BrJP. 2025, v.8:e202552 • https://doi.org/10.63231/2595-0118.202552-en

BrJP
Brazilian Journal of Pain

EDITORIAL

Our concerns about the psychophysical measurement of pain

Nossos desassossegos sobre a mensuração psicofísica da dor

Mariana Rezende Alves de Oliveira[1], Rosemary Conceição dos Santos[1], Tatiane Santana Prado Ferraresi[1], Francisco dos Santos Cardoso[2], Walter Lisboa[3], José Aparecido Da Silva[1]

[1.] Universidade de São Paulo (USP), Ribeirão Preto, SP, Brasil.
[2.] Universidade de Trás-os-Montes e Alto Douro, Vila Real, Portugal.
[3.] Universidade Federal de Sergipe, São Cristóvão, SE, Brasil.

Correspondence to:
José Aparecido Da Silva
jadsilva@ffclrp.usp.br

When talking to friends outside the academic environment about our research and the methods and instruments we use to assess pain, it's not uncommon to be met with a puzzled and even surprised look: even if some don't immediately express it, there seems to be doubt over how this is done and the accuracy or validity of the research. For many, it seems impossible to measure something as subjective as pain. Others can't resist asking: "How is it possible to measure pain, which is so subjective, in a person?".

People, complex and diverse as they are, experience pain and suffering in unique ways. They differ by age, gender, and background, and are often dynamic and, we might even say, chaotic, difficult to "read", understand, or predict; they do not necessarily tell the truth about their pain, suffering, and the emotions that accompany them. Some worry about how others will perceive them and try to make it difficult to manage their impressions, perceptions, emotions, feelings, and pain. Others are simply deceptive. With all these complexities combined with their dynamic and chaotic nature, there is always a sense of skepticism about attempts to quantify, measure, and evaluate pain, just as it is done with other things, or what we call psychological constructs, such as love, creativity, art, leadership, personality, emotional intelligence, happiness, empathy, gratitude, and so on.

Constructs that permeate the essence of human nature – pain, happiness, intelligence, personality, and leadership, among others – generate the most general and constant attempts at definition. You have probably heard people say that love isn't something you can describe and/or pinpoint with numbers; rather, it's just something you can feel. The same is true about measuring pain. At least in the minds of laypeople, and even many professionals, pain is highly associated with subjective descriptions, i.e., with descriptors like "burning," "sharp," "stinging," etc. However, unlike laypeople, psychophysicists, psychometricians, and pain scholars believe that they can measure the perception of pain (its intensity and its affective, cognitive, and emotional correlates) using scientific tools. After all, if something exists, it exists in a certain quantity and can be measured. Once it varies in a detectable way, pain can be quantified. So, the only thing needed is to find a valid way (or ways) to do this[1,2].

Researchers of pain enigmas know and are aware that there are many different reasons for performing a measurement and, consequently, many different types of measurements. Measurements are taken at the beginning of a consultation for diagnosis, to determine a prognosis, to decide on the stages of a clinical condition, its severity, health-related quality of life, appropriate treatment and drug dosage, treatment efficacy and safety, and for many other reasons. Different measurement procedures may be appropriate, even for the same attribute, if the purpose is different, diagnostic measurements need to discriminate between clinical conditions, while measurements seeking to assess treatment efficacy need to be sensitive to changes in clinical conditions[3].

Throughout our talk today, as we have done elsewhere, we want to express our concerns about pain metrics and emphasize that the experience of pain is influenced by a wide range of physical, psychosocial, and behavioral factors. We emphasize that pain is real. The arguments that have been made to replace or eliminate a patient's self-reported pain using indicators from other measurement tools are futile. In one way or another, they complement each other by arriving at a comprehensive assessment of the suffering and pain that affects the patient[4].

