REDUCING COPD READMISSIONS – WHERE ARE WE NOW?

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Jerry A. Krishnan, MD, PhD, is Associate Vice Chancellor for Population Health Sciences at the University of Illinois Hospital & Health Sciences System, and Professor of Medicine and Public Health at the University of Illinois at Chicago. He is a practicing pulmonologist who specializes in the management of patients with asthma and chronic obstructive pulmonary disease (COPD). His area of research expertise is delivery science, which seeks to identify care strategies that improve quality, outcomes, and value of healthcare. He is a Principal Investigator in clinical effectiveness trials to improve care transitions after hospital discharge (PArTNER), use of supplemental oxygen by patients with COPD (PELICAN), care of children with uncontrolled asthma (CHICAGO Plan), and the care of adolescents and adults with sickle cell disease (ISAAC). He is the Chair of the NIH/NHLBI Clinical Trials study section, co-chair of the ERS/ATS COPD exacerbations guidelines, and a member of the GINA asthma guidelines science committee.

OBJECTIVES:
Participants should be better able to:

1. Describe the epidemiology of hospitalizations / readmissions for COPD exacerbations;

2. Understand how penalties are assessed for “excess” unplanned readmissions by the CMS Hospital Readmissions Reduction Program;

3. Define interventions that lower the risk of hospital readmissions;

4. Identify gaps in our understanding about how to reduce avoidable readmissions
DISCLOSURE

Dr. Krishnan has received grant/research support from eMax Health, Adelphi Values, CVS Caremark, UpToDate, Sanofi Data Safety Monitoring Board, and the Global Initiative for Asthma (GINA), but these do not create a conflict related to the following presentation.

Reducing COPD readmissions – where are we now?

Friday, March 24, 2017, 8:00AM to 8:45AM

Jerry A. Krishnan, M.D., Ph.D.
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Professor of Public Health, Department of Epidemiology & Biostatistics
Associate Vice Chancellor for Population Health Sciences
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Disclosures

• **Pharmaceutical industry** No research or speaker board

• **Consultant**
  - Adelphi Values  PRO measure development
  - CVS Caremark  National P&T committee
  - Centura Health  PCORI application
  - eMAX Health  Epidemiology of eosinophilic asthma
  - NIH/NHLBI/NCATS  Grant review committees
  - PCORI  Clinical Trials Subcommittee, Merit Review Panel
  - Sanofi  Independent Data Monitoring Committee
  - UpToDate  Mechanical ventilation in asthma

• **Research funding**  NHLBI/NIH, PCORI

• **Guidelines**
  - ERS/ATS COPD Exacerbations guidelines – Co-chair
  - Global Initiative for Asthma (GINA) – Science Committee

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True or False?

1. Only **COPD-specific** readmissions count towards calculations for 30-day risk of unplanned readmissions following an initial hospitalization for a COPD exacerbation in the CMS HRRP.
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A. True  
B. False

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**True or False?**

2. Most unplanned 30-day hospital readmissions among Medicare beneficiaries hospitalized for COPD are due to conditions **other than COPD**.
2. Most unplanned 30-day hospital readmissions among Medicare beneficiaries hospitalized for COPD are due to conditions other than COPD.

A. True  
B. False

3. There are evidence-based interventions that consistently reduce the risk of unplanned 30-day hospital readmissions in patients with COPD.
3. There are evidence-based interventions that **consistently** reduce the risk of unplanned 30-day hospital readmissions in patients with COPD.

A. True
B. False

**Objectives**

1. Describe the epidemiology of hospitalizations / readmissions for COPD exacerbations

2. Understand how penalties are assessed for “excess” unplanned readmissions by the CMS Hospital Readmissions Reduction Program

3. Define interventions that lower the risk of hospital readmissions

4. Identify gaps in our understanding about how to reduce avoidable readmissions
Epidemiology of COPD
3rd leading cause of death since 2010

<table>
<thead>
<tr>
<th>Causes of death in 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heart disease</td>
</tr>
<tr>
<td>2. Cancer</td>
</tr>
<tr>
<td>3. Chronic lower respiratory diseases</td>
</tr>
<tr>
<td>4. Accidents (unintentional injuries)</td>
</tr>
<tr>
<td>5. Stroke (cerebrovascular diseases)</td>
</tr>
<tr>
<td>6. Alzheimer's disease</td>
</tr>
<tr>
<td>7. Diabetes</td>
</tr>
<tr>
<td>8. Influenza and Pneumonia</td>
</tr>
<tr>
<td>9. Nephritis, nephrotic syndrome and nephrosis</td>
</tr>
<tr>
<td>10. Intentional self-harm (suicide)</td>
</tr>
</tbody>
</table>

~750,000 hospitalizations / yr for COPD in U.S.

