Non-pharmacologic Management of Cough

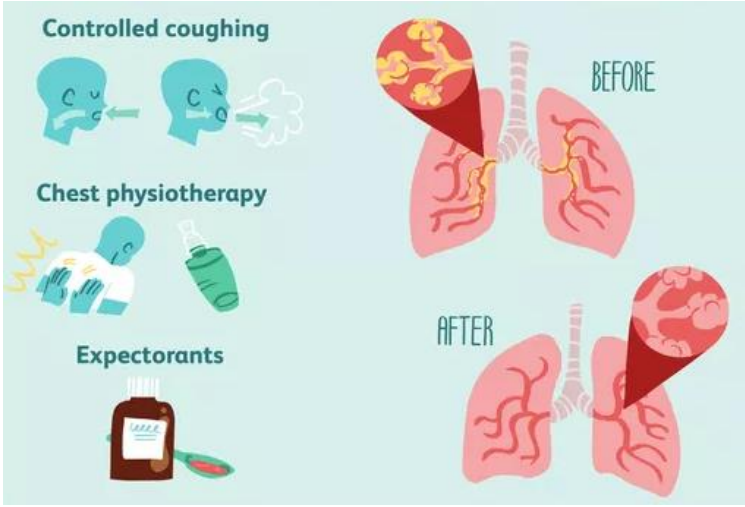
Jun Hyeok Lim
Division of Pulmonology
Department of Internal Medicine
Inha University Hospital

Cough

- Chronic cough: >8weeks in duration
  - Prevalence: 12% in general population

- A vital mechanism for the expectoration of airway secretion in the presence of mucociliary dysfunction, phlegm or excessive amounts of mucus

- Peak Cough Flow (PCF)
  - Commonly used to measure the effectiveness of cough
  - Threshold for effective airway clearance: 160-180L/min



Cough augmentation

- Manual or mechanical hyperinflation : Inspiratory phase
- Manually assisted cough : Expiratory phase
- Mechanical insufflator-exsufflator : Inspiratory and Expiratory phase
- Hyperinflation and manually assisted cough/exsufflator : Inspiratory and Expiratory phase
- Electrical stimulation : Expiratory phase
- Respiratory muscle training : Inspiratory or Expiratory phase (according to muscle group)

Cough control

- **Education**
  - Understanding of physiology and ability for voluntary control
- **Vocal cords hygiene and avoidance of irritant stimuli**
  - Reduction and avoidance of cough sensory input
- **Breathing pattern retraining and other exercises**
  - Distraction and alteration of sensory input
- **Psychological support and psycho-educational counseling**
  - Improve motivation and facilitate realistic goals

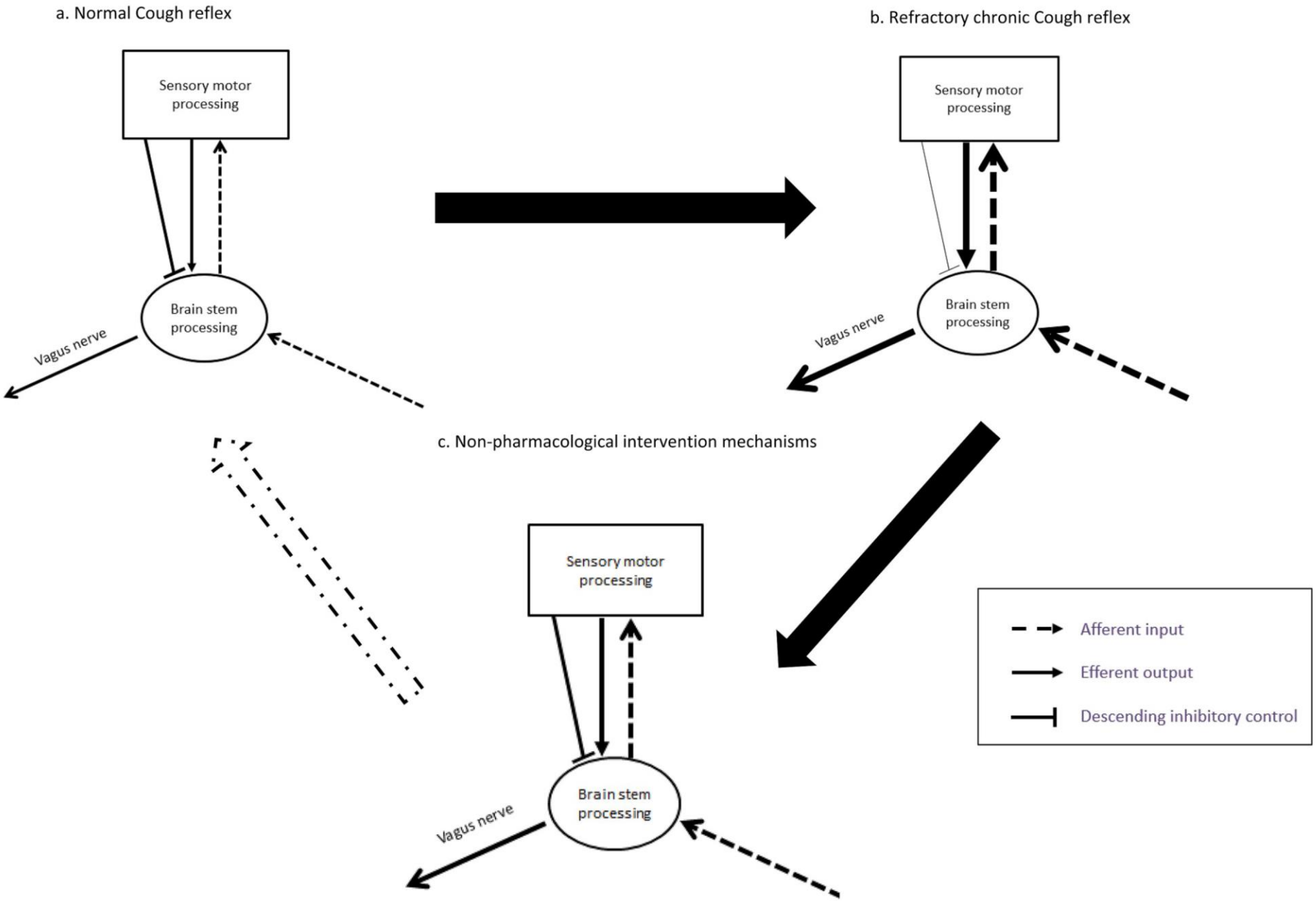


Fig. 2. (a) Normal Cough reflex. (b). Refractory chronic Cough reflex. (c). Non-pharmacological intervention mechanisms.

