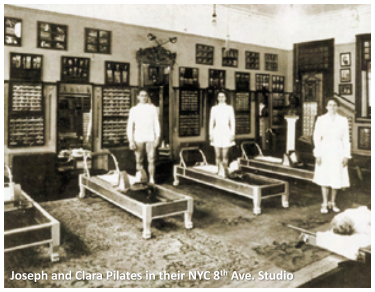
Why is research important to the the Pilates Teacher?

Download Handouts:
http://www.therapilates.com/pilatesmethod.html

with Sherri Betz, PT, DPT, GCS, CEEAA, PMA®-CPT

Contrology

Joseph and Clara Pilates developed the method, originally called *Contrology* from 1926-1971.



2

Joseph Pilates

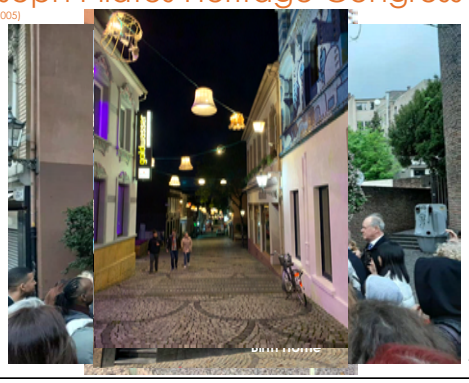
(PMA, 2005)

- Creator of Pilates(Contrology)
- Born near Dusseldorf in Monchengladback, Germany
- Suffered from asthma, rickets and rheumatic fever.
- He managed to overcome his physical limitations by developing his own program of exercise and bodybuilding.

3

Joseph Pilates Heritage Congress

(PMA, 2005)



4

Joseph Pilates, 1945

(Pilates J, 1945)

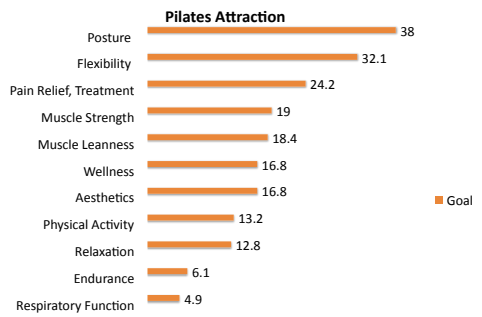
- "***Contrology*** is complete coordination of body, mind and spirit."
- "Physical fitness is the first requisite of happiness. Our interpretation of physical fitness is the attainment and maintenance of a uniformly developed body with a sound mind, fully capable of naturally, easily and satisfactorily performing our many and varied ***daily tasks*** with spontaneous zest and pleasure"

5

What attracted you to the Pilates Method?

von Sperling de Souza M and Brum Vieira C. (2006) Who are the people looking for the Pilates method? *Journal of Bodywork and Movement Therapies* 10(4): 328-334.

6



von Sperling de Souza M and Brum Vieira C. (2006) Who are the people looking for the Pilates method? *Journal of Bodywork and Movement Therapies* 10(4): 328-334.

7

Pilates Peer Reviewed Literature Published As of August 2019…

Systematic Reviews/Meta Analysis	30
Literature Reviews	3
Randomized Controlled Trials	103
Non-Randomized Controlled Trials	13
Descriptive/Obs, Pre-Post Design	69
Case Reports	8
Expert Opinion/Editorials	16+
TOTAL	242

Compiled by Dr. Sherri Betz,
Chair of Pilates Method Alliance Research Committee

8

Pilates in the Literature

Physical or Muscle Benefit	80
Disease or Disability *(not incl LBP)*	66
Low Back Pain	45
Older Adults	32
Balance/Fall Prevention	25
Quality of Life	24
Respiratory	15
Posture	13
Mental/Cognitive	10
Sports/Dance	9
Teaching	6
Adolescents	5
Rehabilitation	4
Cardiovascular	4

Compiled by Dr. Sherri Betz,
Chair of Pilates Method Alliance Research Committee

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Pilates in the Literature

Physical, Functional, or Muscle Benefit — 80 papers

- Functional
- Fitness
- Flexibility
- Body Composition
- Ms Strength/Thickness/Activation
- Endurance
- Intra-Abdominal Pressure
- Motor Control
- Pelvic Floor

The quality and rigor of Pilates research has improved over the past 5 years!

Compiled by Dr. Sherri Betz,
Chair of Pilates Method Alliance Research Committee

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Pilates in the Literature

Disease or Disability — 111 papers

- *Low Back Pain (45 papers)*
- Cancer
- MS
- Osteoporosis
- Neck Pain
- Obesity
- THA/TKA
- Ankylosing Spondylitis
- Fibromyalgia
- Incontinence
- Scoliosis
- Menopause
- Prostatectomy
- Arthritis
- Cardiovascular
- Cerebral Palsy
- COPD
- Heart Failure
- Hypertension
- Lateral Epicondylosis
- Post-partum
- Spondylolisthesis
- Stroke
- TMJD
- Hypermobility *(Expert Opinion)*

Compiled by Dr. Sherri Betz,
Chair of Pilates Method Alliance Research Committee

11

Why is research important to the Pilates industry?

- Pilates is no longer the novel approach to exercise
- Pilates has become more mainstream
- Pilates Industry needs more differentiation from other fitness methods in order to remain a viable and credible exercise approach
- Pilates has reached its peak in popularity and has begun to decline in the fitness industry (in urban markets)
- Studio owners can no longer just open their doors and expect a flood of clients to walk in the door
- We have to work hard at marketing and educating the public to understand that Pilates is not a passé fad
- Research is a way to to create this credible public perception.

12

Pilates needs to be credible…

- To be a credible choice in the evidence-based medical rehabilitation community, the Pilates community needs to invest in research
- Pilates should not depend on anecdotal evidence to support its claims
- Pilates needs to be compared against other forms of exercise in randomized clinical trials with large numbers of subjects in order to be taken seriously by evidence-based medical practitioners
- Many practitioners make claims as to what Pilates can do for certain conditions, but how do they know that it is the Pilates method that is actually making that difference?

13

Client measurable outcomes…

- The difference in the client's outcome could be that the instructor's expertise and intention changed the client's self-perception
- ANY exercise that a client began after being sedentary may have improved their strength, flexibility, posture, balance or decreased their pain
- If we don't compare Pilates side by side with other forms of exercise, controlling for as many variables as possible, we will never know if it is really Pilates that made the difference.

14

Defining Pilates

- The Pilates Method needs to be clearly defined in medical literature for measurable changes to be attributed to Pilates exercise
- Lise Stolze, PT, and member of the PMA Research Committee ran into a roadblock when publishing her 2012 *Journal of Orthopedic & Sports Physical Therapy* paper: "Derivation of a Preliminary Clinical Prediction Rule for Identifying a Subgroup of Patients With Low Back Pain Likely to Benefit From Pilates-Based Exercise"
- Dr. Stolze polled many practitioners and consulted the PMA Board members to help define Pilates.
- She used the word Pilates-based to define the method in her study.
- She worked with renowned researcher, Dr. John Childs, who has been instrumental in establishing Clinical Prediction Rules for many pathologies treated in the field of physical therapy practice.
- The objective of the study was to derive a preliminary clinical prediction rule for identifying a subgroup of patients with low back pain (LBP) likely to benefit from Pilates-based exercise.

15

Types of Research

Hierarchy of Evidence

Graphic From: Evidence-Based Practice in the Health Sciences: Evidence-Based Nursing Tutorial Information Services Department of the Library of the Health Sciences-Chicago, University of Illinois at Chicago. Contact lib-cref {at}uic.edu

16

Systematic Reviews

- Summary of the medical literature
- Uses explicit methods to perform a comprehensive literature search
- Critical appraisal of individual studies
- Statistical techniques analyzed and interpreted
- Results and conclusions drawn from comparison of included studies

17

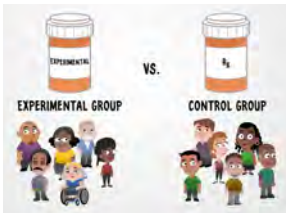
Meta Analysis

- A particular type of systematic review that attempts to combine and summarize quantitative data from multiple studies using sophisticated statistical methodology.

18

Randomized Controlled Trial

- An experimental, prospective study in which "participants are randomly allocated into an experimental group or a control group and followed over time for the variables/outcomes of interest."



19

Cohort Study-Retrospective

- An observational study looking back on outcomes that have already happened or pre-existing data
- Involves identification of two groups (cohorts) of patients
  - Group that received the exposure of interest,
  - Group that did not receive any exposure
- The exposures are defined before looking at the existing outcome data to see whether exposure to a risk factor is associated with a statistically significant difference in the outcome development rate.

20

Cohort Study-Prospective

- More commonly, people are recruited into cohort studies regardless of their exposure or outcome status. This is one of their important strengths.
- People are often recruited because of their geographical area or occupation, and researchers can then measure and analyze a range of exposures and outcomes.
- Involves identification of two groups (cohorts) of patients
  - Group that received the exposure of interest,
  - Group that did not receive any exposure
- The study then follows these participants for a defined period to assess the proportion that develop the outcome/ disease of interest.
- Cohort studies are good for assessing prognosis, risk factors and harm.
- The outcome measure in cohort studies is usually a risk ratio / relative risk (RR).

21

Case-Controlled Study (Observational)

- An observational, *retrospective* study
- Involves identifying patients who have the outcome of interest (cases) and control patients without the same outcome
- Includes two clearly defined groups at the start: one *with* the outcome/disease and one *without* the outcome/disease
- They look *back* to assess whether there is a statistically significant difference in the rates of exposure to a defined risk factor between the groups.

