Clinical Safety & Effectiveness Cohort # 9

Decreasing the number of hours on HFNC in the PIMC at CSRCH

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Financial Disclosure

Sandra Ehlers, MD has no relevant financial relationships with commercial interests to disclose.

Michelle W. Shepherd, RN, PIMC has no relevant financial relationships with commercial interests to disclose.

The Team

- Department: Pediatrics

  CS&E Participants

- Sandra Ehlers, MD: Physician Champion
- Michelle W. Shepherd, RN ,PIMC

Team Members

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- Sponsor Department

Shawn Ralston, MD Division Chief of Inpatient Pediatrics, UTHSCSA

Trisha Montague, RN, CNO of CSRCH

What We Are Trying to Accomplish?

OUR AIM STATEMENT

To decrease the number of hours pediatric patients < 18 months are on HFNC at the CSRCH PIMC by 10% by February 15th 2012.

HFNC: High Flow Nasal Cannula
CSRCH:CHRISTUS Santa Rosa Children's Hospital
PIMC: Pediatric Intermediate Care Unit

Project Milestones

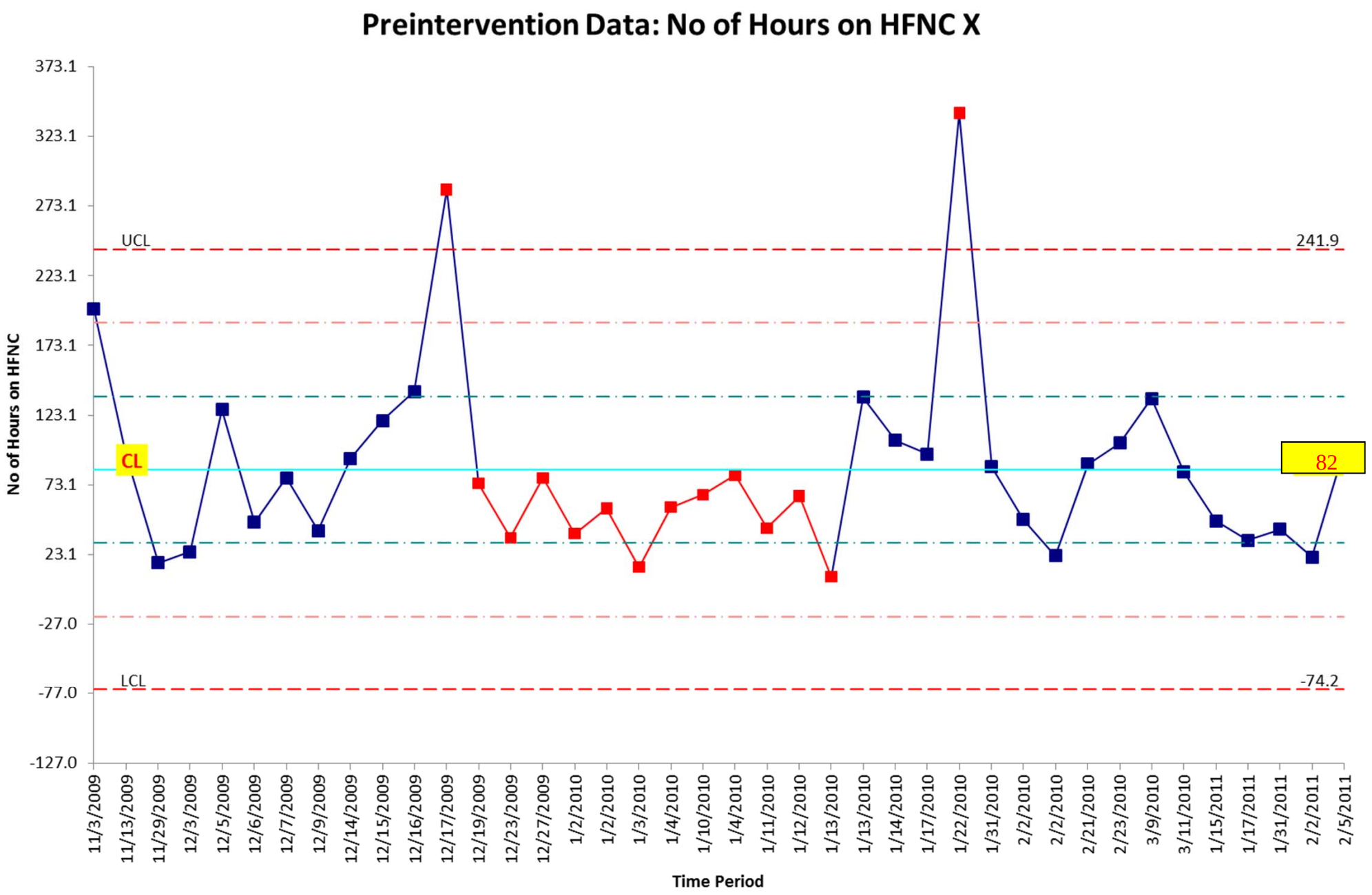
• Team Created	September 2011
• AIM statement created	September 2011
• Weekly Team Meetings	October 2011
• Background Data, Brainstorm Sessions, Workflow and Fishbone Analyses	September 2011
• Interventions Implemented	November 2011
• Data Analysis	February 2012
• CS&E Presentation	February 24, 2012

Background

- Bronchiolitis is a lower respiratory tract infection caused by a variety of viral infections, the most notorious virus being RSV or Respiratory Syncytial Virus.
- The virus affects the smallest of the airways, the bronchioles. Symptoms range from upper respiratory infection symptoms, with mild cough to full blown respiratory distress, requiring mechanical ventilation.

