COPD:
Home NIV…..Is there benefits ?

October 13th Moncton, NB

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Conflict of Interest Disclosures

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☒ 2. I wish to disclose the following potential conflicts of interest, **OR**

Type of Potential Conflict	Employee of Philips Respironics Inc.
Grant/Research Support	
Consultant	
Speakers' Bureaus	
Financial support	
Other	

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1.
2.
3.

COPD – fast facts

- 3rd
- 3
- 1.5

- leading cause of death
- Million afflicted
- Million diagnosed

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Managing COPD patients is a major issue

Growing COPD population

More than

3 million

afflicted in Canada

Up to

50% afflicted

Remain undiagnosed

Increasing economic burden

COPD readmissions are placing increased demands on health systems, governments and payers throughout the world.

SOURCE: Canadian Thoracic Society

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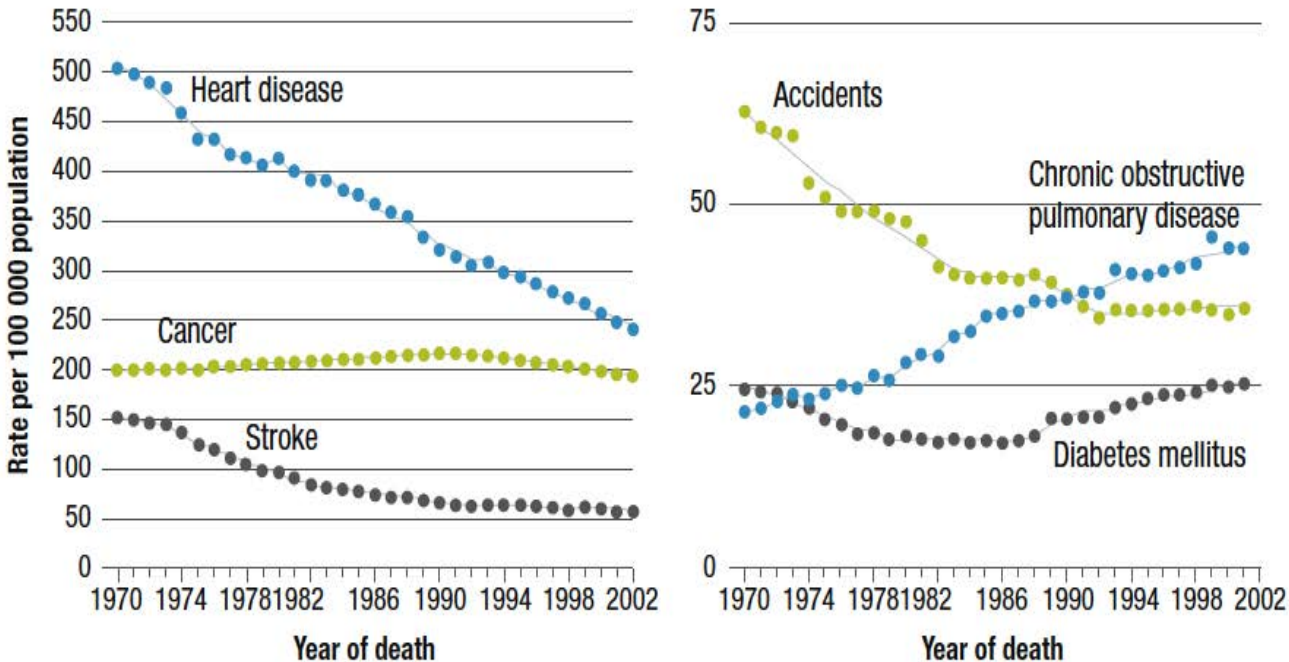
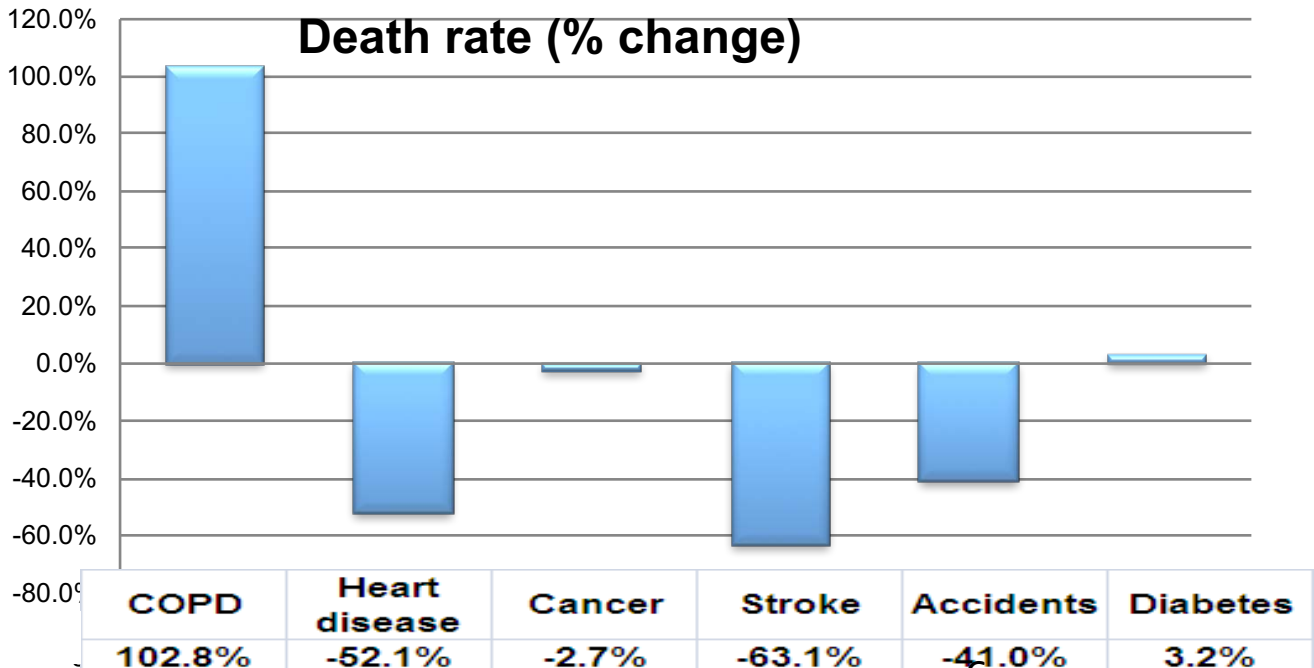
RESPIRONICS

Why focus on COPD?
Only chronic disease where mortality still rising

Figure 12 Trends in age–standardized death rates for the six leading causes in the United States, 1970 to 2020