22

Case Study

- Prospective pre-planned intervention applied to a willing subject
- Case Studies require institutional review board approval for research on human subjects to be published
- Empirical inquiry that investigates a phenomenon within its real-life context
- Can mean single and multiple case studies
- Can include quantitative evidence
- Relies on multiple sources of evidence
- Case studies should not be confused with qualitative research
- Can be based on any mix of quantitative and qualitative evidence

23

Case Series

- A descriptive, observational report on a series of patients with an outcome of interest
- generally small descriptive studies, tracking patients derived by a health care setting (i.e. register of cases) with a known exposure or receiving the same treatment and examine their outcome.
- Observes the experience of a group of patients with the same diagnosis
- No control group involved
- Can describe characteristics or outcomes in a particular group of people, but cannot determine how they compare with people who are treated differently or who do not have the condition.

24

Case Report

- *Retrospective* detailed report of the management of an individual's single case or a group of subjects' unusual condition or a condition that is rare or poorly reported in the literature
- Often a practitioner finds that a particular intervention worked quite well in achieving the desired goals or outcomes and would like to share that information formally with colleagues
- May also describe a novel or unique therapeutic approach to a particular condition
- May be just a chart review or an anecdotal account
- Relatively low level of evidence
- Less scientifically rigorous due to its lack of control over confounding variables and small sample size
- Valuable as evidence to stimulate and share new ideas for further investigation

25

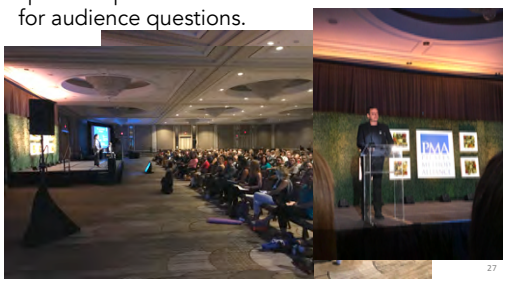
Components of a Case Report

- TITLE
- PURPOSE & BACKGROUND (RELEVANCE TO PILATES TEACHERS OR CLIENTS)
- HUMAN SUBJECTS PROTECTION/ CONFIDENTIALITY & CONSENT
- SUBJECT/CLIENT HISTORY
- METHODS & MATERIALS
- ASSESSMENT/ANALYSIS
- INTERVENTION
- RESULTS & CONCLUSION
- FUNDING SOURCE
- REFERENCES

26

PMA Research Forum Oral Presentations

15-minute oral presentations to a seated audience, with 10 minutes devoted to the speaker's presentation and 5 minutes reserved for audience questions.



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PMA Research Forum: 2 Formats

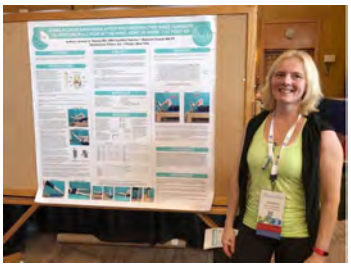
- **Oral Presentations:** Conducted in a large amphitheater where 5-6 presenters have been selected by the PMA Research Committee to present their research projects in 10 min + 5 min devoted to Q & A.
- **Poster Presentations:** Reports in which information is summarized using brief written statements and graphic images printed and mounted on a poster board. The poster is on display throughout the entire conference with designated times to meet the authors.

28

Research Posters

Joanna Telacka's excellent example of a research poster presentation at PMA Conference

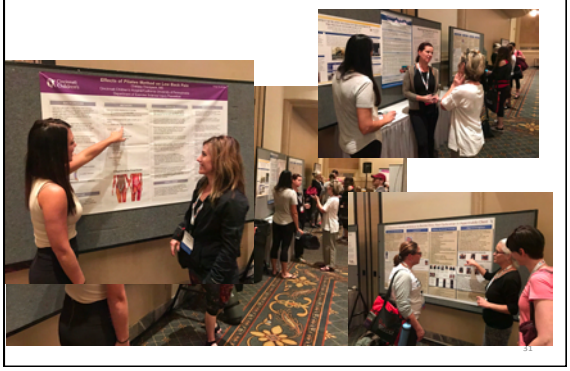
Poster Format



Telacka J, Telacki W. (2017). "Using Pilates exercises after reconstructive knee surgery to restore full ROM in the knee joint in week 6 – 12 post op: Single Case Report. *Poster Presentation PMA Annual Conference 2017 Palm Springs, CA.*

30

PMA Poster Presentations



PMA Research Committee Members

- CHAIR: Sherri Betz, PT, DPT, NCPT
- VICE CHAIR: Karyn Staples, PT, PhD
- SECRETARY: Anne Bishop, BS, Ed.M, NCPT
- Virgina Cowen, PhD, LMT
- Rebecca Hess, BS, MS, MFA, PhD
- Lise Stolze, PT, DSc, NCPT
- Craig Ruby, PT, MPT, D.Ed, NCPT
- Tom Welsh, BA, MS, MA, PhD

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PMA Research Submissions

Call for Research

Pilates Method Alliance
19th Annual Meeting
Research Oral and Poster Presentations
Monterey, CA October 23-26, 2019

Tacoma, WA Nov 4-7, 2020 Conference
Deadline for Submission: 12/1/2019

https://www.pilatesmethodalliance.org/research

33

Pilates Defined in Literature

Wells C et al. (2012) Defining Pilates exercise: A systematic review. *Complement Ther Med* Feb 2012.

"Pilates is a mind-body exercise that targets core stability, strength, flexibility, posture, breathing and muscle control."
Wells, 2012

119 Papers fulfilled inclusion criteria. Quality varied.

Papers had to include assessment of the effectiveness o Pilates, where the term "Pilates" was used to describe the type of prescribed exercise being investigated.

Exercises described as "motor control" or "lumbar stabilisation" did NOT suffice for Pilates.

34

Pilates Defined in Literature

Posture was discussed statistically significantly more often in papers with participants with low back pain compared to papers with healthy participants.

Traditional Pilates principles of centering, concentration, control, precision, flow, and breathing were in 23% of papers.

Apart from breathing, these principles were not mentioned in papers with low back pain participants.

There was general consensus in the literature on the definition of Pilates.

35

Delphi Surveys

Wells C, et al. (2014) The Definition and Application of Pilates Exercise to Treat People With Chronic Low Back Pain: A Delphi Survey of Australian Physical Therapists. *Physical Therapy* 94(6): 792-805.

Wells C, et al. (2014) Indications, Benefits, and Risks of Pilates Exercise for People With Chronic Low Back Pain: A Delphi Survey of Pilates-Trained Physical Therapists. *Physical Therapy* 94(6): 806-817.

36

Delphi Surveys

Giangregorio LM, et al. (2015) Too Fit To Fracture: outcomes of a Delphi consensus process on physical activity and exercise recommendations for adults with osteoporosis with or without vertebral fractures. *Osteoporosis Int* 26(3): 891-910.

Giangregorio LM, et al. (2014) Too Fit To Fracture: exercise recommendations for individuals with osteoporosis or osteoporotic vertebral fracture. *Osteoporosis Int* 25(3): 821-835.

37

Important Systematic Reviews

38

Wells 2013
Systematic Review of Systematic Reviews

Wells C, et al. (2013). Effectiveness of Pilates exercise in treating people with chronic low back pain: a systematic review of systematic reviews. *BMC Medical Research Methodology 13*(1), 7.

5 Systematic Review Papers Selected:

- Aladro-Gonzalvo, 2012
- La Touche, 2008
- Lim, 2011
- Pereira, 2011
- Posadzki, 2011

39

Wells 2013
Systematic Review of Systematic Reviews

5 Systematic Review papers:

- Aladro-Gonzalvo 2013
- La Touche 2008
- Lim 2011
- Pereira 2011
- Posadzki 2011

Total of 10 primary studies found in the 5 Systematic Review Papers:

- Donzelli 2006
- Gladwell 2006
- da Fonseca 2009
- Rydeard 2006
- Vad 2007
- Anderson 2005
- Gagnon 2006
- MacIntyre 2006
- Quinn 2005
- O'Brien 2006

40

Wells 2013
Systematic Review of Systematic Reviews

CONCLUSION: Inconclusive evidence that Pilates is effective in reducing pain and disability in people with chronic low back pain.
Small number and poor methodological quality of primary studies.
The *Revised Assessment of Multiple Systematic Reviews* provides a useful method of appraising the methodological quality of systematic reviews. Individual item scores, however, should be examined in addition to total scores, so that significant methodological flaws of systematic reviews are not missed, and results are interpreted appropriately.

41

Byrnes, 2018

Byrnes K, et al. (2018) Is Pilates an effective rehabilitation tool? A systematic review. *J Bodywork Move Ther* 22(1): 192-202.

- A review of the literature on the effectiveness of Pilates as a rehabilitation tool in a wide range of conditions in an adult population.
- Searching for cohort studies or RCTs
- 23 studies, (2005 – 2016) met inclusion criteria

- *Low Back Pain*
- *Ankylosing Spondylitis*
- *Multiple Sclerosis*
- *Post-Menopausal*
- *Osteoporosis*
- *Non-Structural Scoliosis*
- *Hypertension*
- *Chronic Neck Pain*

42

Byrnes, 2018

LOW BACK PAIN: 14 studies selected
10/14 Studies: Pilates group showed a statistically significant decrease in pain

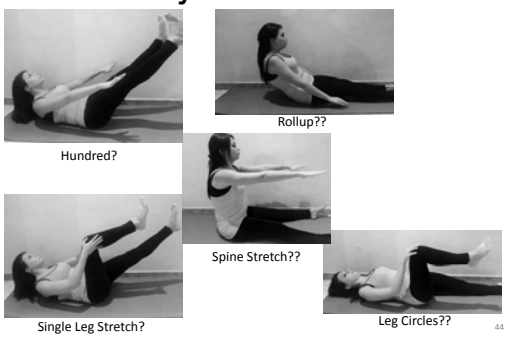
Anand (2014)
Da Luz (2014
Donzelli (2006)
Lee (2014)
Marshall (2013)
Gladwell (2006)
Miyamoto (2013)
Natour (2015
Patti (2016)
Quinn (2011)

Did not:
Gagnon (2005)
Mostagi (2015)
Curnow (2009)
Wasjeweller (2012)

43

Byrnes, 2018

Patti 2016 Quality??



