

Decreased Length of Stay In Asthmatic Patients Using A Multidisciplinary Bronchodilator Titration Guideline

Ariela Agress, MD; Deena Miller, MD; Shanel Mehta, MD; William Cuddy; Georgia Christakis, MD; Peter Eldridge; Candice Williams, MD; Dana Lorber, RN; Kristina Schull-Valiente, RRT, MHA; Yehudit Pollack, MD; Karen Hardy Brandstaedter, MD; Simon Li, MD, MPH
Department of Pediatrics, Maria Fareri Children's Hospital

BACKGROUND

Pediatric asthma is a common cause of hospitalization and high resource utilization. Asthma scores have been used in many hospitals to assess patients admitted with asthma for readiness to wean. However, most scores have only been designed for utilization by one or two provider types.

Our goal for this project was to improve the quality of care provided to patients admitted to Maria Fareri Children's Hospital with status asthmaticus with use of a multidisciplinary asthma score and bronchodilator weaning guideline.

In the initial phase of the project, we developed an asthma score with high content validity for use amongst respiratory therapists, nurses and physicians. It was tested and modified accordingly to have strong inter-rater reliability amongst the three provider types. Improvement in reliability was achieved via repeat education on scoring methodology, scale purification and phased run in.

During development of the titration guideline, decision on score cutoffs was made by using complete agreement of all bedside providers to wean a patient as the gold standard.

OBJECTIVES

- Our objectives for the bronchodilator weaning guideline were as follows:
- Reduced time from admission to dischargeable albuterol dose
 - Reduced overall time from admission to discharge

Balancing outcomes were also tracked to ensure that use of the guideline did not increase rates of any of the following:

- Rapid response
- Escalation of care
- Re-admission or return to ED

METHODS

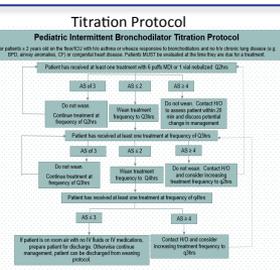
Any patient ≥ 2 years old admitted to any pediatric service (PICU or general floors) receiving bronchodilators more frequently than every 4 hours was eligible for this analysis. Scores were completed by a nurse, RT or physician prior to bronchodilator treatment or every 2 hours if on continuous albuterol.

Scores were used to guide providers on whether to titrate treatment frequency. Adherence to scoring (i.e. actual times a patient was scored divided by number of times the patient was eligible for scoring) in enrolled patients was tracked.

During the study we attempted to improve compliance by creating an order set in our EMR. We initiated daily "aggressive" screening and reminders to specific inpatient teams.

The two-sided Wilcoxon rank sum test was used to compare outcomes between groups. In a multivariate model, after assessing for collinearity, we looked at factors contributing to differences in time to dischargeable albuterol dose and time to discharge.

Sample Asthma Scoring Sheet			
Date & Time	0	1	2
Respiratory Rate (2-5 years old)	≤ 30	31-50	>50
Respiratory Rate (≥ 6 years old)	≤ 20	20-40	>40
Wheezing	None	Expiratory	Expiratory & Inspiratory
Saturation on RA	$>95\%$	90-95%	$<90\%$
Air Entry	Normal	Decreased	
Accessory Muscle	None	Present	
Total Score		(out of 8)	
Action Taken	Weaned	Not weaned	Other
If action is other please explain			

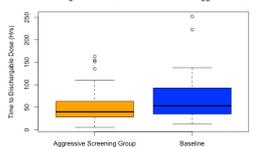


Results

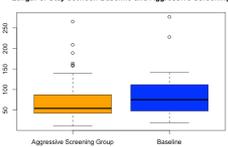
Comparison of Patients: Pre-introduction and post-aggressive screening

	Time to dischargeable dose (Median hrs, IQR)	p value	Length of stay (Median hrs, IQR)	p value
Baseline (n=38)	53.1 (35.7- 90.3)	0.02	75.4 (48-110.6)	0.09
Post aggressive screen (n=95)	39.7 (28-63.1)		54.2 (42.2-87.4)	

