TITLE: Impact of Physical Activity and Functional Capacity on Patients with Chronic Conditions: Clinical Evidence and Guidelines

DATE: 08 October 2013

RESEARCH QUESTIONS

1. What is the clinical evidence regarding the effects of physical activity on the health status or health-related quality of life of patients with chronic conditions such as congestive heart failure (CHF) or chronic obstructive pulmonary disease (COPD) in the community setting?

2. What is the clinical evidence regarding the use of functional capacity as a predictor of morbidity and mortality for patients with chronic conditions?

3. What are the evidence-based guidelines regarding the measurement of physical activity among patients with chronic diseases in the community setting?

4. What are the evidence-based guidelines regarding the measurement of functional capacity among patients with chronic diseases in the community setting?

KEY MESSAGE

Five systematic reviews and nine randomized controlled trials were identified regarding exercise and chronic conditions. No guidelines regarding the measurement of physical activity or functional capacity among patients with chronic diseases in the community setting were identified.

METHODS

A focused search (with main concepts appearing in title or major subject heading) was conducted using key health technology assessment resources, including PubMed and The Cochrane Library (2013, Issue 9). Other resources used include University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied for questions 1 and 2 to limit the retrieval by study type. Methodological filters were applied for questions 3 and 4 to limit retrieval to guidelines. Where possible, retrieval was limited to the human

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population. The search was also limited to English language documents published between January 1, 2009 and September 26, 2013. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

**RESULTS**

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, economic evaluations, and evidence-based guidelines.

Five systematic reviews and nine randomized controlled trials were identified regarding exercise and chronic conditions. No relevant health technology assessments or evidence-based guidelines were identified. Due to the volume of literature identified, relevant non-randomized studies have been included in the appendix, along with other additional references of potential interest.

**OVERALL SUMMARY OF FINDINGS**

Twelve studies\(^1\,\text{4,6-13}\) were identified regarding the effects of physical activity on the health status or health-related quality of life of patients with COPD\(^2,\text{10,12}\) and CHF\(^1,\text{3,4,6-9,11,13}\). Exercise was found to be beneficial in many of the included studies.\(^3,4,6-10,12,13\) Types of beneficial exercise included arm resistance training,\(^10\) aerobic exercise,\(^3,12\) moderate intensity exercise,\(^7\) and high intensity cycling combined with strength training.\(^8\) Two studies\(^5,14\) were identified regarding the use of functional capacity as a predictor of morbidity and mortality for patients with diabetes\(^5\) and COPD.\(^14\) For diabetes, the exercise electrocardiogram test and the cardiopulmonary exercise test may provide important predictive information for future cardiac events.\(^5\) For patients with COPD, there was a moderate to weak relationship between daily physical activity and exercise capacity.\(^14\) More detail regarding the results and conclusions of the included studies are summarized in Table 1.

No guidelines regarding the measurement of physical activity or functional capacity among patients with chronic diseases in the community setting were identified from the literature search.