44

Byrnes, 2018

5 Studies: Statistically significant decrease in **disability** in Pilates group

Donzelli, et al. (2006)
Marshall, et al. (2013)
Miyamoto, et al. (2013)
da Luz, et al. (2014)
Gagnon (2005)

Quinn, et al. (2011) showed small decrease in disability but not significant

45

Byrnes, 2018

3 Studies: **Clinically** significant improvement in **pain** in Pilates group:

Mostagi, et al. (2015)
Miyamoto, et al. (2013)
Natour, et al. (2015)

2 Studies: **Clinically** significant improvement in **pain** and **disability** in Pilates group:

da Luz, et al. (2014)
Marshall, et al. (2013)

46

Byrnes, 2018

2 Studies: Pilates was not better *(but not worse)* than controls:

Mostagi, et al. (2015)
Curnow, et al. (2009)

2 Studies: Both Pilates and Control groups showed significant improvements:

Gagnon (2005)
Wajswelner, et al. (2012)

Suggests that Pilates may be effective, even if it is not more effective than their general exercise program…

47

LETS DIVE IN!

48

PILATES FOR LBP *Quinn, 2011*

Quinn, K., et al. (2011). "Do patients with chronic low back pain benefit from attending Pilates classes after completing conventional physiotherapy treatment?" Physiotherapy Practice and Research 32(1): 5-12.

- Single blinded RCT
- Inclusion Criteria
  - Age 18-60 years
  - No radiating pain below the knee
  - Willing to attend 8 weeks of Pilates classes
  - Some residual LBP
  - Failed SAT (Sahrmann Abdominal Test) for core stability

49

PILATES FOR LBP *Quinn, 2011*

Quinn, K., et al. (2011). "Do patients with chronic low back pain benefit from attending Pilates classes after completing conventional physiotherapy treatment?" Physiotherapy Practice and Research 32(1): 5-12.

- Single blinded RCT
- 181 LBP patient charts who had completed physiotherapy treatment in the participating hospital during a 6 month period were screened for study inclusion.
- 29 women were recruited and randomly allocated.
- Pilates Group: (N=15) 1 hour modified Pilates Mat Class
- Control Group: (N=14) No intervention

50

PILATES FOR LBP *Quinn, 2011*

- Outcome Measures:
  - Visual Analog Pain Scale
  - Roland Morris Disability Questionnaire
  - Sahrmann Abdominal Test for Lumbopelvic Control

51

How did they measure lumbopelvic stability?

- SAT Sahrmann Abdominal Test: a pressure biofeedback unit (PBU) inflated to 40mmHG placed under the lumbar spine of the subject.
- Subject lifts one foot off the floor raising the hip to 90deg flexion and is requested to keep the lumbar spine stable during movement of the leg
- Fails test if pressure reading on the PBU increases by more than 2 mmHg during the upward movement of the leg.

52

PILATES FOR LBP *Quinn, 2011*

Conclusions:

- Some evidence to show that Pilates classes may benefit subjects with LBP
  - reduction of pain
  - improvement of disability
  - lumbopelvic control

53

PILATES FOR LBP DONZELLI, 2006

DONZELLI (2006) Two different techniques in the rehabilitation treatment of low back pain: a randomized controlled trial. *Eura Medicophys 42(3): 205-210.*

Subjects: Ages: 26-65.
Inclusion Criteria: Duration of LBP >3months without peripheral radiation
N= 40, F-26, M-14 (Pilates Group=20, Back School=20)
Experimental Group: Pilates CovaTech Matwork 60 min, 10.5 Consecutive Sessions
Control/Comparison Group: Back School 60 min, 10.5 Consecutive Sessions

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PILATES FOR LBP DONZELLI, 2006

CovaTech Pilates Exercises: Postural education, search for neutral position, sitting exercises, antalgic exercises, stretching exercises, proprioceptivity improvement exercises, breathing education, and mobilization of the cervical spine and the scapula–humeral joint.

55

PILATES FOR LBP DONZELLI, 2006

Outcome Measures:
- Pilates CovaTech Matwork:
  - VAS, pre: 7.3, post: 4.5
  - ODQ, pre: 13.6, post: 6.9
- Back School:
  - VAS (Visual Analog Scale) pre: 6.8, post: 4.3
  - ODQ pre: 10.0, post: 7.7

Conclusions: Both Back School and Pilates interventions were effective in decreasing pain and disability. Subjects reported **greater satisfaction and compliance with Pilates** indicating that Pilates may be a viable alternative to the treatment of chronic LBP.

56

PILATES FOR LBP GLADWELL, 2006

GLADWELL (2006) *Does a program of Pilates improve chronic non-specific low back pain? J. Sport Rehabil. 15, 338-350.*
Subjects: Age 29-54 **Randomized Controlled Trial**
Inclusion Criteria: Between 18-60 years of age. Low back pain chronic for at least 12 weeks not attributable to any specific pathology located below scapulae and above the gluteal fold.
N= 34 (F-26, M-8) Pilates Group=20, Control Group=14
Experimental Group: N=20 Pilates: 1xW x 6 wks, Pilates exercises (posture check, recruitment of "core muscles," etc)
Control/Comparison Group: N=14 6 weeks, continue with normal activities and pain relief

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PILATES FOR LBP GLADWELL, 2006

Outcome Measures:
- Pilates:
  - RMVAS (Roland Morris Visual Analog Scale) pre: 2.7, post: 2.2
  - ODQ (Oswestry Disability Questionnaire) pre: 19.7, post: 18.1
- Control:
  - RMVAS pre: 2.4, post: 2.4
  - ODQ pre: 24.1, post: 18.1

58

PILATES FOR LBP GLADWELL, 2006

Conclusions:
- Significant decrease in pain, but no significant decrease in disability, from pre-intervention to post-intervention.
- Improvements seen in the Pilates group post- intervention period with increases in general health, sports functioning, flexibility, proprioception, and a decrease in pain.
- Control group showed no significant differences in the same measures post- intervention.
- Authors suggest that Pilates method used as a specific core stability exercise incorporating functional movements can improve nonspecific CLBP in active populations.

59

PILATES FOR LBP GLADWELL, 2006

Comments:
Gladwell gradually used more dynamic movements to increase the complexity of the Pilates-based exercises.

Gladwell reported a high compliance rate with 90% (18/20) of the participants in the Pilates group performing home exercises twice per week and 100% performing home exercises at least once a week.

60

Now on to a few more important studies on Pilates and Low Back Pain…

Remember, there are 45 studies published!

PILATES FOR LBP
ALADRO-GONZALVO, 2013

Aladro-Gonzalvo AR, et al. (2013) Pilates-based exercise for persistent, non-specific low back pain and associated functional disability: a meta-analysis with meta-regression. [Review]. *J Bodyw Mov Ther* 17(1): 125-136

9 Trials Selected:

- Rydeard, et al. (2006)
- Donzell,i et al. (2006)
- MacIntyre (2006)
- Anderson (2005)
- Gagnon (2005)
- Gladwell, et al. (2006)
- O'Brien (2006)
- da Fonseca (2009)
- Quinn (2005)

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PILATES FOR LBP
ALADRO-GONZALVO, 2013

Aladro-Gonzalvo AR, et al. (2013)

This **systematic review** provides evidence that Pilates-based exercise is moderately superior to minimal intervention for pain relief in subjects with persistent, non-specific LBP. This finding was based on pooled data from 4 different trials (i.e., therapeutic massage, traditional dynamic lumbar stabilisation exercises, back school and standard physiotherapy) where Pilates was not superior to these particularly prescribed treatments.

63

PILATES FOR LBP *ANDERSON 2005*

Anderson BA. (2005) Randomized clinical trial comparing active versus passive approaches to the treatment of recurrent and chronic low back pain. Dissertation, University of Miami. *(Included in Lim, 2011 and Aladro-Gonzalvo, 2013 Review Papers)*

Subjects: Age 38-58

Inclusion Criteria: Subjects suffered from CLBP: Chronic LBP or RLBP: Recurrent Low Back Pain lasting from 18-58 months

N= 21 (10 Female, 11 Male)

Pilates Group: Pilates Reformers; 50 min 2xW, 12 sessions

Comparison Group: Therapeutic Massage, 30 min, 2xW, 12 sessions

64

PILATES FOR LBP *ANDERSON 2005*

Outcome Measures:

Pilates:

MBI: Miami Back Index Pain Scale: pre 33.5; post 24.2

ODQ: Oswestry Disability Questionnaire-Quality of Life, pre16.7 (4.2); post 13.9 (5.7)

SF-36, Trunk Strength (Back Extensor Strength) greater in Pilates subjects

Therapeutic massage:

MBI-pain, pre: 39.3; post 35

ODQ pre: 18.5; post 17.9

Exercises: Polestar Pilates Reformer basic to intermediate level exercises with modifications as needed. 10-12 participants per session.

65

PILATES FOR LBP *RYDEARD, 2006*

Rydeard R, et al. (2006) Pilates-based therapeutic exercise: effect on subjects with nonspecific chronic low back pain and functional disability: a randomized controlled trial. *J Orthop Sports Phys Ther* 36(7): 472-484.

N= 39 (F-25, M-14)

Pilates Group: N=21 Pilates Mat and Reformer exercises designed to activate lumbo-pelvic stability. PT's taught 60min, 3xW, 12 sessions +15 min Pilates Mat home program performed 6xW.

