2014

A comparison of early skilled therapeutic exercise vs. usual standard care in the treatment of Chronic Obstructive Pulmonary Disease (COPD) following an acute exacerbation and how it affects future hospital readmission

R. Stephen White
Pacific University

A comparison of early skilled therapeutic exercise vs. usual standard care in the treatment of Chronic Obstructive Pulmonary Disease (COPD) following an acute exacerbation and how it affects future hospital readmission

Title: A comparison of early skilled therapeutic exercise vs. usual standard care in the treatment of Chronic Obstructive Pulmonary Disease (COPD) following an acute exacerbation and how it affects future hospital readmission.

Clinical Scenario: The patient who led me to pursue this question is a 60 year old male with a diagnosis of Chronic Obstructive Pulmonary Disease (COPD). Medical treatment to date has included physical therapy in both inpatient and outpatient settings, home-based personal exercise and pharmacological interventions. Problems identified (or PT diagnosis) include dyspnea, inability to perform activities of daily living (ADL's), overall muscular weakness and decreased aerobic capacity.

Brief Introduction: For the purposes of my clinical question, I want to know what the research says about the effect of early skilled therapeutic exercise on patients with COPD. The patients at Providence St. Vincent admitted for COPD as a primary diagnosis or a comorbidity often experience dyspnea, weakness, depression, and wheezing.

Clinical Question: Does early skilled therapeutic exercise following acute exacerbations of Chronic Obstructive Pulmonary Disease (COPD) help reduce readmission to hospitals by increasing exercise capacity?

Clinical PICO:
P: Adults diagnosed with acute exacerbations of COPD
I: Application of early skilled therapeutic exercise post-acute COPD exacerbation
C: No early skilled therapeutic exercise post-acute exacerbation of COPD
O: Hospital readmission due to exacerbation of COPD

Overall Clinical Bottom Line: Based on the results of the outcomes from Eaton *et al*. and Seymour *et al*. there appears to be sufficient data to support the use of early skilled therapeutic exercise in reducing the rate of hospital readmission following acute exacerbation of COPD. The only outcome measure related to the clinical question was hospital readmission within three months following discharge from acute care services. Neither of the studies found any reason as to why a patient should not participate in early skilled therapeutic exercise. Both studies had a relatively low NNT supporting the treatment; however, the confidence interval of Eaton *et al*. reached the negative range in the upper boundary meaning that, to decrease the readmission of one participant to the hospital, an infinite amount of participants may need to be treated with early skilled therapeutic exercise. Chi-square analysis (0.89) of data reported by Eaton *et al*. failed to achieve statistical significance. Additionally, Eaton *et al*. lacked an appropriate power of subjects and had a major lack of participant protocol (only 40%) adherence in the treatment group. Had these threats been eliminated, the study might have different findings. The internal validity of the studies ranged from fair to good (PEDro scores 7/10). The external validity was not compromised and the results may be easily generalized to other patients with COPD. Although the studies were conducted in England and New Zealand, the subjects' demographics appear to reflect characteristics of COPD patients who are treated in the United States.

Search Terms: COPD, exacerbation, hospital admission, exercise, pulmonary rehabilitation, acute.

Appraised By:
R. Stephen White
School of Physical Therapy
College of Health Professions
Pacific University
Hillsboro, OR 97123
whit8241@pacificu.edu

Rationale for chosen articles: I found 8 relevant studies using the search terms, publication date from 2003-2013, linked full-text, the article's similarity to my clinical PICO, and the quality of the study as scored by the Physiotherapy Evidence Database (PEDro). I utilized search engines including CINHAL, PEDro, PUBmed, and other resources available through the library's Physical Therapy Database at Pacific University. Four of the 8 studies were excluded because of one or more of the following: a low PEDro score (< 5/10), publication date before 2003, systematic review, journal article that was not a clinical trial, and availability of a full-text article. Of the four main articles chosen, I narrowed them down to three based on the sample size used in the study, the quality of the journal, and similarity of outcome measures. The three articles I chose to review in this critically appraised topic (CAT) are:

(1) Eaton T, Young P, Fergusson W, Moodie L, Zeng I, O'kane F, Good N, Rhodes L, Poole P, Kolbe J. Does Early Pulmonary Rehabilitation Reduce Acute Health-Care Utilization in COPD Patients Admitted with an Exacerbation? A Randomized Controlled Study. *Respirology* 2009; 14: 230-238.