<table>
<thead>
<tr>
<th>Author, Year, Study Design</th>
<th>Objective</th>
<th>Results</th>
<th>Author’s Conclusions</th>
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<tbody>
<tr>
<td>Zainuldin et al. (2011)(^2) SR (3 studies)</td>
<td>To evaluate the optimal intensity and type of leg exercise training for patients with COPD</td>
<td>When comparing high versus low intensity training, there were no significant differences in endurance time improvement and 6 minute walk distance improvement. When comparing continuous and interval training, there...</td>
<td>The authors concluded that the comparisons between studies were limited due to the small number of studies included in the review and the small number of participants in the included studies.</td>
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<td>Janaudis-Ferreira et al. (2011)</td>
<td>To compare the effect of resistance arm training versus sham training on dyspnea in patients with COPD</td>
<td>The training group showed non-significant improvements in 6 minute pegboard and ring test, unsupported upper limb exercise test, elbow flexion force, elbow extension force, shoulder flexion force, and shoulder abduction force as compared to the sham group. There was no difference between groups in terms of dyspnea during activity of daily living, QoL, or symptoms during exercise capacity tests.</td>
<td>The authors concluded that resistance arm training improved function, exercise capacity and muscle strength but had no effect on dyspnea, QoL or symptoms.</td>
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<td>Borghi-Silva et al. (2009)</td>
<td>To compare the effects of a 6 week aerobic exercise training program with usual care for autonomic modulation of heart rate in patients with COPD</td>
<td>In the training group, there were significant improvements in peak oxygen consumption, blood lactate, minute ventilation, dyspnea at peak exercise, sympathetic activity, and parasympathetic activity at rest and during submaximal exercise.</td>
<td>The authors concluded that neural control of heart rate and other clinically important measures were improved following an aerobic exercise program.</td>
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<td>Davies et al. (2010)</td>
<td>To evaluated the effectiveness of exercise-based interventions on morbidity, mortality, hospitalization, and QoL in patients with CHF</td>
<td>There was no significant difference in pooled mortality in the 13 trials with less than 1 year of follow-up. There was a non-significant trend towards reduced mortality in the 4 trials with more than 1 year of follow-up. A reduction in hospitalization and a significant improvement in health-related QoL was shown with exercise training programs.</td>
<td>The authors concluded that exercise did not increase the risk of all-cause mortality in patients with CHF and may help to reduce heart failure-related hospital admissions. Exercise training may also result in improvements to patients' health-related QoL.</td>
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<td>Hwang et al. (2009)⁴ MA (19 studies)</td>
<td>To evaluate the effectiveness of home-based exercise programs on exercise capacity in patients with CHF.</td>
<td>As compared to usual medical care, there were improvements measured in peak oxygen consumption, exercise duration, and 6 minute walk test. QoL was improved and hospital admission rates were lowered.</td>
<td>The authors concluded that home-based exercise programs showed short-term benefit for patients with CHF. More study is needed to establish long-term effectiveness.</td>
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<td>Belardinelli et al. (2012)⁶ RCT</td>
<td>To compare the effect of a very long-term (10 years) exercise program with no formal exercise for patients with CHF</td>
<td>Peak VO₂ was significantly greater in the exercise group during each year of the study. QoL scores were significantly better in the exercise group. Rate of hospitalization and cardiac mortality were significantly lower in the exercise group.</td>
<td>The authors concluded that the moderate, supervised exercise program was beneficial to patients. Functional capacity and QoL were greater in the treatment group. These improvements were associated with a reduction in major cardiac events.</td>
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<td>Keteyian et al. (2012)⁷ RCT (HF-ACTION)</td>
<td>To examine whether greater volumes of exercise were associated with greater reductions in clinical events in patients with CHF. Included patients who were part of the exercise training arm of HF-ACTION who were event-free 3 months after randomization.</td>
<td>Based on Cox regression, exercise volume was not a significant linear predictor but was a logarithmic predictor for all-cause mortality or hospitalization. For cardiovascular mortality or HF hospitalization, exercise volume was a significant linear and logarithmic predictor. Exercise volume was positively associated with change in peak oxygen uptake at 3 months.</td>
<td>The authors concluded that only moderate levels of exercise (3 to 7 MET-h per week) are required to produce a clinical benefit in patients with CHF.</td>
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<td>Anagnostakou et al. (2011)⁸ RCT</td>
<td>To compare the effects of interval cycle training with or without strength training on vascular reactivity in patients with CHF.</td>
<td>There was a significantly greater improvement in flow-mediated vasodilation in the combined training group. Peak oxygen intake improved significantly in both groups.</td>
<td>The authors concluded that high-intensity interval cycling combined with strength training resulted in a more beneficial effect than interval cycling training alone in patients with CHF.</td>
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<td>Horwich et al. (2011)⁹ RCT (HF-ACTION)</td>
<td>Analysis of the HF-ACTION cohort to examine the effect of aerobic exercise training in</td>
<td>In all groups, a greater BMI was associated with a non-significant increase in all-cause mortality or hospitalization.</td>
<td>The authors concluded that exercise training was associated with a trend towards decreased mortality and hospitalization.</td>
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<td><strong>Table 1: Summary of Included Studies</strong></td>
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<td>*O'Connor et al. (2009)*13   RCT (HF-ACTION)</td>
<td>To test the efficacy and safety of usual care plus aerobic exercise training or usual care alone for patients with CHF</td>
<td>In the exercise training group, an improvement in exercise capacity and QoL was observed in all BMI categories. There was also non-significant reduction in all-cause mortality and hospitalizations across all BMI groups.</td>
<td>Improvement in QoL in all weight categories.</td>
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<td><em>Pan et al. (2013)</em>   MA (4 RCTs)</td>
<td>To examine the effects of Tai Chi training on exercise capacity and QoL in patients with CHF</td>
<td>Tai Chi training significantly improved quality of life. No significant changes were measured in systolic or diastolic blood pressure, 6 minute walking distance, or peak oxygen uptake.</td>
<td>The authors concluded that Tai Chi may help to improve QoL in patients with CHF and could be considered as an addition to cardiac rehabilitation programs. However, there is a lack of evidence that Tai Chi helps to improve exercise capacity.</td>
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<td><em>Yeh et al. (2011)</em>   RCT</td>
<td>To examine the effect of standard care with or without Tai Chi training in patients with CHF</td>
<td>There were no significant differences in change in 6 minute walk test distance or peak oxygen uptake. Patients in the Tai Chi group had greater improvements in QoL, exercise self-efficacy, and mood.</td>
<td>The authors concluded Tai Chi may be useful to improve QoL, mood, and exercise self-efficacy in patients with CHF.</td>
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<tr>
<td>*Guo and Harstall (2009)*5   SR (5 studies)</td>
<td>To assess exercise testing for the prediction of cardiac events in patients with diabetes, COPD, and arthritis.</td>
<td>No studies were identified regarding exercise testing in patients with COPD or arthritis. The included studies demonstrated that prognostic variables, including ECG ST-segment depression, low Duke Treadmill Score, delayed heart rate recovery, impaired chronotropic responses, reduced metabolic</td>
<td>The exercise ECG test and the cardiopulmonary exercise test may provide important predictive information for future cardiac events in patients with diabetes. The authors indicated that the value of these tests might have been overestimated because of potential publication bias.</td>
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**Functional Capacity**

