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# High Flow Nasal Cannula (HFNC) in Bronchiolitis: Managing Care Outside the ICU

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MASSACHUSETTS  
Health & Hospital  
ASSOCIATION

**Wednesday, November 2, 2022**

**11 a.m.**

# Faculty

- Estevan Garcia, MD, DPH, MPA, FAAP, Chief Medical Officer, Massachusetts Department of Public Health
- Alla Smith, MD, Attending Physician, Division of Medical Critical Care, Boston Children's Hospital

# Key Objectives

The webinar is tailored to clinicians who are managing patients with bronchiolitis on HFNC outside the ICU – in both community hospitals and sites where there may be a pediatric ICU that is currently at capacity.

Participants should expect to achieve the following learning objectives through this webinar:

- Summarize the physiologic mechanism for HFNC in bronchiolitis;
- Identify patients with bronchiolitis who may benefit from HFNC;
- Discuss a weight-based approach for initiation, escalation, and weaning of HFNC; and
- Assess how a pathway for management of HFNC in bronchiolitis might be implemented in your health system

# HFNC in Bronchiolitis:

## Managing Care Outside the ICU

Alla Smith, 11/2/2022

# High Flow Nasal Cannula Pathway

HFNC in Bronchiolitis Pathway guides management of patients with bronchiolitis on HFNC using optimal flows and incorporates aggressive weaning.

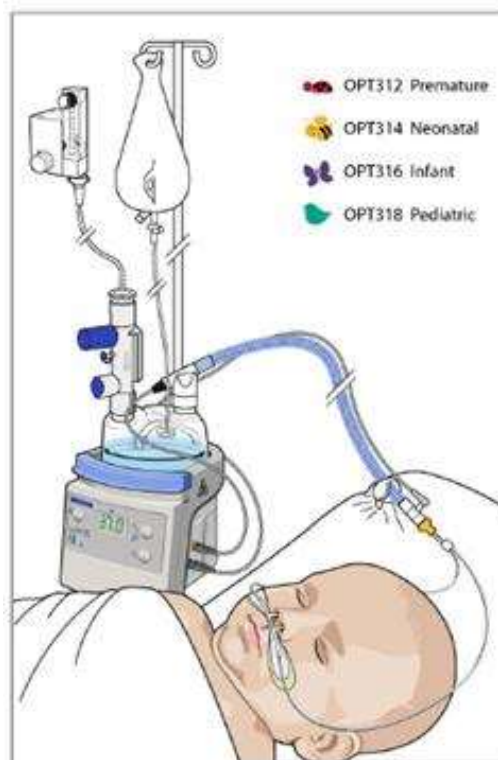
## Goal:

- ▶ Bring this pathway back to your facility- adapt it to that environment
- ▶ Improve staff comfort with this patient population
- ▶ Shorten duration of critical illness/time on HFNC

# HFNC: What is it?

- ▶ Heated, humidified air with titratable FiO<sub>2</sub> (0.21 to 1), typically delivered at flows >4L/minute

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# HFNC: How does it help?

- ▶ Allows for effective dead space wash-out<sup>1</sup>
- ▶ Humidifies airways, which assists with secretion clearance<sup>1</sup>
- ▶ Provides (small) PEEP in patients with bronchiolitis<sup>1</sup>
- ▶ Improves tachypnea and dyspnea in patients with bronchiolitis<sup>2</sup>

1. Milési, C., Baleine, J., Matecki, S., Durand, S., Combes, C., Novais, A. R. B., & Combonie, G. (2013). Is treatment with a high flow nasal cannula effective in acute viral bronchiolitis? A physiologic study. *Intensive Care Medicine*, 39(6), 1088-1094.

2. Rubin, S., Ghuman, A., Deakers, T., Khemani, R., Ross, P., & Newth, C. J. (2014). Effort of Breathing in Children Receiving High-Flow Nasal Cannula. *Pediatric Critical Care Medicine*, 15(1), 1-6.

