OHSIG PRESIDENT'S MESSAGE

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Disrupting the Status Quo

As the incoming OHSIG President, I am humbled and honored to serve such a gifted group of physical therapy professionals. In recent years we have seen outstanding advocacy efforts that have led to expanded roles and responsibilities for physical therapists, but we still have hurdles to overcome.

The public perception of physical therapists has been reported to generally be very positive. All states currently allow patients to access physical therapy directly without a physician referral with or without some restrictions depending on where you live. Recent advocacy efforts in Montana have elevated physical therapists to be recognized as treating physicians under State workers' compensation laws. However, in most states, we still have many barriers to overcome in order to fully practice independently within our scope of expertise.

I led the charge in Louisiana to become the first certified Department of Transportation (DOT) medical examiner under the Federal Motor Carrier Safety Administration. I started this journey in 2013 and crossed the finished line in 2015 after overcoming a few regulatory challenges and battles with medical doctors who did not feel that it was within the scope of physical therapy practice to perform physical examinations. Currently, 9 Physical Therapy State Boards have affirmed that it is within the scope of physical therapy practice to perform physical exams required under the DOT for commercial truck and bus drivers.

I have been in practice now for 32 years. I have probably performed about 5,000 functional capacity evaluations (FCE) in my career, and I have been accepted in various federal, state, and worker's compensation courts as an expert in orthopedic physical therapy, FCEs, functional job analysis, and functional test validation. I have provided expert witness testimony in more than 100 legal cases, including expert work with the Equal Employment Opportunity Commission, and in most of these cases there seems to be a common theme which is the perception among attorneys and judges that because physical therapists are not "medical doctors", we can't diagnose or determine the causation of an individual's injuries.

The Centers for Disease Control (CDC) defines diagnosis as "the act or process of identifying or determining the nature and cause of a disease or injury through evaluation of patient history, examination of a patient, and review of laboratory data." Physical therapists evaluate a patient's history, perform physical examinations, and review lab/radiology data, and other relevant data to determine an evidence-based treatment plan. Of course, our treatment plan is based on our diagnosis and cause of a patient's physical impairments and functional limitations.

I completed training conducted by the American Medical Association (AMA) on how to perform impairment evaluations using the AMA Guides to the Evaluation of Permanent Impairment nearly 20 years ago. After over a decade of performing impairment evaluations, I recently had a claims examiner from the U.S. Department of Labor reject my impairment rating report on an injured postal worker because according to Federal regulations under the Federal Employees' Compensation Act (FECA), impairment ratings must be done by physicians which includes medical doctors, osteopaths, podiatrists, optometrists, dentists, clinical psychologists, and chiropractors. The FECA specifically excludes physical therapists from their list of physicians, noting that physical therapists are not qualified to provide medical opinions to establish causal relationship.

So, let's set the record straight. Physical therapists have the requisite professional education, training, qualifications, and skills necessary to provide medical opinions, determine a diagnosis and causation of injury or illness, and perform impairment evaluations within our scope of practice. We have been complacent far too long. We need to change state and federal laws to remove barriers that hinder our ability to fully practice with our scope. Let's disrupt the status-quo!

THREE MODELS OF ASSESSMENT: OPTIMIZING FUNCTIONAL CAPACITY EVALUATION OUTCOMES IN OCCUPATIONAL HEALTH

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BACKGROUND

Historical research describing the impact of manual material handling (MMH) on the human body in occupational health reflects 3 specific scientific focus models: physiological, biomechanical, and psychophysical.[1-9] Specifically, physiological references include changes in metabolic rates, blood pressure, heart rate (HR), maximal oxygen uptake, and strength.[2,4-6,10,11] Psychophysical outcomes reflect rates of perceived exertion to determine safe lifting rates during an 8-hour shift with men and women, young and old, and in multiple occupational

sectors.[12-15] These measures include the Borg Rate of Perceived Exertion (RPE) 15-point scale (6-20), the Borg category ratio (Borg CR-10), and the OMNI Resistance Exercise scale 0-10 that yield valid and reliable maximum acceptable workloads due to cognitive, perceptual, and motivational factors.[14,16-18] Given technological advancements, biomechanical assessments during MMH tasks flourished since the 1970s, highlighting torque and force estimates, electromyography (EMG), balance mechanisms, and intra-abdominal pressure (IAP) to understand the influences on spinal compressive forces and strength needs to reduce injury, especially at the L5-S1 segment.[1,19-27] Karwowski & Ayoub[28] combined all 3 models in their study to determine safe lifting loads using stooped-back and leg squat techniques while monitoring metabolic energy expenditures, heart rate, and compression factors at the L5-S1 intervertebral disc. With varying weights lifted and lowered between 15.1 and 44.8 kg (33.2 and 98.8 lbs) in frequencies of 1 to 12 lifts per minute in 9 male students (19-23 years old) with little lifting experience, these researchers quantified the impact of psychophysical, biomechanical, and physiological stresses at different stages of occupational function. Contemporary occupational health literature reflects the interplay of these models to better understand patient testing outcomes, especially in functional capacity evaluations (FCE).

