THE UNIVERSITY OF
SCRANTON
A JESUIT UNIVERSITY

DPT Program
Annual Research Night

Saturday, November 9th, 2024
5:00 PM to 8:30 PM

- DeNaples Center, Moskovitz Theater -
& Live Webinar via Zoom

This course is approved for 3 general contact hours (CEUs). However, you must view the entire session to receive credit. The University of Scranton has pre-approved provider status with the PA State Board of Physical Therapy. The PA State Board of Physical Therapy has ultimate authority of the determination.

University of Scranton Physical Therapy:
http://www.scranton.edu/academics/pcps/physicaltherapy

LEAHY PT CLINIC

Student-Run ~ Pro Bono

The mission of the Leahy PT Clinic is to deliver patient-centered care grounded in the Jesuit tradition of educating students "for and with others" by providing pro bono physical therapy services to uninsured and underinsured residents of our local community through collaboration, peer-mentorship, and evidence-based practice. Our student administrative team manages all clinic operations with supervision and guidance from PT Faculty. Practice areas typically include orthopedics, neurology, geriatrics, and cardiopulmonary. Our peer-mentored DPT student groups provide skilled clinical management to address a wide range of issues including (but not limited to): musculoskeletal pain, post-surgical recovery, chronic conditions, balance and gait dysfunction, vestibular disorders, deconditioning, and post-COVID-19 complications.

For more information, please contact us and visit our website: www.scranton.edu/pcps/pt-leahy-clinic.

Do you know anyone who is uninsured or underinsured and needs PT services?

Do know anyone who has exhausted their insurance coverage and would still benefit from skilled PT services?

230 Kressler Court
Scranton, PA
18503

570-941-6112

ptclinic@scranton.edu

Open Tuesdays & Thursdays
3:00pm-6:00pm

Schedule

5:00pm

Introduction: Dr. Janette Scardillo, Director of Clinical Education (DCE)

Group 1:
Title: Effect of Augmented Reality on Balance and Mobility in Adults with Stroke: A Systematic Review
Authors: Sienna Amato, Katarina Bieri, Meghan Duzick, Danielle Elsier, Dr. Jennifer Schwartz, Dr. Renée M. Hakim

Group 2:
Title: The Effectiveness of Ai Chi to Improve Balance in Older Adults: A Systematic Review
Authors: Rachel Hoffman, Kathryn Kwapniewski, Rachel Wells, Amanda Whelan, Dr. Dana Maida, Dr. Jennifer Schwartz

Group 3:
Title: Impact of COVID-19 Infection on Cardiorespiratory Fitness in Physically Active Adults: A Systematic Review
Authors: Andrew Bradley, Matthew S. Derr, Ryan Hawk, Nicholas Zysk, Dr. Michael S. Crowell, Dr. Nicholas J. Rodio

Group 4:
Title: Effectiveness of Technology Versus Non-Technology for Lung Auscultation Education in Healthcare Students: A Systematic Review
Authors: Evan Morgan, Christian Recanatini, Dante Venuto, Dr. Janette Scardillo

Group 5:
Title: Physical Therapy versus Complementary and Alternative Medicine Effects on Post-Episiotomy Pain: A Systematic Review
Authors: Nicolette George, Mary Kallberg, Julia LeMay, Stephanie Patullo, Dr. Huma Riaz, Dr. Lori Walton

Group 6:
Title: Differences in Home Health Quality of Care for Traditional Medicare vs Medicare Advantage Beneficiaries: A Systematic Review
Authors: Alyssa Bevacqua, Charlotte E. Bodack, Isabella Di Benedetto, Jessica L. Hoffmann, Dr. Tracey L. Collins

---------- **BREAK** (30 minutes) ----------

7:00pm

Group 7:
Title: Effectiveness of Animal-Assisted Therapy on Ambulation in Patients with Cardiovascular Disease: A Systematic Review
Authors: Megan Chipper, Jaclyn Keeney, Jessica Letherbarrow, Jessica Slocum, Dr. Anthony Carusotto

Group 8:
Title: Gait Retraining with Real-time Feedback Reduces Pain in Runners: A Systematic Review
Authors: Ryan Peterson, Michael DiLullo, Shane McKeon, Cameron Young, Dr. Jamie Morris, Dr. Michael Crowell

Group 9:
Title: Effects of Soft Robotic Gloves on Hand Function in Persons with iSCI: A Systematic Review
Authors: Allysa Belches, Kevin Gallego-Peña, Bridget Gras, Melissa Menagh, Dr. Renée M. Hakim

Group 10:
Title: Impact of Service in the Prison Setting on DPT Student Perceptions
Authors: Dr. Nicholas Rodio, Dr. Jennifer Schwartz, Dr. Dana Maida, Rachel Hoffman, Kathryn Kwapniewski

Group 11:
Title: Characteristics of Home Health that Contribute to a Positive Patient Experience for Older Adults
Authors: Dr. Tracey L. Collins, Mary Kallberg

Group 12:
Title: A Community-Based Adaptive Cycling Program for Persons with Mobility Limitations: A Special Interest Report
Authors: Dr. Elizabeth Doyle, Dr. Jennifer Schwartz, Dr. Renée M. Hakim, Katarina Bieri, Melissa Menagh

Components of Evidence-Based Practice

Adapted from: APTA Open Access; https://www.apta.org/patient-care/evidence-based-practice-resources/components-of-evidence-based-practice

Evidence-based practice includes the integration of best available evidence, clinical expertise, and patient values and circumstances related to patient and client management, practice management, and health policy decision-making.

All three elements are equally important.

Best Available Evidence

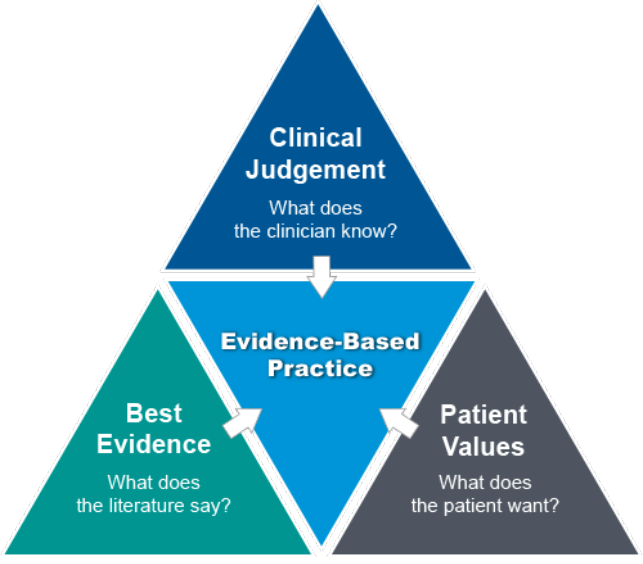
Decision-making is optimized by emphasizing the use of evidence from well-designed and well-conducted research. Although evidence-based practice encompasses more than just applying the best available evidence, many of the concerns and barriers to using evidence-based practice revolve around finding and applying research.

Clinical Expertise/Judgement

The physical therapist and physical therapist assistant's knowledge and skills are a key part of the evidence-based process. This personal scope of practice consists of activities undertaken by an individual physical therapist that are situated within a physical therapist's unique body of knowledge where the individual is educated, trained, and competent to perform that activity. Using clinical decision-making and judgment are critical.

Patient Values

The patient's wants and needs are a key part of evidence-based care. Incorporating a patient's cultural considerations, needs, and values are necessary to provide best practice services.



https://www.mcg.com/blog/2019/06/28/mcg-certification-and-the-commitment-to-evidence-based-practice/

All Evidence is Not Created Equal

Sackett Levels of Evidence / OCEBM (2009)

Level of Evidence	Description
1A	Systematic review of randomized controlled trials (RCTs).
1B	Individual RCT with narrow confidence intervals
1C	All or none
2A	Systematic review of cohort studies
2B	Individual Cohort study/ Low quality RCT
2C	Outcomes research, Ecological studies
3A	Systematic review of case-control studies
3B	Individual Case-Control study
4	Case series, poor quality cohort or case-control study
5	Expert opinion

Fletcher and Sackett, working for the Canadian Task Force on Periodic Health Examination in 1979, are credited as the first to develop a level of evidence scoring scale. Sackett continued to develop the scale based on his own research with the use of anti-thrombotic agents. http://www.physio-pedia.com/Grades_and_Levels_of_Evidence

Oxford CEBM Levels (2011) cover the entire range of clinical questions, in the order (from top row to bottom row) that the clinician requires. While most ranking schemes consider strength of evidence for therapeutic effects and harms, the OCEBM system allows clinicians and patients to appraise evidence for prevalence, accuracy of diagnostic tests, prognosis, therapeutic effects, rare harms, common harms, and usefulness of (early) screening.