Mitchell et al., *Pulm Pharmacol Ther*, 2019

Speech Pathology Evaluation and Intervention for CHronic Cough (SPEICH-C)

John Hunter Hospital, Australia

Vertigan et al., *Thorax*, 2006

Speech Pathology Evaluation and Intervention for CHronic Cough (SPEICH-C)

John Hunter Hospital, Australia

Chronic cough
> 2 months
(N= 87)

Vertigan et al., *Thorax*, 2006

Speech Pathology Evaluation and Intervention for CHronic Cough (SPEICH-C)

Chronic cough
> 2 months
(N= 87)

Treatment (N=43)

Component	Example
Education	No physiological benefit from cough; capacity for voluntary cough control
Strategies to reduce cough	Identify warning signs for cough and replace with modified swallow technique, pursed lip breathing exercise, or relaxed throat breath
Reduce laryngeal irritation	Increase hydration, decrease exposure to irritating stimuli
Psycho-educational counselling	Internalising locus of control; acceptance that treatment is hard work; setting realistic goals

Vertigan et al., *Thorax*, 2006

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Placebo (N=44) : Healthy lifestyle education

- Relaxation
- Stress management
- Exercise
- Diet

Vertigan et al., *Thorax*, 2006

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“8 weeks”
“4 ×30 min sessions”

Placebo (N=44) : Healthy lifestyle education

- Relaxation
- Stress management
- Exercise
- Diet

Vertigan et al., *Thorax*, 2006

Speech Pathology Evaluation and Intervention for CHronic Cough (SPEICH-C)

Table 4 Comparison of mean (SD) pre- and post-intervention symptom scores and degree of change for participants in the treatment and placebo groups

Score	Group	Pre	Post	Difference	95% CI	p value
Total	Treatment†	35.4 (16.0)	22.7 (18.0)	12.7 (12.7)	9.0 to 16.1	<0.001*
	Placebo†	29.9 (13.5)	28.8 (16.5)	2.9 (12.5)	−0.7 to 6.5	0.170
	Difference‡			8.5 (13.9)	4.7 to 14.9	<0.001*
Breathing	Treatment†	7.9 (4.1)	5.0 (4.2)	2.9 (3.6)	1.8 to 3.9	<0.001*
	Placebo†	6.6 (4.7)	5.5 (3.5)	1.1 (3.4)	0.1 to 2.0	0.004*
	Difference‡			2.2 (3.7)	0.4 to 3.2	<0.001*
Cough	Treatment†	8.8 (2.8)	4.9 (3.0)	3.9 (3.2)	3.0 to 4.9	<0.001*
	Placebo†	7.5 (3.6)	6.3 (3.5)	1.2 (3.4)	0.3 to 2.2	<0.001*
	Difference‡			2.8 (3.6)	1.3 to 4.0	0.003*
Voice	Treatment†	7.2 (6.0)	4.7 (5.2)	2.5 (4.3)	1.2 to 3.7	<0.001*
	Placebo†	6.5 (4.6)	6.2 (5.0)	0.3 (4.1)	−0.9 to 1.5	0.959
	Difference‡			1.5 (4.5)	0.5 to 3.9	0.005*
Upper airway	Treatment†	9.2 (6.6)	6.5 (6.3)	2.7 (4.7)	1.4 to 4.1	<0.001*
	Placebo†	7.4 (4.9)	7.4 (5.5)	0.1 (4.1)	−1.1 to 1.2	0.946
	Difference‡			1.5 (4.8)	0.9 to 4.4	0.002*
Limitation	Treatment†	2.3 (1.2)	1.6 (1.0)	0.7 (1.1)	0.4 to 1.0	<0.001*
	Placebo†	2.2 (1.1)	2.0 (1.0)	0.3 (0.9)	0.0 to 0.6	0.038*
	Difference‡			0.5 (1.0)	0.0 to 0.8	0.011*

†Calculated using Wilcoxon signed rank test.
‡Calculated using Mann-Whitney U test.

Limitation of study : No objective outcome measures used

Vertigan et al., *Thorax*, 2006

Speech Pathology Intervention for Chronic Refractory Cough: A Pilot Study Examining the Benefit of Using Prerecorded Videos as an Adjunct to Therapy

*Sarah L. Kapela, †Anne E. Vertigan, and †Peter G. Gibson, *†*New Castle, Australia*

