Evidence-Informed Rehabilitation for Low Back Pain: A Brief Overview

Bryan M. Bond, BSc, BS, DC, MS, PhD

Thank-you!!!!!

- NCMIC!!!
- *You* doctors for participating and listening!!!

Objectives

1. Consider and define the *therapeutic benefit* of exercise in managing low back pain.
2. Describe and discuss the evidence-informed *clinical practice guidelines* to promote appropriate treatment decisions.

Outline

- Introduction and Background
- Clinical Practice Guidelines for LBP
- Clinical Prediction Rules
- Exercise for LBP

Introduction and Background

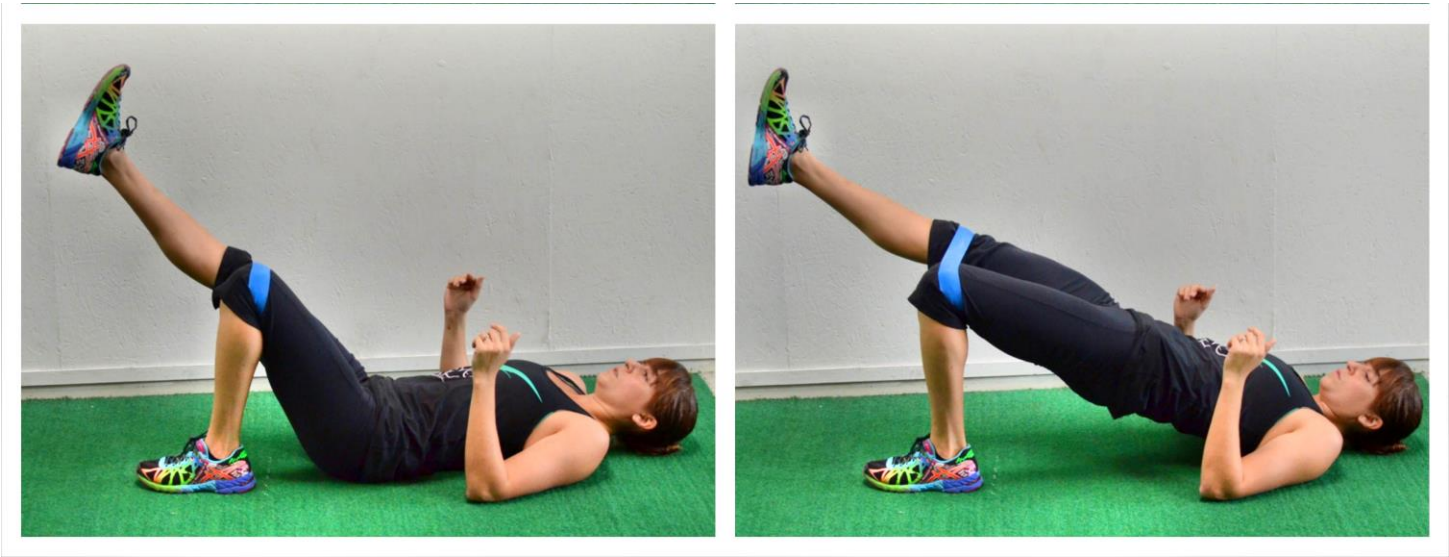
- According to National Board of Chiropractic Examiners (NBCE):
  - Low back disorders represent *the* most common (~ *24%*) primary complaint within chiropractic practice

Introduction and Background

- Low back pain (LBP) affects up to *85%* of adult population costing *$86* billion annually in US (Frymoyer & Cats-Baril, 1991; Luo et al., 2004; Martin et al., 2008)
- *⅓* to *⅔* of patients with *acute* LBP transition to *chronic* LBP (Hush et al., 2011; Itz et al., 2013; Vasseljen et al., 2013)
- Chronic LBP represents *75%* of total treatment costs
  - Associated with significant *disability*
  - Represents *the* major cause of *absenteeism* from workplace worldwide (Frymoyer & Cats-Baril, 1991; Luo et al., 2004; Ehrlich, 2003)

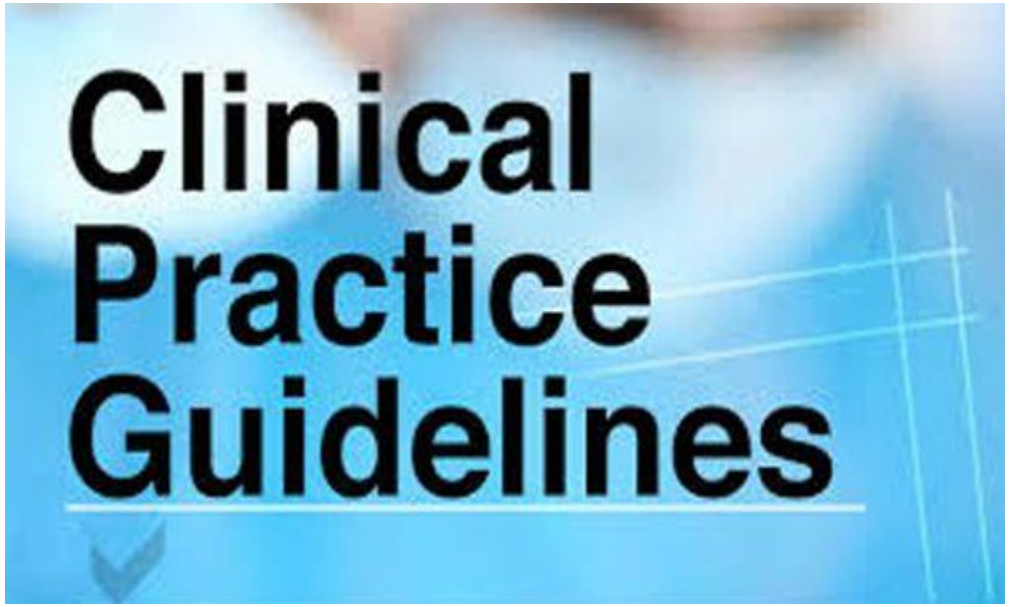
Introduction and Background

- Efficacious interventions may prevent or improve *disability* of chronic LBP (Kovacs et al., 2005; Marcuzzi et al., 2015)
- Exercise is a *viable* treatment option for LBP (Qaseem et al., 2017)

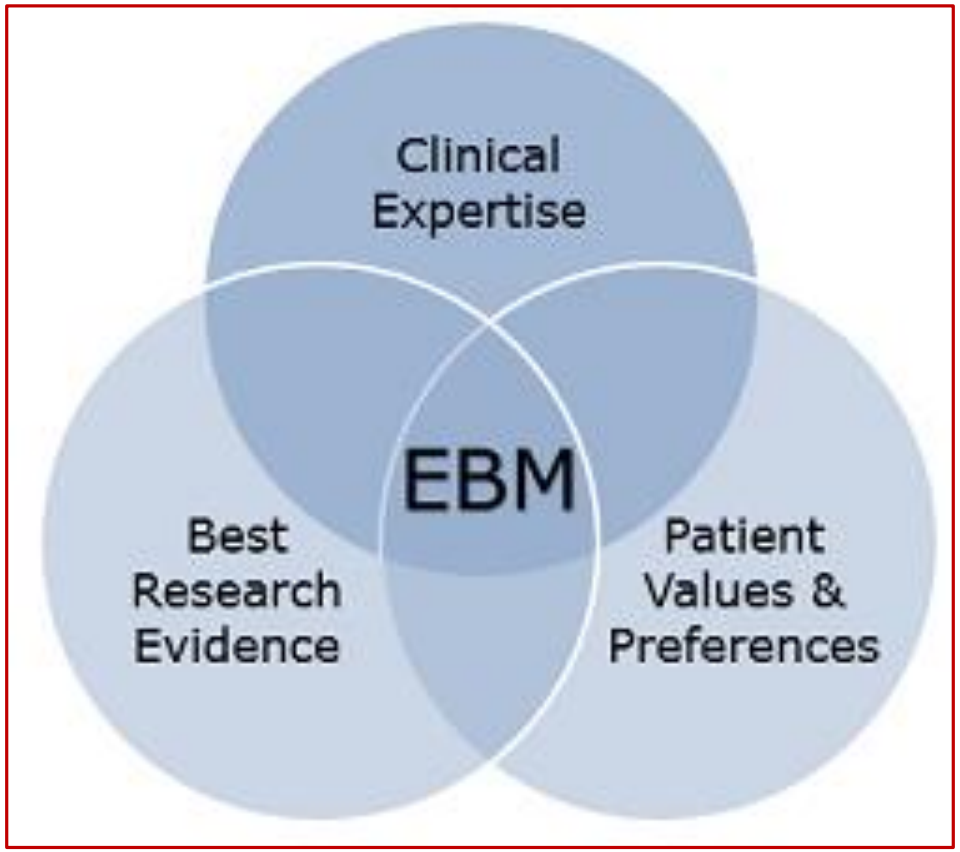


Introduction and Background

- Clinical practice guidelines (CPGs) from around *globe* recommend *exercise* for managing *chronic* LBP patients:
  - United States (Qaseem et al., 2017)
  - Canada (Bussières et al., 2018)
  - United Kingdom (National Guideline, 2016)
  - Europe (Oliveira et al., 2018)



What constitutes *Evidence-Based* Medicine…..or Chiropractic?



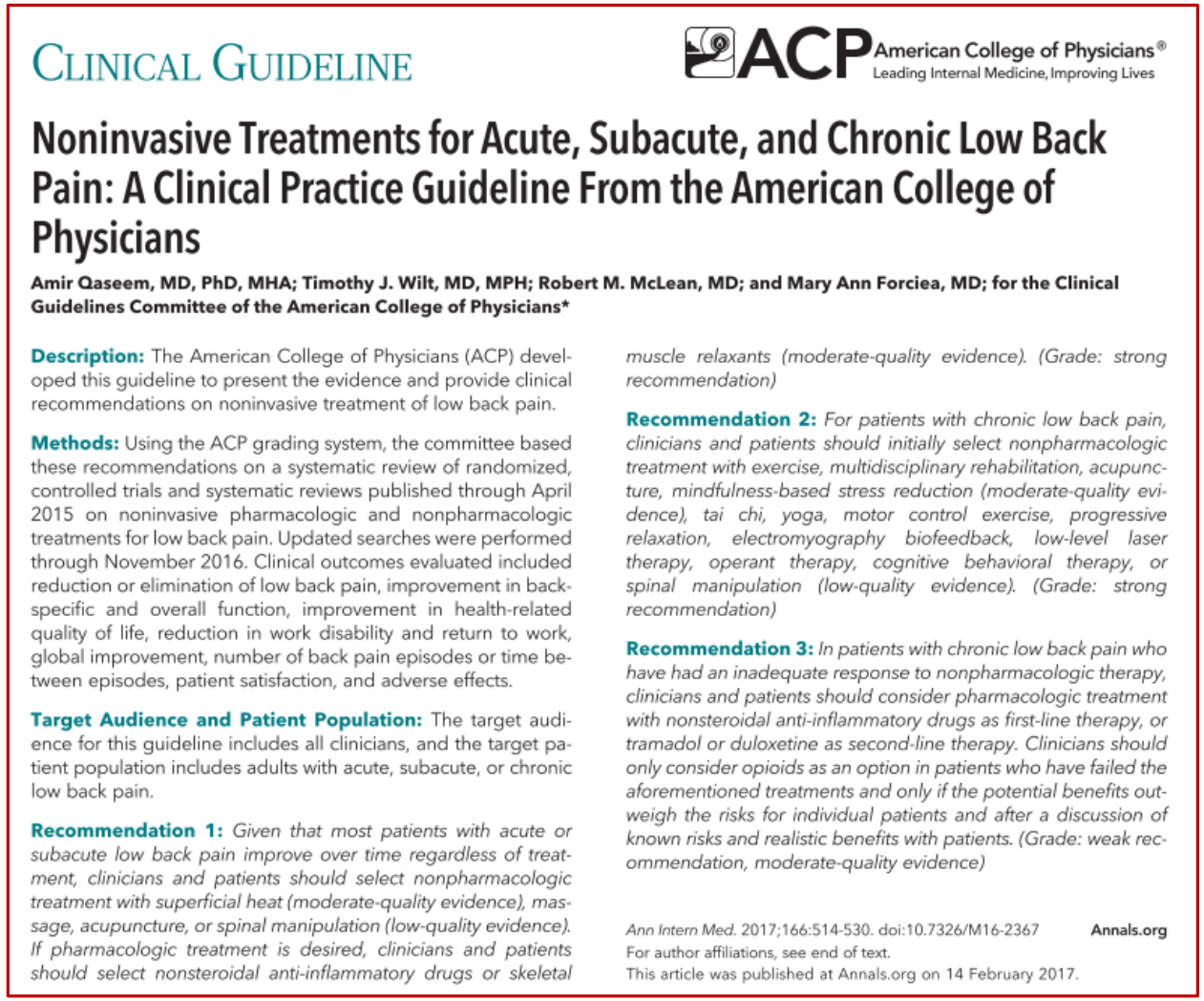
(Haneline, 2007)

What are the chiropractic *clinical practice guidelines* for LBP?

According to *American Chiropractic Association*:

- "The ACA adopts, but is not limited to, the Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline from the *American College of Physicians* as current *best practices* for the treatment and management of low back pain."
- "…..therefore also adopts, but is not limited to, the clinical practice guideline from the *Council on Chiropractic Guidelines and Practice Parameters* (*CCGPP*), to provide *specific* guidance in the management or co-management of a patient within a chiropractic office."

What are evidence-informed *clinical practice guidelines* for low back pain?



CLINICAL GUIDELINE

ACP American College of Physicians® Leading Internal Medicine, Improving Lives

Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians

Amir Qaseem, MD, PhD, MHA; Timothy J. Wilt, MD, MPH; Robert M. McLean, MD; and Mary Ann Forciea, MD; for the Clinical Guidelines Committee of the American College of Physicians*

Description: The American College of Physicians (ACP) developed this guideline to present the evidence and provide clinical recommendations on noninvasive treatment of low back pain.

Methods: Using the ACP grading system, the committee based these recommendations on a systematic review of randomized, controlled trials and systematic reviews published through April 2015 on noninvasive pharmacologic and nonpharmacologic treatments for low back pain. Updated searches were performed through November 2016. Clinical outcomes evaluated included reduction or elimination of low back pain, improvement in back-specific and overall function, improvement in health-related quality of life, reduction in work disability and return to work, global improvement, number of back pain episodes or time between episodes, patient satisfaction, and adverse effects.

Target Audience and Patient Population: The target audience for this guideline includes all clinicians, and the target patient population includes adults with acute, subacute, or chronic low back pain.

Recommendation 1: *Given that most patients with acute or subacute low back pain improve over time regardless of treatment, clinicians and patients should select nonpharmacologic treatment with superficial heat (moderate-quality evidence), massage, acupuncture, or spinal manipulation (low-quality evidence). If pharmacologic treatment is desired, clinicians and patients should select nonsteroidal anti-inflammatory drugs or skeletal muscle relaxants (moderate-quality evidence). (Grade: strong recommendation)*

Recommendation 2: *For patients with chronic low back pain, clinicians and patients should initially select nonpharmacologic treatment with exercise, multidisciplinary rehabilitation, acupuncture, mindfulness-based stress reduction (moderate-quality evidence), tai chi, yoga, motor control exercise, progressive relaxation, electromyography biofeedback, low-level laser therapy, operant therapy, cognitive behavioral therapy, or spinal manipulation (low-quality evidence). (Grade: strong recommendation)*

Recommendation 3: *In patients with chronic low back pain who have had an inadequate response to nonpharmacologic therapy, clinicians and patients should consider pharmacologic treatment with nonsteroidal anti-inflammatory drugs as first-line therapy, or tramadol or duloxetine as second-line therapy. Clinicians should only consider opioids as an option in patients who have failed the aforementioned treatments and only if the potential benefits outweigh the risks for individual patients and after a discussion of known risks and realistic benefits with patients. (Grade: weak recommendation, moderate-quality evidence)*

Ann Intern Med. 2017;166:514-530. doi:10.7326/M16-2367 **Annals.org**
For author affiliations, see end of text.
This article was published at Annals.org on 14 February 2017.

- Clinical guidelines and recommendations for low back pain from *American College of Physicians*…….”non-DC” source (Qaseem et al., 2017)

What are evidence-informed *clinical practice guidelines* for low back pain?

- From ACP (Qaseem et al., 2017):
  - "**Recommendation 1:** Given that most patients with *acute* or *subacute* low back pain improve over time regardless of treatment, clinicians and patients should select *nonpharmacologic* treatment with superficial heat (moderate-quality evidence), massage, acupuncture, or *spinal manipulation* (low-quality evidence). If *pharmacologic* treatment is desired, clinicians and patients should select *nonsteroidal anti-inflammatory* drugs or skeletal *muscle relaxants* (moderate-quality evidence). (Grade: *strong* recommendation)."

What are evidence-informed *clinical practice guidelines* for low back pain?

- From ACP (Qaseem et al., 2017):
  - "**Recommendation 2:** For patients with *chronic* low back pain, clinicians and patients should initially select *nonpharmacologic* treatment with *exercise*, multidisciplinary *rehabilitation*, acupuncture, mindfulness-based stress reduction (moderate-quality evidence), *tai chi*, *yoga*, *motor control exercise*, progressive relaxation, electromyography biofeedback, low-level laser therapy, operant therapy, cognitive behavioral therapy, or *spinal manipulation* (low-quality evidence). (Grade: *strong* recommendation)."

What are evidence-informed *clinical practice guidelines* for low back pain?

- From ACP (Qaseem et al., 2017):
  - "**Recommendation 3:** In patients with *chronic* low back pain who have had an *inadequate* response to *nonpharmacologic* therapy, clinicians and patients should consider pharmacologic treatment with nonsteroidal anti-inflammatory drugs as *first*-line therapy, or tramadol or duloxetine as *second*-line therapy. Clinicians should *only* consider *opioids* as an option in patients who have *failed* the aforementioned treatments and only if the potential benefits *outweigh* the risks for individual patients and after a discussion of known risks and realistic benefits with patients. (Grade: *weak* recommendation, moderate-quality evidence)."

What are evidence-informed *clinical practice guidelines* for low back pain?

ORIGINAL ARTICLE

CLINICAL PRACTICE GUIDELINE: CHIROPRACTIC CARE FOR LOW BACK PAIN

Gary Globe, PhD, MBA, DC,[a] Ronald J. Farabaugh, DC,[b] Cheryl Hawk, DC, PhD,[c] Craig E. Morris, DC,[d] Greg Baker, DC,[e] Wayne M. Whalen, DC,[f] Sheryl Walters, MLS,[g] Martha Kaeser, DC, MA,[h] Mark Dehen, DC,[i] and Thomas Augat, DC[j]

ABSTRACT

Objective: The purpose of this article is to provide an update of a previously published evidence-based practice guideline on chiropractic management of low back pain.

Methods: This project updated and combined 3 previous guidelines. A systematic review of articles published between October 2009 through February 2014 was conducted to update the literature published since the previous Council on Chiropractic Guidelines and Practice Parameters (CCGPP) guideline was developed. Articles with new relevant information were summarized and provided to the Delphi panel as background information along with the previous CCGPP guidelines. Delphi panelists who served on previous consensus projects and represented a broad sampling of jurisdictions and practice experience related to low back pain management were invited to participate. Thirty-seven panelists participated; 33 were doctors of chiropractic (DCs). In addition, public comment was sought by posting the consensus statements on the CCGPP Web site. The RAND-UCLA methodology was used to reach formal consensus.

Results: Consensus was reached after 1 round of revisions, with an additional round conducted to reach consensus on the changes that resulted from the public comment period. Most recommendations made in the original guidelines were unchanged after going through the consensus process.