PEDro Score:7/10

P: 97 adults diagnosed with COPD
I: Early pulmonary rehabilitation following acute exacerbation of COPD
C: Usual care in accordance with the ATS/ERS COPD guidelines
O: Number of COPD related readmissions within three months, time to first COPD-related readmission, number of inpatient days, BMI, airflow obstruction, dyspnea, BODE index, field walking test (6MWD), health related quality of life (HRQL), hospital anxiety and depression scale (HAD)

(2) Seymour J, Moore L, Jolley C, Ward K, Creasey J, Steier J, Yung B, Man W, Hart N, Polkey M, Moxham J. Outpatient Pulmonary Rehabilitation Following Acute Exacerbations of COPD. *Thorax* 2010; 65: 423-428.

PEDro Score:7/10

P: 60 adults diagnosed with COPD
I: Post-exacerbation pulmonary rehabilitation following acute exacerbation
C: Usual follow up care
O: Hospital admission for exacerbation, emergency department attendance for exacerbation, hospital or emergency department for exacerbation and quadriceps maximum voluntary contraction (QMVC)

(3) Man W, Polkey M, Donaldson N, Gray B, Moxham J. Community Pulmonary Rehabilitation After Hospitalization for Acute Exacerbations of Chronic Obstructive Pulmonary Disease: A Randomised Controlled Trial. *British Medical Journal* 2004; 329: 1209-1213.

PEDro Score: 6/10

P: 42 adults admitted with and acute exacerbation of COPD
I: An 8 week pulmonary rehabilitation program for outpatients
C: Usual care
O: Incremental shuttle walk distance, use of hospital resources, number of readmissions, hospital days, visits to the emergency department not requiring admission

Table 1. PEDro score comparisons

	Eaton *et al*.	Seymour *et al*.	Man *et al*.
Eligibility Criteria	1	1	1
Random Allocation	1	1	1
Concealed Allocation	1	1	0
Baseline Comparability	1	1	1
Blind Subjects	0	0	0
Blind Therapists	0	0	0
Blind Assessors	0	0	0
Adequate Follow-up	1	1	1
Intention-to-Treat Analysis	1	1	1
Between-group Comparisons	1	1	1
Point Estimates and Variability	1	1	1
Total Score	7/10	7/10	6/10

Based on the above comparisons, I have chosen to write this critically appraised paper on the articles by Eaton *et al.* and Seymour *et al.* These two were chosen because they apply most directly to my clinical PICO and address directly my clinical question.

Article 1: Eaton T, Young P, Fergusson W, Moodie L, Zeng I, O'kane F, Good N, Rhodes L, Poole P, Kolbe J. Does Early Pulmonary Rehabilitation Reduce Acute Health-Care Utilization in COPD Patients Admitted with an Exacerbation? A Randomized Controlled Study. *Respirology* 2009; 14: 230-238.

Clinical bottom line: The integration of early pulmonary rehabilitation for patients with COPD to decrease the rate of COPD related readmissions to the hospital is inconclusive based on this prospective study of 97 adults diagnosed with COPD and treated with usual standard care. Usual care had a 32.0% (CER=16/34) readmission rate compared to a 23.4% (EER=11/36) readmission rate in the group who was instructed in early pulmonary rehabilitation. The NNT 95% CI, [3.8-(-11)] was 11.63, meaning that 11.63 patients need to be treated with early pulmonary rehabilitation in order to prevent one person from being readmitted to the hospital due to COPD related exacerbations. The authors' goal of determining the effectiveness of early pulmonary rehabilitation is inconclusive due to the infinite boundary of the upper limit of the 95% CI, which implies that to decrease the rate of readmission to the hospital in one patient, we may need to instruct an infinite number of patients, not 11.63, with early pulmonary rehabilitation. Additionally, chi-square analysis failed to reach significance. The study also failed to maintain a strict protocol of the treatment (early pulmonary rehabilitation) with only 40% attending >75% of the rehabilitation sessions. This poses as a serious threat to the internal validity of the study. Subjects were allocated into two groups: patients given usual care (n=50) and patents given early pulmonary rehabilitation (n=47) via randomization to balance the two groups. The study's internal validity was fair (PEDro score 7/10), with three threats including failure to adhere to strict protocol, lack of blinding and an inadequate power. The results of this study can likely be applied to adult COPD patients seen within any physical therapy clinic. It cannot be determined if the outcomes of this study result from the aforementioned threats, or if there are no significant differences between the two groups in readmission to the hospital due to COPD related exacerbations, which is why further research while controlling for these threats is needed.

