



Severity, Irritability, Nature, Stage, and Stability (SINSS): A clinical perspective

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ABSTRACT

Clinical reasoning errors in health-care can be mitigated with the use of systematic strategies and tools. One of these strategies is the SINSS construct, an acronym for Severity, Irritability, Nature, Stage, and Stability. The construct of SINSS appears in several textbooks and peer-reviewed articles. However, it has been inconsistently defined and applied in clinical practice. In this clinical perspective, the terms of the SINSS construct are defined in detail and their application to clinical practice is discussed. Current research showing the application of SINSS as a whole in clinical practice and educational settings is also presented. Recommendations for future application of SINSS are provided to advance the study of clinical reasoning and help minimize diagnostic, prognostic, and interventional clinical errors. The systematic use of SINSS allows the clinician to gain a thorough understanding of the patient's condition and symptoms, which can lead to a well-tolerated and appropriately tailored physical examination and intervention. Additionally, the proper use of this construct can result in more optimal patient outcomes, as well as provide a structure for the mentor and learner in helping uncover errors in the learner's clinical reasoning process.

KEYWORDS

Physical examination; intervention; vigor; extent

Introduction

Clinical reasoning is a foundational skill for all health professionals in clinical practice. Development of clinical reasoning as a core ability requires life-long learning that occurs across a career. This life-long learning process allows health-care professionals to make challenging decisions in the face of uncertainty with complex patient situations [1,2]. Clearly defining clinical reasoning, as well as effectively teaching and assessing it, are challenges shared with all health-care professionals [3,4].

Clinical reasoning is both a cognitive and noncognitive process used by clinicians to competently evaluate and treat patients [4–8]. It requires the clinician to be proficient in active listening; effective data gathering, organization, and interpretation; hypothesis generation and testing; and critical evaluation of alternative diagnostic and treatment strategies [6,9–11]. Clinical reasoning is the core of clinical practice and engaging in this process effectively is a skill that is enhanced through repetition, feedback, reflection, and practice [4,6].



Clinical reasoning in physical therapy integrates cognitive, psychomotor, and affective skills [12]. The physical therapist's interaction with the patient is the essential factor in the clinical reasoning process. This collaboration is a dimension of expert physical therapist practice, as patients are an important source of knowledge [13]. The ability for the clinician to engage

in an integrated approach to clinical reasoning is critical in a dynamic and cyclical process resulting in a collaborative approach to patient/client management [9,12].

Throughout the patient/client management process, errors in clinical reasoning may occur if it is not done in a systematic way. Physical therapists should practice and perfect efficient and repeatable processes to combat errors in clinical reasoning, which will lead to better patient outcomes. Understanding where errors come from and how to mitigate them using effective tools and strategies is essential to becoming an expert practitioner. Table 1 contains common clinical reasoning errors, the results from committing those errors, and recommended strategies to mitigate them. One of these strategies is to use clinical reasoning constructs like SINSS, which is an acronym for Severity, Irritability, Nature, Stage, and Stability. This clinical perspective will discuss SINSS, its application to clinical practice, and how it helps reduce clinical reasoning errors.

Clinical question

Previous research on the teaching and learning of clinical reasoning has identified the need for best educational practices, grounded in the learning sciences, to better reveal gaps in the learner's clinical reasoning ability [5,14–17]. The SINSS construct provides

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Table 1. Common clinical reasoning errors, results of committing the errors, and effective strategies to mitigate them.

Clinical Reasoning Error	Result of Committing the Error	Strategies to Mitigate the Error
<ul style="list-style-type: none"> Ineffective gathering and verification of pertinent information to guide clinical reasoning^[48–51] 	<ul style="list-style-type: none"> Leads to an incomplete clinical picture of the patient May result in premature closure, which is failure to consider reasonable alternatives after an initial diagnosis is made May result in misdiagnosis or poorly matched intervention May result in over-reliance on diagnostic imaging or expensive clinical tests 	<ul style="list-style-type: none"> Perform a patient-focused interview [9,17,23,24,28,29,41,51,52] Use systematic history taking, develop illness scripts, and conduct a hypothesis-based physical exam [9,11,28,53–57] Use clinical reasoning constructs like SINSS [2,28,41,58] Use evidence-based screening strategies and effective questioning techniques [29,59]
<ul style="list-style-type: none"> Failure to filter and group the array of signs and symptoms into meaningful, and manageable chunks of information [8,49,50,52,60] Reference #47 Peile E. Commentary: view from clinical education. <i>BMJ</i>. 2007;335(7612):207–208. should be added to this list. 	<ul style="list-style-type: none"> May result in a focus on clinical information that is not truly pertinent to the actual problem or condition May result in misdiagnosis or poorly matched intervention May waste time in the clinical encounter May make clinical outcomes or prognosis more difficult to predict 	<ul style="list-style-type: none"> Develop pattern recognition skills by using a body chart or symptom map [28,41,42,56,61] Use clinical reasoning constructs like SINSS [2,25,28,41] Use available evidence on the condition being treated to inform decision-making [2,41] Apply metacognitive strategies and make thinking visible [9,28,62,63]
<ul style="list-style-type: none"> Deficits in analytical and experiential knowledge [17,50,64] 	<ul style="list-style-type: none"> May result in inability to pass licensing or advanced training certification examinations May result in misdiagnosis or poorly matched intervention May make clinical outcomes or prognosis more difficult to predict 	<ul style="list-style-type: none"> Attend continuing professional development courses and residency or fellowship training [65–67] Apply metacognitive strategies and make thinking visible [9,28,62,63]
<ul style="list-style-type: none"> Letting personal and professional biases cloud the reasoning process [48,50,63,68,69] 	<ul style="list-style-type: none"> May adversely affect reasoning and clinical judgment May result in misdiagnosis or poorly matched intervention May result in premature closure. May result in an over-reliance on a favored intervention 	<ul style="list-style-type: none"> Admit that one has biases and try to identify them in oneself [50,69] Use “debiasing tools” such as situational awareness, prospective hindsight, and checklists [50,69] Foster reflective feedback and training in clinical reasoning within the work/clinical environment [9,50,69]
<ul style="list-style-type: none"> An over-reliance on heuristics, which are cognitive strategies or mental shortcuts [17,50,58,69]. 	<ul style="list-style-type: none"> May result in misdiagnosis or poorly matched intervention May result in premature closure May result in an over-reliance on a favored intervention 	<ul style="list-style-type: none"> Perform a patient-focused interview [17,23,24,28,29,41,51,52] Use systematic history taking, develop illness scripts, and conduct a hypothesis-based physical exam [11,28,53–57] Apply metacognitive strategies and make thinking visible [9,28,62,63]

