

The Movement System and Diagnosis

Are we there yet?

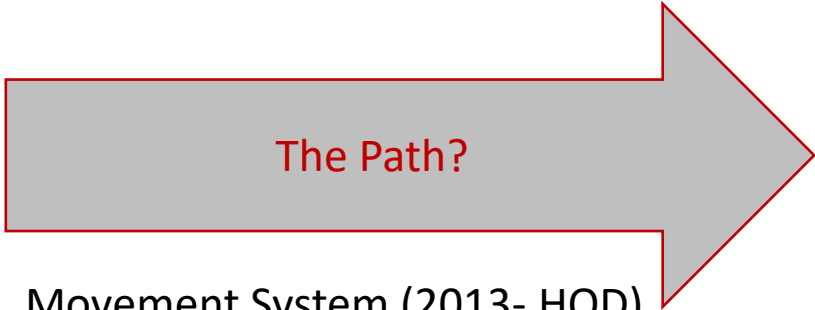


<https://gingerkauffman.com/a-car-stuffed-with-kids-why-not-days/>

Phil McClure PhD, PT, FAPTA
John HP Maley Lecture
July 21, 2024



The Movement System and Diagnosis: Are we there yet?



Movement System (2013- HOD)
Diagnostic Labels (2015- HOD)

Destination

“Transforming society by
optimizing movement to improve
the human experience”

A Long
Struggle for
Professional
Identity

The Not-So-Impossible Dream

My overriding dream is that physical therapy shall achieve greatness as a profession.

HELEN J. HISLOP, Ph.D.

Since the inauguration of this lecture a dozen years ago, there have been scholarly critiques of physical therapy history, philosophy, education, and therapeutics.

The lecturers have been physical therapists who have placed their indelible mark on this profession—those who have proudly received the torch passed on by Mary McMillan and kept its flame burning brightly for the future.

Thus, I am filled with gratitude, responsibility, and humility. If you insist I find a word for it, I can—paralysis. But I am fortified also by this challenge, this opportunity, and this honor.



Helen J. Hislop, Ph.D.

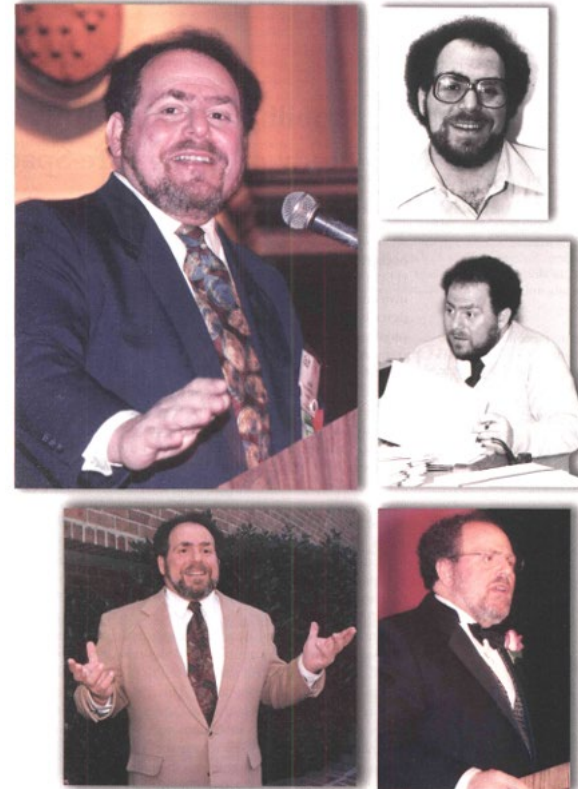
Pathokinesiology—A Name for Our Times?

JULES M. ROTHSTEIN

Key Words: *Pathokinesiology, Physical therapy.*

PTJ 1986

A Long
Struggle for
Professional
Identity



A Long
Struggle for
Professional
Identity

**The Human Movement System:
Our Professional Identity**

Shirley A. Sahmann



White Paper: Movement System Diagnoses in Neurologic Physical Therapy

Lois D. Hedman, PT, DScPT, MS, Lori Quinn, PT, EdD, Kathleen Gill-Body, PT, DPT, NCS, FAPTA, David A. Brown, PT, PhD, FAPTA, Myla Quiben, PT, PhD, DPT, MS, GCS, NCS, Nora Riley, PT, PhD, NCS, and Patricia L. Scheets, PT, MHS, DPT, NC

Background and Purpose: The APTA recently established a vision for physical therapists to transform society by optimizing movement to promote health and wellness, mitigate impairments, and prevent disability. An important element of this vision entails the integration of the movement system into the profession, and necessitates the development of movement system diagnoses by physical therapists. At this point in time, the profession as a whole has not agreed upon diagnostic classifications or guidelines to assist in developing movement system diagnoses that will consistently capture an individual's movement problems. We propose that, going forward, diagnostic classifications of movement system problems need to be developed.

Recommendations for Clinical Practice: The Task Force proposes that diagnostic classifications of movement system problems need to be developed, tested, and validated with the long-range goal to reach consensus on and adoption of a movement system diagnostic framework for clients with neurologic injury or disorder. **Video Abstract available for more insights.** [Video, Supplemental Digital Content \(see www.jnpt.com/JNPTA198\).](#)

Key words: movement - standardized tasks (see www.jnpt.com)



Physical Therapy & Rehabilitation Journal | Physical Therapy, 2023;103:1-4
<https://doi.org/10.1093/ptj/pzad087>
Advance access publication date September 8, 2023
Point of View

Concerns on the Science and Practice of a Movement System

Christopher T. Joyce, PT, DPT, PhD^{1,*}, Jason M. Beneciuk, PT, DPT, PhD, MPH^{2,3}, Steven Z. George, PT, PhD, FAPTA⁴

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Introduction

Theoretically, the movement system is the integration of body systems that generate and maintain all movements contributing to individual function.¹ Movement diagnoses are diagnostic labels ascribed to movements that are hypothesized to be aberrant.² In the context of the International Classification of Functioning, Disability and Health framework, a movement diagnosis may be most appropriately positioned as a "body systems impairment."³ Recently, movement diagnoses have been put forth as fundamental to the movement therapist management being advocated as a model for physical therapist advancement of practice approaches that have yet to be empirically substantiated. In this Point of View, we look

at an activity limitation. To form society by using our skills, knowledge, and expertise related to the movement, promote health and wellness, mitigate the progression of impairment of (additional) disability. In 2013, the APTA adopted an inspiring new vision, "Transforming society, the human experience." This new vision for our profession calls us all to form society by using our skills, knowledge, and expertise related to the movement, promote health and wellness, mitigate the progression of impairment of (additional) disability. In 2013, the APTA adopted an inspiring new vision, "Transforming society, the human experience." This new vision for our profession calls us all to form society by using our skills, knowledge, and expertise related to the movement, promote health and wellness, mitigate the progression of impairment of (additional) disability.

EDITORIAL WHAT IS THE MOVEMENT SYSTEM AND WHY IS IT IMPORTANT?

