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Abstracts

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Introduction

The COPD9USA Conference was held in Chicago in June 2015, and was the third installment in a series of biennial conferences modeled after the successful COPD Conference series held in Europe for the past 18 years. Featuring a faculty of the nation's top COPD experts, and attendees representing the entire health care provider team and patients, the conference focused on providing education and a collaborative exchange of information with the goal of improving the assessment, diagnosis and management of patients with COPD. Nearly 500 individuals attended the 2-day conference which was comprised of more than 20 different lectures, panel discussions and educational sessions. In addition, over 60 abstracts were presented at the conference. We present many of those here.

Cutting Edge Topics Covered in COPD9USA Abstracts

Addressing the protean nature of COPD requires a broad spectrum of health care, health, medical, behavioral and patient expertise. The presentations at the COPD9USA conference addressed all of these areas and more with cutting edge innovations and new approaches to known problems. Not only did abstracts address the hot new topic of the lung microbiome in COPD but provided several potential solutions to the high risk of hospital admission and readmission among people with COPD. Abstracts assessed guideline adherence in hospital care, the development and use of care transition teams in hospitals of all sizes and the important role of engaging patients in the care and management of COPD and its common co-existing multiple morbidities. Abstracts highlighted not only the frequently recognized multi-morbidities such as cardiovascular disease but stressed the important of frailty and nutritional status for people with COPD returning home after the all too brief hospital stays associated with COPD exacerbations. Several abstracts helped bring the patient and family back into the care team as not just recipients but active members of the team with discussions of motivational interviewing, use of social media, new methods for inhaler technique education and an engaging use of a new harmonic device to encourage support group participation. And finally, our epidemiology colleagues were there to remind us of the groups of individuals here and around the world for whom COPD is a by-product of environmental and occupational exposures who require additional prevention work beyond the importance of continued smoking cessation and prevention work. This group of abstracts helps remind us why we need and will continue to benefit from broad inclusion of many types of expertise in our ongoing work to prevent and treat COPD to improve the lives of millions of adults and families worldwide.

The following abstracts have not been edited but are presented here, as they were presented, at COPD9USA in June 2015.

Electronic Medical Record Documentation of Tobacco Cessation Consultation by Student Pharmacists and the Impact on Physician Intervention

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Purpose: Cigarette smoking is the leading cause of preventable death in the United States, accounting for about 443,000 deaths per year. Studies have shown counseling by multiple health professionals along with pharmacotherapy increases tobacco quit rates. This 2-part, IRB approved study assesses how documentation of tobacco cessation consultations by pharmacy services reinforces physician treatment of tobacco dependence through review of the electronic medical record (EMR) and a physician survey.

Methods: Part 1 consists of a retrospective review of physician notes during the 6 months prior to and following hospitalization for patients requesting inpatient tobacco cessation services. Notes were reviewed for pertinent medical history, smoking status, and tobacco dependence treatment. Part 2 entails a survey of Department of Medicine physicians. The survey queried physicians on familiarity with the tobacco cessation consult note, how the note influences interventions, and confidence in providing tobacco treatment.

Results: Of the 134 patients meeting inclusion criteria, 15% of the patients had documentation of tobacco cessation counseling by a physician within 6 months prior to the hospitalization. After the tobacco cessation consult, 24% of patients had documentation of tobacco treatment. The majority of physicians surveyed (77.7%) are not familiar with the tobacco cessation consult note documented by pharmacy services. Among the cohort familiar with the note, only 27% refer to it when making clinical decisions for tobacco cessation. Interestingly, only 48% of physicians reported confidence in providing tobacco cessation treatment.

Conclusions: Overall, improved physician documentation was observed in the EMR for tobacco dependence treatment following tobacco cessation consultation. Although, it appears the majority of physicians are unaware of the consult note available to assist with providing tobacco dependence treatment and further do not tend to refer to such notes.

Evaluation of Systemic Steroid Use in Patients with Chronic Obstructive Pulmonary Disease (COPD) Exacerbations after Implementation of Standardized Dosing

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Background/Purpose: COPD exacerbations negatively impact patients' quality of life, lung function, and result in increased healthcare costs. Systemic steroids are a mainstay of therapy in exacerbations and have been shown to decrease time to recovery, improve lung function and shorten length of hospital stay. However, the optimal dose and duration of steroids are not known. Our institution implemented a COPD exacerbation CPOE "pathway" to prompt all disciplines with evidence-based medicine treatment options. Prior to this pathway, there was no standard for systemic steroid dosing in COPD exacerbations, often resulting in large total daily doses and extended lengths of stay. The objective of this study is to evaluate daily steroid doses received by patients before and after the implementation of this pathway.

Methodology: After submission of this study to the Institutional Review Board for approval, a retrospective chart review will be conducted. Patients with a primary diagnosis of COPD exacerbation and received steroids during admission will be included. Patients will be excluded if they were admitted to a critical care unit, had a concomitant diagnosis of asthma, or received steroids for other indications. The primary endpoint will be the total daily dose of steroids received in prednisone

equivalents. Secondary endpoints will include length of stay, 30-day exacerbation readmissions, blood glucose control, and requirements of as-needed sleep aids and antipsychotics. Baseline demographic data including comorbidities will be collected in addition to pertinent labs and concomitant medications. Usage of the CPOE pathway steroid orders will also be assessed.

Results:
Conclusions:

Presentation Objective: Describe the impact of an evidence based pathway on systemic steroid doses received by patients admitted for COPD exacerbations.

Self-assessment: What are the differences in cumulative systemic steroid dosing and are there any consequences to receiving higher systemic doses?

Frailty Features Are Common in Ambulatory Patients with COPD and May Be Associated with Respiratory Muscle Weakness

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Background: Frailty is a syndrome of decreased physiologic reserve and increased vulnerability to stressors that is an independent predictor of adverse outcomes including falls, disability, hospitalization, and death. Sarcopenia is a defining feature of frailty, but the relationship between frailty syndrome and respiratory muscle strength is not well characterized. Patients with chronic obstructive pulmonary disease (COPD) may be particularly susceptible to differences in frailty status as inhaler device actuation and aerosolized medication distribution require sufficient peak inspiratory flow rates for optimal drug delivery.

Objective: The primary objective of this study was to assess the relationship between physical frailty status and respiratory muscle strength in older adults with COPD.

Methods: Ambulatory patients with a physician diagnosis of COPD and a clinical indication for pulmonary function testing were recruited from the pulmonary function laboratory and pulmonary outpatient clinics at an academic medical center. Patients were excluded if they had a diagnosis of neuromuscular disease. Frailty features including handgrip strength, self-reported physical exhaustion, self-reported weight loss, physical activity level, and gait speed were measured according to the Fried frailty phenotype established in the Cardiovascular Health Study. Additional data collection included demographic information, medical history, and COPD assessment test (CAT) scores. Pulmonary function measurements including spirometry, maximal inspiratory pressure (MIP), maximal expiratory pressure (MEP), and six minute walk distance were performed according to American Thoracic Society guidelines. Frailty scores were defined by the count of frailty characteristics present in a given patient. Categorical variables were compared across frailty score groups using Chi-square or Fischer's exact test, and continuous variables were compared across groups using the t test. We also employed the linear test for trend and linear regression to further examine the relationship between continuous variables and frailty scores and to assess the relationships between MIP, MEP, and grip strength.

Results: To date, 44 patients have been enrolled, including 25 men and 19 women of mean age 72.2 years. Analysis of the available preliminary data indicates frailty features are relatively common in ambulatory patients with COPD. Sixteen patients (36%) had low physical activity levels, ten (23%) had slow gait speed, six (14%) demonstrated low handgrip strength, six (14%) reported exhaustion, and three (7%) reported unintentional weight loss. When we examined groups of patients classified by frailty score, there was a trend towards a positive association between CAT total scores and frailty score (p=0.068). We also observed a trend towards an inverse association between MIP and frailty score (p=0.079). Handgrip strength, whether measured in the dominant or non-dominant hand, was positively correlated with both MIP and MEP. However, only the relationship between non-dominant handgrip strength and MIP was significant after adjusting for age, sex, and COPD severity based on post-bronchodilator FEV_1% (regression coefficient β = 1.87; 95% CI 0.24-3.50; p=0.026).

Conclusion: Frailty characteristics are relatively

common in older adults with COPD. Preliminary findings suggest there may be an inverse relationship between maximal inspiratory pressure and frailty score.

Development of a New COPD Case-Finding Method for Use in Spanish-Speaking Patients: Challenges and Future Directions

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Objective: The Chronic Obstructive Pulmonary Disease (COPD) Health Screening Study aims to develop a case-finding method for identifying cases of undiagnosed clinically significant COPD. The goal is to develop a short instrument that is easy for patients to complete and clinicians to score that can be used with peak expiratory flow (PEF) in primary care settings. We describe the translation process we used and our experience with the first stage of this research in a subset of Spanish speaking participants.

Methods: Prospective, multicenter, case-control study of men and women ≥ 40 years old. Of the 376 case/control subjects, 346 were English speaking (n=186/160) enrolled across all 6 sites; 30 were Spanish speaking (n=17/13) enrolled at Columbia University. All subjects completed a questionnaire booklet that included sociodemographic and health history questions, including the Modified Medical Research Council Dyspnea Scale; COPD Assessment Test (CAT) and 48 candidate items. Research staff performed PEF and collected spirometry information. To enable participation of Spanish speaking patients, the entire questionnaire booklet was translated, with the exception of the CAT (previously translated), using methodology designed to achieve linguistic and cultural equivalence across English and Spanish. This method included two forward translations by native Spanish speakers, one reconciliation by a native Spanish speaker, two back translations by native English speakers fluent in Spanish, and comparison of the back-translated questionnaire to the source text to identify possible discrepancies. Translations were evaluated through interviews with 12 individuals with various educational backgrounds from Cuba, Dominican Republic, Ecuador, Guatemala, Mexico, or Puerto Rico and living in the United States. Their comments were analyzed, final changes were made to the translation, and the booklet was formatted and proofed by two professional native Spanish-speaking translators. Bilingual medical providers conducted visits with Spanish speaking participants. The same study coordinators worked with English and Spanish speaking subjects during the data collection process.

