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Land-Based Exercise and Its Effect on Quality of Life Outcomes in Patients with Knee Osteoarthritis: A Systematic Review

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LAND-BASED EXERCISE AND ITS EFFECT ON QUALITY OF LIFE OUTCOMES IN PATIENTS WITH KNEE OSTEOARTHRITIS: A SYSTEMATIC REVIEW

By

Cody R. Buckner

Lindsay C. Martin

Michael L. Soukup

A doctoral project submitted in partial fulfillment

of the requirements for the

Doctor of Physical Therapy

Department of Physical Therapy

School of Allied Health Sciences

The Graduate College

University of Nevada, Las Vegas

May 2013

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THE GRADUATE COLLEGE

We recommend the doctoral project prepared under our supervision by

Cody R. Buckner
Lindsay C. Martin
Michael L. Soukup

Entitled

Land-Based Exercise and Its Effect on Quality of Life Outcomes in Patients with Knee Osteoarthritis: A Systematic Review

be accepted in partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy
Department of Physical Therapy

Robbin Hickman, D.Sc., Research Project Coordinator

Merrill Landers , Ph.D., Research Project Advisor

Merrill Landers, Ph.D., Chair, Department of Physical Therapy

Thomas Piechota, Ph.D., Interim Vice President for Research &
Dean of the Graduate College

May 2013

Abstract

Background: The purpose of this systematic review was to examine effectiveness of land-based exercise interventions for improving quality of life (QOL) of individuals with symptomatic knee osteoarthritis.

Methods: A systematic search included PubMed, CINAHL, Scopus, Academic Search Premier, and the Cochrane Database of Systematic Reviews. Inclusion criteria included land-based exercise interventions aimed to improve lower extremity strength and QOL, published since 2000. Exclusion criteria included OA of joints other than the knee, and aquatic-based and surgical interventions. Studies were evaluated using a modified version of the American Academy of Cerebral Palsy and Developmental Medicine (AACPDM) methodology score.

Results: Level of evidence for 11 studies ranged from I strong (I-S) to IV. There were 1200 total participants 57.5 to 69.8 years of age with a mean of 64.5. Three common treatment groups were used; exercise, yoga, and education. Twenty outcome measures were used with the Western Ontario and McMaster Universities Arthritis Index (WOMAC), Short Form 36 (SF-36) and strength being most common.

Discussion: Inconsistencies in reporting outcome measures and their subgroups, data, and statistical analyses prevented further data analysis to compare individual intervention effectiveness. However, many articles reported significant improvements in varying QOL subgroups and strength measurements.

Conclusions: This review suggests treatment approaches involving physical activity will be beneficial across all levels of the International Classification of Functioning Disability and Health (ICF), including QOL.

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INTRODUCTION

Osteoarthritis (OA) is the most common type of joint disease.[1] It is characterized by the breakdown of articular cartilage and subchondral bone within any joint.[1] This dynamic pathological process involves all of the tissues within the synovial joint and leads to pain, stiffness, dysfunction, and disability.[2,3] Radiographic images of OA reveal joint space narrowing, sclerotic bone changes, development of osteophytes, and subchondral cyst formation.[1] OA is very prevalent within the geriatric community, and has been recognized as the third leading cause of life years lost to disability.[4] Although OA can affect any joint, the most commonly affected large joint is the knee.[5] Knee OA is the most prevalent chronic disease, and is one of the leading causes of disability in older adults.[3]

Current estimates predict 40 to 80% of individuals with degenerative radiographic changes in their joints will have symptomatic knee OA.[1] Research currently shows 40% of people aged 65 years or older are experiencing symptoms of knee OA.[3,4] Rates and prevalence of OA are on the rise with the National Institutes of Health reporting the clinical prevalence of OA has grown from 21 million in 1995 to over 27 million in 2005.[3] In 2005, an estimated 9,267,000 people were managing symptomatic knee OA (pain, stiffness, dysfunctions, and disability).[3] This increase in incidence is being linked to the growing obesity epidemic and the rise in life expectancy.[6] There is evidence to support the link between obesity and the increase in knee OA, however the major

independent risk factor for knee OA is age.[5,7] Incidence rates are expected to rise further as the baby boomer population continues to age.[8]

Presently there is no known cure for knee OA. The progressive nature of the disease and the pain and disability associated with knee OA greatly impacts an individual's ability to complete activities of daily living, thus decreasing function, mobility, and quality of life (QOL).[9] A large community-based survey discovered that knee OA accounts for the highest level of disability in walking, stair climbing, and general disability.[1,8] Exercise, specifically exercise focused on increasing the strength of the quadriceps femoris muscle (QFM), has been shown to decrease this pain and dysfunction. Although people diagnosed with knee OA may initially avoid exercise due to pain, discomfort, or the belief that exercise will worsen their symptoms, there is substantial evidence to support the benefits of exercise in improving the symptoms of OA.[1,2,4,8,10] In fact, the American College of Rheumatology has recommended a strength training exercise program as a form of treatment for knee OA on their website and in their literature.[10]

<<Insert Figure 1>>

Traditionally, most researchers have focused on improving impairments of body structure and function when designing studies of individuals with knee OA, and those improvements in impairments are assumed to have an impact on an individual's participation level and overall well-being. For example, it is often assumed that a change in the body structure and function category of the World Health Organization's

International Classification of Functioning, Disability and Health (ICF) model, e.g. strengthening of weakened muscles, will have an impact on the participation level of the ICF, e.g. QOL (Figure 1).[11] However, the focus was instead on determining whether functional interventions (activity level of ICF) have an impact on an individual's QOL (participation level of ICF). In other words, this review will examine land-based exercise intervention and their effects on QOL in individuals with knee OA. The review looks more closely at the impact of functional activities on participation. For example, will a change in activity (e.g. improved ability to climb stairs) have an impact on participation (QOL)? And if so, what impact does it have? This review will highlight the effect of the activity (exercise) level of the ICF on the participation (QOL) level for individuals with knee OA.

Exercise has demonstrated many effects on QOL including improved psychological well-being, increased strength of muscles required for daily activities, and improving or maintaining cartilage integrity, all of which can greatly improve QOL.[10] There is much debate, however, about which type of exercise will improve QOL the most for patients who are living with knee OA. Therefore, the purpose of this systematic review was to evaluate existing literature to determine which land-based intervention in the literature provides the greatest improvement in QOL for patients with knee OA. It has been shown that strengthening the QFM in people with knee OA decreases pain, and it is important to understand whether the interventions that decrease pain and improve strength also bring about significant improvements in QOL.

METHODS

Population

The target population of this review included adults who had been diagnosed with, or had reported symptoms of knee OA, including joint pain, stiffness, dysfunction and disability. Individuals were included if they had been involved in a conservative land-based exercise intervention for the treatment and management of symptoms of knee OA. Individuals were excluded if they had sought surgical intervention for symptoms, if they were involved with any aquatic therapy intervention, or if they had reported OA of other joints, including, but not limited to, hip or ankle OA.

Intervention

There are many methods of decreasing the pain and disability of knee OA, including surgical intervention, total knee arthroplasty, exercise, physical therapy, yoga, aquatic therapy and many more. Interventions of interest for this review, however, included any land-based physical therapy exercise intervention designed to strengthen the QFM group. Land-based physical therapy exercise interventions were of particular interest as they allow participants to continue managing knee OA symptoms individually in their homes after the completion of the studies. Therefore, studies involving aquatic interventions were excluded from this review. Studies must have also included some obvious measure of strength gain during the intervention, as well as a reported QOL measure. Interventions not including a control group were accepted secondary to the lack of studies meeting QOL search criteria.

Search Strategy

The American Academy of Cerebral Palsy and Developmental Medicine (AACPDM) methodology was used to establish a valid and reliable manner of searching the literature.[12] By following the steps provided by the methodology, the study population and interventions of interest were defined as described above.

Systematic searches and article assessment were performed independently by three individuals then collectively assessed. Databases were limited to those containing primary sources relevant to the field of physical therapy. Of greatest interest were those databases including exercise interventions relating to the purpose of the study, namely which interventions are best suited to increase QFM strength and QOL (Figure 2).

<<Insert Figure 2>>

Once these databases were identified, a series of systematic search terms were applied to find relevant articles. The Boolean search terms "knee osteoarthritis AND quadriceps strength AND quality of life" were used universally throughout the databases. Next, a system of terms (described in Figure 3) was applied to narrow the results to less than 100 articles per database.

