

Are We Following Evidence-Based Guidelines for the Treatment of Acute COPD Exacerbations at University Hospital?

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Abstract:

The World Health Organization estimates the third leading cause of death worldwide is Chronic Obstructive Pulmonary Disease (COPD). In 2019, COPD caused 3.23 million deaths, of which 80% occurred in low- and middle-income areas. Costs attributable to having COPD were \$32.1 billion in 2010 with a projected increase to \$49.0 billion by 2020. The purpose of this study was to identify the compliance with evidence-based guidelines for the treatment of acute COPD exacerbations at University Hospital by providers.

Our results indicated the best providers compliance with admission chest x rays with a rate of correctly performed of 98% (94.1, 101.9%). Following that, was the use of inhaled anticholinergic bronchodilators and inhaled short acting beta agonists with a rate of 92% (84.5, 99.5%). There was a nearly identical compliance rate observed for use of noninvasive positive pressure ventilation at 84% (73.8, 94.2%) and use of narrow spectrum antibiotic at 86% (76.4, 95.6%). And significant drops were noted in the compliance rate of avoiding mucolytic medications, chest physiotherapy, or methylxanthine bronchodilators at 74% (61.8, 86.2%) and with the compliance rate of use of systemic corticosteroids for 5 to 14 days with a rate of 54.0% (40.2, 67.8%).

Despite achieving high quality adherence in certain aspects of COPD care, our findings suggest the need for additional training in the care of COPD exacerbations.

Introduction:

The World Health Organization estimates that the third leading cause of death worldwide is Chronic Obstructive Pulmonary Disease (COPD).¹ In 2019, COPD caused 3.23 million deaths of which 80% occurred in low- and middle-income areas. Costs attributable to having COPD were \$32.1 billion in 2010 with a projected increase to \$49.0 billion by 2020.

Newark, New Jersey located in Essex County, is the 74th largest city in the United States and largest in the state with over 280,000 people. Over a quarter of the population lives in poverty lacks adequate healthcare, making chronic conditions like COPD hard to manage.² While national and state trends in COPD prevalence have decreased in the recent years, the same can't be said about all counties alike. As a state, New Jersey had a rate of COPD prevalence ranging from 14 to 18 per 10,000 residents during the period from 2000 to 2017 and dropping to 11-13 per 10,000 residents in 2018 and 2019. However, Essex County lags significantly behind relative to its neighboring counties with the highest rate at 13.63 per 10,000 residents, while Middlesex describes at 9.69, Morris at 5.35, Passaic at 5.78, and Bergen at 5.71.³

One of the most frequented hospitals in Newark, is University Hospital, an independent, state-owned teaching hospital. The data in the quality analysis was obtained from charts of patients receiving care in the University Hospital inpatient units and the treatments measured in this analysis were performed by physicians employed at this hospital.

There are several recommendations in the management of COPD exacerbation. The purpose of this study was to identify the compliance with evidence-based guidelines for the treatment of acute COPD exacerbations at University Hospital by physician providers. The treatment course will be compared to guidelines established by American College of Physicians-American Society of Internal Medicine (ACP-ASIM) and the American College of Chest Physicians (ACCP). These guidelines/variables include a chest x-ray completed at the time of the ED visit or initial admission, use of inhaled anticholinergic bronchodilators or inhaled short acting beta agonist, use of systemic corticosteroids for 5 to 14 days, administration of noninvasive positive pressure ventilation in patients with evidence of respiratory acidosis or hypoxemia (9), and use of narrow spectrum antibiotics. The last recommendation that was

measured was whether physicians ordered mucolytic medications, chest physiotherapy, or methylxanthine as these are contraindicated in the management of COPD exacerbation and their use would therefore be against evidence-based guidelines.

These guidelines are graded under the level of evidence by the Oxford Centre for Evidence-Based Medicine (CEBM) with a level of evidence of 2a meaning systematic reviews of cohort studies have shown with homogeneity that the previously mentioned measures are most beneficial to patients.

