THE UNIVERSITY OF SCRANTON
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DPT Program
Annual Research Night

Saturday, November 6th, 2021
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

Edward R. Leahy Jr. Center Clinic for the Uninsured

Physical Therapy Clinic

Our Services:

The non-profit, student-run Physical Therapy (PT) Clinic provides free services to those who have been referred by either The Leahy Medical Clinic or a health care provider. The PT Clinic allows graduate students in The Doctorate of Physical Therapy Program at the University of Scranton to serve patients under the supervision of a licensed physical therapist. The Clinic treats patients with a variety of orthopedic and neurological conditions.

Requirements:

- Resident of Lackawanna County
- Uninsured or Underinsured
- PT referral from The Leahy Medical Clinic or a health care provider

Contact Information:

• Phone: (570) 941-6563 • Fax: (570) 941-6165 • Email: leahy.ptclinic@gmail.com

The University of Scranton, McGurrin Hall
230 Kressler Court Scranton, PA 18503

Schedule

5:00pm

Introduction: Dr. Renée M. Hakim, Chair/Program Director

Group 1:
Title: Impact of Physical Activity on Post-TBI Depression in Adults: A Systematic Review
Authors: Dominick Algeri, Cristina Cacoilo, James Curley, Daniel Passafiume, Dr. Nicholas Rodio

Group 2:
Title: Impact of Home Health Care on Readmission Rates for Adults Diagnosed with Acute Stroke*
Authors: Julianne Burrill, Stephanie Creegan, Paul Sciascia, Forrest Terpe, Dr. Tracey Collins

Group 3:
Title: Effects of Unstable Surface LE Resistance Training on Balance in Older Adults: A Systematic Review
Authors: Thomas Helmstetter, Mark Merli, Ansis Ramolins, Dr. Peter Leininger

Group 4:
Title: The Effectiveness of Complementary/ Alternative Medicine for Pain Management in Postpartum Women: A Systematic Review*
Authors: Colleen R. Berry, Nicholas Anthony Capobianco, Bryan Gorczyca, Jamie Hreniuk, Dr. Lori Marie Walton, Dr. Renée M. Hakim

Group 5:
Title: Effectiveness of Supine Cycling Plus Early Mobility Interventions Versus Early Mobility Interventions Alone For Patients in the ICU: A Systematic Review.
Authors: Brittany Angrosina, Katey Merenyi, Taylor Powers, Dr. Dana Maida, Dr. Janette Scardillo

Group 6:
Title: Wearable Sensors for Balance and Mobility in Adults with Parkinson's Disease: A Systematic Review
Authors: Lindsay Fitchett, Sarah Marie Neff Futrell, Tatiana Mishina, Ashley Scoyni, Dr. Renée M. Hakim

6:30pm

---------- **BREAK** (15 minutes) ----------

7:00pm

Group 7:
Title: Impact of Community-Based Boxing on Non-Motor Outcomes for Individuals with Parkinson's Disease: A Systematic Review
Authors: Ileana Armendi, Christian Huckfeldt, Dylan Kane, Daniela Spagnoli, Dr. Dana R. Maida, Dr. Jennifer Schwartz

Group 8:
Title: Key Anxiogenic Factors in Taking Objectively Structured Clinical Examinations among Healthcare Students: A Systematic Review
Authors: Danielle Higgins, Meghan Kimball, Devanshi Shah, Raven Thomas, Dr. Anthony F. Carusotto

Group 9:
Title: Blood Flow Restriction Therapy Effects on Function and Pain in Adults with Lower Leg Pathology
Authors: Christopher Kovacs, Nicholas Linko, Robert Spitz, SPT, Elijah Walker, Dr. Joshua Prall, Dr. Peter M. Leininger

Group 10:
Title: The Value of Home Health Physical Therapy for Acute Stroke: A Mixed-Methods Systematic Review
Authors: Lindsay Fitchett, Dr. Tracey Collins

Group 11:
Title: The Impact of Home Health Physical Therapy (HHPT) on Readmission Rates in Frail Older Adults
Authors: Ileana Armendi, Dr. Tracey Collins

Group 12:
Title: Long-Term Impact of Community-Based Boxing for Balance and Mobility in Persons with Parkinson's Disease
Authors: Christian Huckfeldt, Daniela Spagnoli, Dr. Jennifer Schwartz, Dr. Dana R. Maida, Dr. Renée M. Hakim, Dr. Mike Ross

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

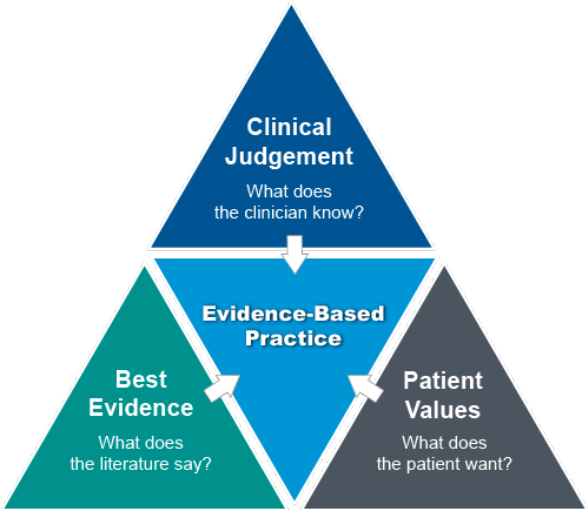
Decision-making is optimized by emphasizing the use of evidence from well-designed and well-conducted research. Although evidence-based practice encompasses more than just applying the best available evidence, many of the concerns and barriers to using evidence-based practice revolve around finding and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

Clinical Expertise

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 is key.

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 is a necessary skill 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 Centre for Evidence-Based Medicine 2011 Levels of Evidence

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.**

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.

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/

Methodological Index for Non-Randomized Studies (MINORS)

Table 2. The revised and validated version of MINORS

Methodological items for non-randomized studies	Score†
1. **A clearly stated aim:** the question addressed should be precise and relevant in the light of available literature	
2. **Inclusion of consecutive patients**: all patients potentially fit for inclusion (satisfying the criteria for inclusion) have been included in the study during the study period (no exclusion or details about the reasons for exclusion)	
3. **Prospective collection of data**: data were collected according to a protocol established before the beginning of the study	
4. **Endpoints appropriate to the aim of the study**: unambiguous explanation of the criteria used to evaluate the main outcome which should be in accordance with the question addressed by the study. Also, the endpoints should be assessed on an intention-to-treat basis.	
5. **Unbiased assessment of the study endpoint**: blind evaluation of objective endpoints and double-blind evaluation of subjective endpoints. Otherwise the reasons for not blinding should be stated	
6. **Follow-up period appropriate to the aim of the study**: the follow-up should be sufficiently long to allow the assessment of the main endpoint and possible adverse events	
7. **Loss to follow up less than 5%**: all patients should be included in the follow up. Otherwise, the proportion lost to follow up should not exceed the proportion experiencing the major endpoint	
8. **Prospective calculation of the study size**: information of the size of detectable difference of interest with a calculation of 95% confidence interval, according to the expected incidence of the outcome event, and information about the level for statistical significance and estimates of power when comparing the outcomes	
Additional criteria in the case of comparative study	
9. **An adequate control group**: having a gold standard diagnostic test or therapeutic intervention recognized as the optimal intervention according to the available published data	
10. **Contemporary groups**: control and studied group should be managed during the same time period (no historical comparison)	
11. **Baseline equivalence of groups**: the groups should be similar regarding the criteria other than the studied endpoints. Absence of confounding factors that could bias the interpretation of the results	
12. **Adequate statistical analyses**: whether the statistics were in accordance with the type of study with calculation of confidence intervals or relative risk	

†The items are scored 0 (not reported), 1 (reported but inadequate) or 2 (reported and adequate). The global ideal score being 16 for non-comparative studies and 24 for comparative studies.

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JBI Critical Appraisal Checklist for Qualitative Research

Reviewer_____Date_____

Author _____Year_____Record Number_____.

		Yes	No	Unclear	Not applicable
1.	Is there congruity between the stated philosophical perspective and the research methodology?	☐	☐	☐	☐
2.	Is there congruity between the research methodology and the research question or objectives?	☐	☐	☐	☐
3.	Is there congruity between the research methodology and the methods used to collect data?	☐	☐	☐	☐
4.	Is there congruity between the research methodology and the representation and analysis of data?	☐	☐	☐	☐
5.	Is there congruity between the research methodology and the interpretation of results?	☐	☐	☐	☐
6.	Is there a statement locating the researcher culturally or theoretically?	☐	☐	☐	☐
7.	Is the influence of the researcher on the research, and vice- versa, addressed?	☐	☐	☐	☐
8.	Are participants, and their voices, adequately represented?	☐	☐	☐	☐
9.	Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	☐	☐	☐	☐
10.	Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

Mixed Methods Appraisal Tool (MMAT), version 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: Impact of Physical Activity on Post-TBI Depression in Adults: A Systematic Review*

Authors: Dominick Algeri, Cristina Cacoilo, James Curley, Daniel Passafiume, Dr. Nicholas Rodio

Purpose/Hypothesis: Depression, a common symptom post TBI, delays recovery and decreases QOL.[4,6] The purpose of this systematic review is to determine the impact of physical activity on depressive symptoms for individuals who sustain a TBI.

