---------------------|---|
| Educational Goal: | <ul style="list-style-type: none"> Recognise and manage acute life-threatening asthma |
| Skills Rehearsal: | <ul style="list-style-type: none"> Prescribe, prepare & administer an IV Magnesium and IV Aminophylline infusion Set up pressure support ventilation (HF vs NIV) |
| Systems Assessment: | <ul style="list-style-type: none"> Rehearse escalation of care and structured handover to seniors/retrieval Departmental access to clinical guidelines & prescribing resources for asthma |

Sample Questions for Debriefing

This case was a child with life threatening asthma. We used this case to highlight recognising and responding to an acutely unwell patient, the use of our guidelines and to practice prescribing, drawing up and administering medications which we may not be familiar with.

I'd like to reflect on the clinical skills we rehearsed:

- What is your experience in managing similar patients in your ED?
- Were there any behaviours or skills highlighted during this scenario today that you will reflect upon and consider a change in your clinical practice?

I'd like to explore the teams decision making:

- Bronchodilator therapy is an important part of initial management. What are the benefits of giving this via MDI and spacer vs nebulised route? Why did you decide to give it the way you did?
- How did you make the decision of when to escalate to IV therapy?
- What challenges came up when preparing and prescribing medications?
- The Asthma algorithm mentions to consider IV Salbutamol and IV Aminophylline – which would you use in your local area and why? (availability, cardiac monitoring requirement, familiarity with drug, access to retrievals/PICU)

Let's take a moment to reflect on our teamwork:

- Were there any examples of good team working you would like to highlight?
- Are there any ways we could improve our communication and replicate in clinical practice? (closed loop communication, using names, leadership and followership)

Fill out our participant survey
to receive a training certificate

(Select Optimus BONUS as course)



Diagnostic Report of In Situ Simulation

Simulation can provide important data about unrecognised latent safety threats within your service.

This form is provided to prompt recording of any Quality and Safety / Systems issues that need escalation within your department.

It is **not** to be used as a recording of personal performance management or to violate candidates' confidentiality.

| Category | Issue identified | Action recommended | Should be escalated to | Follow up date |
|-------------|------------------|--------------------|------------------------|----------------|
| Team | | | | |
| Environment | | | | |
| System | | | | |

Simulation Occurred on _____

Follow up date re : identified issues on _____

Resources for simulation participants



Children's Health Queensland Asthma Guideline



Managing acute asthma Dr Simon Craig at DFTB



IV Magnesium Sulphate as a Loading dose infusion



Nasal High Flow Therapy using the Airvo™ 2

Mask options for BiPAP in children

BiPAP is rarely commenced in children, and as such many emergencies may face confusion when needing to initiate it in a child due to unfamiliarity, but also due to a lack of paediatric sized BiPAP masks.

BiPAP can be a life saving intervention that may mitigate the need to intubate an asthmatic patient and so it's important to still be able to deliver for children.

While paediatric BiPAP masks can be ordered, alternative work arounds include:

1. Small Nivairo + mask for larger children.

For an older child, a small adult mask may be suitable. Watch this video: [Fitting the F&P Nivairo NIV full face mask - YouTube](#) to see how to apply.

2. Second Option : Utilising a Face Mask

Standard anaesthetic masks are frequently used in mixed Eds for administration of procedural sedation such as Quantiflex. They form an appropriate seal and can be easily attached to the ventilator circuit. As such they can be an effective work around to administer BiPAP without an official paediatric mask.

The four point attachments can be used in conjunction with a fabric headgear to create a suitable sized BiPAP attachment. The weight of the vent circuit sitting horizontally from the mask tends to weigh down with time and disrupt the seal, so an elbow adaptor can be attached to angle the vent circuit down (not pictured).