Question	Step 1 (Level 1*)	Step 2 (Level 2*)	Step 3 (Level 3*)	Step 4 (Level 4*)	Step 5 (Level 5)
How common is the problem?	Local and current random sample surveys (or censuses)	Systematic review of surveys that allow matching to local circumstances**	Local non-random sample**	Case-series**	n/a
Is this diagnostic or monitoring test accurate? (Diagnosis)	Systematic review of cross sectional studies with consistently applied reference standard and blinding	Individual cross sectional studies with consistently applied reference standard and blinding	Non-consecutive studies, or studies without consistently applied reference standards**	Case-control studies, or "poor or non-independent reference standard**	Mechanism-based reasoning
What will happen if we do not add a therapy? (Prognosis)	Systematic review of inception cohort studies	Inception cohort studies	Cohort study or control arm of randomized trial*	Case-series or case-control studies, or poor quality prognostic cohort study**	n/a
Does this intervention help? (Treatment Benefits)	Systematic review of randomized trials or *n*-of-1 trials	Randomized trial or observational study with dramatic effect	Non-randomized controlled cohort/follow-up study**	Case-series, case-control studies, or historically controlled studies**	Mechanism-based reasoning
What are the COMMON harms? (Treatment Harms)	Systematic review of randomized trials, systematic review of nested case-control studies, *n*-of-1 trial with the patient you are raising the question about, or observational study with dramatic effect	Individual randomized trial or (exceptionally) observational study with dramatic effect	Non-randomized controlled cohort/follow-up study (post-marketing surveillance) provided there are sufficient numbers to rule out a common harm. (For long-term harms the duration of follow-up must be sufficient.)**	Case-series, case-control, or historically controlled studies**	Mechanism-based reasoning
What are the RARE harms? (Treatment Harms)	Systematic review of randomized trials or *n*-of-1 trial	Randomized trial or (exceptionally) observational study with dramatic effect			
Is this (early detection) test worthwhile? (Screening)	Systematic review of randomized trials	Randomized trial	Non -randomized controlled cohort/follow-up study**	Case-series, case-control, or historically controlled studies**	Mechanism-based reasoning

*** Level may be graded down on the basis of study quality, imprecision, indirectness (study PICO does not match questions PICO), because of inconsistency between studies, or because the absolute effect size is very small; Level may be graded up if there is a large or very large effect size.**

**** As always, a systematic review is generally better than an individual study.**

Physiotherapy Evidence Database (PEDro) Scale is a critical appraisal tool intended to identify methodological flaws in the physical therapy literature providing consumers of research evidence objective data regarding the strength of such evidence.

Study	1	2	3	4	5	6	7	8	9	10	11	Score
Grade												

1. Eligibility criteria were specified.
2. Subjects were randomly assigned to groups.
3. Allocation was concealed 4. Groups were similar at baseline.
5. Subjects were blinded.
6. Therapists who administered the treatment were blinded.
7. Assessors were blinded.
8. Measures of key outcomes were obtained from more than 85% of subjects.
9. Data were analyzed by intention to treat.
10. Statistical comparisons between groups were conducted.
11. Point measure and measures of variability were provided.

Criterion number 1 is not used to generate the total score. Therefore, the total maximum score is 10.

http://www.pedro.org.au/english/downloads/pedro-scale/

Mixed Methods Appraisal Tool (MMAT) - 2018

Category of study designs	Methodological quality criteria	Responses			
		Yes	No	Can't tell	Comments
Screening questions (for all types)	S1. Are there clear research questions?				
	S2. Do the collected data allow to address the research questions?				
	Further appraisal may not be feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.				
1. Qualitative	1.1. Is the qualitative approach appropriate to answer the research question?				
	1.2. Are the qualitative data collection methods adequate to address the research question?				
	1.3. Are the findings adequately derived from the data?				
	1.4. Is the interpretation of results sufficiently substantiated by data?				
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?				
2. Quantitative randomized controlled trials	2.1. Is randomization appropriately performed?				
	2.2. Are the groups comparable at baseline?				
	2.3. Are there complete outcome data?				
	2.4. Are outcome assessors blinded to the intervention provided?				
	2.5 Did the participants adhere to the assigned intervention?				
3. Quantitative non-randomized	3.1. Are the participants representative of the target population?				
	3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?				
	3.3. Are there complete outcome data?				
	3.4. Are the confounders accounted for in the design and analysis?				
	3.5. During the study period, is the intervention administered (or exposure occurred) as intended?				
4. Quantitative descriptive	4.1. Is the sampling strategy relevant to address the research question?				
	4.2. Is the sample representative of the target population?				
	4.3. Are the measurements appropriate?				
	4.4. Is the risk of nonresponse bias low?				
	4.5. Is the statistical analysis appropriate to answer the research question?				
5. Mixed methods	5.1. Is there an adequate rationale for using a mixed methods design to address the research question?				
	5.2. Are the different components of the study effectively integrated to answer the research question?				
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?				
	5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?				
	5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?				

Research Abstracts
and
Supplemental Material

Group 1

Title: Effect of Augmented Reality on Balance and Mobility in Adults with Stroke: A Systematic Review*

Authors: Sienna Amato, Katarina Bieri, Meghan Duzick, Danielle Elsier, Dr. Jennifer Schwartz, Dr. Renée M. Hakim

Purpose: As technology advances, augmented reality (AR) is growing in popularity for balance and mobility training post stroke. The purpose of this systematic review was to synthesize current literature on the effect of AR for improving balance and mobility in adults following a stroke.

Methods: A literature search of EBSCO, Cochrane, CINAHL, and PubMed was conducted with search terms: ("stroke" OR "CVA" OR "cerebrovascular accident") AND ("augmented reality" OR "AR"). Selection limits: 2010-2024, English, peer review, RCT. Selection criteria: adults 18 y/o≥, stroke, AR, balance and/or mobility outcome measures. AR was defined as computer-generated images superimposed on the user's view of the real world. 2 reviewers independently assessed each study for methodological quality and came to consensus using PEDro guidelines.

Results: A total of 1277 articles were screened for eligibility and 5 articles met selection criteria. PEDro scores ranged from 6-8/10 (avg=7.40). Sample sizes ranged from 21-68 (202 total) adult participants, males and females, diagnosed with acute[3], subacute[1,3,4,5], and chronic[2,4] stroke (18-80 y/o). AR training was by a PT in inpatient and home health settings with varied protocols. Control groups received usual care. Treatment sessions (4-20 total) ranged from 30-90 min each, over 1-5 weeks. Each study utilized a different type of projected AR with motion capture feedback, various setups, (treadmill 2 studies)[4,5], and at least 1 standardized measure of balance or mobility. 4 of 5 studies reported statistically significant differences between groups in favor of AR for the following: gait velocity (+0.12m/s)[2], cadence [(+28.20 step/min)[1] and (+10.90 step/min)[2]], step length (paretic side +0.05m)[2], stride length (paretic side +0.10m)[2], and balance TUG [(-8.90s)[1], (-9.30s)[2], (-0.90s)[3],(-5.19s)[5]] and BBS [(+7.50pts)[2], (+4.35pts)[5]]. 3 of 3 studies reported statistically significant improvements within AR groups for gait velocity [(+0.17m/s)[2] and (+0.04m/s)[4], (+0.14m/s)[5]], cadence (+10.40steps/min)[2], step length (paretic side +0.07m)[2], stride length (paretic side +0.15m)[2], and balance, TUG[(-4.70s)[2], (-2.30s)[3],(-8.46s)[5]] BBS (+4.10pts)[2], (+2.70pts)[3],(+11.45pts)[5]]. No adverse events were attributed to AR. Fall risk was examined as a secondary outcome. 1 of 5 studies used an at-risk sample and demonstrated reduced fall risk based on cut off scores of the BBS (32.95pts pre, 44.40pts post)[5].

Conclusions: There is moderate to high-level evidence, from a limited number of studies, supporting the use of AR to improve balance and/or mobility in adults post stroke. Limitations included lack of blinding, utilization of various AR systems, small sample sizes, missing raw data, and variable adherence. Future research is needed to determine optimal intervention parameters and long-term outcomes of AR.

Clinical Relevance: As evidence emerges, PTs may consider the use of AR in post-stroke rehabilitation to improve balance and/or mobility. Various forms of AR demonstrated clinically significant improvements with some outcomes exceeding MCID value for gait velocity (0.10m/s) and MDC values for TUG (-2.90s) and BBS (+2.70pts), regardless of chronicity. A reduced fall risk was demonstrated with for one outcome exceeding the cut off scores from pre to post intervention for the BBS (≤ 44pts). 2 of 4 AR systems are commercially available. Barriers to AR treatment may include cost, space, training, and supervision. The addition of AR to standard PT care is a safe, feasible, task-specific, and motivating option for adults post-stroke.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Academy of Neurologic PT /Stroke SIG Section

	AR Device	Training	Control Groups	AR Groups
Evron et al. (2024)[5] n=33	Selfit Overground projector, with kinematic sensor	30 minutes 15 sessions 4 weeks	15 conventional sessions: ROM, balance, dual-tasking exercises and gait training	9 conventional sessions, 6 Selfit
Lee et al. (2014)[6] n = 21	Head mounted display with a camera and Super Video Graphics Array	30 minutes 20 sessions 4 weeks	20 sessions of general PT program	20 sessions of general PT program with an additional 30 minutes for 12 sessions of AR-based postural control training
Lee et al. (2023)[7] n = 68	UINCARE Projected screen superimposed over reality with kinematic sensor	30 minutes + HEP 20 sessions 4 weeks	Stretching and strengthening exercise program	UINCARE Home
Timmermans et al. (2021)[8] n = 40	C-Mill Treadmill with projection	90 minutes 10 sessions 5 weeks	FALLS program, overground walking therapy	AR gait training with projected visual obstacles and interactive walking adaptability
Yang et al. (2024)[9] n = 40	C-Mill Treadmill with projection	35 minutes 15 sessions 5 weeks	Walking on C-Mill without projections (standard treadmill training), overground walking	Walking on C-Mill with projections for speed, tandem, targeted stepping

