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Increasing Utilization of Gestational Age Based Table for Initial Intubation in a Level IV Neonatal Intensive Care Unit

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Quality Improvement Project:
Increasing Utilization of Gestational Age Based Table for Initial Intubation in a Level IV Neonatal Intensive Care Unit

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Background

Optimal endotracheal tube position (ETT) is important to prevent atelectasis, air leak syndromes and unplanned extubations

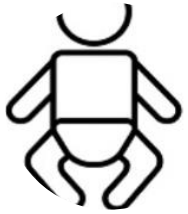
The ideal position of endotracheal tube should be the first thoracic vertebra (T1) and lower border of the second vertebra (T2)

The gold standard method for confirmation of ETT position is by chest radiography

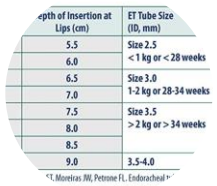
Common methods for estimating the depth of insertion of ETT include:

Weight based method (Tochen):	NTL method – Nasotragus length (Shuka et al)
• 6 + weight (in kg)	

Literature Review



Randomized trials, comparing these methods, have failed to show superiority of any particular method



epth of Insertion at Lips (cm)	ET Tube Size (ID, mm)
5.5	Size 2.5
6.0	< 1 kg or < 28 weeks
6.5	Size 3.0
7.0	1-2 kg or 28-34 weeks
7.5	Size 3.5
8.0	> 2 kg or > 34 weeks
8.5	
9.0	3.5-4.0

T, Moreiras JW, Petrone FL. Endotracheal

Neonatal resuscitation guidelines (8th edition) recommends the utilization of the gestational-based table or the NTL for determining the ETT depth

The weight based method has been highly inaccurate in very low birth weight (VLBW) infants, and commonly overestimates the insertion length and it is not recommended by NRP

Current practice

- There remains variable use on the method used by clinicians to determine the initial ETT depth
- At CMH NICU:
  - An informal survey of neonatologists revealed that the weight (kg) plus 6 method was exclusively used at baseline.

SMART Aim

Reduce right mainstem intubations from 30% to < 20% and ETT placement outside thoracic vertebrae 1- 3 (T1-T3) from 80% to < 40% between February 2021 to September 2022.

Our process measure was the use of the gestational based table.

S
SPECIFIC

- Increase the use of the gestational based table from 0% to > 50%
- Decrease the number of right mainstem intubaions and uneven lung expansion
- Decrease overall number of unplanned extubations
- Decrease % of ETT repositioning after initial intubation

M
MEASURABLE

- Chart review previous data regarding # times ETT required adjustment
- Chart review number of UPEs
- Monitor # of UPEs with new method
- Monitor initial method used for ETT depth (include in note)

