COPD Admissions and Readmission Reduction

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Learning Objectives and Disclosures

• **Learning Objectives:**
  – Understand the Risks associated with COPD Admissions
  – Understand what factors can Predict COPD Readmission
  – Understand what interventions can help decrease COPD Readmissions

• **Disclosures:**
  – Philanthropy grants to study COPD Readmissions
  – Consultant for Astrazenca
COPD: Scope of the problem

- 13.7 million patients in US (6.5% population)
- 10 million office visits
- 1.5 million ED visits
- 700,000 hospitalizations
- 1 Admission every 40 sec
- 10.8% - 90 day mortality rate
  - 422 European Hospitals (Harti., European Respiratory Journal 2016)
## Who is at Risk for Mortality?

### Table 2

Logistic regression model for the risk associated with in-hospital mortality

<table>
<thead>
<tr>
<th></th>
<th>OR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age years</td>
<td>1.064 (1.054–1.074)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Charlson Comorbidity Index points</td>
<td>1.137 (1.087–1.189)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Ventilatory support: yes</td>
<td>3.667 (2.997–4.486)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Respiratory acidosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild versus normal</td>
<td>1.582 (1.286–1.945)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Severe versus normal</td>
<td>2.313 (1.721–3.109)</td>
<td></td>
</tr>
</tbody>
</table>

N=16016. Respiratory acidosis is categorised as: severe, pH < 7.25; mild, pH 7.25–7.35; normal, pH > 7.35. Results are from a random effects model adjusting for country.
Who is at Risk for Mortality?

Harti, European Respiratory Journal 2016
Who is at Risk for Mortality?

Readmission Rates

30-Day Readmission Rate

US
Taiwan
London
Who’s at risk for Readmission in 90 days?

### TABLE 3

Logistic regression model for the risk associated with 90 day post-discharge mortality

<table>
<thead>
<tr>
<th></th>
<th>OR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age years</td>
<td>1.037 (1.029–1.046)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Charlson Comorbidity Index points</td>
<td>1.128 (1.074–1.185)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.661 (0.531–0.822)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Respiratory acidosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild versus normal</td>
<td>1.187 (0.957–1.472)</td>
<td>0.0160</td>
</tr>
<tr>
<td>Severe versus normal</td>
<td>1.858 (1.312–2.632)</td>
<td></td>
</tr>
<tr>
<td>Ventilatory support: yes</td>
<td>2.147 (1.811–2.542)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Respiratory specialists per 1000 beds</td>
<td>0.995 (0.989–0.999)</td>
<td>0.0269</td>
</tr>
<tr>
<td>Previous admission (one or more)</td>
<td>1.622 (1.297–2.030)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

N=15191. Respiratory acidosis is categorised as: severe, pH <7.25; mild, pH 7.25–7.35; normal, pH >7.35. Results are from a random effects model adjusting for country.

Who’s at risk for Readmission in 90 days?

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Adjusted OR (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No follow-up</td>
<td>2.91 (1.06-8.01)</td>
<td>.04</td>
</tr>
<tr>
<td>Previous hospitalizations</td>
<td>2.24 (1.57-3.19)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>FEV₁ (categorized)</td>
<td>1.21 (0.62-2.37)</td>
<td>.59</td>
</tr>
<tr>
<td>Disease duration</td>
<td>1.0 (0.995-1.01)</td>
<td>.72</td>
</tr>
<tr>
<td>Age</td>
<td>1.0 (0.96-1.05)</td>
<td>.97</td>
</tr>
<tr>
<td>Female sex</td>
<td>1.53 (0.43-5.48)</td>
<td>.51</td>
</tr>
</tbody>
</table>

The model includes 166 patients; four patients were excluded because they attended their follow-up visit after they had been rehospitalized, and FEV₁ data were missing for 25 patients.

*Patients who did not attend the follow-up visits with pulmonologists within 30 d of discharge.*

Gavish, CHEST 2015 148, 375-381 DOI: (10.1378/chest.14-1453)

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Clinical and Physiologic Stability Predicts 30 day Readmission Rate

Figure 1 - Clinical and physiological stability and readmission rates. A, Kaplan-Meier plot of time to first readmission within 30 days after hospitalization due to acute exacerbations of COPD (AECOPD) according to clinical stability at discharge. B, Kaplan-Meier plot of time to first readmission within 30 days after hospitalization due to AECOPD according to physiological stability at discharge. C, Kaplan-Meier plot of time to first readmission within 30 days following hospitalization due to AECOPD according to physiological and clinical stability at discharge. D, Forest plot showing ORs for readmission within 30 days after discharge according to physiological and clinical stability at discharge.
## Risk Factors For Readmission – 30 day