Background (cont.)

- All ages can contract the viruses, however, those 2yrs of age and under are those who commonly suffer the highest morbidity.
- Furthermore, those infants and children with predisposing illnesses, such as prematurity, congenital heart defects or other chronic lung disease, are usually the hardest hit.
- That being said, the previously well child can also become very ill and require respiratory support.
- The treatment for Bronchiolitis is, at this time, purely supportive in nature:
  - Nasal Suctioning
  - Assistance with feedings via nasogastric/orogastric tube feedings/ or Intravenous fluids
  - 3% Saline, Racemic Epinepherine or Albuterol nebulization treatments
  - Supplemental Oxygen
    - Simple nasal cannula
    - High Flow Nasal Cannula (HFNC)- a method of delivering oxygen with the added assistance of positive pressure flow.
    - Intubation and Mechanical ventilatory support


Preintervention Data: No of Hours on HFNC X
No of Hours on HFNC
373.1
323.1
273.1
223.1
173.1
123.1
73.1
23.1
-27.0
-77.0
-127.0
UCL
241.9
CL
82
LCL
-74.2
11/3/2009
11/13/2009
11/29/2009
12/3/2009
12/5/2009
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1/22/2010
1/31/2010
2/2/2010
2/2/2010
2/21/2010
2/23/2010
3/9/2010
3/11/2010
1/15/2011
1/17/2011
1/31/2011
2/2/2011
2/5/2011
Time Period

Burden

- The significance of Bronchiolitis in infants and children is evident in the number and costs of hospitalizations. It is estimated that approximately 150,000 hospitalizations a year are accounted for by Bronchiolitis, costing over $500,000,000.*
- Not to mention the overriding significance of the approximately 400 infant deaths per year from the complications of this illness.**

*Pediatrics 2006; 118: 2418-23

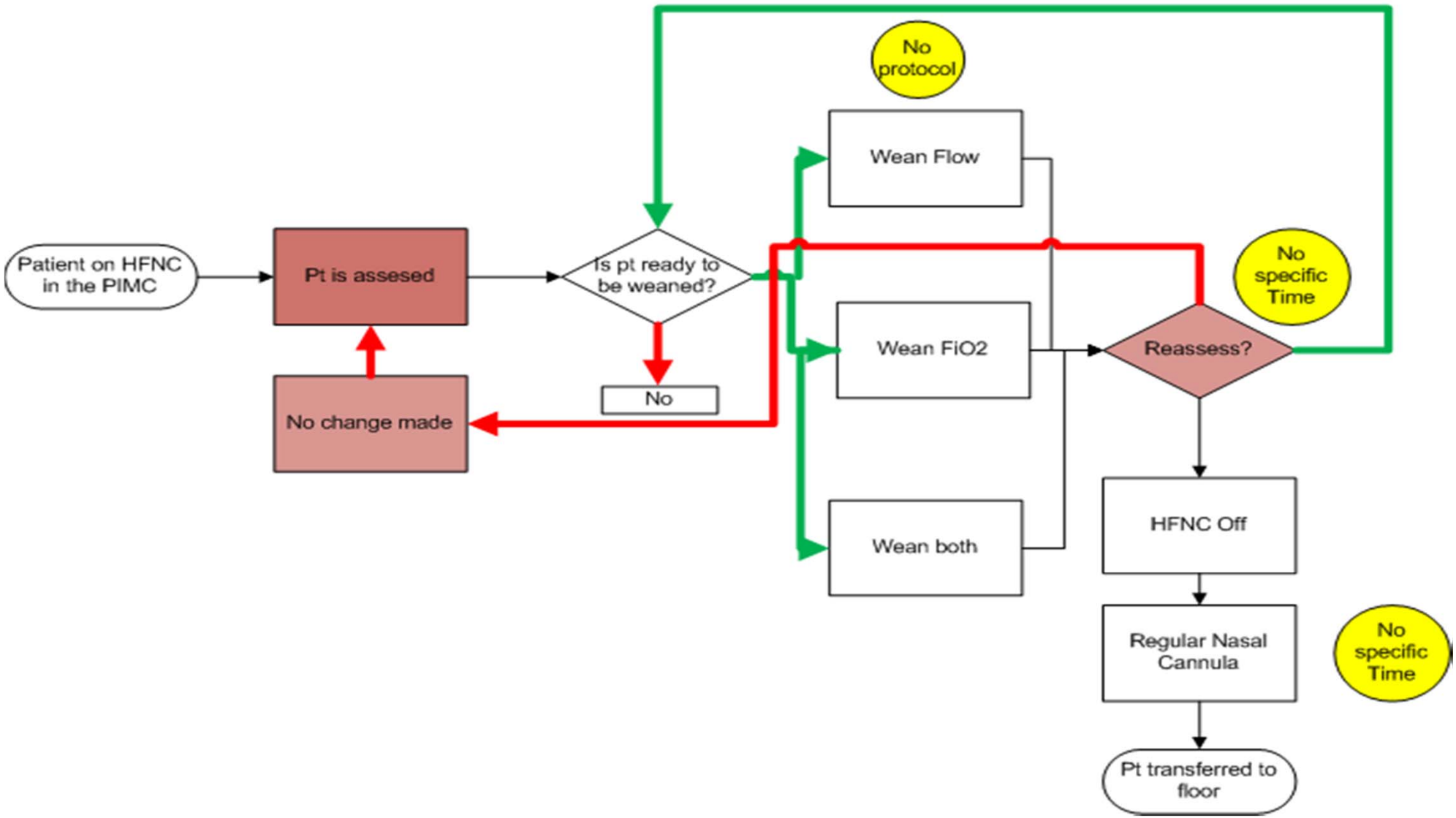
**Cincinnati Children's Evidenced Based Care Guideline, updated 11/2010