A
ACHIEVABLE

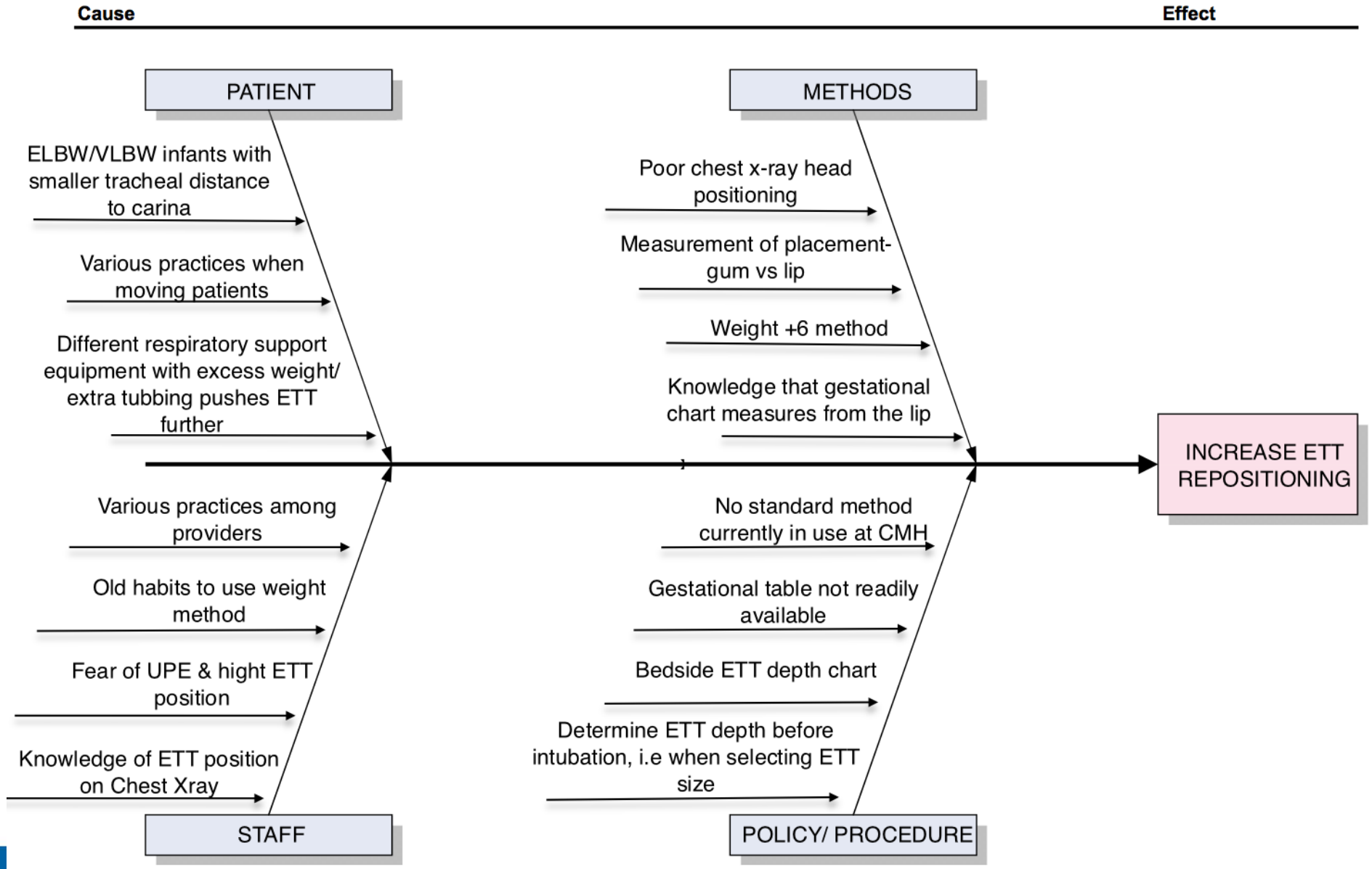
- Determine ET depth at time of determinatining ETT size, prior to intubation
- Increase use of gestational based method by making weight based chart readily available
- Educate ETT positioning on CXR T1-T2, midtracheal

R
REALISTIC

- Utilization of NRP recommended guidelines
- Decrease UPE cost

T
TIME

- Increase use of gestational based table in CMH NICU over the next 6 months and onward
- Decrease % of ETT requiring repositioning in the next 6 months and onward
- Decrease the overall number of unplanned extubations over the next 6 months and onward


Cause
Effect
PATIENT
METHODS
ELBW/VLBW infants with smaller tracheal distance to carina
Various practices when moving patients
Different respiratory support equipment with excess weight/ extra tubbing pushes ETT further
Poor chest x-ray head positioning
Measurement of placement- gum vs lip
Weight +6 method
Knowledge that gestational chart measures from the lip
INCREASE ETT REPOSITIONING
Various practices among providers
Old habits to use weight method
Fear of UPE & hight ETT position
Knowledge of ETT position on Chest Xray
No standard method currently in use at CMH
Gestational table not readily available
Bedside ETT depth chart
Determine ETT depth before intubation, i.e when selecting ETT size
STAFF
POLICY/ PROCEDURE

Methods

- We used LEAN methodology to evaluate outcome and process measures from February 2021 to September 2022, compared to a baseline period from October 2020 to January 2021.