Materials/Methods: A literature search of Pubmed, Proquest, Cinhal, and SpringerLink (no year limit) was conducted using the search terms: ("TBI" OR "traumatic brain injury") AND ("depression" OR "post-head injury depression") AND ("physical activity" OR "therapy" OR "physical therapy" OR "interventions"). Search limits: English, peer-reviewed, and human subjects. Selection criteria: adults age 18 and older who sustained a traumatic brain injury (TBI) and received any type of physical activity intervention with at least one standardized outcome measure of depression. Each study was independently assessed for methodological quality by two reviewers who came to consensus using Oxford Centre for Evidence Based Medicine Levels of Evidence (2011).

Results: A total of 326 articles were screened for eligibility and 5 articles met selection criteria. Study designs included 3 RCTs (Level II), 1 retrospective cohort study (Level III), and 1 single group study (Level IV). Sample sizes ranged from 4-240 participants (368 total) who sustained moderate to severe TBI. All studies administered physical activity interventions using 30-60 minutes of aerobic exercise for 3-5x/week at 50-70% APMHR with durations of 8-12 weeks (Levels II,IV) or 24 weeks (Level III). All studies reported reductions in depressive symptoms following interventions. Aerobic activity groups showed statistically significant improvements in depression in 4 of 5 studies. In 3 studies (Levels II-III) measuring depression using the Becks Depression Inventory, 1 found a statistically significant within group difference (6pts). Another statistically significant between group difference in depression scores (0.92- 0.25pts) was reported using the POMS (Level II). A significant within group decrease in HAMD scores (34.6-69.6% change) was also found (Level IV). No adverse events were reported.

Conclusions: There is low to high evidence in support of physical activity to decrease depressive symptoms in adults post-TBI. Performance of moderate intensity aerobic exercise (both land-based and aquatic) appears to have the most benefit in lowering depressive symptoms in adults. Limitations included small sample sizes, different depression scales, and varied designs. Further high-level research with larger sample sizes should be conducted to determine optimal protocols/parameters for physical activity to decrease depression in adults post-TBI.

Clinical Relevance: Moderate intensity aerobic exercise improved depression in patients who sustained a moderate-severe TBI. Clinically meaningful changes in BDI mean scores exceeded the MCID value of 5 points[4] and HAM-D improvements exceeded the MCID of ≥ 27.1%.[4] Clinicians should educate patients on the benefits of general aerobic activity utilizing programs 3-5 times a week for ≥ 30 minutes at 50-70% APMHR. Physical activity is a feasible intervention that is important to the wellness of patients post-TBI.

* Accepted for poster presentation at American Physical Therapy Association (APTA) Combined Sections Meeting (CSM), San Antonio, TX, February 2022; Academy of Neurologic Physical Therapy

Study	Intensity & Type of Exercise	Outcome Measures	Oxford Level of Evidence
Hoffman et al.	-90 minutes of moderate to vigorous physical activity -Moderate Exercise= 60% APMHR -RPE= >12/20	Beck Depression Inventory (BDI)	2- RCT
Wise et al.	-30 minutes of aerobic exercise at least 4x per week -Moderate Exercise= 60% max HR -RPE 12/20	Beck Depression Inventory (BDI)	2- RCT
Driver et al.	-Experimental group performed an 8-week aquatics program consisting of 1-hour sessions, 3x per week -50-70% MHR	The Profile of Mood States (POMS)	2- RCT
Gordon et al.	-Exercise group; (jogging, biking, swimming) 30 minutes 3x per week	Beck Depression Inventory (BDI)	3- Retrospective Cohort Study
Schwandt et al.	-Treadmill and recumbent step machine groups participated in a 12-week intervention, 3x/week. -At least 70% MHR	Hamilton Rating Scale for Depression (HAMD)	4- Single Group Study

Key: RPE = rate of perceived exertion, APMHR= age predicted max heart rate, HR= Heart Rate, MHR= max heart rate

Group 2

Title: Impact of Home Health Care on Readmission Rates for Adults Diagnosed with Acute Stroke*

Authors: Julianne Burrill, Stephanie Creegan, Paul Sciascia, Forrest Terpe, Dr. Tracey Collins

Purpose: The purpose of this systematic review is to determine the impact of home health(HH) rehabilitation on hospital readmission rates for patients post CVA.

Methods: A literature search (2011-2021) of CINAHL, Pubmed, Proquest, and ScienceDirect using search terms: ("Home Care" OR "Home Health" OR "Home Health Rehab") AND(Rehospitalization OR "Hospital Readmission") AND (CVA OR Stroke OR TIA OR "Cerebrovascular Accident"). Search limits: Peer-reviewed, English language, and human subjects. Selection criteria: adults over 18 years old, intervention of HH within 30 days of discharge from the hospital (PT, OT or Nursing), and primary outcome measure including hospital readmission. Two reviewers independently assessed each study for methodological quality and came to consensus based on Oxford Levels of Evidence (2009).

Results: A total of 811 articles were screened for eligibility. Following detailed appraisals, 6met the selection criteria. From the Oxford Levels of Evidence (2009), 5 of the studies were Level 2b evidence based on being retrospective cohort studies. 1 study was a case control study and was Level 3b evidence. Sample size ranged from 524-130,670 (total N=288,401). The average age was 75.78 ± 5.89 and all participants had a hospital admission with a confirmed diagnosis of acute stroke within the last year. HH treatment parameters varied widely among studies and were provided by PT, OT, SLP, social work (SW), nursing, and home health agency. Period of readmission data collected amongst the studies varied between 30 days to 1 year. HH interventions were compared to a variety of other settings such as outpatient (OP), Skilled Nursing (SNF), Inpatient Rehab (IRF), and no services (NS). Of the 6 studies, 5 report a lower readmission rate (HH 30 day= 11.87% ± 5.67; HH 90 day=16.45%± 3.68) when HH interventions are implemented into care compared to rehabilitation in other settings. (IRF 30day= 15.97% ± 3.87%; SNF 30 day= 14.26% ± 2.70; SNF 90 day= 27.7% ±4.9%; IRF 90 day=23.17% ±1.67%).

Conclusions: The research data reviewed shows moderate to strong evidence to support the use of HH services post-discharge to reduce hospital readmission rates for patients diagnosed with an acute stroke. Limitations include sample size, participant recruitment, loss to follow-up, information on type of stroke, detail on specific interventions used during care, and a limited number of databases searched. Further research should include larger, more detailed sample groups, more in-depth intervention descriptions, and different study designs. Future research could provide more evidence on the effectiveness of utilizing HH for acute stroke patients posthospital discharge.

Clinical Relevance: HH services may provide to be a beneficial and cost-effective approach to reduce hospital readmission rates after hospital discharge for patients following an acute stroke. HH services including PT, OT, and nursing should be considered for the appropriate patient when discharged from acute care to reduce hospital readmission rates

* Accepted for platform presentation at APTA Combined Sections Meeting (CSM), San Antonio, TX, February 2022; Home Health Section

Article by author	Settings Compared	Period of Readmission	Key Findings
Suri M & Qureshi A	○ Home without HH	Not Specified	Patients discharged without home health services were more likely to be readmitted compared to patients discharged with home services
Langstaff C, Martin C, Brown G, et al.	○ Home with HH ○ IRF ○ SNF	365-day	Introducing home rehabilitation services was associated with decreased readmission rates when patients were discharged from acute care to home
Middleton A, Kuo Y-F, Graham JE & Karmarkar A	○ HH ○ NS	30-90 day	Lowest 30-day and 90-day readmission rates for ischemic and hemorrhagic stroke were in patient's D/C to the HH setting
Li C-Y, Karmarker A, Kuo Y-F, et al	○ HH ○ SNF ○ IRF	30-days 90-days	Patients discharged to a HHA demonstrated decreased 30-day and 90-day readmission rates when compared to SNF and IRF
Freburger JK, Li D, Fraber EP	○ HH ○ Outpatient (OP) ○ No Services (NS)	30-60 days	Individuals receiving therapy (HHC or Outpatient) were less likely to be readmitted than individuals receiving no services
Swanson JO & Moger TA	○ No Services (NS) ○ Home Nursing (HN) ○ Rehab ○ Home Nursing + Rehab	90-days 365-days	Patients discharged with no services had lower hospital readmission rates. However, individuals discharged to home nursing or rehab had an increased length of stay, increased incidence of comorbidities, and older average age

Group 3

Title: Effects of Unstable Surface LE Resistance Training on Balance in Older Adults: A Systematic Review*

Authors: Thomas Helmstetter, Mark Merli, Ansis Ramolins, Dr. Peter Leininger

Background and Purpose: Past research has supported lower extremity (LE) resistance training on stable surfaces for improving balance in older adults,[1-2] however, the benefit of utilizing unstable surfaces has not been thoroughly discussed.[3] The purpose of this systematic review was to determine the effects of LE resistance training on unstable surfaces on balance in older adults.

