

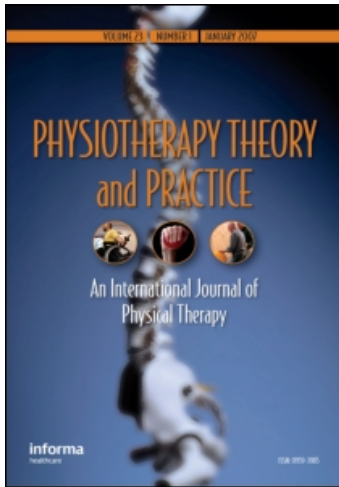
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Psychological stress measure (PSM-9): Integration of an evidence-based approach to assessment, monitoring, and evaluation of stress in physical therapy practice

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Stress can be a primary or secondary contributor to ill health via excessive and sustained sympathetic arousal leading to ischemic heart disease, hypertension, stroke, obesity, and mental ill health, or through related behaviors such as smoking, substance abuse, and over or inappropriate eating; or as a contextual variable in terms of risk factor and lifestyle outcome. In addition, psychosocial stress can impair recovery from any pathological insult or injury. Most assessments of stress relate to life events, and both past and current life stressors, acute and chronic, play a major role. However, beyond the impact of stressors, it is the reported state of feeling stressed that is the critical predictor of ill health. This article describes stress and its correlates, discusses models of stress, and presents the nine-item Psychological Stress Measure (PSM-9). This tool is aimed directly at the state of feeling stressed, is suited for assessing stress clinically in the general population and serving as an outcome measure. The tool is valid and reliable and easy to administer in health care settings; it has a normal distribution, which makes it a very sensitive-to-change instrument in repeated measures to document progress.

Introduction

The role of psychological stress in problems typically treated by physical therapists (e.g., heart disease, high blood pressure, back pain, chronic headaches, fibromyalgia, and whiplash) is increasingly being recognized, but much remains to be done in both theory and practice (Goffaux-Dogniez, Vanfraechem-Raway, and Verbanck, 2003; Schneider, Schmitt, Zoller, and Schiltewolf, 2005). Even in the case of musculoskeletal conditions, researchers report that both patients and physical therapists consider stress and psychological distress as possible contributors to the physical problems, but interrater agreement was low,

showing that psychological stress and distress tend not to be addressed explicitly in the consultation process (Krogh Jorgensen, Fink, and Olesen, 2000).

Within the context of the biomedical model, physical therapy interventions tend to focus on the impairments and the physical symptoms for which clients seek treatment. The psychosocial needs of the clients however are not always satisfied by a treatment focused on this model of care (Hill and Kitchen, 2007). In addition, this approach does not reflect recent evidence about the impact of stress on physiology (Lupien et al, 2002). If the psychosocial context of clients and the backgrounds of their illnesses are ignored by the clinician, clients are unlikely to receive the

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most appropriate care (Grace, 2000; Truchon, 2001). Indeed, health is the by-product of a combination of factors: biological, environmental, behavioral, social, and health care (Lemyre and Orpana, 2002). The efficacy of treatment in physical therapy and risk of relapse appear to be higher, depending on the clients' social context including work stress (Landsman-Dijkstra, van Wijck, and Groothoff, 2006). Stress research is now moving toward a more integrated human social ecology model involving multiple levels (i.e., the onto-system, which includes the individual history and skills; the micro-system consisting of close others and core relationships; the meso-system incorporating the support role of community, work, services; and the macro-system inscribed in societal values and policies). This more holistic systemic integration coincides with a shift toward positive psychology, efficacy, resilience, and empowerment, and more emphasis on one's personal assets and capabilities and social capital. Hobfoll (1989) has been a key proponent of resources analysis along with Caplan, Taylor, Baum, Kielcot-Glaser, and Cohen who have also contributed immensely to reframe these issues (Taylor, 2008). In turn, the emergence of the biopsychosocial model of health has provided a systemic approach to the human ecology of health, which has helped to elucidate the determinants of health in which stress can be an integrative variable (Figures 1 and 2).