<<Insert Figure 3>>

Articles were compiled after an exhaustive search by each individual and included all articles from each individual. Duplicated articles were excluded, and remaining articles were independently reviewed. The results of the initial search procedure left uncertainty with regard to the actual relevance of some articles.

Therefore, it was necessary to use manual exclusion criteria to eliminate irrelevant articles (Figure 4).

<<Insert Figure 4>>

After an article met the inclusion criteria, it was further evaluated for its relevance to physical therapy treatment, QFM strengthening, and QOL outcome measures. Finally, if an article included and reported on these topics it met the inclusion criteria and was retained for further review. Assessors collectively compared and discussed their assessment of each article until a consensus was reached.

Overall, five databases were found to have met the requirements for inclusion in the review: PubMed, CINAHL, Scopus, Academic Search Premier, and the Cochrane Database of Systematic Reviews. In total, 115 articles met the inclusion criteria. After exclusion criteria were evaluated and duplicate articles were removed, there were eleven articles remaining for further analysis.

RESULTS

Table 1 is an illustration of the extracted evidence from each individual source, describing level of evidence, target population, intervention, and outcome measurements used in each study.

<<Insert Table 1>>

Level of evidence

Articles reviewed were assessed for quality of evidence via methods presented in the AACPDM[12] guidelines for developing a systematic review. The evidence presented in the articles ranged from a strong Level I study (I-S) to a Level IV study. Six of the studies were rated as a Level I study with four of those being rated as strong [13-16], one as medium [17], and one as weak.[2] Four studies were rated Level II medium,[10,18-20] and one was determined to be a Level IV study. [21]

Target population

The target population age of the studies ranged from 57.5 to 69.8 years. The combined mean age was 64.5 (SD +/- 4.79) years of age. Combined, there were 1200 subjects analyzed and assessed between the studies with 332 subjects being male and 868 subjects female. Inclusion and exclusion criteria differed between studies. Five studies required either radiographic evidence or clinical symptoms, but also accepted both for inclusion in the study.[13,14,16,18,19] Two studies included participants based upon radiographic evidence of knee OA alone,[2,15] one article required only clinical evidence of OA,[20] and one article required both radiographic and clinical diagnosis for inclusion.[10]

Two articles were not specific about requirements for inclusion with Mikesky et al[17] using participants from a previous knee OA study and Bukowski et al[21] not reporting requirements for inclusion.

Intervention and Comparison Groups

Of the studies evaluated, there were three distinct types of interventions tested across the 11 studies reviewed. Eight articles utilized a form of lower extremity (LE) progressive resistive exercises,[2,10,14,15,17-19,21] two articles investigated education specific to knee OA[13,16], and two articles investigated Iyengar yoga as their intervention[20,21].

Six of the studies utilized some form of comparison group in testing the interventions, with a wide variety of interventions used for controls. Comparison interventions included general arthritis education,[13] exercise without biofeedback,[19] ROM/flexibility,[17] sham ultrasound,[14] no intervention,[2,15,21] and nutrition education.[10] Bukowski et al[21] utilized two treatment groups (yoga and progressive resistive exercise) compared to a control who received no intervention. Three articles utilized a repeated measures design in which subjects served as their own controls.[16, 18, 20]

The length of intervention differed among groups with the shortest being three weeks, [19] and the longest being 12 months.[17] Four studies performed the intervention over six weeks, [13,15,16,21] three over 8 weeks, [2, 18, 20] and one each of 12 weeks[14] and 16 weeks.[10]

Outcome measures

There were a total of 20 different outcome measures used within the studies reviewed. Commonly used QOL outcome measures included the Western Ontario and McMaster Universities Arthritis Index (WOMAC) in 8 articles,[10,13-15,17,19-21] Short Form- 36 (SF-36) in three articles,[10,13,14] Knee Injury and Osteoarthritis Outcome Score (KOOS) in one article,[18] and Arthritis Impact Measurement Scales (AIMS) in one article.[2] Of the articles reporting similar outcome measures, there was no consistency in the reporting of subcategories; and comparisons were made at varying time intervals, sometimes within groups and sometimes between groups, regardless of study design.

Of the articles reporting LE strength, there were four different units of measurement utilized, and one article did not report any unit of measurement.[20] Many different devices were used to assess strength, with the most popular being various types of dynamometers. Six articles reported strength in Kilograms (Kg),[2,10,13,15,18,21] three articles reported strength in Newton meters (Nm),[17-19] one in Newtons (N),[16] and one in Newtons per Kg body weight (N/Kg).[14]

Summary of Findings

There were many inconsistencies in reporting data related to strength and QOL outcome measures. Studies using similar outcome measures did not report the same subcategories of each outcome measure. Six articles did not report p-values for each outcome used and reported, with most of the unreported p-values regarding data with no statistical significance.[13-15,17,20,21] Statistical significance of interventions was unable to be determined in 3 articles due to a lack of information, data, or p-values.[2,14,21]

Kuptniratsaikul et al[2] reported data with significant results within each group, but did not report information regarding a comparison between the experimental and control groups. Yilmaz et al[19] reported a statistical significance with regard to pre and post measurements of each group, but reported there was no significant difference between the experimental and control groups. Three articles reported a significant improvement in some aspect of QOL, but no improvement of LE strength.[17,18,20] One article reported only an improvement in strength,[15] two had improvements in both strength and QOL,[10,16] and two studies reported no statistically significant improvement in either QOL or LE strength.[13,19] Two articles reported there were significant improvements between or within groups during the intervention, but these improvements were not maintained once subjects discontinued treatment.[13,17] It is important to note no articles demonstrated worsening of symptoms across any ICF level.

These findings can be summarized in figures 5-11.

<<Insert Figures 5-11>>

DISCUSSION

This systematic review investigated the effects of land-based exercise intervention for improving QOL for people diagnosed with knee OA. Based upon the evidence gathered, physical activity and mobility had a positive impact on the QOL of patients experiencing symptoms of knee OA. Most studies reviewed demonstrated some improvement in regard to QOL or strength during the interventions. [10,13,15-18,20,21] This indicates that an approach involving exercise would be an appropriate intervention for people with knee pain related to OA. However, it is difficult to determine which exercise program is most effective in improving strength and QOL.

The difficulty in establishing a conclusive exercise intervention for treating symptomatic knee OA is due to the heterogeneity of the measurements used in the studies analyzed. Although several studies reported gains in strength and QOL, there is not enough consistency in data collection and reporting to draw a solid conclusion about which, if any, approach is most successful in improving QOL. [10,13,15-18,20,21] Because of this observed lack of uniformity in results and data, including differences in units and outcome measures used, meta-analysis of the data was not possible.

Based on the assessment of the data, it appears interventions focused on the activity level of the ICF (e.g. yoga, progressive resistive exercise) may have a positive impact on the participation level (e.g. QOL) for people with knee OA. This effectively demonstrates that task-specific interventions (activity, e.g. stair climbing) are important to improving well-being and can be used as intervention techniques, either alongside of

strengthening interventions (body structure and function level of the ICF) or independently, to positively impact the QOL (participation) of people experiencing symptoms of knee OA. This finding corroborates the findings of other studies stating that immobility decreases the health of cartilage and may contribute to increased symptoms of osteoarthritis, and therefore, be detrimental to a person's QOL.[22,23]

In order for future studies to be combined and analyzed, more effort will be necessary to determine consistent methods and units of measurement. This can be achieved by developing an APTA-managed database in which outcome measures for specific tests and measures are established and must be used in research. By doing this, it would allow for more uniformity in research and enable data to be compared for higher quality research, including meta-analyses.

As a final note, none of the studies involved in this systematic review addressed the topic of continuing an exercise program at home after the completion of the study. Self-management of pain and dysfunction is an important aspect to the rehabilitation process as it allows patients to control symptoms after medical assistance has ended, and thus, save money and time. Future research should examine the feasibility of an exercise program to be performed at home, in order to allow participants to maintain gains or further improve their strength, health and QOL.