a structure for mentors to identify clinical reasoning errors made by students and developing clinicians. Additionally, it serves as a scaffold for learners to move from basic content and procedural knowledge to more advanced conceptual knowledge, which can effectively guide decision-making and reduce error [18]. Therefore, we pose the clinical question, ‘Can teaching and utilizing the construct of SINSS minimize diagnostic, prognostic, and interventional clinical reasoning errors?’

The SINSS construct

The construct of SINSS appears in several textbooks and peer-reviewed articles. However, it has been inconsistently defined and applied in clinical practice [19–27]. The components, categories, and definitions of each of the SINSS terms is found in Table 2. The SINSS construct as a whole helps the practitioner understand the detailed aspects of a patient’s symptoms for a given physical condition. It is used to determine the appropriate vigor and extent of a physical examination as well as treatment or intervention

[20,25,28]. It helps the therapist avoid under- or over-examining as well as under- or over-treating the patient. It is a key construct in a systematic, patient/client management approach, which can mitigate clinical reasoning errors.

Understanding the patient’s SINSS can combat the error of ineffective data gathering and verification. Obtaining the information required to identify the components of SINSS requires active listening and systematic questioning. Open-ended questions (e.g. questions beginning with Who, What, When, Where, Why, and How) are used to gather information from the patient, whereas closed-ended questions (e.g. questions that can be answered with yes or no) should be used to help to clarify or verify the information given by the patient [29]. The clinician’s ability to filter or group information is also enhanced by using the SINSS construct as a way of chunking the patient’s responses into categories of information. The clinician can then use this to prioritize the hypothesis list and begin to construct the outline of the physical examination. Finally, the clinician can use the severity and irritability of the patient’s symptoms to determine

Table 2. Severity, Irritability, Nature, Stage, and Stability (SINSS) construct components, categories and definitions.