When a patient has failed to progress in an acute rehabilitative setting within an expected timeframe, a certified practitioner may perform an FCE to determine work-related functional ability for return-to-work capacity. This "comprehensive performance-based assessment conducted over one to two days" reflects the individual's physical and cognitive abilities to perform job-related tasks and assists the occupational health stakeholders in case closure.[29] The contemporary update for physiological response in FCE use is cardiorespiratory measures, given heart rate (HR) is the most measured variable.[29]

Because the cardiorespiratory, biomechanical, and psychophysical models don't always apply to specific reasons for functional test termination, other operationally defined functional test termination criteria have been developed to address this issue. The other test termination criteria are noted in **Table 1** with examples of how to reliably apply them during the administration of content-valid functional testing in a more legally defensible manner.[30]

Use of only one or two measures may result in an incomplete picture of an individual's functional ability, especially over time or within a combined task such as lift, lower, push/pull, and carry. For example, Umer et al[31] studied the validity of the Borg RPE 15-point scale in fatigue monitoring with cardiorespiratory measures in 14 male construction workers on-site with 3 to 30 years of MMH experience using wearable technology. These researchers found that while the individual's heart rate responses correlated significantly with HR (-0.02; $p < 0.01$) and heart rate variability (HRV) (- 0.17; $p < 0.01$), the self-reported fatigue levels using the ratings of fatigue (ROF) scale did not significantly correlate with the Borg RPE and varied greatly among participants.[31]

In contrast, Anwer et al[32] studied the correlation between cardiorespiratory, thermoregulatory responses, and the Borg 6-20 scale in 25 male university students using a 15 kg combined lift, carry, and lower task at 0, 15, and 30 minutes of activity. These researchers found a significant correlation ($p < 0.01$) between the Borg 6-20 scale and 30 minutes of activity with HR (0.821), breathing rate (0.701), local skin temperature (0.465), electrodermal activity (0.369), and physiological stress index for fatigability (0.981).[31] Given the changeability of environments, objects lifted, lifting styles, and weights, movement analysis in biomechanical assessment further validates effort and ability.

The Academy of Neurologic Physical Therapy's Movement System Task Force introduced a framework using seven characteristics to evaluate 6 task-specific core movements – sitting, sit-to-stand, walking, step up/down, and reach/grasp/manipulate in movement analysis.[33] These variables included symmetry, speed, amplitude, alignment, postural control (verticality and stability), coordination (smoothness, sequence, and timing), and symptom provocation - including psychophysical and cardiorespiratory outcomes.[33] These 7 characteristics reflect the nature of movement in an occupational health environment, given the industry standard pacing.

With the variability of a work environment, the job duty requirements, and an individual's demographic presentation with health history, using all these models interchangeably throughout the FCE helps the clinician identify objective medical evidence to better classify valid or invalid results and guide claim closure.

DISCUSSION

As part of their clinical reasoning, FCE examiners should ask themselves 4 questions: what was the individual's resting HR was just prior to each functional test?; what was the % of HR change for each functional test?; what was the % heart rate reserve (HRR)?; and are an individual's self-reports of physical exertion (OMNI 0-10 RPE – refer to **Figure 1**) consistent with biomechanical observations and cardiorespiratory measures?

The following are 4 examples of interplay between biomechanical, cardiorespiratory, and psychophysical models that are applicable during an FCE in an occupational health setting.

Example 1: An individual who underwent 3 right shoulder surgeries (rotator cuff repair and 2 subsequent revision rotator cuff repairs) may demonstrate a valid performance during the physical exam and functional testing but demonstrates inconsistent movements and a self-reported Borg RPE of 18 with a HR of 82 beats per minute when lifting 20 lbs shoulder to overhead for 10 repetitions.

Reflections and clinical reasoning: Clinically knowing that the Borg RPE 6-20 scale correlates with HR and HRV, the movement analysis reflects poor effort that may be due to fears of retearing the rotator cuff. This outcome may be further validated by self-reported outcome measures used, such as the Quick DASH, Tampa Scale of Kinesiophobia, and the Spinal Sort. The termination of the functional test may be reasonable given self-limitation due to the significant past medical history.

