OPTIMUS BONUS :
Bronchiolitis

Queensland Government

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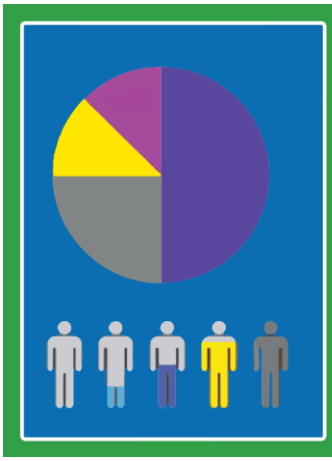
Contents of this educational package:

Simulation

Management of bronchiolitis
Administration of High Flow Nasal O_2



Infographic

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Online Videos
Journal Articles

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Simulation

Introduction by
Donna Franklin, Paediatric Clinical Trials Coordinator, PCCRG, QCH and UQ.

Donna Franklin has a nursing career spanning more than 25 years in Paediatric Intensive Care at Mater Children's Hospital (MCH) and Queensland Children's Hospital (QCH) Brisbane, Australia and The Hospital for Sick Children, Toronto, Canada. Donna was the Nurse Unit Manager of the MCH Paediatric Intensive Care Unit for greater than 10 years. Highlights of her career have included the integration of the new paediatric cardiac service into the MCH, performing and leading the paediatric retrieval service in Queensland and co-authoring minimal standards for paediatrics services across the State of Queensland. She has completed various postgraduate studies, including a Paediatric Critical Care Certificate, Graduate Diploma in Aviation Physiology, Graduate Certificate in Management and a Masters in Business Administration, in which she was awarded both the coveted Statewide and National Outstanding Alumnus of the Year awards at the Southern Cross University.

She is currently in her final months of her PhD studies through the School of Medicine at The University of Queensland which is focused on Nasal High Flow therapy in infants with bronchiolitis. Donna has recently published her findings to her PhD question in The New England Journal of Medicine in 2018. She is a team member of the Paediatric Critical Care Research Group at QCH, Brisbane, Australia, the Clinical Trials Coordinator for several studies relating to Nasal High Flow therapy in paediatrics and a committee member on the Research Committee of the World Federation of Pediatric Intensive and Critical Care Societies (WFPICCS).

"Bronchiolitis is a common viral disease that significantly affects infants less than 12 months of age. Many of these infants require hospitalisation with their severity of respiratory function dictating the modality of respiratory support applied. Furthermore, infants with bronchiolitis has shown increasing hospital admission rates worldwide, which subsequently place a high economic burden on the health care system.
This cohort of infants has been comprehensively studied in terms of management and use of both pharmaceutical and non-pharmaceutical methods and unfortunately no single intervention has shown to reduce the hospital length of stay. The major change that has been observed over the last 2 decades is a decrease in the proportion of infants with bronchiolitis receiving invasive mechanical ventilation, replaced by non-invasive modalities such as CPAP or nasal high-flow. High-flow has superseded CPAP, not necessarily because of its higher efficacy but ease of use.

High-grade evidence (mostly obtained in Australian and New Zealand settings) in the management of this cohort of patients is now ample in respect to what oxygen therapy to apply. Data suggests high-flow as the method of treatment choice for the bronchiolitis infant earlier in the progression of the disease process to avoid escalation and avoid intensive care admission. However, before widespread application occurs, further studies to identify risk groups and distinct selection criteria for use of high-flow needs to be performed to avoid 'over use' of high-flow. The current evidence shows that not all bronchiolitis infants with an oxygen requirement need high-flow therapy. Based on the current evidence, high-flow therapy has a very high safety profile when used outside intensive care. Emergency departments and general paediatric wards are now safely, efficiently and effectively using high-flow therapy using the existing framework of guidelines.

A significant component to ensure effective application of High Flow Nasal Cannula Oxygen Therapy is matching the inspiratory demand with flows applied. Matching the inspiratory demand will offload the diaphragm and thus reduce the work of breathing effort by the infant. It is recommended in the moderately unwell to severe infant with bronchiolitis to apply 2L/kg/min with an inspired oxygen fraction up to 40%. If further increase of respiratory support is required, transfer to a higher level of care needs to be considered. Weaning of flows when the infants is improving is physiologically contra intuitive and should be avoided."