Methods: A literature search of PubMed, ProQuest, CINAHL, and Google Scholar was conducted using search terms: Effects AND ("unstable surfaces" OR instability) AND ("stable surfaces" OR "steady surfaces") AND ("lower extremity" OR LE) AND ("resistance training" OR "strength training") AND balance AND ("older adults" OR geriatrics OR seniors). Search limits: human subjects, peer-reviewed, randomized controlled trials (RCTs). Selection criteria: older adults 65+ with no history of neurologic diagnoses affecting the LEs or recent LE fractures/surgeries, interventions included LE strength training protocols on unstable surfaces, outcomes included standardized balance measures. Two reviewers independently assessed and agreed on the quality of each study using the Physiotherapy Evidence Database (PEDro) scale.

Results: A total of 253 articles were screened. Post-appraisals, 9 RCTs met the selection criteria. PEDro scores ranged from 5-8/10 (avg=6.67). Samples ranged from 14-86 subjects (511 total), aged 65 and older (avg=72.73yrs). Participants were assigned to an unstable surface group (USG) or a stable surface group (SSG), both of which completed a LE resistance training protocol. Study durations ranged from 3wks-6mo (1-5 sessions/wk) and session duration ranged from 30-60min. The USG demonstrated significantly greater improvements in balance outcomes compared to the SSG in five[4-8] of the nine studies. Specifically, the USG walked 11.2% faster after 3 weeks of training while the SSG improved by 6.6% ($p=0.049$).[4] The USG showed greater improvement than the SSG for their center of pressure to the limits of stability as shown by the effect sizes, $d=1.61$ and $d=0.23$, respectively.[5] The USG held tandem stance 12.9 s longer and single leg stance (SLS) 6.0 s longer than the SSG after 2 months ($p<0.02$).[6] The USG increased their side reaching in the multidirectional reach test by 14% ($p=0.036$) while the SSG improved by 4% ($p=0.398$).[7] The USG improved their SLS on foam from 9.42 to 15.30 s ($p=0.03$) after 8 weeks while the SSG improved from 7.07 to 11.27 s ($p=0.20$).[8]

Conclusions: There is mixed evidence in support of unstable surface LE resistance training programs for improving balance in older adults. Limitations included small sample sizes, large sample age range, varying duration of intervention periods, and the relative good health of participants. Further high-level research should be conducted to determine optimal LE exercises and dosage in order to provide maximal balance gains in older adults.

Clinical Relevance: Implementing unstable surface resistance training may reduce risk of future falls as evident by TUG fall risk cutoff scores for community dwelling older adults.[6,9] LE resistance training on unstable surfaces did not lead to increased adverse events and should be considered by clinicians when balance training with older adults, in addition to training on stable surfaces.

* Accepted for platform presentation at APTA Combined Sections Meeting (CSM), San Antonio, TX, February 2022; Academy of Geriatric Physical Therapy

Study	Unstable Surface Group (USG) Parameters	Key findings
Piraua et al. (2019)[3]	**Frequency:** 24 weeks, 3x/week **Duration/Volume:** 30-60 mins, 2-5 sets and 7-12 reps **Exercises:** 45° ROM leg press, bridges **Equipment:** BOSU ball, balance disc, Swiss ball	There were no statistically significant differences between the USG and the stable surface group (SSG) in TUG, BBS, and FES-I scores.
Eckardt (2016)[4]	**Frequency:** 10 weeks, 2x/week **Duration/Volume:** 60 mins **Exercises:** Squats, stair walker, front lunges, bridges, farmer carries **Equipment:** BOSU ball, wobble board, inflatable disc	Both groups improved in the FRT, however free weight USG (F-USG) revealed the largest effect size. There were no statistically significant differences between groups in TUG and FRT scores.
Zhou, Yuan, Ma (2020)[5]	**Frequency:** 5x/week for 3 weeks **Duration:** 30 min sessions **Exercises:** Bodyweight squats, single-leg squats, heel raises **Equipment:** Outdoor environment consisting of grass, sand, gravel, pebbles and plastic	The USG showed statistically significant improvements when compared to the SSG for the 10 mWT. No statistically significant differences were seen in TUG times, SLSTEO, or SLSTEC.
Hamed et al. (2018)[6]	**Frequency:** 2x/week for 14 weeks **Duration:** 1.5 hour sessions **Exercises:** Lunges, jumping, squatting **Equipment:** Wedged soft mat, soft pad, BOSU ball, balance beam, semicircular block, Posturomed device	The USG showed a significantly higher effect size than the SSG for improvements in their center of pressure towards the anterior limit of stability.
Hirase (2015)[7]	**Frequency:** 1x/week for 4 months **Duration:** 60 min sessions **Exercises:** Heel raises, toe raises, free-leg swinging **Equipment:** Foam rubber pad	The USG held SLS and tandem stance significantly longer than the SSG after 2 months. The USG had significantly greater improvements in their TUG and FES scores when compared to the SSG.
Eckardt and Rosenblatt (2019)[8]	**Frequency:** 2x/week for 10 weeks **Duration/Volume:** 60 min sessions **Exercises:** Squats, stair walker, front lunges, bridges, farmer carries **Equipment:** BOSU ball, wobble board, inflatable disc	Free weight USG group increased its side reaching in the MDRT outcome measure by 14%, compared to the SSG group which only improved by 4%.
Kim, Choi, Kim (2016)[9]	**Frequency:** 2x/week for 8 weeks **Duration:** 40 min sessions **Exercises:** Isometric squats, weight shifts in squat stance **Equipment:** TOGU Aero-step Balance Trainer pad	The USG held SLS on a soft surface for a significantly longer time than the SSG. While not statistically significant, the USG improved in their TUG time to a greater degree than the SSG.
Cavalcante (2020)[10]	**Frequency:** 3x/week for 12 weeks **Duration/Volume:** 3 sets of 10-15 reps for each exercise **Exercises:** Wall ball squat, horizontal leg press, bridges, standing calf raises **Equipment:** BOSU ball, balance disc, Swiss ball	The USG showed non-statistically significant improvements in TUG and SPPB scores compared to the SSG.
Eckardt, Braun, Kibele (2020)[11]	**Frequency:** 2x/week for 10 weeks **Duration:** 60 min sessions **Exercises:** Squats, forward lunges **Equipment:** BOSU ball, foam pad, soft pad	There were no significant differences for improvements in FES-I scores between the USG and the SSG after the intervention period.

Group 4

Title: The Effectiveness of Complementary/ Alternative Medicine for Pain Management in Postpartum Women: A Systematic Review*

Authors: Colleen R. Berry, Nicholas Anthony Capobianco, Bryan Gorczyca, Jamie Hreniuk, Dr. Lori Marie Walton, Dr. Renee M. Hakim

Purpose/Hypothesis: The purpose of this systematic review was to determine the impact of complementary/alternative medicine (CAM) on pain in postpartum women.

Materials and Methods: A literature search of ProQuest, PubMed, Cochrane, & CINAHL was conducted with search terms: ("postpartum" OR "postnatal") AND ("pain") AND ("RCT" OR "random* control* trial" OR "random* clinical trial"). Selection criteria: RCT, women (>18 years) with postpartum pain (PP) up to three years, CAM as defined by the National Center for Complementary and Integrative Health, and at least one pain outcome measure. Two reviewers independently assessed each study for methodological quality and came to consensus using PEDro guidelines.

Results: A total of 483 studies were screened for eligibility and 22 RCTs met the selection criteria. PEDro scores ranged from 5/10 to 10/10 (avg=7.5). Samples ranged from 11-500(N=2,952) adult women with PP. Intervention protocols varied widely. Primary pain outcome measures were Visual Analog Scale (VAS) and Numeric Rating Scale (NRS) (11pt scale). There were seven pain categories that emerged with statistically significant between-group reduction of pain in CAM groups vs controls (VAS/NRS for 14 CAM groups, Mean Difference (MD)=-3.66pts, 95% Confidence Interval (CI) [-4.75, -2.57]) including: breast/nipple pain (3/5 statistically significant), perineal pain (5/7), pelvic girdle pain (0/1), low back pain (LBP, 3/3), general PP (2/3), and post-cesarean pain (PCP, 2/2). CAM included lanolin, herbal compresses/ointment, cabbage leaves, cinnamon, lavender, acupressure, acupuncture, dry cupping, mobilization, massage, Turkish classical music (TCM) and abdominal binders (AB). Statistically significant pain reduction was reported for AB on PCP (n=1, -7pts), massage on LBP and PCP (n=2, -2.1, -2.0pts), lumbar mobilization on LBP (n=2, -5.1pts), acupressure on perineal and PP (n=2, -2.4, -0.2pts), acupuncture (n=1, -1.5pts) and cinnamon ointment (n=1, -2.4pts) on perineal pain, cabbage leaves (n=1, -3.1pts). TCM (n=1, -4.28pts), and herbal compresses (n=1, -5.9pts) on breast pain. Adverse events reported in 4 studies included: hemorrhage, removal of AB, tenderness with chiropractic treatment, and mild skin irritation for herbal compresses and lanolin.