Michael L. Yoight, PT, DHS, OCS, SCS, ATC, FAPTA¹
Barbara J. Hoogenboom, PT, EdD, SCS, ATC²

S.A. Sahrman, PT, PhD, FAPTA, Program in Physical Therapy, Washington University School of Medicine, 4444 Forest Park Ave, Box 8502, St Louis, MO 63108

The Human Movement System: Our Professional Identity

Shirley A. Sahrman

The 2015 House of Delegates of the American Physical Therapy Association issued a vision statement that addresses the role of physical therapy in transforming society through optimizing movement. The accompanying guidelines address

PTJ: Physical Therapy & Rehabilitation Journal | Physical Therapy, 2021;101:1-12
<https://doi.org/10.1093/ptj/pzab153>
Advance access publication date June 21, 2021
Perspective

Movement System Diagnoses for Balance Recommendations From the Academy of Physical Therapy's Movement System Task Force

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AD
PTJ: Physical Therapy & Rehabilitation Journal | Physical Therapy, 2021;101:1-8
<https://doi.org/10.1093/ptj/pzab154>
Advance access publication date June 21, 2021
Perspective

A Framework for Movement Analysis of Tasks: Recommendations From the Academy of Physical Therapy's Movement System Task Force

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PTJ: Physical Therapy & Rehabilitation Journal | Physical Therapy, 2021;101:1-4
<https://doi.org/10.1093/ptj/pzab156>
Advance access publication date October 20, 2023
Point of View

Defining Our Diagnostic Labels and Guide Our Next 100 Years

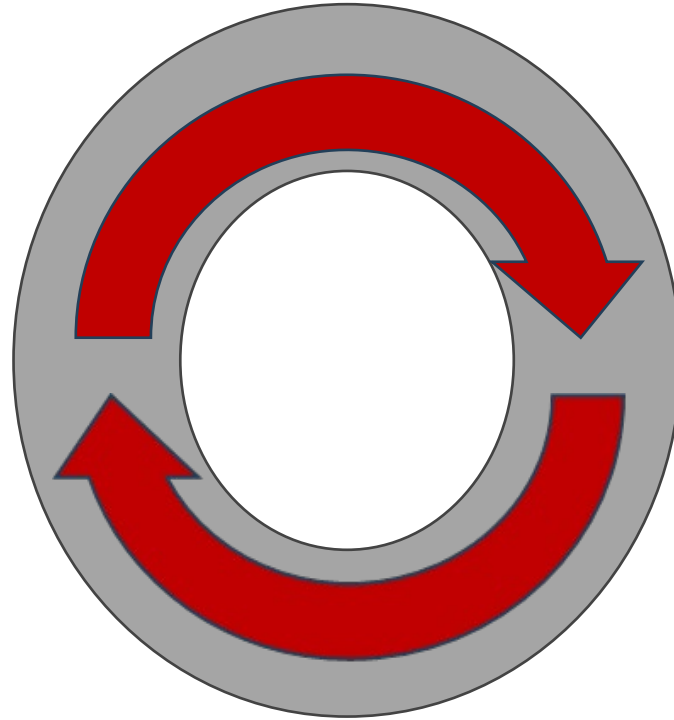
Shirley A. Sahrman, PT, PhD, FAPTA

Many advances have been made in physical therapist practice, education, and research over the past 100 years. These advances were designed to recognize the profession as an autonomous one with a defined body of knowledge. Practitioners are to be recognized as movement experts functioning at the doctoral level, diagnosing the cause of and factors contributing to pain, movement dysfunction, and compromised

Now more than ever the profession must make a clear case that therapists can offer diagnostic insight and conservative treatment that is effective, cost saving, and not available from any other profession. Reducing health care costs is a major focus of the government and insurance companies. Implementation of value-based practice is considered a way of reducing costs. Thus, the profession must strongly and vividly demon-



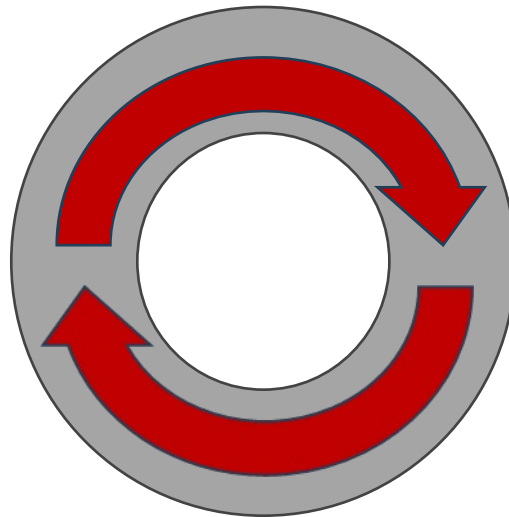
The Movement System and Diagnosis: Are we there yet?



“Transforming society by
optimizing movement to improve
the human experience”

Are we there yet?

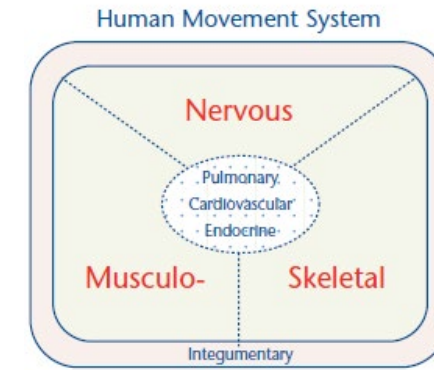
Not until we have an ***Operational Definition*** of the Movement system (Proposal #1)



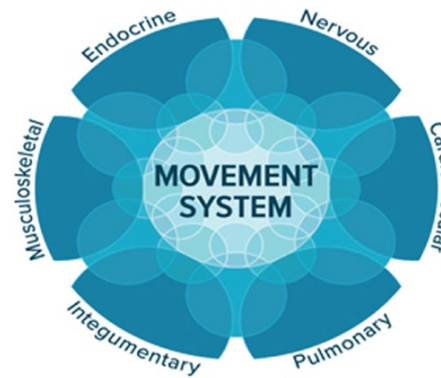
“Transforming society by optimizing movement to improve the human experience”

We need an Operational Definition of the Movement System

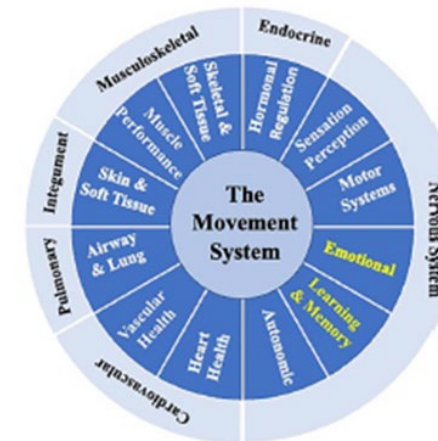
- *“The movement system is the term used to represent the collection of systems (cardiovascular, pulmonary, endocrine, integumentary, nervous, and musculoskeletal) that interact to move the body or its component parts.”*



Sahrmann 2014 PTJ



Voight 2017 IJSPT



Lusardi 2023 PTJ

Challenges to the current definition

What structure or system of the human body does the “movement system” exclude?

What is gained by constructing an alternative and unfamiliar label to encompass all the systems of the human body?

What does such a label add, scientifically and clinically, to the ability of physical therapists to deliver value-based care to patients?

Guccione et al 2019, PTJ

What do clinicians think?