	Balance and/or Mobility Outcome Measures Tested	Between Group Improvements AR vs. Control	Within Group Improvements AR Groups
Evron et al. (2024)[5]	TUG, 10MWT, DGI, ABC, step count, steps per second, movement time	TUG (-8.90s)** Cadence (+28.20 steps/min)*	N/A
Lee et al. (2014)[6]	TUG, BBS, gait velocity, cadence, step length, and stride length	TUG (-9.30s)** Gait Velocity (+0.12m/s)** BBS (+7.50pts)** Cadence (+10.90 steps/min)* Step Length (paretic side +0.05m)* Stride Length (paretic side +0.10m)*	TUG (-4.70s)** Gait Velocity (+0.17m/s)** BBS (+4.10pts)** Step Length (paretic side +0.07m)* Stride Length (paretic side +0.15m)*
Lee et al. (2023)[7]	TUG, POMA, BBS, FES, GDS-SF, EQ-5D	TUG (-0.90s)*	TUG (-2.30s)* BBS (+2.70pts)*
Timmermans et al. (2021)[8]	10MWT, context-specific 10MWT with stationary physical context, context-specific Interactive Walkway assessment All 3 of those above were performed with and without simultaneous performance of cognitive task	N/A	Gait Velocity (+0.04m/s)*
Yang et al. (2024)[9]	10MWT, gait adaptation, BBS, TUG	TUG (-5.19s)*** BBS (+4.35pts)***, (32.95pts pre, 44.40pts post)**	TUG (-8.46s)*** BBS (+11.45pts)*** Gait Velocity (+0.14m/s)***

MCID: Gait velocity = 0.10m/s; **MDC**: TUG = -2.90s, BBS = +2.70pts; **Cut-off score:** BBS $\geq$ 44pts; Statistical Significance*, Clinical Significance**, Both Statistical and Clinical Significance***

Group 2

Title: The Effectiveness of Ai Chi to Improve Balance in Older Adults: A Systematic Review *

Authors: Rachel Hoffman, Kathryn Kwapniewski, Rachel Wells, Amanda Whelan, Dr. Dana Maida, Dr. Jennifer Schwartz

Purpose: Research demonstrates that both aquatic therapy(AT) and tai chi improve balance, gait, and fear of falling in older adults. The purpose of this systematic review was to investigate the effectiveness of ai chi(AC), a type of AT combining qi gong and tai chi, to improve balance in older adults.

Methods: A literature search was conducted in CINAHL, ProQuest, PubMed, ScienceDirect, and Wiley using search terms: [geriatric OR ("older adult" OR "older adults") OR elderly] AND ("ai chi") AND (balance OR "fall risk" OR fall). Search limits: humans, 1993-present, English, peer-reviewed. Selection criteria: adults age ≥65, AC intervention, balance outcomes. Each study was independently assessed for methodological quality by 2 reviewers who reached consensus using the OCEBM Levels of Evidence 2011.

Results: A total of 584 articles were screened for eligibility and 3 met selection criteria after detailed appraisal. One article scored OCEBM Level 2(RCT) and 2 scored Level 3(quasi-experimental). Sample sizes ranged from 19-42 participants (n=93, avg age 74.1yrs ranging from 65.2-82.3). All studies included a traditional AC group with 30min sessions, 2x/wk, for 6-12wks. Balance outcome measures included TUG(n=1), BBS(n=1), POMA-B(n=2), and ABC(n=1). Despite improvement, there was no statistically significant difference between AC and impairment-based AT (BBS, TUG, ABC). In 1 study, AC participants demonstrated statistically significant within-group improvements in performance-based balance outcomes from pre to post intervention (POMA-B: 13.5-15pts, Δ1.5 pts). Two studies reported statistically significant between-group differences at post-test between 3 AC formats: traditional, land-based, and guided imagery (POMA-B: traditional=15 □ □ pts, land=14.4pts, imagery=14.6pts; POMA-B: traditional=14.8pts, land=14pts, imagery=14.1pts). No adverse events were reported in any study. Research findings did not demonstrate clinical significance by exceeding MDC values for outcomes (BBS MDC=3.3pts; ABC MDC=27.3%; POMA-T MDC=4.4pts, TUG MDC=3.5s) or reducing fall risk (cutoff scores: TUG ≥13.5s, POMA-B <10-14pts, BBS=<45pts, ABC=<67%), possibly due to participants' high baseline scores.

Conclusions: Moderate levels of evidence from a limited number of studies support using AC to improve balance in older adults. AC was superior to land-based AC and imagery, and equally effective as AT. Limitations include small sample sizes, low exercise dosage, training parameters, ceiling effect of outcome measures, and inconsistent age parameters for older adults. Future research should investigate long-term benefits and optimal parameters of AC for older adults at risk for falls.

Clinical Relevance: Clinicians may consider using AC as a safe intervention to improve balance in older adults. Although research demonstrated statistically significant improvements, clinical relevance is questionable, given that change did not meet MDC/MCID standards. Thus, AC may be used by older adults as an adjuvant intervention with land-based therapy to mitigate the effects of normal aging, such as decline in mobility and balance, to reduce falls and remain community-dwelling.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Aquatics Section

Between Group Results of AC vs. IBAT[1]	Initial Scores	Final Scores	Cutoff Scores for Fall Risk	MDC Scores
TUG - AC	16.1 ± 6.0	14.2 ± 4.9	≥ 13.5 seconds	3.5 seconds
TUG - IBAT	16.9 ± 3.8	15.8 ± 5.1		
BBS - AC	45.1 ± 6.3	47.6 ± 4.4	< 45 points	3.3 points
BBS - IBAT	42.1 ± 10.4	46.3 ± 5.6		
ABC - AC	63.4 ± 20.3	65.3 ± 15.5	< 67%	27.3%
ABC - IBAT	49.7 ± 19.4	53.9 ± 21.7		

Between Group Results of 3 AC formats[2,3]	POMA - B		
AC Type		Study 2	Study 3
Traditional	Initial	13.5 pts	13.4 pts
	Final	15.0 pts	14.8 pts
Land-based	Initial	13.8 pts	13.6 pts
	Final	14.4 pts	14.0 pts
Imagery	Initial	14.5 pts	13.9 pts
	Final	14.6 pts	14.1 pts
Cut-off Score for predicting fallers		< 10-14 points	

Group 3

Title: Impact of COVID-19 Infection on Cardiorespiratory Fitness in Physically Active Adults: A Systematic Review*

Authors: Andrew Bradley, Matthew S. Derr, Ryan Hawk, Nicholas Zysk, Dr. Michael S. Crowell, Dr. Nicholas J. Rodio

Purpose: COVID-19 has been known to affect the cardiovascular and pulmonary systems both during and post-infection. COVID-19 affects oxygen transportation, leading to the disruption of oxygen delivery methods required for exercising muscles. This may lead to fatigue and affect cardiorespiratory fitness. The purpose of this systematic review was to explore the effects of the COVID-19 on cardiorespiratory fitness (CRF) variables in physically active adults.

Methods: A literature search was conducted using search terms: ("covid-19" OR "SARS-CoV-2" OR "covid") AND ("cardiorespiratory" OR "cardiorespiratory fitness" OR "exercise capacity"). Search limits included: English language, peer-reviewed, scholarly journal, and 2013-2024. Selection criteria: adults with previously contracted COVID-19, participating in any physical activity (PA) as defined by the World Health Organization (WHO), and at least one CRF outcome. Each study was independently assessed for methodological quality by two using the Oxford Centre for Evidence-Based (OCEBM) Levels of Evidence (2011).

Results: 1032 articles were screened for eligibility and 10 articles met selection criteria. Two studies ranked as OCEBM Level 2 and 8 studies ranked as Level 3. Sample sizes ranged from 16-220 adults (total 887) with varied levels of PA, both noncompetitive and competitive, ranging from elite to recreational athletes. All studies examined CRF from 2-72 weeks post infection with one or more of the following outcome measures: VO2max/VO2peak (9/10 studies), HR/resting HR (8/10), and time to exhaustion (1/10). From the studies examining VO2max/peak, 6/9 noted a decrease (-3.6-26.8%), 2/9 noted an increase (+4.4-4.8%), and 1/9 showed no difference. With testing at ≥20 weeks, 4/4 studies showed a decrease in VO2 max/peak. With testing <20 weeks, 2/5 studies showed a decrease 2/5 an increase, a 1/5 no difference. In studies examining HR, 6/8 articles noted no difference, 1/8 a decrease, and 1/8 an increase. The single study that examined time to exhaustion reported a decrease.

Conclusions: There is moderate quality, mixed evidence regarding CRF in adults post-COVID-19 infection. A majority of studies found decreased VO2 max/peak at 20 weeks or later following COVID-19 infection. Findings regarding VO2max and HR were inconclusive with respect to level of PA. Limitations include heterogeneity in test timing after contracting COVID-19, variance in fitness levels of the athletes, different variants of COVID-19 affecting participants, and multiple measures of CRF utilized. Future research should include standardized testing times and protocols, with emphasis on VO2 max testing. Additionally, future studies should examine the effect of training to improve VO2 max after COVID-19 infection.