John Hunter Hospital, Australia

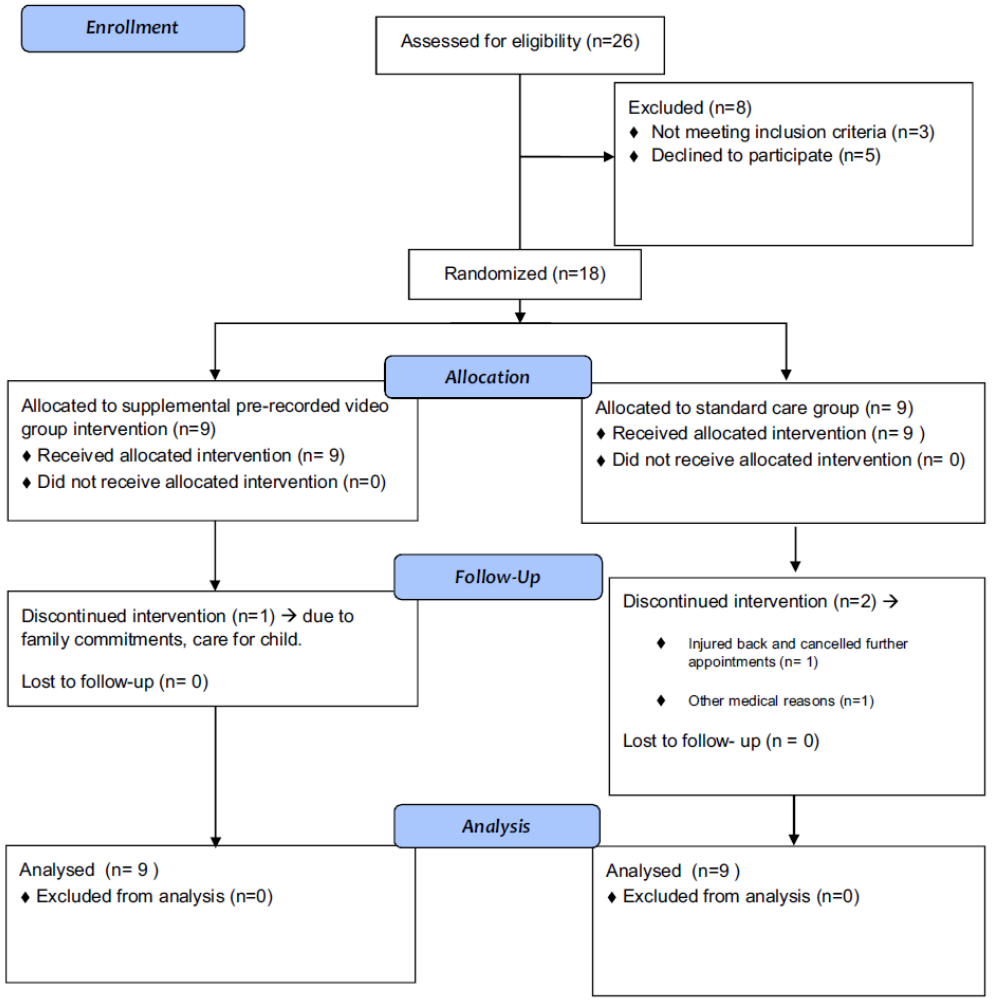

TABLE 5.
Comparison of Pre- and Post-Treatment Outcome Measures (All Participants Combined, n = 18)

Measurement	Baseline Mean (SD)	Post-treatment Mean (SD)	*P* value
Symptom Frequency and Severity Questionnaire total score	24.2 (8.6)	18.3 (8.2)	0.004*
Leicester Cough Questionnaire score	12.9 (3.7)	16.1 (2.5)	0.012*
Consensus Auditory Perceptual Evaluation of Voice (CAPE-V)	16.6 (14.1)	11.4 (10.6)	0.019*

TABLE 6.
Comparison of Outcome Measures Between Groups

Measurement	Supplemental prerecorded video group (n = 9)			Standard care group (n=9)			*P* value Control for pretreatment values
	Baseline mean (SD)	Post-treatment mean (SD)	Change mean (SD)	Baseline mean (SD)	Post-treatment mean (SD)	Change mean (SD)	
Symptom Frequency and Severity Questionnaire total score	25.9 (9.2)	19.5 (9.2)	6.4 (7.3)	22.5 (8.3)	17.1 (7.5)	5.4 (6.9)	0.941
Leicester Cough Questionnaire total score	15.3 (3.0)	16.8 (2.7)	1.5 (2.0)	11.2 (3.3)	15.6 (2.4)	4.4 (4.3)	0.796
Consensus Auditory Perceptual Evaluation of Voice (CAPE-V)	21.9 (16.6)	15.5 (12.5)	6.4 (8.1)	9.8 (5.1)	6.0 (3.3)	3.7 (6.4)	0.575

Kapela et al., *J Voice*, 2020

The effect of mindfulness meditation on cough reflex sensitivity

NIHR | Manchester Biomedical Research Centre

Healthy volunteers
(N= 30)

Chronic cough
> 8 weeks
(N= 30)

Young et al., *Thorax*, 2009

The effect of mindfulness meditation on cough reflex sensitivity

NIHR | Manchester Biomedical Research Centre

Healthy volunteers
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No intervention (N=11)

Mindfulness training (N=10)

Voluntary suppression (N=9)

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Young et al., *Thorax*, 2009

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NIHR | Manchester Biomedical Research Centre

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"Citric acid Cough challenge"

Chronic cough
> 8 weeks
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Young et al., *Thorax*, 2009