SINSS Components		Categories	Category Definitions
Severity			
<ul style="list-style-type: none"> ● Intensity of the patient's pain ● Impact of the pain on activities of daily living (ADLs) ● Amount and type of pain medication taken to control the pain ● Presence or absence of night pain 	Minimal	<ul style="list-style-type: none"> ● Patient self-reported pain rating of 0–3/10 ● Symptoms do not limit or hinder ADLs ● Work or recreational activities are minimally impacted ● Patient's verbal, facial, or body language indicates minimal or no pain with movement or activity ● No guarding of body regions with spontaneous movements ● Patient taking few, if any, pain-relieving medications ● No night pain ● Pain/symptom descriptions: intermittent, superficial, barely noticeable, annoying, mild or dull ache, tightness or stiffness, pulling, bothersome, or low-grade 	
	Moderate	<ul style="list-style-type: none"> ● Symptoms moderately impact or restrict ADLs ● Work or recreational activities are moderately impacted or restricted ● Avoidance of heavier work, recreation, or physical activities ● Patient's verbal, facial, or body language may indicate pain or guarding with movement or activity ● Pain medication: anti-inflammatory or analgesic medication may be required to function. Narcotics are rarely, if ever, used. ● May have some sleep disturbances, but be able to return to sleep. May require pain medication to be able to fall asleep ● Pain/symptom descriptions: constant but variable, more persistent or frequently noticeable, throbbing, cramping, hot, burning, deep ache 	
	Maximal	<ul style="list-style-type: none"> ● Patient self-reported pain rating of 8–10/10 ● Symptoms maximally impact or restrict ADLs ● Even basic grooming, dressing, bathing, cooking, etc. may be limited due to symptom intensity ● Work or recreational activities are maximally impacted or restricted ● Patient may be unable to work or may have stopped recreational activities all together ● Patient's verbal, facial, or body language may indicate intense pain requiring guarded movement or self-splinting of the involved body region ● Pain medication: frequent or regular use of pain medications, including narcotics, for symptom management ● Presence of night pain or significantly disturbed sleep are very likely ● Pain/symptom descriptions: constant, non-varying, burning, boring, lancinating, shooting, stabbing, knife-like, deep bone ache, sharp, or severe 	
Irritability			
<ul style="list-style-type: none"> ● Ratio of the magnitude of aggravating factors to easing factors ● Amount and type of activity to aggravate symptoms ● Amount and type of activity to ease symptoms 	Minimal	<ul style="list-style-type: none"> ● Ratio of at least 2:1 of aggravating activity to easing activity or rest ● Patient may tolerate activities with many repetitions, relative vigor, or sustain a posture or position for a long time before symptoms appear ● When symptoms appear, they may ease quickly with stopping activity or changing positions 	
	Moderate	<ul style="list-style-type: none"> ● Ratio of 1:1 of aggravating activity to easing activity or rest ● Patient may tolerate a moderate amount of activity, which may increase or produce symptoms that return to baseline with periods of rest or relieving motions of the same length of time as it took to bring symptoms on ● If symptoms interrupt sleep, patient may return to sleep in less than 30 min after changing positions 	
	Maximal	<ul style="list-style-type: none"> ● Ratio of 1:2 or greater of aggravating activity to easing activity or rest ● Patient may tolerate very little activity and require significant time or effort to recover from the activity ● Sleep interruptions may be frequent and prolonged, requiring greater than 30 minutes to return to sleep ● Medication may be required to be able to sleep 	

(Continued)

Table 2. (Continued).

SINSS Components	Categories	Category Definitions
Nature	Type of pain	<ul style="list-style-type: none"> ● Mechanical nociceptive ● Inflammatory nociceptive ● Neurogenic ● Viscerogenic ● Central ● Autonomic ● Affective ● Body system diseases (cardiovascular, pulmonary, visceral, immune, etc.) ● Syndromes (subacromial pain, patellofemoral pain, femoroacetabular impingement, etc.) ● Specific anatomical injuries (fracture, sprain, strain, tear, dislocation, etc.) ● Cultural factors ● Age-specific/generational factors ● Personality factors ● Socioeconomic factors ● Pain tolerance factors ● Litigation factors ● Red flag conditions ○ Signs of serious pathology ○ Co-morbidities that could either deter a patient's recovery and function or place the patient at risk for serious medical consequences ● Yellow flag conditions <ul style="list-style-type: none"> ○ Pain associated, psychological distress factors ○ Factors that increase the risk of developing or perpetuating long-term disability and work loss associated with pain ● Symptom duration less than 3 weeks, recent onset ● Symptom duration more than 3 weeks, but less than 6 weeks ● Symptom duration greater than 6 weeks ● Combination of an underlying condition that is chronic (e.g. chronic mild low back pain) with an acute exacerbation or episode of more intense pain (e.g. recent reinjury of same low back region) ● Acute symptoms may also be different, but related to the chronic condition (e.g. chronic low back with acute onset of leg pain or numbness and tingling) ● Combination of an underlying condition that is chronic (e.g. chronic mild elbow pain) with a subacute exacerbation or episode of more intense pain (e.g. subacute reinjury of same elbow region) ● Subacute symptoms may also be different, but related to the chronic condition (e.g. chronic elbow pain with subacute onset of forearm and wrist pain or numbness and tingling in hand)
	Specific condition, classification, or pathology	
	Patient characteristics and how they deal with their condition	
	Conditions warranting special caution or action	
Stage	Acute Subacute Chronic Acute on Chronic	
	Subacute on Chronic	
Stability	Improving	<ul style="list-style-type: none"> ● Overall symptom decrease in intensity, frequency, or location ● Return to regular movement or function ● Restoration of regular sleep patterns ● Less dependence on pain medication ● Overall symptom increase in intensity, frequency, or location ● Regression of movement or function ● Greater disruption of regular sleep patterns ● More dependence on pain medication ● Overall symptoms are not changing with time; no worse, no better ● Progress toward normal function may be stagnant ● No change in current sleep patterns ● No change in amount/type of pain medication ● At times condition seems to be improving, but other times getting worse ● May be dependent on external factors like environment, psychosocial settings, or time of day.
	Worsening	
	Not changing	
	Waxing and Waning	

how many tests and measures the patient will be able to tolerate before their condition worsens and the results become unreliable.

Application of severity to clinical practice

When therapists categorize a patient's symptoms based on severity, they can better determine the appropriate vigor and extent of both the examination and intervention. Vigor refers to the amount of force or pressure applied during a test or measure, or the intensity and complexity of an intervention. Extent refers to the depth of movement into resistance, the number of movements tested, and the magnitude of an examination or intervention technique. One of the key components of severity is how the patient's symptoms affect their activities of daily living (ADLs). Typically, the more severe a patient's symptoms are, the more limited ADLs will be. A positive correlation exists between functional limitations and symptom severity in patients with carpal tunnel syndrome[30]. Pain intensity is also a component of severity. Research shows that illness perceptions, psychological distress, and pain catastrophizing behaviors affect self-reported severity of pain[31].