Example 2: Two individuals demonstrate a floor-to-waist lift assessment in an FCE. One individual demonstrates a safe biomechanical test endpoint with a 50% HR increase and 44% heart rate reserve (HRR) during a 1 repetition baseline below waist lift of 40 lbs and an OMNI RPE of 7 at test termination. The second individual performs the same lift with only a 10% HR increase and 15% HRR during a 1 repetition baseline below waist lift using 20 lbs with the same reported OMNI RPE of 7 and slow, exaggerated movements with poor accuracy of box placement on the shelf.

Table 1. Functional Testing Termination Criteria

Biomechanical and cardiorespiratory signs of exertion and psychophysical factors were monitored throughout the functional testing protocols. The individual's performance for each test was classified as valid if the FCE examiner stopped the test because the individual reached an objective biomechanical and/or cardiorespiratory safe termination point, or if the FCE examiner terminated testing due to participation restrictions, health stability concerns, or if a psychophysical limitation was reasonable. The individual's performance was classified as invalid if testing were self-limited by the individual prior to reaching an objective biomechanical or cardiorespiratory endpoint and there was no reasonable health or safety reason for the testing to end or when an individual demonstrates behavioral concerns that raises significant concerns for safe test administration. The following criteria was used by the FCE examiner as a basis for test termination.

Test Criteria Met	Test termination due to individual's performing meeting the job demand requirement or cut-score, or completion of the task or entire test protocol.
Biomechanical Signs of Exertion	Maximal counterbalancing including trunk hyperextension or lateral trunk lean to maintain safe control of the load during movement.
	Very slow ascent or rapid descent of the load due to near failure to safely control the load during movement.
	Jerking, hesitation, or uncontrolled momentum during load movement.
	Maintains load in very close proximity to the body during movement of the load.
	Maximal primary and accessory muscle use and jaw clenching may be present during movement of the load.
	Muscle fatigue with shakiness and difficulty maintaining safe load control during movement of the load.
	Significant worsening of gait derangement and/or loss of balance during movement of the load.
Cardiorespiratory Signs of Exertion	Activity heart rate ≥85% of age predicted heart rate maximum or activity heart rate ≥70% HRR.
	Recovery HR exceeds 110 bpm with other signs/symptoms (dizziness, paleness, feeling faint) after sitting at rest for 6 minutes.
	Blood pressure reached or exceeded 250/115 mmHg.
	Systolic drop in blood pressure more than 10 mmHg with persistent signs and/or symptoms (dizziness, paleness, feeling faint) after sitting at rest for 6 minutes.
	Systolic blood pressure dropped below 80 mmHg with persistent signs and/or symptoms (dizziness, paleness, feeling faint) after sitting at rest for 6 minutes.
	Oxygen saturation dropped below 80%.
	Respiration rate reached or exceeded 44 breaths per minute.
Participation Restriction	Early test termination or test elimination due to safety protocols (eg, severe high resting BP >200/110 mmHg; resting heart rate >120 bpm, resting O_2 saturation <80%, moderately severe angina, substantial fall risk, significant physical impairment on exam), or participation restrictions imposed by other health practitioners.
Health Stability Concerns	Test termination due to health stability concerns after the individual reports a clinically significant increase in symptoms with activity performance.
Behavioral Concerns	Test termination due to the individual exhibiting maladaptive pain behaviors, or behaving in an uncooperative, unpredictable, or inconsistent manner that raises significant behavioral concerns.
Psychophysical (Self) Limitation	Individual self-limitation of functional testing due to reported inability to continue with testing or progress to higher functional levels. FCE examiner determines reasonableness of self-limitation for classification of results as valid or invalid.

Duration/Frequency, % Heart Rate Reserve, and OMNI RPE

	Duration	Frequency (reps/day)	%HRR	OMNI RPE 0-10
Seldom (<2%)	<10 min/day; <45 min/wk; < 1wk/yr	1-6	69-70%	7-8
Occasional (3-33%)	10 min < 2.5 hrs/day; 45 min <13 hrs/wk; 1 wk < 4 mo/yr	7-100	43-68%	5-6
Frequent (34-66%)	2.5 hrs/day < 5.5 hrs/day; 13 hrs/wk < 3.5 days/wk; 4 mo/yr < 8 mo/yr	101-500	34-42%	3-4
Constant (67-100%)	5.5-8.0 hrs/day; 3.5-7.0 days/wk; 8-12 mo/yr	> 500	≤ 33%	1-2

*Day based on a work schedule of 8 hours daily, 40 hours weekly, and 2080 hours annually.