Figure 1. ICF Model adapted for knee OA[11]

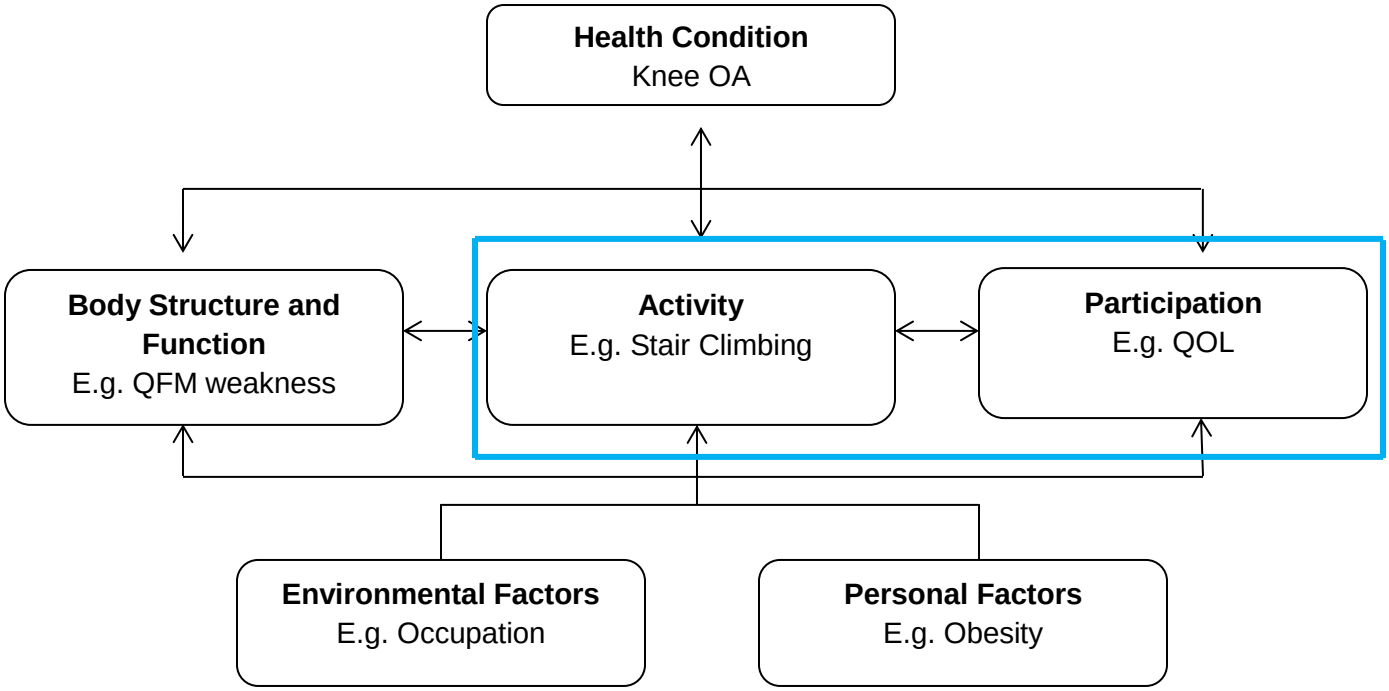


Figure 2. Algorithm for including/excluding databases for terms search

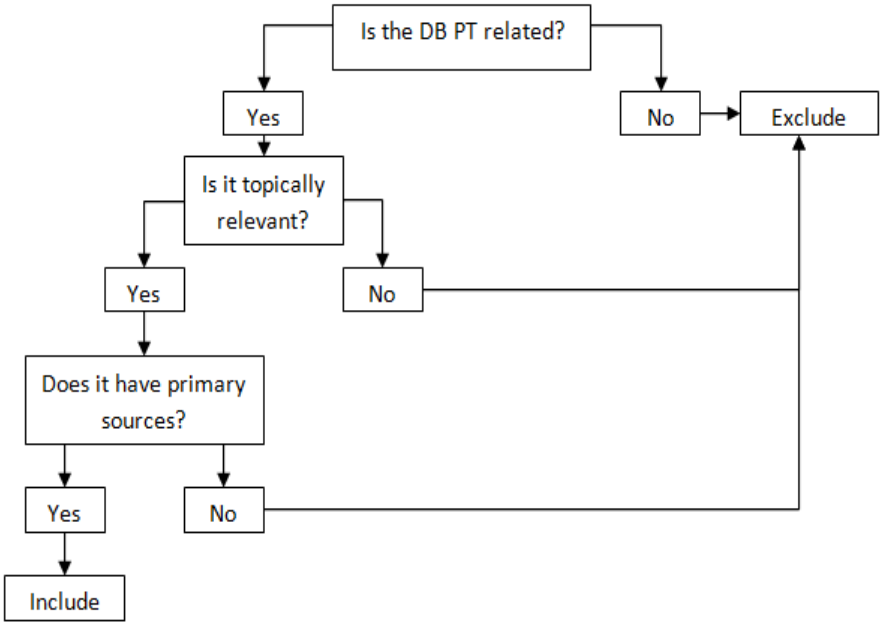


Figure 3. System of terms used to reduce results to less than 100 per database

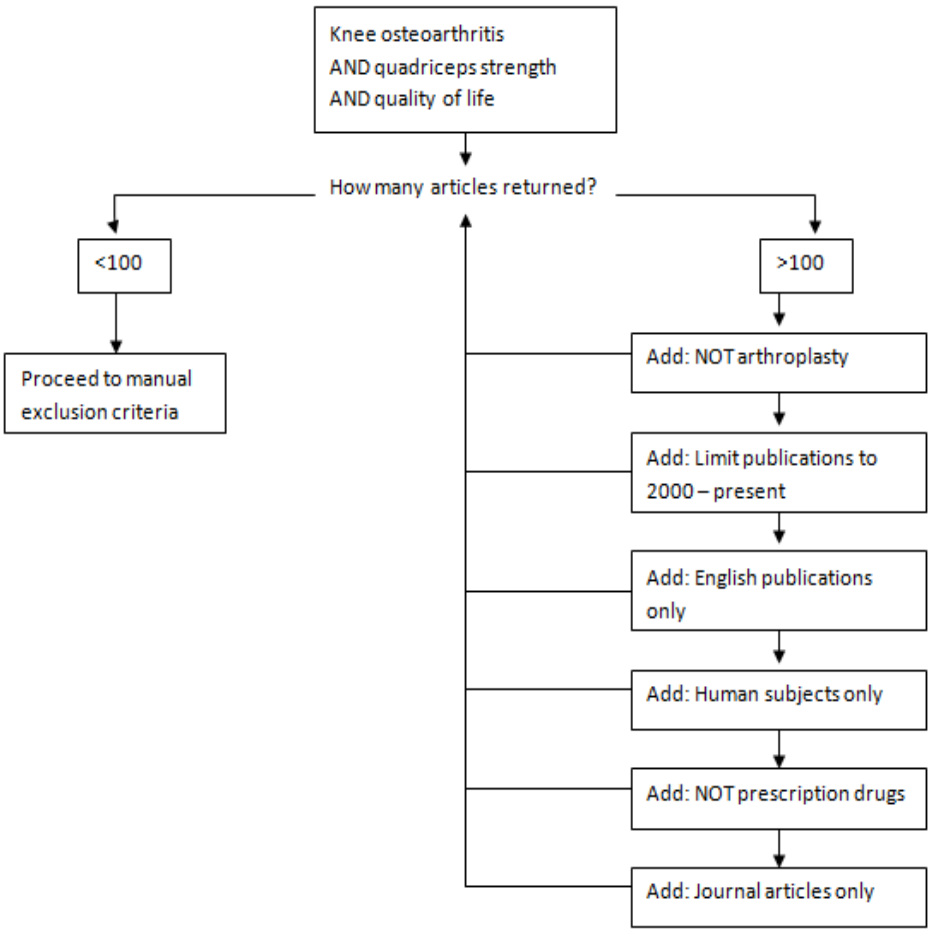


Figure 4. Inclusion/exclusion criteria for final review

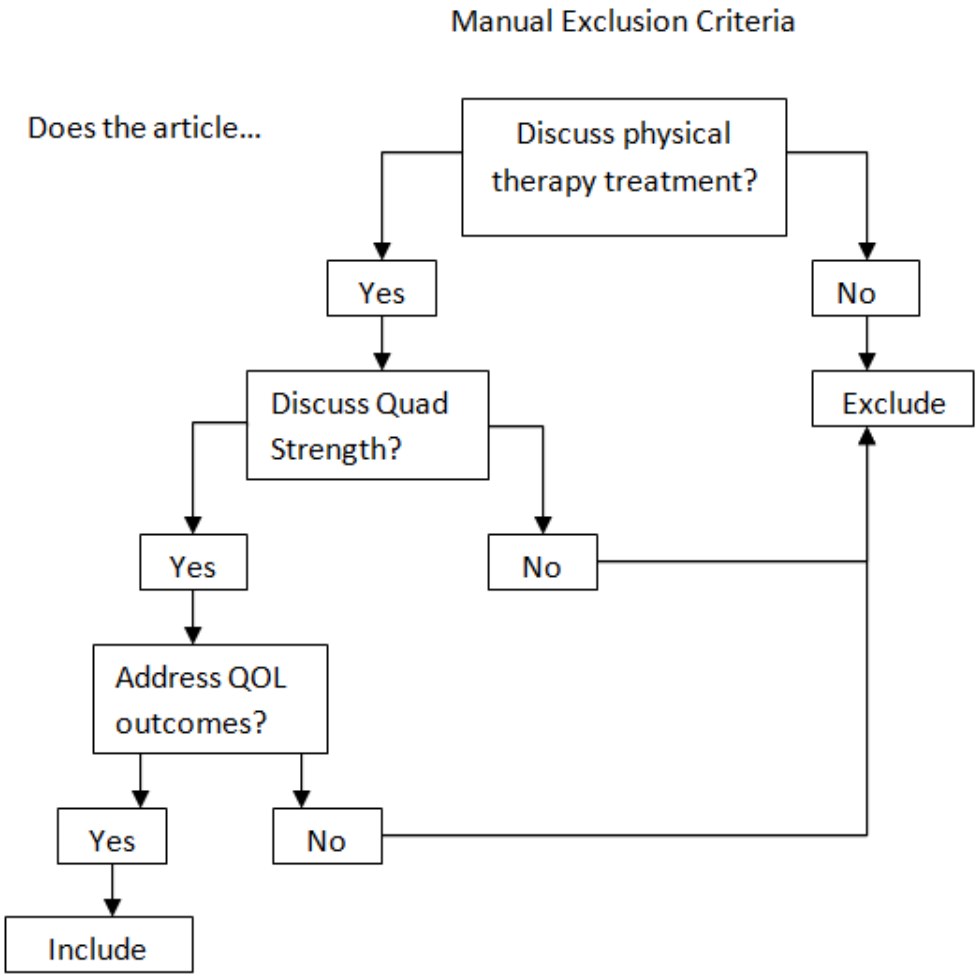


Table 1. Data from selected studies

Source	Level of Evidence	Target Population	Intervention (Freq, Duration, Intensity)	Outcome Measure	Significant Findings	Comparison Group
Coleman S. et al (2012)*	I-S	Mean age = 65 yrs 37 Male 109 Female	Knee OA specific self-management education program vs. general arthritis education 6 weeks, 1x/wk 2.5hrs/session	WOMAC SF-36 Mecmesin Force Gauge Dynamometer	No (p=.057) No, Pain (p=.384) No, Function (p.=122) No**	RCT
McQuade KJ (2011)	II-M	Mean age = 55.8 yrs 5 Male 16 Female	Progressive resisted exercises for knee flexors and extensors 3x/wk, 8 wks	KOOS Knee flex/ext	Yes, Pain (p.=.008) Yes, ADL (p=.02) Yes, QOL (p=.01) No, (p=.65)	Repeated measures
Yilmaz OO. et al (2010)***	II-M	Mean age = 57.5 yrs 5 Male 35 Female	Exercise with or without bio-feedback Supervised group 3x/wk, 3wks, 2x @home on supervised days 3x @home on unsupervised days	WOMAC Isokinetic dynamometry with cybex	No, Pain (p=.67) No, Function (p=.94) No (p.=26)	RCT

Source	Level of Evidence	Target Population	Intervention (Freq, Duration, Intensity)	Outcome Measure	Significant Findings	Comparison Group
Bukowski EL, et al (2006)	IV	Mean age = 63.8 yrs 2 Male 13 Female	Iyengar Yoga vs. progressive resisted exercise vs. non-exercise 2x/wk for 6wks	WOMAC Quadriceps strength	3-93%** 2-210%**	RCT
Mikesky AE, et al (2006)*	I-M	Mean age = 69 yrs 93 Male 128 Female	Progressive LE exercise vs. ROM and flexibility with same schedule 2x/wk at facility 1x @home for 3months 1x at facility and 2x@home for 3months Every other week for 3 months with all others at home 1x/month for 3 months all others at home 6 month follow up to 30 month mark	WOMAC SF-36 Kincom 3 dynomometer	No, Pain** Yes, Function (p.=014) No, Function (p=.254) No (p=.09)	RCT