- My very informal poll results

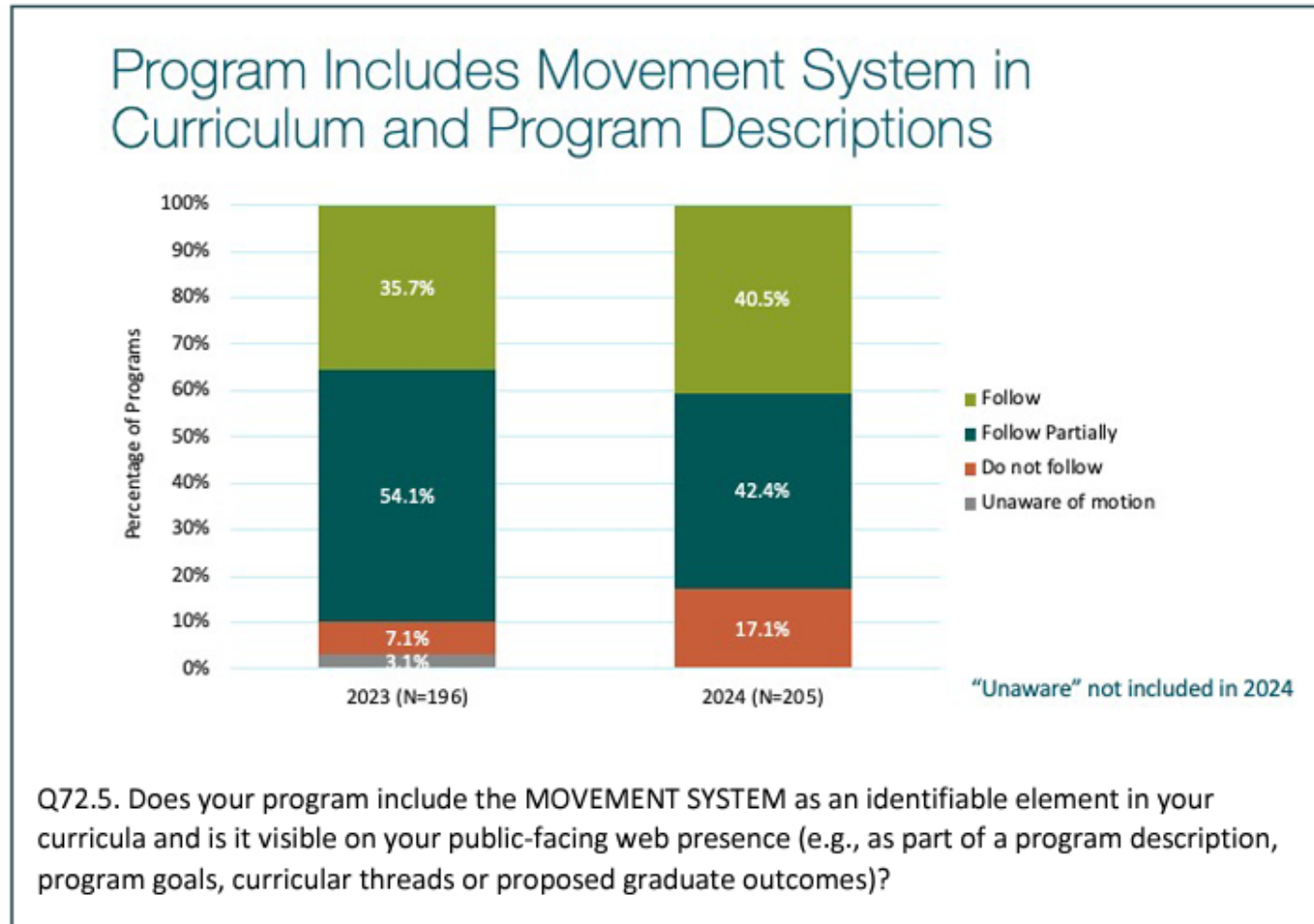
“Describe the term “movement system” and its relevance to clinical practice.”

- Who cares? (about your irrelevant ivory tower idea)
- Vague notions of tissues and systems working together to produce movement
- “Fancy term used by seed eaters to define strengthening exercises using the kinetic chain”

We need an Operational Definition of the Movement System

- *“The movement system is the term used to represent the collection of systems (cardiovascular, pulmonary, endocrine, integumentary, nervous, and musculoskeletal) that interact to move the body or its component parts.”*
- Clinicians?
- Education?
 - CAPTE
 - ACAPT

ACAPT Data : 2023 and 2024



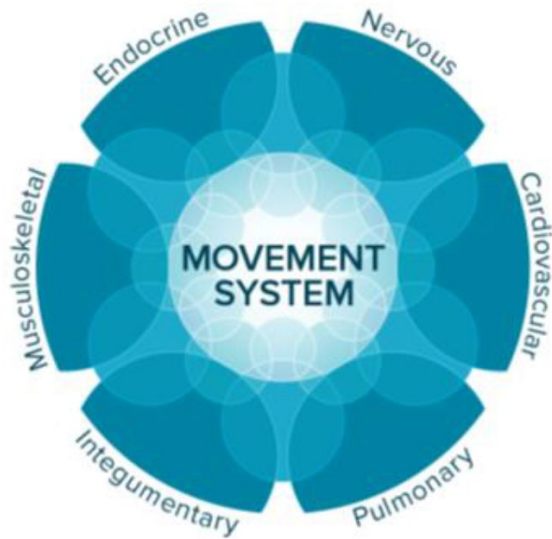
We need an Operational Definition of the Movement System

Ideas are easy.

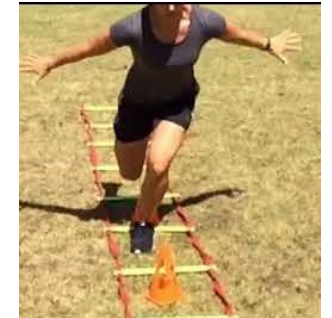
Implementation is hard.

Guy Kawasaki

The current definition is NOT operational



?



Operational Definition

A description of something in terms of the operations (procedures, actions, or processes) by which it could be observed and measured.

Am Psychological Assoc

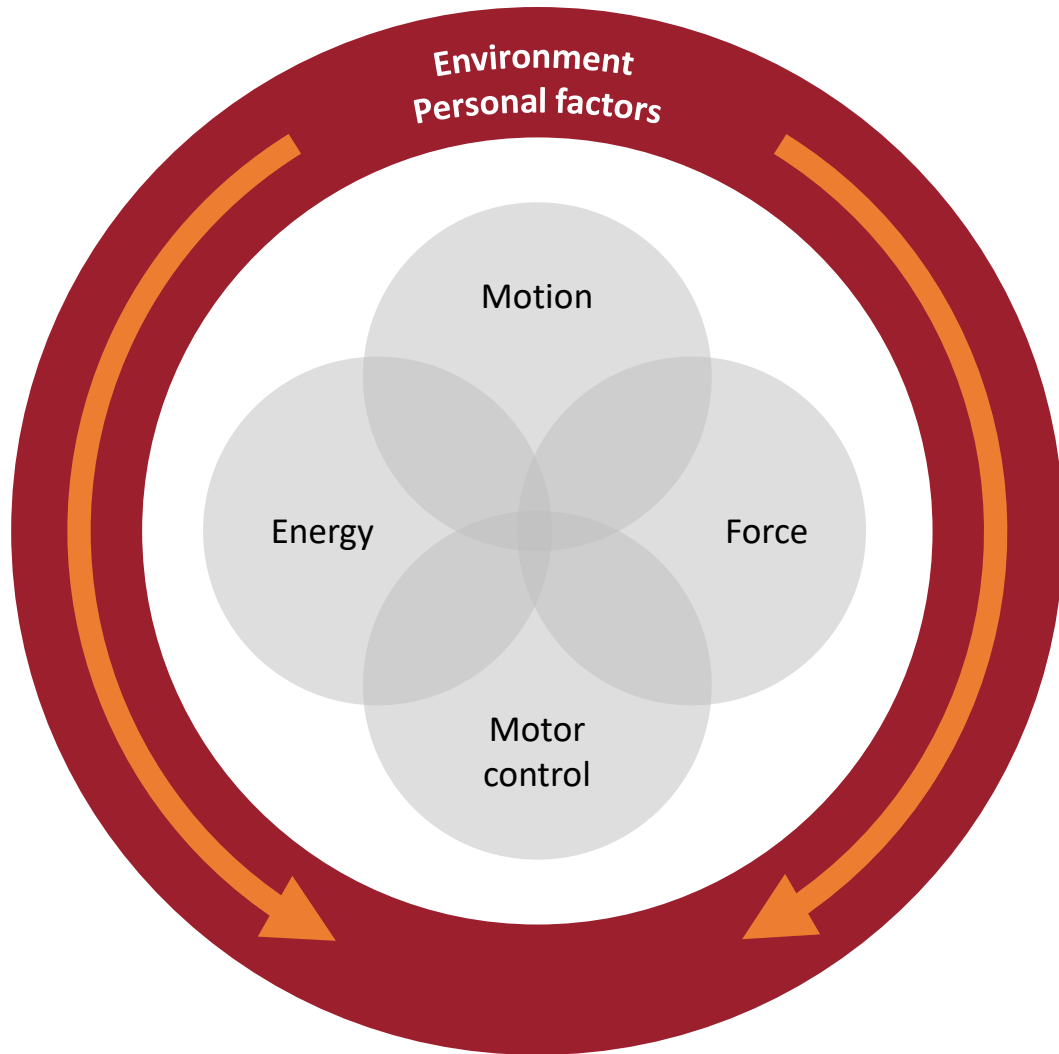
The Challenge

How do we make the Movement System explicit in our curriculum?

