

Chronic Obstructive Pulmonary Disease

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What is COPD?

- Chronic Obstructive Pulmonary Disease
 - Type of obstructive lung disease characterized by poor airflow
 - Fourth leading cause of death in the world (2013)

- Symptoms include:
 - Shortness of breath
 - Presence of sputum whilst coughing
 - Chronic bronchitis and emphysema



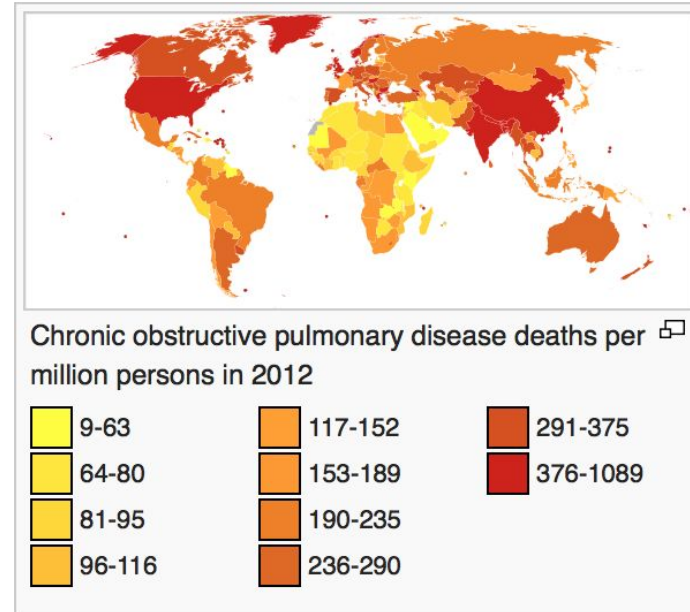
Retrieved from:
<http://www.healthination.com/lungs/copd/what-is-chronic-obstructive-pulmonary-disease-copd/>



Retrieved from: <https://i.ytimg.com/vi/2nBPqSiLg5E/maxresdefault.jpg>

Prevalence/Epidemiology of Disease

- 329 million people (4.8% of population) are affected by COPD
- Increase in developed regions:
 - Increases number of both men and women smoking
 - Increases prevalence of COPD
- More common in the older population:
 - Affects 34-200 out of 1000 people (over age of 65) on average



Retrieved from:

https://en.wikipedia.org/wiki/Chronic_obstructive_pulmonary_disease#/media/File:Chronic_obstructive_pulmonary_disease_world_map-Deaths_per_million_persons-WHO2012.svg

Economic Burden of COPD

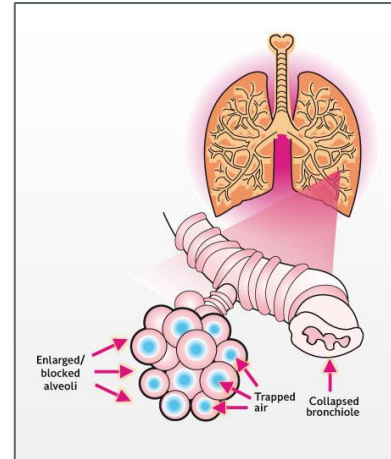
- One of the most expensive conditions in U.S. hospitals in 2011 (\$5.7 billion)
- Global estimated cost of treating COPD: \$2.1 trillion (2010)
 - Direct medical care cost: \$1.9 trillion
 - Indirect medical care cost (missed work etc.): \$0.2 trillion
- Costs expected to more than double by 2030



Retrieved from:
http://www.assignmenthelp.net/assignment_help/health-economics-assignment-help

Mechanism of Disease

- Structural airway changes due to direct inflammatory response
 - Build-up of scar tissue from airway damage
 - Over-proliferation of epithelial cells lining airway
- Parenchymal destruction associated with loss of lung tissue elasticity
 - Airways collapse during exhalation and impedes airflow
- Effects on mucus-secreting cells
 - Damages mucus transporting system and replaces normal cells with mucus-secreting cells
 - Results in presence of excess mucus along airway



