

Using Only Infant Behaviours to Assess Infant Pain: A Painful Compromise?
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In this issue of *Pain*, Vålitalo and colleagues' report on an Item Response Theory analysis examining the informativeness of behavioural indicators and physiological measures of the autonomic nervous system. They concluded by discouraging the use of physiological indicators (found within popular clinical assessment tools) when assessing the pain of mechanically ventilated infants and posit that infant pain assessment could primarily rely on infant behaviours. This is a significant departure from current clinical practice and it would be damaging to infants in care, if clinicians simply used unvalidated modifications to existing tools. However, it draws our attention to unresolved challenges within infant pain assessment.

Pain is a sensory and emotional phenomenon that is ubiquitous; yet the understanding of pain in another is elusive.⁶ On one hand, pain is subjective because the transduction of a noxious stimulus into one's experience of pain is based on an individual's physiology, personal experiences, and social context. Yet, despite one's unique synthesis of noxious stimulation, there are common features of basic nociceptive processing that are shared by all typically developing humans. The challenge of pain assessment is compounded in infancy because the validity of pain assessment can only truly be known by the affected individual and this validation cannot be obtained from the pre-verbal infant.

Furthermore, unlike any other stage in the lifespan, the steep trajectory of cognitive and biological development likely means the experience of pain changes drastically over the first years of life.^{10, 11} Infant pain researchers and clinicians are charged with not only building a biological understanding of infant pain, but mobilizing this knowledge to assess pain and enact appropriate pain treatment strategies.

The Vålitalo article's questioning of the informativeness of physiological measures is not new.^{8, 15} Fundamentally, variation on physiological measures will always lack specificity to pain because changes in physiological activity does not only occur as a direct response to noxious stimulation. It can be argued that both joy and pain are hardly discernible when expressed as a heart rate. Psychometrically, the inter-individual variability in infant responses to noxious stimuli have not been properly examined longitudinally to provide valid norms for a point of comparison.¹⁸ Yet, despite these challenges, physiological indicators are the cornerstones of most pain assessment tools in hospitalized infants. Who is best placed to assess infant pain and how should this assessment be done?

All things being equal, parents are the caregivers who have greatest insight into their infant's behavior.⁷ Interpreting the needs of an infant based on behavior is fundamental to the provision of infant care, and the parental assessment of infant pain is highly reliant on interpreting changes in infant behavior. The most available method they have at their disposal for assessing their infant's pain would indeed be infant pain behaviours such as facial expression, body movements, and cry. Parents have reported that these indicators are most important to their pain judgments¹²,

yet quasi-experimental studies and multivariate modeling of their pain judgments have shown that the preponderance of variance in their pain judgments are not based on infant behaviours.^{13, 14} Similar speculation regarding what nurses and physicians base their judgments on has also been suggested.¹⁴ One cannot accept caregiver Visual Analogue Scale ratings as a gold standard proxy to evaluate the validity of a pain measure without recognizing how caregiver factors bias these ratings.

Helping to reduce bias, clinicians and clinician scientists have more specialized training and formal assessment tools for assessing pain in these young children. Multidimensional or composite pain tools (such as the PIPP-R) integrate physiological and behavioural measures of pain.³ Indeed, the objectivity of physiological measures such as oxygen saturation, heart rate, and blood pressure is alluring. In a basic sense, the measurement of the actual physiological processes is highly reliable and valid. However, as aforementioned, reliance on these measures as indicators of pain are questionable given the lack of specificity to pain and pain alone.

However, the sole dependence on behavioural indicators such as calmness or facial agitation, as suggested by Vålitalo and colleagues, is also limited. The specificity of behavioural pain measures has been questioned¹, as has been the underlying cognitive ability of the young infant to discern and express pain differently compared with other negative affect states.² Moreover, relationships between nociceptive brain activity and different types of infant behavior have also cast doubt on behavior as a surrogate measure of infant pain.^{4 17}

The challenge of infant pain assessment was the recent subject of an international consensus meeting that brought together basic scientists, basic behavioural scientists, clinician scientists and clinicians (Determining a Comprehensive Approach to Measuring Pain in Neonates and Infants: a Consensus Meeting, November 2014). Using both an electronic Delphi consensus methodology and in-person consensus building exercises, the group agreed to a number of key issues. At the forefront was the recognition that cortical, physiological, and behavioural measures by and large do not converge to an extent that would exude confidence. From a purely epistemological vantage point, it appears that basic and clinical scientists may not be measuring the same phenomenon and simplistic attempts to converge them may not be useful.

Basic scientists are trying to establish the fundamental pathways by which noxious events are transmitted and processed by the infant central nervous system, while behavioural scientists address how this process plays out in the behavior and social interactions of the infant. Both build their work on a framework of academic neuroscience and psychology. The infant clinician, on the other hand, is necessarily focused on the problem of inadequately treated pain and seeks a safe and practical solution. Which one is really studying “infant pain”? The answer is all of them. Although, some would argue that given the hallmark of pain being a subjective experience, the answer could be none of them.

The pragmatic need for infant pain assessment does not allow the luxury of prolonged theoretical debate, given rising numbers of repeated painful procedures with inadequate pain prevention and treatment.^{9,16} Clinicians must still take action in the absence of a feasible, valid, and reliable measure of infant pain that adequately takes into account not only steep development within infancy but also the sensory and affective dimensions of pain. Despite the lack of specificity to pain-related distress and the lack of convergence with changes in pain-related brain activity, clinicians would not be amiss to follow Vålitalo et al.'s suggestion to use behavioural measures of pain so long as they are able to make nuanced pain treatment decisions in the context of very fundamental limitations. However, a key omission in the behavioural pain indicators described by the authors were the preterm hand behaviours that have been studied in detail by Holsti & Grunau.⁵

For basic and behavioural scientists, the story must continue as we are actually just at the very beginning of understanding the complexity of pain within the developing nervous system. The development of a clinically-useful pain assessment tool may depend on our understanding of how nociceptive stimulation alters activity across all levels of the peripheral and central nervous system and how this activity is linked to overt behaviours that can be observed in the clinical setting.

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