Initial Endotracheal Tube Insertion Depth (tip to lip) for Orotracheal Intubation	
Gestation (weeks)	**Endotracheal Tube Insertion Depth** (cm)at the **LIPS**
23-24	5.5
25-26	6.0
27-29	6.5
30-32	7.0
33-34	7.5
35-37	8.0
38-40	8.5
41-43	9.0

Adapted from Kempley ST, Moreira JW, Pentrone FL. Endotracheal tube length for neonatal intubation. Resuscitation.2008;77(3):369-373

ETT Size (mm)
2.5 <1,000g or <28 weeks
3.0 1,000-2,000g or 28-34 weeks
3.5 > 2,000g or > 34 weeks
3.5-4.0 > 41 weeks

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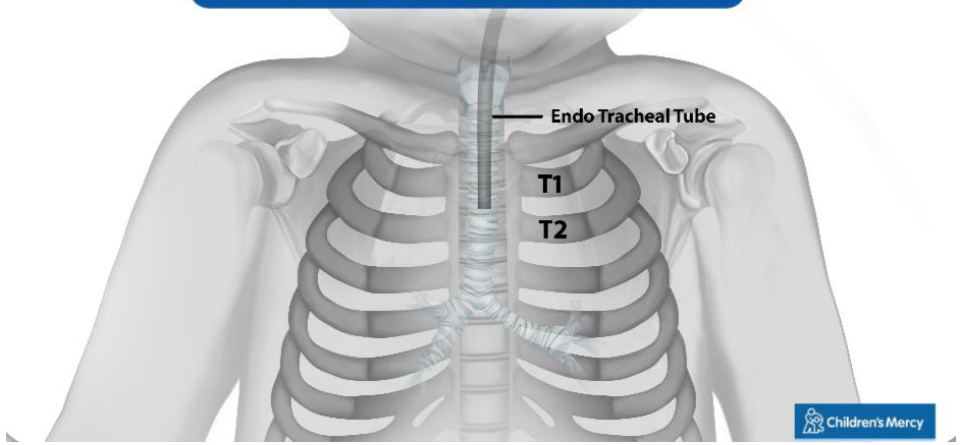
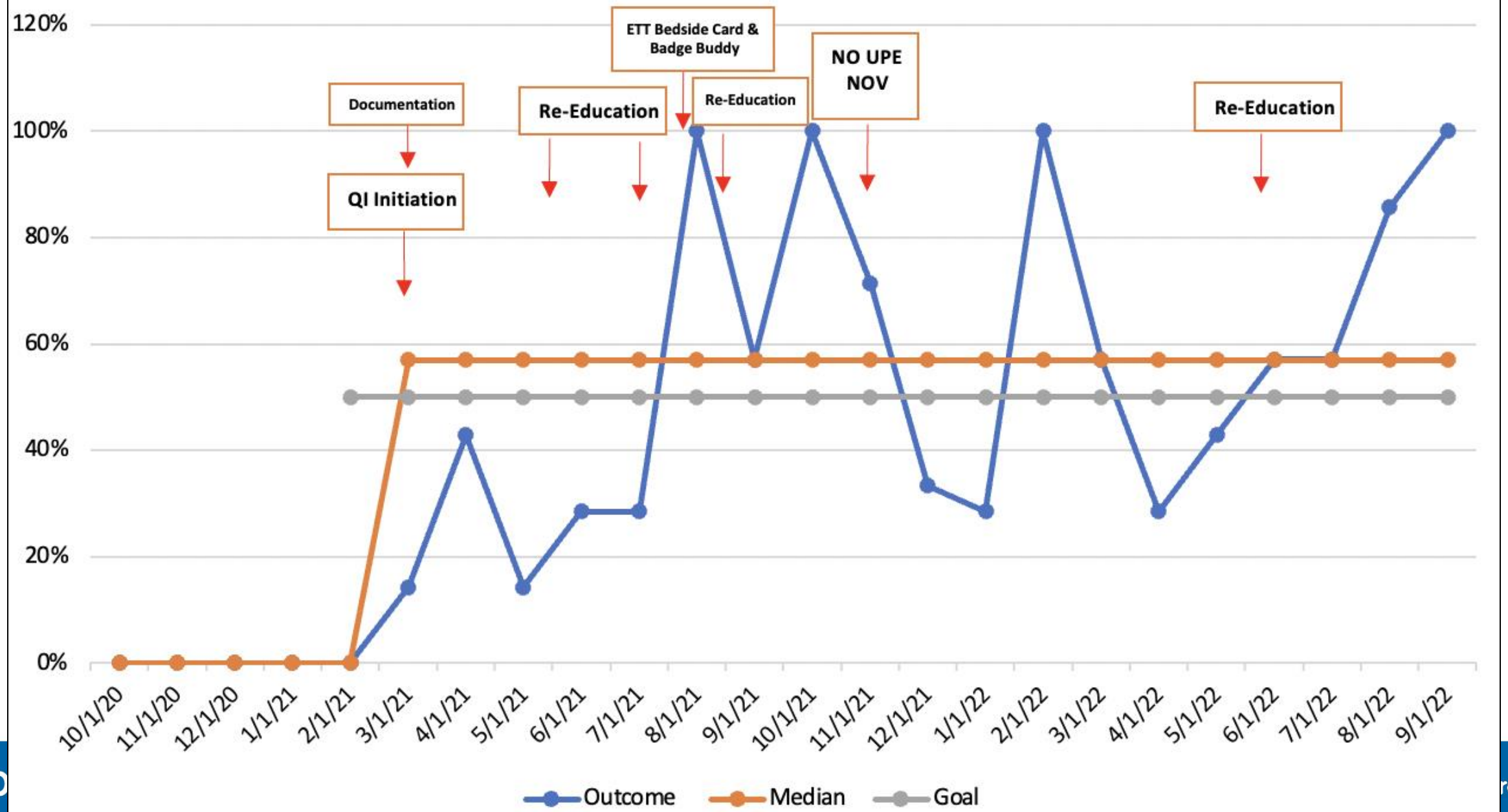
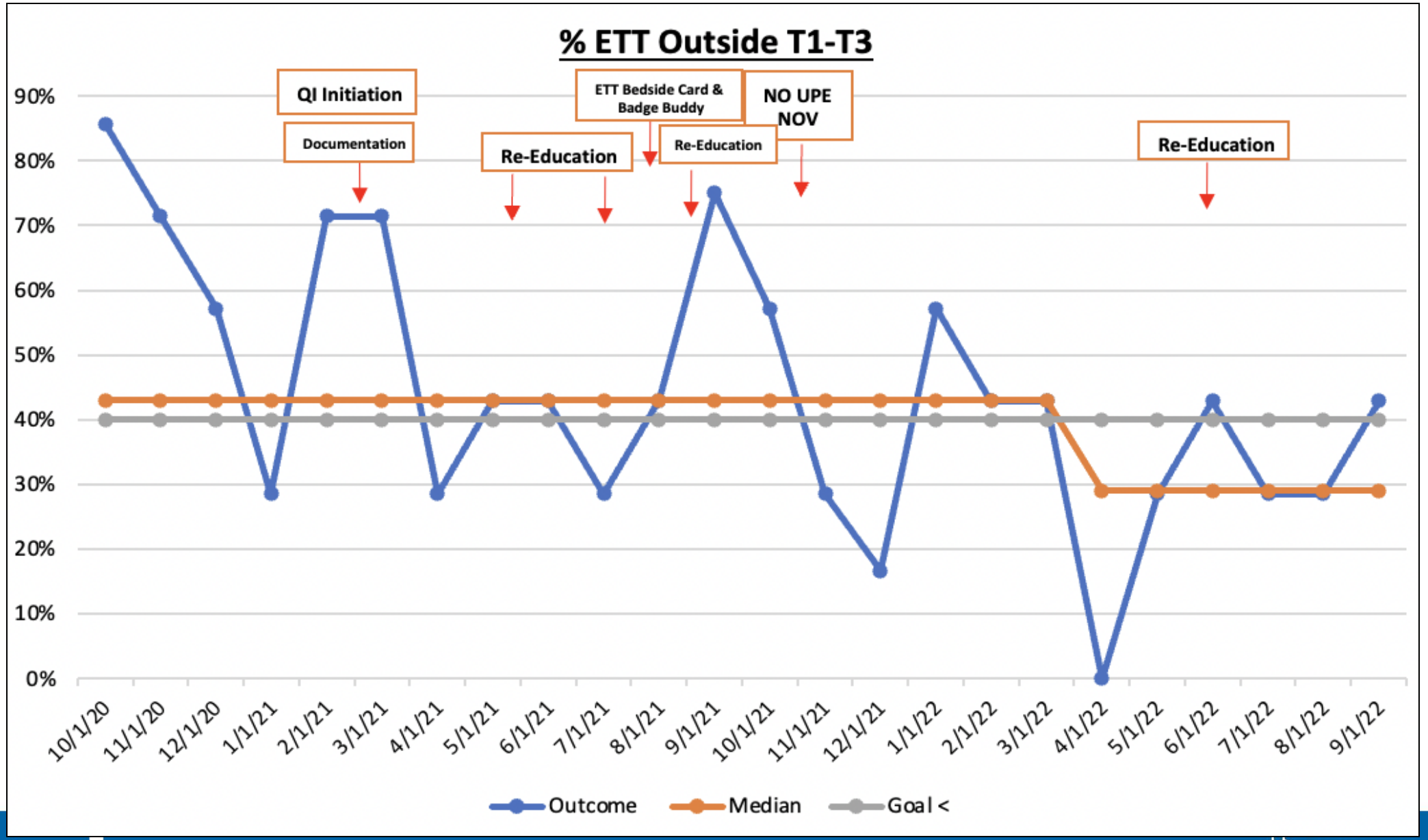
Chest X-Ray Endotracheal Tube Position