# HFNC: Who should get it?

- ▶ Hospitalized patients with moderate to severe bronchiolitis who have failed standard therapies<sup>3</sup>
- ▶ Patients with bronchiolitis (<2yo) who have
  - ▶ Hypoxia requiring >2L/minute LFNC
  - OR
  - ▶ Persistent moderate to severe dyspnea or tachypnea

3. O'Brien, S. *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. *J Paediatr Child H* 55, 746-752 (2019)



# HFNC: What flows are best?

- ▶ Most pediatric inpatient units in US use fixed liter limit flows that are low (<8LPM)<sup>4</sup>
- ▶ Weight-Based Flows
  - ▶ 2L/kg/minute are optimal<sup>5</sup>

4. Kalburgi, S. & Halley, T. High-Flow Nasal Cannula Use Outside of the ICU Setting. *Pediatrics* 146, e20194083 (2020)

5. Milési C, Pierre AF, Deho A, et al. A multicenter randomized controlled trial of a 3-L/kg/min versus 2-L/kg/min high-flow nasal cannula flow rate in young infants with severe viral bronchiolitis (TRAMONTANE 2). *Intens Care Med.* 2018;44(11):1870-1878

# HFNC: Weaning is Important

- ▶ Higher flows are associated with longer LOS<sup>5</sup>
- ▶ Aggressive weaning protocols can shorten LOS<sup>6</sup>
  - ▶ Regularly turn down flows and assess how patients respond

5. Milési C, Pierre AF, Deho A, et al. A multicenter randomized controlled trial of a 3-L/kg/min versus 2-L/kg/min high-flow nasal cannula flow rate in young infants with severe viral bronchiolitis (TRAMONTANE 2). *Intens Care Med.* 2018;44(11):1870-1878. doi:10.1007/s00134-018-5343-1

6. Sokuri P, Heikkilä P, Korppi M. National high-flow nasal cannula and bronchiolitis survey highlights need for further research and evidence-based guidelines. *Acta Paediatr.* 2017;106(12):1998-2003. doi:10.1111/apa.13964

# HFNC: What to do when it fails

- ▶ Some studies suggest reduction in ICU need- but a proportion of children on HFNC (15-50%) will require ICU transfer<sup>7-11</sup>
- ▶ Building in institution-specific transfer criteria is key to pathway success
- ▶ NIV with CPAP or BIPAP is a reasonable next step for most patients

7. Franklin, D., Babl, F. E., Schlapbach, L. J., Oakley, E., Craig, S., Neutze, J., et al. (2018). A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis. *The New England Journal of Medicine*, 378(12), 1121-1131