Article PICO:
P: 97 adults diagnosed with COPD
I: Early pulmonary rehabilitation following acute exacerbation of COPD
C: Usual care in accordance with the ATS/ERS COPD guidelines
O: Number of COPD related readmissions within three months, time to first COPD-related readmission, number of inpatient days, BMI, airflow obstruction, dyspnea, BODE index, field walking test (6MWD), health related quality of life (HRQL), hospital anxiety and depression scale (HAD)

Blinding: Neither the participants nor the health-care providers administering the treatment were blinded to group allocation. Additionally, the authors did not state whether the assessors were blinded and therefore we should assume they were not blinded. The authors stated the nature of the intervention made it impossible to blind the participants to their allocation.

Controls: All participants in the control group were given standardized care and advice from health-care providers in accordance with American Thoracic Society (ATS) and the European Respiratory Society (ERS), which included education about their illness, smoking cessation, oxygen therapy and other standard COPD care that can be found in the ATS/ERS position paper. They were also given standardized advice pertaining to the benefits of exercise and maintaining their daily activities.

Randomization: Subjects were randomly allocated into one of the two groups receiving early pulmonary rehabilitation or usual care. Subjects were recruited from the Auckland City Hospital for COPD exacerbation. The randomization was concealed until the intervention was assigned. Randomization was successful as groups were similar at baseline.

Study: 97 participants who met inclusion criteria and were admitted to Auckland City Hospital for exacerbation of COPD were randomly assigned either to a treatment group that received early pulmonary rehabilitation (30 minutes of personal exercise, including walking and resistance training, per day based on 1 hour supervised exercise training twice per week along with educational sessions delivered by a multi-disciplinary team and a free community gym membership) or a control group that was given usual standard care. The participants were allocated using a computer-generated system. Inclusion criteria were: exertional dyspnea interfering with daily activity, COPD as defined by the ATS/ERS criteria and the ability to complete a health related quality of life questionnaire (HRQL). The participants were excluded if they had: a major cognitive dysfunction, comorbidities precluding the ability to participate in the early pulmonary rehabilitation or unable to participate due to the severity of the comorbid condition.

Outcome Measures: I am investigating the influence of early therapeutic exercise following acute exacerbation of COPD and how it affects future hospital readmission rates. Therefore, the outcomes measure that I am most interested in is the number of COPD related readmissions to the hospital following either pulmonary rehabilitation or the usual care approach. The other measures which included the time to first COPD-related readmission, number of inpatient days, BMI, airflow obstruction, dyspnea, BODE index, field walking test (6MWD), health related quality of life (HRQL), hospital anxiety and depression scale (HAD) were not of importance regarding the clinical question at hand. Outcome measures were assessed at both baseline and at three months following the beginning of the study.

Study Losses: Eight subjects were lost from the early pulmonary rehabilitation group: five from major comorbidities, two withdrew from the study for unknown reasons and one expired (8/47=17% drop-out rate). In the control usual care group, five were lost at follow-up. Four were too sick to attend and one was unable to be contacted (5/50=10% drop-out rate). Due to the high amount of drop-outs, the authors performed an intention-to-treat analysis using between-group comparisons, which involved all subjects regardless of protocol adherence or follow-up, in order to compensate for losses in the early rehabilitation group and usual care groups.

Summary of Internal Validity: This article had fair internal validity (PEDro 7/10). Three threats were found: one significant, one moderate and one minor. First, a significant threat was the lack of strict protocol. Only 19 (40%) of 47 in the early pulmonary rehabilitation group attended >75% of the treatment sessions. Meaning up to 60% of the early pulmonary rehabilitation group could have unintentionally crossed over into the usual care group. The moderate threat was the study lacked an appropriate power to obtain statistically significant difference between the two groups. The authors noted that they would need 80 participants in each group (n=160) in order to gain statistical significance and they only had 97. Lastly, the minor threat was the lack of blinding in all planes of the study. None of the participants, health-care providers or assessors were blinded which creates the possibility of rater bias, Hawthorne effect or a Rosenthal effect.