Change in COPD Mortality compared with other major causes from 1970-2002



U.S. Leading Causes of Death; JAMA, September 14, 2005 – Vol. 294, No. 10

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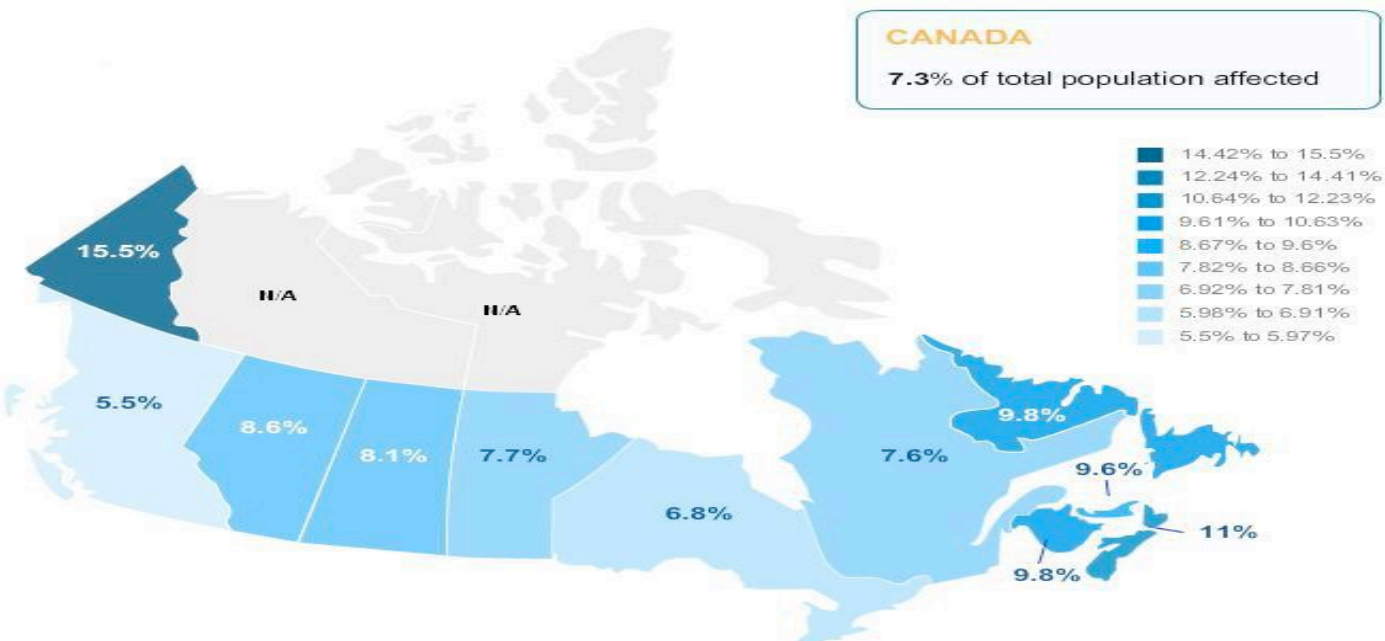
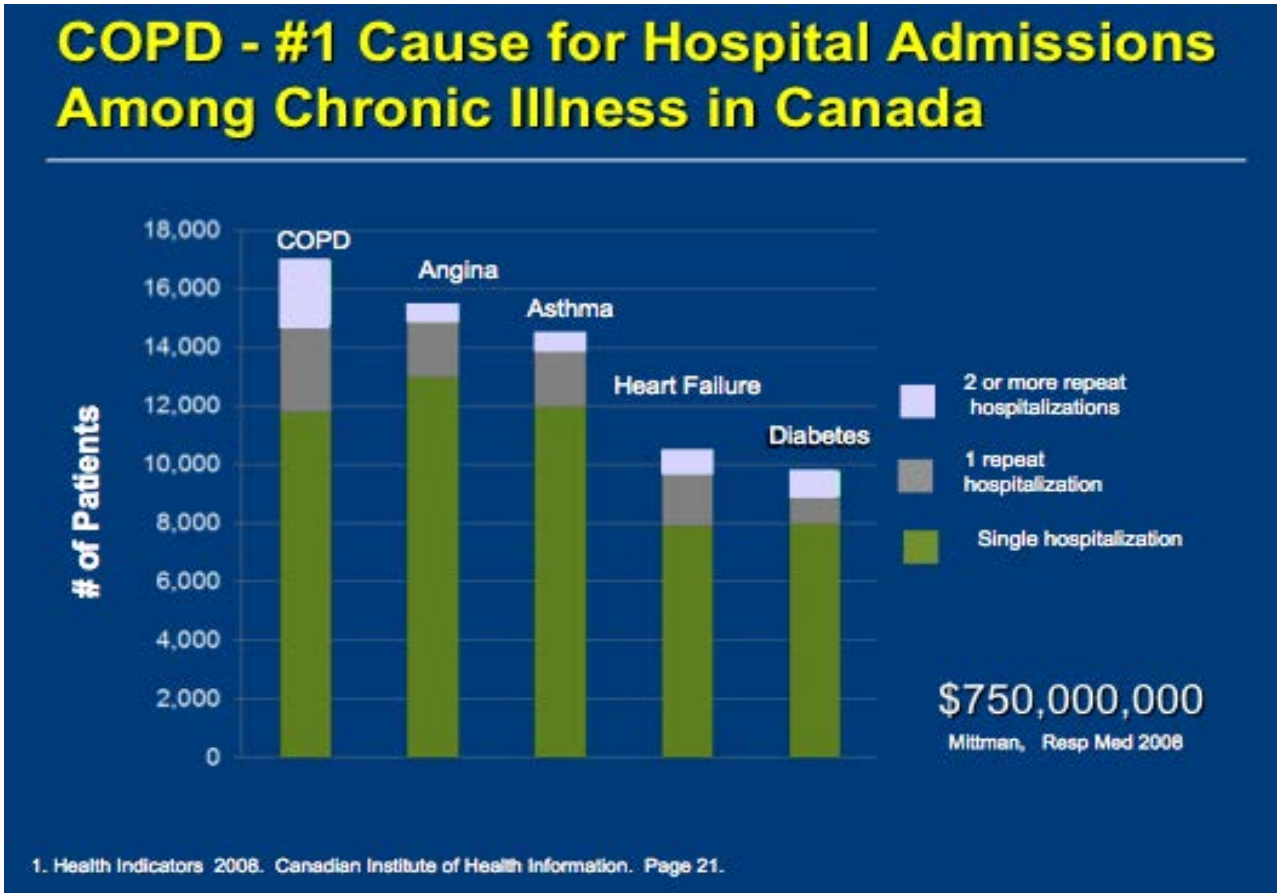
Canada: COPD Prevalence, Aged 65+, 2010



1:4 Canadians >35 years will develop COPD
Hospitalization rates are 60% higher in rural areas

one 2014
Creating the future of healthcare



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New Brunswick: Top 10 most frequent hospital admissions (2011-12)

Hospital admissions	# of cases	Rate per 10,000
1- Vaginal Delivery	4,187	55.7
2- Newborn	3,638	48.4
3- COPD (Chronic Obstructive Lung Disease)	2,955	39.3
4- Enteritis (Inflammation of Small Intestine)	1,718	22.9
5- Viral/Unspecified Pneumonia	1,708	22.7
6- Heart Failure without Cardiac Catheter	1,595	21.2
7- Arrythmia (Abnormal Heartbeat)	1,503	20.0
8- Palliative Care (end of life)	1,487	19.8
9- Heart Attack	1,428	19.0
10- Angina /Chest Pain	1,417	18.9

- **New Brunswick: Hospital readmissions for COPD patients**

- **within 30 days 6%**
- **within 90 days 13%**
- **within 180 days 23%**

- **Source:** CIHI Portal - NB facilities (Acute Care) for 2009/10.

IHE INSTITUTE OF HEALTH ECONOMICS ALBERTA CANADA

Alberta COPD Economic Surveillance

Population at Increased Risk for COPD
539K smokers
$24M

GAP: Limited utilization of smoking cessation programs
Smoking cessation drugs 50K+
Smoking cessation programs 6K+

COPD Onset & Diagnosis
~88K diagnosed
? undiagnosed
$16M

GAP: Coordinated screening
Diagnosis 68K tested

Early Stage COPD treatment
63K patients
$34M

GAP: Community programming
Family doctor visits 157K
Respirologist visits 28K

GAP: Not all receiving drugs
COPD Drugs 45K

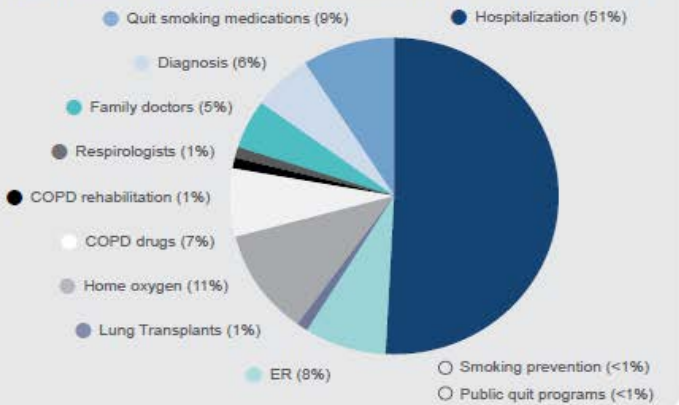
GAP: Rehab capacity
Rehab spots 1K

$180M
Advanced Stage COPD treatment
11.5K+ patients

GAP: Community programming
Hospitalizations 11K
ER visits 21K
Home oxygen 11.5K
Lung transplants 13K

LEGEND
- Population
- Expenditure
- Service Gaps
- Service Utilization

Distribution of $254 Million for COPD Care Services in 2014



From Economic surveillance for chronic obstructive pulmonary disease (COPD) in Alberta (2016), by Dr. A.E. Waye, Dr. P. Jacobs, Dr. M.B. Ospina, Dr. M.K. Strickland, and Dr. I. Mayers; available at www.ihe.ca.

