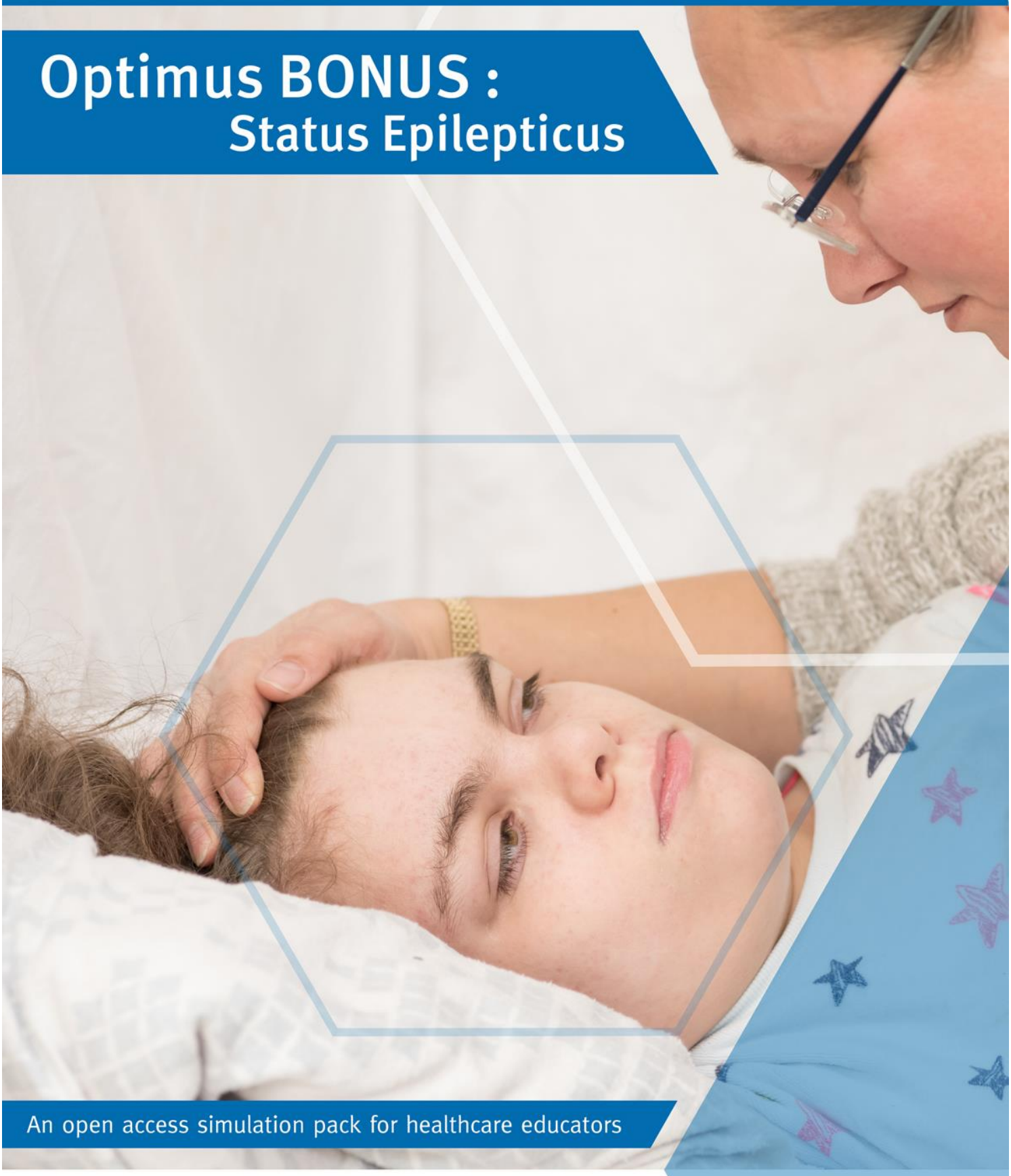
Optimus BONUS : Status Epilepticus



An open access simulation pack for healthcare educators

Queensland Government

Optimus BONUS : Status Epilepticus

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For more information contact:

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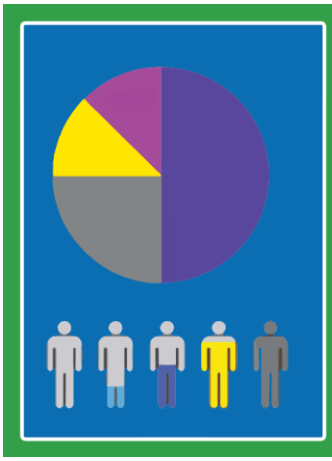
An electronic version of this document is available at https://www.childrens.health.qld.gov.au/research/education/queensland-paediatric-emergency-care-education/optimus-bonus/

Contents of this educational package:

Simulation

Status epilepticus treatment
2020 APLS seizure algorithm
Emergency intubation



Infographic

For sharing in the weeks before or after your simulation via email or in poster format.

Further Reading

Podcasts and Blog Posts
Online Videos
Journal Articles

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Simulation Introduction by Professor Stuart Dalziel

Stuart Dalziel is a Paediatric Emergency Medicine Physician, Director of Emergency Medicine Research at Starship Children's Hospital, Auckland and Professor of Emergency Medicine and Paediatrics, University of Auckland where he is the Cure Kids Chair of Child Health Research.

Stuart is extensively involved in the leadership of multi-centre clinical trials and emergency medicine research networks.

Recently Stuart led a large multi-centre randomised controlled trial into second line management of paediatric convulsive status epilepticus. Within 6 months of publication (Dalziel *et al.* Lancet 2019) the results of this trial were incorporated into international Advanced Paediatric Life Support (APLS) guidelines and translated into emergency department clinical practice.

"Convulsive status epilepticus (CSE) is the most common life-threatening paediatric neurological emergency. Morbidity and mortality are considerable, with a fifth of patients requiring rapid sequence induction (RSI) and intensive care unit (ICU) admission, a third having neurological sequelae, and mortality occurring in 3–5%. Rapid termination of convulsive status epilepticus is the primary goal of management, in order to avoid neurological sequelae and acute life-threatening complications.

Rates of CSE occur in children at four times those seen in adult populations. Despite this until recently there was a paucity of evidence beyond first-line benzodiazepine treatment with management beyond benzodiazepines determined by consensus or extrapolation of adult evidence. Yet, paediatric CSE has considerably different aetiology to that observed in adults with CSE occurring *de novo* in half the children who present with CSE, half the children presenting with CSE being previously neurologically normal, and paediatric CSE having complex febrile convulsions as a frequent cause.

Benzodiazepines are effective in terminating paediatric CSE in around 40–60% of presentations. Midazolam is the preferred benzodiazepine; efficacy is at least equivalent to other benzodiazepines and it can be administered by buccal, intranasal, intramuscular, intravenous and interosseous routes.

Previous paediatric CSE management algorithms have recommended phenytoin followed by RSI for benzodiazepine refractory paediatric CSE. Data from Australia and New Zealand showed that in 50% of cases we failed to achieve RSI and intubation in a timely manner. Beyond benzodiazepines we now have clear evidence, including local evidence, from three large multi-centre randomised controlled trials regarding the use of phenytoin (fosphenytoin), levetiracetam and sodium valproate . All appear equally efficacious in terminating benzodiazepine refractory paediatric CSE at rates of approximately 50-60%. Based on this new evidence the Australian and New Zealand Advanced Paediatric Life (APLS) Support CSE management algorithms recommend levetiracetam, followed by phenytoin, if required, for benzodiazepine refractory paediatric CSE. The benefit of this new approach is that now only half of children with benzodiazepine refractory paediatric CSE need to be exposed to potential toxicity from phenytoin, and that by using both agents prior to RSI and intubation approximately 50% less children will require these measures.

In order to achieve rapid termination of CSE anticipation and preparation of the next management step is of vital importance. Thus when the second benzodiazepine is being administered levetiracetam should be prepared and ICU/anaesthetic help requested, when phenytoin is being administered preparation for possible RSI and intubation should occur. With this anticipation and preparation paediatric CSE can be controlled in a timely manner, limiting long-term sequelae."

Editors note : As of November 2021 the CHQ and APLS seizure algorithm have some differences. In particular the recommended dose of levetiracetam is 60mg/kg in the most recent CHQ algorithm, and the CHQ flowchart provides a larger variety of medication choices for second and third line anti-epileptics. In order to keep this streamlined in our simulation we have kept the infographic emphasising phenytoin or levetiracetam, but increased the recommended dose to 60mg/kg to be consistent with the CREDD book. Please feel comfortable adjusting advice according to your local protocols.