Benefits of Change

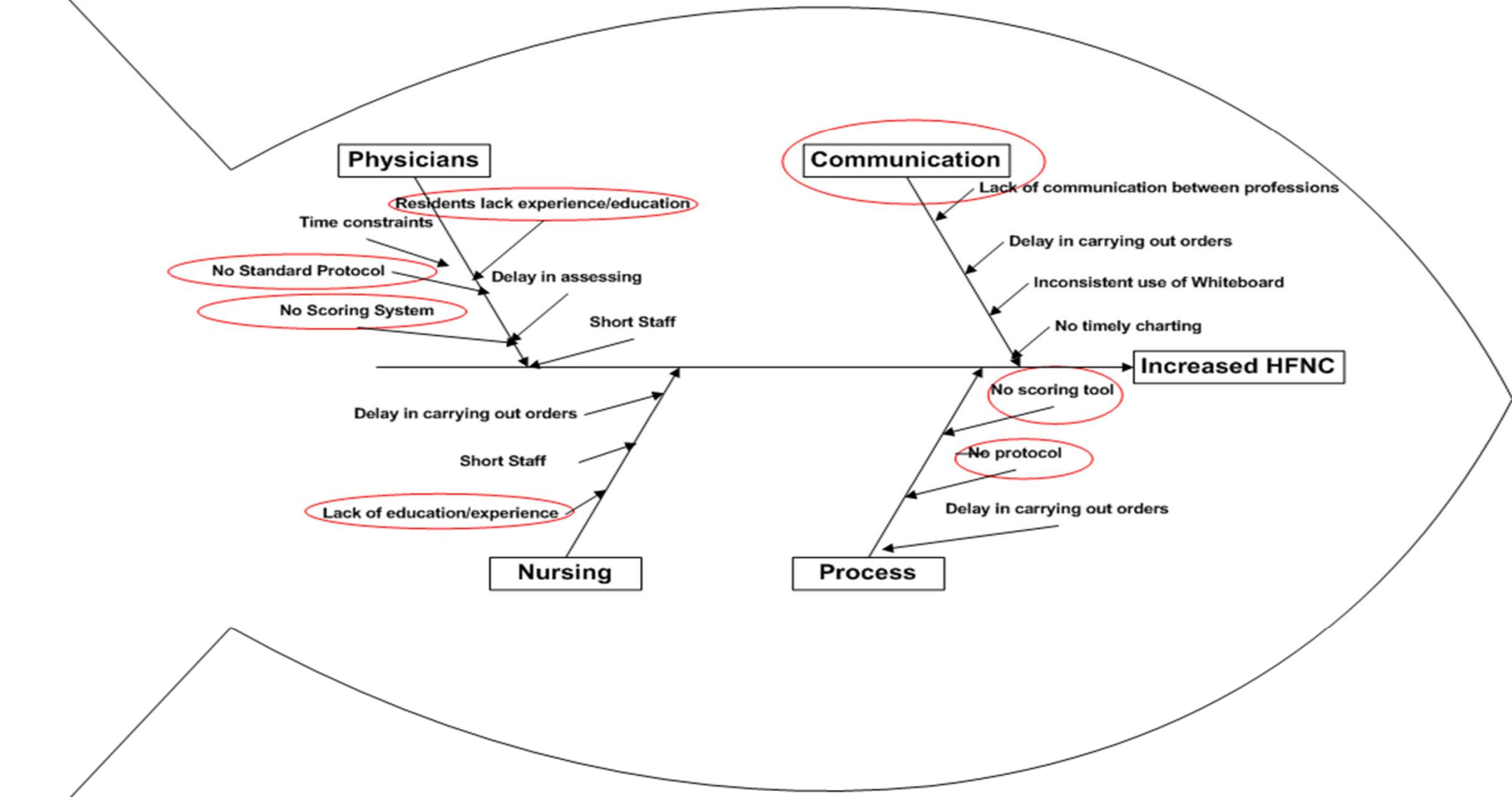
- Available studies in the use of HFNC as a treatment option for infants with Bronchiolitis are limited; we found only one.