<table>
<thead>
<tr>
<th>Patient Factors</th>
<th>Provider Factors</th>
<th>System Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Male</td>
<td>• No SABA</td>
<td>• LOS&lt;2 or &gt;5 days</td>
</tr>
<tr>
<td>• h/o Heart dz</td>
<td>• Oral Steroids</td>
<td>• Lack of F/U s/p d/c</td>
</tr>
<tr>
<td>• Lung Cancer</td>
<td>• Antibiotics</td>
<td></td>
</tr>
<tr>
<td>• Osteoporosis</td>
<td>• No Statin for 12 mos</td>
<td></td>
</tr>
<tr>
<td>• Depression</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ICD-9 Code Data Multivariable Analysis
8,263 Patients

### Reasons For Readmission

<table>
<thead>
<tr>
<th>Reason for Readmission</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD (491, 492, 496)</td>
<td>203 (27.4)</td>
</tr>
<tr>
<td>Respiratory failure (518)</td>
<td>106 (14.3)</td>
</tr>
<tr>
<td>Symptoms involving respiratory system (786)</td>
<td>63 (8.5)</td>
</tr>
<tr>
<td>Pneumonia (486)</td>
<td>31 (4.2)</td>
</tr>
<tr>
<td>Heart failure (428)</td>
<td>17 (2.3)</td>
</tr>
<tr>
<td>Cardiac dysrhythmia (427)</td>
<td>16 (2.2)</td>
</tr>
<tr>
<td>Coronary atherosclerosis (414)</td>
<td>15 (2.0)</td>
</tr>
<tr>
<td>Lung cancer (162)</td>
<td>13 (1.8)</td>
</tr>
<tr>
<td>Septicemia (038)</td>
<td>12 (1.6)</td>
</tr>
<tr>
<td>Acute pulmonary heart disease (415)</td>
<td>7 (0.9)</td>
</tr>
<tr>
<td>Other</td>
<td>258 (34.8)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>741</td>
</tr>
</tbody>
</table>
Preventing Readmissions
Inpatient Order-Sets

Single Tertiary Care Center 44 patients Randomized to Order-sets or Std Care
Parikh, *International Journal of Chronic Obstructive Pulmonary Disease* 2016 March
Post-Hospital follow up by Pulmonary Specialist

Gavish, CHEST 2015 148, 375-381 DOI: (10.1378/chest.14-1453)
Current Evidence: COPD Treatment Plans Reduce AECOPD and Hospitalization

- 96 patients Randomized to Self-guided sessions (education material, action plan and demonstration) Vs. Control

-Cumulative Survival = days until Hospitalization or ED visit

Comprehensive COPD Plans with Inpatient and Outpatient Care

<table>
<thead>
<tr>
<th></th>
<th>Without Plan</th>
<th>With Plan</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td># Admissions per Year</td>
<td>2.39</td>
<td>1.65</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LOS (days)</td>
<td>12.17</td>
<td>9.09</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Intervention: AECOPD identified during hospitalization, individualized plan and Comprehensive follow up and outpatient education. 16-week program

Fanny WS et al, Respiratory Medicine 2014
Lahey Pilot Study: Treatment Plan and Readmissions

Figure 1: Rates of acute exacerbation of chronic obstructive pulmonary disease (AECOPD) compared between the intervention and control groups at 1, 2, 3, 6, and 12 months from discharge.
# Medical Interventions: Selected Studies