Clinical Relevance: Clinicians may consider measuring VO2 max/peak after COVID-19 infection, particularly at 20 weeks or greater post infection, if one of the patient's goals is to return to activities of daily living or sports that require aerobic endurance. If testing is not available, clinicians may also proactively implement VO2 max training, as there is potential for reduced aerobic capacity after COVID-19 infection.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Academy of Cardiovascular & Pulmonary Physical Therapy Section

Study	Test Time	V02 max	HR max	Key Findings
Komici et al.	2	ND	ND	Reduced exercise capacity was not identified, and pulmonary and cardiovascular function were not found to be impaired during the early recovery phase in a population of physically active adults, except FEV1 reduction.
Stojmenovic T. et al.	2	D	ND	No statistically significant differences were observed in terms of achieved maximum heart rate and 3-minute heart rate recovery before and after SARA-CoV-2 infection (p> 0.05). However, $VO2_{max}$ was significantly reduced after SARS-CoV-2 infection (p=0.000).
Babity M. et al.	3	I	D	Significant increase in $VO2_{max}$ (p=0.004) and a significant decrease in HR_{max} (p=0.024). Cardiology screening was performed 2-3 weeks after infection and a second screening 2-4 months after initial testing. This can be associated due to being elite athletes with intensive training.
Jafarnezhadgero AA. et al.	3		ND	HR at the end of the steady-state running period was not different between the two groups P value >0.05. The main findings of this study were that fatigue induced larger decrements in running speed (26%) and running duration (56%).
Anastasio F. et al.	6	D	I	Statistically significant decrease in $VO2_{max}$ (26.48%) in the COVID group compared to control group. CPET findings showed COVID athletes reached their anaerobic threshold fast than the control group (4'48" vs 6'28", P<0.05) and at that threshold: VO2/kg (28.6mL/min vs 38.9mL/min P<0.01)
Schellenberg J. et al.	8	I		Significant increase in $VO2_{max}$ (p=0.069), but recovery and quarantine could have played a part in recovery and being symptom-free.
Ladlow P. et al.	20	D	ND	Significant decrease in VO2 max of hospitalized-symptomatic (29.9± 5.0 mL/kg/min) and community-symptomatic (34.4±7.2 mL/kg/min) individuals when compared to control group (43.9±3.1 mL/kg/min) (p<0.001), measured via a cardiopulmonary functional testing on an average of 5 months following acute illness.
Stojmenovic D. et al.	28	D	ND	Significant decreased aerobic capacity found in study that examined 220 elite athletes for Serbia. A mean decrease of 3.6% in VO2 max was found among athletes infected with any of the 3 COVID-19 strains.
D'Isabel S. et al.	52	D	ND	Significant reduction in peak VO2 (average decline of 2.55 ml·kg−1·min-1) (p<0.001) in firefighters an average of 110 days after reporting mild to moderate COVID-19 symptoms.
Sliz D. et al.	72	D		Exercise performance deteriorated after infection (VO2 max=47.81 ± 7.81 vs 44.97 ± 7.00 mL*kg*min, p <0.001) an average of a 5.9% decrease in $VO2_{max.}$

ND = no difference, I = Increase, D = Decrease, Test time (weeks)

Group 4

Title: Effectiveness of Technology Versus Non-technology for Lung Auscultation Education in Healthcare Students: A Systematic Review*

Authors: Evan Morgan, Christian Recanatini, Dante Venuto, Dr. Janette Scardillo

Purpose: The purpose of this systematic review is to assess the effectiveness of technology vs. non-technology education modalities for teaching lung auscultation to healthcare students.

Methods: A literature search was conducted in APTA Ebsco, ProQuest, PubMed, and ScienceDirect using search terms:("Simulation" OR "technology" OR "manikin" OR "Mannequin") AND "Lung Auscultation" AND("education" OR "learning"). Search limits: peer-reviewed studies from 2013-2024. Selection criteria: healthcare students in undergraduate/graduate programs, ages ≥18, comparator of technology-based to non-technology-based lung auscultation education modalities, outcomes of lung auscultation proficiency as measured by knowledge-based exam and/or skill competency, and all primary research designs. Each study was independently assessed for methodological quality by three reviewers who came to consensus using the Oxford Centre for Evidence-Based Medicine Levels of Evidence (OCEBM 2011).

Results: A total of 801 studies were screened for eligibility, with 10 meeting selection criteria. OCEBM levels ranged 2-3(5 RCTs, 5 cohort studies). Sample sizes ranged from 43-139 participants(n=848) and included undergraduate(n=7) and graduate(3) students from professions including: medicine(2), nursing(7), physical therapy(1). Non-technology lung auscultation education included lecture(3), undescribed traditional(4), standardized patients(2), lab(1), synthetic sounds(1), and paper based(1). Technology education included high fidelity manikins(6), task trainers(2), computer software/apps(3), and simulated stethoscope(1). Knowledge proficiency outcome measures included tests/quizzes(7) and skill assessments(4). Secondary outcome measures included confidence surveys(4). Two out of nine articles showed a statistically significant difference for knowledge proficiency between technology vs non-technology education, and 5/6 studies noted within group statistically significant changes. Additionally, statistically significant improvements were found in favor of technology modalities in confidence survey measurements(2/3).

Conclusions: Moderate to high levels of evidence support the use of both non-technology and technology-based modalities to increase proficiency in performing lung auscultation. Both teaching modalities showed improvement in auscultation proficiency within groups, and technology-based methods showed statistically significant improvements in secondary confidence outcome measures. Limitations included varied education modality types and outcome measures. Further research with standardized measures and education modalities should be conducted as well as further investigation with confidence measures as a primary outcome measure should be explored.

Clinical Relevance: Technology-based lung auscultation may be useful for students to improve knowledge proficiency and confidence. Although technology was superior in improving confidence, non-technology teaching methods appear equally effective in developing proficiency. Barriers such as cost, time, space, and faculty/student support should be considered when deciding whether a program utilizes technology modalities.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Academy of Cardiovascular & Pulmonary Physical Therapy Section

Article	OCEBM Level	Category of Measure	Key Findings for Knowledge and/or Confidence
Arslan et al[12]	3	Written test/quiz	*Significant difference* was found in knowledge **within** groups
Bernardi & Fabris et al[10]	3	Skill assessment	*Significant difference* was found in knowledge **within** groups
Bernardi & Giudici et al[11]	3	Written test/quiz	*Significant difference* was found in knowledge **between** groups
Chen et al[9]	2	Skill assessment	There was **no significant difference** found in knowledge **between** groups or knowledge **within** groups
Goldsworthy et al[5]	3	Written test/quiz	There was **no significant difference** found in knowledge **between** groups or knowledge **within** groups
Higashiyama et al[13]	2	Written test/quiz	*Significant difference* was found in knowledge **within** groups
Saritas et al[14]	2	Confidence assessment Skill assessment	*Significant difference* was found in knowledge **between** groups and confidence **within** groups
Tawalbeh et al[7]	2	Confidence survey	*Significant difference* was found in confidence **within** groups and confidence **between** groups
Uzen et al[15]	2	Written Test/quiz Skill Assessment Confidence Survey	*Significant difference* was found in knowledge **within** groups, confidence **within** groups, and confidence **between** groups
Vatwani et al[8]	3	Written Test/quiz Confidence survey	*Significant difference* was found in knowledge **within** groups and confidence **within** groups

References can be found by scanning the QR code:

Group 5

Title: Physical Therapy versus Complementary and Alternative Medicine Effects on Post-Episiotomy Pain: A Systematic Review*

Authors: Nicolette George, Mary Kallberg, Julia LeMay, Stephanie Patullo, Dr. Huma Riaz, Dr. Lori Walton

Purpose: One in three women who undergo vaginal delivery also receive an episiotomy. This can lead to adverse effects, including perineal pain, which is a prevalent therapeutic postpartum concern. There is very little research on the difference between physical therapy (PT) versus complementary and alternative medicine (CAM) intervention effectiveness on post-episiotomy pain. Therefore, the purpose of this systematic review was to examine the effects of PT versus CAM on post-episiotomy pain.

Methods: A literature search was conducted in CINAHL, Cochrane Library, ProQuest, and PubMed. Search terms: ("women" OR "females") AND ("postpartum" OR "post-delivery") AND ("episiotomy") AND ("physical therapy" OR "physiotherapy" OR "alternative medicine" OR "complementary medicine" OR "CAM") AND ("pain"). Search limits: 2013 - 2024, English, peer-reviewed, human subjects, and RCTs. Selection criteria: postpartum women s/p episiotomy, ≥18 y/o and a primary outcome of pain. Two reviewers independently assessed each article for methodological quality and came to consensus using PEDro guidelines.

