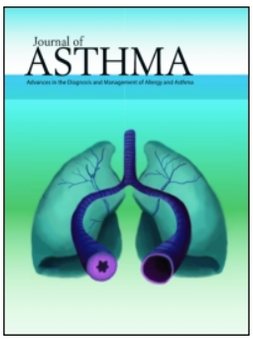

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Asthma treatment and outcomes for children in the emergency department and hospital

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Abstract

Objective: To describe and compare the treatment of acute asthma exacerbations in children seen in the emergency department (ED) and admitted to acute care floor in the hospital or intensive care unit (ICU).

Methods: Retrospective chart review of visits for acute exacerbation of asthma treated at Phoenix Children's Hospital between January 1, 2014 and December 31, 2016.

Results: A total of 287 asthma exacerbation cases were identified including 106 (37%) ED visits, 134 (47%) hospital floor and 47 (16%) ICU admissions. History of a previous ED visit (ED 88%, Floor 60% and ICU 68%; $p<0.0001$) and prior pulmonology inpatient consult (ED 30%, Floor 19% and ICU 15%; $p = 0.05$) varied significantly. Pulmonology inpatient consults were performed more frequently in the ICU than on hospital floor (54% vs 8%; $p<0.0001$). Although overall 145 (51%) of cases were already on inhaled corticosteroids (ICS) at time of visit with no differences across locations, ICS initiation/step-up was greater in the ICU (72%) than hospital floor (54%) and ED (2%) ($p<0.0001$). A recommendation given to the family for follow-up with pulmonology was more frequent for patients who had been admitted to the ICU (68%) as compared to those only admitted to the floor (31%) or ED (4%) ($p<0.0001$). Readmission rates

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were similar for patients previously admitted to hospital (Floor 42%, ICU 40%), but significantly higher for previous ED visits (77%) ($p<0.0001$).

Conclusions: Physicians in the ED have an opportunity to provide preventative care in the acute care setting and should be encouraged to initiate treatment with ICS. Consideration should be given to developing a program or clinical pathway focused on long-term asthma management and maintenance to reduce readmissions and long hospital stays.

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Introduction:

Asthma is a leading chronic illness of childhood, with significant morbidity and substantial impact on health resources utilization[1,2]. Presently, asthma is the third leading cause of hospitalization among children in the United States[3]. In 2011, there were 1.8 million emergency department (ED) visits for children and adults with asthma as the primary diagnosis[4]. The cost to society including medical expenses, loss of productivity resulting from missed school or work days, and/or premature death in 2007 was estimated at $56 billion dollars[5].

The prevalence of asthma continues to increase despite a variety of investigations, proposed interventions and well-established clinical guidelines for acute care management and maintenance therapy. It is believed with maintenance therapies and aggressive early intervention, severe exacerbations of asthma can be ameliorated lessening the impact on resource utilization and lost productivity. Inhaled corticosteroids (ICS) are the mainstay of treatment for control of asthma in the acute setting and or maintenance therapy following exacerbation.[8] The long-term benefits of ICS are well established[9,10,11] and there is evidence supporting the safety of these medications.[12] The National Asthma Education and Prevention Program (NAEPP) guidelines (published by the National Heart Lung and Blood Institute) advocates for the use of ICS, however, most children with persistent asthma do not use ICS on a daily basis[13]. Quality improvement measures have been developed and include use of the asthma action plan, self-assessment tools such as the asthma control test (ACT), and the asthma medication ratio[6,7]. However, these aids are believed to not being used routinely in primary care or the ED setting and may be a contributor to the lack of progress in this disease. As a result, despite aggressive

attempts to disperse recommended guidelines and quality improvement metrics, asthma treatment remains variable with limited impact on overall clinical outcomes.

To begin to address this problem, it is important to identify the role of the quaternary/ tertiary center to advocate for these guidelines and quality improvement measures. The objective of this study was to describe and compare the management of pediatric acute asthma exacerbations treated in the ED or as inpatient on the hospital floor and intensive care unit (ICU) in a busy. Specifically, we wanted to examine the differences in ICS prescription, subspecialty referral to pulmonology, and readmission rates for acute exacerbation of asthma treated by ED, hospital floor and ICU physicians.