Conclusions: The evidence supports that doctors of chiropractic are well suited to diagnose, treat, co-manage, and manage the treatment of patients with low back pain disorders. (J Manipulative Physiol Ther 2016;39:1-22)

Key Indexing Terms: *Chiropractic; Low Back Pain; Manipulation, Spinal; Guidelines*

What are evidence-informed *clinical practice guidelines* for low back pain?

- From Council on Chiropractic Guidelines and Practice Parameters (CCGPP) (Globe et al., 2016):
  - "**CONCLUSIONS:** The *evidence* supports that doctors of chiropractic are *well suited* to diagnose, treat, co-manage, and manage the treatment of patients with low back pain disorders."

Management of *Chronic* LBP According to CCGPP…….

Chronic Pain Management Components in Physician-Directed Case Management

Case management of patients with chronic LBP should be based upon an individualized approach to care that combines the best evidence with clinician judgment and patient preferences. In addition to spinal manipulation and/or mobilization, an active care plan for chronic pain management may include, but is not restricted to, the following:

Procedures

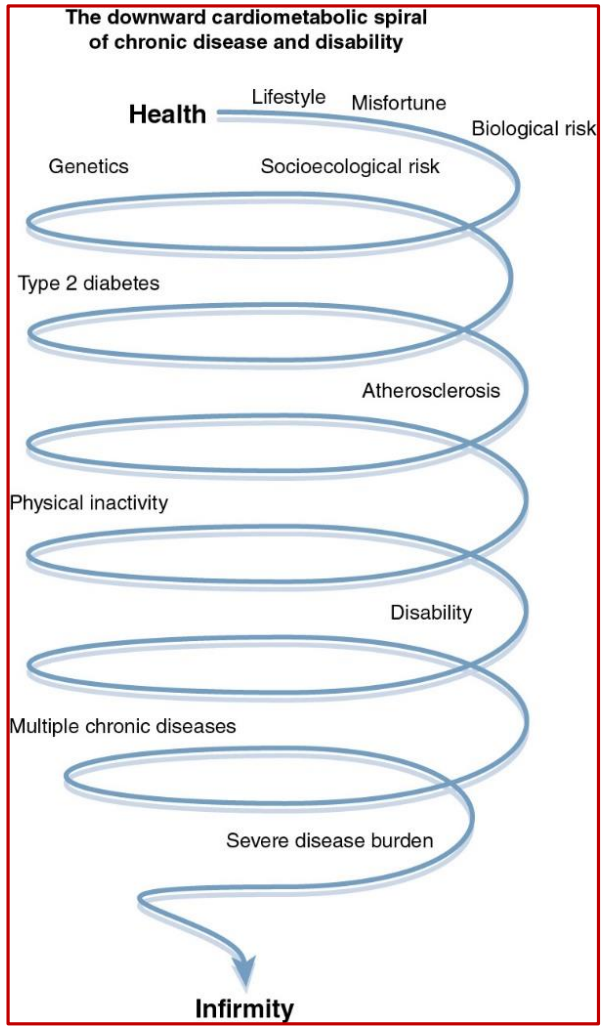
- Massage therapy
- Other manual therapeutic methods
- Physical modalities
- Acupuncture
- Bracing/orthoses

Behavioral and exercise recommendations

- Supervised rehabilitative/therapeutic exercise
- General and/or specific exercise programs
- Mind/body programs (eg, yoga, Tai Chi)
- Multidisciplinary rehabilitation
- Cognitive behavioral programs

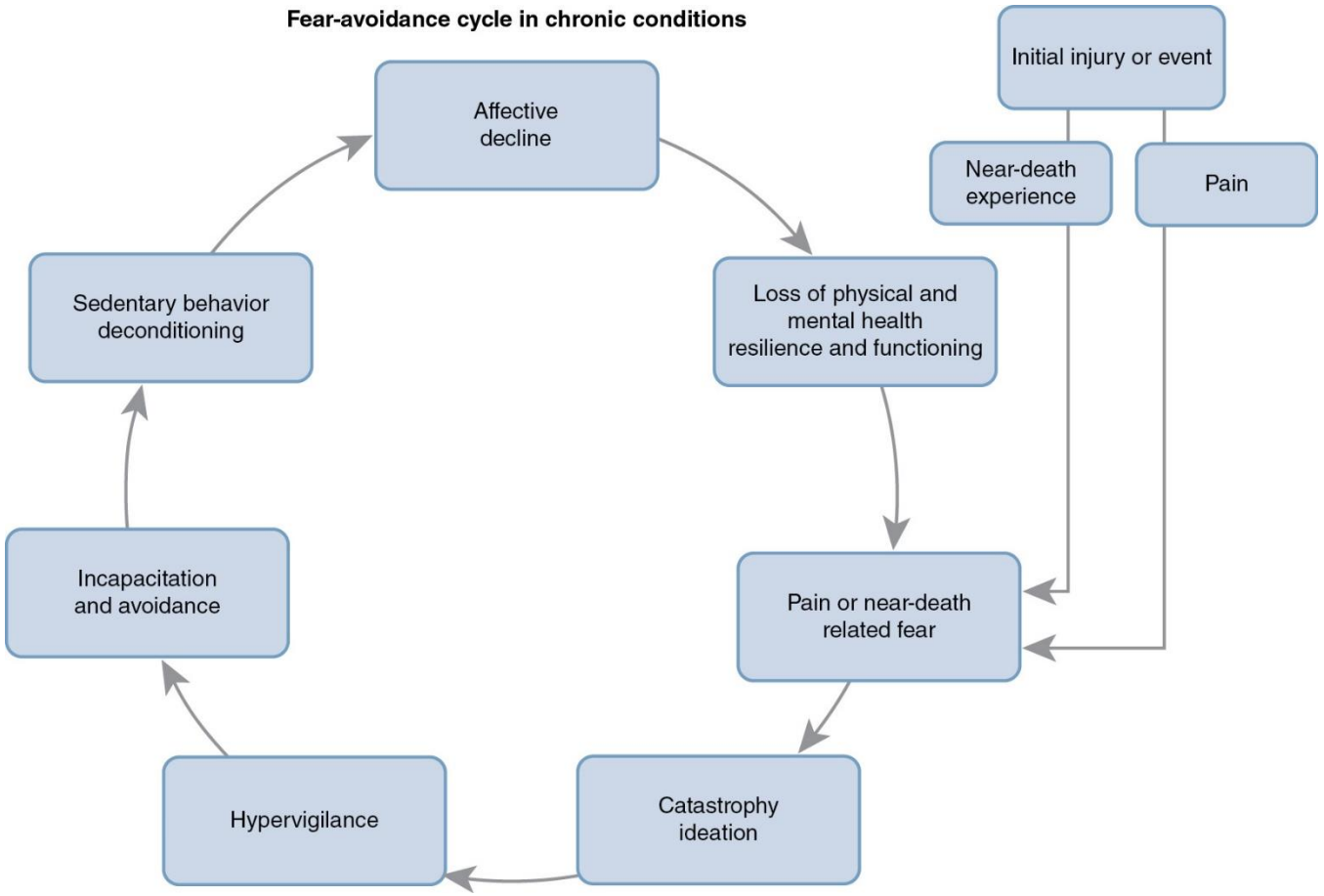
(Globe et al., 2016)

Rationale for Including Physical Activity in *Chronic* Care Management



- Primary reason to emphasize physically active lifestyle is to *avoid* what has been termed the *disuse syndrome* or *downward spiral of chronic disease* (Moore et al., 2016)

Fear-Avoidance *Cycle*

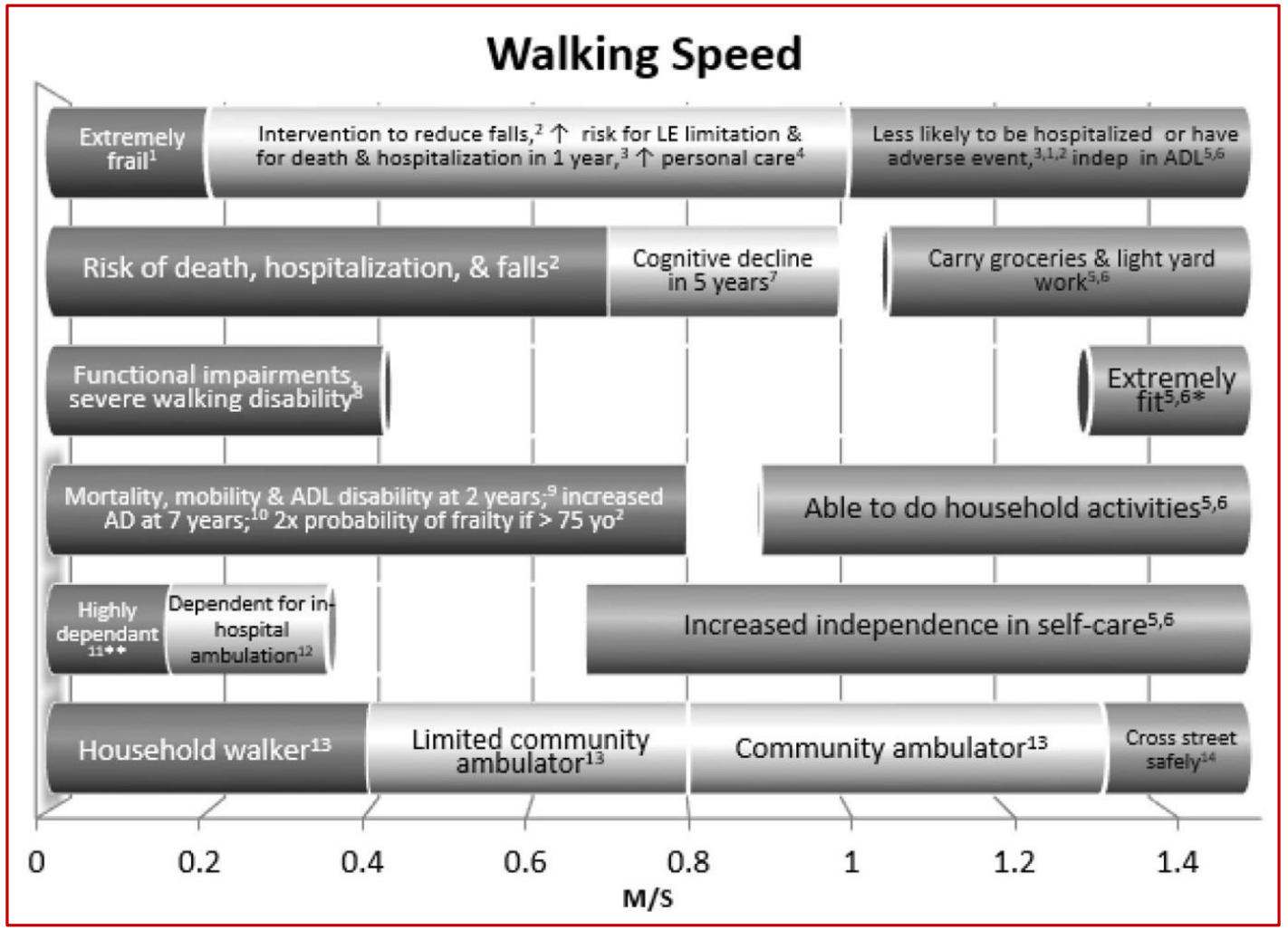


- Fear avoidance is concept that one should *avoid* activities due to *belief* that those activities will cause *pain* or further *injury* (Moore et al., 2016)

Walking Speed as Indicator of Health

- "Walking speed (WS) is a *valid*, *reliable*, *sensitive* measure appropriate for *assessing* and *monitoring* functional status and *overall health* in a wide range of populations. These capabilities have led to its designation as the "*6th vital sign*"." (Middleton et al., 2015)

Walking Speeds and *Associated Outcomes*

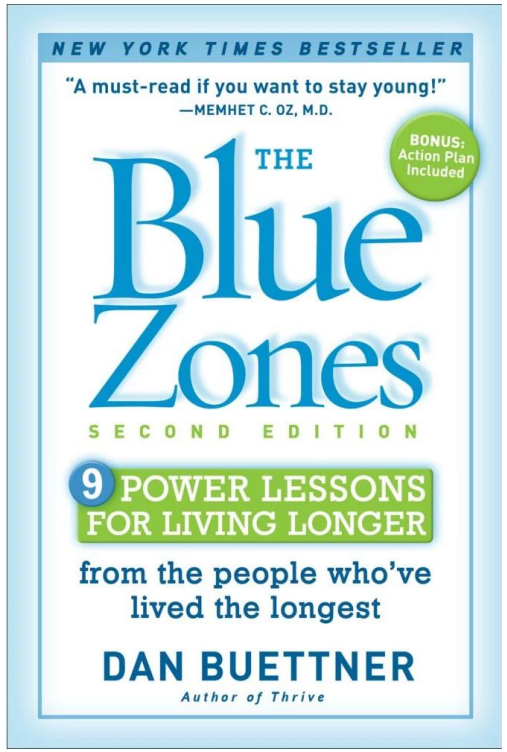


(Middleton et al., 2015)

Exercise in General….
"The Blue Zones"

Think about a disease, especially chronic…..does scientific literature tell us exercise is beneficial?

If you want to become a *Centurion*…….



Research *Hierarchy*

(Yetley et al., 2017)

Exercise for *Chronic* LBP

[LITERATURE REVIEW]

RUBÉN FERNÁNDEZ-RODRÍGUEZ, MSc[1] • CELIA ÁLVAREZ-BUENO, PhD[1] • IVÁN CAVERO-REDONDO, PhD[1]
ANA TORRES-COSTOSO, PhD[2] • DIANA P. POZUELO-CARRASCOSA, PhD[1] • SARA REINA-GUTIÉRREZ, MSc[1]
CARLOS PASCUAL-MORENA, MSc[1] • VICENTE MARTÍNEZ-VIZCAÍNO, MD[1,3]

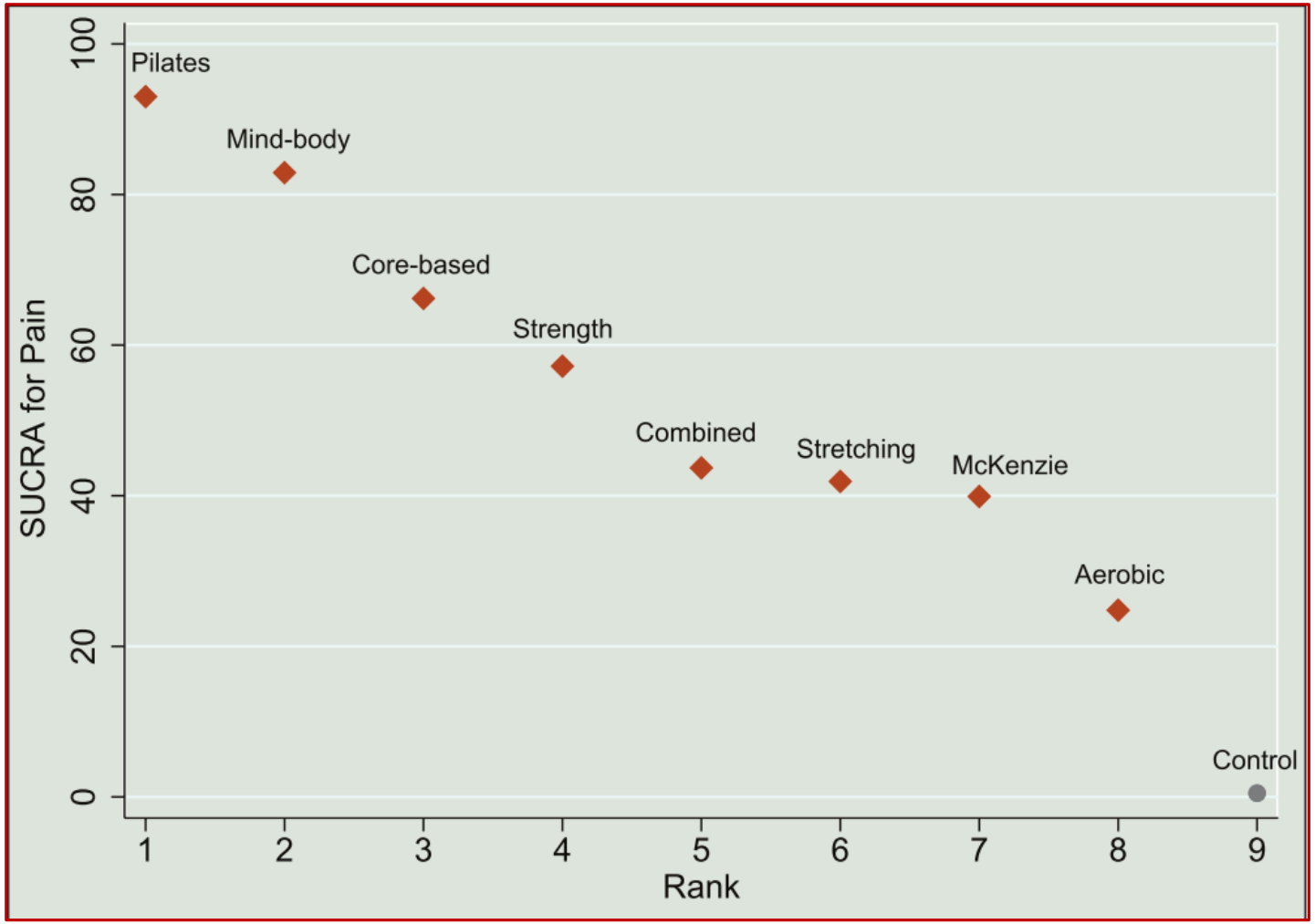
Best Exercise Options for Reducing Pain and Disability in Adults With Chronic Low Back Pain: Pilates, Strength, Core-Based, and Mind-Body. A Network Meta-analysis

(Fernández-Rodríguez et al., 2022)

Exercise for *Chronic* LBP

- CONCLUSION: "Although most exercise interventions had benefits for managing *pain* and *disability* in chronic LBP, the *most beneficial* programs were those that included (1) at least 1 to 2 sessions per week of *Pilates* or *strength* exercises; (2) sessions of less than 60 minutes of *core-based*, *strength*, or *mind-body* exercises; and (3) training programs from 3 to 9 weeks of *Pilates* and *core-based* exercises." (Fernández-Rodríguez et al., 2022)

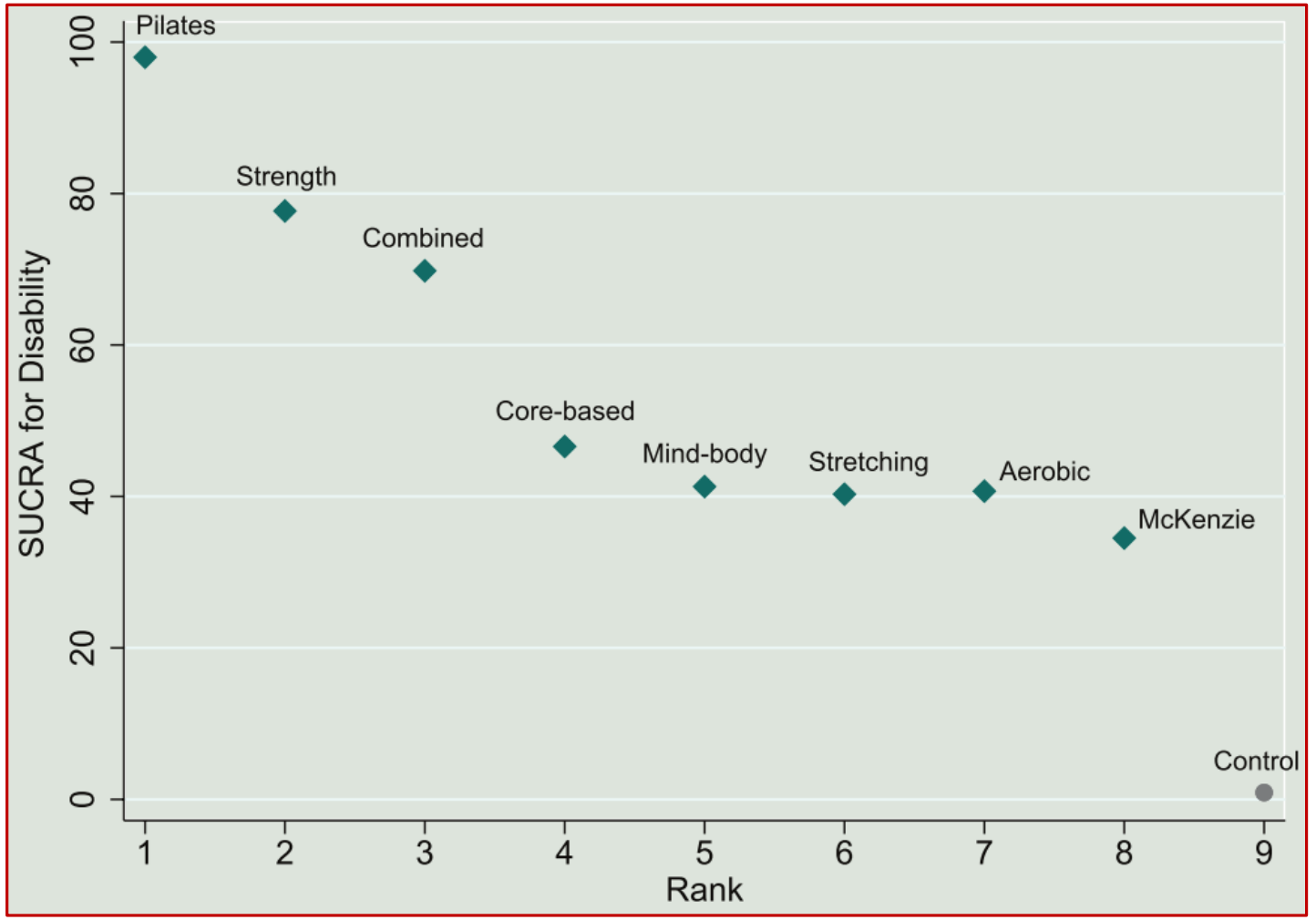
Ranking for Each Intervention on *Pain*



(Fernández-Rodríguez et al., 2022)

- SUCRA = surface under the cumulative ranking curve

Ranking for Each Intervention on *Disability*



(Fernández-Rodríguez et al., 2022)

- SUCRA = surface under the cumulative ranking curve

Clinical Prediction Rules (CPR)

- What are CPR?
- Why use CPRs?
- How to use CPRs?
- Statistical Definitions
- Lumbopelvic Pain

(Glynn & Weisbach, 2010)

What are Clinical Prediction Rules?