  Journal of Pediatrics- Volume 156, Issue 4 (April 2010)
- They designed a study to find out if using HFNC in infants with Bronchiolitis who were admitted to the PICU (Pediatric Intensive Care Unit) were less likely to require intubation if they were placed on HFNC first.
- They compared 58 infants from the season prior to the use of HFNC to 58 infants from the season after the introduction of the HFNC.
- There was a 68% reduction in the length of hospital stay from a median of 6 days in the first year, to a median of 4 days in the HFNC year.
- We wanted to show that adding a weaning protocol to the use of the HFNC, would further improve our length of stay at CHRISTUS Santa Rosa Children's Hospital Pediatric Intermediate Care Unit (PIMC).

Flowchart for HFNC weaning in PIMC at CSRCH



Cause and Effect diagram for HFNC weaning in PIMC at CSRCH



Implementing the Change

- HFNC Weaning Protocol
- Bronchiolitis Scoring system: Both RN/ RT can assess patient and make changes to the HFNC
- Changed current Bronchiolitis standard orders to be floor or PIMC friendly
- Educated Physicians, Nurses and Respiratory Therapists.

Metric used: number of hours on HFNC(SEASONAL)

What Changes Can We Make That Will Result in an Improvement?

- Implement a HFNC weaning protocol

Respiratory Care Plan for High-Flow Nasal Cannula (HFNC) Therapy
CHRISTUS Santa Rosa Children's Hospital

I. **When to initiate the HFNC weaning protocol:**

With physician order only – ie. when patient deemed medically stable to initiate oxygen weaning.

II. **Inclusion/ Exclusion Criteria:**

Children who are considered good candidates for the HFNC weaning protocol are those that have normal cardio-pulmonary circulation and are on room air when well.

III. **Management of Flow Rates and FiO_2:**

A. Oxygen saturation and a respiratory score will be documented at a minimum with each RT assessment or every four hours by nursing.

B. If the SaO_2 is ≥ 91% and the respiratory score is ≤ 2, the flow rate should be decreased:
- by 1L/min every four hours until flow rate of 3L/min is achieved.

C. Once a flow rate of 3L/min is achieved and if both the SaO2 is ≥ 91% and the respiratory score is ≤ 2; the fractionated inhaled oxygen (FiO_2) amount should be decreased:
- by 10% every four hours until the FiO_2 is 30%.

D Once a flow rate of 3L/min is achieved and the FiO_2 of 30% has been tolerated for four hours (respiratory score is ≤ 2); the patient should be transitioned to standard nasal cannula at 3L/min and oxygen is to be weaned per oxygen weaning protocol.

If the SaO_2 is less than 91% *OR* if the respiratory score is ≥ 3, the flow rate will be increased by 1L/min and the FiO_2 may be adjusted until the SaO_2 is ≥ 91% and the respiratory score is ≤ 2.

If the SaO_2 is 91%, the flow rate and FiO_2 will remain the same as long as the respiratory scores are ≤ 2.

E. The respiratory therapist (RT) and/or nurse will document any changes to oxygen flow rates or FiO_2 in the EMR and the patient's white board.

F. Anytime the oxygen flow rate or FiO_2 has been changed, the RT or nurse will document the SaO_2 and a respiratory score five (5) to ten (10) minutes following the adjustment. Further adjustments should be made as needed to reach target SaO_2 as noted above.

IV. **When to Contact Physician:**

A. When patient requires greater than previous or starting level of flow or FiO_2 to maintain SaO_2 91% or if respiratory score is > 3.

B. Patient is not able to be weaned for 24 hrs.

:vised 08/18/2011

- Bronchiolitis Scoring scale

Time/Date/RT initials	Post-Suction Score (if post-suction score is >3, proceed to treatment)	Post-Treatment Score (Notify HO if post-treatment score is ≥ 6
Respiratory Rate 0) Normal 1) Above Tachypnea Threshold (infant greater than 50 when not crying or agitated)		
Accessory Muscles 0) Normal 1) Moderate Retractions 2) Severe Retractions		
Air Exchange 0) Normal 1) Localized Decreased 2) Multi Area Decreased		
Wheezes 0) None/ End Expiratory 1) Entire Expiratory 2) Entire Expiration and Inhalation		
TOTAL SCORE		

Comments:

Time/Date/RT initials	Post-Suction Score (if post-suction score is >3, proceed to treatment)	Post-Treatment Score (Notify HO if post-treatment score is ≥ 6
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Wheezes 0) None/ End Expiratory 1) Entire Expiratory 2) Entire Expiration and Inhalation		
TOTAL SCORE		

Comments:

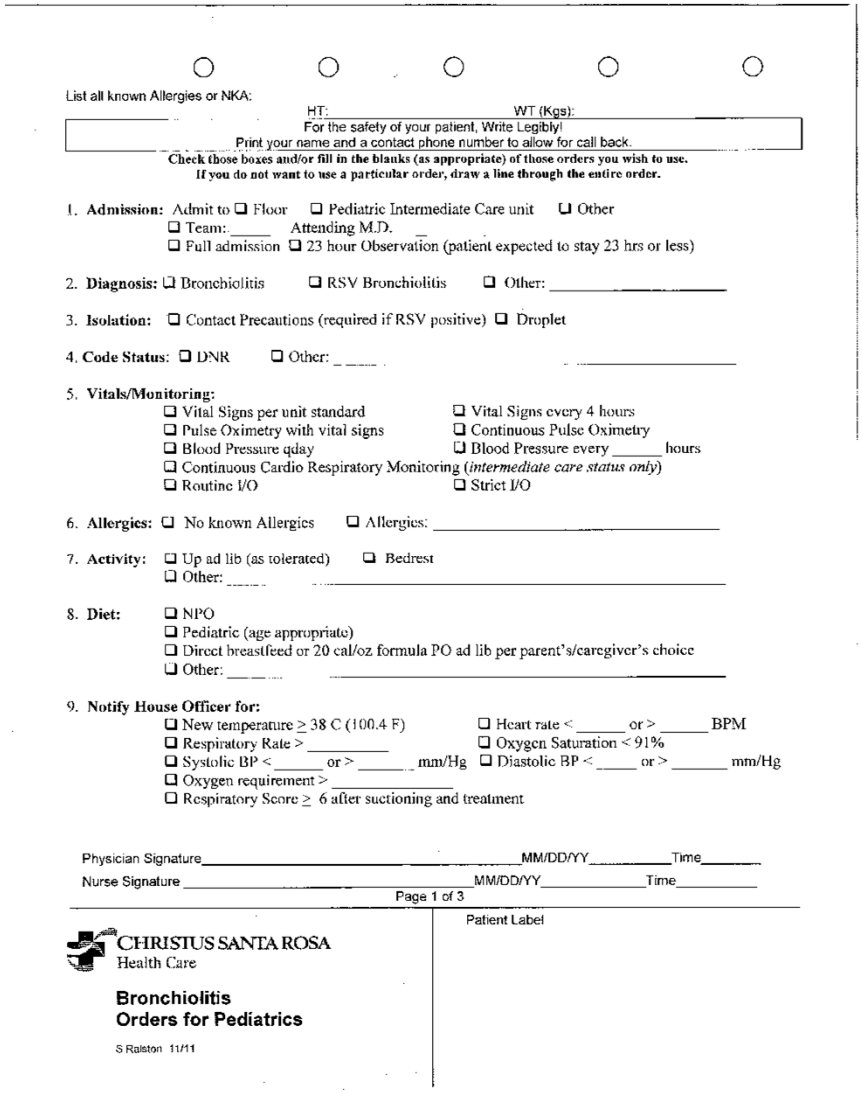
CHRISTUS SANTA ROSA Health Care

Pediatric Bronchiolitis Scoring Sheet

Patient Label

Cont. Changes that were Implemented

- Standardized Bronchiolitis orders for Pediatric Patients



List all known Allergies or NKA:

HT: WT (Kgs):

For the safety of your patient, Write Legibly!
Print your name and a contact phone number to allow for call back.

Check those boxes and/or fill in the blanks (as appropriate) of those orders you wish to use.
If you do not want to use a particular order, draw a line through the entire order.

1. **Admission:** Admit to ❑ Floor ❑ Pediatric Intermediate Care unit ❑ Other
   ❑ Team:_____ Attending M.D. _
   ❑ Full admission ❑ 23 hour Observation (patient expected to stay 23 hrs or less)

2. **Diagnosis:** ❑ Bronchiolitis ❑ RSV Bronchiolitis ❑ Other: _____

3. **Isolation:** ❑ Contact Precautions (required if RSV positive) ❑ Droplet

4. **Code Status:** ❑ DNR ❑ Other: _____

5. **Vitals/Monitoring:**
   ❑ Vital Signs per unit standard ❑ Vital Signs every 4 hours
   ❑ Pulse Oximetry with vital signs ❑ Continuous Pulse Oximetry
   ❑ Blood Pressure qday ❑ Blood Pressure every _____ hours
   ❑ Continuous Cardio Respiratory Monitoring (*intermediate care status only*)
   ❑ Routine I/O ❑ Strict I/O