- Operational – promoted standardized approach and skills for movement analysis
- Readily applied across all areas of practice
- Relevant to entry-level training and clinical practice



The 4-Element Model of the Movement System



PTJ: Physical Therapy & Rehabilitation Journal | *Physical Therapy*, 2021;101:1–10
DOI: 10.1093/ptj/pzab024
Advance access publication date January 23, 2021
Perspective



The 4-Element Movement System Model to Guide Physical Therapist Education, Practice, and Movement-Related Research

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Shailesh Kantak, PhD, PT^{1,2}, Philip Malloy, PhD, PT¹, Kristin Day, PhD, PT¹,
Kshamata Shah, PhD, PT, NCS¹, Amy Miller, PT, DPT, EdD¹, Kathleen Mangione, PhD, PT¹

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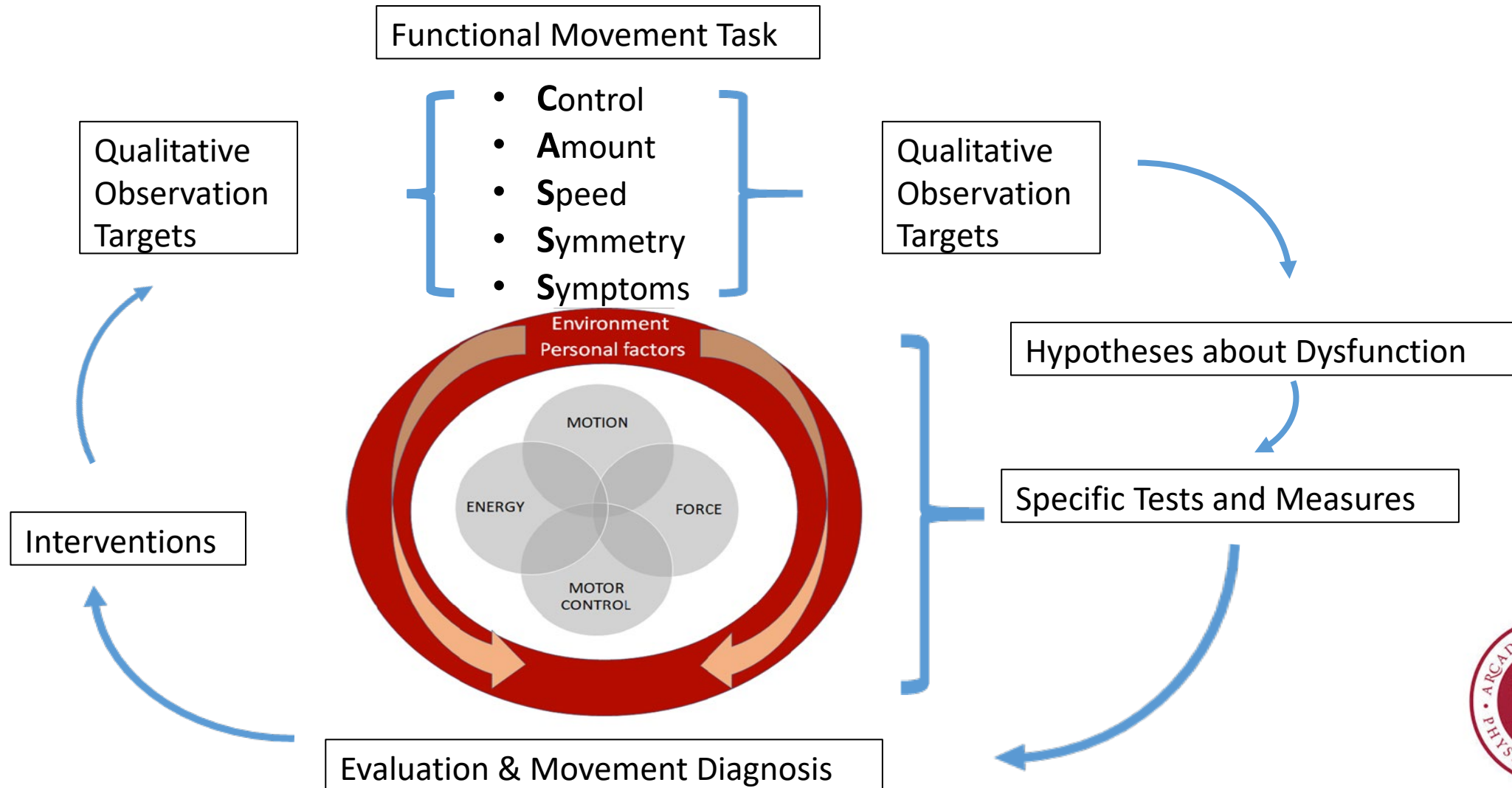
²Moss Rehabilitation Research Institute, Elkins Park, Pennsylvania, USA

*Address all correspondence to Dr McClure at: mcclure@arcadia.edu

PTJ 2021



The 4-Element Movement System

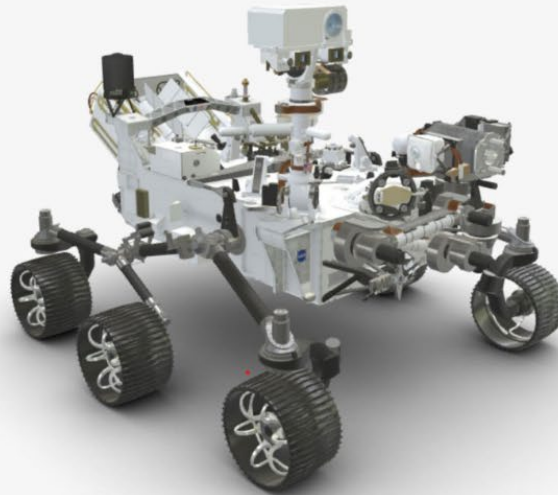


Does a “system” have to be physiologic?

- A “system” is the combination of elements that function together to produce the capability required to meet a need.

SEH 2.0 Fundamentals of Systems Engineering

ENCYCLOPEDIA UPDATED FEB 6, 2019



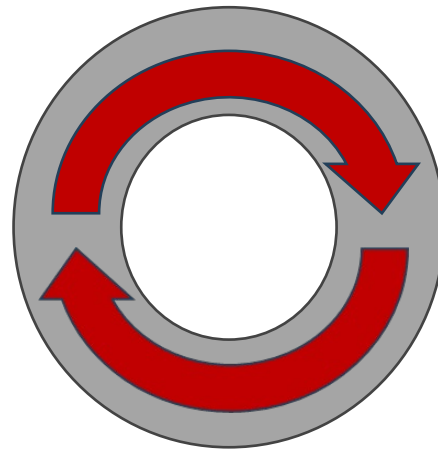
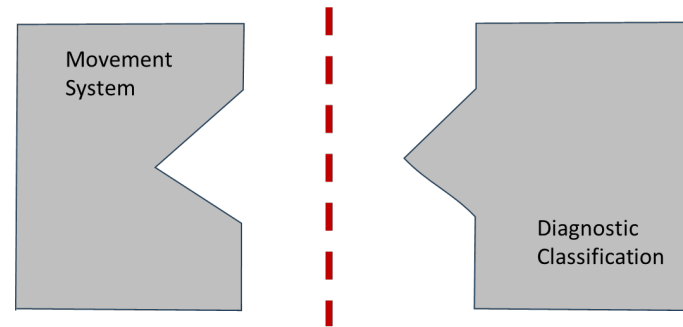
<https://www.nasa.gov/reference/2-0-fundamentals-of-systems-engineering/>

Other pitfalls without a simple operational definition

- Professional Isolation
- Easily understood and embraced by those within AND outside the profession
 - Simplicity is a Feature
 - Enhances adoption and implementation
 - Avoid highly nuanced and PT specific jargon
- We don't "own" the movement system
- We must LEAD in movement-related research

Are we there yet?