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Methods

A retrospective chart review was conducted for patients with acute exacerbation of asthma (ICD10: J45.901), ages 5-18 presenting to the ED (and discharged following evaluation and treatment) or requiring admission to the hospital floor or ICU at Phoenix Children's Hospital between January 1, 2014 and December 31, 2016. Subjects with comorbid conditions, including developmental delay, bronchopulmonary dysplasia due to prematurity, cystic fibrosis, sickle cell disease, and/or interstitial lung disease, were excluded.

Providers in the ED consisted of board certified pediatric ED specialists or nurse practitioners. Providers on the inpatient unit consisted of board certified pediatricians and board certified pediatric intensivists. Approval for this study was granted by Institutional Review Board of Phoenix Children's Hospital.

Data collection included date of birth, gender, insurance type, ethnicity, previous ED visit for asthma (if visits occurred prior to the collection period of 2014, they were also included), prior

pulmonology consult, on ICS at presentation, ICS initiation by physician, recommended pulmonology follow-up, readmission, and performance of spirometry.

Statistical Analyses

Demographic and clinical factors were summarized for ED visits and admissions to the hospital floor and ICU, using counts and percent for categorical variables, and the mean and standard deviation or median and interquartile range for continuous measures. Treatment, follow-up recommendations and outcomes were similarly estimated. Comparisons between treatment locations were made using the Fisher exact test, or the Kruskal-Wallis test, as appropriate for the data distribution. The unit of analyses was the patient visit without any patient-specific correlation adjustment, as each visit represents an independent treatment occasion with likely variation in treating physician and inter-visit variation in clinical course. Statistical analyses were performed using SAS software (Version 9.4 Copyright© 2002-2012 SAS Institute Inc. Cary, NC, USA), and all statistical tests were 2-sided with significance evaluated at the 5% level (p-value of <0.05 was considered statistically significant).

Results

Among a total of 809 cases of acute exacerbation of asthma seen in the ED or hospital, chart reviews were completed for the first 427 patient visits (based on date of visit), due to time constraints.. After excluding 140 unique patients due to age <5, or comorbid condition (cystic fibrosis, chronic respiratory failure, sickle cell disease), study subjects comprised of 126 unique patients and 287 corresponding patient visits. There were 68 (54%), 24 (19%), 13 (10%) and 21 (17%) patients with 1, 2, 3 and >4 visits, respectively). Patient visits included 106 (37%) to ED, 134 (47%) to hospital floor and 47 (16%) to the ICU. All cases admitted to the hospital (floor

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and ICU) were seen in the ED but not counted as an ED visit. All ED visits resulted in the patient being discharged directly from the ED to home.

Among the total 287 patient visits, the average age of the patients was 8.4 (SD = 2.8) years, and the age distribution was similar for visits to the ED, hospital floor or ICU locations (Table 1). A larger percentage of males were admitted to the ICU (76%) compared to hospital floor (58%) (Fisher p-value = 0.03). Overall, in our population, 187 (65% of 287) patient visits were Hispanic with a significantly higher percentage of Hispanics seen and discharged from the ED (72%) than admitted to hospital floor (64%) or ICU (53%) (Table 1). In contrast, African Americans were more likely to be admitted to the ICU (34%) compared to ED (21%) or hospital floor (16%).

Patients presenting to the ED were significantly more likely to have had a previous ED visit (88%) than those admitted to the hospital floor (60%) or ICU (68%) (Table 2). ED cases were also more likely to have had a previous pulmonology consult (30%) compared to those admitted to the hospital floor (19%) or ICU (15%) with borderline significance (Table 2). ICS had been prescribed in 51% of all patients' visits for asthma exacerbations with no differences in the percentage of prior ICS detected by care area (Table 2).