Section I: Scenario Demographics

Scenario Title:	BONUS : Status Epilepticus
Date of Development:	06/02/2020
Target Learning Group:	Multidisciplinary Teams that look after Paediatric Patients

Section II: Scenario Developers

Scenario Developers:	Dr Ben Symon
Reviewed by :	Dr Jason Acworth, Dr Stuart Dalziel

Section III: Curriculum

Learning Goals & Objectives	
Educational Goal:	• Evidence based management of status epilepticus in paediatric patients • Team based approach to intubation in status epilepticus
Skills Rehearsal:	• Intraosseous needle insertion • Antiepileptic infusion prescription, preparation and administration • Team preparation for intubation
Systems Assessment:	• Paediatric Seizure Algorithms • Equipment check : Intraosseous device, Paediatric Intubation Equipment

Case Summary: Brief Summary of Case Progression and Major Events

A 6 year old with cerebral palsy and epilepsy presents via ambulance in status epilepticus for 20 minutes prior to hospital arrival.

- He has received two appropriate doses of buccal midazolam en route, 1 by his parents and 1 by the paramedic team.
- Thomas continues to seize throughout the scenario, requiring :
    - Airway support with opening manoeuvres and then airway adjunct.
    - Intraosseous access (venous cannulation attempts fail)
    - IV Levetiracetam infusion and IV Phenytoin infusion (or an alternative 2nd and 3rd line agent)
    - Team preparation for intubation

Depending on the time available for your simulation and the specific learning objectives for your team, you may prefer to cease the scenario at an earlier time (ie after second antiepileptic infusion starts).

Section IV: Equipment and Staffing

Scenario Cast	
Patient:	☐ Mannequin suitable for 6 year old boy (e.g Sim Junior or Low Fidelity Mannequin)
Clinical Expert	• Healthcare professional familiar with management of status epilepticus
Confederate:	• Paramedic for handover, On call specialist for advice over phone • Optional parent

Required Monitors	
☐ Standard patient monitor	☐ End Tidal CO2 monitoring

Required Equipment		
Antiepileptic Drugs eg :	Antibiotic Drugs eg :	Mannequin accessories :
☐ Levetiracetam	☐ Ceftriaxone	☐ Fluid Drainage Bag
☐ Phenytoin	IV Fluids :	
☐ Phenobarbitone	☐ Normal Saline 0.9%	Intubation Equipment :
☐ Midazolam		☐ Local RSI Checklist
Intubation Drugs eg :	Circulation Equipment :	☐ ETT size 4.5, 5, 5.5
☐ Rocuronium	☐ Intraosseous Equipment	☐ Bag Valve Mask
☐ Suxamethonium	☐ Cannulation Equipment	☐ Nasopharyngeal airway
☐ Propofol	☐ Drug Pumps x 2	☐ End Tidal CO2 monitor
☐ Ketamine		

Moulage

- 2 x IV Cannulas + Drainage bags labelled ‘ No IV Access’
- Consider how participants will give IO fluid in your simulation. (ie Mannequin capable of IO infusion, or brief participants to use IV line once IO inserted).

Approximate Timing

Set-Up:	10	Prebrief :	5	Scenario:	25	Debriefing:	20

Section V : Scripts

Phone Warning followed by Paramedic Handover

"Hello, we are calling to inform you of an imminent patient arrival.
We have a 25kg, 6 year old boy called Thomas with a background of CP and seizure disorder.
He has been in status epilepticus for 20 minutes and he has had 2 x buccal doses of midazolam 0.3mg/kg.
He is continuing to seize and we will be arriving in 5 minutes.
We have been unable to obtain IV access."

Paramedic Handover on arrival of patient

Handover the patient while administering jaw support and oxygen to Thomas.

I : Hi, I'm the paramedic looking after Thomas.