Contact: Arianna Waye (awaye@ihe.ca); Philip Jacobs (pjacobs@ihe.ca)

Funded by an unrestricted grant from Boehringer Ingelheim (Canada) Ltd./Ltée.

Economic COPD impact in Alberta. Key Points

Figure 4: Components of COPD costs in Alberta, total of $254 million (2013)

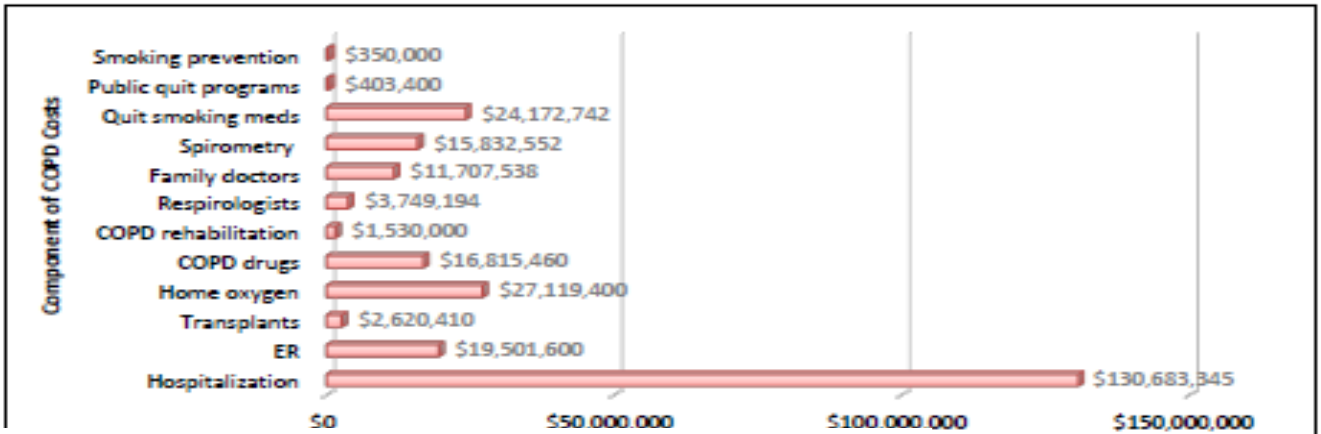
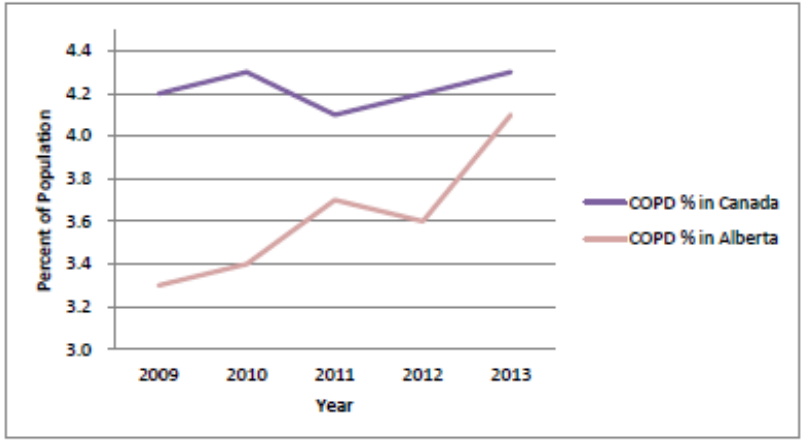
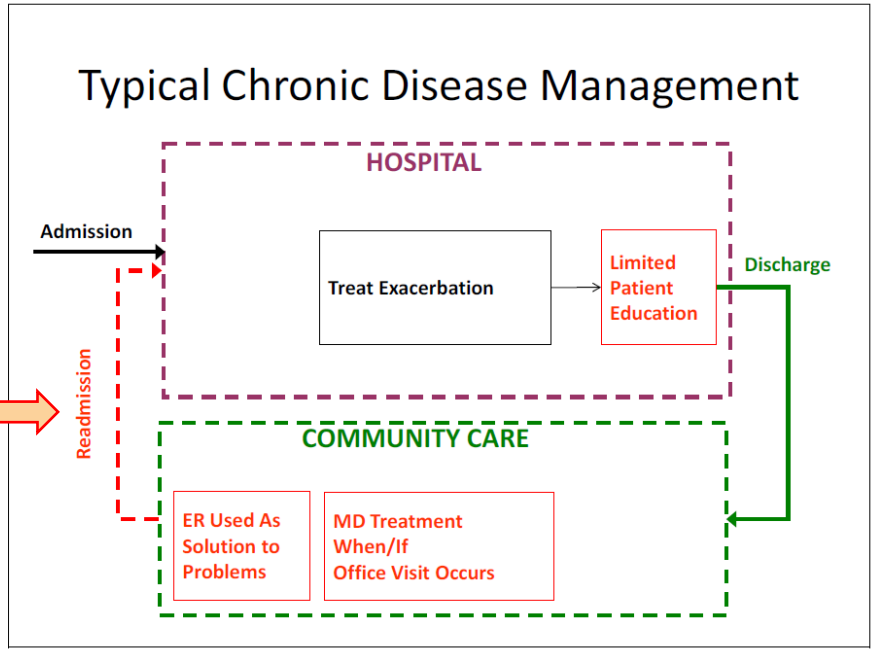


Figure 2: Percent of population diagnosed with COPD in Alberta and Canada, aged 12 years and over (2009 to 2013)