Retrieved from:

<http://www.thinkcopdifferently.com/About%20COPD/What%20is%20COPD/Pathophysiology%20of%20COPD.aspx>

Causes and Pathophysiology

Environmental Factors - Air Pollution

- Outdoor and indoor air pollution worsen COPD
 - NOT a causal relationship
- Increased hospital visits, symptoms, and even deaths

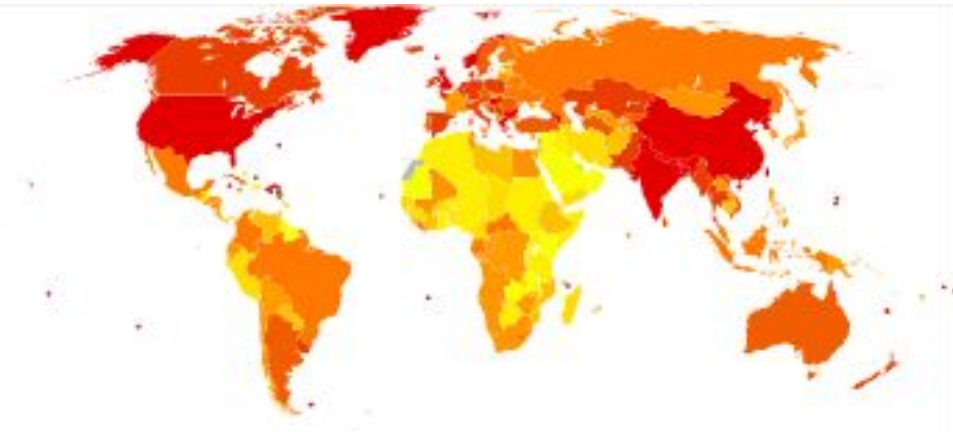


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https://www.google.ca/search?q=air+pollution+and+COPD&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjH_YnTrPFAhWJ7IMKHSI6C1YQ_AUICSgC&biw=1425&bih=776#imgrc=dMHgbrDJZnBDFM%3A

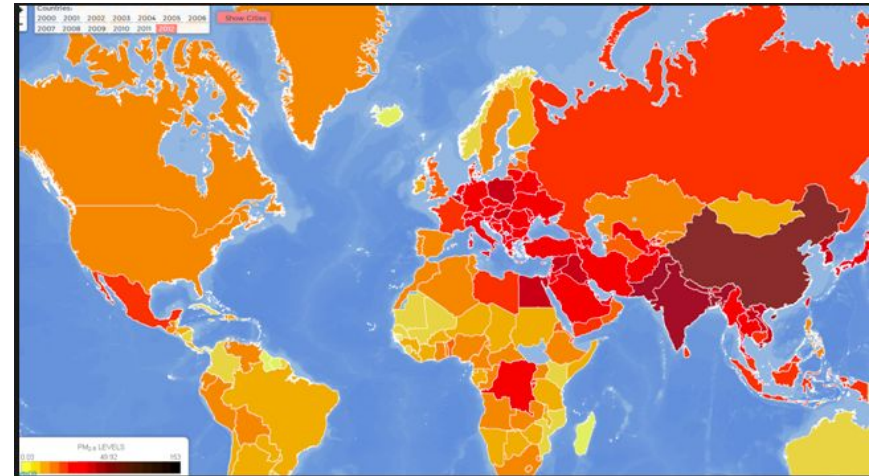
Relationship between COPD deaths and air pollution