Inpatient pulmonology consults, ICS initiation/step-up and recommended follow-up with pulmonology were significantly more frequent in the ICU compared to the hospital floor or ED (Table 2). Inpatient pulmonology consults were performed for 54% of ICU cases, but only for 8% of those admitted to the floor, and for none of the ED visits. Physicians in the ICU initiated or stepped-up ICS for 72% of patients, but treatment was significantly lower for those admitted to the floor (54%) or seen in the ED (2%). Similarly, pulmonology follow-up was recommended

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for a significantly higher percentage of patients in the ICU (68%) compared to hospital floor (31%) or ED (4%).

Among all 77 recommendations to follow-up with pulmonology only 28 (36%) attended a pulmonology follow-up. For the 36 inpatient pulmonology consults, the majority 34 (92%) were recommended to follow-up in pulmonology clinic but only 8 (24% of 34) attended their scheduled appointments. A larger percentage of ED (75%) patients attended follow-up pulmonology consult compared to floor (39%) and ICU (28%) patients though these differences were not statistically significant (Table 2).

The percentage of subsequent re-admissions (to ED or as inpatient) was significantly higher for those discharged from the ED to home (77%) as compared to patients that had been admitted and treated on the hospital floor (42%) or ICU (40%). No differences in re-admission rates were detected between those with and without a pulmonology inpatient consult ($p = 0.6$), or those who did and did not follow-up with a pulmonology visit ($p = 1.0$).

Spirometry was performed (either before or after presenting for the asthma exacerbation) for 100 (35% of 287) patient visits with no significant differences across location visits (Table 2).

Discussion

This study demonstrated significant variations and gaps in the management of acute asthma within the acute care setting in the ED as well as inpatient care in the ICU and floor. Consistent with previous studies, we found that ED physicians rarely initiated ICS therapy[14] and follow-up in outpatient clinics was poor[15,16], though it remains unclear as to the reasons for poor follow-up in this setting. Furthermore, rates of requests for a subspecialist pulmonology consult, referrals to outpatient pulmonology upon discharge, and orders of spirometry were low, despite standard

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recommendations for the diagnosis and treatment of acute exacerbations of asthma. Similarly, it is unclear why those who were seen by a pediatric pulmonologist in clinic or for consultation while in the hospital had a similar rate of readmission within a one year period as compared to those who were not seen by a pulmonologist.

ED Utilization

It is well reported that ED utilization by patients with acute exacerbation of asthma and other chronic medical conditions is often a consequence of poor access to primary preventative care [17, 18, 19]. In 2012, the National Health Interview Survey found that almost 80 percent of adults who visited EDs over a 12-month period said they did so because of a lack of access to other healthcare providers[20]. A Harris Interactive survey reported that ED physicians felt that waiting times for appointments with primary care providers (PCPs) and limited access to physicians on weekends were the leading reasons for non-urgent ED use[21]. Although assessing severity and acuity of onset of the asthma exacerbation in the ED was not part of our data collection, it remains to be studied whether some ED visits for acute exacerbation could have been prevented by improved access to a PCP.

Role of PCP after discharge

Although recent initiatives to improve attendance at follow-up appointments with the child's PCP after asthma exacerbation have reduced ED utilization and readmission[22], pediatric asthma patients continue to underutilize preventative care in the ambulatory setting through their PCP, and some in fact, never use it. The Global Initiative for Asthma (GINA) 2008 guidelines recommends initiation or continuation of controller medications for all patients before discharge from the acute care setting[23]. To ensure adherence to ICS therapy, patient education including

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providing strong evidence of its efficacy is vital. Teaching ICS inhaler technique, environmental control and giving a written action plan are essential and should be reiterated at time of discharge from the inpatient setting and should be reiterated/ reinforced at each PCP visit as well as any acute exacerbations.