Results: A total of 56 articles were assessed for eligibility and 19 RCTs met the selection criteria. PEDro scores ranged from 5/10-10/10 (avg 7.47). Samples ranged from 30-147 subjects (N=1728) with an episiotomy (18-35 y/o). Six of the 19 articles were PT interventions, including low-level laser therapy (LLLT), cryotherapy, far-infrared radiation (FIR), light therapy, and dry heat. Thirteen of the 19 articles were CAM interventions, including various ointments and creams, Reiki, acupuncture, mastic oleoresin, and acupressure. These were given one to three times daily (10-40 min/session) for one to 14 days. There were no adverse events. Primary outcome measures for pain included the Numeric Pain Rating Scale (NPRS), Visual Analogue Scale (VAS), Short-Form McGill Pain Questionnaire (SFMPQ), and Present Pain Intensity Scale (PPi). Four of the six PT interventions showed statistically significant NPRS or VAS pain score decreases between groups ranging from -1.93 to -3.5 pts. Eleven of the 13 CAM interventions showed statistically significant NPRS or VAS pain score decreases between groups ranging from -1.33 to -9 pts. The average decrease in pain scores (NPRS, VAS) between PT and CAM interventions were -2.93 and -4.18, respectively.

Conclusions: There is moderate to high evidence that PT and CAM interventions are effective for treating post-episiotomy pain though PT interventions show greater pain improvements. Limitations included small sample size and limited follow-up. Future research should include larger sample sizes and more adequate follow-up.

Clinical Relevance: Both CAM and PT are vital components of obstetric care as they provide the safest and least invasive methods for post-episiotomy pain control. The most effective interventions to reduce post-episiotomy pain must be considered by PTs. Five of the six PT interventions and 11 of the 13 CAM interventions were clinically significant for interventions that improved post-episiotomy outcomes and met the MCID values for the NPRS (2 pts) or VAS (1.37 pts). This research informs PTs regarding the best evidence-based interventions for reducing post-episiotomy pain.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Pelvic Health Section

Complementary and Alternative Medicine Interventions			
Study	**PEDro**	**Intervention (Parameters)**	**Key Findings**
Asgharikhatooni et al. (2015)	10/10	**Equisetum Arvense (Horse Tail) Ointment** (2x/day for 10 days)	**Decreased perineal pain* (VAS)**
Aydmir et al. (2024)	7/10	**Reiki (Energy-Based Healing)** (1x/day every other day for 7 days, 35-40 min/session)	**Decreased perineal pain* (SFMPQ)**
Cheshfar et al. (2023)	10/10	**Ginger Ointment** (2x/day for 10 days)	Decreased perineal pain (VAS)
Çobanoğlu et al. (2020)	7/10	**Hypericum Perforatum (St. John's Wort) Oil** (3x/day for 10 days)	**Decreased perineal pain* (VAS)**
Hajhashemi et al. (2018)	7/10	**Achillea Millefolium (Yarrow) Ointment** (2x/day for 14 days)	**Decreased perineal pain* (VAS)**
Farzadeh-Kenarsari et al. (2019)	8/10	**Olea (Olive) Ointment** (3x/day for 10 days)	**Decreased perineal pain* (VAS)**
Jaić et al. (2019)	6/10	**Perineal Auricular Acupuncture** (3 needles inserted, removed after 3 days)	**Decreased perineal pain* (VAS)**
Mohammadi et al. (2014)	10/10	**Cinnamon Ointment** (2x/day for 10 days)	**Decreased perineal pain* (VAS)**
Moudi et al. (2018)	6/10	**Mastic Oleoresin** (2x/day for 3 days via perineal smoking)	Decreased perineal pain (VAS)
Sayahi et al. (2024)	10/10	**Camellia Sinensis (Green Tea) Ointment** (2x/day for 14 days)	**Decreased perineal pain* (VAS)**
Shayan et al. (2020)	7/10	**Olive Oil and Honey Cream** (2x/day for 14 days)	**Decreased perineal pain* (VAS)**
Şolt Kirca et al. (2020)	6/10	**Perineal Acupressure** (1 session, 120 seconds pressure, 30 seconds rest, 10 min/session)	**Decreased perineal pain* (VAS)**
Vakili et al. (2018)	9/10	**Hypericum Perforatum (St. John's Wort) Ointment** (2x/day for 10 days)	**Decreased perineal pain* (VAS)**
Physical Therapy Interventions			
Study	**PEDro**	**Intervention (Parameters)**	**Key Findings**
Alvarenga et al. (2017)	9/10	**Low-Level Laser Therapy** (1x/day for 3 days, 90 min/session)	Decreased perineal pain (NPRS)
Beleza et al. (2017)	6/10	**Cryotherapy** (1 session, 20 min/session)	**Decreased perineal pain* (NPRS)**
Huang et al. (2019)	5/10	**Far-Infrared Radiation** (2x/day for 2 days, 40 min/session)	Decreased perineal pain (VAS)
Mohamed et al. (2016)	5/10	**Light Therapy** (1x/day for 5 days, 15 min/session)	**Decreased perineal pain* (PPI)**
Roma et al. (2023)	6/10	**Dry Heat** (2x/day for 10 days, 10 min/session)	**Decreased perineal pain* (VAS)**
Suvarna et al. (2023)	8/10	**Ice Pack** (1x/day for 2 days, 10 min/session)	**Decreased perineal pain* (NPRS)**

Group 6

Title: Differences in Home Health Quality of Care for Traditional Medicare vs Medicare Advantage Beneficiaries: A Systematic Review*

Authors: Alyssa Bevacqua, Charlotte E. Bodack, Isabella Di Benedetto, Jessica L. Hoffmann, Dr. Tracey L. Collins

Purpose: The purpose of this systematic review is to compare Traditional Medicare (TM) and Medicare Advantage (MA) regarding quality of care on patients receiving home health (HH) services.

Methods: A literature search of ProQuest, Wiley, PubMed, and Sage Premier was conducted using search terms: ("Traditional Medicare" OR "Original Medicare") AND ("Medicare Advantage" OR "Medicare Part C") AND ("home health care" OR "home health services" OR "home care service" OR "home care") AND ("quality of care" OR "health care quality" OR "star rating" OR "readmission rates") OR "functional GG codes") AND ("elderly" OR "geriatric" OR "older adult"). Search limits: English language, peer-reviewed, published 2013-2024, and academic journal. Selection criteria included: ≥ 65 years old, HH setting, TM vs MA, quality of care defined by: star rating system, section GG Codes, Outcome and Assessment Information Set (OASIS), and readmission rates. Two researchers independently assessed each study for methodological quality and came to consensus using the Mixed Methods Appraisal Tool (MMAT).

Results: A total of 96 studies were screened for eligibility, 5 met selection criteria: 4 quantitative descriptive, 1 mixed methods. MMAT scores met 100% quality criteria for each article. Sample size ranged from 285,297 to 30,311,210 (total n = 48,565,553). Quality of care was assessed with readmission rates (n = 2)[1,2,3], functional GG Codes/OASIS (n = 3)[2,4,5], and star ratings (n = 2).[1,2] Two studies found MA enrollees are more likely to receive care from home health agencies (HHA) with lower star ratings and less likely to receive care from a 5-star agency.[1,2] Two studies found MA enrollees are less likely to receive HH care following hospital discharge.[3,4] MA beneficiaries enrolled in health maintenance organization (HMO) or preferred provider organization (PPO) plan were less likely to receive HH.[5] One study found MA enrollees are more likely to have lower hospital readmission rates.[3] Two studies reported MA enrollees have a shorter HH length of stay and received fewer visits.[3,5] One study reported MA enrollees are 3% and 4% less likely to improve mobility function and self-care scores, respectively, when using OASIS, and have higher rates of community discharge when compared to TM.[5]

Conclusion: Recent evidence supports that MA enrollees receive lower quality care from HHAs and are less likely to receive care. Limitations include: sample size, participation selection, neglecting prior HH use, inability to adjust for differences in health status and intensity of HH, different types of MA plans, short duration of HH care, reliability and validity of OASIS and star ratings, limited focus on patient outcomes, and consideration for diagnosis and comorbidities. Future research using MA encountered data to assess quality of care in HH settings is needed.

Clinical Relevance: HH clinicians should consider the disparity in care provided to MA recipients and advocate by educating patients on research regarding differences in quality of care between plans. HH clinicians should seek to provide higher value and quality visits for MA beneficiaries who may receive fewer visits.

* Accepted for platform presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Home Health Section

Significant Findings

Study	MMAT Design & Score	Findings
Schwartz ML, et al.[1]	Quantitative Descriptive; 100%	Compared to TM, MA enrollees are more likely to receive care from a HHA with a lower Star Rating despite enrollment in a high- or low-quality MA plan.
Skopec L, et al.[2]	Mixed Methods; 100%	MA enrollees are less likely to utilize HH and more likely to experience a shorter duration of HH care compared to TM. Care from HHA with lower Star Ratings are often provided to MA enrollees. Qualitative interviews suggested MA payment and contracting approaches influence HH use.
Skopec L, et al.[3]	Quantitative Descriptive; 100%	In general, MA enrollees were less likely to receive post-acute care then TM enrollees for 3 common conditions including lower extremity joint-replacement, stroke, and heart failure.
Loomer L, et al.[4]	Quantitative Descriptive; 100%	MA enrollees are less likely to receive post-acute HH compared to TM enrollees. According to OASIS assessment, TM enrollees are 75% more likely to receive HH following hospital discharge.
Prusynski RA, et al.[5]	Quantitative Descriptive; 100%	MA enrollees had a shorter HH length of care and lower OASIS scores compared to TM enrollees. MA enrollees are more likely to experience worse functional outcomes and more likely to discharge to the community compared to TM enrollees.