The biopsychosocial model

The biopsychosocial model has recently been put forward to replace the biomedical model in the context of physical therapy (Barron, Klaber-Moffett, and Potter, 2007). It provides a more holistic approach to viewing the individual in his or her environment and in trying to integrate social and psychological factors along with biological ones to ultimately improve the quality and effectiveness of diagnosis and intervention. Health psychology evidence supports that psychological factors such as personality, social support, perceived stress, and economic status have a major influence on illness and health (for overview see Taylor, 2008). Specifically, psychoneuroimmunology, the study of the interaction of the behavioral, neural, and endocrine systems with immune function, also provides scientific

support for the biopsychosocial model. Indeed, experimental studies performed in psychoimmunology show that psychological factors, such as anxiety, depression, or interpersonal hostility, can negatively impact vulnerability to disease and healing rate (Cohen, Kessler, and Gordon, 1995; Cole-King and Harding, 2001; Fillion, Kirouac, Lemyre, and Mandeville, 1994; Kiecolt-Glaser et al, 2005). Other psychoimmunological studies have shown a link between psychological stress and the speed of wound repair (Broadbent, Petrie, Alley, and Booth, 2003; Ebrecht et al, 2003). Recently, Alford (2006, 2007) discussed the relevance of these findings in the context of physical therapy and highlighted the importance of doing more research on the impact of psychological stress on illness and healing.

Stress

Since the term stress was coined by Hans Selye in 1950, based on his animal studies using electric shocks on frogs, the concept has been largely disseminated in the lay literature and has gained popularity as a key notion to describe people's state of tension from the demands of life. Originally, stress referred to the general adaptation syndrome (GAS) (Selye, 1951), a cluster of physiological responses to any new event or stimulus in the environment in which the body first reacts and then habituates or, if too severe or persistent, exhausts itself. Because stress was shown to be a generic usual response across species to any novelty, reporting being stressed has become socially acceptable. Therefore, it became useful and nonthreatening in clinical intervention to portray stress as a source of an ailment, distress, and disease. In the clinical intake, background factors, such as lifestyle, emotional state, events, work and life conditions, and social support are relevant in discerning the role of stress in an individual's health or ill health.

Biopsychosocial research has shown that stress is closely related to physiology and pathology. Feeling stressed is related to the activation of the sympathetic nervous system, the release of adrenaline, activation of heart pulse, constriction of blood vessels, high blood pressure, and increased breathing (Chandola, Brunner, and Marmot, 2006). This stress response sends messages to the pituitary gland,

which in turn liberates hormones that stimulate the suprarenal adrenal glands and produces corticosteroids, including cortisol, an established biomarker of stress highly involved in heart disease (Karasek and Theorell, 1990). These hormones affect the immune system, both through a diminution of immune cells and the suppression of immune function via a complex system of interregulation of bio-messengers. Some of the exact details remain unclear or undiscovered, but the overall immunosuppression response is well established. Behavioral changes in nutrition and sleep patterns associated with stress also impact the function of various organ systems, including the cardiovascular, immune, and musculoskeletal systems (Buysse et al, 1989; Taylor, 2008).

The biopsychosocial domain of stress nevertheless suffers from inconsistent use of terms and measurements. Hence, we propose to seek consistency and clarity in adopting the dominant model of naming stress the reported phenomenological experience of the person, and calling stressors the external life events and chronic difficulties. Our aim is first to present a model of the nature and role of stress, the Psychological Stress Model, and then to introduce a user-friendly, short, economical, and validated tool, the Psychological Stress Measure (PSM-9), to assess and monitor stress as well as to evaluate the results of intervention in both physical therapy theory and practice.

The psychological stress model

As shown above, ample literature exists on stress and a series of models that rename or emphasize different elements. All in all, however, the field has reached consensus on a schemata adapted from Lemyre (1987). See the synthesis in Figure 1.

Stressors

S-R models

A first generation of stress models, often called S-R for Stimulus-Response, represents the basic link between stressors and response. This model has its roots in Selye's original animal research in which a stimulus (e.g., a mild electric shock or ice water) was applied to the leg of a frog or to a rat, which provoked an orientation and activation response (Selye, 1951). The pattern of activation-adaptation/exhaustion was described as universal and generic. The adaptation response however was not specific to the stimulus or stressors. When extended to human stress research, S-R models gave rise to the measurement of stress via lists of stressors, life events that respondents ticked based on their experience over the past year, and were summed either as number of events or preassigned units of stress, Life Change Units (LCU). Classic in this tradition is the widely used Social Readjustment Rating Scale