- CPRs are algorithmic decision tools designed to aid *clinicians* in:
  - Diagnosis
  - Prognosis
  - Intervention
- Use clinical findings to find statistically meaningful *predictors*:
  - History
  - Physical Examination
  - Diagnostic

(Glynn & Weisbach, 2010)

Why Use CPRs?

- Evidence-based health care defined as conscientious, explicit, and judicious use of *best available* evidence
- CPRs provide best available "real-world" evidence to improve:
  - Patient/clinical outcomes
  - Quality of care
  - Clinical decisions, especially less experienced doctors or uncommon clinical conditions
  - Patient satisfaction????
  - Referrals????

(Glynn & Weisbach, 2010)

How to Use CPRs?

- CPRs intended to augment clinical decision-making in areas where further research required
  - Should *not* use CPRs in *isolation*
- Use CPRs along with:
  - Current existing evidence
  - Patient preferences
  - Clinical experience

But CPRs are NOT 100% predictive…..false negatives/positives!!!

They are helpful TOOLS….like any other procedure!!!

Interpretation of *Likelihood Ratio* (LR) Values

Positive LR	Negative LR	Interpretation
> 10	< 0.1	Large, often conclusive shifts in probability
5-10	0.1-0.2	Moderate shifts in probability
2-5	0.2-0.5	Small, sometimes important shifts in probability
1-2	0.5-1.0	Probability to small, rarely important degree

(Glynn & Weisbach, 2010)

How do you decide *who* benefits or needs *exercise* for LBP?

- Orthopedic testing?
- ROM/mobility?
- Experience? What if you just graduated?
- Patient preferences?
- Everyone gets exercise?
- Nobody gets exercise?
- Educated “assumption” its effective or least not harmful?
- Don’t care or never given much consideration?
- Other rationale?

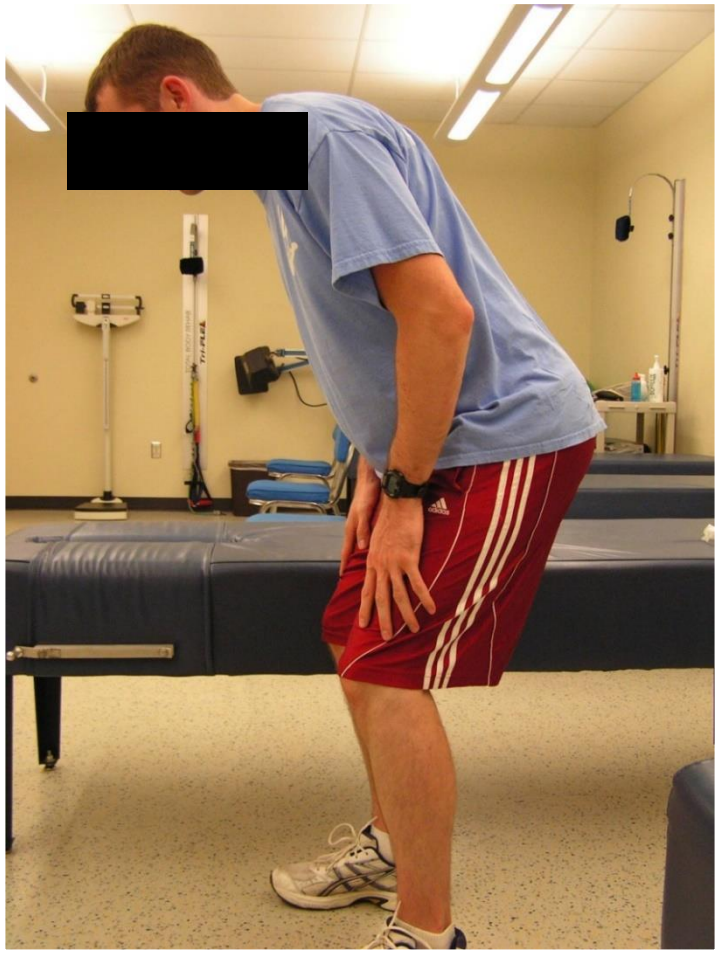
Lumbar Stabilization for Low Back Pain

Predictor Variables of *Success*
1. SLR > 91°
2. < 40 years old
3. Aberrant motion present with forward bending
4. Positive prone instability test
Predictor Variables of *Non-Success*
1. Fear Avoidance Belief Questionnaire – Physical Activity < 8
2. Aberrant movement absent
3. No hypermobility during PA spring testing
4. Negative prone stability test

(Hicks et al., 2005)

SLR with Inclinometer

Aberrant Motion…..
Gower's Sign



Prone Instability Test

https://www.physio-pedia.com/Prone_Instability_Test

Prone Instability Test…*Relaxed*

Prone Instability Test…*Contracted*

P-A *Spring* Testing

Clinical Bottom Line

(Hicks et al., 2005)

- Presence of a least *3* success predictor variables indicates a *small, meaningful* shift in probability of at least *50%* improvement in function after 8 weeks of lumbar stabilization or presence of a least *2* non-success predictor variables indicates a *moderate* shift in probability patient will *not* improve with lumbar stabilization

Success with Stabilization Likely if:	***Failure with Stabilization Likely if:***
•Three or more predictor variables of success present **•+LR 4.0 (95% CI 1.6-10.0)**	**•Three or more predictor variables of non-success present** **•-LR 0.2 (95% CI 0.2-0.4)**

Intervention

- Treatment *2* times a week for *8* weeks
- Treatment included:
  - Exercise including focus on RA, TrA, IO, ES, multifidus, and QL
  - Magazine: Core Values - NYTimes.com/Video - YouTube

Intervention

Table 1: Stabilization Exercises With Criteria for Progression of Each Exercise

Primary Muscle Group*	Exercises	Criteria for Progression
Transversus abdominus	Abdominal bracing	30 repetitions with 8-s hold
	Bracing with heel slides	20 repetitions per leg with 4-s hold
	Bracing with leg lifts	20 repetitions per leg with 4-s hold
	Bracing with bridging	30 repetitions with 8-s hold, then progress to 1 leg
	Bracing in standing	30 repetitions with 8-s hold
	Bracing with standing row exercise	20 repetitions per side with 6-s hold
	Bracing with walking	
Erector spinae/multifidus	Quadruped arm lifts with bracing	30 repetitions with 8-s hold on each side
	Quadruped leg lifts with bracing	30 repetitions with 8-s hold on each side
	Quadruped alternate arm and leg lifts with bracing	30 repetitions with 8-s hold on each side
Quadratus lumborum	Side support with knees flexed	30 repetitions with 8-s hold on each side
	Side support with knees extended	30 repetitions with 8-s hold on each side
Oblique abdominals	Side support with knees flexed	30 repetitions with 8-s hold on each side
	Side support with knees extended	30 repetitions with 8-s hold on each side

*Although certain muscle groups are preferentially activated with each exercise sequence, each exercise progression will promote stability by producing motor patterns of cocontraction among all spinal stabilizing muscles.

(Hicks et al. 2005)

Definition of Success

- *> 50%* on modified Oswestry Disability Index (ODI)
- Non-success defined as < 6-point improvement on ODI

(Hicks et al., 2005)

ALON RABIN, DPT, PhD[1] • **ANAT SHASHUA**, BPT, MS[2] • **KOBY PIZEM**, BPT[3]
RUTHY DICKSTEIN, PT, DSc[4] • **GALI DAR**, PT, PhD[4]

A Clinical Prediction Rule to Identify Patients With Low Back Pain Who Are Likely to Experience Short-Term Success Following Lumbar Stabilization Exercises: A Randomized Controlled Validation Study

STUDY DESIGN: Randomized controlled trial.
OBJECTIVE: To determine the validity of a previously suggested clinical prediction rule (CPR) for identifying patients most likely to experience short-term success following lumbar stabilization exercise (LSE).
BACKGROUND: Although LSE is commonly used by physical therapists in the management of low back pain, it does not seem to be more effective than other interventions. A 4-item CPR for identifying patients most likely to benefit from LSE has been previously suggested but has yet to be validated.

compared with those receiving MT ($P = .03$). In addition, there were main effects for treatment and CPR status. Patients receiving LSE experienced less disability by the end of treatment compared to patients receiving MT ($P = .05$), and patients with a positive CPR status experienced less disability by the end of treatment compared to patients with a negative CPR status, regardless of the treatment received ($P = .04$). When a modified version of the CPR (mCPR) containing only the presence of aberrant movement and a positive prone instability test was used, a significant interaction with treatment was found for final disability ($P = .02$). Of the

tive CPR status ($P = .02$). Also, among patients with a positive CPR status, those receiving LSE experienced less disability by the end of treatment

Orthop Sports Phys Ther 2014;44(1):6-18. Epub 21 November 2013. doi:10.2519/jospt.2014.4888
KEY WORDS: *lumbar spine, manual therapy*

(Rabin et al., 2014)

"A modified version of the CPR that contains only 2 items may possess a better predictive validity to identify those most likely to succeed with an LSE program. Because this modified version was established through post hoc testing, an additional study is recommended to prospectively test its predictive validity."

……."only the presence of aberrant movement and a positive prone instability test was used, a significant interaction with treatment was found for final disability"

Arthrokinematics in a Subgroup of Patients Likely to Benefit From a Lumbar Stabilization Exercise Program

Deydre S Teyhen, Timothy W Flynn, John D Childs, Lawrence D Abraham

Background and Purpose

A clinical prediction rule (CPR) has been reported to identify patients with low back pain who are likely to benefit from stabilization exercises. The aim of this study was to characterize the spinal motion, using digital fluoroscopic video, of a subgroup of subjects with low back pain.

Subjects

Twenty subjects who were positive on the CPR were compared with 20 control subjects who were healthy.

Methods

The magnitude and timing of lumbar sagittal-plane intersegmental angular and linear displacement were assessed. Receiver operating characteristic curves and accuracy statistics were used to develop a kinematic model.

Results

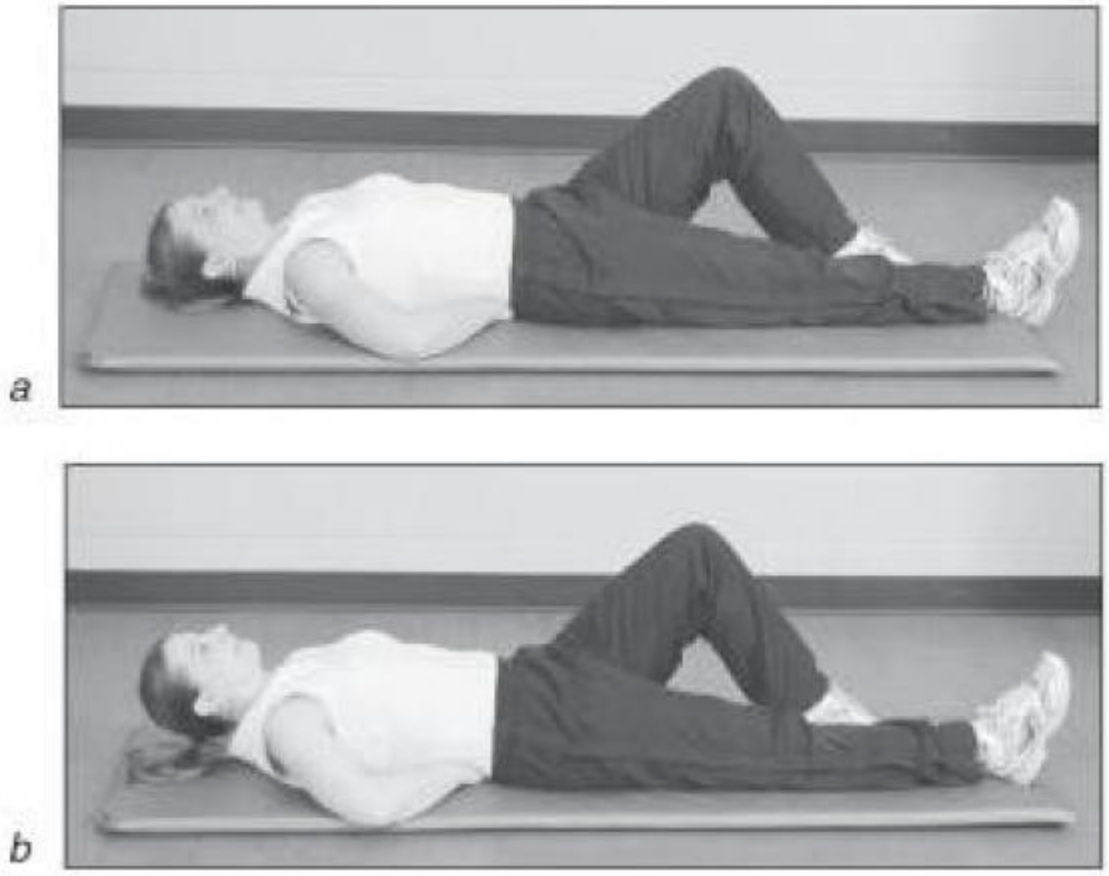
"The findings suggest that individuals with mid-range aberrant motion without signs of hypermobility are likely to benefit from these exercises. The developed model describes altered kinematics of this subgroup of subjects and helps to provide construct validity for the developed CPR."

(Teyhen et al., 2007)

Examples of *stabilization* exercises…

- Exercise including focus on RA, TrA, IO, ES, multifidus, and QL

Curl-Up…..
Beginner's and Intermediate



(McGill, 2007)

Curl-Up…..
Advanced

(McGill, 2007)

Side-Bridge…..
Beginner's

(McGill, 2007)

Side-Bridge…..
Beginner's and Intermediate

(McGill, 2007)

Bird Dog…..
Beginner's

(McGill, 2007)

Bird Dog…..
Beginner's and Intermediate

(McGill, 2007)

Is there relationship between *gluteal* muscle function and LBP?

Gluteus medius muscle activation patterns as a predictor of low back pain during standing

Erika Nelson-Wong, Diane E. Gregory, David A. Winter, Jack P. Callaghan *

Department of Kinesiology, Faculty of Applied Health Sciences, University of Waterloo, 200 University Avenue West, Waterloo, Ontario, Canada N2L 3G1

Received 31 August 2007; accepted 4 January 2008

Interpretation: "Agonist-antagonist co-activation may not be entirely adaptive, and may in fact predispose some individuals to develop low back pain. Muscle activation patterns at the hip may be a useful addition for screening individuals to identify those at risk of developing low back pain during standing."

non-low back pain groups, and comparisons made to visual analog scale scores.

Findings. 65% of previously asymptomatic participants developed low back pain during the protocol. Co-activation of the bilateral gluteus medius muscles was found to be prevalent in the low back pain group ($P = .002$). 76% of the participants were correctly classified into low back pain and non-low back pain groups based on presence or absence of gluteus medius co-activation, with sensitivity = .87 and specificity = .50.

Interpretation. Agonist–antagonist co-activation may not be entirely adaptive, and may in fact predispose some individuals to develop low back pain. Muscle activation patterns at the hip may be a useful addition for screening individuals to identify those at risk of developing low back pain during standing.

Is there relationship between *gluteal* muscle function and LBP?

Sadler *et al. BMC Musculoskeletal Disorders* (2019) 20:463
https://doi.org/10.1186/s12891-019-2833-4

BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

Gluteus medius muscle function in people with and without low back pain: a systematic review

Sean Sadler[1*], Samuel Cassidy[1], Benjamin Peterson[1], Martin Spink[1,2] and Vivienne Chuter[1,2]

Abstract

Introduction: Globally, low back pain (LBP) is one of the greatest causes of disability. In people with LBP, dysfunction of muscles such as the gluteus medius have been demonstrated to increase spinal loading and reduce spinal stability. Differences in gluteus medius function have been reported in those with LBP compared to those without, although this has only been reported in individual studies. The aim of this systematic review was to determine if adults with a history, or current LBP, demonstrate differences in measures of gluteus medius function when compared to adults without LBP.

Methods: MEDLINE, EMBASE, AMED, PsycINFO, PubMED, Pro Quest Database, CINAHL and SPORTDiscus were searched from inception until December 2018 for published journal articles and conference abstracts. No language restrictions were applied. Only case-control studies with participants 18 years and over were included. Participants could have had any type and duration of LBP. Studies could have assessed gluteus medius function with any quantifiable clinical assessment or measurement tool, with the participant non-weight bearing or weight bearing, and during static or dynamic activity. Quality appraisal and data extraction were independently performed by two authors.

Results: The 24 included articles involved 1088 participants with LBP and 998 without LBP. The gluteus medius muscle in participants with LBP tended to demonstrate reduced strength and more trigger points compared to the gluteus medius muscle of those without LBP. The level of activity, fatigability, time to activate, time to peak activation, cross sectional area, and muscle thickness showed unclear results. Meta-analysis was not performed due to the heterogeneity of included studies.

Conclusion: Clinically, the findings from this systematic review should be considered when assessing and managing patients with LBP. Future studies that clearly define the type and duration of LBP, and prospectively assess gluteus medius muscle function in those with and without LBP are needed.

Trial registration: PROSPERO (CRD42017076773).

Keywords: Low back pain, Systematic review, Gluteus medius, Electromyography

Results: "The gluteus medius muscle in participants with LBP tended to demonstrate *reduced strength* and *more trigger points* compared to the gluteus medius muscle of those without LBP."