S : Thomas is a 25kg, 6 year old boy with mild Cerebral Palsy and an associated seizure disorder. He has been in status epilepticus for 25 minutes, which I think is likely due to his concurrent viral illness. He has had two doses total of buccal midazolam. (One by parents, one with us)

B : He has a history of mild CP with generalised tonic clonic seizures approximately once every 6 months and mild lower limb spasticity requiring splints. He is on Phenytoin regularly at home and has been taking it as prescribed. He has developed an URTI in the last 24 hrs with low grade temps to 38 degrees and a lot of coryza and mild, dry cough. His brother and parents all have the same viral symptoms.

He has no allergies and is fully immunised.

A : Thomas has required jaw support for his airway en route, but maintaining 95% sats with O2 mask, he has some rhinorrhoea which has been going for 3 days in the context of an URTI. He has a clear chest. His HR has been 140 and he is hypertensive for age at 130/80. His temp was 37.6 degrees on arrival, and he had paracetamol at home 2 hours ago. We have been unable to get IV access but BGL was 5.

R : We recommend proceeding down your seizure algorithm and you may need to consider intubation.

His parent is on their way in a separate car, they're not far behind us.

Parent Information (if including a parent in sim)

As you are representing parents of children with chronic disease in this scenario, please present as a supportive, sensible parent who knows significant detail about Thomas' care. You have seen him in status once before and while you are worried you're also familiar with the hospital environment. Your goal is to give the healthcare team the best information you can and advocate for your child.

Please provide this information as requested from treating team. Some of it may not be necessary.

Thomas is 6 and has mild Cerebral Palsy secondary to a hypoxic injury at birth. As a consequence of his CP he has mild spastic diplegia and occasional seizures requiring regular antiepileptics. Apart from requiring lower limb splints and his seizures he's been a healthy, delightfully cheeky boy. He is 25kg.

He has had seizures since 2 years of age, which have been pretty well controlled with his regular phenytoin. His dose was adjusted by his paediatrician last month to match his weight. He takes it regularly without complaint. He has buccal midazolam available at home, and you have been instructed to use it if he has seizures lasting > 5 minutes.

Thomas' seizures are generalised, usually lasting 5 – 10 minutes and often associated with a viral illness which seems to drop his seizure threshold. When your whole family started getting cold and flu symptoms this week, you and your spouse were 'waiting for this to happen'.

He has had status epilepticus once before requiring intubation. He's needed midazolam twice over the last few years which has previously worked.

Section VI: Scenario Progression

Scenario States			
State 1 : Paramedic Handover & Primary Survey			
Patient State	**Patient Status**	**Learner Actions, Modifiers & Triggers to Move to Next State**	
Rhythm: Sinus **HR:** 160 **BP:** 130/80 **Cap refill** 2 secs centrally, 4 secs peripherally **RR:** 30 **O_2 SAT**: 95% on O2 **T:** 37.6 C **AVPU** = U **Actively seizing** **BGL 5**	Status Epilepticus continues. Peripherally pale and team is unable to cannulate. Requires active jaw thrust to oxygenate, obstructed upper airway sounds until NPA inserted.	☒ Receive handover ☒ Allocate roles ☒ ABCDE assessment ☒ Support airway and consider NPA ☒ Attempt IV access (fails) ☒ Secure IO access (successful) ☒ Check BGL (5) ☒ Obtain appropriate blood tests, including venous gas.	Modifiers Decrease Sats low enough to prompt a response if airway manoeuvres or adjuncts are not applied.
State 2 : Prescribe, prepare and administer 1st anti-epileptic infusion + Parent arrival			
Rhythm: Sinus **HR:** 160 **BP:** 130/80 **Cap refill** 2 secs centrally, 4 secs peripherally **RR:** 30 **O_2 SAT**: 95% on O2 **T:** 37.6 C **AVPU** = U **Actively seizing** **BGL 5**	Status Epilepticus continues. Vitals do not change. Requires active jaw thrust to oxygenate, obstructed upper airway sounds until NPA inserted. Optional : Parent arrival	☒ Insert airway adjunct (NPA recommended) ☒ Utilise seizure algorithm appropriate for your service ☒ Proceed through algorithm ☒ Identify 2 x benzodiazepine doses already given ☒ Administer first antiepileptic infusion e.g. Levetiracetam 60mg/kg over 5 mins	Modifiers If participants call for help from expert, guide them to seizure algorithm in your department. If needing more assistance, advise Levetiracetam 60mg/kg over 5 minutes via Intraosseous Needle.