Section I: Scenario Demographics

Scenario Title:	BONUS – Bronchiolitis
Date of Development:	June 2019
Target Learning Group:	Multidisciplinary Teams that look after Paediatric Patients

Section II: Scenario Developers

Scenario Developers:	Dr Sonia Twigg, Dr Benjamin Symon, Dr Ben Lawton, Ms Louise Dodson, Mrs Tricia Pilotto
Reviewed by :	Ms Donna Franklin

Section III: Curriculum

Learning Goals & Objectives	
Educational Goal:	• Manage infant with severe Bronchiolitis according to evidence-based guidelines
Skills Rehearsal:	• Setting up High Flow Nasal Cannula Oxygen Therapy
Systems Assessment:	• Availability of an evidence based guideline for management of Bronchiolitis • Departmental Protocol for escalation of care for an infant in respiratory distress

Case Summary: Brief Summary of Case Progression and Major Events

- 10 month old girl with severe Bronchiolitis – Day 2 with increased work of breathing.
- She was seen in the ED, diagnosed with bronchiolitis and started on nasal prong oxygen due to marginal SaO2 of 90%.
- Initially she improved with nasal suctioning and oxygen but her work of breathing is increasing, she is grunting and her oxygen requirement rising – she is now on nasal prong oxygen at 2L/min.
- She requires suctioning, escalation of oxygen therapy, and nasogastric tube insertion for decompression of stomach and for feeding.

Section IV: Equipment and Staffing

Scenario Cast	
Patient:	☒ Mannequin
Clinical Expert	Senior Doctor or Nurse.
Confederate:	Optional Parent : Appropriately caring and cooperative. If not enough faculty for this confederate then triage nurse at handover explains parent has gone to move the car.
Confederate 2:	Triage nurse: Hands over patient to Emergency Department Staff.
Confederate 3:	Senior Doctor who the team can call for help. This may be a local Senior Medical Officer if not already a participant or Retrieval Consultant as appropriate for location. Gives helpful advice so team achieves tasks. If team not achieving tasks then confederate should call the team and advise over the phone.

Required Monitors	
☒ ECG leads	☒ Temperature Probe
☒ NIBP cuff	
☒ Pulse oximetry	

Required Equipment	
☒ Gloves	☒ High flow nasal prongs
☒ Stethoscope	☒ Non-rebreather mask
☒ IV bags/ lines	☒ Humidified High Flow Nasal Cannula Oxygen Unit
☒ Nasogastric tube	☒ Soft Suction Catheters
☒ Nasal prongs	☒ Yankeur suction

Moulage
None

Approximate Timing			
Set-Up: 15 mins	Pre-brief: 10 mins	Scenario: 20 mins	Debriefing: 20 mins

A. Patient Profile and History

Patient Name: Sam		**Age:** 10 months	**Weight:** 10kg
Gender: F			
Chief Complaint: Increased work of breathing			
History of Presenting Illness: Rhinorrhoea for one day, Cough for 2 days, Fever for 2 days, Increased WOB since yesterday and worse today, decreased solid food intake but still drinking formula.			
Past Medical History:	• Born at 36/40, required CPAP in NICU for 2 days. • Admission at age one week for apnoeas.	**Medications:** Nil regular	**Immunisations:** Up to date
Allergies : NKDA			
Social History : Lives with parents and big brother. Attends day care two days per week. Mother smokes cigarettes.			
Family History : Mother has Asthma.			

C. Handover

<u>Handover from Bedside nurse using ISBAR format.</u>
I: Hi, I am the nurse who has been looking after Sam, our 10 month old patient and her parent.

S: I have brought Sam through to the resuscitation area because she is tachypnoeic, working hard to breathe, grunting and SaO2 was 87% on oxygen via nasal prongs 2L/min.