(Sadler et al., 2019)

Combined Stabilization and Gluteal Exercises for Chronic LBP

J. Phys. Ther. Sci.
27: 3813–3816, 2015

Original Article

The effects of gluteus muscle strengthening exercise and lumbar stabilization exercise on lumbar muscle strength and balance in chronic low back pain patients

Ui-Cheol Jeong, MS[1)], Jae-Heon Sim, MS[2)], Cheol-Yong Kim, PT, PhD[3)], Gak Hwang-Bo, PhD[1)], Chan-Woo Nam, PT, MS[1)*]

[1)] *Department of Physical Therapy, College of Rehabilitation Science, Daegu University: 201 Daegudae-ro, Gyeongsan-si, Gyeongsangbuk-do, Republic of Korea*
[2)] *Department of Physical Therapy, Ulsan Jaseng Hospital of Korean Medicine, Republic of Korea*
[3)] *Department of Physical Therapy, Ulsan College, Republic of Korea*

Abstract. [Purpose] The aim of this study was to examine the effects of exercise to strengthen the muscles of the hip together with lumbar segmental stabilization exercise on the lumbar disability index, lumbar muscle strength, and balance. [Subjects and Methods] This study randomly and equally assigned 40 participants who provided written consent to participate in this study to a lumbar segmental stabilization exercise plus exercise to strengthen the muscles of the gluteus group (SMG + LES group) and a lumbar segmental stabilization exercise group. [Results] Each evaluation item showed a statistically significant effect. [Conclusion] Clinical application of exercise in this study showed that lumbar segmental stabilization exercise plus exercise to strengthen the muscles of the gluteus resulted in a greater decrease in low back pain disability index and increase in lumbar muscle strength and balance ability than lumbar segmental stabilization exercise in chronic low back pain patients receiving the exercise treatments during the same period.

Key words: Muscle strengthening exercise, Lumbar stabilization exercise, Chronic low back pain

(This article was submitted Aug. 20, 2015, and was accepted Sep. 17, 2015)

(Jeong et al., 2015)

Conclusion: "Clinical application of exercise in this study showed that lumbar segmental *stabilization exercise* plus *exercise to strengthen the muscles of the gluteus* resulted in a greater *decrease* in low back pain *disability* index and *increase* in lumbar muscle *strength* and *balance* ability than lumbar segmental stabilization exercise in chronic low back pain patients receiving the exercise treatments during the same period."

What about *training* the *gluteal* muscles?

Physiotherapy Theory and Practice, 28(4):257–268, 2012

ISSN: 0959-3985 print/1532-5040 online
DOI: 10.3109/09593985.2011.604981

informa
healthcare

SYSTEMATIC REVIEW

A literature review of studies evaluating gluteus maximus and gluteus medius activation during rehabilitation exercises

Michael P. Reiman, PT, DPT, OCS, SCS, ATC, FAAOMPT, CSCS,[1] Lori A Bolgla, PT, PhD, ATC,[2] and Janice K. Loudon, PT, PhD, SCS, ATC, CSCS[3]

[1]*Doctor of Physical Therapy Division, Department of Community and Family Medicine, Duke University School of Medicine, Durham, NC, USA*

[2]*Department of Physical Therapy, Georgia Health Sciences University, Augusta, GA, USA*

[3]*Department of Physical Therapy and Rehabilitation Science, University of Kansas Medical Center, Kansas City, KS, USA*

(Reiman et al., 2012)

Exercise Prescription Based on EMG……..

- *Progression* of exercise may be based on EMG activity of hip muscles
- Maximum Voluntary Isometric Contraction (MVIC):
  - Low level activation: *0-20%* MVIC
  - Moderate level activation: *21-40%* MVIC
  - High level activation: *41-60%* MVIC
  - Very high level: >60% MVIC

(Reiman et al., 2012)

Exercise Prescription EMG: Gluteus *Maximus*

Low/Moderate EMG Activity for Neurological Re-education 0-40% (in ascending order)	Higher Level EMG activation (41-60%) for Strength gain (in ascending order)
Prone bridge/plank (9% MVIC)	Sideways lunge (**41%** MVIC)
Lunge with backward trunk lean	Lateral step-up
Bridge	Transverse lunge
Clamshell with 30° hip flexion	Quadruped arm and leg lift
Lunge	Wall squat
Clamshell 60° hip flexion (**39%** MVIC)	Single-limb squat
	Single-limb deadlift
	Forward step-up – highest!!! (74% MVIC)

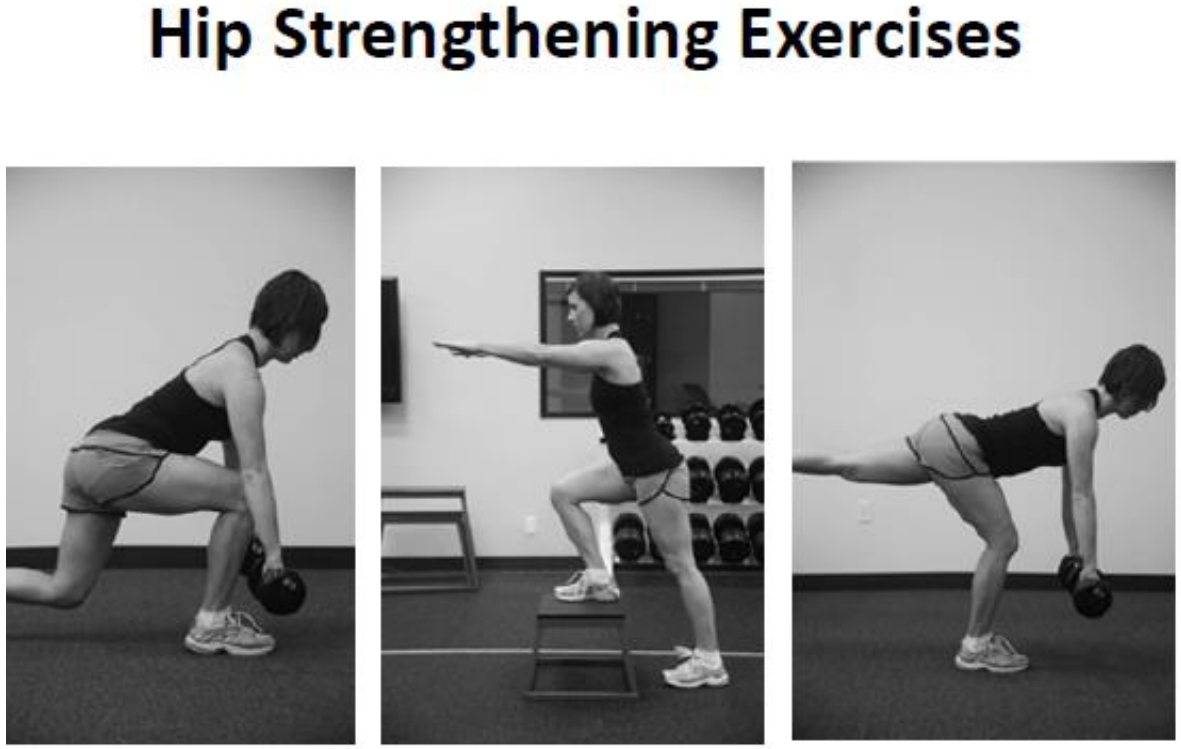
(Reiman et al., 2012)

Forward Step-Up

Forward step-up - YouTube

Exercise Prescription

- Changing a *neutral* trunk to a *forward* trunk lean
  - Increases gluteus *maximus* activation by 22% during lunge exercise



Exercise Prescription: Gluteus *Medius*

Low/Moderate EMG Activity for Neurological Re-education 0-40% (in ascending order)	Higher Level EMG activation (41-60%) for Strength gain (in ascending order)
Prone bridge plank (**27%** MVIC)	Lateral step-up (**41%** MVIC)
Lunge trunk neutral	Quadruped with contralateral arm and leg lift
Unilateral mini-squat	Forward step-up
Clamshell 60° hip flexion	Unilateral bridge
Sideways lunge	Transverse lunge
Clamshell 30° hip flexion (**40%** MVIC)	Side-lying hip abduction
	Single-limb deadlift (**58%** MVIC)

(Reiman et al., 2012)

Bridging Exercise

Manual Therapy 22 (2016) 211–215

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Original article

Modifying the hip abduction angle during bridging exercise can facilitate gluteus maximus activity

Sun-Young Kang [a], Sung-Dae Choung [b], Hye-Seon Jeon [c, *]

[a] Department of Physical Therapy, The Graduate School, Yonsei University, 1 Yonseidae-gil, Wonju, Kangwon-do, Republic of Korea
[b] Department of Physical Therapy, Baekseok University, Anseo-dong, Dongnam-gu, Cheonan-si, Chungcheongnam-do, Republic of Korea
[c] Department of Physical Therapy, College of Health Science, Yonsei University, 1 Yonseidae-gil, Wonju, Kangwon-do, Republic of Korea

Table 2
Back and hip extensor muscle activity and anterior pelvic tilt angle in hip abduction angles.

	Hip abduction angle			
	0°	15°	30°	*p*
EMG[a] amplitude (% MVIC)				
Erector spinae (ES)	50.68 ± 4.93[b]	48.69 ± 5.37	46.82 ± 5.06	0.002[c]
Gluteus maximus (GM)	16.62 ± 1.09	17.96 ± 1.53	20.34 ± 1.40	0.012[c]
GM/ES EMG ratio	0.33 ± 0.04	0.38 ± 0.05	0.45 ± 0.08	0.000[c]
Anterior pelvic tilt angle (°)	8.27 ± 1.19	7.30 ± 0.95	4.66 ± 0.77	0.000[c]

[a] Electromyography.
[b] Mean ± standard deviation.
[c] $p < 0.05$.

Bridging Exercise

- Using TheraBand® isometric contraction with bridge *increased* GMax activity compared to *no* TheraBand® (Choi et al., 2015)

[RESEARCH REPORT]

DAVID M. SELKOWITZ, PT, PhD, OCS, DAAPM[1] • GEORGE J. BENECK, PT, PhD, OCS[2] • CHRISTOPHER M. POWERS, PT, PhD, FAPTA[3]

Which Exercises Target the Gluteal Muscles While Minimizing Activation of the Tensor Fascia Lata? Electromyographic Assessment Using Fine-Wire Electrodes

- Abnormal hip kinematics such as hip *internal rotation* (IR) and hip ADDuction linked to LE disorders
  - TFL is a hip abductor but also an *internal rotator* (IR)
- May want to strengthen hip *abd*uction *without* activating IR muscles….?

[RESEARCH REPORT]

DAVID M. SELKOWITZ, PT, PhD, OCS, DAAPM[1] • GEORGE J. BENECK, PT, PhD, OCS[2] • CHRISTOPHER M. POWERS, PT, PhD, FAPTA[3]

Which Exercises Target the Gluteal Muscles While Minimizing Activation of the Tensor Fascia Lata? Electromyographic Assessment Using Fine-Wire Electrodes

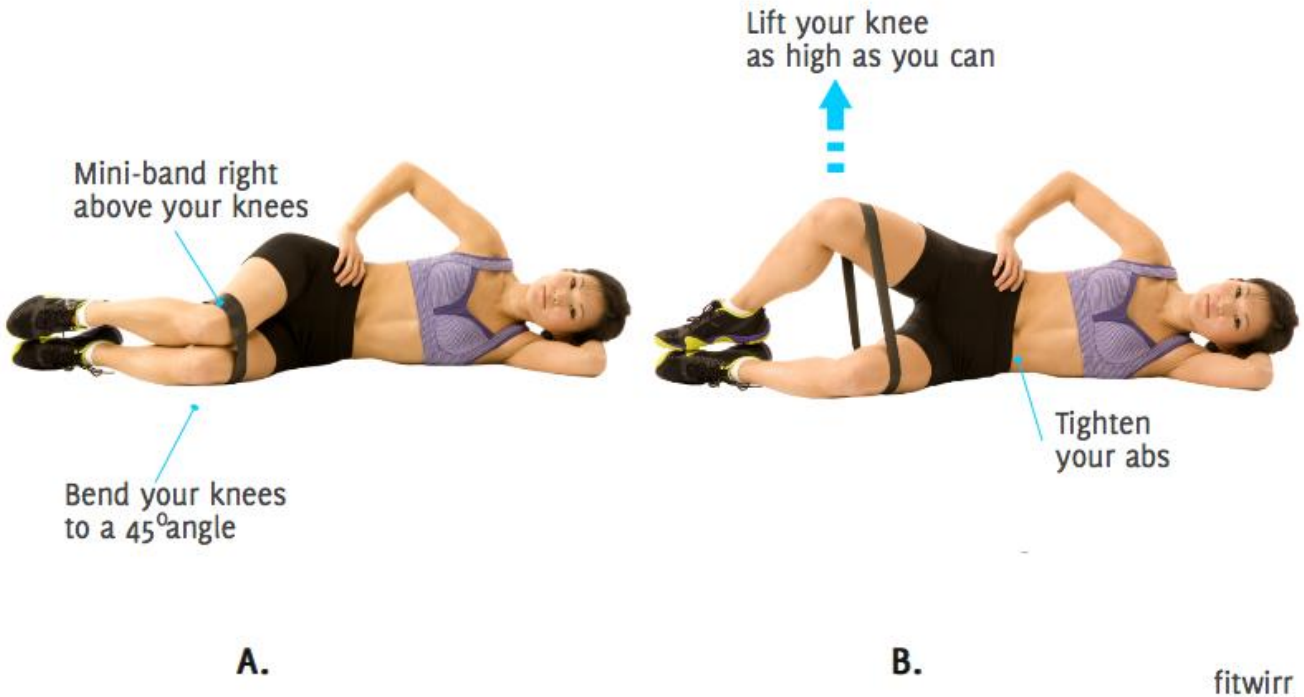
TABLE 2 GLUTEAL-TO-TFL INDEX FOR EACH EXERCISE

Exercise	Gluteal-to-TFL Activation Index
Clam*	115
Sidestep*	64
Unilateral bridge*	59
Quadruped hip extension, knee extending*	50
Quadruped hip extension, knee flexed*	50
Sidelying hip abduction	38
Step-up	32
Bilateral bridge*	32
Squat*	28
Hip hike	28
Lunge	18

Abbreviation: TFL, tensor fascia lata.
**Exercises in which both gluteal muscles demonstrated significantly higher normalized electromyographic signal amplitude than the TFL.*

- Exercises with *high* activity of GMED and GMAX with *low* TFL activity

Clamshell Exercise



Clamshell and Hip Abduction Exercise

- Selkowitz et al., 2014:
  - Clamshell exercises decrease TFL activation when compared to side-lying hip ABD exercises
  - Rotating hip (ER/IR) did *not* affect activation of TFL in side-lying hip ABD
  - Varying hip angle 30°, 45°, 60° did *not* affect activation of TFL in clamshell exercise
  - If goal is to *decrease TFL* activation…….*side-lying CLAM is preferred!*

[RESEARCH REPORT]

JUSTIN W. BERRY, PT, DPT[1] • THERESA S. LEE, BS[2]
HANNA D. FOLEY, BS[2] • CARA L. LEWIS, PT, PhD[2]

Resisted Side Stepping: The Effect of Posture on Hip Abductor Muscle Activation

TABLE 1 MUSCLE ACTIVITY LEVEL FOR EACH LIMB IN EACH POSTURE

	Gluteus Maximus	Gluteus Medius	Tensor Fascia Lata
Upright standing posture*			
Moving limb	8.9 ± 4.3	18.7 ± 8.0	45.2 ± 20.3
Stance limb	12.6 ± 6.7	22.9 ± 9.5	56.2 ± 24.5
Squat posture*			
Moving limb	12.1 ± 7.3	23.3 ± 11.2	33.7 ± 16.5
Stance limb	24.6 ± 12.8	35.7 ± 13.8	38.6 ± 25.0
Statistical analysis†			
Limb	<.001	<.001	<.001
Posture	<.001	<.001	<.001
Side	.756	.610	1.000
Limb by posture	<.001	<.001	.066

*Values are mean ± SD percent maximum voluntary isometric contraction.
†Values are P values. Statistical analysis included linear regression with generalized estimating equation correction.

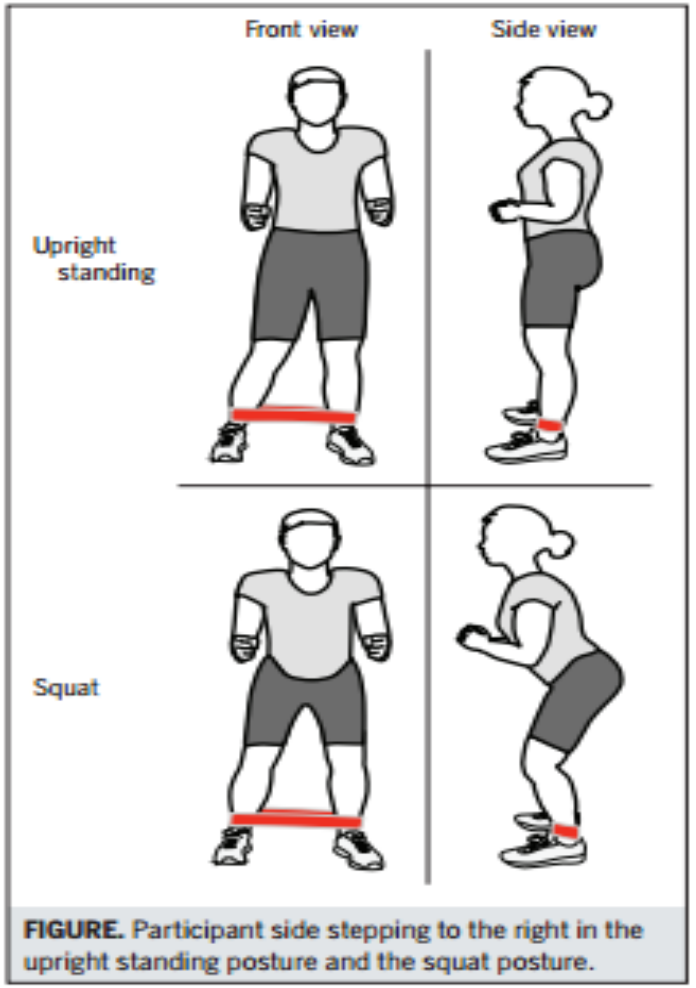


FIGURE. Participant side stepping to the right in the upright standing posture and the squat posture.

- Hip *abd*uctors in *stance* limb more active than *moving* limb
- *Squat* position: TFL activity *reduced*, while GMax and GMed activity *increased*

Summary

- Introduction and Background:
  - LBP *the* most common primary complaint for DC
  - Chronic LBP represents 75% of total treatment costs
- Clinical Practice Guidelines for LBP recommend exercise:
  - ACP (Qaseem et al., 2017)
  - CCGPP (Globe et al., 2016)
- Clinical Prediction Rules:
  - Exercises for LBP

To close, I'd like to ask you to do this one thing.....

Consider *exercise/movement* and its *benefit* for *LBP*!!!

Questions???

Comments or Feedback.....

Please email……bryan.bond@allencollege.edu

NCMIC®

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Objectives

1. Consider and define the *therapeutic benefit* of exercise in managing low back pain.
2. Describe and discuss the evidence-informed *clinical practice guidelines* to promote appropriate treatment decisions.