Pain is a complex, multidimensional phenomenon that extends beyond the simple transmission of nociceptive signals. It is simultaneously a sensory, affective, cognitive, and cultural experience. Unlike vision or hearing, pain is diffuse: it can be originated in almost any body region or even arise without external stimuli, shaped by memory, expectation, and emotion. This complexity makes pain both a

central topic of medical concern and a persistent challenge for scientific measurement. Given this complex nature of pain, psychophysical research is a valuable tool to describe and characterize meaningful differences in pain responding that often have implications for clinical pain experience. Psychophysical methods seek to understand how perceptual experiences are defined by physical changes in the environment. The nervous system receives, processes, and transmits information throughout the body. Sensory neurons specialize in receiving information from the environment and converting that information into an electrical signal in a process called sensory transduction. After transduction, the electrical impulses travel along nerve fibers or axons which congregate into large nerve bundles that connect to the central nervous system (spinal cord and brain). While there are multiple applications of psychophysics within neuroscience, we will focus on its common use in pain[5,6].

The International Association for the Study of Pain (IASP) defines pain as: "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage"[7]. Thus, pain is a psychological perception usually associated with nociception. Nociception refers to the signaling of free nerve endings on Aδ (A-delta) and c-fibers, known as nociceptors, which send a message to the body that a certain tissue is being damaged or may become damaged. Psychophysical studies are particularly relevant to pain because nociception and the experience of pain can be separate processes. For example, some forms of pain may be produced without any external stimuli or measurable nociception. Thus, psychophysical methods can investigate the relationship between nociception and pain.

In the paper "Pain as a Psychophysical Problem", published almost 15 years ago, we address some of these issues by proposing psychophysical methods as valid and necessary tools for studying and quantifying pain. The central claim is that only by distinguishing the sensory, affective, and cognitive components of pain science may advance toward more precise and clinically meaningful assessment. The authors emphasize that pain should not be treated as a one-dimensional experience. Instead, it involves at least three interdependent dimensions[8]:

1. Sensory-discriminative: concerns intensity, location, duration, and quality of the painful sensation; 2. Affective-motivational: refers to the unpleasantness, suffering, and aversion associated with pain, and 3. Cognitive-evaluative: involves interpretation, attention, memory, and expectation.

In clinical settings, pain descriptions often emerge indirectly through narratives: patients report "tolerable," "severe," or "unbearable" pain. In experimental contexts, however, researchers explicitly ask participants to assign ratings on numerical or analogical scales[9]. These contexts produce different judgments, highlighting the need to separate the components being measured.

The central difficulty is that pain cannot be directly observed – it is accessible only through subjective report or indirect indicators. Researchers have attempted to address this challenge by using three main categories of measurement[3,8]:

1. Self-report indicators: verbal descriptors, numerical scales (e.g., 0–10), or multidimensional instruments like the McGill Pain Questionnaire. These remain the most direct but are vulnerable to biases of interpretation, scale anchoring, and cultural differences; 2. Behavioral indicators: observable signs such as facial expressions, postural changes, withdrawal reflexes, or requests for pharmacological treatment. These provide important clues, but they can be masked or exaggerated; and 3. Physiological indicators: measures such as heart rate, skin conductance, evoked brain potentials, or neuroimaging. While being seemingly objective, they correlate imperfectly with the subjective experience of pain.

In addition, we stressed that no single indicator is sufficient. Self-report remains essential but must be complemented with behavioral and physiological measures, ideally in an integrated psychophysical framework. On the other hand, considering psychophysics, the discipline relating physical stimulation to subjective perception, it also provides methodological tools to tackle the multidimensionality of pain. Techniques such as threshold detection, magnitude estimation, and scaling allow systematic evaluation of how individuals perceive painful stimuli. Most importantly, psychophysical paradigms can dissociate intensity (sensory dimension) from unpleasantness (affective dimension)[9,10].

For example, two stimuli of equal intensity may be perceived differently depending on the person's emotional state or cultural context. Psychophysical studies show that attention, expectation, or anxiety can amplify or dampen pain perception, demonstrating the interplay between cognitive and affective domains. Thus, psychophysics is not limited to "how much pain," but extends to "what kind of pain" and "what meaning" it carries.