- Payer mix
  - 69% Medicare, 10% Medicaid
  - 16% Private
  - 3% Uninsured

- LOS 4.7 days

- $7,500 / hospitalization, $6.1B
  - $345M for readmissions (Medicare)

- Discharge location
  - Home 67%, other facility 13%, deaths 1.6%

Wier LM, AHRQ HCUP, Statistical Brief #106, 2011

30-day COPD readmission rates: 17 to 28% across 3,018 US hospitals

Regional COPD readmission rates:
- Quartile 1: 19.25 - 21.3%
- Quartile 2: 21.31 - 21.9%
- Quartile 3: 21.90 - 22.68%
- Quartile 4: 23.05 - 25.55%

Sjoding M and Cooke C, AJRCCM 2014
Why do patients hospitalized for COPD exacerbations get readmitted within 30 days?

- Medicare claims data from 7 states, 2006-2010
  - 947,000 hospitalizations for COPD

- Top 10 causes for readmissions (based on principal ICD-9 codes)
  - COPD, 28%; Respiratory failure, Pneumonia, asthma
  - Heart failure, cardiac dysrhythmias
  - Septicemia
  - Fluid & electrolyte disorders
  - Intestinal infections
  - Non-specific chest pain
  - Other

Shah T Chest 2015;147:1219-26

Objectives

1. Describe the epidemiology of hospitalizations / readmissions for COPD exacerbations

2. Understand how penalties are assessed for “excess” unplanned readmissions by the CMS Hospital Readmissions Reduction Program

3. Define interventions that lower the risk of hospital readmissions

4. Identify gaps in our understanding about how to reduce avoidable readmissions
CMS HRRP (Hospital Readmissions Reductions Program)

- 2015: CMS HRRP expanded to include readmissions after COPD exacerbations
- Penalties for ‘excess’ unplanned readmissions to any inpatient acute care facility for any reason within 30 days after discharge
- Hospitalizations for COPD exacerbations based on ICD-9 codes
  - Excludes patients who die prior to discharge, leave AMA, transferred to another acute care facility during index hospitalization
- Risk standardization based on patient age and comorbidities, but not patient race or SES
- Penalty is up to 3% of all payments by CMS for COPD, HF, AMI, PNA, THA/TKA

Feemster L, AJRCCM 2014

Objectives

1. Describe the epidemiology of hospitalizations / readmissions for COPD exacerbations
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4. Identify gaps in our understanding about how to reduce avoidable readmissions
Conceptual framework for hospital readmissions

**CLINICAL FACTORS**
- Primary diagnosis and comorbidities
- Medications (polypharmacy, problem medications)
- Prior hospitalizations
- Psychological / Depression

**QUALITY AND ACCESS**
- Hospital-based care
- Discharge coordination
- Access to ambulatory care

**SOCIOECONOMIC RESOURCES**

- Social factors:
  - Education, employment, income
  - Social Support
  - Housing & neighborhood
- Behavioral / cognitive:
  - Adherence to discharge instructions
  - Substance abuse
  - Health Literacy

Exaggerated in lower SES populations

Prieto-Centurion V, Ann Am Thorac Soc 2013

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**On admission**

**Prior to discharge**

- Estimated percentage

Mularski RA
J Comp Eff Res 2012
Evidence-based programs

- Do not address COPD specific needs
  - $\text{O}_2$ therapy, inhaler / nebulizer technique, CPAP or BiPaP
  - Multiple causes of dyspnea; comorbidity

Naylor 1994; Jack, 2009; Coleman, 2006; Hansen, 2011

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**SYSTEMATIC REVIEW**

Interventions to Reduce Rehospitalizations after Chronic Obstructive Pulmonary Disease Exacerbations
A Systematic Review

Prieto-Centurion V, Ann Am Thorac Soc 2014

- PubMed, EMBASE, CINAHL, the Cochrane Library
- 913 titles and abstracts screened
- 5 eligible studies (1 in U.S.)
Some or many of 19 interventions