<table>
<thead>
<tr>
<th>Medication</th>
<th>Details</th>
<th>Benefit</th>
<th>Statistics</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Active Bronchodilator</td>
<td>60 day readmissions</td>
<td>10.1% vs. 22.6%</td>
<td>P=0.001</td>
<td>Nasser 2017</td>
</tr>
<tr>
<td>LAMA vs LABA</td>
<td>1 year, 7,376 pts</td>
<td>LAMA prolonged time to AE by 42 days</td>
<td>CI 0.77-0.9, p&lt;0.001</td>
<td>COPD-PET NEJM 2011</td>
</tr>
<tr>
<td>LABA/ICS vs. LAMA</td>
<td>1 year, 440 pt</td>
<td>No diff in AE</td>
<td>N.S.</td>
<td>INSPIRE AJRCCM 2008</td>
</tr>
<tr>
<td>Triple vs LAMA/LABA</td>
<td>1 year, 449 pts</td>
<td>No Diff in AE</td>
<td>RR 0.53, CI 0.33-0.86, P=0.01</td>
<td>Vestbo, AJRCCM 2013</td>
</tr>
<tr>
<td>LABA/ICS vs Either alone</td>
<td>1 year</td>
<td>25% lower AE -17% lower Hosp</td>
<td>P&lt;0.001 P=0.03</td>
<td>TORCH, NEJM 2007</td>
</tr>
<tr>
<td>LAMA vs Pcbo</td>
<td>4 yrs, 5,993 pts</td>
<td>-14% lower AE -Time to Hosp lower</td>
<td>P&lt;0.001 HR=.86, CI 0.78-0.95, P&lt;0.001</td>
<td>UPLIFT, AJRCCM 2006</td>
</tr>
<tr>
<td>Phosphodiesterase-4 Inhibitors</td>
<td>Roflumilast, 3091 pts, 1 yr</td>
<td>17% decr AE but not Hosp</td>
<td>P=0.0003</td>
<td>Calverley, Lancet 2009</td>
</tr>
</tbody>
</table>
Macrolide

Medium Time to Exacerbation 266 vs 174 days, (P<0.001)

Note:
Trend toward reduced hospitalizations (0.74 vs 0.94 – underpowered)

Albert, NEJM 2011

Figure 1
Kaplan-Meier curve demonstrating the reduction in proportion of patients free of exacerbation while taking azithromycin for 1 year
Home Nocturnal NIV s/p AECOPD for severe patients (LTNIV vs. Std)

<table>
<thead>
<tr>
<th></th>
<th>LTNIV</th>
<th>Std Care</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality @ 1yr</td>
<td>6.6%</td>
<td>11.1%</td>
<td>P&lt;0.05</td>
</tr>
<tr>
<td>Readmission @ 1 yr</td>
<td>28.6%</td>
<td>84.7%</td>
<td>P&lt;0.05</td>
</tr>
</tbody>
</table>

Suraj, *Indian Journal of Critical Care Medicine* 2018

NIV Non invasive ventilation
AECOPD acute exacerbation
Disease Management

Figure 2
There was a significant reduction in COPD-related hospital admissions and ED visits that was evident early during the observation period and persisted during the study. Cum = cumulative; DM = disease management; Hosp Adms = hospital admissions; UC = usual care. (Reprinted with permission of the American Thoracic Society. Copyright © 2010 American Thoracic Society Kathryn L. Rice, Naresh Dewan, Hanna E. Bloomfield, Joseph Grill, Tamara M. Schult, David B. Nelson, Sarita Kumari, Mel Thomas, Lois J. Geist, Caroline Beaner, Michael Caldwell, and Dennis E. Niewoeher/Jour/10/Disease Management Program for Chronic Obstructive Pulmonary Disease: A Randomized Controlled Trial American Journal of Respiratory and Critical Care Medicine/Vol. 182/pp 890-896 An official Journal of The American Thoracic Society)
Depression and COPD

• Incidence is higher in COPD Patients
  – 16.2/1000 Pt yrs vs. 9.4/1000 Pt yrs in Non-COPD population

• Associated with poor outcomes
  – Incr. Readmission
  – Decr. QOL
  – Incr. Healthcare utilization

• Mechanism
  – Bidirectional?
  – Chronic Inflammation (IL6)
  – Smoking?

• Underrecognized – 1/3 Pts fail to get therapy

• Treatment
  – Pharmacy (Cochran lacks support)
  – Pulmonary Rehab
  – Psychosocial and Behavior therapy.

Yohannes European Respiratory Journal Rev 2014
LACE

- LACE = LOS, Acuity of admission, Co-morbidities, and ED visits w/î 6 months
- 2,662 patients in Sydney
- 25% 30 day Readmission rate
- Moderate correlation

Hakim et al, *Journal of Clinical Epidemiology* 2018
RACE

- **RACE** = Readmission After COPD Exacerbation Scale
- State Database (NY, FL, CA, WA) 6 years using multivariant analysis
- 258,113 Patients

### Independent factors associated with increased readmission rates

- Age 40-65
- Male
- African American
- 1st or 2nd Quartile income
- Medicaid or Medicare
- Anemia
- CHF
- Depression
- Psychosis

All $p < 0.01$

Figure 4 Readmission After COPD Exacerbation (RACE) scores vs percent readmission among all patients.