Source	Level of Evidence	Target Population	Intervention (Freq, Duration, Intensity)	Outcome Measure	Significant Findings	Comparison Group
Bennell KL, et al (2005)	I-S	Mean age = 68.6 yrs 46 Male 94 Female	Knee taping, soft tissue massage, t-spine manipulation, and graded exercise vs. sham ultrasound 12wks with 12wk follow-up 1x/wk, 4wks every other week for 8wks	WOMAC SF-36 Kincom dynamometer	Unable to determine** Unable to determine** Unable to determine**	RCT
Kolasinski SL, et al (2005)	II-M	Mean age = 58.6 yrs 0 Male 7 Female	Iyengar Yoga 1x/wk for 8wks 1-1.5hr session	WOMAC 50ft walk time	Yes, Pain(p=.04) Yes, Function (p=.04) No**	Repeated measures
Foley A, et al (2003)	I-S	Mean age = 69.8 yrs 30 Male 37 Female	Progressive resistive exercise vs. telecommunication with control group 3x/wk for 6wks 30min/session	WOMAC Quadriceps strength	No** Yes, (p<.001)	RCT
Kuptniratsaikul V, et al (2002)****	I-W	Mean age = 67.7 yrs 86 Male 306 Female	Resisted exercise for quad vs. control group 2x/wk for 8wks 1hr session	Functional incapacity Dynamometer	Undetermined Undetermined	RCT

Source	Level of Evidence	Target Population	Intervention (Freq, Duration, Intensity)	Outcome Measure	Significant Findings	Comparison Group
Baker KR (2001)	II-M	Mean age = 68.5 yrs 10 Male 36 Female	4 month home-based progressive resistance strength training vs. nutrition education 2 sets of 12 reps for 3x/wk for16wks	WOMAC SF-36 Total knee extension	Yes, pain (p=.013) No, Function (p=.07) No, Pain (p=.06) Yes, Function (p=.01) Yes (p=.002)	RCT
Hopman-Rock M (2000)	I-S	Mean age = 65.3 yrs 18 Male 87 Female	1hr education 1hr progressive resisted exercise 1xwk/6wks 2hrs/session	QOL VAS Left Leg Knee Extension	Yes (p=.039) Yes (p=.028)	Repeated measures
*Significance found during study but did not hold over time **p-values were not listed for this measure *** Significance found pre-vs. post treatment but not between groups ****Study reported within-group p-values but not between group values						