Control/Comparison Group: N=18 Usual care (consults with physicians/health care professionals PRN.) Health usual care, analgesics, PT PRN, no exercise. Instructed to continue participating in their usual physical activity.

66

PILATES FOR LBP *RYDEARD, 2006*

Rydeard R, et al. (2006)

Outcome Measures:

Pilates:

NRS-101 (Pain): pre: 23.0, post: 18.3 ↓

RMDQ-HK (Roland Morris Disability Questionnaire-Hong Kong): pre: 3.1, post: 2.0 ↓

Control:

NRS-101 (Pain): pre: 30.4, post: 33.9 ↑

RMDQ-HK: pre: 4.2, post: 3.2 ↓

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PILATES FOR LBP *RYDEARD, 2006*

Conclusions: Main finding was that a program of specific exercise directed at retraining neuromuscular control, provided by a physiotherapist, and ***based*** on the Pilates method was more efficacious in reducing pain intensity and functional disability levels when compared to usual care. Changes were maintained over a 12 month period in the Pilates group.

Pilates Exercise: Pilates subjects recruited the pelvic floor and lumbar multifidus and then activated the gluteus maximus during a variety of movement patterns involving hip extension. Movements were initially performed in supine with lumbar spine in neutral and then progressed to more upright postures with movement out of neutral postures.

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PILATES FOR LBP *SCHENCK, 2017*

Schenck E. (2017) The Pilates Method of Exercise: Effectiveness in the Treatment of Chronic Low Back Pain and Intervention Limitations. *Presented at PMA Research Forum* 2017, Las Vegas.

Objective

Introduces several articles on low back pain, revealing limitations often encountered in Pilates research.

Goal of article: Assess effectiveness of the Pilates method in treatment of chronic low back pain by reviewing scientific studies in which the Pilates Method was used as treatment.

Critical look at studies' limitations and types of exercises used.

Studies required to meet scholarly standards, be peer reviewed and be randomized and controlled trials.

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PILATES FOR LBP: *SCHENCK, 2017*

Study inclusion criteria

A Boolean search for randomized controlled and clinical trials using (Pilates) AND "low back pain" on PubMed (including MEDLINE) returned 24 results.

1 study was excluded because it was not available as full text.

1 study was only the protocol of a randomized control without results.

11 studies were excluded because they were reviews or not randomized controlled or clinical trials or because they showed up in the results without actually incorporating both keywords.

11 studies were selected.

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PILATES FOR LBP: *SCHENCK, 2017*

The effectiveness of Pilates in treatment of low back pain:

Regardless of the limitations of the selected studies described below, the success of Pilates-based exercise in the rehabilitation of low back pain is undeniable:

Author	Results
Borges et al., 2014	There was significant reduction in pain intensity and quality of life after the Pilates exercise protocol. In the control group, the parameters remained the same or deteriorated. When the groups switched, a significant response in almost all parameters was seen during the second evaluation.
Cruz-Díaz et al., 2015	There were significant differences between groups after 6 weeks of treatment, with better results in the Pilates group. After 1-year follow-up, only the Pilates group showed better results compared with baseline.
Cruz-Díaz et al., 2015	Only the Pilates group showed improvement in fear of falling and functional mobility and balance after treatment, and also had better results in pain than the physiotherapy-only group.

PILATES FOR LBP: *SCHENCK, 2017*

Author	Results
da Fonseca et al., 2009	The Pilates method can improve weight discharge in gait and reduce pain compared with no intervention.
da Luz et al., 2014	Equipment-based Pilates showed a significant improvement in all measures after 6 weeks as well as after 6 months. Mat-Pilates showed a significant improvement in all measures after 6 weeks and all but 1 measure after 6 months.
Gladwell et al., 2006	Pilates can improve non-specific chronic low back pain compared to no intervention. Pilates can improve general health, pain level, sports functioning, flexibility, and proprioception in individuals with chronic low back pain.
Lee et al., 2014	Balance and pain decreases significantly for the mat and the equipment Pilates groups.
Miyamoto et al., 2013	Improvements were observed in pain, disability and global impression of recovery in favor of the Pilates group, but these differences were no longer statistically significant at 6 months.

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PILATES FOR LBP: *SCHENCK, 2017*

Author	Results
Natour et al., 2015	Statistical differences favoring the Pilates group were found with regard to pain, function and quality of life. Statistical differences were also found between groups regarding the use of pain medication at T45, T90 and T180, with the Pilates group taking fewer NSAIDs than the CG.
Rydeard et al., 2006	The individuals in the specific-exercise-training group reported a significant decrease in pain and disability, which was maintained over a 12-month follow-up period. Treatment with a modified Pilates-based approach was more efficacious than usual care in a population with chronic, unresolved LBP.
Wajswelner et al., 2012	An individualized clinical Pilates program produced similar beneficial effects as a general exercise program in community volunteers with chronic low back pain.

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PILATES FOR LBP: *SCHENCK, 2017*

Due to the different measurements and intervention ranges, there is no statistical data analysis possible.

Following a comparative result list:
- 10 studies demonstrate greater beneficial effects compared to other exercise therapies or the control group.
- 1 study demonstrates similar beneficial effects compared to other exercise therapies or the control group.
- All 10 studies measure pain intensity (among other measures), which decreases post-Pilates intervention in all studies.

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PILATES FOR LBP: *SCHENCK, 2017*

General limitations in Pilates research

Pilates exercises are being used by physical therapists to support rehabilitation programs for various musculoskeletal conditions, sports injuries, and neurological disorders, focusing especially on the spine and its stabilization.

The increased use of Pilates-based exercises makes it imperative to understand, among other characteristics, its applications, its contraindications, and how to use it appropriately.

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PILATES FOR LBP: *SCHENCK, 2017*

General limitations in Pilates research on Pilates & LBP

Scholarly standards: Some studies don't meet scholarly standards; studies not randomized controlled trials or clinical trials or are not peer reviewed.

Measurements: Some studies use only subjective data analysis tools (scales and questionnaires) that evaluate parameters (pain intensity and disability); others also use functional tests, such as balance and flexibility.

Study methods: While subject numbers are generally >20, which is satisfactory, the most significant factors observed are the differences in intervention length and frequency, with 4 weeks being the shortest intervention time.

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PILATES FOR LBP: *SCHENCK, 2017*

General limitations in Pilates research

Following are inconsistencies related to movement standards that influence scientific evaluation and are further detailed in subsequent pages:

Pilates equipment: Most studies use only Mat exercises, but some studies use original Pilates equipment, which is a different biomechanical approach.
A few studies use equipment often associated with Pilates, but has its origin in fitness or rehabilitation, such as balls, Therabands, and foam rollers.

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PILATES FOR LBP: *SCHENCK, 2017*

General limitations in Pilates research

Type of Pilates exercises: Even though all studies claim they utilize the Pilates method or Pilates-based exercise, applications vary widely. Most studies use contemporary Pilates, none use the original, classical Pilates. The type of Pilates also determines another important factor, which is the amount of exercises given.

Addition of non-Pilates-exercises: Some studies incorporate other types of exercises, such as movement protocols from physical therapy or yoga.

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PILATES FOR LBP
ENJA SCHENCK & HEATHER KING-SMITH, 2017

Classical Pilates, contemporary Pilates and therapeutic exercise similarities and differences:

Repetitions: <10x for classical Pilates, >10x for therapeutic exercise. Contemporary Pilates uses both approaches.

Focus area:

Classical Pilates: whole-body exercise, regardless of injury.

Contemporary Pilates: additional exercises from the fitness and rehabilitation fields may be incorporated into a session to enhance optimal muscle recruitment and address weaknesses or injuries.

Therapeutic exercise movements are mostly spot-specific and selected to strengthen the area of injury or weakness. The client is often asked to recruit certain muscles groups.

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PILATES FOR LBP
ENJA SCHENCK & HEATHER KING-SMITH, 2017

Classical Pilates, contemporary Pilates and therapeutic exercise similarities and differences:

Flow:

Classical Pilates the client moves through the exercise sequence with a maximum of 10 repetitions per exercise.

In **therapeutic exercise**, exercises are repeated until the desired muscle recruitment is achieved and the muscle is fatigued.

Contemporary Pilates may combine both approaches.

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PILATES FOR LBP
ENJA SCHENCK & HEATHER KING-SMITH, 2017

Limitations: Exercise protocol definition and challenges

Most exercises taught to physical therapists in the USA for LBP patients fall into general categories of spinal ROM and strengthening exercises that may be described as:

- core stability
- dynamic stabilization
- lumbo-pelvic stabilization
- spinal stabilization
- co-contraction mat exercises
- ball exercises
- progressive resistive exercises with weights or elastic bands
- functional activities.

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PILATES FOR LBP
ENJA SCHENCK & HEATHER KING-SMITH, 2017

Limitations: Exercise protocol definition and challenges

Where is the boundary between such therapeutic exercise protocols and Pilates?

A comparison of the 11 selected studies shows that the Pilates protocol used is not always clearly defined and may not even be Pilates.