Group 7

Title: Effectiveness of Animal-Assisted Therapy on Ambulation in Patients with Cardiovascular Disease: A Systematic Review*

Authors: Megan Chipper, Jaclyn Keeney, Jessica Letherbarrow, Jessica Slocum, Dr. Anthony Carusotto

Purpose: Animal assisted therapy (AAT) has been shown to improve a multitude of health issues that result from cardiovascular disease (CVD) by promoting both physical and psychological benefits.The purpose of this systematic review was to determine the impact of AAT on ambulation in patients with CVD.

Methods: A literature search was conducted in Pubmed, ProQuest Central, Academic Search Premier (EBSCO), CINAHL, SAGE Premier and Wiley Online Library using search terms: ("Heart disease" OR "Cardiovascular Stroke" OR "ischemic stroke" OR "hemorrhage stroke" OR "stroke rehab*" OR hypertension OR arrhythmia* OR "heart valve problem*" OR "heart valve disease" OR "cardiovascular disease*" OR "cardiovascular condition*" OR Stroke* OR "Myocardial Infarct*" OR Infarct* OR "Heart Attack*" OR "heart failure*") AND ("Pet therapy" OR "animal therapy*" OR "animal assisted*" OR "canine*" OR "dog therap*") AND (ambulat* OR gait OR "walking" OR "ambulatory status") AND ("physical therapy*" OR physiother* OR "physical rehab*"). Search limits: peer-reviewed, English language and Journals. Selection criteria: adults with CVD, participation in AAT and outcomes relating to gait. Each study was independently assessed for methodological quality by two reviewers who reached consensus using the Oxford Centre for Evidence-Based Medicine (OCEBM) Levels of Evidence (2011).

Results: 1,873 articles were screened for eligibility; 3 met selection criteria. OCEBM Levels ranged from 2 to 3. Sample size ranged from 4 to 64 adult participants with CVD (n =162). All intervention groups received AAT ranging from 30-60 minute sessions, 10 days to 8 weeks. Intervention groups were compared to either a control or historical group. One study found a statistically significant increase in cadence (14.67steps/min), gait speed (.25m/s), and stride length (.13m) with AAT when compared to a control. Another study found a statistically significant increase in distance walked with AAT (235.7 steps) when compared to a control (120.2). The last study showed a statistically significant increase in gait speed (.40m/s). In addition, a decrease in gait deviation was shown, however, failed to be statistically significant.

Conclusions: Moderate evidence from minimal amount of studies (OCEBM 2-3) supports the use of AAT to improve gait parameters in persons with CVD. Limitations include a lack of consistent dog breed, small sample size, and lack of control groups. The results cannot be generalized, and there lacks long term follow-up. Future research should include various patient populations and rehabilitation settings, the comparison between dog breeds, and examine the efficacy of AAT on postural stability during ambulation.

Clinical Relevance: Clinicians may consider using AAT as an intervention for persons with CVD to improve cadence, gait speed, stride length, gait pattern, and distance of ambulation. Improvements in gait speed with AAT demonstrated clinically meaningful changes exceeding the MCID (10MWT=0.1m/sec). AAT provides a beneficial, non-pharmacological intervention that may be integrated into rehabilitation programs to improve gait outcomes for persons with CVD.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Academy of Cardiovascular & Pulmonary Physical Therapy Section

Study	Study Design	OCEBM Level of Evidence (LoE)	Intervention	Key Findings
Ho-Jung et al. (2021)	RCT: Quantitative Randomized Controlled Trial	2	30 min, 1 session x 8 weeks Ambulated 8 m, measured by wearable sensor BTS G-Walk® Dog had chest strap connected to waist belt of the patient	Improved cadence*, gait speed*, stride length* and symmetric index*
Abate et al. (2011)	RCT: Quantitative Experimental Study	2	Sessions dependent on length of stay Steps ambulated, measured by pedometer Handler holding dog, patient did not control dogs lead	Greater distance ambulated*
Rondeau et al. (2010)	Non-randomized, multiple single case study, ABA experimental design	3	60 min therapy session, 4x per week 10 m walk test; Ranchos Los Amigos Observational Gait Analysis Dog with leather harness and handle, used as a walking aide	Improved gait speed*, clinical improvement in gait pattern
LoE Range	2-3			
* = statistically significant				

Group 8

Title: Gait Retraining with Real-time Feedback Reduces Pain in Runners: A Systematic Review*

Authors: Ryan Peterson, Michael DiLullo, Shane McKeon, Cameron Young, Dr. Jamie Morris, Dr. Michael Crowell

Purpose: Running-related lower extremity (LE) pain limits training and performance. The purpose of this systematic review was to determine the effectiveness of gait retraining (GR) with real-time feedback (RTF) on LE pain in runners.

Methods: A literature search was conducted in EBSCO, ProQuest, PubMed, and ScienceDirect using search terms: ("gait retraining" OR "run retraining" OR "feedback") AND (run OR running) AND (pain OR injury) and limits: English language, peer-reviewed, and human subjects. Selection criteria were: runners ≥18 years with LE pain, received GT with RTF, and assessed pain. Each study was independently assessed for methodological quality using the Oxford Centre for Evidence-Based Medicine Levels of Evidence (2011) and NIH Study Quality Assessment Tools (2021).

Results: Of 217 articles screened, 8 met selection criteria. There were 4 level II studies[1,3,6,7], and 4 level IV studies.[2,4,5,8] Among level II studies, one was rated as good quality, two were rated as fair quality, and one was rated as poor quality. Of level IV studies, two were rated as good quality and two were rated as fair quality. Sample sizes ranged from 21-69 for level II studies, 16-28 for level II studies, and 1-33 for level IV studies. Intervention groups received RTF including instruction to adopt a forefoot strike[1,3], increase step rate using a metronome[1-3,6,7], verbal feedback on running mechanics[1,4,7,8], and real-time visual feedback on biomechanics.[5,8] The most common treatment frequencies were 8-10 sessions over 4-6 weeks. One RCT (8 sessions, 2 weeks) found a significant between-group difference in pain from pre-post treatment (mean difference 2.6 (95% CI 1.3, 3.9)) and from pre-treatment to follow-up (mean difference 3.6 (95% CI 2.2, 5.0)).[1] The other RCT (3 sessions, 8 weeks) found no significant reduction in pain with GR compared to education but did find a significant within-group reduction in pain from pre-post treatment and pre-treatment to follow-up.[1] All level II/IV studies reported within-group decreases in pain (5 utilized VAS,[2-5,7] pre-post treatment decrease range = 2.2-5.0, pre-treatment to follow-up range = 1.4-5.0; 2 studies NPRS,[6,8] pre-post treatment decrease range = 2.1-5.2, pre-treatment to follow-up decrease range = 2.1-5.9).

Conclusion: There is low-level evidence to support GR with RTF to reduce LE pain in runners. Limitations included varied GR protocols, a small number of RCTs, heterogeneity in outcome measures, and high dropout rates. Further research should include randomized designs with larger sample sizes using well-defined training parameters and outcomes.

Clinical Relevance: Clinicians may consider GR with RTF to reduce LE pain in runners. The most effective strategy appears to be 8-10 sessions over 4 weeks using real-time verbal feedback to achieve a non-rearfoot strike and increasing step rate with a metronome, with within group changes all exceeding the MCID for the VAS and NPRS. However, it is unclear if GR with RTF is more effective than standard treatments for LE pain in runners.

* Accepted for platform presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Sports Section

Study	OCEBM	NIH	Key Findings
Bonacci et al	Level II	Fair	- Reduced pain with RTF to increase running cadence - 10 sessions over 6 weeks
Roper et al	Level II	Good	- RTF led to greater reduction in pain compared to exercise - 8 sessions over 2 weeks
dos Santos et al	Level II	Poor	- FFS, increase of step cadence, and FTL are each effective at reducing knee pain - 4 sessions/week for 2 weeks
Esculier et al	Level II	Fair	- RTF led to greater reduction in pain compared to education and exercise - 5 sessions over 8 weeks
Hunter et al	Level IV	Fair	- Reduction in pain with RTF for pelvic-rotation angle - 9 sessions over 4 weeks
Mazzone et al	Level IV	Fair	- Reduced pain with RTF for NRFS landing - 6-8 sessions over 2 weeks
Bramah et al	Level IV	Good	- Reduced pain with RTF to increase running cadence - 1 session with normal running for 4 weeks
Willy et al	Level IV	Good	- Visual RTF with mirror led to reduction in pain - 8 sessions over 12 weeks

Key:
RTF= Real time feedback
FFS= Foreoot strike
FTL= Forward Trunk lean
NRFS= Non-RearFoot Strike

Group 9

Title: Effects of Soft Robotic Gloves on Hand Function in Persons with iSCI: A Systematic Review*

Authors: Allysa Belches, Kevin Gallego-Peña, Bridget Gras, Melissa Menagh, Dr. Renée M. Hakim

Background and Purpose: iSCIs can produce severe deficits on the impairment and functional levels. The purpose of this study is to synthesize evidence regarding the effectiveness of soft robotic gloves to improve impairments in hand function and/or limitations in participation and activities in persons with iSCI.