Evidence: The data of interest in this section is the comparison of participants diagnosed with COPD and if early pulmonary rehabilitation changed the likelihood of readmission within three months to the hospital. The authors used a unpaired *t*-test, which was not significant, in order to compare between-group differences in the number of hospital readmissions following exacerbation. Although there was no chi-square analysis or reported p-value discussed by the authors, I have created a 2 X 2 contingency table (Table 2) to perform a chi-square analysis. The results from the 2 X 2 chi-square analysis (0.89) is not statistically significant between observed and expected hospital readmissions due to PR (P-value-0.05). The table shows the results of readmission to the hospital within three months of admission to the study.

Table 2. Results of readmission to hospital following treatment for both groups.

	Event (Hospital readmission)	**Non-Event** (No hospital readmission)
Treatment (Pulmonary rehabilitation)	**11**	**36**
Control (Usual care)	**16**	**34**

In Table 3, there are calculated statistics from the 2 X 2 table (using Dr. Bush's evidence-based statistics calculator) that can be used to interpret whether the reported outcomes were clinically important.

Table 3. Summary of outcome measures on the effectiveness of therapeutic treatment

CER	0.320
EER	0.234
ARR (CI 95%)	0.09 (-0.09-0.26)

RRR (CI 95%)	0.27 (-0.41-0.62)
NNT (CI 95%)	11.63 [3.8-(-11)]
RR (CI 95%)	0.73 (0.38-1.41)
OR (CI 95%)	0.65 (0.26-1.60)

Based on the data presented by the authors, the Control Event Rate (CER) was 0.320, meaning that 32.0% of the subjects in the usual care group had had a COPD related hospital readmission at follow-up, as compared to the 23.4% rate of readmission in the early pulmonary rehabilitation group (Experimental Event Rate, or EER). The Absolute Risk Reduction (ARR) showed that there was a 9.0% decrease in COPD related readmission recurrence if the subject was given early pulmonary rehabilitation. The Relative Risk Reduction (RRR) of 27% means that there would be a decrease in readmission for the general population if everyone with COPD was given usual care after an acute exacerbation of COPD. The low end of the 95% confidence intervals for the ARR and RRR (-0.09-0.26 and -0.41-0.62, respectively) are in the negative range, suggesting that sometimes not giving early pulmonary rehabilitation to patients with COPD can also decrease the COPD related readmissions to hospitals. The Number Needed to Treat (NNT) was 11.63. This means that 11.63 patients who are treated with early pulmonary rehabilitation need to be treated for one person to not have a COPD related readmission. However, since the high end of the 95% CI [3.8-(-11)]is limitless, this indicates that for prevention of readmission to occur in one person, an infinite number of patients may need to be given the early pulmonary rehabilitation for COPD. The Relative Risk (RR) of 0.73 shows the percent chance of having a bad event if a patient was to receive early pulmonary rehabilitation. The Odds Ratio (OR) of 0.65 indicates that a COPD related readmission is less likely to occur if the subject was given early pulmonary rehabilitation.

Applicability of study results:

Benefits vs. Costs: The results of the study were inconclusive in whether instructing patients in early pulmonary rehabilitation vs. usual care decreased the COPD related readmission rate in hospitals. This conclusion was made based on the infinite boundary of the 95% CI for the NNT and the failure to adhere to a strict protocol within the study's internal validity. The treatment protocol of early pulmonary rehabilitation costs each patient time (30 minutes per day of personal exercise time and1 hour twice a week of supervised exercise training) from going about their daily life. Financial costs of transport to and from the facility where the supervised exercise training is given also increased the cost to the patient when it covers a two month (8 week) span. Additionally, the cost of outpatient services including a multi-disciplinary approach to the education of the patient along with a local gym pass for exercise adherence will cost the patient extra financially. However, this might be a small amount in comparison with the costs of readmission and inpatient care costs that would accumulate if the patient is readmitted for exacerbation of COPD. In a side-by-side comparison the usual care

would be more cost effective if the patient did not have any readmissions in contrast to paying for outpatient therapy sessions required by the treatment. The treatment does not require any specific equipment and to our knowledge does not cause any adverse events due to treatment adherence.