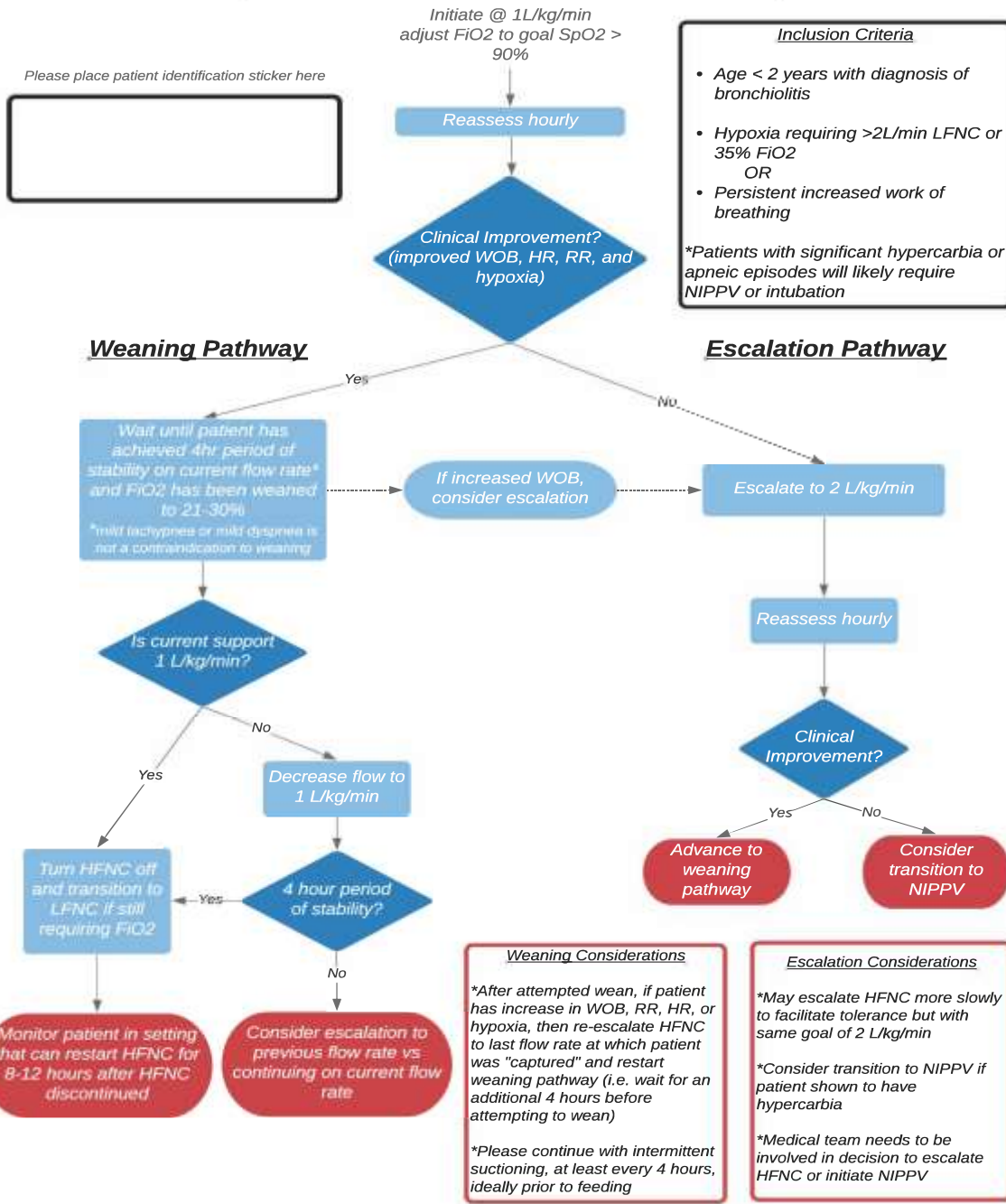
8. Willer, R. J. *et al.* Implementation of a Weight-Based High-Flow Nasal Cannula Protocol for Children With Bronchiolitis. *Hosp Pediatrics* 11, 891-895 (2021)

9. Kepreotes, E., Whitehead, B., Attia, J., Oldmeadow, C., Collison, A., Searles, A., et al. (2017). High-flow warm humidified oxygen versus standard low-flow nasal cannula oxygen for moderate bronchiolitis (HFWHO RCT): an open, phase 4, randomised controlled trial. *The Lancet*, 389(10072), 930-939

10. Mayfield, S., Bogossian, F., O'Malley, L., & Schibler, A. (2014). High-flow nasal cannula oxygen therapy for infants with bronchiolitis: Pilot study. *Journal of Paediatrics and Child Health*, 50(5), 373-378