Deaths per million people from COPD



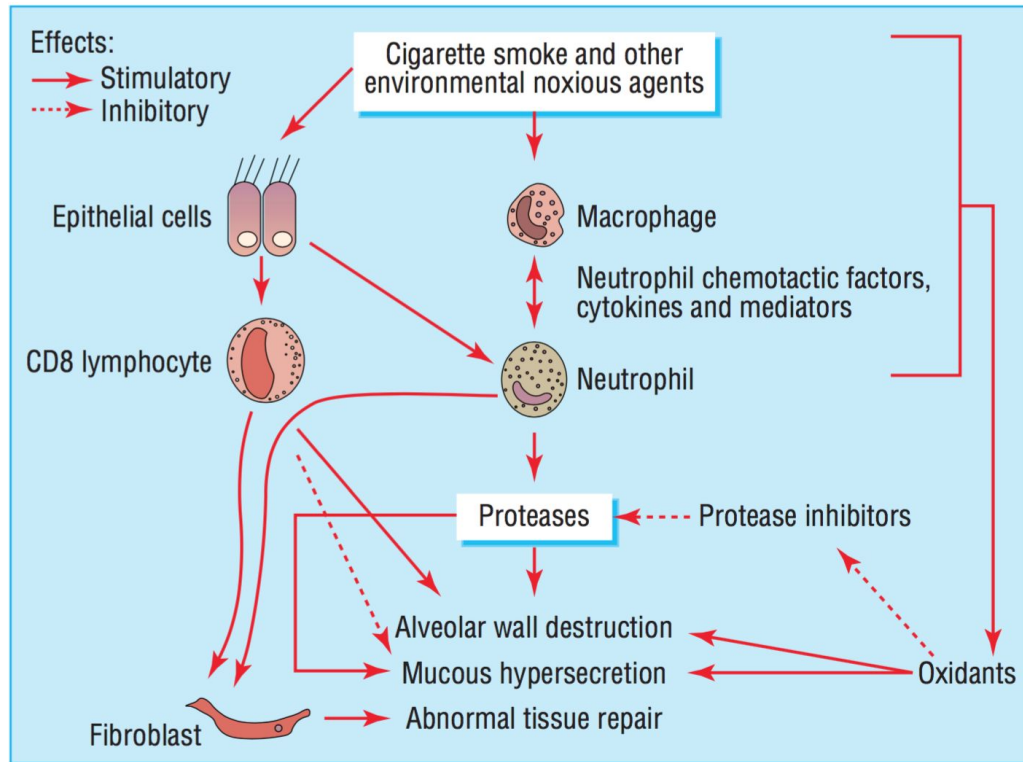
Retrieved from:
https://en.wikipedia.org/wiki/Chronic_obstructive_pulmonary_disease#/media/File:Chronic_obstructive_pulmonary_disease_world_map-Deaths_per_million_persons-WHO2012.svg

Air Pollution around the world



Retrieved from:
<https://blogs.scientificamerican.com/plugged-in/files/2014/06/Map-2.png>

Environmental Factors - Smoking



Retrieved from (MacNee, 2006)

Biological Perspective- Structural Changes

- Airway Smooth Muscle
 - Inverse correlation between airway smooth muscle quantity and lung function
- Cytokines (IL-8) and Chemokines (CXCL10)
- Neutrophils

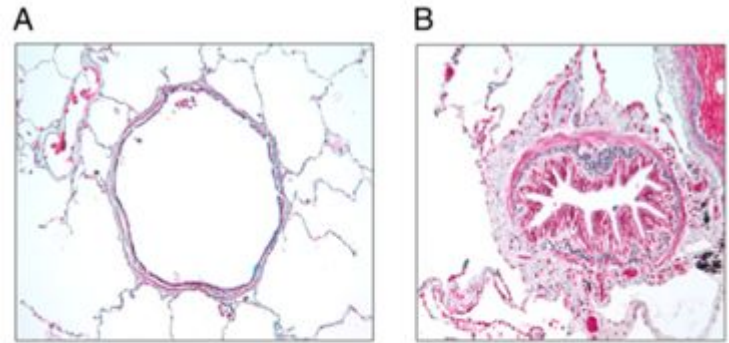


FIGURE 1. A, Normal small airway. B, Abnormal small airway with airway remodeling in COPD. The airway is narrowed by deposition in the interstitial space. (Reprinted with permission from Hogg et al.⁶⁷) Retrieved from: (Berge et al., 2011)