Feasibility of treatment: The method of treating COPD with usual care or early pulmonary rehabilitation is deemed feasible for the majority of patients and can be easily applied in a clinical setting. Routine exercise for 30-60 minutes a day does not require any additional training on the part of the physical therapist but, the educational sessions might require some extra training in order to ensure proper patient education. Since the intervention requires little training and is easy to instruct, it is deemed feasible.

Summary of external validity: The results may be generalized to other patients with COPD. Furthermore, the three threats to the study's internal validity does not compromise the ability to generalize the results to other patients. Although the study was conducted in Auckland, New Zealand, the subjects and demographics appear to reflect characteristics of COPD patients who are treated in physical therapy clinics in the United States. However, the study might have been even more easily generalized had the authors been able to obtain an appropriate power for better population representation, helping further eliminate any threats to the external validity as well as increase the statistical significance of the data in the study. There is a small possible threat of multiple treatment interference for patients in the control group; there is no foreseeable compromise to the external validity of the study.

Article 2: Seymour J, Moore L, Jolley C, Ward K, Creasey J, Steier J, Yung B, Man W, Hart N, Polkey M, Moxham J. Outpatient Pulmonary Rehabilitation Following Acute Exacerbations of COPD. *Thorax* 2010; 65: 423-428.

Clinical bottom line: The application of Post-Exacerbation Pulmonary Rehabilitation (PEPR) for patients with COPD to decrease the rate of COPD related hospital readmissions can decrease the readmission rate based on this prospective study of 60 adults diagnosed with COPD and treated with usual care (UC). UC had a 33.0% (CER=10/20) readmission rate compared to a 6.7% (EER=2/28) readmission rate in the group who was given PEPR. The NNT was 3.75, meaning that 3.75 patients with COPD need to be treated with PEPR in order to prevent one readmission to the hospital due to COPD related exacerbations. Subjects were allocated into two separate groups: patients given usual care (n=30) and patients given PEPR (n=30) via randomization to establish comparability at baseline between patients. The study's internal validity was good (PEDro score 7/10), with one minor threat due to lack of blinding of subjects, assessors, and therapists. The results of the study can likely be applied to adult COPD patients seen within any physical therapy clinic. Additional research addressing greater participant pools, higher PEDro scores, participant blinding, and more specific protocols are needed in order to help clarify clinical usefulness of PEPR..

Article PICO:
P: 60 adults diagnosed COPD
I: Post-exacerbation pulmonary rehabilitation (PEPR) following acute exacerbation
C: Usual follow up care (UC)
O: Hospital admission for exacerbation, emergency department attendance for exacerbation, hospital or emergency department for exacerbation and quadriceps maximum voluntary contraction (QMVC)

Blinding: There was no blinding during the course of this study. The authors mentioned that due to the nature of the intervention and the personnel required for the assessments, it would be impossible to blind the assessors or the subjects to allocation.

Controls: Both the UC and the PEPR were given general information regarding COPD prior to randomization and were offered out-patient services with their health care provider. This helped minimize the treatment (independent) variable to the PEPR alone. The UC group were not given any additional instructions following discharge.

Randomization: Participants were randomized into either UC group or PEPR group one week following discharge from the hospital. Each subject (n=60) was then allocated by concealed randomization by a statistician using minimization. Minimization is an appropriate method because of the small number of subjects. It establishes baseline characteristics in regards to age, sex, predicted FEV_1, duration of admission, and incremental walk test distances. This strategy helps decrease the possibility of imbalance between groups at baseline with respect to prognostic variables.

Study: 60 patients following hospitalization at three hospitals in England for acute COPD exacerbation were allocated to a group that received post-exacerbation pulmonary rehabilitation (PEPR) involving aerobic and resistance training, or a group that received usual care (UC). All subjects prior to admission had a diagnosis of COPD. Participants in the PEPR group (n=30) were given bi-weekly exercise and educational classes totaling two hours per session regarding COPD and coping strategies for a period of eight weeks. The PEPR exercises given were a mix of strengthening and aerobic exercises. The UC group (n=30) was given general information about COPD and offered outpatient consults with their physician or respiratory team. Inclusion criteria were: Prior diagnosis of COPD, ratio of forced expiratory volume in 1 second to forced vital capacity of <.7 and/or the presence of emphysema with a CT scan, self reported smoking history, clinical signs and symptoms consistent with COPD and exertional dyspnea, admitted to hospital for > 24 hours and received an oral corticosteroid therapy and/or antibiotic, willingness to participate within one week of discharge. Participants were then excluded if they had comorbidities precluding exercise testing or training or if they were unable to attend a pulmonary rehabilitation class in the preceding year.