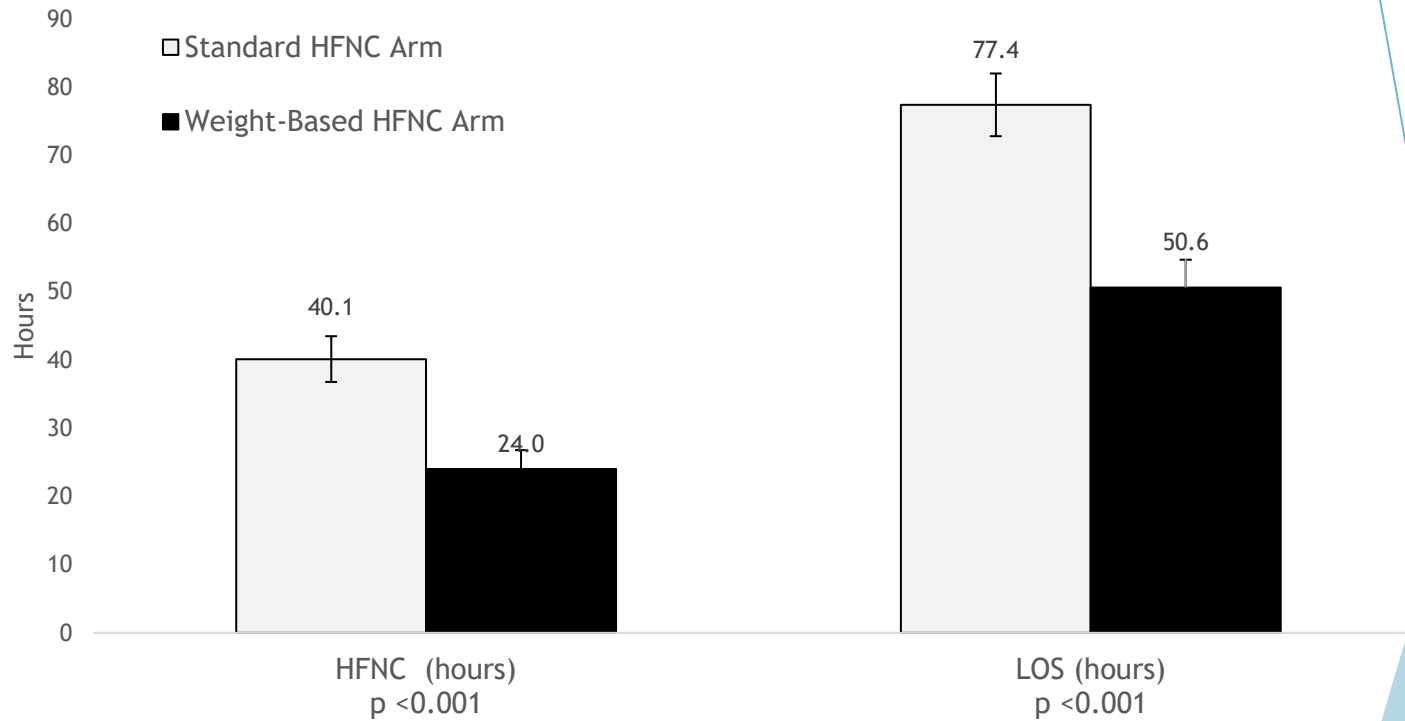
11. Clayton, J. A., McKee, B., Slain, K. N., Rotta, A. T., & Shein, S. L. (2019). Outcomes of Children With Bronchiolitis Treated With High-Flow Nasal Cannula or Noninvasive Positive Pressure Ventilation. *Pediatric Critical Care Medicine*, 20(2), 128-135.

# HFNC in Bronchiolitis Pathway



# HFNC Pathway at a Community Hospital

Average Hours on HFNC and LOS by Arm Group



# HFNC Pathway at BCH

Compared with Standard Practice at BCH:

- ▶ Reduction in Time on HFNC
- ▶ Reduction in Hospital and Critical Care LOS
- ▶ Decrease in the percentage of patients who require escalation to NIV or IMV\*

\*preliminary data

# HFNC: What are the risks?

- ▶ Minimal.
  - ▶ Risk of air leak is very low, even when using higher flows
    - ▶ Recent large (~1500) patient RCT did not demonstrate any air leak<sup>7</sup>

<sup>7</sup> Franklin, D., Babl, F. E., Schlapbach, L. J., Oakley, E., Craig, S., Neutze, J., et al. (2018). A Randomized Trial of High-Flow Oxygen Therapy in Infants with Bronchiolitis. *The New England Journal of Medicine*, 378(12), 1121-1131

# HFNC Pathway: RN/RT Staffing

- ▶ HFNC does not obviate or reduce the need for RN and RT support
  - ▶ Patients generally staffed at 1:2 to 1:3 for nursing
  - ▶ RT supports vary- but they are often involved in assessments/flow changes



# PIMCU Network

- ▶ Interested in high-acuity care outside the ICU?
  - ▶ Join the PIMCU Network! Email me or the network administrator\* for an invitation to the group's website. Post questions/share pathways etc. Over 150 members nationally
  - ▶ Join the new AAP Sub-committee on Pediatric Intermediate Care (under SOHM and SOCC)