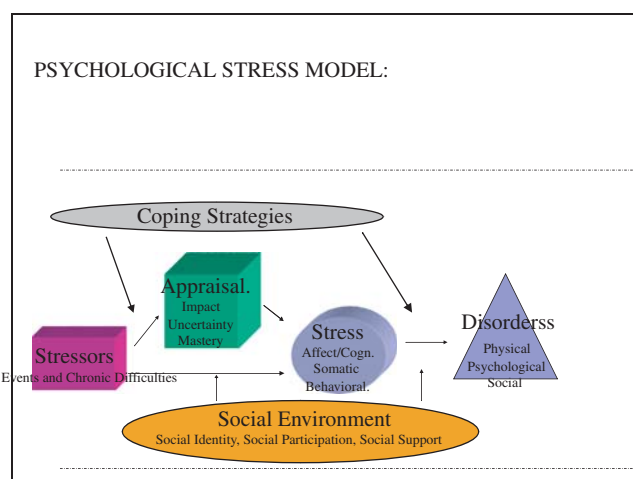


Figure 1. The psychological stress model.

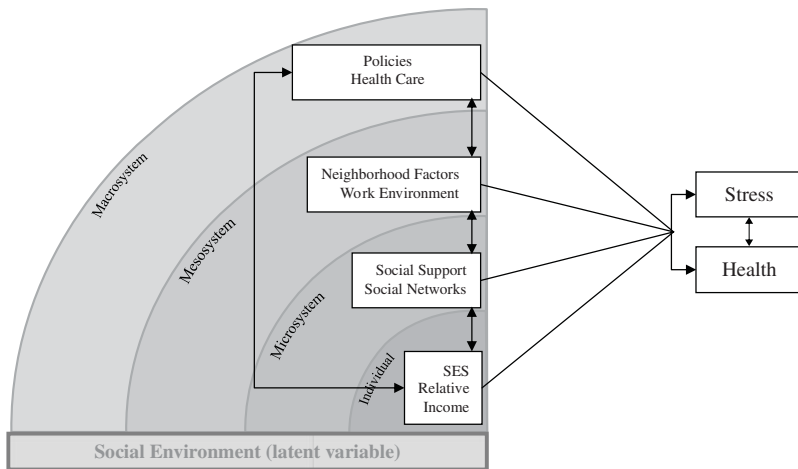


Figure 2. The ecological model of stress and health (drawing from S. Gibson).

(SRS) of Holmes and Rahe (1967), which consists of a list of 42 stressors weighted with points.

The more that people report stressful life events over the past year, the more likely they are to have an illness in the following year (Sommerfield and McCrae, 2000). A series of modified versions of the original Holmes and Rahe scale have flourished. The addition of chronic stressors beyond predictable life events was also a landmark contribution exemplified by the Hassles and Uplifts questionnaires (Aneshensel, 1992; Dohrenwend, Dohrenwend, Dodson, and Shrout, 1984). Then, lists of stressors were designed for a range of situations, subpopulations, and incidents. Overall, the results showed the more that people actually identified stressful incidents, the more they report experiencing stress and distress and, to a lesser extent, they will later show occurrence of illness.

Stress and stressor a 'normal' process and state

As most people report, the notion of stress relates to the phenomenological experience of feeling stressed, a state of mental tension (Lemyre and Tessier, 1988). Sometimes extreme and then debilitating, but at times energizing and mobilizing, it is recognized consensually as a normally distributed phenomenon with most people reporting average levels fluctuating across periods of life, with exceptional acute high states and unusual low levels (Lemyre and Tessier, 2003). So, psychological stress can be defined as a continuous personal psychological

experience, a state of psychological tension. It is related to both positive and negative events and circumstances that could be construed as a challenge or demand, which here we differentiate with the term “stressors” (Lemyre and Tessier, 1987). By reserving the word stressor to the life event or chronic situation, one indicates more clearly the role of the environment as a provoking agent or precipitator to feeling stressed (Orpana and Lemyre, 2004; Orpana, Lemyre, and Kelly, 2007).