Outcome Measures: Since I am investigating the influence of early skilled exercise and how it affects hospital readmission, the only outcome measure of interest is the hospital admission for exacerbation during a three month period. The other outcome measures including: Emergency department attendance for exacerbation, hospital or emergency department for exacerbation and quadriceps maximum voluntary contraction (QMVC) are not of importance because they do not help answer the clinical question. Outcome measures were assessed at both baseline and at three months following the beginning of the study.

Study Losses: There was one loss (participant expired) during the study in the PEPR group (1/30=3.33% drop-out rate). Participants were analyzed on an intention-to-treat basis regardless of compliance.

Summary of Internal Validity: This article had good internal validity (PEDro 7/10). There was one minor threat to the validity of the study. The threat was a lack of blinding of participants, assessors, and therapists. The reason the lack of blinding is only a minor threat is because the outcome of interest does not involve any judgment on the part of the assessors. This threat allows the possibility of a Hawthorne effect (Subjects tend to act differently when they know they are being studied), Rosenthal effect (Knowing you are being treated might cause unusual outcomes due to the knowledge you are being assessed, i.e.- White Coat effect) and Rater bias. The authors acknowledge the lack of blinding by stating that due to the nature of the study and the personnel required to assess and interact with the patients, it was not possible to blind any of the participants, assessors, or therapists that helped with the study.

Evidence: The statistics in this section compare persons with diagnosed with COPD and if PEPR vs. UC changes the likelihood of readmission (i.e., exacerbation of COPD) within three months to the hospital. I have created a 2 X 2 contingency table to perform a chi-square analysis. Table 4 shows the results of readmission to the hospital within

three months of admission to the study. Chi-square analysis result of 6.66 with a p-value=0.02 indicate statistical significance between groups in the following data.

Table 4. Results of readmission to hospital following treatment for both groups.

	Event (Hospital readmission)	**Non-Event** (No hospital readmission)
Treatment (PEPR)	**2**	**28**
Control (Usual care)	**10**	**20**

In Table 5, there are calculated statistics from the 2 X 2 table (using Dr. Bush's evidence-based statistics calculator) that can be used to interpret whether the reported outcomes were clinically important.

Table 5. Summary of outcome measures on the effectiveness of therapeutic treatment

CER	0.333
EER	0.067
ARR (CI 95%)	0.27 (-0.08-0.46)
RRR (CI 95%)	0.80 (0.16-0.95)
NNT (CI 95%)	3.75 (2.2-13.2)
RR (CI 95%)	0.20 (0.38-0.84)
OR (CI 95%)	0.14 (0.03-0.72)

Based on the data presented by the authors, the Control Event Rate (CER) was 0.333, meaning that 33.0% of the subjects in the UC group had had a COPD related hospital readmission at follow-up, as compared to the 6.7% rate of readmission in the PEPR group (Experimental Event Rate, or EER). The Absolute Risk Reduction (ARR) showed that there was a 27.0% decrease in COPD related readmission recurrence if the subject was given PEPR. The Relative Risk Reduction (RRR) of 80.0% means that there would be a decrease in readmission for the general population if everyone with COPD was given UC after an acute exacerbation of COPD. The low end of the 95% confidence intervals for the ARR (-0.08-0.46, respectively) is in the negative range, suggesting that sometimes not giving PEPR to patients with COPD can also decrease the COPD related readmissions to hospitals. The Number Needed to Treat (NNT) was 3.75. This means that 3.75 patients who are treated with PEPR need to be treated for one person to not have a COPD related readmission. This is a low NNT which heavily supports the use of PEPR as a rehabilitative protocol for patients with COPD in the future. The Relative Risk (RR) of 0.20 shows the percent chance of having a bad event if a patient

was to receive PEPR. The Odds Ratio (OR) of 0.14 indicates that a COPD related readmission is less likely to occur if the subject was given PEPR.