Figure 5. Summary of significant findings in WOMAC function

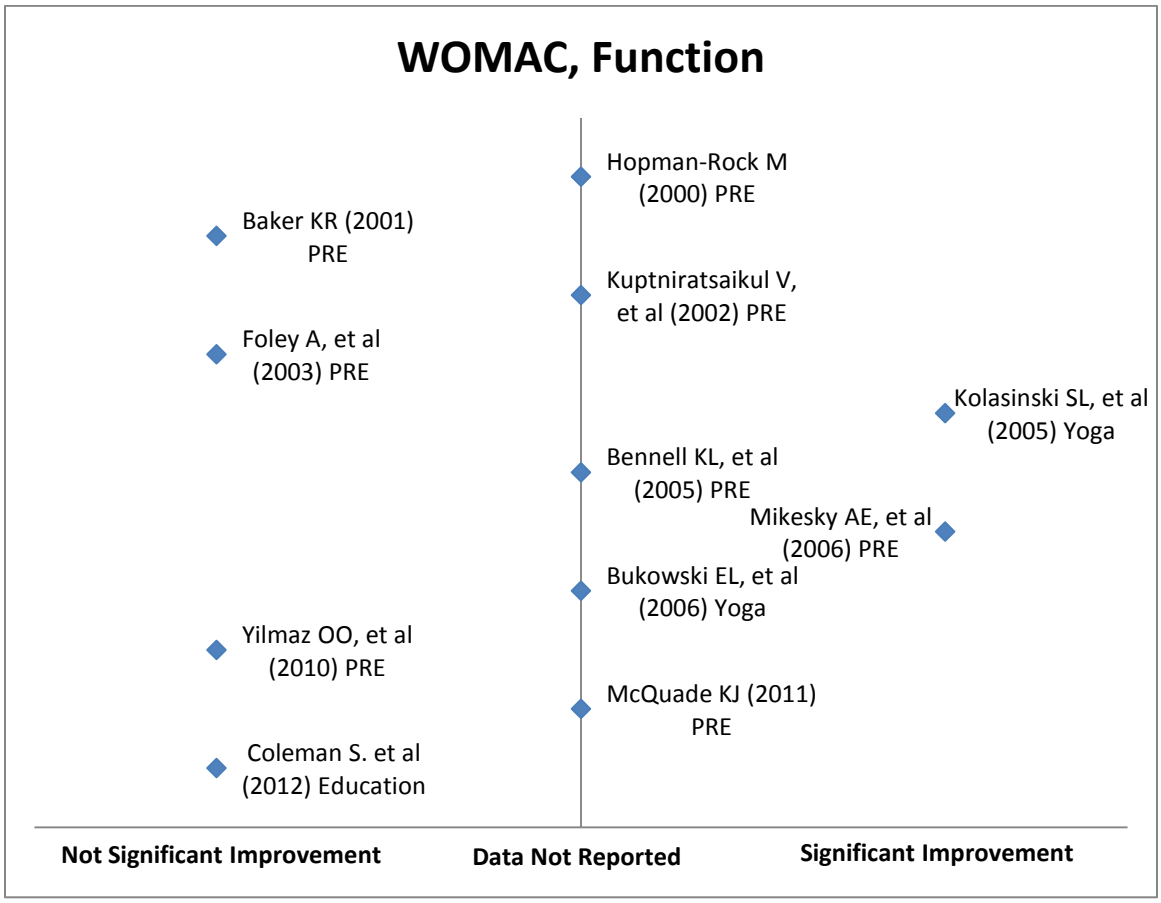


Figure 6. Summary of significant findings in WOMAC pain

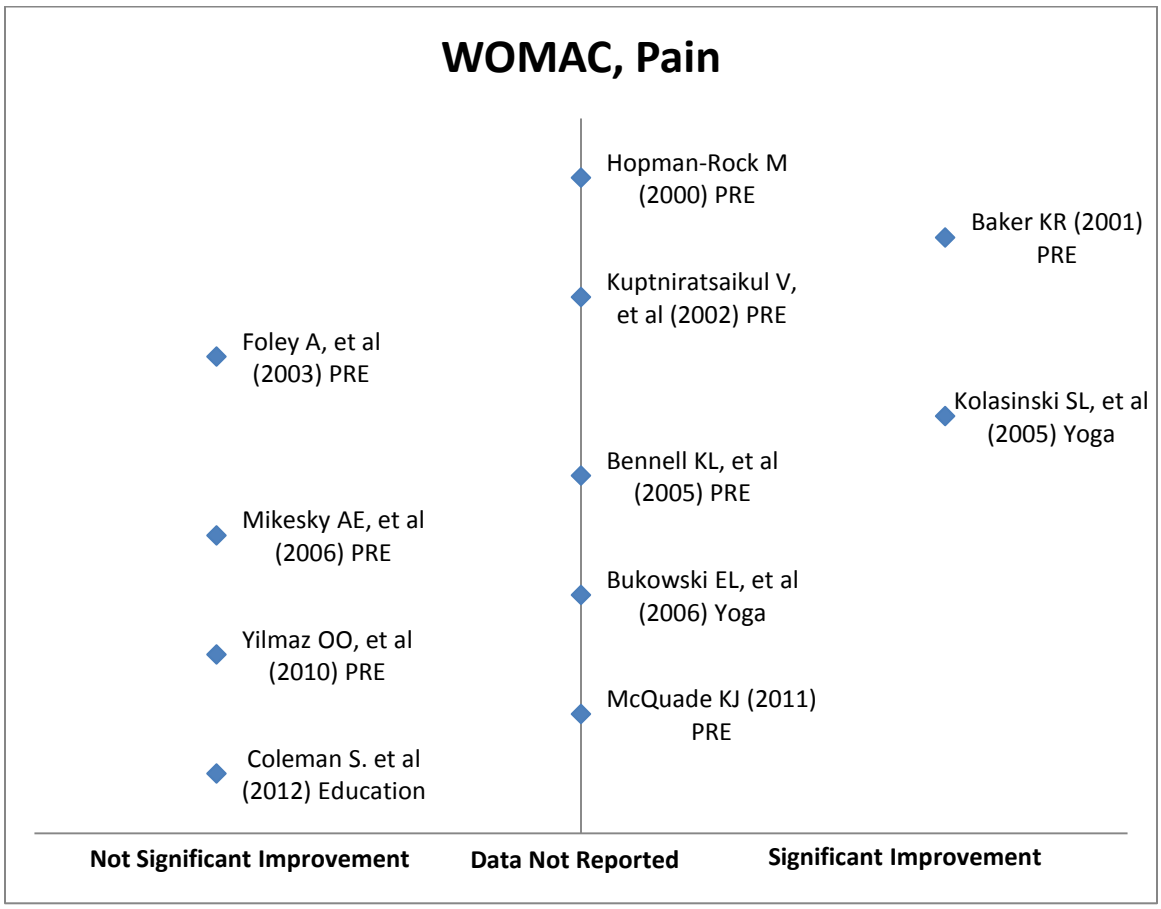


Figure 7. Summary of significant findings in SF-36 function

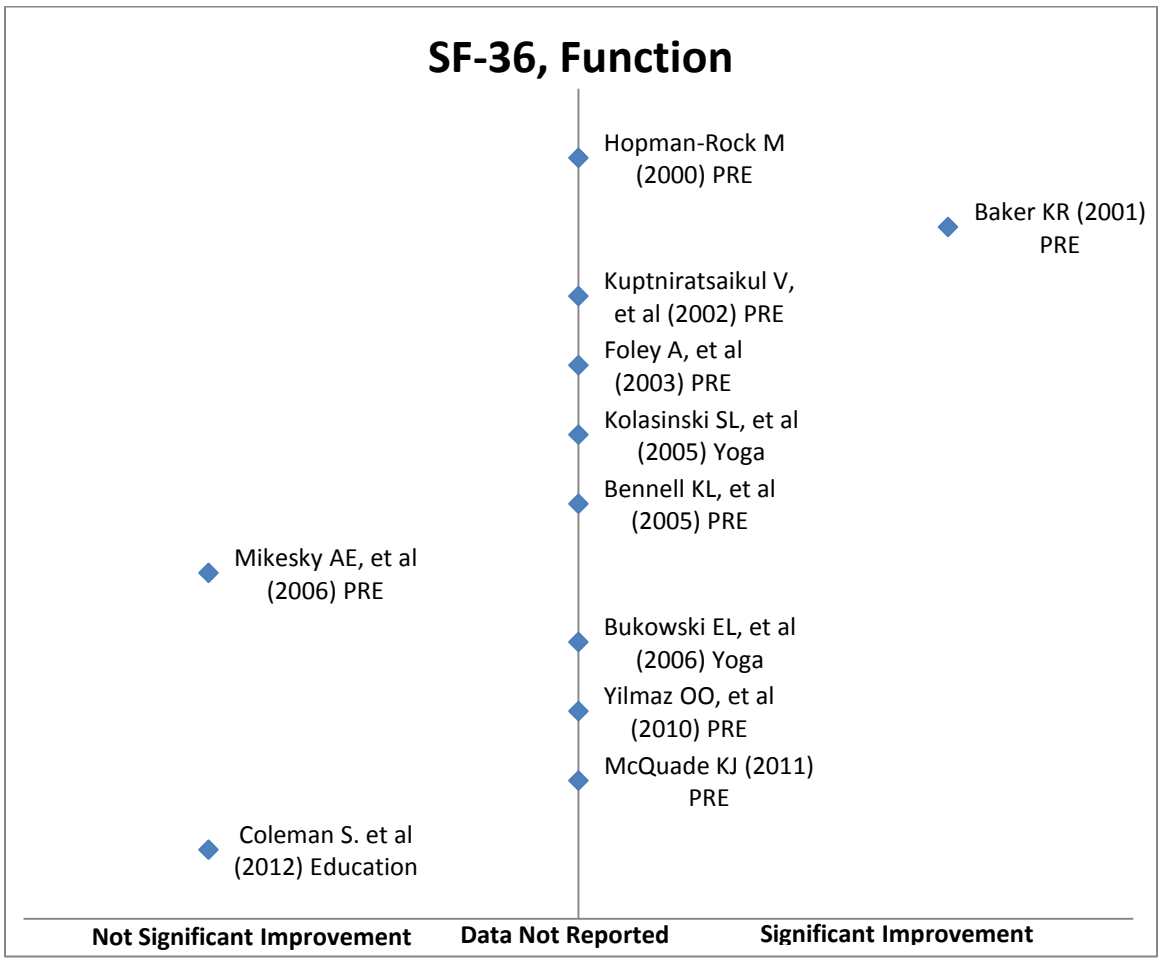


Figure 8. Summary of significant findings in SF-36 pain

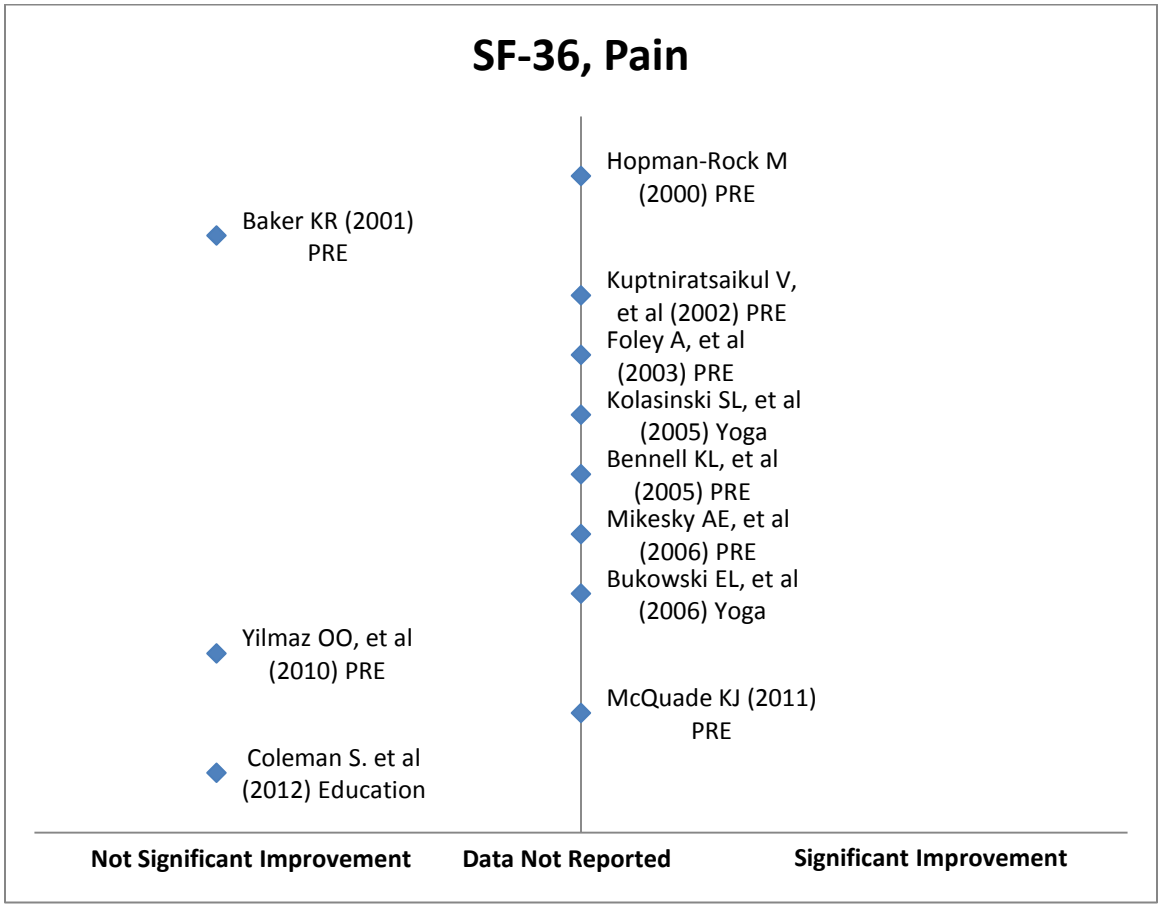


Figure 9. Summary of significant findings of other measures of function

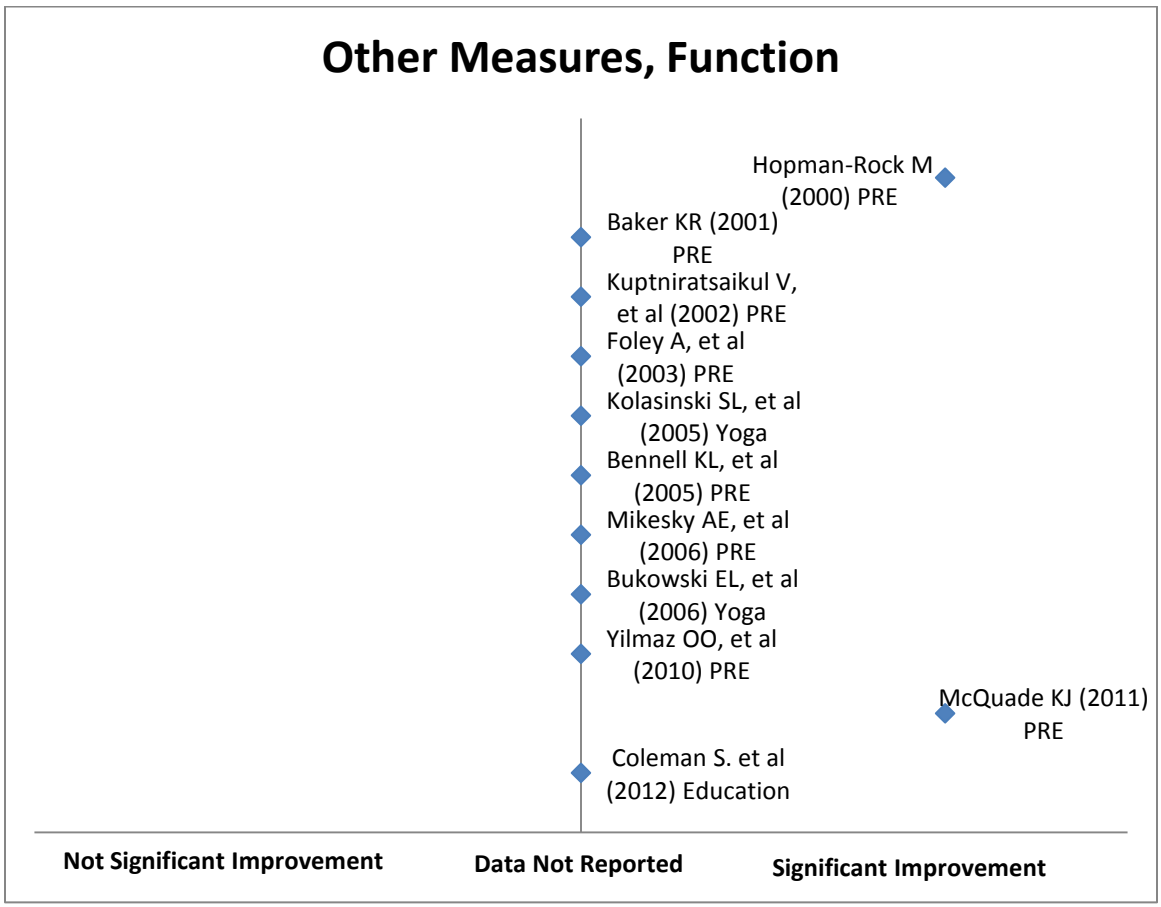


Figure 10. Summary of significant findings of other measures of pain

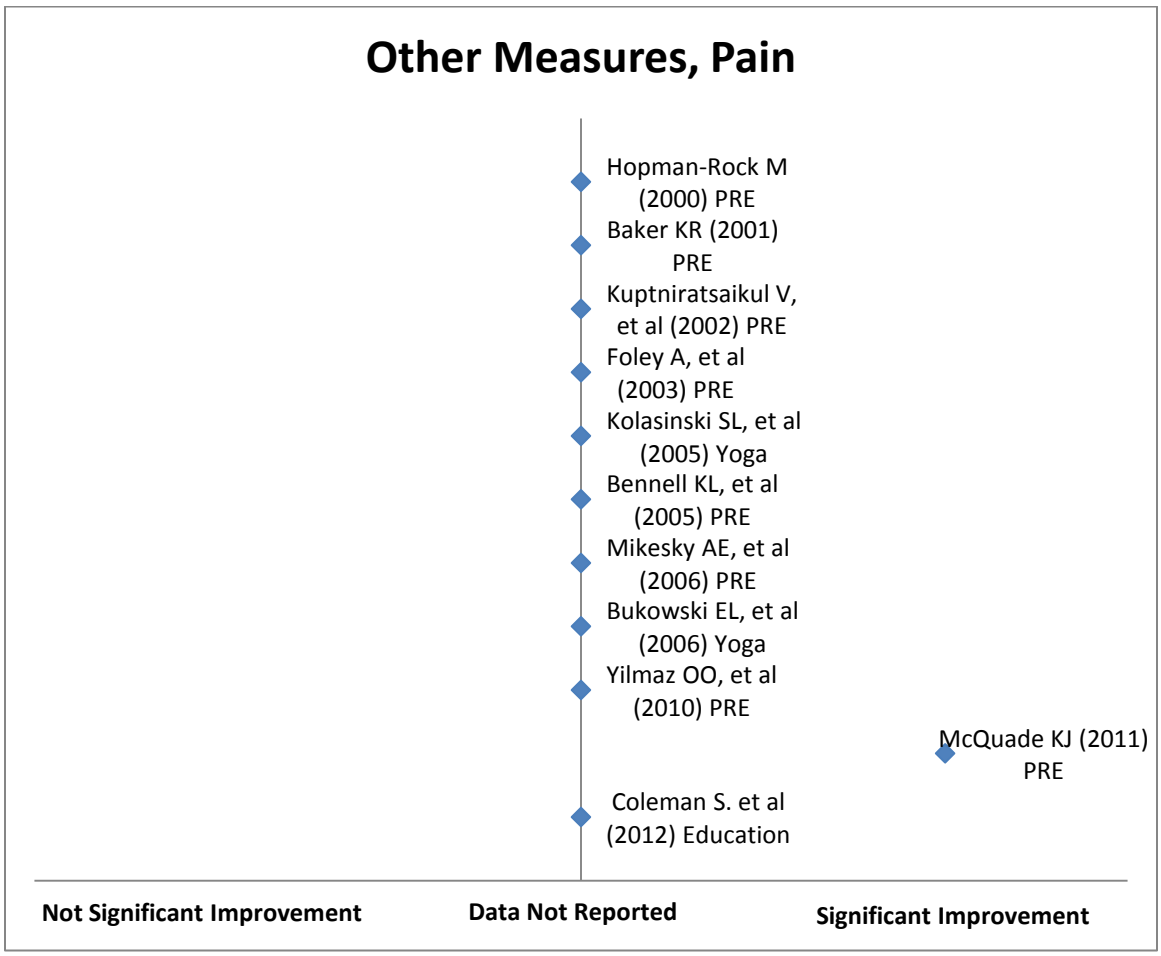
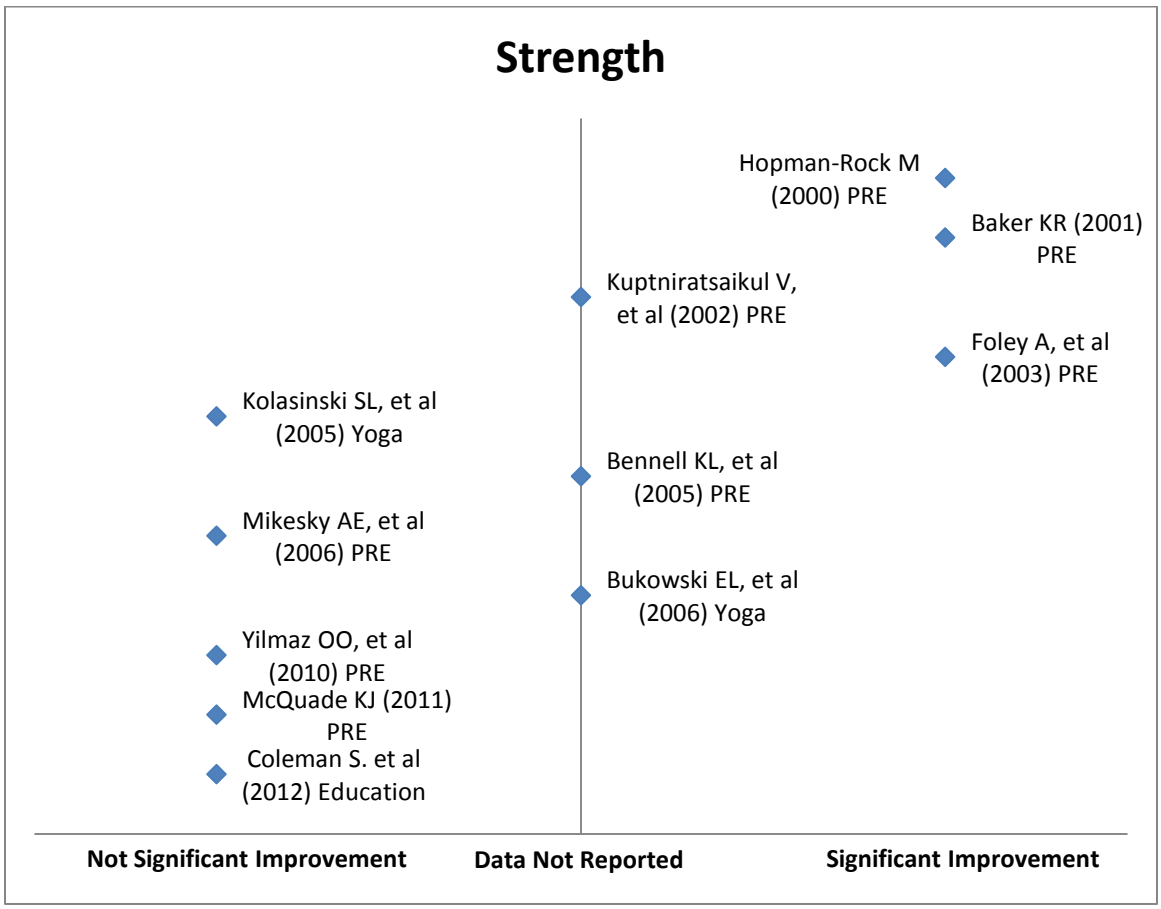


Figure 11. Summary of significant findings of strength



Appendix

Letter of Grant Award

UNLV School of NURSING

UNIVERSITY OF NEVADA, LAS VEGAS

May 24, 2012

Sue Schuerman
UNLV School of Allied Health Sciences

Dear Dr. Schuerman:

Congratulations! I am pleased to inform you that your proposal, entitled "*Self-management and Quality of Life of Overweight/Obese Women with Knee Osteoarthritis,*" has been approved for funding by the School of Nursing & School of Allied Health.

Your requested funds totaling $24,451 will be deposited in an account for your project. You will be able to access these funds once you have obtained IRB approval, submitted a copy of the IRB approval to Lisa Escher, and your team has attended postaward training. The training will be scheduled within 30 days of receipt of the IRB approval letter. Please schedule an appointment with your chair later in the semester to discuss the progress of your project. As stated in the School of Nursing Intramural grant policy, you are expected to submit a