Biological Perspective - Genetics

- Alpha 1-antitrypsin deficiency (A1AD)
- Genome Wide Association Studies (GWAS) determined more genes associated with COPD susceptibility
- Genes coding for:
 - Proteases and antiproteases
 - Xenobiotic Metabolizing Enzymes
 - Inflammatory Mediators
 - Antioxidant
 - Mucociliary clearance
 - Airway hyperresponsiveness

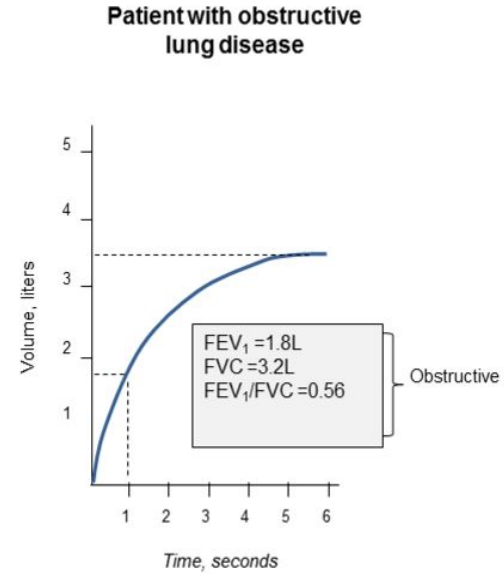
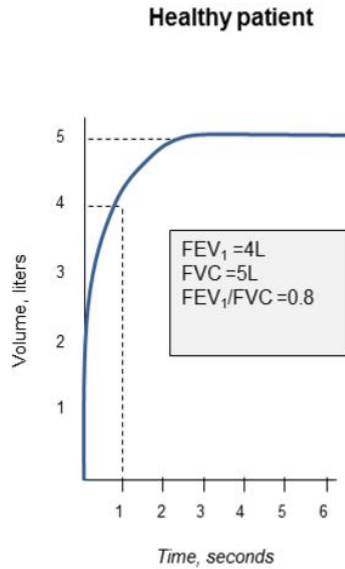


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<https://3pw8zx30ta4c3jegjv14ssuv-wpengine.netdna-ssl.com/wp-content/uploads/sites/2/2015/11/GeneticTesting-690x380-650x358.jpg>

Diagnosis

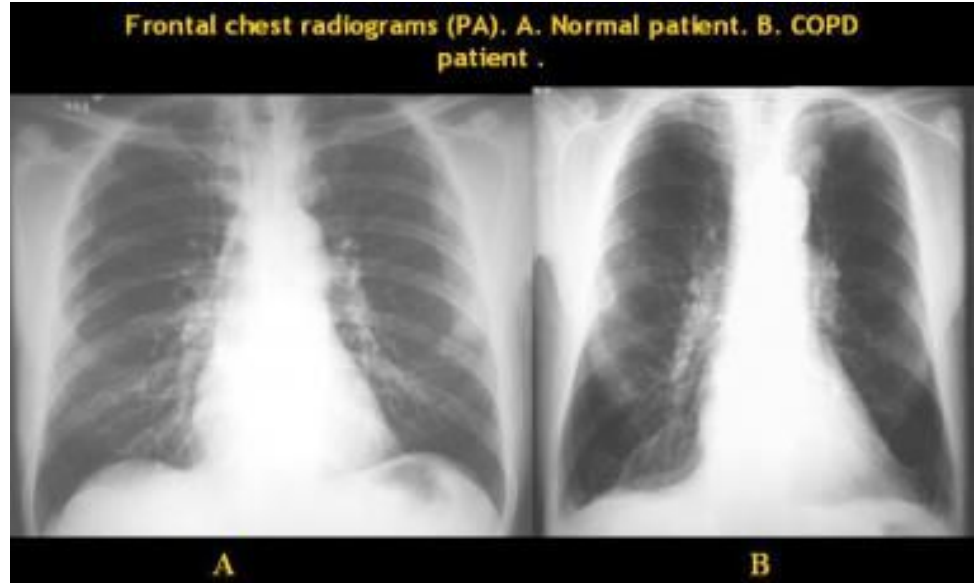
Spirometry

- **FEV1**= forced expiratory volume in one second
- **FVC**= forced vital capacity