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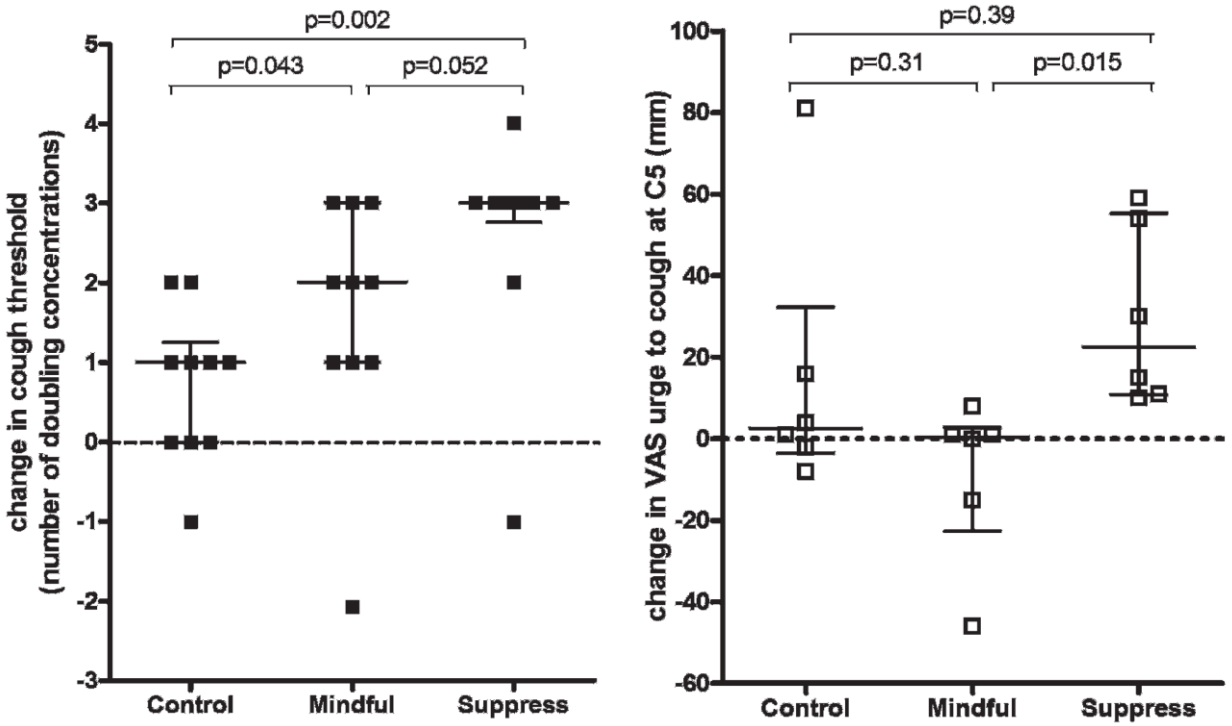
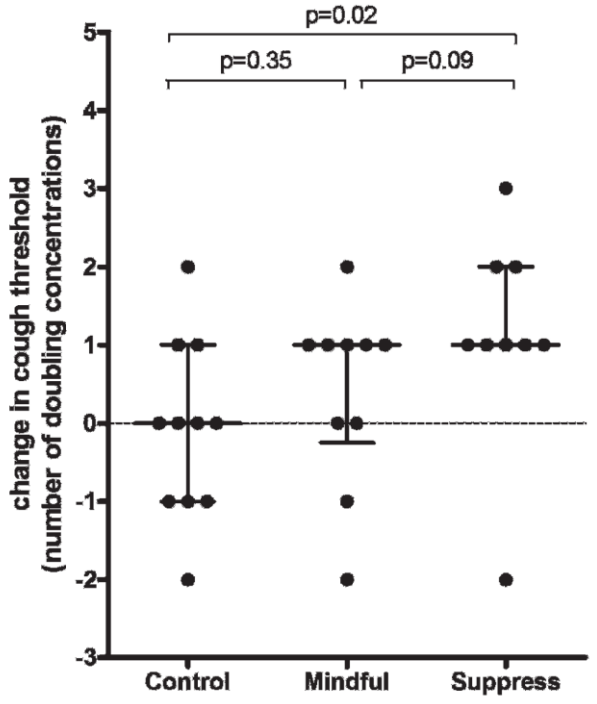
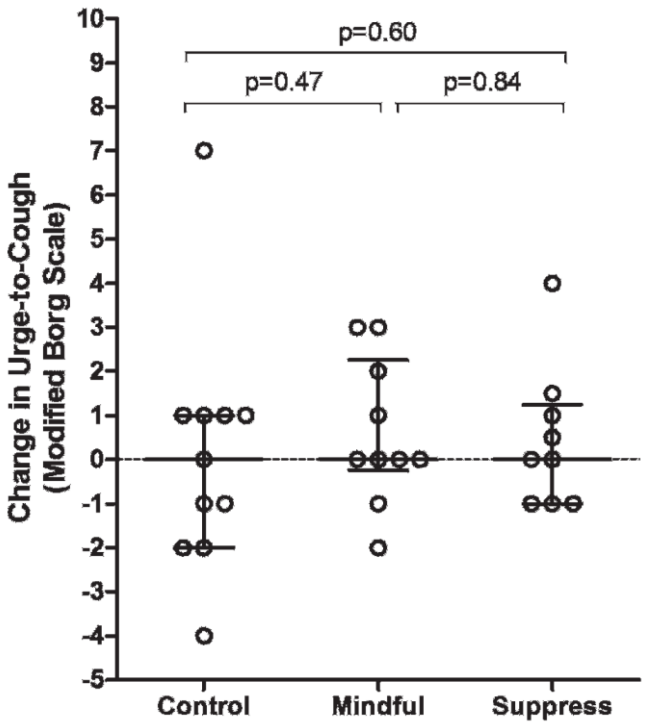


Healthy volunteer





Patients with chronic cough

Young et al., *Thorax*, 2009

Physiotherpy, and Speech And Language Therapy Intervention (PSALTI)

King's College Hospital NHS Foundation Trust

Lancashire Teaching Hospitals NHS Foundation Trust

Northumbria Healthcare NHS Foundation Trust

Chronic cough
> 2 months
(N= 75)

Mitchell et al., *Thorax*, 2017

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Chronic cough
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(N= 75)

PSALTI (N=34)

Table 1 PSALTI components

PSALTI component	Technique
Education	Educate patients on the cough reflex, chronic cough and cough reflex hypersensitivity. Explain the negative effects of repeated coughing. Educate patients on voluntary control of cough.
Laryngeal hygiene and hydration	Increase frequency and volume of water and non-caffeinated drinks. Reduce caffeine and alcohol intake. Promote nasal breathing.
Cough control	Teach patients to identify their cough triggers. Teach patients to use cough suppression or distraction techniques at the first sign or sensation of the need or urge to cough. These cough-suppression/distraction techniques include: forced swallowing, sipping water and sucking sweets. Teach patients breathing exercises: breathing pattern re-education promoting relaxed abdominal breathing pattern technique; pursed lip breathing to use to control cough.
Psychoeducational counselling	Motivate patients, reiterate the techniques and the aims of therapy. Behaviour modification: to try to reduce over-awareness of the need to cough. Stress and anxiety management

Control (N=41) : Healthy lifestyle education

- Relaxation
- Stress management
- Exercise
- Diet

Mitchell et al., *Thorax*, 2017

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Health-related quality of life (HRQoL) at week 4
24-hour objective cough frequency
Cough reflex sensitivity

Mitchell et al., *Thorax*, 2017

Physiotherpy, and Speech And Language Therapy Intervention (PSALTI)

Table 3 Primary and secondary efficacy endpoint analysis: change between PSALTI and control groups at baseline to 4 weeks and at 4 weeks to 3 month follow-up

