Evaluation of Factors Affecting Length of Stay in Pediatric Asthma

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Background and Objectives: Weaning albuterol based on patient's asthma scores using Cardinal Glennon Children's Hospital's (CGCH) Inpatient Asthma Care Pathway is an effective way to reduce overall length of stay. Despite following the asthma care pathway, some patients have a length of stay longer than 48 hours. This leads to a reduced quality of life and potentially increased hospital expenses, so it is important to elucidate which factors may be contributing to these patient's length of stay so that they may be adequately prevented or more efficiently addressed. According to the National Heart, Lung, and Blood Institute (NHLBI) 2007 Guidelines, albuterol and other short-acting bronchodilators (SABAs) are the therapy of choice for the relief of acute asthma symptoms and prevention of exercise-induced bronchoconstriction (EIB), with evidence level A. The CGCH Asthma Care Pathway uses albuterol to effectively reduce the length of stay in patients with a documented history of asthma experiencing acute asthma exacerbations. In spite of this, some patients on the existing protocol still experience a length of stay greater than or equal to 48 hours. This proposal aims to enhance knowledge of factors that may contribute to extended lengths of stay so that they may be more adequately prevented or more efficiently addressed.

Methods: This study is a retrospective chart review of patients with a length of stay greater than 48 hours that received albuterol with weaning per Cardinal Glennon's current asthma care pathway. Data was collected through review of electronic medical records (EMR) since the implementation of the current asthma care pathway in August of 2012 to present. Eligible patient charts for review were identified by the principal investigator Dr. Lisa Lubsch using the aforementioned pathway, provided that they fulfilled the inclusion criteria/exclusion criteria. Data collection occured in an Excel spreadsheet and was monitored by the investigator, Eric Gray. Dr. Lisa Lubsch functioned as a supervisor and had access to the data. In addition, no patient identifiers were included on the spreadsheet to maintain confidentiality. All data was collected and stored on a secure, password-protected network.   Only these two primary investigators had access to the data, and it was destroyed/shredded upon completion of the analysis. The purpose of this study was to evaluate co-occurring conditions and factors present in patients with a length of stay longer than 48 hours despite albuterol weaning per the Cardinal Glennon asthma care protocol. The primary objective was to determine if there is a correlation between any patient-specific factors (i.e. concurrent infection) and an increased length of stay. Data collected assessed patient demographics including age, gender, hospital length of stay, use of mechanical ventilation at home, obesity status, asthma step therapy on admission, and the number of hospitalizations for asthma within the past 30 days and within the past year. Furthermore, the details of stay were assessed to include comorbidities concurrent with asthma exacerbation.

Results: Of 148 patients isolated via the inclusion criteria, 54 patients were excluded based on the exclusion criteria. 60 of the remaining 94 patients (63.8%) were fully assessed (n = 60). The range for length of stay in these patients was 48 hours and 17 minutes to 183 hours and 25 minutes, with a mean of 63 hours and 33 minutes. 23 (38.3%) of patients were classified as normal weight, 2 (3.3%) were underweight, 13 (21.7%) overweight, 9 (15%) obese, and 13 (21.7%) with unknown weight status. In regards to asthma step therapy at admission, 0 (0%), 8 (13.3%), 14 (23.3%), 3 (5%), and 6 (10%) patients were on steps 1-5, respectively. The age range for this data set was 2-18.8 years old, with a mean of 8.7