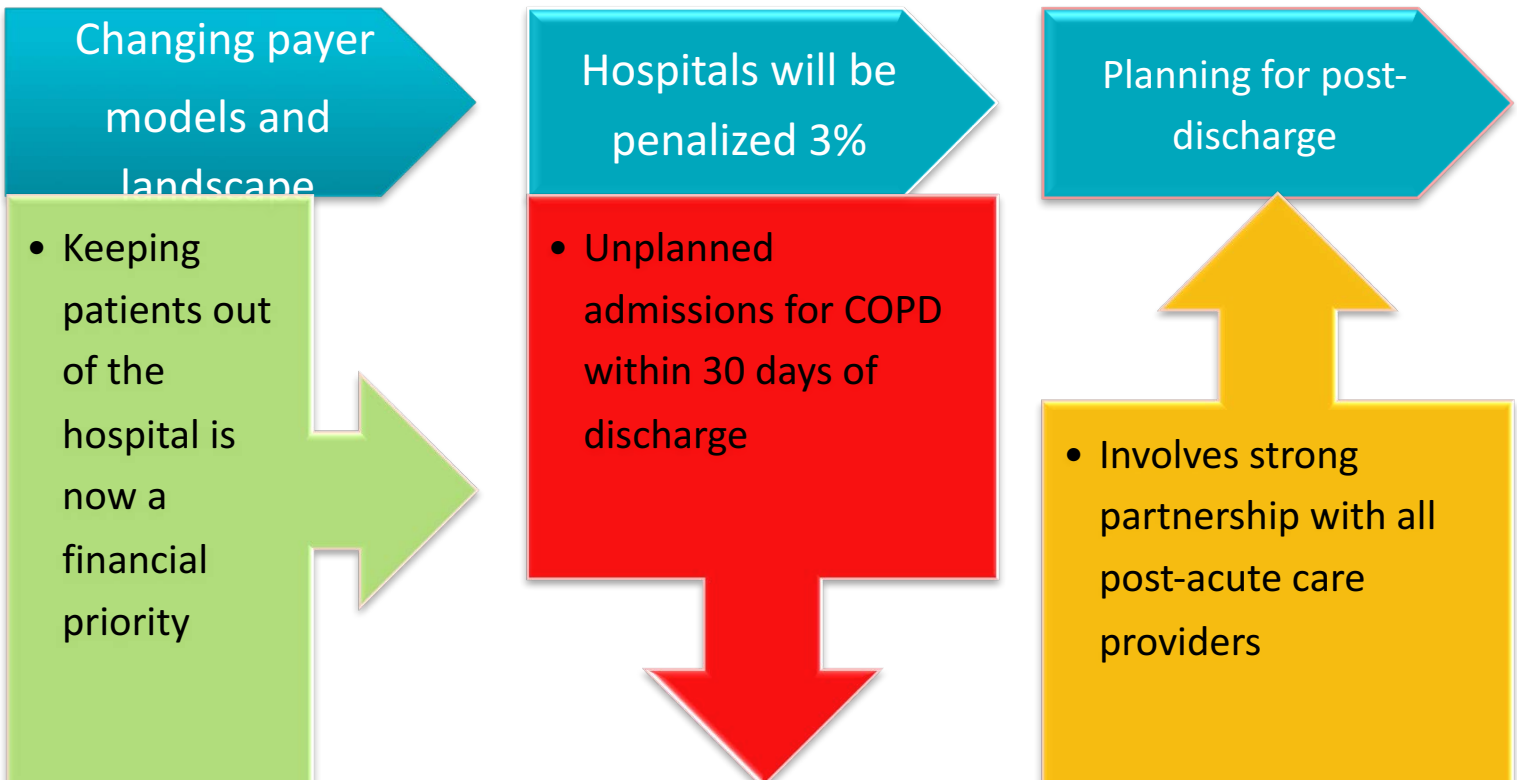
Current COPD patient readmittance scenario

23% of patients readmitted within 30-180 days[2] @ $7,400 per patient average readmission[1]



[1]Toy et al. The economic impact of exacerbations of COPD and exacerbation definition. A review. *COPD* 2010: 7:214-228
[2]National Quality Forum #1891, October 26, 2012

Market Dynamics



COPD is not glamour !

Dr John Haggie, minister of health , NL

Clinical Evidence

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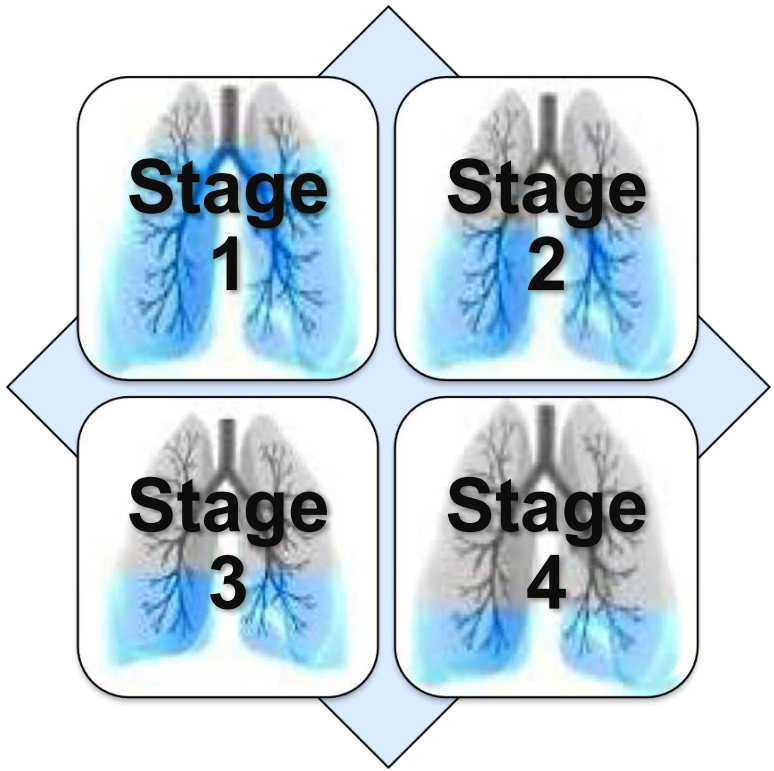
COPD stages
Severity classified by spirometry



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COPD stages

Stage 1

80% normal lung function

MILD

- FEV_1 / FVC < 70%
- $FEV_1 \geq 80\%$ predicted
- With or without symptoms

GOLD Pocket Guide to COPD Diagnosis, Management, and Prevention. A guide for Health Care Professionals Updated 2010. See also www.goldcopd.org

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COPD stages

Stage 2

50 – 80% normal lung function

MODERATE

- FEV_1 / FVC < 70%
- 50% ≤ FEV_1 < 80% predicted

GOLD Pocket Guide to COPD Diagnosis, Management, and Prevention. A guide for Health Care Professionals Updated 2010. See also www.goldcopd.org

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COPD stages

Stage 3

30 – 50% normal lung function

SEVERE

- FEV_1 / FVC < 70%
- 30% ≤ FEV_1 < 50% predicted

Modified from GOLD Pocket Guide to COPD Diagnosis, Management, and Prevention. A guide for Health Care Professionals Updated 2010. See also www.goldcopd.org

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COPD stages

Severity classified by spirometry

Stage 4

Less than 30% normal lung function

VERY SEVERE

- FEV_1 / FVC <70%
- FEV_1 <30% predicted

Modified from GOLD Pocket Guide to COPD Diagnosis, Management, and Prevention. A guide for Health Care Professionals Updated 2010. See also www.goldcopd.org

COPD

Simply put; its an **AIR OUT** problem. CO2 has to be cleared to manage pt. ventilation.

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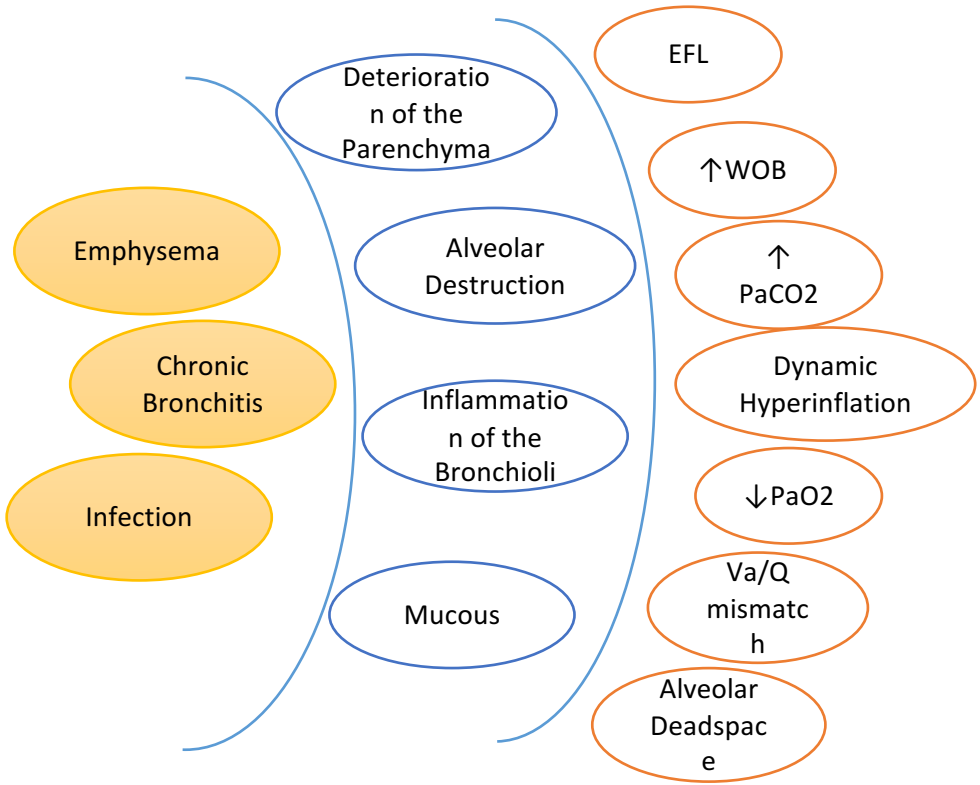
Pathological links from Disease to Signs