Severity also influences prognosis and outcomes. Patients with moderate to maximal levels of severity frequently necessitate more conservative estimates of prognosis. An increase in severity level has been linked to a fear of movement, which is a contributing factor to poor outcomes[32]. Patients' perception of their pain experience can also affect their recovery. Lindberg et al. [33] found that higher pain levels were associated with prolonged recovery in patients following total knee arthroplasty. Multiple symptom severity scale measures and tools have been utilized to assist clinicians in predicting outcomes based on severity. The STarT Back Screening Tool has been validated for use on patients with low back pain for prognosis and intervention decision-making[34]. Ozyurekoglu et al. [35] found the Carpal Tunnel Syndrome Symptom Severity Scale to be sensitive in detecting change in a patient's status. Tools like these can provide objective categorization to assist the clinician in identifying severity levels in various conditions.

Application of irritability to clinical practice

When planning both the physical examination and intervention, the therapist should consider the patient's symptom irritability level. There are limited irritability measures or tools in the current literature aside from the definition described by Maitland [23,24]. Previous studies [19,20,25] assessed irritability by judging 1) the vigor of activity required to provoke a patient's symptoms, 2) the severity of those symptoms, and 3) the time it takes for the symptoms to

subside once aggravated. However, these studies limited therapists to dichotomously categorize symptoms as either 'irritable' or 'non-irritable' and otherwise did not operationally define irritability.

Barakatt et al. [19] used these two categories and found a moderate inter-rater agreement between physical therapists on levels of irritability. In a later study, Barakatt et al. [20] tailored treatment approaches to the level of symptom irritability in patients with low back pain (LBP). Those patients judged as having 'irritable' LBP received a greater number of McKenzie-based treatments, physical agents, and manual therapy than those judged as having 'non-irritable' LBP. Patients in the 'non-irritable' group, in contrast, were given treatments of more aggressive stretching, strengthening, and functional exercises. Cook et al. [36] found that minimal to no irritability of symptoms was associated with positive outcomes for total visits and extent of recovery. Therefore, once the clinician establishes the level of irritability, initial treatment programs should avoid positions or activities which exacerbate the patient's symptoms. Movement should be initiated with respect to the healing process, but unnecessary symptom provocation should be avoided [37]. Previously aggravating movements or activities can be reintroduced once the irritability level decreases.

Health-care practitioners should carefully consider both the severity and irritability of a patient's symptoms together when determining the extent and vigor of the physical examination and intervention. The combination of these two categories will inform the clinician of how many tests and measures can be done, and whether the patient's pain can be reproduced without prolonged exacerbation. With high severity and high irritability, the physical examination should only be taken to the active limit of movement due to the elevated level of symptoms and the risk of prolonged exacerbation. In contrast, a combination of high severity and low irritability can be treated differently, because any symptoms provoked will reduce quickly. In this case, a patient could be taken to the passive limit of motion. When severity is low and irritability is high, the clinician should be cautious going to the limit of pain, due to the risk of prolonged exacerbation or latent pain. Conversely, low severity and low irritability can be assessed and treated more aggressively, while still avoiding unnecessary symptom exacerbation.

Application of nature to clinical practice

It is beyond the scope of this clinical perspective to discuss the nature and clinical presentation of various musculoskeletal and non-musculoskeletal conditions a clinician might encounter. There are

excellent textbooks that describe such conditions and assist the clinician in differentially diagnosing a patient's symptoms [29,38–40]. It is crucial for clinicians to be able to distinguish conditions which fall outside the scope of their practice versus those they can examine or treat independently or with the assistance of a multidisciplinary approach [2,29]. Additionally, when clinicians use evidence-based screening strategies, such as a medical intake form, they will be able to better determine the nature of a condition and prescribe the proper plan of care [2,29,40,41].

Not only does nature include a specific diagnosis and the associated symptoms patients experience but it also encompasses the nature of the patients themselves and how they mentally and physically handle their condition. The current definition of pain is 'an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.' [42] Patients' interpretations of the pain experience widely varies and can complicate the initial clinical presentation as well as the patient/client management process. Multiple factors influence a patient's pain experience including cultural, socioeconomic, personality, generational, pain tolerance, and litigation. Therefore, each patient's clinical presentation will be unique, and the therapist should acknowledge it with a truly patient-centered approach.

Application of stage to clinical practice

The clinician's ability to accurately determine the stage that a condition is in helps with understanding both its nature and its prognosis. The progression from one stage to another is not always linear and varies depending on the nature of the condition, the accuracy and efficacy of the prescribed intervention, and the patient's adherence to that intervention [43,44]. It is also important for the therapist to determine if the condition is new to the patient, or if it is one that has been recurring over time. Finally, understanding a condition's stage will help the clinician determine what may be happening at the tissue level of healing. This will lead to better application of intervention and optimal outcomes.