Results: English and Spanish speaking participants shared similar demographic characteristics, except for education status (Table 1). Although actual time to complete the questionnaire was not measured, study coordinators observed that Spanish-speaking participants took longer to complete the questionnaires compared to English-speaking participants. Spanish speaking participants also required more clarification of items. For example, it was noted that many Spanish speakers were unfamiliar with the term "Enfermedad Pulmonar Obstructiva Crónica (EPOC)" (COPD).

Table 1. Educational Level of English & Spanish Speaking Participants

Education Status n (%)	English Speaking N=346	Spanish Speaking N=30
Less than high school	21 (6.1%)	10 (33.3%)
High school	122 (35.3%)	7 (23.3%)
Associated degree, technical or trade school	76 (22.0%)	5 (16.7%)
College	103 (29.8%)	7 (23.3%)
Post graduate degree	24 (6.9%)	1 (3.3%)

Conclusions: Spanish-speaking participants had more difficulty completing the questionnaire booklet, perhaps due to the educational level of this group. The final case-finding questionnaire will include a limited number of easy-to-complete questions selected from the item pool, with consideration given to language and literacy. Our

experience further highlights an opportunity to improve health literacy as a means to more effectively screen for undiagnosed clinically significant COPD.

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Evaluation of Prescribing Guideline Recommended Medications to Reduce the Frequency and Severity of Future COPD Exacerbations at Hospital Discharge

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Background/Purpose: COPD is a costly and debilitating chronic disease. Medications are central to the management of COPD and have been shown to reduce symptoms, reduce exacerbations, and improve health status. Based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) Guidelines risk assessment, patients experiencing one or more hospitalization for COPD exacerbation should be considered high risk. Our institution embarked on an ongoing initiative to improve the quality of care of these high risk COPD patients. As part of this initiative, a dedicated pharmacist provides patient and provider education, medication adherence assessments, medication therapy recommendations, quality monitoring, and is a member of the COPD multidisciplinary team. For high risk patients, the GOLD guidelines recommend medication management with an inhaled corticosteroid plus long acting beta agonist, and/or a long acting anticholinergic. With under-treatment of COPD being reported in the literature, the prescribing of guideline recommended medications for COPD maintenance therapy at hospital discharge is a current target of the pharmacist's quality monitoring.

Description of undertaking/Methods: Prior to implementation of the quality initiative a sample of patients was evaluated for documentation of guideline recommended medications at discharge. Results showed that 40% were not prescribed a long-acting anticholinergic at discharge, 31% were not prescribed a long-acting beta agonist at discharge, and 28% were not prescribed an inhaled corticosteroid at discharge. As part of the hospital wide COPD initiative, steps were taken to improve prescribing of guideline recommended medications. These steps included implementation a computerized provider order entry (CPOE) pathway for COPD exacerbation which included the recommendations for maintenance medication therapy; provider education of GOLD guideline recommendations; and development of a process to utilize the pharmacist to provide medication assistance to patients with financial constraints. After implementation of these steps, retrospective quality monitoring to evaluate the prescribing of guideline recommended medications at discharge in patients with a primary diagnosis code of COPD exacerbation was conducted. Patients that discharged home on hospice, left against medical advice, or expired were not evaluated.

Results: pending analysis

QVA149 Shows Rapid Onset of Bronchodilation Versus Placebo and its Mono-Components In Patients With Moderate to Severe COPD: Pooled Data From the FLIGHT Studies

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Rationale: Rapid onset of bronchodilation helps in achieving quick relief of symptoms, which is one of the key objectives in the management of chronic obstructive pulmonary disease (COPD). Combination of a LABA and a LAMA bronchodilator is recommended by the GOLD recommendations as an alternative choice if symptoms are not adequately managed by a single bronchodilator.[1] QVA149 is a rapid onset, long-acting

dual bronchodilator combining indacaterol (long-acting β2-agonist) and glycopyrronium (long-acting muscarinic antagonist), for maintenance treatment of patients with moderate to severe COPD.

Methods: FLIGHT1 and FLIGHT2 were 12-week, multicenter, double-blind studies that randomized (1:1:1:1) patients with moderate-to-severe COPD to QVA149 (27.5/12.5 µg), indacaterol (27.5 µg), glycopyrronium (12.5 µg) or placebo (all twice daily via the Breezhaler® device). Data from these studies was pooled and improvement in forced expiratory volume in 1 sec (FEV_1) at 5 min and 15 min post-dose on Day 1 with QVA149 versus placebo was evaluated and reported here.

Results: In this analysis, data from 2038 patients from the FLIGHT1 and FLIGHT2 studies was pooled and evaluated (QVA149, n=508; indacaterol, n=511; glycopyrronium, n=511 and placebo, n=508). QVA149 showed rapid bronchodilation as demonstrated by significant improvement in FEV_1 at 5 min and 15 min post dose on Day 1 versus placebo (109 mL and 144 mL, respectively; both $p<0.001$). Improvement in FEV_1 at 5 min and 15 min was also statistically significant with QVA149 versus indacaterol (40 mL and 64 mL, respectively; both $p<0.001$) and glycopyrronium (45 mL and 32 mL, respectively; both $p<0.001$). Percentage of patients achieving ≥100 mL and ≥200 mL improvement in FEV_1 at 5 min was higher in the QVA149 treated group (54.1% and 18.0%, respectively) compared with placebo treated group (10.2% and 2.1%). The median time to onset of action (≥100 mL increase in FEV_1 from baseline on Day 1) was 14.7 min for patients taking QVA149.

QVA149 showed rapid bronchodilation versus placebo and its mono-component and can be treatment option for quick relief of symptoms in patients with moderate to severe COPD.

Reference

1. Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2014. Available from: http://www.goldcopd.org/

QVA149 Provides Superior Improvement in Lung Function Versus Its Monocomponents in Patients With Moderate-To-Severe COPD: The FLIGHT2 Study

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Rationale: Combination of long-acting bronchodilators has been shown to be more effective than single bronchodilator for the treatment of patients with moderate-to-severe chronic obstructive pulmonary disease (COPD).[1] QVA149 is a fixed-dose combination of indacaterol (a long-acting β2-agonist [LABA]) and glycopyrronium (a long-acting muscarinic antagonist [LAMA]). The FLIGHT2 study evaluated twice-daily (b.i.d.) QVA149 versus its monocomponents and placebo in patients with moderate-to-severe COPD.

Methods: FLIGHT2 was a 12-week, randomized, multicenter, double blind, parallel-group, placebo- and active-controlled study. Patients were randomized (1:1:1:1) to twice-daily QVA149 (27.5 µg indacaterol/12.5 µg glycopyrronium), indacaterol 27.5 µg b.i.d., glycopyrronium 12.5 µg b.i.d. or placebo, all delivered via the Breezhaler® device. The primary objective was to demonstrate superiority of QVA149 versus indacaterol and glycopyrronium in terms of area under the curve for forced expiratory volume in one second (FEV_1 $AUC_{0\text{-}12h}$) at Week 12. Secondary objectives included demonstrating superiority of QVA149 measured in terms of trough FEV_1, peak FEV_1, and rescue medication use over 12 weeks.

Results: Of the 1001 (QVA149, n=250; indacaterol, n=251; glycopyrronium, n=251, placebo, n=249) patients randomized; 963 (96.2%) patients completed the study. The primary objective was met with QVA149 showing statistically significant improvement in FEV_1 $AUC_{0\text{-}12h}$ at Week 12 compared with indacaterol

(least square mean [LSM] treatment difference 112 mL; $p<0.001$) and glycopyrronium (LSM treatment difference 79 mL; $p<0.001$). QVA149 significantly improved trough FEV_1 versus its monocomponents and placebo at Week 12 ($p<0.001$ for all comparisons). QVA149 showed statistically significant improvements in peak FEV_1 over the first four hours compared to its monocomponents and placebo on Day 85 ($p<0.001$). A statistically significant reduction in the mean daily rescue medication use was observed with QVA149 versus placebo ($p<0.001$) and versus glycopyrronium ($p<0.05$). The safety profile of QVA149 was similar to that of its monocomponents and placebo.

Conclusions: QVA149 provides superior bronchodilation compared to its monocomponents indacaterol and glycopyrronium in this study. QVA149 also demonstrated a statistically significant reduction in rescue medication use.

Reference: Bateman ED et al. *Eur Respir J.* 2013;42(6):1484–94

QVA149 Reduces Dyspnea in Patients with Moderate-To-Severe COPD as Measured by the Transition Dyspnea Index: The FLIGHT2 Study

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Rationale: Dual bronchodilation is recommended by the current GOLD strategy to achieve better symptom control in patients with moderate-to-severe chronic obstructive pulmonary disease (COPD).[1] The FLIGHT1 and FLIGHT2 studies assessed the efficacy and safety of twice-daily QVA149, a fixed-dose combination of indacaterol (a long-acting β2-agonist) and glycopyrronium (a long-acting muscarinic antagonist) versus placebo and its monocomponents in patients with moderate-to-severe COPD. Here, we report the improvement in dyspnea with QVA149 as measured by transition dyspnea index (TDI) total score in the FLIGHT2 study.