Responsibility for outpatient asthma care is currently dispersed amongst pediatricians, family practitioners, pediatric pulmonologists, and allergists. Amongst this spectrum, there is a discrepancy in knowledge base, treatment plans, and referral patterns. In a survey completed by 202 inner-city PCPs, Wisnivesky and colleagues found that adherence to the NAEPP guidelines was 62% for ICS use, 9% for asthma action plan use, and 10% for allergy testing. The most common adherence barrier for health care providers was a lack of outcome expectancy and poor provider self-efficacy[24]. There has also been a widely reported concern by general pediatricians about side effects of ICS[25]. For these reasons, many PCPs often feel more comfortable referring children to an allergist or pediatric pulmonologist for the diagnosis and management of asthma. When the patient presents to the ED who has not been utilizing preventative care or ICS, physicians in the ED have an important role to reiterate asthma education utilizing the well established guidelines. In the interest of an ED physician's time, respiratory therapists or asthma educators could be utilized in the ED to educate families about asthma control. It is important to study and show the efficacy of this intensive and repeated education on reducing acute exacerbations and ultimately PCP and ED burden. Nevertheless, to achieve optimal care, it is important to advocate for timely follow-up in the ambulatory setting with the PCP, as well as provide ongoing preventative care and education. Similarly, a clinical pathway could be

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developed for the appropriate referral to a subspecialist pulmonology for further complex care reducing the impact on a stretched resource.

Pulmonology Referral

The impact of subspecialty care in reducing the rate of asthma readmission is sparsely reported in the literature. Schatz[26] reported a reduction in ED visits for asthma with Allergy specialist care, although statistical significance was borderline. Bucknall et. al demonstrated significant decline in readmission rate between patients seen by a physician with special interest in respiratory medicine versus without this interest[27]. Kelly et al demonstrated a significant benefit when patients were seen at an allergy clinic versus general pediatric clinic in terms of hospitalizations and ED visits[28]. In our study, there was no significant difference in the readmission rate after seeing a pulmonologist on the ambulatory side. There was also no difference in readmission rate after consultation by a pulmonologist during hospitalization. The reason for this can vary but still remains unclear. It is possible the lack of efficacy demonstrated in this study is due to the small sample size. It is also possible that the lack of difference was due to a higher rate of severe persistent asthmatics referred to the subspecialist and issues of prescription and compliance with recommendations for preventative care. Further study of this is required to better define and improve the quality role of the subspecialist pulmonologist in this patient population.

Since we speculate that referral patterns to the pediatric pulmonologist were a more severe subset of asthmatics, it seems reasonable to assume there is a benefit to subspecialty evaluation. Pediatric pulmonologists are valuable resources not only to treat and educate about asthma, but also to exclude a diagnosis which can mimic asthma. Younger kids especially have a greater

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possibility of an alternative diagnosis such as gastroesophageal reflux, cystic fibrosis, aspiration syndrome, immune deficiency, congenital heart disease and bronchopulmonary dysplasia. Spirometry which is a valuable tool recommended by NAEPP, oftentimes, can be performed in a pulmonologists office but is generally not found in the PCP office. Subspecialists are more likely to monitor the clinical course rather than seeing the patient only when symptomatic. They are more likely to be familiar with the various medication options and devices used for aerosol delivery and counsel patients and families appropriately. They also are likely to be supported by experienced respiratory therapists and asthma educators. The challenge is adequately categorizing and then triaging patients appropriately to maximize the efficiency and efficacy of this resource.

Unfortunately, since there is a national shortage of pediatric pulmonologists[29], there has to be a push not only for ED initiation of standard guidelines for controllers and appropriate subspecialty evaluation, but also strong PCP involvement. It would be helpful to create an evidence-based asthma program intended to provide PCPs with decision aids to support best practice regarding asthma assessment, diagnosis, and early management as well as education for patient self-management.

Since there is a considerable time investment, learning curve, and questionable adherence to asthma guidelines by PCPs, asthma targeted programs have been proposed as a useful method to improve outcomes. At the Royal Victoria Hospital of Barrie, Ontario, the best practice model for pediatric asthma involves actively encouraging primary care physicians and ED physicians to refer children with asthma to the Pediatric Asthma clinic (PAC). Quarterly visits are scheduled with a pediatrician and asthma educator. This practice resulted in a two thirds decrease in asthma

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related ED visits and 85% decrease in admissions[30]. Although PCP provided education has been well received and has shown to improve outcomes short term, it is unclear whether this is sustainable over many years. In addition, few PCPs seem to have the time to devote to this effort, and incorporate teaching in a chronic care model of practice. Networked models of communication and care, the medical home, new web based educational tools, and telemedicine have the potential to help fill these roles but further study is needed to show efficiency and efficacy.

