Implementation of an Electronic Pulmonary Exacerbation Score Tool to Improve Treatment of Adult CF Patients
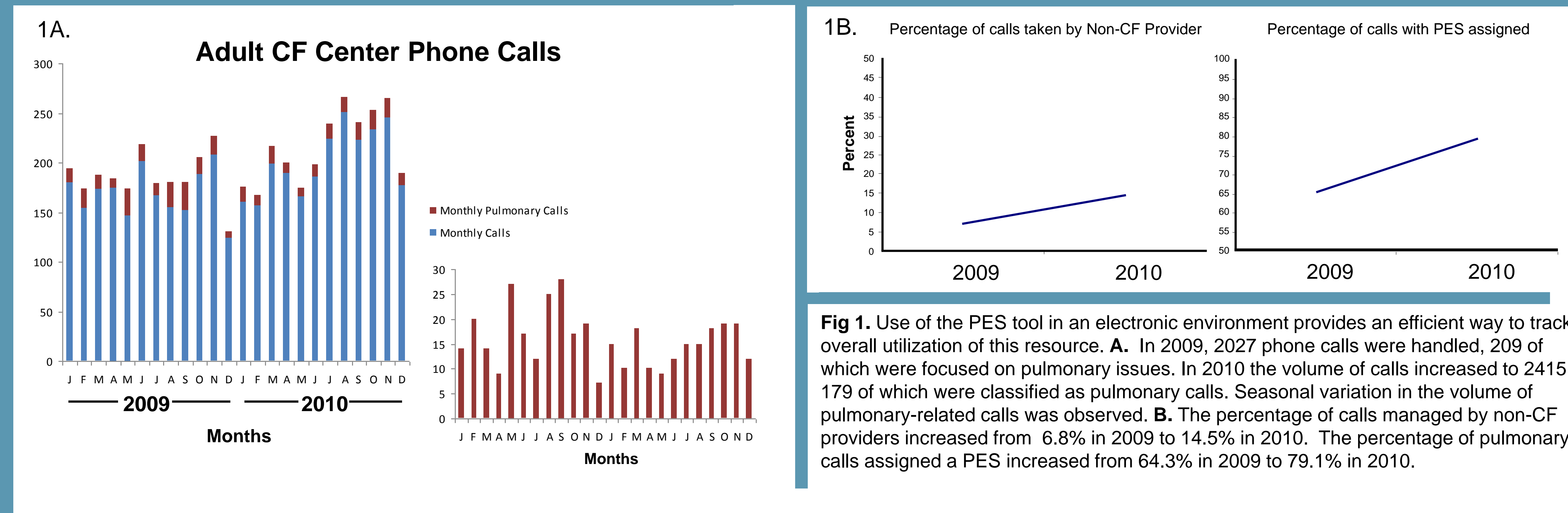
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Introduction

The course of cystic fibrosis (CF) lung disease is typically punctuated by pulmonary exacerbations (PE's), which appear to play an important role in pulmonary function decline. We have been interested in utilizing an electronic PE score (PES) tool to develop a more proactive approach to treatment of PE's in our adult CF program which follows more than 70 patients (1). We previously implemented an electronic version of the PES sheet developed by Kraynack et al (2) in order to standardize our management. This follow up project examines practice patterns and outcomes after 2 years of use of the system.

Methods

All phone call to the Adult CF Program at Maine Medical Center were logged in an electronic medical record (EHR), which has an embedded PES tool. Calls during the calendar years 2009-2010 were retrospectively reviewed to identify the nature of the call, the providers involved in decision making, and the frequency of use of the PES tool. Calls that dealt primarily with a pulmonary issue were designated as "Pulmonary Calls." As part of a Plan-Do-Check-Act cycle (PDCA), periodic education about the availability of the tool was provided at provider administrative meetings and via e-mail. Month-by-month frequency of PES usage was evaluated.

The mean PES was compared between groups receiving no treatment (Group A), oral antibiotics (Group B), or IV antibiotics (Group C). Patients were followed for 30 days following the initial contact and treatment failures (TF) were recorded. In the untreated group, TF was defined by subsequent need for antibiotics during 30 day follow up. TF in the group prescribed oral antibiotics was defined by subsequent need for IV antibiotics during 30 day follow up. PES values in TF vs. non-TF patients were compared by Student's t-test. Pulmonary function for the cohort of patients was compared between 2009 and 2010.

Results

Fig 1. Use of the PES tool in an electronic environment provides an efficient way to track overall utilization of this resource. **A.** In 2009, 2027 phone calls were handled, 209 of which were focused on pulmonary issues. In 2010 the volume of calls increased to 2415, 179 of which were classified as pulmonary calls. Seasonal variation in the volume of pulmonary-related calls was observed. **B.** The percentage of calls managed by non-CF providers increased from 6.8% in 2009 to 14.5% in 2010. The percentage of pulmonary calls assigned a PES increased from 64.3% in 2009 to 79.1% in 2010.

Fig 2. Dot plots for 2009 (panel A) and 2010 (panel B). The average PES for untreated patients (blue dots) were 5.28 (95% CI 4.19-6.37) and 4.61 (95% CI 3.90-5.31) for 2009 and 2010, respectively. The average PES for those treated with oral antibiotics (red dots) were 6.63 (95% CI 5.92-7.34) and 6.72 (95% CI 6.08-7.36) for 2009 and 2010, respectively. The average PES for those treated with IV antibiotics (green dots) were 9.54 (95% CI 8.83-10.25) and 9.22 (95% CI 8.33-10.11). Horizontal lines indicate mean values for each group.

