Chronic Obstructive Pulmonary Disease

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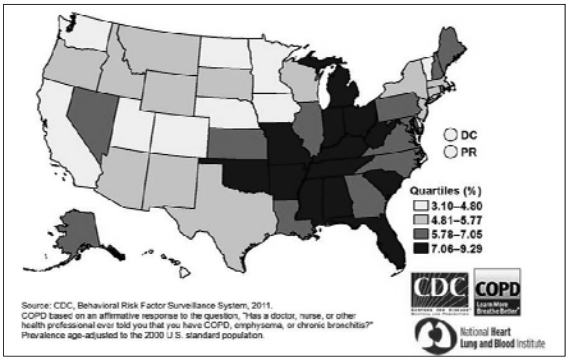
Impact of COPD in U.S.

- **12 million people diagnosed**
- **715,000 hospital admissions per year**
- **134,000 deaths/year**
- **Annual cost up to $50 billion**
  - **$30 billion direct**
  - **$20 billion indirect**

Prevalence of COPD 2011



COPD: Mortality by gender, 1999-2009

Source: U.S. Centers for Disease Control

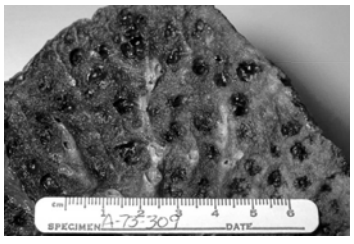
Risk Factors For COPD

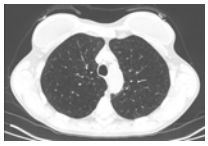
- Tobacco smoke
- Occupational exposures
- Air pollution
- Genetics
- Low birth weight
- Recurrent infections
- Chronic asthma

Inherited Emphysema

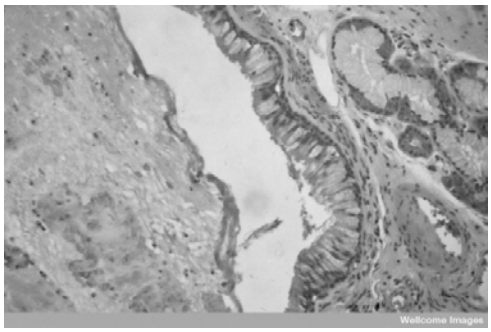
- Alpha-1 antitrypsin deficiency
  - Consider in young patients with COPD and those with lesser smoking histories
  - Diagnosed by A1AT levels
  - Accounts for 2-3% of COPD
  - Average of 3 doctors and 7 years from symptom onset to diagnosis
- Other genetic conditions???

One End Of The COPD Spectrum: Emphysema





The Other End Of The COPD Spectrum: Chronic Bronchitis



Five Components Of COPD Management:

1. Diagnosis and staging
2. Reduce risk factors
3. Manage stable COPD
4. Manage exacerbations
5. Reduce readmissions

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Diagnosis of COPD

- Symptoms of COPD:
  - Dyspnea
  - Cough
  - Sputum production
- Risk factor for COPD
- Obstruction on spirometry:
  - Post-bronchodilator FEV1/FVC ratio < 70%
  - Severity of obstruction based on FEV1

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COPD Mimics:

Wheezing:

- Airway tumors
- Vocal cord dysfunction
- Foreign body aspiration
- Heart failure

Obstruction:

- Chronic obstructive asthma
- Tracheostenosis
- Bronchiectasis
- Bronchiolitis obliterans

Classification of Obstruction*

GOLD I: Mild	FEV_1 > 80%
GOLD II: Moderate	FEV_1 = 50-80%
GOLD III: Severe	FEV_1 = 30-50%
GOLD IV: Very Severe	FEV_1 < 30%

*GOLD criteria: Assumes an FEV1/FVC < 70%

Spirometry

Photo: Cosmed

Can you have emphysema with normal spirometry?

Yes!