We'll be closer when the movement system is isolated as a foundational concept or model - separate from diagnostic classification schemes
(Proposal #2)



“Transforming society by
optimizing movement to improve
the human experience”

Our profession is simply too broad for a single comprehensive diagnostic system to be meaningfully applied.

ABPTS

- Cardiovascular and Pulmonary.
- Clinical Electrophysiology.
- Geriatrics.
- Neurology.
- Oncology.
- Orthopaedics.
- Pediatrics.
- Sports.
- Pelvic Health.
- Wound Management.



White Paper: Movement System Diagnoses in Neurologic Physical Therapy

Lois D. Hedman, PT, DScPT, MS, Lori Quinn, PT, EdD, Kathleen Gill-Body, PT, DPT, NCS, FAPTA, David A. Brown, PT, PhD, FAPTA, Myla Quiben, PT, PhD, DPT, MS, GCS, NCS, Nora Riley, PT, PhD, NCS, and Patricia L. Scheets, PT, MHS, DPT, NC

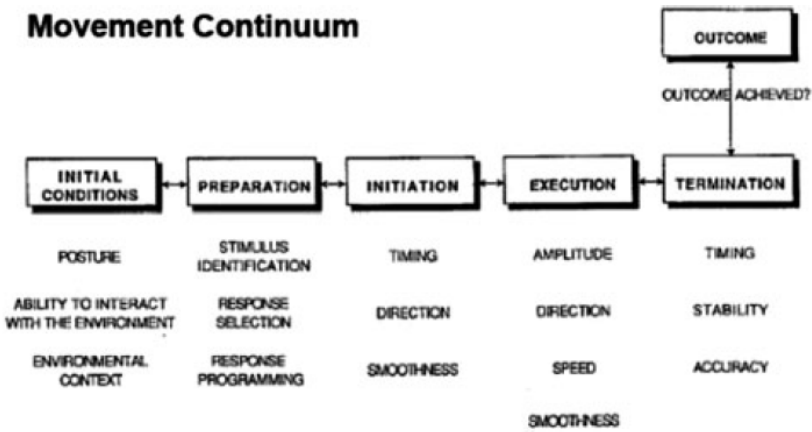


Figure 3. The movement continuum is composed of 6 stages of movement that are identified in the figure along with movement-related parameters to consider with each stage (used with permission from Hedman et al²²).

From JNPT 2018

The Case for Developing a Movement System Framework for Older Adults

Michelle M. Lusardi ¹, PT, DPT, PhD, FAPTA^{1*}, Gregory W. Hartley ², PT, DPT, FNAP, FAPTA², Susan J. Leach ³, PT, DPT, PhD³, Laura Z. Gras ⁴, PT, DPT, DSc⁴, Marni Larkin, PT⁵, Kenneth L. Miller ⁶, PT, DPT⁶, Myles Quiben, PT, DPT, PhD⁷

Lusardi et al

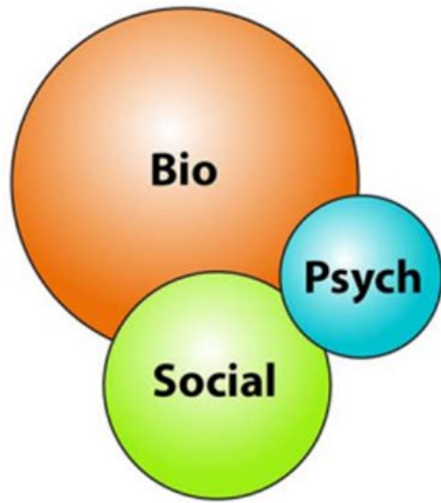


Figure 2. The Geriatric 5Ms^{31,32} incorporates shared decision making, with the cornerstone being "What Matters Most" to the older adult and their family. Adapted with permission from Table 1 of: Molnar F, Frank CC. Optimizing geriatric care with the GERIATRIC 5Ms. *Can Fam Physician*. 2019;65(1):39.

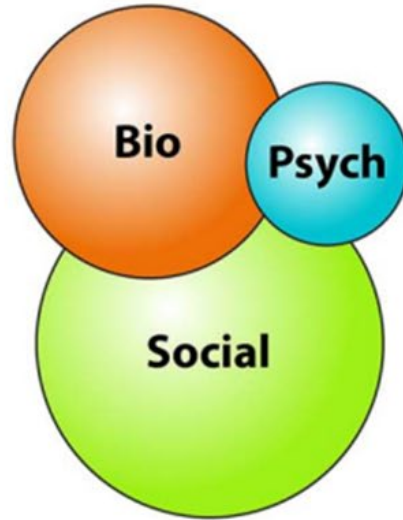


Figure 3. Movement System Model. Adapted with permission of the American Physical Therapy Association.

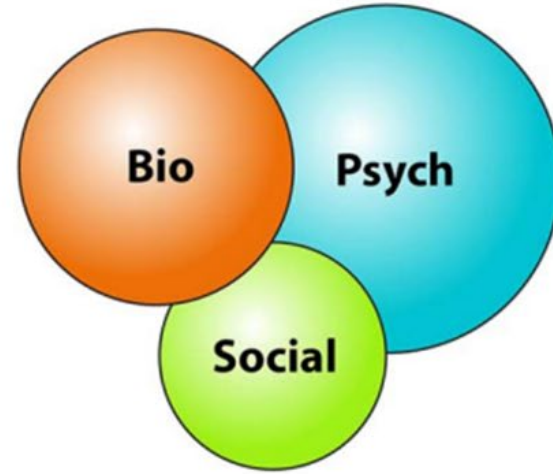
From PTJ 2023



patient 1



patient 2

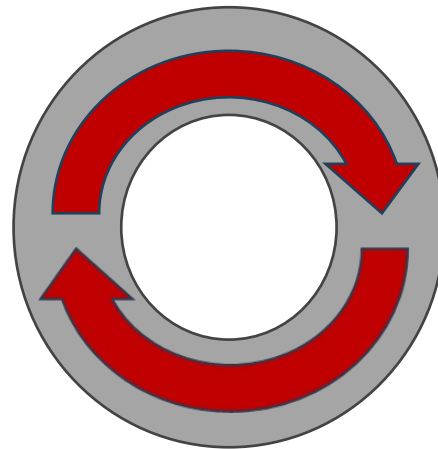
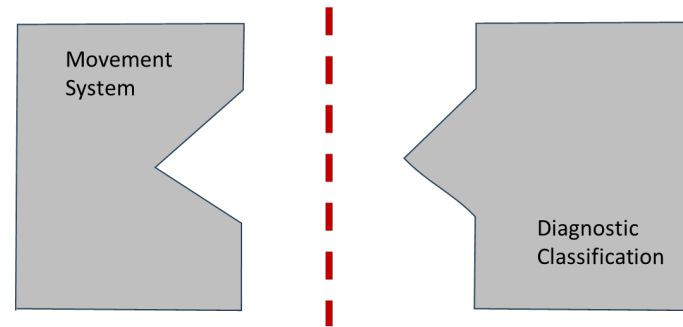


patient 3

From Jull 2017 BMJ

Are we there yet?