Discharge planning  
Disease education  
Inhaler use teaching  
Meds given for action plan  
Development of action plan  
Health counseling  
Smoking cessation counseling  
Assessment of comorbidities

Prieto-Centurion V, Ann Am Thorac Soc 2014

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**Study #1**

**Glasgow supported self-management trial (GSuST) for patients with moderate to severe COPD: randomised controlled trial**

BMJ 2012;344:e1090 doi: 10.1136/bmj.e1090 (Published 6 March 2012)

C E Bucknall consultant respiratory physician†, G Miller research fellow†, S M Lloyd biostatistician‡, J Cleland professor of medical education§, S McCluskey senior research nurse¶, M Cotton consultant respiratory physician‖, R D Stevenson consultant respiratory physician‡, P Cotton professor of learning and teaching‖, A McNamara deputy director¶

†Department of Respiratory Medicine, Glasgow Royal Infirmary, Glasgow G4 0SF, UK; ‡Robertson Centre for Biostatistics, University of Glasgow, Glasgow; §Division of Medical and Dental Education, School of Medicine, University of Aberdeen, Aberdeen, UK; ¶Undergraduate Medical School, University of Glasgow
Intervention #1

- Both groups
  - “Long term treatment optimized”
  - Inhaler technique teaching
  - Offered smoking cessation advice and pulmonary rehabilitation

- Control group
  - Managed by their physician

- Intervention group – “supported self-management”
  - 4 home visits over 2 mos, then q6 weeks, plus PRN
  - Diary cards to record Sx, then initiate tx with Abx X 7 days and prednisone X 5 days based on algorithm

Bucknall CE, BMJ 2012

Hospitalized or death from COPD, %

Intervention v control: 48% vs. 47%, Relative hazard 1.05 (0.8 to 1.38)

Bucknall CE, BMJ 2012
Study #2

Integrated care prevents hospitalisations for exacerbations in COPD patients


ABSTRACT: Hospital admissions due to chronic obstructive pulmonary disease (COPD) exacerbations have a major impact on the disease evolution and costs. The current authors postulated that a simple and well-standardised, low-intensity integrated care intervention can be effective to prevent such hospitalisations.

Therefore, 155 exacerbated COPD patients (17% females) were recruited after hospital discharge from centres in Barcelona (Spain) and Leuven (Belgium). They were randomly assigned to either integrated care (IC; n=66; age mean ± SD 70.7 ± 9 yrs; forced expiratory volume in one second (FEV1) 1.1 ± 0.5 L, 43% predicted) or usual care (UC; n=90; age 72.8 ± 9 yrs; FEV1

Intervention #2

- 2 hospitals, 155 patients

- Usual care
  - Managed by their physician

- Integrated Care
  - 2 hr education by RN before DC
  - Home visit by physician and others
  - Phone calls to reinforce self-management once per wk X 4 wks, then periodically afterwards
    - RN case manager at call center, web access to medical records

Casas A, ERJ 2006
Results #2

- N=155, 65 intervention, 90 usual care
- Baseline
  - Mean 70 YO
  - 83% men
  - FEV1 42% predicted
  - 26% current smoker
  - 17% LTOT
- Intervention began before DC

![Graph showing HR for readmission IC v UC: 0.55 (95% CI 0.34-0.87)](image)

No differences in deaths, IC v UC: 19 v 16%

Casas A, ERJ 2006

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BREATHTrial Study #3

*A Comprehensive Care Management Program to Prevent Chronic Obstructive Pulmonary Disease Hospitalizations*

A Randomized, Controlled Trial

Vincent S. Fan, MD, MPH; J. Michael Cistino, MD, MPH; Robert Low, PhD; Jean Bourbeau, MD, MSc; Sandra G. Adams, MD, MG; Sarah Lauberman, MS; Sue See Teh, PhD, MS; Grant D. Huang, PhD, MPH; Richard Robbins, MD; Perennou S. Srim, MD; Amit Shashikant, MD; M. Jeffrey Adler, MD; George Sostaric, MD; Ralph J. Fajardo, MD; Palmschat Rastegir, MD; Todd H. Wagner, PhD; Steven A. Muzzuca, PhD; Colleen Shannon, MPH; Cindy Colling, RPH, MS; Matthew H. Liang, MD, MPH; James K. Stoller, MD, MS; Louis Foye, MD, MPH; and Dennis E. Niewoehner, MD