Methods: This 12-week, multi-center, double blind, parallel-group, placebo- and active-controlled study randomized COPD patients with moderate-to-severe airflow limitation to QVA149 (27.5 µg indacaterol/12.5 µg glycopyrronium), indacaterol 27.5 µg, glycopyrronium 12.5 µg or placebo (1:1:1:1, all delivered twice daily via the Breezhaler® device). Here, we present the results of a key secondary objective of FLIGHT2 study i.e. the level of breathlessness experienced by the patients with QVA149 compared to placebo and its monocomponents, assessed using the TDI total score after 12 weeks of treatment.

Results: After 12 weeks, patients treated with QVA149 exceeded the minimal clinically important difference (MCID) of ≥1 unit in TDI total score with a least squares mean [LSM] treatment difference of 2.03 (95% confidence interval [CI]: 1.52, 2.54; $p<0.001$) versus placebo. In addition, patients treated with the monocomponents also achieved MCID when compared with placebo (LSM difference: 1.13 and 1.02 for indacaterol and glycopyrronium, respectively; both $p<0.001$). The difference in the TDI total score was also statistically significant for QVA149 compared to its monocomponents, with LSM differences as 0.90 and 1.01 versus indacaterol and glycopyrronium, respectively; $p<0.001$ for both. Additionally, the proportion of patients who achieved the MCID (≥1 unit) at Week 12 was higher with QVA149 than with placebo (70.4% versus 37.8%, odds ratio 3.99, $p<0.001$). Similar results were observed in the replicative FLIGHT1 study (ClinicalTrials.gov Identifier: NCT01727141) where QVA149 had a statistically significant and clinically meaningful improvement in TDI total score versus placebo.

Conclusion: In this study, QVA149 provided statistically significant improvement in dyspnea, as measured by TDI, over placebo and its monocomponents in patients with moderate to severe COPD. Also, the proportion of responders achieving MCID was significantly higher with QVA149 compared to placebo.

Reference: Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2014. Available from: http://www.goldcopd.org/

Curbing COPD Readmissions: Finding the Target Population While They are Still in Their Hospital Beds

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Rationale: Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of readmissions and is now included in the Medicare Hospital Readmissions Reduction Program (HRRP). Despite existence of significant discrepancies between physician-labeled and discharge claims coding for hospitalizations due to acute exacerbations of COPD (AECOPD), the target population for the HRRP is defined by the latter. Hospitals seeking to intervene on AECOPD inpatients are therefore challenged to identify these patients prior to discharge when the coding subsequently occurs. We developed a multidisciplinary task force to identify these patients during their admission as a first step towards implementing an intervention to reduce COPD readmissions targeted to the correct population. We present our success using a novel screening algorithm and data on patient- and hospital-level demographics to understand the COPD population under the HRRP in our institution.

Methods: We developed a non-medical provider assisted electronic chart screening tool over two pilot phases, from development in February– July 2014 and real-time implementation from August – mid-October at the University of Chicago Medicine, Chicago, IL. We examined algorithm effectiveness by blinded hospital coder comparison to determine the sensitivity and positive predictive value (PPV). Comparing patient- and hospital-level demographics of AECOPD patients who were readmitted to those not readmitted, Chi squared and Fisher's exact tests were used for categorical variables; independent sample t-tests were used for normally distributed continuous variables and the Wilcoxon rank-sum test was used for non-normally distributed continuous variables.

Results: Over the study period there were 327 AECOPD admissions of which 61 patients were readmitted within 30 days. In phase one, 839 patients were screened with 226 identified as likely admitted for AECOPD (sensitivity 67.8%, PPV 38.9%). In phase two, 562 patients were screened with 90 identified as likely admitted for AECOPD (sensitivity 83.4%, PPV 68.6%). Index patients tended to be Black (90%), female (58.5%), had a median age of 64.3 (SD 11.6) and BMI of 26.7 (IQR 22.2-32.1). Female gender (62.6% vs. 41.3%, p=0.002), higher body mass index (27.5 v. 23.7, p=0.002), and shorter median length of stay (3 vs. 4 days, p=0.03) were associated with a lower risk of readmission. There was a statistically significant difference in prevalence of diseases between patients readmitted and those who were not, including for congestive heart failure (47.62% vs. 36.33%, p=0.01) and renal disease (28.57% vs. 17.60%, p=0.01). Forty-four percent of patients were treated in the intensive care unit (ICU) during admission. ICU use was associated with a trend towards increased risk of early readmission (p=0.08).

Conclusion: Our novel, highly sensitive screening algorithm identifies AECOPD admissions under the HRRP prior to discharge. This ability to identify the target population is a critical first step towards developing a successful program that improves COPD care and reduces the 30-day COPD readmission rate.

Driving Down Readmissions: An Evaluation of the Development and Implementation of a Multidisciplinary Program to Reduce Readmissions After COPD

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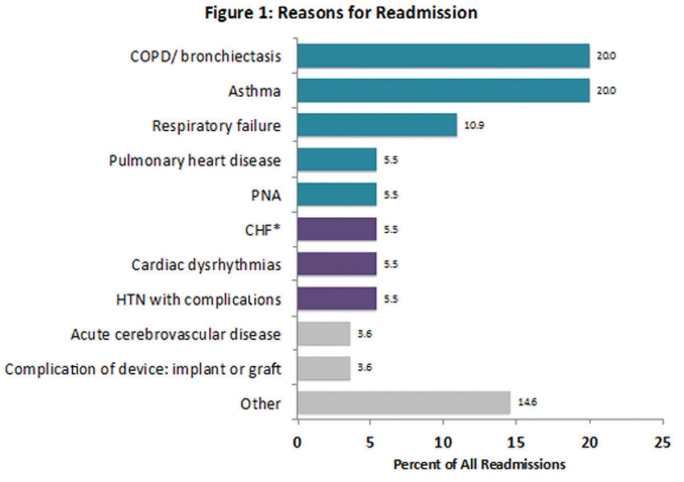
Rationale: The Hospital Readmissions Reduction Program (HRRP) is a legislative measure to address quality and rising costs by penalizing hospitals for specific disease 30-day readmissions and now includes COPD. Few data exist to support the effectiveness of interventions to reduce early readmission risk in the first 30 days after discharge for an acute exacerbation of COPD (AECOPD). We developed a multidisciplinary program spanning both the inpatient and outpatient care settings targeted to all patients admitted with AECOPD. Our objective was to reduce all-cause 30-day readmissions. We present the preliminary feasibility and outcomes data from on our program.

Methods: We piloted program elements in two phases using a quality improvement model at the University of Chicago Medicine from February- July 2014 and August to mid-October 2014, respectively. Components implemented in phase one included: comprehensive patient education on COPD, self-management techniques using a COPD action plan, and inhaler teaching using the validated Teach-To-Goal method, and a pulmonary consultation using a comprehensive disease management checklist. Phase two involved implementing: an advance practice nurse (APN)-led pulmonary consultation using a modified checklist, follow-up outpatient evaluation within one-week of patient discharge with the same APN, and a 24-hour patient and emergency room provider hotline for up to 30 days after discharge. Our intervention phase formally started in mid-October 2014, and included: addition of a 48 hour RN-led discharge phone call, and focusing the comprehensive teaching bundle to only inhaler and self-management education. AECOPD was defined by HRRP pre-specified discharge coding guidelines. Data on reasons and time to readmission, utilization of hospital services post-discharge, and readmission within 30 days was obtained by chart review and administrative claims data.

Results: Over the pilot phases and intervention phase up to December 31, 2014, there were 327 AECOPD admissions; of these, 61 patients were readmitted within 30 days. Respiratory-related diseases accounted for 61.8% of the reason for readmission with COPD and asthma each accounting for 20%. Cardiac-related etiologies accounted for 16.4% of readmissions (Figure 1). The median time to readmission was 14 days [IQR 10-21], to observation not upgraded to readmission was 15 days [IQR 5-22], and emergency room visit with discharge to home was 11 days [IQR 7-19]. The readmission rate at the start of pilot phase one was 23.8% and decreased to 12.5% by December 2014. Examining the average readmission rate in the first four months of the study period to the last four months when the intervention was fully running demonstrated a 50%



reduction in the 30-day readmission rate to our hospital.

Conclusion: Our multidisciplinary, multi-care setting program demonstrates clinical success with a 50% reduction in the 30-day all-cause COPD readmission rate. Median time to readmission was longer compared to national data1 suggesting a potential benefit of close follow-up within one week. Pulmonary diseases accounted for the majority of reasons for readmission. Our data suggests that targeted intervention with a comprehensive program can reduce early admissions for AECOPD.

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Diastolic Dysfunction Contributes to Pauci-inflammatory Exacerbations of COPD

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Introduction: A significant proportion of acute exacerbations of chronic obstructive pulmonary disease (COPD) are associated with a distinct paucity of both pulmonary and systemic inflammation. The etiology of these exacerbations is not clear. Due to the high prevalence of diastolic dysfunction in stable COPD, we hypothesized that a subset of acute exacerbations are precipitated by decompensated diastolic dysfunction, and are more likely to be pauci-inflammatory.

Methods: Consecutive patients hospitalized for acute exacerbation of COPD were enrolled. Those with known congestive heart failure were excluded. Color and tissue doppler echocardiography were performed to assess diastolic function within 36 hours of hospitalization. Diastolic dysfunction (DD) was defined by American Society of Echocardiography criteria. We used lung ultrasonography to assess lung congestion. Systemic inflammation was defined by serum C-reactive protein >10 mg/L. Inflammatory cytokines were also assessed in exhaled breath condensate (EBC) to estimate pulmonary inflammation. Coronary ischemia and cardiac stretch were assessed by serum troponin and brain natriuretic protein (BNP).