final report to me within 1 month of the project end date. Additionally, as stated in the A-26 policy (attached), you are expected to submit a proposal for extramural funding. Please note that if this project is not completed and funds not expended with 24 months, your account will be closed and these funds will be used to support other research studies.

Wishing you the best as you begin this project,

Carolyn Yucha

Carolyn Yucha, PhD, RN, FAAN
Dean and Professor
Schools of Nursing and Allied Health Sciences

Cc: Patricia Alpert
Lisa Escher

References

1. Fransen M, McConnell S. Exercise for osteoarthritis of the knee. *Cochrane Database Syst Rev*. 2008;(4)CD004376.
2. Kuptniratsaikul V, Tosayanonda O, Nilganuwong S, Thamalikitkul V. The efficacy of a muscle exercise program to improve functional performance of the knee in patients with osteoarthritis. *J Med Assoc Thai*. 2002;85:33-40.
3. Lawrence RC, Felson DT, Helmick CG, et al. Estimates of the prevalence of arthritis and other rheumatic conditions in the united states part II. *Arthritis & Rheumatism*. 2008;58:26-35.
4. Coleman S, Briffa NK, Carroll G, Inderjeeth C, Cook N, McQuade J. Effects of self-management, education and specific exercises, delivered by health professionals, in patients with osteoarthritis of the knee. *BMC Musculoskeletal Disorders*. 2008;9:1-7.
5. Heijink A, Gomoll A, Madry H, et al. Biomechanical considerations in the pathogenesis of osteoarthritis of the knee. *Knee Surgery, Sports Traumatology, Arthroscopy*. 2012;20:423-435.
6. Neogi T. Clinical significance of bone changes in osteoarthritis. *Ther Adv Musculoskelet Dis*. 2012;4:259-267.