Lau et al, International Journal of COPD 2017
Summary

• **Patient Factors**
  – Severity Illness at baseline and at time of discharge
  – Comorbidities
  – Medication compliance and inhaler technique

• **Provider Factors**
  – Correct diagnosis
  – Order-sets
  – Treatment guidelines vs individual treatment
  – Discharge planning and follow up

• **System and workflow factors**
  – Identify high risk patients
  – Capacity to provide education
  – Multidisciplinary follow up for Depression/Anxiety
  – Access to providers
## GOLD Recommendations for hospital Discharge and Follow up s/p AECOPD (Consensus)

### Discharge and Follow-up Recommendations
- Review clinical and lab data – Identify all abnormalities
- Review maintenance therapy, understanding and inhaler technique
- Review Prednisone and antibiotic therapy
- Assess need for Oxygen
- Ensure follow up within 4 weeks

### 1-4 weeks Follow up
- Review treatment and inhaler techniques
- Reassess Oxygen needs
- Document Symptoms (i.e. CAT or mMRC scores)
- Determine status of co-morbidities

### 12-16 weeks
- Evaluate ability to cope with environment
- Review treatment and inhaler techniques
- Reassess Oxygen needs
- Review capacity for physical activities and AODL
- Measure FEV1
- Determine status of co-morbidities
Example 1

- Situation:
  - 72 y/o F with COPD returns for regular scheduled visit.

- Background: She had severe (GOLD IV) COPD with history of pseudomonas pneumonia, Lung cancer s/p xrt/chemo and RULobectomy presents to the office. On chronic Oxygen and Steroids. On interview, she is angry because I did not see her during the past 3 admissions for ”COPD exacerbation”

- Assessment:
  - Pseudomonas Abscess and Chronic Respiratory Failure.
Example 2

• Situation:
  – Patient calls me from hospital bedside

• Background: 76 y/o man with stage IV COPD on chronic Oxygen and steroids admitted twice in 1 week for AECOPD at OSH.

• Now in Stepdown unit at OSH treated with NIV acutely, RR 26.

• Hospital medicine plan to discharge to rehab

• Assessment:
  – Ready for discharge?
  – Home NIV?
Addressing Two Questions

• Are we capturing the correct patients and documenting the severity of illness?

• Is the treatment plan and follow up adequate to make a meaningful impact on outcome and reduce readmissions?
Effects of Accurate Physician Documentation

• High Risk for Readmissions

  – 10% relative reduction
Addressing Two Questions

Right Patient
- Are we capturing the correct patients and documenting the severity of illness?

Right Treatment
- Is the treatment plan and follow up adequate to make a meaningful impact on outcome and reduce readmissions?
Lahey Comprehensive Treatment Bundle

- Personalized Inpatient Management
- Personalized COPD Action Plan
- Inhaler Education and Medication Review
- Pulmonary Rehab
- Smoke Cessation
- Lung CA Screening
- Outpatient Telemonitoring and Phone Call follow Up
- Outpatient Provider Follow Up (4 weekly visits in 30 days)
Customized Intense Disease Management

- Make the right diagnosis
- Customize Inpatient Treatment
  - Beyond Steroids and Abx
- Intense Education at Transition of Care at Discharge
  - Action plan
  - Sent home with nebulizer
- Customize Outpatient management and Follow up
  - Post Hospital Calls
  - 4 weekly office visits
- Access to Pulmonary office for “Urgent Care”
- Patient Outreach and Education
  - COPD Lecture Series
  - COPD support group
- Tobacco Cessation
  - Inpatient and outpatient)
- Multidisciplinary Team in pulmonary department
  - Psychologist
  - Pharmacist
Evidence To Date

Medicare COPD 30-Day Unplanned (by Quarter)
Future Direction

• Defining AECOPD
• Statins?
• Home therapy for AECOPD
• Monitoring remotely
• Eosinophils/biologics?
How can the PCP help?

- Increase the contact time with patents s/p AECOPD in the month following admissions
- Identify which hospitalized patients with AECOPD are at highest risk for readmissions
- Individualize COPD therapy (Moving beyond Bronchodilators, Steroids and Antibiotics)
  - GOLD guidelines and medication adherence
  - Pulmonary Rehab
  - Tobacco Cessation
  - Vaccines, Lang Cancer Screening
  - NIV, etc.
- Refer complicated patients early to an “Engaged” Pulmonary Team comfortable with comprehensive COPD care.
Treating Patients, not just their Problems

Questions?