Scenario States

State 3 : Prescribe, Prepare and Administer second anti-epileptic infusion

Patient State	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State	
Rhythm: Sinus **HR:** 160 **BP:** 130/80 **Cap refill** 2 secs centrally, 4 secs peripherally **RR:** 30 **O_2 SAT**: 95% on O2 **T:** 37.6 C **AVPU** = U **Actively seizing**	Status Epilepticus continues. Vitals do not change.	☒ Proceed through Seizure Algorithm : ☒ Administer second antiepileptic infusion e.g. Phenytoin 20mg/kg over 20 mins ☒ Prepare for intubation ☒ Escalate care as appropriate for your service, e.g. PICU or Retrieval Services ☒ If parent present, explain plan for intubation and further care.	<u>Modifiers</u> Depending on time available and your preferred learning objective, if you would like to focus the debrief on the seizure algorithm, you may end scenario after the second anti-epileptic infusion begins.

State 4 : Prepare for Intubation and Escalation of Care

Rhythm: Sinus **HR:** 160 **BP:** 130/80 **Cap refill** 2 secs centrally, 4 secs peripherally **RR:** 30 **O_2 SAT**: 95% on O2 **T:** 37.6 C **AVPU** = U **Actively seizing**	Status Epilepticus continues. Adjust observations as per RSI choice and technique regarding hypoxia / BP.	☒ Proceed through Seizure Algorithm : ☒ Prepare for intubation ☒ Consider RSI drugs in Status ☒ Obtain advice as appropriate for your service, e.g. PICU or retrieval services.	<u>Modifiers</u> End scenario according to your teaching goals, ie. Prior to intubation, after RSI checklist or after intubation.

End Scenario

Section VII: Supporting Documents, Laboratory Results, & Multimedia

Venous Gas Result

	Results	Units	Normal Range
pH	7.32		**7.32 – 7.42**
pCO2	56	mmHg	**41 – 51**
pO2	42	mmHg	**25 – 40**
Bicarb	26	mmol/L	**22 – 33**
BE	-2	mmol/L	**-3 - +3**
HCT	0.35		**0.3 – 0.42**
Hb	119	g/L	**105 – 135**
Na+	141	mmol/L	**135 – 145**
K+	4.3	mmol/L	**3.2 – 4.5**
Ca++ (ionised)	1.21	mmol/L	**1.15 – 1.35**
Glucose	6.1	mmol/L	**3.0 – 7.8**
Lactate	2.2	mmol/L	**0.7 – 2.5**

Section VIII: Debriefing Guide

Objectives	
Educational Goal:	• Evidence based management of status epilepticus in paediatric patients • Team based approach to intubation in status epilepticus
Skills Rehearsal:	• Intraosseous needle insertion • Antiepileptic infusion prescription, preparation and administration • Team preparation for intubation
Systems Assessment:	• Paediatric Seizure Algorithms and Protocols • Equipment check : ○ Intraosseous device, Paediatric Intubation Equipment

Sample Questions for Debriefing

I'd like to explore the team's approach to the seizure algorithm :

- Where can you find a seizure algorithm in our area?
- Is our local protocol consistent with 2020 changes to the APLS status epilepticus algorithm or the 2021 changes to the CHQ guideline?
- How did you determine which antiepileptic infusion to administer?
- Were there challenges during prescription, preparation or administration?
  - Are you aware of online resources that can help?
  - What drug calculation tools do we use for kids in our service?

I'd like to discuss your approach to RSI in paediatric status epileptics :

- Did the fact that the patient was seizing alter your RSI drug choice?
- Can you explain to the group how?

Can we take some time as a group to brainstorm any systems changes we can make to help us deliver better care to real patients who present in status epilepticus?

- Who should we contact to consider implementing those solutions?

Key Moments

- Handover
- Identification of a seizure algorithm
- Engagement and involvement with parent of a child with chronic disease
- Selection, Prescription, Preparation and Administration of drugs
- RSI drug choice in Status Epilepticus
- Intubation

Complete our online survey and receive a training certificate!
Scan the QR code with your phone :

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

Convulsive status epilepticus: the evidence – Stuart Dalziel | PAC 2019

APLS Status Epilepticus Algorithm

Preparation of IV Phenytoin Load Online Demonstration Video

Intraosseous Insertion Online Demonstration Video

Qld Paediatric Status Epilepticus Clinical Guideline

MEDICATIONS IN STATUS EPILEPTICUS

Maintain ABCDE. Treat reversible causes.