**PIMCU**  
PEDIATRIC INTERMEDIATE  
CARE NETWORK

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# Acknowledgements

- ▶ Network Team

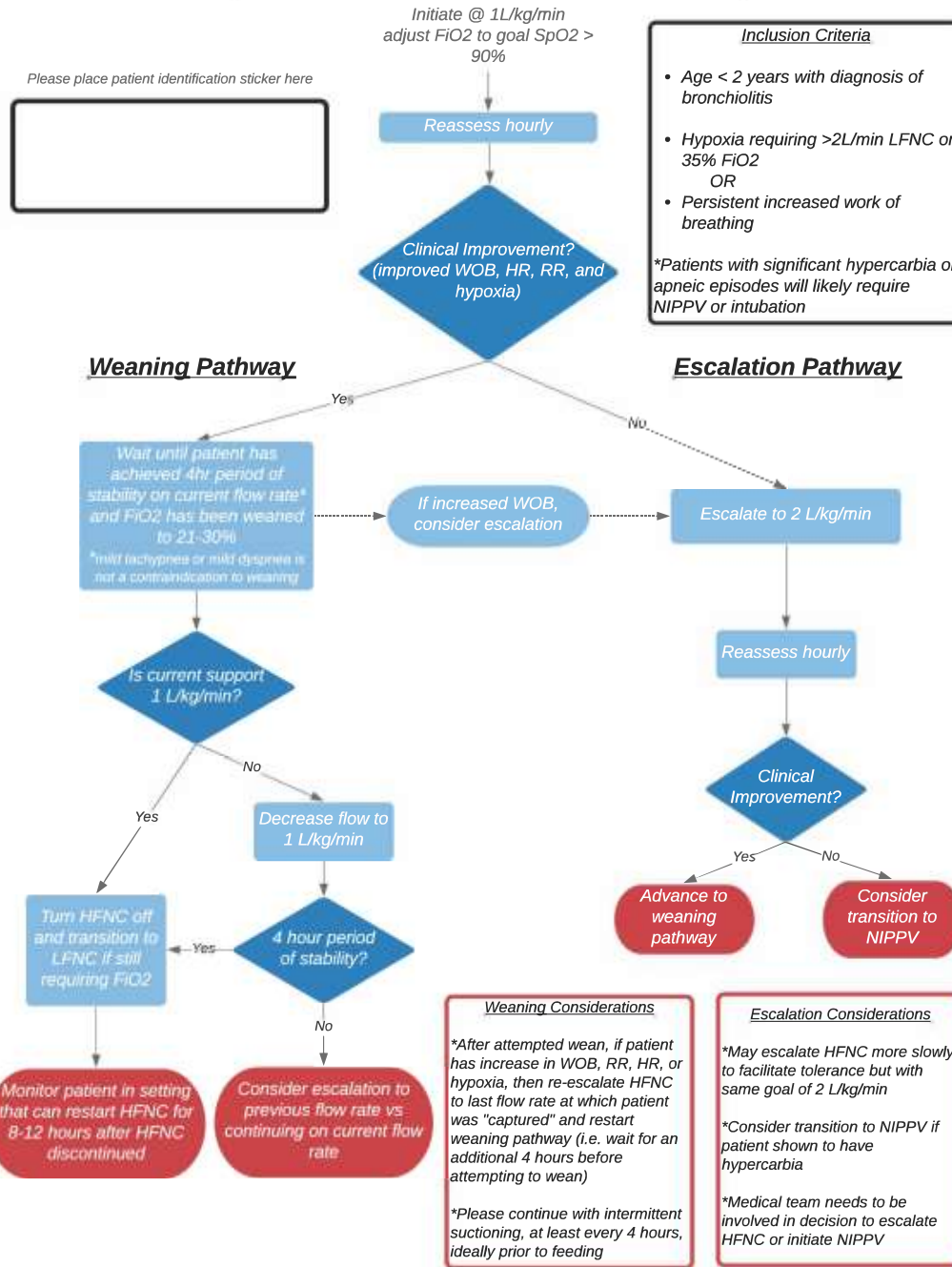
- ▶ Debra Banville
- ▶ Mark Waltzman
- ▶ Karen Gruskin
- ▶ Jesslyn Lenox

