THE USE OF THE VISUAL ANALOGUE SCALE (VAS) IN REHABILITATION OUTCOMES

The Visual Analogue Scale (VAS) is a common form of response option in health outcome studies, often used to measure pain, amongst other things, and is generally presented as a single line of 100 mm with anchor words at either end (e.g. no pain – worst possible pain). It was first published in the early 1920’s (1, 2) though not widely used at that time (3). There are variations on the VAS theme, sometimes with shorter lines (e.g. 65 mm), and whatever the length, while they are typically presented in horizontal format, they can also be presented as vertical lines (4), and the two forms of presentation have been considered as equivalent (5). Another alternative is where it is presented as a thick line of blocks (looking much like bricks laid end-to-end) with 11 categories, ranging from 0–10, which is called a Numeric Rating Scale (NRS). VAS and NRS formats have also been shown to be equivalent (6, 7). The VAS has a long history of use in medical outcome studies, and is ubiquitous across all specialties, including Physical and Rehabilitation Medicine (8–10). It is used either in the form of a single Item scale (e.g. for pain), or as a type of response option for multiple item scales (11,12). For example, the VAS is used as part of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (13), the Chalder Fatigue Scale (14), and the EuroQol-5D (15).

A VAS is considered to reduce the confounding effect of variation between individual interpretations of the graduations used for rating scales, is preferred by participants who perceive their desired response as not corresponding with rating scale graduations (16) and enables a finer distinction between subjective states to be made (3). However, it has also been found that patients find it difficult to judge how to rate their pain on the pain VAS line, finding it ‘not very accurate’, ‘sort of random’, ‘almost guesswork’ or having to ‘work it into numbers first’ (17). Consequently, in some studies, very low test-retest reliability has been reported (18).

An implicit assumption made by the majority of people who use a VAS (or NRS) in either their clinical practice or research, is that the scale is interval in nature, or even ratio (7, 19–21). Thus, all sorts of mathematical and parametric procedures are applied. For example Bland and Altman plots have been used together with intra-class correlation coefficient (ICC), two-way mixed effects analysis of variance model with patients random and rating method fixed (7). Means and standard deviations are all commonly reported for VAS and its variants (22). Other types of calculations such as Minimally Important Difference (MID) are also common (23–27). This is a little unfortunate as it has been shown that the type of data derived from a VAS does not support such calculations (3, 28–30). In the British Medical Journal over 20 years ago, the authors of one paper clearly stated that ‘although usually converted to either cm or per cent the visual analogue scale has no true unit of measurement and is accordingly ordinal only’ (28). It has also been shown that VAS data cluster into 7 distinct groups, which are not equally spaced (29). Svensson (30) also clearly placed the VAS among ordinal scales.

It was again in the predecessor of the Journal of Rehabilitation Medicine, the Scandinavian Journal of Rehabilitation Medicine, that the first empirical evidence was presented which clearly demonstrated that the VAS was ordinal (31). Using Rasch analysis, that study showed the non-linear nature of the VAS, whereby the scale works just like any other ordinal scale. Since that time, other work has shown the same and, how misuse of VAS scales can, for example, lead to the calculation of spurious effect sizes, which could affect outcomes from clinical trials, or sample size estimates (32). Likewise, in a study comparing VAS with a verbal rating scale, a conclusion was reached that VAS should be analysed as non-continuous using statistical methods for ordinal data (33).

However, despite these warnings, a common practice has been, and remains so, to treat the VAS as an interval scale. For example, several papers published over the past 5 years in rehabilitation journals have used a VAS as either their primary or secondary outcome of their study, and have used parametric analyses to evaluate the results (34–37). The ordinal nature of VAS data means that change scores cannot be used to compare change in individuals or groups of patients, as a given change in one patient may be of different magnitude than the same apparent change in another. Similarly, VAS change scores may seriously over- or underestimate changes resulting from rehabilitation. Thus, incorrect analyses, using parametric statistics on VAS data, may have implications for the interpretation of the effectiveness of interventions and services. Consequently, and particularly when VAS are used as primary outcome measures, there is a risk that effective services may not be commissioned, or closed down, because they seem to be ineffective when the VAS is treated as an interval scale. The opposite may also occur, that ineffective rehabilitation interventions or services are inappropriately continued. Further, using VAS as interval scaled data for sample size calculations in clinical trials will risk over- or underpowered studies and may, as a consequence, lead to inappropriate conclusions of trials.

CONCLUSION

This commentary has summarised the evidence for the measurement properties of the VAS, a type of outcome scale widely used in Physical and Rehabilitation Medicine. We conclude that there is sufficient evidence that VAS data are ordinal. Consequently the VAS should be treated as such, and analysed appropriately from a statistical perspective by using non-parametric statistics.

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REFERENCES