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PILATES FOR LBP
ENJA SCHENCK & HEATHER KING-SMITH, 2017

Author	Type of Pilates	Are there non-Pilates additions?
Borges et al., 2014	Contemporary	No
Cruz-Díaz Martínez-Amat, Osuna-Pérez, De la Torre-Cruz, & Hita-Contreras, 2015	Contemporary	No
Cruz-Díaz et al., 2015	No info, not identifiable	No info
da Fonseca Magini, de Freitas, 2009	No info, not identifiable	Only a description of required muscle recruitments.
da Luz et al., 2014	Contemporary	No
Gladwell, Head, Haggar, Beneke,	Contemporary	No

PILATES FOR LBP
ENJA SCHENCK & HEATHER KING-SMITH, 2017

Author	Type of Pilates	Are there non-Pilates additions?
Lee, Hyun, Kim, 2014	Contemporary	1/3 of the mat exercises are yoga based.
Miyamoto, Pena Costa, Galvanin, Nunes Cabral, 2013	Contemporary	Defined as "modified Pilates" in title.
Natour, de Araujo Cazotti, Ribeiro, Baptista, Jones, 2015	Contemporary	No
Rydeard, Leger, Smith, 2006	Not Pilates	No exercise names but muscle recruitments are emphasized.
Wajswelner, Metcalf, Bennell, 2012	Not Pilates	Therapeutic exercise on Pilates equipment.

PILATES FOR LBP *SCHENCK, 2017*

• Cruz-Díaz (2015) & da Fonseca (2009) do not provide **any information** about the exercises used

• Da Fonseca (2009): only brief information about muscle recruitment concepts, protocol more closely related to therapeutic exercise than to Pilates.

• Rydeard et al. (2006) provides more detailed description about the exercises, but the protocol is also about muscle recruitment strategies and doesn't mention any Pilates exercises, in spite of the title of the study: "Pilates-based therapeutic exercise: effect on subjects with nonspecific chronic low back pain and functional disability".

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PILATES FOR LBP *SCHENCK, 2017*

• Wajswelner et al. (2012) promise "Clinical Pilates" in the study title, but they use therapeutic exercises which are performed on the Pilates equipment. It is questionable if the use of equipment makes the exercises Pilates exercises.

• 1/3 of the mat exercises that Lee at al. (2014) use are yoga based, such as "seated hip stretch" and "knee over knee twist stretch", not Pilates.

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PILATES FOR LBP *SCHENCK, 2017*

Conclusion

- There is evidence that Pilates-based exercise in the rehabilitation of low back pain is effective.
- Additional peer-reviewed and randomized, controlled research is needed to produce scientifically reliable meta-analyses, preferably utilizing similar measurements, intervention durations, frequencies and equipment
- For further scientific evaluation and in order to achieve reproducible exercise protocols and results, a **standardization** of contemporary Pilates exercises would be desirable.
- Classical Pilates has not been scientifically analyzed.

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Byrnes, 2018

ANKYLOSING SPONDYLITIS

2 Studies Selected:

Altan L, et al. (2012) Effect of Pilates training on people with ankylosing spondylitis. *Rheumatol Int* 32(7): 2093-2099.

Rosu MO, et al. (2014) Effects of Pilates, McKenzie and Heckscher training on disease activity, spinal motility and pulmonary function in patients with ankylosing spondylitis: a randomized controlled trial. *Rheumatol Int* 34(3): 367-372.

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Byrnes, 2018

ANKYLOSING SPONDYLITIS:

Altan et al. (2012)

Compared Pilates to a control group who continued with normal routine.

Pilates group showed significant improvement in the BASFI (Bath Ankylosing Spondylitis Functional Index)

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Byrnes, 2018

ANKYLOSING SPONDYLITIS:

Rosu MO, et al. (2014)

Compared Pilates *(very strange version of Pilates)*, McKenzie and Heckscher to Kinetic (Aerobic Exercise) and showed significant improvement in all outcome measures for both groups. (Poorly designed study)

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Byrnes, 2018

MULTIPLE SCLEROSIS
2 Studies Selected:
Bulguroglu I, et al. (2017) The effects of Mat Pilates and Reformer Pilates in patients with Multiple Sclerosis: A randomized controlled study. *Neuro Rehabilitation* 41(2): 413-422.

Kalron et al. (2017) Pilates exercise training vs. physical therapy for improving walking and balance in people with multiple sclerosis: A randomized controlled trial." *Clin Rehabil*. Vol 31 (3) 319-328.

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Byrnes, 2018

MULTIPLE SCLEROSIS
2 Studies Selected:
Both studies on MS used physical therapy as a comparator

Bulguroglu I, et al. (2017) found significant improvement with Pilates compared to PT

Kalron et al. (2017) found improvement in outcome measures in both groups

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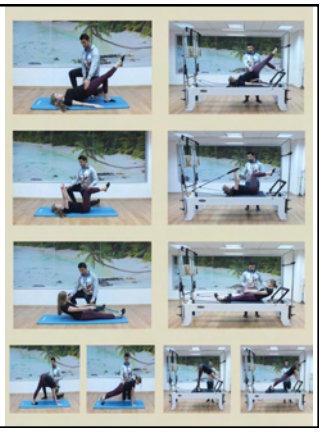
Byrnes, 2018

MULTIPLE SCLEROSIS
Bulguroglu (2017)



And while we are on the topic of Multiple Sclerosis…

Pilates for MS *Sanchez-Lastra 2019*

Sanchez-Lastra, M. A., et al. (2019). "Pilates for people with multiple sclerosis: A systematic review and meta-analysis." *Mult Scler Relat Disord* 28: 199-212.

14 studies selected

- 10 randomized controlled trials
- 4 quasi-experimental studies

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Pilates for MS *Sanchez-Lastra 2019*

- Methodological quality low
- Further research is needed in order to consolidate the scientific evidence regarding the efficacy of for MS
- Samples usually consisted of people with a low to moderate level of disability (EDDS stages 1–4.5)
- Generalization of the findings to individuals with more severe disease is questionable
- Authors of the studies did not report whether the requisite 80% power for selected sample size was met

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Pilates for MS *Sanchez-Lastra 2019*

- Pilates is a feasible therapy for people with MS that can lead to improvements on their physical function, and it might be helpful for reducing self-perceived fatigue.
- The potential beneficial effects of Pilates are not significantly greater than those derived from the performance of other physical therapies.
- Further high-quality RCTs are needed to consolidate the existing scientific evidence regarding the impact of Pilates on this population.

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And back to Byrnes 2018 Systematic Review…

Byrnes, 2018

POST-MENOPAUSAL OSTEOPOROSIS
2 Studies selected:
Kucukcakir N, et al. (2013) Effects of Pilates exercises on pain, functional status and quality of life in women with postmenopausal osteoporosis. *J Bodyw Mov Ther* 17(2): 204-211.
Angın E, et al. (2015) The effects of clinical Pilates exercises on bone mineral density, physical performance and quality of life of women with postmenopausal osteoporosis. *Journal of Back & Musculoskeletal Rehabilitation* 28(4): 849-858.

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Pilates and Osteoporosis *Kucukcakir, 2013*

Subjects: 70 women age 45-65 randomized to Pilates 2xw for 1 year or Home Exercise group performing thoracic extension exercises

Outcomes (improvements were shown in all areas in both groups, but moreso in the Pilates group):
- 6 min walk test
- 1 minute sit to stand test
- Visual Analogue Scale (VAS) pain level
- QUALEFFO-41 and SF-36 QOL measures

Kucukcakir N, et al. (2013) Effects of Pilates exercises on pain, functional status and quality of life in women with postmenopausal osteoporosis. *J Bodyw Mov Ther* 17(2): 204-211.

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Pilates and Osteoporosis *Angin, 2015*

Subjects: 41 women randomised to Pilates or Control Group
Outcomes:
- BMD lumbar evaluated pre and post intervention showed increase in Pilates group and decrease in control group.
- Physical performance level improved.
- Visual Analogue Scale pain level decreased.
- QUALEFFO-41 QOL improved.

Angın E, et al. (2015) The effects of clinical Pilates exercises on bone mineral density, physical performance and quality of life of women with postmenopausal osteoporosis. *Journal of Back & Musculoskeletal Rehabilitation* 28(4): 849-858.

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Pilates and Osteoporosis

Kucukcakir N, et al. (2013)
Angın E, et al. (2015)

The 2 Studies showed a statistically significant ($P < 0.05$) improvement in pain (VAS) and quality of life (QUALEFFO-41) in the Pilates group compared to controls.

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PILATES EFFECT ON BONE MINERAL DENSITY *BETZ 2005*

CASE REPORT: Female patient age 39
- History of 4 vertebral compression fractures
- Began TheraPilates® for Osteoporosis Video 3x per week at home
- 1 hr 1x per week using Pilates Equipment
- 4 x per week Walking Program

1st year: Spine BMD increased 15% : –1.15 to -1.00
2nd year: Spine BMD increased to -.9

Betz SR. "Modifying Pilates for Osteoporosis." *IDEA Fitness Journal* April 2005.

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New 2019 RCT comparing Pilates, Whole Body Vibration and Osteoporosis…

de Oliveira LC, et al. (2019) Effects of Whole-Body Vibration vs. Pilates on Bone Mineral Density in Postmenopausal Women: A Randomized and Controlled Clinical Trial. *J Geriatr Phys Ther* 42(2): E23-e31.

Pilates, WBV & Osteoporosis *DE OLIVEIRA (2019)*

de Oliveira LC, et al. (2019)

PURPOSE: Compare the effects of WBV versus Pilates exercise on BMD in postmenopausal women.
SUBJECTS: Vibration (n=17) Pilates (n=17), Control (n=17) 3xW for 6 months; 78 sessions
Outcome Measures: Areal BMD (aBMD) (Lumbar Spine, Femoral Neck, Total Hip, Trochanter, Intertrochanter, and Ward's area) assessed by DEXA at baseline and follow-up.
RESULTS: 3 Weekly Sessions of WBV or Pilates x 6 months were equally effective at improving aBMD of lumbar spine, and trochanter

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And back to Byrnes 2018 Systematic Review…

Byrnes, 2018

NON-STRUCTURAL SCOLIOSIS:
Alves de Araujo (2011) The effectiveness of the Pilates method: reducing the degree of non-structural scoliosis, and improving flexibility and pain in female college students. *J Bodyw Mov Ther* 16(2): 191-198.