We'll be closer when the movement system is isolated as a foundational concept or model - separate from diagnostic classification schemes
(Proposal #2)



“Transforming society by
optimizing movement to improve
the human experience”

24th John H.P. Maley Lecture

Beyond Limits: Unmasking Potential Through Movement Discovery

Beth E. Fisher

Beth E. Fisher, PhD, PT, FAPTA,
Department Biokinesiology and
Physical Therapy and Department of
Neurology, University of Southern
California, 1540 E. Alcazar St,
CHP-155, Los Angeles, CA
90089-9006 (USA). Address all
correspondence to Dr Fisher at:



24th John H.P. Maley Lecture

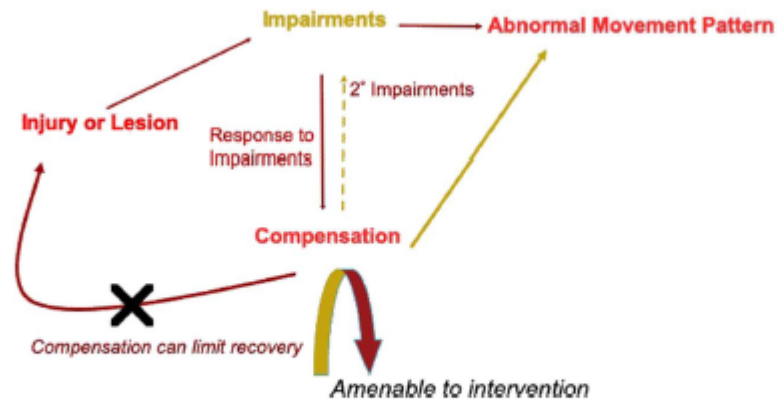


Figure 3. This figure demonstrates that an individual's implicit "response to the impairments" factors into the observed movement abnormalities and feeds back on direct lesion impairment secondary to limited use and practice. The implicit choice to compensate limits the "practice" necessary for recovery. Importantly, however, a therapist can help a patient alter their compensation and thus improve function as well as facilitate recovery.

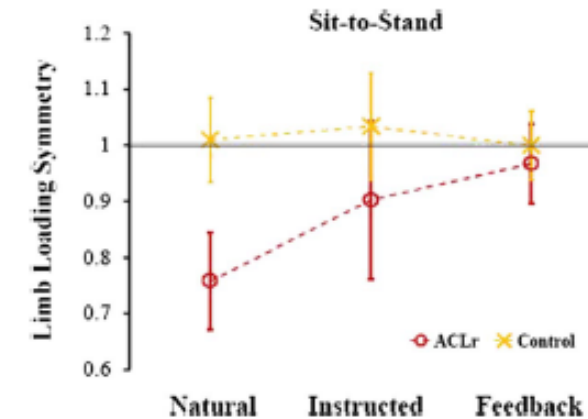


Figure 4. Limb loading symmetry during sit-to-stand across natural, instructed, and feedback conditions for age-matched controls and individuals with ACL reconstruction (ACLR).

Data from Chan and Sigward 2019 MSSE

Analysis of Lumbar Spine and Hip Motion During Forward Bending in Subjects With and Without a History of Low Back Pain

Marcia A. Esola, MS, PT,*† Philip W. McClure, MS, PT,‡
G. Kelley Fitzgerald, MS, PT,‡ and Sorin Siegler, PhD§

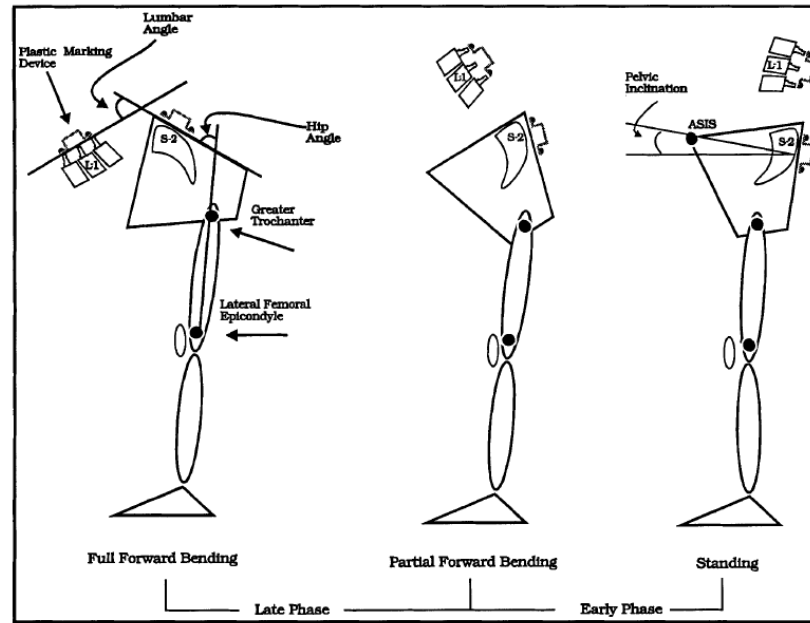


Figure. Model used to describe forward bending. L1=first lumbar vertebra, S2=second sacral vertebra (calculated as the midpoint between two digitized points on the sacrum), ASIS=anterior superior iliac spine.

Kinematic Analysis of Lumbar and Hip Motion While Rising From a Forward, Flexed Position in Patients With and Without a History of Low Back Pain

Philip W. McClure, PhD, PT,* Marcia Esola, MS, PT,† Rachel Schreier, MPT,‡
and Sorin Siegler, PhD§

Research Report

The Effect of Hamstring Muscle Stretching on Standing Posture and Forward Bending
Li et al 96, PTJ

Shoulder Function and 3-Dimensional Kinematics in People With Shoulder Impingement Syndrome Before and After a 6-Week Exercise Program

PTJ 2004

Shoulder Function and 3-Dimensional Scapular Kinematics in People With and Without Shoulder Impingement Syndrome

PTJ 2006

Direct 3-dimensional measurement of scapular kinematics during dynamic movements in vivo

Philip W. McClure, PhD, PT,^a Lori A. Michener, MEd, PT, ATC,^b Brian J. Sennett, MD,^c and Andrew R. Karduna, PhD,^d Glenide and Philadelphia, Pa, and Richmond, Va

JSES 2001

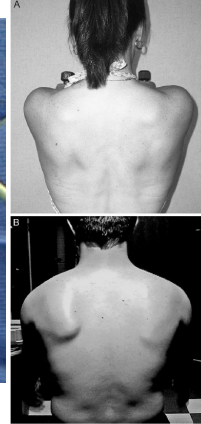
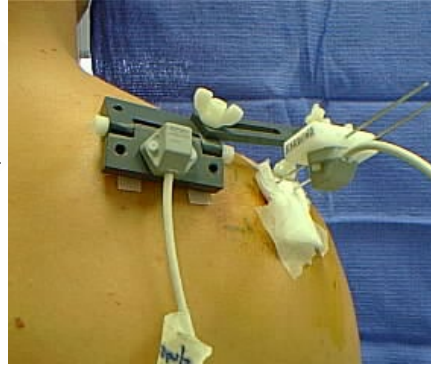
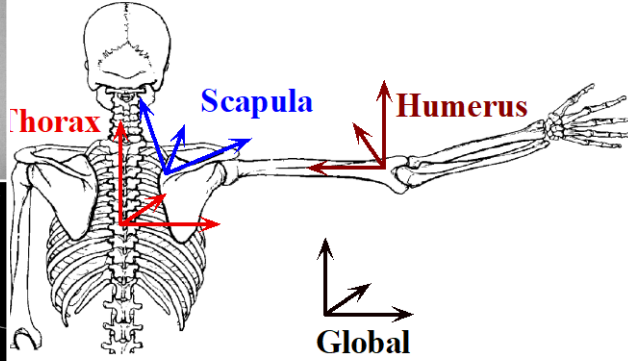


Figure 2. Participants performing flexion with dumbbell. A, The



Scapular motion and muscle activity, at least as we have studied and measured it, does not readily explain most shoulder pain.