In the acute stage of healing, the inflammatory process is most active. Characteristics of this stage include changes in vasculature, clot formation, exudation of cells and chemicals, and phagocytosis. Patients often report the onset of pain before tissue resistance is felt during movement. Therefore, the goals of intervention at the acute stage are controlling the effects of inflammation and preventing the deleterious effects of rest [45].

Tissue proliferation and repair characterize the sub-acute stage of healing. During this stage, tissues undergo growth of capillary beds, removal of noxious stimuli, collagen formation, and growth of granulation tissue. Tissues must be handled cautiously at this stage since they are very fragile and easily injured. Pain usually comes on at the same time as tissue resistance is felt. In this stage, subacute goals include the promotion of healing and the development of mobile scar tissue [45].

The key characteristics in the chronic stage of healing include tissue maturation, remodeling, and contraction of connective tissue. During this time, collagen aligns with the direction of stress. Therefore, controlled movement is integral at this phase so that the collagen aligns properly and does not overly restrict normal movement. Patients often report the onset of pain after tissue resistance is felt, enabling more aggressive range of motion and stretching during this stage. Goals of treatment at this stage are to increase the tensile quality of the scar tissue and to promote functional independence [45].

Application of stability to clinical practice

Clinicians determine a condition's stability by establishing baseline symptoms and constantly reevaluating changes in those symptoms. Conditions that are worsening may not immediately show an improvement following a given intervention. Examples of worsening conditions include those in which pain intensity and frequency increase, pain location changes or spreads, and the function of the patient declines despite the intervention. Minimal improvement could be due in large part to the worsening stability of the condition, rather than a lack of effectiveness of the intervention. Therefore, clinicians should continuously reassess treatment response, not only after the initial intervention, but between and within each successive treatment session. The therapist should carefully reevaluate and reflect on conditions which fail to improve despite dedicated intervention to determine the nature of the decline.

The therapist should also reflect on conditions which are improving to determine the nature of the improvement. Improving conditions include those in which pain intensity and frequency decrease, pain location minimizes or disappears, and the function of the patient improves as the result of the intervention or on its own. Many conditions improve despite any dedicated professional assistance due to the body's natural healing process. If there is overall improvement following an intervention, the therapist should not solely attribute this to the intervention provided, but rather a combination of this and the improving condition.

A condition that is unchanging, especially despite matching intervention, can present a greater challenge for the clinician. Unchanging conditions are typically associated with chronic pathology, or an acute injury where the inflammatory response has stalled. Therapists should consider improvements, or lack thereof, in the context of the tissue healing process. Intervention may need to be regressed if the tissue is in a constant state of inflammation, or it may need to be more aggressive if improvement has stalled. Overall, clinicians should judge the stability of a condition in the context of SINSS as a whole, rather than as an isolated component of the condition.

Previous application of the SINSS construct in physical therapy practice and recommendations for future research

A clinical reasoning tool incorporating the SINSS construct has been created and utilized in fellowship-level academic and clinical orthopedic settings[28]. This tool helps the mentor and learner uncover errors in the learner's clinical reasoning process. Additionally, the SINSS portion of the tool guides students' decision-making regarding the extent and vigor of the physical exam and matching intervention.

Besides the use of SINSS in clinical reasoning tools, the construct has been highlighted in case studies that detail the clinical decision-making process with various orthopedic, musculoskeletal conditions [2,25,28,41]. These case studies show the utility of the construct in helping the practitioner make sound clinical decisions and reduce the likelihood of committing errors in the clinical reasoning process.

Although the SINSS construct as a whole can be primarily attributed to the Maitland approach to patient/client management, other systematic evaluation and intervention approaches, such as McKenzie, Cyriax, Canadian, etc., utilize components of SINSS within their methods[27]. The Appendix to this manuscript contains five clinical vignettes, which highlight how the construct of SINSS guides clinical reasoning on examination, intervention, and overall management and outcomes.

To advance the study and application of clinical reasoning, future research should focus on answering the question posed in this clinical perspective, 'Can teaching and utilizing the construct of SINSS minimize diagnostic, prognostic, and interventional clinical reasoning errors?' This can be accomplished in three ways. First, the SINSS construct should be taught in entry-level physical therapy education to help the novice learner progress more quickly from basic content and procedural knowledge to more advanced conceptual knowledge. Second, clinical reasoning reflection tools that use the SINSS construct [28] can be adapted

to entry-level education to facilitate the development of clinical reasoning. Third, the impact of understanding and applying SINSS can be studied in the didactic and clinical settings to assess if it truly reduces diagnostic, prognostic, and interventional clinical errors. As clinical reasoning skills are applied and measured in physical therapy practice, the quality and efficiency of patient care will improve and result in more optimal patient outcomes [12,46].