This paper showed improvement in the Pilates Group in all three outcome measures compared to the control group. (P 1/4 0.0001):
- Cobb Angle
- Trunk Flexion
- Pain

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PILATES FOR SCOLIOSIS: *ALVES DE ARAUJO, 2011*

Alves de Araujo (2011)

Subjects: Age 18-25 Female Sedentary PT Students
Inclusion Criteria: Presence of Non-Structural Dorso-Lumbar Scoliosis with SRC (Rightward convexity) or LRC, muscle shortening of the posterior chain, pain in a vertebral segment. Assessed by Adams Test (Forward Bending Rib Hump), Radiographs and Cobb Angle Measurement.
N= 31 (All Females) **Randomized Controlled Trial**

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PILATES FOR SCOLIOSIS:
ALVES DE ARAUJO, 2011

Experimental Group: N=20 Pilates exercise program of 60 min, 2xW, 12 weeks. All subjects taught by the same PT
Control/Comparison Group: N=11 No intervention
Outcome Measures:
BORG CR-10 Pain Scale:
Pilates: pre: 5.3, post: 1.8
Control: pre: 4.4, post: 3.8
Cobb Angle:
Pilates: pre: 7.6, post: 4.8
Control: pre: 7.1 , post: 6.9 (no significant difference)
Range of Motion:
Pilates: pre: 9.6, post: 17.6
Control: pre: 8.2, post: 7.8

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PILATES FOR SCOLIOSIS:
ALVES DE ARAUJO, 2011

Conclusion: 38% decrease in scoliosis in Pilates group. 80% increase in trunk flexion. Pilates group showed a significant decrease of 60% in pain.
Comments: Small sample, good study design. Strange and confusing description of typical Pilates Apparatus exercises.
Exercises:
Warm-Up: 8 min treadmill or elliptical walking
Stretching:
Pilates Spine Stretch Forward
Pilates Rollover
Child's Pose
Quadruped: while raising ipsilateral arm and leg to stretch the concave side of spine only

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PILATES FOR SCOLIOSIS:
ALVES DE ARAUJO, 2011

SPECIFIC EXERCISES:
Using 65cm Swiss Ball:
• Supine Legs on Ball Bridging with legs straight
• Supine Legs on Ball-bending knees, bringing the knees to chest, lift the ball off the floor to strengthen abdominals and hip flexors
Ladder Barrel: Supine Stretch position, feet on the back of a chair and performing sit ups to strengthen rectus abdominus
Wunda Chair: seated on long box performing Mermaid with heavy spring to stretch concave side
Ladder Barrel Ballet Stretch: Hip External Rotation Position- Perform lateral flexion to stretch concave side

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PILATES FOR SCOLIOSIS:
ALVES DE ARAUJO, 2011

Wunda Chair: Standing on 10° inclined Ramp in plantarflexion performing Push Down/Washer Woman to mobilize the spine and stretch thoracic and lumbar regions
Trapeze Table:
• Long Spring Leg Series-(B) Plantar Flexion/Adduction, (B) Knee/Hip Extension
• Rolldown
• Standing Rolldown
Reformer: Arm Arcs and Triceps Press with 2 heavy springs
Relaxation using 75cm Swiss Ball (5min):
• Lie on side of ball with concave side up
• Lie prone on the ball supported by feet and hands
• Lie supine on the ball and stretch arms overhead

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Byrnes, 2018

HYPERTENSION
1 Study Selected:
Martins-Meneses DT, et al. (2015) et al. Mat Pilates training reduced clinical and ambulatory blood pressure in hypertensive women using antihypertensive medications. *Int J Cardiol* 179: 262-268. (average quality)

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Byrnes, 2018

HYPERTENSION
Martins-Meneses DT, et al. (2015)
• 44 hypertensive women, avg age 50
• 60 min 2xw x 6 weeks *(40 min Mat Pilates based on Return to Life, Brooke Siler, and Merrithew Manual)*
• The study found that the Pilates group showed significant improvement ($P < 0.05$) in all outcome measures compared to the control.
• **Outcomes:** clinically significant decrease in blood pressure, height, waist/hip circumference, flexibility, and right/left hand strength

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Byrnes, 2018

CHRONIC NECK PAIN:

1 Study Selected

Scollay F. (2016) The effect of Pilates and home-based exercise on pain, disability, and quality of life in people with chronic non-specific neck pain: a randomised controlled trial. *Master Osteopat.* Unitec Inst. Technol.

Inclusion Criteria: Chronic Neck Pain, age 18-58

Intervention:

Pilates Group: N=15 Equipment Pilates and home-based exercise

Control Group: N=9 Home-based exercise only

Duration: 8 to 10 weeks

Follow Up Assessment: Weeks 4, 9 and 12

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Byrnes, 2018

CHRONIC NECK PAIN:

Scollay F. (2016)

Found a clinically and statistically significant improvement in the Pilates group in all outcome measures, including pain, disability and quality of life.

VAS (pain), NPQ (disability), SF-36 (quality of life)

She found that the comparator group of home exercise also improved in all outcome measures, but to a lesser extent than the Pilates group.

The study scored 6/10 on the PEDro scale and 20/24 on the CONSORT checklist.

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Byrnes, 2018

New RCT on Chronic Neck Pain recently published and was not included in the Byrnes Systematic Review:

De Araujo Cazotti, et al. (2018) Effectiveness of the Pilates Method in the Treatment of Chronic Mechanical Neck Pain: A Randomized Controlled Trial. *Archives of Physical Medicine & Rehabilitation* 99(9): 1740-1746.

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PILATES FOR NECK PAIN: *DE ARAUJO CAZOTTI, 2018*

De Araujo Cazotti, et al. (2018)

Subjects: N= 64 (Pilates Group N=32, Control Group N=32)

Inclusion Criteria: Adults with Chronic Mechanical Neck Pain

Pilates Group: 2xW for 12 weeks (Mat and Apparatus)

Control Group: Std Pharmacological intervention only

Outcome Measures: PG improved in all measures **(**Numerical Pain Scale, the Neck Disability Index for function, and the SF-36 for quality of life)

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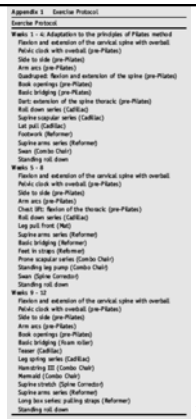
DE ARAUJO CAZOTTI, 2018 EXERCISE PROTOCOL



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PILATES AND BALANCE *ROLLER, 2018*

Purpose:

Investigate the effects of a Pilates-based exercise intervention in improving balance and reducing fall risk with a population of adults over 65 who are known fallers or at risk for falls.

Roller, M., et al. (2018). "Pilates Reformer exercises for fall risk reduction in older adults: A randomized controlled trial." *J Bodywork & Movement Therapies* 22(4): 983-998.

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PILATES AND BALANCE *ROLLER, 2018*

55 Subjects
- (Pilates Group=27, Controls=28)
- 38 females, 17 males
- mean age 77.6 years, range 65-95)

Inclusion Criteria:
- Self-reported history of two or more falls or one injurious fall in the past year or
- Timed Up and Go (TUG) test of ≥13.5 seconds suggesting risk for falling

Exclusion Criteria:
- Mini-Mental State Examination (MMSE) score <24/30
- Impaired postural reaction time on NeuroCom® Motor Control Test (MCT)
- Presence of neurologic system pathology

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PILATES AND BALANCE *ROLLER, 2018*

- Subjects attended 10 sessions of a 45-minute Pilates-based Reformer exercise program 1xW
- Participant to instructor ratio was 4 or 5:1 with all subjects working on Reformers concurrently in a group class format
- Each subject performed 10 specific exercises, 10 repetitions each, using varying resistance of 2-4 springs progressed according to each participant's ability

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PILATES AND BALANCE *ROLLER, 2018*

Pilates-based exercise group improved significantly at p<0.05 level:

- **ABC scores significantly improved from 69.3% to 76.3%** indicating **decreased fall risk** and improved balance confidence.
- **TUG times significantly decreased from 12.4 to 10.5 seconds** suggesting **reduced fall risk** and improved dynamic balance.
- **BBS scores significantly increased from 51.2 to 53.4/56** suggesting **reduced risk for falls** and **improved static and dynamic balance**.
- **10MWT time significantly improved from 9 seconds to 8 seconds** demonstrating **improved gait velocity**.
- **ADT scores significantly improved for toes down perturbations** suggesting improved stability during changes in surfaces.
- **AROM significantly increased in both legs** for straight leg raise, hip extension, and ankle DF resulting in improved range of LE motion.

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PILATES AND BALANCE *ROLLER, 2018*

This study suggests that rehabilitation focusing on Pilates exercise using the Reformer once per week is an effective intervention to improve balance and mobility and decrease fall risk in older adults.

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PILATES AND BALANCE *BIRD, 2012, 2014*

Bird ML and Fell J. (2014) Positive long-term effects of Pilates exercise on the aged-related decline in balance and strength in older, community-dwelling men and women. *J Aging Phys Act* 22(3): 342-347.

Bird ML, et al. (2012). A randomized controlled study investigating static and dynamic balance in older adults after training with Pilates. *Arch Phys Med Rehabl* 93(1): 43-49.

Poor studies due to crossover design and no significant differences between groups.

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PILATES & BALANCE *MORENO-SEGURA (2018)*

Search in 7 databases included 15 randomized controlled trials:

- Pilates was the primary intervention
- Outcomes related to balance and falls.
- All participants were over 60 years.

Moreno-Segura N, et al. (2018) The Effects of the Pilates Training Method on Balance and Falls of Older Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Journal of Aging & Physical Activity* 26(2): 327-344.