Conclusions: Strong evidence supports CAM to decrease pain in postpartum women, with greater pain reduction than usual care in some cases. Limitations included small samples, lack of blinding, long-term follow-up, and adherence. Further research is needed to determine optimal treatment parameters, long-term and co-intervention effects of CAM for PP.

Clinical Relevance: For optimal clinical management, physical therapists (PTs) should review evidence of CAM in the PT scope of practice including mobilization, massage, and acupressure. Meaningful clinical improvements were found for AB, lumbar mobilization, cabbage leaves, and herbal compresses which exceeded the NRS Minimal Clinically Important Difference (MCID) value (-3.0pts). Clinicians should be prepared to educate and refer as needed for women with PP who are considering or already using CAM as part of holistic clinical management.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), San Antonio, TX, February 2022; Pelvic Health Section.

STUDY	CAM TREATMENT USED	TYPE OF PAIN	CLINICAL SIGNIFICANCE?
Gausel et al. (2019)	Chiropractic Treatment	Pelvic Girdle Pain	No
Dennis CL et al. (2012)	Lanolin Ointment	Nipple Pain	No
Sailo ML et al. (2018)	Peppermint Water	Nipple Pain	**Yes**
Jackson K et al. (2016)	Lanolin	Nipple Pain	No
Vieira F et al. (2017)	Lanolin	Nipple Pain	No
Wong BB et al. (2018)	Cabbage Leaves	Breast Pain	**Yes**
Sukwadee K et al. (2018)	Herbal Compresses	Breast Pain	**Yes**
Jaic KK et al. (2018).	Auricular Acupuncture	Perineal pain	No
Akbarzade M et al. (2015)	Acupressure	Perineal Pain	**Yes**
Malekuti J et al. (2019)	Myrtus Communis Herbal	Perineal Pain	**Yes**
Kwan WS et al. (2014)	Ear Acupressure	Perineal Pain	No
Vaziri F et al. (2017)	Lavender Oil Aroma	Perineal Pain	**Yes**
Mohammadi A et al. (2014)	Cinnamon Water	Perineal Pain	**Yes**
Vakilian K et al. (2011)	Lavender Essential Oil	Perineal Pain	**Yes**
Solt KA et al. (2020)	Acupressure	Perineal Pain	**Yes**
Kim M et al. (2019)	Acupuncture	General Post-Partum Pain	No
Afravi S et al. (2019)	Hugo Point Pressure	General Post-Partum Pain	**Yes**
Toker E et al. (2021)	Turkish Classical Music	General Post-Partum Pain	**Yes**
Schwerla F et al. (2015)	Osteopathic Manipulative Therapy	Low Back Pain	**Yes**
Kamel DM e al. (2016)	Lumbar Mobilization	Low Back Pain	**Yes**
Lee HG (2015).	Back Massage	Low Back Pain	**Yes**
Saatsaz S et al. (2016)	Massage	Post-Cesarean Pain	**Yes**
Ghana S et al. (2017)	Abdominal Binders	Post-Cesarean Pain	**Yes**

Group 5

Title: Effectiveness of Supine Cycling Plus Early Mobility Interventions Versus Early Mobility Interventions Alone for Patients in the ICU: A Systematic Review.

Authors: Brittany Angrosina, Katey Merenyi, Taylor Powers, Dr. Dana Maida, Dr. Janette Scardillo

Purpose/Hypothesis: The purpose of this systematic review was to determine the effectiveness of supine cycling plus early mobility compared to early mobility interventions alone for adults in the Intensive Care Unit (ICU).

Material/Methods: A literature search of Cochrane Library, PubMed, EBSCO Discovery Services, and ProQuest was conducted using the search terms: ("Physical Therapy" OR Physiotherapy OR PT) AND ("supine cycling" OR "in-bed cycling") AND (ICU OR "Intensive Care Unit"). Search limits: peer reviewed, English, years 2011-2021, humans. Selection criteria: Adults 18+ in the ICU, supine cycling plus early mobility compared to early mobiliy alone. Studies were independently assessed by 2 reviewers for methodological quality based on OCEBM Levels of Evidence (2009).

Results: A total of 119 articles were screened for eligibility and 5 studies met selection criteria. Levels of evidence ranged from 1B-2B. Sample sizes ranged from 66-312 subjects (n=727) ≥18 years old admitted to the ICU. Treatment parameters varied with durations ranging from 15-60 minutes and 5-7 days per week. Treatment began at enrollment into the studies (upon awakening or at randomization of groups) and ended at ICU discharge. Each of the studies compared supine cycling plus early mobility to early mobility alone using a variety of outcome measures. Outcomes assessed included strength (4/5), functional mobility (5/5), and endurance (3/5). All of the articles demonstrated no statistically significant between-group differences across any of the outcome measures. Additionally, protocols varied for the intervention groups, adjunctive interventions included functional electrical stimulation during cycling (1/5), electrical stimulation performed at a separate time from cycling (1/5), and resistance training (1/5). Adverse events were rare, occurring in <1% of all participants (4/5). Adverse events were not attributable to supine cycling when reported in slightly greater than 1% of all participants (1/5).

Conclusions: Available moderate levels of evidence do not currently support the addition of supine cycling to traditional early mobility programs. No statistically significant differences were found for strength, functional mobility, or endurance measures when supine cycling and early mobility were used versus early mobility alone. Limitations included variability in severity of illness and variability of interventions, protocols, and outcome measures. Additionally, blinding of physical therapists and patients was not possible. Future research should include specific intervention protocols, a focus on common ICU diagnoses (ICU acquired weakness, cardiac pathologies, neurological deficits, etc.), and specifically examine supine cycling when early mobility is not possible, especially for those with altered levels of consciousness.

Clinical Relevance: In order to optimize patient outcomes in acute care setting, utilizing evidence-based interventions is paramount. Based on the available evidence on this topic, clinicians should continue to focus on using skilled functional mobility interventions, such as bed mobility, gait training, and stair negotiation, to promote improved outcomes for adults in the ICU. Although no adverse events occurred, supine cycling has not been shown to enhance recovery from critical illness in the ICU population.

Article Citation	Cycling Intervention Parameters	Outcome Measures	Key Findings
Berney S, Hopkins RO, Rose JW, et al. Functional electrical stimulation in-bed cycle ergometry in mechanically ventilated patients: A multicentre randomised controlled trial. *Thorax*. 2021;76(7):656-663. doi: 10.1136/thoraxjnl-2020-215093.	**Frequency:** ≥ 5 days/week **Intensity**: Not defined **Type:** FES-assisted cycling **Time:** up to 60 minutes per day	• Manual muscle strength • Hand grip strength • PFITs • FSS-ICU • 6MWT • SPPB • Katz ADL • Lawton's IADL	Patients demonstrated no benefit of FES-cycling plus usual care rehabilitation, compared to usual care rehabilitation alone
Nickels MR, Aitken LM, Barnett AG, et al. Effect of in-bed cycling on acute muscle wasting in critically ill adults: A randomised clinical trial. *J Crit Care*. 2020;59:86-93. doi:10.1016/j.jcrc. 2020.05.008.	**Frequency:** Once daily, up to 6 days/week **Intensity**: Not defined **Type:** Supine cycling using MOTOmed Letto2 **Time:** up to 30 minutes per session	• Manual muscle strength • Handgrip strength • FSS- ICU • 6MWT • ICU Mobility Score	There were no statistically significant between-group differences across the primary and secondary outcomes.
Fossat G, Baudin F, Courtes L, et al. Effect of in-bed leg cycling and electrical stimulation of the quadriceps on global muscle strength in critically ill adults: A randomized clinical trial. *JAMA.* 2018;320(4):368-378. doi:10.1001/ jama.2018.9592.	**Frequency:** 5 days/week **Intensity**: Not defined **Type:** Supine cycling using MOTOmed Letto2; Electrical stimulation applied to quadriceps muscle at a different time than cycling **Time:** 15 minutes per cycling session; 50 minutes of electrical stimulation to quadriceps muscle	• Manual muscle strength • ICU Mobility Score • Katz ADL	Early in-bed cycling and electrical stimulation of the quadriceps muscles added to early rehabilitation, compared with early rehabilitation alone, did not result in improved outcomes at ICU discharge.
Eggmann S, Verra ML, Luder G, Takala J, Jakob SM. Effects of early, combined endurance and resistance training in mechanically ventilated, critically ill patients: A randomised controlled trial. *PLoS One*. 2018;13(11):e0207428. doi:10.1371/journal.pone. 0207428.	**Frequency:** up to 3 times per day, 5 days/week **Intensity**: 20 cycles per minute (passive cycling), motor assisted and active intensities not defined **Type:** Supine cycling using MOTOmed Letto2 **Time:** between 20-60 minutes, depending on participation level	• 6MWT • FIM • Manual muscle strength • Handgrip strength	Researchers did not find any functional benefits of adding early exercise training to active usual care rehabilitation in mechanically ventilated, critically ill adults.
Kho ME, Molloy AJ, Clarke F, et al. Multicentre pilot randomised clinical trial of early in-bed cycle ergometry with ventilated patients. *BMJ Open Respiratory Research*. 2019;6(1). doi:10.1136/ bmjresp-2018-000383	**Frequency:** 5 days/week **Intensity**: 5 revolutions per minute for first minute. Patients continued with passive, active-assisted or active cycling for the next 29 minutes, according to their level of participation **Type:** Supine cycling using RT300 supine cycle **Time:** 30 minutes per session	• PFITs	No significant difference in PFITs scores were found between groups at any time point.