The exercise ECG test and the cardiopulmonary exercise test may provide important predictive information for future cardiac events in patients with diabetes. The authors indicated that the value of these tests might have been overestimated because of potential publication bias.
Table 1: Summary of Included Studies

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<td>Zwerink et al. (2013)¹⁴</td>
<td>A secondary analysis of the COPE-II data to investigate the relationship between daily physical activity level and exercise capacity in patients with COPD.</td>
<td>In the intervention group correlation between the change in steps per day and the change in exercise capacity measures. In the control group, these correlations were weak or non-existent.</td>
<td>The authors determined there was a moderate to weak relationship between daily physical activity and exercise capacity.</td>
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</table>

BMI = body mass index; CHF = chronic heart failure; COPD = chronic obstructive pulmonary disease; COPE = COPD study at the department of Pulmonology in Enschede; ECG = electrocardiography; HF = heart failure; HF-ACTION = Heart Failure: A Controlled Trial Investigating Outcomes in Exercise Training; MA = meta-analysis; MET = metabolic equivalent; QoL = quality of life; RCT = randomized controlled trial; SR = systematic review
REFERENCES SUMMARIZED

Health Technology Assessments
No literature identified.

Systematic Reviews and Meta-analyses


Functional Capacity


Randomized Controlled Trials

Exercise


PubMed: PM21907317

PubMed: PM20724740

PubMed: PM21518942

PubMed: PM19464865

PubMed: PM19351941

Functional Capacity

PubMed: PM23085213

Guidelines and Recommendations
No literature identified.

PREPARED BY:
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APPENDIX – FURTHER INFORMATION:

Non-Randomized Studies


Functional Capacity


Review Articles


Additional References