Methods:

This study was a retrospective chart review of 50 patients that were admitted to University Hospital for acute COPD exacerbation as the primary diagnosis between July 15, 2021, and September 15, 2021. An IRB was approved to for this study 2021001489. Inclusion criteria other than primary diagnosis was solely age older than 18. Exclusion criteria included patients who expired during the admission, patients who had active COVID-19 infection as well as patients who had other active primary lung disease (lung cancer, pneumonia, cystic fibrosis, pulmonary hypertension, or pulmonary emboli). Collected data was recovered from the demographics, medication administration record (MAR), provider notes, and admission summary sections of the electronic health record (EHR) which was EPIC. All patient charts with an admission diagnosis of COPD exacerbation were collected between the previously stated dates. At the time of subject selection for analysis, each patient chart was compiled on to a list and given a number with a total of 80 subjects. A random number generator (5) was then used to select 50 patients to be used for data analysis.

During the patients' admission we looked for the use of all the following: a chest x-ray completed at the time of the ED visit or initial admission, use of inhaled anticholinergic bronchodilators or inhaled short acting beta agonist, use of systemic corticosteroids for 5 to 14 days (those shorter or exceeding were counted as incorrectly done) administration of noninvasive positive pressure ventilation, and use of narrow spectrum antibiotics. The last recommendation that was measured was whether physicians used mucolytic medications, ordered chest physiotherapy, or methylxanthine. These latter measures are contraindicated in the management

of COPD exacerbation and their use would therefore be against evidence-based guidelines and were recorded as incorrectly done.

Compliance rates by providers were calculated out of 50 as correctly or incorrectly done. Furthermore, a 95% confidence interval was statistically derived for all values.

Results:

Our results indicated the best compliance by providers with admission chest x rays. Out of the 50 cases we looked at, 49 of them were correctly performed resulting in a 98% (94.1,101.9%) compliance rate. Following that, was the compliance rate of the use of inhaled anticholinergic bronchodilators and inhaled short acting beta agonists with a rate of 92% (84.5, 99.5%) meaning only 4 out of the 50 cases were not treated properly.

There was a nearly identical compliance rate observed for use of noninvasive positive pressure ventilation at 84% (73.8, 94.2%) and use of narrow spectrum antibiotic at 86% (76.4, 95.6%). And a significant drop was noted in the compliance rate of avoiding mucolytic medications, ordering chest physiotherapy, or methylxanthine bronchodilators at 74% (61.8, 86.2%). An even further drop was seen with the compliance rate of use of systemic corticosteroids for 5 to 14 days with a rate of 54.0% (40.2, 67.8%). We further discuss hypotheses for these lower rate findings in our discussion section below.

Table 1 COPD Exacerbation Management Compliance at University Hospital

	Correctly Done Out of 50	Proportion Done Correctly	Proportion Done Incorrectly	Confidence Interval Lower Bound	Confidence Interval Upper Bound
Admission CXR or CXR at time of ED visit	49	98.00%	2.00%	94.10%	101.90%
Use of inhaled anticholinergic bronchodilators or inhaled short acting beta agonist	46	92.00%	8.00%	84.50%	99.50%
Use of systemic corticosteroids administered for 5-14days	27	54.00%	46.00%	40.20%	67.80%
NPPV administered under supervision	42	84.00%	16.00%	73.80%	94.20%
Narrow spectrum antibiotics as first line agents	43	86.00%	14.00%	76.40%	95.60%
Avoid mucolytic medications, chest physiotherapy, or methylxanthine bronchodilators.	37	74.00%	26.00%	61.80%	86.20%

Discussion:

Our sample group is consistent with the intended population of study which was Newark, NJ University Hospital patients of all backgrounds being admitted for COPD exacerbations. To further understand the precision of our randomization we looked at prevalence rates between men and women. We found a prevalence ratio of 1.7 in men to women. Previous global studies have shown that the prevalence of COPD in men is 9.8% and women is 5.6% with a ratio of 1.75 nearly identical to our findings. This indicates that the randomization process for our selection of patient was adequate. (8)