- ▶ BCH Team

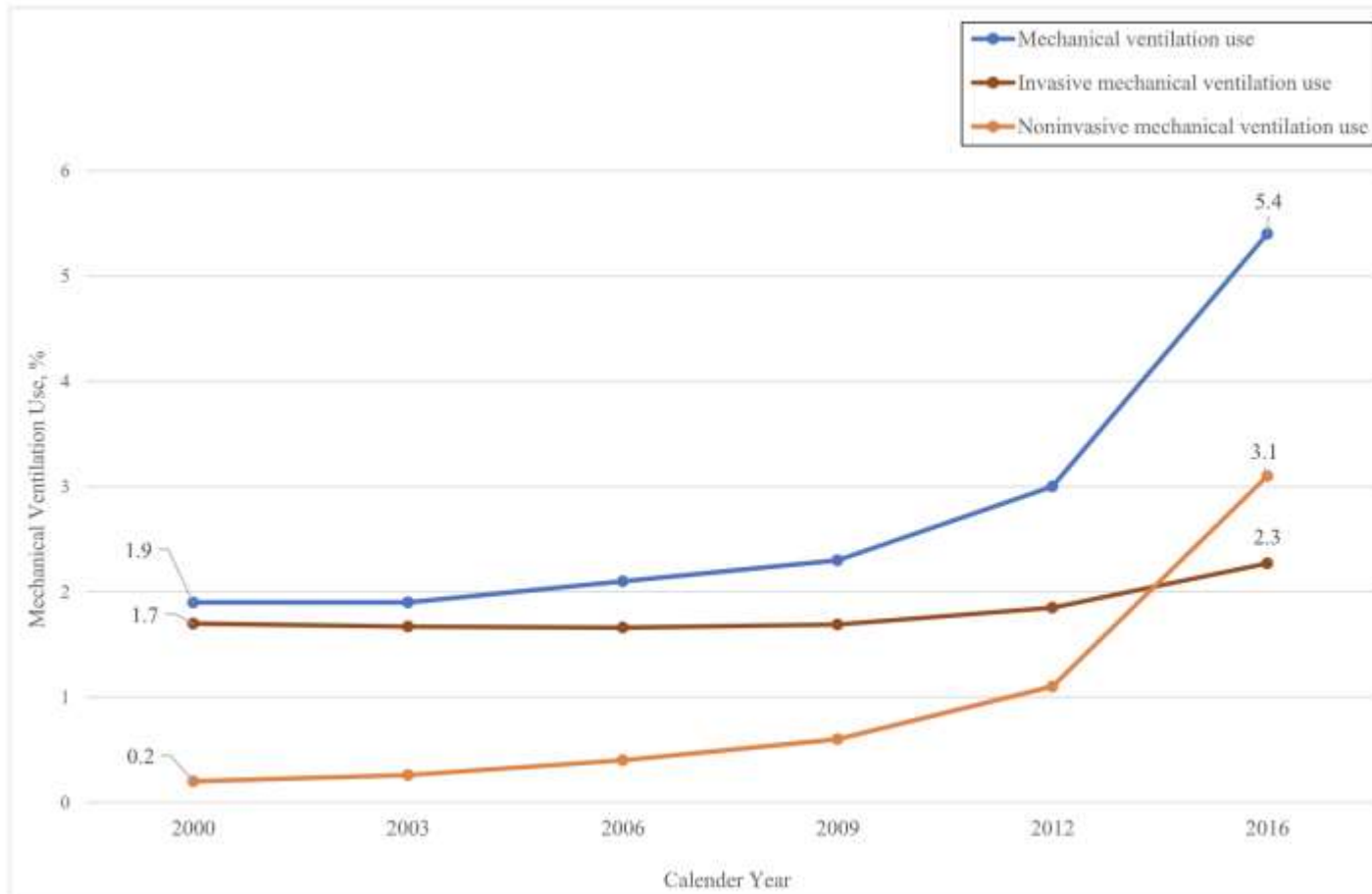
- ▶ Michael Agus
- ▶ Christiana Russ
- ▶ Elyse Jones
- ▶ Daria Donnelly

And many others!

# HFNC in Bronchiolitis Pathway



# High Flow Nasal Cannula- trends



- ▶ Fujiogi, M. *et al.* Trends in Bronchiolitis Hospitalizations in the United States: 2000-2016. *Pediatrics* 144, e20192614 (2019).