Group 6

Title: Wearable Sensors for Balance and Mobility in Adults with Parkinson's Disease: A Systematic Review*

Authors: Lindsay Fitchett, Sarah Marie Neff Futrell, Tatiana Mishina, Ashley Scoyni, Dr. Renée M. Hakim

Purpose/Hypothesis: The purpose of this systematic review was to evaluate use of wearable sensors during examination and intervention for balance and mobility in adults with Parkinson's Disease (PD).

Materials & Methods: A literature search of CINAHL, Cochrane Library, MEDLINE/PubMed, ProQuest Central, and Wiley was conducted using search terms: (Parkinson's OR Parkinson's Disease OR Parkinson Disease OR Parkinsons OR Parkinsons Disease OR PD) AND (smart sensors OR smart wearable sensors OR wearable movement sensors OR wearable technology OR wearable sensor OR wearable body sensor OR body worn sensor OR accelerometer) AND (Physical Therapy OR PT). Search limits: human, English, peer-reviewed. Selection criteria: Diagnosed PD, at least one outcome for balance and/or mobility, and use of body worn sensors to analyze movement kinetics and kinematics. Methodological quality was assessed by two independent reviewers who came to consensus using Oxford CEBM Levels of Evidence (2011).

Results: A total of 986 articles were screened for eligibility and 10 articles met selection criteria. Levels of evidence ranged from 2 to 4. Sample sizes ranged from 10-263 (926 total) participants with clinically diagnosed PD (H&Y I-IV; age range 40-85 y/o when provided). Body worn sensors included triaxial accelerometers (n=9) and gyroscopes (n=8) on the trunk and pelvis (n=9), LEs (n=3), and dorsal hand (n=2). Two studies (Level 2-3) differentiated between PIGD and TD subtypes of PD as the PIGD group had significantly greater duration, steps, and turning yaw during the iTUG (Level 3) and significantly decreased daily physical activity (Level 2). Two studies (Level 2-3) compared fallers to non-fallers and found significant differences in gait quality, but not quantity (Level 2), and early detection of fall risk for non-fallers (Level 2). Dual-task walking data showed significant between-group differences in gait speed and stride length (Level 3). Three studies (Level 3-4) detected mobility impairments in PD compared to healthy groups showing differences in sit-to-stand and sit-to-walk transitions, overlapping turning strategy during the TUG, and decreased postural control. In two studies (Level 2-4), use of sensors to enhance balance and mobility interventions provided no significant advantages.

Conclusions: Body-worn sensors were effective in examination of balance and mobility in patients with PD to define subgroup differences (Level 2-3), predict fall risk (Level 2-3), and measure movement strategies (Level 2-4). Sensor use during intervention did not provide an advantage (Level 2-4). Limitations included small, heterogeneous sample sizes, sensor application variations, sensor availability, and repeated authors through accepted studies. Further research should include comparing sensor diagnostics to Hoehn and Yahr stages and evaluating sensor clinical utility.

Clinical Relevance: Medical professionals treating patients with PD may consider utilizing body worn sensors to improve objective measurements of balance and mobility. Sensor data collection was more accurate, sensitive, and specific in detecting PD severity than clinical outcome measures. Current research supports feasibility of sensor use in both clinical and daily-living settings; but cost may limit adoption. Sensors are easy to attach, lightweight, and small, and have the potential to enhance long-term management of PD.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), San Antonio, TX, February 2022; Academy of Neurologic Physical Therapy, Degenerative Diseases Special Interest Group (SIG)

Diagnostic Studies

Article	Design/Level of Evidence	Examination Category	Sensors	Findings
Galperin I, et al.	Cross-sectional study Level 2	Differences in PIGD and TD subtypes	Triaxial accelerometer and gyroscope Attached to the low back via a belt	Motor complications and lower extremity bradykinesia related to PD may lead to decreased daily physical activity. The PIGD subtype demonstrated decreased quantity and quality of physical activity compared to the TD subtype and healthy controls.
Herman T, et al.	Non-randomized controlled cohort Level 3	Differences in PIGD and TD subtypes	Triaxial accelerometer and gyroscope Attached to the low back	Use of sensors applied to the iTUG can detect subtle differences in performance between PIGD and TD subtypes. PIGD participants demonstrated greater iTUG duration with a greater number of steps. During the sit to stand transition, PIGD participants demonstrated decreased acceleration and angular velocity, indicating more rigid movement.
Weiss A, et al.	Cross sectional design with longitudinal follow-up Level 2	Assessment of fall risk	Triaxial accelerometer and gyroscope Attached to the low back via a belt	PD fallers had higher gait variability and decreased smoothness. For PD non-fallers, time to first fall after the study period was significantly sooner in those with more variable gait measured during the study period. Sensors were able to predict development of fall risk in PD non-fallers better than the TUG and DGI.
Smulders K, et al.	Follow up/subset of an RCT Level 3	Assessment of fall risk	Triaxial accelerometer Attached to the low back at the pelvis	Recurrent fallers had significantly lower gait speed and smaller stride length compared to non-recurrent fallers. During dual task conditions, gait speed was significantly lower and stride length was significantly shorter for recurrent and non-recurrent fallers.
Bernad-Elazari H, et al.	Non-randomized cohort study Level 3	Assessment of movement strategies	Triaxial accelerometer and gyroscope Attached to the lower back	Sensor data detected variations in motor performance between healthy controls, mild PD, and severe PD. Patients with PD used greater sit to stand transition and fewer sit to walk transitions compared to healthy older adults.
Weiss A, et al.	Non-randomized controlled cohort study Level 3	Assessment of movement strategies	Triaxial accelerometer and gyroscope Attached to the low back via an elastic belt	Sensors detected poorer postural and gait control with overlapping turning strategies associated with longer PD duration, poorer scores on outcome measures, and worse FOG symptoms.
Salarian A, et al.	Case control study Level 4	Assessment of movement strategies	Triaxial accelerometers and gyroscopes One attached to the trunk, two attached to the LEs at the shank	Sensors were able to detect differences in daily mobility activities between healthy adults compared to PD patients in both ON and OFF phases of DBS stimulation with excellent sensitivity and specificity. Sensors had significant correlation with UPDRS-III scores.
Shawen N, et al.	Follow up to a non-randomized controlled trial Level 3	Assessment of tremor and bradykinesia	Triaxial accelerometers and gyroscopes Attached to one or both hands	Pairing gyroscope and accelerometer data improved detection of bradykinesia, whereas accelerometer data alone was sufficient for detecting tremor

Intervention Studies

Article	Design/Level of Evidence	Sensors	Findings
Carpinella I, et al.	RCT Level 2	Triaxial accelerometer and gyroscope Attached to the upper and lower trunk and the LEs	The Gamepad System, computerized wearable sensor biofeedback training technology, requires further research. The experimental group, which used the Gamepad System, did not make significant improvements over traditional PT interventions for PD in outcomes including the TUG, BBS, and 10MWT.
Conradsson D, et al.	Longitudinal pretest-posttest design of an RCT Level 4	Triaxial accelerometer Attached to the lateral left hip above the iliac crest	Use of wearable sensors is feasible in clinical settings to collect objective information regarding motor and gait-related balance in patients with PD.

Group 7

Title: Impact of Community-Based Boxing on Non-Motor Outcomes for Individuals with Parkinson's Disease: A Systematic Review*

Authors: Ileana Armendi, Christian Huckfeldt, Dylan Kane, Daniela Spagnoli, Dr. Dana R. Maida, Dr. Jennifer Schwartz

Background & Purpose: Community-Based Boxing (CBB) aims to slow disease progression for individuals with Parkinson's disease (PD), and programs continue to increase in availability. Motor benefits of CBB have been established in the literature; therefore the purpose of this systematic review was to identify the impact of CBB on non-motor outcomes for individuals with PD.

Materials and Methods: A literature search was performed across 4 databases: CINAHL, PubMed, ProQuest, and ScienceDirect. Search terms: (Boxing OR "Boxing Exercise" OR "Boxing Training") AND ("Parkinson* disease" OR PD). Search limits: peer-reviewed, English, human subjects. Selection criteria: adults 18+ with diagnosis of PD, participation in CBB, and report of at least 1 non-motor outcome. Studies were independently assessed for methodological quality by 2 reviewers using the OCEBM Levels of Evidence (2011) and the Joanna Briggs Institute Checklist for Qualitative Research (JBI).