Outline

- Introduction and Background
- Clinical Practice Guidelines for LBP
- Clinical Prediction Rules
- Exercise for LBP

Introduction and Background

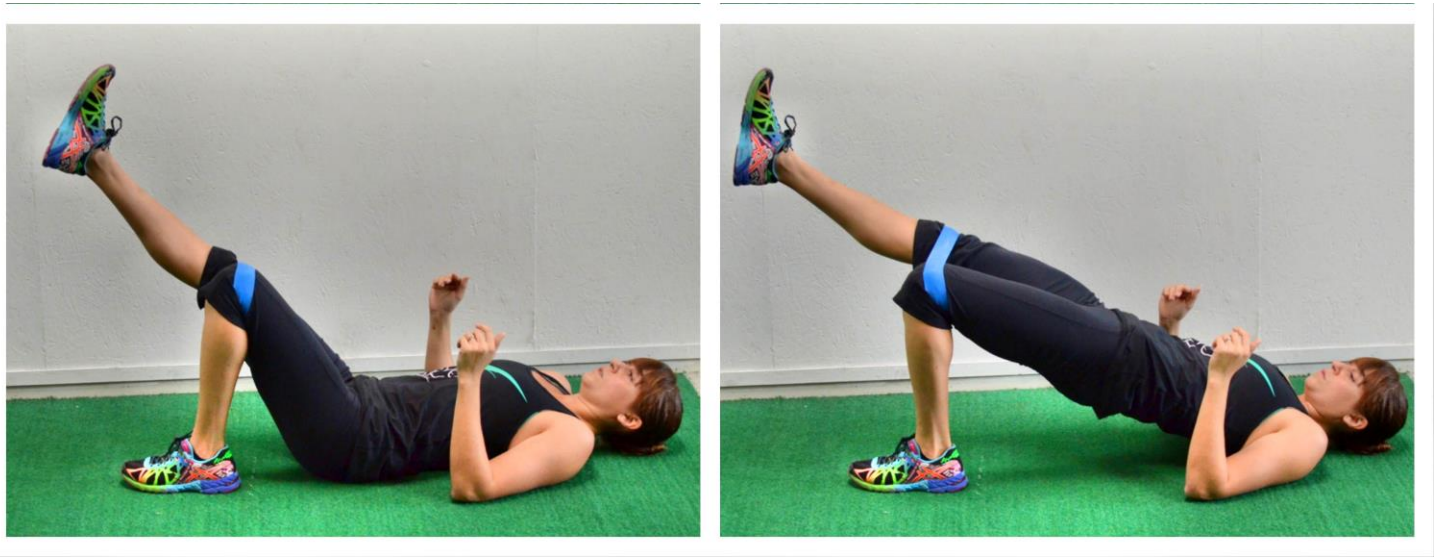
- According to National Board of Chiropractic Examiners (NBCE):
  - Low back disorders represent *the* most common (~ *24%*) primary complaint within chiropractic practice

Introduction and Background

- Low back pain (LBP) affects up to *85%* of adult population costing *$86* billion annually in US (Frymoyer & Cats-Baril, 1991; Luo et al., 2004; Martin et al., 2008)
- *⅓* to *⅔* of patients with *acute* LBP transition to *chronic* LBP (Hush et al., 2011; Itz et al., 2013; Vasseljen et al., 2013)
- Chronic LBP represents *75%* of total treatment costs
  - Associated with significant *disability*
  - Represents *the* major cause of *absenteeism* from workplace worldwide (Frymoyer & Cats-Baril, 1991; Luo et al., 2004; Ehrlich, 2003)

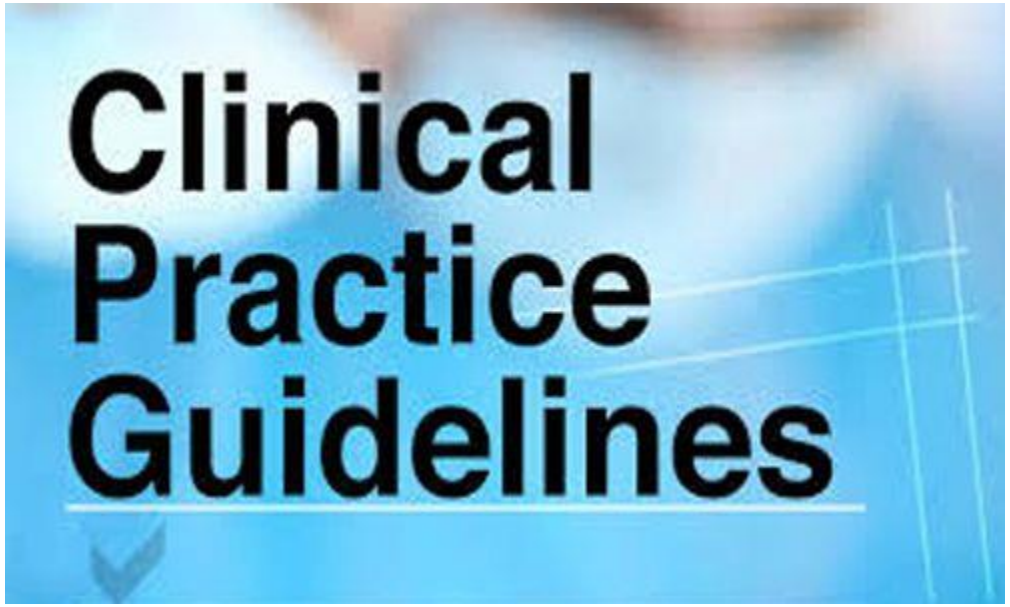
Introduction and Background

- Efficacious interventions may prevent or improve *disability* of chronic LBP (Kovacs et al., 2005; Marcuzzi et al., 2015)
- Exercise is a *viable* treatment option for LBP (Qaseem et al., 2017)

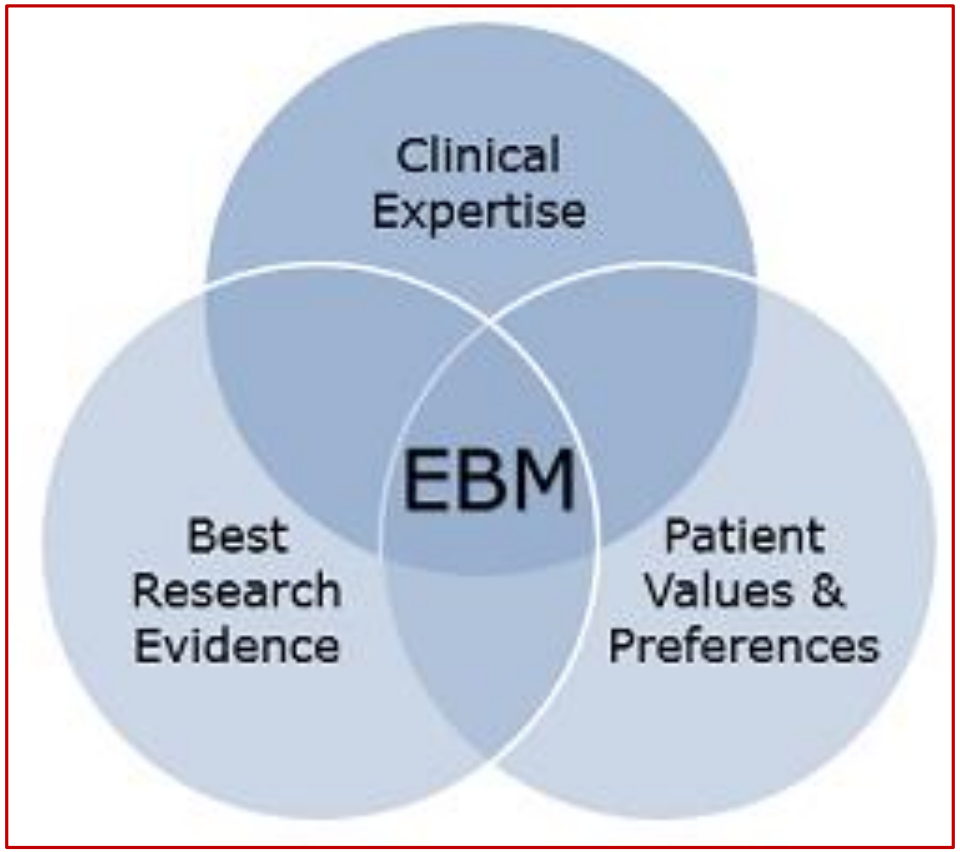


Introduction and Background

- Clinical practice guidelines (CPGs) from around *globe* recommend *exercise* for managing *chronic* LBP patients:
  - United States (Qaseem et al., 2017)
  - Canada (Bussières et al., 2018)
  - United Kingdom (National Guideline, 2016)
  - Europe (Oliveira et al., 2018)



What constitutes *Evidence-Based* Medicine…..or Chiropractic?

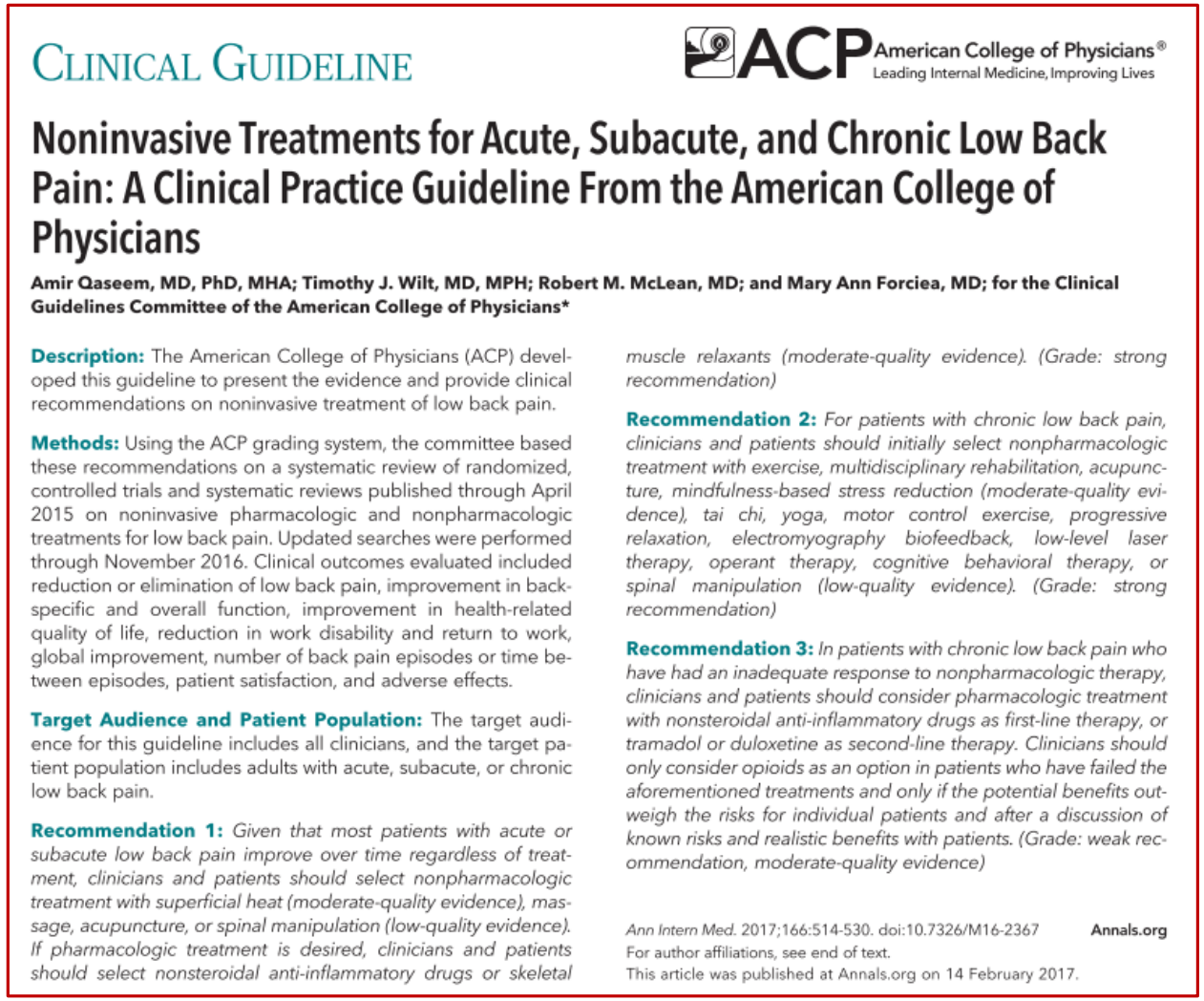


(Haneline, 2007)

What are the chiropractic *clinical practice guidelines* for LBP?

- According to *American Chiropractic Association*:
  - "The ACA adopts, but is not limited to, the Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline from the *American College of Physicians* as current *best practices* for the treatment and management of low back pain."
  - "…..therefore also adopts, but is not limited to, the clinical practice guideline from the *Council on Chiropractic Guidelines and Practice Parameters* (*CCGPP*), to provide *specific* guidance in the management or co-management of a patient within a chiropractic office."

What are evidence-informed *clinical practice guidelines* for low back pain?



CLINICAL GUIDELINE

ACP American College of Physicians® Leading Internal Medicine, Improving Lives

Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians

Amir Qaseem, MD, PhD, MHA; Timothy J. Wilt, MD, MPH; Robert M. McLean, MD; and Mary Ann Forciea, MD; for the Clinical Guidelines Committee of the American College of Physicians*

Description: The American College of Physicians (ACP) developed this guideline to present the evidence and provide clinical recommendations on noninvasive treatment of low back pain.

Methods: Using the ACP grading system, the committee based these recommendations on a systematic review of randomized, controlled trials and systematic reviews published through April 2015 on noninvasive pharmacologic and nonpharmacologic treatments for low back pain. Updated searches were performed through November 2016. Clinical outcomes evaluated included reduction or elimination of low back pain, improvement in back-specific and overall function, improvement in health-related quality of life, reduction in work disability and return to work, global improvement, number of back pain episodes or time between episodes, patient satisfaction, and adverse effects.

Target Audience and Patient Population: The target audience for this guideline includes all clinicians, and the target patient population includes adults with acute, subacute, or chronic low back pain.

Recommendation 1: *Given that most patients with acute or subacute low back pain improve over time regardless of treatment, clinicians and patients should select nonpharmacologic treatment with superficial heat (moderate-quality evidence), massage, acupuncture, or spinal manipulation (low-quality evidence). If pharmacologic treatment is desired, clinicians and patients should select nonsteroidal anti-inflammatory drugs or skeletal muscle relaxants (moderate-quality evidence). (Grade: strong recommendation)*

Recommendation 2: *For patients with chronic low back pain, clinicians and patients should initially select nonpharmacologic treatment with exercise, multidisciplinary rehabilitation, acupuncture, mindfulness-based stress reduction (moderate-quality evidence), tai chi, yoga, motor control exercise, progressive relaxation, electromyography biofeedback, low-level laser therapy, operant therapy, cognitive behavioral therapy, or spinal manipulation (low-quality evidence). (Grade: strong recommendation)*

Recommendation 3: *In patients with chronic low back pain who have had an inadequate response to nonpharmacologic therapy, clinicians and patients should consider pharmacologic treatment with nonsteroidal anti-inflammatory drugs as first-line therapy, or tramadol or duloxetine as second-line therapy. Clinicians should only consider opioids as an option in patients who have failed the aforementioned treatments and only if the potential benefits outweigh the risks for individual patients and after a discussion of known risks and realistic benefits with patients. (Grade: weak recommendation, moderate-quality evidence)*

Ann Intern Med. 2017;166:514-530. doi:10.7326/M16-2367 **Annals.org**
For author affiliations, see end of text.
This article was published at Annals.org on 14 February 2017.

- Clinical guidelines and recommendations for low back pain from *American College of Physicians*…….”non-DC” source (Qaseem et al., 2017)

What are evidence-informed *clinical practice guidelines* for low back pain?

- From ACP (Qaseem et al., 2017):
  - "**Recommendation 1:** Given that most patients with *acute* or *subacute* low back pain improve over time regardless of treatment, clinicians and patients should select *nonpharmacologic* treatment with superficial heat (moderate-quality evidence), massage, acupuncture, or *spinal manipulation* (low-quality evidence). If *pharmacologic* treatment is desired, clinicians and patients should select *nonsteroidal anti-inflammatory* drugs or skeletal *muscle relaxants* (moderate-quality evidence). (Grade: *strong* recommendation)."

What are evidence-informed *clinical practice guidelines* for low back pain?

- From ACP (Qaseem et al., 2017):
  - "**Recommendation 2:** For patients with *chronic* low back pain, clinicians and patients should initially select *nonpharmacologic* treatment with *exercise*, multidisciplinary *rehabilitation*, acupuncture, mindfulness-based stress reduction (moderate-quality evidence), *tai chi*, *yoga*, *motor control exercise*, progressive relaxation, electromyography biofeedback, low-level laser therapy, operant therapy, cognitive behavioral therapy, or *spinal manipulation* (low-quality evidence). (Grade: *strong* recommendation)."

What are evidence-informed *clinical practice guidelines* for low back pain?

- From ACP (Qaseem et al., 2017):
  - "**Recommendation 3:** In patients with *chronic* low back pain who have had an *inadequate* response to *nonpharmacologic* therapy, clinicians and patients should consider pharmacologic treatment with nonsteroidal anti-inflammatory drugs as *first*-line therapy, or tramadol or duloxetine as *second*-line therapy. Clinicians should *only* consider *opioids* as an option in patients who have *failed* the aforementioned treatments and only if the potential benefits *outweigh* the risks for individual patients and after a discussion of known risks and realistic benefits with patients. (Grade: *weak* recommendation, moderate-quality evidence)."

What are evidence-informed *clinical practice guidelines* for low back pain?

ORIGINAL ARTICLE

CLINICAL PRACTICE GUIDELINE: CHIROPRACTIC CARE FOR LOW BACK PAIN

Gary Globe, PhD, MBA, DC,[a] Ronald J. Farabaugh, DC,[b] Cheryl Hawk, DC, PhD,[c] Craig E. Morris, DC,[d] Greg Baker, DC,[e] Wayne M. Whalen, DC,[f] Sheryl Walters, MLS,[g] Martha Kaeser, DC, MA,[h] Mark Dehen, DC,[i] and Thomas Augat, DC[j]

ABSTRACT

Objective: The purpose of this article is to provide an update of a previously published evidence-based practice guideline on chiropractic management of low back pain.

Methods: This project updated and combined 3 previous guidelines. A systematic review of articles published between October 2009 through February 2014 was conducted to update the literature published since the previous Council on Chiropractic Guidelines and Practice Parameters (CCGPP) guideline was developed. Articles with new relevant information were summarized and provided to the Delphi panel as background information along with the previous CCGPP guidelines. Delphi panelists who served on previous consensus projects and represented a broad sampling of jurisdictions and practice experience related to low back pain management were invited to participate. Thirty-seven panelists participated; 33 were doctors of chiropractic (DCs). In addition, public comment was sought by posting the consensus statements on the CCGPP Web site. The RAND-UCLA methodology was used to reach formal consensus.

Results: Consensus was reached after 1 round of revisions, with an additional round conducted to reach consensus on the changes that resulted from the public comment period. Most recommendations made in the original guidelines were unchanged after going through the consensus process.

Conclusions: The evidence supports that doctors of chiropractic are well suited to diagnose, treat, co-manage, and manage the treatment of patients with low back pain disorders. (J Manipulative Physiol Ther 2016;39:1-22)

Key Indexing Terms: *Chiropractic; Low Back Pain; Manipulation, Spinal; Guidelines*

What are evidence-informed *clinical practice guidelines* for low back pain?

- From Council on Chiropractic Guidelines and Practice Parameters (CCGPP) (Globe et al., 2016):
  - "**CONCLUSIONS:** The *evidence* supports that doctors of chiropractic are *well suited* to diagnose, treat, co-manage, and manage the treatment of patients with low back pain disorders."

Management of *Chronic* LBP According to CCGPP…….