	Between-group difference Baseline to 4 weeks		Between-group difference 4 weeks to 3-month follow-up	
	Mean difference (95% CI)	p Value	Mean difference (95% CI)	p Value
LCQ total	1.53 (0.21 to 2.85)	0.024*	0.01 (−1.62 to 1.64)	0.994
$CF_{per\ hour}$ (fold change)	0.59 (0.36 to 0.95)	0.030*	1.01 (0.55 to 1.86)	0.966
VAS severity	−9.72 (−20.80 to 1.36)	0.084	1.6 (−15.48 to 18.74)	0.848
SF-36 PCS	0.56 (−2.52 to 3.64)	0.717	0.48 (−3.27 to 3.37)	0.977
SF-36 MCS	0.81 (−3.10 to 4.72)	0.680	0.72 (−3.06 to 4.51)	0.703
VPQ	3.90 (−0.33 to 8.12)	0.070	−0.20 (−3.43 to 3.03)	0.901
HADS—Anxiety	−0.42 (−1.96 to 1.13)	0.590	0.88 (−0.57 to 2.34)	0.225
HADS—Depression	−0.44 (−1.69 to 0.81)	0.486	−0.18 (−1.36 to 0.99)	0.753
C2 (fold change)	1.11 (0.76 to 1.61)	0.575	NA	NA
C5 (fold change)	1.11 (0.80 to 1.54)	0.512	NA	NA

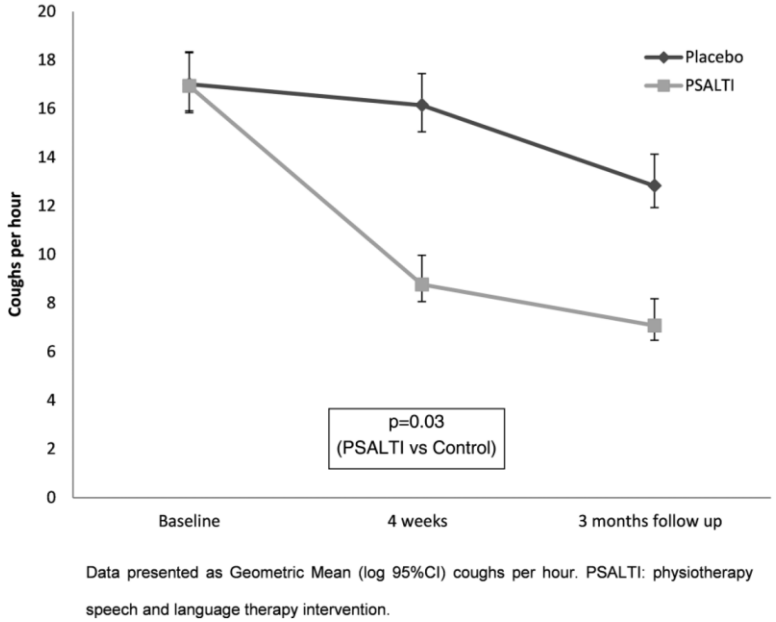


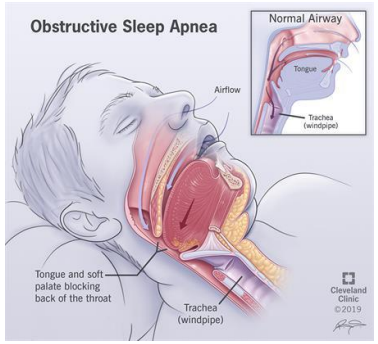
Figure 2 Change in objective cough frequency in physiotherapy, and speech and language therapy intervention (PSALTI) and control groups.

Table 4 Primary and second efficacy endpoints: within-group change

	Change from baseline to 4 weeks				Change from 4 weeks to 3-month follow-up			
	PSALTI Mean difference (95% CI)	p Value	Control Mean difference (95% CI)	p Value	PSALTI Mean difference (95% CI)	p Value	Control Mean difference (95% CI)	p Value
LCQ total mean	3.40 (2.26 to 4.55)	<0.001*	1.66 (0.78 to 2.54)	<0.001*	−0.17 (−1.49 to 1.15)	0.794	0.27 (−0.82 to 1.35)	0.616
$CF_{per\ hour}$ (fold change)	0.55 (0.33 to 0.75)	0.002*	0.82 (0.60 to 1.22)	0.205	1.26 (0.84 to 1.90)	0.236	0.91 (0.59 to 1.39)	0.655
VAS severity	−21.18 (−29.83 to −12.53)	<0.001*	−11.84 (−20.11 to −3.57)	0.007*	9.74 (−3.60 to 23.08)	0.143	0.79 (−10.73 to 12.31)	0.888
C2 (fold change)	1.28 (0.96 to 1.71)	0.089	1.06 (0.81 to 1.36)	0.666	NA	NA	NA	NA
C5 (fold change)	1.24 (1.02 to 1.50)	0.035*	1.08 (0.87 to 1.36)	0.469	NA	NA	NA	NA
SF-36 PCS	1.62 (−0.96 to 4.21)	0.208	0.50 (−1.30 to 2.31)	0.574	0.54 (−1.82 to 2.89)	0.639	0.76 (−1.66 to 3.18)	0.522
SF-36 MCS	0.53 (−2.69 to 3.75)	0.736	−0.26 (−2.92 to 2.40)	0.843	1.09 (−1.91 to 4.09)	0.456	0.49 (−2.35 to 3.32)	0.727
VPQ	4.04 (0.12 to 7.97)	0.044*	0.73 (−1.94 to 3.39)	0.582	−1.63 (−4.17 to 0.91)	0.193	−0.57 (−3.29 to 2.15)	0.666
HADS—Anxiety	−1.27 (−2.51 to −0.032)	0.045*	−0.90 (−1.96 to 0.17)	0.095	−0.11 (−1.16 to 0.94)	0.826	0.95 (−0.22 to 2.11)	0.104
HADS—Depression	−0.68 (−1.57 to 0.21)	0.126	−0.21 (−1.11 to 0.69)	0.641	0.06 (−1.42 to 1.53)	0.937	0.05 (−0.66 to 0.76)	0.878

Mitchell et al., *Thorax*, 2017

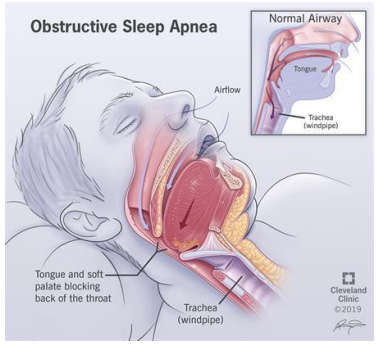
CPAP for patients with chronic cough and obstructive sleep apnea



Chronic cough > 2 months
+ Obstructive Sleep Apnea
(N= 18)