Part 1: Reliability

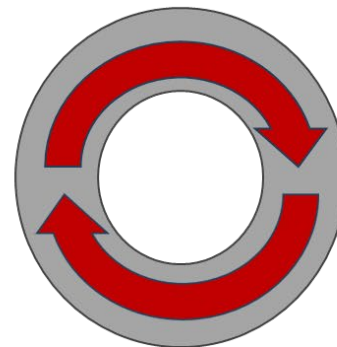
Journal of Athletic Training
© 2006 American Association of Colleges of Podiatric Medical Education

Philip McClure, PhD, PT,^a; Angela R. Tate, PhD, PT+^b; Stephen Kareklas, DPT, PT,^c; Ericica Zupenko, DPT, PT,^d; Dominic Irwin, DPT, PT,^e; ATC, CSCCST,††; Ericica Zupenko, DPT, PT,^d

original research

Movement is and should remain our core expertise

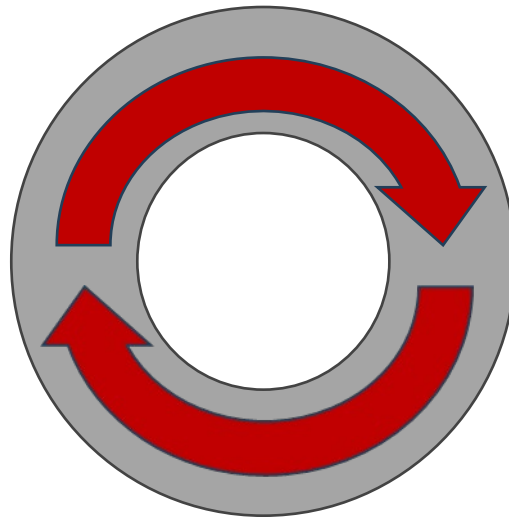
- Critical to health and well-being
- An excellent fit for our profession
- A Movement System should be isolated from premature adoption of
 - Standardized examination
 - Diagnostic labels
 - Corresponding Interventions



“Transforming society by
optimizing movement to improve
the human experience”

Are we there yet?

Yes, when clinical scientists develop and test diagnostic classification systems that guide decision making for the movement system.
(proposal #3)



“Transforming society by
optimizing movement to improve
the human experience”

Original Shoulder Guideline Group

Martin Kelley PT, DPT, OCS

John Kuhn MD

Phil McClure PT, PhD

Lori Michener PT, PhD, ATC, SCS

Mike Shaffer PT, OCS, ATC

Amee Seitz PT, DPT, OCS

Tim Uhl PT, PhD, ATC



CLINICAL PRACTICE GUIDELINES

MARTIN J. KELLEY, DPT • MICHAEL A. SHAFFER, MSPT • JOHN E. KUHN, MD • LORI A. MICHENER, PT, PhD
AMEE L. SEITZ, PT, PhD • TIMOTHY L. UHL, PT, PhD • JOSEPH J. GODGES, DPT, MA • PHILIP W. MCCLURE, PT, PhD

Shoulder Pain and Mobility Deficits: Adhesive Capsulitis

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health From the Orthopaedic Section of the American Physical Therapy Association

J Orthop Sports Phys Ther 2013;43(5):A1-A31. doi:10.2519/jospt.2013.0302

Staged Approach for Rehabilitation Classification: Shoulder Disorders (STAR–Shoulder)

PTJ 2015

Philip W. McClure, Lori A. Michener

Table 3.
Operational Definitions for 3 Stages of Tissue Irritability Derived by Consensus^a

	Stage of Irritability		
	High	Moderate	Low
History and examination findings	High pain ($\geq 7/10$) Consistent night or rest pain Pain before end of ROM AROM < PROM High disability	Moderate pain (4–6/10) Intermittent night or rest pain Pain at end of ROM AROM ~ PROM Moderate disability	Low pain ($\leq 3/10$) Absent night or rest pain Minimal pain with overpressure AROM = PROM Low disability
Intervention focus	Minimize Physical Stress Activity modification Monitor impairments	Mild–Moderate Physical Stress Address impairments Basic-level functional activity restoration	Moderate–High Physical Stress Address impairments High-demand functional activity restoration

^a ROM—range of motion, AROM—active range of motion, PROM—passive range of motion.

Staged Approach for Rehabilitation Shoulder Disorders

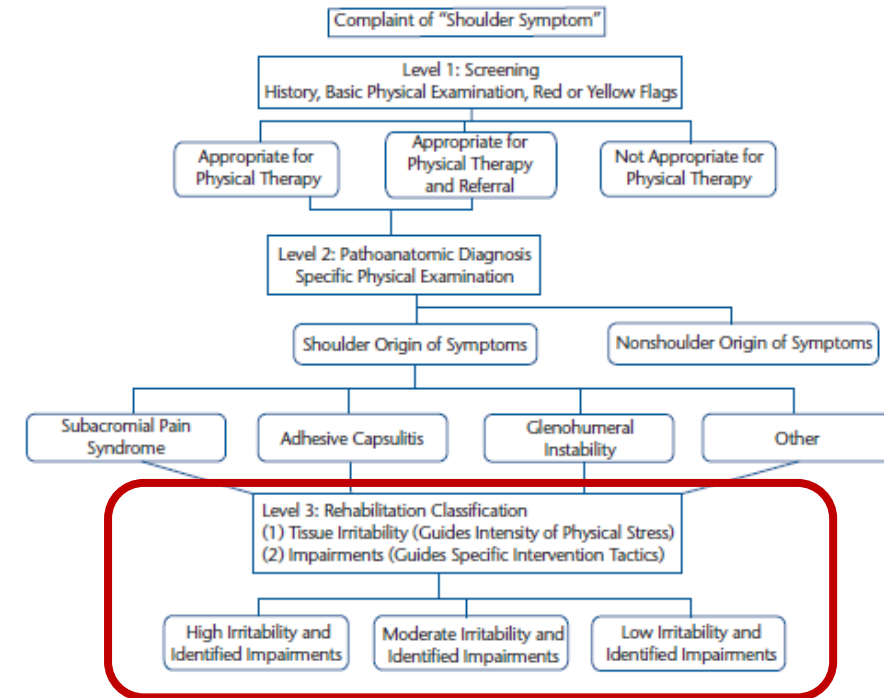


Figure.

Overall system for classification incorporating screening, pathoanatomic diagnosis, and rehabilitation classification. The specific pathoanatomic diagnoses shown at level 2 are only given as common examples; these are not meant to represent a complete list. For clarity, pathoanatomic diagnoses and rehabilitation classification are listed sequentially. However, they both are derived primarily from the history and physical examination and, in practice, likely occur in parallel rather than sequentially.

Application of the Staged Approach for Rehabilitation Classification System and Associated Improvements in Patient-Reported Outcomes Following Rehabilitation for Shoulder Pain

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PTJ 2024

Care	MDC for Pain (NPRS)		Total
	Met	Not Met	
Matched	161	157	318
Unmatched	112	262	374
Total	273	419	692

Care	MDC for QuickDASH		Total
	Met	Not Met	
Matched	236	82	318
Unmatched	167	207	374
Total	403	289	692

	Mean difference between groups	95% CI	t	p	Cohen d
Change in Pain	1.19	0.82 – 1.57	6.26	<.001	0.48
Change in QuickDASH	12.7	9.94 – 15.45	9.04	<.001	0.70

$$\chi^2(1) = 29.92, p < .001, \text{phi} = 0.21$$

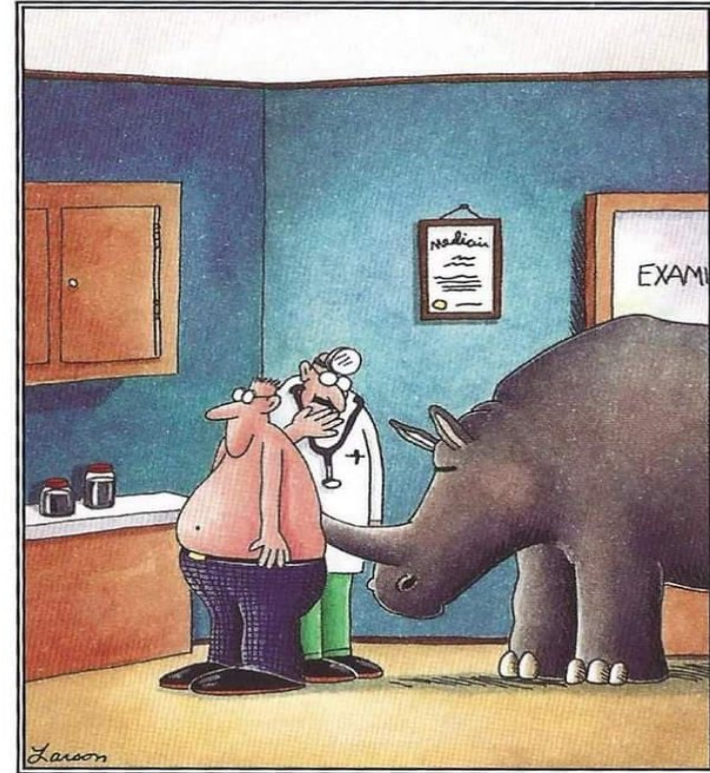
$$\chi^2(1) = 60.54, p < .001, \text{phi} = 0.30$$

What could intentional support look like?