6. **Allergies:** ❑ No known Allergies ❑ Allergies: _____

7. **Activity:** ❑ Up ad lib (as tolerated) ❑ Bedrest
   ❑ Other: _____

8. **Diet:** ❑ NPO
   ❑ Pediatric (age appropriate)
   ❑ Direct breastfeed or 20 cal/oz formula PO ad lib per parent's/caregiver's choice
   ❑ Other: _____

9. **Notify House Officer for:**
   ❑ New temperature ≥ 38 C (100.4 F) ❑ Heart rate < _____ or > _____ BPM
   ❑ Respiratory Rate > _____ ❑ Oxygen Saturation < 91%
   ❑ Systolic BP < _____ or > _____ mm/Hg ❑ Diastolic BP < _____ or > _____ mm/Hg
   ❑ Oxygen requirement > _____
   ❑ Respiratory Score ≥ 6 after suctioning and treatment

Physician Signature_____MM/DD/YY_____Time_____
Nurse Signature _____MM/DD/YY_____Time_____

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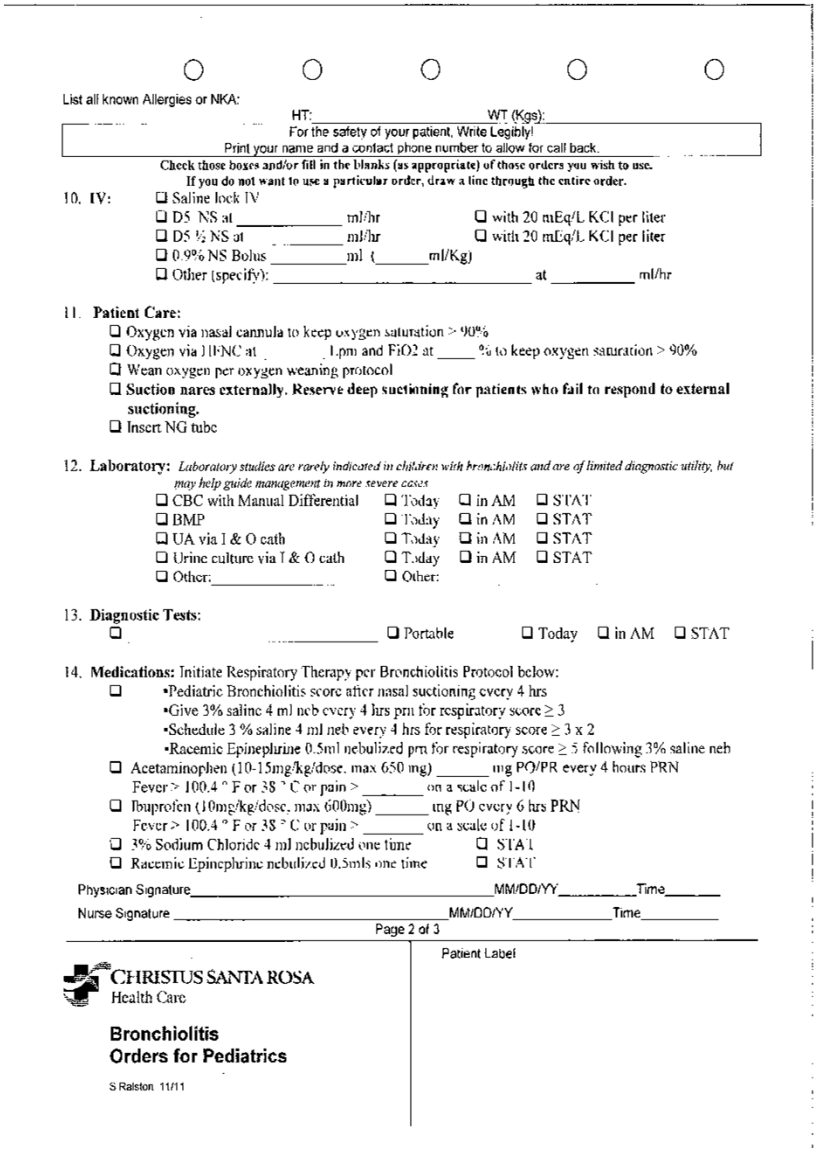
CHRISTUS SANTA ROSA Health Care

Bronchiolitis Orders for Pediatrics

S Ralston 11/11

Patient Label



List all known Allergies or NKA:

HT: WT (Kgs):

For the safety of your patient, Write Legibly!
Print your name and a contact phone number to allow for call back.

Check those boxes and/or fill in the blanks (as appropriate) of those orders you wish to use.
If you do not want to use a particular order, draw a line through the entire order.