Sundar et al., *Lung*, 2020

CPAP for patients with chronic cough and obstructive sleep apnea



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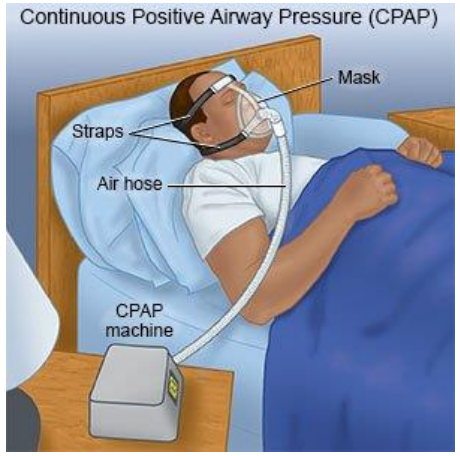
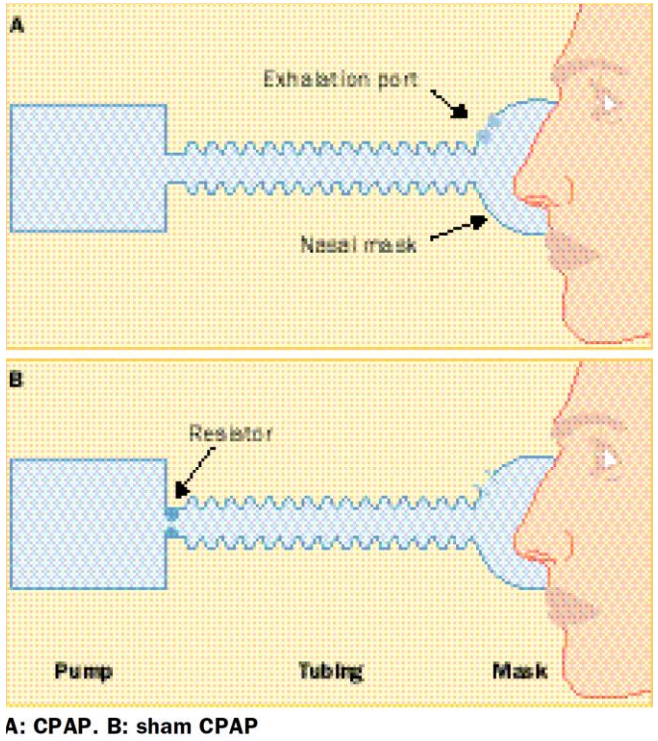


CPAP (N=9)



A: CPAP. B: sham CPAP

Sham-CPAP (N=9)

Lancet, 1999

Sundar et al., *Lung*, 2020

CPAP for patients with chronic cough and obstructive sleep apnea

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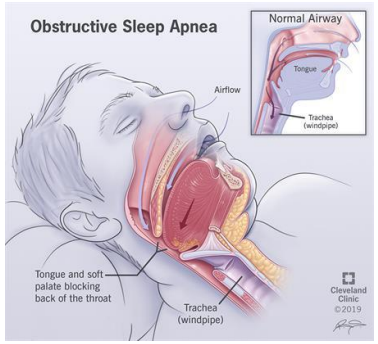

Chronic cough > 2 months
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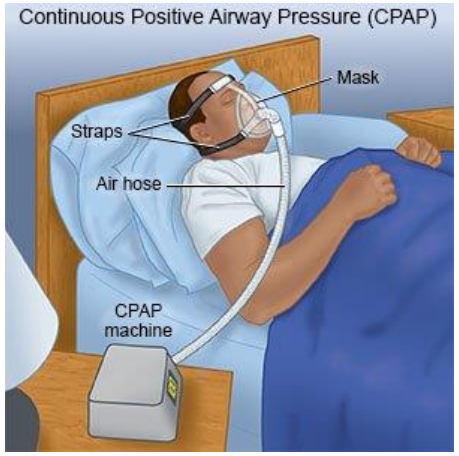
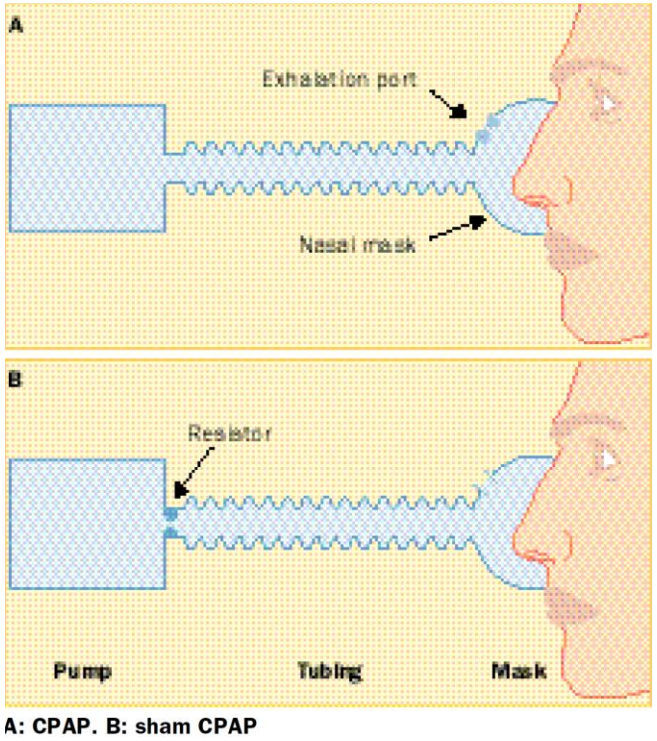
(N= 18)



CPAP (N=9)



A: CPAP. B: sham CPAP

Sham-CPAP (N=9)

Lancet, 1999

Health status assessed with LCQ
Exhaled breath marker of inflammation

Sundar et al., *Lung*, 2020

CPAP for patients with chronic cough and obstructive sleep apnea

UNIVERSITY OF UTAH SCHOOL OF MEDICINE

	CPAP	Sham CPAP	p value
Duration of cough (months)	35.1 ± 57.1 (3–180)	162.7 ± 153.8 (24–420)	0.023
Total LCQ	10.63 ± 3.94	12.62 ± 4.13	0.185
Physical	3.54 ± 0.96	4.43 ± 1.07	0.053
Psychological	3.65 ± 1.61	4.09 ± 1.51	0.439
Social	3.44 ± 1.6	4.09 ± 1.51	0.359
CPAP compliance			
% days used	47% (± 37%)	40% (± 28%)	0.302
Avg. minutes per night	246.9 ± 143.6 (> 6 h)	192.6 ± 114.7 (> 3 h)	0.272

