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Title: The effect of positive expiratory pressure for airway clearance on ventilation inhomogeneity in individuals with stable COPD and chronic sputum expectoration

Mr. Christian 5754 Osadnik crosadnik@students.latrobe.edu.au [1], Dr. Christopher 5755 Stuart-Andrews c.stuart-andrews@alfred.org.au [2], Dr. Samantha 5756 Ellis s.ellis@alfred.org.au [3], Prof. Bruce R. 5757 Thompson b.thompson@alfred.org.au [2], Prof. Dr Christine F. 5758 McDonald christine.mcdonald@austin.org.au MD [4,5] and Prof. Anne E. 5759 Holland a.holland@latrobe.edu.au [1,6]. [1] Physiotherapy, La Trobe University, Melbourne, Victoria, Australia, 3086 ; [2] Allergy, Immunology and Respiratory Medicine, Alfred Health, Melbourne, Victoria, Australia, 3181 ; [3] Radiology, Alfred Health, Melbourne, Victoria, Australia, 3181 ; [4] Institute for Breathing and Sleep, Austin Health, Melbourne, Victoria, Australia, 3084 ; [5] Respiratory and Sleep Medicine, Austin Health, Melbourne, Victoria, Australia, 3084 and [6] Physiotherapy, Alfred Health, Melbourne, Victoria, Australia, 3181 .

Body: Background: Positive expiratory pressure (PEP) is commonly used to promote airway clearance, however little is known about its mechanism of action in individuals with COPD. Aim: To determine whether PEP mask therapy improves ventilation inhomogeneity and increases functional residual capacity (FRC) more than controlled huffing and coughing. Methods: Twelve participants with stable COPD (mean FEV1 45% predicted) and chronic sputum expectoration performed PEP mask therapy (10-20 cms H2O) or controlled huffing and coughing in random order on separate days. Measures of acinar and conductive airways ventilation (Sacin, Scond), lung volumes, spirometry and sputum weight were recorded before, immediately after and 90 minutes following treatment. Ease of expectoration (visual analogue scale [VAS], higher = worse) and oxyhaemoglobin saturation were assessed immediately following treatment. Data were analysed via linear mixed model analyses. Results: No significant difference existed between the two test conditions for any test parameter at any time point. Immediately following the PEP and control conditions, mean Sacin was 0.465L-1 and 0.438L-1, respectively ($p = 0.45$ for comparison between conditions) and Scond 0.042L-1 and 0.039L-1 ($p = 0.55$). Mean FRC was 5.07L and 5.03L ($p = 0.38$), mean sputum wet-weight was 7.06g and 6.15g ($p = 0.51$), and VAS scores were 4.8cm and 4.1cm ($p = 0.53$), respectively. Conclusion: Any therapeutic benefits of PEP mask therapy in individuals with COPD are unlikely to be mediated by improvements in ventilation inhomogeneity or increases in lung volumes.