# HFNC Study: Weight Based Protocol

Initiate HFNC @ Initial 1 lpm/kg and 21% Oxygen

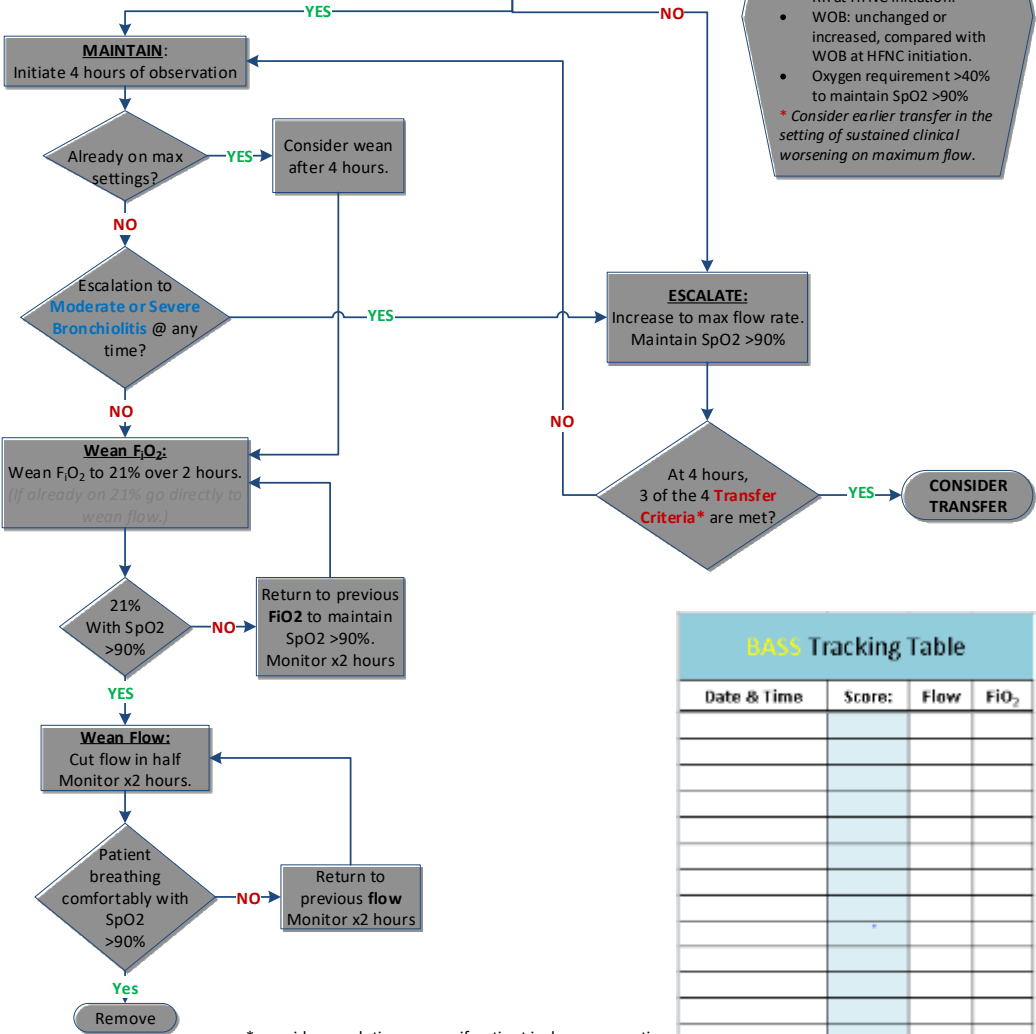
	<b>Infants &amp; Children</b>	<b>Children &amp; Adolescents</b>
<b>Initial Flow Rate</b>	5-20 kg 1 lpm/kg	>20 kg 1 lpm/kg
<b>Max Flow Rate</b>	2 lpm/kg	40 lpm

Does the patient have a BASS score of mild bronchiolitis after 2 hours?\*

**TRANSFER CRITERIA:**

- HR: unchanged or increased, compared with HR at HFNC initiation.
- RR: unchanged or increased, compared with RR at HFNC initiation.
- WOB: unchanged or increased, compared with WOB at HFNC initiation.
- Oxygen requirement >40% to maintain SpO<sub>2</sub> >90%

\* Consider earlier transfer in the setting of sustained clinical worsening on maximum flow.