	CPAP	Sham CPAP
Baseline LCQ	10.63 ± 3.94	12.62 ± 4.13
6 week LCQ	17.24 ± 3.97	14.69 ± 3.94
Mean LCQ change	6.61 ± 1.36 (SE)	2.07 ± 0.98 (SE)
No. with LCQ Δ of 1.3	9/9	4/9

***p* = 0.016**

	NOX (µmol/L)	IL- 8 (pg/mL)	8iso (pg/mL)	H2O2 nmol/L
CPAP—treated ($n = 9$)				
Baseline	3.34 ± 2.07	1.52 ± 1.41	4.92 ± 2.23	2458.02 ± 324.88
Post 6 weeks	2.91 ± 2.32	1.00 ± 0.21	7.35 ± 3.47	1654.07 ± 239.71
p value*	0.685	0.299	0.212	0.097
Sham CPAP—treated ($n = 8$)				
Baseline	3.35 ± 2.81	1.02 ± 0.24	3.99 ± 1.89	1714.42 ± 337.1
Post 6 weeks	5.26 ± 0.18	1.04 ± 0.18	5.04 ± 2.13	1468.04 ± 143.58
p value*	0.334	0.771	0.199	0.061
Difference between CPAP—treated and sham CPAP—treated groups (*p* value#)	0.258	0.594	0.156	0.643

Sundar et al., *Lung*, 2020

John Hunter Hospital, Australia

Chronic cough
(median duration
= 60 months)
(N= 17)

Ryan et al., *Cough*, 2010

John Hunter Hospital, Australia

Chronic cough
(median duration
= 60 months)
(N= 17)

Refractory to
medications

Ryan et al., *Cough*, 2010

Cough reflex sensitivity improves with speech language pathology management

John Hunter Hospital, Australia

Chronic cough
(median duration
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Refractory to
medications

Speech pathology treatment (×6)

(a) Education
(b) Cough suppression strategy
(c) Vocal hygiene training
(d) Psychoeducational counselling

Ryan et al., *Cough*, 2010

Cough reflex sensitivity improves with speech language pathology management

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(median duration
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Refractory to
medications

Speech pathology treatment (×6)

(a) Education
(b) Cough suppression strategy
(c) Vocal hygiene training
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Capsaicin Cough Reflex Sensitivity (CRS) testing
Leicester Cough Monitor (LCM)

Ryan et al., *Cough*, 2010

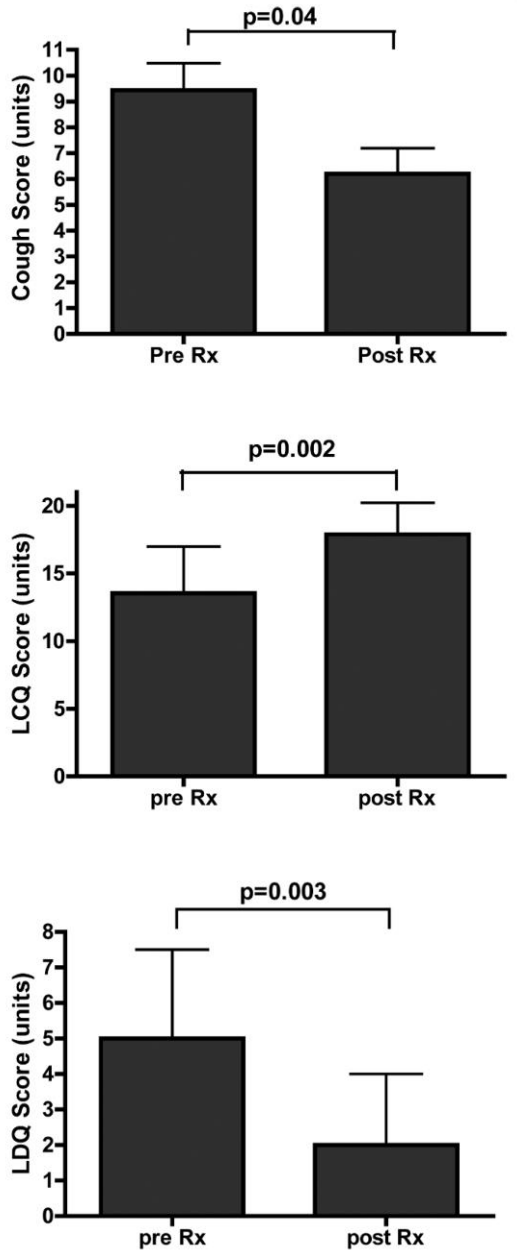

Figure 1 Cough subjective measures of a) Cough Score b) Cough Quality of Life and c) Laryngeal Dysfunction (Baseline vs Post Treatment). Effect of speech-language pathology treatment on refractory chronic cough outcomes of a) Cough symptoms scores (Mean ± SD). b) Leicester cough questionnaire Median (IQR) and c) Laryngeal dysfunction questionnaire Median (IQR).