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PILATES & BALANCE
MORENO-SEGURA (2018) SYSTEMATIC REVIEW

RCTs Rated for quality and scientific rigor by PEDro

High:
8 – Gabizon (2016) Mat
7 – Appell (2012) Mat
7 – Bird (2012) Mat & App
7 – Markovic (2015) Mat
6 – Barker (2016) Mat & App
6 - de Andrade-Mesquita (2015) Mat
6 – Vieira (2017) Mat
6 – Irez (2011) Mat
6 – Mokhtari (2013) Mat
6 – Takiran (2014) Mat

Moderate:
5 - de Oliveira (2015) App
5 – Hyun (2014) Mat
5 – Josephs (2016) App
4 - de Siqueira (2010) Mat & App
4 – Donath (2016) Mat

Roller (2018) not included since it was not published yet…

Moreno-Segura N, et al. (2018) The Effects of the Pilates Training Method on Balance and Falls of Older Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Journal of Aging & Physical Activity* 26(2): 327-344.

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PILATES & BALANCE
MORENO-SEGURA (2018) SYSTEMATIC REVIEW

Most common outcome measures:
TUG test (8/15) – Dynamic Balance
Berg Balance Scale (4/15) – Overall State of Balance
Functional Reach Test (3/15) – Static Balance

4-square step test (2/15)
Tinetti score (2/15)
One-leg stance test (1/15)
Sit to Stand Test (1/15)
Fullerton Advanced Balance Scale (1/15)
Activities-Specific Balance Confidence Scale (1/15)
Gleichgewichtstest (1/15) *Also known as the Body Balance Test developed in Germany and is 14 item test including a balance beam*
Posturography tests (8/15) *heterogenous-unable to compare*

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PILATES & BALANCE
MORENO-SEGURA (2018) SYSTEMATIC REVIEW

"When Pilates seeks to enhance balance it is highly recommendable to work on unstable surfaces and perform exercises in the standing position oriented to strengthen the effects in the neuromuscular system."

- Granacher et al. (2013) concluded that a stable and strong core may contribute to an improvement in dynamic balance.
- Cancela, Oliveira, and Rodríguez-Fuentes (2014) concluded that there is strong evidence for Pilates on improvements of static and dynamic balance in older adults
- Barker et al. (2015) and Bullo et al. (2015) supported the findings of this review.

"Pilates may produce moderate but greater effects on balance when compared to other types of training."

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PILATES & THORACOABDOMINAL EXPANSION *CAMPOS, 2019*

Campos JL, et al. (2019) Effects of mat Pilates training and habitual physical activity on thoracoabdominal expansion during quiet and vital capacity breathing in healthy women. *J Sports Med Phys Fitness* 59(1): 57-64.

Effects of 12 weeks of Mat Pilates training and habitual physical activity on thoracoabdominal motion of healthy and physically active women

- 35 women (Age 18-35) without experience in Pilates
  - Habitual physical activity group: N.=14
  - Mat Pilates group: N.=21

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PILATES & THORACOABDOMINAL EXPANSION *CAMPOS, 2019*

Campos JL, et al. (2019)

- Thoracoabdominal Expansion IMPROVED with Pilates:
  - Superior Thorax 35%
  - Inferior Thorax 33%
  - Abdomen 37%
- Thoracoabdominal Expansion **DECREASED 13%** in (Habitual Physical Activity) control group.

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PILATES & LUNG FUNCTION *ALVARENGA, 2019*

Alvarenga GM, et al. (2018) The influence of inspiratory muscle training combined with the Pilates method on lung function in elderly women: A randomized controlled trial. *Clinics,* Vol 73, Iss 0 (2018)(0).

Table 1 - Pre- and post-intervention pulmonary function comparisons between the GPTI (n=11), the GP (n=11) and the CG (n=9).

Parameter	Groups	Pre		Post		*p*-value
		Mean	SD	Mean	SD	
MIP (cm/H_2O)	GPTI	36.55^{bA}	8.86	78.55^{aA}	14.12	<0.0001
	GP	51.64^{aA}	17.93	66.18^{aA}	15.73	
	CG	40.44^{aA}	19.33	34.67^{aB}	12.00	
MEP (cm/H_2O)	GPTI	53.45^{aA}	10.47	82.18^{aC}	18.71	<0.0014
	GP	58.54^{aA}	21.33	80.00^{aBC}	16.78	
	CG	52.44^{aA}	19.94	50.67^{aAB}	17.09	
6MWT (meters)	GPTI	423.36^{bA}	46.26	513.09^{aA}	48.04	<0.01
	GP	406.54^{aA}	100.32	515.18^{aA}	117.04	
	CG	361.78^{aA}	76.59	395.89^{aA}	87.86	
ABD (repetitions)	GPTI	16.18^{bA}	7.19	36.18^{aA}	6.95	<0.00001
	GP	14.18^{aA}	10.12	34.73^{aA}	10.61	
	CG	13.11^{aA}	10.00	12.44^{aA}	11.94	

GPTI, inspiratory muscle training and Pilates method group; GP, Pilates group; CG, control group; MIP, maximal inspiratory pressure; MEP, maximal expiratory pressure; 6MWT, six-minute walk test; ABD, abdominal curl up.
Different lowercase letters indicate statistically significant differences intra-groups, $p<0.05$ (pre x post).
Different uppercase letters indicate statistically significant difference between groups, $p<0.05$.

PILATES EFFECT ON WELLNESS IN THE ELDERLY *ROH, 2016*

Roh SY. (2016) The effect of 12-week Pilates exercises on wellness in the elderly. *J Exerc Rehabil* 12(2): 119-123.

- 88 elderly (63 females, 25 males) completed a Wellness Scale.
- Elderly participated in Pilates exercises and completed the same scale afterwards.
- Results of paired t-test showed significant improvement in:
  - physical (t=2.762, P<0.01)
  - social (t=3.362, P<0.001)
  - spiritual (t=2.307, P<0.05)
  - emotional wellness (t=2.489, P<0.05)

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PILATES & ADOLESCENT TRUNK STRENGTH *GONZALEZ-GALVEZ (2019)*

PURPOSE: Analyze effectiveness of a 6-week Pilates program on trunk endurance and extensibility in adolescents with a history of back pain.
MATERIALS AND METHODS: 52 students with history of back Pilates Group (PG; n=26) or control group (CG; n=26).
MEASUREMENTS: Trunk flexion (BTC test), extension (SOR test), and hamstring extensibility (TT test)
RESULTS: PG improved significantly in BTC, SOR, and TT tests
CONCLUSION: The Pilates program enhanced trunk endurance and extensibility in adolescents with a history of back pain. Trunk flexor endurance was better in the PG.

Gonzalez-Galvez N, et al. (2019) Functional improvements after a Pilates program in adolescents with a history of back pain: A randomised controlled trial. *Complement Ther Clin Pract* 35: 1-7.

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PILATES & BREAST CANCER
PINTO-CARRAL (2018)

Pinto-Carral A, et al. (2018) Pilates for women with breast cancer: A systematic review and meta-analysis. *Complement Ther Med* 41: 130-140.

OBJECTIVE: To identify and evaluate the characteristics and methodological quality of the studies that have proposed Pilates as a rehabilitation strategy for women with breast cancer and to determine its benefits on health outcomes in this population.
METHODS: A systematic review was conducted and 5 RCTs and 2 uncontrolled studies were selected

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PILATES & BREAST CANCER
PINTO-CARRAL (2018)

RESULTS: 5 randomized controlled trials and 2 un-controlled studies were analyzed:

Eyigor et al. (2010)	RCT	PG=27, CG=25	Mat
Martin et al. (2012)	RCT	PG=8, Ex=8, CG= 10	Mat & App
Gajbhiye & Deshpande (2013)	RCT	PG=15, CG=15	Mat
Zengin Alpozgen et al. (2017)	RCT	PG=18, Ex=18, CG=19	Mat
Şener et al. (2017)	RCT	PG=30, CG=30	Mat
Keays, et al. (2008)	Pre-Post	N=4	Mat & App
Stan, et al. (2012)	Pre-Post	N=15	Mat

Pinto-Carral A, et al. (2018) Pilates for women with breast cancer: A systematic review and meta-analysis. *Complement Ther Med* 41: 130-140.

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PILATES & BREAST CANCER
PINTO-CARRAL (2018)

RESULTS: 4 of the randomized controlled trials pooled in meta-analysis for Pilates positive and significant effects on:

- Shoulder ROM
- Quality of Life
- Pain
- Self-Reported Upper Extremity Function
- Functional status
- Mood
- Fitness
- Upper Extremity Circumference

The meta-analysis showed that effects of Pilates on Shoulder ROM and QoL, was not significantly greater than the other exercise programs.

CONCLUSIONS: Pilates relieves the impact of breast cancer-related symptoms. These effects are not significantly greater than those derived from the performance of other therapies, with the exception of pain and self-reported upper extremity function.

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PILATES AND MENTAL HEALTH
FLEMING (2018)

Fleming KM and Herring MP. (2018) The effects of Pilates on mental health outcomes: A meta-analysis of controlled trials. *Complement Ther Med* 37: 80-95.
PURPOSE: This meta-analysis estimated the population effect size for Pilates effects on mental health outcomes.
SEARCH TERMS: Pilates, Pilates method, mental health, anxiety, and depression.
STUDIES INCLUDED: 8 English-language publications that included Pilates intervention or non-active control and a measure of anxiety and/or depressive symptoms at baseline and after the Pilates intervention

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PILATES AND MENTAL HEALTH
FLEMING (2018)

Symptoms measured:

- Anxiety
- Depressive Symptoms
- Feelings of Energy
- Fatigue
- Quality of Life

Data Synthesis: Pilates resulted in significant, large, heterogeneous reductions in depressive, anxiety symptoms, feelings of fatigue, and increases in feelings of energy
Conclusions: Small number of controlled trials with small sample sizes and non-active control conditions of variable quality, the available evidence reviewed here supports that Pilates improves mental health outcomes.