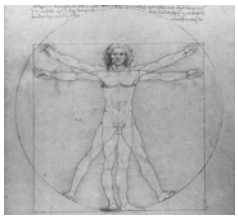
- Suspect in at-risk patients with dyspnea and either:
  - Hyperinflation by lung volumes
  - Low diffusing capacity
- Confirmation by high resolution chest CT

COPD Co-Morbidities:

- Myocardial ischemia
- Heat failure
- Osteoporosis
- Respiratory infection
- Depression
- Diabetes
- Lung cancer

COPD is a systemic disease

- Weight loss
- Malnutrition
- Skeletal muscle dysfunction
- Depression



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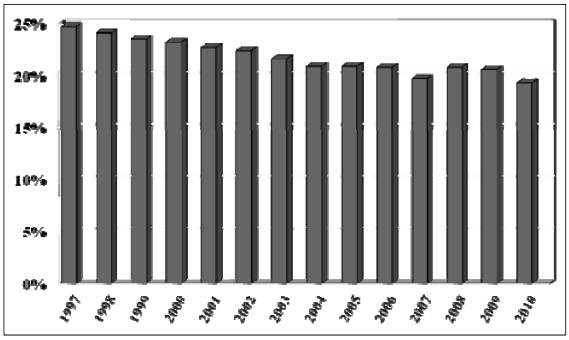
Reduce Risk Factors

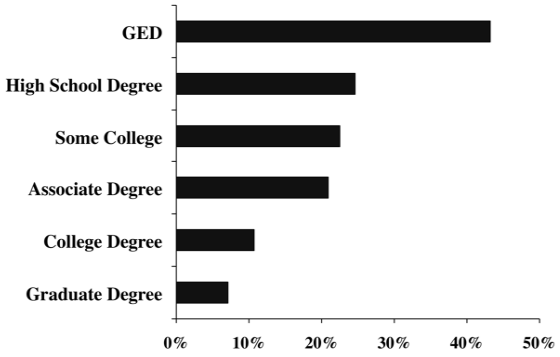
- Smoking cessation!!!
- Eliminate environmental tobacco smoke
- Reduce air pollution exposure
- Reduce occupational dust & chemical exposure

Prevalence Of Adult Smokers In The United States



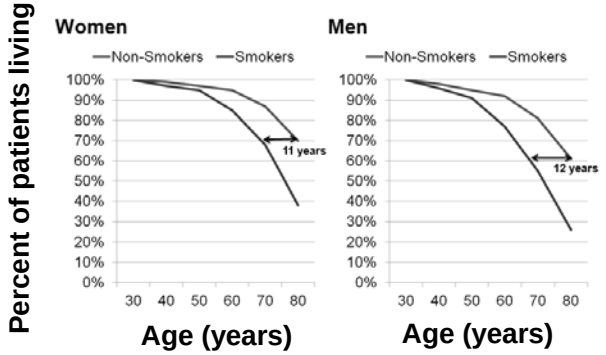
Centers for Disease Control

Who Smokes In The United States?



Centers for Disease Control

Life expectancy for smokers and non-smokers



N Engl J Med 2013; 368:341-50

The average smoker loses 15 minutes of life for every cigarette smoked

Smoking cessation slows the loss of lung function

The Five A's Of Smoking Cessation

Ask	"Do you smoke?" – every visit!
Advise	smokers to quit
Assess	willingness to quit smoking
Assist	by prescribing and counseling
Arrange	follow-up

Smoking Cessation Resources

- Individual physician counseling
- Inpatient counseling service
- Outpatient counseling
- Nicotine replacement
  - Patches
  - Lozenges
  - Inhalers
  - Gum
  - Electronic cigarettes
- Wellbutrin
- Varenicline
- Cytisine (not in U.S.)