B: Her mother tells me she has had a runny nose, cough and fever for a few days. She has had increased work of breathing since yesterday. Her brother has a cold. Sam is usually well with no other medical problems, no allergies and is fully immunized.

A: She has been seen here in ED, diagnosed with Bronchiolitis and overnight observation arranged. She initially seemed to improve with nasal suctioning and a bit of oxygen via nasal prongs at 1L/min. But after a couple of hours of observation she seems to be deteriorating.

R: I thought we needed to escalate our management so I brought her through to resus.

D. Confederate – parent script.

<u>History from Sam's parent if confederate parent is present :</u>

- Sam has had a runny nose for 3 days, a cough and fever for 2 days and has been working hard to breathe since yesterday morning.
- Sam has gone off her solid food but is still having a bottle of formula in the morning and night and sometimes during the day.
- Her big brother has a cold at the moment.
- Yesterday afternoon they went to see their GP who reassured them Sam probably had Bronchiolitis but advised them to come to hospital if Sam got worse.
- Today she got worse so they came to ED.
- She seemed a bit better in ED after suctioning out her nose and having a bit of oxygen. But over the last hour seems to be getting worse again – working harder to breathe and making a grunting noise with breathing.
- Sam was by NVD at 36/40 and spent a couple of days in NICU on CPAP. She did have one admission at one week of age due to apnoeas – but these resolved.
- She is fully immunized and has no allergies.
- Her mother suffers from Asthma and is a smoker.
- She lives with her parents, her brother, and attends day care 2 days per week.

Section VI: Scenario Progression

<table>
<tr><th colspan="4">Scenario States</th></tr>
<tr><th colspan="4">State 1: Administration of Oxygen</th></tr>
<tr><th>Patient State</th><th>Patient Status</th><th colspan="2">Learner Actions, Modifiers & Triggers to Move to Next State</th></tr>
<tr>
<td>Rhythm: NSR
HR: 170
BP: 95/60
Cap refill: 3s
RR: 65
O₂ SAT: 84%
T: 38°C
BSL: 4.6
AVPU = A</td>
<td>Congested with increased work of breathing :

Mod recession</td>
<td>☐ Apply cardiac and respiratory monitoring
☐ Full set of vital signs including BP, temp, BSL.
☐ Apply oxygen
☐ Nasopharyngeal suction
☐ Revise history if parent available
☐ Examine child</td>
<td><u>Modifiers</u>
If nasal prong oxygen increased, SaO2 improves to 87%.
If oxygen applied via Non-rebreather mask, SaO2 improves to 89%
If salbutamol given, no improvement in symptoms and HR increases to 180.
<u>Triggers</u>
5 minutes or completed tasks.</td>
</tr>
<tr><th colspan="4">State 2: Diagnosis and Consideration of Respiratory Support</th></tr>
<tr>
<td>Rhythm: NSR
HR: 170
BP: 95/60
Cap refill: 3s
SaO2: 87% if NP
SaO2: 89% if NRBM
RR: 65
T: 38°C
BSL: 4.6
AVPU = A</td>
<td>Minimal improvement with oxygen.

Increased work of breathing : Persistent grunt.</td>
<td>☐ Discuss if High Flow Nasal Cannula Oxygen Therapy is indicated.