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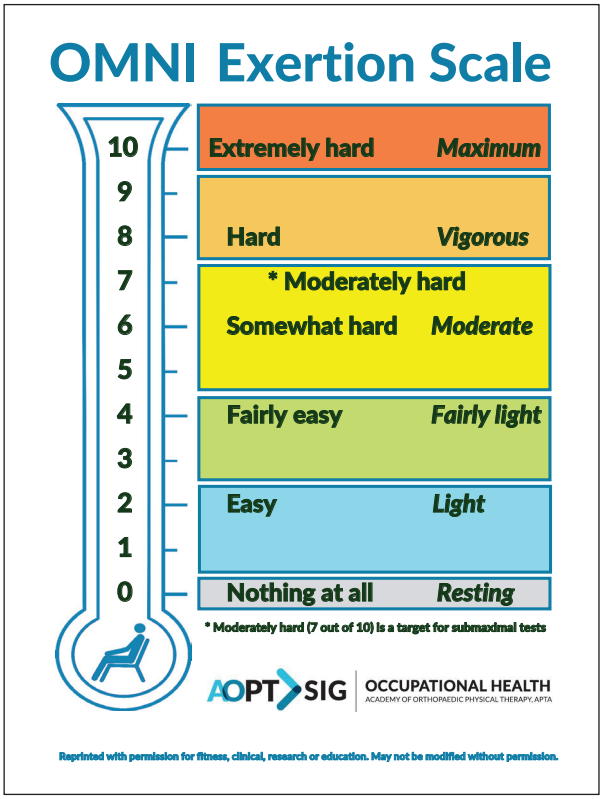
Figure 1. OMNI 0-10 RPE Scale



Reflections and clinical reasoning: The first individual's cardiorespiratory, biomechanical, and psychophysical responses were consistent with the functional tasks, validating this assessment. The second individual's response demonstrated an inconsistent biomechanical outcome with the cardiorespiratory response and psychophysical report. This discrepancy needs to be examined further using patient-reported outcome measures and similar subtask testing for correlative measures.

Example 3: An individual's HR response during a 5-minute MMH circuit to assess their ability to safely tolerate lifting/carrying/pushing/pulling of 40 lbs at an occasional frequency shows an HRR of 30% with good body mechanics and a Borg RPE of 11. This contrasts with a 30-minute MMH circuit that demonstrates an HRR of 60% and a Borg RPE of 13, and observed counterbalancing using increased lumbar extension, amplified momentum, and fair accuracy with box placement.

Reflections and clinical reasoning: Given the need to demonstrate functional ability over an 8-hour working day, using all 3 models in a 30-minute MMH session may provide validity about the individual's ability to safely perform MMH for longer durations.

Example 4: An individual with a history of lumbar spine pain demonstrated a 1 repetition baseline below waist lift of 50 lbs with a 50% HR increase, increased momentum with observed shoulder hiking, and an OMNI RPE of 3 at test termination.

Reflections and clinical reasoning: This is a common finding with individuals who are test-competitive. Though the heart rate and observed movement analysis correlate with the load lifted, the self-perceived rate of exertion is inconsistent, indicating the individual has a skewed sense of effort relative to load that will require education on rest intervals and pacing for successful return to work capacity.

CONCLUSION

Historical use of the biomechanical, cardiorespiratory, and psychophysical models of assessment during the administration of FCE testing has allowed qualified healthcare practitioners to make more reliable and valid determinations about the residual functional capacity of injured workers. More recent best practice FCE guidelines recommend use of additional operationally-defined functional test termination criteria for improved reliability and legal defensibility of the results.

The APTA Orthopedics, Occupational Health Special Interest Group offers an Independent Study Course FCE monograph for a deeper understanding of the proper design, administration, interpretation, and reporting of FCE results. This monograph is 1 part of a 6-part series leading to an Occupational Health Practitioner certificate.

Clinical Applications:

- A medical diagnosis provides documentation about an individual's anatomical/physiological pathological condition, but it provides no valid or reliable evidence about an individual's functional ability to safely participate in activities of daily living, including work.
- An FCE is a complex evaluation, and it requires the clinical skills and experience of a qualified healthcare practitioner. Formal training in the design, administration, interpretation, and reporting of FCE results is strongly recommended.
- Operationally defined functional testing criteria goes beyond the traditional biomechanical, physiological, and psychophysical categories, and it is crucial for ensuring the results from functional testing is valid and reliable.
- Without a proper evaluation of an individual's function, work capacity and disability are at best an educated guess.

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