Five Components Of COPD Management:

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Management of Stable COPD

- Stepwise, symptom based approach
- Inhaled medications are preferred
- Bronchodilator treatment central to symptomatic management
- Consider inhaled steroids for patients with FEV< 60% predicted
- Combination inhaled therapy often more effective than single inhaled drug

Global Initiative for Chronic Obstructive Lung Disease, 2013

Management of Stable COPD *(continued)*

- Avoid chronic treatment with oral steroids
- All COPD patients benefit from exercise training programs
- Influenza vaccine – all patients
- Pneumococcal vaccine – patients > 65 years or FEV1 < 40%
- Mucolytics are marginally effective in some patients
- Oxygen prolongs life in hypoxemic patients

Global Initiative for Chronic Obstructive Lung Disease, 2013

Goals of COPD Management

1. Relieve symptoms
2. Prevent disease progression
3. Improve exercise tolerance
4. Improve health status
5. Prevent and treat complications
6. Prevent and treat exacerbations
7. Reduce mortality

Re-Defining GOLD Groups

	FEV1	Symptoms	mMRC Score
A	> 50%	Less	0-1
B	> 50%	More	≥ 2
C	< 50%	Less	0-1
D	< 50%	More	≥ 2

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mMRC Score

0 – Only breathless with strenuous activity

1 – Short of breath when hurrying on ground level or walking up a slight hill

2 – Walk slower than people of similar age on level ground or have to stop walking at my own pace

3 – Stop for breath after walking 100 yards or a few minutes on level ground

4 – Too breathless to leave the house or breathless when dressing

Non-Pharmacologic Management

Group	Smoking Cessation	Flu & Pneumonia Vaccine	Physical Activity	Pulmonary Rehab
A	Yes	Yes	Yes	No
B, C, D	Yes	Yes	Yes	Yes

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Pharmacologic Management of Stable COPD

Group	First Choice	Second Choice
A	Albuterol prn or Ipratropium prn	Long-acting beta agonist or Long-acting anti-cholinergic
B	Long-acting beta agonist or Long-acting anti-cholinergic	Long-acting beta agonist + Long-acting anti-cholinergic

Long-acting beta agonists:
Salmeterol ("Serevent")
Arformoterol ("Brovana")
Formoterol ("Foradil")
Indacaterol ("Arcapta")

Long-acting anticholinergics:
Tiotropium ("Spiriva")
Aclidinium ("Tudorza")

Pharmacologic Management of Stable COPD

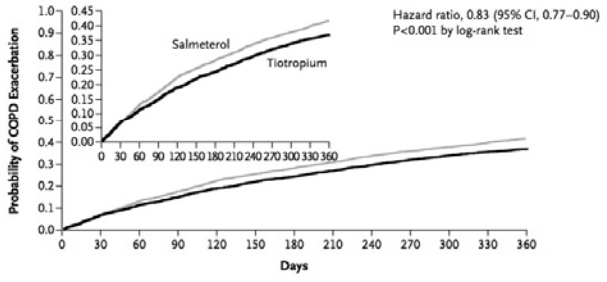
Group	First Choice	Second Choice
C	ICS/LABA or Long-acting anticholinergic	Long-acting beta agonist + Long-acting anticholinergic
D	ICS/LABA or Long-acting anticholinergic	(1) Long-acting beta agonist + Long-acting anticholinergic (2) Inhaled corticosteroid + Long-acting anti-cholinergic (3) ICS/LABA + Long-acting anticholinergic (4) + Roflumilast

ICS/LABA = Inhaled corticosteroid + Long-acting beta agonist combination:
Budesonide/formoterol ("Symbicort")
Fluticasone/salmeterol ("Advair")
Mometasone/formoterol ("Dulera")

Lets make it simple:

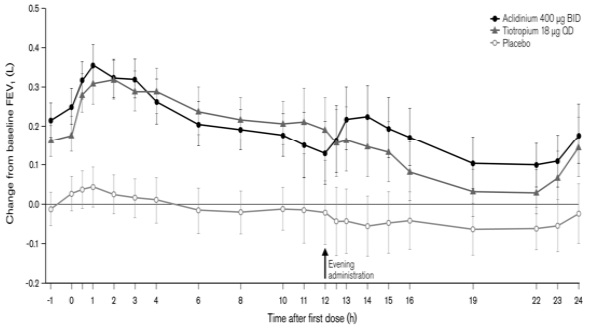
- **Occasional symptoms:**
  - **Albuterol PRN**
- **Frequent symptoms and FEV1 > 50%:**
  - **Add long-acting anticholinergic**
- **Frequent symptoms and FEV1 < 50%:**
  1. **Add steroid + long-acting beta agonist combo**
  2. **Add roflumilast**