☐ Consider nutrition and hydration

☐ Discuss if chest xray required.</td>
<td><u>Modifiers</u>

<u>Triggers</u>
5 minutes or completed tasks.</td>
</tr>
</table>

State 3: Administration of High Flow Nasal Cannulae Oxygen Therapy			
Rhythm: NSR **HR:** 170 **BP:** 95/60 **Cap refill**: 3s **SaO2:** 87% if NP **SaO2:** 89% if NRBM **RR:** 65 **T:** 38°C **BSL:** 4.6 **AVPU** = A	Needs escalation of oxygen therapy.	☐ Call for help – discuss with Senior Medical Officer or call Retrieval Service for advice. ☐ Start High Flow Nasal Cannula Oxygen Therapy. ☐ Insert ng tube to decompress stomach.	Modifiers Senior Doctor advises team to check protocol and start to High Flow Nasal Cannula Oxygen Therapy – advise how to set it up if needed. Advise against salbutamol or other therapies. If asked about CXR or antibiotics, explore differential diagnoses considered by team. If diagnosis of bronchiolitis is clear to team, then no need. - advise to put in nasogastric tube and consider starting continuous feeds at 2/3 maintenance. Triggers 5 minutes or completed tasks.
State 4 : Increase FiO2			
Rhythm: NSR **HR:** 155 **BP:** 95/60 **Cap refill**: 3s **RR:** 55 Grunt has ceased. **O_2 SAT**: 89% on mask, grades up to 94% on 2L/kg HFNP once FiO2 35% or higher. **AVPU** = A	Tachypnoea improves with High Flow Nasal Cannula Oxygen Therapy however Hypoxia persists until FiO2 increased to 35% or higher.	☐ Recognise child improved. ☐ Arrange disposition. ☐ Prescribe continuous 2/3 maintenance formula via ngt or IV.	Modifiers If hospital does not usually care for children on High Flow Nasal Cannula Oxygen Therapy, senior doctor prompts discussion regarding safe disposition within network. Triggers 5 minutes or completed tasks.

Section VII: Supporting Documents, Laboratory Results, & Multimedia

Venous Blood Gas Result

VBG	Results	Units	Normal Range
pH	7.28		**7.32 – 7.42**
pCO2	60	mmHg	**41 - 51**
pO2	35	mmHg	**25 - 40**
O2 Saturations	50%	%	**40 - 70**
Bicarb	21	mmol/L	**22 - 33**
BE		mmol/L	**-3 - +3**
HCT			**0.3 - 0.42**
Hb	110	g/L	**105 - 135**
Na+	132	mmol/L	**135 - 145**
K+	4.5	mmol/L	**3.2 - 4.5**
Ca++ (ionised)	1.2	mmol/L	**1.15 – 1.35**
Glucose	5.0	mmol/L	**3.0 – 7.8**
Lactate	1.8	mmol/L	**0.7 – 2.5**

Section VIII: Debriefing Guide

Objectives	
Educational Goal:	Manage infant with severe Bronchiolitis according to evidence-based guidelines
Skills Rehearsal:	Setting up High Flow Nasal Cannula Oxygen Therapy
Systems Assessment:	Availability of an evidence based guideline for management of Bronchiolitis Departmental Protocol for escalation of care for an infant in respiratory distress

Sample Questions for Debriefing

- How do you decide whether to treat for bronchiolitis or for a pneumonia?
- What guidelines do you use to guide your treatment for Bronchiolitis?
- How does High Flow Nasal Cannula Oxygen Therapy help to improve the child's work of breathing and oxygenation?
- What resources do you have in your hospital to guide you to set up and use HFNC oxygen therapy?
- When does a child with Bronchiolitis need retrieval or transfer to PICU?

Key Moments

- Diagnosing Bronchiolitis
- Implementing supportive care for Bronchiolitis
- Hydration strategy : IV vs NG
- O_2 delivery
- Escalation to High Flow Nasal Cannula OxygenTherapy.
- Disposition planning

Ask participants to complete our online survey!

Scan the QR code with their phone camera

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BRONCHIOLITIS

Treatment is supportive :

O2

Target Sats 92% or above
Nasal High flow is
indicated if persistently hypoxic
and moderate
to severe recessions.

Fluid

NG hydration or
IV Isotonic Fluid is appropriate.
Ideal volume is unproven.
Consider nutrition as well
as hydration.