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Readmission Risk factors

- Previous hospital admission (ICU/ventilation)
- Higher levels of $PaCO_2$
- Dyspnea
- Long-term oxygen therapy
- No routine physical activity
- Poor medication compliance
- No support/care giver

Economic COPD impact in Alberta. Key Points

7.2 Acute exacerbation care gap: missing service

There is evidence to suggest that the use of non-invasive (NIV) therapy in the emergency department, which is generally administered by a respiratory therapist, is highly effective. Specifically, a Cochrane review suggests that NIV results in fewer complications of treatment (68% reduction), lower risk of intubation (58%), reduced mortality risk (59%), and shorter hospital length of stay (3.24 fewer days) (Lightowler et al. 2003). There is no available information on the use (or availability) of NIV therapy in emergency departments and/or the hospital setting in Alberta.

There is a vicious circle of resource use in the care of persons with COPD. The highest costs are expended at advanced stages of COPD, in the form of frequent hospitalizations, emergency department visits, and oxygen supplementation. People with COPD progress through the disease until they reach a point where they need costly and urgent treatments. At the start of the respiratory health continuum, where the movement to progressed disease can be slowed, very few services are provided in the form of primary care and rehabilitation COPD program

Carbon Dioxide is a risk factor for readmission

- Elevated PCO_2 is a risk factor for hospital admission for a COPD patient.[1]
  - 52% of the studies reported PaCO2 as a risk factor for readmission.[2]
- NIV has been shown to be the most effective treatment option for reducing $PaCO_2$ in hypercapnic COPD patients.[3]
- Clinical studies on NIV in hypercapnic COPD show improved blood gases and lower hospitalization rates compared to patients not treated with NIV at home.[4,5]

1. Kessler R, Faller M, Fourgaut G, Mennecier B, Weitzenblum E. 1999. Predictive factors of hospitalization for acute exacerbation in a series of 64 patients with chronic obstructive pulmonary disease. *American Journal of Respiratory & Critical Care Medicine*, 159:158–64
2. Bahadori, K, Fitzgerald, M. Risk factors of hospitalization and readmission of patients with COPD exacerbation – systematic review, *International Journal of COPD* 2007:2(3) 241–251
3. Ligtowler JV et al. Non-invasive positive pressure ventilation to treat respiratory failure resulting from exacerbations of COPD; Cochrane Systematic Review. BMJ. 2003. Jan 25:326(7382):185.
4. Duiverman ML, Wempe JB, et al. Two-year home-based nocturnal noninvasive ventilation added to rehabilitation in chronic obstructive pulmonary disease patients: a randomized controlled trial. Respir Res. 2011 Aug 23;12:112.
5. De Backer L, Vos W, et al. The effects of long-term noninvasive ventilation in hypercapnic COPD patients: a randomized controlled pilot study. Int J Chron Obstruct Pulmon Dis. 2011;6:615-24.

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Why do COPD patients exacerbate?

- They fail in adherence of steroidals
- They fail in med neb adherence of bronchodilators
- Their activity levels decrease or stop
- They fail to make follow up physician appointments.

If we know the causes of these exacerbations, why are readmission rates as high as 23%?

- WHAT IS MISSING? NIV ?

- Why would we want to treat these patients any differently in the home than we do when they arrive in the ER??

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Treating COPD in the home

- NIV has shown to be the most effective in reducing CO_2 in stable hypercapnic COPD patients.[3]

- When initiated early this can help reduce hospital admission rates and the cost of healthcare, while improving the quality of life.[3]

[3](Ligtowler JV, Wedzicah JA, Elliott MW, Ram Fs. Non-invasive ventilation positive pressure ventilation to treat respiratory failure resulting from exacerbations of COPD. Cochrane Systematic Review. BMJ 2003 Jan 25: 326 (7382): 185

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Respiratory Medicine (2014) 108, 722–728

Available online at www.sciencedirect.com

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journal homepage: www.elsevier.com/locate/rmed

Home non-invasive ventilation use following acute hypercapnic respiratory failure in COPD

Jonathan A. Galli*, Jason S. Krahnke, A. James Mamary, Kartik Shenoy, Huaqing Zhao, Gerard J. Criner

Temple University, Division of Pulmonary and Critical Care Medicine, Philadelphia, PA, USA

Results: Patients in the NPPV post discharge group demonstrated superior event-free survival compared to the no-NPPV post discharge group ($\varphi^2 = 23.8$, $p < 0.0001$). The NPPV post discharge group had a statistically significant reduction in hospital readmissions (40% versus 75%, $p < 0.0001$) through 180 days from the index admission.

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Table 2 Results for secondary endpoints comparing NPPV post discharge versus no-NPPV post discharge.

	Used NPPV post discharge ($N = 78$)	No-NPPV post discharge ($N = 88$)	P value
Number of patients with readmission – no (%)			
At 30 days	12 (15%)	35 (40%)	<0.001
At 90 days	20 (26%)	53 (60%)	<0.0001
At 180 days	31 (40%)	66 (75%)	<0.0001
Number of patients with readmission to ICU – no (%)			
At 30 days	2 (3%)	12 (14%)	0.01
At 90 days	5 (6%)	20 (23%)	0.004
At 180 days	6 (8%)	28 (32%)	0.0001
Number of patients intubated at readmission – no (%)			
At 30 days	1 (1%)	7 (8%)	0.07
At 90 days	4 (5%)	11 (13%)	0.11
At 180 days	5 (6%)	16 (18%)	0.03
Mortality – no (%)			
At 30 days	3 (4%)	6 (7%)	0.5
At 90 days	6 (8%)	11 (13%)	0.44
At 180 days	8 (10%)	17 (19%)	0.13

NPPV, non-invasive positive pressure ventilation; ICU, intensive care unit.