Tiotropium versus Salmeterol in COPD



Vogelmeier et al. N Engl J Med 2011; 364: 1093-1103

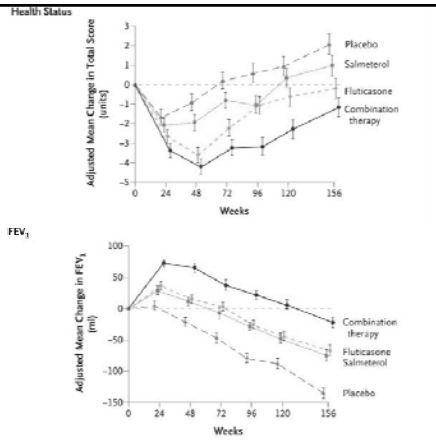
Aclidinium is similar to tiotropium



Chest 2012; 141:745-52

Pharmacologic Therapy: Corticosteroids

- Inhaled steroids for:
  - FEV1 < 60%
  - Patients with frequent exacerbations
- Inhaled steroid + Long-acting beta agonist more effective than inhaled steroid alone
- Inhaled steroids may be associated with more frequent pneumonia
- Avoid chronic oral steroids

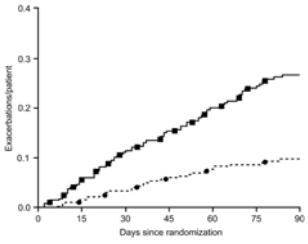


The NEW ENGLAND JOURNAL of MEDICINE

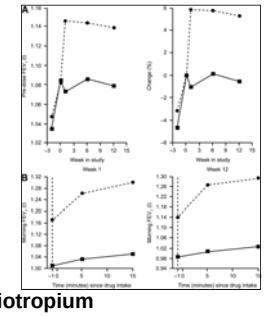
Calverley P et al. N Engl J Med 2007;356:775-789

"Triple Therapy" is effective (Steroid/LABA + Tiotropium)

Exacerbations



FEV1

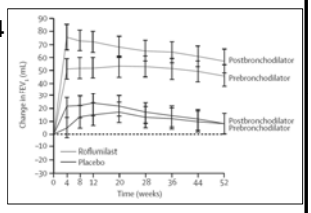


Circles = budesonide/fomoterol + tiotropium
Squares = placebo + tiotropium

Am J Respir Crit Care Med 2009; 180:741-50

Roflumilast in COPD

- **Study design:**
  - **Roflumilast: n=1,537**
  - **Placebo: n=1,554**
- **Exacerbations/year:**
  - **Roflumilast: 1.14**
  - **Placebo: 1.37**
- **FEV1 increased 48 ml more with roflumilast than placebo**



Lancet 2009; 374: 685-94

Correct use of common inhalers

Ruthann Kennedy, CNP

Oxygenation Assessment

- **Resting pulse oximetry**
- **Arterial blood gas**
- **6 minute walk test**
- **Oxygen titration study**
- **Overnight oximetry**
- **High altitude hypoxia simulation test**

6 Minute Walk Test

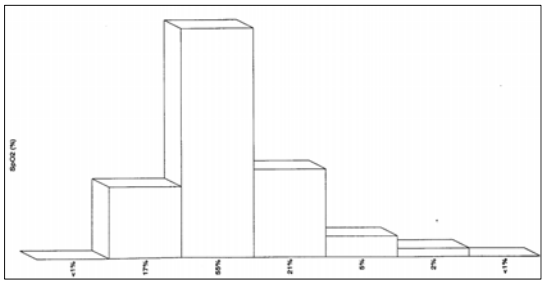
- **Oxygen saturation**
- **Distance walked**
- **Heart rate**
- **Dyspnea scale (Borg scale)**