Chronic Pain Management Components in Physician-Directed Case Management

Case management of patients with chronic LBP should be based upon an individualized approach to care that combines the best evidence with clinician judgment and patient preferences. In addition to spinal manipulation and/or mobilization, an active care plan for chronic pain management may include, but is not restricted to, the following:

Procedures

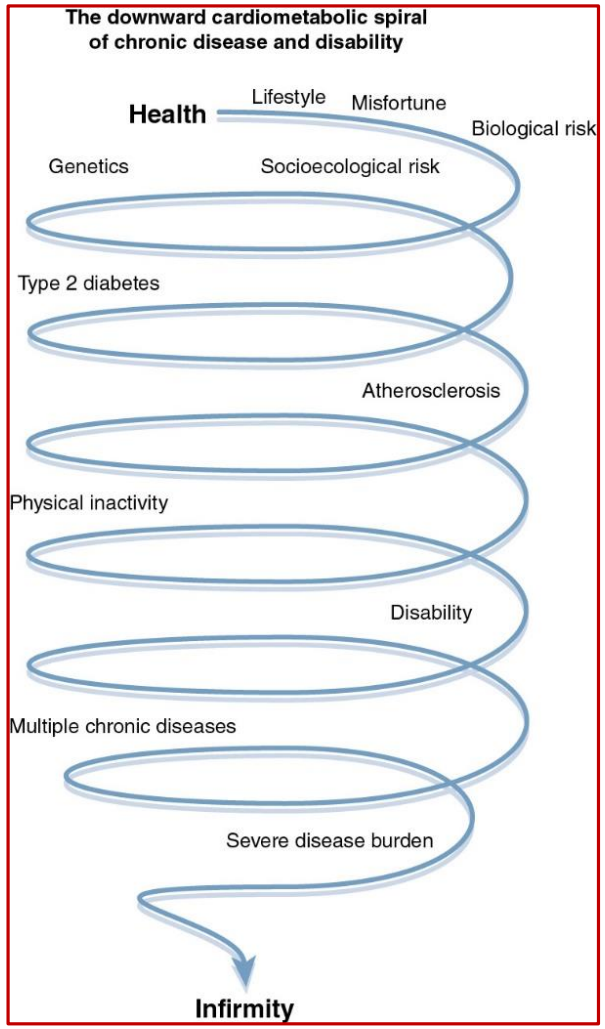
- Massage therapy
- Other manual therapeutic methods
- Physical modalities
- Acupuncture
- Bracing/orthoses

Behavioral and exercise recommendations

- Supervised rehabilitative/therapeutic exercise
- General and/or specific exercise programs
- Mind/body programs (eg, yoga, Tai Chi)
- Multidisciplinary rehabilitation
- Cognitive behavioral programs

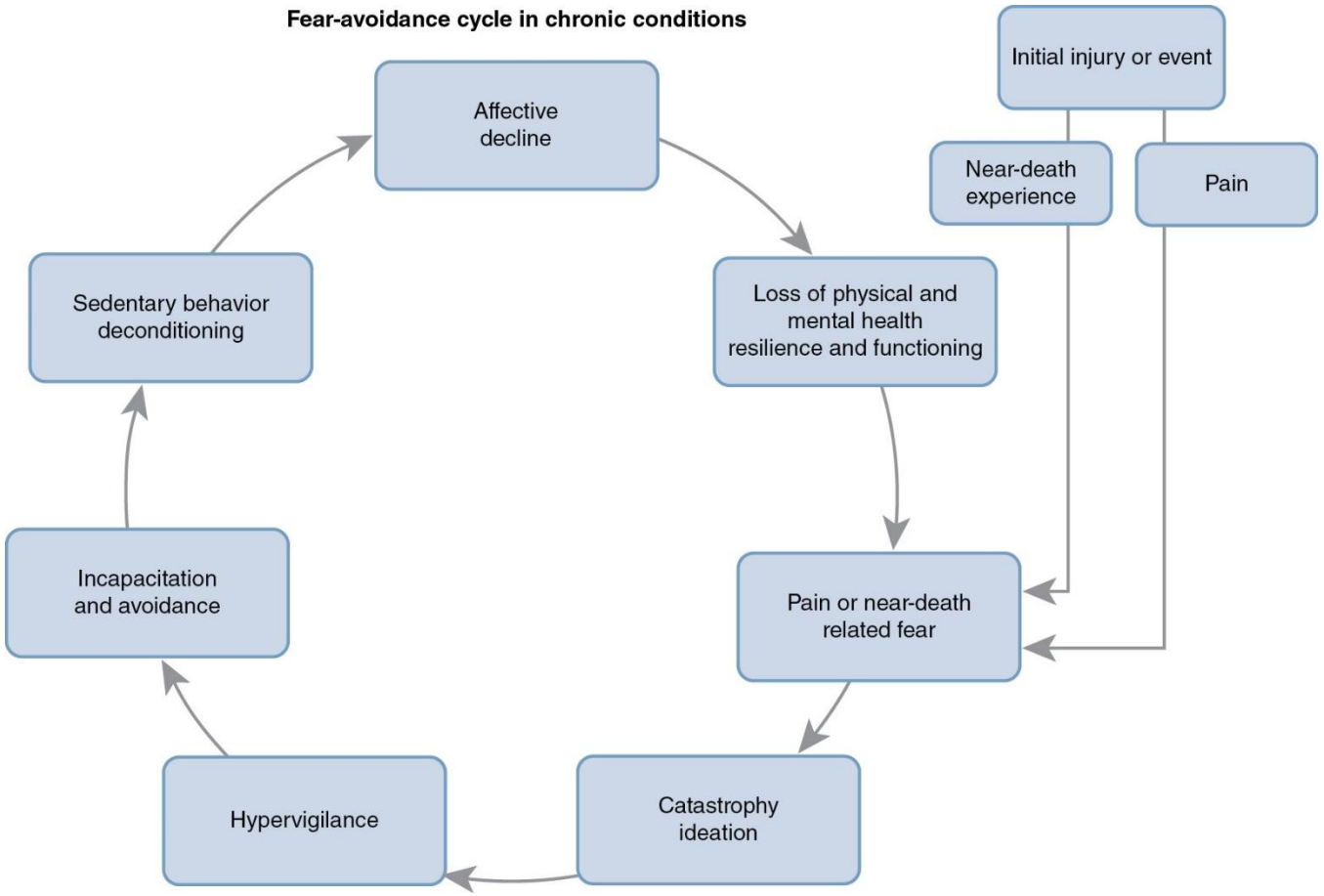
(Globe et al., 2016)

Rationale for Including Physical Activity in *Chronic* Care Management



- Primary reason to emphasize physically active lifestyle is to *avoid* what has been termed the *disuse syndrome* or *downward spiral of chronic disease* (Moore et al., 2016)

Fear-Avoidance *Cycle*

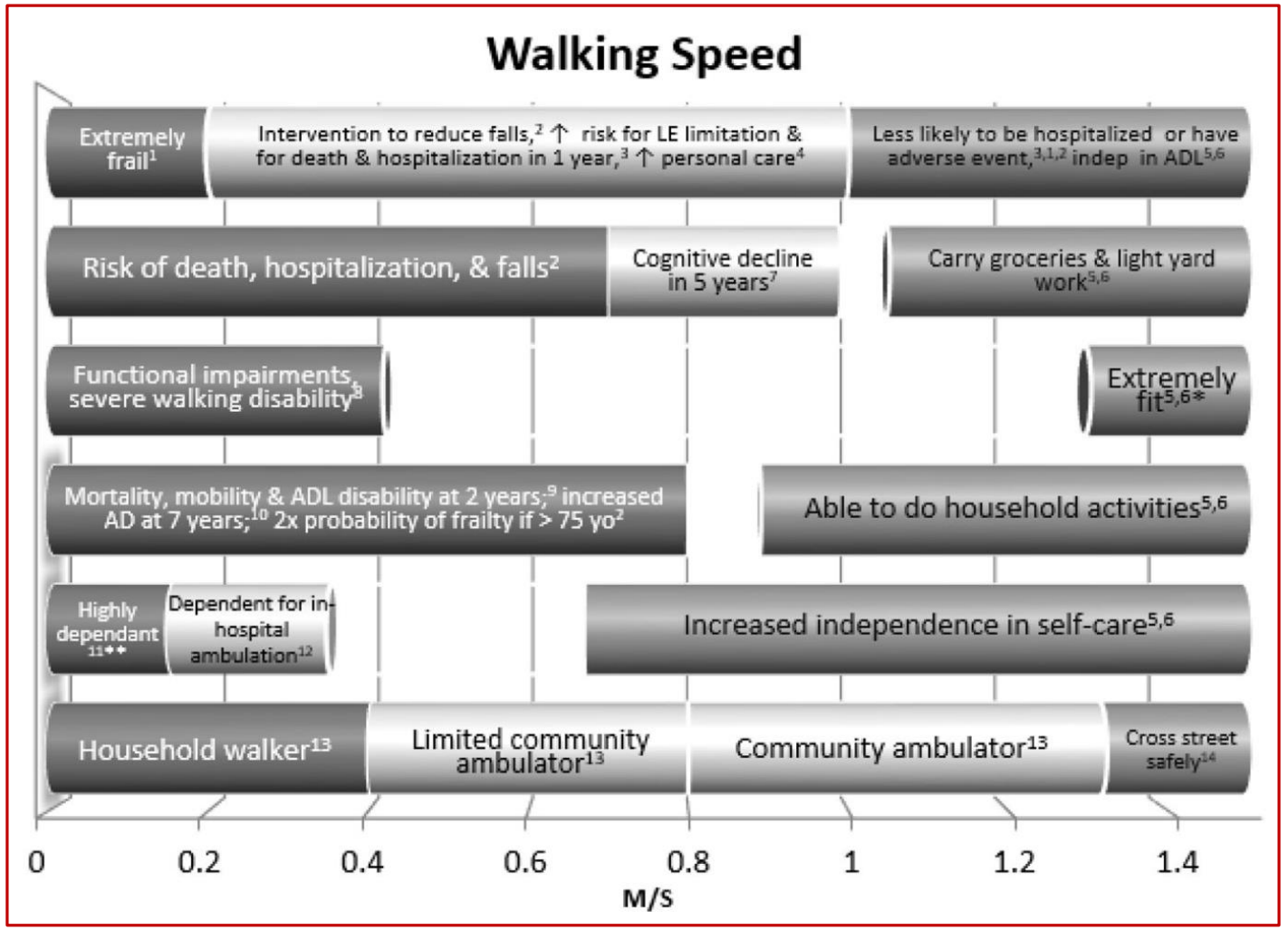


- Fear avoidance is concept that one should *avoid* activities due to *belief* that those activities will cause *pain* or further *injury* (Moore et al., 2016)

Walking Speed as Indicator of Health

- "Walking speed (WS) is a *valid*, *reliable*, *sensitive* measure appropriate for *assessing* and *monitoring* functional status and *overall health* in a wide range of populations. These capabilities have led to its designation as the "*6th vital sign*"." (Middleton et al., 2015)

Walking Speeds and *Associated Outcomes*

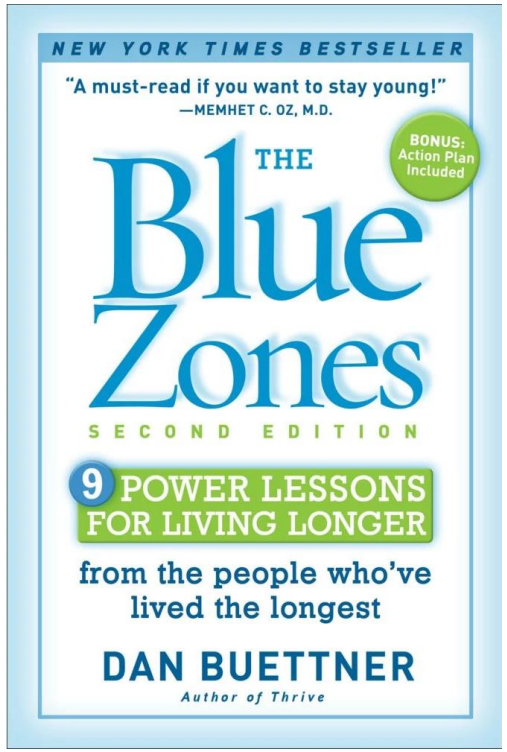


(Middleton et al., 2015)

Exercise in General….
"The Blue Zones"

Think about a disease, especially chronic…..does scientific literature tell us exercise is beneficial?

If you want to become a *Centurion*…….



Research *Hierarchy*

(Yetley et al., 2017)

Exercise for *Chronic* LBP

[LITERATURE REVIEW]

RUBÉN FERNÁNDEZ-RODRÍGUEZ, MSc[1] • CELIA ÁLVAREZ-BUENO, PhD[1] • IVÁN CAVERO-REDONDO, PhD[1]
ANA TORRES-COSTOSO, PhD[2] • DIANA P. POZUELO-CARRASCOSA, PhD[1] • SARA REINA-GUTIÉRREZ, MSc[1]
CARLOS PASCUAL-MORENA, MSc[1] • VICENTE MARTÍNEZ-VIZCAÍNO, MD[1,3]

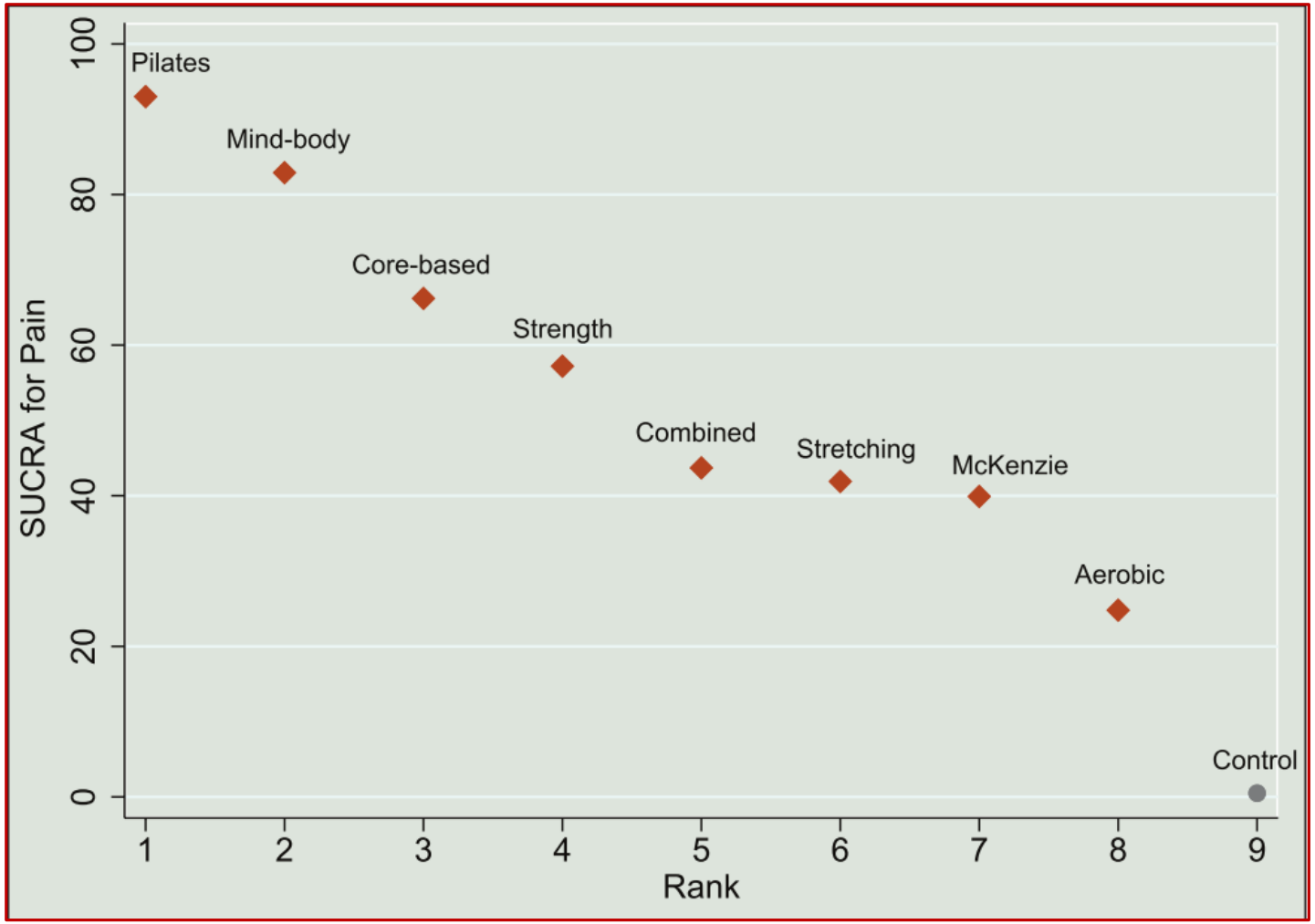
Best Exercise Options for Reducing Pain and Disability in Adults With Chronic Low Back Pain: Pilates, Strength, Core-Based, and Mind-Body. A Network Meta-analysis

(Fernández-Rodríguez et al., 2022)

Exercise for *Chronic* LBP

- CONCLUSION: "Although most exercise interventions had benefits for managing *pain* and *disability* in chronic LBP, the *most beneficial* programs were those that included (1) at least 1 to 2 sessions per week of *Pilates* or *strength* exercises; (2) sessions of less than 60 minutes of *core-based*, *strength*, or *mind-body* exercises; and (3) training programs from 3 to 9 weeks of *Pilates* and *core-based* exercises." (Fernández-Rodríguez et al., 2022)

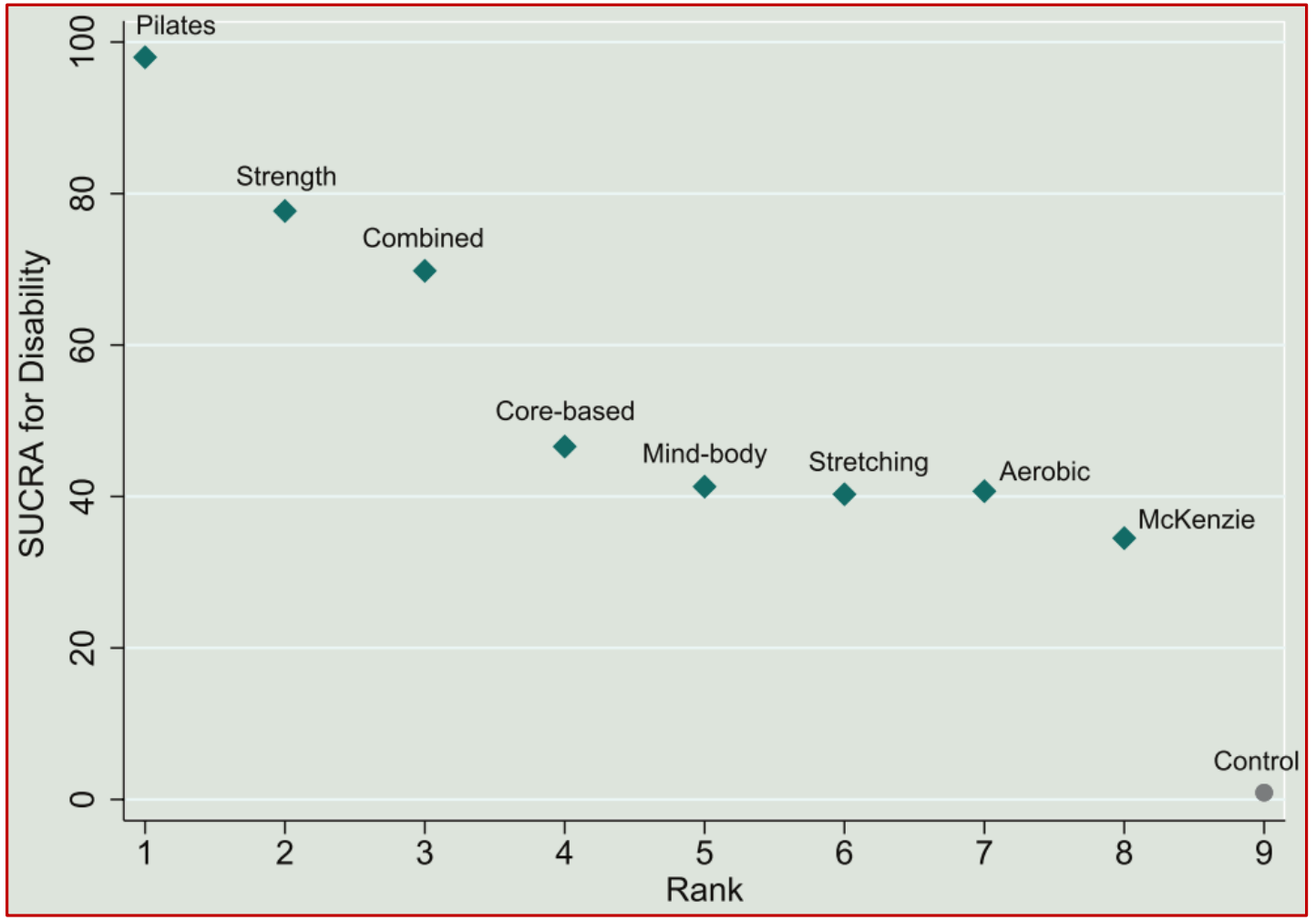
Ranking for Each Intervention on *Pain*



(Fernández-Rodríguez et al., 2022)

- SUCRA = surface under the cumulative ranking curve

Ranking for Each Intervention on *Disability*



(Fernández-Rodríguez et al., 2022)

- SUCRA = surface under the cumulative ranking curve

Clinical Prediction Rules (CPR)

- What are CPR?
- Why use CPRs?
- How to use CPRs?
- Statistical Definitions
- Lumbopelvic Pain

(Glynn & Weisbach, 2010)

What are Clinical Prediction Rules?