7. Guccione AA, Felson DT, Anderson JJ, et al. The effects of specific medical conditions on the functional limitations of elders in the framingham study. *Am J Public Health*. 1994;84:351-358.
8. Fransen M, Crosbie J, Edmonds J. Physical therapy is effective for patients with osteoarthritis of the knee: A randomized controlled clinical trial. *J Rheumatol*. 2001;28:156-164.
9. Nguyen UDT, Zhang Y, Zhu Y, Niu J, Zhang B, Felson DT. Increasing prevalence of knee pain and symptomatic knee osteoarthritis: Survey and cohort data. *Ann Intern Med*. 2011;155:725-732.
10. Baker KR, Nelson ME, Felson DT, Layne JE, Sarno R, Roubenoff R. The efficacy of home based progressive strength training in older adults with knee osteoarthritis: A randomized controlled trial. *J Rheumatol*. 2001;28:1655-1665. Accessed 4 August 2012.
11. Towards a common language for functioning, disability and health ICF. Towards a Common Language for Functioning, Disability and Health ICF Web site. http://www.who.int/classifications/icf/training/icfbeginnersguide.pdf. Updated 2013. Accessed 5/8, 2013.
12. Wiart L, Kolaski K, Butler C, et al. Interrater reliability and convergent validity of the american academy for cerebral palsy and developmental medicine methodology for conducting systematic reviews. *Dev Med Child Neurol*. 2012;54:606-611.
13. Coleman S, Briffa NK, Carroll G, Inderjeeth C, Cook N, McQuade J. A randomised controlled trial of a self-management education program for osteoarthritis of the knee delivered by health care professionals. *Arthritis Res Ther*. 2012;14:R21.
14. Bennell KL, Hinman RS, Metcalf BR, et al. Efficacy of physiotherapy management of knee joint osteoarthritis: A randomised, double blind, placebo controlled trial. *Ann Rheum Dis*. 2005;64:906-912.