Results: 391 articles were screened. 5 quantitative and 2 qualitative studies met selection criteria. Quantitative studies included 2 RCT (level II), 1 observational study (level II), and 2 case series (level IV). Both qualitative studies utilized a phenomenological design and scored 8-9/10 on the JBI. Sample sizes ranged from 6-47 participants (n=152), 51-89 years old with a diagnosis of PD (H&Y stages I-IV). Quantitative study interventions included participation in CBB 1-3x/week, 60-90 minutes for 6-36 weeks. Qualitative interviews reported variable amounts of CBB for 1-12 months. At least 1 non-motor outcome improved in all 7 studies. 6/7 studies showed improvement in QOL; 3 studies (level II/IV) showed improved PDQ scores [avg=-23.7pts (p=0.012), -4.0pts, -5.2pts (p<.001) respectively]. 1 study (level IV) showed most individuals improved UPDRS ADL sub-scores (avg change=-5.2). 2 qualitative interviews (JBI=8-9/10) and 1 post-test survey noted improved mood, fatigue, and social participation. Balance confidence improved in 2 quantitative studies and 1 qualitative study [level II/IV, ABC scores (avg increase 2.5%)]. 1 study (level IV) showed improved daytime sleepiness and sleep quality via Epworth Sleepiness Scale (ESS) (avg decrease -3.1pts, MCID -2.65) and Parkinson's Disease Sleep Scale (avg increase 13.9). 1 study (level IV) reported decreased depression via Hamilton Depression Scale [avg decrease -4.7pts (p=0.003)]. No adverse events were reported.

Conclusions: Despite popularity, there is widely varied, limited evidence supporting the utilization of CBB to improve or maintain non-motor outcomes for individuals with PD. Further research is needed to address limitations including small sample sizes, lack of reporting on H&Y staging, varied training parameters, and outcome measures.

Clinical Relevance: Community exercise programs, including CBB, are safe, feasible options for persons with PD to remain active and slow associated motor and non-motor impairments. Any degree of participation may result in meaningful statistical or clinical improvements. Therefore, clinicians may consider referring patients to such programs to promote wellness to combat the degenerative nature of PD and improve function and QOL.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), San Antonio, TX, February 2022; Academy of Neurologic Physical Therapy, Degenerative Diseases Special Interest Group (SIG)

Authors	Type of Study (Level of Evidence)	Training Description	Boxing Parameters	Non-Motor Outcomes
Combs et al.	Quantitative (OCEBM Level II)	RSB (warm up, circuit boxing training, general endurance)	90 minutes/session 2-3x/week 12 weeks	**Balance Confidence**: ABC **QOL**: PDQOL
Dawson et al.	Quantitative (OCEBM Level II)	RSB (warm up, circuit boxing training, core cool down)	90 minutes/session 1x/week 16 weeks	**QOL**: EQ-5D
Urrutia et al.	Quantitative (OCEBM Level IV)	Community boxing gym (warm up, high intensity boxing, cooldown)	60 minutes/session 2x/week 6 weeks	**Sleep Quality**: PDSS, ESS **Depression:** HDS
Combs et al.	Quantitative (OCEMB Level IV)	RSB (warm up, agility, strengthening, endurance, boxing, and cool down)	90 minutes/session 2-3x/week 12 weeks	**Balance Confidence**: ABC **QOL**: PDQOL **Impairment:** UPDRS
Sangarapilai et al.	Quantitative (OCEBM Level II)	RSB (warm up, high intensity boxing, endurance, and cooldown)	60 minutes/session 3x/week 10 weeks	**QOL:** PDQ-39
Humphrey et al.	Qualitative (JBI = 8/10)	PD specific class at community boxing gym (non-contact boxing)	75 minutes/session 3-4x/week 3-5 months	**Subjective Interview:** QOL, balance confidence, social engagement, cognition
MacCosham et al.	Qualitative (JBI= 9/10)	RSB affiliate CBB gym (gait training warm up, stretching, posture, endurance, boxing circuit, functional training)	60 minutes/session 2x/week 1-12 months	**Subjective Interview:** Perception of physical, social, and psychological symptoms

Group 8

Title: Key Anxiogenic Factors in Taking Objectively Structured Clinical Examinations among Healthcare Students: A Systematic Review*

Authors: Danielle Higgins, Meghan Kimball, Devanshi Shah, Raven Thomas, Dr. Anthony F. Carusotto

Background/Purpose: OSCEs (Objectively Structured Clinical Examinations) may be anxiogenic for healthcare students, thus causing decreased academic performance, self-confidence, and overall well-being. Currently, there is a lack of synthesized qualitative evidence on the key anxiogenic factors that may affect healthcare student performance on OSCEs. The purpose of this systematic review is to explore the most commonly reported anxiogenic factors associated with completing OSCEs, through the perceived lived experiences of healthcare students.

Methods: A literature search of PubMed, CINAHL, NCBI, and ProQuest Central from August 2020 to December 2021 was conducted using search terms: (Anxiety OR stress OR motivation OR psychological distress) AND (OSCEs OR Objective Structured Clinical Examinations OR practical examinations) AND (health students OR graduate OR students OR medical students). Search limits: human subjects, adults, peer-reviewed, and English language. Selection criteria: healthcare students (18+ years) taking OSCEs, undergraduate studies or graduate studies, college or university setting, primary measure of self-reported anxiogenic factors. Two reviewers independently assessed and agreed on methodological quality of each study using the Joanna Briggs Institute (JBI) tool.

Results: 67 articles were assessed for eligibility and nine articles met selection criteria. All nine articles scored a 10/10 in accordance with the JBI tool. Sample sizes ranged from 20 to 730 participants (1,873 total) aged 20-46 years. Academic programs included physical therapy (n=105), medical (n=413), undergraduate nursing (n=696), and medical imaging (n=47). Qualitative methods utilized to evaluate anxiogenic factors included interview questions and surveys using open-ended questions. Common anxiogenic themes extracted from the articles consisted of the environment of assessment (7/9 articles), the lack of preparedness (6/9 articles), proctor interaction (4/9), pressure to pass (2/9 articles), and low self-esteem (2/9).

Conclusions: Key themes most commonly identified from this study as being anxiogenic factors related to taking OSCEs in healthcare students included the environment of assessment and lack of preparedness. Limitations included a lack of generalizability to one specific sector of healthcare academia, and a lack of standardized method of assessment. Future research should focus on the use of standardized interview protocols or questionnaires to assist with mitigation of the negative effects of anxiety on students' mental health and overall wellbeing.

Clinical relevance: The results from this study provide helpful feedback on key anxiogenic factors for healthcare students undergoing OSCE assessments. The information provided may assist healthcare programs in modifying or adapting to student needs with emphasis on the OSCE testing environment as the most commonly identified anxiogenic theme. In turn, by lessening anxiogenic factors, anxiety may decrease, possibly improving student performance with OSCEs.

* Accepted for a poster presentation at APTA Combined Sections Meeting (CSM), San Antonio, Tx, February 2022; Academy of Education

	Healthcare Students	Key Anxiogenic Themes	JBI Score
Brighton et al.	Undergraduate nursing students	Environment, lack of preparedness, proctor interaction	10/10
Cazzell et al.	Undergraduate nursing students	Environment, lack of preparedness, pressure, proctor	10/10
Duncumb et al.	Graduate medical students	Environment, low-self esteem, pressure to pass	10/10
Karol et al.	Medical students	Proctor, environment	10/10
Majumder et al.	Graduate medical students	Environment	10/10
Massey et al.	Undergraduate nursing students	Lack of preparedness	10/10
Saunders et al.	First-year nursing students	Lack of preparedness	10/10
Taylor et al.	Bachelor of Medical Imaging	Environment, lack of preparedness	10/10
Zhang et al.	Master of Physical Therapy students	Lack of preparedness, proctor, difficulty, environment, low self-esteem	10/10

Group 9

Title: Blood Flow Restriction Therapy Effects on Function and Pain in Adults with Lower Leg Pathology*

Authors: Christopher Kovacs, Nicholas Linko, Robert Spitz, Elijah Walker, Dr. Joshua Prall, Dr. Peter M. Leininger

Purpose/Hypothesis: The purpose of this systematic review is to synthesize current literature to determine if Blood Flow Restriction Therapy (BFRT) is a safe and effective intervention to decrease pain and improve function in individuals with lower leg pathologies.

Materials/Methods: A literature search (2011-2021) was conducted using Cinahl/EBSCOhost, Google Scholar, PEDro, ProQuest, and PubMed databases with search terms: (Blood flow Restriction OR KAATSU OR Vascular Occlusion OR BFR) AND (Lower leg pathologies OR injuries OR post-surgical) AND (Physical therapy OR training OR rehabilitation OR recovery OR interventions OR strengthening) AND (Effects OR Benefits). Search limits: English language, human subjects, and peer reviewed. Selection criteria: Adults ≥18 years with impairment and decreased function in the lower leg (distal to the knee). Each study was independently assessed for methodological quality by 2 reviewers who came to consensus based on the Oxford Center for Evidence-Based Medicine (OCEBM) Levels of Evidence (2011).