Results: Of 33 subjects enrolled, 12 had DD (36% prevalence) with 9 (75%) having grade 2 or greater

	Overall (n=12)	"Inflammatory" (n=8)	"Pauci-inflammatory" (n=4)
Age (years)	58.2 (7.7)	54.2 (3.4)	66.0 (8.0) *
Gender, female (%)	7 (47)	2 (25)	3 (75)
Race, Caucasian (%)	4 (33)	3 (38)	1 (25)
FEV_1/FVC	0.56 (0.23)	0.57 (0.25)	0.52 (0.27)
FEV_1 %predicted	55.6 (25.3)	57.7 (26.4)	49.5 (30.4)
Diastolic Dysfunction (%)	6 (50)	3 (38)	3 (75)
Inspiratory Capacity (L)	1.59 (0.25)	1.63 (0.24)	1.32 (0.24)
C-reactive protein (mg/L)	11.1 (5.7)	14.3 (3.3)	4.5 (2.8) *
Serum Troponin (ng/ml)	0.11 (0.01)	0.005 (0.004)	0.02 (0.01)*
Serum Pro-NT BNP(ng/ml)	2.59 (3.71)	2.81 (4.65)	3.37 (2.97)
CAT score	28.3 (8.0)	27.3 (7.9)	30.5 (8.9)
MMRC	2.3 (1.4)	1.8 (1.4)	3.5 (0.6) *

Table 1: Baseline demographics and comparison of exacerbations associated with systemic inflammation with pauci-inflammatory group. Significant inflammation was defined as CRP level ≥ 10 mg/L. * p value<0.05 for comparisons between the two groups. FEV_1 = Forced expiratory volume in the first second. FVC = Forced vital capacity. BNP = Brain natriuretic protein. CAT = COPD assessment test. MMRC = Modified Medical Research Council score.

DD. Of those with DD, more than half (53%) had evidence of lung congestion on ultrasonography. We present separate results for the first 12 subjects who have a full complement of imaging and laboratory data. Comparisons between "pauci-inflammatory" and "inflammatory" exacerbations are shown in Table 1. DD was more common in the pauci-inflammatory group. Pro-NT BNP was slightly higher in those with diastolic dysfunction than in those without (4.08+5.02 vs. 1.29+1.34 ng/ml; p=0.15). Diastolic dysfunction was associated with a trend toward lower levels of systemic inflammation (C-reactive protein 9.8+6.9 vs. 12.3+4.6 mg/L; p = NS) though there was no difference in levels of inflammatory markers (IL-6 and TNF-alpha) in exhaled breath condensate. Of note, 50% of those with diastolic dysfunction at index admission had CRP level less than 10 mg/L, whereas 83.3% of those without diastolic dysfunction had elevated CRP, suggesting lower levels of inflammation in subjects with "congestive" exacerbations.

Conclusions: Diastolic dysfunction likely contributes to acute exacerbations of COPD, especially to the subset of patients with a distinct lack of systemic and/or

pulmonary inflammation.

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CardioPulmonary Exercise Testing in Pulmonary Rehabilitation

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Introduction: Pulmonary Rehabilitation is a treatment method comprised of exercise therapy and education, and is used to manage and improve the symptoms of patients with several chronic lung diseases.It is well understood that pulmonary rehabilitation is useful and improves quality of life in COPD patients. Except for the Six Minute Walk Study, there have not been other tests that are routinely used to objectively measure improvements after pulmonary rehabilitation.

CardioPulmonary Exercise Testing (CPET) has been known to be a validated measure of testing cardiopulmonary physiology in many cardiac and pulmonary diseases.

Objectives: To determine objective improvement in cardiopulmonary physiology by CPET testing after pulmonary rehabilitation in COPD patients.

Methods: Retrospective study of 14 consecutive severe COPD (FEV_1< 50% predicted) who underwent pulmonary rehabilitation between January 2013 to December 2013 . All the fourteen patients underwent pre and post cardiopulmonary exercise testing by SHAPE Cardiopulmonary Exercise Testing device. Four parameters were measured : Breathing Efficiency (VE/VCO_2 Slope), Resting Pulmonary Blood Flow ($PetCO_2$;mmHg), Change in Pulmonary Blood Flow ($\Delta PetCO_2$;mmHg), and Predicted O_2 Uptake Efficiency Slope(OUES).

Results: Breathing efficiency (VE/VCO_2) improved in nine out of 14 patients (64%) with a 9% improvement overall as a group (*P*= 0.06). Pulmonary resting blood flow ($PETCO_2$) improved in 8 out of 14 patients (57%) with a 9.4% improvement as a group (*P*= 0.01). Change in Pulmonary blood flow ($\Delta PetCO_2$;mmHg) 6 out of 14 improved, 4 unchanged and 4 patients had worsening and there was no overall statistical difference in the pre and post rehab values. For the Oxygen Uptake Efficiency slope measurements, 7 out of 14 patients showed improvement and 4 showed worsening and 3 patients had no change with no overall statistically significant difference.

Conclusion: There was a statistically significant improvement in Breathing Efficiency (VE/VCO_2) and Pulmonary Resting Blood Flow ($PETCO_2$) and no significant improvement in Change in $PETCO_2$ ($\Delta PetCO_2$;mmHg) and Oxygen Uptake Efficiency Slope(OUES). These findings support the use of Cardiopulmonary Exercise testing at baseline assessment in order to provide an accurate measure of the effects on Pulmonary rehabilitation on Cardiopulmonary physiology. These findings also confirm that cardiopulmonary physiology pulmonary rehabilitation in at least two of the four parameters measured by CPET testing. Further studies are recommended to confirm this and also to see if Pulmonary Rehabilitation can be modified to make definite improvements in the measured parameters for better objectivity and to achieve better standards.

Chronic Obstructive Pulmonary Disease in Peru: Prevalence Risk Factors Across Four Geographically Diverse Settings

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Background: Geographic and sociocultural factors may impact the prevalence of Chronic Obstructive Pulmonary Disease (COPD). In Peru, we assessed the prevalence and risk factors for COPD across four settings with variation in biomass fuel use, altitude, and urbanization.

Methods: We collected clinical and sociodemographic data, and post-bronchodilator spirometry in a randomly selected, age-, sex- and site-stratified, population-based study among 2,957 adults aged ≥35 years across four settings: Lima, Tumbes, urban and rural Puno. We defined COPD as a post-bronchodilator $FEV_1/FVC<70\%$. We performed regression analyses to determine characteristics associated with COPD and calculated population attributable risks (PARs) for significant factors.

Results: The prevalence of COPD was 6% (95% CI 5.1-6.8%), with notable differences across sites: highest in rural Puno (9.9%), followed by Lima (6.2%), urban Puno (6.1%) and semi-urban Tumbes (3.6%; $p<0.001$ for differences among sites). Daily smoking was uncommon (3.3%), and the PARs of COPD from smoking ≥10 pack-years were less than 10% for all sites. Other risks varied by site. In Lima, the highest PAR of COPD for both men and women was post-treatment tuberculosis (16% men, 22% women). In rural Puno, women who cooked with biomass fuel were more likely to have COPD (prevalence ratio 2.22, 95% CI 1.02-4.81), and the PAR was 55%.

Conclusions: COPD in Peru varied across sites, and in contrast to other settings, could not be primarily explained by tobacco smoking. We highlight the importance of local factors, including biomass fuel use and often neglected pulmonary tuberculosis, in COPD prevalence.

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COPD Co-morbidities: Examining Multiple Chronic Conditions Using Population-based Data

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Among the Healthy People 2020 objectives for COPD is "reduce hospitalizations for COPD." As a leading cause of hospitalization in older adults, COPD and its co-morbidities constitute a major public health burden on patient quality of life and healthcare costs. For Medicare beneficiaries, stroke and COPD, and COPD and chronic kidney disease are two of the five most costly dyads when examining multiple chronic conditions (MCCs). Using North Carolina (NC) as a case study, this presentation highlights population-based data on COPD prevalence, co-morbidities and smoking, the major risk factor.

2013 NC Behavioral Risk Factor Surveillance Survey (BRFSS) and NC inpatient hospitalization data provide background information on the prevalence and hospitalization burdens of COPD in North Carolina. A more detailed picture is then presented from two perspectives: adults with COPD and associated chronic diseases, and adults with these chronic conditions and COPD. The sample size of the NC BRFSS was over 8,800 adults aged 18 and older in households with telephones.

NC's COPD prevalence was 7.4% compared to 6.5% for the U.S. Significantly higher rates in NC were among those 55 years and older – the highest in the 65-74 year age group (14.1%). Rates for hospitalizations due to COPD in NC and the US were 5.68 per 1,000 population and 5.49 per 1,000, respectively. Inpatient hospitalization charges for COPD in NC totaled over $371 million in 2013, accounting for almost three-fourth (73.8%) of the charges for all chronic lower respiratory diseases. Adults with COPD reported the following chronic conditions: disability (65.8%); arthritis (63.1%); depression (43.8%); asthma (33.2%); history of cardiovascular diseases (29.4%); diabetes (25.7%); kidney disease (8.4%). Some adults with one of these chronic conditions also reported having COPD. Among adults with disability, 21.0% reported also having COPD; for those with arthritis, 17.8%; depression, 17.4%; history of cardiovascular disease, 22.1%; diabetes, 16.7% reported also having COPD; and kidney disease, 24.2%.