Chest X-Rays

- Characteristics of COPD patient X-rays:
 - Pulmonary edema
 - Pneumothorax (collapsed lung)
 - Pneumonia
 - Flattened diaphragm
- Image: decreased vasculature to lung



Retrieved from: <http://emedicine.medscape.com/article/355688-overview>

Management and Treatment

Pulmonary Rehabilitation

What is pulmonary rehabilitation?

- Widely used for long-term COPD treatment
- Main elements:
 - Exercise training
 - Cardio and strength training
 - Education on disease
 - How to use oxygen therapy
 - Understanding medications
 - Nutritional support
 - Psychosocial support

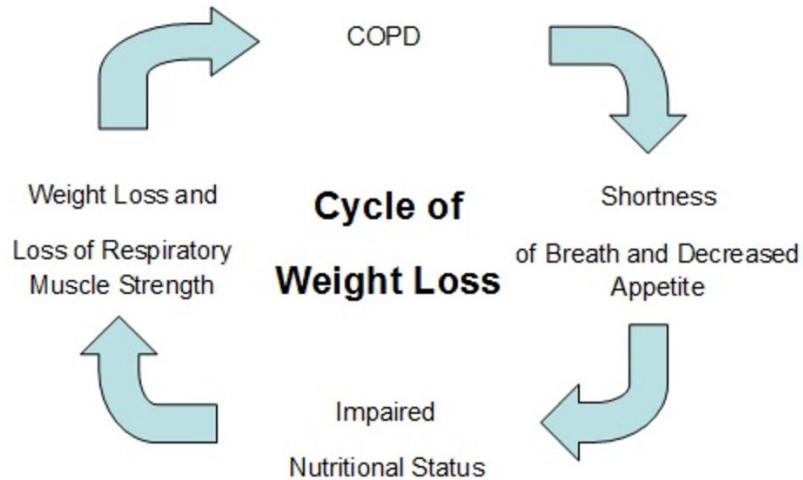


Retrieved from:
<http://drvijaynair.8m.com/>

Retrieved from:
<http://blog.copdstore.com/the-official-guide-to-copd-nutrition>

Primary reason for attending pulmonary rehab: weight loss

- Associated with increased mortality of COPD patients
- Detecting and managing is crucial to rehabilitation



Outcomes of pulmonary rehabilitation

More physically active/better exercise endurance

Increased lung function/capacity

More independent

Improved quality of life



Clinical evidence of pulmonary rehab

Berry et al. (1999)

- Group participating in pulmonary rehab (active group)= significantly **increased exercise endurance**

Table 4—Six-Minute Walking Distances for Control and Active Groups*

Groups	Study Entry	3 mo	6 mo
Control	273 (19)	266 (22)	281 (21)
Sample size	28	28	23
Active	245 (18)	304 (19)†	320 (28)
Sample size	36	32	22

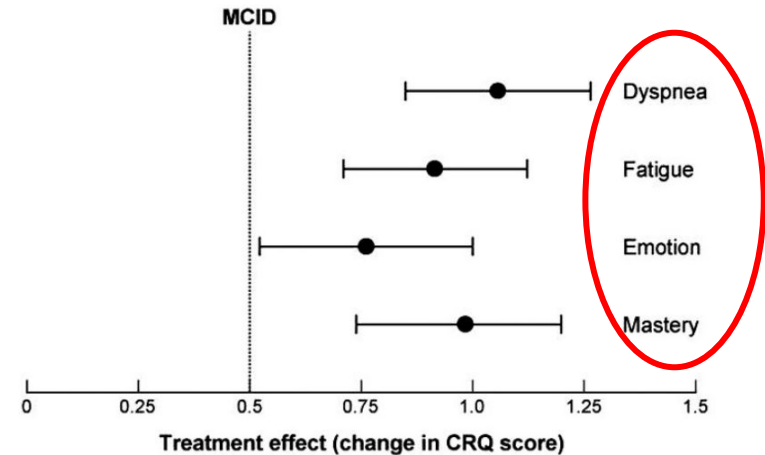
*Data are presented as mean (SE) or No.