Hot-HMV

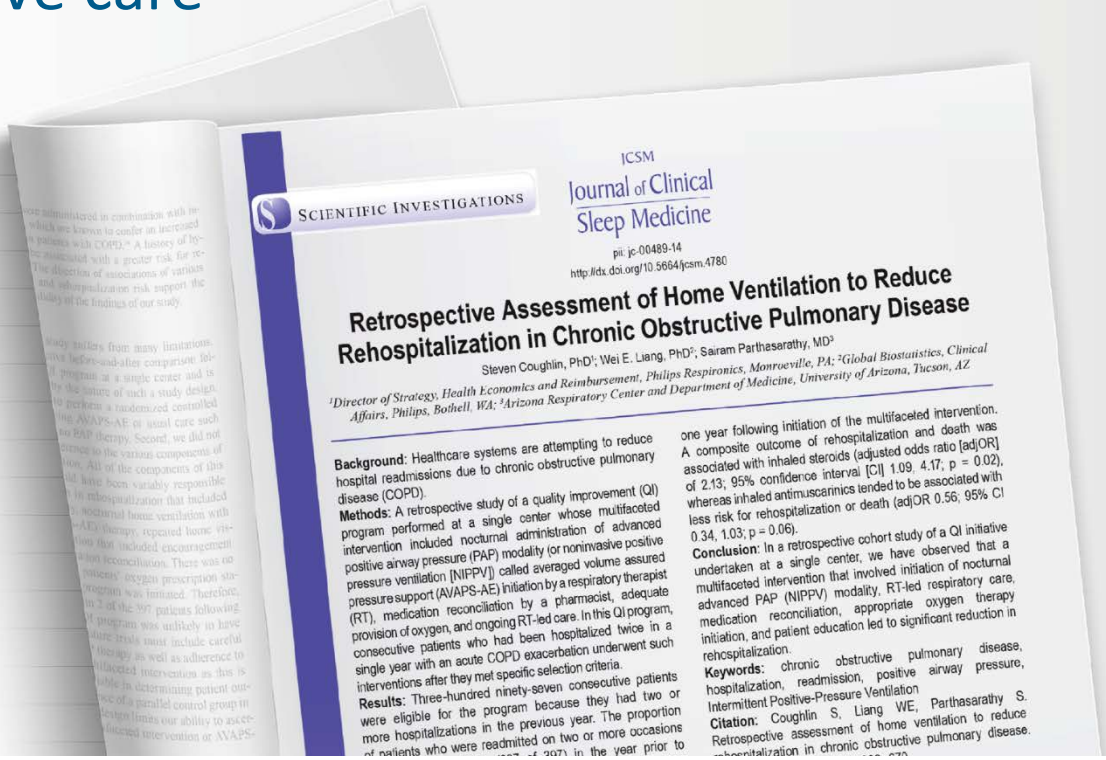
ERS 2016 abstract

- Multi-centre, RCT funded by Philips Respironics and ResMed
  - 116 patients
    - Severe COPD
    - Recent life threatening exacerbation
    - PaCO2 > 7 kPA
  - Intervene in the recovery phase
  - Follow up at 6 weeks, 3 months and 1 year

- Titration strategy
  - High pressures to correct nocturnal hypoventilation
    - Mean IPAP = 24
    - Mean rate = 14
    - Mean EPAP = 4
  - O2 started at daytime rate

- Results
  - Prolonged admission free survival form 1.4 to 4.3 months (p=0.007)

Multifaceted COPD program shown to improve care



SCIENTIFIC INVESTIGATIONS

JCSM Journal of Clinical Sleep Medicine

pii: jc-00489-14
http://dx.doi.org/10.5664/jcsm.4780

Retrospective Assessment of Home Ventilation to Reduce Rehospitalization in Chronic Obstructive Pulmonary Disease

Steven Coughlin, PhD[1]; Wei E. Liang, PhD[2]; Sairam Parthasarathy, MD[3]

[1]Director of Strategy, Health Economics and Reimbursement, Philips Respironics, Monroeville, PA; [2]Global Biostatistics, Clinical Affairs, Philips, Bothell, WA; [3]Arizona Respiratory Center and Department of Medicine, University of Arizona, Tucson, AZ

Background: Healthcare systems are attempting to reduce hospital readmissions due to chronic obstructive pulmonary disease (COPD).

Methods: A retrospective study of a quality improvement (QI) program performed at a single center whose multifaceted intervention included nocturnal administration of advanced positive airway pressure (PAP) modality (or noninvasive positive pressure ventilation [NIPPV]) called averaged volume assured pressure support (AVAPS-AE) initiation by a respiratory therapist (RT), medication reconciliation by a pharmacist, adequate provision of oxygen, and ongoing RT-led care. In this QI program, consecutive patients who had been hospitalized twice in a single year with an acute COPD exacerbation underwent such interventions after they met specific selection criteria.

Results: Three-hundred ninety-seven consecutive patients were eligible for the program because they had two or more hospitalizations in the previous year. The proportion of patients who were readmitted on two or more occasions

one year following initiation of the multifaceted intervention. A composite outcome of rehospitalization and death was associated with inhaled steroids (adjusted odds ratio [adjOR] of 2.13; 95% confidence interval [CI] 1.09, 4.17; p = 0.02), whereas inhaled antimuscarinics tended to be associated with less risk for rehospitalization or death (adjOR 0.56; 95% CI 0.34, 1.03; p = 0.06).

Conclusion: In a retrospective cohort study of a QI initiative undertaken at a single center, we have observed that a multifaceted intervention that involved initiation of nocturnal advanced PAP (NIPPV) modality, RT-led respiratory care, medication reconciliation, appropriate oxygen therapy initiation, and patient education led to significant reduction in rehospitalization.

Keywords: chronic obstructive pulmonary disease, hospitalization, readmission, positive airway pressure, Intermittent Positive-Pressure Ventilation

Citation: Coughlin S, Liang WE, Parthasarathy S. Retrospective assessment of home ventilation to reduce rehospitalization in chronic obstructive pulmonary disease.

1. Coughlin S., Liang WE, Parthasarathy S. Retrospective Assessment of Home Ventilation to Reduce Rehospitalization in Chronic Obstructive Pulmonary Disease. J Clin Sleep Med. 2015 Jun 15;11(6):663-70.

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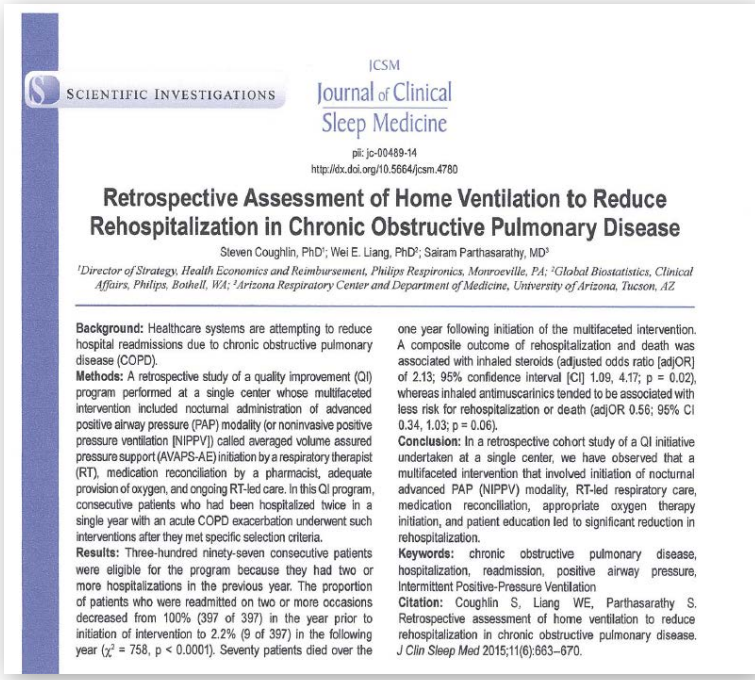
AVAPS-AE: Clinical Evidence

Retrospective Assessment of Home Ventilation to Reduce Rehospitalization in COPD
Coughlin et al. JCSM Vol 11. No. 6, 2015

- Retrospective Cohort Study
- Single centre in the US
- n = 397
- COPD patients with ≥ 2 hospitalisations in prev. year with AE-COPD
- Multifaceted quality improvement (QI) intervention
  - nocturnal NIV with AVAPS-AE
  - RT-led respiratory care
  - Medication reconciliation by a pharmacist
  - Appropriate oxygen therapy initiation
  - Patient education



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Results: Three-hundred ninety-seven consecutive patients were eligible for the program because they had two or more hospitalizations in the previous year. The proportion of patients who were readmitted on two or more occasions decreased from 100% (397 of 397) in the year prior to initiation of intervention to 2.2% (9 of 397) in the following year (χ^2 = 758, p < 0.0001). Seventy patients died over the one year following initiation of the multifaceted intervention. A composite outcome of rehospitalization and death was associated with inhaled steroids (adjusted odds ratio [adjOR] of 2.13; 95% confidence interval [CI] 1.09, 4.17; p = 0.02), whereas inhaled antimuscarinics tended to be associated with less risk for rehospitalization or death (adjOR 0.56; 95% CI 0.34, 1.03; p = 0.06).
Conclusion: In a retrospective cohort study of a QI initiative undertaken at a single center, we have observed that a multifaceted intervention that involved initiation of nocturnal advanced PAP (NIPPV) modality, RT-led respiratory care, medication reconciliation, appropriate oxygen therapy initiation, and patient education led to significant reduction in rehospitalization.
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Citation: Coughlin S, Liang WE, Parthasarathy S. Retrospective assessment of home ventilation to reduce rehospitalization in chronic obstructive pulmonary disease. *J Clin Sleep Med* 2015;11(6):663–670.