15. Foley A, Halbert J, Hewitt T, Crotty M. Does hydrotherapy improve strength and physical function in patients with osteoarthritis - A randomised controlled trial comparing a gym based and a hydrotherapy based strengthening programme. *Ann Rheum Dis*. 2003;62:1162-1167.
16. Hopman-Rock M, Westhoff MH. The effects of a health educational and exercise program for older adults with osteoarthritis for the hip or knee. *J Rheumatol*. 2000;27:1947-1954.
17. Mikesky AE, Mazzuca SA, Brandt KD, Perkins SM, Damush T, Lane KA. Effects of strength training on the incidence and progression of knee osteoarthritis. *Arthritis Care and Research*. 2006;55:690-699.
18. McQuade KJ, de Oliveira AS. Effects of progressive resistance strength training on knee biomechanics during single leg step-up in persons with mild knee osteoarthritis. *Clin Biomech (Bristol, Avon)*. 2011;26:741-748.
19. Yilmaz OO, Senocak O, Sahin E, et al. Efficacy of EMG-biofeedback in knee osteoarthritis. *Rheumatol Int*. 2010;30:887-892.
20. Kolasinski SL, Garfinkel M, Tsai AG, Matz W, Van Dyke A, Schumacher HR. Iyengar yoga for treating symptoms of osteoarthritis of the knees: A pilot study. *J Altern Complement Med*. 2005;11:689-693.
21. Bukowski EL, Conway A, Glentz LA, Kurland K, Galantino ML. The effect of iyengar yoga and strengthening exercises for people living with osteoarthritis of the knee: A case series. *Int Q Community Health Educ*. 2006;26:287-305.
22. Vanwanseele B, Lucchinetti E, Stussi E. The effects of immobilization on the characteristics of articular cartilage: Current concepts and future directions. *OARS*. 2002;10:408-419.
23. Akeson WH, Amiel D, Abel MF, Garfin SR, Woo SL. Effects of immobilization on joints. *Clin Orthop Relat Res*. 1987;(219):28-37.

Cody Buckner **APTA Member# 533102** **Lic# OR, Pending**

Education

University of Nevada, Las Vegas June 2010 – May 2013

- Doctor of Physical Therapy

Brigham Young University – Idaho Aug 2005 – Dec 2009

- B.S. Exercise Science
- Minor in Spanish (member Sigma Delta Pi honor society)

Faculty Directed Research Feb 2011 – June 2013

- Headed group of students in successful writing grant proposal for UNLV School of Nursing & School of Allied Health ($30,000)
- Prepared budget for implementation of study
- Organized and directed writing of a systematic review regarding land based exercise programs for people with knee osteoarthritis

Related Work Experience

George E. Wahlen Veterans Affairs Medical Center – Clinical Affiliation Jan – Apr 2013
(Salt Lake City, UT)

Pro-Motion Physical Therapy – Clinical Affiliation Oct – Dec 2012
(Yakima, WA)

Intermountain Heath Care
Utah Valley Regional Medical Center – Clinical Affiliation July – Sept 2012
(Provo, UT)

Physiotherapy Assoc. Children's Therapy Center – Clinical Affiliation June – July 2011
(Henderson, NV)

Riverside Rehabilitation – Office Manager Aug 2009 – Jan 2010
(Rexburg, ID)

Integrated Therapies – Volunteer Technician May 2009 – Aug 2009
(Rexburg, ID)

Lindsay C. Martin

EDUCATION:

University of Nevada at Las Vegas, Las Vegas, Nevada
Doctor of Physical Therapy — May 2010 – May 2013

Creighton University, Omaha, Nebraska
Bachelor of Science – Exercise Science — August 2007 – May 2010

CAREER-RELATED EXPERIENCE:

The Keith Kleven Institute, Las Vegas, NV
Outpatient Clinical Affiliation — January 2013 – April 2013

Summerlin Hospital, Las Vegas, NV
Rehabilitation Clinical Affiliation — October 2012 – December 2012

Sunrise Hospital, Las Vegas, NV
Acute Clinical Affiliation — July 2012 – September 2012

- Attended a body mechanics course to assure both patient and therapist safety during transfers

Barton Memorial Hospital, South Lake Tahoe, CA
Rural Clinical Affiliation — June 2011 – July 2011

- Examined and evaluated numerous patients with musculoskeletal and neurologic pathologies in the acute and outpatient settings

Omaha Sports Physical Therapy, Omaha, Nebraska
Physical Therapy Intern — August 2009 – December 2009

RESEARCH EXPERIENCE:

Mentored Group Research Project
Student Investigator — February 2011 – May 2013

- Co-authored a $30,000 Arthritis Foundation Quality of Life Grant Application involving self-management of knee osteoarthritis in post-menopausal women
- Received a $30,000 grant from UNLV School of Nursing to conduct a study to assess two different approaches to treating knee osteoarthritis
- Conducted a systematic review investigating land-based exercise and its effect on quality of life outcomes in patients with knee osteoarthritis

PROFESSIONAL MEMBERSHIPS/ CERTIFICATIONS:

American Physical Therapy Association
Member since 2010

American Heart Association
Healthcare Provider – CPR and AED Certified since 2006

CONTINUING EDUCATION:

American Physical Therapy Association
Combined Sections Meeting – Chicago, Illinois — February 2012

Explain the Pain Seminar
Presented by Dr. Adrian Louw – Las Vegas, Nevada — February 2012

Michael Soukup

Education:

- Doctor of Physical Therapy Anticipated graduation date: May 2013
  - University of Nevada, Las Vegas
  - Cumulative GPA: 3.73
  - WICHE scholarship recipient
  - Differential Tuition Scholarship recipient
  - UNLV Access grant recipient
  - American Indian Graduate College fellowship recipient
- Bachelor of Science in Health Ecology 2009
  - University of Nevada, Reno
  - Cumulative GPA: 3.6
  - Millennium Scholarship recipient
  - Harriet Wolf scholarship recipient

Relevant Experience

- VA Southern Nevada Healthcare System
  - Outpatient PT clinical affiliation Jan 2013-April 2013
    - Participated in specialty clinics to address specific issues such as falls, prosthetics, and motorized mobility.
- Complex Care Hospital at Tenaya Oct 2012-Dec 2012
  - LTACH PT clinical affiliation
- Spring Valley Hospital Medical Center June 2012-Sept 2012
  - Acute PT clinical affiliation
- Body Wise Physical Therapy June 2011-Aug 2011
  - Orthopaedic outpatient clinical affiliation
    - Evaluated and treated patients with various orthopaedic problems in several rural northern Nevada clinics.
- Body Wisdom Physical Therapy April 2009-May2010
  - Physical therapy tech
- Reno Orthopaedic Clinic Jan 2008-Aug 2008
  - Physical therapy tech

Mentored Student Research

- Grant co-author: Study design comparing effects of two exercise treatments and effects on quality of life in women with knee osteoarthritis
- Awarded $30,000 internal grant from UNLV to conduct study

Memberships/Certifications

- Nevada PT license pending
- APTA since 2010