- CPRs are algorithmic decision tools designed to aid *clinicians* in:
  - Diagnosis
  - Prognosis
  - Intervention
- Use clinical findings to find statistically meaningful *predictors*:
  - History
  - Physical Examination
  - Diagnostic

(Glynn & Weisbach, 2010)

Why Use CPRs?

- Evidence-based health care defined as conscientious, explicit, and judicious use of *best available* evidence
- CPRs provide best available "real-world" evidence to improve:
  - Patient/clinical outcomes
  - Quality of care
  - Clinical decisions, especially less experienced doctors or uncommon clinical conditions
  - Patient satisfaction????
  - Referrals????

(Glynn & Weisbach, 2010)

How to Use CPRs?

- CPRs intended to augment clinical decision-making in areas where further research required
  - Should *not* use CPRs in *isolation*
- Use CPRs along with:
  - Current existing evidence
  - Patient preferences
  - Clinical experience

But CPRs are NOT 100% predictive…..false negatives/positives!!!

They are helpful TOOLS….like any other procedure!!!

Interpretation of *Likelihood Ratio* (LR) Values

Positive LR	Negative LR	Interpretation
> 10	< 0.1	Large, often conclusive shifts in probability
5-10	0.1-0.2	Moderate shifts in probability
2-5	0.2-0.5	Small, sometimes important shifts in probability
1-2	0.5-1.0	Probability to small, rarely important degree

(Glynn & Weisbach, 2010)

How do you decide *who* benefits or needs *exercise* for LBP?

- Orthopedic testing?
- ROM/mobility?
- Experience? What if you just graduated?
- Patient preferences?
- Everyone gets exercise?
- Nobody gets exercise?
- Educated “assumption” its effective or least not harmful?
- Don’t care or never given much consideration?
- Other rationale?

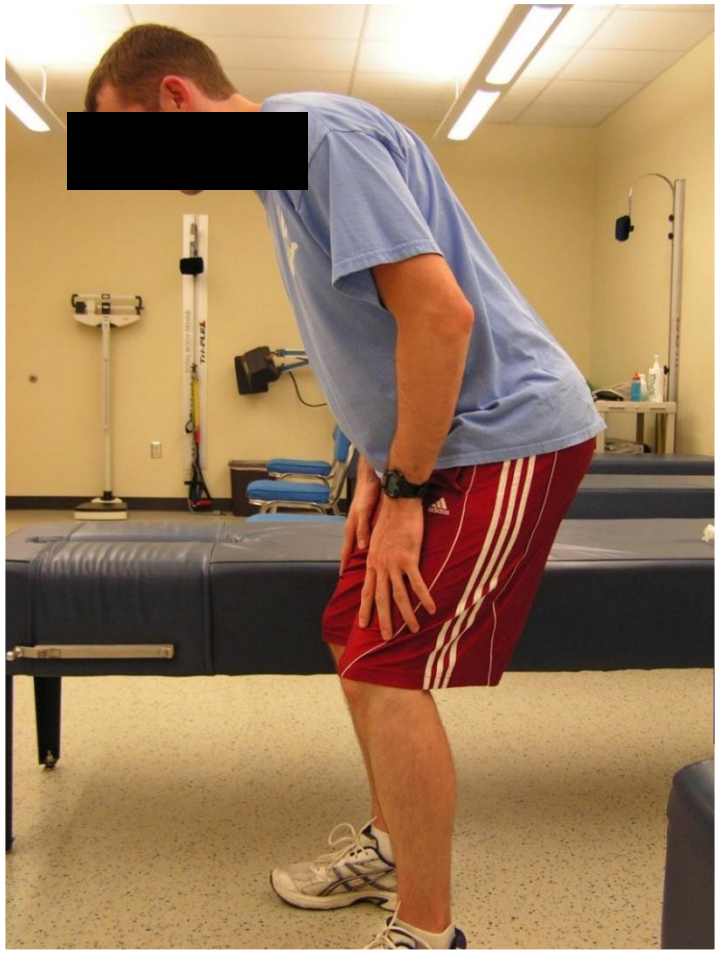
Lumbar Stabilization for Low Back Pain

Predictor Variables of *Success*
1. SLR > 91°
2. < 40 years old
3. Aberrant motion present with forward bending
4. Positive prone instability test
Predictor Variables of *Non-Success*
1. Fear Avoidance Belief Questionnaire – Physical Activity < 8
2. Aberrant movement absent
3. No hypermobility during PA spring testing
4. Negative prone stability test

(Hicks et al., 2005)

SLR with Inclinometer

Aberrant Motion…..
Gower's Sign



Prone Instability Test

https://www.physio-pedia.com/Prone_Instability_Test

Prone Instability Test…*Relaxed*

Prone Instability Test…*Contracted*

P-A *Spring* Testing

Clinical Bottom Line

(Hicks et al., 2005)

- Presence of a least *3* success predictor variables indicates a *small, meaningful* shift in probability of at least *50%* improvement in function after 8 weeks of lumbar stabilization or presence of a least *2* non-success predictor variables indicates a *moderate* shift in probability patient will *not* improve with lumbar stabilization

Success with Stabilization Likely if:	***Failure with Stabilization Likely if:***
•Three or more predictor variables of success present **•+LR 4.0 (95% CI 1.6-10.0)**	**•Three or more predictor variables of non-success present** **•-LR 0.2 (95% CI 0.2-0.4)**

Intervention

- Treatment *2* times a week for *8* weeks
- Treatment included:
  - Exercise including focus on RA, TrA, IO, ES, multifidus, and QL
  - Magazine: Core Values - NYTimes.com/Video - YouTube

Intervention

Table 1: Stabilization Exercises With Criteria for Progression of Each Exercise

Primary Muscle Group*	Exercises	Criteria for Progression
Transversus abdominus	Abdominal bracing	30 repetitions with 8-s hold
	Bracing with heel slides	20 repetitions per leg with 4-s hold
	Bracing with leg lifts	20 repetitions per leg with 4-s hold
	Bracing with bridging	30 repetitions with 8-s hold, then progress to 1 leg
	Bracing in standing	30 repetitions with 8-s hold
	Bracing with standing row exercise	20 repetitions per side with 6-s hold
	Bracing with walking	
Erector spinae/multifidus	Quadruped arm lifts with bracing	30 repetitions with 8-s hold on each side
	Quadruped leg lifts with bracing	30 repetitions with 8-s hold on each side
	Quadruped alternate arm and leg lifts with bracing	30 repetitions with 8-s hold on each side
Quadratus lumborum	Side support with knees flexed	30 repetitions with 8-s hold on each side
	Side support with knees extended	30 repetitions with 8-s hold on each side
Oblique abdominals	Side support with knees flexed	30 repetitions with 8-s hold on each side
	Side support with knees extended	30 repetitions with 8-s hold on each side

*Although certain muscle groups are preferentially activated with each exercise sequence, each exercise progression will promote stability by producing motor patterns of cocontraction among all spinal stabilizing muscles.

(Hicks et al. 2005)

Definition of Success

- *> 50%* on modified Oswestry Disability Index (ODI)
- Non-success defined as < 6-point improvement on ODI

(Hicks et al., 2005)

ALON RABIN, DPT, PhD[1] • **ANAT SHASHUA**, BPT, MS[2] • **KOBY PIZEM**, BPT[3]
RUTHY DICKSTEIN, PT, DSc[4] • **GALI DAR**, PT, PhD[4]

A Clinical Prediction Rule to Identify Patients With Low Back Pain Who Are Likely to Experience Short-Term Success Following Lumbar Stabilization Exercises: A Randomized Controlled Validation Study

STUDY DESIGN: Randomized controlled trial.
OBJECTIVE: To determine the validity of a previously suggested clinical prediction rule (CPR) for identifying patients most likely to experience short-term success following lumbar stabilization exercise (LSE).
BACKGROUND: Although LSE is commonly used by physical therapists in the management of low back pain, it does not seem to be more effective than other interventions. A 4-item CPR for identifying patients most likely to benefit from LSE has been previously suggested but has yet to be validated.

compared with those receiving MT ($P = .03$). In addition, there were main effects for treatment and CPR status. Patients receiving LSE experienced less disability by the end of treatment compared to patients receiving MT ($P = .05$), and patients with a positive CPR status experienced less disability by the end of treatment compared to patients with a negative CPR status, regardless of the treatment received ($P = .04$). When a modified version of the CPR (mCPR) containing only the presence of aberrant movement and a positive prone instability test was used, a significant interaction with treatment was found for final disability ($P = .02$). Of the

tive CPR status ($P = .02$). Also, among patients with a positive CPR status, those receiving LSE experienced less disability by the end of treatment

Orthop Sports Phys Ther 2014;44(1):6-18. Epub 21 November 2013. doi:10.2519/jospt.2014.4888
KEY WORDS: *lumbar spine, manual therapy*

(Rabin et al., 2014)

"A modified version of the CPR that contains only 2 items may possess a better predictive validity to identify those most likely to succeed with an LSE program. Because this modified version was established through post hoc testing, an additional study is recommended to prospectively test its predictive validity."

……."only the presence of aberrant movement and a positive prone instability test was used, a significant interaction with treatment was found for final disability"

Arthrokinematics in a Subgroup of Patients Likely to Benefit From a Lumbar Stabilization Exercise Program

Deydre S Teyhen, Timothy W Flynn, John D Childs, Lawrence D Abraham

Background and Purpose

A clinical prediction rule (CPR) has been reported to identify patients with low back pain who are likely to benefit from stabilization exercises. The aim of this study was to characterize the spinal motion, using digital fluoroscopic video, of a subgroup of subjects with low back pain.

Subjects

Twenty subjects who were positive on the CPR were compared with 20 control subjects who were healthy.

Methods

The magnitude and timing of lumbar sagittal-plane intersegmental angular and linear displacement were assessed. Receiver operating characteristic curves and accuracy statistics were used to develop a kinematic model.

Results

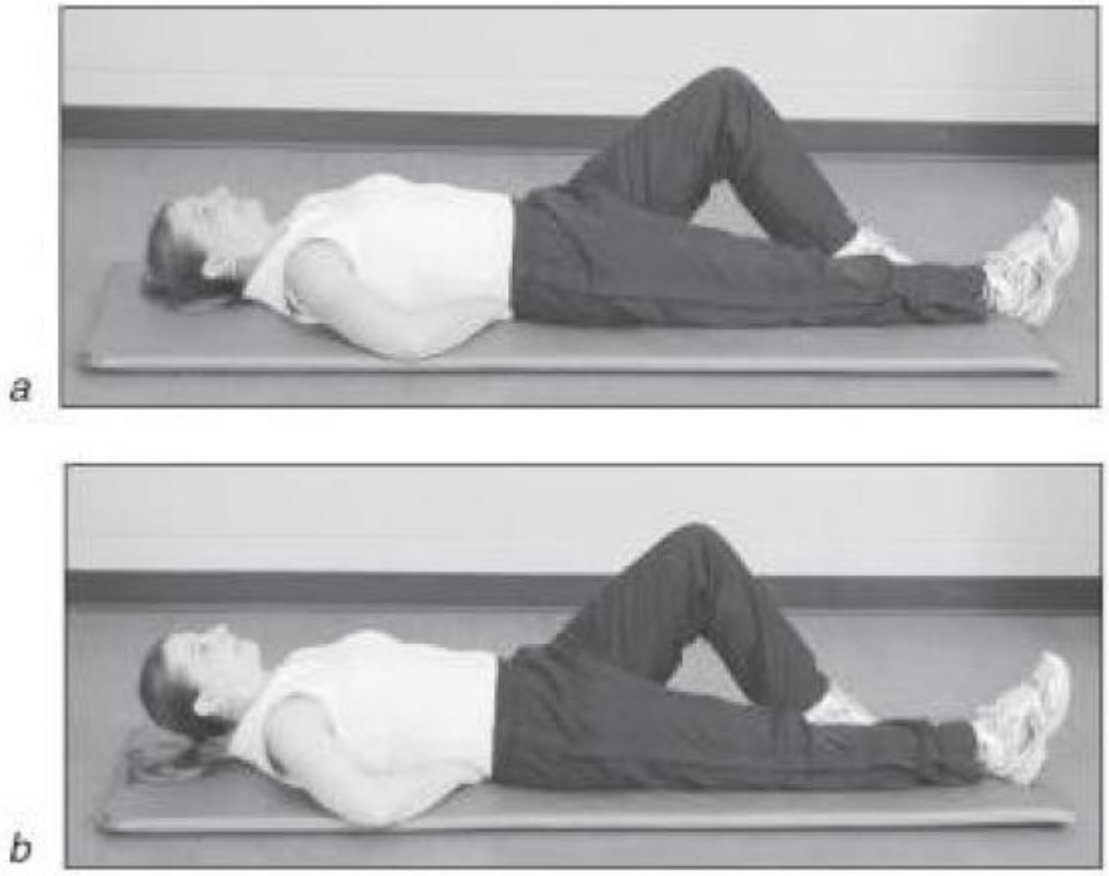
"The findings suggest that individuals with mid-range aberrant motion without signs of hypermobility are likely to benefit from these exercises. The developed model describes altered kinematics of this subgroup of subjects and helps to provide construct validity for the developed CPR."

(Teyhen et al., 2007)

Examples of *stabilization* exercises…

- Exercise including focus on RA, TrA, IO, ES, multifidus, and QL

Curl-Up…..
Beginner's and Intermediate



(McGill, 2007)

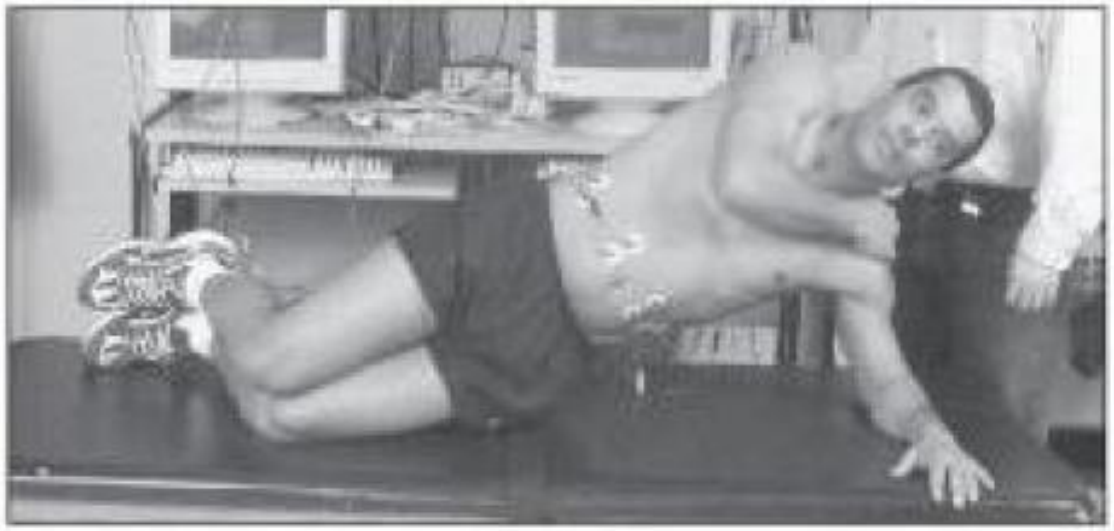
Curl-Up…..
Advanced

(McGill, 2007)

Side-Bridge…..
Beginner's

(McGill, 2007)

Side-Bridge…..
Beginner's and Intermediate



(McGill, 2007)

Bird Dog…..
Beginner's

(McGill, 2007)

Bird Dog…..
Beginner's and Intermediate

(McGill, 2007)

Is there relationship between *gluteal* muscle function and LBP?

Gluteus medius muscle activation patterns as a predictor of low back pain during standing

Erika Nelson-Wong, Diane E. Gregory, David A. Winter, Jack P. Callaghan *

Department of Kinesiology, Faculty of Applied Health Sciences, University of Waterloo, 200 University Avenue West, Waterloo, Ontario, Canada N2L 3G1

Received 31 August 2007; accepted 4 January 2008

Interpretation: "Agonist-antagonist co-activation may not be entirely adaptive, and may in fact predispose some individuals to develop low back pain. Muscle activation patterns at the hip may be a useful addition for screening individuals to identify those at risk of developing low back pain during standing."

non-low back pain groups, and comparisons made to visual analog scale scores.

Findings. 65% of previously asymptomatic participants developed low back pain during the protocol. Co-activation of the bilateral gluteus medius muscles was found to be prevalent in the low back pain group ($P = .002$). 76% of the participants were correctly classified into low back pain and non-low back pain groups based on presence or absence of gluteus medius co-activation, with sensitivity = .87 and specificity = .50.

Interpretation. Agonist–antagonist co-activation may not be entirely adaptive, and may in fact predispose some individuals to develop low back pain. Muscle activation patterns at the hip may be a useful addition for screening individuals to identify those at risk of developing low back pain during standing.

Is there relationship between *gluteal* muscle function and LBP?

Sadler *et al. BMC Musculoskeletal Disorders* (2019) 20:463
https://doi.org/10.1186/s12891-019-2833-4

BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

Gluteus medius muscle function in people with and without low back pain: a systematic review

Sean Sadler[1*], Samuel Cassidy[1], Benjamin Peterson[1], Martin Spink[1,2] and Vivienne Chuter[1,2]

Abstract

Introduction: Globally, low back pain (LBP) is one of the greatest causes of disability. In people with LBP, dysfunction of muscles such as the gluteus medius have been demonstrated to increase spinal loading and reduce spinal stability. Differences in gluteus medius function have been reported in those with LBP compared to those without, although this has only been reported in individual studies. The aim of this systematic review was to determine if adults with a history, or current LBP, demonstrate differences in measures of gluteus medius function when compared to adults without LBP.

Methods: MEDLINE, EMBASE, AMED, PsycINFO, PubMED, Pro Quest Database, CINAHL and SPORTDiscus were searched from inception until December 2018 for published journal articles and conference abstracts. No language restrictions were applied. Only case-control studies with participants 18 years and over were included. Participants could have had any type and duration of LBP. Studies could have assessed gluteus medius function with any quantifiable clinical assessment or measurement tool, with the participant non-weight bearing or weight bearing, and during static or dynamic activity. Quality appraisal and data extraction were independently performed by two authors.