Summary

Clinical reasoning requires clinicians to be able to integrate experience, knowledge, and the ability to monitor cognitive processes efficiently and effectively. Clinicians need to be adaptive learners as they use their continued development of metacognitive skills that are central to reflection in, on, and for action[18]. This life-long process requires deliberate practice and consistent effort. Utilizing systematic tools and strategies, like the SINSS construct, can help the learner move more rapidly from the beginning to the more advanced stages of learning and performance. Additionally, the SINSS construct provides a structure for the mentor and learner in helping uncover errors in the learner's clinical reasoning process. The construct also allows the clinician to gain a thorough understanding of the patient's condition and symptoms, which can lead to a well-tolerated and appropriately tailored physical examination and intervention. Finally, understanding and implementing the SINSS construct in orthopedic clinical settings may reduce diagnostic, prognostic, and interventional clinical reasoning errors and result in more effective and efficient patient outcomes[47].

Key points

- (1) Clinical reasoning requires clinicians to be able to integrate experience, knowledge, and ability to monitor cognitive processes efficiently and effectively.
- (2) Utilizing systematic tools and strategies, like the SINSS construct, can help learners move more rapidly from the beginning to more advanced stages of learning and performance.
- (3) The SINSS construct provides structure for the mentor and learner in helping uncover errors in the learner's clinical reasoning process.
- (4) The SINSS construct allows the clinician to gain a thorough understanding of the patient's condition and symptoms, which can lead to a well-tolerated and appropriately tailored physical examination and intervention.
- (5) Understanding and implementing the SINSS construct in orthopedic clinical settings may reduce diagnostic, prognostic, and interventional clinical reasoning errors and result in more effective and efficient patient outcomes.

Disclosure of Interest

The authors report no conflict of interest.

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Appendix. Clinical Case Scenarios with SINSS Assessment and Clinical Reasoning Guidance

Clinical Vignette #1

Patient History: The patient primarily reports right anteromedial knee pain, but also has intermittent right thigh pain that seems connected to the knee pain. Pain is a constant, deep ache that does not vary much, rated at 7–9/10. There is no reported pain or other symptoms elsewhere in the body. Pain significantly limits the patient's ADLs, hobbies, and work ability. Patient takes both an anti-inflammatory and a narcotic drug for pain relief. Patient reports pain disrupts sleep at least once a night over the last two weeks. Returning to sleep requires frequent position changes, additional medication, and hot baths. Patient reports no recent trauma or specific aggravating event, but states the same knee was injured about a year ago while hiking and stepping on uneven surfaces. Pain in the knee and thigh started worsening over the last two weeks for no apparent reason. Current pain feels different than that felt a year ago, although both pains are in the same location. Past medical history is otherwise unremarkable, other than the patient reports feeling very discouraged and depressed.

Assessment of SINSS	<ul style="list-style-type: none"> ● Severity: Maximal ● Irritability: Maximal ● Nature: Both musculoskeletal and non-musculoskeletal components may be present; Nature of pain could be mechanical or inflammatory nociceptive, and/or affective. Both red and yellow flag conditions may be present. Patient is not coping well with condition. ● Stage: Acute on Chronic ● Stability: Worsening
Clinical Reasoning about Examination and Differential Diagnosis	<ul style="list-style-type: none"> ● Both vigor and extent of the physical exam should be very limited due to maximal severity and irritability. ● Range of motion testing should be applied just to the first onset or increase of pain. ● Low number of tests and measures should be performed to not exacerbate the condition, while still providing information to guide decision-making. ● Differential diagnosis includes musculoskeletal conditions such as a muscle strain, ligament sprain, bone injury, cartilage injury, etc. Referred pain from proximal regions (low back, hip) needs to be considered. However, more sinister diagnoses need to be ruled out first (cancer, space occupying lesion, infection, etc.)
Clinical Reasoning about Intervention and Patient/Client Management	<ul style="list-style-type: none"> ● Both vigor and extent of the intervention should be very limited due to maximal severity and irritability. ● Intervention should focus on pain relief, positions of comfort, activity modification, and use of assistive devices as needed. ● No intervention should be applied that could potentially worsen the condition. ● Consultation and communication with primary care physician is highly recommended with the possibility of ordering additional diagnostic tests. ● Condition requires careful management with a multidisciplinary approach (Doctor, PT, Psychologist, etc.).
Likely Patient Outcome	<ul style="list-style-type: none"> ● Fair to poor, based on complexity and uncertainty of condition until a definitive diagnosis and prognosis are established.

Clinical Vignette #2

Patient History: The patient primarily reports right anteromedial knee pain, but also has chest and abdominal pain that is connected by the mechanism of injury. Pain in the knee is variable and constant, both superficial and deep, and ranges from 2–8/10. Pain in the chest and abdomen is a deep, dull ache at 5/10. There is no reported pain or other symptoms elsewhere in the body. Pain significantly limits the patient's ADLs, hobbies, and work ability and the patient is unsure if returning to full function is even a possibility. Patient states pain just worsens for no reason, but that lying down, not moving, and taking pain medication eases the pain relatively quickly. Patient takes pain medication daily and sometimes takes more than what is recommended. Patient reports pain does not disrupt sleep, but that dreams of the accident do. Patient reports a car accident about a month ago caused the pain when the knee hit the dashboard of the car and the seatbelt restricted movement across the chest and abdomen. Patient reports no previous knee, abdomen, or chest pain before the accident. Some days it feels like things are improving, but other days condition worsens. Overall, it's not getting better. Past medical history is otherwise unremarkable, other than a family history of high blood pressure. Patient reports litigation is pending on the accident.