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Conclusion

Many opportunities remain to improve long term asthma control through collaborative partnerships between the patient, ED physician, inpatient pediatric hospitalist, PCP and subspecialty pulmonologist. Integration of care should yield the best patient outcomes while minimizing resource utilization. These goals require institution of preventative care and education to ensure compliance with the recommendations. Physicians in the ED have an important opportunity to provide preventative care and education in the acute care setting and should be encouraged to initiate treatment with ICS. They should actively coordinate care by encouraging follow up with the PCP and also informing the PCP of the ED visit to ensure adequate follow-up in the ambulatory setting. Referrals to the subspecialty pulmonologist should be considered when appropriate, but consideration should be given to creating collaborative preventative and educational programs focusing on asthma care to be utilized in the ambulatory setting. Furthermore, accountability of asthma management extends beyond the patient and healthcare provider and requires a supply chain integration model based on supply and demand forecasting, standardized work, and readiness for change.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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References:

1) National Heart Lung and Blood Institute. 2010 Global Initiative for Asthma GINA 2011
2) CDC National Health Interview Survey (NHIS) data: 2011 lifetime and current asthma. Atlanta, GA: US Department of Health and Human Services, CDC: 2012
3) Health, United States, 2005. Hyattsville, MD: National Center for Health Statistics,
4) http://www.cdc.gov/asthma/most_recent_data.htm
5) Barnett, SBL, Nurmagambetov TA. Costs of asthma in the United States 2002-2007. J Allergy Clin Immunol 2011; q127: 145-52
6) Schatz M, The controller-to-total asthma medication ratio is associated with patient-centered as well as utilization outcomes. Chest. 2006; 130(1):43-50.
7) Voorend-van Bergen S, Asthma control questionnaires in the management of asthma in children: A review. Pediatr Pulmonol. 2015; 50(2):202-8.
8) http://www.nhlbi.nih.gov/health-pro/guidelines/current/asthma-guidelines/full-report
9) Adams RJ, Impact of inhaled antiinflammatory therapy on hospitalization and emergency department visits for children with asthma. Pediatrics. 2001; 107(4):706-11.
10) Suissa S, Low-dose inhaled corticosteroids and the prevention of death from asthma. N Engl J Med. 2000; 3;343(5):332-6.
11) Long-term effects of budesonide or nedocromil in children with asthma. The Childhood Asthma Management Program Research Group. N Engl J Med. 2000; 12;343(15):1054-63.
12) Bisgaard H, Yes, steroids are safe in infants with asthma-like symptoms. Pediatrics. 2004; 114(3):904.

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13) Finkelstein JA, Underuse of controller medications among Medicaid-insured children with asthma. Arch Pediatr Adolesc Med. 2002;156(6):562-7.

14) Lenhardt RO, Improving pediatric asthma care through surveillance: the Illinois Emergency Department Asthma Collaborative. Pediatrics. 2006;117(4 Pt 2):S96-105.

15) Leickly FE, Self-reported adherence, management behavior, and barriers to care after an emergency department visit by inner city children with asthma. Pediatrics. 1998;101(5):E8.

16) Zorc JJ, Scheduled follow-up after a pediatric emergency department visit for asthma: a randomized trial. Pediatrics. 2003;111(3):495-502.

17) Uscher-Pines L. Emergency department visits for nonurgent conditions: systematic literature review. Am J Manag Care. 2013;19(1):47-59.

18) Weisz, D. Emergency Department Use: A Reflection of Poor Primary Care Access? Am J Manag Care. 2015;21(2):e152-e160

19) Crain EF. Reported difficulties in access to quality care for children with asthma in the inner city. Arch Pediatr Adolesc Med. 1998;152(4):333-9.