The 2013 BRFSS data showed that 87.3% of the NC adults with COPD reported two or more chronic diseases compared to 21.2% for respondents without COPD. Among adults with COPD, for those with two or more chronic diseases, 72.4% also had arthritis, 50.2% also had depression, 38.2% also had asthma, 29.4% also had diabetes, 9.6% also had kidney disease, 71.2% also had some form of disability, and 33.3% also had a history of cardiovascular diseases. Among adults with COPD, 38.9% were current smokers and 35.9% were

former smokers; 32.9% were exposed to secondhand smoke in their house at least one day a week and 26.7% were exposed to secondhand smoke seven days a week.

Based on these and other data, the NC COPD Taskforce has implemented community- and healthcare provider-based programs that employed multifaceted approaches that promoted awareness and education about COPD. Other strategies and activities involving healthcare networking and collaboration are presented to demonstrate the application of population-based data to address COPD issues in defined geographic regions within North Carolina.

A COPD Support Group Using a Novel Harmonic Device

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Funding Sources: Harmonica Techs supplied a Pulmonica® pulmonary harmonica to each participant. The Senior Friendship Center in Sarasota, Florida, supplied the space for the group meetings.

Objective: The objective of the program was to assess the effectiveness of a COPD support group that used a novel harmonic device requiring no musical ability or prior musical training. The purpose and function of the unique harmonic device is to vibrate the airways that lead to the lungs to loosen tenacious secretions, encouraging coughing and making it more productive.

Participants and Methods: Nine participants with either Stage II or Stage III COPD were selected and had their histories documented, including: chest findings, co-morbidities, plausible confounds, spirometry, six-minute walk tests, and Quality of Life (QOL) assessments. Each of the participants attended at least four of eight group sessions conducted by the authors and two assistants. Participants were taught diaphragmatic breathing, proper therapies, and simple home exercises. The harmonic device, a Pulmonica® pulmonary harmonica, was given to each participant during the second group session. These specially tuned harmonicas deliver low frequency pulses into the lungs that can be felt on participants' chests or backs. During group sessions, lively discussions occurred, often comparing Pulmonica® experiences. At the study's end, each participant was interviewed and clinically reassessed.

Results: Clinically significant improvements in most measures were observed for each participant. The group had only nine participants but due to the substantial changes in the pre and post testing, statistically significant ($p < .05$) improvements occurred in six-minute walk, FVC, FEV1, and QOL scores. From the nine participants, 35 pairs of pre-post testing results were obtained for these four key measures. The one measure that could not be obtained was a six minute walk post-test for a participant experiencing arthritic knee pain. Of the 35 paired tests obtained, only two pairings (5.7%) declined (FEV_1 for one participant and 6-minute walk for another). Further, only one pairing showed no change (6-minute walk). After accounting for those three paired measures, 91.4 percent of all paired assessments showed an improvement over eight weeks. The largest effect sizes were seen for FVC and FEV_1. As a group, FVC improved a relative 46 percent, and FEV_1 improved a relative 34 percent. Further, each of the participants stated that the pulmonary harmonica helped clear tenacious secretions, promoted diaphragmatic breathing as a habit, and characterized daily use of the Pulmonica® as enjoyable.

Limitations: Co-morbidities, additional clinical attention, and confounding life situations are also assumed to influence the clinical measurements and QOL scores but could not be statistically controlled with a group of nine participants.

Conclusions: This non-random, single group, COPD support group focusing on pulmonary harmonica use produced statistically significant improvements in clinical and psychosocial assessments for all nine participants. Influences of co-morbidities and potential confounds highlight the need for scrutiny of factors other than disease pathology affecting the clinical presentations of COPD. Although the positive influence from pulmonary harmonicas on symptoms of COPD was not rigorously proven, the effectiveness of the

pulmonary harmonica was unanimously affirmed by participants' anecdotal reports of improved breathing with clearance of tenacious sputum after using the pulmonary harmonica.

Incorporating Noninvasive Open Ventilation (NIOV™) System into a Pulmonary Rehabilitation Program: Effect on Exercise Endurance

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Funding Sources: None

Purpose: Pulmonary rehabilitation (PR) has been shown to improve dyspnea, exercise capacity, and hospitalization rates.[1-2] Numerous adjunctive treatments that aim to further improve rehabilitation outcomes have been studied.[3] Increasing activity and exercise capacity are important factors in improving long-term outcomes in chronic lung disease. The intent of this study was to evaluate whether the wearable noninvasive open ventilation (NIOV) system would improve exercise endurance beyond a standard PR program.

Methods: In this retrospective case series, we evaluated the effect of a wearable noninvasive open ventilation system on exercise endurance in subjects with chronic respiratory disease in a PR program. To allow a general assessment of efficacy, we incorporated a control group of subjects with similar baseline characteristics. All subjects participated in the Pulmonary Rehabilitation Program at Saint Barnabas Medical Center in Livingston, NJ, and completed a 36-visit PR program. Subjects in the test group used the NIOV System during exercise for all PR visits (NIOV group). Subjects in the control group used standard oxygen as needed during exercise for all PR visits. The exercise regimen for both groups consisted of a standardized set of exercise activities administered by the Saint Barnabas PR staff.

Results: Seven subjects (7F/0M) with moderate to very-severe chronic lung disease were assessed in the NIOV group. Nine subjects (5F/4M) with moderate to severe chronic lung disease comprised the control group. Mean age ± SD was 59.0 ± 18.0 and 63.3 ± 8.9 years for the NIOV group and the control group, respectively. Mean pulmonary function was significantly (p<0.05) poorer in the NIOV group as indicated by FEV_1% predicted, FEV1/FVC, and median GOLD stage. At the end of 36 PR visits, the mean change in exercise time was significantly higher (p=0.0302) in the NIOV group (24.3 ± 9.1 minutes) vs. the control group (15.2 ± 6.0 minutes). Absolute exercise time was also higher in the NIOV group (42.3 vs. 37.8 minutes), however, was not statistically significant (p=0.1654).

Conclusions: Despite a more severe chronic lung condition with poorer pulmonary function values and greater need for supplemental oxygen, the subjects in the NIOV group demonstrated a significantly greater improvement in mean exercise time vs. control group. In addition, absolute exercise time was slightly longer. Although the numbers are small, this initial case series indicates that incorporating the NIOV into a standard PR program for select patients may achieve greater benefits from their training regimens.

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Lung Microbiome Dynamics in Chronic Obstructive Pulmonary Disease (COPD) Exacerbations

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Increasing evidence suggested that bacterial infection plays an important role in the development of COPD and its exacerbation. We carried out a 16S rRNA based longitudinal survey on sputum samples collected from 87 COPD patients at four disease stages: exacerbation, post therapy, recovery and stable. We found a notable bacterial composition shift toward a higher ratio of Proteobacteria/Firmicutes during exacerbation, which was mainly driven by a decrease of Streptococcus and a significant increase of Moraxella at the genus level. In addition, Principal Coordinate Analysis and UPGMA clustering showed a distinct clustering of patients with pre-defined bacterial- and eosinophil-predominant exacerbations, suggesting microbiome has a potential to distinguish certain COPD exacerbation phenotypes. Different treatments exhibited varying effects on the alternation of microbial community. In particular, there was an increased ratio of Proteobacteria/Firmicutes through time in patients treated with steroid alone, whereas a reversal trend was observed in patients with antibiotic treatment or a combination of both treatments. Co-occurrence analysis suggested a "non-coexistence" relationship between several bacterial pathogens and their closely related non-pathogenic counterparts, consistent with bacterial interference theory that commensal bacteria could interfere with pathogens by competing for resources. This study furthers our understanding of the lung microbiome's role in COPD severity and its potential for respiratory therapeutics.

The study was sponsored by University Hospitals of Leicester NHS Trust. Study cohort BEAT-COPD was co-funded by Medical Research Council, UK and AstraZeneca with analysis funded by GSK.

Pulmonary Function Among Latino Thoroughbred Workers – A Pilot Study

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Background/Objectives: Evidence suggests working in horse barns is associated with adverse respiratory effects among Latino thoroughbred workers, yet no studies to date have measured pulmonary function. We examined the prevalence of self-reported respiratory symptoms, abnormal pulmonary function, and associated occupational factors among Latino thoroughbred farmworkers.

Methods: Participants were recruited via a community-based, purposive sampling strategy and participated in an interview-administered survey and spirometer test. 80 surveys and spirometry tests were administered by two trained health promoters (Promotoras) in July-September 2014. Pulmonary function (abnormal/normal) was classified by a pulmonologist. Demographic and occupational factors—such as years living in the US, years employed on current farm, hours of barn/dust exposure, and use of dust masks—were assessed for associations with respiratory outcomes.

Results: Participants were primarily male (74%) and of Mexican nationality (76%), while 21% were current smokers, 18% were former smokers, and 61% had never smoked. On average, participants were 37 years old, had lived in the US for 17 years, and were employed for 5 years at the current horse farm. Participants reported working in a barn an average of 21 hours/week and working in dusty conditions an average of 22 hours/week. 28% of participants reported wearing a dust mask in the barn with largely infrequent usage (94%). A significant proportion of participants (79%) reported experiencing upper and/or lower respiratory symptoms in the past 12 months. The prevalence of physician or nurse diagnosed asthma was 18% and the prevalence of abnormal pulmonary function was 27%. Among those with abnormal pulmonary function, one participant showed signs of obstructive lung function, while the remainder showed signs of restrictive lung function. Multivariate logistic regression indicates that a shorter duration of horse farm employment (≤5 versus >5 years) and a shorter time living in the US (≤10 versus >10 years) increases the odds of abnormal pulmonary function.