Methods: : A literature search of ScienceDirect, ProQuest Central, BioMed Central, and PubMed Central was conducted using the following search terms: ("spinal cord injury" OR "spinal cord injuries") AND ("soft robotic glove" OR "soft exoskeleton"). Search limits: English, Spanish, Peer-reviewed. Selection criteria:18+ with cervical iSCI, use of fabric wearable robotic gloves, and hand impairment/function outcomes. The OCEBM was used by two reviewers to assess the methodological quality of the studies.

Results: Of the 519 articles screened for eligibility, 7 articles met the selection criteria. Three articles ranked as OCEBM Level 4 (1 case series[1], 2 case studies[2,3]) and 4 Level 3 (cohort studies[4-7]). The sample size ranged from 1-15 (n=48) with age ranging from 20-73 years. Sessions ranged from 2-240 min for 1-7x/wk (2 studies unspecified) with durations of 1 d-18 wks. The soft gloves used tendon actuators (n=5)[1-5]or pneumatic compression (n=2)[6,7] to assist 3 (n=1)[1] or 5 (n=6)[2-7] digits. Hand impairment/function outcomes were categorized using the ICF model. Six of 7 studies reported improvements in hand impairment (n=5)[3-7] and function (n=4)[2-5]. Statistically significant within group improvements were seen at the impairment level with AROM (index MCP flex +20.4*[6], thumb MCP flex +14.6*[6], index PIP ext +19.6*[6], index PIP flex +63.2*[7] and middle PIP flex +58.6*[7]), lift force (+1.0N[5],) pinch grip (+1.2N[6]), key grip (+1 N[4]), power grip (+9.5[6]), jaw grip (+.5 N[4]) and functional level with the TRI-HFT (+44.44 pts[5], +8.6 pts[4]). Descriptive findings included improvements of impairments for FM-UE (+1.0 pts[3]) and function for BBT (+2 blocks[2]), MAL-AOU (+0.6 pts[3]) MAL-HW (+0.7 pts[3]), and GAS (+23.1pts[3]) respectively. Decreased performance was found for 3 devices with key grip (-30.0N[1]) , TRI-HFT (-0.5 pts[1]), JHFT (+0.7s[6], +44.5s[1]), and BBT (-6 blocks[3]).

Conclusions: Most studies had low-mod levels of evidence in support of using a wearable soft robotic glove. The most effective type of glove and protocol remains unclear. Limitations include small samples, lack of numerical data, widely varied devices, protocols, and outcomes. Future research should include additional studies on device prototypes with longer durations, larger sample sizes, and more consistent protocols and outcomes.

Clinical Relevance: Clinicians may consider the use of a soft robotic glove in the treatment of patients with cervical iSCI with robust improvements noted at the impairment (AROM[6,7], multiple grips[4,6]) and functional (TRI-HFT[4,5]) levels. Preliminary evidence suggests the gloves may be used for rehabilitation in clinical[4-6] and home settings[4,5]. Different gloves were used in all studies, with improvements noted for 5 digit gloves powered by either tendon actuators or pneumatic compression. Future advances may reduce cost, increase accessibility, and enhance QOL of people living with cervical iSCIs.

* Accepted for platform presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Academy of Neurologic PT /Spinal Cord Injury SIG Section

Citation	Glove Type	OCEBM Level	Hand Impairment Outcomes	Numerical Values (Impairment)	Hand Function Outcomes	Numerical Values (Function)
Alicea R, Xiloyannis M, Chiaradia D, Barsotti M, Frisoli A, Masia LA soft, synergy-based robotic gloves for grasping assistance. *Wearable Technologies*. 2021;2. doi.org/10.1017/wtc.2021.3.	5-digits Tendon Actuator	4	N/A	N/A	Box and Block Test (BBT)***	+2 blocks***
Cappello L, Meyer JT, Galloway KC, Peisner JD, Granberry R, Wagner DA, Engelhardt, Paganoni S, Walsh CJ. Assisting hand function after spinal cord injury with a fabric-based soft robotic glove. *J. Neuroeng Rehabilitation*. 2018;15:59.	5-digits Tendon actuator	3	Lift force*	+1.0N*	Toronto Rehabilitation Institute Hand Function Test (TRI-HFT)*	+44.44 pts *
Correia C, Nuckols K, Wagner D, Zhou YM, Clarke M. Improving grasp function after spinal cord Injury with a soft robotic glove. *IEEE trans neural netw*. 2020;28(6):1407-1415. Doi: 10.1109/TNSRE.2020.2988260	5-digits Pneumatic Compression	3	Active Range of Motion (AROM)* Pinch Grip* Power grip*	Index MCP flexion: +20.4 deg*; Thumb MCP flexion: +14.6 deg*; Index PIP extension: +19.6 deg* +2.7 N* +9.5N*	Jebsen Taylor Hand Function Test (JHFT)**	+0.7 sec**
Jiryaei Z, Alvar AA, Bani MA, Vahedi M, Jafarpisheh AS, Razfar N. Development and feasibility of a soft pneumatic-robotic glove to assist impaired hand function in quadriplegia patients: A pilot study. *J of Bodywork and Movement Therapies*. 2021;27:731-736.	5-digits Pneumatic Compression	3	Active Range of Motion (AROM)*	Index finger flexion: +63.2 deg * Middle finger flexion: +58.6 deg *	N/A	N/A
Osuagwu BAC, Timms S, Peachment R, Dowie S, Thrussell H, Cross S, Shirley R, Segura-Fragoso A, Taylor Julian. Home-based rehabilitation using a soft robotic hand glove device leads to improvement in hand function in people with chronic spinal cord injury: a pilot study. *J. Neuroeng.Rehabilitation.* 2020; 17 (1): 40. Doi: 10.1186/s12984-020-00660-y	Soft Extra Muscle (SEM) Glove 5-digits Tendon Actuator	3	Key grip strength* Jaw grip strength* Tip to Tip grip strength Modified Ashworth Scale (MAS) ASIA-UE Scale	+.9 N* +.5N*	Toronto Rehabilitation Institute Hand Function Test (TRI-HFT)* Short-Form 36 (SF-36) Participant Diaries: Usage Amount and Tasks/ADLs at home	+8.6 pts*
Tran P, Elliott D, Herrin K, Bhatia S, Desai JP. Evaluation of the FLEXotendon glove-III through a human subject case study. *Biomedical Engineering Letters*. 2023;13(2):153-163. doi:https://doi.org/10.1007/s13534-023-00262-2	FLEXotendon Glove-III 3-digits Tendon Actuator	4	Modified ASIA-UE Modified Ashworth Scale (MAS) Capabilities of UEs Questionnaire (CUE-Q) Orthotics Prosthetics Users Survey (OPUS)	N/A	Toronto Rehabilitation Institute Hand Function Test (TRI-HFT)** Jebsen Taylor Hand Function Test (JHFT)**	-0.5pts ** 44.5 sec **
Yurkewich A, Ortega S, Sanchez J, Wang RH, Burdet E. Integrating hand exoskeletons into goal-oriented clinic and home stroke and spinal cord injury rehabilitation. *J. of Rehabilitation and Assistive Technologies Engineering*. 2022;9:205566832211309. doi:https://doi.org/10.1177/20556683221130970	Hand Extension Robot Orthosis Grip Glove (HERO) 5-digits Tendon Actuator	4	Fugl-Meyer Upper Extremity (FM-UE)*** American Spinal Injury Association Upper Extremity Scale (ASIA-UE) Modified Ashworth Scale (MAS)	+1.0pts***	Box and Block Test (BBT)** Goal Attainment Scale (GAS)*** Motor Activity Log (MAL) *** Functional Independence Measure (FIM)	-6 blocks** +23.1pts*** MAL-AOU: +0.6pts*** MAL-HW: +0.7pts***

* = Statistically Significant Improvements; ** = Decrease; *** = Descriptive Improvements; No asterisk = unchanged

Group 10

Title: Impact of Service in the Prison Setting on DPT Student Perceptions*

Authors: Dr. Nicholas Rodio, Dr. Jennifer Schwartz, Dr. Dana Maida, Rachel Hoffman, Kathryn Kwapniewski

Purpose: Limited research exists related to the role of rehab professionals and students in the prison setting. One study noted improved perceptions for OT students receiving education/exposure to the setting. The purpose of this study was to examine PT student perception on working with prisoners before and after voluntary participation in a wellness program at a local prison.

Number of Subjects: 7

Methods: PT students at a single university were invited to a service opportunity for women in a local prison with/without participation in a pre/post-test group experimental study. Interested students were assigned a code by a department secretary and given survey links. The surveys consisted of generalized questions, Attitudes Toward Prisoners Scale (ATP), and abbreviated APTA Core Values Assessment for professional behavior. The ATP is a valid and reliable scale describing attitudes toward prisoners. The prison wellness program consisted of weekly, 45-minute sessions, including warmup stretching, group sport play or yoga, and meditation cool down. A faculty member supervised each session while the students instructed the group. Survey results were analyzed using the online survey application.