years old. The gender distribution was fairly equal, with 28 (46.7%) male and 32 (53.3%) female patients. 6 patients had been hospitalized for 1 separate asthma exacerbation within the 30 days prior to the assessed admission, and 2 had been hospitalized for 3 asthma exacerbations within that time frame. For total hospitalizations for asthma within the past year, 8 patients had 1 exacerbation, 1 patient had 3 exacerbations, 1 patient had 6 exacerbations, and 1 patient had 7 exacerbations. 1 patient was found to be on CPAP at home, which is relevant to their differential diagnosis of obstructive sleep apnea. 32/60 patients (53.3%) were first admitted to the PICU before being trasnferred to the ED. In regards to progression of the albuterol asthma pathway, at 24 hours (from admission to the ED), 1 patient (1.6%) was still on continuous albuterol, 14 patients (23.3%) were on albuterol every 2 hours, 13 patients (21.7%) were on albuterol every 3 hours, and 32 patients (53.3%) were on albuterol every 4 hours. At 48 hours, 1 patient (1.6%) was on albuterol every 2 hours, 7 patients (11.7%) were on albuterol every 3 hours, 27 patients (45.0%) were on albuterol every 4 hours, and 25 patients (41.7%) were no longer on albuterol. Per the medication administration records (MARs) for each patient, 41 patients (68.3%) were on the albuterol asthma pathway dosing at 48 hours from their admission. The mean amount of time on the pathway was 38 hours and 14 minutes, with a range of 17 minutes to 105 hours and 29 minutes. 15 patients (25%) were reported to be on the pathway for less than 24 hours. In accordance with the asthma pathway, 57 out of 60 patients (95%) were correctly placed on a 2 mg/kg (or 60 mg) dose of oral corticosteroid (OCS), while the other 3 patients were put on the wrong dose of OCS. 8 patients (13.3%) received OCS within 30 minutes of arrival. Clinical asthma scores (CAS) at 48 hours (+/- 4 hours) from admission to the ED were 0 for 14 patients (23.3%), 1 for 6 patients (10%), 2 for 2 patients (3.3%), 3 for 1 patient (1.7%), and were not assessed within the allotted time frame for 37 patients (61.7%). The results that follow were used to assess the differential diagnoses for these patients. X-ray results indicated evidence of hyperinflation in 10 patients (16.7%), atelectasis in 19 patients (31.7%), infiltrates in 6 patients (10%), and pleural effusion in 1 patient (1.7%). Results were normal in 18 patients (30%), and x-rays were not taken in 10 patients (16.7%). 4 patients (6.7%) had a fever at some point during their stay. 2 patients (3.3%) of patients received oseltamivir during their stay, 1 patient received metronidazole (1.6%), 3 patients (5%) received ceftriaxone, 3 patients (3.3%) received azithromycin, 1 of which (1.6%) also received sulfamethoxazole-trimethoprim, 1 patient (1.6%) received ampicillin, and 4 patients (6.7%) received amoxicillin. 46 patients (76.7%) received no antibiotic. In regards to allergy testing, 33 patients (55%) were found to have elevated IgE levels (> 30 units/mL). Notably, 1 patient (1.6%) was on dornase alfa (Pulmozyme), indicating the presence of COPD. Taking the above information into account as well as written notes on patient profiles, the following information on differential diagnoses was gathered: 8 patients (13.3%) had community acquired pneumonia, 1 patient (1.6%) had complicated pneumonia, 26 patients (43.3%) had a viral upper respiratory infection (URI), 4 patients (6.7%) had acute otitis media, 7 patients (11.7%) had sinusitis, 10 patients (16.7%) had obstructive sleep apnea, 13 patients (21.7%) were overweight, 9 patients (15%) were obese, 44 patients (73.3%) had possible influence from allergies, and 1 patient had COPD (1.6%).

Conclusions: The presence of allergies, viral URIs, obstructive sleep apnea, pneumonias, sinusitis, acute otitis media, and COPD may all impact the overall length of stay in patients admitted for asthma exacerbations, with the data being strongest for allergies and infectious processes. Weight status may also play a role in these patients. Additionally, failure to provide an OCS in a timely manner may affect length of stay. Exacerbations associated with allergies may be prevented with adequate outpatient allergy treatment. Apart from this, adequate testing and treatment for infections (viral URIs, pneumonias, acute otitis media), including in patients that are afebrile, may be key in reducing the length of stay in patients experiencing asthma exacerbations. All patients should also be assessed for sinusitis. COPD requires optimal adherence at home to keep under control, so this should be stressed with all relevant patients. Overweight and obese patients could be encouraged and counseled at each

visit about ways to improve their weight status that are tailored to their individual needs. Strengths of this study include thorough assessment of patient specific factors using all available information in patient charts reported in EPIC. There was also a fairly wide patient population to assess due to using information from August 2012 to present. The sample size was also reasonable with 60 patients being fully assessed. Limitations of this study include the retrospective chart review design, due to the inability to adjust for misreporting of data in patient notes and MAR administrations. As a result of this type of data collection, it was difficult to address certain factors that could potentially skew data such as adherence reporting, as well as possible inaccuracies in reported asthma pathway durations and discharge diagnoses. Beyond this, the data does not explicitly analyze the impact on length of stay for patients with multiple differential diagnoses. Finally, while the sample size assessed was reasonable, there were additional patients that could have been included that were not due to time limitations. This study indicates a number of preventable or otherwise treatable factors that may lead to a length of stay greater than 48 hours in patients with asthma exacerbations. Some of these may inherently be associated with a longer length of stay, but recognizing and appropriately dealing with these factors may improve patient quality of life and medical costs. Future studies may be warranted to increase the sample size and thus better address the impact of comorbidities found to be less prevalent in this study.