Results: Sixty-five articles were assessed for eligibility. After appraisal, 5 studies met our selection criteria including 1 case report, 2 case series, 1 cross-over study design, and 1 single-blinded RCT. Levels of Evidence ranged from 2-4. Sample sizes ranged from 1-28 (57 total) subjects with lower leg pathology ranging from 19-49 years old. Treatment parameters used the Delfi System protocol, 4 sets (30, 15, 15, 15 reps), with an avg. of 45 sec between set rest period. Four studies utilized the 8-minute protocol at 60-80% of lower limb occlusion. One study used the Hokanson AG 101 cuff insulator air source, E20 rapid cuff inflator, and cc17 thigh cuff using 4 sets until failure with 30 sec between set rest periods. Duration ranged from 2 days to 6 weeks. Primary outcome measures for pain and function included: Visual Analog Scale (VAS), Brief Pain Inventory (BPI), and Lower Extremity Functional Scale (LEFS). Two studies (Level 2, $p < 0.01$) showed pain reduction (66-19 points on VAS) throughout the intervention and BPI after the intervention (13-0). One study (Level 4) found improvement using the Delfi System at 80% of lower limb occlusion on the LEFS at week 5.5 (49 pts) vs week 2 (14 pts).

Conclusions: There is low to moderate evidence supporting use of BFRT in adults who have lower leg pathologies to decrease pain and improve function. Limitations include lack of established training protocols and follow-up, small sample sizes, lack of control groups, and heterogeneous lower limb injuries. High-level research with precise training parameters and adequate follow-up is needed for more conclusive evidence of BFRT with lower leg pathologies.

Clinical Relevance: An innovative therapeutic intervention such as BFRT may be used to decrease pain (VAS MCID = 30 mm) with clinically meaningful improvement in function (exceeded LEFS MCID = 9 pts.) Based on evidence, physical therapists may consider the use of BFRT in conjunction with standard interventions as a safe and effective intervention for patients with lower leg injuries.

* Accepted for a platform presentation at APTA Combined Sections Meeting (CSM), San Antonio, TX, February 2022; Cardiopulmonary Section

Articles	Level Of Evidence	Design	Outcome Measures
Di Lemme et al. (2020)	Level 4	Case Report	Brief Pain Inventory (BPI), Lower Extremity Functional Scale (LEFS), Leg circumference (cm)
Killinger et al. (2020)	Level 2	Cross over study design	Surface EMG muscle activation, SmO2, RPE during exercises
Ladlow et al. (2018)	Level 2	Single-Blind RCT	Muscle Hypertrophy (CSA and volume measurements), Muscle Strength (5-RM knee extension and leg press test), Isometric hip extension (dynamometer), Endurance (MSLT), Balance (Y-balance test), Pain (VAS)
Hylden et al. (2015)	Level 4	Case Series	Biodex Dynamometer
Yow et al. (2018)	Level 4	Case Report	Power (j/s), Peak torque

Key Findings

Di Lemme et al. (2020)	BPI pain assessment decreased, LEFS score improved
Killinger et al. (2020)	Surface MEG muscle activation improved, SmO2 decreased, RPE increased
Ladlow et al. (2018)	Muscle hypertrophy increased, muscle strength increased, isometric hip extension increased, muscle endurance increased, balance improved, pain decreased
Hylden et al. (2015)	Average power increased
Yow et al. (2018)	Power and peak torque increased

Group 10

Title: The Value of Home Health Physical Therapy for Acute Stroke: A Mixed-Methods Systematic Review*

Authors: Lindsay Fitchett, Dr. Tracey Collins

Purpose: The purpose of this study was to determine the value of home health physical therapy compared to alternative post-acute care for acute stroke patients.

Materials and Methods: A literature search of CINAHL, Cochrane, MEDLINE/PubMed, ProQuest, and Wiley was conducted using the search terms:("home health physical therapy" OR "home health PT" OR "home health therapy" OR "home health rehabilitation" OR "home-based physical therapy" OR "home-based PT" OR "home-based therapy" OR "home-based rehabilitation" OR "home physical therapy" OR "home PT" OR "home therapy" OR "home rehabilitation" OR "rehabilitation at home" OR "physical therapy at home" OR "PT at home") AND ("acute stroke" OR "acute CVA"). Search limits: English, human, peer reviewed, scholarly journal, 2011-2021. Selection criteria: Adults 18+ within 6 months of stroke onset receiving home health rehabilitation by a PT, delivered in person, minimum frequency one session per week, comparison to alternative post-acute rehabilitation setting, explores at least one component of value. Each article was assessed for methodological quality by two independent reviewers who came to consensus using the Oxford CEBM 2011 Levels of Evidence (n = 5), or the JBI Checklist for Qualitative Research (n = 1).

Results: A total of 489 articles were screened for eligibility, and after detailed appraisal, 7 articles met selection criteria. Levels of evidence ranged from 2-3 (mean = 2.3) and the JBI score was 8/10. Sample size ranged from 27-306 (1,068 total) acute stroke patients (mean age = 71.34 years old). Six articles reported on patient outcomes. Intervention groups were discharged directly home from inpatient care and received rehabilitation at home from a multidisciplinary team consisting of a PT, OT and either a nurse or physician. PT interventions ranged from 1-5 times per week for 4-5 weeks with a focus on individualized programs of functional activity training developed by the rehabilitation team. After the intervention period, participants were referred to outpatient PT or discharged from care. Alternative post-acute settings studied included inpatient, outpatient, and hospital day units. Intervention groups showed significant improvement in outcomes such as the BI, mRS, and Tinetti. Intervention groups also improved significantly more than control groups in outcomes such as the BI, mRS, Tinetti, TIS, and NRS for ADLs and walking ability. Two articles reported on cost, finding similar direct costs between home and outpatient rehabilitation and significantly greater costs for inpatient compared to home rehabilitation. One article reported on patient experience. Positive experience aspects of home health PT included reports of good communication, competent professionals, and good continuity of care from hospital to home. Negative experience aspects included inadequate information provided to patients and their caregivers.

Conclusions: There is moderate to strong evidence that home health physical therapy improves patient outcomes with equal or greater effectiveness compared to alternative post-acute care settings for acute stroke patients. Conclusions cannot be made about cost or patient experience components of value due to minimal current research. Limitations include lack of well-defined control groups, short intervention periods, poor selection of outcome measures, and comparison to mostly outpatient settings. The lack of evidence shows a need for new research exploring all three components of value in comparing home health PT to a broader range of post-acute care settings.

Clinical Relevance: Home-based physical therapy after acute stroke provides a setting that is safe and effective at improving patient outcomes. Home health physical therapy should be considered at discharge from acute hospital care for acute stroke patients.

* Accepted for a platform presentation at APTA Combined Sections Meeting (CSM), San Antonio, Tx, February 2022; Home Health Section

Patient Outcomes

Article	PAC Comparison	Key Findings
Gjelsvik et al.	**Experimental Group (EG) 1:** Day rehabilitation with coordinated, multidisciplinary care **EG 2:** Coordinated, multidisciplinary care including home health physical therapy (HHPT) **Control group (CG):** No coordinated care, outpatient (OP) PT only as needed	Greater improvements in the Trunk Impairment Scale (TIS) in EG 2 compared to EG 1 and the CG. Greater improvements in ADL performance in both EG 1 and EG 2 groups compared to the CG.
Hofstad et al.	**EG 1:** Day rehabilitation with coordinated, multidisciplinary care **EG 2:** Coordinated, multidisciplinary care including HHPT **CG:** Mixed CG of inpatient (IP) rehabilitation and OP PT	Both EG 1 and EG 2 made significant improvement from baseline in the Modified Rankin Scale (mRS) at 3 month follow up. No significant improvement in the CG.
Rafsten et al.	**EG:** Coordinated, multidisciplinary care including HHPT **CG:** No coordinated care, OP PT only as needed	The EG had significantly lower mRS and anxiety at 3 month follow up compared to the CG.
Rasmussen et al.	**EG:** Coordinated, multidisciplinary care including HHPT **CG:** No coordinated care, OP PT only as needed	The EG had significantly lower mRS and higher quality of life (QOL) at 90 days compared to the CG. The EG made significant improvement from baseline to 90 days in the mRS and Motor Assessment Scale (MAS).
Lopez-Liria et al.	**EG:**Coordinated, multidisciplinary care including HHPT **CG:** Individualized OP PT	Both the EG and CG made significant improvements from baseline in the Barthel Index (BI) and Tinetti. Follow-up scores for the EG were significantly higher than the CG only for the BI.
Yu-Ju et al.	**EG:** Coordinated, multidisciplinary care including HHPT **CG:** Multidisciplinary IP rehabilitation	The EG made significantly greater improvements in ADL performance despite significantly fewer rehabilitation hours.