Results: Students anonymously completed the online survey (9 pre, 7 post). 12 sessions were held. Student participation ranged from 2-4 sessions (avg. 3). Average ATP scores demonstrated improved perceptions (116.90 to 121.36/144). Average abbreviated APTA Core Values Assessment scores increased from 4.63 to 4.83/5, with the largest growth in social responsibility (4.41 to 4.83). Survey results indicated that students believe PTs have a role in providing services to underserved and underrepresented populations (97% to 100%). Students reported increased comfort level interacting with prisoners (6.78 to 8.85/10). 100% of post survey responses indicated 10/10 willingness to participate in future prison programming.

Conclusions: Overall, DPT students reported positive experiences in the prison and increased comfort working with this underserved/protected population. Initial biases reported in the pre-survey were recognized and students demonstrated growth in willingness to advocate for these populations and enhance future wellness services in this setting. Limitations included small, volunteer sample and time constraints/student availability due to prison schedule. Additionally, high initial outcome measure scores may have limited notable change. Future research could include a larger sample size, other disciplines, and a variety of wellness programs.

Clinical Relevance: The Code of Ethics for PT promotes advocacy to reduce health disparities and inequities, improve access to services, and address preventative needs. Prisoners are a vulnerable population with unique circumstances, but healthcare needs are similar to the general population. Students are expected to develop competence in treating patients across the lifespan, including vulnerable populations. This study showed a positive change in perception with limited exposure, and programs should consider experiential learning opportunities to help students better serve and advocate for this marginalized group.

* Accepted for platform presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Leadership & Innovation Section

Attitude Towards Prisoners Scale

The statements listed below describe different attributes toward prisoners in jails and prisons in the United States. There are no right or wrong answers, only opinions. You are asked to express *your* feelings about each statement by indicating whether you:
(1) Disagree Strongly, (2) Disagree, (3) Undecided, (4) Agree, or (5) Agree Strongly.

Indicate your opinion by writing the number that best describes your personal attitude.
Please answer every item.

1. Prisoners are different from most people. ___*
2. Only a few prisoners are really dangerous.___
3. Prisoners never change.___*
4. Most prisoners are victims of circumstance and deserve to be helped.___
5. Prisoners have feelings like the rest of us.___
6. It is not wise to trust a prisoner too far.___*
7. I think I would like a lot of prisoners.___
8. Bad prison conditions just make a prisoner more bitter.___
9. Give a prisoner an inch and he'll take a mile.___*
10. Most prisoners are stupid.___*
11. Prisoners need affection and praise just like anybody else.___
12. You should not expect too much from a prisoner.___*
13. Trying to rehabilitate prisoners is a waste of time and money.___*
14. You never know when a prisoner is telling the truth.___*
15. Prisoners are no better or worse than other people.___
16. You have to be constantly on your guard with prisoners.___*
17. In general, prisoners think and act alike.___*
18. If you give a prisoner your respect, he'll give you the same.___
20. There are some prisoners I would trust with my life.___
21. Prisoners will listen to reason.___
22. Most prisoners are too lazy to earn an honest living.___*
23. I wouldn't mind living next door to an ex-prisoner.___
24. Prisoners are just plain mean at heart.___*
25. Prisoners are always trying to get something out of somebody.___*
26. The values of most prisoners are about the same as the rest of us.___
27. I would never want one of my children dating an ex-prisoner.___*
28. Most prisoners have the capacity for love.___
29. Prisoners are just plain immoral.___*
30. Prisoners should be under strict, harsh discipline.___*
31. In general, prisoners are basically bad people.___*
32. Most prisoners can be rehabilitated.___
33. Some prisoners are pretty nice people.___
34. I would like associating with some prisoners.___
35. Prisoners respect only brute force.___*
36. If a person does well in prison, he should be let out on parole.___

* Reverse scored items

Reference:
Melvin KB, Gramling LK, Gardner WM. Attitudes toward prisoners scale. *CJB*. 1985;12(2):241-253. doi:10.1037/t57287-000

Group 11

Title: Characteristics of Home Health that Contribute to a Positive Patient Experience for Older Adults*

Authors: Dr. Tracey L. Collins, Mary Kallberg

Purpose: Due to the rapid aging of the population, there is increasing demand for care in the home environment that is value driven and patient centered.[1] The purpose of this integrated literature review is to determine the characteristics of home health that contribute to a positive patient experience for older adults.

Methods: A literature search of ProQuest, CINAHL, PubMed and Health Source: Nursing/Academic Edition (EBSCO) was conducted using search terms: ("home health" OR "home healthcare" OR "homecare" OR "home care") AND ("older" OR "elderly" OR "aged") AND ("frail" OR "fragile" OR "homebound" OR "home bound") AND ("need*" OR "service*" OR "demand*" OR "experience*" OR "requirement*"). Search limits: English language, peer-reviewed, published 2014-2024, and academic journal. Selection criteria included: ≥ 65 years old and home health care setting. Two researchers independently assessed each study for methodological quality using the JBI Critical Appraisal Checklist for Qualitative Research[2] and dependability/credibility using the ConQual[3] approach.

Results: A total of 843 articles were screened for eligibility and 5 met the selection criteria: all were qualitative.[1,4-7] (1 exploratory descriptive,[1] 1 descriptive,[4] 1 case study,[6] 1 empirical narrative,[5] 1 grounded theory[6], 1 lifeworld approach[7]). Four of the studies[1,4-6] were conducted in Europe (2 in Sweden[4,6], 1 in Norway[5], 1 in the Czech Republic[1], and one in Canada[7]. Sample sizes ranged from 1-26 (total n=66). Participants were ≥ 65 years old receiving home health care. Methodological outcome: credibility 3 High,[1,4,6] 2 Moderate;[5,7] dependability: four unequivocal,[1,4,6,7] one equivocal.[5] ConQual score Moderate. Positive patient experiences included: Safe and secure care (education and experience of nurses, continuity of care),[1,4,5,7] patient autonomy[1,4-6] and individualized plans of care/person-centered care,[1,4,6,7] relationships with care professionals (personality and partnerships),[1,4,5,7] requires responsibility of the caregiver,[6] communication with patient (scheduling visits, introducing themselves).[5,7] Negative patient experiences included: care threatened by insufficient organizational resources',[4] sharp or edgy communication from care providers,[5] coming to home without communicating with patient,[5,7] not knowing who each provider is,[5] feeling like a guest in their own home/losing privacy.[6,7]

Conclusions: Moderate evidence to support that older adults had a positive patient experience in home health when the providers were knowledgeable, provided consistent care, respected patient autonomy, communicated well, provided a positive caring relationship and developed a personalized plan of care.

Clinical Relevance: The provision of home health care is inherently individualized and home health professionals should aim to provide valued driven patient-centered care: knowledgeable, prepared, continuity of care, including good communication with their patient's, respect them as individuals and develop a plan of care that is personalized, with a positive relationship.

* Accepted for platform presentation at APTA Combined Sections Meeting (CSM), Houston, TX, February 2025; Home Health Section

Group 12

Title: A Community-Based Adaptive Cycling Program for Persons with Mobility Limitations: A Special Interest Report*

Authors: Dr. Elizabeth Doyle, Dr. Jennifer Schwartz, Dr. Renée M. Hakim, Katarina Bieri, Melissa Menagh

Purpose: The purpose of this special interest report is to describe a community-based program designed to improve safety/self-efficacy with use of adaptive cycles and participation on an outdoor nature trial for individuals with mobility limitations and their caregivers.

Description: Adaptive cycling is a mode of recreational, therapeutic, or competitive exercise for people with physical disabilities that provides many physical and psychological benefits. Adaptive cycling equipment is available in many forms to accommodate the individual rider's abilities, including upright or recumbent hand cycles, recumbent leg cycles, tandem cycles, and power-assisted cycles. The "Bike Buddy" adaptive cycle training program was designed to train participants and their caregivers on safe use of equipment and promote participation/access on the local nature trail. The individual training session lasted approximately 1 hour and included equipment management, transfers on/off the bike, positioning, terrain negotiation, assistance needed, and safety. The program was conducted by PTs and DPT students in partnership with local volunteer/non-profit organizations; one dedicated to enriching the lives of individuals with mobility impairments and another conserving/promoting the region's heritage and natural resources. All adaptive cycling equipment and training was provided free of charge at a location adjacent to the trail.

Summary of Use: During the initial implementation phase (~13 months), 11 individuals with mobility impairments (age 18-79 years) resulting from a wide variety of neurologic and/or orthopedic disorders (e.g., MS, CVA, ALS, CP, BKA, OA, amputation) participated in the "Bike Buddy" program. Individuals' typical level of activity varied widely (0-360 minutes exercise/week) and most had no prior use of an adaptive cycle. Before and following the training session, 8 riders and 6 caregivers/buddies rated their levels of confidence with each component of the program. Overall, both riders and buddies reported confidence gains of 1-4 points on a Likert scale from 1-5 (1=strongly disagree to 5=strongly agree) across all tasks. All recommended the training program as 5/5.

Importance to Members: Persons with physical disabilities are at high risk for a sedentary lifestyle, leading to reduced quality of life and development of chronic health conditions. Participating in the "Bike Buddy Program" provides a means to gain confidence with adaptive recreation for meeting CDC exercise recommendations with improved independence. Caregivers may also assist with safe participation in adaptive fitness activities. Additionally, this program may serve as a model for clinicians, PT programs, and community organizations to form partnerships and inform their own program development. This type of program may help empower individuals with physical disabilities and their caregivers to utilize adaptive cycling to maintain fitness.

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