Conclusions: Latino thoroughbred workers may be at risk for adverse respiratory conditions due to chronic exposure to dusty barn environments and limited use of dust masks. Our results also indicate that recent arrival in the US was associated with decreased pulmonary function, which may be exacerbated by respiratory exposures encountered on the horse farm. This risk may be further heightened by the belief that those new

to the horse farm may be placed in the least desirable and dustiest jobs. Future research will further clarify the occupational and social factors affecting the respiratory health of this worker group.

The Role of the Pharmacist on Multidisciplinary COPD Care Transition Teams

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Background: Positioning nurse care managers at the point of hospital discharge has become a mainstream countermeasure to reduce preventable readmissions. In the management of complex populations with intensive medication regimens, such as COPD patients, a multidisciplinary team approach has advantages. In particular, the presence of a full-time pharmacist, specially trained to manage COPD and its comorbidities in both inpatient and outpatient settings, can be invaluable in educating patients, reducing adverse drug reactions, and enhancing medication adherence. Workflow design is of paramount importance when blending professionals to assure that team members complement one another, overlap and duplication are minimized, and individuals are empowered to perform at the "top of their licenses".

Methods: In Pittsburgh Regional Health Initiative's Primary Care Resource Center (PCRC) Project, hospital-based care coordination hubs were created in 6 community health systems in western Pennsylvania and northern West Virginia, specifically charged with lowering readmission rates for COPD and its major comorbid conditions (heart failure and coronary artery disease). Each PCRC team was comprised of 1 pharmacist, 3-4 nurse care managers, and an administrative assistant. Teams engaged patients at the point of admission, and applied a prescribed clinical protocol through discharge and possibly one or more home visits, communicating all findings to the primary care physician. Pharmacists were given two critical tasks to be performed on each enrolled patient: (1) comprehensive medication management, either during the admission (at bedside) or within 5 days of discharge (by telephone or at a PCRC office visit); and (2) telephone check-in with the patient within 72 hours of discharge. (Nurse care managers were accountable for other services in the discharge task bundle, such as identifying and addressing the root cause for admission, providing disease-specific education, and reinforcing the discharge action plan.) Pharmacists kept records of value-added services, and were encouraged to design site-specific innovations.

Results: Between July 2013 and September 2014, the 6 PCRC teams engaged 7,318 admissions, of which 2,920 (39.9%) had a diagnosis of COPD. PCRC pharmacists performed 5,098 telephone calls, reaching 69.7% of discharges within 72 hours. Comprehensive medication management was completed in 80.7% of admissions. Pharmacist-reported interventions included: identifying drug-drug interactions; promoting drug adherence; inhaler training; refinement of the discharge medication list, with elimination of duplications; management of polypharmacy; generic switching; and helping patients obtain prescriptions. Qualitatively, the pharmacist was a reliable and irreplaceable part of the care team. Site-specific innovations by the pharmacists included: creating a system to reconcile discharge medications directly into physicians' office electronic medical records; creating customized medication action plans; supporting smoking cessation; and proactively identifying patients on high-hazard medications for additional counseling.

Conclusion: A full-time pharmacist is a valuable addition to a COPD care transitions team. In the model described, the lone pharmacist at each PCRC was challenged by the volume demands of the hospitals. In a highly integrated team model, the singular contributions of the pharmacist are evident, but difficult to quantify.

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Creating a Multidisciplinary COPD Clinical Pathway to Complement a COPD Care Transition Team

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Background: Clinical pathways are invaluable opportunities for hospitals to revisit and redefine standards of comprehensive multidisciplinary care, specifically aligned with its own workforce and culture. Published reports indicate that preparing patients prior to discharge has a positive impact on these outcomes; however creating a way to efficiently coordinate this care across disciplines can be challenging. To support an innovative COPD care transition pilot, an evidence-based inpatient care management pathway was developed to lead to a "perfect" COPD discharge, to customize evidence-based care at the local level, and to integrate inpatient and post-acute care services. In addition to basic diagnostic and treatment elements, the pathway drives engagement of the COPD care transition team at the time of admission to focus on preparing the patient for discharge.

Methods: In collaboration with the Pittsburgh Regional Health Initiative (PRHI), a community hospital launched a comprehensive COPD readmission reduction initiative, the Primary Care Resource Center (PCRC) pilot project. An extensive literature review was conducted, and national and local experts consulted to provide input into the development of an evidence-based COPD clinical pathway. A multidisciplinary pathway design team was assembled six months prior to PCRC launch to customize the pathway based on local capabilities and culture. Bi-weekly meetings were held with the team that included representatives from pharmacy, respiratory therapy, social work services, hospital administration, quality improvement, nursing leadership, and designated physician champions. In addition, a representative from clinical informatics was added to the pathway design team to ensure alignment of the electronic health record (EHR) with the pathway design and documentation. A "current state" assessment was conducted, updated clinical recommendations reviewed, and a comprehensive COPD inpatient care pathway developed. Key design elements include: early activation of consultants; early assessment of functional capacity to identify those in need of rehabilitation; inpatient training on anticipated discharge inhaler regimen; optimization of inpatient and family education; and early conversion of nebulizers to inhalers. In addition to basic diagnostic and treatment elements, the pathway drives engagement of an interdisciplinary team at the time of admission to focus on preparing the patients for discharge. Elements of the pathway supported by the EHR include patient identification mechanisms, consultant activation, and a COPD-specific physician discharge checklist. Reports driven off of the EHR database help to support pathway quality improvement efforts.

Results: In the year following implementation of the PCRC and customized COPD clinical pathway, there is evidence of pathway impact: all-cause COPD admissions and readmissions have decreased, the percent of smokers has decreased, patients prescribed appropriate therapy at discharge has increased. In addition, patients routinely receive an inpatient pharmacist visit and medication review, patients have received education about managing their disease and medications prior to discharge, and referrals to cardio-pulmonary rehabilitation have increased.

Conclusions: It is often a challenge to successfully integrate evidence-based care pathways into practice. Creating a multidisciplinary team supports local customization of an evidence-based pathway and successfully integrates complementary COPD care transition team members.

Source of Funding: Jewish Healthcare Foundation

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Standardizing Inhaler Training Across a COPD Care Management Project

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Background: A barrier to inhaler efficacy in COPD care is poor self-administration technique – revealed in observations of both patients and training providers.

Aside from the absence of consensus-driven training protocols, the problem has been compounded by the proliferation of new medications with idiosyncratic delivery systems. Standardizing a training program across inpatient and outpatient settings is a daunting challenge. However, it is feasible to standardize and perfect training in a core group of committed COPD care transition specialists, with the expectation that those learnings will spread.

Methods: In Pittsburgh Regional Health Initiative's Primary Care Resource Center (PCRC) Project, a team of 29 full-time nurses and pharmacists, representing 6 community health systems in Pennsylvania and West Virginia, was charged with lowering COPD 30-day readmission rates. All providers received 8-hours of live classroom training in advanced disease management by the COPD Foundation in October 2013. A core principle of the project is that 100% of COPD inpatients receive inhaler training and teach-back assessment from a PCRC team member before discharge; however between July 2013 and June 2014, only 1,316 of 2,210 (59.5%) COPD inpatients received that training. Gap analysis revealed not only unclear accountability for inhaler education, but PCRC staff also cited low confidence in training skills and discomfort with the expectation to master 12 delivery systems (identified in site surveys).

A COPD steering group was assembled comprised of nurses, pharmacists, respiratory therapists, and a pulmonologist. Review of 2012-4 regional paid-claims data from Highmark, Inc., showed that 80% of inhalers prescribed for COPD were from only 5 delivery systems: generic albuterol metered-dose inhaler (34.7%); salmeterol/fluticasone dry power (16.4%), aerosolized tiotropium (16.1%); ipratropium/albuterol (11.8%); budesonide/formaterol (7.7%); all others (13.2%). A three-hour training program was created for only the 5 commonly used devices, utilizing checklist-driven protocols, role-playing breakouts (patient, clinician, and rater), and pre- and post-test self-assessments. Placebo inhalers were obtained from medical suppliers or vendors. For uncommonly prescribed agents, patient education videos were archived to be loaded onto hand-held tablet computers suitable for bedside teaching. Continuing education credits were offered for the training.

Results: (To be updated before presentation) The COPD inhaler training curriculum will be delivered to an estimated 40 trainees at 5 PCRC project sites in March-April 2015. Only three trainers will be required for the entirety of the training. Pre- and post-test knowledge assessment scores will be reported, as well as the qualitative impact on provider self-confidence. Trainees will be re-evaluated for knowledge retention at 30-days. The impact on 30-day COPD readmission rates self-assessment scores will be reported. It is anticipated that the experience will meet the needs of the providers, boosting their confidence as care managers.

Conclusion: A completely standardized inhaler training program can be rapidly conducted across multiple health systems with as few as 3 facilitators, providing content is limited to high prevalence medications, a core of trainee champions is identified, and reinforcement is planned.

Source of Funding: CMS Innovation Center (Health Care Innovation Award)

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Motivational Interviewing to Improve Patient Engagement in COPD Care Transitions

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Background: Patient self-motivation is a critical driver of success in the management of patients with complex conditions dependent on medication adherence and lifestyle modifications. This is particularly important in COPD population management, where inhaler compliance, smoking cessation, pulmonary rehabilitation, and adherence to a disease action plan are essential to prevent needless re-hospitalizations. Motivational interviewing (MI) is a tool providers can be taught to more effectively engage their patients in healthy behaviors. It employs guided, goal-oriented conversation to address the natural ambivalence toward change, building trust through the patient's own value system, and specifically avoiding messaging that subconsciously triggers resistance (such as judging,

scare tactics, etc.) MI has great potential to enhance outcomes in readmission reduction programs, but optimal training strategies for providers are unclear.