CONCLUSION

- Reduction in hospitalisations (decrease from 100% to 2.2%)

Talking Points: Methods Used

- Consecutive patients who had been hospitalized twice in a single year with an acute COPD exacerbation were screened for eligibility and admitted if:
  - COPD GOLD stages 2, 3 or 4
  - (b) Bode Index Score greater than or equal to 5 ;
  - (c) one of the following:
    - PaO2 less than or equal to 60 mmHg or
    - PacO2 greater than or equal to 52 mmHg or
    - FEV1 less than or equal to 40%
- Patients received:
  - Medication reconciliation by a pharmacist,
  - The (continued) provision of oxygen,
  - AVAPS-AE initiation by a respiratory therapist
  - Ongoing respiratory therapist -led care

AVAPS-AE

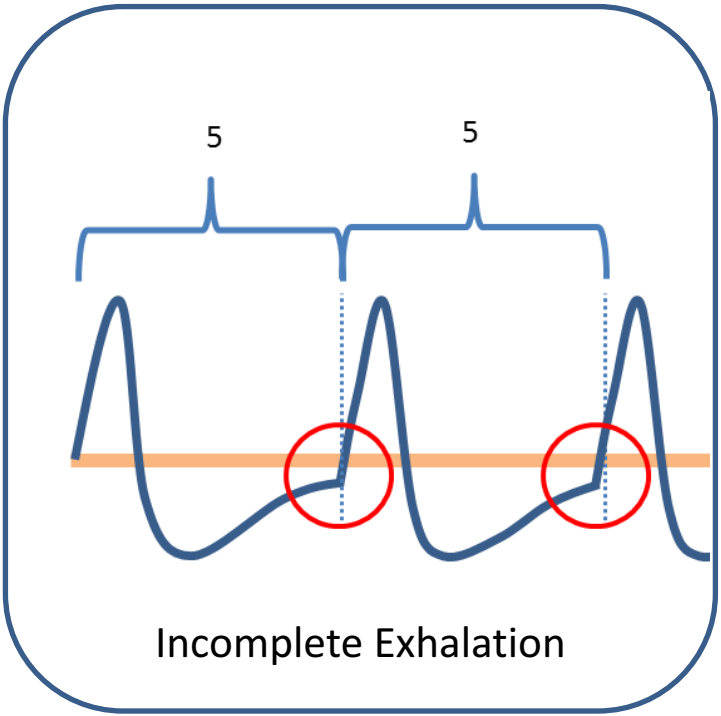
AVAPS-AE *is a auto-titration mode of noninvasive ventilation designed to better treat respiratory failure patients (OHS, COPD and NMD) in the hospital and homecare environments*

- Proven performance of AVAPS
  - Maintains targeted tidal volume
- Auto EPAP
  - Maintains patent upper airway at comfortable pressure utilizing PRI clinically proven proactive algorithm
- Auto backup rate
  - Prevents breath stacking

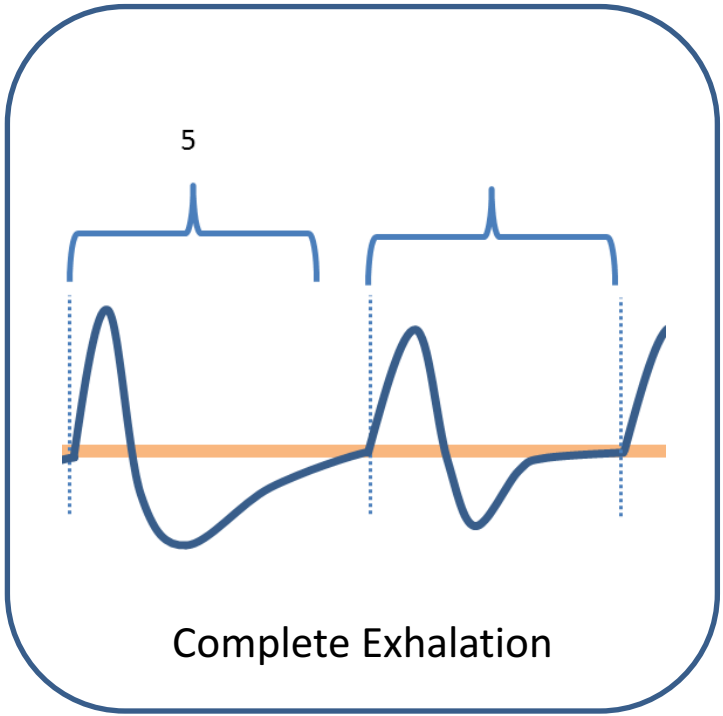
Auto Backup Rate

- Auto backup rate combined with the tidal volume assurance of AVAPS provides a minimum level of ventilation
- Comfortable assistance when needed
- No manual adjustments
- Allows the patient to fully exhale before the next timed breath is delivered to **prevent breath stacking**.

Spontaneous rate calculated and back-up rate set to 12

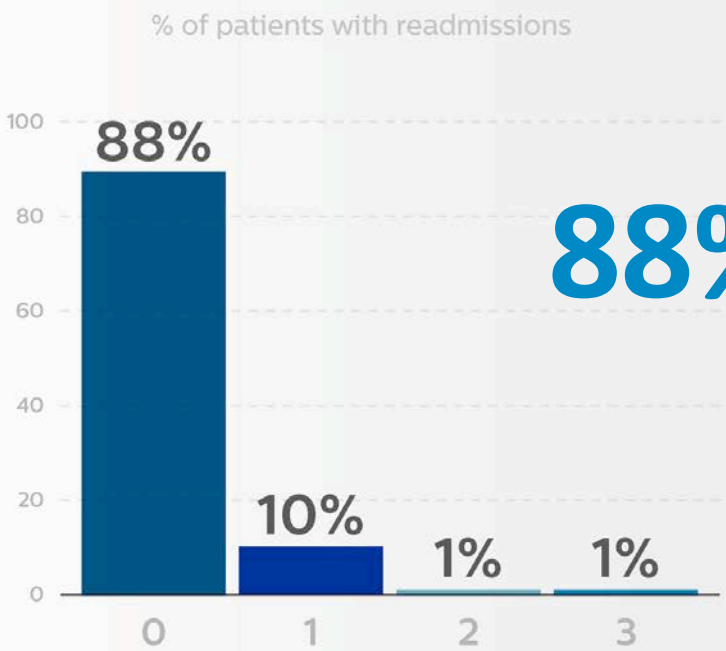


Incomplete Exhalation



Complete Exhalation

Proven to reduce readmissions



In a review of 398 COPD patients*

88% reduction

in hospital readmissions[1]

*All receiving NIV and meeting program eligibility requirements. All subjects were admitted at least twice in the prior 12 months before enrollment.

1. Coughlin S., Liang WE, Parthasarathy S. RetrospectiveAssessment of Home Ventilation to Reduce Rehospitalization in Chronic Obstructive Pulmonary Disease. J Clin Sleep Med. 2015 Jun 15;11(6):663-70.

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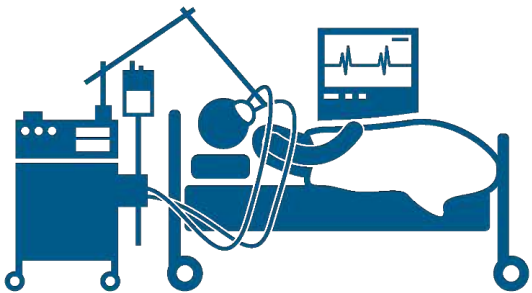
Proven to reduce costs



In a review of 398 COPD patients*

719 fewer

hospital readmissions in the year following enrollment

Saving approximately

$8 million[1]

*All receiving NIV and meeting program eligibility requirements. All subjects were admitted at least twice in the prior 12 months before enrollment.