Oxygen Titration Study

- Baseline oxygen saturation
- Add oxygen when SaO2 δ 88%
- Increase FiO2 based on oxygen saturation
- Used to determine oxygen flow rate prescription

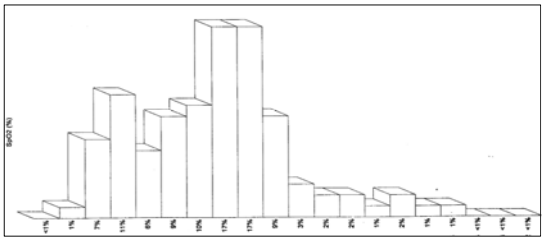
****Now required for all oxygen prescriptions in the United States**

Normal Overnight Oximetry



98% 97% 96% 95% 94% 93% 92%

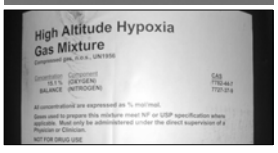
Nocturnal Hypoxemia



91% 89% 87% 85% 83% 81% 79% 77% 75%

High Altitude Hypoxia Simulation Test

- Simulates to 8,000 ft elevation
  - 15% FiO2
  - Commercial aircraft cabin oxygen pressure
- Arterial blood gas
  - pO2 < 55 - oxygen needed at altitude
  - pO2 < 50 - oxygen needed in flight



Home Oxygen Options

- Concentrators
  - Standard (5 L flow)
  - High-Flow (10 L flow)
  - Portable (4-6 L pulse flow)
- Compressed oxygen gas
  - E tank (4.4 hours at 2 L flow)
  - D tank (2.5 hours at 2 L flow)
- Liquid oxygen
  - Reservoir (4-6 weeks)
  - Portable tank (8 hours at 2 L flow)

Pulmonary Rehabilitation

- 8 week program
- 3 days per week
- 2 hours per session
- Focus on:
  - Education
  - Aerobic conditioning
  - Quality of life

Psychologic contributions to the perception of dyspnea

Pain
Anxiety
Depression
Anger

Sensation **Of Dyspnea** → ***Perception*** **Of Dyspnea**

Improving Dyspnea Perception

- Education
- Relaxation
- Desensitization
- Pharmacologic therapy:
  - Anti-depressants
  - Anxiolytics
  - Pain control

Lung Reduction Surgery

Patients who benefit:

- Localized upper lobe emphysema
- Low exercise capacity

Medicare guidelines:

- FEV1 < 45%
- RV > 150%
- BMI < 31 (M); 32 (F)
- pO2 > 45 mm
- pCO2 < 60 mm
- Exercise capacity:
  - < 25 watts (F)
  - < 40 watts (M)

Lung Transplantation

Amy Pope-Harman, MD
Medical Director, Lung Transplantation

Bryan Whitson, MD, PhD
Surgical Director, Lung Transplantation

OSU Lung Transplant Center: 614-293-5822

Five Components Of COPD Management:

1. Diagnosis and staging
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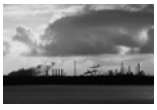
Identifiable Risks For Exacerbations

Viruses: 30-70%

Bacteria: 30-50%



Pollution: 20-30%

Photo: Petr Kratochvil

COPD Exacerbations

- Sputum cultures not usually necessary
- Antibiotics if increased sputum volume, dyspnea, or sputum purulence
- Bronchodilators (albuterol +/- ipratropium)
- Oral/IV steroids (prednisone 40 mg/day x 10 days)
- Non-invasive ventilation (if severe)

Bacteria causing COPD exacerbations

• Haemophilus influenza	13-50%
• Moraxella catarrhalis	9-21%
• Streptococcus pneumoniae	7-26%
• Pseudomonas aeruginosa	1-13%

Which Antibiotic?