In many research contexts, psychophysical researchers are often interested in measuring thresholds for pain, or a variety of stimuli, depending on the research question. The notion of threshold, such as the point at which a warm sensation becomes painful, indicates the pain threshold as a function of temperature. Thus, threshold is defined as a measurable stimulus level at which point either detection or awareness is achieved in the perception. The concept of threshold may be subdivided into absolute threshold or difference threshold. Absolute pain threshold addresses questions such as, "What is the minimum intensity of a given stimuli required for an individual to perceive pain?". The difference threshold addresses questions such as "What is the minimum intensity is required for a participant to perceive a difference between two painful stimuli?". A critical element in pain threshold determination is the particular sensory experience an individual considers painful[6,10].

Another important concept to consider is pain tolerance, or the maximum amount of pain a person can cope with. As with pain threshold, pain tolerance can vary from one person to another experiencing a particular painful stimulus. Pain tolerance can vary due to several factors, including genetic, developmental, family-relates, social, and cultural variables. It is important to note that pain tolerance can be conceptualized as an affective (pain-related suffering) and motivational (desire to escape the stimulus) measure while pain threshold evaluates sensory discrimination[6].

Integrating multiple sensory modalities may also be employed in cross-modality matching, whereby one sensory system is

matched to another sensory system for comparison. For example, an observer would be asked to adjust the magnitude of one stimulus (e.g., pain intensity) until they felt it "matched" the magnitude of another stimulus (e.g., sound intensity). The importance of cross-modality matching is the concept of invariance or constancy between the assigned numbers and magnitude of the stimulus. In addition, this research method supports the generalizability of the concept of magnitude which is applicable to a wider spectrum of sensory systems[6].

Another major psychophysical endpoint is the evaluation of perception above threshold (suprathreshold perception). The principle is to have the subject represent the sensory experience on a quantitative continuum – often referred to as "scaling" perception. Scaling may be defined as the assignment of measurements to perceptual events in relation to a physical stimulus. Psychophysical researchers frequently use scaling when assessing the subjective experience of pain. For example, the Numerical Rating Scale (NRS) is commonly used in pain assessments to measure subjective pain intensities in response to a specific stimulus intensity or a series of different stimuli. NRS measures are used both in psychophysical protocols and in clinical settings to ask patients to rate their pain often using a 0-10 scale, with the scale endpoints anchored with "no pain" and "worst possible pain". However, many pain researchers choose to use a 0-100 NRS with the same anchors as above in their studies, and some use a 0-20 scale. In fact, many studies use alternative scales for pain, including visual analog scales or facial expression-based scales with different advantages and disadvantages[1].

Understanding pain as a psychophysical problem has major implications[5,6]:

a) Clinical assessment: pain is now considered the "fifth vital sign," and systematic measurement is mandatory. Psychophysical tools provide clinicians with more reliable scales to monitor intensity and quality, helping to guide treatment decisions.
b) Research in analgesia: Experimental paradigms reveal how drugs, placebo, and attention modify the perception of pain. Such insights support the development of new treatments and the refinement of pain management strategies.
c) Individual variability: Psychophysical methods highlight differences in pain sensitivity among individuals, shaped by genetics, personality, and sociocultural background. Recognizing this variability prevents the reduction of pain to a single numerical value.
d) Integration with neuroscience: Combining psychophysical reports with physiological data (brain imaging, autonomic markers) creates a more complete picture of how the nervous system processes and regulates pain.

Psychophysics as a research method provides systematic and objective measures of sensory perception that can be used by nursing scientists to explore complex, subjective phenomena such as pain perception. While there needs to be improved standardization of terms and techniques, psychophysical approaches are diverse and may be tailored to address or augment current pain research paradigms. The inherent, interdisciplinary nature of psychophysics, when applied in different clinical settings, provides a unique lens for understanding how our perceptions are influenced by measurable sensations within our environment. While the quest to understand human perception is far from complete, nursing science has an opportunity to contribute greatly to pain and, more broadly, to general perceptual science by incorporating the cadre of tools and methods available through psychophysical procedures in clinical and hospitals pain management[5,6].