Applicability of study results:
Benefits vs. Costs: The results of this study support the hypothesis that PEPR provide a decreased chance of readmission to the hospital due to exacerbation of COPD. This conclusion is based on the NNT (3.75) and ARR (27%). Due to the high cost of hospital admission and acute care required once admitted and the relatively low cost of PEPR (Including patient and therapist time and equipment), it is cost effective and effective to refer patients with COPD to PEPR to decrease readmission due to exacerbation of COPD. The treatment protocol costs each patient time (4 hours per week for 8 weeks), and money.

Feasibility of treatment: The method of treating COPD with UC or with PEPR is deemed feasible for the majority of patients and can be applied easily within the clinical setting. Routine exercise and patient education for 4 hours per week for 8 weeks does not require any additional training on the part of the physical therapist however, the education might require some extra training to ensure proper and effective patient education. Because the treatment requires little training and is easily administered it is deemed feasible.

Summary of external validity: The results may be easily generalized to other patients with COPD, especially due to the consistency of the study's internal validity. The subjects although from England appear to be similar in demographics to the population of interest in the USA and in hospital settings. The authors reported in order to obtain statistical significance they would require 30 participants per group. However, the results might be more easily generalized to a greater population if the authors had obtained a larger number of participants.

Synthesis/Discussion: The purpose of this critically appraised topic was to determine if early skilled therapeutic exercise following COPD exacerbation helps reduce the readmission rate to hospitals by increasing exercise capacity. I am able to support the findings of Eaton *et al*. and Seymour *et al*. in their conclusion that early skilled exercise rehabilitation helps decrease hospital readmission rates following acute exacerbation of COPD. However, it is necessary to note that Eaton *et al*. had a significant threat to internal validity because of poor protocol adherence by the patients in the early pulmonary rehabilitation group as well as a small sample size. Additionally, both Eaton *et al*. and Seymour *et al*. lacked blinding to their subjects, therapists and assessors which is deemed a minor threat to the studies internal validity. The reason the lack of blinding is only a minor threat is because the outcome of interest does not involve any judgment on the part of the assessors. Furthermore, chi-square analysis of data obtained by Eaton *et al*. failed to reach statistical significance between groups. However, overall these two studies provide no reason not to refer patients to participate in early skilled therapeutic exercise to help decrease hospital readmission rates following exacerbation. I feel confident in my decision to refer patients to participate in early skilled therapeutic exercise to patients with COPD in order to decrease their risk of

readmission to acute care in hospitals. I look forward to appraising and reviewing future research with greater PEDro scores, larger subjects sizes, greater longevity following hospital readmission outcomes and blinded participants that will help more clearly answer the question whether early skilled therapeutic exercise helps decrease readmission rate in hospitals due to acute exacerbations of COPD.

References:

American Thoracic Society/European Respiratory Society Task Force Report. Standard for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. *Eur Respir.* J. 2004; 23: 932-46.

Eaton T, Young P, Fergusson W, Moodie L, Zeng I, O'kane F, Good N, Rhodes L, Poole P, Kolbe J. Does Early Pulmonary Rehabilitation Reduce Acute Health-Care Utilization in COPD Patients Admitted with an Exacerbation? A Randomized Controlled Study. *Respirology* 2009; 14: 230-238.

Frownfelter D, & Dean E. (2006). *Cardiovascular and Pulmonary Physical Therapy Evidence and Practice*: St. Louis, Missouri: Mosby Elsevier.

Goodman C, & Fuller K. (2009). *Pathology: Implications For The Physical Therapist*: St. Louis, Missouri: Saunders Elsevier.

Man W, Polkey M, Donaldson N, Gray B, Moxham J. Community Pulmonary Rehabilitation After Hospitalization for Acute Exacerbations of Chronic Obstructive Pulmonary Disease: A Randomised Controlled Trial. *British Medical Journal* 2004; 329: 1209-1213.

Physiotherapy Evidence Database. The George Institute for Global Health. Available at: www.pedro.org.au. Accessed on August 15, 2013.

Rehabilitation Measures Database. Available at: http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=1010. Accessed on September 1, 2013.

Seymour J, Moore L, Jolley C, Ward K, Creasey J, Steier J, Yung B, Man W, Hart N, Polkey M, Moxham J. Outpatient Pulmonary Rehabilitation Following Acute Exacerbations of COPD. *Thorax* 2010; 65: 423-428.

Special Acknowledgments:

Richard Rutt PT, PhD

Ken Bush PT, PhD

Erin Jobst PT, PhD