Results: The 24 included articles involved 1088 participants with LBP and 998 without LBP. The gluteus medius muscle in participants with LBP tended to demonstrate reduced strength and more trigger points compared to the gluteus medius muscle of those without LBP. The level of activity, fatigability, time to activate, time to peak activation, cross sectional area, and muscle thickness showed unclear results. Meta-analysis was not performed due to the heterogeneity of included studies.

Conclusion: Clinically, the findings from this systematic review should be considered when assessing and managing patients with LBP. Future studies that clearly define the type and duration of LBP, and prospectively assess gluteus medius muscle function in those with and without LBP are needed.

Trial registration: PROSPERO (CRD42017076773).

Keywords: Low back pain, Systematic review, Gluteus medius, Electromyography

Results: "The gluteus medius muscle in participants with LBP tended to demonstrate *reduced strength* and *more trigger points* compared to the gluteus medius muscle of those without LBP."

(Sadler et al., 2019)

Combined Stabilization and Gluteal Exercises for Chronic LBP

J. Phys. Ther. Sci.
27: 3813–3816, 2015

Original Article

The effects of gluteus muscle strengthening exercise and lumbar stabilization exercise on lumbar muscle strength and balance in chronic low back pain patients

Ui-Cheol Jeong, MS[1)], Jae-Heon Sim, MS[2)], Cheol-Yong Kim, PT, PhD[3)], Gak Hwang-Bo, PhD[1)], Chan-Woo Nam, PT, MS[1)*]

[1)] *Department of Physical Therapy, College of Rehabilitation Science, Daegu University: 201 Daegudae-ro, Gyeongsan-si, Gyeongsangbuk-do, Republic of Korea*
[2)] *Department of Physical Therapy, Ulsan Jaseng Hospital of Korean Medicine, Republic of Korea*
[3)] *Department of Physical Therapy, Ulsan College, Republic of Korea*

Abstract. [Purpose] The aim of this study was to examine the effects of exercise to strengthen the muscles of the hip together with lumbar segmental stabilization exercise on the lumbar disability index, lumbar muscle strength, and balance. [Subjects and Methods] This study randomly and equally assigned 40 participants who provided written consent to participate in this study to a lumbar segmental stabilization exercise plus exercise to strengthen the muscles of the gluteus group (SMG + LES group) and a lumbar segmental stabilization exercise group. [Results] Each evaluation item showed a statistically significant effect. [Conclusion] Clinical application of exercise in this study showed that lumbar segmental stabilization exercise plus exercise to strengthen the muscles of the gluteus resulted in a greater decrease in low back pain disability index and increase in lumbar muscle strength and balance ability than lumbar segmental stabilization exercise in chronic low back pain patients receiving the exercise treatments during the same period.

Key words: Muscle strengthening exercise, Lumbar stabilization exercise, Chronic low back pain

(This article was submitted Aug. 20, 2015, and was accepted Sep. 17, 2015)

(Jeong et al., 2015)

Conclusion: "Clinical application of exercise in this study showed that lumbar segmental *stabilization exercise* plus *exercise to strengthen the muscles of the gluteus* resulted in a greater *decrease* in low back pain *disability* index and *increase* in lumbar muscle *strength* and *balance* ability than lumbar segmental stabilization exercise in chronic low back pain patients receiving the exercise treatments during the same period."

What about *training* the *gluteal* muscles?

Physiotherapy Theory and Practice, 28(4):257–268, 2012

ISSN: 0959-3985 print/1532-5040 online
DOI: 10.3109/09593985.2011.604981

informa
healthcare

SYSTEMATIC REVIEW

A literature review of studies evaluating gluteus maximus and gluteus medius activation during rehabilitation exercises

Michael P. Reiman, PT, DPT, OCS, SCS, ATC, FAAOMPT, CSCS,[1] Lori A Bolgla, PT, PhD, ATC,[2] and Janice K. Loudon, PT, PhD, SCS, ATC, CSCS[3]

[1]*Doctor of Physical Therapy Division, Department of Community and Family Medicine, Duke University School of Medicine, Durham, NC, USA*

[2]*Department of Physical Therapy, Georgia Health Sciences University, Augusta, GA, USA*

[3]*Department of Physical Therapy and Rehabilitation Science, University of Kansas Medical Center, Kansas City, KS, USA*

(Reiman et al., 2012)

Exercise Prescription Based on EMG……..

- *Progression* of exercise may be based on EMG activity of hip muscles
- Maximum Voluntary Isometric Contraction (MVIC):
  - Low level activation: *0-20%* MVIC
  - Moderate level activation: *21-40%* MVIC
  - High level activation: *41-60%* MVIC
  - Very high level: >60% MVIC

(Reiman et al., 2012)

Exercise Prescription EMG: Gluteus *Maximus*

Low/Moderate EMG Activity for Neurological Re-education 0-40% (in ascending order)	Higher Level EMG activation (41-60%) for Strength gain (in ascending order)
Prone bridge/plank (9% MVIC)	Sideways lunge (**41%** MVIC)
Lunge with backward trunk lean	Lateral step-up
Bridge	Transverse lunge
Clamshell with 30° hip flexion	Quadruped arm and leg lift
Lunge	Wall squat
Clamshell 60° hip flexion (**39%** MVIC)	Single-limb squat
	Single-limb deadlift
	Forward step-up – highest!!! (74% MVIC)

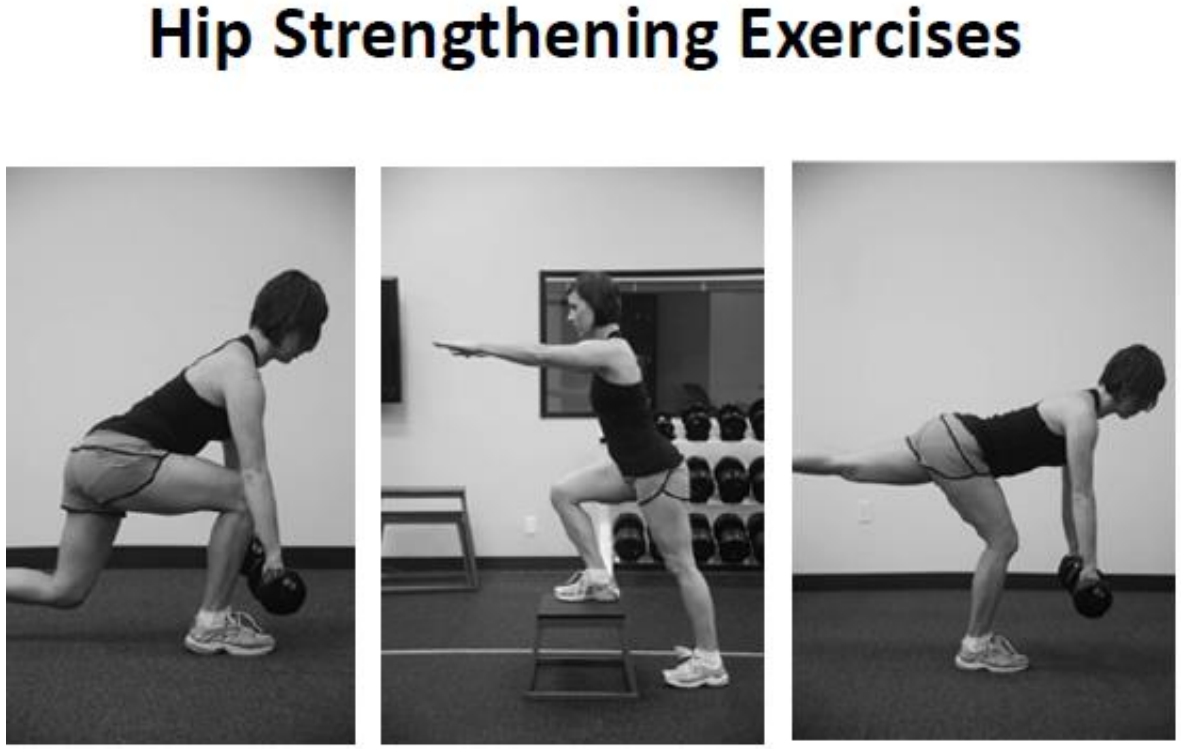
(Reiman et al., 2012)

Forward Step-Up

Forward step-up - YouTube

Exercise Prescription

- Changing a *neutral* trunk to a *forward* trunk lean
  - Increases gluteus *maximus* activation by 22% during lunge exercise



Exercise Prescription: Gluteus *Medius*

Low/Moderate EMG Activity for Neurological Re-education 0-40% (in ascending order)	Higher Level EMG activation (41-60%) for Strength gain (in ascending order)
Prone bridge plank (**27%** MVIC)	Lateral step-up (**41%** MVIC)
Lunge trunk neutral	Quadruped with contralateral arm and leg lift
Unilateral mini-squat	Forward step-up
Clamshell 60° hip flexion	Unilateral bridge
Sideways lunge	Transverse lunge
Clamshell 30° hip flexion (**40%** MVIC)	Side-lying hip abduction
	Single-limb deadlift (**58%** MVIC)

(Reiman et al., 2012)

Bridging Exercise

Manual Therapy 22 (2016) 211–215

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Original article

Modifying the hip abduction angle during bridging exercise can facilitate gluteus maximus activity

Sun-Young Kang [a], Sung-Dae Choung [b], Hye-Seon Jeon [c, *]

[a] Department of Physical Therapy, The Graduate School, Yonsei University, 1 Yonseidae-gil, Wonju, Kangwon-do, Republic of Korea
[b] Department of Physical Therapy, Baekseok University, Anseo-dong, Dongnam-gu, Cheonan-si, Chungcheongnam-do, Republic of Korea
[c] Department of Physical Therapy, College of Health Science, Yonsei University, 1 Yonseidae-gil, Wonju, Kangwon-do, Republic of Korea

Table 2
Back and hip extensor muscle activity and anterior pelvic tilt angle in hip abduction angles.

	Hip abduction angle			
	0°	15°	30°	*p*
EMG[a] amplitude (% MVIC)				
Erector spinae (ES)	50.68 ± 4.93[b]	48.69 ± 5.37	46.82 ± 5.06	0.002[c]
Gluteus maximus (GM)	16.62 ± 1.09	17.96 ± 1.53	20.34 ± 1.40	0.012[c]
GM/ES EMG ratio	0.33 ± 0.04	0.38 ± 0.05	0.45 ± 0.08	0.000[c]
Anterior pelvic tilt angle (°)	8.27 ± 1.19	7.30 ± 0.95	4.66 ± 0.77	0.000[c]

[a] Electromyography.
[b] Mean ± standard deviation.
[c] $p < 0.05$.

Bridging Exercise

- Using TheraBand® isometric contraction with bridge *increased* GMax activity compared to *no* TheraBand® (Choi et al., 2015)

[RESEARCH REPORT]

DAVID M. SELKOWITZ, PT, PhD, OCS, DAAPM[1] • GEORGE J. BENECK, PT, PhD, OCS[2] • CHRISTOPHER M. POWERS, PT, PhD, FAPTA[3]

Which Exercises Target the Gluteal Muscles While Minimizing Activation of the Tensor Fascia Lata? Electromyographic Assessment Using Fine-Wire Electrodes

- Abnormal hip kinematics such as hip *internal rotation* (IR) and hip ADDuction linked to LE disorders
  - TFL is a hip abductor but also an *internal rotator* (IR)
- May want to strengthen hip *abd*uction *without* activating IR muscles….?

[RESEARCH REPORT]

DAVID M. SELKOWITZ, PT, PhD, OCS, DAAPM[1] • GEORGE J. BENECK, PT, PhD, OCS[2] • CHRISTOPHER M. POWERS, PT, PhD, FAPTA[3]

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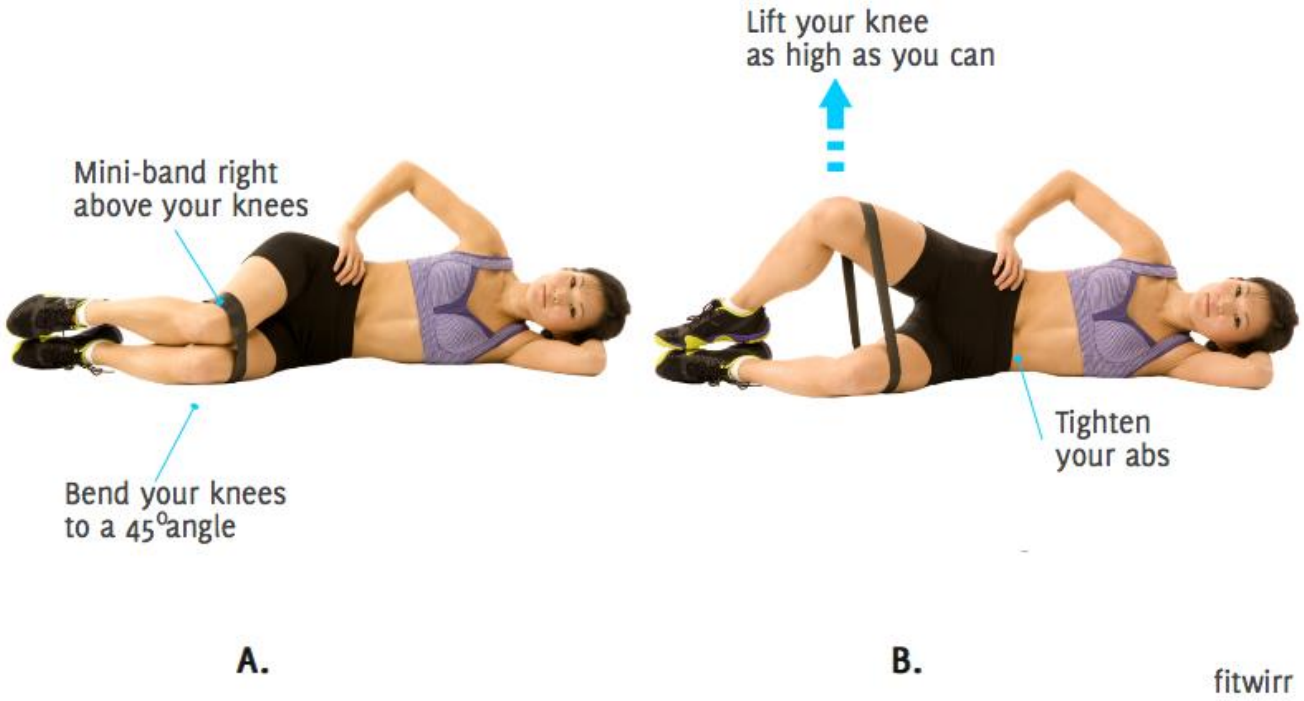
TABLE 2 GLUTEAL-TO-TFL INDEX FOR EACH EXERCISE

Exercise	Gluteal-to-TFL Activation Index
Clam*	115
Sidestep*	64
Unilateral bridge*	59
Quadruped hip extension, knee extending*	50
Quadruped hip extension, knee flexed*	50
Sidelying hip abduction	38
Step-up	32
Bilateral bridge*	32
Squat*	28
Hip hike	28
Lunge	18

Abbreviation: TFL, tensor fascia lata.
**Exercises in which both gluteal muscles demonstrated significantly higher normalized electromyographic signal amplitude than the TFL.*

- Exercises with *high* activity of GMED and GMAX with *low* TFL activity

Clamshell Exercise



Clamshell and Hip Abduction Exercise

- Selkowitz et al., 2014:
  - Clamshell exercises decrease TFL activation when compared to side-lying hip ABD exercises
  - Rotating hip (ER/IR) did *not* affect activation of TFL in side-lying hip ABD
  - Varying hip angle 30°, 45°, 60° did *not* affect activation of TFL in clamshell exercise
  - If goal is to *decrease TFL* activation…….*side-lying CLAM is preferred!*

[RESEARCH REPORT]

JUSTIN W. BERRY, PT, DPT[1] • THERESA S. LEE, BS[2]
HANNA D. FOLEY, BS[2] • CARA L. LEWIS, PT, PhD[2]

Resisted Side Stepping: The Effect of Posture on Hip Abductor Muscle Activation

TABLE 1 MUSCLE ACTIVITY LEVEL FOR EACH LIMB IN EACH POSTURE

	Gluteus Maximus	Gluteus Medius	Tensor Fascia Lata
Upright standing posture*			
Moving limb	8.9 ± 4.3	18.7 ± 8.0	45.2 ± 20.3
Stance limb	12.6 ± 6.7	22.9 ± 9.5	56.2 ± 24.5
Squat posture*			
Moving limb	12.1 ± 7.3	23.3 ± 11.2	33.7 ± 16.5
Stance limb	24.6 ± 12.8	35.7 ± 13.8	38.6 ± 25.0
Statistical analysis†			
Limb	<.001	<.001	<.001
Posture	<.001	<.001	<.001
Side	.756	.610	1.000
Limb by posture	<.001	<.001	.066

*Values are mean ± SD percent maximum voluntary isometric contraction.
†Values are P values. Statistical analysis included linear regression with generalized estimating equation correction.

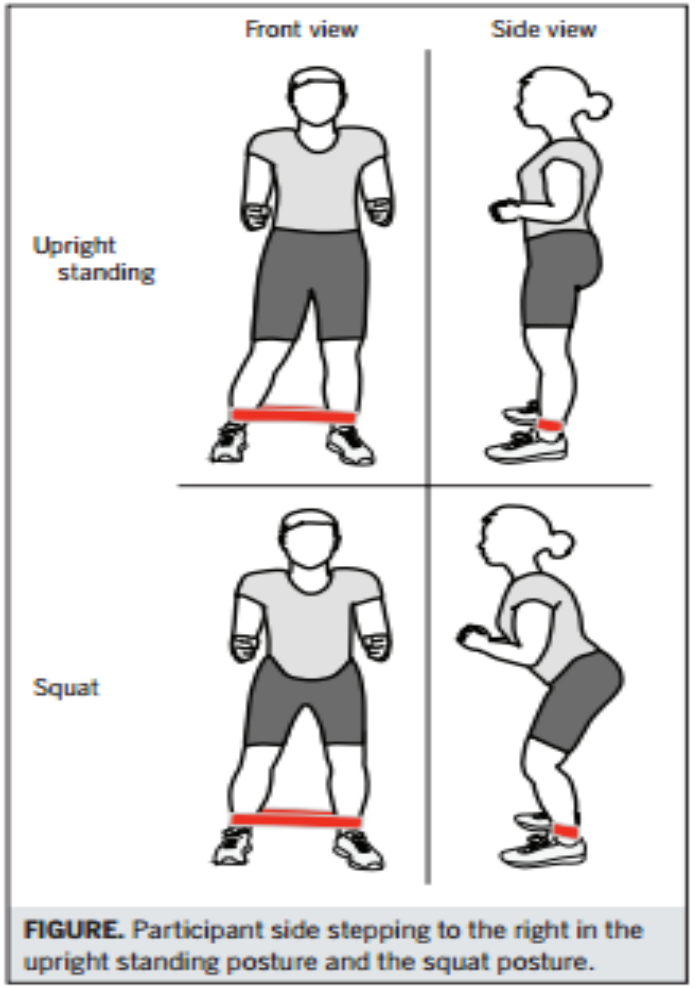


FIGURE. Participant side stepping to the right in the upright standing posture and the squat posture.

- Hip *abd*uctors in *stance* limb more active than *moving* limb
- *Squat* position: TFL activity *reduced*, while GMax and GMed activity *increased*

Summary

- Introduction and Background:
  - LBP *the* most common primary complaint for DC
  - Chronic LBP represents 75% of total treatment costs
- Clinical Practice Guidelines for LBP recommend exercise:
  - ACP (Qaseem et al., 2017)
  - CCGPP (Globe et al., 2016)
- Clinical Prediction Rules:
  - Exercises for LBP

To close, I'd like to ask you to do this one thing.....

Consider *exercise/movement* and its *benefit* for *LBP*!!!

Questions???

Comments or Feedback.....

Please email……bryan.bond@allencollege.edu

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