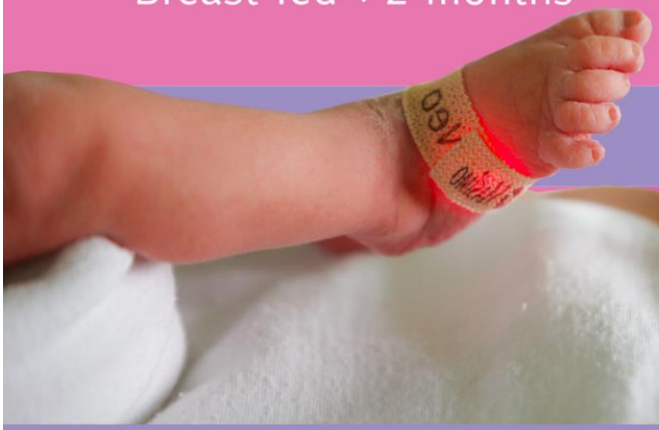
These interventions won't change outcomes :

Salbutamol Corticosteroids Adrenaline Hypertonic Saline Antibiotics
Chest Physiotherapy Antivirals Viral PCR testing

Risk factors for more serious illness :

Gestation ‹ 37 weeks
Chronological age ‹ 10 weeks
Post natal smoking exposure
Breast fed ‹ 2 months

Failure to thrive
Chronic Lung Disease
Congenital Heart Disease
Chronic neurological conditions
Indigenous ethnicity



To learn more scan this :

Check out the Children's Health Queensland online bronchiolitis guidelines

Queensland Government

Bronchiolitis Learning Resources for Sim (Pre or Post Reading)

Children's Health Queensland
Bronchiolitis Guideline

Latest evidence in Bronchiolitis
Dr Franz Babl at DFTB18

Airvo2 Simulator App
For guide and video on how to set up high flow

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 Bronchiolitis.

OPTIMUS CORE	OPTIMUS PRIME	OPTIMUS BONUS
Assessment of a deteriorating child	Escalating Care	Setting up High Flow Nasal Cannula Oxygen Therapy
Respiratory Assessment	Airway management	Evidence based management for Bronchiolitis

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

Access to paediatric resources on: • Bronchiolitis • Assessing a child in respiratory distress	☐ ☐
Equipment Check: • Access to and Use of High Flow Nasal Cannula Oxygen Therapy	☐
Departmental Protocols for: • Clinical Guidelines for Bronchiolitis • Care of children requiring High Flow Nasal Cannula Oxygen Therapy in your hospital. • Trigger points for escalation of care in your hospital.	☐ ☐ ☐

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 Sonia Twigg : Primary Author
@LankyTwig
FACEM, MBBS, BA, BSc
Fellow, STORK (Simulation Training Optimising Resuscitation for Kids)
Queensland Children's Hospital

Dr Sonia from STORK is an emergency physician doing subspecialty training in Paediatric Emergency Medicine and works at the Queensland Children's Hospital as a fellow in the emergency department and for the STORK simulation team.
She is part of the ALIEM faculty incubator program for 2019-2020 and facilitated the 2019 Health Workforce Queensland workshops for GPs on Paediatric Emergency Medicine. Sonia is interested in critical care, medical education and ultrasound. She is passionate about fun, creativity and innovation in education.

Dr Ben Symon : Consultant Supervisor, Infographics and Editor
@symon_ben
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 has recently been invited to join as 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.

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.
- BONUS was proposed as a solution to skill and knowledge decay after these courses are run.

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 .

Resources for Participants:

- Bronchiolitis - Emergency management in children. Queensland Paediatric Guideline. Children's Health Queensland Hospital and Health Service, June 2019. Available at: https://www.childrens.health.qld.gov.au/guideline-bronchiolitis-emergency-management-in-children/
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- Airvo 2 Simulator App. Fisher & Paykel Healthcare. Available at: https://www.fphcare.com/au/hospital/adult-respiratory/optiflow/airvo-2-system/

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6. Nasal High Flow Therapy. Children's Health Queensland Hospital and Health Service. May 2019. Available at: https://qheps.health.qld.gov.au/__data/assets/pdf_file/0026/702737/gdl-70025.pdf

7. O'Brien S, Craig S, Babl F, Borland M et al Rational use of high-flow therapy in infants with bronchiolitis. What do the latest trials tell us? A Paediatric Research in Emergency Departments International Collaborative perspective. Journal of Paediatrics and Child Health, 2019 (55): 746-752.

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

This educational package has been reviewed by content experts and a State-wide Steering Group Review on behalf of Children's Health Queensland.