Batterham S, Heywood S, and Keating J. Systematic review and meta-analysis comparing land and aquatic exercise for people with hip or knee arthritis on function, mobility and other health outcomes. BMC Musculoskeletal Disorders 2011; 12:123-135.

Design: Systematic Review and meta-analysis of randomized clinical trials
Date: 5-4-15 LM

Study Question: To assess the advantages of aquatic exercise compared to land-based therapeutic exercise for people with hip or knee OA in terms of improved physical function and mobility.

PICOs:

- **Patients:** Participants 18 years of age or over with hip or knee rheumatoid arthritis or osteoarthritis (OA) without joint replacement surgery.
- **Interventions:** Aquatic exercise
- **Comparison interventions:** Any land-based therapeutic exercise regimens including any exercise designed to improve muscle strength, resistance, endurance, or aerobic capacity whether gym or a home based program.
- **Outcomes:** Each RCT needed to include assessment of either function, mobility, or patient satisfaction using any assessment instruments:
- **Study types:** Randomized controlled trials (RCTs) comparing aquatic exercise with some form of land-based therapeutic exercise not in conjunction with other interventions.

Study selection:

- Databases included MEDLINE, CINAHL, AMED, and the Cochrane Library through July 2010.
- Two review authors independently assessed articles for trial inclusion and resolved any disagreements through consensus or consulting a third review author.
- All included trials were critically appraised for quality by the first author using the 11 item PEDro scale.
- As the studies used a variety of different scales to measure comparable outcomes across trials, a unitless measure of treatment effect size was needed to allow the results of the various RCTs to be pooled. Standardized mean differences (SMD) were used to calculate treatment effect sizes, and to obtain a summary estimate. A SMD <0.2 was considered a small effect, 0.5 (>0.2, <0.8) a moderate effect and >0.8 a large effect.
- Data at baseline and immediately following the intervention were extracted. Long term effectiveness of exercise interventions was not assessed.
- Heterogeneity in meta-analysis was assessed with the I^2 statistic. Data was pooled and outcomes combined using the random-effects model for a meta-analysis if I^2 was greater than 50%, otherwise a fixed effects model was used for the analysis. An I^2 greater than 50% was considered as representing substantial heterogeneity.

Results:

- Overall 10 studies with a total of 532 participants with symptomatic hip or knee OA were included. Only two RCTs had more than 50 participants in each allocation.
- There was considerable variability between trials in key program characteristics including prescribed exercises and design quality.
- Nine studies evaluated more traditional muscle strengthening, functional training and aerobic fitness programs, and one study evaluated a specific 'Tai Chi for Arthritis' program.
- Symptom duration varied among study participants from less than one year to more than 20 years.
- Study quality was assessed with the PEDro scale. Six of the 10 studies scored 7 or 8 on the PEDro scale, 2 studies scored 6, and 2 studies scores 5. Eight of the 10 included RCTs were assessed as 'low risk of bias' for allocation concealment while two had 'uncertain risk'. None of the included RCTs were able to blind participants or therapists providing the interventions to treatment allocation. All but one of the included RCTs reported blinding of the outcomes assessor. All studies provided random allocation.
- Meta-analyses were performed for function and mobility. For the function outcome, there was moderate quality evidence from 8 studies (422 participants) that showed a nonsignificant effect between aquatic and land-based exercise groups (SMD = 0.07, 95% CI = -0.26, 0.12) in favor of land based exercise. Between-study heterogeneity was negligible (I^2 = 0%).
- There was high-quality evidence on the mobility outcome from 5 studies (395 participants) that showed that there was no statistically significant difference between aquatic exercise and land-based exercise (SMD = 0.04, 95% CI = -0.15 to 0.24). Between-study heterogeneity was negligible (I^2 = 0%).
- Three trials (197 participants), two of high quality and one of moderate quality, assessed dynamic balance. No significant difference between exercise groups was detected (SMD = 0.16, 95% CI = -0.29, 0.62). Statistical heterogeneity was significant (I^2 = 52%) and a random effects model was applied.

Authors' conclusions:

- For the overall results of the meta-analysis in this review, no statistically significant differences were found for function, mobility, or dynamic balance following water based exercise compared to land based exercise.
- Overall, aquatic and land based exercises appeared to result in comparable outcomes for function and mobility for participants. Meta-analysis did not provide confidence that either aquatic or land based exercise provided better function or mobility outcomes.
- Aquatic exercise appears neither more nor less effective than land based exercise.
- Variability in study parameters, study quality and exercise interventions may have contributed random error to outcomes, confounding the view of effects, however both approaches yielded comparable results.
- The prescription of aquatic exercise for arthritic conditions may not be warranted due to the cost and limited availability of aquatic programs.

- For people who have significant mobility or function limitations and are unable or find it difficult to perform exercise on land, aquatic exercise appears to be a legitimate alternative that may enable people to successfully participate in exercise.
- Further research should explore participant preferences for aquatic exercise compared to land based exercise. Future studies should also include high quality trial design, with intention-to-analysis, adequate follow-up, and baseline similarity. Rationale for choice of exercise components would also be beneficial to understand.

Comments:

- Three high quality trials each found no significant difference in outcomes for land compared to aquatic exercise.
- While a wide variety of functional outcomes were used, the WOMAC was the most common. The majority of trials assessed timed walks for the mobility outcome.
- ClinicalTrials.gov and the WHO trials portal were not included in the search and could result in publication bias. In addition, unpublished studies were not searched.
- Components of exercise programs were poorly reported by the majority of trials.
- There were marked differences between the 10 included RCTs in the content and duration of the exercise programs provided. These extreme differences in treatment dosage and duration make it impossible to develop recommendations for effective treatment.
- Justification for the content of exercise interventions or exercise selection was rarely provided and few trials reported enough detail for both land and aquatic exercise programs to be reproduced reliably.
- Some trials may have included participants with a history of surgery within the previous 3 months, but in most cases participants were being treated for OA.
- Six of the 10 included RCTs had a low risk of bias. However, all the results may be vulnerable to performance and detection bias, since none of the RCTs were able to blind participants to treatment allocation, and the outcome of physical function was participant self-reported.
- Some of the studies had significant baseline differences which may distort effect sizes and mask any true between group differences. Significant baseline differences may also signal inadequate randomization of participants. Analyses with and without trials with significant baseline differences did not change any of the conclusions.
- Only two trials found a statistically significant difference between land and aquatic exercise for any assessed outcome, but baseline differences and high attrition rates confounded these valid differences.
- Clinical decision making regarding exercise choice should consider patients' specific requirements and disabilities, patients' preferences, therapist expertise and best available evidence as well as practical considerations such as availability and cost.

Assessment:

- Adequate quality meta-analysis which supports good evidence that aquatic exercise and land-based exercise show comparable outcomes for function and mobility among people with symptomatic osteoarthritis of the knee or hip.