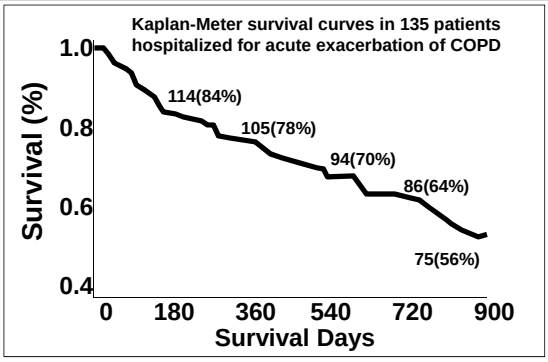
- Uncomplicated COPD exacerbation:
  - Doxycycline
  - Trimethoprim-sulfamethoxazole
  - Macrolide
  - Cephalosporin
- Complicated COPD exacerbation:
  - Amoxicillin-clavulanate
  - Fluoroquinolone
- Risk for pseudomonas:
  - Ciprofloxacin

Pulmonary embolism and COPD exacerbations:

- 20% of COPD exacerbations are accompanied by PE
  - 25% of hospitalized patients
  - 3% of emergency department patients
- Signs and symptoms are similar
- Suspect PE in:
  - Patients failing to respond to treatment
  - Patients with increased risk of PE

Chest 2009; 135:786

Mortality After Hospitalization for COPD



P Almagro et al, *Chest* 2002; 121:1441-1448

Mortality After Hospitalization for COPD

Causes of Death

Etiology	*No.(%)*
Respiratory Disease	32 (50)
Cardiovascular Disease	12 (19)
Cancer	4 (6)
Other	3 (5)
Unknown	13 (20)

P Almagro et al, CHEST 2002; 121:1441-1448

Mortality Risk Post-COPD Exacerbation

Independent predictors:

- Dyspnea
- Depression
- Re-admission
- Co-morbidity
- Marital status

P Almagro et al, CHEST 2002; 121:1441-1448

New Concepts in COPD Management

- Faster is better
  - Antibiotics
- Continuous is better
  - Azithromycin
- Less is better
  - Oxygen
- More is not better
  - Steroids
- Longer is not better
  - Steroids

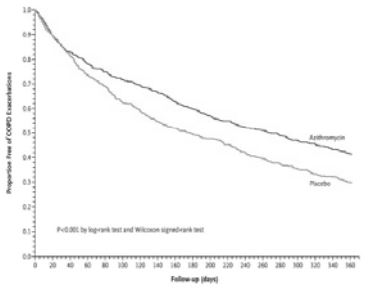
Faster is better: antibiotics in COPD exacerbations

Variable	Early Antibiotic	Late Antibiotic
Mechanical ventilation	1.07%	1.80%
Mortality	1.04%	1.59%
Treatment failure	9.77%	11.75%
30-Day readmission	7.91%	8.79%

N = 84,621 patients

Rothberg et al. JAMA 2010; 303:235-42

Continuous is better: azithromycin reduces COPD exacerbations



- **Azithromycin 250 mg/day**
- **Exclusion: QTc > 450**
- **Total subjects:**
  - **1,142 azithromycin**
  - **572 placebo**
- **Exacerbations per year:**
  - **1.48 azithromycin**
  - **1.83 placebo**

N Engl J Med 2011; 365:689-98

Less is better – oxygen in COPD exacerbations

- **405 patients transported to hospital with presumed COPD exacerbation**
- **Randomized to:**
  - **High flow oxygen by mask regardless of O2 saturation**
  - **Oxygen by nasal prongs titrated to keep O2 saturation 88-92%**
- **58% reduction in mortality in patients treated with low flow titrated oxygen**

Austin et al. BMJ 2010; 341:c5462

More is not better: dosing of steroids

- **79,985 hospitalizations for acute COPD exacerbation**
- **High dose IV versus low dose oral steroids**
- **No difference in outcomes**

Lindenauer, et al. JAMA 2010; 303: 2358-67

Longer is not better: dosing of steroids

- 314 patients presenting to the emergency department with acute COPD exacerbation
- 5-day versus 14-day oral prednisone 40 mg per day
- No difference in outcomes

JAMA. 2013; 309:2223-31

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Medicare re-hospitalization rates

30-day readmission rates:

All	21.0%
CHF	26.9%
Pneumonia	20.1%
COPD	22.6%

Total Cost: $17.4 billion

Jencks, N Eng J Med 2009; 360:1418-28

Center for Medicare & Medicaid Services

- Developed plan to fine hospitals for high readmission rates:
- 2012 Diagnoses:
  - Heart failure
  - Myocardial infarction
  - Pneumonia
- 2015 Diagnoses:
  - COPD
  - Coronary artery bypass grafting
  - Urinary tract infection
  - Coronary angioplasty
- In 2013:
  - 1% of Medicare payment maximum penalty
  - 71% of hospitals were penalized (2217)
  - Estimate $850 million total penalties
- In 2014:
  - 2% of Medicare payment maximum penalty
- In 2015:
  - 3% of Medicare payment maximum penalty

Who gets re-admitted?

- Patients without physician follow-up within 30 days of discharge
  - (Hernandez, JAMA 2010;303:1716-22)
- African Americans
  - (Joynt, JAMA 2011; 305:675-81)
- Older patients
  - (Jencks, N Engl J Med 2009; 360:1418-28)

Why do they get re-admitted?

- Insufficient outpatient follow-up
- Medication errors
- Inadequate post-discharge support
- Poor transfer of information to primary care providers
- Poor healthcare literacy
- Inability to pay for medications

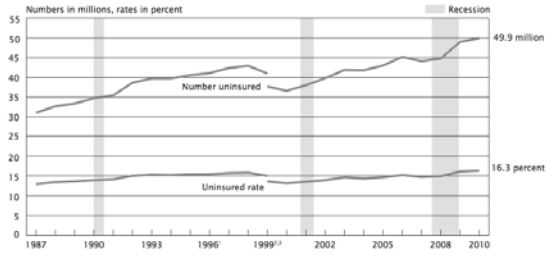
Disease management program for COPD

- Intervention:
  - 1-1.5 hour education session
  - Self-treatment action plan
  - Monthly follow up calls
- Hospital Admission & Emergency Department Visits:
  - 0.82 usual care group
  - 0.48 intervention group

Rice Am J Respir Crit Care Med 2010; 182:890-6

The problem with uninsured and underinsured in the United States

Uninsured In The United States



Source: U.S. Census Bureau

Inhaler costs:

$50 — **$250**

Albuterol

Steroid + LABA
Anticholinergics

COPD Admissions At OSU East Hospital

- **High risk population:**
  - **Elderly**
  - **African American**
  - **Low income**
- **33% of patients at OSU East are current smokers**
- **Length of stay:**
  - **OSU East: 4.40 days**
  - **Benchmark: 4.37 days**

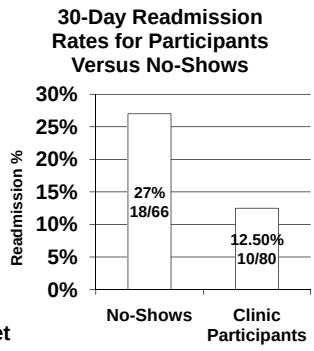
CarePoint East Pulmonary Transition Clinic

Pulmonary COPD Transition Clinic Using A Nurse Practitioner Pulmonary Specialist

- Clinic appointment within 5 working days of discharge
- Assess response to treatment
- Follow up lab and radiology tests
- Arrange pulmonary function tests
- Medication reconciliation
- Refer to indigent patient medication program
- Arrange pulmonary rehabilitation
- Smoking cessation
- Insure correct use of inhaler

Preliminary results of the OSU East Pulmonary Transition Clinic

- Began summer 2011
- Jointly funded by hospital and physician practice group
- However, 46% no-show rate
- High percentage of patients with:
  - No insurance
  - No Medicare part D
  - Concurrent use of street drugs



Key Points about COPD

1. Increasing incidence and death rate
2. Spirometry necessary for diagnosis
3. Beware of co-morbid diseases
4. Utilize GOLD group-based treatment plan
5. Pulmonary rehabilitation is underutilized
6. Incidence of PE in exacerbations is high
7. Reducing readmissions is a priority