10. **IV:** ❑ Saline lock IV
    ❑ D5 NS at _____ ml/hr ❑ with 20 mEq/L KCl per liter
    ❑ D5 ½ NS at _____ ml/hr ❑ with 20 mEq/L KCl per liter
    ❑ 0.9% NS Bolus _____ ml (_____ ml/Kg)
    ❑ Other (specify): _____ at _____ ml/hr

11. **Patient Care:**
    ❑ Oxygen via nasal cannula to keep oxygen saturation > 90%
    ❑ Oxygen via HFNC at _____ Lpm and FiO2 at _____ % to keep oxygen saturation > 90%
    ❑ Wean oxygen per oxygen weaning protocol
    ❑ **Suction nares externally. Reserve deep suctioning for patients who fail to respond to external suctioning.**
    ❑ Insert NG tube

12. **Laboratory:** *Laboratory studies are rarely indicated in children with bronchiolitis and are of limited diagnostic utility, but may help guide management in more severe cases*
    ❑ CBC with Manual Differential ❑ Today ❑ in AM ❑ STAT
    ❑ BMP ❑ Today ❑ in AM ❑ STAT
    ❑ UA via I & O cath ❑ Today ❑ in AM ❑ STAT
    ❑ Urine culture via I & O cath ❑ Today ❑ in AM ❑ STAT
    ❑ Other:_____ ❑ Other:

13. **Diagnostic Tests:**
    ❑ _____ ❑ Portable ❑ Today ❑ in AM ❑ STAT

14. **Medications:** Initiate Respiratory Therapy per Bronchiolitis Protocol below:
    ❑ •Pediatric Bronchiolitis score after nasal suctioning every 4 hrs
    •Give 3% saline 4 ml neb every 4 hrs prn for respiratory score ≥ 3
    •Schedule 3 % saline 4 ml neb every 4 hrs for respiratory score ≥ 3 x 2
    •Racemic Epinephrine 0.5ml nebulized prn for respiratory score ≥ 5 following 3% saline neb
    ❑ Acetaminophen (10-15mg/kg/dose, max 650 mg) _____ mg PO/PR every 4 hours PRN
    Fever > 100.4 ° F or 38 ° C or pain > _____ on a scale of 1-10
    ❑ Ibuprofen (10mg/kg/dose, max 600mg) _____ mg PO every 6 hrs PRN
    Fever > 100.4 ° F or 38 ° C or pain > _____ on a scale of 1-10
    ❑ 3% Sodium Chloride 4 ml nebulized one time ❑ STAT
    ❑ Racemic Epinephrine nebulized 0.5mls one time ❑ STAT

Physician Signature_____MM/DD/YY_____Time_____
Nurse Signature _____MM/DD/YY_____Time_____

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CHRISTUS SANTA ROSA Health Care