Cost

Article	HHPT Group	Alternative PAC Group	Key Findings
Rasmussen et al.	Combined acute care and HHPT: $54,118	Combined acute care and OP PT: $54,242	No significant difference between groups; however, only direct costs, and not indirect costs, were evaluated.
Yu-Ju et al.	Home rehabilitation: $1,053.92 $\pm$ 418.59	Inpatient rehabilitation: $2699.19 $\pm$ 1107.12	Costs were significantly lower for the home rehabilitation group.

Patient Experience

Article	PAC Comparison	Key Findings
Cobley et al.	**EG:** Coordinated, multidisciplinary care including HHPT **CG:** No coordinated care, OP PT only as needed	Positive HHPT experiences: good communication, competent professionals, smooth transition from hospital to home Negative HHPT experiences: inadequate information about stroke provided to patients and caregivers

Group 11

Title: The Impact of Home Health Physical Therapy (HHPT) on Readmission Rates in Frail Older Adults*

Authors: Ileana Armendi, Dr. Tracey Collins

Background: The population of frail older adults is known for their complex health status.[1,2] Due to their complicated medical conditions, their healthcare needs are demanding and therefore require individualized care to meet their necessities. Older age, multiple chronic conditions, and functional limitations are all factors associated with risk of readmission to acute hospital stays.[3] The care for older adults with various comorbidities are often poorly coordinated as reflected in a steady increase in the rates of preventable hospitalizations.[4] Optimal transitional care for older adults with frailty from acute care stays have yet to be determined in order to prevent readmission.[2,5] Physical therapy services at home may be an effective solution in the prevention of acute care readmissions in frail older adults.

Purpose/Hypothesis: The purpose of this literature review is to identify the impact of home health physical therapy (HHPT) on readmission rates in frail older adults.

Materials and Methods: A literature search was conducted in CINAHL, PubMed, ProQuest, and ScienceDirect using the following search terms: ("Home health" OR "home care" OR "home-based rehab" OR "home health rehab") AND (Physical Therapy OR PT OR rehab OR rehabilitation) AND (Hospital readmission OR rehospitalization) AND ("elderly individuals" OR "elderly persons" OR "elderly patients" OR "older adults") AND (Frailty OR Frailties OR Frailness). Search limits included peer-reviewed, English, human subjects, publication within last ten years. Selection criteria required adults 65+ with frailty receiving HHPT after hospitalization within the last year.

Results: Three articles met the selection criteria. The first article, 13.2% of the restorative model participants receiving physical therapy (PT) were readmitted to the hospital during homecare compared to 17.6% not receiving PT. The second article was an RCT and yielded a significantly lower mean number and proportion of ED visits not leading to hospitalization receiving PT at home 6-12 months after baseline. The third article, also an RCT concluded that the participants in the exercise program, nurse home visit, and telephone follow-up (ExN-HaT) group or the nurse home visit and telephone follow-up (N-HaT) group were 3.6 and 2.6 times respectively significantly less likely to have an unplanned readmission 28 days following discharge. Furthermore, individuals in the ExN-HaT or N-HaT groups were 2.13 and 2.63 times respectively less likely to have an unplanned readmission in the 12 weeks after discharge.

Conclusions: There is limited research available relevant to the impact of HHPT on readmission rates in frail older adults. The lack of evidence found in this literature review indicates the need for further research in regards to the impact of HHPT on readmission rates in older adults with frailty.

Clinical Relevance: Physical therapy services at home may decrease the rate of readmissions in frail older adults. Clinicians may consider referring home health physical therapy services to frail older adults in order to decrease readmissions to the hospital.

* Accepted for a platform presentation at APTA Combined Sections Meeting (CSM), San Antonio, Tx, February 2022; Home Health Section

Authors	OCEBM Level of Evidence	Inclusion Criteria	Methods	Key Findings
Tinetti et al.	Level III	- Age 65+ - Dependence of >1 activities of daily of living - Referred to home care after recent acute care hospitalization	Compared readmission to acute care stays in patients receiving HHPT with nursing care based on a restorative model (restorative group) to nursing and aides (usual care group)	Restorative group had fewer readmissions compared to usual care group
Sandberg et al.	Level II	- Age 65+ - Dependent in at least 2 activities of daily living - Admitted to hospital at least twice or had at least 4 visits to outpatient or primary care in last 12 months	Compared ED readmissions in patients receiving at home nursing and physiotherapy care (intervention group) to patients receiving just nursing care of medication monitoring (control group)	Intervention group had significantly fewer ED visits compared to control group 6-12 months after baseline
Finlayson et al.	Level II	- Age 65+ - Admitted with medical diagnosis - Had at least 1 risk factor for readmission	Compared unplanned hospital readmission in standard care, exercise only, nurse home visit and telephone follow-up (N-HaT), or exercise program and nurse home visit and telephone follow-up (ExN-HaT)	ExN-HaT were less likely to have an unplanned readmission 28 days following discharge compared to rest of groups

Group 12

Title: Long-Term Impact of Community-Based Boxing for Balance and Mobility in Persons with Parkinson's Disease*

Authors: Christian Huckfeldt, Daniela Spagnoli, Jennifer Schwartz, Dr. Dana R. Maida, Dr. Renée M. Hakim, Dr. Michael Ross

Background & Purpose: Community-based boxing (CBB) programs have become a popular form of exercise for persons with Parkinson's disease (PD). However, few reports described the number of individuals who have a positive outcome with CBB programs. Thus, the purpose of this retrospective study was to describe the impact of long-term participation (≥6 months) in CBB on balance and mobility for persons diagnosed with PD, and describe characteristics for those experiencing a positive outcome with this training method.

Number of Subjects: Thirty-one individuals (21 males, 10 females; mean age: 67.8±7.2 years) diagnosed with PD (mean time of diagnosis prior to training program: 3.9±5.0 years; range: 6 months to 25 years).

Materials and Methods: Training programs included 90-minute sessions with boxing drills, traditional stretching, strengthening, and endurance exercises. Outcome measures included the Timed Up and Go (TUG), 30 second sit-to-stand test (30 STS), and the Fullerton Advanced Balance Scale (FAB), all evaluated prior to the start of the program and after at least 6 months participation. For the purposes of this study, a positive outcome was defined as exceeding the previously established minimal detectable change for 2 of the 3 outcome measures at follow-up. T-tests were used to compare participants' measures of balance and mobility prior to and following CBB. T-tests and chi-square tests were used to compare those who had a positive outcome with those that did not according to age, gender, duration of PD, number of training sessions completed, and duration of follow-up. Statistically significant differences were determined for all analyses using $p<0.05$.

Results: Participants attended 31-127 boxing training sessions (mean: 77.4 ± 25.6 sessions) over a mean of 12.0 ± 3.5 months (range: 6 to 18 months). All outcome measures improved statistically ($p<0.05$) (TUG: 9.2 ± 3.8 versus 7.3 ± 1.9 seconds; 30 STS: 13.1 ± 3.7 versus 15.9 ± 5.0 repetitions; FAB: 32.9 ± 6.7 versus 35.7 ± 5.2 points). Overall, 23/31 patients (74.2%) had a positive outcome. Individuals with a positive outcome were more recently diagnosed with PD (2.8 versus 7.2 years, $p<0.05$) and attended more training sessions (79.6 versus 71.1 sessions, $p<0.05$). There were no significant differences between those individuals who had a positive outcome and those that did not for length of follow-up, gender, or age. No adverse outcomes or events, such as falls or mechanical injuries, occurred during the boxing training sessions.

Conclusions: The majority of participants in this study showed modest but clinically significant long-term improvements in balance and mobility after CBB. Limitations included a relatively small sample size and the lack of a control group. Future research should examine the mechanisms underlying the benefits of CBB and further describe characteristics of individuals who have a positive outcome.

Clinical Relevance: Given the results of this study, and others, individuals with PD should be encouraged to participate in CBB training programs to improve balance and mobility, especially early in the course of the disorder. These programs provide safe, feasible options for participants to combat the progressive effects of PD.

* Accepted for poster presentation at APTA Combined Sections Meeting (CSM), San Antonio, Tx, February 2022; Neurology Section/Degenerative Diseases Special Interest Group (SIG)

Table 1: Boxer Demographic Data

Variable	Mean (n=31)
Age	67.8 ± 7.2
Gender	21 males (68%), 10 females (32%)
Date of Diagnosis (Prior to Training Program)	3.9 ± 5.0 years
Range (Time between PD Diagnosis and Initial Evaluation)	6 months to 25 years

Table 2: Comparison of Patients with a Positive Outcome (PO) vs. Non-Positive Outcome (NPO)

Positive Outcome: defined as exceeding the previously established minimal detectable change for 2 of the 3 outcome measures at follow-up

Results: 23/31 (74%) of patients had a positive outcome

Variable	Average Positive Outcome (PO)	Average Non-Positive Outcome (NPO)
Time between PD diagnosis and evaluation	2.8 years	7.2 years
Number of RSB training sessions attended	79.6 sessions	71.1 sessions
30 STS	13.1 ± 3.7 reps	15.9 ± 5.0 reps
FAB	32.9 ± 6.7 points	35.7 ± 5.2 points
TUG	9.2 ± 3.8 seconds	7.3 ± 1.9 seconds