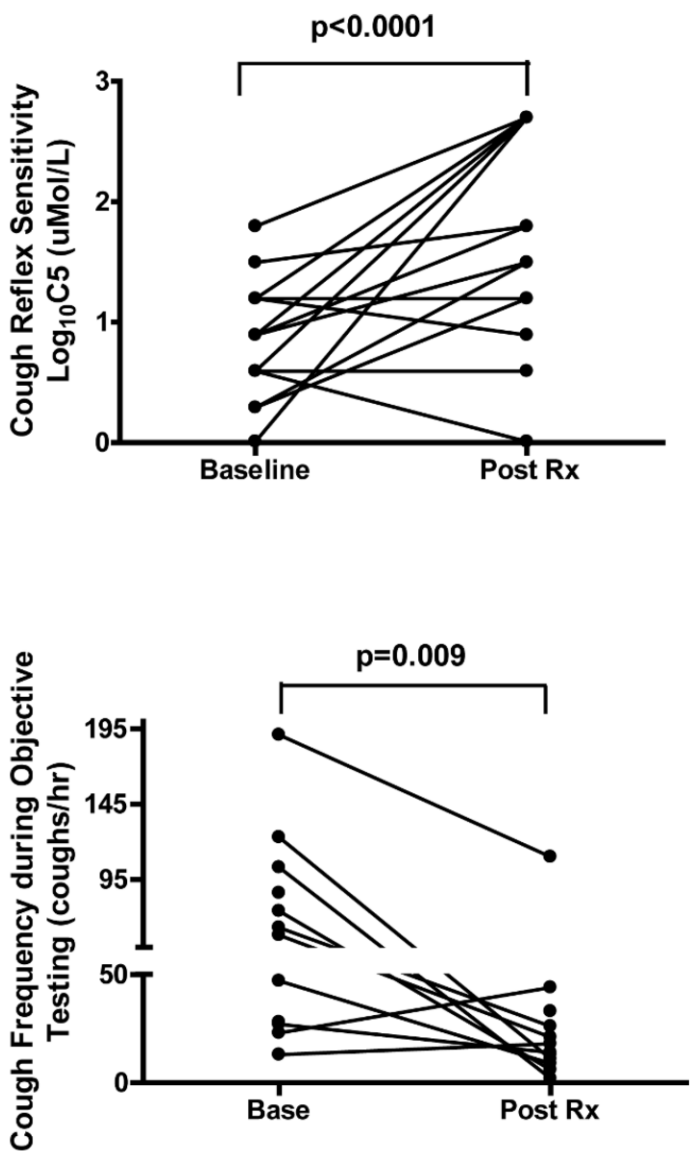

Figure 2 Objective cough measures of a) Cough Reflex Sensitivity (C5) and b) Cough Frequency (Baseline vs Post Treatment). Effect of speech-language pathology treatment on refractory chronic cough outcomes of a) Log Cough Reflex Sensitivity at baseline (Base), and post treatment (Post Rx) for individual data. C5 = capsaicin dose to elicit 5 or more coughs 30 sec after dose administered. b) Cough Frequency at baseline (Base), and post treatment (Post Rx).

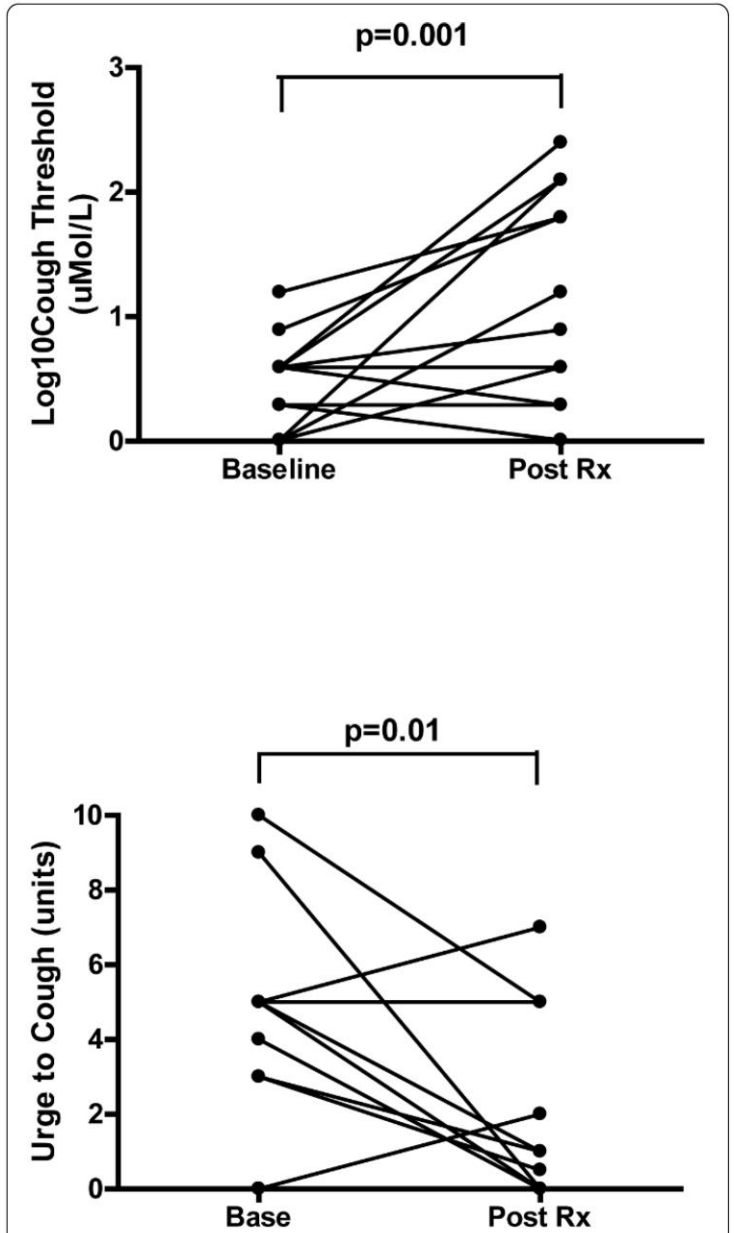

Figure 3 Objective measure-Cough Threshold (a) and Participants urge-to-cough at C5 (b) (Baseline vs Post Treatment). Effect of speech-language pathology treatment on refractory chronic cough outcomes of a) Log Cough Threshold at baseline (Base), and post treatment (Post Rx). b) Urge to Cough score at baseline (Base), and post treatment (Post Rx).

Ryan et al., *Cough*, 2010

The future of non-pharmacologic interventions

- **Patient selection**
  - Smoking history, Laryngoscopy, Respiratory failure…

- **Standardisation of terminology**

Different names for non-pharmacological intervention for chronic cough in the literature.

Speech and Language Led non-pharmacological studies	Physiotherapy led non-pharmacological studies
Speech pathology management/ treatment	Cough-suppression physiotherapy
Speech pathology evaluation and intervention for chronic cough (SPEICH-C)	
Physiotherapy and Speech and Language Therapy Intervention (PSALTI)	

The future of non-pharmacologic interventions

- **Standardisation of treatments**
  - Throating massage, Breathing exercise, Frequency, Duration
- **Timing of non-pharmacological interventions**
- **Outcome measures used**
- **Treatment delivery**
  - Video vs. Face to face, Group class vs. 1 to 1

Thank you for your attention