Appraisal models

Over the past 30 years, the need to describe stressors more broadly and across contexts called for a paradigm shift that added social cognition and subjective appraisal to the strict S-R response model. Richard Lazarus was a pioneer in this era, and his books with co-author Susan Folkman remain the most widely cited (Lazarus and Folkman, 1984). They proposed a transactional model of stress by which the critical ingredient is the person's perception of his or her stressors (i.e., the interaction between the environment and the person's evaluation [appraisal] of it). It is posited that the individual appraises situations in terms of his or her self-esteem, health, or wealth (First Appraisal); then assess his or her capability to respond or cope with the challenge (Second Appraisal); and the residual perceived threat constitutes the stress

experience, an emotion that has affective, cognitive, physiological, and behavioral expressions.

This was a landmark proposal that generated thousands of studies. Three key points carry strong legacies in the stress domain: 1) the dimensions of appraisal, 2) the strategies of coping, and 3) the subjectivity of the process.

Initial work by Lazarus and Folkman (1984) had focused on threat as the central dimension of appraisal. Subsequent work identified the relevance of other dimensions to qualify stressors such as desirability, valence, predictability, control, and uncertainty. A synthesis of the literature as well as a factorial analysis reveal three core aspects of stressors that predict stress, distress, or illness: 1) severity, 2) mastery, and 3) uncertainty (Lemyre, 1987; Sweet, Lemyre, and Savoie, 1999). The more a life event or chronic situation is perceived as severe in terms of its impact, the less one has a sense of mastery over it, and the more it conveys uncertainty, the more stressed the person will feel and the more likely he or she will report falling ill.

To face such stressors, Lazarus and Folkman (1984) are well known for attempting to identify coping strategies that minimize the experience of stress or distress. They documented almost a dozen coping strategies, from planning to denial that they subsumed into two major groups: emotion-focused strategies and problem-solving strategies. In general, problem-solving strategies are associated with better prognoses, and emotion-focused strategies relate more to depression. Several caveats for the researcher have undermined the robustness of these categories and now investigators refer more to either active or passive coping, approach coping or avoidance coping, and characterize further strategies as behavioral or cognitive (i.e., concrete and tangible actions or mere mental rehearsal). Actually, both have been shown to be highly effective (Hobfoll, 1989; Lemyre and Lee, 2006). In clinical practice, the appraisal model implies that the therapist gains insight into the stress experienced by his or her client by inquiring about perception. Because most of the time, the therapist cannot influence the severity of external stressors, she or he should encourage developing skills and a sense of internal control over the issue, as well as provide as much information as possible to reduce uncertainty and lack of knowledge.

Stress and strain

Less frequently used now, the word strain appears at times in the literature to refer to the internal tension, whereas the term stress is used to describe external stressors. Strain as a term has also been disseminated in the well-known work of Theorell (2007) who, in the organizational setting, relates strain to jobs with high demands and low control. Similarly, Siegrist et al (2004) has demonstrated that stress in workers correlates with jobs with high demands and low rewards. Based on this understanding of the word strain, it indeed refers to the state of psychological tension that we have termed stress, and it correlates with biomarkers of stress such as cortisol levels and stress-related physiological responses (Lupien et al, 2002; Theorell, 2007).

Stress and distress

Stress is distinguished from distress and psychopathology. However, too often, due to the lack of readily accessible alternatives, stress is measured by mental health diagnostic screening instruments. For example, depression inventories are commonly used (e.g., Beck Depression Inventory [BDI] or Derogatis' Brief Symptom Inventory [BSI]; or clinical diagnostic interviews such as the Present State Examination, the Hospital Instrument) (Derogatis and Coon, 1993; Goldberg, 1972; McDowell and Newell, 1996). Such tools have typically been designed and validated for psychiatric use to measure pathological states. Their statistical properties makes them skewed and insensitive to small improvements.

In physical therapy practice

From this synthesis of the literature and our own qualitative and quantitative research (Lemyre and Lee, 2006; Orpana, Lemyre, and Kelly 2007), the experience of feeling stressed is a core construct in the adaptation process to life demands and prediction of health. Three easy evidence-based functions can successfully improve clinical practice: 1) assessment, 2) monitoring, and 3) evaluation. For example, assessing stress with a short questionnaire at intake can shed light on tense contexts or critical phases of life that may have aggravated one's physical condition or that

are likely to impact compliance with treatment and exercise. Monitoring progress through charting at regular intervals allows professionals and patients alike to assess improvement and review treatment plan, compliance, or diagnosis itself. Personal charts are easy to design in either paper form or electronic versions that can be automatically saved on a secure confidential server. Patients can complete psychosocial profiles at workstations in the waiting room. At the time of consultation with the physical therapist, a printout can be made available for discussion. A printout can provide the basis for a personal portfolio or be the basis of case studies on the part of the practitioner. Similarly, self-monitoring is possible with each patient keeping his or her records along with an interpretation grid that empowers people to judge their relative stress status and flags areas of concerns in relation to the Canadian PSM norms and centiles (e.g., Lemyre, Tessier, and Fillion, 1990; www.passeportsante.net).