Curriculum

This package is designed for **individuals** to refresh and retain the following skills learned in previous OPTIMUS courses as well as add new knowledge on specific conditions.

| Optimus CORE | Optimus PRIME | Optimus BONUS |
|---|---|--|
| Assessment of the sick child | Recognition and management of clinical deterioration in a child | Recognition of life-threatening asthma |
| Assessment of respiratory distress in a child | Preparation for retrieval | Prescription and preparation of IV magnesium and aminophylline |
| | | Positive pressure ventilation |

This package is designed to offer your **department** a systems level check regarding :

| | |
|---|--|
| Access to paediatric resources on : <ul style="list-style-type: none"> Asthma clinical guideline (CHQ) Drug calculations (CREDD book) | <input type="checkbox"/> <input type="checkbox"/> |
| Equipment Check : <ul style="list-style-type: none"> IV MgSO₄ HFNC Non invasive ventilation | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> |
| Departmental Protocols for: <ul style="list-style-type: none"> Retrieval checklist | <input type="checkbox"/> |

If you would like any assistance obtaining access or advice for any of the above issues, please contact stork@health.qld.gov.au

About the Creators :



Dr Fiona Brown

Simulation Fellow, STORK (Simulation Training Optimising Resuscitation for Kids)
Queensland Children's Hospital

Fiona is a doctor who has a keen interest in medical education and simulation. After starting her educational career as a simulation fellow in the UK, she swapped rainy England for a warmer climate and has been very grateful to work with the STORK team, delivering paediatric education around Queensland. She has plans to continue her medical training in Australia and is currently enjoying working in intensive care and paediatric emergency medicine.



Dr Ben Symon : Editor

@symon_ben

RACP PEM, MBBS, BAnim

Simulation Consultant and Paediatric Emergency Physician

Queensland Children's Hospital, Mater Hospital and The Prince Charles Hospital

Dr Symon is a PEM Physician and Simulation enthusiast with a passion for translating clinical and educational research to front line health care workers. He is co-producer of the podcast '[Simulcast](#)', faculty on the APLS Educational Skills Development Course and is international faculty for the Master Debriefing Course by [the Debriefing Academy](#). His original degree in Animation has proved surprisingly useful in his career in medical education.

What is OPTIMUS?

OPTIMUS is a suite of courses designed to create a complete paediatric life support training package.

It has been developed to address Queensland's training needs in paediatric critical care in line with the recommendations of NSQHS Standard 8 - recognising and responding to acute deterioration.

- **CORE** is a course for first responders to a paediatric emergency, and teaches recognition of the deteriorating patient, Children's Early Warning Tools, and resuscitation competencies
- **PRIME** is a course for mid-phase responders who look after unwell patients while awaiting retrieval or escalation to an Intensive Care setting. It aims at contextualising seizure management, endotracheal intubation and inotrope administration.
- **PULSE** is a CPR refresher designed around the principles of Rapid Cycle Deliberate Practice
- **BONUS** is a standalone simulation with supportive educational material. It is one solution to skill and knowledge decay after courses are run.

The Optimus Curriculum is a spiral curriculum where the learning objectives for effective paediatric resuscitation are taught throughout our courses while providing opportunities for spaced practice, clinical contextualisation and quality improvement moments.

About BONUS:

Optimus BONUS is a bank of useful simulations that are open access and available for free use. They are designed by the STORK team for Children's Health Queensland and have been used around the world.

We aim to use the packages to provide :

- Spaced repetition to reinforce learning objectives from CORE and PRIME
- Connections to high quality, up to date paediatric resources for health professionals
- Quality and Safety checks for local hospitals regarding paediatric clinical guidelines, resources and equipment

The scenarios have been designed in response to :

- Paediatric coronial investigations in Queensland, Australia.
- Clinical skills issues revealed through In Situ translational simulations in hospitals throughout Queensland.
- Quality and Safety Initiatives
- Updates to paediatric protocols and guidelines

About STORK

In 2014, Children's Health Queensland funded the 'Simulation Training Optimising Resuscitation for Kids' service. STORK is a paediatric education team focused on improving healthcare outcomes for children throughout the state.

If you would like to know more information about STORK or acquire copies of our resources, please contact us at stork@health.qld.gov.au .

References

This Simulation Template has been adapted from the [template from emsimcases.com](https://www.emsimcases.com).

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