Courtesy of D. Niewoehner, MD

Ann Intern Med 2012;156:673-683
BREATH Trial: Study Design

- RCT, VA Cooperative Studies Program, of case-manager facilitated self-management vs. usual care
  - Target 960 patients at 20 sites
  - Study stopped <50% enrollment due to excess adverse events in 1 group
- Major eligibility criterion = COPD-related hospitalization in prior year

- Intervention
  - “Living Well with COPD” (4 individual and 1 group sessions, each 1-1.5 hours)
  - Written action plan with refillable antibiotic and prednisone prescriptions
  - Case manager made calls q1 month X 3 mos, then q3 months; plus PRN by patient
- Primary outcome – 1st COPD hospitalization over 1-3 years

Courtesy of D. Niewoehner, MD
Ann Intern Med 2012;156:673-683

BREATH Trial
Study terminated early (<50% of ~1000 VA patients)

Lesson #3:
Interventions to prevent re-hospitalizations can be harmful

Courtesy of D. Niewoehner, MD
Ann Intern Med 2012;156:673-683
Study #4 (after SR publication)

Health Coaching and Chronic Obstructive Pulmonary Disease Rehospitalization
A Randomized Study

Roberto Benzo1, Kristin Vickers2, Paul J. Novotny3, Sharon Tucker4, Johanne Hout1, Pamela Neufeld4,
John Connell5, Kate Long6, and Charlene McEvoy3
1Mindful Breathing Laboratory, Division of Pulmonary and Critical Care Medicine, 2Department of Psychology, and 3Department of Biomedical Statistics and Informatics, Mayo Clinic, Rochester, Minnesota; 4University of Iowa Hospitals & Clinics, Iowa City, Iowa; 5HealthPartners Institute for Education and Research, Bloomington, Minnesota; 6Academic Health Center, University of Minnesota, Minneapolis, Minnesota; and 7Stanford Patient Education Research Center, Palo Alto, California

Benzo R et al. AJRCCM 2016

Intervention #4

• Control group
  – Usual care

• Intervention group – health coach using motivational interviewing
  – One in-person visit prior to DC, then follow-up sessions by phone (12 sessions)
  – Written action plan plus provided prednisone and antibiotics
  – Written self-management materials
  – Brief exercise plan, with exercise equipment
  – Coordination with provider

Benzo R, AJRCCM 2016
Objectives

1. Describe the epidemiology of hospitalizations / readmissions for COPD exacerbations

2. Understand how penalties are assessed for “excess” unplanned readmissions by the CMS Hospital Readmissions Reduction Program

3. Define interventions that lower the risk of hospital readmissions

4. Identify gaps in our understanding about how to reduce avoidable readmissions
No consistently effective intervention to lower the risk of COPD readmissions

Prieto-Centurion V, Ann Am Thorac Soc 2014

Effect of PR after COPD exacerbation on hospital readmission

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pulmonary rehab</th>
<th>Control</th>
<th>Odds Ratio M-H Random 95% CI</th>
<th>Weight</th>
<th>Odds Ratio M-H Random 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive rehab programmes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behnke 2000</td>
<td>3/14</td>
<td>9/12</td>
<td>8.8 %</td>
<td>0.09 [0.01, 0.56]</td>
<td></td>
</tr>
<tr>
<td>Ko 2011</td>
<td>16/30</td>
<td>13/30</td>
<td>14.0 %</td>
<td>1.49 [0.54, 4.14]</td>
<td></td>
</tr>
<tr>
<td>Ko 2016</td>
<td>44/90</td>
<td>63/90</td>
<td>16.8 %</td>
<td>0.41 [0.22, 0.76]</td>
<td></td>
</tr>
<tr>
<td>Mar 2004</td>
<td>3/20</td>
<td>12/21</td>
<td>9.5 %</td>
<td>0.08 [0.02, 0.45]</td>
<td></td>
</tr>
<tr>
<td>Seymour 2010</td>
<td>2/30</td>
<td>10/30</td>
<td>9.9 %</td>
<td>0.14 [0.03, 0.72]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>184</td>
<td>183</td>
<td>58.9 %</td>
<td>0.28 [0.10, 0.78]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 67 (Pulmonary rehab), 97 (Control)
Heterogeneity: TAU² = 0.89; CHI² = 13.82, df = 4 (P = 0.01); I² = 71%
Test for overall effect: Z = 2.41 (P = 0.015)
Effect of PR after COPD exacerbation on hospital readmission