Assessment of SINSS	<ul style="list-style-type: none"> ● Severity: Maximal ● Irritability: Minimal to Moderate ● Nature: Both musculoskeletal and non-musculoskeletal components may be present; Nature of pain could be mechanical nociceptive, viscerogenic, and/or affective. Yellow flag condition is likely present. Patient is not coping well with condition. ● Stage: Subacute ● Stability: Waxing and waning
Clinical Reasoning about Examination and Differential Diagnosis	<ul style="list-style-type: none"> ● Both vigor and extent of the physical exam should be moderately limited due to maximal severity and varying irritability. ● Range of motion testing should be applied just to the active limit of what the patient can tolerate. ● Low number of tests and measures should be performed to not exacerbate the condition, while still providing information to guide decision-making. ● Differential diagnosis includes musculoskeletal conditions such as a muscle strain, ligament sprain, bone injury, cartilage injury, etc. Referred pain from proximal regions (low back, hip) still needs to be considered. Presentation of abdominal and chest pain could also be musculoskeletal (rib cage, chest muscles), but underlying viscerogenic and cardiopulmonary pathology should also be ruled out.

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Clinical Reasoning about Intervention and Patient/Client Management	<ul style="list-style-type: none"> • Both vigor and extent of the intervention should also be moderately limited due to maximal severity and varying irritability. • Intervention should focus on reassurance, positive outlook, encouragement of early motion and light function within tolerable limits, and progression of intensity and duration of functional activity as quickly as able. • Litigation factors complicate patient/client management, but they should be addressed and factored into decision-making. • Consultation and communication with primary care physician is highly recommended to ensure proper imaging has been completed and viscerogenic and serious musculoskeletal injuries have been ruled out. • Condition requires careful management with a multidisciplinary approach (Doctor, PT, Psychologist, etc.).
Likely Patient Outcome	<ul style="list-style-type: none"> • Fair to poor, based on complexity of condition, litigation factors, and pain-associated psychological distress factors.

Clinical Vignette #3

Patient History: The patient primarily reports right anteromedial knee pain. There is no reported pain or other symptoms elsewhere in the body. Pain is intermittent, mostly dull, and very mild, unless the patient runs more than 1 mile. Then pain becomes sharp, stabbing, and knee 'catches.' After running, knee swells and becomes stiff. Patient rates pain at rest 0–1/10, however, after running, pain increases to 6/10. It takes several hours for the pain and swelling to subside after running for 7–10 minutes. If patient avoids running, all ADLs, hobbies, and work ability are fine. Patient takes anti-inflammatory medication and applies ice only after running. Pain does not disrupt sleep. Patient reports an 'old injury' a couple years ago twisting the same knee when slipping on wet stairs. Initial injury slowly improved over time. However, since the patient has been trying to run for exercise and weight loss over the past month, knee continues to ache and swell. Overall, patient reports knee condition is not improving. Past medical history is otherwise unremarkable other than patient is borderline obese.

Assessment of SINSS	<ul style="list-style-type: none"> • Severity: Minimal to Moderate • Irritability: Maximal (with specific aggravating factor) • Nature: Musculoskeletal; Nature of pain could be mechanical or inflammatory nociceptive. There are no red or yellow flag conditions present. Patient appears to be coping with condition if running is avoided. • Stage: Subacute on Chronic • Stability: Not improving
Clinical Reasoning about Examination and Differential Diagnosis	<ul style="list-style-type: none"> • Both vigor and extent of the physical exam could be minimally limited as there seems to be only one main aggravating activity that increases symptom irritability. As long as this one is avoided, patient should tolerate a comprehensive exam. • Range of motion testing could be applied to the passive limit. • Moderate number of tests and measures could be performed to guide decision making and differential diagnosis. • Differential diagnosis includes mainly musculoskeletal conditions such as a cartilage injury, bursa issue, or intra-articular pathology. Underlying biomechanical factors should be considered (e.g. running form, body type, joint mechanics above and below the knee). Referred pain from proximal regions (low back, hip) still needs to be considered. It is unlikely that anything more sinister is present (red flag conditions), but a careful review of systems is still important.
Clinical Reasoning about Intervention and Patient/Client Management	<ul style="list-style-type: none"> • Both vigor and extent of the intervention could also be minimally limited as long as the aggravating factor or similar types of activities (e.g. running, jumping, twisting) are avoided. • Intervention should focus on treating the impairments and possible underlying pathology of the condition. • Conservative treatment should be attempted first and if dedicated therapy is not effective, additional imaging or consultation to a specialist is indicated. • Condition can be managed primarily by a physical therapist with communication with the primary care physician.
Likely Patient Outcome	<ul style="list-style-type: none"> • Good, based on the single aggravating factor and minimal impact on ADLs, work etc. If the cause of the condition is found and treated appropriately, prognosis and outcome are favorable.