Time to Dischargeable Dose between Baseline and Aggressive Screen



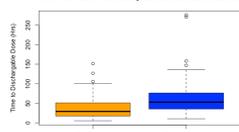
Length of Stay between Baseline and Aggressive Screening



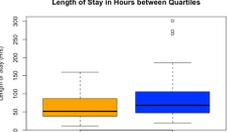
Comparison of Patients: Most and Least Adherent

Most Adherent 25th percentile (n=78)	28.98 (17.5-50)	<0.001	51.6 (37.9-86.4)	0.005
Least Adherent 25th percentile (n=79)	52.8 (35.6-76)		67.9 (47.3-105.8)	

Time from Admit to Dischargeable Dose between Quartiles



Length of Stay in Hours between Quartiles



RESULTS

Baseline data was collected from March to July 2016 (n=38). Implementation of the scoring system and guideline started May 2017 to April 2019 (n=168), after which time an electronic order set for the weaning protocol was implemented into our electronic health system. We continued to monitor data with the electronic order from April 2019 until August 2019 (n=53), at which time we additionally implemented daily reminders to the resident team to score patients (n=181).

The overall median time to dischargeable albuterol dose by age group was 41.6 hours in patients < 6 years old, 47.5 hours in ages 6-12 years old, and 53.1 hours in ages > 12 years old. PICU admissions (n=165) vs. floor admissions (n=129) had median time to dischargeable dose of 55.3 hours vs. 36 hours (p<0.001).

In the bivariate analysis of 316 scored patients, the median scoring adherence in the most and least adherent quartiles was 87% and 14% respectively. With high adherence (n=78), we observed a median reduction of 24 hours in the time to dischargeable albuterol dose (p<0.001). Similarly, median length of stay was significantly reduced by 16 hours (p<0.005).

The multivariate analysis factoring age, initiation of resident reminders, and highest patient score during the first 24 hours of admission showed that for every 10% increase in compliance there was a 4.5 hour reduction in time to dischargeable albuterol dosing (p<0.001) and a 4 hour reduction in length of stay (p<0.001).

Balancing factors such as rapid responses and readmissions within 7 days did not increase during use of the guideline.

DISCUSSION / CONCLUSIONS

Insights:

- High score compliance and guideline adherence is associated with increased efficiency in treatment of patients admitted with status asthmaticus, especially after factoring severity of illness.
- Deliberate development of this guideline has led to safe implementation.
- Use of our strategy is associated with a significant reduction in time to dischargeable albuterol dose and length of hospitalization.

Limitations:

- The possibility of a Hawthorne Effect is real.
- Additionally, there has been some non-adherence (i.e. variability in timing of scores, lack of weaning when scoring warrants, missing documentation) which can bias our result in either direction.

REFERENCES

- Smith SR, Baty JD, Hodge D. Validation of the pulmonary score: an asthma severity score for children. Acad Emerg Med. 2002;9(2):99-104.
- Dexheimer JW, Borycki EM, Chiu KW, Johnson KB, Aronsky D. A systematic review of the implementation and impact of asthma protocols. BMC Med Inform Decis Mak. 2014;14:82.
- Biondi EA, Gottfried JA, Dutko Rotavanti L, Schriefer JA, Alligne CA, Leonard MS. Interobserver reliability of attending physicians and bedside nurses when using an inpatient paediatric respiratory score. J Clin Nurs. 2015;24(9-10):1320-6.
- Fassi BA, Nkoy FL, Stone BL, Srivastava R, Simon TD, Uchida DA, Koopmeiners K, Greene T, Cook LJ, Maloney CG. The Joint Commission Children's Asthma Care Quality Measures and Asthma Readmissions. Pediatrics. 2012; 130(3): 482-491.
- Louis C, Christakis G, Fonseca F, Alonge G, Eldridge P, Shi Q, Welker J, Li S. An asthma score with high interobserver agreement for use in a multidisciplinary treatment guideline. Research Snapshot - Society of Critical Care Medicine Annual Congress, January 2017.