Finally, we conclude that treating pain as a psychophysical problem is not only scientifically rigorous but also clinically necessary. Pain should be assessed in its multidimensional nature, integrating sensory, affective, and cognitive components. Self-report measures remain central, yet they must be interpreted critically and complemented with behavioral and physiological data[11,12]. Psychophysics offers the methodological foundation to achieve this integration. By applying its principles, researchers and clinicians can move beyond the simplistic question "how intense is the pain?", toward a richer understanding of pain as lived experience. This approach may ultimately lead to more effective treatments, improved communication between patients and healthcare providers, and a deeper comprehension of one of the most universal human experiences[6].

Taking all together, we can say that the scientific knowledge generated from psychophysics will help advance precision medicine-based interventions for our modern multidisciplinary healthcare team. Additionally, psychophysics may improve our understanding of pain and address concerns related to pain assessment and management, especially in populations in which clinical research may be difficult to conduct.

REFERENCES

1. Da Silva JA, Santos RC, Campos LAM, Guimarães SS, Silva JAD. Elementos de Psicometria da Dor. Ribeirão Preto: Escrita Livros; 2024.
2. Da Silva JA. Avaliação dos componentes sensoriais, afetivos e cognitivos do paciente com dor. In: Posso IP, Grossman E, Fonseca PRB, Perissinotti DMN, Oliveira Junior JO, Souza JB, Serrano SC, Vall J, editors. Tratado de dor. Rio de Janeiro: Atheneu; 2017. p. 377–406.
3. Da Silva JA, Perissinotti DMN, Sardá-Junior J. Avaliação da dor e de quem tem dor. In: Perissinotti DMN, Sardá-Junior J, editors. Psicologia e Dor: o que você deve saber. São Paulo: Editora dos Editores; 2019. p. 79–92.
4. Da Silva JA. Mecanismos psicocomportamentais em dor. In: Posso IP, Grossman E, Fonseca PRB, Perissinotti DMN, Oliveira Junior JO, Souza JB, Serrano SC, Vall J, editors. Tratado de dor. Rio de Janeiro: Atheneu; 2017. p. 265–82.
5. Da Silva JA, Ribeiro-Filho NP. A dor como um problema psicofísico. Rev Dor. 2011;12(2):138-51. doi.org/10.1590/S1806-00132011000200011.
6. Da Silva JA, dos Santos RC, Matsushima EH, de Freitas RL. Cardoso F do S, Rossini JC, et al. Elementos de Psicofísica da dor. Ribeirão Preto: Escrita Livros; 2024.
7. International Association for the Study of Pain [site on the Internet]. Terminology – pain. Washington, DC: IASP; 2025 [cited 2025 Oct 10]. https://www.iasp-pain.org/resources/terminology/
8. Ferraresi TSP, Santos RC, Cardoso F S, Da Silva JA. Mensurando a dor clínica: escalas, inventários e questionários. Ribeirão Preto: Escrita Livros; 2025.
9. Da Silva JAP, Neves B. Propriedades psicométricas das medidas de avaliação e mensuração de dor. In: Morete M, Brandão E, editors. Gerenciamento da dor e a enfermagem. São Paulo: Casa do Novo Autor Editora; 2017. p. 118–41.
10. Freitas RLD, Da Silva JA. The challenge of measuring pain. Br J Pain. 2018;1(1):2-3. doi.org/10.5935/2595-0118.20180002.

11. Souza JB. Pain beyond the brain-centered paradigm. Br J Pain. 2024;7:1-2. doi.org/10.5935/2595-0118.20240063-pt.

12. Lisboa W, Perissinotti DMN. Neuropsicologia, reabilitação cognitiva e dor crônica: uma revisão. Cad Psicol. 2025;4(3):1-19.