†p < 0.02.

Retrieved from: Berry et al. (1999)

Lacasse et al. (2006)

- Pulmonary rehab **improvement of other symptoms**



Retrieved from: Lacasse et al. (2006)

Popular Aspects of Pulmonary Rehabilitation

Diet

- Fatty fish → polyunsaturated fatty acids
- Fruits (antioxidants) → protective effects
- High protein → rebuild muscles
- Overall: increase caloric intake
 - Due to higher energy expenditure from breathing



Smoking Cessation

- Best thing to begin the slowing of the disease progression
- Less goblet cells, which secrete mucus → improvement in respiratory symptoms



Effects of Smoking Cessation Within the First Year in COPD

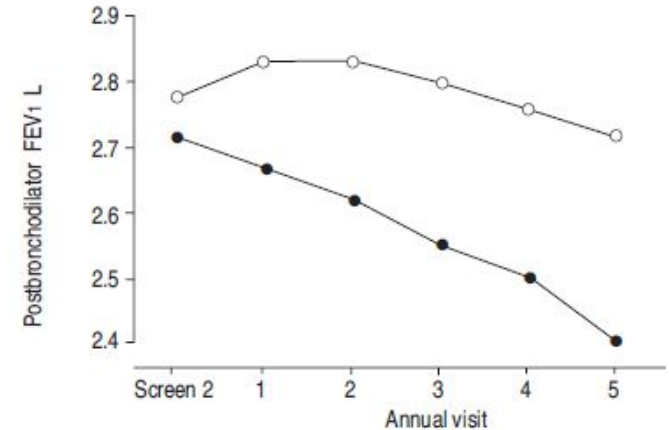


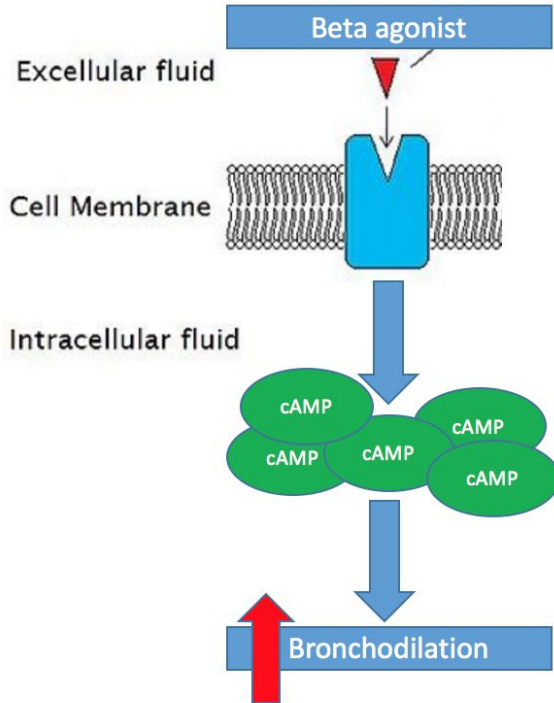
Fig. 1. – Effect of smoking cessation (○: persistent smoking cessation; ●: continued smoking) on postbronchodilator forced expiratory volume in one second (FEV₁) decline. From [64].