Fig. 3. PES for patients who were successfully left untreated (n= 11 and n=29) or successfully treated with antibiotics (n=41 and n=49) are shown with black bars for 2009 and 2010, respectively. Scores for study-defined treatment failures are shown with white bars. In 2009 n= 11 and 10 for untreated and oral antibiotic-treated patients that failed, respectively. Likewise, in 2010 n=7 and 17 for untreated and antibiotic-treated patients, respectively. Whiskers show the upper bound of the 95% confidence interval.

Fig. 4. Median FEV$_1$ % predicted is shown for all patients that were followed in our program for both 2009 and 2010 (n=56). The blue square indicates a patient that underwent lung transplant during 2009. The green circles indicate two patients who expired. The red line (with triangles) shows the group median values (56% predicted and 59% predicted for 2009 and 2010, respectively).
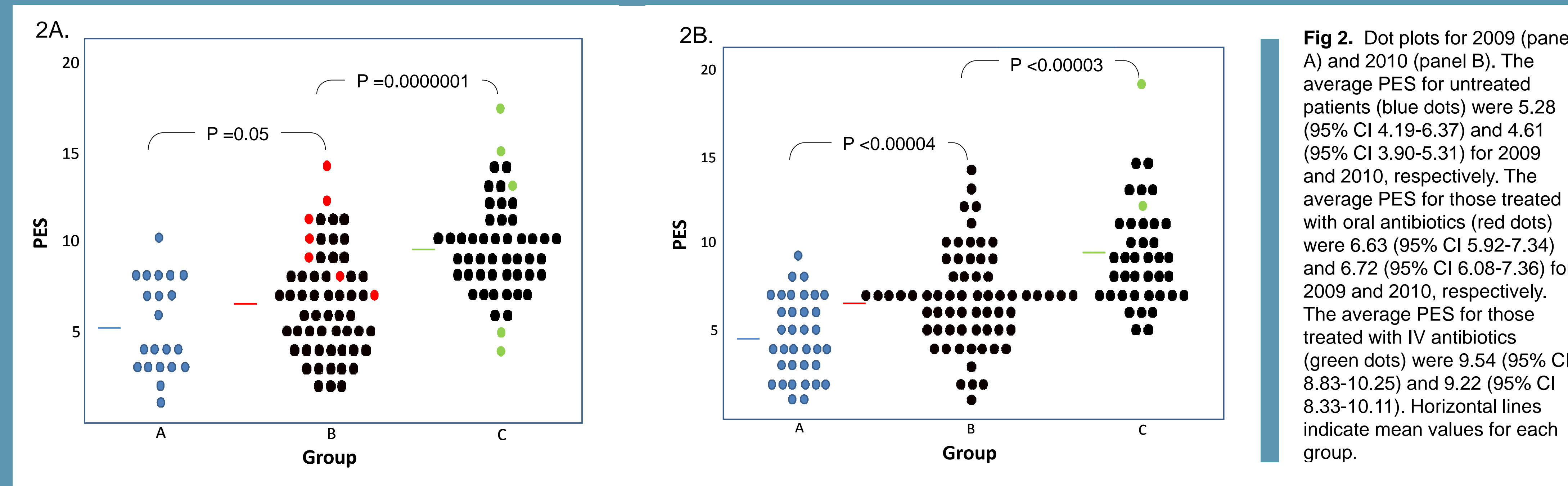
Results Summary

In 2009 data was collected for 61 adults (median age 28; range 18-60). In 2010 data was collected for 64 adults (median age 30; range 19-62). The EHR recorded 209 and 179 phone calls for pulmonary issues in 2009 and 2010, respectively. The proportion of calls handled by non-CF providers increased from 6.8% to 14.5% from year 1 to 2. The proportion of pulmonary calls with PES assigned increased from 64.3% (95% CI, 0.58-0.71) to 79.1% (95% CI, 0.73-0.85) in 2009 and 2010, respectively. We observed seasonal variations in both the frequency of calls and resultant prescription of therapy for exacerbations. Use of the PES tool led to a range of measurable changes in practice including between-scheduled-visit spirometry for patients with borderline scores. The median values of FEV1% predicted for the 56 patients followed in both 2009 and 2010 were 56.75% and 59.25%, respectively.

Conclusions

Use of the PES questionnaire in an electronic environment provides an efficient way to track overall utilization of this resource. When used in concert with the PDCA cycle, the application was increasingly utilized over a two year period by CF and non-CF providers. The instrument has helped us standardize outpatient management of CF pulmonary symptoms in a busy general pulmonary practice. Use of this tool was associated with improvement in lung function among an intensely treated cohort of adult CF patients.

Future Directions

We plan to further assess the pattern of individual item responses on the PES questionnaire in the treatment success and failure groups to see whether the scoring system can be further refined to help guide therapy in our patient population. In addition, we plan to integrate the PES into our regular clinic visit workflow.

References

1. Fletcher MD, Prato BS, Zuckerman JB et al. Use Of A Pulmonary Exacerbation Score (PES) To Improve Treatment Of Adult Cystic Fibrosis Pulmonary Exacerbations *Am J Respir Crit Care Med* 181;2010:A1826
2. Kraynack NC, Singh C, Sheers T, Bryson E, McBride J. Standardization of a Pulmonary Exacerbation Score Designed to Uniformly Indentify Pulmonary Exacerbations in Cystic Fibrosis is Associated with Continued Improvement in Pulmonary Function. *Pediatric Pulmonology.* 2007. 42:S30. p 372.