Methods: In Pittsburgh Regional Health Initiative's Primary Care Resource Center (PCRC) Project, hospital-based care coordination hubs were created in 6 community hospitals in western Pennsylvania and northern West Virginia, specifically charged with lowering readmission rates for COPD and its major comorbid conditions (heart failure and coronary artery disease). By project protocol, patients are enrolled at the index hospitalization, then given disease-specific education, counseling, and support that extends through discharge and one or more home visits by the PCRC team. A recognized barrier was the number of patients who refused engagement with the PCRC team. The 6 PCRCs were staffed with 35 nurse care managers, pharmacists, and administrative assistants, all of whom underwent 8 hours of didactic training in MI as a group in November 2013. Training involved review of MI concepts, case discussions, and patient simulations using paid actors. Beginning four months later, a PRHI MI facilitator conducted personal coaching of PCRC team members using observations of live patient visits or telephone encounters, then scoring them pre- and post-coaching using a Modified-MITI (Motivational Interviewing Treatment Integrity) scale. Patient refusals of PCRC enrollment were tracked throughout.

Results: In the study sample between October 2013 and July 2014, the 6 PCRC teams enrolled 2,596 patients into the project, with 169 individuals refusing. Fourteen PCRC team members successfully received personalized coaching between March and July 2014, exhibiting a 14.3% increase in their modified-MITI scores. During the post-coaching period, the number of refusals was 34% lower. In the project quarter that followed coaching (July-October 2013), the 30-day all-cause COPD readmission rate fell 19.1% compared to the like quarter in the prior year (p=0.12).

Conclusions: Motivational interviewing is a valuable provider tool to improve patient engagement in COPD population management. A standardized multi-stage protocol of training is proposed, with early results suggesting a possible contribution to better COPD outcomes.

Source of Funding: CMS Innovation Center

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Reducing Readmission and Costs with Specialized COPD Care Transition Teams: The Primary Care Resource Center Project

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Background: Targeted use of care managers at the point of hospital discharge has shown promise in reducing preventable readmissions. We describe successful implementation of a novel team model of hospital-based transition support, specifically designed to manage COPD populations. Unique components of the care model include: (1) specialized advanced team training in both COPD and major comorbid conditions (heart failure and coronary disease); (2) establishing a full-time pharmacist as a key team member; and (c) integrating the team into the seamless transition of care to primary care offices. The model is designed for mid-sized community hospitals, and aspires to be an effective alternative to costly specialty-sponsored disease management clinics.

Methods: In 2013, Pittsburgh Regional Health Initiative (PRHI) launched the Primary Care Resource Center (PCRC) Project in 6 community hospitals (150-500 beds) in western Pennsylvania and northern West Virginia. At each site, a PCRC was built within the hospital, and staffed by a full-time team of nurses, pharmacists, and administrative assistants. Teams were charged with engaging all inpatients with COPD, heart failure (HF), and acute myocardial infarction (AMI) and implementing a 6-part "Perfect Discharge" bundle: a root cause analysis of the admission/readmission; 30 minutes of bedside education for patients and families; comprehensive medication management by the PCRC pharmacist; coordination of an action plan with specialist and primary care physicians; telephone call to all patients within 72 hours of discharge; and electronic communication of all results to physicians within 72 hours. Home visits by the same PCRC team within 5

days was offered. The 35 staff personnel hired for the PCRCs received training from the following groups: advanced COPD care, from the COPD Foundation (8 hours), advanced cardiac care, from the American Heart Association (8 hours), quality improvement, from PRHI (24 hours); and motivational interviewing, from PRHI (8 hours).

Results: Between July 2013 and November 2014, the 6 PCRC hospital teams engaged 6,648 admissions, of which 2,674 had COPD alone or in combination with HF and/or AMI. By 3Q2014, inpatients were receiving 84% of the intended 6-element "Perfect Discharge" bundle, and 20% consented to home visits. Qualitative endpoints included improved inhaler self-administration proficiency, and increased referrals to pulmonary rehabilitation, smoking cessation, and end-of-life planning. In 3Q2014, 30-day all-cause, all-payer COPD readmission rates had fallen 19.1% (p=0.12) at PCRC hospitals, compared to the like-quarter of the prior year. Review of 90-day post-acute care costs of Highmark Medicare Part C beneficiaries revealed a $1,099 (7.85%) savings per beneficiary for the 3 target diseases, with significant re-hospitalization prevention cost savings only partially offset by slight increases in prescriptions and outpatient care.

Conclusions: The PCRC Project is an economical, efficacious, and cost-efficient model for community hospitals to lower COPD readmissions and total costs of care, while simultaneously impacting HF and AMI outcomes. A longer study period will be needed to attain statistical significance of gains.

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COPD, Asthma, and Pulmonary Function in the 2007-2010 National Health and Nutrition Examination Survey

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Introduction: The National Health and Nutrition Examination Survey (NHANES) is a series of cross-sectional surveys to assess the health and nutrition status of the U.S. population. In the NHANES 2007-2010 cohort, 12,752 adults participated, of which 9,565 had spirometry data. Those participants with self-reported COPD, self-reported current asthma, or neither were included in the current analysis. Pulmonary function outcomes were evaluated including mean FEV_1(% predicted), mean FEV_1/FVC, % with spirometry, % with obstruction, % with restriction, % with bronchodilator, % with significant bronchodilator response, and mean % improvement in FEV_1.

Results:

Table 1. Statistical Analysis for Lung Function Examination

Measurement	Self-Reported COPD	Self-Reported Current Asthma	None
Mean FEV_1 (% predicted)	85.5	86.3	95.4
Mean FEV_1/FVC	0.72	0.73	0.76
% having spirometry	67	77.9	78.9
% with obstruction	29.6	31.9	17.8
% with restriction	13.6	14.3	9.9
% with bronchodilator	11.5	19	11
% with significant responsea	11.4	18.8	8.8
Mean % improvement in FEV_1[b]	5.9	7.9	4.9

[a]Significant response: After bronchodilator, % improvement in FEV_1 > 12% and the increase in FEV_1 or FVC > 200ml.

[b] % improvement in FEV_1 = ((FEV1 after bronchodilator - FEV_1 before bronchodilator)/FEV_1 before bronchodilator)×100.

Table 2. Difference (95% CI) or OR (95% CI) Between Each Group and the Reference Group[a]

Measurement	Self-Reported COPD	Self-Reported Current Asthma	None
Mean FEV_1 (% predicted)	-7.8 (-11.4 to -4.3)	-9.3 (-12.0 to -6.7)	Ref (0.0)
Mean FEV_1/FVC	-0.03 (-0.04 to -0.01)	-0.04 (-0.05 to -0.02)	Ref (0.0)
% having spirometry	0.62 (0.43-0.91)	0.83 (0.60-1.16)	Ref (1.00)
% with obstruction	1.63 (1.04-2.56)	3.15 (2.01-4.92)	Ref (1.00)
% with restriction	1.18 (0.75-1.84)	1.27 (0.85-1.91)	Ref (1.00)
% with bronchodilator	0.77 (0.46-1.29)	2.31 (1.48-3.60)	Ref (1.00)
% with significant response[b]	1.66 (0.34-8.07)	1.90 (0.66-5.50)	Ref (1.00)
Mean % improvement in FEV_1[c]	3.2 (-0.3 to 6.8)	2.4 (0.5 to 4.2)	Ref (0.0)

[a] Adjusted for age, gender, BMI, race/ethnicity, education, physical activity, and cigarette smoking.

[b] Significant response: After bronchodilator, % improvement in FEV_1 > 12% and the increase in FEV1 or FVC > 200ml.

[c] % improvement in FEV_1 = ((FEV_1 after bronchodilator - FEV_1 before bronchodilator)/FEV_1 before bronchodilator)×100.

Discussion: Compared with those without asthma and COPD, participants with COPD were significantly less likely to have spirometry, although participants with

asthma or COPD had significantly decreased lung function. The proportion of participants with abnormal spirometry (either obstruction or restriction) was also increased in the two disease groups, although over 25% of participants without these two diseases had abnormal spirometry. Participants with asthma were more likely to have a bronchodilator than the other two groups, although their mean improvement in the FEV_1 relative to the baseline value was similar to that seen in the COPD group.

Conclusion: People with self-reported COPD or self-reported asthma had impaired lung function compared with people without these diseases; however, these people were less likely to have spirometry examination, especially for those with self-reported COPD. More than a quarter of people with neither disease also have abnormal lung function.

The Effectiveness of Social Media For COPD Patient Education

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This was a self-funded research initiative.

Abstract: The current state of COPD education in the United States is poor. The results of the 2014 COPE survey from the COPD Foundation highlight many deficits throughout the primary care system, from lack of physician preparation to the inability of patients to retain training. While research continues into the most effective design for a COPD patient education program, existing data suggests that the most effective patient education programs are those that are multidisciplinary, multimedia, and longitudinal.

Unfortunately, with recent major reductions in reimbursement for pulmonary rehabilitation and the ever-present threat of reimbursement reductions throughout primary care, physicians simply do not have the time or resources to develop such programs for their patients. In addition, larger hospital systems have been slow to adopt continuum-of-care programs to improve coordination between inpatient management of COPD and the outpatient world.

Many patients are thus left in the position of being motivated to properly manage their COPD, but not having the proper tools or knowledge to do so. This leaves them to seek information on their own, oftentimes using the Internet to do so. However, the unregulated nature of the Internet provides a fertile breeding ground for faulty or biased information, scams, and confusion. Despite these negative aspects, the accessibility and ease of use of the Internet, as well as its ability to deliver information in a variety of formats and in an asynchronous fashion, make it an ideal educational tool.