Retrieved from: Willemsen et al. (2004)

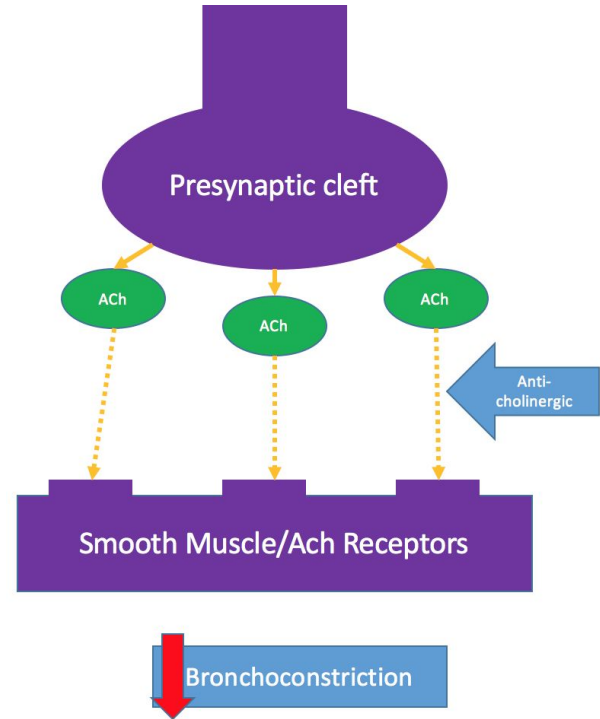
Medications- Bronchodilators

Types of of bronchodilators:

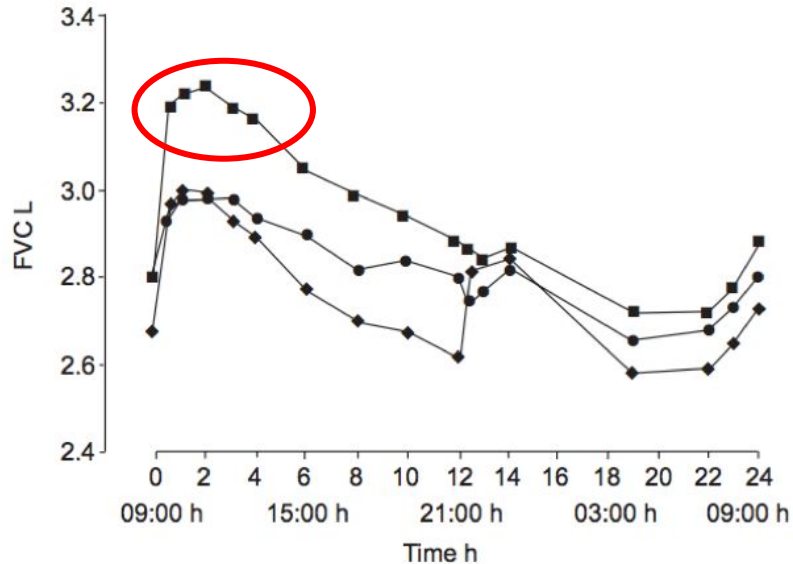
1. Beta agonists



2. Anti-cholinergics



Which is better?



Retrieved from: Van Noord et al (2005)

- Use of beta- agonists associated with improvements in:
 - Symptoms of fatigue
 - Lung capacity
 - Dyspnea
- Clinical study by Van Noord et al. (2005) showed combination made a difference for in the first 12-24 hours, specifically severe COPD cases

Conclusion

Question 1: What is the most common course of management for COPD?

1. Provide protein that they are lacking since COPD is always due to a Alpha 1-antitrypsin deficiency
2. Anti-cholinergic drugs
3. Pulmonary rehabilitation and beta-agonists ##
4. Pulmonary rehabilitation
5. None of the above

Question 2: What are 3 environmental factors that worsen COPD symptoms?

1. Smoking, asthma, allergies
2. Air pollution, dust, smoking
3. Dust, drinking, poor diet
4. Smoking, indoor air pollution, outdoor air pollution ##
5. Outdoor air pollution, occupational pollution, diet