Specific conditions

Stress assessment has been shown to be of particular relevance to patients with conditions such as heart disease, stroke, high blood pressure, arthritis, back pain, and during recovery from a major health event or an accident (Truchon, 2001). In some instances, unduly severe and prolonged stress might be part of the causal factors for a condition or impairment. Stress also may be viewed as a marker of prognosis. Invoking stress in the causal pathway does not infer that the condition is psychosomatic in the prejudicial sense of being “in the head,” but rather that there is a likely plausible pathway from psychological tension to modification of neurotransmitters, hormones, and immune messengers via the central nervous system, the limbic and pituitary glands, and the humoral system. Therefore, both research and clinical practice benefit from documenting with valid measures the intricate connections between psychosocial experiences and function and functional capacity. Guidelines for best practice can then be elaborated upon on the basis of evidence recommending thresholds of reported stress levels.

We developed a measure, the Psychological Stress Measure (PSM), that specifically addressed this concept of psychological stress in the general

population. We required that it reflect affective, cognitive, behavioral, and somatic components; and although simple, economical, and easy to administer, it needed to correlate with physiological markers of endocrine and immune functions and demonstrate sound psychometric properties.

The psychological stress measure

The PSM was designed by using 49 items drawn from descriptors about stress generated by focus groups. For content validity, we conducted a quantitative analysis of items selected as the best indicators of stress. We then tested for internal consistency, retaining the indicators that had inter-item and item-total correlations of between 0.35 and 0.85, a Cronbach α coefficient of approximately 0.95, and the normality of distribution.

The scale is unifactorial in structure and maintains a test-retest stability of 0.68 to 0.80 under apparently constant conditions. To validate the tool, we compared groups that differed in social and economical status and urban density, during school examinations and holidays, and health prognosis, namely, having benign vs. malignant diagnostic biopsies. Convergence validity was established with classic depressive or anxiety scales; divergence validity was established by distinct factorial scores on these measurements. Concomitant validity with immune competence was shown in a double before-after design of school stress and holidays, using salivary immunoglobulin concentrations. The discriminatory power of the PSM was also tested on a clinical sample of patients with schizophrenia and major depression. Finally, the predictive power of the PSM over 8 months, with respect to indicators of physical health among child care workers was significant. The PSM's responsiveness and normality of distribution provide it with statistical power in analyses. For longitudinal follow-up protocols with repeated measurements, two parallel 25-item versions were developed on the basis of the original long version, and each showed a Cronbach α coefficient of 0.92 and 0.93.

For general surveys of health and well-being in the workplace, an abridged nine-item version was developed (Table 1) to meet various research needs and applications. The PSM-9 version is used by Hydro-Québec and Renault (France) as well as in public service, hospitals,

Table 1. The Psychological Stress Measure, PSM-9 (English version).

Mark the number that best indicates the degree to which each statement applies to you recently, that is in the last 4–5 days

Not at all	Not really	Very little	A bit	Somewhat	Quite a bit	Very Much	Extremely	
1	2	3	4	5	6	7	8	
1. I feel calm								1 2 3 4 5 6 7 8
2. I feel rushed; I do not seem to have enough time.								1 2 3 4 5 6 7 8
3. I suffer from physical aches and pains: sore back, headaches, stiff neck, stomach aches.								1 2 3 4 5 6 7 8
4. I feel preoccupied, tormented or worried.								1 2 3 4 5 6 7 8
5. I feel confused; my thoughts are muddled; I lack concentration and I cannot focus my attention.								1 2 3 4 5 6 7 8
6. I feel full of energy and keen.								1 2 3 4 5 6 7 8
7. I feel a great weight on my shoulders.								1 2 3 4 5 6 7 8
8. I have difficulty controlling my reactions, emotions, moods or gestures.								1 2 3 4 5 6 7 8
9. I feel stressed.								1 2 3 4 5 6 7 8

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and community services. Concomitant validity with immune competence was demonstrated in a double before-after design of school stress and holidays, using salivary immunoglobulin concentrations. The discriminatory power of the PSM was also tested on a clinical sample of patients with schizophrenia and major depression.