- Specialty Academies
 - Task forces (neurology, geriatrics)
 - Develop conceptual frameworks and proposals
 - Provides a starting point for studies
 - Funding Mechanisms
 - Foundation for Physical Therapy Research
- Strongly Recommend
 - Multidisciplinary
 - Consider *Implementation* challenges at the start
 - Rate of Matched Care unchanged despite training and strong clinical support in Podshun study

Are diagnosis and associated labels really our biggest problem?

- Does a diagnostic label really guide treatment?
- Which patients are likely to benefit?
 - Where do we provide most Value?
- Two practical examples
 - STarT Back Model
 - ACR Appropriateness Criteria

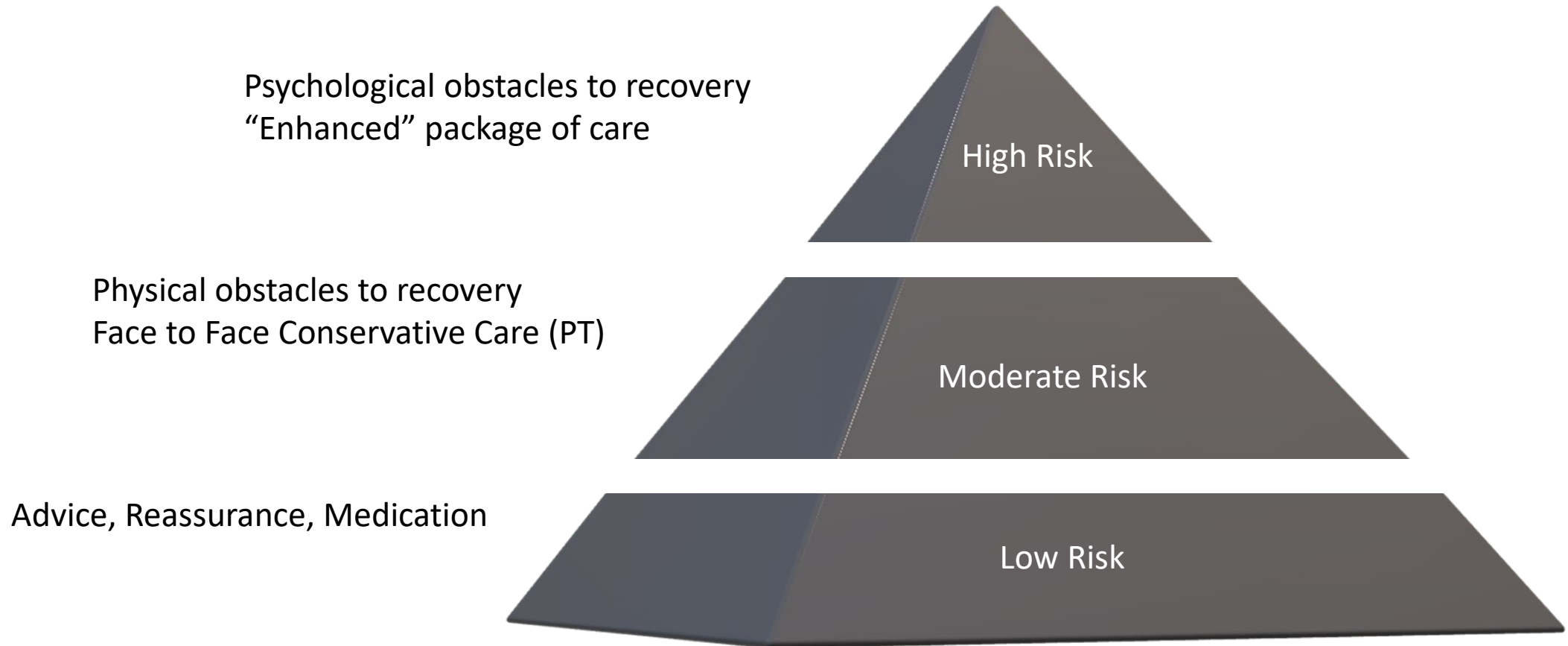


“Wait a minute here, Mr. Crumbley. ...
Maybe it isn't kidney stones after all.”

<https://x.com/TheFarSide6/status/1156189549573263360>

Keele STarT Back Model

Hill et al, 2011, Lancet



American College of Radiology Appropriateness Criteria

Variant 2: **Chronic shoulder pain. Suspect rotator cuff disorders or subacromial subdeltoid bursitis (no prior surgery). Initial radiographs normal or inconclusive. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
US shoulder	Usually Appropriate	0
MR arthrography shoulder	Usually Appropriate	0
MRI shoulder without IV contrast	Usually Appropriate	0
Image-guided anesthetic +/- corticosteroid injection shoulder or surrounding structures	May Be Appropriate	Varies
CT arthrography shoulder	May Be Appropriate	⊕⊕⊕⊕
Radiography shoulder additional views	Usually Not Appropriate	⊕
MRI shoulder without and with IV contrast	Usually Not Appropriate	0
Bone scan shoulder	Usually Not Appropriate	⊕⊕⊕
CT shoulder with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT shoulder without and with IV contrast	Usually Not Appropriate	⊕⊕⊕
CT shoulder without IV contrast	Usually Not Appropriate	⊕⊕⊕
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	⊕⊕⊕⊕

Unwarranted Variation in Use of PT Services for LBP

- Group Health: generally < 10%
- Workers Compensation : > 50%

Bottom line

- Development of a clear guides for appropriate referral to physical therapy would be a huge achievement.
 - Multidisciplinary consensus guided by evidence
 - Easily accessed and implemented



Are we there yet?

Many Challenges Ahead

- Healthcare system often dysfunctional
 - Struggling to incentivize value-based care
 - Incentives often malaligned
- Reimbursements are inadequate
- Professional Education costs too much

Reasons for Optimism

- Research capacity and evidence base stronger than ever
- Our primary “tools” have strong evidence
- We offer great value

Dr. Jules Rothstein responding to Dr. Helen Hislop's 1975 McMillian Lecture

- *“Ten years later, we still may be inspired to believe that all things are possible. But how can we dream together when the visions are divergent? How can we follow a vision when we do not know what it is? We must realize that our collective task as members of a great profession is to identify those with the visions worth following so that we might be a profession with a face to the world, rather than a consortium of practitioners loosely tied together by historical accidents.”*



Jules Rothstein 1986 PTJ

The Movement System and Diagnosis: Are we there yet?



- **Operational Definition of the Movement System**
- **Isolate the Movement System as a foundational model**
- **Clinical scientists developing and validating diagnostic classification schemes**

“Transforming society by optimizing movement to improve the human experience”



Acknowledgements

- Bill Boissionault
- Rebecca Craik
- Steve George
- Shailesh Kantak
- Kate Mangione
- Michael Tevald
- Arcadia Faculty members