Social media can be particularly effective. In addition to the other advantages of the Internet, social media offers the kind of support and experiential learning that is invaluable to COPD management, and can give otherwise-isolated patients a sense of belonging to a community. This poster examines the experience of COPD Navigator, a Facebook group administered by a respiratory therapist and certified COPD Educator, including the results of a survey of COPD patients regarding attitudes and quality of life both before and after joining the group. Objective and anecdotal data suggest that groups like COPD Navigator can be effective teaching and support environments for the management of COPD, and may be able to help guide patients to resources that would otherwise be inaccessible or overlooked.

Changes in Dyspnea Accompanying Exercise Training in Patients with Moderate to Severe COPD

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Study Objectives: Dyspnea is a debilitating symptom that affects exercise capacity, quality-of-life, morbidity and mortality in many chronic diseases including COPD. Dyspnea is multidimensional and its importance in clinical decision-making is accumulating. This study examines and quantifies dyspnea using multiple instruments, before and following exercise rehabilitation from a quality-of-life perspective, as well as, during exercise stress using multiple exercise testing strategies.

Design, Patients and Intervention: This prospective clinical trial enrolled 126 patients with moderate to severe COPD (%PredFEV_1 = 45.9 ±12.5%) who were evaluated before and after 16 weeks of exercise

training (ET). Patient assessments included: pulmonary function tests; gas exchange; cycle ergometry (CE) and arm ergometry (AE); 6-minute walk test (6MWT) with dyspnea measured using Borg scores and with the multidimensional Chronic Respiratory Disease Questionnaire (CRQ).

Results: Following ET, work performance was significantly increased for CE, AE and 6MWT (p <.0001) and these changes were also considered clinically significant albeit with no change in pulmonary function (p >.05). Borg scores at peak exercise decreased for CE (–0.95 ± 2.8 units, p <.003); AE (-0.8 ± 2.6 units, p <.02) and 6MWT (-0.5 ± 2.3 units, p <.05) even though the total work output was significantly greater. Borg scores for CE and AE at isotime demonstrated significant improvement (CE –1.4 ± 2.0, p <.0001 & AE –1.0 ± 2.1, p<.0001). Statistically significant and clinically relevant improvement in CRQ dyspnea (7.00 ± 5.76 (p <.0001); emotional function (4.5 ± 6.3, p <.0001); fatigue (4.1 ± 4.1 p <.0001); mastery 3.1 ± 3.5, p <.0001) and total CRQ score (20.0 ± 15.9, p <.0001) were observed. Our data further suggest that a 13-watt or 12-watt or greater increase for CE and AE respectively represents clinically significant improvements.

Conclusion: ET improves upper and lower extremity work performance and significantly reduces dyspnea during exercise. CRQ data suggest that improvements in exercise capacity are perceived to favorably impact quality-of-life via a reduction in dyspnea during activities of daily living. Thus, ET is able to reverse some of the functional loss imposed by chronic COPD with a reduction in dyspnea. Lastly, a 13-watt increase in CE and 12-watt increase in AE can be considered as the minimally clinically significant change in workload for the legs and arms respectively.

Assessing the Relationship Between Lung Function and Dust Exposure Among Farm Show Participants: A Pilot Study

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Background/Aim of Study: Occupational exposure can help to explain approximately 20 percent of patients with COPD. While smoking remains the primary risk factor for COPD, 20 percent of patients who die from COPD are never smokers. Agricultural workers are exposed to occupational inorganic and organic dust, placing them at an increased risk for lower respiratory diseases, such as COPD. The goal of this research was to evaluate whether there is a correlation between dust exposure and respiratory lung function among participants of two Agricultural Farm Shows utilizing the Vitalograph COPD-6®. The Vitalograph device can provide a simple and innovative method to determine those at risk for early stage COPD.

Methods: In 2015, 134 participants were evaluated based on their occupation, exposure to dust, smoking history, and other respiratory co-morbidities. Our main outcome measure was lung function, assessed through a Vitalograph COPD screening device. This classified subjects as "Obstructed" (FEV_1/FEV_6 < 0.70) and "Low lung function" (FEV_1 < 80% predicted). Note that these two are not mutually exclusive! We developed regression models to determine correlates of obstruction and low lung function, focusing on reported dust exposure.

Results: Of 134 farm show participants, 90 were male (67.7%) with a mean age (SD) of 48.7 (17.1). The majority of the participants were married (74.4%), Caucasian (96.3%), and lived on farms (64.4%) and 63 participants identified agricultural as their primary mode of income (47.0%). 29 were ever smokers (21.80%) and 100 of the participants reported being exposed to dust (74.6%). 16 (11.9%) were obstructed and 33 (24.6%) had low lung function. The logistic regression model show that those with dust exposure had more obstruction (odds ratio [OR] 2.6, 95% confidence interval [CI] 0.6, 12.1), whereas no affect was seen predicting low lung function (OR 0.72, 95% CI 0.3, 1.7).

Conclusion: Preliminary findings suggest that compared to participants who report no dust exposure, those individuals with dust exposure are more likely to have obstruction, but not low lung function.

Funding Source: The Central Appalachian Regional Education and Research Center (CARERC) pilot funding project.

A Quality Improvement Study to Decrease COPD-Related Readmission and Average Length of Stay Through the Implementation of a COPD Transitions of Care Program

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Background: Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death in the United States and patients with COPD utilize significant healthcare resources with an estimated cost of 50 billion dollars annually. Centers of Medicare and Medicaid Services (CMS) has proposed penalties on hospitals for readmissions with certain diagnoses, and in 2015 plans to expand it to patients admitted with COPD exacerbation. Winthrop University Hospital (WUH) implemented a multidisciplinary approach in an effort to decrease the rate of hospital length of stay for patients with COPD exacerbations and prevent readmissions.

Methods: In a prospective quality improvement study, all patients admitted to WUH with COPD exacerbation from January 2010 to May 2014 were included. A COPD Transitions of Care Program (CTC) was initiated on January 2013 to develop an orderly transition from the hospital to a safe discharge. CTC included educational initiatives for medical personnel, formation of a specially-designed sub-acute rehabilitation transition program and development of a standardized order set. A dedicated Pulmonary Nurse Specialist/ Transition Care Coordinator supervised the program and education sessions. We analyzed pre and post intervention average length of stay (ALOS) and number of readmissions.

Results: A total of 1627 COPD admission cases were reviewed for a period of 52 months from January 2010 to May 2014. From 2010 to 2012, ALOS for COPD patients with exacerbations for WUH was 6.60 days whereas ALOS was 5.83 days for other hospitals in the Long Island Health Network (LIHN). Post-intervention ALOS was 5.53 days for WUH compared to 5.67 days for LIHN in 2013. The readmission rate was 16.2% (n=180/1111) for WUH pre-intervention and 14.3% (n=74/516) post-intervention. The post-intervention readmission rate was compared to the New York Presbyterian Healthcare system readmission rate of 18.5% in a 2013 Member Performance Report. Of the hospitals in the NYP system, Winthrop had the second lowest readmission rate for COPD (13.7%) in 2013.

Conclusion: In a single center quality improvement study, implementation of a COPD transition program helped reduce readmission rates and ALOS. This study highlights the importance of collaborative intervention aimed at education, early mobilization and physical rehabilitation.

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The Relationship between GOLD Grouping and Nutritional Status in Patients with Chronic Obstructive Pulmonary Disease

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Background: The Global Initiative for Chronic Obstructive Lung Disease (GOLD) strategy for the assessment of COPD was revised in 2014, and COPD patients are classified into groups A, B, C, and D. The GOLD ABCD groups help the treatment for COPD patients more efficient, but malnutrition was often neglected in the managements of patients with COPD.

Aim: This study examined the nutritional status of patients with COPD, and explored the relationship between GOLD grouping and nutritional status.

Methods: A total of 116 subjects were recruited at a medical center in northern Taiwan. For the combined COPD assessment, we selected the COPD assessment test (CAT) scale for assessing symptom, and used lung function and the history of exacerbation to assess the risk of exacerbation. The nutritional status was evaluated using the Mini Nutritional Assessment (MNA) questionnaire and body composition was measured with a body fat analyzer (Tanita BC-565-WH, Japan).

Results: The subjects were mostly men (96.6%) and had a mean age of 70.6 (SD=10.9) years. Underweight (BMI<20kg/m^2) occurred in 15.5% of the COPD patients. The nutritional status indicators of the elderly patients (>75 years old) were worse than in younger patients, particularly in terms of BMI, fat-free mass (FFM) and fat-free mass index (FFMI). Patients who did not work had worse FFM and FFMI result, because most of them were older retirees. The nutritional statuses of COPD patients with comorbidities were unnecessarily worse. This was due to the fact that many COPD patients may also have metabolic syndrome. Exacerbation frequency was significantly associated with the MNA scores ($p<0.001$). $FEV_1/FVC\%$ of lung function was positively correlated with FFM ($r=0.229$, $p=0.014$). In terms of the GOLD grouping, 32.8% of the subjects were group A, 25.9% were group B, 17.2% were group C, and 24.1% were group D. 68.8% of the patients in groups C and, D were malnourished and at risk for malnutrition. The MNA scores were generally lower with increasing COPD severity according to GOLD grouping ($p<0.001$). In multiple linear regression analysis, the MNA scores were related to the severity of COPD base on GOLD grouping.

Conclusions: The GOLD grouping were significantly associated with MNA scores, so we suggested that nutritional assessments and dietary health education should be conducted for COPD patients classified in groups C and D of the GOLD grouping in order to improve the health status and prognosis for each of these patients.

Key words: chronic obstructive pulmonary disease (COPD), malnutrition, nutritional status ABCD groups, mini nutritional assessment (MNA), body composition