

DEBATE

HOW SHOULD WE USE THE VISUAL ANALOGUE SCALE (VAS) IN REHABILITATION OUTCOMES? III: ON THE VALIDATION REQUIREMENTS FOR ASSESSMENTS USING VAS WITH RATIO PROPERTIES

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Kersten et al. (1) discuss some very important methodological matters pointing on failure to apply appropriate statistical methods for the relevant data level. Using appropriate statistical methods, with regard to data level of outcome measurements, is always a concern to the researcher, in order not to under or over estimate the conclusions that can be drawn. Kersten et al. (1) argue that pain intensity level assessed on visual analogue scale (VAS) can only be used as ordinal and not interval data, and that only non-parametric statistics can be used. I would argue that there are other, maybe more important concerns for which statistical method that should be used such as normal distribution and that the design allows for within subject comparisons. If these requirements are fulfilled and the population is large enough one usually gets the same result independently if parametric or non-parametric statistics is used.

However, depending on a number of prerequisites that deal with a set of underlying assumptions the accuracy of the assessments is influenced and thereby the conclusions that can be drawn. The more precise the question is posed to the patient, the more reliable, and probably valid the answer will be. Is it about pure pain intensity or is the affective component also involved? Is it pain intensity averaged over the last week or is it in a specific situation? Is it pain during rest or during a certain movement? What are the anchors of the VAS line? Discomfort or pain? Worst pain ever perceived or worst pain that you can imagine?

There might also be problems involved when the assessment requires cognitive ability, which VAS does. Elderly with cognitive deficits and small children might perceive difficulties to translate the pain perception to a line. The assessment also requires manual and visual ability.

In treating VAS assessments as ordinal and not as interval data you still run into the problem to quantify the measurement error, and you need to distinguish how many millimeters on the VAS that constitute a real perceived difference, i.e. a cut off for higher or lower intensity level (2). Instead, as the authors point out, one solution might be to use the assessed millimeter values and make a Rasch analysis and then use the transformed values in the following statistical analyses. Another way can be to use log transformed values in the statistics if the data are not normally distributed, that easily happens if there are floor or ceiling effects.

Non-linearity of pain assessment is argued by Kersten et al. (1) as a reason to always treat the data on ordinal level. However, in

validation procedures pain intensity has been found to increase logarithmically with provocation stimuli, eg for temperature provoked pain, and VAS has been found to allow measurements with ratio properties (3). The Borg Category Ratio (CR-10) scale is another instrument for assessments of pain intensity levels and constructed to handle the logarithmic increase by placing verbal pain intensity descriptors distributed accordingly between the numbers 0–10 (4). In a study with experimentally provoked pain that lasted for some minutes and where both the CR-10 scale and VAS were used by the same individuals in randomised order at different occasions, the assessed pain intensity levels on both scales followed each other nicely (during a 12 min period approaching a straight regression line ($r=0.964$ for VAS and $r=0.986$ for CR-10) during periods with external weights. However, some individuals was shown to make slightly more reliable assessments using CR-10 and others using VAS (5). Thus the non linear but logarithmic increase *per se* in pain intensity seems to be an invalid reason for the recommendation by Kersten et al. (1) not to use VAS assessments as interval data and to always use non-parametric statistics.

In clinical practice and research the validation procedure of VAS assessments is far more complicated than in a laboratory setting as there is no simple instrument that can be used as golden standard that allow comparisons of different intensity levels. If e.g. a corresponding level of overall functioning is chosen, it might very well be so that the individual chose to be active up to a certain, tolerable, pain intensity level. Something similar has been shown for perceived exertion when performing straining forestry work during long hours (6). If the corresponding relation between pain intensity and activity level is valid the functioning of the individual might very well increase during a rehabilitation period despite unchanged perceived pain intensity level. Thus it might be very difficult from clinical data to argue that the pain intensity levels do *not* have interval properties. However, when translating the pain intensity levels to percentage of perceived pain, where e.g. 50 % pain relief can constitute both a difference of 2 mm, clearly within the measurement error, or 20 mm, there is definitely a misuse of the statistical methods and calculations, as the Kersten et al. (1) argue. So far I never had one patient who said that “today the pain is 30 % worse than yesterday”.

Measurements for research purpose always rely on some kind of operationalisation and simplification. One always

has to consider different risks for making wrong conclusions due to a number of things such as asking too wide questions, categorizing the assessed millimeters into larger classes where two values close to each side of a border is categorized in two different classes, and using statistical methods where the prerequisites for the method are not fulfilled. This article by Kersten et al. (1) pin points the importance to consider data level of outcome assessments using VAS, but fails to describe experimental studies where VAS has been found to allow measurements not only with interval but with ratio properties. Thus, not only data level, but data distribution and sample size have to be taken into account when choosing statistical methods.

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