The results show that University Hospital physicians have great compliance with regards to admission chest x-rays, use of inhaled anticholinergic bronchodilators or inhaled short acting beta agonists, but their compliance with NPPV, use of narrow spectrum antibiotics and avoiding mucolytics still has room for improvement. Additionally, during our data recovery it was noted that more patients than reported in our results were indeed given systemic corticosteroids. However, given our inclusion criteria of a duration of 5 to 14 days (as per guidelines), however,

they did not meet the requirements. It appears that the physicians know to give the corticosteroids but that varied beliefs of appropriate duration still linger. Over the years, these guidelines have been altered and the use of tapering the steroids further creates ambiguity which could explain our findings.

The next lowest compliance rate was seen with the avoidance of mucolytics, chest physiotherapy, or methylxanthine bronchodilators. In about 26% of the cases we analyzed there was continued use of these measures, notably, we saw a large use of guaifenesin specifically when patients were admitted with it already part of their home medications. It appears, several times that the medication was not removed. It is likely that given the intuitive logic behind using mucolytics in COPD that many disregard it. Further literature review seems to indicate that while it is contraindicated, it is mainly due to the lack of evidence to showing any benefit in shortening the course or improving outcomes of patients in five randomized trials. Furthermore, more recent guidelines summarized in the GOLD report excludes any mention of mucolytics during exacerbations. Methylxanthines however, continue to be contraindicated and future quality assurance studies could be performed to look specifically at the use of these medications at University Hospital. (4)(9)

We were not able to acquire comparison data for all the variables we analyzed however, we were able to compare our data on ventilatory support as well as systemic corticosteroids and bronchodilator use. Our data was compared to both the National Committee of Quality Assessment (NCQA) measures on pharmacotherapy management of COPD exacerbation and to the European COPD Audit published in the European Respiratory journal in 2016. The European COPD Audit was study aimed at studying factors associated with inpatient COPD exacerbations and collected data from 13 European countries. The NCQA sought to assess COPD exacerbation therapies based on different types of health insurance and coverage. For the purpose of this study we compared our data to the NCQA findings for the average between Medicaid, commercial HMO, and commercial PPO coverage in 2019 as that makes up the majority of our patient population coverage. The NCQA collects data from over 191 million Americans who are enrolled in health care plans that report to the Healthcare Effectiveness Data and Information Set (HEDIS) for quality assessment. They have collected yearly data on the use of systemic

corticosteroids and use of bronchodilators by insurance type which allows a national based comparison for us to compare our data to. (6,7)

When comparing our data to the NCQA for use of systemic corticosteroids the average performed as stated above for the year 2019 was 73.6% compliance. Our 54.0% (40.2, 67.8%) falls significantly below that indicating we fall below national standards and have room for improvement. Additionally, the NCQA average for the use of bronchodilators in 2019 was 80.3%. (7) Our average of 92% (84.5, 99.5%) oppositely falls significantly above the national average indicating good practice at University Hospital. Lastly the European COPD Audit published in 2016 that only 45% of patients with mild acidosis and 77.2% with severe acidosis received ventilatory support for an average of 61.1%. Our 84% (73.8, 94.2%) compliance rate falls above that indicating that physician practicing University Hospital outperforms the European national average with regards to ventilation of patients presenting with COPD exacerbation in respiratory acidosis. (6) While these data points are not exact in comparison with our data given likely variation in population and subject groups, it still provides a basis for comparison. As we move forward, however, we recognize the limitations this brings to our analysis and realize the scope to which we compare is also limited. Additionally, we recognize the limitations of the length of our studied and know that our window from July 15 to September 15 may not be an accurate representation of the overall yearly performance of University Hospital.

Our findings suggest a space for additional training in the care of COPD exacerbations at University Hospital and shines some light on the outstanding performance seen in certain aspects of our study.

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