20) https://www.cdc.gov/asthma/nhis/2012/data.htm

21) Uscher-Pines L, Pines J, Kellermann A, Gillen E, Mehrotra A. Deciding to visit the Emergency Department for Non-Urgent Conditions: A systematic Review of the Literature. Am J Manag Care 2013; 19(1):47-59

22) Bergert L. Linking patient-centered medical home and asthma measures reduces hospital readmission rates. Pediatrics. 2014:134(1):e249-56.

Downloaded by [Australian Catholic University] at 07:10 19 August 2017

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23) Global Strategy for Asthma Management and Prevention. Global Initiative for Asthma (GINA); 2009

24) Wisnivesky JP. Barriers to adherence to asthma management guidelines among inner-city primary care providers. Ann Allergy Asthma Immunol. 2008;101(3):264-70.

25) Nicholas RJ. Local Side Effects of Inhaled Corticosteroids: Current Understanding and Review of the Literature. Chest. 2004; 126(1): 213--219

26) Schatz M, Cook EF, Nakahiro R, Petitti D. Inhaled corticosteroids and allergy specialty care reduce emergency hospital use for asthma. J Allergy Clin Immunol. 2003;111(3):503-8

27) Bucknall CE, Differences in hospital asthma management. Lancet. 1988;1(8588):748-50.

28) Kelly, CS, Outcomes Evaluation of a Comprehensive Intervention Program for Asthmatic Children Enrolled in Medicaid. Pediatrics. 2000(105);5

29) Plumley, DA. Pediatric subspecialty shortage: a looming crisis. Pediatric Health Editorial

30) Fleming K. Kuzik B, Chen C. Hospital-based inter-professional strategy to reduce in-patient admissions and emergency department visits for pediatric asthma. Healthc Q. 2011;14 Spec No 3:47-51.

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Table 1. Distribution of demographic factors for asthma patients visits to the Emergency department, and admissions to the hospital floor and ICU.

Factor	Emergency N=106	Admitted to Floor N=134	Admitted to ICU N=47	P-value
Age, Mean (SD) Median (Q_1, Q_3)	8.0 (2.4) 7 (6,10)	8.7 (3.2) 8 (6,11)	8.6 (2.7) 9 (6,10)	0.39[1]
Sex, N(%) *Male* *Female*	 70 (66) 36 (34)	 78 (58) 56 (42)	 36 (76) 11 (24)	0.07[2]
Ethnicity, N(%) *African American* *Native American* *Hispanic* *Caucasian*	 23 (21) 4 (4) 76 (72) 3 (3)	 22 (16) 8 (6) 86 (64) 18 (14)	 16 (34) 3 (6) 25 (53) 3 (6)	0.01[2]
Insurance, N(%) *Medicaid* *Non-medicaid*	 95 (90) 11 (10)	 111 (83) 23 (17)	 41 (87) 6 (13)	0.33[2]

Abbreviations SD = standard deviation, Q = quartile

[1]Kruskall-Wallis test p-value

[2]Fisher-exact p-value

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Table 2. Distribution of clinical factors among asthma patients visits to the Emergency department and admissions to the hospital floor and ICU.

Outcome	Emergency N=106	Admitted to Floor N=134	Admitted to ICU N=47	P-value[1]
Previous ED visit, N (%)	93 (88)	81 (60)	32 (68)	<0.0001
Previous Pulm consult, N (%)	32 (30)	25 (19)	7 (15)	0.05
On ICS, N (%)	52 (49)	70 (52)	23 (50)	0.88
ICS initiation/step-up, N (%)	2 (1.9)	72 (54)	34 (72)	<0.0001
Inpatient Pulm consult, N (%)	0(0)	11 (8)	25 (54)	<0.0001
Pulm follow-up, *Recommeded*, N (%) *Attended*, n/N (%)	4 (4) 3/4 (75)	41 (31) 16/41 (39)	32 (68) 9/32 (28)	<0.0001 0.17
Readmission, N (%)	82 (77)	56 (42)	19 (40)	<0.0001
Spirometry, N (%)	44 (42)	40 (30)	16 (34)	0.17

[1]Fisher-exact test p-value

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