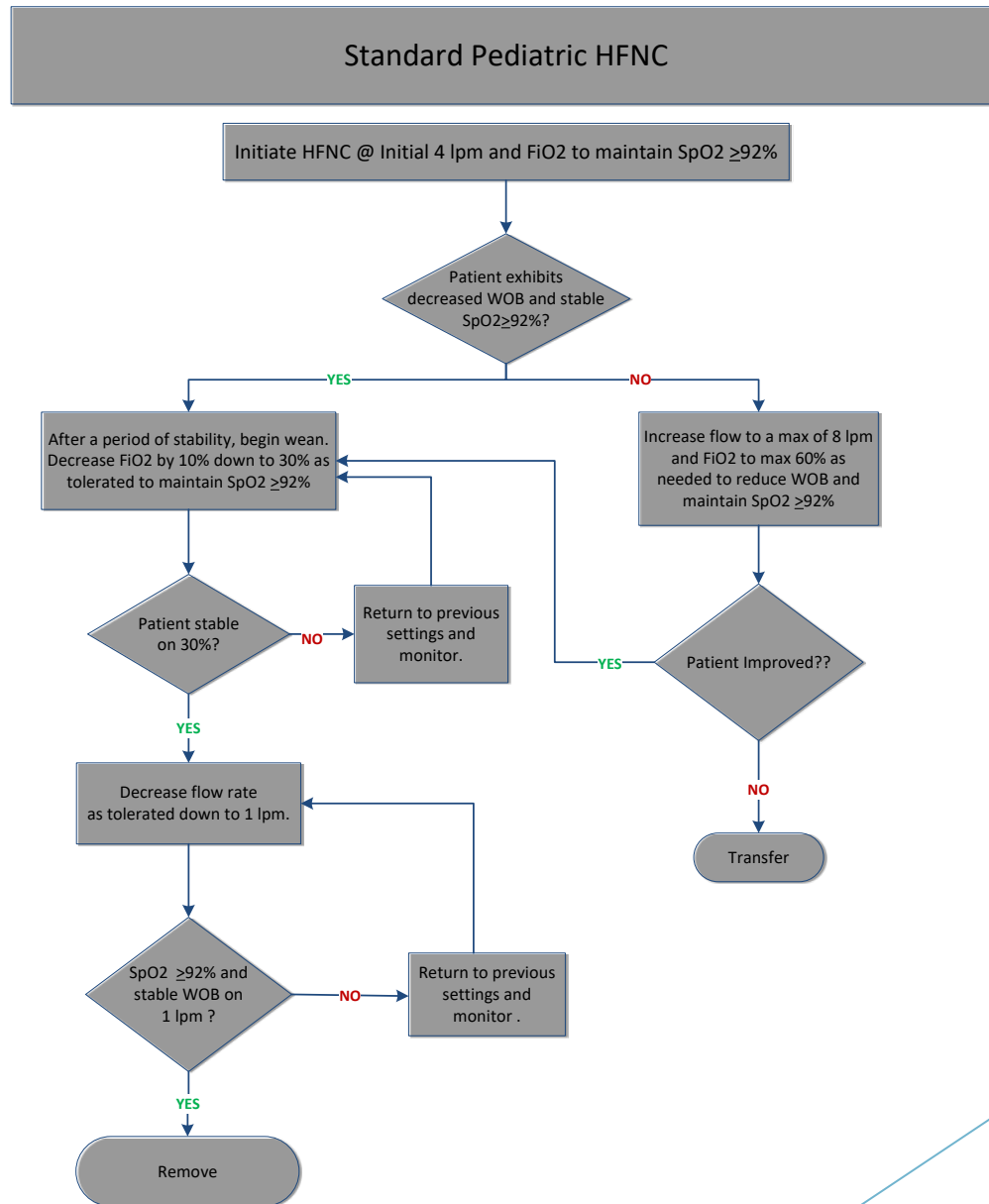


**BASS Tracking Table**

Date & Time	Score:	Flow	FiO <sub>2</sub>

\* consider escalating sooner if patient is decompensating

## Standard Pediatric HFNC



# Follow Up & Next Steps

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