Midazolam

since seizure started

Buccal / Nasal	Intramuscular / Intravenous
	
0.3 mg/kg (max 10 mg)	0.15 mg/kg (max 10 mg)

since 1st benzo

Repeat dose of midazolam

since 2nd benzo & still seizing

Levetiracetam		Phenytoin
	OR	 Side Effects: Arrhythmia & Respiratory Depression
60 mg/kg (max 2500 mg) Infuse over 5 minutes IV or IO		20 mg/kg (max 1500 mg) Infuse over 20 minutes IV or IO with filter

since first infusion completed & still seizing

 Administer the other second line agent. 

Prepare for Intubation. Escalate care.

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
Intraosseous Vascular Access	Management of Status Epilepticus	2020 APLS Algorithm
Use of airway opening techniques	Preparation and Administration of antiepileptic infusions	2021 CHQ Status Epilepticus Algorithm
Insertion of a Nasopharyngeal Airway	Team based approach to Intubation	

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

Access to paediatric resources on : • Paediatric Status Epilepticus • Paediatric RSI Checklist	☐ ☐
Equipment Check : • Paediatric Intubation Equipment • Paediatric Difficult Airway Equipment • Smart Pump Infusion Software Check : Levetiracetam and Phenytoin • Paediatric Intraosseous Equipment	☐ ☐ ☐ ☐
Departmental Protocols for : • Paediatric Status Epilepticus	☐

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 Ben Symon : Author, Infographics and Editor

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RACP PEM, MBBS, BAnim
Simulation Consultant and Paediatric Emergency Physician
Queensland Children's 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' and facilitates the Simulcast Online Journal Club, an online journal club for simulation educators throughout the world. He is faculty on the APLS Educational Skills Development Course and is international faculty for the Master Debriefer Course by the Debriefing Academy. His original degree in Animation has proved surprisingly useful in his career in medical education.

Dr Carolina Ardila : eLearning and Multimedia
@caroelearning
MBBS, MPH(TH), GradDipHlthMgt

Dr Ardila is a medical doctor from Colombia with an award winning skill set in eLearning development. Carolina has been working on eLearning for the last 4 years at the Royal Brisbane and Women's Hospital and Children's Health Queensland. During these years she has developed extensive knowledge in designing, developing and implementing engaging courses and launching award winning paediatric eLearning. She has a special interest in emergency and neonatology and in her spare time loves making videos and improving her animation and drawing skills.

Ms Louise Dodson : Phenytoin Preparation Video
BHlthSc**,** GradCertClinSim

Louise has been a Simulation Leader since establishing the Simulation Program for the Royal Children's Hospital in Brisbane over 10 years ago. She co-created the original OPTIMUS CORE course in 2013 to improve paediatric resuscitation training throughout Queensland.
The course has been delivered to more than 5000 health care professionals throughout Queensland since that time. Louise has a background in paediatric emergency nursing and tries to keep her left foot in clinically. She has also completed a grad cert in simulation and clinical education.

About the BONUS Project :

The Optimus BONUS project is a bank of useful scenarios that are open access and available for free use. It has been designed by the Simulation Training Optimising Resuscitation for Kids team for Children's Health Queensland.

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

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.

STORK has developed a number of courses aimed at different phases of paediatric critical care:

- 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 for retrieval or escalation to an Intensive Care. It aims at contextualising Seizure Management, Intubation, and Inotrope Administration within host hospital's real clinical environments in order for healthcare teams to generate their own practice improvement strategies as well as link peripheral hospitals with high quality resources.
- PULSE is a CPR refresher course designed around the principles of Rapid Cycle Deliberate Practice.
- BONUS is a collection of downloadable simulation packages for local educators to use at their discretion. They are designed to reinforce and extend the skills and knowledge initially gained from previous Optimus courses.

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 educational package has been reviewed by content experts on behalf of Children's Health Queensland.

This Simulation Template has been adapted from the template from emsimcases.com, available at : https://emsimcases.com/template/

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