1. Coughlin S., Liang WE, Parthasarathy S. RetrospectiveAssessment of Home Ventilation to Reduce Rehospitalization in Chronic Obstructive Pulmonary Disease. J Clin Sleep Med. 2015 Jun 15;11(6):663-70.

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Dyspnea: key concern for COPD patients

In a CDC study, 62% of COPD patients said shortness of breath affected their quality of life[1].

1. Behavioral Risk Factor Surveillance System, United States, 2011. Available at http://www.cdc.gov/brfss/annual_data/2011/pdf/codebook11_llcp.pdf

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Solutions exist; patients want more

Daily medications

Rescue inhalers

Pursed lip breathing

Anxiety management techniques

Inspiratory muscle training

Pulmonary rehabilitation

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Dyspnea: key concern for COPD patients

In a Philips focus group, 55% of COPD patients indicated that shortness of breath was their biggest concern[2].

2. Internal Philips Respironics focus group held 4/4/12 with 25 COPD patients

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Keep patients out of the cycle

Your patient feels breathless

She avoids activities that make her breathless

She does fewer activities

Her muscles become weaker and less efficient

She gets more breathless when she has to be active

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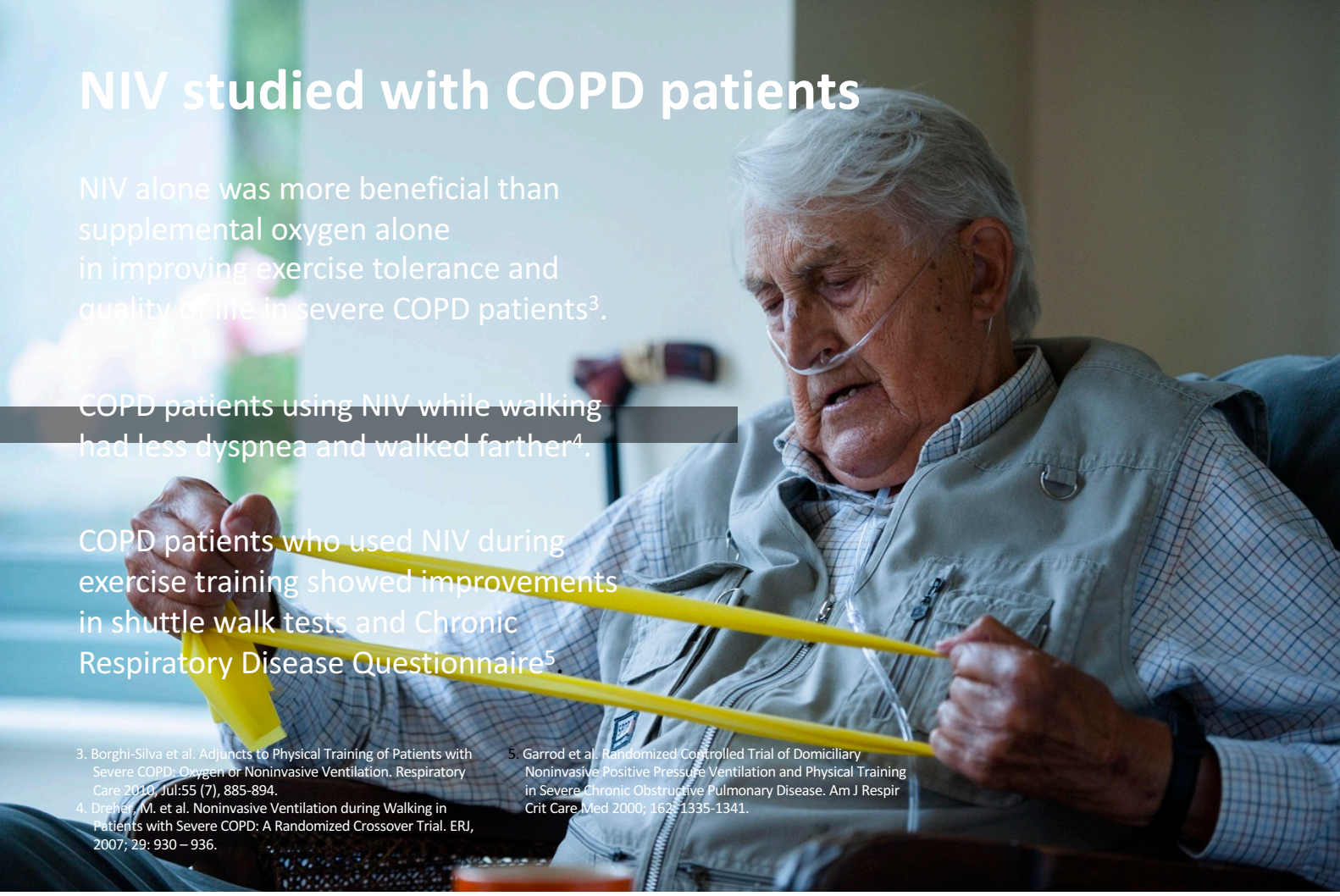
NIV studied with COPD patients

NIV alone was more beneficial than supplemental oxygen alone in improving exercise tolerance and quality of life in severe COPD patients[3].

COPD patients using NIV while walking had less dyspnea and walked farther[4].

COPD patients who used NIV during exercise training showed improvements in shuttle walk tests and Chronic Respiratory Disease Questionnaire[5].



3. Borghi-Silva et al. Adjuncts to Physical Training of Patients with Severe COPD: Oxygen or Noninvasive Ventilation. Respiratory Care 2010, Jul:55 (7), 885-894.
4. Dreher, M. et al. Noninvasive Ventilation during Walking in Patients with Severe COPD: A Randomized Crossover Trial. ERJ, 2007; 29: 930 – 936.
5. Garrod et al. Randomized Controlled Trial of Domiciliary Noninvasive Positive Pressure Ventilation and Physical Training in Severe Chronic Obstructive Pulmonary Disease. Am J Respir Crit Care Med 2000; 162: 1335-1341.

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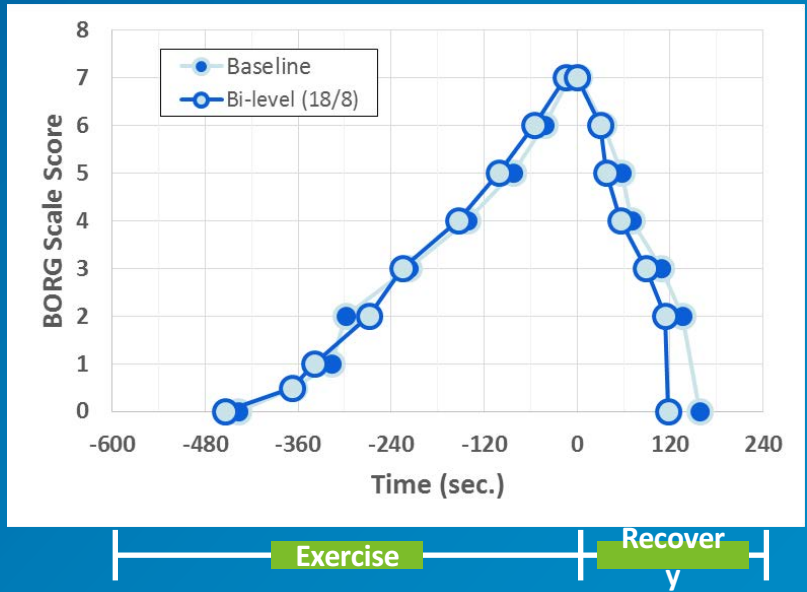
NIV helps COPD patients recover

Bi-level of 18/8 demonstrated statistically significant reduction in recovery time compared to baseline[6]



6. Mahadevan A. et al. The Impact of PEP, CPAP and Bilevel in post-exercise recovery from dyspnea in COPD Patients. ERJ September 1, 2012 vol. 40 no. Suppl 56 P3532.

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