Clinical Vignette #4

Patient History: The patient primarily reports right anteromedial knee pain. There is no reported pain or other symptoms elsewhere in the body. Pain is intermittent, superficial, and mild. Patient rates pain at rest 0/10 and 3/10 at worst. Patient is able to do all ADLs, hobbies, and work requirements without difficulty despite knee pain. Pain does not disrupt sleep and patient does not take any medication to control pain. Patient reports 3 days ago helping a friend move and was going up and down stairs for several hours while carrying boxes and some furniture. Patient reports no trauma or falls or any knee pain prior to 3 days ago. Knee was a little sore and stiff the next day, but is getting better on its own. Patient is otherwise healthy and has no significant past medical history.

Assessment of SINSS

- Severity: Minimal
- Irritability: Minimal
- Nature: Musculoskeletal; Nature of pain could be mechanical or inflammatory nociceptive. There are no red or yellow flag conditions present. Patient appears to be coping very well with condition.

Clinical Reasoning about Examination and Differential Diagnosis

- Stage: Acute
- Stability: Improving
- Both vigor and extent of the physical exam could be unlimited or minimally limited as the condition is both minimally severe and minimally irritable.
- Range of motion testing could be applied at end range using sustained or combined movements.
- High number of tests and measures could be performed, if needed, to guide decision making and differential diagnosis.
- Differential diagnosis includes mainly musculoskeletal conditions such muscle strain, joint inflammation, ligament sprain, etc. Referred pain from proximal regions (low back, hip) are unlikely, but should still be quickly ruled out. Non-musculoskeletal pathology is very unlikely.

Clinical Reasoning about Intervention and Patient/Client Management

- Both vigor and extent of the intervention could also be unlimited or minimally limited as the condition is both minimally severe and minimally irritable.
- The patient is likely to improve on own without any formal intervention.
- If professional intervention is sought, it could focus on conditioning and proper lifting/carrying mechanics to avoid future injury, which can be provided independently by the physical therapist.

Likely Patient Outcome

- Excellent, based on an already improving acute condition. Patient is otherwise healthy and coping well with condition. Prognosis and outcome are very favorable.

Clinical Vignette #5

Patient History: The patient primarily reports right anteromedial knee pain, but also has low back pain and feeling of 'clumsiness' in right leg. There is no reported pain or other symptoms elsewhere in the body. However, patient reports back pain seems to be spreading into thigh and the leg and 'just does not feel the same as the other one.' Patient also reports back and knee pain increase when coughing or sneezing. Knee pain is 5–7/10 and back pain is 4–6/10. Both are constant and variable. Patient is still able to perform the majority of duties as a truck driver, but has had to limit the amount of time driving at one time. Can sit/drive for 1 hour before leg and back pain worsen. Sometimes it takes almost an hour to completely return to baseline symptoms by getting out of truck, walking around, and standing. Most of the time, the patient tries to just deal with the pain and continue to work, but that has gotten more difficult over the last several weeks. Otherwise, ADLs and hobbies are not significantly affected by the pain. Patient takes pain medication three times a day to get through workday. Does not take any medication when not at work. Pain does not disrupt sleep. Patient denies trauma or specific injury to knee or back, although both pains have been present for years, which is attributed to job requirements. However, condition is definitely worsening, and patient is concerned about losing job. Patient has not had any prior formal treatment to back or knee. Patient has additional past medical history of hypertension, diabetes, and obesity.

Assessment of SINSS

- Severity: Moderate
- Irritability: Moderate
- Nature: Both musculoskeletal and non-musculoskeletal components may be present; Nature of pain could be mechanical nociceptive, inflammatory nociceptive, or neurogenic. Potential red flag conditions need to be explored further. Patient coped with condition initially, but is starting to struggle.

Clinical Reasoning about Examination and Differential Diagnosis

- Stage: Chronic
- Stability: Worsening
- Both vigor and extent of the physical exam should be moderately limited due to moderate severity and moderate irritability.
- Range of motion testing should be applied just to the active limit of what the patient can tolerate.
- Low number of tests and measures should be performed to not exacerbate the condition, while still providing information to guide decision-making.
- Differential diagnosis includes musculoskeletal conditions such as degenerative joint changes, postural syndrome, muscle strains, ligament sprains, discogenic or radicular pathology. Referred pain from proximal regions (upper back to lower back, low back to hip or knee, hip to knee) needs to be considered. Potential red flag conditions (loss of normal leg function) need to be explored further. Additionally, patient has underlying multi-system co-morbidities, which need to be factored into examination and differential diagnosis (HTN, Diabetes).

Clinical Reasoning about Intervention and Patient/Client Management

- Both vigor and extent of the intervention should also be moderately limited due to moderate severity and moderate irritability.
- Intervention should focus on pain centralization, activity modification, pain control modalities, work ergonomics, and appropriately matched therapeutic exercises.
- Consultation and communication with primary care physician is highly recommended to ensure proper imaging has been completed and potential red flag conditions are addressed. Coordination with other health care professionals may also be indicated due to patient's past medical history.
- Condition requires careful management with a multidisciplinary approach (Doctor, PT, Orthopedic or Spine specialist, Dietician, etc.).

Likely Patient Outcome

- Fair to Good, based on patient's motivation, no prior intervention to address concerns, multiple pain areas with potential red flag condition, underlying co-morbidities.