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PILATES & CHRONIC DISEASE
MIRANDA (2018)

OBJECTIVE: Investigate the effects of Pilates in the 4 major groups of NCDs and the main cause of mortality worldwide: Chronic cardiovascular diseases, cancer, chronic respiratory diseases and diabetes.
SELECTION: 12 studies, mostly of moderate quality, were included with 491 participants
FINDINGS: 78.6% females; age range 13-70 years old with:

- Breast cancer (3)
- Diabetes (3)
- Chronic stroke (2)
- Cystic fibrosis (n1)
- Heart failure (1)
- Arterial hypertension (1)
- Chronic Obstructive Pulmonary Disease (1)

Miranda S & Marques A. (2018) Pilates in noncommunicable diseases: A systematic review of its effects. *Complement Ther Med* 39: 114-130.

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PILATES & CHRONIC DISEASE
MIRANDA (2018)

The best-evidence synthesis revealed strong evidence for improving exercise tolerance;
Moderate evidence for improving symptoms, muscle strength and health-related quality of life and limited or conflicting evidence on vital signs, metabolic parameters, body composition, respiratory function, functional status, balance, flexibility and social support.

Conclusions: Pilates should be considered for patients with NCDs, as it improves **exercise tolerance**.

Miranda S & Marques A. (2018) Pilates in noncommunicable diseases: A systematic review of its effects. *Complement Ther Med* 39: 114-130.

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IMPROVING QUALITY OF PILATES INSTRUCTOR EDUCATION PROGRAMS *ROH, 2016*

Roh SY (2016). An exploration of implications for the development of Pilates instructor system through identification of instructors' difficulties. *J Exerc Rehabil* 12(4): 355-362.

- Study aimed at exploring ideas for the development of Pilates instructor qualification system by identifying a range of difficulties Pilates instructors are experiencing.
- Open-ended questionnaires and semi-structured interviews were conducted to collect data before they were analyzed with inductive content analysis method.

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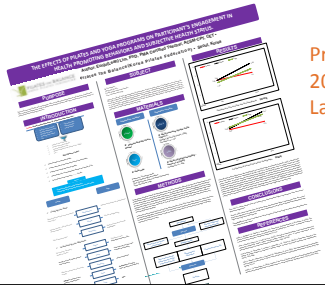
Lim E, et al. (2018) THE EFFECTS OF PILATES AND YOGA PROGRAMS ON PARTICIPANT'S ENGAGEMENT IN HEALTH PROMOTING BEHAVIORS AND SUBJECTIVE HEALTH STATUS.



Presented at PMA 2018 Research Forum Las Vegas

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Lim E, et al. (2019) SAFETY CONSIDERATION FOR THE DESIGN AND OPERATION OF A PILATES FITNESS CENTER

Accepted as a Literature Review for Presentation at PMA 2019 Research Forum Monterey, CA

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Let's Write a Case Report!

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Case Report

- *Retrospective* detailed report of the management of an individual's single case or a group of subjects' unusual condition or a condition that is rare or poorly reported in the literature
- Often a practitioner finds that a particular intervention worked quite well in achieving the desired goals or outcomes and would like to share that information formally with colleagues
- May also describe a novel or unique therapeutic approach to a particular condition
- May be just a chart review or an anecdotal account
- Relatively low level of evidence
- Less scientifically rigorous due to its lack of control over confounding variables and small sample size
- Valuable as evidence to stimulate and share new ideas for further investigation

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Components of a Case Report

- TITLE
- PURPOSE & BACKGROUND (RELEVANCE TO PILATES TEACHERS OR CLIENTS)
- HUMAN SUBJECTS PROTECTION/ CONFIDENTIALITY & CONSENT
- SUBJECT/CLIENT HISTORY
- METHODS & MATERIALS
- ASSESSMENT/ANALYSIS
- INTERVENTION
- RESULTS & CONCLUSION
- FUNDING SOURCE
- REFERENCES

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How to write a case report

- Ask a question.
- Gather current data on your question.
- Questionnaires: A simple questionnaire can be administered to each new client and administer the same questionnaire again periodically to see if the response to the questions changes over time after receiving Pilates lessons.
- Case Reports: Information gathered from a *past* client who did well with your intervention. Documenting exercises in lessons, pain-levels, and functional improvements for an individual client can be assembled into a case report.

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Where to find published research

- University Databases
- Pubmed
- PedRo (Australian Database)
- Published Texts
- Pro-Quest (not peer-reviewed, unpublished dissertations are listed here)

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Writing a Case Report

Questions to consider:

- Has this information been published before?
- Would this case report inform Pilates professionals and enhance or change the practice of teaching Pilates?
- Would this case report include practical and repeatable applications?
- Why is this particular client intervention suitable for a case report?

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Title

The title must include the words Case Report, i.e.

"Case Report: Using Pilates as an Intervention for Total Shoulder Replacement"

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Purpose and Background

- A literature review must be conducted to provide the rationale for sharing the information from the case report.
- If other articles have been published on this same topic, then the report may not be needed.
- If randomized controlled trials have been published, a case report on the same or similar topic would not be necessary and would unlikely be accepted for publication in a peer-reviewed journal.

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Purpose and Background

- A literature review must be conducted to provide the rationale for sharing the information from the case report.
- If other articles have been published on this same topic, then the report may not be needed.
- If randomized controlled trials have been published, a case report on the same or similar topic would not be necessary and would unlikely be accepted for publication in a peer-reviewed journal.
- Provide a scholarly discussion of the importance and necessity of the topic, noting what has been published on the topic.
- Summarize the assessment, findings and exercise interventions. State the main purpose of the report that is supported with background information.

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Human Subjects Protection/ Confidentiality and Consent:

- Case reports that involve retrospective analysis do not require an Institutional Review Board review
- Must have approval from the research subject and be reported confidentially (with names and unique indentifying characteristics removed)
- Be sure to follow HIPPA (Health Insurance Portability and Accountability Act) guidelines, keeping all personal information confidential and avoiding use of first or last name of the client
- Obtain signed consent forms informing the client of his/her participation and permission to use the information and any photos from their interventions and outcomes in the case report

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Subject/Client History

- Clients are usually referred to as "Subject" in most research reports.
- Report client's age, gender, weight, height, ethnicity and other pertinent characteristics.
- Do not include the client's name or identifying characteristics and be sure to maintain confidentiality.
- Include the reason why the client sought the intervention, relevant medical history, co-morbidities (all known diagnoses), chief complaints, prior services received related to the condition or episode, and client goals.
- Use relative dates instead of calendar dates) (e.g. years, months or days since onset of injury or start of intervention.)
- Explain the primary problem and any other conflicting variables that may confound the interventions and outcomes.

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Methods & Materials

- Describe the overall plan of intervention (frequency of sessions, length of sessions, and general focus of exercises)
- Explain why this particular client is a good candidate for a case report
- Include techniques used to collect the data
- Include materials and equipment incorporated within the study
- Briefly summarize the Pilates intervention including a description of the exercises (Apparatus and/or Mat) and comparison interventions (where applicable).

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Assessment/Analysis

- Clearly describe the tests and measures that will be performed to obtain baseline or objective information to be used to select appropriate exercises as interventions.
- These same tests and measures will be used at the end of the intervention to determine progress and outcomes.
- All tests and measures must be described in detail so that others could replicate them.
- State the rationale for the selection of tests and measures. Cite available studies on reliability and validity of measurements.
- If not available, acknowledge this fact, and provide a presumptive argument for the selection of the test.
- Quality of life measures can also be included as pre and post assessments.

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Intervention

- Describe the exercise intervention
  - Include how intervention was selected and developed
  - how it was taught to the client in sufficient detail that others could replicate the exercises
- Add tables, figures, and appendixes to enhance the detailed description
- Provide the parameters of the intervention (ie, intensity, frequency, and duration) and rules for progression
- State changes in exercises over time, along with the rationale for the changes
- List any co-interventions that the patient may have received but that are not directly related to the purpose of the case.

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Results

- Briefly summarize the results of the case.
- Describe any factors that accounted for the results.
- Clearly report the major findings.
- Include outcome measures at the person level (e.g. outcomes related to activity or participation) in addition to any other relevant outcome measures.
- Priority is given to validated outcome measures (meaning the measures have been tested for inter-rater reliability).
- Compare follow-up outcomes to baseline.
- Use tables and figures to enhance the description.
- Discuss whether or not the client met their own goals.

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Funding Sources

- State any source of funding or support for the research and indicate whether any of the authors have any conflict of interest or potential for material gain as a result of the study.
- Avoid stating:
  - "sales of products"
  - "gain more clients"
  - "increased referrals."
- If none, state none.

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References

- Include at least 5 references from peer-reviewed research publications that directly informed the development of your research methods.
- Include at least 2 references published less than 5 years ago.
- Use the following formatting for your peer-reviewed references:

Dos Santos AN, et al. (2016). "Pilates improves lower limb strength and postural control during quiet standing in a child with hemiparetic cerebral palsy: A case report." *Dev Neurorehabil* 19(4): 226-230.

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CA Clinic

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LA Clinic

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Bon Temps Pilates Studio in West Monroe, Louisiana

Thank you PAA!

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PMA Research Submissions

PMA PILATES METHOD ALLIANCE

Call for Research

Pilates Method Alliance
19th Annual Meeting
Research Oral and Poster Presentations
Monterey, CA October 23-26, 2019

Deadline for Submission: 12/1/2019
For Tacoma, WA Nov 4-7, 2020 Conference
https://www.pilatesmethodalliance.org/research

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