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pulmonary rehab n/N</th>
<th>Control n/N</th>
<th>Odds Ratio M H/R</th>
<th>Random, 95% CI</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Less-extensive rehab programmes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eaton 2009</td>
<td>11/47</td>
<td>15/50</td>
<td>14.8 %</td>
<td>0.71 [0.29, 1.77]</td>
<td></td>
</tr>
<tr>
<td>Greening 2014</td>
<td>108/69</td>
<td>84/151</td>
<td>17.8 %</td>
<td>1.41 [0.90, 2.21]</td>
<td></td>
</tr>
<tr>
<td>Murphy 2005</td>
<td>2/13</td>
<td>5/13</td>
<td>8.5 %</td>
<td>0.29 [0.04, 1.90]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>229</td>
<td>214</td>
<td>41.1 %</td>
<td>0.92 [0.44, 1.93]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 121 (Pulmonary rehab), 104 (Control)
Heterogeneity: Tu = 0.21; Ch2 = 3.94, df = 2 (p = 0.14); I2 = 49%
Test for overall effect: Z = 0.22 (p = 0.83)

Effect of PR after COPD exacerbation on mortality

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pulmonary rehab n/N</th>
<th>Control n/N</th>
<th>Odds Ratio M H/R</th>
<th>Random, 95% CI</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Extensive rehab programmes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ko 2011</td>
<td>0/30</td>
<td>2/30</td>
<td>66.8 %</td>
<td>0.19 [0.01, 4.36]</td>
<td></td>
</tr>
<tr>
<td>Truett 2002</td>
<td>62/64</td>
<td>12/19</td>
<td>195.9 %</td>
<td>0.19 [0.08, 0.42]</td>
<td></td>
</tr>
<tr>
<td>Mar 2004</td>
<td>100</td>
<td>2/2</td>
<td>92.5 %</td>
<td>0.01 [0.04, 1.99]</td>
<td></td>
</tr>
<tr>
<td>Ko 2006</td>
<td>10/90</td>
<td>12/90</td>
<td>258.8 %</td>
<td>0.01 [0.02, 0.50]</td>
<td></td>
</tr>
<tr>
<td>Balenie 2000</td>
<td>2/14</td>
<td>1/16</td>
<td>77.5 %</td>
<td>0.01 [0.01, 4.14]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>178</td>
<td>172</td>
<td>69.5 %</td>
<td>0.90 [0.26, 0.99]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 18 (Pulmonary rehab), 19 (Control)
Heterogeneity: Tu = 5.92; Ch2 = 3.4, df = 1 (p = 0.24); I2 = 20%
Test for overall effect: Z = 2.16 (p = 0.03)

2 Less-extensive rehab programmes

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Pulmonary rehab n/N</th>
<th>Control n/N</th>
<th>Odds Ratio M H/R</th>
<th>Random, 95% CI</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greening 2014</td>
<td>41/63</td>
<td>23/51</td>
<td>30.5 %</td>
<td>1.88 [1.36, 3.33]</td>
<td></td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>169</td>
<td>151</td>
<td>30.5 %</td>
<td>1.88 [1.36, 3.33]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 18 (Pulmonary rehab), 19 (Control)
Heterogeneity not applicable
Test for overall effect: Z = 2.16 (p = 0.03)

Total (95% CI) | 347 | 323 | 100.0 % | 0.68 [0.28, 1.67] | |

Test for subgroup differences: Ch2 = 633.3, df = 1 (p = 0.00), I2 = 88%
Potential role for PR to reduce hospital readmissions and mortality


Pulmonary Rehabilitation After Hospitalization for COPD Study

Under review. If awarded by NIH/NHLBI, 12/1/17 to 5/31/24
True or False?

1. Only COPD-specific readmissions count towards calculations for 30-day risk of unplanned readmissions following an initial hospitalization for a COPD exacerbation in the CMS HRRP.

2. Most unplanned 30-day hospital readmissions among Medicare beneficiaries hospitalized for COPD are due to conditions other than COPD.

3. There are evidence-based interventions that consistently reduce the risk of unplanned 30-day hospital readmissions in patients with COPD.