Results

Utilization of Gestation Based Table for ETT Intubations 2020-2022




% ETT Outside T1-T3
QI Initiation
Documentation
Re-Education
ETT Bedside Card & Badge Buddy
Re-Education
NO UPE NOV
Re-Education
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10/1/20
11/1/20
12/1/20
1/1/21
2/1/21
3/1/21
4/1/21
5/1/21
6/1/21
7/1/21
8/1/21
9/1/21
10/1/21
11/1/21
12/1/21
1/1/22
2/1/22
3/1/22
4/1/22
5/1/22
6/1/22
7/1/22
8/1/22
9/1/22
Outcome
Median
Goal <

Median % ETT Outside T1-T3

Prior to QI	Since QI
43%	29%

Median % NRP Utilization for ETT Depth

Prior to QI	Since QI
0%	57%

Next Steps

Challenges

- Hesitancy to long standing practice habits
- Difficulty remembering use of gestation table during emergent intubations
- Need for continued reminder education regarding practice change

THANK YOU!

References

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- Takeuchi S, Arai J, Nagafuji M, Hinata A, Kamakura T, Hoshino Y, Yukitake Y (2020) Ideal endotracheal tube insertion depth in neonates with a birthweight less than 750 g. Pediatr Int 62(8): 932–936. https://doi.org/10.1111/ped.14245


LOVE WILL.