

***Quality improvement initiative to reduce excess use of heated humidified high-flow nasal cannula in infants with bronchiolitis.***

A collaboration of:

Divisions of Pediatric Critical Care & Pediatric Hospital Medicine, Doernbecher Children's Hospital (DCH)

Respiratory Care

Information Technology

OHSU School of Medicine

Erin Burns, Michelle Noelck, Serena Kelly, Bradley Meyers, Carly Byrne, Andrea Smith, Karen Alles, Mackenzie Treible, Mina Tahai, Tamara Wagner, Pearl Peyton, Laura Ibsen

**Abstract:**

**Quality issue:** Use of heated humidified high flow nasal cannula (HHFNC) is common and increasing among pediatric bronchiolitis patients despite a lack of standardization or known efficacy. In our center, it is associated with longer hospitalization and capacity strain when used in excess at lower flows. We aim to acculturate accelerated HHFNC weaning practice across multiple hospital units via a novel protocol.

**Initial assessment:** Key stakeholders reviewed practices during the previous season (Sept 1 2016 – Apr 30 2017), noting large variation in respiratory support at time of transfer from PICU to pediatric ward. We hypothesized that we could a) successfully implement the protocol, b) reduce HHFNC use at transfer, and c) reduce hospital LOS.

**Choice of solution:** Our group developed a novel Simple Cannula / Room Air Trial for Children (SCRATCH) to rapidly trial qualifying patients on 2LPM simple cannula or room air for 60 minutes at 0400 daily. A daily management system monitored adherence and patient safety as we piloted this protocol in our PICU.

**Results:** A review of 2 months' (Jan 15 – Mar 15 2018) post-implementation data revealed 46 subjects meeting criteria for primary diagnosis. Six patients were excluded for young age (<1 mo) or chronic cardiopulmonary disease. Of the remaining 40 patients, we observed 53 patient-days where patients on HHFNC were eligible for a trial. Of these opportunities, 24 trials were done on 22 patients (45% compliance.) SCRATCHed patients were significantly less likely to leave PICU on HHFNC compared to non-SCRATCHed patients in either season. Two patients who passed a trial were left on HHFNC per clinician judgement. One patient who left PICU on room air was later restarted on HHFNC. No patients were intubated or re-admitted to PICU following a trial. Hospital and PICU LOS were not significantly different between groups.

**Lessons learned:** In the setting of lower compliance during this pilot, we safely reduced incidence of HHFNC use at time of ward transfer for SCRATCHed patients compared to both contemporary and historical controls. This did not translate into shorter LOS for

SCRATCHed patients, likely reflecting our small single-unit sample and non-randomized implementation. Less-ill patients may have been rapidly weaned and discharged from PICU or transferred prior to a SCRATCH opportunity, thus skewing LOS findings in favor of non-SCRATCH patients. Barriers to SCRATCH compliance included lapses in ordering, transfer of patients prior to trial times, and subjective clinical concerns by staff regarding safety of rapid weaning (a primary target of this initiative.) Next steps include further staff education, finalization of an order set and flowsheet to streamline ordering and documentation, and implementation of the trial on the pediatric ward. Goals for next season include hospital-wide implementation with >90% compliance and ongoing reduction in HHFNC usage.

**Table 1. Comparison of Pre- and Post-SCRATCH Oxygen Support and LOS.**

	2016-17 Historical Controls (n=60)	2017-18, Controls (n=18)	2017-18, SCRATCH (n=22)	Comparison of SCRATCH patients to <sup>1</sup>	
				2016-17 Historical Controls, p-value	2017-18 Controls, p-value
<b>Support at PICU to ward transfer, n (%)</b>					
HHFNC	27 (45.0)	14 (77.8)	2 (10.5)		
Simple cannula	10 (16.7)	1 (5.5)	7 (36.8)		
Room air	21 (35.0)	1 (5.5)	10 (52.6)	<b>0.015</b>	<b>&lt;0.0001</b>
<b>Discharged home from PICU, n (%)</b>	2 (3.3)	2 (11.1)	3 (15.8)	0.084	0.810
<b>LOS in hospital (days), mean (St.Dev.)</b>	6.58 (4.47)	4.84 (1.86)	6.33 (2.65)	0.806	0.051
<b>LOS in PICU (days), mean (St.Dev.)</b>	4.03 (3.20)	3.11 (2.05)	3.95 (2.12)	0.914	0.214

Abbreviations: LOS, length of stay; SD, standard deviation

The mean age for the 2016-17 historical controls is 4.21 months (SD 4.64) and the mean age for the overall 2017-18 cohort is 5.23 months (SD 4.58).

<sup>1</sup> p-values for categorical variables are from chi-square tests and for continuous variables are from Student's t-tests. p-values in bold designate those comparisons that are statistically significant at the 0.05 level.