Bronchiolitis Orders for Pediatrics

S Ralston 11/11

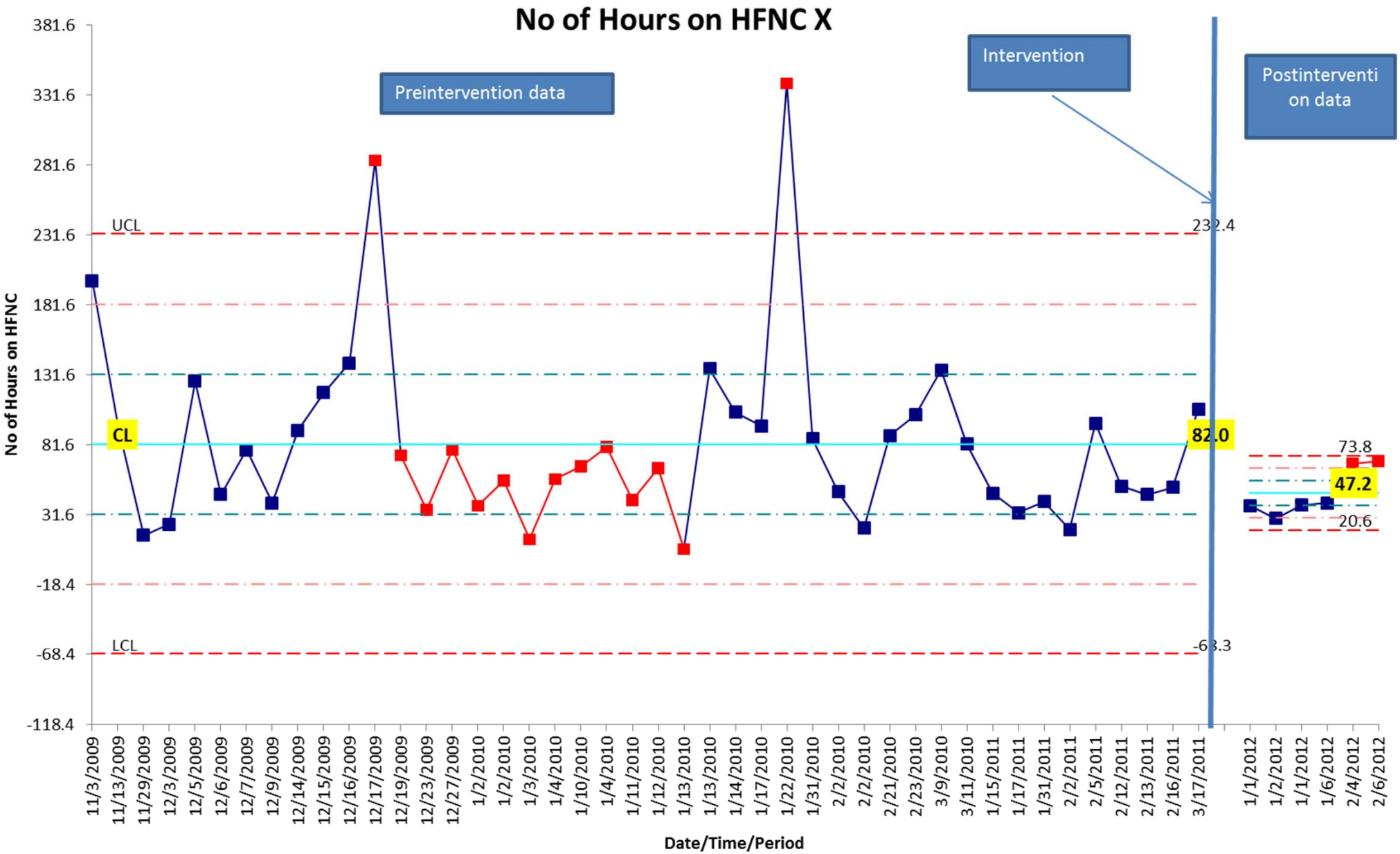
Patient Label

Challenges

- We had a very light and late RSV season
- Having a very high unit census in the PIMC, which required nurses to float into the unit that were unfamiliar with the HFNC weaning protocol
- Communication between RN/RT regarding changes made to the HFNC. (we implemented writing any changes made to the HFNC on the patients white board in their room to assist with communication)
- Having rotating residents/attending physicians making it difficult to ensure that all physicians were familiar with the new protocol

How Will We Know That a Change is an Improvement?

- We reviewed the charts of all patients that were admitted with Bronchiolitis to the PIMC from November 2009 to March 2011. We measured the number of hours the patients were on the HFNC. Also, we made sure that the patients were less than 18 months of age, had no predisposing conditions, and born greater than 36 wks.
- November 1, 2011 to February 15, 2012 all infants with Bronchiolitis on HFNC were evaluated and reviewed for meeting criteria for the HFNC weaning protocol.
- We hope to decrease the amount of hours patients are on the HFNC by 10% (decrease of 8.2hrs)


No of Hours on HFNC X
Intervention
Preintervention data
Postinterventi on data
381.6
331.6
281.6
231.6
181.6
131.6
81.6
31.6
-18.4
-68.4
-118.4
UCL
LCL
CL
232.4
82.0
-68.3
73.8
47.2
20.6
No of Hours on HFNC
11/3/2009
11/13/2009
11/29/2009
12/3/2009
12/5/2009
12/6/2009
12/7/2009
12/9/2009
12/14/2009
12/15/2009
12/16/2009
12/17/2009
12/19/2009
12/23/2009
12/27/2009
1/2/2010
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1/31/2011
2/2/2011
2/5/2011
2/12/2011
2/13/2011
2/16/2011
3/17/2011
1/1/2012
1/2/2012
1/1/2012
1/6/2012
2/4/2012
2/6/2012
Date/Time/Period

Expansion of Our Implementation

- This project just concentrated on only previously well children <18 months of age, we believe that the HFNC weaning protocol can benefit all children requiring HFNC for Bronchiolitis despite their age.
- Also, we can expand the HFNC weaning protocol to patients with Bronchiolitis who have previous predisposing conditions, i.e. cardiac defects, neurovascular defects.
- We can further consider using the HFNC weaning protocol for ALL patients on the HFNC for the treatment of other illnesses.

Return on Investment

- Our pre-intervention data revealed that the average # of hrs patients were on HFNC was 82 hrs
- Our post-intervention data revealed that we decreased by an average of 34.8 hours per a patient.
  - Decreasing time on HFNC ($23/hr) by 37.2 saves $800/pt
  - Decreasing time in hospital by 2 days saves $5,676/pt
- For the six patients in this study we saved $38,856

Conclusion

- In conclusion, we found that by instituting a weaning protocol to assist us in weaning patients off of the HFNC, we were able to reduce the variability and the number of hours required on HFNC. The average number of hours on HFNC decreased from 82 hours to 47.2 hours or 42%, thus exceeding our expectations.
- Thus, we extrapolated that we have also been able to reduce the number of hospital days for these patients, increase the number of available beds in the PIMC unit (which are usually at a premium during RSV season), and ultimately, improve the care we give to these infants.

Future Goals

- Continue to record the number of hrs on HFNC for the remainder of the season and further evaluate any roadblocks there may be in the implementation of the protocol.
- Broaden the indications for the utilization of this protocol, to include children of all ages and with any predisposing conditions.
- Continue to promote CHRISTUS Santa Rosa Children's Hospital's goal of never being closed to new admissions; by decreasing the number of hours/days these infants need to be hospitalized and thus increasing bed availability.

Thank you!

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