Implications of use of the PSM-9 in physical therapy practice: A framework and a tool research and science

As the science of physical therapy moves toward a better understanding of the various biopsychosocial determinants and their interaction in pathology, physical damage, and in the recovery process, stress is a promising integrative concept as a critical factor and mediator in the endoneuroimmune pathways and/or of vulnerability and interaction as illustrated in Figure 1 (the Psychological Stress Model). Research examining the precursor of harm, recovery, or relapse would benefit from integrating a short valid measure of psychological stress as a control variable and risk factor, as provided by the PSM-9.

Clinical practice

Because professional practice demands evidence for improvement, benchmark of assessment, and documentation of progress, the use of the PSM-9 contributes to clinical practice. Insurance audit can be enlightened by repeated measure charts with the use of the PSM-9. Furthermore, information from assessments based on the PSM-9 enable the physical therapist-patient relationship by promoting communication about the patient's life events, stressors, and coping strategies into physical therapy practice.

Discussion

Only a handful of investigations have examined the specific relationship between psychological stress and bodily symptoms in a physical therapy context. They yielded interesting results, yet remained limited in the way they treated and measured psychological stress. Some studies, for example, have reported that the treatment of physiological symptoms with massage therapy, or psychodynamic body therapy have a positive impact on psychological problems such as anxiety (Bost and Wallis, 2006; Monsen and Monsen, 2000). Associations have also been

reported between stress-related behaviors and physical problems treated in physical therapy (Meurle-Hallberg and Armelius, 2006). However, some of this research refers to stress as an anxiety disorder rather than stress understood by lay people as a state of tension experienced within the general population. Under the anxiety disorder approach, the psychosomatic relationship (link between the mind [*psycho*] and body [*soma*]) becomes a form of psychopathology rather than a normal functional relationship between emotional states, activation of the neuronal system, endocrine response, and immune cascade (Fillion, Lemyre, Mandeville, and Piché, 1996). Alternatively, some researchers have examined stress based on challenging life events or “stressors” experienced by their clients prior to injury or disease. For instance, Chen, Yu, and Wong (2008) showed that occupational stressors were important predictors of musculoskeletal pain. These variations in the understanding and measurement of stress can lead to confusion among practitioners and researchers and represent a challenge in clinical assessment and conducting sound research and prescribing interventions that target psychological stress.

The administration of the PSM-9 scale in physical therapy practice could facilitate discussion on this matter with both colleagues and clients. It could also be used to assess the level of stress at various stages of the treatment, track its concomitance with the physiotherapeutic interventions, and monitor progress. If stress levels are judged to be chronically high according to the PSM norms, clients could be judiciously referred to psychosocial professionals whose help, in conjunction with physical therapy, could optimize treatment outcome.

In a context where practitioners are increasingly called on to work in multidisciplinary contexts, the PSM scale is a useful instrument to elicit dialogue among health professionals in search for the most appropriate and comprehensive treatment for their clients. Thus, the PSM scale could be a promising tool for physical therapists to assess their clients holistically and tailor their interventions more closely to the clients’ needs. Finally, the PSM scale is a valid tool for use in physical therapy research of stress as a primary or secondary variable of interest.

Conclusion

Physical therapy deals with patients who either through their lifestyles, jobs, circumstances or because of the very physical condition for which they seek care, experience stress. Stress, a common life experience of psychological tension and physiological activation that involves the nervous, endocrine, and immune systems, often presents concurrently with physical complaints or conditions. Because of the biopsychosocial pathway between the mind and the body, stress is a useful marker to assess and monitor in physical therapy irrespective of whether the patient’s problem is primarily psychosocial or physical. Stress can lead to a physical condition, exacerbate it, or impair recovery; thus, its assessment and evaluation can be integral to the patient’s overall response to his or her condition or its care in physical therapy research as well as in the clinic.

In summary, given that psychological stress is an important component of health, a good predictor of disease, and that few measures directly address the concept in the general population, we propose that the PSM offers a useful and valid tool for physical therapists who practice in a health care context to assess and follow stress levels in their patients.

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